



General Programmatic Terms and Conditions (PTC) for the Engineering Research Centers (ERC) (NSF 98-146) Cooperative Agreements

1. Program Description:

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

2. Project Governance and Governing Responsibilities:

The Awardee will ensure that an efficient and effective project governing structure is in place throughout the award period to support all critical or significant project activities and shall be responsible for planning, operating, self-assessing, and managing the ERC in accordance with its proposal.

NSF expects the lead and core partner universities to function as an integrated whole, with shared research and education goals, shared elements of the curricula, and a shared program of industrial collaboration. The lead university accepts the overall management and financial responsibility for the Center. The Awardee will receive the funds for the Center from NSF and other sources - including industrial partners - and disburse them to the core partner universities and funded outreach partners, based on their level of effort determined by the ERC's strategic planning process, and their performance.

The Foundation expects the Awardee and the Center Director, the Deputy Director, and the core partner universities and their lead Principal Investigators (PIs), to be responsible for fulfilling the terms of this Agreement, in accordance with their proposal submitted under the Engineering Research Centers Program Announcement, as mentioned on the cover page of the Cooperative Agreement.

This ERC will have the following key features:

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

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

- a. A multi-institution configuration of the lead and up to four other institutions in long-term partnership, complemented by affiliations with outreach institutions and NSF-supported diversity awardees;
- b. Director, Deputy or Associate Director(s) and other members of a leadership team who define and evolve the vision, implement the plan and manage the Center;
- c. Leadership, faculty, and student teams that are diverse in gender, race, and ethnicity;
- d. Cross-disciplinary team of faculty and students who carry out the research and education programs;
- e. Management systems to deploy the Center's resources to achieve its goals;
- f. Mechanisms for securing external advice from academic and industrial experts, a Scientific Advisory Board and an Industrial Advisory Board that advise on strategic directions and the selection and assessment of projects, and internal advisory boards to develop internal policies,

- including cross-university policies;
- g. Experimental, computational, and other equipment, facilities, and laboratory space required to conduct the proposed research and enable a robust learning environment;
- h. Institutional commitment at all levels to facilitate and foster the culture of the ERC and its diversity, provide headquarters space to promote interdisciplinary collaboration and communication, and generally support center-level activities; and
- i. Support from the lead and core partner academic institutions, industry, and other sources to augment NSF's support.

- **Industrial Membership:**

- a. NSF requires the ERC to develop a center-level, generic membership agreement that governs industrial/practitioner (hereinafter referred to as industrial) participation, specifies the Center's intellectual property policy, and delineates the forms of unrestricted cash and in-kind contributions from industry required for membership in the Center. Besides for-profit industrial firms, other organizations that can be considered as members include, local and state government agencies, and other Federal agencies. Organizations contributing research and educational participants in the Center, such as other universities, institutes, and hospitals should not be included as members. Foreign firms may be members of the ERC as long as they participate in accordance with the same membership agreement as U.S. firms do. These industrial members are required to become involved with the planning, research, education, and technology transfer activities of the Center. Membership fees are to be pooled and allocated to Center functions according to the strategic and operational plans of the Center, as developed and implemented by the Center's leadership. Industrial members may provide additional support above the membership fees for activities such as sponsored research projects, equipment donations, intellectual property donations, or educational grants. Firms that have not joined the Center, but contribute support for projects that fall under the scope of the ERC's strategic plan and are included in the Center's annual report are not considered members but may be given another designation, such as affiliates. Firms and other organizations that provide donations but are not members may be classified as contributing donors. Attendance or participation at meetings, workshops, seminars, or site visits are benefits/responsibilities of membership, but do not qualify a firm for membership.
- b. At start-up, the ERC is required to hold a meeting with its industrial members who have committed to or interested in supporting the Center no later than three months after the effective date of the first

year's award. The purpose of the meeting is to gain industrial end-user insights, guidance, and support in strategic planning, to help assure that the activities of the ERC are relevant to industry's long-term interests and needs, to enhance technology transfer, and to obtain industrial input for the development of the Center's final membership agreement and the refinement of its Intellectual Property policy. Finally, the involvement of firms who have not yet committed to membership should encourage their commitment to joining the ERC.

- c. The ERC is required to form an Industrial Advisory Board (IAB) comprised of representatives of member companies, and hold meetings of this board at least twice during every year of operation. Each year, at one of these meetings, the industrial members shall carry out an analysis of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) to the survival of the ERC, and present the results to the ERC's leadership team. All or selected representatives of member companies are expected to participate in the annual NSF site visit, where the SWOT analysis will also be presented to the review team in a private session.
 - d. The ERC shall continue to develop and refine its technology transfer strategy and its Intellectual Property agreement, the latter in accordance with NSF's Intellectual Property guidelines (Grant Policy Manual, Section 730, "Intellectual Property") and the Awardee's policies.
 - e. Industrial membership funds must be allocated for use for Center purposes. In the event that industrial membership funds are not expended in the year in which they are received, such funds must be placed in a Center account and reported to NSF and industry as unexpended funds that are held in reserve for future use. Progress reports on the expenditure of these funds should be provided to NSF in the Center's annual report and to industry during the IAB meetings.
 - f. Costs for organizing meetings with industry will be borne by the ERC or the participants through a registration fee, as deemed appropriate. Costs for attending these meetings by industry will be borne by their organizations.
- **Student Leadership Council:** The ERC is required to form a Student Leadership Council (SLC) comprised of the representatives of the undergraduate and graduate students involved in the ERC. The SLC is responsible for organizing student activities. It also is responsible for carrying out a SWOT analysis of the ERC and communicating the results to the ERC Director, the ERC's leadership team, and the NSF site visit team in a private session.
 - **Joint NSF-Awardee Activities:**

- a. NSF requires the Center Director, Deputy Director, Administrative Director, Education Program Director, Industrial Liaison Officer, other key leadership or staff personnel, and representatives of the Student Leadership Council (at least one graduate and one undergraduate student) to attend the annual ERC meetings organized by NSF. The purpose of these meetings is to serve as a means to identify management and other issues common to the ERCs, to facilitate cross-center communication, to share successes, and to identify innovative means to approach common problems. Costs for attending these meetings will be borne by the ERCs.
 - b. NSF expects the ERCs to participate in evaluation and other types of studies of the ERC Program initiated by NSF. Such studies include but are not limited to the outcomes and impacts of the ERC Program. NSF also expects the ERCs to participate in workshops organized by NSF to study various issues common to the system of centers. Costs for attending these meetings will be borne by the ERCs.
- **Electronic Access:** The Awardee shall establish and maintain an electronic access capability via the Internet to transfer the quantitative and qualitative data to an NSF database. It is expected that access to this electronic information will be protected and only NSF will have and grant access. The Center is expected to establish a WWW "Home Page" containing some elements with public access to make available any information about the Center's goals, activities, and accomplishments. The Center is expected to develop and use an identifying logo that is consistent with the Awardee's policies and procedures and approved by the Awardee as a graphic identity to be used on brochures, newsletters, on the Center's WWW "Home Page," etc.

3. Reporting Requirements:

- **Start-Up Strategic Plan:** For start-up ERCs, an initial detailed strategic plan containing updates of the ERC's strategic plans for research, diversity, education, educational outreach, and industrial/practitioner collaboration and technology transfer is due 90 days after the effective date of this Agreement. Industrial involvement in the strategic planning process is expected.
- **Annual Progress Report:** The Awardee shall submit an Annual Progress Report which will contain specific information including, but not limited to, the following: the progress and plans of the ERC in achieving its vision with supporting data developed from the data submitted to the ERC Program's data base of indicators of progress and impact, information on

revenues and expenditures, and proposed budgets. The annual report, due at least five weeks prior to the annual site visit and at least 10 weeks prior to the anniversary date of the award, will serve in part as the Awardee's request for continuing support. The annual reports must be prepared according to the online document "Guidelines for Preparing ERC Annual Reports and Proposals for Continuing or Renewal Support," which is located at: <http://chaffee.qrc.com/nsf/eng/ercweb/start.cfm>

The ERC's generic membership agreement and Intellectual Property policy and a certification by the ERC members of their financial contributions for the year covered by the report, signed by the Awardee's AOR, must be included in the Center's Annual Report.

- **Data Tables:** A set of quantitative and qualitative data prescribed by NSF must be maintained. Data tables in Annual Reports and in the ERC Indicators database will be identical. A set of table templates is available via the web to the centers for simultaneous preparation of Annual Report tables and Indicators data base tables. The Indicators data base tables must be submitted via the web at the time of submission of the annual report. Centers will print completed tables formatted for their Annual Report directly from the web. Data reported about the current year in Annual Reports may not go back more than 14 months prior to the month of submission of the Annual Report to NSF. All data in tables concerning prior years, as well as in subsequent Annual Reports, should be annualized based on this time frame. These data will serve as indicators of personnel involved, resources available to the ERC and how they are spent, Center performance with respect to its goals and objectives, and the impact of Center output and results on knowledge, industry, education, and the scientific and engineering workforce. Details for preparing data tables and templates for submission are available through the following site: <http://chaffee.qrc.com/nsf/eng/ercweb/start.cfm>
- **Renewal Proposal:** In lieu of the third-year and sixth-year annual reports, respectively, the Awardee may submit a cumulative progress report and renewal proposal to NSF requesting support for an additional five-year period beginning at the end of the third year and for an additional four-year period beginning at the end of the sixth year of this Agreement. The progress report/renewal proposal is due at NSF by a date agreed upon between NSF and the Awardee. NSF will specify the format of the progress report/renewal proposal, the review process, and review criteria approximately six months before the date agreed upon for submission. If the Awardee chooses not to submit a renewal proposal, NSF support to the Center will be phased down over the two years remaining in the period of support provided by this Agreement.

- **Final Report:** In lieu of an annual report, a final report prepared according to guidelines which will be provided by the ERC Program Official at the appropriate time and consistent with NSF policy at that time, will be due within 90 days of the expiration date of this Agreement. Current guidelines for the ERC final report are available on the following site: <http://chaffee.grc.com/nsf/eng/ercweb/start.cfm>

4. Awardee Support of Ongoing Management and Oversight: The Awardee will ensure full commitment and cooperation among the governing structure components and all project staff during all ongoing NSF project management and oversight activities. The Awardee will ensure availability of all key institutional partners during any desk or on-site review as well as timely access to all project documentation.

- **Annual Review:** NSF will carry out annual site visits to review the progress and plans of the Center, with renewal reviews in years three and six. In years four and five and seven through ten, the ERC Program, in consultation with the ERC Director, may determine that an annual site review is not necessary. This determination will be based on the level of performance in the prior year and needs of the Center Director. The site visits will occur a minimum of six weeks prior to the anniversary date of the award. The purpose of the annual review is to review performance and to provide advice to the ERC. The level of continued NSF support will be negotiated with the Awardee annually and will depend upon a review of progress through the annual site review or other means, the Program Officer's assessment of progress, the industrial support level, other requirements stated in the previous Section 4 under "Annual Progress Report," and the availability of funds for the program. NSF's agreement with a center might be terminated as a result of an annual review if there is insufficient progress in organizing the ERC to achieve its vision, or one or more key features of the center have not been addressed. In the case of termination, NSF support to the center will be phased down over the next one or two years.

- **Evaluation of the ERC and Renewal of NSF Support:**

- a. If a renewal proposal is submitted during the third year of the Center's operation, the Foundation will conduct a major site evaluation/review to determine whether NSF will continue to support full ERC operations or provide decreased funding to phase out NSF support of the ERC over one or the two years. If NSF decides to continue full ERC operations, a new level of support will be negotiated to cover the five-year period beginning at the start of the fourth year of the Center's operation. This five-year renewal period will cover Years 4 through 8 of the Center's operation. If the Awardee chooses not to submit a renewal proposal, NSF support to

the ERC will be phased down over the two-year period covering Years 4 and 5 of the Center's operation.

- b. If the Awardee chooses to submit a renewal proposal during the sixth year of the Center's operation, the ERC will be evaluated in the manner described above to determine whether NSF will continue to support full ERC operations or provide decreased funding to phase out NSF support of the ERC over the two-year period covering Years 7 and 8 of the Center's operation. If NSF decides to continue full ERC operations, a new level of support will be negotiated to cover the four-year period beginning at the start of the seventh year of the Center's operation. This four-year renewal period will cover Years 7 through 10 of the Center's operation, completing a ten-year life cycle with a phasing down of NSF support in Years 9 and 10. If the Awardee chooses not to submit a renewal proposal, NSF support to the ERC will be phased down over the two-year period covering Years 7 and 8 of the Center's operation.

- After the end of the Agreement with NSF, NSF expects the ERC to continue in a self-sufficient mode, maintaining the ERC culture with support from funds outside the ERC Program. Under no circumstances will the ERC receive ERC Program support to continue its center operations after the Agreement expires, although it may receive ERC Program support through subawards from other ERCs or through special purpose awards designed to capitalize on past ERC Program investments. Members of a graduated or about to graduate ERC's team may submit a proposal for a new ERC, provided that it has a distinctively new vision and, therefore, involves new faculty and a refreshed set of industrial partners.

5. Program-Specific Terms and Conditions:

- **Awards Involving Pre-college Students:** In accordance with sections 1869a and 1869b of title 42 of the United States Code, the Awardee will do the following:
 - a. Obtain from the school board or comparable authority responsible for the schools considering participation in the project, written approval prior to involvement of pre-college students in pre-college education research and development, pilot-testing, evaluation, and revision of experimental and innovative pre-college curriculum.
 - b. Include in every publication, testing, or distribution agreement involving instructional materials developed under this grant (including, but not limited to, teachers' manuals, textbooks, films, tapes, or other supplementary material) a requirement that such material be made available within the school district using it for

inspection by parents or guardians of children engaged in educational programs or projects using such material of that school district.

- **Diversity:** Engineering Research Centers must embrace the cultural, gender, racial, and ethnic diversity of the U.S. in the composition of their leadership, faculty, and student teams and their graduates in order to assure that all talented people can pursue and receive engineering degrees and be engaged in engineering research and education. NSF expects the faculty and staff of all ERCs and the administrations of all institutions receiving NSF funding to share this commitment and to devote the time and effort required to ensure that the diversity of the Centers' leadership teams, faculty, and students at all levels serves as a model for diversity within each institution and for the nation as a whole. This expectation is made with the understanding by NSF that ERCs do not have the authority to hire faculty, accept students, or grant degrees. Each ERC is expected to demonstrate a significant commitment to and success in exceeding national engineering-wide averages for the involvement of women, underrepresented racial minorities, and Hispanic Americans as leaders, faculty, undergraduate, masters, and doctoral students, and as ERC students who have graduated. Since no set of formal requirements can ensure that a desired level of dedication to achieving diversity is engendered, the following are required elements of a diversity strategy, the success of which depends in large part on the spirit in which they are implemented by the center and its collaborating departments and university-level schools. In fulfilling its obligations under the agreement and in compliance with the requirements of federal law, no university receiving federal funds will employ quotas or set-asides based on race.

Each ERC will:

- a. Prepare and execute a diversity strategic plan with goals, milestones, and intended actions to increase the diversity of the center's leadership team, faculty, undergraduate and graduate students and its graduates. The ERC will include the diversity strategic plan in its annual report/renewal proposal and will include in that annual report/renewal proposal a report on the execution of the previous year's diversity strategic plan, the outcomes and impacts achieved (statistical and other information), and an updated version of the diversity strategic plan for the coming year. The updated strategic plan should highlight key deficiencies identified in the previous year's plan and new strategies to rectify them. The focus of these diversity efforts will be on achieving a demonstrated impact by exceeding national engineering-wide averages for the involvement of women, African Americans, Native Americans, and Pacific Islanders (underrepresented racial

- minorities) and Hispanic Americans (underrepresented ethnic minority) who are U.S. citizens or permanent residents in the research and education activities of the ERC as leaders, faculty, undergraduate, masters, and doctoral students, and as graduates.
- b. Demonstrate the existence of a partnership among the affiliated Deans of Engineering, other Deans, and the chairs of departments of the affiliated ERC faculty to increase the diversity of the center's leadership team, faculty, undergraduate and graduate students, and graduates over the duration of NSF's support.
 - c. Develop outreach connections with NSF programs focused specifically on increasing diversity of science and engineering students and faculty through the involvement of women, underrepresented racial minorities, and Hispanic American students. This will include connections with one of the NSF's Louis Stokes Alliance for Minority Participation (LSAMP), and with one or more of the NSF-sponsored awardees focused on diversity such as the NSF Alliances for Graduate Education and the Professoriate (AGEP), Colleges and Universities that serve predominantly Native American Populations, and other ongoing NSF programs serving underrepresented groups. These connections will involve faculty and undergraduate and graduate students in the ERC's research and education programs and provide fellowships to students to facilitate matriculation of diverse cadres of undergraduate and graduate students in the graduate programs of the ERC's partner institutions, with some significant fraction of such students becoming involved in the ERC.
 - d. Develop and strengthen long-term core and/or outreach partnerships with predominantly female, African American, Native American, and Hispanic American serving institutions.
 - e. Introduce diverse cadres of precollege students to the excitement and challenges of engineering through summer and/or year-round programs focused on design and research.
 - f. Focus any Research Experiences for Undergraduates (REU) and Research Experiences for Teachers (RET) programs on diversity.