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Engineering Research Centers (ERC)
Partnerships in Transforming Research, Education and Technology

PROGRAM SOLICITATION
NSF 04-570
REPLACES DOCUMENT NSF 02-24

National Science Foundation
Directorate for Engineering
　　Division of Engineering Education and Centers

Letter of Intent Due Date(s) *(required):*

　　September 10, 2004

Preliminary Proposal Due Date(s) *(required):*

　　November 08, 2004

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

　　June 16, 2005

　　　　By Invitation Only

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

　　Engineering Research Centers (ERC)
　　Partnerships in Transforming Research, Education and Technology

Synopsis of Program:

　　Engineering Research Centers (ERC) focus on the definition, fundamental understanding, development, and validation of the technologies needed to realize a well-defined class of engineered systems with the potential to spawn whole new industries or radically transform the product lines, processing technologies, or service delivery methodologies of current industries. ERC faculty, students and industry partners integrate discovery and learning in an interdisciplinary environment that reflects the complexities and realities of real-world technology. This environment adds an integrative dimension that is enabled by the critical size of ERCs. ERC innovations in research and education are expected to impact curricula at all levels from precollege to life-long learning and to be disseminated to and beyond academic and industry partners. ERCs fulfill NSF's strategic goal to increase the diversity of the scientific and engineering workforce by including all members of society regardless of race, ethnicity, or gender in all aspects of the centers' activities. Because ERCs play critical roles in academe by integrating research, education, diversity, outreach, and industrial collaboration, NSF views ERCs as change agents for academic engineering programs and the engineering community at large. The absence of a compelling strategy for achieving demonstrable impact in any one of these areas is sufficient reason to deny funding.

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

- 47.041 --- Engineering

Eligibility Information

- **Organization Limit:**

  See Section III. Eligibility Information, Organizational Limit

- **PI Eligibility Limit:**

  See Section III. Eligibility Information, PI Eligibility and Current Involvement in Ongoing or Graduated NSF-funded Centers

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

Award Information

- **Anticipated Type of Award:** Cooperative Agreement
- **Estimated Number of Awards:** 4
- **Anticipated Funding Amount:** $12,000,000 for 4 new ERCs funded at $3.0 M each in FY 2006; out years funding for each award is anticipated to be up to $3.25 M (year 2), $3.5 M (year 3), $4 M (years 4) , and $4 M (year 5) subject to performance and the availability of funds

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from 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 required (Percentage).
- **Cost Sharing Level/Amount:** 20%
- **Indirect Cost (F&A) Limitations:** Not Applicable.

- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Letters of Intent** *(required)***:**
  - September 10, 2004
- **Preliminary Proposals** *(required)* **:**
  - November 08, 2004
- **Full Proposal Deadline Date(s)** (due by 5 p.m. submitter's local time):
  - June 16, 2005
    - By Invitation Only

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

The National Science Foundation (NSF) strives to enhance the leading edge capability of the United

States in all aspects of science, mathematics, and engineering by promoting the discovery and use of new knowledge in service to society and the education of our populace. In pursuit of its historic mission, NSF invests in *people* to develop a diverse, internationally competitive and globally-engaged workforce of engineers, scientists, and well-prepared citizens; in *ideas* to provide a deep and broad fundamental science and engineering knowledge base; and in *tools* to provide a widely accessible, state-of-the-art science and engineering infrastructure. The nation's economic vitality, security, and overall quality of life depend on having a population that is scientifically and technologically literate, a diverse world class science and engineering professional workforce, and a steady stream of knowledge breakthroughs and technological and educational innovations.

The 41 Engineering Research Centers (ERC) established since program initiation in 1985 are at the forefront in helping NSF achieve its strategic goals. They have made significant contributions to the viability and global competitiveness of US industry, are leaders in developing interdisciplinary cultures in academe, and produce a wide range of knowledge and technological advances and a diverse workforce with proven capability for innovation in industry and academe. To achieve this, the ERCs have been leaders in innovations in research management, education, precollege outreach, and technology transfer. These innovations are documented by ERC participants in the *ERC Best Practices Manual* http://www.erc-assoc.org/manual/bp_index.htm. Information on contacts at and the activities of individual ERCs can be obtained from the fact sheets available at https://www.nsf.gov/pubs/2000/nsf00137/start.htm. Information on the new ERC Class of 2003 is available at https://www.nsf.gov/pubs/2002/nsf0224/nsf0224.htm. The operations of ERCs have evolved continuously as the complexity of their mission and the breadth of fundamental knowledge needed to perform cutting-edge engineering research has increased; proposals submitted to this solicitation are expected to show strong promise of advancing this evolution. Therefore, proposers should view current ERC practices summarized in this manual as a baseline for further innovation in the proposed structures of their centers, rather than as constraints.

II. PROGRAM DESCRIPTION

A. GOAL AND KEY FEATURES

The goal of the Engineering Research Centers Program is to enable transforming systems technologies and educate a globally competitive and diverse engineering workforce in an integrated, interdisciplinary research environment where academe and industry join in partnership to advance fundamental knowledge and engineered systems.

NSF expects the faculty and staff of all ERCs and the administrations of all institutions receiving NSF funding to participate in an ERC to devote the time and effort required to ensure that the diversity of the ERC's leadership team, faculty, and students at all levels serves as a model for diversity within each institution and for the nation as a whole. Since no set of formal requirements can ensure that a desired level of dedication to achieving diversity is engendered, the following are required elements of a diversity strategy, the success of which depends in large part on the spirit in which they are implemented.

NSF expects each ERC and its associated administrators to increase the participation of U.S. citizens and permanent residents who are women and underrepresented minorities at all levels and in all aspects of the programs of the ERC. Underrepresented groups include: women, racial minorities (African Americans, Native Americans, Alaskan Natives, and Pacific Islanders) and ethnic groups (Hispanic Americans) whose representation in science and engineering is less than their representation in the population. Initially, an ERC achieves diversity by developing strategies to increase the diversity of faculty and students involved in the ERC from the participating core institutions. This diversity is complemented by outreach collaborations with women's colleges, predominantly minority-serving institutions, and precollege institutions to involve diverse teams of faculty, teachers, and students in its research and education programs. In addition, an ERC increases the diversity of the engineering workforce by creating synergistic links with some or all of the following elements of NSF's 21st century workforce activities. Each ERC is required to form a collaborative partnership with at least one Louis Stokes Alliance for Minority Participation (LSAMP), http://www.ehr.nsf.gov/EHR/HRD/amp.asp. In addition, the ERC will form collaborative partnerships with one or more awardees from the Alliances for Graduate Education and the Professoriate (AGEP) Program, http://www.ehr.nsf.gov/hrd/age.asp; the Tribal Colleges and Universities Program (TCUP), http://www.ehr.nsf.gov/hrd/tcup.asp; and the Centers for Research Excellence in Science and Technology (CREST) Program, http://www.ehr.nsf.gov

/hrd/crest.asp.

All ERCs share the following key features:

- Long-term, strategic vision for an emerging engineered system with the potential to spawn a new industry or transform a current industry, service delivery or infrastructure system;
- Long-term strategic vision to strengthen the diversity of the U.S. engineering and scientific workforce;
- Strategic plans to realize the research, education, and diversity goals;
- Research program conducted by a committed, cross-disciplinary team to integrate fundamental science and engineering research with research focused on the advancement of technology through test beds designed to test theory and functionality in proof-of-concept systems;
- Partnerships with industry and other practitioners to formulate, evolve, and strengthen the ERC and speed technology transfer;
- Education program that integrates research results into curricula for precollege and college students and practitioners, and teams undergraduate and graduate students in research and education; and
- Precollege outreach to involve a diverse group of teachers and students in the ERC, strengthen the role of engineering in precollege education, and attract a diverse group of young people to engineering and science careers.

All ERCs have the following resources and infrastructure to achieve their goals:

- A multi-institution configuration of the lead and up to four other institutions in long-term partnership, complemented by affiliations with outreach institutions and NSF-supported diversity awardees;
- Director, Deputy or Associate Director(s) and other members of a leadership team who define and evolve the vision, implement the plan, and manage the Center;
- Leadership, faculty, and student teams that are diverse in gender, race, and ethnicity;
- Cross-disciplinary team of faculty and students who carry out the research and education programs;
- Management systems to deploy the Center's resources to achieve its goals;
- Mechanisms for securing external advice from academic and industrial experts who set strategic directions and advise on the selection and assessment of projects; plus internal advisory boards to develop internal policies, including cross-university policies;
- Experimental, computational, and other equipment, facilities, and laboratory space required to perform the proposed research and enable a robust learning environment;
- Institutional commitment at all levels to facilitate and foster the culture of the ERC and its diversity; provide headquarters space to promote interdisciplinary collaboration and communication; and generally support Center-level activities; and
- Support from the lead and core partner academic institutions, industry, and other sources to augment NSF's support.

B. INSTITUTIONAL CONFIGURATION, INTELLECTUAL SCOPE AND FOCUS OF AN ERC

Institutional Configuration:

A proposed ERC will be multi-university, with a lead university and up to four core partner universities or colleges. This model has developed over time and has proven to be a successful approach to addressing the scale and complexity inherent in an ERC.   In multi-university ERCs, the team functions as an integrated whole, with shared research, education, precollege outreach, diversity, and industrial collaboration programs. The Director, a recognized leader in research and education, is the PI and a member of the faculty of the lead university, which assumes overall management and financial responsibility. The Director accepts funding from NSF and other sources and allocates funds among the core partner universities based on their respective roles in the strategic plan and their performance. The lead university is responsible for the cost sharing, which will come from the lead institution and any or all of the core partner institutions.

In addition to the core partners, each ERC is expected to form a limited number of other research and education outreach partners to strengthen its capacity to deliver and its broader impact. These may include colleges, universities, and Federal Laboratories. These outreach partners are not expected to cost share the effort. In addition, college-level outreach will be expanded through a Research Experiences for Undergraduates (REU) program.

To achieve a significant impact on the diversity of the ERC's team and the science and engineering workforce, the proposed ERC will include institutions that serve underrepresented groups as core partners and/or as outreach affiliates. These will be long-term relationships involving teams of faculty (at least 3) and undergraduate (at least 3) and graduate (at least 6) students in the ERC's research programs.   These students will also benefit from the education programs of the ERC and may assist with the ERC's precollege programs. In addition, the proposed ERC will form a collaborative partnership with at least one LSAMP and will form additional partnerships with one or more of the awardees from the NSF-supported AGEPs, CRESTs, or TCUPs. These partnerships will involve diverse teams of students and faculty in the ERC's research and education programs.

Precollege outreach will involve teachers and students in activities focused on the research and education programs of the ERC from precollege institutions located nearby the lead and core partner institutions, including some that serve underrepresented populations.

Vision and Rationale: The research vision of an ERC is focused on an emerging, potentially revolutionary engineered system with the potential to transform current practices or establish wholly new industries. An engineered system is a combination of components that work in synergy to collectively perform a useful function. A prospective ERC team should develop a ten-year vision for advances in an emerging and potentially revolutionary or transforming engineered system. While high quality research on one or more of the enabling technological components of the system will be required to realize the functionality of the system, a focus on the individual components without their integration into an engineered system is not appropriate for an ERC. Part of the complexity of systems is associated with their use in industry and society, including their impacts on natural or societal systems or the human body, as appropriate to the technology chosen. This complexity should be factored into the development of the vision, the strategic plan, the research and education programs, and the composition of the team of faculty, students, and industrial partners. The Diversity vision, supported by a strategic plan, is focused on building leadership, faculty and students teams that are diverse in gender, race, and ethnicity to contribute graduates capable of strengthening the engineering and science workforce in the U.S.

NSF has no preference regarding the technological focus of a proposed ERC. However, if there is an ongoing ERC or other government-supported major center working in the proposed topic area, the proposing team should explain how it will pursue the topic from a radically different point of view and indicate how their efforts will be coordinated with the efforts of any such centers. Descriptions of ongoing ERCs and access to their web sites can be obtained at http://www.erc-assoc.org/centers.htm. Descriptions of the four new ERCs made as an outcome of NSF 02-24 are available at https://www.nsf.gov/od/lpa/news/03/pr03115.htm.

Strategic Research Plan: An ERC must have a strategic research plan incorporating a thorough analysis of the state of the art. The objective of the strategic plan is to define a critical path to the realization of the system goals that advances the state of the art in knowledge and technology. The strategic plan will evolve with the progress of the Center and the field. Since the focus will be on emerging, highly speculative technological opportunities, the ultimate implementation at the systems level may be uncertain. Nevertheless, initial systems goals, specific knowledge gaps, technology goals/deliverables, and barriers to achieving these goals should be identified at the start and will evolve in depth and sophistication over time. These barriers motivate and guide the selection of proposed research projects and test beds. The project-level descriptions explain the approaches to be taken in the context of known results and theory to demonstrate that the desired results are attainable. The test beds enable proof-of-concept inquiries of enabling and systems-level technologies to test the new ideas/components and their relationships in an environment that simulates their intended application. The quality of the plan and its execution through an integrated research program, as presented in the proposal, will be a key selection factor in the ERC competition.

Proposers must provide a conceptual diagram using a customized version of the ERC Program's Three-Plane Strategic Planning Chart. A Power Point version of this chart can be found on the ERC Program's home page (http://www.eng.nsf.gov/eec/erc.htm). The proposed strategic plan diagram will show how the systems goals of the ERC drive and integrate its major research goals and test beds to realize the systems-level vision. In addition, proposers must provide a 10-year, milestone chart indicating the critical paths through key research projects and test beds to achieve the major research goals and deliverables. There is no preferred model for this chart; however, it should be presented in a format that clearly indicates the points of integration.
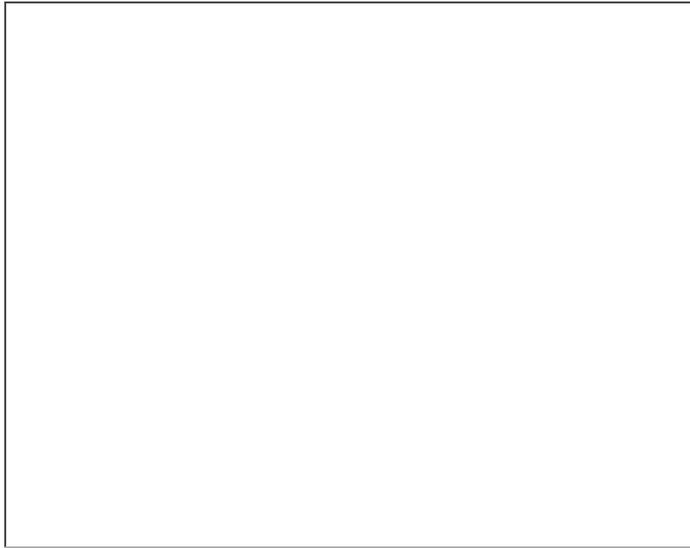
Research Program: The research program of an ERC merges the fundamental research culture of academe and the technology and product-development culture of industry. Deliverables include both long-term contributions to fundamental knowledge and technology and nearer-term results to meet industry's impending needs. The research program is cross-disciplinary in nature, encouraging teaming among faculty and students, and including a significant commitment to involve undergraduate students in research during the academic year and in the summers. The projects are organized into thrusts focused on each of the major research goals. Synergies within and across thrusts are necessary to achieve the goals of the ERC and test beds play a critical role in integrating the research and exploring the realities of enabling and systems-level technology. It should be understood that ERC test beds are not expected to approach the "product/process realization" stages found in industry but rather their role in an ERC is for proof of concept to explore the technology and speed technology transfer. Often, they generate new research directions.

Education and Educational Outreach Program: ERCs are expected to develop a team-based, research/technology-inspired, and industrial practice-oriented culture for the education of undergraduate and graduate students. They enrich education at the university, precollege, and practitioner levels by integrating their research findings and knowledge of educational best practices into new courses and course modules for insertion into existing courses. Some create new degree programs or degree options, where appropriate for the field. All ERCs must evaluate their curricular contributions and disseminate those that are successful. As multi-university ERCs, the education mission is shared among the lead and core partner universities, with each partner contributing to the education effort and the students from each deriving educational benefit from the multi-university nature of the Center. The ERC will involve a diverse team of undergraduate and graduates students in research during the academic year. In addition, the ERC will offer a Research Experience for Undergraduates (REU) program to expand the involvement of non-ERC students in research during the summer months. The students from the affiliated LSAMP will be involved in the ERC's REU program for more than one summer to facilitate matriculation as graduate students in the ERC's associated departments and as members of the ERC's graduate student team. The proposing ERC should be prepared to support its REU program from base NSF support; if an ERC award is made, the center may submit a proposal for a supplemental REU award from the ERC Program or for a site award from the NSF-wide REU Program.

ERCs are required to have precollege outreach programs that involve teachers and students in activities focused on the center's research and education programs to motivate students to study engineering and to bring engineering concepts into precollege classrooms. The ERC's precollege outreach program should build upon precollege outreach programs of the participating universities but the resulting effort must be focused by the research topic of the proposed ERC. The precollege outreach programs are largely supported by base NSF support and should include a tracking and assessment component. The proposing ERC should be prepared to support its own Research Experiences for Teachers program, modeled after the NSF/ENG Research Experiences for Teachers (RET) Program https://www.nsf.gov/pubs/2003/nsf03554/nsf03554.htm. Support should be proposed from base NSF support; if an ERC award is made, the center should submit a proposal to the RET solicitation to compete for an RET site award. The RET program will involve the teachers in the ERCs research and education programs to provide them with knowledge of engineering derived from the ERC's research to enhance their ability to teach engineering concepts in the classroom. The programs focused on

students will involve them in research, design competitions, and other engineering experiences so they will acquire a better understanding and appreciation of the field of engineering as a career choice. The Education chapter of the *ERC Best Practices Manual* is an excellent source of information on ERC education and outreach programs, http://www.erc-assoc.org/manual/bp_ch4.htm.

Industrial Collaboration and Technology Transfer: ERCs develop and sustain partnerships with member firms and other practitioner organizations (hospitals and state and local government agencies) to facilitate an exchange of information, provide mentors for students, speed technology transfer, and financially support the ERC. ERCs target particular sectors needed to fulfill their visions and develop technology transfer strategies that include the involvement of industry/practitioner organizations in planning, research, test beds, and education. Member organizations should be carefully selected for their abilities to contribute to the development and execution of the strategic and operational plans of the ERC. Members are expected to serve on the Center's Industrial/Practitioner Advisory Board. They provide access to key industrial facilities and personnel for ERC faculty and students, knowledge of industrial practice, and needs for future technological innovation. Involvement with industry speeds knowledge and technology transfer and provides additional mentors for students. The anticipated roles of individual committed members should be stated in the proposal so that it is clear how they will contribute to Center plans. Foreign firms may be ERC members, as long as they execute membership agreements with the same conditions and expectations as those for domestic firms.

Members pay cash membership fees, which are deposited in a Center account for allocation to activities to fulfill the goals of the ERC at the discretion of the Director. Generally, there is a sliding scale of fees geared to large, medium, and small-scale firms. In addition to membership fees, members also may provide the Center in-kind and directed or sponsored project support. In addition, in most ERCs non-member and member organizations provide support directly to ERC faculty for sponsored projects that contribute directly to the ERC's strategic plan. Some also receive cash and in-kind donations from non-member organizations. As many public agencies may not provide cash membership support to an ERC, they can be recognized as full members through the provision of in-kind support such as equipment, materials, or personnel time to work on research projects. There are no minimum requirements for membership support as judgments of sufficiency vary by field.

An ERC is required to formalize its partnerships with industry and other user communities through a center-wide, membership agreement. Membership agreements specify the terms, fees, and benefits of membership and intellectual property (IP) rights. As a multi-institutional center, the firms must participate as members of the whole ERC, not just as campus-level affiliates. The proposed fee and benefit terms of the membership agreement and the general terms of the IP policy will be summarized in the preliminary proposal. A finalized membership agreement and IP policy will be included in the invited full proposal. The Industrial Collaboration and Technology Transfer Chapter of the *ERC Best Practices Manual* is an excellent source of information on ERC industrial collaboration programs and the basic terms of a typical ERC membership agreement and intellectual property policy, http://www.erc-assoc.org/manual/bp_ch5.htm.

C. LEADERSHIP, TEAM, MANAGEMENT, ORGANIZATION, AND FACILITIES

Leadership, Team, Management, and Organization: Each ERC must have the following members:

- Center Director, a leader in engineering research and education, a tenured faculty member and the NSF Principal Investigator (PI), responsible for leading the ERC and administering the award in accordance with the terms and conditions of the Cooperative Agreement issued by the NSF in the event of an award;
- Deputy Director, also a tenured faculty member, shares the leadership and management responsibilities;
- Thrust Leaders, tenured and tenure-track faculty members responsible for leading and managing major research thrusts;
- Faculty, other investigators, and undergraduate and graduate students carrying out the research and curriculum development programs;
- Education Program Director (tenured faculty), responsible for curriculum development, and an Educational Outreach Director (staff at the lead institution), responsible for educational outreach;
- Industrial Collaboration and Technology Transfer Director (staff at the lead institution), responsible for developing and coordinating industrial involvement, industrial support, and technology transfer;
- Administrative Director (staff at the lead institution) and staff, responsible for management and administration;

- Student Leadership Council (SLC), comprised of undergraduate and graduate students responsible for coordinating student activities and participating in management to strengthen the ERC;
- Scientific/Engineering Advisory Board of outside experts and Industrial Advisory Board of ERC member companies to advise the Director; and
- Internal Academic Policy Board to coordinate ERC plans and policies with departmental and university leaders and committees.

The designation of individuals serving as the Educational Outreach Director, the Administrative Director, the Industrial Liaison Officer, and the leaders of the Student Leadership Council may occur after notification of award.

Leadership of an ERC requires a Director who can lead and integrate a team of faculty and staff to achieve the center's vision for research and technology, diversity, and education; and form long-term partnerships with industry and all levels of the university administration to sustain the ERC. The person must be a recognized leader in research and education with proven managerial skills that come from prior experience leading and managing teams in academe to achieve shared goals. The Deputy Director has skills and a background that complement those of the Director. Together, they are responsible for the strategic vision of the center, its strategic plans for research and diversity, its management, and sustained success. They depend upon faculty members who serve as research thrust leaders to carry out the research program with the efforts of ERC faculty and students. This role is essentially that of a group leader with responsibilities to achieve the thrust's goals in synergy with the goals of the ERC. The faculty member who leads the ERC's education program prepares its education strategic plan and is responsible for leading a team of faculty and students and working with associated department chairs to implement the plan. Strong partnerships with the associated department chairs are critical for the success of the ERC's education and diversity programs. The leader of the educational outreach program, a staff person, works in collaboration with the Education Director and the other members of the ERC to fulfill the outreach components of the plan. The ERC's students are often active leaders and participants in the precollege outreach efforts. The Industrial Collaboration and Technology Transfer Director is responsible developing the ERC's partnership with industry, facilitating contacts between industry and the researchers, and speeding the technology transfer process. The Administrative Director is responsible for the day-to-day management of the center and developing and sustaining its financial management and information systems. This person is key to the success of the ERC and its interface with the administrative offices of the participating universities.   The leaders of the Student Leadership Council are responsible for organizing the ERCs' students to assure that the center fulfills the ERC Program's goals for their education and research experiences. Plan for a small budget to support their activities. See the ERC Best Practices Student Leadership Chapter for a summary of typical SLC activities http://www.erc-assoc.org/manual/bp_ch8.htm.

The ERC must report to the Dean of Engineering of the lead institution, who is advised by a Council of Deans comprised of the Deans of Engineering of the core partner institutions. He/she works with Deans from outside the Engineering School in ERCs that involve faculty from other schools.

Team Diversity: NSF expects the leadership, faculty, and students involved in an ERC to be diverse in gender, race, and ethnicity at levels that exceed engineering-wide national averages. This diversity is expected of the participants from the lead and core partner institutions and it will be enhanced by the inclusion of institutions serving underrepresented groups as core partners and outreach affiliates, including NSF-supported diversity awardees. ERCs prepare and execute diversity strategic plans with goals and intended actions and they report annually on impact.

Support for Outreach: Outreach efforts are supported by ERC funds. However, NSF funds may not be used to support Federal Laboratory staff. NSF funds may not be used to support foreign faculty for work that is performed in a foreign country.

Experimental Equipment and Center Headquarters Infrastructure: The preliminary proposal and invited full proposal will include information on the available and needed equipment and laboratory space. An ERC must be provided with a physical and communications infrastructure that enables efficient headquarters operation and the collaboration of faculty and students across laboratory, departmental, and institutional lines. The lead university is expected to provide a detailed specification of the proposed headquarters infrastructure in the invited full proposal.

D. FINANCIAL SCOPE AND SCALE OF THE ERC

NSF Award Size: Proposed budgets may not exceed $3.0 M for year one, $3.25 M for year two, $3.5 M for year three, $4.0 Mfor year four, and $4.0 M for year five. The actual funding level in any given year will depend upon a detailed analysis of proposed work, progress to date, financial need, and the availability of funds.

Total Support : ERCs establish a center account into which the following types of support are deposited: ERC program base and supplemental support, university cash cost sharing, industrial membership fees, industrial support for sponsored projects that is provided directly to the center, donations from industry, state support, other government agency support, and other support provided to the center. Except for university cost sharing, these funds are considered leverage to the NSF support. State and other government agency support are not required.

The lead university is responsible for providing 20 percent cost sharing in cash and/or in kind as defined in Budget Section V.B. Cost sharing is the responsibility of the lead and any or all of the core partner institutions may contribute. Cost sharing is not required or expected of outreach institutions. In the preliminary proposal and in the invited full proposal, cost sharing contributions must be detailed by institution and by year and in a cumulative amount for the five-year period of the initial award. The cost of headquarters space provided by the lead university is not considered cost sharing. Only the 20 per cent cost sharing will be listed on line M of the NSF budget.

Ongoing ERCs are required to have industry members paying cash membership fees. Preliminary proposals are not required to demonstrate financial commitment by industry. By the full proposal stage, NSF expects the level of industrial support from firms committed to ERC membership, if the award is made, to demonstrate strong industry interest in the proposed ERC. There are no minimum requirements for membership support as judgments of sufficiency vary by field.

III. ELIGIBILITY INFORMATION

Organizational Limit:

Only U.S. academic institutions with undergraduate and doctoral engineering programs may submit preliminary and invited full proposals as the lead institution. As a multi-university effort, the lead university will be joined by up to four long-term core partner academic institutions that share the responsibility for the ERC. These core partner institutions must have undergraduate and/or graduate engineering programs. College-level outreach in research and education and precollege outreach involving precollege teachers and students are required. At least one of the core partner or outreach institutions must be an institution that serves populations underrepresented in engineering and at least one of the outreach affiliates must be an NSF-supported Louis Stokes Alliance for Minority Participation.

Only universities able to provide headquarters space for the proposed ERC may submit invited proposals as the lead institution. The provision of this space is not required in the preliminary proposal.

There is no restriction on the number of preliminary or invited full proposals that may be submitted by a lead institution, or on the number of core partner or outreach relationships proposed by an institution. Since there will be no institution with two fully operational ERCs by FY 2006, all eligible institutions may submit preliminary proposals under this solicitation

PI Eligibility Limit:

The Center Director must be a tenured faculty member in an engineering department at the lead institution. The Director's doctoral degree must be in engineering or an associated field of science; if the latter, she/he must have substantial career experience in engineering.

Current Involvement in Ongoing or Graduated NSF-funded Centers

Proposing teams involving key faculty who are members of ERCs or other NSF-funded centers that have graduated or are within two years of graduation by the time the award is made are eligible to submit proposals to establish new ERCs. However, it is imperative that the proposed ERC demonstrate a substantially new vision, research, and education and there be substantial value added over all aspects of the prior Center's work to justify an NSF investment.

Proposals substantially duplicating the research scope of ongoing ERCs or other major federally funded

centers will not be supported.

IV. AWARD INFORMATION

Awards: At least $12.0 M is expected to be available to support four new ERCs in FY 2006 with year one budgets of up to $3.0 M. These budgets are expected to grow to $3.25 M in year two, $3.5 M in year three, $4.0 M in year four, and $4.0 M in year five, subject to performance and availability of funds. The actual number of centers funded will depend on the scale and scope of the proposed centers, the level of funding provided in the FY 2006 NSF budget, and the quality of the proposals submitted. Awards will be made as cooperative agreements between NSF and the lead university, with subawards to the core partner institutions and the college-level outreach institutions involved.

Life Cycle under NSF Support: An ERC is supported under a cooperative agreement between the lead university and NSF, the duration of which is potentially 10 years. The first award under the agreement is for five years. Each ERC submits annual reports of progress and plans. Based on these reports, a center's performance and plans are reviewed annually through merit review by outside experts. Continuing support levels are based on the outcomes of the annual reviews and the availability of funds. In the third and sixth years, an ERC may submit a renewal proposal, which will undergo merit review by outside experts. If the third-year renewal review is successful, a new term of five years of support begins in year four. If the sixth-year renewal review is successful, a final term of four years of support begins in year seven. If an annual or a renewal review is not successful, NSF support is phased down for up to two years. The frequency of annual reviews between years four and nine depends upon the progress of the Center and the outcome of the third and sixth-year renewal reviews. NSF support for successful ERCs is phased-down in years nine and ten to prepare the Center for self-sufficiency, since ERCs are expected to be self-sustaining after ten years when NSF support ceases.

Post-Award Guidance and Oversight: NSF provides assistance in developing an ERC through program oversight, the ERC Annual Meeting, and the annual and renewal review processes. NSF also supports small teams of experienced staff from ongoing ERCs (the ERC Consultancy) to visit new ERCs to help establish effective programs of administration and industrial collaboration. In addition, NSF staff will brief the new ERCs on site at the lead awardee institution on program and performance expectations shortly after notification of award.

NSF requires ERCs to submit annual reports that are more extensive in scope than those required of single investigator awards. NSF provides guidelines for these reports. NSF also requires ERCs to collect and submit to NSF data on indicators of progress, outcome, impact, and financialial management. NSF proivdes data definition guidelines and templaes for the recording and submission of these data through a securite web site.

Members of all ERCs' leadership teams are required to participate in the ERC Annual Meeting, held annually in the Washington, DC area to share successes and failures, receive updates on the ERC Program, and provide input for future Program improvements. Prospective centers should include funds in their travel budgets to support the participation in a three-day meeting of the Director, the Deputy Director, the Administrative Director, the Education/Outreach Program Directors, the Industrial Collaboration and Technology Transfer Director, and at least two leaders of the Student Leadership Council.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent *(required):*

A one to two-page letter of intent is required to facilitate the NSF review process. The letter should be submitted by e-mail to ercintent@nsf.gov no later than the date specified in this solicitation. The subject heading of the email will include a brief title of the ERC and the name of the lead institution. Each letter must include the following:

    1. Name of the proposed ERC, the name of the lead university, the names of the core partner

universities, and the names of any affiliated outreach institutions.

2. Brief statements of the vision and goals of the ERC, its research program including research thrust titles and goals, and its education, outreach, diversity, and industrial collaboration/technology transfer programs, all at a sufficient level of detail to understand the proposed ERC.

3. Names of the Director, Deputy Director, and other key faculty and their departmental and institutional affiliations.

Preliminary Proposals *(required):*

Preliminary proposals are required. Follow the full proposal instructions, where the differences between the preliminary and full proposals are articulated. Preliminary proposals will be grouped into like topics, and panels will be formed to review these groups of proposals. Preliminary proposals will be reviewed individually by members of the panel to which the proposal is assigned; occasional mail reviews will be requested to round out the expertise of a panel. The panel will take these individual reviews into consideration in their discussions and deliberations, and will prepare a panel summary regarding findings and recommendations.

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: https://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.

Invited full proposals will be reviewed by selected members of the panel that reviewed its preliminary proposal and selected members of the "Blue Ribbon" ERC Panel. The ERC Panel will meet to consider these reviews, discuss the proposals and recommend site visits. Each site visit review team will be developed to have the appropriate disciplinary coverage to review the proposed content. That team's deliberations will be facilitated by NSF staff. One or two members of the ERC Panel will attend each site visit as observers. The site visit reports will be returned to the site visited PIs and will be sent to all the members of the ERC Panel. The ERC Panel will convene for its final meeting to recommend awards. The PIs and up to three members of the proposed team will brief this panel and respond to questions. After a round of discussions and deliberations, the ERC Panel will recommend awards.

The text of the project description of the preliminary and the invited full proposals must be single-spaced in 12-point type. Tables and lists in the project description may be in smaller but readable type. Supplementary materials may also be in smaller but readable type. Both will include the items listed below in the order indicated. As a multi-university ERC, the preliminary proposal and any invited full proposal must be submitted as an integrated proposal by the lead institution, with proposed sub awards to the other partner institutions. Separate preliminary and full proposals from each partner will not be accepted.

The required format for preliminary and invited full proposals is indicated below. Sections required in the full proposal; but not in the preliminary proposal are noted. The preliminary proposal must include the information requested in brief but to be successful, there must be clear statements of goals and clear statements of how these goals will be addressed. The invited full proposal would have a fuller explication of goals and methods.

(1.) Cover Sheet. -   For planning purposes, June 1, 2006 should be shown as the start date. The proposed Center Director must be shown as the Principal Investigator.

(2.) Project Summary (one page). The summary should be written in the third person and should make a compelling case for the ERC. The summary should be informative to persons working in the same or related fields and, insofar as possible, understandable to a scientifically or technically literate lay reader. Include the ERC's name, the Director's name, and the lead institution's name, and the names of the core partner institutions at the top of the page. Write a clear description of the Center, stating its vision and goals and a clear description of the transforming nature of the systems technology. Provide highlights of the proposed research, education, precollege outreach, diversity, industrial collaboration and technology transfer goals and strategies. Briefly indicate the unique opportunities that the Center will provide and its interdisciplinary composition. **A preliminary proposal or invited full proposal that**

does not include titled sections (Intellectual Merit and Broader Impacts) referencing the NSF review criteria and specific reference to how the proposal will address these criteria will be returned without review.

(3.) Table of Contents will be generated automatically by FastLane.

(4.) Project Description The project description must contain sections 4.a-4.g and is limited to 25 pages for preliminary proposals and 40 pages for full proposals, including all figures, tables, and charts. These page limits are **extended by the length of the list of participants, advisors, and supporters (section 4.a).** The project description should be prepared with reference to the review criteria and the guidance provided in this and the preceding sections of this solicitation. The intellectual merit and broader impacts of the ERC must be addressed and described as an integral part of the narrative.

The project description will not include the normally-required separate section on prior NSF support, as this information will be integrated into the discussion of the state of the art.

Include outreach affiliations planned for years one through five in the preliminary proposal and invited full proposal. **These affiliations may not change after submission of the full proposal.**

Start the project description with the lists of participants, advisory, and industrial/agency supporters, detailed in section 4a. NSF will extend the page limits above by the number of pages taken up by these lists. For example, a three-page list extends the page limit for the narrative for the preliminary proposal to 28 and for an invited full proposal to 43. These page limits include other lists, charts, figures, and tables required as a part of the narrative and others the proposers wish to include. **If the project description section exceeds these extended page limits, the preliminary proposal or invited full proposal will be returned without review.**

(4.a) List of Academic and other Participants and of Industrial and Other Supporters. List the Academic and Other Participants Carrying out the Research and Education Functions of the ERC, committed and contacted members of its Scientific Advisory Board, and the firms, agencies committed to membership and support. A sample table is provided below and proposers are free to improve upon the table format for clarity and ease of reading. The font can be smaller than 12 point. NSF will use these lists to determine whether potential reviewers have conflicts-of-interest and as a reference for the staffing and industrial participation in the proposed ERC. Insert the table at the beginning of the project description.

Title of the ERC

Lead Institution	**Name**	**City**	**State**
Core Partner Institutions	**Name**	**City**	**State**
Affiliated Outreach Institutions including precollege	**Names**	**City**	**State**

Leadership Team

Director	**Name**	**Department**	**Institution**
Deputy Director	**Name**	**Department**	**Institution**
Education Program Director	**Name**	**Department**	**Institution**
Education Outreach Program Director	**Name**	**Department**	**Institution**
Industrial Collaboration and Technology Transfer Director	**Name, if known**	**Staff**	**Institution**
Administrative Director	**Name, if known**	**Staff**	**Institution**

Thrusts - List each thrust separately.

Name of Thrust

Thrust Leader	Name	Department	Institution
Faculty Members in the Thrust (row per person)	Name	Department	Institution
Non-Faculty Investigators (from the ERC's institutions, affiliated Federal labs or affiliated hospitals, etc.	Name	Department	Institution/ Agency, etc.

Advisors

Scientific Advisory Committee Members (Committed and nominated)	Name	Department/ Division	Institution

Industrial Collaborators

Preliminary Proposal: List the firms/agencies, etc. contacted for membership	Name of the Firm/ Agency	Sector/Function	
Full Proposal: List only the firms/agencies committed to membership and support	Name of the Firm/ Agency	Sector/Function	

In addition to the FastLane instructions, the proposer must send the following two documents via email. After receipt of the proposal number from FastLane, send an email to ercintent@nsf.gov. The subject heading of the email should note the proposal number and the lead institution. Attach the following documents to it:

(1) Prepare the following table in Excel. The table will have the following column headings: Preliminary Proposal #; Name of Center Director; Lead Institution; Core Partner Institutions; Outreach Institutions; NSF-Supported Diversity Awardees, Leaders & Faculty (Names of the Director, Deputy Director, Education and Outreach Directors, and all faculty proposed to be involved in the ERCs research and education programs from the lead, core partner, and affiliate institutions, do not include precollege teachers); Departments (of the people listed in the prior column) Institutions (of the people listed); Committed or Nominated Members of the Scientific Advisory Board; for the preliminary proposal, Firms/Agencies contacted for Membership; for the full proposal, Firms/Agencies Committed to Membership. This table will be used by NSF to check for conflicts of interest in assembling the review community. Remember to email this, don't use FastLane.

(2) Prepare the following in Power Point: one slide summarizing the vision of the ERC and another showing its strategic plan. These will be used during the review panels to support the proposal review discussions. Remember to email this, don't use FastLane.

(4.b) Vision and Rationale for the ERC. State the vision of the ERC and explain its systems focus and the transforming or "disruptive" nature of the technology. Provide a brief review of the state of the art and practice, key advances made in the field by the team members under NSF and other support and by others nationally and internationally. Reference the names and institutional affiliations of major contributors. If there are ongoing ERCs, Science and Technology Centers, or Materials Research Science and Engineering Centers, or other major government-supported centers working in the field proposed, position the proposed ERC relative to the work of these ongoing centers. Based on this analysis, position the proposed ERC in the field, focusing on the opportunities for value added in knowledge, technology, education and the diversity of the workforce. Include a brief discussion of the key barriers to achieving the ERC's vision. Justify why it is necessary to develop a center, as opposed to a collection of individual projects or a small group, to address these barriers to achieve this vision.

If the ERC team is totally or in large part derived from a center or a combination of centers that currently operate with government or private sector support as recognized centers, provide a brief summary of the current goals and achievements of these centers and a clear justification of the difference in vision of the proposed ERC. Explain whether these centers will continue to function independently from the ERC,

in synergy with the ERC, or be absorbed into it.

(4.c) Strategic Research Plan and Research Program. Given the ERC's engineered system vision, present the ERC's strategic research plan, including its deliverables, the major barriers in the way of achieving them, and the major research goals. From this, describe the research program and how the engineered systems-level vision will drive and integrate the fundamental, enabling technology, and systems level research and the role of the test beds. Provide a graphical depiction of the strategic plan using the ERC Program's 3-Plane Strategic Planning Chart. Describe how the ERC's research program will be structured into thrusts or groups of projects and the role of test beds to achieve the vision. Provide a milestone chart or "road map" depicting the timing of the key research topics and their interdependencies, the test beds, and deliverables of the ERC over a ten-year period, with greater detail for years one through five. Discuss the overall balance of the research across the three planes through time. Fully discuss and any major projects and test beds designed to integrate the findings to achieve the deliverables.   Do not include education deliverables in this chart as these will be provided in the Education Strategic Plan. Other figures may be added as needed to depict the ERC's research strategy.

For each thrust area, provide the following information as a minimum. At the start of each thrust's narrative, provide a small table listing the faculty participants by name, their departments, and institutions. Discuss the goals and objectives of the thrust *vis-a-vis* the goals of the ERC. Position it in the state of the art and discuss its role in the ERC's three-plan strategic plan. Provide information on projected knowledge and technology deliverables, and the specific barriers the thrust will address in the context of the ERC's strategic plan. Provide specific examples of key research projects in sufficient detail for the reviewers to judge how the work will be done and methodologies to be used. Discuss the integration of projects within the thrust and the interdependencies among the thrusts. Discuss the cross-disciplinary mix needed to achieve the thrust's goals.

(4.d) Education and Educational Outreach Program. Provide a strategic plan for the ERC's education program, including how it will develop an interdisciplinary, practice-oriented, team culture, the mix of undergraduate and graduate students involved during the academic year, the plans to integrate knowledge from the ERC's research into undergraduate and graduate curricula and continuing education for practitioners. There is no standard model for this plan. Justify why this curricular impact is needed. Impact of the ERC's research on courses is required, while impact on new degree programs or options is optional, depending on the needs in the field. Discuss the development, evaluation, implementation and dissemination strategy for educational materials. Describe how the students will benefit from the multi-university configuration of the ERC in their research and education. Describe how the core partner institutions will collaborate to achieve a cross-institution education program that impacts all and how the college-level outreach institutions will participate in and be impacted by the ERC's education program. Discuss the proposed REU program.

Discuss the goals and mechanisms for involvement of precollege teachers and students in the research and education programs of the ERC and how the ERC's research will impact precollege classroom materials. Both types of involvement should be substantive and of sufficient duration to inform the teachers and students about the nature of engineering research and practice. Involvement in one-day open houses is not sufficient. Include a tracking and assessment component. Discuss the proposed RET program.

Integrate into the college and precollege narrative how these programs support the ERC's diversity strategic plan.

(4.e) Industrial collaboration and technology transfer. Discuss the goals and strategies of the ERC's industrial collaboration/technology transfer program, including its strategy for the composition of the industry/practitioners membership, i.e., manufacturers, suppliers, practitioners/user agencies, etc. Refer the reader to the table of committed and interested members at the beginning of the project description to avoid another table. Discuss how industry and other appropriate users/practitioners have been involved in the development of the ERC's vision and strategy and will be involved in its planning, research, education, and technology transfer programs, if an award is made. Discuss the role of the Industrial/Practitioner Advisory Board. Discuss how the proposed multi-university ERC will function as a unified whole as opposed to a collection of collaborations with industry. Discuss the general terms of the ERC's membership agreement and intellectual property policy in the preliminary proposal and provide the finalized agreement and policy in the invited full proposal. Indicate if there will be a flat fee or different levels of membership fees; and, if so, indicate the difference in benefits to be received at each level. Members of committed firms should be involved in the drafting of the final policy. If the ERC

involves a partnership with state and/or local governments or hospitals, etc. (as users, as opposed to members of the research team) indicate the goals and objectives of this partnership and how this will facilitate technology transfer.

Only invited full proposals will include in supplemental documents letters from all the firms/agencies committed to membership if an award is made. Commitments for financial support from industry are not required for preliminary proposals but they are for full proposals.

The finalized membership agreement and intellectual property policy will be included in supplemental documents in invited full proposals.

(4.f) Infrastructure

Institutional Configuration, Team, Diversity, and Administration Partnership

Justify the institutional configuration given the vision. Discuss the role of the ERC in the strategic plans of the lead and core partner institutions. Discuss the partnership with the associated deans and department chairs to assure the ERC's success.

Discuss the composition and roles of the leadership team, including the Director, Deputy Director, Research Thrust Leaders, Education and Educational Outreach Program Directors, Industrial Collaboration and Technology Transfer Director, Administrative Director, and Student Leadership Council. Provide summary information on the disciplinary composition of the faculty team, based on their departmental affiliations or degrees, as appropriate for each person.

Provide the ERC's 10-year diversity strategic plan, including goals, milestones, and, intended actions for success in building diverse leadership, faculty, graduate and undergraduate student teams and diverse cadres of ERC graduates. Plans may not include quantitative targets; however, upon award, annual reports will include information on impacts benchmarked against engineering-wide averages. Provide quantitative data by lead, core partner, and any affiliated college-level institutions on the diversity of the leadership team, faculty, and students who have been identified to participate in the ERC during years one through five. If no students have been identified that is understandable and those rows can be left blank. These data must include the number of men and the number of women (US citizens and permanent residents) and the number of US citizens or permanent residents who are members of racial groups underrepresented in engineering (African American, Pacific Islander, Native American, Alaskan Native) and ethnic groups underrepresented in engineering (Hispanic American) who are involved in the ERC's research and curriculum development efforts. Insert a table. The columns will be: total participants (including foreigners who are not citizens or permanent residents); for citizens and permanent residents, show the total number of males, total number of females, total numbers separately of African Americans, Native Americans, and Pacific Islanders; and the total number of Hispanic Americans. The rows will be: leadership team, faculty, graduate students, and undergraduate students. Do not include postdocs, technicians, or office staff.

Organizational Structure and Management System

Describe the proposed organizational structure including information on how the members from participating universities and precollege institutions will be developed into an integrated team. Include an organization chart for the ERC. Discuss the roles of the Council of Deans from the lead and core partner institutions, the university policy boards, and the Scientific Advisory Board and the Industrial Advisory Board. Describe how projects will be selected and evaluated and who will be responsible for integration of projects to achieve the ERC's deliverables.

Headquarters and Equipment Infrastructure

Briefly discuss the laboratories, shared facilities and equipment for the ERC, referring the reader to the required section on Facilities and Equipment in Supplementary Documents as discussed in Section 12. Discuss those that will be shared by members of the ERC team. Distinguish between equipment and facilities that are already available any that will be developed by the Center. For invited full proposals include a description of headquarters space, its size and functionality.

Financial Plan and Support (for Full proposals only)

Discuss the ERC's strategy for gaining financial and in-kind support beyond that requested from NSF. Provide a table showing committed support for year one as indicated below. For university support, the

lead and core partner universities are required to cost share this effort with NSF (20 percent of NSF support in cash and/or in-kind). The outreach and affiliate universities and precollege institutions are not required to cost share. Letters from administrators of the universities providing the cost sharing are requested as instructed below.

Committed Support for Year 1 and Amount of Request from NSF

(In cash and in-kind)

Source	Cash	In-Kind	Total
Industry			
University cash cost sharing			
State Gov.			
Local Gov.			
Other Federal Agency			
Other			
Total Non-NSF			
Requested from NSF			
Total			

Functional Budget for Year 1

(Committed Support and Amount Requested from NSF)

Source/ Support	Industry	University Cash Cost Sharing	State/ Local Gov.	Other Fed. Agencies	Other	NSF	Total
Thrust 1 (1)							
Thrust 2, Thrust N							
Total Research							
Shared Equipment & Facilities (2)							
Education & outreach (3)							
Industrial Collab. (4)							
Mgt. (5)							
Travel (6)							
Indirect Cost							
Total							

(1)   Include personnel & benefits, PI-level equipment, other costs. Include student stipends, fellowships, and tuition support for students carrying out the research.

(2)   Equipment & facilities that benefit the entire ERC

      (3)   Cost of course and curriculum development, precollege outreach, etc.

      (4)   Industrial meetings, technology transfer activities

      (5)   Director's, Deputy Director's, Education Directors' time in management; salaries for Administrative Director and staff, Educational Outreach Director, Industrial Collaboration and Technology Transfer Director, and other administrative costs.

      (6)   Conference travel, other travel.

(5) References Cited. Section not to exceed five pages.

(6) Current and Pending Support. Include only for the Director, Deputy Director, and Research Thrust Leaders, and other faculty expected to receive more than $80,000 in year 1 from the ERC.

(7)   Biographical Sketches (two-page limit per person) The basic GPG guidelines for biographical material apply. Biographical sketches are required of all the key participants (e.g., the Director, Deputy Director, Education Director, Educational Outreach Director (if known), Industrial Collaboration and Technology Transfer Director (if known), the Research Thrust Leaders, and other faculty expected to receive more than $80,000 in year 1 from the ERC. For faculty, up to 5 publications of high levels of relevance to the proposal may be listed in each biographical sketch.

(8) Budgetary Information.   The preliminary proposal and invited full proposal will include a budget for each of the five years proposed. FastLane will automatically provide a cumulative budget. Enter the anticipated total level of subcontract support on line G5, Subawards. Preliminary proposals should not include any subcontracts. Full proposals require the inclusion of separate budgets for subcontracts for the core partner institutions at any level and for outreach affiliates if the budget exceeds $100,000 per year. For the other outreach affiliates include the costs for these in the aggregate on line 5, subawards, of the budget.

In the budget justification section of the invited full, provide as a pie chart or a table the planned distribution of funds in Year 1 among the lead, core partner, and outreach institutions.

The lead university is responsible for providing 20 per cent tangible cost sharing in cash and in kind, which may come from the lead and any or all of the core partner institutions, at both the preliminary proposal and full proposal stages. All cost sharing must be provided from non-Federal sources. Provide in the budget justification, a table showing committed cost sharing by institution and year, including cumulative totals.

If the information provided exceeds the FastLane budget justification limit, place the remaining information in Supplementary Documents and direct the reader to their location

(9) Reviewer Information. Use FastLane to enter a "List of Suggested Reviewers," if desired.

(10) Supplementary Documents. The following items must be provided as supplemental documents.

Preliminary Proposals and Invited Full Proposals:

Letters: From the lead institution, provide letters of commitment to the goals of the ERC and to cost sharing from the Dean of Engineering and higher-level university officials authorized to commit the lead institution to cost sharing. Similar letters from similar individuals should be included from the core partner institutions. Letters are not required from outreach institutions. In the full proposal only, include letters from all firms/agencies committed to membership. **All letters must be placed in the Supplementary Documents section of the FastLane proposal and submitted electronically, as part of the proposal. Please do not mail, fax or e-mail paper copies of the letters to the NSF.** The letters should be addressed to Ms. Lynn Preston, Leader of the ERC Program, Division of Engineering Education and Centers, Suite 585, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

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SUMMARY OF REQUIREMENTS

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Topic	Preliminary proposal	Full Proposal
Proposal Requirements		
Commitment of industrial funds	No	Yes
20%tangible cost sharing by lead and any or all of the core partner institutions	Yes	Yes
Cost Sharing by outreach institutions	No	No
Identification of participating faculty members from the lead and core partner institutions	Years 1-5	Years 1-5
Identification of participating faculty/staff members at any outreach institutions	Years 1-5	Years 1-5
Names of participating Precollege Institutions	Yes	Yes
Names of Precollege teachers	No	No
Names and affiliations of industry/agency personnel contacted for membership in the ERC	Yes	No
Names and affiliations of industry/agency personnel committed to membership in the ERC	Yes	Yes
Names of persons nominated or committed to serving on ERC advisory committees	Yes	Yes
Membership agreement and intellectual property policy	General Terms	Finalized agreement and IP policy
Submission Requirements		
List of Participants and 2 PowerPoint slides on vision and strategic plan emailed to ercintent@nsf.gov	Yes	Yes
Notice of Intent submitted to ercintent@nsf.gov	Yes	No
Mode of Submission	Submission in FastLane	Submission in FastLane only by Invitation
Format		
Information About PI	Yes	Yes
NSF Cover Sheet	Yes	Yes
FastLane Submission of Cover Sheet	Yes	Yes
FastLane Submission of Proposals	Yes	Yes
Table of Contents	Yes	Yes
List of Academic Participants, in Narrative	Yes	Yes
List of Committed Industrial/Agency Partners, in Narrative	Yes	Yes
List of Nominated and Committed Advisory Board Members, in narrative	Yes	Yes
Project Summary with Reference to Intellectual Merit and Broader Impacts	Yes	Yes
Project Descriptions	25 pages, including charts, etc., but extended by the size of the list of participants	40 pages, including charts, etc., but extended by the size of the list of participants
Letters:		
Academic Letters committing to ERC and cost sharing	Yes	Yes
Letter from Lead Institution committing to HQ space	No	Yes
Letters of Commitment to membership and Support for ERC from Industry/other Users	No	Yes
Budgetary Information		
Separate FastLane budgets for years 1-5	Yes	Yes
Cumulative FastLane budget for years 1-5	Generated by FastLane	Generated by FastLane
Allocation of Funds by Function (Year 1 only)	No	Yes
Allocation of Funds by Institution (Year 1 only)	No	Yes
Justification for Secretarial & Admin. Support	No	Yes

Proposers are reminded to identify the program announcement/solicitation number (04-570) 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 of 20 percent of the funds requested from NSF is required. Cost sharing includes cash and in-kind support for purposes such as new tenured or tenure-track faculty positions, salaries for staff to support the ERC's goals. Costs for refurbishing or building headquarters space and release time for faculty are not elgible for cost sharing.

Cost sharing at a level of 20 percent of the requested total amount of NSF funds is required for all proposals submitted in response to this announcement/solicitation. The proposed cost sharing must be shown on line M on the proposal budget. Documentation of the availability of cost sharing must be included in the proposal.

Only items which would be allowable under the applicable cost principles, if charged to the project, may be included in the awardee's contribution to cost sharing. Contributions may be made from any non-Federal source, including non-Federal grants or contracts, and may be cash or in kind (see OMB Circular A-110, Section 23). It should be noted that contributions counted as cost sharing toward projects of another Federal agency may not be counted towards meeting the specific cost sharing requirements of the NSF award.

All cost sharing amounts are subject to audit. Failure to provide the level of cost sharing reflected in the approved award budget may result in termination of the NSF award, disallowance of award costs and/or refund of award funds to NSF.

Other Budgetary Limitations:

Other budgetary limitations apply. Please see the full program announcement/solicitation for further information.

C. Due Dates

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

Letters of Intent *(required):*

> September 10, 2004

Preliminary Proposals *(required):*

> November 08, 2004

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

> June 16, 2005
> > By Invitation Only

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:

Additional review criteria for preliminary proposals and full proposals are as follows:

- Proposal defines an emerging engineered system with strong potential to spawn new industries, transform our current industrial base, service delivery system or infrastructure, and have a broad societal impact;
- The ERC's diversity strategy will yield an ERC whose leadership, faculty, and student teams are more diverse than national engineering-wide averages in gender, race, and ethnicity and as a consequence it will have a significant impact on the diversity of the engineering and science workforce;
- Research plan targets critical systems goals, identifies challenging scientific and technical barriers to be overcome and proposes high quality research projects and proof-of-concept test beds to address these barriers; demonstrates a clear knowledge of the state of the art and presents a persuasive strategy for advancing it;
- Research thrusts propose significant goals, target significant barriers, use high quality research methodologies that will advance the state of the art; integrating knowledge from other projects and thrusts, and involve a diverse team with the skills and disciplines needed to achieve the goals;
- Education plan integrates the ERC's research activities into the curricula at all levels, achieves a team-based, cross-disciplinary research culture for a diverse team undergraduate and graduate students from the core and outreach institutions/affiliates, and incorporates effective plans for implementation, assessment and dissemination of curricular materials;
- Precollege outreach involves a diverse cadre of teachers and students in the ERC's research and education programs, enables precollege teachers to bring knowledge of engineering to precollege classroom, and motivates students to study engineering;
- Convincing rationale for the selection of industrial/user partners and means to engage these partners in planning, research, education, and technology transfer;
- Proposed terms of the industrial membership agreement will structure a center-wide program of industrial collaboration to support overall ERC goals, as opposed to a collection of individual industrially sponsored projects; proposed terms of the intellectual property policy will facilitate technology transfer;
- Institutional configuration is appropriate to the goals of the ERC and collaboration is integrated across the participating core universities; the university administrators from the lead and core partner institutions will join in partnership with the ERC to facilitate its interdisciplinary configuration, reward interdisciplinary research and the integration of research and education, and deliver on its diversity goals;
- ERC has expertise in all disciplines required to attain its goals, a capable leader and leadership team
- Leadership, faculty and student teams are diverse in gender, race, and ethnicity and diversity strategic plan will result in a very diverse team with a strong impact on the diversity of the engineering workforce;
- Organizational structure and management plan effectively organize and integrate the resources of the ERC across the lead and core partner institutions to achieve its goals and include strong advisory and project selection/evaluation systems;
- Experimental, computational, and other required equipment, facilities, and laboratory space are in place or proposed to support the research of the Center.

For full proposals only:

- Headquarters space and cross-institution communications equipment will effectively encourage and facilitate interdisciplinary collaboration and house the management functions of the ERC.
- Commitments from firms to be fee-paying members of the ERC represent a significant commitment to the ERC given the field, if an award is made.

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. Pre-proposals and invited full proposals submitted in response to this solicitation will receive a peer review by experts outside of NSF. .

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 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 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 are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC). 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 Grants and Agreements.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards /managing/. Paper copies of these documents 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 https://www.nsf.gov /publications/pub_summ.jsp?ods_key=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.

NSF requires ERCs to submit annual reports that are more extensive in scope than those required of single investigator awards. NSF provides guidelines for these reports. NSF also requires ERCs to collect and submit to NSF data on indicators of progress, outcome, impact, and financialial management. NSF proivdes data definition guidelines and templaes for the recording and submission of these data through a securite web site.

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:

- Lynn Preston, Leader of the Engineering Research Centers Program and Deputy Division Director (Centers), Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-5358, fax: (703) 292-9051, email: lpreston@nsf.gov

- Bruce M. Kramer, Program Director, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-5348, fax: (703) 292-9051, email: bkramer@nsf.gov

- Vilas Mujumdar, Program Director, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-7262, fax: (703) 292-9052, email: vmujumda@nsf.gov

- Sohi Rastegar, Program Director, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-5379, fax: (703) 292-9051, email: srastega@nsf.gov

- Mary F. Poats, Program Manager, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-5357, fax: (703) 292-9051, email: mpoats@nsf.gov

Other Program Directors from other Divisions of NSF may be consulted regarding the development of preliminary proposals. NSF Program Directors outside of the Division of Engineering Education and Centers who are familiar with the ERC Program by virtue of serving as a lead ERC Program Director or leaders of past ERC review panels are: Leon Esterowitz, Division of Bioengineering and Environmental Systems; Fil Bartoli, Larry Goldberg and Rajinder Khosla, Division of Electrical and Communications

Systems; Glenn Schrader, Division of Chemical and Transport Systems, Delcie Durham, Division of Design, Manufacture and Industrial Innovation; Joy Pauschke, Division of Civil and Mechanical Systems.

For questions related to the use of FastLane, contact:

- Esther M. Bolding, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-5342, fax: (703) 292-9051, email: ebolding@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 https://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 https://www.nsf.gov /home/ebulletin, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's MyNSF News Service (https://www.nsf.gov/mynsf/) to be notified of new funding opportunities that become available.

Other center programs of special interest may be the Industry/University Cooperative Research Centers, Science and Technology Centers, and the Materials Research Science and Engineering Centers.

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 (FASED) 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 https://www.nsf.gov

- **Location:**   4201 Wilson Blvd. Arlington, VA 22230

- **For General Information**   (703) 292-5111
  (NSF Information Center)**:**

- **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.

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