Teacher Professional Continuum (TPC)

Program Solicitation
NSF 03-534

National Science Foundation
Directorate for Education and Human Resources
Division of Elementary, Secondary and Informal Education
Division of Undergraduate Education

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

May 19, 2003
required for categories I, II, and III; not required for category IV

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

September 10, 2003

REVISIONS AND UPDATES

This solicitation replaces the Teacher Enhancement program component (NSF 01-60) and STEM Teacher Preparation (NSF-02-130).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Teacher Professional Continuum (TPC)

Synopsis of Program:

TPC addresses critical issues and needs regarding the recruitment, preparation, enhancement, and retention of

science, technology and mathematics (STM) teachers for grades K-12. Its goals are to improve the quality and coherence of the learning experiences that prepare and enhance STM teachers; to develop innovative resources that prepare and support STM teachers and school and district administrators; to research and develop models and systems that support the teacher professional continuum; to research teacher learning and its impact on teaching practice; and to disseminate this research as well as innovative models and resources to a national audience.

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

- 47.076 --- Education and Human Resources

Eligibility Information

- **Organization Limit:** None Specified.
- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 25 to 35 - The program anticipates funding a broad range of awards including small-scale research projects under category I
- **Anticipated Funding Amount:** $28,000,000 FY 2004 pending availability of funds

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:** Indirect costs are not allowed on participant support costs.
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Preliminary Proposals *(required)* :**
  May 19, 2003
  required for categories I, II, and III; not required for category IV
- **Full Proposal Deadline Date(s)** (due by 5 p.m proposer's local time):
  September 10, 2003

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria apply.

Award Administration Information

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

It has been argued that learning to teach is best regarded as a continuum of programs and professional experiences (Bransford, Brown, & Cocking, 1999; National Research Council, 2000; Wilson, Floden, & Ferrini-Mundy, 2001). This teacher professional continuum begins with a teacher's K-12 experiences and continues with teacher preparation programs, instructional practice, professional development, leadership development, and other life and professional experiences. In particular, teacher preparation and professional development should be viewed as different parts of the same, complex, life-long learning continuum. In reality however, teacher preparation programs and professional development experiences are too often disjointed and, even worse, disconnected from classroom practice (Garet, Porter, DeSimone, Birman, & Yoon, 2001; Goodlad, 1990). This disconnect adversely impacts the teaching and learning of science, technology, and mathematics (STM) in K-12 classrooms. The continuous process of teacher learning should therefore be restructured comprehensively and coherently, and not incrementally in a series of unrelated efforts. It is with this vision of a comprehensive, coherent, and integrated approach to teacher life-long learning that the "Teacher Professional Continuum" (TPC) program has been conceptualized and defined. Based on documented national needs, recommendations from nationally-recognized experts, and compelling research on STM teaching, the TPC program presents a systematic effort to develop strategies to remedy the present disconnect between teacher preparation and teaching practice by addressing critical issues and needs surrounding the recruitment, preparation, enhancement, and retention of STM teachers for grades K-12.

Foremost among the TPC program objectives is to promote quality STM teaching and learning. Improving the quality of STM teaching and learning in U.S. schools clearly requires a significant investment in the K-12 teaching workforce and its supporting infrastructure. The current K-12 STM teaching workforce is faced with many challenges that thwart quality teaching and learning. The teacher workforce is rapidly changing due to STM teacher shortages, attrition (teachers leaving the field for other careers), migration (teachers moving to different schools), and retirement. Ingersoll (2001) refers to this constant change as a "revolving door." This constant change in the teacher workforce impacts school districts in every state, and is even more dramatic in the STM disciplines and in communities serving low-income children (Darling-Hammond, 2000). The consequences of the revolving door phenomenon are severe. Schools are forced to hire large numbers of unqualified teachers every year. Out-of-field teachers are assigned to teach STM

disciplines even though they admit that they are neither comfortable nor prepared to teach these content areas. Some schools have even eliminated STM courses such as high school physics due to teacher shortages. The most serious consequence is the detrimental impact on student achievement (National Commission on Teaching and America's Future, 2002). While schools try to grapple with these serious staffing problems, they must simultaneously meet the challenge of the recent *No Child Left Behind* legislation that requires a qualified teacher in every classroom by the end of the 2005-2006 school year.

In order to meet this demanding requirement, stronger candidates must undoubtedly be attracted to, and retained in, the STM teaching profession. However, simply increasing the supply of teachers into the field does not provide a qualified teacher for every classroom (Darling-Hammond, 2000; Ingersoll, 2001; National Commission on Teaching and America's Future, 2002). More importantly, it is necessary to address organizational sources of low teacher retention (Ingersoll, 2001), build systems and develop resources that support teachers in their efforts to effectively promote student learning, strengthen the teaching profession (Hinds, 2002), and organize successful professional development that improves teaching practice in large numbers of classrooms (Elmore, 2002). It is also necessary to address deficiencies in the supporting infrastructure such as: the shortage of teacher leaders and teacher mentors; the paucity of qualified STM professional development providers; and the lack of university faculty to appropriately prepare qualified STM teachers. All of these challenges require a continuum of coordinated efforts, building on the knowledge base from the science of learning (Bransford, Brown, & Cocking, 1999). The TPC program is committed to successfully meet these challenges.

II. PROGRAM DESCRIPTION

Mission and Project Categories

The principal mission of the TPC program is to promote quality STM teaching. This mission rests on a triadic foundation: (1) the production of resources, (2) the development of infrastructure, and (3) the advancement of knowledge. To fulfill its mission, the TPC program set the following goals:

- To improve the quality and coherence of the learning experiences that prepare and enhance STM teachers;
- To develop innovative curricula, materials, tools, ideas, and information resources that prepare and support STM teachers and administrators;
- To research, develop, and identify models, organizational structures, and systems that support the teacher professional continuum;
- To use scientifically-based studies to research teacher learning throughout the teacher professional continuum and its impact on teaching practice;
- To advance the knowledge base on the preparation, enhancement, and retention of STM teachers, and on the strategies that strengthen and diversify the STM teaching profession; and
- To disseminate this knowledge and research, as well as innovative models and resources, to a national audience.

To improve the quality of STM teaching in particular, and to strengthen the STM teaching profession in general, it is important to develop (1) a coherent continuum of professional experiences that not only enables STM teachers to grow in their profession but also contributes to the knowledge base on STM teaching (National Research Council, 2000), and (2) the resources, environments, and infrastructure to recruit, prepare, support, enhance, and sustain STM teachers throughout the professional continuum. The TPC program will invest in sound research studies as well as in the research and development of models and strategies that address these critical needs. The entire TPC effort cannot be undertaken without the participation of teachers, administrators, schools, and districts. It is expected that teachers (at every phase of the continuum) and administrators be actively engaged in, and make significant contributions to the TPC program.

In order to accomplish its goals, the TPC program encourages the submission of proposals for projects that fall within one of the following four categories:

I. Research Studies

II. Research and Development of Educational Models and Systems

III. Professional Resources Development

IV. Conferences and Symposia

All projects must address science, mathematics, and/or technology. Projects may target teachers at different stages along the continuum. Projects may also target specific grade bands, such as elementary, middle, and/or secondary. Each proposal must contain a rationale for selecting the intended audience.

Special attention will be given to projects that address issues either across the STM professional continuum or at transition points along the way. Clearly focused research studies from first-time PIs are encouraged. Projects that choose to address the preparation of undergraduate teacher candidates must include the entire undergraduate experience (not just the final two years) and, in particular, must address the role of science, technology, engineering, and mathematics (STEM) faculty in the preparation of future teachers.

For purposes of review, proposals should clearly identify the category for which the proposal is to be considered. Additionally, each proposal must explain how the proposed work addresses the merit review criteria, *intellectual merit* and *broader impacts*, established by the National Science Board. Proposals addressing more than one category should specify the appropriate categories. In addition, proposals involving innovative and/or high-risk efforts are encouraged at any time. Potential Principal Investigators (PIs) should discuss such proposals with the TPC Section Head prior to proposal submission.

I. Research Studies

The TPC program supports research studies that contribute to the knowledge base for how to effectively recruit, prepare and support qualified STM teachers, how to create supportive structures and environments that sustain STM educators at all levels, and how to impact teaching practice with teacher learning. Special attention will be given to projects that investigate: (1) how people learn, through informal and formal experiences across the continuum, to be effective K-12 STM teachers; (2) what resources and supports teachers need to be effective; (3) how teachers' needs change as they progress through the continuum; (4) how successful professional development experiences can be designed in order to improve teaching practice in large numbers of classrooms and with diverse populations; and (5) how teaching practice impacts student achievement.

Competitive proposals for Research Studies should contain the following elements in the Project Description section of the proposal. Proposal reviewers will examine the extent to which these elements are effectively incorporated and integrated in the overall project plan.

Rationale.
Reference literature and evidence to support the rationale for the proposed work. Describe how the proposed project: (1) addresses a national need, problem, or issue in the STM teaching field; (2) articulates the theoretical framework and research that ground the work; (3) builds on, and relates to, previous and on-going developments in educational practice; and (4) contributes to the research base on STM teacher preparation, teacher development, or teaching practice.

Design.
Identify the research question(s) or focus, design, instrumentation, data collection, analysis and interpretation, and a coherent chain of reasoning linking the questions, theory, and design.

Work Plan.
Provide a detailed plan of the proposed work, including a complete timeline that indicates who is responsible for each facet of the work. Projects are expected to have a duration of two-to-five years.

Dissemination.

Explain how the PIs intend to share information about the project with professionals, including teachers and administrators, in STM discipline and education communities. It is expected that TPC PIs will network with PIs involved in other NSF research and development projects to inform existing NSF initiatives of TPC supported research.

Personnel.
Describe the expertise, experience, role, and commitment level of each member of the key personnel.

Results of Prior NSF Support.
If key personnel have received funding from NSF in the last five years, information on the prior awards is required IF RELEVANT TO THE PROPOSED SCOPE OF WORK (see *Grant Proposal Guide* NSF 03-2). Provide evidence and data-informed results from previous support, including a discussion of lessons learned from both successes and failures. Specifically indicate how the proposed work differs from, and where appropriate, builds upon prior efforts.

II. Research and Development of Educational Models and Systems

The TPC program supports projects that research, develop, and disseminate exemplary models and systems that prepare (both in undergraduate degree programs and alternative pathways), support, and sustain K-12 STM teachers and/or strengthen the STM teaching profession. Projects may include studies of existing STM educational models and systems as well as the development and testing of new ones. It is expected that projects will not only evaluate the effectiveness of the model/system, but also research how the components, and the respective relationships among these, influence its effectiveness. Special attention will be given to projects that address problems either across the STM teaching professional continuum or at transition points along the way.

Competitive proposals for the *Research and Development of Educational Models and Systems* category should contain the following elements in the Project Description section of the proposal. Proposal reviewers will examine the extent to which these elements are effectively incorporated and integrated in the overall project plan.

Goals and Outcomes.
Describe the major goals and anticipated outcomes of the project. The goals must be clearly defined and aligned with appropriate national standards. Include a description of the target population(s), including the numbers of participants, that will be engaged in project activities.

Rationale.
Reference literature and evidence to support the rationale for the proposed work. Describe how the proposed project: (1) addresses a national need, problem, or issue in the STM teaching field; (2) articulates the theoretical framework and research that grounds the work; (3) builds on, and relates to, previous and on-going developments in educational practice; and (4) contributes to the research base on STM teaching.

Design.
The design plan should clearly explain how the project goals will be achieved and what criteria will be used to determine their achievement. The plan should define the model, including the components and respective relationships; describe the context in which the model will be implemented; and identify the design that will demonstrate and test the implementation of that model. Anticipated outcomes would investigate questions such as: What indicators determine that the model "works?" Does it work? How does it work? Why does it work? When does it work? Who makes it work? With whom does it work? Can it be replicated, transferred, adapted, and scaled?

Work Plan.
Provide a detailed plan of the proposed work, including a complete timeline that indicates who is responsible for each facet of the work. Projects are expected to have a duration of two-to-five years.

Project Evaluation.
The evaluation plan must include two independent components: (1) the formative evaluation and (2) the summative evaluation. Results of both components must be reported to NSF.

The project evaluation section must identify:

- the guiding framework;
- a rationale for the design plan, based on evaluation literature;
- questions to guide and focus the evaluation design;
- measurable indicators associated with the project goals (e.g., recruitment and retention of STM teachers, changes in teacher knowledge and practice, impact on student learning);
- sources of information;
- types of data to be collected;
- methods to be used to collect, analyze and interpret data;
- a timeline linking the questions to the sources of information and to the methods of data collection and analysis; and
- the evaluator(s) to lead the effort. Please note that the summative evaluation must be conducted by an external, third-party evaluator.

As part of a national analysis of the TPC program, each project must participate in an NSF-initiated third-party evaluation and other research activities, including a longitudinal study of impact. As part of this evaluation, projects must provide requested data to the NSF program evaluator. This third-party evaluation will be funded by NSF separately.

Dissemination.
Explain how the PIs intend to share information about the project with professionals, including STEM and education faculty, university administrators, teachers and school and district administrators, and other professionals in the STEM education communities. It is expected that TPC PIs will network with PIs involved in other NSF research and development projects to inform existing NSF initiatives of TPC supported research.

Sustainability.
Describe how the project activities will be institutionalized after the funding period ends.

Personnel.
Describe the expertise, experience, role, and commitment level of each member of the key personnel. Project teams should include STM practitioners and educators, classroom teachers, administrators, and assessment and evaluation experts. Faculty from Colleges of Education and Colleges of Arts and Sciences working in partnership are encouraged, as appropriate.

Results of Prior NSF Support.
If key personnel have received funding from NSF in the last five years, information on the prior awards is required IF RELEVANT TO THE PROPOSED SCOPE OF WORK (see *Grant Proposal Guide* NSF 03-2). Provide evidence and data-informed results from previous support, including a discussion of lessons learned from both successes and failures. Specifically indicate how the proposed work differs from, and where appropriate, builds upon prior efforts.

III. Professional Resources Development

The TPC program supports the development of resources for teaching including, but not limited to, materials, tools, teacher education curricula, and information resources that can be used to prepare, support, enhance, and sustain K-12 STM teachers, leaders, and administrators. The resources must be grounded in recent advances in research on teaching and learning, and must address a national need. Projects must advance the knowledge base on STM teaching and/or the STM teaching profession. PIs are encouraged to access the Teacher Education Materials (TE-MAT) database (http://www.te-mat.org) during the proposal development process. This database contains reviews of several hundred materials that can be used for the professional development of mathematics and science teachers. PIs should review these resources to ensure that their project does not duplicate materials that have already been developed. PIs are also encouraged to search the new National Science Digital Library (www.nsdl.org) for educational materials related to their proposed work. Projects should consider how resources may be adapted and utilized across the teacher professional continuum.

Competitive proposals for Professional Resources Development projects should contain the following elements in the Project Description section of the proposal. Proposal reviewers will examine the extent to which these elements are effectively incorporated and integrated in the overall project plan.

Goals and Outcomes.
Describe the major goals and the anticipated outcomes of the project. Projects that focus on resources for teacher learning experiences must define the learning goals of the resources and align them with research and relevant national standards for content, instructional strategies, and assessment. Projects that focus on resources that enhance the STM teaching profession must be aligned with research and professional standards.

Anticipated Products.
Describe the format and content of the resources to be produced (e.g., curricula, software, videos, CD-ROMs, tools, ideas, information resources).

Rationale.
Reference literature and evidence to support the rationale for the proposed work. Describe how the proposed resources: (1) address a national need, problem or issue in the STM teaching field; (2) articulate the theoretical framework and research that grounds the work; (3) build on, and relate to, previous and on-going developments in educational practice; (4) support learning experiences or enhance the teaching profession for STM teachers; and ultimately (5) support teaching and learning in STM classrooms.

Design and Work Plan.
The design plan should clearly explain how the project goals will be achieved and what criteria will be used to determine their achievement. Explain how the resources will be created, reviewed, pilot-tested, field-tested, evaluated, revised, and published and/or distributed. Provide a detailed plan, including a complete timeline that indicates who is responsible for each facet of work. Projects are expected to have a duration of two-to-five years.

STM educators, similar to those who will ultimately be the audience for the resources, must be included in development and field testing. Provide a description of the audience for pilot and field testing, including the number of participants. Field tests must include a broad range of STM educators with diverse backgrounds, and results from these field tests must be used to inform revisions of the resources.

Project Evaluation.
The evaluation plan must include three independent components: (1) the formative evaluation, (2) the summative evaluation, and (3) an external and formal review of the resources produced. The external review should ensure accuracy of the content, appropriateness of the pedagogy, and suitability of the contexts, language, etc., for the intended audience. Results of all three evaluation components must be reported to NSF.

The project evaluation section must identify:

- the guiding framework;
- a rationale for the design, based on evaluation literature;
- questions to guide and focus the evaluation design;
- measurable indicators associated with project goals (e.g., changes in teacher knowledge and practice, retention of STM teachers, impact on student learning);
- sources of information;
- types of data to be collected;
- methods to be used to collect, analyze, and interpret data;
- a timeline linking the questions to the sources of information and to the methods of data collection and analysis; and
- the evaluator(s) to lead the effort. Please note that the summative evaluation must be conducted by an external, third-party evaluator.

As part of a national analysis of the TPC program, each project must participate in an NSF-initiated third-party evaluation and other research activities. As part of this evaluation, projects must provide requested data to NSF program evaluators. This third-party evaluation will be funded by NSF separately.

Dissemination.
Explain how the PIs intend to share information about the project with professionals, including teachers and administrators, in STM education communities. This plan must include a strategy for publication and/or wide distribution of the resources, as well as a plan for educating appropriate audiences on the effective use of the resources. Provide a timeline for securing a publisher or identifying another appropriate distribution outlet. Submission of materials to the National Science Digital Library and TE-MAT is strongly encouraged.

Personnel.
Describe the expertise, role, and commitment level of each member of the key personnel. The resources must be developed with input from experts in academic disciplines, pedagogy, and adult learning. Mathematicians, scientists, and/or engineers are required to participate in the project. It is expected that the development team will also include STM educators, classroom teachers, administrators, and experts in assessment and evaluation.

Results of Prior NSF Support.
If key personnel have received funding from NSF in the last five years, information on the prior awards is required IF RELEVANT TO THE PROPOSED SCOPE OF WORK (see *Grant Proposal Guide* NSF 03-2). Provide evidence and data-informed results from previous support, including a discussion of lessons learned from both successes and failures. Specifically indicate how the proposed work differs from, and where appropriate, builds upon prior efforts.

IV. Conferences and Symposia

The TPC program supports conferences and symposia that: (1) assemble experts to discuss and/or synthesize research and/or STM education issues, (2) introduce research and/or exemplary educational models, (3) assemble innovators in the field, or (4) develop action plans for future TPC research and development projects.

These proposals may be submitted at any time and do not require submission of a preliminary proposal, but prior discussion with a TPC Program Director is encouraged. Proposals should be submitted at least one year in advance of the planned activity.

Competitive proposals for conferences and symposia should contain the following elements in the Project Description section of the proposal. Proposal reviewers will examine the extent to which these elements are effectively incorporated and integrated in the overall project plan.

Goals and Outcomes.
Describe the major goals and anticipated outcomes of the project.

Activity.
Describe the content, format, purpose, audience, method of announcement or invitation, location, and dates for the proposed activity.

Rationale.
Reference literature and evidence to support the rationale for the proposed work. Describe how the proposed project: (1) addresses a national need, problem or issue; (2) builds on, and relates to, previous and on-going efforts in the field; (3) selects and/or recruits participants; and (4) advances the knowledge and/or awareness among professionals in STM education communities.

Work Plan.
Explain how the project goals will be achieved. Provide a detailed plan for the proposed work, including a complete timeline that indicates who is responsible for each facet of the work. Projects are expected to have a duration of one-to-two years. Describe the plan for producing proceedings or publications of findings that will result from the proposed events.

Program Assessment.
Describe how the conferences or symposia will be assessed and reported to NSF.

Dissemination.
Explain how the PIs intend to share information about the project and proceedings with professionals, including teachers and administrators, in STM education communities.

Personnel.
Describe the expertise, experience, role, and commitment level of each member of the key personnel who will design and facilitate the effort.

Results of Prior NSF Support.
If key personnel have received funding from NSF in the last five years, information on the prior awards is required IF RELEVANT TO THE PROPOSED SCOPE OF WORK (see *Grant Proposal Guide* NSF 03-2). Provide evidence and data-informed results from previous support, including a discussion of lessons learned from both successes and failures. Specifically indicate how the proposed work differs from, and where appropriate, builds upon prior efforts.

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Hinds, M. (2002). *Teaching as a clinical profession: A new challenge for education*. New York: Carnegie Corporation of New York.

Ingersoll, R. (2001). Teacher turnover and teacher shortages. *American Educational Research Journal* 38 (3): 499-534.

National Commission on Teaching and America's Future. (2002). *Unraveling the "Teacher Shortage" problem: Teacher retention is the key*. Washington, DC: author.

National Research Council. (2000). *Educating teachers of science, mathematics and technology: New practices for the new millennium* (Committee on Science and Mathematics Teacher Preparation). Washington, DC: National Academy Press.

Wilson, S. M., Floden, R. E., & Ferrini-Mundy, J. (2001). *Teacher preparation research: Current knowledge, gaps, and recommendations*. Seattle, WA: Center for the Study of Teaching and Policy.

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the Grant Proposal Guide are eligible to submit proposals under this program solicitation.

Proposals may be submitted by universities, two- and four-year colleges, state and local education agencies, school districts, professional societies, research laboratories, informal science education centers, private foundations, or other public and private organizations whether for-profit or not-for-profit. The challenges addressed by the TPC program cannot be solved without the participation of teachers, administrators, schools, and districts. It is expected that teachers (at every phase of the continuum) and administrators be actively engaged in, and make significant contributions to, TPC projects.

IV. AWARD INFORMATION

The program anticipates funding 25 to 35 awards in FY 2004. The following table gives the maximum award amounts for the respective TPC categories:

Category	Award Maximum	Duration
I & II	$1,000,000 per year	2-5 years
III	$500,000 per year	2-5 years
IV	$250,000 for the duration of the project	1-2 years

Estimated program budget, number of awards, and average award size/duration are subject to the availability of funds.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals *(required):*

Projects falling within Categories I, II, or III require a preliminary proposal as a prerequisite for the full proposal submission. Preliminary proposals must be submitted via FastLane no later than 5:00 p.m., local time, on the specified deadline. Preliminary proposals are not required for Category IV.

Submission of preliminary proposals via FastLane requires completion of the following FastLane forms:

Cover Sheet. Complete this form with the appropriate information and make sure to check the preliminary proposal box.

Project Summary. Provide a one-page summary that includes a heading and the project abstract. The heading should include the title of the proposed endeavor, the names of the submitting institution and Principal Investigator, and the project category. The abstract should briefly describe the project goals, content, and duration. It must also include a description of the project participants including discipline(s) and grade level(s). **Note**: The abstract must address both National Science Board merit review criteria, *Intellectual Merit* and *Broader Impacts*. Effective October 2002, NSF will return, *without review,* proposals that do not address both merit review criteria in separate statements. The abstract should not exceed 250 words.

Project Description. Identify the TPC program category for which the proposal is to be considered, and describe the following project elements: (a) rationale and related research, (b) goals and projected outcomes, (c) work plan for accomplishing the goals, (d) personnel, (e) essential features and characteristics, (f) evaluation plans (if applicable), and (g) dissemination plans. Limited to six pages with 2.5-cm margins on all sides, the project description should be single-spaced and use a legible, 12-point font.

Budgets. Provide an estimated budget for the total amount of money requested from NSF, with information on salaries and other expenses, including but not limited to, equipment (where allowable), participants, consultants, travel, subawards, and indirect costs. Include a budget narrative that describes and justifies each of the expenses.

Preliminary proposals require cumulative budgets only. Given FastLane's present constraints, the only option available is to enter the project's cumulative budget as the Year 1 budget. FastLane automatically creates the cumulative budget, which, in the case of preliminary proposals, is identical to the Year 1 budget. Enter a one-page budget-explanation narrative in the Budget Justification section.

Biographical Sketches. Provide a brief narrative describing the key personnel expertise, relevant to the proposed work. Biographical sketches should be sufficiently detailed to show that the necessary expertise is available to conduct the project.

Supplementary Documents. Appendices and letters of support are NOT permitted for preliminary proposals.

Carefully selected reviewers from the field and members of the NSF staff will review preliminary proposals. Ultimate submission of a formal proposal is either encouraged or discouraged based on the reviewers' perceptions of the likelihood that a proposal, as written, will be successful in the formal merit-review process. *This recommendation is strictly an advisory opinion; formal proposals may be submitted regardless of the recommendation*. Written reviews are intended to provide constructive feedback and suggestions that will help strengthen the final proposal. Reviews are returned as expeditiously as possible, but no later than one month prior to the full-proposal submission date.

Full Proposal Instructions:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Website at: http://www.nsf.gov/cgi-bin/getpub?gpg. 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.

Proposals for projects falling within Categories I, II, or III must be submitted via FastLane no later than 5:00 p.m., local time, on the specified deadline. Submission of full proposals via FastLane requires completion of the following FastLane forms:

Cover Sheet. Complete this form with the appropriate information. Make sure to enter both the program announcement/solicitation number and related preliminary-proposal number. Failure to submit this information may delay proposal processing.

Project Summary. Provide a one-page summary that includes a heading and the project abstract. The heading should include the title of the proposed endeavor, the names of the submitting institution and Principal Investigator, and the project category. The abstract should briefly describe the project goals, content, and duration. It must also include a description of the project participants including discipline(s) and grade level(s). **Note**: The abstract must address both National Science Board merit review criteria, *Intellectual Merit* and *Broader Impacts*. Effective October 2002, NSF will return, *without review,* proposals that do not address both merit review criteria in separate statements. The abstract should not exceed 250 words.

Project Description. Refer to the *Program Description* section of this solicitation, which clearly outlines the requirements for the project description section (of the proposal) for each specific TPC category. Limited to 15 pages with 2.5-cm margins on all sides, the project description narrative should be single-spaced and use a legible, 12-point font.

References. List all literature cited in the project description narrative.

Biographical Sketches. Include a biographical sketch for each member of the key personnel. Limited to two pages, each sketch should be sufficiently detailed to show that the necessary expertise is available to conduct the project.

Budget. Provide a budget request for each year of the project. If applicable, also include a complete budget for each year of individual subawards. FastLane automatically creates the cumulative project budget. Limited to three pages, the accompanying budget justification should clearly explain how each line-item was determined.

Current and Pending Support. Enter requested information on all current, pending, and future support (including non-NSF sources) for each member of the key personnel. The proposed project, and all other projects, requiring a portion of the personnel time should be included, even if no salary support is provided. This information is necessary to ensure that every member of the leadership team has sufficient time to carry out the project, and that there is no duplication of support.

Facilities, Equipment & Other Resources. Complete the applicable information requested.

Special Information/Supplementary Documentation. If applicable, provide additional documents such as letters of support. Please note that reviewers are not required to read the supporting documents. Therefore, make certain that the project description provides sufficient information about the project that will enable reviewers to make informed judgements.

Proposers are reminded to identify the program announcement/solicitation number (03-534) in the program announcement/solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required in proposals submitted under this Program Solicitation.

Indirect Cost (F&A) Limitations:

Indirect costs are not allowed on participant support costs.

Other Budgetary Limitations:

Funding Levels -- Budgets should reflect the scope and impact of the proposed work. The level of funding is determined by the size and nature of the activity. The program anticipates funding a broad range of awards including small-scale research efforts in Category I.

Projects involving *Research Studies* (Category I) or *Research and Development of Educational Models and Systems* (Category II) may not exceed $1,000,000 per year. Projects involving the *Professional Resources Development* (Category III) may not exceed $500,000 per year. Projects involving *Conferences and Symposia* (Category IV) may not exceed $250,000 over the duration of the project.

Budget Preparation Instructions:

Equipment purchases that support the efforts of the research and development process or the development of professional resources are allowed, but must be justified in the *Project Description* and *Budget Justification* of the full proposal.

A direct stipend of up to $100 per day (prorated for partial days) for participation in project activities occurring outside of paid school time is allowed. The total stipend may exceed that amount if it is supplemented from other sources. Stipends/honoraria for conference or symposia attendance are not allowed.

The use of NSF funds to hire substitute teachers is allowed under the following conditions: (1) it is necessary to meet the goals and objectives of the project, and (2) it can be documented that the substitute teachers are directly replacing teachers participating in the NSF-funded project. Substitute teachers should be paid in accordance with established school-district policies, and in lieu of paying the teachers participating in the project. Records must be maintained on the hiring and use of substitutes.

Requests for publication costs for conference and symposia proceedings are allowed.

C. Due Dates

Proposals must be submitted by the following date(s):

Preliminary Proposals *(required):*

May 19, 2003
required for categories I, II, and III; not required for category IV

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

September 10, 2003

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: http://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program

announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: http://www.fastlane.nsf.gov

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

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 non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 (NSB 97-72). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued Important Notice 127, Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the Grant Proposal Guide Chapter III.A for further information). The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which he/she is qualified to make judgments.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may

be the benefits of the proposed activity to society?

NSF staff will give careful consideration to the following in making funding decisions:

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

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

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Panel Review.

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

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

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 the Division Director. This informal notification is not a guarantee of an eventual award.

NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the date of receipt. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards 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 Website at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/cgi-bin/getpub?gpm. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at http://www.gpo.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.

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

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project reporting system, available through FastLane, for preparation and submission of annual and final project reports. 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 a proposal or in earlier updates using the electronic system.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- General TPC Information, telephone: (703) 292-8613,
- Kathryn Chval, Section Head (Acting), Teacher Professional Continuum, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5088, fax: (703) 292-9044, email: kchval@nsf.gov
- David B. Campbell, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5093, fax: (703) 292-9044, email: dcampbel@nsf.gov
- V. Celeste Carter, Program Director, Directorate for Education & Human Resources, Division of Undergraduate Education, 835 n, telephone: (703) 292-4656, fax: (703) 292-9015, email: vccarter@nsf.gov

- Katherine Denniston, Program Director, Directorate for Education & Human Resources, Division of Undergraduate Education, 835 N, telephone: (703) 292-4620, email: kdennist@nsf.gov

- Patricia K. Freitag, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-7322, fax: (703) 292-9044, email: pfreitag@nsf.gov

- Michael R. Haney, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5102, fax: (703) 292-9044, email: mhaney@nsf.gov

- Theodore W. Hodapp, Program Director, Directorate for Education & Human Resources, Division of Undergraduate Education, 835 N, telephone: (703) 292-4640, email: thodapp@nsf.gov

- Karen King, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5105, fax: (703) 292-9044, email: kking@nsf.gov

- Monica Mitchell, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5120, fax: (703) 292-9044, email: mmitchel@nsf.gov

- Monica Neagoy, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-4688, fax: (703) 292-9044, email: mneagoy@nsf.gov

- Joan T. Prival, Program Director, Directorate for Education & Human Resources, Division of Undergraduate Education, 835 N, telephone: (703) 292-4635, fax: (703) 292-9015, email: jprival@nsf.gov

- Jill Singer, Program Director, Directorate for Education & Human Resources, Division of Undergraduate Education, 835 N, telephone: (703) 292-4651, fax: (703) 292-9015, email: jsinger@nsf.gov

- Wayne W. Sukow, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5122, fax: (703) 292-9044, email: wsukow@nsf.gov

For questions related to the use of FastLane, contact:

- ESIE FastLane contact, telephone: (703) 292-8620, email: ehr-esie-info@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding 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 or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF Website at http://www.nsf.gov/home/ebulletin, and in individual program announcements/solicitations. 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.

The NSF *Guide to Programs* is a compilation of funding 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.

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The Division of Elementary, Secondary, and Informal Education also has programs in Centers for Learning and Teaching (CLT), Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST), Instructional Materials Development (IMD), Advanced Technological Education (ATE), Informal Science Education (ISE), and Information Technology Experiences for Students and Teachers (ITEST). Brief descriptions and solicitations for these programs can be found at www.ehr.nsf.gov/esie.

There are programs in other EHR Divisions that also may be of interest to proposers to TPC:

The Division of Undergraduate Education has programs in Advanced Technological Education (ATE), Assessment of Student Achievement in Undergraduate Education (ASA); Course Curriculum and Laboratory Improvement (CCLI); National Science, Mathematics, Engineering and Technology Education Digital Library (NSDL); and Noyce Scholarship. Brief descriptions and solicitations for these programs can be found at www.ehr.nsf.gov/due.

The Division of Research, Evaluation and Communications has programs in Research on Learning and Education (ROLE) and the Interagency Education Research Initiative (IERI). Brief descriptions and solicitations for these programs can be found at www.ehr.nsf.gov/rec.

The Division of Graduate Education has the program for the Graduate Teaching Fellowships in K-12 Education (GK-12). A brief description and the solicitation for this program can be found at www.ehr.nsf.gov/dge.

Information and the solicitation for the Math and Science Partnership program (MSP) can be found at www.ehr.nsf.gov/msp.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees 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 from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete 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, although 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 (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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

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

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: pubs@nsf.gov

  or telephone: (301) 947-2722
- **To Locate NSF Employees:** (703) 292-5111

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; 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 applicant 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 this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.

The National Science Foundation
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Tel: 703-292-5111, FIRS: 800-877-8339 | TDD: 703-292-5090