

ENGINEERING RESEARCH CENTERS

Program Announcement

Division of Engineering Education and Centers
Directorate for Engineering

Due Dates

Letter of Intent:	<i>December 30, 1994</i>
Stage 1 Pre-Proposal Deadline:	<i>February 9, 1995</i>
Stage 2 Notification:	<i>April 5, 1995</i>
Stage 2 Proposal Deadline:	<i>July 31, 1995</i>
Awards Announcement:	<i>January, 1996</i>



NATIONAL SCIENCE FOUNDATION

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When connected, press `Enter`. At the login prompt, enter `public`.

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```
get stisdirm
```

You will receive instructions for this service.

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For Additional Assistance Contact:

E-mail: `stis@nsf.gov` (Internet)

Phone: (703) 306-0214 (voice mail)

TDD: (703) 306-0090

The Engineering Education and Centers Division is accepting proposals from academic institutions to establish six or seven Engineering Research Centers (ERC) in FY 1996. These may be entirely new ERCs. They also may be ERCs from the Classes of 1985 or 1986 which are competing for a new Cooperative Agreement to begin near the end of their eleven-year ERC life span.

The Engineering Research Centers Program supports cross-disciplinary centers where academe and industry join to bring engineering and scientific disciplines together to focus on the next generation of technological advances in engineering systems. These centers address major areas of technology that are the foundation for the competitiveness of U.S. industry. The ERCs are designed to catalyze a new research and educational culture in academe, where disciplines mix, research and education are integrated, and industrial and academic perspectives on research, education, and technology blend.

The ERCs are intellectual partnerships among academe, industry, and NSF which produce advances in fundamental knowledge and new engineering systems, processes, and devices. The research program of a center is a mixture of fundamental inquiries exploring the underlying scientific and engineering principles in an area, moving through to applications in testbeds. ERCs are designed to test concepts and explore barriers to advancement in experimental proof-of-concept testbeds. These centers promote active collaboration between academe and industry through joint projects, industrial mentors for students, student and faculty visits to industry to develop on-site testbeds, etc.

The integration of research and education in ERCs is designed to catalyze a new culture in academe. They provide an alternative educational environment where the cross-disciplinary, systems perspective of the research becomes integrated into the educational process. ERCs involve undergraduate and graduate students in the research, working in integrated cross-disciplinary teams. They cultivate a new breed of students capable of integrating knowledge to advance technology and familiar with industrial practice. ERCs develop new and modified courses, many of which are team-taught across disciplines, and new degree programs. For students, the ERC experience and their close association with industry have proven to be a market advantage. Industry prefers to hire these students because of their ability to use different disciplinary perspectives to define and solve problems, their familiarity with technology and systems, and their experience with industry. ERC students have a proven ability to "come up to speed" more quickly in industry than others. Students who move into academic careers take their ERC culture with them.

ERCs are responsible for involving a significant number of women, underrepresented minorities and persons with disabilities at all levels. To augment the pool available on their own campuses, ERCs compete for supplemental support from the NSF Engineering Research Centers Program and other NSF educational and human resource development programs to develop outreach programs focused on women, underrepresented minorities, and the disabled. They implement Re-

search Experiences for Undergraduates (REU) programs where students from other institutions spend the summer in ERC projects. Some ERCs develop outreach programs to Historically Black Colleges and Universities (HBCUs) and schools with predominantly female or other underrepresented populations to bring these students and their faculty to the ERC. Others have developed special outreach programs to precollege students and teachers. Because all of these outreach efforts involve students directly in meaningful research with a technological perspective, they have proven valuable in stimulating an interest in engineering on the part of these students. Many have gone on to choose engineering as a major and pursue graduate work in engineering.

NSF is exploring ways to extend the concept and scope of the ERCs to encompass new modes of industry-university-government partnerships with other agencies and/or consortia of firms, particularly in technological areas of national importance. Such partnerships would be jointly selected and monitored by the major funders. Separate announcements will be issued for such special initiatives.

It should be understood that there is no preference for any topic areas in this announcement; all topics will be treated equally in the review process according to the review criteria.

Necessary Features of an ERC:

- A clear and coherent vision guiding high quality fundamental engineering and scientific research in areas critical to U.S. economic competitiveness;
- A strategically focused systems-oriented, cross-disciplinary research program spanning knowledge creation to experimentation in testbeds, delivering knowledge and technological advances ;
- A cross-disciplinary team effort fostering partnerships across engineering and scientific disciplines among faculty, students and other individuals from the participating school(s) and from industry;
- A strong cross-disciplinary educational component involving both undergraduate and graduate students in research which provides opportunities to interact with participating industries and focuses on engineering systems, preparing them for engineering practice, and developing course and curriculum innovations based on the unique features of the ERC (linkage with NSF-funded educational innovation programs, such as Engineering Education Coalitions or Course and Curriculum Development Awards may be appropriate if there is value added to both parties);
- A mechanism to develop and foster intellectual ties with engineers and scientists from industry to facilitate a two-way flow of ideas leading to participation in the transfer of knowledge and technological advances and participation in the planning and assessment of the research and education programs of the ERC;

- Substantial support from non-NSF sources, including funds and equipment donations from participating companies and from state or other government sources;
- Major or specialized experimental capabilities not available through single-investigator projects;
- Formal recognition and support from the university administration to facilitate the cross-disciplinary, industrially relevant culture change inherent in an ERC, including substantial financial support, space, and facilities as needed to integrate the ERC with the participating departments and programs, and tenure and other reward practices that support involvement in cross-disciplinary, industrially relevant research;
- Special emphasis on enriching the Nation's engineering workforce by including a significant number of women, underrepresented minorities, and persons with disabilities at all levels of the ERC team; and
- Programs of outreach, such as summer research programs for undergraduates from other colleges and universities, joint research projects with other universities where complementary expertise or facilities are available, programs to expose pre-college teachers and students to engineering and industry, and contributions to the continuing education of practicing engineers; these often increase as an ERC progresses.

CENTER LEADERSHIP AND MANAGEMENT

The organization and management of an ERC requires a Director and a team of faculty with a strategic vision and the ability to plan and focus resources to achieve that end. It requires a major time commitment by the Center Director and the willingness of faculty to work as a team, as well as the investment of industrial and institutional resources.

The Center Director provides intellectual leadership and is supported by a small management team, as needed, for administrative and financial management, coordination of educational activities, industrial collaboration/technology transfer, etc. The Center Director is the NSF Principal Investigator and has primary responsibility for administering the award in accordance with NSF's Grants General Conditions (GC-1) and the special terms of the Cooperative Agreement with NSF.

ERCS AND SELF-SUSTAINABLE ACADEMIC CULTURAL CHANGE

The ultimate goal of the ERC Program is to establish a changing mix of ERCs which will have a long-term sustainable impact on the research and educational cultures in academe. The ERCs establish an integrated cross-disciplinary, systems-oriented research and education culture that includes fundamental inquiries that blend science and engineering disciplines and extend to proof-of-concept in testbeds, all in

collaboration with industry. While it is recognized that different centers will require different time frames to achieve this state depending upon the chosen technology, academic attitudes and infrastructures, institutional policies, etc., it is expected that the home institution(s) of the ERC will assure that changes are facilitated and endure after NSF support ends.

WHO MAY SUBMIT

U.S. academic institutions with graduate and undergraduate engineering research and education programs may submit proposals. Proposals may be submitted by a single institution or by a lead institution involving other institutions. In the case of multi-institutional arrangements, a management capability of the lead institution that will achieve close interaction and integration of research and education programs across the participating institutions must be demonstrated. To be considered a joint ERC the partner school would have a significant role in planning and execution of the ERC. Schools undertaking specific research and/or education projects only should be listed in the outreach section.

Existing ERCs in the final two years of their initial eleven-year life span are eligible to re compete for a new award and may submit a proposal in this competition. These centers will have to demonstrate both high-quality performance and a fresh, challenging vision for the future. They may propose to enhance significantly their ongoing programs, focusing on continuing work to be done, building on the past, and modifying their approaches for the future to address new issues that have become important in recent years. They also may propose a significantly different activity. Thus, NSF expects either an invigorated approach to the ERC's research strategy or a reorientation of the center's vision and plans, with evidence, in either case, of high levels of continuing challenges, potential for continuing accomplishments, and continuing competence. **Please note special sections in the proposal format and review criteria below that apply in this case.**

In areas already addressed by existing ERCs and/or other large-scale efforts or centers funded by NSF or other sources (such as the NSF Science and Technology Centers and the Materials Research Science and Engineering Centers), proposers should justify what the proposed ERC will contribute that is new and different from the body of work already underway. Centers currently supported by the ERC Program are listed at the end of this announcement. Conversion of another type of existing center funded by NSF or another source to an ERC would require a major change in the centers vision and program strategy, and the proposal must demonstrate the need to do so.

To foster the integration of research and education in academe, there is an interest in connections between ERCs and the existing Engineering Education Coalitions, provided the connection is mutually beneficial and enhances the educational impact of both efforts. These Coalitions are listed at the end of this announcement.

Participation in an ERC does not preclude individual investigators from receiving NSF support for their own research or education efforts through other NSF Programs.

Award Size

Initial awards will be made under five-year cooperative agreements. The first year budget from NSF should not exceed \$2.0M. Annual increments may be requested not to exceed \$3.0M by the fifth year. Current ERC's which successfully recomplete may have budgets no greater than \$2.0M per year.

TWO STAGE AWARD COMPETITION

For the first time, the ERC competition is now organized into two stages, plus a Letter of Intent. The purpose of the two-stage competition is to reduce the proposal preparation workload for academe and reduce the number of contacts made to industry to commit financial support for proposals. Pre-proposals (Stage 1) should result from a **planning workshop** or other means of communication with industry. The purpose is to focus teams of academic and industrial personnel on the conceptualization and selection of a topic and a clear vision important for competitiveness. The pre-proposal will center on articulation of the vision, the development of a preliminary strategic plan, the identification of research themes and thrust areas, and a few key examples of research to be carried out. These pre-proposals also will include a strategy for industrial collaboration as well as a brief summary of educational goals. A list of industrial contacts involved in the Stage 1 pre-proposal preparation must accompany the pre-proposal. Commitments to provide financial and other support from industry and other sources will be expected with the final proposals (Stage 2).

Pre-proposals will be reviewed by outside experts from academe, industry, government, and professional societies. The proposers of those ranked best will be invited to submit a final (Stage 2) proposal. Final proposals (Stage 2) will be full-scale proposals with budgets and financial commitments from industry and other sources. These also will be reviewed by outside experts and the finalists of this Stage will receive a site visit. The proposers of pre-proposals (Stage 1) not invited to submit a final proposal will be notified and sent their reviews when Stage 2 proposals are requested.

LETTER OF INTENT

To assist in the selection of reviewers and for other planning purposes, the proposed Center Director should indicate plans to submit an ERC pre-proposal by sending a **letter of intent** to the ERC Program. This letter must be no longer than two pages. It must contain the title of the ERC, a statement of the technical focus of the ERC, and a brief statement of the research areas to be covered. It must indicate the names and departmental and institutional affiliation of the Center Director and key research-thrust leaders. *Submission of this letter of intent is not a prereq-*

uisite nor does it commit the sender to submit a pre-proposal. Letters of intent are due at NSF by December 30, 1994 and must be countersigned by the Dean of Engineering. Please send this information by any of the following means: by e-mail to lpreston@nsf.gov, by FAX at (703) 306-0290 or -0326, or by letter to Ms. Lynn Preston, Deputy Director, Division of Engineering Education and Centers, Room 585, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230.

PRE-PROPOSAL (STAGE 1) GUIDELINES AND FORMAT

The pre-proposal must be prepared following the guidelines below and should contain **only the materials requested by this announcement**. *Copies of the required forms are contained in the NSF document Grants Proposal Guide (GPG) (NSF 94-2)*. Single copies of this brochure are available at no cost from the Forms and Publications unit of NSF — telephone your request to (703) 306-1130, or FAX your order to (703) 644-4278. This brochure is also available via electronic mail: pubs@nsf.gov (INTERNET).

Fifteen copies of the pre-proposal (Stage 1) must be mailed to arrive at the following address by 5:00 pm, February 9, 1995. **Please send the pre-proposals in a box clearly marked "Pre-Proposal: Not a New Proposal" to Ms. Lynn Preston, Division of Engineering Education and Centers, Room 585, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230.**

Please note that the submission of a pre-proposal (Stage 1) is a prerequisite to, but does not obligate the submission of a final proposal (Stage 2). All pre-proposals submitted in response to this announcement that are received after the deadline will be returned without review. Stage 2 proposals will be requested of proposers who successfully complete the pre-proposal (Stage 1) review.

The pre-proposal should consist of **no more than 20 pages of text in length, not including charts, tables, and requested appendices**, single-spaced in 10 point type. If the proposal exceeds the page limit it will not be accepted for review. The proposal will consist of the following:

- (1) **Cover Sheet** (NSF Form 1207, page 1 of 2): This form must be signed by the Principal Investigator (Center Director), with EEC listed as the NSF Organization Unit and the Engineering Research Centers (ERC) Announcement Number NSF 94-150 listed as the Program Announcement Number in the upper-left hand corner of the form.
- (2) **Table of Contents** (NSF Form 1359). Key Table of Contents to page numbers of major sections of the proposal.
- (3) **Vision and Rationale for the Center**: Present the vision for the role of the proposed ERC in enhancing U.S. competitiveness. Describe the engineering systems focus of the center.

(4) **Research Plan**

Focus: Given the overall research vision of the proposed ERC and its engineering systems focus, discuss the key barrier issues in the state-of-the-art and practice, and the advances needed for the next generation of technological systems. Indicate the proposed scope of the Center in addressing these.

Strategic Plan: Present a preliminary strategic plan to organize the research to address these barrier issues and the key knowledge and technological advances planned, or the ERC's deliverables. This plan should provide milestones of the key accomplishments in knowledge and technological advances upon which the ERC will focus. A succinct milestone chart which depicts this strategy must be provided. The chart should show the key deliverables of the work for the first eleven years.

State-of-the-Art: Discuss the state-of-the-art in the proposed research areas. Briefly explain why the proposed ERC is needed in the light of this ongoing work.

Objectives, Plans, and Research of Each Thrust Area: Present the organization of the research program into areas or thrusts. Provide information on the objectives and plans for each research area, and show their relationship to the Centers overall strategic research plan. For each area, give examples of critical research issues to be addressed, providing a discussion of key problems driving the research and methodology to be used. Describe any experimental testbeds needed to explore and validate research results. Describe any novel approaches to be used, the cross-disciplinary mix needed, and how the systems-integration approach is to be maximized.

(5) **Industrial Collaboration and Technology Transfer:**

Provide an overview (up to two pages) of the center's preliminary strategy to achieve an active partnership with industry. Include in an appendix a list of industrial contacts involved in the pre-proposal planning stage. A commitment for active involvement and financial support from firms will be required in Stage 2.

(6) **Education:** Provide an overview (up to two pages) of the Education Program. Specific information will be requested in Stage 2.

(7) **Management and Infrastructure:** Indicate who will be the Director of the ERC and the others who will assume leadership positions. Provide an overview of the management system, and equipment/facilities infrastructure to support the ERC.)

8) **Appendices:**

- **List of industrial personnel** involved in planning for the pre-proposal.

- **Budget:** The pre-proposal must include in an appendix a five-year financial plan, showing annual estimates of aggregate levels of support from NSF and other sources for the first five years. The first year budget from NSF should not exceed \$2.0M. Annual increments may be requested not to exceed \$3.0M by the fifth year. Current ERCs which successfully re-compete may have budgets no greater than \$2.0M per year.

- Biographical sketches (NSF Form 1362): Curriculum vitae of the Director and key participants in the center (maximum length, two pages each).

INQUIRIES

For program inquiries, contact the Program Staff, Division of Engineering Education and Centers: (703) 306-1381.

REPORT ON PAST PERFORMANCE (FOR EXISTING ERCs ONLY):

Existing ERCs in the final two years of their eleven-year life-cycle must demonstrate the quality of their past performance through submission of a separate progress report. The plan for future work is a part of the separate pre-proposal.

The progress report will be a summation of progress from inception to date, 20 pages in length, which will address:

- the state-of-the-art and vision in research and technology when the center was established;
- the current state-of-the-art and the ERC's contributions to this progress;
- the impact on the institution's research culture;
- the impact of the ERC on the institution's education programs;
- the evolution of industrial collaboration with the ERC;
- examples of significant impacts of the ERC on industry/users; and
- the progress made in increasing the number of women, underrepresented minorities and the disabled on the faculty and student body working within the ERC;
- efforts undertaken by the institution to "institutionalize" the ERC, e.g. endowments, buildings, Chairs, etc.;
- other pertinent information.

Existing ERCs choosing to enter this competition will be provided with sample formats for required tables and charts.

STAGE 1 REVIEW AND STAGE 2 PROPOSALS

Pre-proposals will be reviewed by panels according to review criteria on pages 5 and 6. The most highly recommended applicants will be selected for submission of a final (Stage 2) proposal. Stage 2 proposal guidelines will be mailed to these proposers. *Only proposers of those pre-proposals will be invited to submit a final (Stage 2) proposal. Other proposals will be returned.* Proposers of pre-proposals who were not invited to submit a final proposal will be notified and sent their reviews when Stage 2 proposals are requested.

Six to seven awards are planned from final (Stage 2) proposals. Announcement of awards is planned for January, 1996.

AWARD/OVERSIGHT SYSTEM

ERCs have a potential life span of eleven years before recompetition. While new ERCs have this potential initial life span, mature ERCs (the Classes of 1985 or 1986) may receive new cooperative agreements with a life of three, five or 11 years, depending on the quality of their past performance and future plans. Each award to an ERC (new or mature) that is given a potential life span of 11 years will be made as a cooperative agreement between NSF and the awardee for an initial period of five years. During the third year, a non-competitive renewal evaluation will be conducted to help NSF management decide whether to extend the award beyond the first five years. If the decision is positive, a five-year renewal award will be added to the end of the third year, thus extending the award to a total of eight years. If the decision is negative, the remaining (fourth and fifth) years will be funded at decreasing levels for a gradual phase-out. An ERC renewed in its third year also will have a non-competitive renewal evaluation in its sixth year of operation. In order for an ERC to receive funding from NSF beyond the end of the second renewal period, it must re compete in an announced competition in its 10th or 11th year. Mature ERCs which receive agreements for a new three or five-year life span may re compete for a new award in the year before the final year of their agreement.

Awards will be administered in accordance with the NSF Grant General Conditions (GC-1), and Cooperative Agreement General Conditions (CA-1), copies of which may be requested from the NSF Forms and Publications Unit cited above. More comprehensive information is contained in the NSF Grant Policy Manual (NSF 88-47) available through a subscription offered by the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

REVIEW AND AWARD SELECTION PROCESS

Pre-proposals (Stage 1) will be evaluated by merit review, which may include individual and panel review, and final proposals (Stage 2) will be evaluated in several stages of merit

review, which may include individual and panel reviews, site visits, and NSF management reviews. Final proposals (Stage 2) not selected for a site visit will be declined when final award decisions are made.

The criteria used in the review are based on the principles described in the NSF document GPG (NSF 94-2), page 13. They are, in their order of priority:

A. Intrinsic Merit of the Research Program and its Impact on U.S. Competitiveness

1. Clarity and importance of vision for industrial competitiveness; coherence of plans; quality and innovativeness of the proposed research; systems-integration and cross-disciplinary nature of the research; potential impact of the ERCs advances on the knowledge and technology base and on the competitiveness of U.S. industry.
2. Value added by the center over a collection of individual projects and over other work, including that of other centers already established in the field, and over the past work of the center itself if it is already an ERC.

B. Strength and Impact of the Educational Program

Magnitude and quality of graduate and undergraduate student involvement in research; exposure of students to cross-disciplinary teamwork and systems aspects of engineering, as well as to industrial perspectives on research needed to advance technology; plans for innovative curriculum/course development and improvement resulting from center research; value added by connections to other NSF-funded educational activities (if proposed); and continuing education for practicing engineers.

C. Utility, Relevance, and Strength of Industrial Interaction

Degree and quality of participation of industrial and other user personnel in ERC activities such as research planning, joint projects, experimentation with testbeds, mentoring students, and personnel exchange; industrial and other user commitment for financial, equipment, and other forms of support; plans to develop mechanisms and vehicles for active knowledge and technology exchange, and means for the effective transfer of useful advances to use in industry.

D. Leadership and Performance Competence

Vision, intellectual leadership, planning, integrating, and managing skills of the proposed Center Director; capability of the participating investigators, appropriateness of the cross-disciplinary mix, cohesiveness of the faculty team, and strong involvement of women, under-represented minorities and the disabled on the faculty and student body; and effective advisory and management systems.

E. Institutional Environment and Support

University administrations support for integrating the proposed center within the framework of established departments and other relevant programs; institutional

policy toward tenure and reward for center participants; institution's commitment to increasing the involvement of underrepresented groups on the faculty and in the student body; and institutional and/or state/local governments commitment of resources to help support the proposed center.

F. Impact on the Infrastructure of Engineering

Potential to lead in research and education in the field; plans to reach out and broaden participation to include non-ERC institutions; impact on how engineering is taught and practiced in the future; commitment to increase the number of women, underrepresented minorities, persons with disabilities on the ERC faculty and as undergraduate and graduate students within the center; and potential to improve the effectiveness of the distribution of the Nation's research and education resources.

G. Special Criteria for Existing ERCs Seeking New ERC Awards

High quality past performance in meeting the key features of an ERC, along with a high level of potential to continue high quality performance in the future. The ERC should have demonstrated important contributions to engineering knowledge and technological advancement, to the research and educational culture of its home institution(s), and to the Nation. For example, significant knowledge and technological advances will have been made by the ERC, many of which are in use in industry; the ERC is considered a National leader in its field; a cohesive cross-disciplinary team has been formed; industry has provided high levels of commitment and financial support and the ERC has a strong record of close collaboration with industry in research and education; the cross-disciplinary, systems nature of the ERC has impacted the curricula and educational culture of its home institution(s); and the ERC will have established a diverse group of faculty and students, with strong involvement of women, underrepresented minorities, and persons with disabilities. For the future, the ERC should demonstrate a fresh and challenging vision with continuing strong industrial support and involvement and high quality plans for continued contributions in the full dimensions of the key features of an ERC.

[Planned for establishment in FY 1995]
Center Director: Rodney M. Goodman. Telephone: 818-395-6357.

- **Engineering Design Research at Carnegie Mellon University.** (1986)
Center Director: Daniel P. Siewiorek. Telephone: 412-268-3372.
- **Data Storage Systems at Carnegie Mellon University.** (1990)
Center Director: Mark Kryder. Telephone: 412-268-3513.
- **Opto-electronic Computing Systems at the University of Colorado and Colorado State University.** (1987)
Center Director: Kristina Johnson. Telephone: 303-492-1888.
- **Telecommunications Research at Columbia University.** (1985)
Center Director: Anthony Acampora. Telephone: 212-854-3123.
- **Emerging Cardiovascular Technologies at Duke University and other North Carolina Institutions.** (1987)
Center Director: Olaf von Ramm. Telephone: 919-660-5137.
- **ERC for Particle Science and Technology at the University of Florida.** (1994)
Center Director: Brij M. Moudgil. Telephone: 904-392-6670.
- **ERC on Low-Cost Electronics Packaging at Georgia Institute of Technology.** (1995)
[Planned for establishment in FY 1995]
Center Director: Rao Tummala.
Telephone: 404-894-9097.
- **Compound Semiconductor Microelectronics at the University of Illinois, Urbana-Champaign.** (1986)
Center Director: Stephen Bishop. Telephone: 217-333-3097.
- **Advanced Technology for Large Structural Systems at Lehigh University.** (1986)
Center Director: John W. Fisher. Telephone: 215-758-3535.
- **Systems Research at the University of Maryland.** (an FY 1985 ERC re-established in FY 1994)
Center Director: Steven I. Marcus. Telephone: 301-405-7589.
- **Biotechnology Process Engineering at the Massachusetts Institute of Technology** (an FY 1985 ERC re-established in FY 1994)

Engineering Research Centers Currently Supported by NSF:

- **Advanced Combustion Engineering Research at Brigham Young University and the University of Utah.** (1986)
Center Director: L. Douglas Smoot. Telephone: 801-378-4326.
- **Center for Neuromorphic Systems Engineering at California Institute of Technology.** (1995)

Center Director: Daniel I.C. Wang. Telephone: 617-253-2504.

- **Interfacial Engineering** at the *University of Minnesota* (1989)
Center Director: D. Fennell Evans. Telephone: 612-625-6828.
- **Computational Field Simulation** at *Mississippi State University*. (1990)
Center Director: Joe F. Thompson. Telephone: 601-325-8278.
- **Center for Biofilm Engineering** at *Montana State University*. (1990)
Center Director: J. William Costerton. Telephone: 406-994-4770.
- **Advanced Electronic Materials Processing** at *North Carolina State University and other North Carolina Institutions*. (1989)
Center Director: Nino Masnari. Telephone: 919-515-3001.
- **Net Shape Manufacturing** at *The Ohio State University*. (1986)
Center Director: Taylan Altan. Telephone: 614-292-5063.
- **Collaborative Manufacturing** at *Purdue University*. (an FY 1985 ERC re-established in FY 1994)
Center Director: James J. Solberg. Telephone: 317-494-7715.
- **Offshore Technology** at *Texas A&M University and The University of Texas at Austin*. (1989)
Center Director: Richard Seymour. Telephone: 409-845-7252.
- **Plasma-Aided Manufacturing** at the *University of Wisconsin-Madison and the University of Minnesota* (1989)
Center Director: J. Leon Shohet. Telephone: 608-262-1191.

- Gateway Coalition
Coalition Director: Eli Fromm.
Telephone: 215-895-2201.
- Greenfield Coalition
Coalition Director: Leo Hanifin.
Telephone: 313-993-1216.
- Southern California Coalition for Education in Manufacturing Engineering
Coalition Director: J. Richard Williams.
Telephone: 310-985-5121.
- SUCCEED Coalition
Coalition Director: Carl F. Zorowski.
Telephone: 919-515-7901.
- Synthesis Coalition
Coalition Director: Alice M. Agogino.
Telephone: 501-642-6450/3458.

ADDITIONAL INFORMATION

Copies of all relevant NSF publications, including GPG, and this Announcement (NSF 94-150) are available at no cost from:

National Science Foundation
Forms and Publications- P-15
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