BAA-AFOSR-2012-03

BROAD AGENCY ANNOUNCEMENT (BAA)
UNIVERSITY CENTER OF EXCELLENCE:
INTEGRATED COMPUTATIONAL MATERIAL SCIENCE AND ENGINEERING OF STRUCTURAL MATERIALS

OVERVIEW INFORMATION

This is a special BAA in support of the Air Force Research Laboratory's AFRL University Center of Excellence (CoE) for Integrated Computational Material Science and Engineering of Structural Materials. This center is a joint project between the AFRL's Air Force Office of Scientific Research and the Materials and Manufacturing Directorate. The CoE extends the research capabilities of AFRL and provides opportunities for a new generation of US scientists and engineers to address Air Force research needs. CoEs were previously identified as Science and Technology Workforce for the 21st Century (STW-21) centers.

AFOSR invites proposals for research in the areas described in detail in Section I, Funding Opportunity Description. The schedule for this announcement is given below.

AFOSR will not issue paper copies of this announcement. AFOSR reserves the right to select and fund for award all, some, or none of the proposals in response to this announcement. AFOSR provides no funding for direct reimbursement of proposal development costs. Technical and costs proposals, or any other material, submitted in response to this BAA will not be returned. It is our policy to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

1. Federal Agency Name:
Air Force Office of Scientific Research
875 North Randolph Street, Suite 325, Room 3112, Arlington VA 22203-1768

2. Funding Opportunity Title:
University Center of Excellence for Integrated Computational Material Science and Engineering of Structural Materials

3. Announcement Type:
Broad Agency Announcement (BAA) - This is the initial announcement

4. Funding Opportunity Number:
BAA-AFOSR-2012-03

5. Catalog of Federal Domestic Assistance (CFDA) Numbers
12.800

• **Dates:**
- White Papers (encouraged, but not required) Due 15 Feb 2012

- The proposal must be received in this office no later than 4:00 PM EST, 2 Apr 2012
- Selection Mid May 2012
- Research start date (estimated) Jul 2012

Table of Contents

I. Funding Opportunity Description

This is a special BAA in support of the AFRL's University Center of Excellence for Integrated Computational Material Science and Engineering of Structural Materials. In collaboration with AFRL Materials and Manufacturing Directorate (Wright Patterson AFB, OH), AFOSR invites proposals for research in the areas described in detail below. The schedule for this announcement is given in Section II, Award Information.

This research effort will consist of interdisciplinary teams of researchers with the skills needed to address the relevant research challenges necessary to meet the program goals. Multi investigator and/or multi university teaming is encouraged but not required. Proposals should describe cutting-edge efforts on basic scientific problems. Further, in order to satisfy AFOSR Policy on University CoE (e.g. "Educate students within the US in vital technology areas and offer opportunities for AFRL new employee recruitment") students involved in the program will be US nationals or permanent residents. The duration of the proposed effort is three years. Also, only one award is anticipated. The amount of resources made available to this BAA will depend on the quality of proposals received and the availability of funds, but probably will not exceed $1,000,000/year. Proposers are highly encouraged to confer with the designated points of contact as soon as possible. Their contact information can be found at the end of this section. White Papers briefly summarizing your ideas and why they are different from what others are doing are highly encouraged, but not required. Coordination with the AFOSR and the Materials and Manufacturing Directorate is highly encouraged but not required.

Only a few universities in the country can provide the technical breadth and depth needed to fully encompass the range of computational and experimental expertise needed for range of materials addressed in this BAA. It is anticipated that proposing academic teams may include more than one university and the ICMSE team would come together through reviews, summer interactions, and formation of the common framework. Strong collaborative interactions, including periodic student visits to the AFRL, are anticipated. Matching contributions will also

be required. Regardless, proposals will be reviewed on merit, with an eye toward overcoming existing cultural divisions to deliver a broader impact to the academic community.

Finally, proposals will need to include a data management plan, outlining how samples and data collected in the program will be stored and managed. This includes but is not restricted to issues such as: standards for data and metadata collection, content and format, data archiving, database management, and data sharing within and outside the CoE. This precondition is modeled on the National Science Foundation Data Management Plan requirement (e.g. http://nsf.gov/eng/general/ENG_DMP_Policy.pdf).

University Center of Excellence: Integrated Computational Material Science and Engineering of Structural Materials

Background: Current aerospace applications are restricted by the limitations of available structural materials and the ability to integrate new and existing materials into the design process. While the engineering of system components has significantly matured with the expanded capability and use of computational design tools, advances in computational and experimental methods in the materials community have very limited integration into the component design process. This limitation reflects the underlying complexity of material processing-structure-property relationships and the basic differences in the various classes of structural materials (e.g. metals, polymer matrix composites, and ceramics). The materials science paradigm, applicable to all structural materials, strives to relate the internal structure, produced through processing, with the balance of desired properties and performance. In order to synchronize materials opportunities with computational mechanics methods, significant advances in accurate and commonly accepted characterization, multi-scale property measurements and modeling will be required. A "computational backbone" that integrates computational tools and data handling methods with "high pedigree" experimental methods will accelerate materials transition into the component design to achieve improved product performance, manufacturability, and sustainability.

As part of the AFRL effort to advance Integrated Computational Materials Engineering (ICME), this center focuses on developing the fundamental science of computational and experimental methods common to all structural materials. The CoE will: inform and engage the larger academic community on Integrated Computational Materials Science and Engineering (ICMSE) development, selectively leverage (and potentially integrate) advanced academic ICMSE capabilities, leverage and extend limited in-house capability within the Materials and Manufacturing Directorate of the Air Force Research Laboratory (AFRL/RX), compliment developmental AFRL/RX activities (i.e. Foundational Engineering Problems) with fundamental efforts, and provide a technical and human (via education of students) foundation for Air Force to grow this vital technical area.

Specifically, the CoE will focus on 4-dimensional (spatial and temporal) multi-scale, mechanical modeling of polymer matrix composite materials and high temperature metals including spatial and temporal property prediction and damage propagation (e.g. strength, residual stress, crystal plasticity, fracture, and fatigue). Methods addressing these needs include, but are not limited to Finite Element, Crystal Plasticity and Multi-Phase Modeling Methods. It is anticipated that

significant advances in these methods will be required to efficiently describe the evolution of heterogeneities and outlier structures and their effect on the balance of structural properties for metals as well as polymeric composites. Alternative constructs for simulating the dependence of structural properties across material classes are methods is encouraged. In order to verify and validate these methods, it is anticipated that multi-scale 4-D structural characterization techniques and scale dependent testing methods at environmentally relevant conditions (high temperatures, stress-corrosion, thermoxidative, hot-wet, etc.) will be required. This work is a pacing issue because only when the science is well understood can the required standards and protocols be established for experimental and computational methods, as well as their overall integration into the ICMSE framework.

Over the last ten years several successful DARPA and AFOSR initiatives have focused on breaking down the barriers between materials developers and component designers. The successful proof of concept and the significant improvements in performance and cost reductions for several real world applications has led to the call for a national initiative in Integrated Computational Materials Engineering as summarized in a 2008 National Research Council (NRC) report [1]. AFRL/RX is spearheading a major initiative in Integrated Computational Material Science and Engineering which encompasses both the "Science" and "Engineering" of materials development and insertion within a digital framework. As advocated in the 2008 NRC report, the "engineering" portion of this initiative will seek proposals for several Foundational Engineering Problems (FEPs) of common and current interest to aerospace original equipment manufacturers (OEMs) and the Air Force. The FEP's are intended to address ubiquitous materials and design issues, but will ultimately focus ICMSE development on a specific structural component. This CoE complements the FEPs by establishing and maturing the basic science behind the methods required for materials/component design integration. In short, ICMSE will be the "how" materials will be developed in the digital age.

Research in this CoE will provide the scientific basis for generic characterization, representation, and property assessment tools that can be developed and applied across structural material classes through a common framework while having an integral reciprocity relationship to simulations.
Ultimately, science based protocols and standards are required for:

(1) 4-D multi-scale characterization of materials microstructure, including 'defect' feature statistics, where simulation frameworks drive characterization & visa versa.
(2) Rapid multi-scale materials testing techniques (strength, toughness, ductility, creep, fatigue resistance, reaction kinetics, time-evolving heterogeneous morphologies).
(3) Multi-scale FEM representations of structure and properties from experiment or other computational tools (MD, analytical, etc) translatable to the scale of a structural component (e.g., support struts, bulkheads, turbine disks or airfoils).
(4) Uncertainty Quantification in characterization of microstructure using advanced statistical methods, including but not limited to: mean values, outlier statistics, functional definitions of Representative Volume Element, Statistical Volume Element, and related constructs for dealing with the effects of heterogeneities.

The CoE will explore promising methods for the (1) multi-scale testing, (2) rapid 4-D characterization, (3) robust computational representation of structural materials in a common

computational framework, and (4) development of novel mathematical and statistical methods enabling and supporting these activities. In order to ensure that the methods developed at the center can be used across different classes of materials, we recommend the research focus on at least four "test cases" with two representative examples of both metals and polymer matrix composites. This will also serve in providing both technical focus and strong collaboration with in-house researchers on materials systems of current Air Force interest. Specifically, we recommend choosing a well-characterized structural material system as a "baseline" case and an emerging material system having more challenging microstructure-property relationships. This may include, but would not be limited to the following examples. For polymeric matrix composites, a "baseline" choice might be a bismaleimide (BMI) model polymer/carbon fiber system such as Matrimid 5292 which can be used to represent many of the processing-structure-property challenges of formulated resin products used on current weapons systems (F-22, F-35, etc.). An emerging PMC might be a BMI/CF textile system with hierarchical nano-scale reinforcement for enhanced interfacial strength, notch toughness, and thermal/electrical transport. Similarly, a representative "baseline" high temperature metal might be a Ni-based superalloy, while an advanced Ti alloy could be used to represent the variability of this class of materials. In both cases, experimental and computational methods can be brought to a known structural materials system and used as a basis on which the value of emerging technology can be robustly assessed.

Objective: Establishment of a University Center of Excellence for structural materials, focused on developing the fundamental science of computational and experimental methods that will serve as a bridge between the materials engineer and the component designer. While the Center will serve to establish broad tools that can be used across the structural materials communities the team is not expected to develop the systems engineering for a particular material and component. Success will be measured by the widespread use of the emerging tools and the relevance of student training and research. By informing and engaging the larger academic community on Integrated Computational Materials Engineering development, the center will put the Science into ICME to create Integrated Computational Material Science and Engineering and train the next generation scientists and engineers in this emerging discipline.

Research Concentration Areas:
This proposed center would seek expertise in a variety of disciplines including, but not limited to, experimental methods, mathematical and statistical methods, modeling techniques and the theory of materials relevant to the development or assessment of metallic and polymeric-matrix composites. These methods could include:

- Integration of multi-scale mechanical modeling (FEM) techniques (nano-micro-meso-macro) for strength prediction of polymers, metals, and high-aspect-ratio reinforcements
- Experimental methods and criteria determination for defining Representative Volume Elements (RVE) and Statistical RVE's (sRVE's)
- New methods development for rapid, multi-modal 3-D structure characterization (e.g. X-ray tomography or femto second laser serial sectioning) and virtual representation
- Design and instrumentation of rapid multi-scale property measurements methods at ambient conditions, high temperatures, and performance limiting environments (hot-wet, HCF, etc.)
- Damage prediction methods, including crystal plasticity and discrete fracture, employing multi-scale (spatial and temporal) methods

Up to now, lack of robust and validated mathematical and statistical techniques to drive such methods has limited their effectiveness. Addressing these shortcomings for methods applicable to structural materials (i.e. metals and polymer matrix composites) would significantly benefit the ICMSE infrastructure and is a key requirement.

Impact: Over the next decade successful CoE participants will become leaders of the research and development of Integrated Computational Materials Science and Engineering. Their success will lead to a revolution in the way materials are developed, qualified and integrated into structural components. As more students are trained in this discipline the cost to transition materials will fall. This will also lead to significant improvements in performance as the simultaneous optimization of materials (properties) and component design becomes accepted industrial practice.

AFOSR Program Manager:
Dr. Fariba Fahroo
AFRL/AFOSR/RSL
Tele: (703) 696-8429
DSN: 426-8429
FAX: (703) 696-8450
Email: **fariba.fahroo@afosr.af.mil**

AFRL/RX Points of Contact:
Dr. Christopher Woodward
AFRL/RXL
TEL: 937-255-90816
E-mail: **christopher.woodward@wpafb.af.mil**

Dr. Timothy D. Breitzman
AFRL/RXB
TEL: 937-255-3104
E-mail: **timothy.breitzman.1@us.af.mil**

II. Award Information

The anticipated types of awards are project grants with participation solely from academic researchers, but AFOSR encourages the sharing and transfer of technology and welcomes proposals that envision cooperation among two or more partners from academia, industry, and Air Force organizations.

The amount of resources made available to this BAA will depend on the quality of proposals received and the availability of funds, but probably will not exceed $1,000,000/year and only one award is anticipated. The duration of the proposed effort is three years. It is expected that the research effort will consist of an interdisciplinary team with the skills needed to address all of the

relevant research challenges necessary to meet the program goals. Multi-university teaming is encouraged.

The following additional items should also be considered prior to submission of a full proposal.

- *White Papers:* Submission of a brief white paper (1-5 pages) describing the potential research effort is highly encouraged (but not required) prior to proposal submission. White papers will be reviewed by AFRL researchers familiar with the AF research interests in this area. Copies of publications or student theses will not be considered as white papers. White papers should be submitted at least six weeks prior to the proposal submission deadline.
- *AFRL Points-of-Contact (POC):* The successful principal investigator awarded funding under this BAA will be expected to develop and conduct a regular dialogue with AFRL POC's who are familiar with the AF research interests in this area.

The anticipated schedule for awards is as follows:

- White Papers (encouraged, but not required)	15 Feb 2012
- The proposal must be received in this office no later than	4:00 PM EST, 2 Apr 2012
- Selection	Mid May 2012
- Research start date (estimated)	Jul 2012

Any proposal received at the Government office designated in the BAA after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, and the Contracting/Grants Officer determines that accepting the late offer would not unduly delay the award, and

(1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

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

(3) It is the only proposal received.

III. Eligibility Information

All responsible, potential applicants from academia are eligible to submit proposals. AFOSR particularly encourages proposals from historically black colleges and universities, minority institutions and minority researchers. However, no portion of this BAA is set aside for a specific group. Cost sharing is encouraged but not required.

IV. Application and Submission Information

1. Address to Request Announcement Package – This announcement may be accessed from the Internet at the Grants.gov web site (http://www.grants.gov). See 'For Electronic Submission' below.

2. Content and Form of Application Submission

a. White Paper. Before submitting a research proposal, you may wish to further explore proposal opportunities. You can do this by contacting the AFOSR program manager or the AFRL/RX POCs who can provide greater detail about this particular opportunity; the program manager may then ask for a preliminary proposal or white paper. However, in your conversations with a Government official, be aware that only warranted contracting and grants officers are authorized to commit the Government.

If you prefer, or the program manager requests, you may submit a preliminary proposal (White Paper), which should briefly describe the proposed research project's (1) objective, (2) general approach, and (3) impact of Department of Defense (DoD) and civilian technology. The white paper may also contain any unique capabilities or experience you may have (e.g., collaborative research activities involving Air Force, DoD, or other Federal laboratory.) The Program Manager may have additional guidelines regarding form and content of preliminary proposals.

White Paper Format

- Paper Size – 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing – single or double spaced
- Font – Times New Roman, 10 or 12 point
- Copies –as discussed with the Program Manager
- Content – as described above
- Page limit – No more than 4 pages, excluding cover letter, cover and curriculum vitae

b. Full Proposals. The proposal may be submitted either electronically or in hard copy form, but not both. All proposers must include the SF 424 (R&R) form as the cover page. Unnecessarily elaborate brochures, reprints or presentations beyond those sufficient to present a complete and effective proposal are not desired. To convert attachments into PDF format, Grants.gov provides a list of PDF file converters at http://www.grants.gov/help/download_software.jsp

Full Proposal Format

- Paper Size – 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing – single or double spaced

- Font – Times New Roman, 10 or 12 point
- Page Limitation – No more than 25 single-sided pages. The cover, table of contents, list of references, letters of support and curriculum vitae are excluded from the page limitations

- Attachments – submit in PDF format (Adobe Portable Document Format)
- Copies for hardcopy submissions – (one original, number of copies as discussed with the Program Manager)
- Content – as described below

(1) Advance Preparation For Electronic Submission - Electronic proposals must be submitted through Grants.gov. There are several one-time actions your organization must have completed before it will be able to submit applications through Grants.gov. Well before the submission deadline, you should verify that the persons authorized to submit proposals for your organization have completed those actions. If not, it may take them up to 21 days to complete the actions before they will be able to submit applications.
The process your organization must complete includes obtaining a Dun and Bradstreet Data Universal Numbering System (DUNS) number, registering with the Central Contract Registry (CCR), registering with the credential provider, and registering with Grants.gov. (Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called MPIN are important steps in the CCR registration process.) Go to http://www.grants.gov/applicants/get_registered.jsp. Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/section3/OrganizationRegCheck.pdf to guide you through the process. To submit a proposal to through Grants.gov, applicants will need to download Adobe Reader. This small, free program will allow you to access, complete, and submit applications electronically and securely. To download a free version of the software, visit the following web site: http://www.grants.gov/help/download_software.jsp. Consult Grants.gov to ensure you have the required version of Adobe Reader installed. Should you have questions relating to the registration process, system requirements, how an application form works, the submittal process or Adobe Reader forms, call Grants.gov at 1-800-518-4726 or support@Grants.gov for updated information.

(2) Submitting the Application

(a) For Electronic Submission – Application forms and instructions are available at Grants.gov. To access these materials, go to http://www.grants.gov, select “Apply for Grants”, and then follow the instructions. In the Grants.gov search function, enter the funding opportunity number for this announcement (BAA-AFOSR-2012-03). You can also search for the CFDA Number 12.800, Air Force Defense Research Sciences Program. On the Selected Grant Applications for Download page, click on 'download' under the heading 'Instructions and Applications' to download the application package.
The funding opportunity will be listed multiple times. The funding opportunity number is identical for each listing. Select the Competition ID and Competition Title for the directorate specific to your area of interest to download the instructions and application.
If you are unsure which directorate and program manager is appropriate for your specific area of interest, select the Competition ID and Competition Title “Other” to download.

Note: All attachments to all forms must be submitted in PDF format (Adobe Portable Document Format). Grants.gov provides links to PDF file converters at this site: http://grants.gov/agencies/asoftware.jsp#3.

(b) For Hard Copy Submission – For hard copy submission, the original proposal and copies must be delivered to the attention of the program manager at the Air Force Office of Scientific Research at the following address:

AFOSR (Attn: Dr. Fariba Fahroo)
Air Force Office of Scientific Research
875 North Randolph Street, Room 3112
Arlington VA 22203

In case of difficulties in determining the appropriate AFOSR addressee, proposals may be submitted to:

AFOSR/PKC
875 Randolph Street, Room 3112
Arlington VA 22203-1954

(c) SF 424 Research and Related (R&R) - The SF 424 (R&R) form must be used as the cover page for all electronic and hard copy proposals. No other sheets of paper may precede the SF 424 (R&R) for a hard copy proposal. A signed copy of the SF 424 (R&R) should be submitted with all hardcopy proposals. Complete all the required fields in accordance with the "pop-up" instructions on the form and the following instructions for the specified fields. To see the instructions, roll your mouse over the field to be filled out. You will see additional information about that field. For example on the SF 424 (R&R) the Phone Number field says 'PHONE NUMBER (Contact Person): Enter the daytime phone number for the person to contact on matters relating to this application. This field is required.' Mandatory fields will have an asterisk marking the field and will appear yellow on most computers. In grants.gov, some fields will self populate based on the BAA selected. Please fill out the SF 424 first, as some fields on the SF 424 are used to auto populate fields in other forms. The completion of most fields is self-explanatory except for the following special instructions:

- Field 2: The Applicant Identifier may be left blank.
- Field 3: The Date Received by State and the State Application Identified are not applicable to research.
- Field 7: Complete as indicated. If Small Business is selected, please note if the organization is Woman-owned and/or Socially and Economically Disadvantaged. If the organization is a Minority Institution, select "Other" and under "Other (Specify)" note that you are a Minority Institution (MI).
- Field 9: List Air Force Office of Scientific Research as the reviewing agency. This field is pre-populated in grants.gov.
- Field 17: Choose 'No'. Check 'Program is Not Covered By Executive Order 12372'.
- Attachments: All attachments to all Grants.gov forms must be submitted in PDF format (Adobe Portable Document Format). To convert attachments into PDF format, Grants.gov provides a list of PDF file converters at http://www.grants.gov/resources/download_software.jsp

A signed copy of the SF 424 (R&R) should be submitted with all hardcopy proposals.

(d) Certification - All awards require some form of certifications of compliance with national policy requirements. For assistance awards, i.e., grants and cooperative agreements, proposers using the SF 424 (R&R) are providing the certification required by 32 CFR Part 28 regarding lobbying. (The full text of this certification may be found at http://www.wpafb.af.mil/shared/media/document/AFD-070817-127.pdf). If you have lobbying activities to disclose, you must complete the optional form SF-LLL, Standard Form – LLL, 'Disclosure of Lobbying Activities' in the downloaded Adobe forms package.
If it is determined a contract is the appropriate vehicle, AFOSR will request additional documentation from prospective awardees. For contract awards, prospective contractors shall complete electronic annual representations and certifications at http://www.bpn.gov/orca. The representations and certifications shall be submitted to ORCA as necessary, but updated at least annually, to ensure they are current, accurate, and complete. These representations and certifications are effective until one year from date of submission or update to ORCA. In addition to the ORCA representations and certifications, prospective contractors shall complete the AFOSR Contract Certification which can be located at http://www.wpafb.af.mil/shared/media/document/AFD-070820-024.doc.

(e) Research and Related (R&R) Other Forms: The following other forms must be used for all electronic and hard copy proposals: R&R Senior/Key Person Profile form, R&R Project/Performance Site Locations form, R&R Other Project Information form and the R&R Budget form. The R&R Subaward Budget Attachment Form is required when subawardees are involved in the effort. The SF-LLL form is required when applicants have lobbying activities to disclose. PDF copies of all forms may be obtained at the grants.gov website.

(f) R&R Senior/Key Person Profile Form – Complete the R&R Senior/Key Person Profile Form for those key persons who will be performing the research. Information about an individual is subject to the requirements of the Privacy Act of 1974 (Public Law 93 579). The information is requested under the authority of Title 10 USC, Sections 2358 and 8013. The principal purpose and routine use of the requested information are for evaluation of the qualifications of those persons who will perform the proposed research. Failure to provide such information will delay award. For the principal investigator and each of the senior staff, provide a short biographical sketch and a list of significant publications (vitae) and attach it to the R&R Senior/Key Person Profile Form.

(g) R&R Project/Performance Site Locations Form – Complete all information as requested.

(h) R&R Other Project Information Form - Human Subject/Animal Use and Environmental Compliance.

Human Subject Use. Each proposal must address human subject involvement in the research by addressing Field 1 and 1a of the R&R Other Project Information Form. If Field 1 indicates "Yes", the Air Force must receive a completed OMB No. 0990-0263 form before a contract, grant, or cooperative agreement may be awarded to support research involving the use of human subjects. Attach the document to the R&R Other Project Information Form. If using grants.gov,

a completed OMB No. 0990-0263 form shall be attached in field 11 of the R&R Other Project Information Form. The OMB No. 0990-0263 is available electronically at: http://apply.grants.gov/apply/forms/sample/ProtectionofHumanSubjects-V1.1.pdf
Refer any questions regarding human subjects to the AFOSR Directorate of Mathematics, Information and Life Sciences (Stephanie Bruce) at (703) 588-0664.

Animal Use. Each proposal must address animal use protocols by addressing Field 2 and 2a of the R&R Other Project Information Form. If selected for award, additional documentation in accordance with Air Force standards will be required. Refer any questions regarding animal subjects to the AFOSR Directorate of Mathematics, Information and Life Sciences (Stephanie Bruce) at (703) 588-0664.

Environmental Compliance. Federal agencies making contract, grant, or cooperative agreement awards and recipients of such awards must comply with various environmental requirements. The National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. Sections 4321-4370 (a), requires that agencies consider the environmental impact of "major Federal actions" prior to any final agency decision. With respect to those awards which constitute "major Federal actions," as defined in 40 CFR 1508.18, federal agencies may be required to comply with NEPA and prepare an environmental impact statement (EIS) even if the agency does no more than provide grant funds to the recipient. Questions regarding NEPA compliance should be referred to the AFOSR legal staff at (703) 696-9705. Most research efforts funded by AFOSR will, however, qualify for a categorical exclusion from the need to prepare an EIS. Air Force instructions/regulations provide for a categorical exclusion for basic and applied scientific research usually confined to the laboratory, if the research complies with all other applicable safety, environmental and natural resource conservation laws. Each proposal shall address environmental impact by filling in fields 4a through 4d of the R&R Other Project Information Form. This information will be used by AFOSR to make a determination if the proposed research effort qualifies for categorical exclusion.

Abstract - Include a concise (not to exceed 300 words) abstract that describes the research objective, technical approaches, anticipated outcome and impact of the specific research. In the header of the abstract include the program manager's name and directorate who should receive the proposal for consideration and evaluation. Attach the Abstract to the R&R Other Project Information form in field 6.

(i) R&R Other Project Information Form - Project Narrative Instructions

Project Narrative – Describe clearly the research including the objective and approach to be performed keeping in mind the evaluation criteria listed in Section V of this announcement. Also briefly indicate whether the intended research will result in environmental impacts outside the laboratory, and how the proposer will ensure compliance with environmental statutes and regulations. Attach the proposal narrative to R&R Other Project Information form in field 7.

Project Narrative - Statement of Objectives – Describe the actual research to be completed, including goals and objectives, on one-page titled Statement of Objectives. This statement of objectives may be incorporated into the award instead of incorporating the entire technical

proposal. Active verbs should be used in this statement (for example, “conduct” research into a topic, “investigate” a problem, “determine” to test a hypothesis). It should not contain proprietary information.

Project Narrative - Research Effort – Describe in detail the research to be performed. State the objectives and approach and their relationship and comparable objectives in progress elsewhere. Additionally, state knowledge in the field and include a bibliography and a list of literature citations. Discuss the nature of the expected results. The adequacy of this information will influence the overall evaluation. Proposals for renewal of existing support must include a description of progress if the proposed objectives are related.

Project Narrative – Principal Investigator (PI) Time. PI time is required. List the estimate of time the principal investigator and other senior professional personnel will devote to the research. This shall include information pertaining to other commitments of time, such as sabbatical or extended leave; and proportion of time to be devoted to this research and to other research. Awards may be terminated when the principal investigator severs connections with the organization or is unable to continue active participation in the research. State the number of graduate students for whom each senior staff member is responsible. If the principal investigator or other key personnel are currently engaged in research under other auspices, or expect to receive support from other agencies for research during the time proposed for AFOSR support, state the title of the other research, the proportion of time to be devoted to it, the amount of support, name of agency, dates, etc. Send any changes in this information as soon as they are known. Submit a short abstract (including title, objectives, and approach) of that research and a copy of the budget for both present and pending research projects.

Project Narrative – Facilities. Describe facilities available for performing the proposed research and any additional facilities or equipment the organization proposes to acquire at its own expense. Indicate government-owned facilities or equipment already possessed that will be used. Reference the facilities contract number or, in the absence of a facilities contract, the specific facilities or equipment and the number of the award under which they are accountable.

Project Narrative – Special Test Equipment. List special test equipment or other property required to perform the proposed research. Segregate items to be acquired with award funds from those to be furnished by the Government. When possible and practicable, give a description or title and estimated cost of each item. When information on individual items is unknown or not available, group the items by class and estimate the values. In addition, state why it is necessary to acquire the property with award funds.

Project Narrative – Equipment. Justify the need for each equipment item. Additional facilities and equipment will not be provided unless the research cannot be completed by any other practical means. Include the proposed life expectancy of the equipment and whether it will be integrated with a larger assemblage of apparatus. If so, state who owns the existing apparatus.

Project Narrative – High Performance Computing Availability. Researchers that are supported under an AFOSR grant or contract, and meet certain restrictions, are eligible to apply for special accounts and participation in a full-spectrum of activities within the DOD high performance

computing modernization program. This program provides, at no cost to the user, access to a range of state-of-the-art high performance computing assets and training opportunities that will allow the user to fully exploit these assets. Details of the capabilities of the program can be found at the following Internet address: http://www.hpcmo.hpc.mil. Researchers needing high performance cycles should address the utilization of this program to meet their required needs. AFOSR program managers will facilitate the establishment of accounts awarded.

(j) R&R Budget Form - Estimate the total research project cost. Categorize funds by year and provide separate annual budgets for projects lasting more than one year. In addition to the Research & Related Budget forms available on Grants.gov, the budget proposal should include a budget justification for each year, clearly explaining the need for each item. Applicants who enter a fee on Part J of the budget will not be eligible to receive a grant or cooperative agreement. Attach the budget justification to Section K of the R&R Budget form. (http://www.wpafb.af.mil/library/factsheets/factsheet.asp?id=9388).

4. Other Submission Requirements

Proposals submitted in whole or in part by electronic media (computer disk or tape, facsimile machine, electronic mail, etc.) will not be accepted (unless the full proposal is submitted electronically through Grants.gov).

5. Application Receipt Notices.

a. For Electronic Submission - The applicant's approved account holder for grants.gov will receive a confirmation page upon completing the submission to Grants.gov. This confirmation page is a record of the time and date stamp that is used to determine whether the proposal was submitted by the deadline. A proposal received after the deadline is "late" and will not be considered for an award. After an institution submits an application, Grants.gov generates a submission receipt via email and also sets the application status to "Received". This receipt verifies the Application has been successfully delivered to the Grants.gov system. Next, Grants.gov verifies the submission is valid by ensuring it does not contain viruses, the opportunity is still open, and the applicant login and applicant DUNS number match. If the submission is valid, Grants.gov generates a submission validation receipt via email and sets the application status to "Validated". If the application is not validated, the application status is set to "Rejected". The system sends a rejection email notification to the institution and the institution must resubmit the application package. Applicants can track the status of their application by logging in to Grants.gov.

b. For Hard Copy Submission – An applicant that submits a hard copy proposal to AFOSR will receive an email from the agency approximately ten days after the proposal due date to acknowledge receipt of the proposal and provide the agency's assigned tracking number. The email is sent to the authorized representative for the applicant institution. A hard copy proposal received at an agency's listed mailing address after the deadline, if one is specifically listed in the announcement, is "late" and will not be considered for an award, except for cases in which

there is acceptable evidence to establish that the proposal was delivered to the agency and was under the agency's control prior to the deadline.

6. Submission Dates and Times. Proposals must be submitted by 4:00 P.M. Eastern Time, 2 April 2012.

V. Application Review Information

AFOSR's overriding purpose in supporting this research is to advance the state of the art in areas related to the technical problems the Air Force encounters in developing and maintaining a superior Air Force; lowering the cost and improving the performance, maintainability, and supportability of Air Force weapon systems; and creating and preventing technological surprise.

Proposals submitted under this BAA are evaluated through a peer or scientific review process, and selected for award on a competitive basis according to Public Law 98-369, Competition in Contracting Act of 1984, 10 USC 2361, and 10 USC 2374.. Subject to funding availability, all other proposals will be evaluated under the following two primary criteria, of equal importance, as follows:

1. The scientific and technical merits of the proposed research.
2. The potential contributions of the proposed research to the mission of the USAF.

Other evaluation criteria used in the technical reviews, which are of lesser importance than the primary criteria and of equal importance to each other, are:

1. The likelihood of the proposed effort to develop new research capabilities and to broaden the university research base in support of national defense, and the potential to contribute to the education of future scientists and engineers in disciplines critical to the mission of the USAF.
2. The proposer's, principal investigator's, team leader's, or key personnel's qualifications, capabilities, related experience, facilities, or techniques or a combination of these factors that are integral to achieving USAF objectives.
3. The proposed involvement and interaction with DoD or other federal laboratories, industry or other existing research centers of excellence.
4. The realism and reasonableness of proposed costs.

No further evaluation criteria will be used in source selection. The technical and cost information will be analyzed simultaneously during the evaluation process.

Technology sharing and transfer is encouraged; in this respect, AFOSR welcomes proposals that envision university-industry cooperation. Non-industry proposers are encouraged to specify in their technical proposals their interactions with industry and the Air Force Research Laboratory's Technical Directorates, including specific points of contact. Cooperation with or use of facilities of the Air Force Research Laboratory is also encouraged. Personnel interaction (e.g., university faculty or students performing research at industry or Air Force Research Laboratory sites;

industry or Air Force staff working in university laboratories) is viewed as highly desirable. Further information regarding the Air Force Research Laboratory may be viewed at http://www.afrl.af.mil.

VI. Award Administration Information

1. Award Notices.

Should your proposal be selected for award, the principal investigator will receive a letter from the Technical Directorate stating this information. This is not an authorization to begin work. Your business office will be contacted by the grant or contracting officer to negotiate the terms of your award.

2. Reporting Requirements.

Grants and cooperative agreements typically require annual and final technical reports, financial reports, and final patent reports. Contracts typically require annual and final technical and patent reports. Copies of publications and presentations should be submitted.

Additional deliverables may be required based on the research being conducted.

VII. Agency Contacts

Should you have questions about a technical research area, contact the program manager listed for the research topic areas listed in Section I. Should you have questions about the BAA or procedures for submission of a proposal, please email afosr.baa@afosr.af.mil.

** Important Notice Regarding Questions of a Business Nature **
All questions shall be submitted in writing by electronic mail.
Questions presented by telephone call, fax message, or other means will not be responded to.

VIII. Additional Information

1. The cost of proposal preparation in response to this Announcement is not considered an allowable direct charge to any resulting award. Such cost is, however, an allowable expense to the normal bid and proposal indirect cost specified in FAR 31.205-18, or 2 CFR Part 220, Cost Principles for Educational Institutions (Formerly OMB Circular A-21), or 2 CFR Part 230 Cost Principles for Non-Profit Organizations (Formerly OMB Circular A-122).

2. Every effort will be made to protect the confidentiality of the proposal and any evaluations. The proposer must mark the proposal with a protective legend in accordance with FAR part 15.609, Use and Disclosure of Data, if protection is desired for proprietary or confidential information.

2. Every effort will be made to protect the confidentiality of the proposal and any evaluations. The proposer must mark the proposal with a protective legend as indicated in paragraph VIII.9. below.

3. Offerors are advised that employees of commercial firms under contract to the Government may be used to administratively process proposals. These support contracts include nondisclosure agreements prohibiting their contractor employees from disclosing any information submitted by other contractors.

4. Only contracting or grants officers are legally authorized to bind the government.

5. The AFOSR website is available at http://www.wpafb.af.mil/AFRL/afosr/.

6. Responses should reference Broad Agency Announcement BAA-AFOSR-2012-03.

7. Prospective awardees shall be registered in the CCR database prior to award, during performance, and through final payment of any award resulting from this announcement. Offerors may obtain information on registration and annual confirmation requirements via the Internet at http://www.ccr.gov or by calling 1-888-227-2423, or 269-961-5757.

8. AFOSR expects the performance of research funded by this announcement to be fundamental. DoD Directive 5230.24 and DoD Instruction 5230.27 define contracted fundamental research in a DoD context as follows:

“Contracted Fundamental Research. Includes [research performed under] grants and contracts that are (a) funded by budget Category 6.1 ("Research"), whether performed by universities or industry or (b) funded by budget Category 6.2 ("Exploratory Development") and performed on-campus at a university. The research shall not be considered fundamental in those rare and exceptional circumstances where the 6.2-funded effort presents a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense, and where agreement on restrictions have been recorded in the contract or grant."

9. Marking of Proposals - AFOSR is seeking proposals that do not contain proprietary information. If proprietary information is submitted, AFOSR will make every effort to protect the confidentiality of the proposal and any evaluations. However, under the Freedom of Information Act (FOIA) requirements, such information (or portions thereof) may potentially be subject to release. It is the offerors responsibility to notify AFOSR of proposals containing proprietary information and to identify the relevant portions of their proposals that require protection. The entire proposal (or portions thereof) without protective markings or otherwise identified as requiring protection will be considered to be furnished voluntarily to AFOSR without restriction and will be treated as such for all purposes. If protection is desired for proprietary or confidential information, the proposer must mark the proposal with the protective legend as follows:

(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.

10. Federal Awardee Performance and Integrity Information System (FAPIIS)

Potential offerors should be aware that as of April 2010 (SAF/AQC Memo, "Contractor Responsibility (EPLS and FAPIIS Requirements) awardees of contracts or recipients of grants have been required to update the information in the Federal Awardee Performance and Integrity Information System (FAPIIS) on a semi-annual basis, throughout the life of the agreement, by entering the required information in the Central Contractor Registration database at http://www.ccr.gov (see 52.204-7). Contract clauses and Grant articles provide specific information on this requirement.

11. Additional Subcontract /Subaward Reporting Requirements

The Federal Funding and Transparency Act and 22 September 2010 DDR&E memo, "New Reporting required Under DoD Grant and Cooperative Agreements" require that as of 1 October 2010 awardees of contracts and recipients of grants have been required to report Executive Compensation and First-Tier Subcontract/Subrecipient Awards for any contract or grant valued at $25,000 or more excluding classified contracts or contracts/grants with individuals. Two articles have been added to all awards as a consequence of this requirement. See below:

CCR Registration: Unless exempted by 2 CFR 25.110 all offerors must:

(1) Be registered in the Central Contractor Registration (CCR) prior to submitting an application or proposal;

(2) Maintain an active CCR registration with current information at all times during which it has an active Federal award or an application or proposal under consideration by an agency; and

(3) Provide its DUNS number in each application or proposal it submits to the agency.

Reporting Subawards and Executive Compensation.

a. *Reporting of first-tier subawards.*

1. *Applicability.* Unless you are exempt as provided in paragraph d. of this award term, you must report each action that obligates $25,000 or more in Federal funds that does not include Recovery funds (as defined in section 1512(a)(2) of the American Recovery and Reinvestment Act of 2009, Pub. L. 111–5) for a subaward to an entity (see definitions in paragraph e. of this award term).

2. *Where and when to report.*

i. You must report each obligating action described in paragraph a.1. of this award term to *http://www.fsrs.gov.*

ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)

3. *What to report.* You must report the information about each obligating action that the submission instructions posted at *http://www.fsrs.gov specify.*

b. *Reporting Total Compensation of Recipient Executives.*

1. *Applicability and what to report.* You must report total compensation for each of your five most highly compensated executives for the preceding completed fiscal year, if—

i. the total Federal funding authorized to date under this award is $25,000 or more;

ii. in the preceding fiscal year, you received—

(A) 80 percent or more of your annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(B) $25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

iii. 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.*)

2. *Where and when to report.* You must report executive total compensation described in paragraph

b.1. of this award term:

i. As part of your registration profile at *http://www.ccr.gov.*

ii. By the end of the month following the month in which this award is made, and annually thereafter.

c. *Reporting of Total Compensation of Subrecipient Executives.*

1. *Applicability and what to report.* Unless you are exempt as provided in paragraph d. of this award term, for each first-tier subrecipient under this award, you shall report the names and total compensation of each of the subrecipient's five most highly compensated executives for the subrecipient's preceding completed fiscal year, if—

i. in the subrecipient's preceding fiscal year, the subrecipient received—

(A) 80 percent or more of its annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(B) $25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts), and Federal financial assistance subject to the Transparency Act (and subawards); and ii. 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.*)

2. *Where and when to report.* You must report subrecipient executive total compensation described in paragraph c.1. of this award term:

i. To the recipient.

ii. By the end of the month following the month during which you make the subaward. For example, if a subaward is obligated on any date during the month of October of a given year (*i.e.*, between October 1 and 31), you must report any required compensation information of the subrecipient by November 30 of that year.

d. *Exemptions*

If, in the previous tax year, you had gross income, from all sources, under $300,000, you are exempt from the requirements to report:

i. Subawards,

and

ii. The total compensation of the five most highly compensated executives of any subrecipient.

e. *Definitions.* For purposes of this award term:

1. *Entity* means all of the following, as defined in 2 CFR part 25:

i. A Governmental organization, which is a State, local government, or Indian tribe;

ii. A foreign public entity;

iii. A domestic or foreign nonprofit organization;

iv. A domestic or foreign for-profit organization;

v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.

2. *Executive* means officers, managing partners, or any other employees in management positions.

3. *Subaward:*

i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.

ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see Sec. __ .210 of the attachment to OMB Circular A–133, "Audits of States, Local Governments, and Non-Profit Organizations").

iii. A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.

4. *Subrecipient* means an entity that:

i. Receives a subaward from you (the recipient) under this award; and

ii. Is accountable to you for the use of the Federal funds provided by the subaward.

5. *Total compensation* means the cash and noncash dollar value earned by the executive during the recipient's or subrecipient's preceding fiscal year and includes the following (for more information see 17 CFR 229.402(c)(2)):

i. *Salary and bonus.*

ii. *Awards of stock, stock options, and stock appreciation rights.* Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.

iii. *Earnings for services under non-equity incentive plans.* This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.

iv. *Change in pension value.* This is the change in present value of defined benefit and actuarial pension plans.

v. *Above-market earnings on deferred compensation which is not tax-qualified.*

vi. Other compensation, if the aggregate value of all such other compensation (e.g. severance, termination payments, value of life insurance paid on behalf of the employee, perquisites or property) for the executive exceeds $10,000.

12. Indirect Cost Limitation for Basic Research Awards Notices:

Information on DoD appropriations for FY2012 will be disseminated as received. The DoD Appropriations Act of 2011 did not carry forward the Indirect Cost Limitation for Basic Research Awards as originally set forth in Section 8115 of the Department of Defense Appropriations Act, 2008 (P.L. 110-116) and subsequently included in the 2009 and 2010 Appropriation Acts which limited payments of negotiated indirect cost rates on contracts, grants, and cooperative agreements (or similar arrangements) to not more than 35 percent of the total cost of the instrument. However, efforts using FY2008 funds after 14 Nov 2007, FY2009 and FY2010 appropriations remain subject to the 35 percent restriction on indirect cost reimbursement. Records in the contractor's or recipient's financial management system must be able to identify the sources and applications of funding adequately to demonstrate compliance with the limitation.

13. Grant Payment Process

(1) Effective 1 November 2011, the Air Force Office of Scientific Research will no longer set up automatic payments for Grants to educational and nonprofit recipients. Therefore, all Grantees must access Wide Area Workflow (WAWF) and complete WAWF's Standard Form (SF) 270, Request for Advance or Reimbursement, for payment. Grantees should submit SF 270s as expenses occur; however, Grantees should have no more than one month cash on hand at any given time.

(2) Each Grantee must register with WAWF at https://wawf.eb.mil. To begin the registration process, click on the accept button at the bottom of the page. WAWF will display the login page with a block for new users with hyperlinks to instructions for "Pre-registration for Vendors" and the actual "Registration" link.
Please note that each Grantee must be registered in CCR and have an Electronic Business Point of Contact set up to approve new registrations within their Institution. Each Grantee will also need to set up a Group Administrator (GAM) to register their CAGE Code and DUNS number, in addition to setting up an organizational email address for email notification from WAWF advising on the status of vouchers submitted for payment. The Grantee will also need to contact the WAWF Help Desk to register their CAGE code within the WAWF system. WAWF Help Desk information is available at the WAWF web site.

(3) If you encounter any problems with your WAWF registration please click on "Vendor Customer Support" in the blue bar at the bottom of the login page. This link will provide phone numbers and an email address to the WAWF Help Desk.

(4) Please direct questions regarding changes in the invoicing process to Dorothy Howe at 703-588-8618 or Dorothy.Howe@afosr.af.mil. Please direct all WAWF questions to Vendor Customer Support.

14. Ombudsman

(a) An ombudsman has been appointed to hear and facilitate the resolution of concerns from offerors, potential offerors, and others for this acquisition. When requested, the ombudsman will maintain strict confidentiality as to the source of the concern. The existence of the ombudsman does not affect the authority of the program manager, contracting officer, or source selection official. Further, the ombudsman does not participate in the evaluation of proposals, the source selection process, or the adjudication of protests or formal contract disputes. The ombudsman may refer the party to another official who can resolve the concern.

(b) Before consulting with an ombudsman, interested parties must first address their concerns, issues, disagreements, and/or recommendations to the contracting officer for resolution. Consulting an ombudsman does not alter or postpone the timelines for any other processes (e.g., agency level bid protests, GAO bid protests, requests for debriefings, employee-employer actions, contests of OMB Circular A-76 competition performance decisions).

(c) If resolution cannot be made by the contracting officer, concerned parties may contact the Center/MAJCOM or AFISRA ombudsmen,

Ombudsman: Ms. Barbara G. Gehrs, HQ AFRL/PK, Wright-Patterson AFB OH
Telephone: (937) 904-4407
Email: Barbara.Gehrs@wpafb.af.mil

Concerns, issues, disagreements, and recommendations that cannot be resolved at the MAJCOM/DRU or AFISRA level, may be brought by the concerned party for further consideration to the Air Force ombudsman, Associate Deputy Assistant Secretary (ADAS) (Contracting), SAF/AQC, 1060 Air Force Pentagon, Washington DC 20330-1060, phone number (703) 588-7004, facsimile number (703) 588-1067.

(d) The ombudsman has no authority to render a decision that binds the agency.

(e) Do not contact the ombudsman to request copies of the solicitation, verify offer due date, or clarify technical requirements. Such inquiries shall be directed to the Contracting Officer.