

CLEANER: Project Office to Coordinate Network Activities

Program Solicitation

NSF 05-549



National Science Foundation

Directorate for Engineering

Division of Bioengineering and Environmental Systems

Division of Electrical and Communications Systems

Division of Chemical and Transport Systems

Division of Civil and Mechanical Systems

Division of Design, Manufacture and Industrial Innovation

Directorate for Geosciences

Division of Earth Sciences

Letter of Intent Due Date(s) (optional):

March 15, 2005

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

April 21, 2005

REVISIONS AND UPDATES

References to collaborations are made throughout the solicitation. The purpose of this update is to confirm that collaborative proposals may be submitted, provided that:

(A) All collaborating organizations submitting a proposal must meet the eligibility criterion in the solicitation: "Proposals under this program solicitation will be accepted from U.S. universities and colleges and non-profit organizations." Any collaborating organization that does not meet that criterion cannot submit a separate proposal; it can only be included as a sub-award.

(B) If eligible organizations decide to submit collaborative proposals, they must follow the guidelines in Chapter II.D.3. "Collaborative Proposals" in the Grant Proposal Guide. In particular, "All collaborative proposals must clearly describe the roles to be played by the other organizations, specify the managerial arrangements, and explain the advantages of the multi-organizational effort within the project description. PIs are strongly encouraged to contact the cognizant NSF Program Officer prior to submission of a collaborative proposal."

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

CLEANER: Project Office to Coordinate Network Activities

Synopsis of Program:

CLEANER (Collaborative Large-scale Engineering Analysis Network for Environmental Research).

The goal of **CLEANER** is to fundamentally transform and radically advance the scientific and engineering knowledge base to address the challenges of large-scale human-dominated complex environmental systems.

CLEANER will:

- Be an integrated system of distributed, networked facilities and researchers to more readily identify knowledge gaps related to environmental quality issues;
- Enable the development of effective engineering approaches to complex, national-scale environmental problems;
- Consist of (a) interacting field sites networked through cyberinfrastructure; (b) groups of investigators studying landscapes stressed by human activities and/or highly urbanized regions; (c) specialized personnel, facilities, and technology that support the investigators, and (d) an analysis network with common modeling platforms and analysis protocols that will serve as the central organizational framework for collaborative investigations;
- Support collection of critical environmental data with advanced sensor array systems and in situ instrumentation;
- Facilitate data mining and aggregation and provide analytical tools for data visualization, exploratory data analysis, and predictive modeling of large-scale dynamic environmental management strategies;
- Enable more effective adaptive management approaches for human-dominated environmental systems based on enhanced observations, experimentation, modeling, engineering analysis, and design;
- Enable participation from a broad engineering and science community, including educators, students, practitioners, and public sector organizations and individuals, who will have access to **CLEANER**'s equipment, data, models, and software; and
- Transform engineering education by engaging the academic community in large-scale and complex real-world problems.

Contaminants are widespread in the 21st century environment, posing threats to human life, wellbeing, and environmental sustainability at all levels. Even remote areas, such as the Arctic, now are polluted with toxic materials such as mercury and chlorinated organic chemicals, even though the human activities that generate them often are many thousands of miles away. Contaminated water resources are a special concern, with major problems documented in large rivers (e.g., the Mississippi and Hudson), coastal waters (e.g., Gulf of Mexico, Chesapeake Bay), numerous ground-water aquifers, and many lakes of all sizes. For example, despite improvements in wastewater treatment, many surface-water systems are impaired by nutrient enrichment, and pathogenic microorganisms, still common in the nation's waters, threaten recreation and drinking water supplies. Organic chemicals and heavy metals from municipal and industrial sources pose risks to human health and to aquatic organisms.

To address the large-scale environmental problems facing the United States in the 21st century, we need fundamental knowledge of (1) the sources of contaminants and how they are linked to different types and levels of human activities; (2) the persistence, transport processes and degradation mechanisms of these contaminants; and (3) the risks they pose to the environment and humans (Ref. NRC Report "Envisioning the Agenda for Water Resources Research in the Twenty-First Century", NAS Press, 2001). Because pollutants move between air, water, and land, we need to understand the interplay between these media and how efforts to control pollutants in one compartment affect environmental quality in other media. In addition, we need more effective ways to select among management strategies (e.g., promoting the use of alternative materials versus developing enhanced waste treatment options) to address complicated environmental problems. To enable the engineering research and education communities to address these issues, the Directorate for Engineering proposes **CLEANER**.

VISION: CLEANER has the strategic intent to create a system where theorists, experimentalists, and computational experts collaborate on significant environmental problems, thereby identifying and resolving knowledge gaps related to these problems. This collaboration will operate using an *adaptive* management framework, in which management strategies are improved over time based on the knowledge gained by studying how environmental systems respond to management actions. Modeling would be the central component for analysis, knowledge synthesis, and design of further experimentation. Modeling for adaptive management would include systems analysis and life cycle assessment (LCA) models that incorporate consideration of economics, uncertainty and risk in decision-making.

The **Directorate for Engineering** is conducting planning that, subject to the availability of funding from the Major Research Equipment and Facilities Construction (MREFC) account, may lead to construction of an integrated network focused on critical science questions related to solving large-scale environmental pollution problems. The network will have the following characteristics: (1) sets of physical, chemical, and biological sensors and instruments that will enhance collection of basic environmental data related to major pollution issues; (2) a distributed cyberinfrastructure that supports networks of researchers through real-time communications and software; (3) multi-scale modeling capabilities that interface consistently among spatial and temporal scales; (4) database systems and data-mining techniques to allow sharing of multimedia information pertaining to different environmental systems; (5) facilities to support experimental research on

problems described by the observation network and defined by analysis/modeling activities; (6) support services to promote the effective shared-use and open access of these resources; and (7) capabilities to incorporate new construction or additions to existing facilities to enhance the network.

An integral component of this planning is the establishment of a Project Office to coordinate and assist with activities leading to the establishment of CLEANER. These activities first and foremost include (1) refining the key science questions (grand challenges for environmental engineering) that CLEANER will address and (2) developing a unified community vision for the facilities and infrastructure needed to address these issues. A conceptual design that describes the research, education, and outreach plans will be a natural consequence of these activities. An important task of the Project Office is to develop a community consortium that has the capability to plan, design, construct, and operate the **CLEANER** network.

Cognizant Program Officer(s):

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

- 47.041 --- Engineering
- 47.050 --- Geosciences

Eligibility Information

- **Organization Limit:**

Proposals under this program solicitation will be accepted from U.S. universities and colleges and non-profit organizations.

- **PI Eligibility Limit:**

One cannot be both the Director, PI, or Co-PI of the **CLEANER** Project Office and a PI or Co-PI of a Field Site simultaneously. Other than this restriction, all individuals or organizations that are involved in the **CLEANER** Project Office will be eligible to participate as PIs/Co-PIs or organizational homes of Field Sites in the **CLEANER** network. Because the Director, PI and Co-PIs of the Project Office will have to arbitrate disagreements between Field Sites, they are not to have substantial responsibility for a Field Site.

- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Cooperative Agreement
- **Estimated Number of Awards:** 1
- **Anticipated Funding Amount:** \$1,000,000 per year for two years pending the availability of funds and quality of proposals.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is optional. Please see the full text of this solicitation for further information.
- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Due Dates

- **Letters of Intent (optional):**
March 15, 2005
- **Full Proposal Deadline Date(s)** (due by 5 p.m. proposer's local time):
April 21, 2005

Proposal Review Information

- **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:** Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

"Nothing is more fundamental to life than water. Not only is water a basic need, but adequate safe water underpins the nation's health, economy, security, and ecology. The strategic challenge for the future is to ensure adequate quantity and quality of water to meet human and ecological needs in the face of growing competition among domestic, industrial-commercial, agricultural, and environmental uses." (Ref. NRC Report "Confronting the Nation's Water Problems: The Role of Research", NAS Press, 2004).

The NRC report highlights the need to focus on major knowledge gaps in water research with a systems approach. The report presents several common themes that should be used to evaluate water research areas, namely:

- The interdisciplinary nature of the research,
- The need for a broad systems context in phrasing research questions and pursuing answers,
- The incorporation of uncertainty concepts and measurements into all aspects of research, and
- How well the research addresses the role of adaptation in human and ecological response to changing water resources.

These themes are the basis for **CLEANER** (Collaborative Large-scale Engineering Analysis Network for Environmental Research). The concept of **CLEANER** has been developed over the past three years in a national symposium and a series of six workshops held in various locations around the United States. Proceedings of the workshops and symposium are found on the **CLEANER** web site: <http://CLEANER.NACSE.org>. The workshops have led to a set of three key science questions and four national needs that **CLEANER** should address, along with a longer list of 25 environmental research topics that the program could focus on. The workshops also have developed several models for the program structure and basic network design. NSF currently is funding 12 planning grants involving 22 academic and research institutions to conduct preliminary studies on cyberinfrastructure and field facilities needed to make **CLEANER** operational.

The NRC Report puts forth the question:

In the future, will there be adequate water to meet the needs of competing uses?

CLEANER, an engineering and science research and education thrust, centers on this very issue, especially on the safety and quality of water. The widespread occurrence of contaminants in the environment poses threats to human life, wellbeing, and environmental sustainability, even remote areas, such as polar regions, where contaminants are delivered primarily by long-range atmospheric transport from sources linked to human activities many thousands of miles away. However, even in such cases, routes of exposure to humans usually involve aquatic resources, either for drinking purposes or as a source for food. Contaminants in water resources are a major concern in the United States, with serious problems documented in rivers, coastal waters, and lakes of all sizes. Excessive levels of nutrients and sediments impair uses in many surface waters; pathogenic microorganisms still are widely distributed in the nation's waters and they threaten recreation and drinking water supplies. Organic chemicals and heavy metals from municipal and industrial sources pose risks to human health and to aquatic organisms.

Technological issues, such as process and product redesign and manufacturing, as well as behavioral factors, such as economic and other social forces that affect consumption and adoption of new technologies and materials, are important factors in preventing or eliminating contaminants. Studies aimed at reducing adverse human/environmental impacts of resource use, as well as maximizing efficient use of materials throughout their life cycles, are elements of the **CLEANER** strategy.

As a nation, we seek long-term economic growth that creates jobs and other economic opportunities while improving and sustaining the environment for future generations. A new generation of manufacturing, processing, and construction technologies is needed that supports pollution avoidance/prevention (at the source), efficient resource use, and industrial ecology. Besides addressing issues of economic competitiveness, such technologies can contribute to solutions of large-scale environmental problems. Because industry is as an important component of human-dominated environmental systems, the imperative for fundamental research on industrial operations is obvious. Research that advances the development of

manufacturing and processing technologies directed at avoiding or minimizing pollutant generation forms another element of the comprehensive **CLEANER** strategy.

A major focus of **CLEANER** will be on improving knowledge about contaminant fate and transport processes in human-dominated environmental systems. Multi-scale models, which are currently lacking, will advance our understanding of atmospheric, geospheric, and hydrospheric interactions in large-scale, human-dominated systems. These models will reduce the need to make assumptions about environmental processes, narrow the uncertainty in parameter values, and provide better information about time variability of model parameters and structure. They also will establish a foundation for identifying knowledge gaps and the discoveries and advances needed to fill these gaps, and they will be important in developing engineering options for resource management. A distributed network of coordinated facilities in natural and built environments is essential to facilitate these advancements. This network will provide dynamic databases for an *engineering analysis network (EAN)* that will facilitate experimental studies to solve problems described by the field network and defined by the multi-scale models. Integration and analysis of field and experimental data and modeling/collaborative tools in the **EAN** will be enabled by a cyberinfrastructure that will extend the capabilities of the database and provide standard visualization and analysis tools to the research community. The result will be the ability to "leapfrog" current capabilities.

To accomplish these goals within the MREFC guidelines (<http://www.nsf.gov/pubs/2003/nsf03049/nsf03049.pdf>), the Engineering Directorate invites proposals from interested groups to establish a **CLEANER Project Office. This office will coordinate and assist with activities that NSF anticipates may lead to the establishment of **CLEANER**, including developing: (i) a unified community vision for the key scientific questions on which **CLEANER** will focus; (ii) a community consortium (described below); (iii) a conceptual design, including research, education, outreach and cyberinfrastructure plans; (iv) a strategy for involving other relevant government agencies and private sector organizations in **CLEANER**; and (v) a preliminary plan describing how the project would be accomplished. Proposals will be accepted from U.S. universities and colleges and non-profit organizations.**

The new observational and analysis capabilities made possible by this network will significantly enhance the engineering and science communities, providing the means for conducting fundamental research on natural and human-induced environmental change over broad geographic and temporal scales. As such, the **CLEANER** initiative directly addresses NSF's three strategic goals related to People, Ideas, and Tools:

People: **CLEANER** will provide the transformative infrastructure to integrate research and education in the engineering community, especially for environmental engineering.

CLEANER embraces society's large-scale environmental problems that today involve expenditures of billions of dollars. The challenge of these issues, coupled with **CLEANER**'s resources, provides a basis for new collaborations across disciplines and new curricula in environmental management and modeling. **CLEANER**'s facilities, data, and computational resources will be broadly accessible through tools and incentives to promote collaboration among **CLEANER researchers** and with other environmental observatories. Partnerships or collaborations will be encouraged among members of the **CLEANER** community and other educational communities.

Ideas: Multi-scale community models for adaptive dynamic management of large-scale human-dominated complex environmental systems are the vehicles for knowledge synthesis, not only by network members, but also by the broader research and education communities.

Simulation and modeling are as important to discovery and innovation as theory and experimentation. Models developed with **CLEANER** thus will provide new knowledge on the transport and transformation processes of contaminants in aquatic systems. **CLEANER** also will provide a mechanism for testing model parameters and the open-source models will furnish a basis for ongoing research on key uncertainties. Therewith, **CLEANER** will create an environment where engineers, bio-physical and social scientists, and computational experts collaborate to develop improved approaches to managing complex environmental systems that reflect their underlying dynamics. This community of scholars will be led by researchers known for working close to the problem, using theory and computation to develop a deep understanding of the interplay between air, water, and land, and how controlling pollutants in one compartment affects environmental quality in the other media.

As highlighted in a recent GAO Report, 'WATERSHED MANAGEMENT: Better Coordination of Data Collection Efforts Needed to Support Key Decisions' (GAO-04-382) www.gao.gov/cgi-bin/getrpt?GAO-04-382, enhanced coordination of data collection efforts by federal and state agencies could reduce duplication of efforts, improve data compatibility and quality, and allow for better use of data being generated to improve water quality and water resource management. Along with other environmental observatories under development, **CLEANER** will play a key role in facilitating the development of integrated standards, a major element of data collection. Data collected by **CLEANER**, as required to address the science questions, will be openly available to maximize participation from the engineering and scientific communities and provide on-going educational outreach to students and the public.

Because the environmental problems driving the need for **CLEANER** are broad in scope and encompass nearly every area of engineering and science, the proposed networked facility constructed as part of this initiative will promote multidisciplinary research on adaptive environmental management. This will provide the engineering/science research community with a new

mode of addressing a grand challenge in engineering research, namely the ability to embrace the scale of environmental problems faced by society today.

Tools: The technology to conduct research and model complex environmental systems will be revolutionized by emerging developments in cyberinfrastructure and sensors. To focus this activity, **CLEANER** will identify needs for sensors and also catalyze their development and deployment.

CLEANER's infrastructure, as a cyber-based network, will support both long-term and specialized (*ad hoc*) data collection using advanced instrumentation, and where possible and appropriate, in situ sensor arrays. Relevant cyberinfrastructure will include software for data mining and aggregation, tools for data analysis and visualization, and platforms for multi-scale dynamic modeling of the consequences of alternative environmental management strategies. To ensure maintenance of state-of-the-art capabilities, the **CLEANER** grid will incorporate an architecture that allows assimilation of new applications over the project life. **CLEANER** will provide shared-use resources available to the broad community at all sites, centered on specialized field and laboratory instrumentation, analytical and collaborative tools, and curated databases and model repositories.

II. PROGRAM DESCRIPTION

The Directorate for Engineering now is soliciting proposals from interested groups to establish a **CLEANER** project office. This office will refine the science plan for **CLEANER** and develop an overall design for the network.

Organization and Functions of the Project Office:

Operation of the **CLEANER** Project Office will require a team whose aggregate credentials must demonstrate expertise and accomplishments in the following areas: engineering and science research (including the physical, biological, and social sciences relevant to environmental systems), project management and engineering, organizational development, committee management, community outreach, operation/management of major facilities for scientific research, and web site development/maintenance. The successful team also must provide expertise for technical report editing and web-based publications. The project office will be expected to successfully complete the following tasks, which are listed in approximate order of the timeline for accomplishing them:

1. *Identify and facilitate committees for continued refinement of the **CLEANER** science plan and network design:* The project office, in consultation with the engineering and science research communities and NSF, will establish an advisory structure that provides the engineering and the bio-physical and social science leadership required to define all facets of **CLEANER**, including the major science questions to be addressed by the program, nature of the distributed field components and centralized facilities needed to address those questions, and the nature of the integrated analysis network. The advisory structure will include committees to address technical issues related to implementing the network, including cyberinfrastructure needs, data management, standardization of system components, and sensors and sensor networks. A key committee will be established to develop an enabling organizational structure for the **CLEANER** project, *i.e.*, a community consortium (see task 3). Proposals should describe how committees will be organized, led, and operated, and how they will interact to reach consensus and disseminate their discussions and findings.

2. *Define the science plan for **CLEANER**:* As noted above, previous workshops have developed lists of research topics that the **CLEANER** network could address and have merged these topics into three "grand challenge" questions related to four national needs (see **CLEANER** web site for details). Through its committee structure and in consultation with the broader research community, the project office will define the science plan for **CLEANER**. As an overarching vision, this will include: (i) refinement of the grand challenges, (ii) the national needs they address, and (iii) the specific research questions on which **CLEANER** will be expected to focus in its initial operational phase. *The project office (and committees) also will describe how this overarching vision translates into facility needs and into an overall design for the network and associated infrastructure.*

3. *Organize the community into a Consortium:* Based on discussions with the advisory structure, the project office will develop an enabling organizational structure appropriate for the engineering and scientific leadership, overall governance, construction, operation, and administration of the **CLEANER** network, namely a community consortium. The consortium could be a newly developed entity, but consideration also should be given to the economies that may be realized by basing it on an existing consortium, such as the Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI). Plans for the consortium are to be developed in the first year of this award with the goal that the consortium will be operational early in the second half of 2006. It is anticipated that continued development and planning for **CLEANER** will be conducted under the aegis of the consortium in subsequent years.

Proposals submitted in response to this solicitation should describe possible organizational structures for **CLEANER** and also describe (i) how they will be analyzed in the initial stages of the project and (ii) how this analysis will be used to inform development of the community consortium. Proposals should discuss important decision points in determining which options

will be selected.

The project office also will work with NSF to facilitate participation of the engineering and science communities in the later phases of design, construction, and eventual shared-use of **CLEANER** facilities. As planning for **CLEANER** progresses, an important role of the project office will be to help foster close interactions between existing and planned observing systems, including other appropriate NSF research initiatives, such as Hydrologic Observatories, National Ecological Observatory Network (NEON), Earthscope, and Ocean Observatories Initiative (OOI). Such interactions may include shared use of facilities, co-location of field sites, development of common databases, and standardized protocols for commonly measured variables. Because of the common needs for water cycle measurements in **CLEANER** and the Hydrologic Observatories, it is expected that especially close relationships will be developed between these two programs. In addition, the project office will work with NSF to develop a strategy for involving other relevant government agencies and private sector organizations as active partners in **CLEANER**.

*4. Develop a strategy for incorporating socio-economic considerations into the **CLEANER** planning process and research agenda:* Economic, cultural, and political considerations are critically important in shaping how resources like clean water are used and in creating forces that promote or impede efforts to cope with natural resource degradation. Consequently, understanding how these forces operate is essential for successful implementation of the technical findings of **CLEANER**. A strategy for understanding the human dimensions of resource use and degradation, as well as the human dynamics involved in developing implementable solutions to environmental problems, should include provisions to collect and disseminate the types of data that will allow investigation of these issues. Educational uses of such data and needs for software development to facilitate its use in such settings also need to be addressed in this task.

*5. Develop a conceptual design for **CLEANER**:* The project office will develop a conceptual design for **CLEANER** based on input from the advisory structure and broader community. This design will describe the major research challenges that **CLEANER** will address (the “science plan”) and the enabling technologies to address these needs. The conceptual design must define **CLEANER** scientifically and technically, its relationships to the engineering and science communities, and its framework for educational outreach. The design will incorporate overviews of the cyberinfrastructure and sensor network plans described in tasks 6-7.

*6. Develop a **CLEANER** Cyberinfrastructure Plan:* **CLEANER** will rely heavily on the use of distributed cyberinfrastructure for data acquisition, analysis, dissemination and archiving, and for collaborative research by researchers distributed across the United States. The project office will formulate a strategy to enable a large-scale cyberinfrastructure, incorporating (i) the development of sensor and sensor network operations, (ii) data and model standards and protocols, and repositories, (iii) data sharing technologies, and (iv) tools and services to ingest, retrieve, archive and analyze data, metadata and models in a secure collaborative environment. It is expected that long-term data from the network will be openly distributed in near real-time. The cyberinfrastructure strategy will include the need to implement the most appropriate current approaches, while preserving flexibility to accommodate future enhancements.

Development of this strategy will need to occur in close cooperation with related cyberinfrastructure activities for environmental observatories at NSF and similar efforts at other agencies, such as the U.S. EPA, NOAA, USDA, NASA, DOD, DOE, USGS, Army Corps of Engineers, and/or other relevant federal and state agencies. The project office also will collaborate with these entities in developing policies for community access to **CLEANER** data. From the perspective of users, the environmental observatories should provide seamless access to multiple data streams for research and education.

*7. Develop a **CLEANER** Sensor and Sensor Network Plan:* There is a critical need for new and enhanced sensors for environmental observational networks, especially those that measure biological and chemical variables (concentrations as well as fluxes) in human-dominated systems. With input from the advisory structure, the project office will define the framework for sensor and sensor network development that would provide data on variables of highest priority (e.g., nutrients, micro-contaminants, industrial chemicals).

Ideal sensors will characterize processes in a variety of natural, urban, and industrial environments and operate unattended for collection of long-term datasets of high priority variables. Attaining these ideals for various sensors relevant to environmental research activities needs to be viewed as a process that will continue throughout the lifetime of the **CLEANER** program, and the program should be involved in these efforts. Based on the science plan and resulting data needs, the project office will evaluate which variables need to be measured continuously (or periodically) by unattended networks and which types of variables need to be measured by campaigns using in situ instrumentation or more conventional sampling/laboratory analysis programs. The project office will need to monitor progress in this rapidly developing field on a continuing basis to evaluate key gaps in technology that will need to be addressed to enable full-scale deployment of the sensor networks and in situ instrumentation required by **CLEANER**. The strategy will provide clear guidance to the sensor development community regarding these needs and describe the areas of highest priority. The guidance will address bio-fouling, measurement ranges needed from sensors, cost requirements, and other related deployment issues.

*8. Operate an interactive web site for communicating with the engineering and science research and education communities and others regarding **CLEANER** activities/planning:* Within twelve months after the award, the Project Office will assume operation of the existing **CLEANER** web site (<http://cleaner.nacse.org>). The site will be used to provide information on project

activities and will be the source for meeting minutes, workshop announcements, and reports. The expectation is that in the operational phase of **CLEANER** the site will become the definitive source for network results, activities, major findings and discoveries of researchers, private industries, and local, state and federal agencies, and a resource for **CLEANER** educational activities, which are broadly defined to include formal instruction at all levels and informal education for the community

9. *Develop a preliminary program plan for **CLEANER**, including organizational structure, governance, costs, construction, commissioning, and operating plans:* The preliminary plan that is the focus of this task represents the summation of results from the preceding tasks. The plan will be based on the conceptual design (see task 5) and recommendations from the community-based advisory structure established by the project office. The program plan will describe the science plan and how that leads to the proposed facilities, network design, and linking cyberinfrastructure. The plan also will describe the proposed organizational structure to guide the development, construction and operation of the **CLEANER** network and provide preliminary system-level construction and operation cost and schedule estimates. The system-level cost estimates and schedule estimates should be based on scaling from other projects.

Although proposals for the **CLEANER** Project Office must address the tasks outlined above, proposers are encouraged to identify additional tasks that they feel are important to complete prior to the **CLEANER** construction phase.

TIMELINE REQUIREMENT

The tasks described above are expected to be completed within the two-year timeframe of this award. The following timeline for completion of individual tasks is based on an assumed starting date for the award of June 2005. If the starting date changes, dates in the timeline will be adjusted accordingly.

1	Establish Project Office.	June 2005
2	Office establishes committees with broad representation to develop documents for the following CLEANER component plans, all relying on prior CLEANER planning efforts: (i) science plan, (ii) conceptual design, including research and education goals and activities; (iii) strategy to incorporate social sciences into CLEANER research; (iv) network design; (v) sensor and sensor network strategy, including R&D needs; (vi) cyberinfrastructure, including data management systems; and (vii) strategy for interaction with other NSF environmental observatories and for involving relevant non-NSF government agencies and private organizations in operations/activities of CLEANER .	July 2005
3	Project Office begins analysis of organizational alternatives for CLEANER and development of consortium representing community consensus.	July 2005
4	Draft document completed for CLEANER science plan.	December 2005
5	Draft documents completed for six CLEANER component plans: (i) conceptual design, including research and education goals; (ii) network design; (iii) sensor and sensor network strategy, including strategy for R&D needs; (iv) cyberinfrastructure, including data management systems; (v) strategy for CLEANER as a collaborative effort among agencies and research organizations; and (vi) strategy to incorporate social sciences into CLEANER research.	June 2006
6	Planning for community consortium completed with goal that early in the second half of 2006 it becomes an established entity able to receive awards from federal government (if not already able to do so) for construction, management and operation of CLEANER .	July 2006
7	Outline of preliminary program plan completed.	October 2006
8	Final planning documents completed for seven CLEANER components: (i) science plan; (ii) conceptual design, including research and education goals; (iii) network design; (iv) sensor and sensor network strategy; (v) cyberinfrastructure (including data management systems); (vi) strategy to incorporate social sciences into CLEANER research; and (vii) collaborative strategy for CLEANER .	December 2006
9	Preliminary program plan submitted to NSF by Project Office; end of initial two-year award.	May 2007

III. ELIGIBILITY INFORMATION

Proposals under this program announcement/solicitation will be accepted from U.S. universities and colleges and non-profit organizations.

IV. AWARD INFORMATION

Funds (up to \$1,000,000 per year, pending availability of funds) will be provided over a two-year period, with a target award date of May 15, 2005. After the second, fourth, and sixth quarters of the two-year performance period of the Project Office, a panel selected by NSF will review the progress of this office to determine whether the base period of performance is proceeding successfully and whether this office has made acceptable progress towards planning and establishing the capabilities needed to manage the five-year construction and operational capability period of **CLEANER**. If the results of the planning processes conducted as part of this two-year award are positive relative to the development of a full-scale **CLEANER** program, it is expected that a new solicitation will be issued in the spring of 2007 to continue the functions of the project office for the final planning and construction phases of the **CLEANER** infrastructure.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (*optional*):

A letter of intent to submit a full proposal is requested and should be submitted by March 15, 2005. Such letters should be submitted via Fastlane and directed to Patrick L. Brezonik, Program Director, Directorate for Engineering, Division of Bioengineering and Environmental Systems, Room 565 at NSF. Letters of intent should include names and institutional affiliations of the PI and co-PI(s), a proposed title, list of possible participating organizations (if applicable), and a brief synopsis that describes the proposed work in sufficient detail to permit an appropriate selection of reviewers.

Full Proposal Instructions:

Proposals submitted in response to this program announcement/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 pubs@nsf.gov.

Proposals must be submitted by FastLane and must follow guidelines described in the GPG. The following instructions supplement the guidelines in the Grant Proposal Guide. In addition, NSF's "Facilities Management and Oversight Guide" (<http://www.nsf.gov/pubs/2003/nsf03049/nsf03049.pdf>) should be consulted for guidance on planning, construction, and operations of the **CLEANER** infrastructure. Also consult "Additional Review Criteria" below and address issues raised in these criteria. Note additional reporting requirements listed in section VII.C of this solicitation.

Project Summary (one page)

The Project Summary should include a list of the PI and CoPIs from the cover sheet and their organizations, a brief description of the project activities and a separate statement about the broader impacts of the project. Please note that a Project Summary that does not include both activities and broader impacts of these activities will be returned without review. Detailed explanation can be found at <http://www.nsf.gov/pubsys/ods/getpub.cfm?iin127>.

Project Description

The Project Description section must not exceed 25 pages. Figures, including charts, graphs, maps, photographs, and other pictorial representations can be submitted as supplemental documentation and are not included in this 25-page limit. References cited and biographical sketches are also not included in this page limit. Additionally, a Supplementary Documentation section (see description below) is not included in the 25-page limit. Non-conforming proposals will be returned without review. The Project Description section must contain the following sections, 1 through 8, in the sequence and with the headings shown below.

Section 1: List of All Project Personnel. List the name, professional title, department, organizational affiliation, and mailing

and email addresses for each project staff member.

A Principal Investigator (PI)/Director must be designated who will have day-to-day involvement with this effort. The PI may be assisted by Co-PIs, consultants who bring additional expertise needed to conduct the duties of the office, and administrative/clerical staff. In particular an individual or organization with experience in management of large engineering/construction projects should be included on the project staff. An experienced webmaster also should be included in the budget. Office and meeting facilities must be available for the project, including Internet communications capabilities and meeting space necessary to conduct planned activities. The PI will work closely with the cognizant NSF Program Manager to keep NSF informed of Project Office activities and also to solicit input on aspects related to program planning.

Section 2: Results from Prior NSF Support (up to 5 pages). If the principal investigator or co-principal investigator(s) have received NSF funding in the past five years, information on prior awards is required. Reviewers will be asked to comment on the quality of the prior work described in this section of the proposal.

If no prior NSF support, the proposer should so signify.

Section 3: Vision for Development of the CLEANER Project Office. Discuss the proposer's vision for the development of the **CLEANER** Project Office as aligned with the concept for **CLEANER** as articulated in this program solicitation. Describe how the Project Office will be organized and staffed to achieve the tasks given in Section II. Program Description.

Section 4: Project Milestones, Outcomes, and Activities. Identify and discuss all project milestones and outcomes. As part of the Supplementary Documentation section, provide in tabular form a concise list of project activities that are keyed to the milestones and outcomes. Provide rationale for why these activities are selected, who will organize, facilitate, and participate in them (cite types of backgrounds, disciplines, etc., rather than specific participant names), and the methods/metrics that will be used to evaluate their effectiveness to fulfill project milestones and outcomes. Describe the proposed plan, process, and activities during the project period that will be used to:

1. Develop a **CLEANER** science plan, including the national needs they address and the specific research topics that will be focused on initially to address the key scientific questions.

2. Develop a conceptual design for **CLEANER** based on the science plan, including both research and education plans and the scope of facilities needed to achieve these plans, all based on input and recommendations from the advisory structure. The conceptual design will include major research challenges and the enabling technologies to address unmet needs;

3. Identify and facilitate committees for continued refinement of the **CLEANER** design. The project office, in consultation with the engineering research community and NSF, will establish an advisory structure that provides the broad engineering and scientific leadership required by the community to define user needs for the research and education network that includes **CLEANER** field components. Describe how the committees will be organized, led, operate, interact, reach consensus, and disseminate their discussions and findings;

3. Conduct planning and provide leadership for organization of the community into a consortium that could be legally incorporated (if it does not evolve from an entity that already has this status). Identify and engage all constituencies of the engineering and science research and education communities in consensus-building activities, including for shared-use experimentation. Discuss how outlying or dissenting input will be addressed. Based on discussions with the advisory structure, develop an enabling organizational structure appropriate for the engineering and scientific leadership, administration, community participation, and overall governance for the **CLEANER** network;

4. Develop a strategy for involvement of other relevant government agencies and private-sector organizations in the operation, maintenance, and use of **CLEANER** as a collaborative activity;

5. Develop a strategy to incorporate social sciences into **CLEANER** research;

6. Develop a consensus vision for the **CLEANER** Cyberinfrastructure Plan. The project office will formulate a management strategy for a large-scale cyberinfrastructure, incorporating the development of collaborative tools, data and model standards and protocols, data and model repositories, data sharing technologies, and wireless sensor and sensor network operation. The strategy will also include the need to implement most appropriate technical approaches, while preserving flexibility to accommodate future enhancements. The cyberinfrastructure strategy will include a **CLEANER** data management system to include the framework for data and model repositories and tools and services to ingest, retrieve, archive and analyze data, metadata and models in a secure collaborative environment [based on discussions with other relevant federal agencies, state environmental agencies (where appropriate), as well as the engineering and science research and education communities];

7. Develop a **CLEANER** Sensor and Sensor Network strategy. With the input from the advisory structure, the project office will define the framework for sensor and sensor network development that would provide data on environmental parameters

of highest priority (e.g., nutrients, oxygen, micro-contaminants, industrial chemicals). This strategy will have the objective of providing clear guidance to the sensor development community regarding these needs, and of mapping out how to build an interdisciplinary community of researchers who can work together to address them, concentrating on the areas of highest priority;

8. Operate a web site for communicating with the engineering and science communities regarding **CLEANER** activities and planning. Describe how the web site will be integrated into project activities and used to provide timely and definitive information and communications among the engineering/science research and education communities; and

8. Develop a **CLEANER** preliminary program plan that includes a the science plan, conceptual design, system-level cost estimates, organizational structure, and operating plans.

Section 5: Risks. Discuss any risks associated with establishing a **CLEANER** management and governance structure for the development and construction phases of the project and discuss the strategy planned to manage these risks. Discuss lessons learned by the proposing team from past experience in the development of organizations and consensus building for similar types of organizations and broad constituencies.

Section 6: Project Schedule. Provide a clearly organized Gantt chart with key milestones, outcomes, and major activities over the two-year project period. Identify and discuss the critical path for development and incorporation of the **CLEANER** management and governance structure. The schedule should show the sequencing of all major activities to be conducted in sufficient detail to justify the proposed budget.

Section 7: Management Plan, Organizational Structure, and Project Staffing. Provide a management plan for the Project Office. Discuss the administrative and organizational structure and qualifications of the project staff. Discuss why each member of the project staff, including all sub-awardees and consultants (if any), is needed. Provide a table that shows for each staff member, including all sub-awardees and consultants, the following: name, administrative position/title on the project, level of effort (monthly and annually), activities assigned, and responsibilities for achievement of key milestones and outcomes. Provide a functional project budget in tabular form showing how resources will be allocated for management and project milestones, outcomes, and activities. Provide a plan for semi-annual project critical self-assessment that includes measurable metrics and discuss how the results of the self-assessment will be used for project improvement.

Section 8: Facilities. Describe office and meeting facilities that will be available for the project, including office equipment, communications capabilities, and meeting space necessary to conduct project business.

Proposal Budget:

Provide a yearly budget, to include sub-awards if applicable, that contains the following:

- Cost/Budget proposal, including a fully detailed budget that substantiates the costs proposed.
- Narrative describing performance and other risks assessed, judgmental factors applied, and assumptions made in preparing the proposal.
- Detailed breakout of costs in terms of labor, materials, overhead, G&A, fees (if applicable) and other costs as appropriate.

When sub-awards are involved the above mentioned is required for each proposed sub-award budget. A budget justification should be provided for both the proposer and any sub-awardees. A careful and realistic budget will add to the overall strength of a proposal.

Supplementary Documentation:

In the Supplementary Documentation section include a single alphabetized list (by last name), in a table, with the full names and affiliations of all persons with conflicts of interest for all senior personnel (PI and Co-PI's) and any named personnel whose salary is requested in the project budget. Conflicts to be identified are (1) PhD thesis advisors or advisees, (2) collaborators or co-authors, including postdocs, for the past 48 months, and (3) any other individuals, including spouses, or institutions with which the investigator has financial ties (please specify type).

Proposers are reminded to identify the program announcement/solicitation number (05-549) in the program announcement/solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required by NSF in proposals submitted under this Program Solicitation.

C. Due Dates

Proposals must be submitted by the following date(s):

Letters of Intent (*optional*):

March 15, 2005

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

April 21, 2005

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal 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 announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

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. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: <http://www.fastlane.nsf.gov>

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 ([NSB 97-72](#)). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued [Important Notice 127](#), Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the [Grant Proposal Guide](#) Chapter III.A for further information). 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 he/she is qualified to make judgments.

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 and original 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?

NSF staff 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 general review criteria established by the National Science Board, proposals will be reviewed against the following merit review criteria:

Project Office

- Were advisory committees identified and sufficiently described so that it is clear how they will facilitate the development of the **CLEANER** design? Will the advisory committees be organized and operated so that they can interact with the broader research community to ensure that their recommendations represent the consensus of the broader community?
- Has a coherent concept for organizational structure been identified that guides the selection of project milestones, outcomes, and activities?
- Have appropriate milestones, outcomes, and activities been identified for the **CLEANER** Project Office development and establishment?
- Have the risks to achieving the **CLEANER** Project Office been identified, and has a strategy been provided to address or mitigate them?
- Is the project schedule reasonable? Has the critical path leading to the establishment of the **CLEANER** Project Office been identified?
- Are project resources effectively allocated?

Proposal Team

- Is there evidence that the proposing team has provided leadership and coordination for the development of organizations and consensus building for similar types of organizations and broad constituencies in the past?
- Does the proposing team provide all the expertise needed to conduct this project?
- Does the proposing team have knowledge of the key stakeholders in the engineering and science research and education communities?
- Will the proposing team be successful in engaging a broad constituency across the engineering and science research and education communities?

Consortium

- Were advisory committees identified and sufficiently described so that it is clear how they will facilitate the development of the Consortium within the **CLEANER** design?
- Have coherent concepts for possible Consortium organizational structures been identified?
- Have appropriate milestones, outcomes, and activities been identified for Consortium development? Is the project schedule reasonable? Has the critical path leading to the establishment of the Consortium been identified?
- Have the risks to achieving the Consortium been identified, and has a strategy been provided to address or mitigate them?

Communication

- Have appropriate milestones, outcomes, and activities been identified for defining and coordinating communication activities for **CLEANER**?
- How effective are the plans for communications with the engineering and science research and education communities?
- Is the plan for an interactive web site sufficient to provide timely information to the engineering and science research and education communities?

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by 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.

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 Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

NSF is striving to be able to tell proposers whether their proposals have been declined or recommended for funding within six months. The time interval begins on the closing date of an announcement/solicitation, or the date of proposal receipt, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Contracts and Complex 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 or Contracting 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 or Contracting Officer in the Division of Contracts and Complex Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division 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.A. 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 (NSF-GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Applicable Agreement Terms and Conditions. Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Contracts and Complex Agreements.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at <http://www.nsf.gov/cgi-bin/getpub?gpm>. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at <http://www.gpo.gov>.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

The activities of the awardee will be monitored through monthly teleconferences and quarterly progress reports. After the second, fourth, and sixth quarters of the project, a panel selected by NSF will review the progress of this office to determine if performance is proceeding successfully. (See **Section IV. AWARD INFORMATION**). In lieu of a fourth quarter report, an annual report on progress and plans will be submitted by the awardee to the NSF Program Officer. NSF will provide the format for these reports within one month of the award date. Both quarterly and annual reports must address progress of the **CLEANER** Project Office regarding the duties outlined in the Solicitation.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. 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. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, 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.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- Patrick L. Brezonik, Program Director and Solicitation Coordinator, Directorate for Engineering, Division of

Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-8320, fax: (703) 292-9098, email: pbrezoni@nsf.gov

- Richard J. Fragaszy, Program Director, Directorate for Engineering, Division of Civil & Mechanical Systems, 545 S, telephone: (703) 292-8360, email: rfragasz@nsf.gov
- Delcie R. Durham, Program Director, Directorate for Engineering, Division of Design, Manufacture, & Industrial Innovation, 529 S, telephone: (703) 292-7060, fax: (703) 292-9056, email: ddurham@nsf.gov
- Robert M. Wellek, Deputy Division Director, Directorate for Engineering, Division of Chemical & Transport Systems, 525 N, telephone: (703) 292-8370, fax: (703) 292-9054, email: rwellek@nsf.gov
- Paul J. Werbos, Program Director, Directorate for Engineering, Division of Electrical & Communications Systems, 675 S, telephone: (703) 292-8339, fax: (703) 292-9147, email: pwerbos@nsf.gov
- L. Douglas James, Program Director, Directorate for Geosciences, Division of Earth Sciences, 785 S, telephone: (703) 292-8549, email: ldjames@nsf.gov
- Joanne D. Culbertson, Staff Associate for Planning and Evaluation, Directorate for Engineering, 505 N, telephone: (703) 292-4602, fax: (703) 292-9013, email: jculbert@nsf.gov

For questions related to the use of FastLane, contact:

- Marcia Rawlings, Information Technology Specialist, Directorate for Engineering, Division of Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-7956, fax: (703) 292-9098, email: mrawling@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF *E-Bulletin*, which is updated daily on the NSF Website at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's *MyNSF News Service* (<http://www.nsf.gov/mynsf/>) to be notified of new funding opportunities that become available.

X. APPENDIX -- DEFINITIONS

Consortium: a legally established partnership or association of institutions organized for a specific purpose (in this case, the construction and operation of the **CLEANER** network).

Cyberinfrastructure: a highly reliable, common, national network of resources that provides access to and integrates shared repositories for data, models, and tools with shared facilities for experimentation and computation; and that supports data acquisition, analysis, searching, and information extraction; real-time simulation; and distributed collaboration. <http://www.nsf.gov/eng/general/cyber/index.jsp>

Earthscope: an NSF supported project initiated in FY03. It is an undertaking to apply modern observational, analytical and telecommunications technologies to investigate the structure and evolution of the North American continent and the physical processes controlling earthquakes and volcanic eruptions. Detailed information can be found at <http://www.earthscope.org/>

Environmental observing systems: infrastructure for research of complex environmental systems, consisting of a series of interacting field sites, enabled by an integrating cyberinfrastructure. The cyber-based network will support long-term data collection with advanced sensor array systems, data aggregation, analytical tools for visualization and exploratory data mining.

National Ecological Observatory Network (NEON): a continental scale research instrument consisting of geographically distributed infrastructure, networked via state-of-the-art communications. NEON's synthesis, computation, and visualization infrastructure will permit the development of a predictive understanding of the direct effects and feedbacks between environmental change and biological processes. <http://www.nsf.gov/bio/neon/start.htm#contact>

Ocean Observatories Initiative (OOI): to characterize the temporal processes occurring in the ocean, new types of infrastructure are needed that are capable of providing long-term, high-resolution observations of critical environmental parameters. This approach will allow the study of multiple inter-related properties, variables, and processes over a range of time scales. <http://www.coreocean.org/DEOS>

Sensor Network: a system of sensors and sensor arrays that measure various environmental conditions and are linked electronically to a central data repository.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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: pubs@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; 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 applicant 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 needing information as part of the review process or in order to coordinate programs; 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," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). 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 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 this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.

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