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GRANTS FOR VERTICAL INTEGRATION OF RESEARCH AND EDUCATION IN THE MATHEMATICAL SCIENCES (VIGRE)

Program Announcement

DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES
DIVISION OF MATHEMATICAL SCIENCES

LETTER OF INTENT: ***JANUARY 15, 1999***
PROPOSAL DEADLINE: ***FEBRUARY 16, 1999***

LETTER OF INTENT: ***JUNE 18, 1999***
PROPOSAL DEADLINE: ***JULY 19, 1999***

NATIONAL SCIENCE FOUNDATION

Matrix of Program Requirements

GENERAL INFORMATION

Program Name: Grants for Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE)

Short Description/Synopsis of Program:

In response to many reports and recommendations on higher education, the Division of Mathematical Sciences (DMS) designed this program of grants to departments in the mathematical sciences to carry out innovative educational programs in which research and education are integrated and in which undergraduates, graduate students, postdoctoral fellows, and faculty are mutually supportive. The goals of VIGRE are: (1) to prepare undergraduate students, graduate students and postdoctoral fellows for the broad range of opportunities available to individuals with training in the mathematical sciences; and (2) to encourage departments in the mathematical sciences to consider the full spectrum of education activities and their integration with research, with particular attention to the interaction of scholars across boundaries of academic age and departmental standing. With these goals in mind, each VIGRE proposal must present a coherent plan for the vertical integration of three main program components: (1) a graduate traineeship program, (2) an undergraduate research experience program, and (3) a postdoctoral fellowship program. Two optional components, the first in the area of curriculum/educational materials development and the second focused on outreach activities, will also be considered for funding, if properly aligned with one or more of the main components.

Cognizant Program Officer: Dr. Joe W. Jenkins, Program Officer, Room 1025, Division of Mathematical Sciences, telephone 703.306.1879, e-mail: jjenkins@nsf.gov.

Applicable Catalog of Federal Domestic Assistance (CFDA) No.: 47.049 – Grants in the Mathematical and Physical Sciences

ELIGIBILITY

- **Limitation on the categories of organizations that are eligible to submit proposals:** Proposals may be submitted by academic institutions in the U.S. and its territories on behalf of departments that grant the PhD and have programs in the mathematical sciences at both the graduate and undergraduate levels.

- **PI eligibility limitations:** None

- **Limitation on the number of proposals that may be submitted by an organization:** At most one proposal may be submitted by a given department to each of the VIGRE competitions that will be conducted in FY1999.

AWARD INFORMATION

- **Type of award anticipated:** Continuing Grant (initial funding for three years, extended for another two years pending the outcome of a third-year review by NSF).

- **Number of awards anticipated in FY1999:** 5-10 awards are expected in the February 1999 competition; 8-12 awards are anticipated in the July 1999 competition.

- **Amount of funds available:** At this time, it is estimated that $12.0 million will be available for the February 1999 VIGRE competition, while an estimated $15.0 million is expected to be available for the July 1999 competition.

- **Anticipated date of award:** September 1999 for the February 1999 competition; February 2000 for the July 1999 competition.

PROPOSAL PREPARATION & SUBMISSION INSTRUCTIONS

Proposal Preparation Instructions

- **Letter of Intent requirements:** An e-mail letter of intent (VIGRE@nsf.gov) is required.

- **Preproposal requirements:** None

- **Proposal Preparation Instructions:** Standard instructions from the Grant Proposal Guide (GPG), NSF 99-2, are to be followed, with exceptions as noted below.

- **Supplemental proposal preparation instructions:** Two appendices are required, the first compiling baseline data in a number of categories and the second presenting documentation of institutional support or cost sharing, as well as documentation of affiliation with or support from proposed internship organizations.

- **Deviations from standard proposal proposal preparation instructions:** Depending on whether a VIGRE proposal contains optional program components or not, between 30 and 40 pages are allowed for the Project Description, which must include a status report on the curriculum review, a recruitment/ retention plan, an organization and management plan, and a performance assessment plan. Separate budgets for the main and optional program components must be provided.

Budgetary Information

- **Cost sharing/matching requirements:** There are no formal cost sharing requirements for proposals submitted in response to this solicitation, although cost sharing is implicit in the limitation of postdoctoral fellowship support during the academic year to at most 50% of an FTE (with a host institution funded teaching requirement for the remaining percentage time) and in the limit of $10,500 per student per year for graduate student tuition and fee expenses. Proposed cost sharing must be shown on line M on the proposal budget (NSF Form 1030).

- **Indirect cost (F&A) limitations:** Indirect costs are limited to 8% of modified total direct costs; no indirect costs are allowed on cost-of-education funding.

- **Other budgetary limitations:** None

FastLane Requirements

- **FastLane proposal preparation requirements:** FastLane use is optional for full proposal submission; FastLane submission of Cover Sheet and Project Summary is required.

- **FastLane point of contact:** Florence Rabanal, FastLane Coordinator for the Directorate of Mathematical and Physical Sciences, telephone:703.306.1998, e-mail: frabanal@nsf.gov.

Deadline Dates

- **Letter of Intent Deadlines:**
  5:00 PM, local time, January 15, 1999; 5:00 PM local time, June 18, 1999

- **Full Proposal Deadlines:**
  5:00 PM, ET, February 16, 1999; 5:00 PM, ET, July 19, 1999

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** The standard National Science Board approved criteria will be used.

- **Additional Review Criteria:** A number of Vigre-specific criteria will be used.

- **Integration of Research and Education:** NSF staff will give a project's blend of research and education careful consideration in making VIGRE program funding decisions.

- **Integrating Diversity into NSF Programs, Projects, and Activities:** NSF staff will consider diversity issues carefully when making VIGRE program funding decisions.

AWARD ADMINISTRATION INFORMATION

- **Grant Award Conditions:** GC-1 or FDP III

- **Special Grant Conditions Anticipated:** A successful third-year performance review by NSF will be required in order for the final two years of support to be awarded. The criteria on which this review will be based will be stated in the award letter.

- **Special Reporting Requirements Anticipated:** Program specific data that must be provided in annual reports, the first two of which will furnish some of the performance indicators for the third-year review, will be identified in the award letter. Reports must be submitted via FastLane.

INTRODUCTION

The Division of Mathematical Sciences (DMS) announces a program of grants to institutions with PhD-granting departments in the mathematical sciences to carry out high quality educational programs, at all levels, that are vertically integrated with the research activities of these departments. The long-range goal of the Grants for Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) program

is to increase the number of U.S. citizens, nationals, and permanent residents who receive training for and subsequently pursue careers in the mathematical sciences. Two developments stand out as crucial to the attainment of this objective: (1) the broader preparation of undergraduate students, graduate students, and postdoctoral fellows for the wide range of career opportunities available to individuals with training in the mathematical sciences; (2) a greater readiness on the part of departments in the mathematical sciences to initiate or improve education activities that strongly lend themselves to integration with research, especially activities that stimulate interaction among scholars across boundaries of academic age and departmental standing.

The VIGRE program responds to and accords with the recommendations of numerous reports. See, for example: the NSF report, *Graduate Education and Postdoctoral Training in the Mathematical and Physical Sciences* (1995); the National Research Council (NRC) report, *Mathematical Sciences, Technology and Economic Competitiveness* (1991); the NRC report, *Educating Mathematical Scientists: Doctoral Study and the Postdoctoral Experience in the United States* (1992); the NRC report, *Reshaping the Graduate Education of Scientists and Engineers* (1995); and the NSF *Report of the Senior Assement Panel of the International Assessment of the U.S. Mathematical Sciences* (1998). The NSF publications may be obtained via the World Wide Web at www.nsf.gov, the NRC reports at www.nas.edu. Another report of relevance is the SIAM report *Mathematics in Industry* (1995), which can be found at www.siam.org. More recent reports germane to the VIGRE program are the Carnegie Foundation's Boyer Commission report *Reinventing Undergraduate Education* (1998), which can be accessed electronically at www.sunysb.edu, and the AAU *Report and Recommendations of the Committee on Postdoctoral Education* (1998), which can be found at the website www.tulane.edu/~aau, under the heading "AAU Policy Issues."

PROGRAM DESCRIPTION

The intent of the VIGRE program is to promote the development of a diverse community of researchers and scholars whose members interact on an appreciably wider scale than is now commonly observed, breaking through long-standing barriers that have served to compartmentalize the scholarly activities of undergraduates, graduate students, postdoctoral fellows, junior faculty, and senior faculty. A community characterized by the kind of vertical integration just indicated would not only provide a setting conducive to more meaningful educational experiences for undergraduate and graduate students alike, but also be a stimulus to continuing professional development at the postdoctoral level and beyond. This sort of community is most likely to flourish in an atmosphere where research and education are looked upon as naturally tandem activities. The removal of obstacles to interdisciplinary research would also contribute substantially to the growth and sustenance of the community. It is, of course, possible for communities of the general type envisioned to evolve in a multitude of forms and in vastly different academic environments. However, a broad and up-to-date curriculum that opens the door to a rich array of career opportunities is seen as an essential prerequisite to the formation of any such community. (For possible benchmarks in the curriculum realm, see the Boyer Commission report cited in the introduction.) *In line with the preceding remarks, every VIGRE proposal must have at its core a coherent plan, incorporating a thorough review of both the graduate and the undergraduate curriculum, for the vertical integration of:*

- *a graduate traineeship program*
- *an undergraduate research experience program*
- *a postdoctoral fellowship program.*

Two optional program components will also be indicated below.

Undergraduate and Graduate Curriculum Review. A thoughtful reassessment of existing graduate and undergraduate curricula, in response to an ever increasing awareness of the many career options now available to mathematical scientists, is considered crucial to the success of the VIGRE program in achieving its stated long-term objectives. Although the activities involved in the curriculum review will not benefit directly from VIGRE program funding, the review is nonetheless a significant part of the proposal and will be a factor in its evaluation, for a department's sensitivity to curriculum issues provides a strong indicator of faculty commitment to the principles that lie at the heart of the VIGRE initiative. It is expected that the curriculum review will have been completed or at least be well underway at the time of a VIGRE proposal's submission. The proposal should describe the review process and furnish details about the particular focus of the review. In cases where it has already been completed, proposals should state the conclusions arrived at on the basis of the review, identifying any significant changes in curriculum prompted by it and presenting plans for the implementation of such changes. If the review is on-going when the VIGRE proposal is submitted, the proposal should describe its status and provide a schedule for its completion. Recent trends within the mathematical sciences professions strongly suggest that a forward-looking curriculum should prepare students for a broader range of mathematically oriented careers than has traditionally been contemplated and for the probable need to change careers over the course of one's working life. It should also emphasize inquiry-based learning, especially in the undergraduate program; involve graduate students in research earlier than is typical in current practice; and develop analytic, computational, and communication skills. Exposure to other disciplines in which mathematics plays a significant role would be a highly desirable element in such a curriculum. The preparation of future K-12 mathematics teachers has become

another important responsibility of many mathematical sciences departments, yet the curriculum appropriate to this mission is often not in place. Creation and adaptation of curriculum to fill this void are activities consistent with VIGRE program goals.

Vertical Integration. Proposals must identify the anticipated interactions among the three program components, whether they occur within some formal framework specifically designed to encourage interaction or are more subtly woven into the natural fabric of department culture, together with the expected benefits that will derive from such interactions. Since diversity is an important feature of the envisioned community of scholars, proposals must also discuss efforts for the recruitment and retention of U.S. citizens, nationals, and permanent residents as well as women and members of underrepresented groups.

Main Program Components. Detailed descriptions of the three main program components follow.

Graduate Traineeships: The centerpiece of each VIGRE proposal should be a program of graduate traineeships for PhD students. These traineeships are intended as a vehicle for: broadening graduate education; shortening the average time-to-degree for the doctorate; improving communication skills; and expanding career opportunities. The program is meant to be a year-round program, allowing significant time for such additional activities as research; internship experiences in industry, business, government laboratories, or other science/engineering departments; and cross-disciplinary course work to broaden the trainee's knowledge. An individual student can receive up to 33 months of nonteaching support from a VIGRE award. One of the goals of the VIGRE program is to shorten the average time-to-degree to five years. The years of nonteaching support should be arranged with this goal clearly in mind. In addition, graduate trainees are expected to have a significant teaching experience. It should include a minimum of one year of supervised teaching, with at least one term in which the student has substantial responsibility for a class. The university is expected to bear the cost of this teaching activity. The development of skills for communicating with both expert and nonexpert audiences is viewed as an important aspect of the traineeship. In particular, traineeship activities should be designed to help students develop proficiency in the presentation of original mathematical research in both written and oral formats and the ability to place that research in context.

Departments are expected to utilize the traineeships to improve the quality, not the size, of the graduate program. In particular, the traineeships are not meant to increase the size of the graduate program by enabling departments to hire additional teaching assistants, nor are they meant to replace current university funding of fellowships or scholarships. VIGRE is not intended to provide support for Master's degree programs.

Undergraduate Research Experience: In this solicitation, the term "research experience" is interpreted broadly to embrace all activities that introduce undergraduates to the thrill of discovery and generate within them excitement for the mathematical sciences. Examples of research experiences include: faculty directed projects; internships in industry, business, or government laboratories; and participation in interdisciplinary research teams. Such experiences, running the gamut from group-oriented activities to one-on-one mentoring of an undergraduate by a faculty member or an internship supervisor and from academic year projects to summer REU programs, are intended first and foremost to give students a meaningful glimpse into the creative aspects of mathematics in a nonclassroom setting. They are also expected to contribute in a significant way to the development of students' communication skills, with particular emphasis on the presentation of mathematical concepts in both written and oral contexts. Internship experiences are particularly encouraged, for they exert a strong broadening influence on young scholars, they naturally engage participants in a vertically integrated activity, and their use might allow for the involvement of students in greater numbers than would be possible with some other activities.

Postdoctoral Fellows: For postdoctoral fellows, the goal of the program is to produce professionals ready to become full-fledged members of academic departments. (For postdoctoral fellows interested in careers in industry and business, see *University-Industry Cooperative Research Program in Mathematical Sciences*, NSF 94-100.) The expectation is that a VIGRE postdoctoral fellow will emerge from the experience with a well-defined independent research program, teaching skills at various levels, a broad perspective of his or her field and its place in the surrounding mathematical landscape, and a comprehension of the responsibilities of the profession. The size of the request for postdoctoral support should be consonant with the projected availability of highly qualified candidates and the capability of the department to provide fellows with an optimal environment for professional development. It is the intention that each postdoctoral fellow be supported for 31 months, beginning within 18 months of completion of the PhD. The structure of the

postdoctoral program should be flexible. It could include, for instance, interdisciplinary research experiences in other academic departments and programs, industry, business, or government laboratories, or it could allow a postdoctoral fellow to spend a year at a research institute whose program is suitably aligned with the individual's research interests. Development of communications skills should be an important part of the program. A key objective here is to improve the quality of oral and written presentations of mathematical ideas in order to serve a variety of purposes; e.g., preparing articles for publication in professional journals, giving colloquium level talks, formulating the essential contents of mathematical results in terms that even general audiences can appreciate, and drafting research proposals that are clear and compelling to readers who, though scientifically literate, might have limited technical expertise in the precise research area. As a component of this development, each VIGRE fellow is expected to submit a research proposal to a funding agency at some point during the course of the fellowship. Postdoctoral fellows are expected to teach each semester while in residence at the sponsoring university; over the duration of the fellowship, this teaching should encompass a diverse set of instructional experiences. In any term devoted to off-site program activities by a VIGRE postdoctoral fellow, partial funding should be provided by the research institute, industrial/business host or government laboratory with which the fellow is affiliated for the period in question.

Optional Program Components. Proposals may include one or both of the following optional components:

- Curriculum/instructional materials development
- Outreach.

Curriculum/Instructional Materials Development: Projects may incorporate elements that fall under either or both of the following rubrics: (1) creative adaptation/implementation of materials and practices developed elsewhere, or (2) development of innovative learning materials with the potential for national dissemination. It should be stressed that a department is expected to provide its own resources to cover costs for normal changes in its curriculum and upgrades in the standard infrastructural elements required for its instructional mission. The optional projects envisioned for a VIGRE proposal should involve significant changes, exhibit substantial originality, and be highly portable. Activities devoted to the preparation of future K-12 teachers, such as curriculum development and research experiences, may also be appropriate. K-12 teacher preparation projects and instructional materials development projects concerned with undergraduate education may be jointly considered and funded by the Division of Undergraduate Education (DUE). For further information on the type of projects funded by DUE, see *Division of Undergraduate Education: Program Announcement and Guidelines* (NSF 98-45).

Outreach: Activities that form and strengthen linkages to K-12 and informal education are considered desirable objectives of this program. These might include teacher enhancement, informal education in a variety of forms, and involvement in state, urban, and local systemic initiatives. Both the teacher enhancement and informal education components may be considered in conjunction with and jointly funded by the Division of Elementary, Secondary, and Informal Education (ESIE). For further information on the type of projects funded by ESIE, see *Elementary, Secondary, and Informal Education: Program Announcement and Guidelines* (NSF 98-4).

The activities described under these optional components must be consistent with the goals of the three main components of the project. They should not constitute the primary thrust of the proposal, nor should the major effort involved in carrying out these projects fall on the shoulders of either graduate students or postdoctoral fellows.

ELIGIBILITY

Academic institutions in the United States and its territories are invited to submit proposals on behalf of departments that grant the PhD and have programs in the mathematical sciences at both the graduate and undergraduate levels. In each of the two competitions covered by this solicitation, an institution is permitted to submit at most one proposal from a given department. Stipend recipients must be citizens, nationals, or permanent residents of the U.S.

AWARD INFORMATION

VIGRE funds will provide awards in amounts up to $1,000,000 per year (including direct and indirect costs) to support the three main program components for a duration not to exceed five years. However, it is expected that the average award size will be under $500,000 per year. Each proposal should describe a five-year program. Awards will be made initially for a three-year period, which may be extended for another two years pending the outcome of a third-year review by NSF. A modest amount of additional funding may be available to support the two indicated optional components. (Funding for these activities may also be requested as a supplement at a later date.) The number and size of awards will depend on the

advice of reviewers, resource constraints, and NSF's determination. The Division of Mathematical Sciences anticipates making between 5 and 12 awards in each of the two competitions announced in this document, pending the availability of funding. An e-mail letter of intent to submit a VIGRE proposal is due by January 15, 1999 for the February 16, 1999 proposal deadline, and by June 18, 1999 for the July 19, 1999 deadline. It is anticipated that awards resulting from the February competition will be announced in September 1999, and those from the July competition in February 2000.

INSTRUCTIONS FOR PROPOSAL SUBMISSION

A. Proposal Preparation Instructions

Proposals submitted in response to this program solicitation should be prepared in accordance with the general guidelines contained in the *Grant Proposal Guide* (GPG), NSF 99-2. The complete text of the GPG, including electronic forms, is available electronically on the NSF Website at: http://www.nsf.gov/. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone 301.947.2722, or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program solicitation number (NSF 99-16) in the program announcement/solicitation block on the NSF Form 1207, "*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.

The proposal must be typed or printed single-spaced on a single side of the page using margins, fonts, and spacing consistent with requirements described on pages 5 and 6 of the GPG. Proposals that do not strictly adhere to the specified page limitations (given below), including those in required or permitted appendices, will be ineligible for consideration and will be returned.

The proposed project should have a five-year duration. The proposal must describe: the vision, scope, and objectives of the program, as well as the program's anticipated impact on the department, its students, graduate trainees, and postdoctoral fellows; the research components and educational elements that will be interwoven to effect a coherent program, including the specific roles of the undergraduate students, graduate students, and postdoctoral fellows in each component; a recruitment and retention plan; a management plan with the names of principal participants; a budget and its justification; consortial arrangements or partnerships, if any are involved in the project; and a performance evaluation plan. The proposal must further identify the efforts that will be made to enhance the diversity among graduate trainees and postdoctoral fellows.

Each proposal must contain the following elements in the order indicated:

1. *NSF Cover Sheet* (NSF Form 1207). Clearly indicate in the appropriate box that the proposal is intended for consideration by the VIGRE program.

2. *Project Summary*. On a separate page, provide a brief (200 words or less) description of the program, including the research themes, education features, and objectives.

3. *Table of Contents*. Provide a Table of Contents with page numbers for each section and for major subdivisions of the project description (see below).

4. *VIGRE Project Description*. Particular attention must be paid to the following items in preparing the description:

> **A.** Vision, objectives, and anticipated impact of the program, at the local institution and beyond. This discussion may not exceed 2 pages.
>
> **B.** Description of the program for the principal components. This section should provide a discussion of the programs envisioned for graduate trainees, undergraduate research experiences, and postdoctoral fellows, prefaced by a progress report on the curriculum review and a provisional plan for implementing the changes, if any, resulting from that review. It should clearly describe how the three components, as well as research and education more generally, are integrated. It should also include a description of ways in which the project will broaden the experience of the students and postdoctoral fellows involved and enhance career opportunities. In cases where the project includes industrial internships or arrangements with government laboratories, businesses, or other academic departments, the proposal should describe those aspects of the program in some detail and explain their impact on other parts of the program. Teaching requirements for the graduate trainees and the postdoctoral fellows must be described; in the former case, the description should address time-to-degree questions. The proposed means of improving communications skills at all levels should be indicated. This section must not exceed 18 pages.
>
> **C.** Description of the program for the optional components. If the program is to include (a) curriculum/instructional materials development and/or (b) outreach, a description of such components should be given here, together with an explanation of how these optional project elements mesh with one or more of the main components. The development of any new materials and the plans for their dissemina-

tion should be discussed. (Dissemination is a DMS requirement for VIGRE projects in which new materials are developed.) If outreach to K-12 or informal education is part of the program, then the goals, the audience, and the proposed activities should be described. Plans for the preparation of future teachers or the enhancement of current teachers should also be discussed here. Supplemental funding may be available to support efforts in this direction. Budgetary justifications for these additional components should be explicitly identified. The description of each optional component proposed may not exceed 5 pages.

5. *Recruitment and Retention.* Plans for the recruitment and retention of students and postdoctoral fellows should be described. Specific provisions for the recruitment of U.S. citizens, nationals, and permanent residents as well as women and members of groups underrepresented in the mathematical sciences must be included. This section must not exceed 2 pages.

6. *Organization and Management Plan*. The plans and procedures for the development and monitoring of all components of the project, for the proposed duration, should be described. In particular, plans to ensure that appropriate mentoring of students and postdocs is carried out should be discussed. Evidence of the faculty commitment necessary for the implementation of the proposed program should be provided. If the program involves industrial internships or arrangements with government laboratories, businesses, or other departments, then the proposal should discuss existing arrangements, the mechanisms for expanding these arrangements if necessary, and the personnel involved in managing these linkages. This section must not exceed 3 pages.

7. *Performance Assessment.* Each proposal should describe a performance evaluation plan that includes goals, objectives, indicators, and specific measurements for assessing the progress toward the achievement of the goals. This plan will form the basis of the required annual progress reports as well as an in depth review to be conducted by NSF during the third year. Examples of indicators that may be useful are the qualifications of individuals awarded traineeships or postdoctoral fellowships, shortening time-to-degree, broadening career opportunities, assessment of the postdoctoral fellows' and graduate trainees' performance, impact of the research experience on the career plans of undergraduates, placement of graduate students and postdoctoral fellows upon completion of the program, and the participation of women and members of underrepresented groups. This section must not exceed 5 pages.

Each proposal should include an appendix (Appendix 1) indicating: (a) the number of baccalaureate degrees in the mathematical sciences awarded by the relevant department(s) in each of the past five years; (b) the number of full-time PhD students for each of the past five years; (c) a list of PhD recipients during the past five years, along with each individual's citizenship status, baccalaureate institution, time-to-degree, post-PhD placement, and thesis advisor; (d) the names of postdoctoral fellows (e.g., holders of named instructorships, 2- or 3-year terminal assistant professors) during the past five years, their mentors, and post-appointment placements; (e) the dollar amount of non-teaching (i.e., fellowship) support of graduate students supplied by the university for each of the past five years and the anticipated changes in university support of this kind in the event of an award; (f) the dollar amount of funding by federal agencies for graduate students and for postdocs in each of the past five years; (g) the anticipated size of the graduate program should this award be received. This information will provide baseline data to be used in subsequent performance assessments.

8. *Budget*. A budget for each year of support requested should be provided, along with cumulative budgets for the first three years and for all five years. The budget(s) for optional program components should be separate from the budget covering the principal components. NSF Form 1030 must be used. Indirect costs on awards are limited to 8% of modified total direct costs. Moreover, no indirect costs will be allowed on cost-of-education funding.

Funding Categories. The major portion of awarded funds must be used for training and educational activities for graduate students, undergraduate students, and postdoctoral fellows. In particular, VIGRE awards will provide funds for senior faculty salary only under the circumstances described in item F below.

A. Graduate Students: The projected graduate stipend is $15,000 per student for eleven months each year, with an allowance for actual tuition and fee costs of up to $10,500 per year per student. Stipends may be supplemented during nonteaching periods with support from other sources. The University is strongly encouraged to provide health insurance coverage for graduate students.

B. Undergraduate Students: The stipends for summer projects are expected to be at least $1,000 per month, with academic year stipends comparable on a pro rata basis.

C. Postdoctoral Fellows: The full-time stipend for the fellows is set at $36,000 per academic year. The percentage time appointment on grant funds can vary from 25% to 50%. The host university is expected to provide an academic appointment paid by university funds for the balance of the percentage of time. The full-time rate for the university appointment will be at least $36,000 for the academic year. The teaching duties assigned to the postdoctoral fellow are

expected to be prorated based on the percentage time appointment on university funds and should not exceed an average of seven classroom contact hours per week for a full-time appointment. In addition, the grant will provide summer support for two summers at the rate of $6,500 per summer. The fellow is expected to apply to an appropriate external funding agency for support for the third summer. Funding for the postdoctoral fellowships should include a total of $7,500 for the three years to cover travel, equipment, and supplies. The university is expected to provide for health care benefits for the postdoctoral fellows and other fringe benefits that are provided employees with 50% or more time appointments.

D. Curriculum Review: It is not anticipated that either the curriculum review itself or the implementation of changes stemming from it will require funding. However, if the review leads to significant curriculum development projects, DMS will consider requests for support of such development either as part of the Optional Components of the original proposal or as a supplement submitted at a later time within the duration of the award.

E. Optional Components: Requests for funding to support either or both of the two optional components will be considered.

F. Other: Requests for funds required to gain access to the laboratories of other disciplines or to provide release time during the first two award years for faculty who organize cooperative opportunities with other disciplines, industry, or business will be considered.

9. *Budget Justification*. A brief justification for funds in each budget category should be provided. This section may not exceed 3 pages.

Appropriate documentation of commitments by the institution and other sources should be provided in an appendix (Appendix 2). If industrial internships are planned, the willingness of the industrial organization and of individual industrial mentors (if known) to participate should also be documented in Appendix 2.

10. *Biographical Sketches*. A curriculum vitae or short biographical sketch should be provided for each of the key personnel. This should include a list of no more than 10 publications, the names of PhD students and postdoctoral fellows supervised, and the names of individuals with whom the faculty member has collaborated within the last 48 months. The information may not exceed 2 pages for each individual. NSF Form 1362 may be used. This information should be supplied ONLY FOR KEY PARTICIPANTS IN THE PROJECT, not for every member of the department.

11. *Current and Pending Support* (NSF Form 1239). This information should only be provided for the PI and each Co-PI.

12. *Appendices*. Only the appendices described above in sections 7 and 9 are allowed.

13. *Additional Information*. One completed copy of *Information about Principal Investigators/ Project Directors*, NSF Form 1225, must be provided and should be attached to the copy of the proposal that bears the original signatures. This item is for NSF internal use only.

B. Cost Sharing Requirements

While there is no formal requirement of cost sharing for proposals submitted in response to this solicitation, cost sharing is implicit in the restrictions of the postdoctoral fellowship academic year stipend to at most a 50% percentage time appointment (based on a full-time rate of $36,000 per academic year) and the limitation of reimbursement for graduate student tuition and fee costs to at most $10,500 per year per student. The proposed cost sharing must be shown on line M on the proposal budget (NSF Form 1030).

The amount of cost-sharing must be shown in the proposal in enough detail to allow NSF to determine its impact on the proposed project. Documentation of availability of cost sharing must be included in the proposal.

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

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

C. Proposal Deadlines

Letter of Intent. To help expedite the review process for VIGRE proposals, a one-page e-mail (VIGRE@nsf.gov) letter of intent to submit a proposal should be sent by the PI by 5:00 PM, local time, on January 15, 1999 for the February 16, 1999 proposal deadline and June 18, 1999 for the July 19, 1999 proposal

deadline. This letter of intent should contain the following information: the title of the project, a brief project description, the names of the principal investigators, and the name of the submitting institution. Failure to meet the letter of intent deadline will disqualify a VIGRE proposal from consideration.

Formal Proposal. The proposal itself, clearly identified as a VIGRE proposal, must be received by NSF no later than February 16, 1999 for the first competition and no later than July 19, 1999 for the second one. **Both the Cover Sheet (NSF Form 1027) and the Project Summary must be submitted using the NSF FastLane system for electronic proposal submission and review** (see section D below). FastLane, upon receipt of the Cover Sheet and Project Summary, will automatically assign to the proposal a proposal identification number. In the case of a paper submission, that proposal identification number must be added to the proposal by the PI prior to the proposal's submission. Institutions are strongly encouraged to employ FastLane for submission of the entire VIGRE proposal. VIGRE proposals that do not meet the proposal deadline will be returned to the submitting institutions.

For paper submission of proposals, ten (10) copies of the proposal bearing the FastLane-generated proposal identification number **MUST** be received at NSF by 5:00 PM, ET, of the relevant proposal deadline date. The copies should be submitted according to the normal procedures for paper proposals identified in the GPG. The address to which they are to be sent is:

Program Solicitation NSF 99-16
Proposal Processing Unit (PPU)
National Science Foundation
4201 Wilson Blvd., Room P60
Arlington, VA 22230.

For electronic submission of proposals, the proposal **MUST** be received by 5:00 PM, local time, of the relevant proposal deadline date. Copies of the signed proposal Cover Sheet must be submitted in accordance with the instructions indicated below.

The attention of PIs is brought to the following details concerning the use of FastLane in conjunction with VIGRE proposals: (1) on the organizational unit pull-down menu for the Cover Sheet, select both the Division of Mathematical Sciences and the Infrastructure Program, and enter only the number of the program solicitation (NSF 99-16) in the Program Announcement/Solicitation field; (2) the Table of Contents automatically generated by FastLane will be adequate for VIGRE proposal submitted completely via FastLane; (3) since FastLane is presently set up to handle only a standard budget (in this case, annual budgets and a cumulative five-year budget for the main VIGRE program components), all the remaining budget sheets required for a full proposal submission should be attached as a PDF file to the budget justification; (4) in the case of complete FastLane submission, Appendices 1 and 2 should be included as extra pages in the Project Description; (5) NSF Form 1225, *Information about Principal Investigators/Project Directors*, will be generated by FastLane automatically.

Submission of Signed Cover Sheets. A signed proposal Cover Sheet, indicating the proposal identification number assigned to the proposal by FastLane, should be forwarded to the following address and received by NSF no later than February 23, 1999 for the first competition announced in this document and no later than July 26, 1999 for the second competition:

National Science Foundation
DIS-FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230.

A proposal may not be processed until the complete proposal (including signed Cover Sheet) has been received by NSF.

D. FastLane Submission

The NSF FastLane system is available for electronic preparation and submission of a proposal through the Web at the FastLane Web site http://www.fastlane.nsf.gov. The Sponsored Research Office (SRO or equivalent) must provide a FastLane Personal Identification Number (PIN) to each Principal Investigator (PI) to gain access to the Fastlane "Proposal Preparation" application. PIs who have not submitted a proposal to NSF in the past must contact their SRO to be added to the NSF PI database. This should be done as soon as the decision to prepare a proposal is made.

In order to use NSF FastLane to prepare and submit a proposal, the following are required:

Browser (must support multiple buttons and file upload)
- Netscape 2.0 or greater
- Microsoft Internet Explorer 4.0 or greater

PDF Reader (needed to view/print forms)
- Adobe Reader 3.0 or greater

PDF Generator (needed to create project description)
- Adobe Acrobat 3.01 or greater
- Aladdin Ghostcript 5.10 or greater.

A list of registered institutions and the FastLane registration form are located on the FastLane Web page.

For paper submission of proposals, the delivery address **must clearly identify the NSF solicitation number** under which the proposal is being submitted.

PROPOSAL REVIEW INFORMATION

A. Merit Review Criteria

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

Proposals will be reviewed against the following general merit review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal and for which he/she is qualified to make judgments.

What is the intellectual merit and quality of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field and 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 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, 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?

Additional Review Criteria

In addition to the above generic review criteria, reviewers will be asked to apply a number of program specific criteria when reviewing VIGRE proposals. These criteria, not necessarily in the order of importance, are:

- Quality of the department's overall graduate program and the expected improvement in quality that would result from an award
- The clarity of the goals of the project and the quality of the evaluation plan
- Evidence of the faculty commitment necessary for the implementation of the proposed program
- Impact of the grant on the PhD program in the mathematical sciences such as shortening the time-to-degree to five years or inclusion of additional training in related disciplines
- The effectiveness of the program in expanding the career opportunities for students both at the undergraduate and graduate level
- How the integration of research and education will be achieved at all levels and how the proposal complements existing efforts; how the integration of the various levels of students and faculty into a community of scholars will be achieved
- The effectiveness of the mentoring of undergraduate students, graduate students, and postdoctoral fellows participating in the program
- The effectiveness of the plan for the development of communication skills
- The likely effectiveness of the postdoctoral program in developing the skills of the fellows as professional mathematical scientists
- The quality of the curriculum review and progress in the implementation of changes resulting from it
- The quality and likely success of the strategy for recruitment of members of underrepresented groups
- The quality and likely effectiveness of the organization and management plan
- The quality and likely effectivesness of the performance assessment plan
- The appropriateness of the budget
- The extent and nature of the institutional commitment
- The effectiveness of the additional components and their compatibility with the overall goals of the project.

B. NSF Staff Considerations

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 learner perspectives. PIs should address this issue in their proposals to provide reviewers with the information necessary to respond fully to both NSF merit review criteria. NSF staff will give it careful consideration in making funding decisions.

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. PIs should address this issue in their proposals to provide reviewers with the information necessary to respond fully to both NSF merit review criteria. NSF staff will give it careful consideration in making funding decisions.

GENERAL NSF PROCESS

Merit Review Process and Associated Customer Service Standard

Most proposals submitted to NSF are reviewed by mail review, panel review, or some combination of mail and panel review. VIGRE proposals will be reviewed by panel review only.
All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Reviewers will be asked to formulate a recommendation to either support or decline each proposal. A program officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation. In most cases, proposers will be contacted by the program officer after his or her recommendation to award or decline funding has been approved by his or her supervisor, the division director. This informal notification is not a guarantee of an eventual award. NSF will be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 95 percent of proposals in this category. The time interval begins on the proposal deadline date and ends when the division director accepts the program officer's recommendation.

In all cases, after final programmatic approval has been obtained, the recommendation then goes to the Division of Grants and Agreements (DGA) 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 an NSF program officer. A principal investigator or organization that makes financial or personal commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

AWARD AND ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made ***to the submitting organization*** by a Grants and Agreements Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator.

B. Grant Award Conditions

An NSF grant consists of: (1) the award letter, which includes any special conditions applicable to the grant 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 grant conditions, such as Grant General Conditions (NSF GC-1)* or Federal Demonstration Partnership (FDP) Terms and Conditions* ; and (5) the VIGRE program solicitation referenced in the award letter. Electronic mail notification is the preferred way to transmit NSF grants to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

* These documents may be accessed electronically on NSF's Web site at http://www.nsf.gov/. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone at 301.947.2722, or by e-mail from pubs@nsf.gov.

C. Reporting Requirements

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

Within 90 days after expiration of a grant, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availabilty of required data.

NSF has implemented a new electronic project reporting system, available through FastLane, which permits electronic submission and updating of project reports, including information on: project participants (individual and organizational); activities and findings; publications; and other specific products and contributions. Reports will continue to be required annually and after the expiration of the grant, but PIs will not need to re-enter information previously provided, either with the proposal or in earlier updates using the electronic system.

Effective October 1, 1998, PIs are required to use the new reporting format for annual and final project reports. PIs are required to submit all reports electronically via FastLane.

CONTACTS FOR ADDITIONAL INFORMATION

Questions concerning the VIGRE program should be sent electronically to VIGRE@nsf.gov. The lead Program Director for VIGRE is Dr. Joe W. Jenkins, Room 1025, Division of Mathematical Sciences, National Science Foundation, Arlington, VA 22230, telephone 703.306.1879, e-mail:jjenkins@nsf.gov. For questions related to use of FastLane, contact: Florence Rabanal, MPS FastLane Coordinator, 703.306.1998, e-mail:frabanal@nsf.gov, or Connie Sellars-Wright, DMS FastLane Expert, 703.306.0559, e-mail:csellars@nsf.gov.

OTHER PROGRAMS OF INTEREST

The NSF Guide to Programs is a compilation of funding opportunities for research and education in science, mathematics, and engineering. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter. Beginning in fiscal year 1999, the NSF Guide to Programs only will be available electronically. Many NSF programs offer announcements concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices listed in Appendix A of the GPG.

Information on deadlines and target dates for the submission of proposals is avilable via the E-Bulletin, available electronically on the NSF Web site at: http://www.nsf.gov/. The direct URL for recent issues of the Bulletin is http://www.nsf.gov/home/ebulletin/. Subscribers can also sign up for NSF's Custom News Service to find out what funding opportunities are available.

Specific programs related to VIGRE that might be of interest include the following.

Grant Opportunities for Academic Liaison with Industry (GOALI NSF 98-142)

University-Industry Cooperative Research Program in Mathematical Sciences (NSF 94-100)

Integrative Graduate Education and Research Training Program (IGERT NSF 98-96)

Research Experiences for Undergraduates (REU NSF 96-102)

*Elementary, Secondary, and Informal Education: Program Announcement and Guidelines (*NSF 98-4)

Division of Undergraduate Education Program: Announcement and Guidelines (NSF 98-45)

Mathematical Sciences Postdoctoral Research Fellowship Program (NSF 98-135)

NSF Graduate Fellowship Program (NSF 98-143)

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. (For more information, see Section V.G.)

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 703.306.0090, FIRS at 1.800.877.8339.

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees; to provide or obtain data regarding the application review process, award decisions, or the administration of awards; to government contractors, experts, volunteers, and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF 50, Principal Investigators/Proposal File and Associated Records, and NSF-51, 60 Federal Register 4449 (January 23, 1995). Reviewer/Proposal File and Associated Records, 59 Federal Register 8031 (February 17, 1994). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to:

Mary Lou Higgs
Acting Reports Clearance Officer
Information Dissemination Branch
Division of Administrative Services
National Science Foundation
Arlington, VA 22230.

YEAR 2000 REMINDER

In accordance with Important Notice No.120 dated June 27, 1997, Subject: Year 2000 Computer Problem, NSF Awardess are reminded of their responsibility to take appropriate actions to ensure that the NSF activity being supported is not adversely affected by the Year 2000 problem. Potentially affected items include: computer systems, databases, and equipment. The National Science Foundation should be notified if an awardee concludes that the Year 2000 problem will have a significant impact on its ability to carry out an NSF funded activity. Information concerning Year 2000 activities can be found on the NSF Web site at: http://www.nsf.gov/oirm/y2k/start.htm.

This program is described in the Catalog of Federal Domestic Assistance category 47.049 (Mathematical and Physical Sciences).

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