

# Engineering Research Centers (ERC)

## Partnerships in Transforming Research, Education and Technology

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### Program Solicitation

NSF 07-521

*Replaces Document(s):*

NSF 04-570



**National Science Foundation**

Directorate for Engineering  
Engineering Education and Centers

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

February 02, 2007

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

May 03, 2007

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

October 30, 2007

Invited Full Proposals

### REVISION NOTES

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In furtherance of the President's Management Agenda, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via [Grants.gov](http://Grants.gov) or via the [NSF FastLane](#) system.

Due to the complexity of the proposals being submitted, however, use of FastLane to prepare and submit proposals is strongly encouraged.

This solicitation differs from [NSF 04-570](#) as follows: 1. The new ERC will have a stronger focus on combining fundamental research and research and education focused on innovation. The innovation focus will support small firms engaged in translational research within the ERC's research program to speed innovation and expose students to the innovation process. Partnerships will include state, local government, or academic programs designed to stimulate entrepreneurship. 2. The ERC will be focused on preparing its students for success in a global economy and will include activities to accomplish this, which may include a foreign university as a core partner. Support for the foreign university participants will be provided by foreign sources during the first year of center operation but the partnership has to be in place in the preliminary proposal. 3. The education program will be strategically planned to develop graduates who are experienced in the creative process and cross-cultural collaboration and able to define pathways to explore and realize innovation opportunities to prepare them for success in a global economy. 4. Base NSF support levels will be flat through years one to five and an awarded ERC may submit a supplemental proposal to augment support each year. There are no requirements for cost sharing from academe or other sources.

## SUMMARY OF PROGRAM REQUIREMENTS

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### General Information

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#### Program Title:

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

#### Synopsis of Program:

The goal of the Generation Three (Gen-3) Engineering Research Centers (ERC) Program is to create a culture of innovation in engineering research and education that links scientific discovery to technological innovation through transformational engineered systems research in order to advance technology and produce engineering graduates who will be creative innovators in a global economy. These ERCs will be at the forefront as the U.S. competes in the 21st century global economy where R&D resources and engineering talent are internationally and domestically distributed. Recognizing that optimizing efficiency and product quality is no longer sufficient for U.S. industry to remain competitive, these ERCs will optimize academic engineering research and education to stimulate increased innovation. They will develop this culture of discovery and innovation through a symbiotic relationship between academic researchers, small innovative firms, and larger industrial and practitioner partners. These ERCs will build bridges from science-based discovery to technological innovation by focusing on research needed to realize transforming engineered systems. They will have the opportunity to partner with foreign universities and provide unique opportunities for research and learning collaboration that will prepare U.S. engineering graduates for leadership in innovation in a global economy. Their faculty will be diverse and talented individuals who will prepare diverse and talented domestic and international graduates who can function in a global world where design and production efforts cross national borders. Their transforming engineering education programs will strategically impart the capacity to create and exploit knowledge for technological innovation.

#### Cognizant Program Officer(s):

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

- 47.041 --- Engineering

### Award Information

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**Anticipated Type of Award:** Cooperative Agreement

**Estimated Number of Awards:** 5

**Anticipated Funding Amount:** \$16,250,000 is expected to be available to support five new Gen-3 ERCs in FY 2008 with year one start-up budgets of up to \$3,250,000. This will be the base budget level of the award for years two through five. This level may be enhanced through supplements in years two through five as described in Section II.C, subject to performance, a 20 percent limit on supplements for the award period, and availability of funds. The actual number of centers funded will depend on the scale and scope of the proposed centers, the availability of funds, and the quality of the proposals submitted. Awards and future funding levels are subject to the availability of funds.

## Eligibility Information

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### Organization Limit:

Proposals may only be submitted by the following:

- Only U.S. academic institutions with undergraduate, masters, and doctoral engineering programs of sufficient depth and breadth appropriate to support the vision may submit proposals as the lead institution. Proposals must be submitted by the lead institution with subaward budgets for partner domestic academic institutions. Separately submitted collaborative proposals are not acceptable and will be returned without review.

### PI Limit:

The center director must be a tenured faculty member at the lead institution in an engineering department or may hold a joint appointment in an engineering department. 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 and a joint appointment in an engineering department.

### Limit on Number of Proposals per Organization:

None Specified

### Limit on Number of Proposals per PI:

None Specified

## Proposal Preparation and Submission Instructions

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### 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 Proposals:**
  - Full Proposals submitted via FastLane: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpg](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg).
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: <http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf/>)

### B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.

- **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

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

February 02, 2007

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

May 03, 2007

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

October 30, 2007

Invited Full Proposals

### Proposal Review Information Criteria

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**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

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**Award Conditions:** Standard NSF award conditions apply

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

### TABLE OF CONTENTS

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#### Summary of Program Requirements

- I. **Introduction**
- II. **Program Description**
- III. **Award Information**
- IV. **Eligibility Information**
- V. **Proposal Preparation and Submission Instructions**
  - A. Proposal Preparation Instructions
  - B. Budgetary Information
  - C. Due Dates
  - D. FastLane/Grants.gov Requirements
- VI. **NSF Proposal Processing and Review Procedures**
  - A. NSF Merit Review Criteria
  - B. Review and Selection Process
- VII. **Award Administration Information**
  - A. Notification of the Award
  - B. Award Conditions

VIII. Agency Contacts

IX. Other Information

## I. INTRODUCTION

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Gen-3 Engineering Research Centers (ERC) build on two generations of achievement of over 43 successful ERCs funded between 1985 and 2006. At the request of the White House and the National Academy of Engineering, the ERC program was established in 1984 to develop a new interdisciplinary culture in engineering research and education in partnership with industry to strengthen the competitiveness of U.S. industry. The goal was to educate new generations of engineers who would be capable of integrating fundamental knowledge across disciplines to advance systems-level technology. The first generation of 19 successful ERCs, established between 1985 and 1990, focused on next-generation technological systems and the expansion of design and manufacturing in the academic engineering experience. The second generation of 24 successful ERCs, established from 1994 to 2006, focused on transformational engineered systems with the potential to transform industrial processes and product lines, became multi-disciplinary in configuration, significantly engaged in pre-college education, and focused on significantly increasing the diversity of their faculty and students. Each of these ERCs formed a partnership with industry and other practitioners to bring knowledge of industrial practices and needs to academe and speed the translation of their research into useful products and processes. These partnerships have educated thousands of ERC engineering graduates who have proven to be more effective in speeding innovation in industry.

The beginning of the 21st century finds the U.S. again faced by economic challenges and opportunities. There have been a series of major publications analyzing the position of the U.S. economy in the world economy and raising a significant call for action:

- Engineering Research and America's Future, Committee to Assess the Capacity of the U.S. Engineering Research Enterprise, National Academy of Engineering (NAE), Washington, DC, 2005;
- The Engineer of 2020, NAE, 2004 and Educating the Engineer of 2020, NAE, 2005;
- Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future, National Research Council/ COSEPUP, Washington, DC. 2005;
- Innovate America: National Innovation Initiative Final Report, Council on Competitiveness, Washington, DC, 2005; and
- The World is Flat: A Brief History of the Twenty-First Century, Thomas L. Friedman, Farrar, Straus, and Giroux, New York, 2005.

These publications point to the following challenges and opportunities:

- Recognizing that optimizing efficiency and product quality is not enough, we must increase the capacity of U.S. society for creative innovation;
- Support a culture of innovation through a symbiotic relationship between research, commercialization, and life-long skill development;
- Build bridges from science-based discovery to technological innovation by creating wholly new fields at the interface of science and engineering research;
- Stimulate diverse domestic and international talent to pursue engineering careers in the U.S.;
- Transform engineering education to impart the capacity to create and exploit knowledge for technological innovation; and
- Produce engineering graduates who can compete in a global world where design and production efforts cross national borders.

To address these needs, the core key features of a Gen-3 ERC, as presented below, will position Gen-3 ERCs to build on the proven strengths of the ERC concept with new features that will:

- Build a culture of innovation in academe;

- Link scientific discovery to technological innovation by directly engaging small innovative firms in the ERC's research teams to carry out translational research to speed innovation;
- Build and sustain membership partnerships with industry/practitioners in research, education, and technology transfer;
- Build partnerships with academic, state, and local government, and other programs designed to stimulate entrepreneurship, start-up firms, and otherwise speed the transition of academic knowledge into technological innovation;
- Engage ERC students in all phases of the innovation process both here and abroad so they understand what is required to transition fundamental knowledge discoveries into innovation;
- Strategically design education programs to produce creative, innovative engineers;
- Provide faculty and students with cross-cultural, global research and education experiences through partnerships with foreign universities or other means;
- Explore collaboration with foreign university(ies) where unique research synergistically merges with U.S. research to achieve new discoveries and/or system development; and
- Build long-term sustained partnerships with pre-college institutions to increase the enrollment and diversity of domestic students in college-level engineering degree programs.

Thus, Gen-3 ERCs, their industrial/practitioners partners, small R&D firm research partners, spin-off start-up firms, and their faculty and graduates will be positioned to thrive as innovators in a highly competitive, global economy.

## II. PROGRAM DESCRIPTION

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### A. Goal and Key Features of Generation Three ERCs

The goal of the Generation Three Engineering Research Centers Program is to create a culture of innovation in engineering research and education that links scientific discovery to technological innovation through transformational engineered systems research and education to advance technology and produce engineering graduates who will be creative innovators in a global economy.

To achieve this goal, Gen-3 ERCs will have the following key features:

- A vision for the exploration of transformational engineered systems technology;
- A culture of innovation through direct involvement of small firms in the ERC's research teams and partnerships with programs designed to support entrepreneurship and speed innovation;
- A global experience designed to provide students and faculty with opportunities to collaborate across cultures and thereby achieve new heights of innovation;
- A strategically planned research program motivated by a transformational systems vision and the opportunity to explore innovations through collaborative research with small firms and proof-of-concept test beds;
- A strategically focused educational program designed to develop engineering graduates who are experienced in the creative process and in cross-cultural collaboration, and able to work in teams to define pathways to explore and realize innovation opportunities;
- Long-term sustained partnerships with pre-college educational institutions and their teachers and students to bring engineering concepts into the classroom, engage talented high school students in the ERC's research programs as Young Scholars, and raise the enrollment and diversity of domestic students in engineering and science degree programs;
- Partnerships with industry or practitioners dedicated to speeding the translation of ERC's research into commercially viable products and developing students capable of innovation;

- Partnership with academic, state, and local government, or other programs designed to stimulate entrepreneurship, and with start-up firms to speed the translation of academic knowledge into technological innovation; and
- A diverse, cross-disciplinary team of faculty and students from the U.S. and abroad, who embrace and respect gender, racial, ethnic, and cultural diversity, involve persons with disabilities, and mentor students from all backgrounds to succeed in engineering.

These ERCs will require the following infrastructure to succeed:

- A multi-university configuration comprised of a lead U.S. university and a manageable number of partner universities committed in a long-term partnership in research and education, which must include at least one that serves students predominantly underrepresented in engineering, and it may include a foreign university(ies);
- Leadership and management systems to develop, operate, and sustain the ERC during its NSF funding life and beyond;
- Effective cross-institution collaboration among faculty and students through shared resources (e.g., data, shared experimentation, shared simulations, and test beds), and shared programs of education, enabled by the cyberinfrastructure; and
- Academic policies that sustain and reward the ERC's cross-disciplinary, global culture of the ERC, its goals for technological innovation, and the role of its faculty and students in mentoring and pre-college outreach.

## B. Guidance Regarding Gen-3 Key Features:

Given the broad shift in the key features of the Gen-3 ERCs, the NSF expects each proposing team to develop new modes of effectively realizing these features. The Best Practices Manual ([http://www.erc-assoc.org/manual/bp\\_index.htm](http://www.erc-assoc.org/manual/bp_index.htm)), developed by staff from ongoing ERCs, is a good source of advice but some current practices may not be relevant to the Gen-3 ERC goals.

1. **Systems Vision:** A prospective ERC team should develop a ten-year vision for advances in an emerging and potentially revolutionary or transforming engineered system with the potential to transform current practices or establish wholly new industries. The vision should be positioned at the cusp of emerging discoveries in science and engineering. An engineered system is a combination of components that work in synergy to collectively perform a useful function. 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 and the strategic plan.

There are no NSF preferences regarding the systems vision of the proposed ERC. The systems vision should provide an opportunity for national economic growth or contribute to the solution of a major societal problem that has a national and perhaps an international impact. The vision will focus on systems technology with a significant potential for a transformational impact on current practices or the establishment of wholly new industries or public sector services. Visions that focus on incremental advances to current practices are not suitable. Additionally, proposers should avoid focusing on an engineered system that is too closely aligned with those of ongoing or recently graduated ERCs. Descriptions of ongoing ERCs and access to their web sites can be obtained at <http://www.erc-assoc.org/centers.htm>. Descriptions of the five new ERCs made as an outcome of NSF 04-570 are available on the NSF web site. [http://www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=107939&org=olpa&from=news](http://www.nsf.gov/news/news_summ.jsp?cntn_id=107939&org=olpa&from=news)

2. **Institutional Configuration:** The institutional configuration will be determined by the ERC's research, innovation, diversity, and educational visions.
  - a. **Multi-Institution:** The ERC will have a multi-institution configuration, comprised of a lead university and partners in research, education, and innovation. The number of partners is not restricted but should be kept reasonably small, as NSF requires the effort to be integrated across the partner institutions. The lead and partner institutions must be committed to a shared configuration to fulfill the research, education, and innovation goals of the proposed ERC. The selection of these partners should be governed by their contributions to advancing the research, diversity, education, and innovation goals of the center. At least one of these partners in research and education will be a university or college that serves students predominantly underrepresented in engineering. To reduce the institutional complexity, Gen-3 ERCs are not required or expected to include additional universities as outreach affiliates in research and education. Letters of institutional commitment to the goals of the ERC and

participation will be provided in the preliminary and invited full proposal.

- b. **Involvement of Foreign Universities:** One of the goals of the program is to provide an opportunity for domestic students and faculty to collaborate in a globally connected university research and education environment to strengthen the ERC, provide new opportunities for innovation, and to enable its graduates to work effectively in a global world. Thus, it may be appropriate to include a foreign university as a partner. The decision to involve a foreign university will depend upon the nature of the topic chosen. It is left up to the proposing team to determine the appropriate institutional configuration, given the guidance in the Systems Vision section above. If a foreign university partner is chosen, it is critical for the U.S. investigators to work with foreign investigators whose goals, interests, and intellectual resources complement those of the U.S. investigators and contribute significantly to the ERC achieving its goals. The foreign university or its government will provide funds for this partnership. Foreign students (not a U.S. citizen or permanent resident) matriculated in U.S. degree programs or on a post doc appointment, or foreign faculty serving on a visiting faculty appointment to the lead or one of the U.S. partner universities may be supported by U.S. funds. However, Research Experiences for Undergraduates funds may not be used to support foreign students. If a foreign university partner is proposed, the foreign university is expected to commit to that partnership at the time of the submission of the preliminary proposal. Funding from foreign sources for the foreign faculty and students to work at their home university as ERC partners is expected to be in place during the first year of operation of the center. The preliminary and invited full proposal will include a letter of commitment from the foreign university administrator regarding participation.
  - c. **Pre-college Institutional Partners:** The ERC will include long-term partnerships with a few selected middle and high schools to impact broadly diverse populations of students. These institutions and their teachers will be committed to working with the ERC's faculty and students to provide experiences for teachers and students that will result in the inclusion of engineering concepts in students' pre-college educational experience to stimulate student interest in engineering careers. The pre-college institutions must also assist the ERC with assessing the impact of these efforts. The ERC and its pre-college partners will be committed to the involvement of high school students in a Young Scholars research opportunity in the ERC's laboratories.
  - d. **Innovation Partners:** The ERC will include a partnership(s) with academic, state or local government, or other organizations designed to stimulate start-up firms, entrepreneurship, and otherwise speed innovation. The preliminary and invited full proposals will include a letter of commitment from the organization(s). The research program will include the support for staff from innovative small firms to participate in translational research to speed innovation. However, specification of specific firms at the proposal stage is not required, as the timing of their inclusion will depend on the stage of the research program at start-up and the speed of the pathway of the research toward innovation. These will be partners engaged in fulfilling the mission of the ERC as distinct from the industrial/practitioner partnership program.
3. **Strategic 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 is dynamic over time and 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 at this time. Nevertheless, initial systems goals and requirements, specific knowledge gaps, technology goals and deliverables, and barriers to achieving these goals should be identified in the preliminary and invited full proposal and will evolve in depth and sophistication over time. If the topic chosen would require many years of exploration through fundamental research before systems goals could be understood, the topic is not appropriate for an ERC and other sources of support should be pursued until the systems opportunities are more apparent.

These systems goals and barriers motivate and guide the selection of proposed research projects, test beds, and the role of small firms in the research program to speed innovation. The project-level descriptions in the research section of the proposal explain the fundamental barriers the research will address and the approaches to be taken to address them in the context of known results and theory to demonstrate that the desired results constitute breakthroughs and 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. Small, innovative firms will be included in the research program with ERC funds at the appropriate time to carry out research to strategically speed innovation. 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.

The role of the small firms in the research program should be strategically planned to engage staff from these firms, teamed with the ERC's students, in translational research designed to speed the transfer of knowledge into innovation. This will provide the opportunity for the ERC's students at all levels to work with members of these small firms in the ERC's laboratories to assure they learn about the innovation process as a part of their degree activities. The timing of the inclusion of these firms depends on the timing of the readiness of the research for the translational phase.

The plan also should include support for technical staff to work with students and faculty to build the systems test beds and transition from completed enabling and systems technology research to early-stage prototypes.

Proposers must provide a conceptual diagram using a customized version of the ERC Program's Three-Plane Strategic Planning Chart. 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. This chart is available at [http://www.erc-assoc.org/topics/6-erc\\_proposal.html](http://www.erc-assoc.org/topics/6-erc_proposal.html).

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.

- 4. 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 involvement of 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 and 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.

The research program will form collaborations of the best faculty and students working in fields that support the vision. It will integrate engineering disciplines with other scientific disciplines needed to achieve the vision.

The research program will develop a culture of innovation for all students to complement the discovery aspects of each person's research. The innovation efforts of the ERC will play a leading-edge role in bridging the gap between the discovery and successful product commercialization in the private sector. A key player in that process is the small, start-up business sector. At the appropriate stage of the research, the research program will create symbiotic relationships between the faculty and students and small start-up firms through translational research and innovation partnerships funded by the ERC's research program. The involvement of students with research-based entrepreneurs will enhance their education and better prepare them for leading roles in innovation during their studies and after graduation.

If the topic proposed would lead to an innovation in professional practice or services, as opposed to a 'product,' small firms contributing to enhancing innovations in these services and speeding their use in practice should be engaged in the place of technologically-focused start-up firms.

The ERC's research teams will be supported by appropriate research equipment and facilities, shared data, shared experimentation, and shared simulations or test beds. These should be supported by the cyberinfrastructure to facilitate collaboration across space and time. The research program also requires staff to manage the development of proof-of-concept enabling and systems technology test beds.

The research program will include graduate and undergraduate students in core activities at a ratio of 2:1 and undergraduate participation will be augmented by a summer Research Experiences for Undergraduates (REU) program. Augmenting the diversity of the ERC's teams is a focus of an ERC's REU programs. The ERC will budget for the REU program using its base budget. Post-award, the ERC may submit a proposal to the NSF REU program solicitation for site or supplemental support from that program to support these efforts. However, if the supplemental proposal is not awarded, the ERC will continue to use its base budget to support this program.

- 5. University Education Program:** The goal of the education program is to strategically nurture and develop graduates who are adaptive, creative innovators with the capacity to advance fundamental knowledge and create and exploit that knowledge to advance enabling technology and engineered systems innovations in the context of the ERC's research program as described above. The education program must be structured to develop engineering graduates at the B.S., M.S. and Ph.D. levels who have the knowledge, skills, and experiences needed to be successful in a globally connected, innovation driven, technological world. To be successful, the partner institutions will need to plan and develop education programs in much the same manner as they plan the center's research program. In like fashion to the research, a compelling vision for a center graduate needs to be developed and presented and consistent with the goals of the Gen-3 ERC program to produce graduates who will be effective innovators in industry or academia in a global economy. An educational strategic plan must be provided describing how the educational vision will be achieved within the center in collaboration with the partnering schools' education programs. The educational strategic plan will specify the desired characteristics of the ERC's graduates, how the ERC will provide its students with experiences designed to impart these

characteristics (knowledge, skills, and experiences), and measures and methods to assess progress and impact. These activities will include course materials derived from the ERC's cross-disciplinary and systems research, and if suitable, degree programs and options. An assessment plan will be developed and used to monitor and improve the program and assess its long-term impact. Given the projected 10-year life span of the center, it is expected that longitudinal data will be collected and assessments of the impact of the education program will be carried out. The quality of the educational plan will be judged on the quality of the vision for the future graduates and the innovative nature of the educational plan. It is expected that the ERC's education team may need to be supported by faculty with backgrounds in research on engineering education, research on innovation, and assessment research.

- 6. Pre-college Education Program:** The pre-college education program of the ERC will form long-term partnerships with a small number of pre-college institutions (middle through high school) that are committed to including engineering concepts in their students' educational experience to stimulate interest in engineering careers and increasing the diversity of domestic students studying engineering at the college level. It will involve their administrators, faculty, and students. The goal is to involve pre-college teachers in the ERC's research to enable them to develop course modules to bring engineering concepts into the classroom to inform pre-college students about engineering and stimulate them to choose baccalaureate engineering degree programs in community colleges, colleges, and universities. In addition, some promising pre-college high school students from these institutions will be offered an ERC Young Scholars research opportunity within the ERC's research program at the center. Upon completion of the Young Scholars experience, each will receive a certificate as an effort to impart recognition and prestige for their achievement. It is expected that the ERC's faculty and students will participate in these activities and their efforts will be recognized and rewarded by their home institutions. The pre-college program will include a Research Experience for Teachers (RET) program using the ERC's base budget to support teachers from the ERC's pre-college partner schools. Post-award, the ERC may submit a proposal to the Directorate for Engineering RET solicitation for site or supplemental support from that program. However, if the supplemental proposal is not awarded, the ERC will continue to use its base budget to support this program.

These programs are expected to adopt best practices in program implementation and assessment already developed by ongoing NSF-funded and other pre-college education programs.

The preliminary and invited full proposals will include letters from the appropriate administrators of the selected pre-college institutions indicating their commitment to participate.

- 7. Industrial/Practitioner Partnership and Innovation:** The ERC's industrial/practitioner partnership program will be strategically designed to optimize innovation and speed commercialization/utilization of ERC advances. Through this program, the ERC will take the lead role in bridging discovery to successful product commercialization and utilization via technological innovation. The Gen-3 ERC will include as members a mix of sizes of firms and, as appropriate for the field, it will include practitioner organizations. It will recognize the important role of domestic small firms in transforming high-risk research into successful commercial products for the U.S. economy.

The partnership program will be a shared program of industrial/practitioner collaboration that serves the ERC as a whole. The members will provide guidance on strategic planning, research opportunities, education, the role of innovation within the ERC, and will help to speed the translation of ERC research into innovation. It is also expected that industry/practitioners will contribute to the ERC's research and education program by providing knowledge of manufacturing, product design, or the practices involved in service delivery and help establish the culture of innovation and a global experience required for its students and faculty.

Given the field, the ERC will strategically determine the right types of industrial/practitioner partners (e.g. state or local government infrastructure agencies for ERCs focused on the infrastructure or hazards) needed to assume the essential risks involved in advancing discoveries to technological innovations that impact products and services. It is expected that there will be a mix of small, medium, and large firms (both domestic and foreign). The mix will depend upon the field. The small firms engaged as research partners in translational research within the ERC's research program would not be expected to be members of the industrial/practitioner partnership program ERC.

For ERCs focused on public sector service delivery or the infrastructure, practitioners from appropriate service delivery agencies should be included as partners functioning like industry as users of the knowledge and technology generated to improve service delivery.

The ERC will include innovative ways to speed the translation of knowledge into innovation. These will include small firms engaged in translational research within the ERC's research program as discussed in the research section. It also will include the partnerships with other small, high technology firms engaged in commercializing innovative technology as well as partnerships with federal, state, or local government programs designed to develop entrepreneurs, support start-up firms, and otherwise speed the translation of academic knowledge into practice and products. The ERC will exploit opportunities offered by the federal Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) programs. The ERC will include

analyses to determine the most effective methodologies to use to achieve these innovation goals through these types of partnerships.

Gen-3 ERC's industrial/practitioner partnership program will be governed by an ERC-wide membership agreement that defines the scope and function of the ERC's partnership with industry/practitioners and the ERC's Intellectual Property (IP) policies. Guidance on effective agreements and IP policies is available on the ERC Best Practices Manual in the chapter focused on industrial collaboration but some may not be appropriate given the new features of Gen-3 ERCs. It is advised that the IP policies be developed to facilitate these new roles and be flexible in recognizing IP jointly developed by faculty in different universities or that developed by joint industry and university research.

The ERC will be expected to function with an Industrial Advisory Board (IAB) involving all of its industry/practitioner partners. The IAB will carry out an analysis of the ERC's strengths, weaknesses, opportunities, and threats to survival (a SWOT analysis), meet twice a year, and participate in the annual NSF review of the ERC's performance and plans.

## 8. Infrastructure

a. **Leadership and Team:** Each ERC must have the following leaders and team members:

1. Center Director: a tenured faculty member and the NSF Principal Investigator (PI) who is 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;
2. Deputy or Associate Director(s): faculty who share the leadership and management responsibilities;
3. Thrust leaders: faculty members responsible for leading and managing major research thrusts;
4. Other Investigators: other faculty, postdocs, staff, and undergraduate and graduate students carrying out the research and education programs;
5. Education Program Director: faculty responsible for the development and execution of the ERC's strategic education plan who is supported by staff as needed;
6. Pre-College Education Program Director: faculty or staff member who is responsible for the pre-college education programs, supported by faculty, students, and staff;
7. Industrial Collaboration and Innovation Director: staff member at the lead institution who is responsible for marketing the ERC to industry/practitioners, developing and coordinating industrial/practitioner involvement, managing the role of small firms in research and innovation, managing the partnerships for innovation, etc.;
8. Administrative Director: staff member at the lead institution who is supported by staff and responsible for management, financial management, data collection, publicity, and reporting, etc.;
9. Student Leadership Council (SLC), comprised of undergraduate and graduate students responsible for coordinating student activities to strengthen the ERC;
10. Scientific Advisory Board: outside experts who meet collectively as a board to advise the leadership team;
11. Industrial/Practitioner Advisory Board: representatives of member companies/agencies who meet collectively as a board to advise the leadership team;
12. Internal Academic Policy Board: administrators from the lead institution who meet collectively as a board to coordinate ERC plans and policies with departmental and university leaders and committees; and

13. Council of Deans: led by the Dean of Engineering from the lead institution, this Council of Deans from the lead and partner academic institutions meets collectively as a board to coordinate the ERC's research and education efforts across the lead and partner campuses.

The designation of individuals serving as the Administrative Director, the Industrial Collaboration and Innovation Director, and the leaders of the SLC may occur after notification of award.

- b. **Diversity:** NSF expects the leadership, faculty, and students involved in an ERC to be diverse in gender, race, and ethnicity and to include persons with disabilities at levels that exceed the academic engineering-wide national averages. This diversity is expected of the participants from all the lead and partner academic institutions that will include at least one institution serving groups predominantly underrepresented in engineering (women, African Americans, Native Americans, Pacific Islanders, Alaskan Natives, Hispanic Americans, and persons with disabilities). The ERC also will be multicultural through the involvement of faculty and students from other countries by virtue of their role as faculty or students in the ERC's institutions and, if proposed, through the involvement of faculty and students from the foreign partner university. The ERC will include pre-college institutions with diverse student bodies as discussed above. The ERC will prepare and execute diversity strategic plans in collaboration with the home departments of the ERC-affiliated faculty. These plans articulate the ERC's diversity goals and intended actions. Post-award annual reports include these plans and their impact on diversity.
- c. **Organization and Management Systems:** The ERC must report to the Dean of Engineering of the lead institution. The ERC will function with management systems to assure effective integration of its components to meet its goals, sound financial management and reporting systems, and project selection and assessment systems that include input from its Scientific and Industrial/Practitioner Advisory Boards.
- d. **Facilities, Equipment, and Headquarters:** The ERC will have appropriate facilities and equipment to achieve its goals. It will be supported by headquarters of sufficient space and resources to support the leadership, management, and collaboration functions of the ERC. The ERC also will be supported by the cyberinfrastructure with appropriate software and staff to enable effective cross-campus collaboration.
- e. **Institutional Commitment:** The ERC will be a partnership with the associated lead and partner higher education institutions in support of the ERCs research, education, and innovation culture. To gauge the commitment to this culture, the ERC Program expects that there will be policies in place to reward faculty in the tenure and promotion process for cross-disciplinary research, research on education, research and other activity focused on advancing technology and innovation, and mentoring carried out by university faculty. In addition, the ERC Program expects that university students engaged in mentoring other university students and in pre-college outreach will receive credit or official recognition for this activity. The pre-college partners of the ERC are expected to be committed to a long-term partnership that will involve teachers and students in the ERC, a Young Scholars program, and will be expected to include engineering information and activities in their curricula.

### C. FINANCIAL SCOPE AND SCALE OF THE ERC

1. **NSF Award Size:** Start-up support will not exceed \$3,250,000 for year one. This level will serve as the base level of annual support for years two through five. Pending satisfactory performance in starting up the ERC and availability of funds, supplemental funding may be provided in years two through five based on satisfactory performance, need, and availability of funds to increase the level of core effort or address a new area. The supplemental funding level from one year will not increase the base level of support for the following year. Thus, if the ERC receives supplemental funding in year two and wishes to continue that work in year three, it must submit a new supplemental funding request in year two. It may also submit a request to start new work through additional supplemental funding support. The total of all supplemental funds provided in years 1-5 may not exceed 20 percent of the base award level for years one through five. Budget submissions will be provided at the level of \$3,250,000 for each of the five requested years of support. Supplemental budget requests would be provided with each annual report.

If a foreign university is proposed as a partner, non-U.S. government support for that partner for the first five years will be expected to be committed during year one.

2. **Total Support:** ERCs establish a center account into which is deposited the ERC program base and supplemental support and any other support provided by other sources to carry out the ERCs goals.

There are no requirements for cost sharing on this award.

### III. AWARD INFORMATION

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**Awards:** \$16,250,000 is expected to be available to support five new Gen-3 ERCs in FY 2008 with year one start-up budgets of up to \$3,250,000. This will be the base budget level of the award for years two through five. This level may be enhanced through supplements in years two through five as described in Section II.C, subject to performance. The actual number of centers funded will depend on the scale and scope of the proposed centers, the availability of funds, and the quality of the proposals submitted.

Awards will be made as cooperative agreements between NSF and the lead university, with subawards to the partner institutions as appropriate for their role in the ERC. ERCs are expected to compensate pre-college teachers for time spent carrying out research in the ERCs laboratories and the materials needed to develop the courseware.

**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 an updated strategic plan for all aspects of the center within 90 days of award, which serves as the start-up report. Subsequently, the ERC submits annual reports of progress and plans and data on indicators of performance and impact. Based on these reports, a center's performance and plans are reviewed at start-up and annually thereafter through merit review by outside experts, usually on-site at the lead institution. 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. The sixth-year renewal proposal contains a business plan for self-sufficiency from ERC Program support after year 10. 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. 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. It is expected that at least the domestic lead and partner universities will provide core support to sustain the administrative, pre-college educational, and industrial collaboration functions of a graduated ERC during its transition to self-sufficiency after NSF support ceases.

**Post-Award Guidance and Oversight:** NSF provides assistance in developing an ERC and improving its performance through program oversight, the ERC program's 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 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 financial management. NSF provides data definition guidelines and templates for the recording and submission of these data through a secure web site.

Members of all ERCs' leadership teams are required to participate in the ERC program's annual meeting, held in the Washington, DC area to share successes and challenges, 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, selected Research Thrust Leaders, 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.

### IV. ELIGIBILITY INFORMATION

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#### Organization Limit:

Proposals may only be submitted by the following:

- Only U.S. academic institutions with undergraduate, masters, and doctoral engineering programs of sufficient depth and breadth appropriate to support the vision may submit proposals as the lead institution. Proposals must be submitted by the lead institution with subaward budgets for partner domestic academic institutions. Separately submitted collaborative proposals are not acceptable and will be returned without review.

#### PI Limit:

The center director must be a tenured faculty member at the lead institution in an engineering department or may hold a joint appointment in an engineering department. 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 and a joint appointment in an engineering department.

**Limit on Number of Proposals per Organization:**

None Specified

**Limit on Number of Proposals per PI:**

None Specified

**Additional Eligibility Info:**

**Organizational Limit:**

Only U.S. academic institutions with undergraduate, masters, and doctoral engineering programs of sufficient depth and breadth appropriate to support the vision may submit proposals as the lead institution. As a multi-university effort, the lead and partner institutions share the responsibility for the ERC. The other university partner institutions must have graduate or undergraduate engineering programs or both. At least one of these academic partners will be a university or college that serves students predominantly underrepresented in engineering. These partners also must include a few middle and high schools committed to long-term sustained partnerships to bring engineering concepts into the classroom and engage talented older pre-college students in the ERC's research programs as Young Scholars in order to raise the enrollment and diversity of domestic students in engineering and science degree program. The partners must also include an organization devoted to speeding entrepreneurship or innovation as discussed above. Full proposals must include letters from firms/agencies indicating that they are committed to the ERC's industrial/practitioner partnership program. Proposals may include a foreign university as a long-term partner in research and education.

Only universities able to provide headquarters space for the proposed ERC may submit preliminary and invited full proposals as the lead institution. This headquarters should provide space for the administrative staff, the director, the deputy director, and physical and virtual conferencing. It may also provide space for facilities to support the ERC's research needs.

**Preliminary and invited full proposals that do not comply with these requirements will be returned without review.**

There is no restriction on the number of proposals that may be submitted by a lead institution and there is no restriction on the number of proposals in which a partner institution is involved. Since there will be no institution with two fully operational ERCs by FY 2007, all eligible institutions may submit 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 and a joint appointment in an engineering department.

**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.

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## **V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS**

### **A. Proposal Preparation Instructions**

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### **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 via FastLane 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 names and locations of the lead university and the partner institutions.
2. Brief statements of the vision and goals of the ERC, its research program including research thrust titles and goals, and its university and pre-college education, 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, thrust leaders, education program director, and other key faculty including their departmental and institutional affiliations.

### **Letter of Intent Preparation Instructions:**

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- SPO Submission is Not Required when submitting Letters of Intent
- TITLES OF RESEARCH THRUSTS is Required when submitting Letters of Intent
- EMAIL ADDRESS OF THE PI is Required when submitting Letters of Intent
- Submission of multiple Letters of Intent are allowed

### **Preliminary Proposals (required):**

Preliminary proposals are required. Follow the full proposal instructions where the differences between the preliminary and full proposals are articulated.

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpg](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg). Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov). Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (<http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf>). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

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, August 1, 2008 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 ERC, stating its vision and goals, the transforming nature of the systems technology, the fundamental barriers in the way, and its impact on innovation. Under the headings Intellectual Merit and Broader Impact as relevant, provide highlights of the proposed research, education, pre-college outreach, innovation strategy, 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 or Grants.gov.
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.

The configuration of partner institutions may not change after submission of the invited full proposal.

Start the project description with the list of participants, Scientific Advisory Board members, and industrial/practitioner partners, detailed in section 4.a. NSF will extend the page limits above by the number of pages taken up by this list. For example, a three-page list extends the page limit for the narrative for a preliminary proposal to 28 pages and for a full proposal to 43 pages. 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 or full proposal will be returned without review.

- a. **List of Academic and other Participants, Scientific Advisory Board, and Industrial and Practitioner Members.** List (1) the academic and other partners carrying out the research, education, innovation/technology transfer functions of the ERC, (2) nominated members of its Scientific Advisory Board for the preliminary proposal and nominated and committed for the full proposal, and (3) the firms and agencies contacted to be partners in the preliminary proposal and committed to be partners in the full proposal. A sample table is provided below and proposers are free to improve upon the table format for clarity and ease of reading. The font may be smaller than 12 point but must be easily readable. 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
Other Partner Institutions, 1 row each	Name	City	State/Country

#### **Leadership Team**

Director	Name	Department	Institution
Deputy Director	Name	Department	Institution
Education Program Director	Name	Department	Institution
Pre-college Education Program Director	Name	Department	Institution
Industrial Collaboration and Innovation Director	Name, if known	Staff	Lead Institution
Administrative Director	Name, if known	Staff	Lead Institution

#### **Thrusts - List each thrust separately.**

Name of Thrust			
Thrust Leader	Name	Department	Institution
Faculty Members in the Thrust (1 row per person)	Name	Department	Institution

Non-Faculty Investigators	Name	Department	Institution/ Agency/firm, etc.
<b>Other Partners Carrying Out ERC's Mission</b>			
Pre-College Institutions	Name (indicate middle or high school)	City and State/	
Innovation Partners	Name of Organization	City and State/	
<b>Advisors</b>			
Preliminary Proposal: Scientific Advisory Board Members (Nominated)	Name	Department/ Division	Institution
Full Proposal: Scientific Advisory Board Members (Nominated and Committed)	Name	Department/ Division	Institution
<b>Industrial Partners</b>			
Preliminary Proposal: List separately the firms/agencies or practitioner organizations, etc. contacted to be partners and those already committed	Name of the Firm/ Agency	Sector/Function -	
Full Proposal: List separately only the firms/agencies or practitioner organizations committed to be partners	Name of the Firm/ Agency	Sector/Function -	

In addition to the FastLane or Grants.gov instructions, the proposer must send the following two documents via email. After receipt of the proposal number from FastLane or Grants.gov, send an email to [ercintent@nsf.gov](mailto: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. The table of participants and partners inserted into an Excel spreadsheet available on the ERC Program's Website (<http://erc-assoc.org>). This table will be used by NSF to check for conflicts of interest in assembling the review community. Remember to email this table to [ercintent@nsf.gov](mailto:ercintent@nsf.gov); do not submit it through FastLane or Grants.gov.
2. Power Point Slides: one slide summarizing the vision of the ERC and another showing the ERC's 3-plane strategic planning chart. These will be used during the review process. Remember to email these documents to [ercintent@nsf.gov](mailto:ercintent@nsf.gov); do not submit the slides through FastLane or Grants.gov.

The following sections should be prepared with reference to the guidance in Section II above and the review criteria.

- b. Vision and Rationale for the ERC.** State the vision of the ERC, position the proposed ERC in the state of the art, and provide a rationale for value added by the creation of the ERC.
- c. Strategic Research Plan and Research Program.** Given the ERC's engineered system vision and strategy for innovation, present the ERC's strategic research plan, including its deliverables, the major fundamental and technological barriers in the way of achieving them, and the major research goals. 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 small firms, test beds, and partnerships with entities designed to speed innovation in achieving 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.

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-?-vis the goals of the ERC. Position the research proposed for the thrust in the state of the art and discuss its role in the ERC's three-plane strategic plan. Provide information on projected fundamental knowledge and technology deliverables, and the specific fundamental knowledge and other 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. Discuss when and how small firms will be involved in translational research to speed innovation.

- d. University and Pre-college Education Programs.** Given the guidance in Section II, University Education, provide the desired characteristics of the ERC's graduates, the strategy to achieve them, and the implementation and assessment plans to determine progress and impact. The educational program should encompass all the partner academic institutions and should take advantage of available cyberinfrastructure for cross-institution educational impact.

Given the guidance in Section II, Pre-college Education, describe the ERC's pre-college education program goals, its strategy, its metrics for success and its assessment plan. Discuss the role of the ERC's faculty and students and the pre-college institutions administrators, teachers, and students in the program.

- e. **Industrial Collaboration and Innovation.** Given the guidance in Section II, for industrial/practitioner collaboration and innovation, provide the ERC's goals and strategies to address these challenges. For the preliminary and full proposals, discuss the general terms of the ERC's membership agreement and intellectual property policy.

Preliminary and invited full proposals must include supplemental documents letter(s) from partner organizations or programs, etc. devoted to entrepreneurship, nurturing start-up firms to speed innovation, etc.

Preliminary proposals also may include in supplemental documents up to ten letters from firms and/or other organizations that involve practitioners, such as state and local infrastructure agencies, committed to membership in the ERC's Industrial/Practitioner Partnership if an award is made. Full proposals will include letters from all firms/organizations committed to partnership. Neither proposal will include letters from those only interested in partnership.

- 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 partner institutions. If a foreign university(ies) is/are partners in the ERC, discuss how that partnership will be administered.

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 Innovation Director, Administrative Director, and Student Leadership Council. Provide summary information in the form of a pie chart indicating 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 a table of the current diversity of the leadership team and faculty U.S. citizens and permanent residents of the proposed ERC using the following sample format.

ERC Name	Total #*	Male	Female	African American	Native American, Pacific islander	Hispanic American	Persons with Disabilities
Leadership Team	.	.	.	.	.	.	.
Faculty Total	.	.	.	.	.	.	.
Total	.	.	.	.	.	.	.

\* It is understood that the total will equal the total of males and females and the totals for racial and ethnic minorities and disabled will be larger than that total due to double counting. A person with a disability is one with one or more impairment that affects substantially one or more activities of daily living that is/are not completely correctable with assistive devices.

The data provided in this table will be the diversity of the leadership team and faculty who have been identified to participate in the ERC during years one through five from the lead and the university-level domestic partner institutions. These data must include the number of men and the number of women (U.S. citizens and permanent residents) and the number of U.S. citizens or permanent residents who are members of racial groups underrepresented in engineering (African American, Pacific Islander, Native American, Alaskan Native), ethnic

groups underrepresented in engineering (Hispanic American), and persons with disabilities who are involved in the ERC's research and curriculum development efforts. Since it is not clear at the proposal stage which students will be involved, please do not include students. Do not include non-tenured-track faculty, research staff, post-doctoral students, technicians, or office staff. Do not include pre-college teachers or students.

Discuss the commitment of the partner institutions to the goals of the proposed ERC and how they will assure their policies and practices support the center in achieving its goals.

### **Organizational Structure and Management System**

Describe the proposed organizational structure including information on how the members from participating universities and pre-college institutions will be developed into an integrated team. Include an organization chart for the ERC. Discuss the roles of the Council of Deans in coordinating the partner institutions, the lead university policy boards, the Student Leadership Council, 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 the FastLane proposal template for more detail. Discuss those that will be shared by members of the ERC team. Distinguish between equipment and facilities that are already available and any that will be acquired by the Center. Invited full proposals only will include a description of headquarters space, its size, and functionality. Discuss how the facilities and equipment of the ERC and the Cyberinfrastructure will be used to form a collaborative team with shared resources and information.

5. **References Cited.** Section not to exceed five pages.

6. **Biographical Sketches** (two-page limit per person). The basic 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 Innovation Director (if known), the Research Thrust Leaders, and other faculty expected to receive more than \$80,000 in year one from the ERC. For faculty, publications listed should be highly relevant to the proposal.

7. **Budgetary Information.** The preliminary and invited full proposals will include a budget for each of the five years proposed. FastLane or Grants.gov will automatically provide a cumulative budget. Preliminary proposals should not include any subcontracts, however enter the anticipated total level of subcontract support on line G5, Subawards and provide a budget justification or the planned levels for subcontracts to the partners. Full proposals require the inclusion of separate budgets for subcontracts for the partner institutions at any level.

In the budget justification section of the preliminary and invited full, provide as a pie chart or a table the planned distribution of funds in year one among the lead and partner institutions.

Cost sharing is not required by NSF.

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

8. **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.

9. **Facilities, Equipment, Resources, and Headquarters** Supplementary information to support text in the proposal.

10. **Reviewer Information.** Use FastLane or Grants.gov to enter a "List of Suggested Reviewers," if desired.

11. **Supplementary Documents. The following items must be provided as supplemental documents.** For Grants.gov users, supplementary documents should be attached in Field 11 of the R&R Other Project Information Form

### **Preliminary Proposals and Invited Full Proposals:**

**Letters:** From the lead institution, provide letters of commitment to the goals of the ERC from the Dean of Engineering and higher-

level university officials authorized to commit the lead institution to the goals of the ERC. Similar letters from similar individuals should be included from the other partner institutions. In the preliminary proposal, include up to ten letters from firms or agencies committed to partnership and for the invited full proposal, include letters from all firms or agencies committed to partnership. The letters as they appear in the proposal 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. **All letters must be placed in the Supplementary Documents section of the FastLane or Grants.gov proposal and submitted electronically, as part of the proposal. However, please instruct the authors of these letters not to mail, email, or fax copies to the NSF.**

### SUMMARY OF REQUIREMENTS

Topic	Preliminary Proposal	Invited Full Proposal
<b>Proposal Requirements</b>		
Commitment of academic and industrial funds	No	No
Commitment from Foreign Partner University(ies), if included	Yes	Yes
Identification of participating faculty members from the lead and university-level partner institutions	Years 1-5	Years 1-5
Names of participating Pre-college Institutions	Yes	Yes
Names of Pre-college Teachers	No	No
Name of participating program devoted to entrepreneurship, stimulating innovation, etc.	Yes	Yes
Names and affiliations of industry/agency or practitioner organization personnel committed to partnership in the ERC	Yes	Yes
<b>Submission Requirements</b>		
List of Participants in NSF's Excel spreadsheet and 2 PowerPoint slides on vision and strategic plan emailed to <a href="mailto:ercintent@nsf.gov">ercintent@nsf.gov</a>	Yes	Yes
Notice of Intent submitted through FastLane	Yes	No
Mode of Submission of Proposal	Submission in FastLane	Submission in FastLane or Grants.gov, only by Invitation
<b>Format</b>		
Information About PI	Yes	Yes
NSF Cover Sheet	Yes	Yes
FastLane or Grants.gov Submission of Cover Sheet	FastLane only	Either
Table of Contents	Yes	Yes

Project Summary with Reference to Intellectual Merit and Broader Impacts	Yes	Yes
List of Participants and partners, at the start of the project description	Yes	Yes
Project Description	25 pages, including charts, etc., but extended by the size of the list of participants/partners	40 pages, including charts, etc., but extended by the size of the list of participants/partners
<b>Letters:</b>		
Letters from required institutional partners committing to ERC	Yes	Yes
Letter from Lead Institution committing to HQ space	Yes	Yes
Letters of Commitment to partnership from Industry/Practitioners	Up to 10	All
<b>Budgetary Information</b>		
Separate budgets for years 1-5	Yes	Yes
Cumulative budget for years 1-5	Generated by FastLane	Generated by FastLane or Grants.gov
Allocation of Funds by Institution (Year 1 only)	No	Yes
Justification for Secretarial & Admin. Support	No	Yes

## B. Budgetary Information

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**Cost Sharing:** Cost sharing is not required by NSF in proposals submitted to the National Science Foundation.

### Other Budgetary Limitations:

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

## C. Due Dates

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

February 02, 2007

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

May 03, 2007

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

October 30, 2007

Invited Full Proposals

## D. FastLane/Grants.gov Requirements

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- **For Proposals Submitted Via FastLane:**

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

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

- **For Proposals Submitted Via Grants.gov:**

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: <http://www.grants.gov/CustomerSupport>. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: [support@grants.gov](mailto:support@grants.gov). The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

## VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts with the proposer.

### A. NSF Merit Review Criteria

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

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

**What is the intellectual merit of the proposed activity?**

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative 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 invited full proposals are as follows:

#### **Vision and Research**

- Proposal effectively defines a transformational engineered system at the cusp of emerging discoveries in science and engineering and emerging opportunities for technological innovation;
- Proposal defines a culture of discovery and innovation with a symbiotic relationship between research, education, innovation, and life-long skill development in a global economy to stimulate innovation and provide students and faculty with a globally-oriented research and education experience;
- Research strategic plan targets critical systems goals and breakthrough fundamental knowledge and technology barriers and defines:
  - High quality cross-disciplinary research program that addresses these barriers through fundamental research and enabling and systems level research and proof-of-concept test beds;
  - Creative role for small firms to carry out translational research within the ERC to speed technology transfer and provide students with an innovation experience;
- Research thrusts propose significant goals, target significant fundamental and technical barriers, use high quality research methodologies that will advance the state of the art, integrate knowledge from other projects and thrusts, and involve a diverse team with the skills and disciplines needed to achieve the goals.

#### **Education**

- Education strategy defines an education program that will develop graduates who are adaptive, creative innovators with the capacity to advance fundamental knowledge and exploit it to create innovations;
- Structured to develop graduates who have the knowledge, skills, and experience needed to be successful in a globally connected, innovation-driven world;
- Effective plans proposed to integrate ERC's cross-disciplinary and systems research into courseware and curricula;
- Strategic plan specifies desired characteristics, proposes how education program will impart these to students, and how it will measure and assess progress and impacts through longitudinal data;
- Pre-college outreach programs will develop an effective long-term partnership with a few pre-college institutions (middle and high schools) to bring knowledge of engineering to pre-college classroom, engage a broadly diverse group of students in the ERC's programs to motivate them to study engineering, and provide a Young Scholars research program for promising high schools students;
- Effective programs and assessment tools for college and pre-college programs based on best practices.

#### **Industrial/Practitioner Partnership to Advance Innovation**

- Convincing rationale for the selection of industrial or user partners and means to engage these partners in planning, research, education, and innovation;
- Clear strategy for how small firms will be key players and help speed innovation;
- Strong partnership with organizations and programs dedicated to speeding innovation;
- Representative group of firms/organizations involving practitioners (state infrastructure agencies for example) committed to membership;
- Active engagement of industry/practitioner organizations through an Industrial/Practitioner Advisory Board;
- Proposed terms of the industrial membership agreement will structure a center-wide program of industrial/practitioner collaboration to support overall ERC goals;
- Intellectual property policy will facilitate collaboration with industry through shared rights for joint work and speed technology transfer.

## Infrastructure

- Institutional configuration is appropriate to the goals of the ERC and there is a convincing strategy for cross-institution collaboration in research and education;
- If there is a foreign university partner, it is committed to the goals of the ERC and will be a strong addition to the team;
- Diversity strategic plan evidences strong commitment to diversity at all levels and will result in a very diverse team with a strong impact on the diversity of the engineering workforce through:
  - Including partner institutions serving students underrepresented in engineering to enhance diversity;
  - Leadership, faculty and student teams that are diverse in gender, race, and ethnicity, and includes persons with disabilities;
- University administrators from the lead and partner institutions will join in partnership with the ERC to facilitate and reward its cross-disciplinary configuration, reward cross-disciplinary research and participation in pre-college outreach, support its educational strategy, and deliver on its diversity goals;
- ERC has expertise in all disciplines required to attain its goals, a capable leader and leadership team;
- Organizational structure and management plan effectively organize and integrate the resources of the ERC across the 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;
- The cyberinfrastructure is effectively used to achieve collaboration and sharing of information;
- Headquarters space is sufficiently large to house the leaders and staff, and support the management, communication, and cross-disciplinary collaboration functions of the ERC and cross-institution communications equipment will effectively encourage and facilitate collaboration.

## B. Review and Selection Process

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Proposals submitted in response to this program solicitation will be reviewed by Adhoc Review or Panel Review or Site Visit Review or Panel and Site Visit.

Preliminary and full proposals will be reviewed through a combination of ad hoc and panel reviews. A subset of the invited full proposals will receive on-campus site visits. At the conclusion of all the site visits, small teams from each of the site-visited proposed ERCs will brief a review panel at NSF. Based on the information gained from these reviews and recommendations, NSF will select a subset of proposals for award.

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

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

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

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize

the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

## VII. AWARD ADMINISTRATION INFORMATION

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### A. Notification of the Award

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

### B. Award Conditions

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

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

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpm](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpm).

### C. Reporting Requirements

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

Failure to provide the required annual or final project reports will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

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 financial management. NSF provides data definition guidelines and templates for the recording and submission of these data through a secure web site.

## VIII. AGENCY CONTACTS

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General inquiries regarding this program should be made to:

- Lynn Preston, Leader of the Engineering Research Centers Program and Deputy Division Director (Centers), 585 N, telephone: (703) 292-

5358, fax: (703) 292-9051, email: [lpreston@nsf.gov](mailto:lpreston@nsf.gov)

- Deborah Jackson, Program Director, 585N, telephone: 703-292-7499, fax: 703-292-9051, email: [djackson@nsf.gov](mailto:djackson@nsf.gov)
- Barbara Kenny, Program Director, 585, telephone: (703) 292-4667, fax: (703) 292-9051, email: [bkenny@nsf.gov](mailto:bkenny@nsf.gov)
- Bruce Kramer, Program Director, 585 N, telephone: (703) 292-5348, fax: (703) 292-9051, email: [bkramer@nsf.gov](mailto:bkramer@nsf.gov)
- Vilas Mujumdar, Program Director, 585 N, telephone: (703) 292-7262, fax: (703) 292-9051, email: [vmujumda@nsf.gov](mailto:vmujumda@nsf.gov)
- Sohi Rastegar, Program Director, 585 N, telephone: (703) 292-5379, fax: (703) 292-9051, email: [srastega@nsf.gov](mailto:srastega@nsf.gov)
- Mary Poats, Program Manager, 585 N, telephone: (703) 292-5357, fax: (703) 292-9051, email: [mpoats@nsf.gov](mailto:mpoats@nsf.gov)
- Win Aung, Program Director, 585N, telephone: 703-292-5341, fax: 703-292-9051, email: [waung@nsf.gov](mailto:waung@nsf.gov)
- Darlene Suggs, Senior Program Assistant, 585N, telephone: 703-292-5361, fax: 703-292-9051, email: [dsuggs@nsf.gov](mailto:dsuggs@nsf.gov)

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: [fastlane@nsf.gov](mailto:fastlane@nsf.gov).
- Esther M. Bolding, 585 N, telephone: (703) 292-5342, fax: (703) 292-9051, email: [ebolding@nsf.gov](mailto:ebolding@nsf.gov)

For questions relating to Grants.gov contact:

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

For information on all aspects of the ERC construct, strategic planning and the solicitation in general, contact Lynn Preston. For technical guidance contact Deborah Jackson (EEC) for optics, Barbara Kenny for microelectronics, Bruce Kramer for manufacturing and processing, Vilas Mujumdar for infrastructure, and Sohi Rastegar for bioengineering. For university-level education, contact Win Aung. For pre-college education, REUs, RETs, and diversity partnerships contact Mary Poats. In addition to the ERC Program Directors (PD) above, the following PDs in other Engineering Divisions/Offices are knowledgeable about ERCs by virtue of their participation in site visits to ongoing ERCs, in site visits and panels during previous ERC competitions, or their experience as a current or former lead ERC PD responsible for the oversight of an ERC. These are: Larry Goldberg ([lgoldber@nsf.gov](mailto:lgoldber@nsf.gov)) and Rajinder Khosla ([rkhosla@nsf.gov](mailto:rkhosla@nsf.gov)) in the Division of Electrical, Communications, and Cyber Systems; Leon Esterowitz ([lesterow@nsf.gov](mailto:lesterow@nsf.gov)), Bruce Hamilton ([bhamilto@nsf.gov](mailto:bhamilto@nsf.gov)), Fred Heineken ([fheineke@nsf.gov](mailto:fheineke@nsf.gov)), and Judy Raper ([jraper@nsf.gov](mailto:jraper@nsf.gov)) in the Division of Chemical, Biological, Environmental and Transport Systems; George Hazelrigg ([ghazelri@nsf.gov](mailto:ghazelri@nsf.gov)), Joy Pauschke ([jpauschk@nsf.gov](mailto:jpauschk@nsf.gov)) and Mario Rotea ([mrotea@nsf.gov](mailto:mrotea@nsf.gov)) in the Division of Civil, Mechanical, and Manufacturing Innovation; and Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov)) and Rose Wesson ([rwesson@nsf.gov](mailto:rwesson@nsf.gov)) in the Division of Industrial Innovation and Partnerships.

## IX. OTHER INFORMATION

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

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

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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

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

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

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

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

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
  
- **For General Information** (NSF Information Center): (703) 292-5111
  
- **TDD (for the hearing-impaired):** (703) 292-5090
  
- **To Order Publications or Forms:**
  - Send an e-mail to: [pubs@nsf.gov](mailto:pubs@nsf.gov)
  - or telephone: (703) 292-7827
  
- **To Locate NSF Employees:** (703) 292-5111

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## PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and

researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

Suzanne H. Plimpton  
Reports Clearance Officer  
Division of Administrative Services  
National Science Foundation  
Arlington, VA 22230

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Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

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