

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

Program Solicitation

NSF 00-40

DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES
DIVISION OF MATHEMATICAL SCIENCES

LETTER OF INTENT: June 16, 2000
PROPOSAL DEADLINE: July 17, 2000

NATIONAL SCIENCE FOUNDATION



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Matrix of Activity 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 these types 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 initiate or improve education activities that lend themselves to integration with research, especially activities that promote 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 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 during this competition.
- ◆ **Stipend recipients must be citizens, nationals, or permanent residents of the U.S.**

AWARD INFORMATION

- ◆ **Type of award anticipated:** Continuing Grant (initial funding for three years, with a possible extension for another two years contingent upon the outcome of a third-year review by NSF, and subject to availability of funds).
- ◆ **Number of awards anticipated in FY2001:** 5-10 awards are expected to result from this competition, contingent upon availability of funds.
- ◆ **Amount of funds available:** Pending availability of funds, it is estimated that about \$16.0 million will be available for this competition.
- ◆ **Anticipated date of award:** February 2001

PROPOSAL PREPARATION & SUBMISSION INSTRUCTIONS

- ◆ **Proposal Preparation Instructions**
 - **Letter of Intent requirements:** An e-mail letter of intent sent to VIGRE@nsf.gov is required by June 16, 2000.
 - **Pre-proposal requirements:** None
 - **Proposal Preparation Instructions:** Standard instructions from the Grant Proposal Guide (GPG), NSF 00-2, are to be followed, with exceptions as noted below.
 - **Supplemental proposal preparation instructions:** Two appendices are required
 1. Appendix (1) – Data: Compilation of baseline data requested in a number of categories;
 2. Appendix (2) – Support: Documentation of institutional support or cost sharing, as well as documentation of affiliation with or support from proposed internship organizations.

- **Deviations from standard 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. Each section of the Project Description has a page limitation that is specified in the body of the proposal solicitation. Separate budgets for the main and optional activity components must be provided.

◆ **Budgetary Information**

- **Cost sharing/matching requirements:** [Proposed cost sharing must be shown on line M on the proposal budget (NSF Form 1030).]
 - NSF will pay up to 50% of stipend costs of VIGRE postdoctoral fellowships during the academic year up to a maximum of \$18,000. This full-time stipend is based on an academic FTE rate of \$36,000. The host institution is required to provide an academic appointment paid by university funds for the balance of the percentage of time.
 - The institution must bear the cost of the one-year teaching requirement for VIGRE graduate trainees.
 - There could be an implicit cost sharing requirement in the limitation to \$10,500 per student per year of funding for graduate student tuition and fee expenses, depending on the level of an institution's graduate tuition, fee, etc. and on its policy with regard to payment of costs-of-education.
 - Indirect costs (F&A) are limited to 8% of modified total direct costs; no indirect costs are allowed on cost-of-education funding.
- **Other budgetary limitations:** Awards for up to \$1,000,000 per year, although average award size is expected to be approximately \$500,000 per year. Stipends for VIGRE Graduate traineeships are limited to \$15,000 annually. Stipends for VIGRE Postdoctoral Fellowships are limited to \$18,000 per academic year.

◆ **FastLane Requirements**

- **FastLane proposal preparation requirements:** FastLane submission is required.
- **FastLane point of contact:** Florence Rabanal, FastLane Coordinator for the Directorate of Mathematical and Physical Sciences, telephone:703.306.1998, e-mail:dmsfl@nsf.gov.

◆ **Deadline Dates**

- **Letter of Intent:** 5:00 PM, PI's local time, June 16, 2000
- **Full Proposal Deadline:** 5:00 PM, PI's local time, July 17, 2000

PROPOSAL REVIEW INFORMATION

- ◆ **Merit Review Criteria:** The standard National Science Board approved criteria (www.nsf.gov/pubs/1999/iin125/iin125.html) 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 funding decisions.
- ◆ **Integrating Diversity into NSF Programs, Projects, and Activities:** NSF staff will consider diversity issues carefully when making VIGRE funding decisions.
- ◆ **Additional Review Criteria:** A number of VIGRE-specific criteria will be used. (See section entitled "Proposal Review Information.")

AWARD ADMINISTRATION INFORMATION

- ◆ **Grant Award Conditions:** GC-1 or FDP III
- ◆ **Special Grant Conditions Anticipated:** The final two years of funding will be contingent upon the outcome of a third-year review by NSF, and subject to availability of funds.
- ◆ **Special Reporting Requirements Anticipated:** Program specific data that must be provided in annual reports.

INTRODUCTION

The Division of Mathematical Sciences (DMS) announces a new competition in its 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) activity 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 activity 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 Assessment 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 activity 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.)

Every VIGRE proposal must have at its core a coherent plan, incorporating a thorough review of both the *graduate and undergraduate curriculum*, for the *vertical integration* of the following *primary components*:

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

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 activity in achieving its stated long-term objectives. Although the activities involved in the curriculum review will not benefit directly from VIGRE activity 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 activity goals.

Vertical Integration. Proposals must identify the anticipated interactions among the three primary 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.

Primary Components. Detailed descriptions of the three primary components follow.

Graduate Traineeships: The centerpiece of each VIGRE proposal should be a program of graduate traineeships for PhD students. These traineeships are intended to be a vehicle for: broadening graduate education; shortening the average time-to-degree for the doctorate; improving communication skills; and expanding career opportunities. It is hoped that VIGRE trainees will conclude their doctoral studies well-grounded in traditional core areas of mathematics and enriched by significant exposure to mathematics in its sundry applied and computational aspects, mathematics as it manifests itself in client disciplines, and statistics. Ideally, these young professionals should enter the workforce, academic or otherwise, undaunted by the prospect of stepping through disciplinary barriers in order to bring their expertise to bear on the wide range of problems for which mathematical insight is crucial to progress. The activity 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. It is not in accord with the spirit of VIGRE merely to create a source of summer support for students who are required to teach throughout the academic year. An individual student can receive up to 33 months of non-teaching support from a VIGRE award. One of the goals of the VIGRE activity is to shorten the average time-to-degree to five years. The years of non-teaching support should be arranged with this goal clearly in mind. In addition, graduate trainees are expected to have a significant teaching experience. This 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. It is recognized that the nature of this class and the precise degree of the student's responsibility for it may be constrained by institutional policies or regulations. That fact notwithstanding, the teaching experience is regarded as an essential part of a VIGRE traineeship. The appropriateness of the teaching activities proposed to fulfill this requirement is included among the VIGRE review criteria. The university is expected to bear the cost of a VIGRE trainee's required teaching. The development of skills for communicating with both expert and non-expert audiences is viewed as another 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. DMS is sensitive, however, to the fact the many PhD programs in the mathematical sciences experienced unsought contraction in the mid-1990s. Limited re-growth in a program where this occurred would not be regarded as counter to the stated expectation. On the other hand, the traineeships are not meant to promote

expansion of graduate programs just by enabling departments to hire additional teaching assistants, nor should they replace existing university funding of fellowships or scholarships. VIGRE is not intended to provide support for Master's degree programs.

Undergraduate Research Experience: In this program solicitation, the term "research experience" is interpreted loosely enough 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 non-classroom 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 activity 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 rationale for the 18 month restriction lies in the vision of a VIGRE postdoctoral appointment as a capstone educational and training experience, following which a VIGRE Fellow is prepared to enter a regular academic position. While designed to allow for the possibility that an individual might spend the first year after completing the PhD at a research institute or as an intern in a government lab or industry, the restriction is meant to rule out a second extended postdoctoral appointment in an academic setting. Exceptions to the 18 month restriction, which will be rare, will require approval from the VIGRE Program Director.

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 required to teach each term, whether semester or quarter, while in residence at the sponsoring university. Over the duration of the fellowship, this teaching should encompass a diverse set of instructional experiences.

Optional 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 infra-structural 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: Proposal solicitation 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 jointly considered and 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: Proposal solicitation 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. An institution may submit at most one proposal to this competition from a given department. All VIGRE 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 activity 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 funding the first three years of the project. Additional funding for the remaining two years will be contingent upon the outcome of a third-year review by NSF, and subject to availability of funds. A modest amount of additional funding may be available to support the two 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, availability of funds, and NSF's determination. The Division of Mathematical Sciences anticipates making between 5 and 10 awards in this competition. An e-mail letter of intent to submit a proposal must be sent by June 16, 2000, and the proposal must be submitted via FastLane by July 17, 2000. For more precise information on both the letter of intent and FastLane submission, consult the next section of this program solicitation. It is projected that awards resulting from the competition will be announced in February 2001.

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 00-2. 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.

All VIGRE proposals must be submitted via FastLane. Proposers are reminded to identify the program solicitation number (NSF 00-40) in the program announcement/solicitation block on the NSF Form 1207, "*Cover Sheet for Proposal to the National Science Foundation*." The Cover Sheet should also identify the Division of Mathematical Sciences and the Infrastructure Program as the organizational unit to receive the proposal. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

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. Proposals that do not strictly adhere to the specified page limitations will be declared ineligible for consideration.

1. *NSF Cover Sheet* (NSF Form 1207).
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*. A Table of Contents will be automatically generated by FastLane.
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 three primary 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 issues. 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 primary components. The development of any new materials and the plans for their dissemination should be discussed. (Dissemination is required 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.

- D. *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, national, 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.
- E. *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.
- F. *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 (1) - Data 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 PhD institutions, postdoctoral 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.

5. *Budget.* A budget for each year of support requested should be provided. The budget(s) for optional program components must be included as part of the Budget Justification PDF file. The budget(s) for optional program components should be separate from the budget covering the principal components. NSF standard FastLane Budget Form (*i.e.* 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. *Additional information on how to handle the budgets in FastLane is presented later in this document.*

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 graduate traineeship 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 non-teaching periods with support from other sources.

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.

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. Requests for funds to enable graduate or undergraduate students to attend professional meetings or conferences will also be considered.

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

Letters of commitments by the institution and other sources in support of the project should be provided in an Appendix (2)- Support. If industrial internships are planned, letters indicating the willingness of the industrial organization and of individual industrial mentors (if known) to participate should also be included. These documents should be scanned and uploaded as a PDF file into the FastLane supplementary documentation section.

7. *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. This information should be supplied **ONLY FOR KEY PARTICIPANTS IN THE PROJECT**, not for every member of the department.

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

9. *Appendices.* Only the appendices described above in sections 4 and 6 are allowed.

B. Cost Sharing Requirements [Proposed cost sharing must be shown on line M on the proposal budget (NSF Form 1030).]

- NSF will pay up to 50% of stipend costs of VIGRE postdoctoral fellowships during the academic year up to a maximum of \$18,000. This full-time stipend is based on an academic FTE rate of \$36,000. The host institution is required to provide an academic appointment paid by university funds for the balance of the percentage of time.
- The institution must bear the cost of the one-year teaching requirement for VIGRE graduate trainees.
- There could be an implicit cost sharing requirement in the limitation to \$10,500 per student per year of funding for graduate student tuition and fee expenses, depending on the level of an institution's

graduate tuition, fee, etc. and on its policy with regard to payment of costs-of-education.

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

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 letter of intent to submit a proposal **MUST** be sent by the PI to VIGRE@nsf.gov by 5:00 PM, PI's local time, on June 16, 2000. This letter of intent should contain the following information: the title of the project, a brief project description, the names of the Principal and any Co-Principal Investigators, and the name of the submitting institution. Failure to meet the letter of intent deadline will disqualify a subsequent VIGRE proposal from consideration.

Formal Proposal. The proposal itself, clearly identified as a VIGRE proposal, **MUST** be submitted via FastLane by 5:00 PM, PI's local time, on July 17, 2000. A signed proposal Cover Sheet **MUST** be submitted in accordance with the instructions provided below. VIGRE proposals that do not meet the proposal deadline will be declared ineligible for the competition.

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 00-40) in the program announcement/solicitation field; (2) 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 activity components), all other required budget sheets should be collected in a PDF file and attached to the budget justification; (3) Appendices 1 and 2 should be included as extra pages in the Project Description; (4) NSF Form 1225, **Information about Principal Investigators/Project Directors**, will be generated by FastLane automatically.

Submission of Signed Cover Sheets. The signed copy of the proposal Cover Sheet (NSF Form 1207) must be postmarked (or contain legible proof of mailing date assigned by the carrier) within five working days following proposal submission and be forwarded to the following address:

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 Requirements

Proposers are required to prepare and submit all proposals for this solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at:

<https://www.fastlane.nsf.gov/a1/newstan.htm>

Information on submission of signed cover sheets is found in the previous section C “Proposal Deadlines.”

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. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from nonacademic institutions, minority serving institutions, adjacent disciplines to that principally addressed in the proposal, 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?

PIs should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to the above-described NSF merit review criteria. NSF staff will give these elements careful consideration in making future decisions.

- **Integration of Research and Education**

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learner perspectives.

- **Integrating Diversity into NSF Programs, Projects, and Activities**

Broadening opportunities and enabling the participation of all citizens – women and men, underrepresented minorities, and persons with disabilities – is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Additional Review Criteria

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:

- 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
- Quality of the department's overall graduate program and the expected improvement in quality that would result from an award

- 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 appropriateness of the significant teaching experience proposed for graduate trainees
- 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 effectiveness of the performance assessment plan
- The appropriateness of the budget
- The effectiveness of the additional components and their compatibility with the overall goals of the project.

B. Merit Review Process

Most of the 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 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 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 availability of required data.

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

CONTACTS FOR ADDITIONAL INFORMATION

Questions concerning the VIGRE activity 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: dmsfl@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. The NSF Guide to Programs is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices listed in Appendix A of the GPG. Any changes in NSF's fiscal year programs occurring after press time for the Guide to Programs will be announced in the NSF Bulletin, available monthly (except July and August), and in individual program announcements.

The Bulletin is available electronically via the NSF Web site at: <http://www.nsf.gov/home/ebulletin>. Subscribers can also sign up for NSF's Custom News Service (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become 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: Proposal solicitation 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 (FASSED) 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 and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or

party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 *Federal Register* 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 *Federal Register* 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

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

The National Science Foundation is committed to making all of the information we publish easy to understand. If you have a suggestion about how to improve the clarity of this document or other NSF-published materials, please contact us at plainlanguage@nsf.gov.

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

OMB NO. 3145-0058

P.T. 22,34

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NSF 00-40 (Replaces NSF 99-16)