Frontiers in Earth System Dynamics

PROGRAM SOLICITATION
NSF 12-547

REPLACES DOCUMENT(S):
NSF 10-577

National Science Foundation

Directorate for Geosciences
Division of Earth Sciences
Division of Ocean Sciences
Division of Atmospheric and Geospace Sciences

Preliminary Proposal Due Date(s) ***(required)*** (due by 5 p.m. proposer's local time)***:***

July 02, 2012

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

March 04, 2013

Full Proposals are by invitation only. (Invitations will be made by NSF based on the review of Preliminary Proposals)

IMPORTANT INFORMATION AND REVISION NOTES

Revisions Include:

1. Change of deadlines (pre-proposals and full proposals)

2. Change of page length (pre-proposals and full proposals).

3. Change of some program directors.

4. Full proposals: The required "Management and Integration Plan," and "Results of Prior Support," which were previously included in "Supplementary Documents" have been moved into the Project Description section. The number of pages for these two sections remains the same as in the previous solicitation.

5. Minor wording changes have been made throughout.

6. Additions have been made to the FAQs.

7. Award conditions: changed to state that all FESD awards will be standard or continuing awards. Cooperative agreements have been removed as a funding mechanism.

8. Budget requests may not exceed $5M.

9. Changes have been made in the treatment of costs for research platforms and facilities, such as ship time. The total FESD budget, including platform and facility costs, must be included in the $5M budget cap.

10. Minor wording changes have been made in the description of Type II proposals.

11. Requirements for pre-proposal budgets have been modified.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Frontiers in Earth System Dynamics

Synopsis of Program:

The Earth is often characterized as "dynamic" because its systems are variable over space and time, and they can respond rapidly to multiple perturbations. The goals of the Frontiers in Earth System Dynamics (FESD) program are to: (1) foster an inter-disciplinary and multi-scale understanding of the interplay among and within the various sub-systems of the Earth, (2) catalyze research in areas poised for a major advance, (3) improve data resolution and modeling capabilities to more realistically simulate complex processes and forecast disruptive or threshold events, and (4) improve knowledge of the resilience of the Earth and its subsystems.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Chungu Lu, telephone: (703) 292-8524, email: clu@nsf.gov
- Therese Moretto Jorgensen, Program Director, AGS, 775 S, telephone: (703) 292-8518, email: tjorgens@nsf.gov
- Robin Reichlin, Program Director, EAR, 785 N, telephone: (703) 292-4741, email: rreichli@nsf.gov
- Simone Metz, Program Director, OCE, 725 N, telephone: (703) 292-4964, email: smetz@nsf.gov
- Paul Cutler, Program Director, EAR, 785 N, telephone: (703) 292-4961, email: pcutler@nsf.gov
- James Beard, Program Director, OCE, 725 N, telephone: (703) 292-7583, email: jbeard@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.050 --- Geosciences

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 6 to 10 --NSF anticipates funding a combined total of 6-10 Type I (Frontier Research projects) and Type II (Geoscience Collaboratories or Synthesis Centers) proposals. Project sizes for Type I and Type II proposals are expected to range from approximately $3,000,000 to $5,000,000 for 3-5 years duration, although smaller awards may be made in some circumstances. The scope of FESD projects is expected to be well beyond that which can be supported in GEO's core programs. There are no fixed constraints on the number of Type I and Type II proposals that will be funded.

Anticipated Funding Amount: $28,000,000

A total of $28,000,000 for FY13 and 14, pending availability of Funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI or Co-PI: 2

An individual may serve as Director (project, center or collaboratory director) on only one FESD proposal (either Type I or Type II), but may be involved in a second proposal in another capacity. No individual may be involved in more than two FESD proposals (either Type I or Type II). The project/center/collaboratory director role is defined in the Program Description section of the FESD solicitation in the description of Type I and Type II proposals.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- Letters of Intent: Not Applicable
- Preliminary Proposals: Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- Full Proposals:
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- Cost Sharing Requirements: Inclusion of voluntary committed cost sharing is prohibited.

- Indirect Cost (F&A) Limitations: Not Applicable
- Other Budgetary Limitations: Not Applicable

C. Due Dates

- Preliminary Proposal Due Date(s) ***(required)*** (due by 5 p.m. proposer's local time)*:*

  July 02, 2012

- Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

  March 04, 2013

  Full Proposals are by invitation only. (Invitations will be made by NSF based on the review of Preliminary Proposals)

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

Enormous strides have been made in recent decades in understanding the dynamics of individual components of the Earth system (e.g. space weather, mantle geodynamics, marine population dynamics). Major advances in instrumentation, experimental facilities and observing networks are providing unprecedented volumes of data on physical, chemical, geological, and biological processes operating within the Earth system, and are transforming our view of the dynamics of inaccessible realms from geospace to the deep ocean to the Earth's core. These advances have led to the development of more realistic, 3-D, time-dependent models of complex Earth system components and better forecasting of disruptive events and their potential impact.

Despite these remarkable advances, we lack a comprehensive knowledge of how the Earth and surrounding geospace environment operates as a *system*. The Earth system, as defined for this solicitation, includes the solid Earth (core, mantle and crust), it's terrestrial surface, oceans, atmosphere, and geospace (upper regions of the atmosphere, ionosphere, magnetosphere, and solar atmosphere), and the physical, chemical, geological, and biological processes that drive the system. Major challenges for the near future include: 1) developing an integrated and multi-scale understanding of diverse Earth processes that couple across spatial and

temporal scales; 2) improving data resolution and modeling capabilities to develop a better predictive understanding of how rapidly these systems change; and 3) determining how resilient these systems are to human intervention.

Many important scientific questions in the earth system lie at the intersection of the traditional disciplines within the earth, ocean, atmospheric, geospace and ecological sciences supported by the Geoscience Directorate. Mechanisms are needed to facilitate collaborative research groups drawn from these different disciplines, as well as to train the next generation of geoscientists to work together to address key problems in Earth-system dynamics. Progress in many frontier research areas in Earth system science requires assembling teams of investigators to work on large, complex systems that are beyond the scope of projects typically supported by the Directorate for Geosciences (GEO) core research programs. Understanding and predicting the behavior of the complex and evolving Earth system is identified in the recently published *GEOVision* report (2009) as one of major challenges facing the geosciences community. The Frontiers in Earth System Dynamics (FESD) program has been developed to address this challenge.

II. PROGRAM DESCRIPTION

FESD will support fundamental research into Earth system dynamics, focusing on scientific questions at the frontiers of the geosciences. FESD is a program involving all Divisions in the Directorate of Geosciences (GEO): Atmospheric and Geospace Sciences (AGS); Earth Sciences (EAR); and Ocean Sciences (OCE), and their component science programs. It will complement and strengthen individual, investigator-driven science funded through GEO's core research programs and the ongoing Climate Research Investment portfolio (CRI), capitalizing, where appropriate, on major facility investments GEO is already making (e.g. Ocean Observing Initiative (OOI), EarthScope, NSF/NCAR GV aircraft).

The focus of FESD will be to explore the coupling among different aspects of the Earth's component systems over a range of temporal and spatial scales. FESD projects must ultimately advance our understanding of first-order questions at the frontiers of the geosciences. Domains for research can involve the Earth's core and mantle, the terrestrial, marine, atmospheric, and geospace systems and the linkages among these various parts of the planet as well as connections to solar processes. Possible themes may include, but are not limited to, self-organization within and between components of the Earth system; response to and recovery from major perturbations; rates and mechanisms of dynamic processes; improving resolution of measurements; long-term changes in the Earth system dynamics. Some examples of potential science themes that would be appropriate for FESD are listed in the attached Frequently Asked Questions (FAQs). These are not intended to be exclusive, but merely representative of the scope of projects that would be appropriate for FESD.

Projects are expected to involve collaborations among investigators from different Geoscience disciplinary specialties. Inclusion of collaboration with other science fields is also welcome. FESD also strongly encourages the involvement of early-career investigators.

FESD will support two types of awards:

(a) Type I: Projects that bring together interdisciplinary teams of researchers to address a specific frontier research problem or grand challenge in the geosciences. These proposals may include investigators at all career levels, and as with most NSF proposals, may include student and post-doctoral support and training. Type I proposals should identify a project director who will serve as PI, and will be responsible for coordination and integration of all aspects of the project. (see FAQs for additional information about the difference between Type I and Type II projects).

(b) Type II: Research Synthesis Centers or Geoscience Collaboratories that promote interdisciplinary investigation of frontier research questions in the academic scientific community, build and sustain collaborative and interdisciplinary connections among investigators, integrate research results from existing data and models, and attract students and early-career researchers to these frontier research areas. Synthesis or Collaboratory activities should be aimed at creating opportunities at the community level that reach beyond the scope of the proposing team and include development of new modes of collaboration and training. Type II proposals should include mechanisms for community input and oversight of the activity within the management plan. Type II projects should identify a center or collaboratory director who will serve as PI, and will be responsible for management, coordination and integration of all aspects of the center or collaboratory. (see FAQs for additional information about the difference between Type I and Type II projects).

All FESD projects will be expected meet NSF's broader impacts review criteria by fostering integration of research and education, broadening participation of underrepresented groups, enhancing infrastructure for research and education and/or disseminating scientific results to the broader scientific community and to the general public. The activities of FESD-funded synthesis centers or collaboratories will be specifically designed to attract students and early career researchers. Successful projects will include creative, integrative and effective broader impact activities developed within the context of the mission, goals, and resources of the organizations involved. Partnerships with institutions serving students under-represented in the Geosciences are especially encouraged. The broader impacts activities must be an integral part of the proposed research and this should be reflected in the expertise of collaborators, the proposal budget and budget justification.

III. AWARD INFORMATION

NSF anticipates funding a combined total of 6-10 Type I (Frontier Research projects) and Type II (Geoscience Collaboratories or Synthesis Centers) proposals. Project sizes for Type I and Type II proposals are expected to range from approximately $3,000,000 to $5,000,000 for 3-5 years duration, although smaller awards may be made in some circumstances. The scope of FESD projects is expected to be well beyond that which can be supported in GEO's core programs.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI or Co-PI: 2

An individual may serve as Director (project, center or collaboratory director) on only one FESD proposal (either Type I or Type II), but may be involved in a second proposal in another capacity. No individual may be involved in more than two FESD proposals (either Type I or Type II). The project/center/collaboratory director role is defined in the Program Description section of the FESD solicitation in the description of Type I and Type II proposals.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals ***(required):*** Preliminary proposals are required and must be submitted via the NSF FastLane system, even if full proposals will be submitted via Grants.gov.

Preliminary Proposals (required): Deadline July 2, 2012

Preliminary proposals will be reviewed by NSF staff and selected external reviewers to determine the merit and suitability of the proposed project for the FESD competition. A subset of applicants will be invited to submit full proposals. Invitations to submit full proposals will be sent by email no later than December 28, 2012.

Preliminary proposals should be submitted by a single institution, with a PI who will be the project lead (Type I) or center director (Type II). If multiple institutions are involved, this information should be included in the lead institution's submission.

The preliminary proposal must include the following:

1. NSF Cover page indicating Type 1 or Type 2 proposals. Check the box labeled "If this is a preliminary proposal".
2. Title: The title for the FESD project must begin with "FESD Preliminary Proposal, Type I" or "FESD Preliminary Proposal, Type II: "
3. Project Summary may be no more than 1 page in length. The project summary should include a brief summary of the collaborating institutions and personnel. It should clearly summarize the major features of the project and explicitly address intellectual merit and broader impacts.
4. Project Description-7 pages total (a maximum of 5 pages to describe the project, plus 2 pages for a coordination plan). The 5 page description should lay out the project objectives, their relationship to the FESD program goals, and the work plan to accomplish the objectives. *The project description should explicitly include a brief description of 1) a statement about why the proposed research is poised for a major advance, 2) why it requires a team-based interdisciplinary approach, and 3) why it is potentially transformative. The project description should also outline the creative, integrative and effective broader impact activities developed within the context of the mission, goals, and resources of the organizations involved.* The 2 page coordination plan should include a list of the full set of collaborators and their role in the project, as well as a description of the management plan that addresses how the project and people will be coordinated.
5. NSF biosketches of proposed PI, Co-PIs and collaborators from all institutions
6. A cumulative budget should be included in the official budget section of the proposal (annual budgets are not necessary). Any amounts going to collaborating institutions should be totaled and indicated under subcontracts. Also include an additional page in the budget justification to show a breakdown of the totals going to each institution listed in the subcontracts using the same categories used for NSF budgets. This page should be a single spreadsheet showing the Total budget by major category and institution. A sample template for this spreadsheet is available at http://www.nsf.gov/geo/fesd.
7. Electronic Documents: The proposers must send the following document immediately after submission of their pre-proposal. This document must be in Excel, CSV format, e-mailed manually to fesd@nsf.gov after proposal submission, with subject heading referring to the 7-digit proposal number assigned by NSF. The description of content of this document follows:

   * "List of Personnel, Collaborators and Affiliates": After receipt of the proposal number from FastLane, send an e-mail to fesd@nsf.gov. The subject heading of the e-mail should note the proposal number and the lead institution. Attach the document described below, prepared on a template that is available at http://www.nsf.gov/geo/fesd. NSF personnel will use automated data handling of this document. To facilitate this, the file should be in the CSV "flat text" format, with unformatted data entry under the column headings (Proposal Number, PI or SP Last_Name, etc.) in the template. Carriage returns, splitting items over multiple cells, extra spaces, etc., will interfere with automated handling. The document is an Excel spreadsheet containing two lists: one (columns C-E) lists the last names, first names and institutional affiliations of all PIs, Co-PIs, and other senior personnel; the second (columns F-H) lists the full names and institutional affiliations of all people having conflicts of interest with any PIs, Co-PIs, and other senior personnel. This list will be used by NSF to check for conflicts of interest in assembling the review community. The file name should be the full seven digit NSF proposal number; not the temporary proposal number used during proposal preparation) followed by the three characters "coi" (for example, for a proposal number 1212345, this file name will be 1212345coi.csv where the extension csv will be automatically added by Excel when saving the file using the CSV format). The 7-digit proposal number should appear in every row of the file, in column B, as indicated by the sample that is available at http://www.nsf.gov/geo/fesd. Each project participant in columns C-E should be listed (repeatedly) in all rows that name his/her conflicted individuals in columns F-H, as in the sample.

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

FESD full proposals may be submitted by invitation only. PIs will be notified by email no later than December 28, 2012 if they are invited to submit a full proposal. Any deviations from the research team cited in the preliminary proposal, deviations from the scope of the preliminary proposal, or deviations from the preliminary proposal budget by more than 10%, must be approved by NSF prior to full proposal submission.

All FESD proposals must be submitted by a single institution (not as separately submitted "collaborative proposals"), with the lead PI as the project (Type I) or center (Type II) director. When multiple institutions are involved (which is expected to be common), budgets should be included for subcontracts to secondary institutions and collaborating personnel. FESD projects and centers are expected to have strong management and integration plans that clearly articulate how the group activity will be coordinated and function.

(A) Cover page - The title of the proposed project should begin with the string "FESD Type I:..." or "FESD Type II:..."

(B) Project Summary- The first text of the Project Summary must be the NSF-generated PRE-PROPOSAL NUMBER (to be placed in the overview section text box). The Project Summary may be no more than 1 page in length. It should clearly summarize the major features of the project and explicitly address intellectual merits and broader impacts in the text boxes provided.

(C) Project Description, comprised of three sections with specific length conditions:

1) Proposed Research: 20 pages maximum (see detailed description below)

2) Management and Integration plan: 2 pages for Type I proposals and 3 pages for Type II proposals

(these pages are in addition to the 20 pages for proposed research, details are provided below)

3) Results of prior support: 1 page per team member, as described below

(these pages are in addition to the 20 pages for proposed research, details provided below)

(i) Proposed Research. (Narrative, 20 pages)

- A description of the proposed research and how it fits into the Earth System Dynamics theme.
- An explanation of the scientific context and timeliness of the proposed project.
- A complete list of all personnel and institutions involved in the project, and explicit justification for all personnel.
- A justification for why a multidisciplinary team approach is necessary to achieve the project goals, and how the proposed team fulfills this requirement.
- A work plan and time line to achieve the proposed scientific objectives.
- Plans for disseminating the results, including the sharing of data, models, infrastructure and other tools developed as part of the proposed research.
- Plans for student mentoring, outreach, diversity and other broader impacts.

ii) Statement of eligibility for FESD. The proposal must include an explicit eligibility statement of up to one page length within the 20-page project description (entitled "Eligibility Statement for FESD"), stating why the proposed research (a) is poised for a major advance and is potentially transformative; (b) requires a multi-disciplinary team approach, and how the proposed team fulfills this requirement; (c) addresses coupling of dynamic processes across temporal and/or spatial scales; (d) goes beyond existing approaches that can be addressed within the core programs of the Geosciences Directorate; (e) is 'high-risk, high-return" research and that clearly describes both the opportunities and challenges; and (f) provides creative, integrative and effective broader impact activities developed within the context of the mission, goals, and resources of the organizations involved. Reviewers will be asked to evaluate the eligibility statement as an additional review criterion.

(iii) Management and Integration Plan (2 or 3 pages depending on proposal type). Both Type I and Type II proposals must have a detailed management and integration plan. For Type I proposals, this plan can be up to two pages in length. Type II proposals can be up to a maximum of 3 pages in length. The management and integration plan should describe how the group effort will be coordinated, how the disciplinary components will be integrated, how data, models, infrastructure developments and ideas will be disseminated and shared with the community. A clear time line of expected outcomes should be included, as well as plans for the integration of research and education. Type II proposals should also include information about the management of community outreach and training activities, as well as assessment and oversight of educational activities.

a) Modes of Collaboration and Training. The following components are optional (within the Management and Integration Plan) and can be included if appropriate:

* A description of new modes of collaboration
* A description of new modes of training graduate students, postdoctoral researchers, or undergraduates.
* A description of planned workshops and a list of types of participants that will be involved.

iv) Results of Prior Support. A maximum of one page per team member (PI, coPI, post doc, collaborator) should be included in the supplementary documents. Any researcher who has received prior support from any NSF grant must include results of prior support.

If a collaborator has not had prior support, an explicit statement should be included to that effect in this section.

Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. You can decide where to include this section within the project description.

(D) References. Publications in the references section that include any of the team collaborators should have an asterisk as the first character of the reference.

(E) Biographical sketches. For all key personnel, please provide a brief biographical sketch. Do not exceed two pages per person for the sketch. Up to five publications most closely related to the proposal and up to five other significant publications may be included, including those accepted for publication. Biographical Sketches must conform to the guidelines described in the GPG.

(F) A full description of the total level of current and pending support from all sources for the key personnel. It is important to identify the number of salary-months covered by each source and whether these are summer, academic or calendar months.

(G) A description of the facilities (including laboratories, meeting or office space, and computational facilities) that will be made available to the project.

(H) Supplementary Documents

i) Budgets for Research Platforms and Facilities: The cost of GEO facilities utilized by FESD proposals will be handled in the same manner as proposals submitted to GEO core programs. Projects that will be utilizing NSF research platforms (e.g. ships, airplanes, etc) or other shared use facilities (e.g. field instrumentation, analytical or experimental facilities) are responsible for filing a copy of their Request for Facility Support as a supplementary document in their proposal. Any costs that will be associated with such facilities should be clearly documented, and PIs should coordinate their requests with the appropriate facility to ensure that access is available to the facility and fits within the time line of the proposed research. Costs for research platforms and facilities that are not covered by the facility must be included in the budget cap of $5M. Please contact a cognizant NSF program director for information about which facility costs must be included in your proposal. For projects that will be utilizing NSF computational facilities, a copy of the allocation request that would be submitted to the facility in question should be provided as a supplementary document.

ii) Postdoctoral Research Mentoring Plan: Proposals that request funding for postdoctoral researchers must include a one-page mentoring plan in accordance with guidance in the GPG.

iii) A Data Management Plan, in accordance with guidance in the GPG.

I. Single copy documents: Full proposals that do not provide the following information will be returned without review.

(a) Project Personnel (text-searchable PDF, in FastLane, under Additional Single Copy Documents). List all Senior Personnel in the project. For each person, provide the last name, first name, and institution/organization. In the main body of the proposal, a corresponding biographical sketch should be provided for all individuals included on this list, as instructed in Section II.C.2.f of the Grant Proposal Guide.

(b) Collaborators/Individuals with Conflicts of Interest (text-searchable PDF, in FastLane, under Additional Single Copy Documents). Provide a list, in an alphabetized table, of the full names and institutional affiliations of all persons with potential conflicts of interest as specified in NSF's Grant Proposal Guide. For each PI, Co-PI, collaborator and other Senior Personnel, include all co-authors/editors and collaborators (within the past 48 months), all graduate advisors and advisees, and any other individuals or institutions with which the investigator has financial ties (please specify type). In addition, list all subawardees who would receive funds through the FESD award.

J. Additional Required documents

* "List of Personnel, Collaborators and Affiliates": After receipt of the proposal number from FastLane, send an e-mail to fesd@nsf.gov. The subject heading of the e-mail should note the proposal number and the lead institution. Attach the document described below, prepared on a template that will be available at http://www.nsf.gov/geo/fesd/ NSF personnel will use automated data handling of this document. To facilitate this, the file should be in the CSV "flat text" format, with unformatted data entry under the column headings (Proposal Number, PI or SP Last_Name, etc.) in the template. Carriage returns, splitting items over multiple cells, extra spaces, etc., will interfere with automated handling. The document is an Excel spreadsheet containing two lists: one (columns C-E) lists the last names, first names and institutional affiliations of all PIs, Co-PIs, and other senior personnel; the second (columns F-H) lists the full names and institutional affiliations of all people having conflicts of interest with any PIs, Co-PIs, and other senior personnel. This list will be used by NSF to check for conflicts of interest in assembling the review community. The file name should be the seven-digit proposal number --not the temporary proposal number used during proposal preparation) followed by the three characters "coi" (for example, for a proposal number 1212345, this file name will be 1212345coi.csv where the extension csv will be automatically added by Excel when saving the file using the CSV format). The 7-digit proposal number should appear in every row of the file, in column B, as indicated by the sample that will be available at http://www.nsf.gov/geo/fesd. Each project participant in columns C-E should be listed (repeatedly) in all rows that name his/her conflicted individuals in columns F-H, as in the sample.

(There is redundancy between the Additional Single Copy Documents, which become part of the FastLane proposal file, and Electronic Document (a), which is used for automated data handling. At present, it is not technically possible for one document to perform both functions.)

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

Budget Preparation Instructions:

Research Platforms and Facilities: Projects that will be utilizing NSF research platforms (e.g. ships, airplanes, etc) or other shared use facilities (e.g. field instrumentation, analytical or experimental facilities) are responsible for filing a copy of their Request for Facility Support as a supplementary document in their proposal. Any costs that will be associated with such facilities should be clearly documented, and PIs should coordinate their requests with the appropriate facility to ensure that access is available to the facility and fits within the time line of the proposed research. Costs for Research platforms and facilities that are not covered by the facility must be included in the budget cap of $5M. Please contact a cognizant NSF program director for information about which facility costs must be included in your proposal.

C. Due Dates

- Preliminary Proposal Due Date(s) ***(required)*** (due by 5 p.m. proposer's local time)***:***

  July 02, 2012

- Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

  March 04, 2013

  Full Proposals are by invitation only. (Invitations will be made by NSF based on the review of Preliminary Proposals)

D. FastLane / Grants.gov Requirements

- For Proposals Submitted Via FastLane:

  Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

  Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

- For Proposals Submitted Via Grants.gov:

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

  Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years (FY) 2011-2016*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the core strategies in support of NSF's mission is to foster integration of research and education through the programs, projects and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the variety of learning perspectives.

Another core strategy in support of NSF's mission is broadening opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. Both criteria are to be given full consideration during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (GPG Chapter II.C.2.d.i. contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- Intellectual Merit: The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- Broader Impacts: The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

In addition to the National Science Board merit review criteria, reviewers will be asked to apply several specific criteria when reviewing FESD proposals. These criteria include:

* The extent to which the proposed research is poised for a major advance and is potentially transformative

* The extent to which the science goals require a multi-disciplinary team approach, and whether the proposed team and structure are appropriate to achieve the stated science goals. Does the research require a large team approach that goes beyond the scope that can be addressed within the core discipline programs of the Geosciences Directorate?

* The extent to which the proposed research or center activity addresses coupling of dynamic processes across temporal or spatial scales,

* The extent to which the proposed effort constitutes 'high-risk, high-return" research. Have the investigators clearly identified the opportunities and potential challenges?

* Quality and appropriateness of the Management and Integration Plan. This includes 1) a well defined management plan with a highly qualified project or center director, 1) the extent to which the group effort is focused on a cohesive, well-delineated goal or set of goals, 2) the quality of the plans for dissemination and sharing of data, models, tools and ideas, 3) the adequacy and appropriateness of the proposed timeline, and 4) the appropriateness of the proposed modes of collaboration, training and outreach.

* The extent to which the proposed broader impact activities are creative, integrative and effective within the context of the mission, goals, and resources of the organizations involved.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). Within 90 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should

examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Chungu Lu, telephone: (703) 292-8524, email: clu@nsf.gov
- Therese Moretto Jorgensen, Program Director, AGS, 775 S, telephone: (703) 292-8518, email: tjorgens@nsf.gov
- Robin Reichlin, Program Director, EAR, 785 N, telephone: (703) 292-4741, email: rreichli@nsf.gov
- Simone Metz, Program Director, OCE, 725 N, telephone: (703) 292-4964, email: smetz@nsf.gov
- Paul Cutler, Program Director, EAR, 785 N, telephone: (703) 292-4961, email: pcutler@nsf.gov
- James Beard, Program Director, OCE, 725 N, telephone: (703) 292-7583, email: jbeard@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

NO FUTURE DEADLINES ARE ANTICIPATED. THIS SOLICITATION IS THE LAST FOR THE FRONTIERS IN EARTH SYSTEM DYNAMICS PROGRAM.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "My NSF" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "My NSF" also is available on NSF's website at http://www.nsf.gov/mynsf/.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

Relationship of FESD to Other Programs of Interest

The FESD solicitation will complement and strengthen individual, investigator-driven science funded through GEO's core research programs. Consequently, proposals where the scope and budget are such that they would normally be submitted to the core programs or special programs of EAR, OCE, and AGS, will not be considered. In addition, proposals that fit within the scope of NSF's new CRI and SEES solicitations currently available (see Dear Colleague Letter NSF 10-040 at http://www.nsf.gov) will not be considered by FESD. These include:

- Climate Change Education (Solicitation NSF 11-574)
- Ocean Acidification (Solicitation NSF 12-500)
- Water Sustainability and Climate (Solicitation NSF 11-551)
- Decadal and Regional Climate Prediction Using Earth System Models (Solicitation NSF 12-522)
- Dimensions of Biodiversity (Solicitation NSF 12-528)
- Climate Change Education (Solicitation NSF 12-523)
- Sustainable Energy Pathways (Solicitation NSF 11-590)
- Sustainability Research Networks (Solicitation NSF 11-574)
- Dynamics of Coupled Natural and Human Systems (Solicitation NSF 10-612)

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

- Location: 4201 Wilson Blvd. Arlington, VA 22230
- For General Information (NSF Information Center): (703) 292-5111
- TDD (for the hearing-impaired): (703) 292-5090
- To Order Publications or Forms:

  Send an e-mail to: nsfpubs@nsf.gov

  or telephone: (703) 292-7827
- To Locate NSF Employees: (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Arlington, VA 22230

X. APPENDIX

Frequently Asked Questions:

How many proposals were reviewed, and which projects were funded from the first FESD competition (NSF-10-577)?

Sixty nine pre-proposals were submitted to the first FESD competition, and 33 full proposals were invited. Of the 33 full proposals, five were Type II and the remainder Type I. A total of seven projects were awarded in the first FESD competition. One was a Type II project, and the others were Type I.

The NSF press release listing FESD awards can be found at http://www.nsf.gov/news/news_summ.jsp?cntn_id=121842

What is the difference between Type I and Type II proposals?

Type I projects consist of a group of collaborators who are all focused on the proposed research questions. The team and collaborators are defined in the proposal.

Type II projects are open to participants from the broader community. The proposal will include funds to support interactions with the community. For example, a synthesis center will define ways to bring the outside community together to solve problems. An educationally focused type II might involve workshops or other activities that will be open to a broad range of individuals coming together to work on multidisciplinary problems. The key difference is the openness of Type II projects to the community beyond the proposing team members. There should also be a mechanism for community input, such as a steering or advising committee.

What is the Earth System?

The Earth system, as defined for this solicitation, includes the solid Earth (core, mantle and crust), it's terrestrial surface, oceans, atmosphere, and geospace (upper regions of the atmosphere, ionosphere, magnetosphere, and solar atmosphere).

What are System Theory and System Dynamics?

System theory has the goal of explaining complex phenomena characterized by a large number of mutually interacting and interrelated parts. From a geosciences perspective these interactions may involve coupling between 1) layers, 2) levels of organization, 3) latitudinal/longitudinal zones, 4) constituents, 5) flow regimes, and 6) temporal and/or spatial scales. System dynamics refers to the spatial and temporal behavior of the system and the causes and consequences of such behavior.

What are some examples of themes that would fit within the scope of FESD?

NOTE: The themes listed below are meant only to provide examples of the type of research problems relevant to the FESD solicitation. FESD proposals are not limited to these topics.

· Dynamical processes governing tropical cyclone development and impacts bridge multiple interfaces (e.g. air-sea exchanges of heat, moisture and momentum) and have impacts ranging from coastal wave dynamics, inundation, and alteration of coastal ecosystems, to hydrologic processes accompanying heavy rainfall extending well inland.

· Developing a better understanding of fundamental physical processes associated with geohazards, such as great earthquakes, tsunamis, marine and terrestrial landslides, debris flows, floods, and volcanic eruptions in order to forecast or predict them and their consequences.

· Quantifying the regional heterogeneity of particle export, physical mixing, and gas exchanges between the surface ocean and both the deep ocean and the atmospheric boundary layer by developing a three dimensional view on how properties such as heat, salt, tracers, gases, carbon, micro- and macro-nutrients and organisms are exchanged or exported between the surface ocean, deep ocean, and the atmosphere.

· The early history of the Earth including the processes that lead to the differentiation of the mantle, core, and crust; the chemical evolution of the atmosphere and ocean; the evolution of continents; and the co-evolution of life forms instrumental in Earth system change.

· The relationship among tectonics, climate, biota, and landscape evolution including the mantle response to topographic changes, effects of mountain building on atmospheric circulation patterns, changes in erosion patterns and rates and the numerous interconnections and feedbacks among these components.

· Dynamical processes resulting from complex interfaces and interactions between the solar atmosphere and the Earth's upper atmosphere, ionosphere, and magnetosphere involving multiple time and spatial scales that exhibit complex system behavior characterized by nonlinear coupling and feedback, cross-scale coupling, emergent phenomena, preconditioning, and memory.

· Elucidating the nature and storage capacity of deep mantle reservoirs for water, carbon, and other volatiles, and measuring rates of exchange between these deep reservoirs and the exosphere to develop a planetary-scale understanding of interactions between climate, the biosphere, and geodynamic processes.

What proposals are not applicable for this solicitation?

The FESD solicitation will complement and strengthen individual, investigator-driven science funded through GEO's core research programs, capitalizing, where appropriate, on major facility and observational investments GEO is already making (e.g., the Ocean Observing Initiative (OOI), EarthScope, the NSF/NCAR GV high altitude jet research aircraft). Consequently, proposals where the scope and budget are such that they would normally be submitted to the core programs or special programs of AGS, EAR, and OCE, will not be considered. In addition, proposals that fit within the scope of NSF's SEES solicitations currently available (access the SEES website at: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707) will not be considered by FESD. These include:

- Climate Change Education (Solicitation NSF 11-574)
- Ocean Acidification (Solicitation NSF 12-500)
- Water Sustainability and Climate (Solicitation NSF 11-551)
- Decadal and Regional Climate Prediction Using Earth System Models (Solicitation NSF 12-522)
- Dimensions of Biodiversity (Solicitation NSF 12-528)
- Climate Change Education (Solicitation NSF 12-523)
- Sustainable Energy Pathways (Solicitation NSF 11-590)
- Sustainability Research Networks (Solicitation NSF 11-574)
- Dynamics of Coupled Natural and Human Systems (Solicitation NSF 10-612)

Since FESD is a GEO program involving AGS, EAR and OCE, do proposals have to be of interest to two or more of GEO's Divisions?

No. Proposals may involve topics that involve a multidisciplinary team of researchers typically supported by more than one Division in GEO, or from other parts of NSF, but this is not a requirement. Provided the project meets the eligibility requirements stated in the solicitation, proposals that involve a multi-disciplinary team of investigators from only one division within the GEO directorate can also be supported through FESD. However, the breadth of the disciplines must go beyond the scope of a single core program.

What is a synthesis center in the context of this solicitation?

These are regional and/or national centers that use existing data or newly acquired data to address grand challenges at the frontiers of geosciences and related disciplines. They are open to, and bring together, many types of scholars, including university faculty at all career stages, post-doctoral associates, sabbatical fellows and graduate students, working in a collaborative environment. Such centers have a strong outreach and education component. A useful analog is described in the Environmental Synthesis Center solicitation (NSF 10-521).

What is a geoscience collaboratory?

A collaboratory is a "center without walls" where researchers perform studies focused on a grand challenge in the geosciences without regard to physical location. Such collaborations involve colleague interaction, sharing of data and computational resources, and instrument sharing where appropriate. The ultimate aim of such a structure is to integrate the various components of a complex problem such that the whole is more than the sum of its parts.

My project is large and complex; can I request additional space in the Project description?

No. All proposals must adhere to the page limits described above.

Can an individual serve as a the Director of both a Type I and Type II proposal?

No. An individual may serve as Director (project, center, or collaboratory director) for only one FESD proposal, either Type I or Type II. The project/center/collaboratory director role is defined in the Program Description section of the FESD solicitation in the description of Type I and Type II proposals.

Can Type I projects include major infrastructure investments for new equipment, instrumentation or observing systems?

No, acquisition of new major infrastructure is not intended to be covered, although requests for some instrumentation and technique development, as well as deployment of field instrumentation can be included in the project budget.

What do you mean by "high-risk, high-return" research? Can you give examples of risks that might be associated with FESD proposals?

There can be various kinds of risk associated with a particular proposal. There can be technical risks, for example a crucial new instrument might fail or a new experimental technique may not be successful. There also can be intellectual risks, for example a new idea or hypothesis may ultimately be proven incorrect. Finally, there can be operational risks, for example bad weather may cause a cruise to be canceled or compromise a field experiment. These risks have to be weighed against the possible transformative research that might be accomplished if the project is successful. Research at the frontiers of a field of research is often risky. FESD wants to encourage proposals that may have a higher-than-normal element of risk associated with them, if the potential payoff in terms of transforming our understanding of Earth's dynamic systems is high.

Do all proposals require data, project management, and integration plans?

Yes. All proposals require project management and integration plans, as well as data and model sharing plans, where appropriate. If you do not expect your proposal to generate data, please state this in your data management plan.

Is there an upper limit on the cost of a project submitted to this competition?

Yes, there is an upper limit of $5,000,000. We anticipate that project sizes for most Type I and Type II proposals will range from approximately $3,000,000 to $5,000,000. Please see the "Estimated Number of Awards" and "Anticipated Funding Amounts" sub-sections in Awards Information section of the solicitation for guidance, and descriptions of Type I and Type II proposals in the Program Description section. The budget should accurately reflect the efforts of all parties, as detailed in the Budget Justification.

Is there a lower limit on the cost of a project submitted to this competition?

No, although we expect that most awards will be between $3,000,000 and $5,000,00. The intention of the FESD funding opportunity is to facilitate multidisciplinary research programs well beyond the scope of current programmatic opportunities in the Geosciences Directorate.

Are Postdoctoral Mentoring plans required?

Postdoctoral mentoring plans are required of all NSF proposals that request funding for postdoctoral researchers. Proposers should adhere to the guidelines laid out in the GPG.

What do you mean by partnerships with institutions serving students under-represented in the Geosciences?

GEO would like to broaden the pool of academic and research institutions that participate in programs in the Directorate. We encourage the scientific community to establish research partnerships with faculty and students from Community Colleges, Tribal Colleges, Historically Black Colleges and Universities, institutions serving students with disabilities, and Hispanic Serving Institutions.

For further information, the Geosciences Directorate has developed the "GEO Education and Diversity Strategic Plan," which will be available at: http://www.nsf.gov/geo/adgeo/education.jsp.

Can non-geoscientists be involved as collaborators on a FESD project?

Inclusion of collaboration with investigators from other science fields is welcome provided the disciplinary connections are well described and contribute to overall FESD goals. Some examples of other disciplines might include mathematics, computer sciences, genetics, ecosystem sciences, or engineering, although this list is not intended to be exhaustive or exclusive.

What should I do if I still have questions?

Please contact the Program Officer in the Division that most closely matches your scientific focus (please see the solicitation which lists the Program Officers, their associated Division, and relevant contact information).

Can I volunteer to be on one of the review panels?

Yes; however, PIs and co-PIs that have submitted a proposal for this solicitation are not allowed to be on review panels and the NSF Conflict of Interest Policy applies.

What are some of the relevant documents issued by NSF and other Federal Agencies?

1. GEOVISION Report (Unraveling Earth's Complexities Through The Geosciences), NSF Advisory Committee for Geosciences, 2009. http://www.nsf.gov/geo/acgeo/geovision/start.jsp

2. Landscapes on the Edge: New Horizons for Research on Earth's Surface. National Research Council, National Academies Press, Washington, D.C., 2010. http://www.nap.edu/openbook.php?record.id=12700&page=R1

3. Grand Challenges in Geodynamics: Outstanding geodynamics problems and emerging research opportunities for the Earth Sciences, 2010. http://geodynamics.org/cig/proposalsndocs/documents/gwp-final

4. Origin and Evolution of Earth: Research Questions for a Changing Planet. National Research Council, National Academies Press, 2008. http://books.nap.edu/openbook.php?record_id=12161&page=R1

5. National Science Board: Hurricane Warning: The Critical Need for a National Hurricane Research Initiative, 2007. http://www.nsf.gov/nsb/committees/archive/hurricane/initiative.pdf

6. National Science and Technology Council, 2005: Grand Challenges for Disaster Reduction, 2005. http://www.nehrp.gov/pdf/grandchallenges.pdf.

7. CSEDI: Cooperative Studies of the Earth's Deep Interior, 2004. http://www.csedi.org/

8. NCEAS: National Center for Ecological Analysis and Synthesis. http://www.nceas.ucsb.edu/

9. COSMIC: Constellation Observing System for Meteorology Ionosphere and Climate. http://www.cosmic.ucar.edu/

10. GEO Education and Diversity Strategic Plan, 2010, http://www.nsf.gov/geo/adgeo/education.jsp.

11. The Sun to the Earth--and Beyond: A Decadal Research Strategy in Solar and Space Physics, 2003, http://www.nap.edu/catalog.php?record_id=10477#toc.

12. New Research Opportunities in the Earth Sciences (NROES), National Academy of Sciences, December, 2011, http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=13236

May PIs from FFRDC's submit proposals to the FESD solicitation? Can I submit a proposal if I am an NCAR employee?

PI's from non-NSF-funded FFRDC's are not permitted to submit proposals to FESD. PI's from the National Center for Atmospheric Research (NCAR), an NSF-funded FFRDC, are permitted to submit proposals to FESD subject to certain conditions: (1) NCAR's participation must be consistent with the NCAR mission of enabling or fostering focused new community research; (2) NCAR's participation is expected to be in partnership with non-FFRDC organizations; and (3) funding requested by NCAR can include project-related costs including travel, and lab or experimental costs not normally covered under the NCAR-NSF Cooperative Agreement. Salary costs for post-docs, visitors, and students are permitted, as are salary costs for science support staff and associate scientists necessary for the completion of the proposed work and not covered by the Cooperative Agreement.