

**FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT**



**U.S. Department of Energy
Office of Science
Office of Fusion Energy Sciences**

***Collaborative Research in Magnetic Fusion Energy Sciences
on International Research Facilities***

Funding Opportunity Number: DE-FOA-0000714

Announcement Type: Initial

CFDA Number: 81.049

ISSUE DATE:	April 16, 2012
Pre-Application Due Date: (Pre-Applications are required)	May 14, 2012
Application Due Date:	June 21, 2012

NOTE: REQUIREMENTS FOR GRANTS.GOV

Where to Submit: Applications must be submitted through Grants.gov to be considered for award. You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Remember you have to update your Central Contract Registry (CCR) registration annually. If you have any questions about your registration, you should contact the Grants.gov Helpdesk at 1-800-518-4726 to verify that you are still registered in Grants.gov.

Registration Requirements: There are several one-time actions you must complete in order to submit an application through Grants.gov (i.e., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the CCR, register with the credential provider, and register with Grants.gov). Use the Grants.gov Organization Registration Checklist at <http://www.grants.gov/assets/OrganizationRegCheck.pdf> to guide you through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in the CCR registration process. Applicants, who are not registered with CCR and Grants.gov, should allow at least 21 days to complete these requirements. It is suggested that the process be started as soon as possible.

IMPORTANT NOTICE TO POTENTIAL APPLICANTS: When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

Questions: Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. Part VII of this Funding Opportunity Announcement (FOA) explains how to submit other questions to the Department of Energy (DOE).

Application Receipt Notices

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of four e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to two (2) business days from application submission to receipt of email Number 2. The titles of the four e-mails are:

Number 1 - Grants.gov Submission Receipt Number

Number 2 - Grants.gov Submission Validation Receipt for Application Number

Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number

Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number

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PART I – FUNDING OPPORTUNITY DESCRIPTION

GENERAL INQUIRIES ABOUT THIS FOA SHOULD BE DIRECTED TO:

Technical/Scientific Program Contact:

Dr. Steve Eckstrand, Office of Fusion Energy Sciences, SC-24.2

PHONE: (301) 903-5546

E-MAIL: steve.eckstrand@science.doe.gov

STATUTORY AUTHORITY

Public Law 95-91, US Department of Energy Organization Act

Public Law 109-58, Energy Policy Act of 2005

APPLICABLE REGULATIONS

U.S. Department of Energy Financial Assistance Rules, codified at 10 CFR Part 600

U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 CFR Part 605

SUMMARY:

The Office of Fusion Energy Sciences (FES) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications from multi-institutional teams to carry out experimental research in magnetic fusion energy sciences on international tokamak facilities. The FES International Collaboration portfolio supports U.S scientific teams who work in collaboration with foreign scientists to explore critical science and technology issues at the frontiers of magnetic fusion research. These collaborations take advantage of the unique capabilities of the most advanced international research facilities. The Fusion Energy Sciences Advisory Committee (FESAC) International Collaboration Panel recently submitted a report entitled “International Collaboration in Fusion Energy Sciences Research: Opportunities and Modes during the ITER Era” on compelling opportunities for international collaboration:

http://science.energy.gov/~media/fes/pdf/workshop-reports/20120309/FESAC-Intl_Collaborations-final-report.pdf

The specific areas of interest for this FOA involve one of the major scientific challenges identified in this report: achieving high performance core plasma regimes suitable for long pulse. Specific topical areas of interest include:

1. Exploring and understanding the transport properties of high performance tokamak plasmas, including the dynamics of the current profile evolution consistent with transport behavior;
2. Studying and developing integrated control schemes capable of maintaining high performance plasmas at the desired operating point for long periods of time;
3. Establishing the physics and engineering of auxiliary systems that provide the means of controlling plasmas for long periods of time;
4. Understanding processes that couple the plasma to the material walls and exploring integrated solutions for the plasma material interface compatible with high performance core plasmas; and

5. Investigating and understanding the physics of transient events such as disruptions to ensure that they can be reliably avoided and developing mitigation techniques as a backup.

To be considered for funding, applicants must have discussed their proposed research with the program leaders and key scientific collaborators at the international facility or facilities where they propose to carry out collaborative research and must provide a letter of support for the proposed collaborative research from a program leader at each facility.

More specific information on each area of interest is included in the Description of Topical Areas section under SUPPLEMENTARY INFORMATION below.

A companion Program Announcement to DOE National Laboratories (LAB 12-714) will be posted on the Office of Science Grants and Contracts web site at: <http://www.science.doe.gov/grants>

SUPPLEMENTARY INFORMATION:

The mission of the Fusion Energy Sciences (FES) program is to expand the fundamental understanding of matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. As a major step toward realizing this mission, the U.S. is a partner in an international project to build and operate ITER, the world's largest scientific facility, to demonstrate the scientific and technological feasibility of fusion energy. ITER is currently under construction in Cadarache, France and is scheduled to begin operation around 2020. Looking toward the ITER era, a major goal of the FES program is develop the scientific work force needed to be a leader in burning plasma science so that the U.S. can contribute to and benefit from participation in the next generation of fusion research facilities, including ITER. While ITER is under construction, the FES program intends to make effective use of limited resources to explore critical issues at the frontiers of fusion research with a balanced program that exploits both the strength of its domestic research program and new capabilities that are becoming available on foreign fusion facilities.

One of the major scientific challenges that must be addressed on the path to fusion energy is: achieving high performance core plasma regimes suitable for long pulse.

Description of Topical Areas

The specific areas of interest for this FOA involve extending high performance regimes to long pulse and are the following:

1. Transport

The focus of this topical area is research on the transport of energy, particles and momentum in high performance tokamak plasmas. Understanding the dependence of transport on dimensionless parameters has proven to be a valuable tool in making extrapolations to future devices such as ITER. Multi-device studies of the normalized gyroradius (ρ^*) and collisionality (ν^*) dependences are needed to reduce the uncertainties in projections to future devices. In a very long-pulse tokamak, the plasma current must be sustained non-inductively by a combination of neutral beam

or radio-frequency current drive and the pressure gradient-driven bootstrap current. Since the pressure gradient depends on transport processes, it is also important to understand the interaction between the transport processes in the plasma and the current profile evolution.

2. Long Pulse Control

The focus of this topical area is research on integrated control schemes capable of maintaining high performance plasmas at the desired operating point for long periods of time. This involves operating near stability limits for pulse lengths much longer than have been achieved in current tokamaks and non-inductive sustainment of the plasma current. In a high beta plasma with high bootstrap fraction, the transport of energy, particles, momentum, and current become strongly interdependent. Further, the plasma stability is governed largely by the plasma pressure profile and the current density profile, which evolve on the transport time scale and the current redistribution time scale respectively. A key challenge is developing control schemes to maintain plasmas within stable operational boundaries and actively manage deleterious events such as tearing modes, ELMs and disruptions. This requires exploration of the operational limits to identify and optimize these limits, as well as the development and optimization of specific control tools such as 3-D field coils or localized current drive systems. An area of mutual benefit is to develop a range of techniques for stability control, ELM control or amelioration and disruption avoidance or mitigation in flexible U.S. facilities and then to participate in the extension of these techniques to long pulse in superconducting devices (where rapid change in some parameters is precluded).

3. Plasma Wall Interaction

The focus of this topical area is research on the processes that couple the plasma to the material walls and exploring integrated solutions for the plasma material interface that are compatible with high performance core plasmas. The materials for the plasma facing components in a fusion device must withstand high thermal power fluxes, retain a small fraction of incident fuel particles and maintain structural strength under intense neutron irradiation. One major concern is the long term survivability of plasma facing components due to materials degradation, erosion and migration. To date, power densities approaching those of a fusion power plant have been attained for only a few seconds. Moreover, these experiments used plasma facing materials not suitable for a fusion environment involving tritium fuel and intense neutron irradiation. The U.S. can develop candidate materials domestically, and assess them in test bed and tokamak facilities, though likely not to full thermal equilibrium. Furthermore, many facets of the structural evolution of materials under plasma exposure develop on a longer timescale. Important issues for collaborative research include: material erosion, migration and re-deposition, surface morphology evolution, material migration, and in-vessel inventory control of hydrogenic isotopes including co-deposition and permeation processes. A major opportunity is collaboration on plasma wall experiments using fusion relevant materials such as tungsten under the high temperature conditions $> 500^{\circ}\text{C}$ required for an efficient fusion power system.

4. Magnetic Divertor Optimization

Most designs for future fusion devices retain a magnetic divertor to channel the particles and heat away from the core plasma to a region where they can more easily be extracted. However, as average heat loads increase, better materials alone will not be sufficient to handle the heat flux. The heat flux depends on the scaling of the scrape-off-layer (SOL) profiles and parallel heat fluxes. Research is needed to better understand the physics of the SOL and to develop new

divertor configurations that spread the heat flux over a wider area without affecting the performance of the plasma core. There may be opportunities to extend new divertor configurations that are being studied current copper coil devices to new superconducting facilities.

5. Auxiliary Systems

The focus of this topical area is research on the physics and engineering of auxiliary systems that provide the means of controlling plasmas for long periods of time. In order to achieve and sustain high performance plasmas, systems that can heat and fuel the plasma, drive plasma current, handle the exhaust of heat and particles from the plasma, and modify the profiles of current density and pressure need to be developed or extended to meet the requirements of long-pulse to steady-state operation. An opportunity for mutual benefit is participation in the design and operation of such systems on large, superconducting tokamaks.

These research areas are interconnected, and success in developing fusion power requires that all of them be integrated in robust operating scenarios. Thus, proposed research may focus on one research area or a combination of areas. In addition, the proposed research may involve collaborations with one or more than one foreign facility.

Additional Considerations

All applications submitted in response to this FOA should be for topical teams that propose a coordinated US program of research on one or more foreign facilities. The decision on whether to focus on one or more than one foreign facility should be based on the specific research program being proposed. Topical teams involving scientists from national laboratories, universities, and/or industry are encouraged.

Management Structure

The applicants must propose and describe a management structure that enables an effective collaboration among the participants from various disciplines and institutions. The structure and management must be sufficiently flexible to adapt quickly to changing technical challenges and scientific needs. To that end, applicants must identify a Lead Principal Investigator, Principal Investigator(s) for each of the other institutions involved, and Senior/Key Personnel. Furthermore, they should specify the requested level of support from FES for each task. Typical duties, responsibilities and authorities for each category are provided below:

- **Lead Principal Investigator** - The Lead Principal Investigator must be employed by the Lead institution and will serve as the primary contact responsible for communications with DOE Program Officials on behalf of all of the Principal Investigators in the team.
- **Principal Investigator** - A Principal Investigator (PI) is the individual designated by each collaborating institution and empowered with the appropriate level of authority and responsibility for the proper conduct of the research within that organization. These authorities and responsibilities include the appropriate use of funds and administrative requirements such as the submission of scientific progress reports to DOE.
- **Senior/Key Personnel** - A senior/key person is an individual who contributes in a substantive, measurable way to the scientific or technical development or execution of the project.

Additional Guidance to Applicants

Applications must be formulated as three-year project with specific goals and deliverables that demonstrate the scientific merit and impact of the proposed research.

Additional Resources

1. Magnetic Fusion Energy Sciences Research Needs Workshop (ReNeW) report, June 2009,
http://science.energy.gov/~media/fes/pdf/workshop-reports/Res_needs_mag_fusion_report_june_2009.pdf
2. FESAC Report on Priorities, Gaps and Opportunities: Towards a Long-Range Strategic Plan for Magnetic Fusion Energy, October 2007,
http://science.energy.gov/~media/fes/fesac/pdf/2007/Fesac_planning_report.pdf

PART II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT.

DOE anticipates awarding Cooperative Agreements under this FOA.

B. ESTIMATED FUNDING.

It is anticipated that up to \$6,000,000 per year will be available for two to three topical teams. Thus, it is anticipated that up to eight awards may be made in FY 2013, contingent on the availability of appropriated funds. This amount is the total available funding for both this FOA and the associated Program Announcement. Awards are expected to be made for a period of three years at a funding level appropriate for the proposed scope, with out-year support contingent on the availability of appropriated funds and satisfactory progress. Funding for the final year is contingent upon satisfactory completion of a progress review during the second year of each project.

DOE is under no obligation to pay for any costs associated with the preparation or submission of an application. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this FOA. FES reserves the right to make fewer awards than would be possible at \$6,000,000 per year, if an insufficient number of applications are judged to be of suitable scientific quality or of sufficient relevance to the programs.

C. MAXIMUM AND MINIMUM AWARD SIZE.

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

D. EXPECTED NUMBER OF AWARDS.

It is expected that two to three awards will be made depending on the availability of appropriated funds.

E. ANTICIPATED AWARD SIZE.

The award size is expected to be \$2,000,000 - \$3,000,000 per team and will depend on the number of meritorious applications and the availability of appropriated funds.

F. PERIOD OF PERFORMANCE.

A maximum of three years will be considered. Out-year funding will depend upon suitable progress and the availability of appropriated funds. Funding for the final year is contingent upon satisfactory completion of a progress review during the second year of each project.

G. TYPE OF APPLICATION.

DOE will accept new applications under this FOA.

PART III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS.

All types of domestic entities are eligible to apply, except other Federal agencies, Federally Funded Research and Development Center (FFRDC) Contractors, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.

B. COST SHARING.

Cost sharing is not required.

C. OTHER ELIGIBILITY REQUIREMENTS.

N/A

PART IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE.

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 select "**Download a Grant Application Package**". Enter the CFDA and/or the funding opportunity number located on the cover of this FOA and then follow the prompts to download the application package.

B. LETTER OF INTENT AND PRE-APPLICATION.

1. Letter of Intent.

N/A

2. Pre-Application.

Pre-Applications are **REQUIRED** and must be submitted by May 14, 2012, 11:59 PM Eastern Time. **Failure to submit a pre-application by an applicant will preclude the full application from due consideration.** The pre-application should be submitted electronically by E-mail to Steve.Eckstrand@science.doe.gov and John.Sauter@science.doe.gov. **Please include "Pre-Application for DE-FOA-0000714" in the subject line.** A response to the pre-applications encouraging or discouraging formal applications will be communicated to the applicants by May 21, 2012. Applicants who have not received a response regarding the status of their pre-application by this date are responsible for contacting the program to confirm this status.

Pre-Applications should include cover page information, a brief description of the proposed work (1-2 pages, including text with minimum font size 11 point, figures, and references), and a one-page curriculum vitae from each Principal Investigator (PI), co-Principal Investigator (co-PI), and senior collaborator or consultant. The cover page should include: (a) A statement that the document is a pre-application in response to FOA # DE-FOA-0000714; (b) Lead PI information: name, institutional affiliation, telephone number, fax number, and e-mail address; and, (c) names and institutions of all Institutional PIs, and senior collaborators or consultants (excluding postdoctoral associates and graduate students). Since among the purposes of the pre-application is to facilitate FES in planning the merit review and the selection of peer-reviewers without conflicts of interest, it is important that applicants ensure their list of supported or unsupported participants is as comprehensive as possible.

Pre-applications will be reviewed by FES program officials for responsiveness to this FOA, eligibility of the applicant organization, and qualification of the applicant's personnel for carrying out materials research activities. Only those applicants who receive notification from DOE encouraging a full application may submit a formal application. **No other formal applications will be considered.**

C. CONTENT AND FORM OF APPLICATION – SF 424 (R&R).

You must complete the mandatory forms and any applicable optional forms (e.g., SF-LLL-Disclosure of Lobbying Activities) in accordance with the instructions on the forms and the additional instructions below. **Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this FOA.**

1. SF 424 (R&R).

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. The list of certifications and assurances referenced in Field 17 can be found on the DOE Financial Assistance Forms Page at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>, under Certifications and Assurances.

By submitting an application in response to this FOA the Applicant certifies that:

- It is **not** a corporation that has been convicted (or had an officer or agent of such corporation acting on behalf of the corporation convicted) of a felony criminal violation under any Federal law within the preceding 24 months,
- It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability,
- If the Applicant's financial assistance application is chosen for award and the award is in excess of \$1,000,000, the applicant will, by the end of the fiscal year, upgrade the efficiency of their facilities by replacing any lighting that does not meet or exceed the energy efficiency standard for incandescent light bulbs set forth in Section 325 of the Energy Policy and Conservation Act (42 U.S.C. 6295).

2. RESEARCH AND RELATED Other Project Information.

Complete questions 1 through 6 and attach files. The files must comply with the following instructions:

Project Summary/Abstract (Field 7 on the Form).

The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s) (PD/PI), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public. The project summary must not exceed 1-2 pages when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click "Add Attachment."

Project Narrative (Field 8 on the Form).

The project narrative **must not exceed 25 pages** of technical information, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5” by 11” paper with 1 inch margins (top, bottom, left, and right). **EVALUATORS WILL ONLY REVIEW THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE.** The font must not be smaller than 11 point.

Please submit letters of support only from the foreign facility program managers and from unfunded collaborators whose work is important to the research project, if applicable.

Please do not submit general letters of support as these are not used in making funding decisions and can interfere with the selection of peer reviewers.

Do not include any Internet addresses (URLs) that provide information necessary to review the application, because the information contained in these sites will not be reviewed. See Part VIII.D for instructions on how to mark proprietary application information. To attach a Project Narrative, click “Add Attachment.”

The application narrative should begin with a cover page that includes: the project title, the Lead PI’s name and complete contact information.

The cover page must also include the following information (this page will not count in the project narrative page limitation):

Applicant/Institution:

Street Address/City/State/Zip:

Principal Investigator:

Postal Address:

Telephone Number:

Email:

Funding Opportunity Announcement Number: DE-FOA-0000714

DOE/Office of Science Program Office: Office of Fusion Energy Sciences

DOE/Office of Science Program Office Technical Contact: Dr. Steve Eckstrand

DOE Grant Number (if Renewal or Supplemental Application):

Is this a Collaboration? If yes, please list ALL Collaborating Institutions/Pis and indicate which ones will also be submitting applications. Also indicate the Lead PI who will be the point of contact and coordinator for the combined research activity. Since this FOA involves research collaborations on one or more foreign research facilities, all applicants must discuss their proposed research with the program leaders and key scientific collaborators at each of the international facilities where they propose to collaborate and provide a letter of support for the proposed collaboration from a program leader at each facility.

Collaborative applications submitted from different institutions should clearly indicate they are part of a topical project/team. Every partner institution must submit an application through its own business office. Each application within the topical team, including the narrative and all required appendices and attachments, should be identical with one exception: each application should

contain unique budget and budget justification documents corresponding to the expenditures for that application's submitting institution only. Each topical team can have only one Lead PI and one lead institution, which should be identified in the common narrative. The common narrative should also contain a summary table listing the institutions involved, the PI for each institution, and a budget breakdown by institution for all participants.

Each application belonging to a collaborative group should have the same title in Block 11 of the SF 424 (R&R) form.

Our intent is to create from the various applications associated with a collaborative group one document for merit review that consists of the common, identical required appendices and attachments combined with a set of detailed budgets from the partner institutions. Thus, it is very important that every application in the collaborative group be exactly identical (including the title) with the exception of the budget and budget justification pages.

Project Objectives:

This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.

The Project Narrative comprises the research plan for the project, it should contain enough background material in the Introduction, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the method to be used. It should also include a timeline for the major activities of the proposed project, and should indicate which project personnel will be responsible for which activities.

Appendix 1: Biographical Sketch.

Provide a biographical sketch for the project director/principal investigator (PD/PI) and each senior/key person listed in Section A on the R&R Budget form. **Provide the Biographical Sketch information as an Appendix to your Project Narrative. Do not attach a separate file. The Biographical Sketch Appendix will not count in the Project Narrative page limitation.**

The biographical information (curriculum vitae) for each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include:

Education and Training. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

Research and Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume

number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than 5 professional and scholarly activities related to the effort proposed.

Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers. Provide the following information in this section:

Collaborators and Co-editors: List in alphabetical order all persons, including their current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this application. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the Principal Investigator interacted on a regular basis while the research was being done. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this application. If there are no collaborators or co-editors to report, state “None.”

Graduate and Postdoctoral Advisors and Advisees: List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s) during the last 5 years. Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates during the past 5 years.

Appendix 2: Current and Pending Support.

Provide a list of all current and pending support (both Federal and non-Federal) for the Project Director/Principal Investigator(s) (PD/PI) and senior/key persons, including subawardees, for ongoing projects and pending applications. For each organization providing support, show the total award amount for the entire award period (including indirect costs) and the number of person-months per year to be devoted to the project by the senior/key person. **Provide the Current and Pending Support as an Appendix to your Project Narrative. Do not attach a separate file. The Current and Pending Support Appendix will not count in the Project Narrative page limitation.** Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review.

Appendix 3: Bibliography and References Cited.

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. **Provide the Bibliography and References Cited information as an Appendix to your Project Narrative. Do not attach a separate file. This Appendix will not count in the Project Narrative page limitation.**

Appendix 4: Facilities and Other Resources.

This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. **Provide the Facilities and Other Resources information as an Appendix to your Project Narrative. Do not attach a separate file. The Facilities and Other Resources Appendix will not count in the Project Narrative page limitation.**

Appendix 5: Equipment.

List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities. **Provide the Equipment information as an Appendix to your Project Narrative. Do not attach a separate file. The Equipment Appendix will not count in the Project Narrative page limitation.**

Appendix 6: Other Attachment.

If you need to elaborate on your responses to questions 1-6 on the “Other Project Information” document, **please provide the Other Attachment information as an Appendix to your Project Narrative. Do not attach a separate file. The Other Attachment Appendix will not count in the Project Narrative page limitation.**

Do not attach any of the requested Appendices described above as files for fields 9, 10, 11, and 12. Instead follow the above instructions to include the information as Appendices to the Project Narrative file (these Appendices will not count in the Project Narrative page limitation).

3. RESEARCH AND RELATED BUDGET.

Complete the Research and Related Budget form in accordance with the instructions on the form and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this FOA (See PART IV, G).

Budget Justification (Field K on the form).

Provide the required supporting information for the following costs: equipment; domestic and foreign travel; participant/trainees; material and supplies; publication; consultant services; ADP/computer services; subaward/consortium/contractual; equipment or facility rental/user fees; alterations and renovations; and indirect cost type. Provide any other information you wish to submit to justify your budget request. **Attach a single budget justification file for the entire project period in Field K.** The file automatically carries over to each budget year.

4. R&R SUBAWARD BUDGET ATTACHMENT(S) FORM.

Budgets for Subawardees, other than DOE FFRDC Contractors. You must provide a separate cumulative R&R budget for each subawardee that is expected to perform work estimated to be more than \$100,000 or 50 percent of the total work effort (whichever is less). If you are selected for award, you must submit a multi-year budget for each of these subawardees. Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET ATTACHMENT(S) FORM and e-mail it to each subawardee that is required to submit a separate budget. After the Subawardee has e-mailed its completed budget back to you, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee’s name (plus .xfd) as the file name (e.g., ucla.xfd or energyres.xfd).

5. PROJECT/PERFORMANCE SITE LOCATION(s).

Indicate the primary site where the work will be performed. If a portion of the project will be performed at any other site(s), identify the site location(s) in the blocks provided.

Note that the Project/Performance Site Congressional District is entered in the format of the 2 digit state code followed by a dash and a 3 digit Congressional district code, for example VA-001. Hover over this field for additional instructions.

Use the Next Site button to expand the form to add additional Project/Performance Site Locations.

6. SF-LLL Disclosure of Lobbying Activities.

If applicable, complete SF- LLL. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

Summary of Required Forms/Files

Your application must include the following documents:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH AND RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative, including required appendices	PDF	Field 8
RESEARCH & RELATED BUDGET	Form	N/A
Budget Justification	PDF	Field K
PROJECT/PERFORMANCE SITE LOCATION(S)	Form	N/A
SF-LLL Disclosure of Lobbying Activities, if applicable	Form	N/A

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS.

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR Part 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable

E. SUBMISSION DATES AND TIMES.

1. Letter of Intent.

N/A

2. Pre-Application.

Pre-Applications are **REQUIRED** and must be submitted by May 14, 2012, 11:59 PM Eastern Time. **Failure to submit a pre-application by an applicant will preclude the full application from due consideration.** The pre-application should be submitted electronically by E-mail to steve.eckstrand@science.doe.gov and John.Sauter@science.doe.gov. **Please include "Pre-Application for DE-FOA-0000714" in the subject line.** A response to the pre-applications encouraging or discouraging formal applications will be communicated to the applicants by May 21, 2012. Applicants who have not received a response regarding the status of their pre-application by this date are responsible for contacting the program to confirm this status.

Pre-Applications should include cover page information, a brief description of the proposed work (1-2 pages, including text with minimum font size 11 point, figures, and references), and a one-page curriculum vitae from each Principal Investigator (PI), co- Principal Investigator (co-PI), and senior collaborator or consultant. The cover page should include: (a) A statement that the document is a pre-application in response to FOA # DE-FOA-0000714; (b) Lead PI information: name, institutional affiliation, telephone number, fax number, and e-mail address; and, (c) names and institutions of all Institutional PIs, and senior collaborators or consultants (excluding postdoctoral associates). Since among the purposes of the pre-application is to facilitate FES in planning the merit review and the selection of peer-reviewers without conflicts of interest, it is important that applicants ensure their list of supported or unsupported participants is as comprehensive as possible.

Pre-Applications will be reviewed by FES program officials for responsiveness to this FOA, eligibility of the applicant organization, and qualification of the applicant's personnel for carrying out materials research activities. Only those applicants who receive notification from DOE encouraging a full application may submit a formal application. **No other formal applications will be considered.**

3. Formal Applications.

APPLICATION DUE DATE: June 21, 2012, 11:59 PM Eastern Time

Formal applications submitted in response to this FOA must be received by Thursday, June 21, 2012, 11:59 PM Eastern Time, to permit timely consideration of awards in Fiscal Year 2012. **You are encouraged to submit your application well before the deadline. APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

F. INTERGOVERNMENTAL REVIEW.

This program is not subject to Executive Order 12372 Intergovernmental Review of Federal Programs.

G. FUNDING RESTRICTIONS.

Cost Principles. Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600. The cost principles for commercial organization are in FAR Part 31.

Pre-award Costs. Recipients may charge to an award resulting from this FOA pre-award costs that were incurred within the ninety (90) calendar-day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90-day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS.

1. Where to Submit.

APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV TO BE CONSIDERED FOR AWARD.

Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@grants.gov.

2. Registration Process.

You must COMPLETE the one-time registration process (all steps) before you can submit your first application through Grants.gov. We recommend that you start this process at least three weeks before the application due date. It may take 21 days or more to complete the entire

process. To register with Grants.gov go to “Get Registered” at http://grants.gov/applicants/get_registered.jsp. Use the Grants.gov Organization Registration Checklist at <http://www.grants.gov/assets/OrganizationRegCheck.pdf> to guide you through the process. **IMPORTANT:** During the CCR registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called "Marketing Partner Identification Number" (MPIN). When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e., Grants.gov registration).

You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Remember you have to update your CCR registration annually.

3. Application Receipt Notices.

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of four e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to two (2) business days from application submission to receipt of email Number 2. The titles of the four e-mails are:

Number 1 - Grants.gov Submission Receipt Number

Number 2 - Grants.gov Submission Validation Receipt for Application Number

Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number

Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number

PART V - APPLICATION REVIEW INFORMATION

A. CRITERIA.

1. Initial Review Criteria.

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR Part 605.10(b) to determine that (1) the applicant is eligible for the award; (2) the information required by the FOA has been submitted; (3) all mandatory requirements are satisfied; and (4) the proposed project is responsive to the objectives of the FOA. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

2. Merit Review Criteria.

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance codified at 10 CFR Part 605.10(d):

1. Scientific and/or Technical Merit of the Project

- *What is the potential impact of proposed research on the feasibility of fusion energy and what is the urgency of carrying out this research?*
- *How significant and distinctive would the US contribution be?*
- *Does the proposed research have a positive synergy with US domestic research programs?*
- *Would the proposed research program strengthen and extend the US scientific workforce in areas needed to carry out the US fusion program in the longer term?*

2. Appropriateness of the Proposed Method or Approach

- *Is the conceptual framework of the proposed research adequately developed and appropriate?*
- *Does the proposed research effectively exploit US scientific strengths?*
- *Are there significant potential problems in the proposed method or approach? If so, are the applicant's plans to address these problems—including the consideration of alternative strategies—adequate?*

3. Competency of Applicant's Personnel and Adequacy of Proposed Resources

- *Has the applicant identified a credible and cost-effective collaboration between US scientists and foreign scientists?*
- *Have the resources needed from the host facility been clearly identified?*
- *Do the Lead Principal Investigator and other Principal Investigators have proven records of success in managing diverse teams of scientific and technical experts and delivering results?*
- *Are the roles and intellectual contributions of the Lead Principal Investigator, the other Principal Investigators and senior/key personnel adequately described and supported?*

4. Reasonableness and Appropriateness of the Proposed Budget

- *Is the applicant's requested budget appropriate?*
- *Does the requested budget support the applicant's specified management structure?*

The evaluation process will include program policy factors such as the relevance of the proposed research to the terms of the FOA and the agency's programmatic needs. Note that external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES.

It is anticipated that selections will be completed by August 28, 2012.

PART VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES.

1. Notice of Selection.

Selected Applicants Notification: DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Part IV.G with respect to the allowability of pre-award costs.)

Non-selected Notification: Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award.

An Assistance Agreement issued by the contracting officer is the authorizing award document. It normally includes, either as an attachment or by reference: 1. Special Terms and Conditions; 2. Applicable program regulations, if any; 3. Application as approved by DOE; 4. DOE assistance regulations at 10 CFR Part 600; 5. National Policy Assurances to Be Incorporated As Award Terms; 6. Budget Summary; and 7. Federal Assistance Reporting Checklist, which identifies the reporting requirements.

For grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular 2 CFR, the Award also includes the Research Terms and Conditions located at <http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp>

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS.

1. Administrative Requirements.

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR Part 600 and 10 CFR Part 605 (See: <http://ecfr.gpoaccess.gov>). Grants and cooperative agreements made to universities, non-profits and other entities subject to Title 2 CFR are subject to the Research Terms and Conditions located on the National Science Foundation web site at <http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp>.

DUNS and CCR Requirements.

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR, Part 25 (See: <http://ecfr.gpoaccess.gov>). Prime awardees must keep their data at CCR current. Subawardees at all tiers must obtain DUNS numbers and provide the DUNS to the prime awardee before the subaward can be issued.

Subaward and Executive Reporting.

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR, Part 170. (See: <http://ecfr.gpoaccess.gov>). Prime awardees must register with the new FSRS database and report the required data on their first tier subawardees. Prime awardees must report the executive compensation for their own executives as part of their registration profile in the CCR.

2. Special Terms and Conditions and National Policy Requirements.

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at: <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>. The National Policy Assurances to Be Incorporated As Award Terms are located at <http://www.nsf.gov/bfa/dias/policy/rtc/appc.pdf>.

Intellectual Property Provisions.

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at <http://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards>.

Statement of Substantial Involvement.

Either a grant or cooperative agreement may be awarded under this FOA. If the award is a cooperative agreement, the DOE Contract Specialist and DOE Project Officer will negotiate a Statement of Substantial Involvement prior to award.

C. REPORTING.

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F4600.2, attached to the award agreement. For a sample Checklist, see <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>.

PART VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS.

Questions regarding the content of the FOA must be submitted through the FedConnect portal. You must register with FedConnect to respond as an interested party to submit questions, and to view responses to questions. It is recommended that you register as soon after release of the FOA as possible to have the benefit of all responses. More information is available at:

https://www.fedconnect.net/FedConnect/PublicPages/FedConnect_Ready_Set_Go.pdf.

DOE will try to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website.

Applications submitted through FedConnect will not be accepted.

Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. DOE cannot answer these questions.

B. AGENCY CONTACTS.

Technical/Scientific Program Contacts:

Dr. Steve Eckstrand, Office of Fusion Energy Sciences, SC-24.2

PHONE: (301) 903-5546

E-MAIL: steve.eckstrand@science.doe.gov

PART VIII - OTHER INFORMATION

A. MODIFICATIONS.

Notices of any modifications to this FOA will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification or an FOA message is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon after release of the FOA as possible to ensure you receive timely notice of any modifications or other FOAs. More information is available at <http://www.fedconnect.net>.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE.

DOE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS.

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. PROPRIETARY APPLICATION INFORMATION.

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the application which are to be restricted:

“The data contained in pages ____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government’s right to use or disclose data obtained without restriction from any source, including the applicant.”

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

“The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation.”

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL.

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM.

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See “Notice of Right to Request Patent Waiver” in paragraph G below.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE’s own needs or to insure the commercialization of technology developed under a DOE agreement.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER.

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this FOA, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.12, http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title10/10cfr784_main_02.tpl.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

H. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES.

N/A

I. AVAILABILITY OF FUNDS.

Funds are not presently available for this award. The Government's obligation under this award is contingent upon the availability of appropriated funds from which payment for award purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the Contracting Officer for this award and until the awardee receives notice of such availability, to be confirmed in writing by the Contracting Officer.