Frontiers in Earth System Dynamics

PROGRAM SOLICITATION
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)***:***

October 01, 2010

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

March 15, 2011

IMPORTANT INFORMATION AND REVISION NOTES

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

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):

- Robin Reichlin, Program Director, EAR, telephone: (703) 292-4741, email: rreichli@nsf.gov
- Richard F. Yuretich, Program Director, EAR, telephone: (703) 292-4961, email: ryuretic@nsf.gov
- Bradley F. Smull, Program Director, AGS, telephone: (703) 292-8524, email: bsmull@nsf.gov
- Simone Metz, Associate Program Director, OCE, telephone: (703) 292-4964, email: smetz@nsf.gov
- Farzad Kamalabadi, Program Director, AGS, telephone: (703) 292-8529, email: fkamalab@nsf.gov
- William I, Ridley, Program Director, OCE, telephone: (703) 292-7583, email: wridley@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 or Cooperative Agreement

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 larger and 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. Type I proposals may be funded as either grants or cooperative agreements, depending on the size, scope and

complexity. Type II proposals will be funded as cooperative agreements.

Anticipated Funding Amount: $28,000,000 $28,000,000 for FY11, subject to availability of Funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- 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.
- 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.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per 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:** Cost Sharing is not required under this solicitation.
- **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)***:***

  October 01, 2010

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

  March 15, 2011

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: Additional award conditions apply. Please see the full text of this solicitation for further information.

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 geospatial environment operates as a *system*. The Earth system, as defined for this solicitation, includes the solid Earth (core, mantle and crust), 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.

(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 PI team and include development of new modes of collaboration and training. 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. Type II proposals should include mechanisms for community input and oversight of the activity within the management plan.

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 larger and 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. Type I proposals may be funded as either grants or cooperative agreements, depending on the size, scope and complexity. Type II proposals will be funded as cooperative agreements.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- 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.
- 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.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per 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. **Additional Eligibility Info:**

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 October 1, 2010

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 30, 2010.

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 (maximum 5 pages) that describes 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) the management plan, 2) a statement about why the proposed research is poised for a major advance, 3) why it requires a team-based interdisciplinary approach, and 4) why it is potentially transformative. The project description must also list a full set of collaborators and their role in the project, and should outline the creative, integrative and effective broader impact activities developed within the context of the mission, goals, and resources of the organizations involved.*
5. NSF biosketches of proposed PI and Co-PIs from all institutions
6. Total budget (one page) by major category and institution (subawards for collaborating institutions).
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 that starts with "11". 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 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 proposal number (which begins with "11"; not the temporary proposal number used during proposal preparation) followed by the three characters "coi" (for example, for a proposal number 1112345, this file name will be 1112345coi.csv where the extension csv will be automatically added by Excel when saving the file using the CSV format). The 7-digit proposal number beginning with "11" 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.)

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 30, 2010 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 subawards 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 function as a well coordinated and focused activity.

(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. 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.

(C) Project Description, not to exceed fifteen pages, including the following items:

(i) Proposed Research. (Narrative)

- 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.
- Some documents that are normally included in the Project description may instead be included in the Supplementary Documents: 'Results of Prior Support' and a 'Management and Integration' plan can be included in the supplementary documents.

(ii) Statement of eligibility for FESD. The proposal must include an explicit eligibility statement of up to one page length within the 15-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.

(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. The following documents can placed in the supplementary documents section

(i) Management and Integration Plan. 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 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.

(ii) 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.

(iii) 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. Please contact a cognizant NSF program director for information about which facility costs must be included in your proposal.

(iv) 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.

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 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. Electronic Documents: The proposers must send the following document immediately after submission of their 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 that starts with "11". 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 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 proposal number (which begins with "11"; not the temporary proposal number used during proposal preparation) followed by the three characters "coi" (for example, for a proposal number 1112345, this file name will be 1112345coi.csv where the extension csv will be automatically added by Excel when saving the file using the CSV format). The 7-digit proposal number beginning with "11" 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: Cost sharing is not required under this solicitation.

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. 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)***:***

  October 01, 2010

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

  March 15, 2011

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. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. 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 where they will be reviewed if they meet NSF proposal preparation requirements. 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 who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the 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.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals 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 diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- 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.

Additional 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.

Special Award Conditions: Type I Awards will be issued as Cooperative Agreements or Grants. Type II Awards will be issued as Cooperative Agreements.

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 before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after 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 that PI. 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 FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report 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.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Robin Reichlin, Program Director, EAR, telephone: (703) 292-4741, email: rreichli@nsf.gov
- Richard F. Yuretich, Program Director, EAR, telephone: (703) 292-4961, email: ryuretic@nsf.gov
- Bradley F. Smull, Program Director, AGS, telephone: (703) 292-8524, email: bsmull@nsf.gov
- Simone Metz, Associate Program Director, OCE, telephone: (703) 292-4964, email: smetz@nsf.gov
- Farzad Kamalabadi, Program Director, AGS, telephone: (703) 292-8529, email: fkamalab@nsf.gov
- William I. Ridley, Program Director, OCE, telephone: (703) 292-7583, email: wridley@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.

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, National Science Foundation Update is a free e-mail subscription service 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 Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

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 10-542)

* Ocean Acidification (Solicitation # NSF 10-530)

* Water Sustainability and Climate (Solicitation # NSF 10-524)

* Decadal and Regional Climate Prediction Using Earth System Models (Solicitation # NSF 10-554)

* Dimensions of Biodiversity (Solicitation # NSF 10-548)

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 40,000 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 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
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

X. APPENDIX

Frequently Asked Questions:

What is the Earth System?

The Earth system, as defined for this solicitation, includes the solid Earth (core, mantle and crust), 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 landslides, 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 liofe forms instrumental in Earth system change.
- The relationship among tectonics, climate, 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 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:

- Ocean Acidification (Solicitation # 10-530)
- Water Sustainability and Climate (Solicitation # 10-524
- Decadal and Regional Climate Prediction Using Earth System Models (Solicitation # NSF 10-554)
- Dimensions of Biodiversity (Solicitation #10-548)
- Climate Change Education (Solicitation #10-542)

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 part of the GEO community can also be supported through FESD.

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 15-page limit. However, please note that Results of Prior Support and the Management and Integration Plan can be submitted as supplementary information, and thus are not part of the 15-page limit.

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?

No. Although we anticipate that project sizes for most Type I and Type II proposals will range from approximately $3,000,000 to $5,000,000, higher requests will be considered. 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, 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 expertise (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 Beyong: A Decadal Research Strategy in Solar and Space Physics, 2003, http://www.nap.edu/catalog.php?record_id=10477#toc.