

Advanced Technological Education (ATE)

PROGRAM SOLICITATION

NSF 11-692

REPLACES DOCUMENT(S):

NSF 10-539



National Science Foundation

Directorate for Education & Human Resources
Division of Undergraduate Education
Research on Learning in Formal and Informal Settings

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

- October 20, 2011
- October 18, 2012
- October 17, 2013

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the *NSF Proposal & Award Policies & Procedures Guide (PAPPG)*, [NSF 13-1](#), was issued on October 4, 2012 and is effective for proposals submitted, or due, on or after January 14, 2013. Please be advised that the guidelines contained in [NSF 13-1](#) apply to proposals submitted in response to this funding opportunity. Proposers who opt to submit prior to January 14, 2013, must also follow the guidelines contained in [NSF 13-1](#).

Please be aware that significant changes have been made to the PAPPG to implement revised merit review criteria based on the National Science Board (NSB) report, [National Science Foundation's Merit Review Criteria: Review and Revisions](#). While the two merit review criteria remain unchanged (Intellectual Merit and Broader Impacts), guidance has been provided to clarify and improve the function of the criteria. Changes will affect the project summary and project description sections of proposals. Annual and final reports also will be affected.

A by-chapter summary of this and other significant changes is provided at the beginning of both the [Grant Proposal Guide](#) and the [Award & Administration Guide](#).

Please note that this program solicitation may contain supplemental proposal preparation guidance and/or guidance that deviates from the guidelines established in the [Grant Proposal Guide](#).

A revised version of the *NSF Proposal & Award Policies & Procedures Guide (PAPPG)*, [NSF 11-1](#), was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in [NSF 11-1](#) apply to proposals submitted in response to this funding opportunity.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: *Grant Proposal Guide (GPG)* [Chapter II.C.2.g\(xi\)](#) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: <http://www.nsf.gov/bfa/dias/policy/dmp.jsp>. See [Chapter II.C.2.j](#) of the GPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See [Chapter II.C.2.j](#) of the GPG for further information about the implementation of this requirement.

Changes in the ATE program solicitation for FY 2012, FY 2013, and FY 2014 include:

Preliminary proposals have been eliminated.

Indirect cost limitations on center planning grants and small grants for institutions new to ATE are no longer applicable.

The Project Description must begin with the subsection on Results of Prior Support if applicable.

Specific activities targeting student recruitment, retention, and completion are encouraged both for projects and centers.

The ATE program encourages the recruitment and retention of Veterans in STEM advanced technological programs as a means to diversify and increase the STEM workforce. Proposals that recruit a cohort of Veterans and suggest strategies to retain them are encouraged.

Project Summary: Prospective PIs are reminded that full proposals that do not separately and specifically address both merit review criteria, using the words intellectual merit and broader impacts, within the one-page Project Summary will be returned without review.

Special documentation and Supplementary Materials: As a reminder, a document listing all of the people receiving compensation from the project and their affiliation is required (aside from participants).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Advanced Technological Education (ATE)

Synopsis of Program:

With an emphasis on two-year colleges, the Advanced Technological Education (ATE) program focuses on the education of technicians for the high-technology fields that drive our nation's economy. The program involves partnerships between academic institutions and employers to promote improvement in the education of science and engineering technicians at the undergraduate and secondary school levels. The ATE program supports curriculum development; professional development of college faculty and secondary school teachers; career pathways to two-year colleges from secondary schools and from two-year colleges to four-year institutions; and other activities. Another goal is articulation between two-year and four-year programs for K-12 prospective teachers that focus on technological education. The program also invites proposals focusing on research to advance the knowledge base related to technician education.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- V Celeste Carter, Lead Program Director, 835 N, telephone: (703) 292-4651, email: vccarter@nsf.gov
- Duncan E. McBride, Associate Lead Program Director, 835 N, telephone: (703) 292-4630, email: dmcbride@nsf.gov
- David R. Brown, Program Director, 835 N, telephone: (703) 292-8831, email: drbrown@nsf.gov
- David B. Campbell, Co-Lead Program Director, DRL, 885 S, telephone: (703) 292-5093, email: dcampbel@nsf.gov
- Connie K. Della-Piana, Program Director, 835 N, telephone: (703) 292-5309, email: cdellapi@nsf.gov
- R. C. Hovis, Program Director, 835 N, telephone: (703) 292-4625, email: chovis@nsf.gov
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- Zhanjing (John) Yu, Program Director, 835 N, telephone: (703) 292-4647, email: zyu@nsf.gov

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

- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 75 to 90

Anticipated Funding Amount: \$64,000,000 is anticipated to be available for new and continuing awards in this program in FY2012. Funding in all years is subject to the availability of funds.

Eligibility Information

Organization Limit:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposals:** Not applicable.
- **Full Proposals:**
 - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
 - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):
 - October 20, 2011
 - October 18, 2012
 - October 17, 2013

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

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

The Advanced Technological Education (ATE) program promotes improvement in the education of science and engineering technicians at the undergraduate and the secondary school levels (grades 7 through 12). Proposals to the program may aim to affect specialized technology courses or core science, mathematics, and technology courses that serve as immediate prerequisites or co-requisites for specialized technology courses. The curricular focus and the activities of all projects should demonstrably contribute to the ATE program's central goals: producing more qualified science and engineering technicians to meet workforce demands, and improving the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of these technicians and the educators who prepare them.

The ATE program focuses on two-year colleges and expects two-year colleges to have a leadership role in all projects. Effective technological education programs should involve partnerships in which two-year colleges work with four-year colleges and universities, secondary schools, business, industry, and government, and should respond to employers' needs for well-prepared technicians with the ability to learn and embrace change.

An important building block of the "Educate to Innovate" campaign is the education of students with 21st century knowledge and skills to create a world-class workforce. The ATE program is responsive to this goal as the program prepares well-qualified science and engineering technicians for existing and emerging advanced technological fields as well as preparing effective teachers for these fields. Many of these fields also play a vital role in national security and sustainable energy production and management. Fields of technology supported by the ATE program include, but are not limited to, agricultural technology, biotechnology, chemical technology, civil and construction technology, computer and information technology, cyber security and forensics, electronics, energy, environmental technology, geospatial technology, manufacturing and engineering technology, marine technology, multimedia technology, nanotechnology, telecommunications, and transportation technology. The ATE program is particularly interested in projects addressing issues in rural technician education. The ATE program does not support projects that focus primarily on students who will become health, veterinary, or medical technicians.

Activities may have either a national or a regional focus, but not a purely local one. All projects must be guided by a coherent vision of technological education--a vision that recognizes students as life-long learners together with the needs of the modern workplace and the articulation of educational programs at different levels.

The ATE program supports projects, centers, and targeted research on technician education proposals. A project or center is expected to communicate a realistic vision for sustainability and a plan to achieve it. It is expected that at least some aspects of both centers and projects will be sustained or institutionalized past the period of award funding. Being sustainable means that a project or center has developed a product or service that the host institution, its partners, and its target audiences want continued. To be sustainable is to ensure a center's or project's products and services have a life beyond ATE funding. For example:

- The institution commits to maintaining some of the positions for faculty hired by the project.
- Partners pledge to supply external resources to fund parts of the project after the NSF award ends.
- The institution commits to continuing to use, improve and disseminate curricula and instructional materials developed in the project.

The almost 1000 ATE projects supported to date provide a base upon which future ATE projects should build. Information about these projects can be found on the NSF web site (<http://www.nsf.gov/>). The ATE Centers website (<http://www.atecenters.org/>) provides information about resources that projects may wish to adapt. Additionally, ATE Central (<http://www.atecentral.net>) directs users to a full range of high-impact ATE resources available online, including curricula, learning objects, and podcasts. The SCATE Center hosts a website of interest to the ATE community (<http://teachingtechnicians.org>). A large-scale evaluation of the ATE program has been performed by the Evaluation Center at Western Michigan University and includes several research studies on best practices in technician education (<http://www.wmich.edu/evalctr/ate/>). The Evaluate Center at Western Michigan University partners with ATE projects and centers to expand their use of exemplary evaluation practices, strengthen the knowledge base of the ATE program about evaluation and support the continuous improvement of technician education throughout the nation (<http://www.evaluate-ate.org/>).

II. PROGRAM DESCRIPTION

A. PROGRAM TRACKS

The ATE program supports proposals in three major tracks: Projects, Centers, and Targeted Research in Technician Education. Proposals in all tracks should demonstrate a thorough awareness of previous relevant ATE grants, research on effective technician education, and contemporary developments in the relevant field(s) of technology. Whenever feasible, projects should utilize and innovatively build upon successful educational materials, courses, curricula, strategies, and methods that have been developed through other ATE grants, as well as other exemplary resources (including those not supported by NSF) that can be adapted to technological education. Proposers should contact the Principal Investigators (PIs) of previously funded projects to explore the possibilities for adapting materials, evaluating materials, receiving guidance, or collaborating in other ways, such as conducting research projects which focus on the effectiveness of technician education.

1. ATE PROJECTS

ATE Projects focus on one or a few of the activities described below. Multifaceted projects that cut across some of these activity categories are encouraged.

Program Development and Improvement: These projects should increase the relevance of technician education to modern practices and assure an increased number of students with enhanced competencies entering the high performance workplace. Proposed activities should enhance a curriculum in multiple ways, producing a coherent sequence of classes, laboratories, and work-based educational experiences that revitalize the learning environment, course content and technical experiences for students preparing to be science and engineering technicians. Employers must be involved, and the resulting program should constitute a model that could be disseminated broadly. The improved program should lead students to an appropriate associate degree or specific occupational competency or certification, provide business and industry and public sector agencies with a larger pool of skilled technicians, and induce an increased proportion of students who enroll to complete programs. The PI should articulate clear project goals and objectives, and the evaluative activities should provide evidence on the extent to which the project goals and objectives are realized.

Components of the program development and improvement process might include:

- adapting educational materials or courses developed elsewhere or developing new ones that add rigorous STEM content to technician courses and programs;
- developing innovative methods for using laboratory-, field- and work-based experiences to improve students' understanding of basic principles and the modern workplace;
- using modern instrumentation and new technologies to address the knowledge, skills, and competencies needed for the evolving, converging, and emerging technical workplace;
- integrating industry standards and workplace competencies into the curriculum including 21st century skills (www.p21.org);
- improving the recruitment and retention of students by providing educational opportunities for an increasingly diverse student body;
- developing life-long career and educational pathways for technicians to support the changing workplace, including improving articulation between programs at secondary schools and two-year colleges, and pathways from two-year colleges to four-year college or university programs;
- providing professional development for educators;
- using appropriate assessment instruments to measure student learning; and
- implementing strategies to support student recruitment, retention, and completion. For example, faculty-industry teams might mentor students both within the high school and the community college technician education program with follow-up as the students enter the workforce.

Curriculum and Educational Materials Development: A project may also focus on curriculum and materials development with the intent of nationally disseminating the developed products. Proposed project activities should affect the learning environment, course content, and experience of instruction for students preparing to be science and engineering technicians and for their teachers. Projects develop new print, electronic, and multimedia materials, including simulations, scenarios, and web-based collections as well as laboratory experiments and manuals. It is expected that products will be developed with input from business, industry, and government, validated by experts from these organizations, field tested in diverse locations, and validated in terms of their effectiveness in meeting learning goals.

The ATE program also anticipates funding a few Large Scale Materials Development (LSMD) projects that build on smaller scale efforts whose success has been demonstrated through evaluation. These projects may target course sequences or multiple courses that are integrated and taken concurrently or major changes in teaching strategies. They should be research-based, build upon cognitive science, leverage existing resources, and respond to documented national needs. Such projects involve several diverse academic institutions, often bringing different kinds of expertise to the project. Materials may be pilot tested locally, but field tests must be done at a wide range of academic institutions. Evaluation activities are deep and broad, demonstrating the impact of the project on many students and faculty. Evaluation must include measures of increased student learning of content and processes and have input from employers. Dissemination and outreach activities that have national impact are an especially important element of LSMD projects, as are the opportunities for faculty to learn how to best adapt project innovations to the needs of their students and academic institutions.

Professional Development for Educators: The ATE program supports projects that provide current secondary school teachers and college faculty with opportunities for continued professional growth in areas that directly impact technician education. These projects should be designed to enhance the educators' disciplinary capabilities, teaching skills, and understanding of current technologies and practices, and 21st century skills. Activities typically include workshops, intensive seminars, industrial internships, or a combination of these. Such activities typically last from a few days to several weeks and are usually conducted in the summer, with follow-up activities conducted during the academic year. To effect long-term change, workshop participants should demonstrate institutional support. The program particularly encourages activities that involve secondary (grades 7 through 12) school teachers and two-year college faculty working together. Additionally, the program encourages activities that provide pedagogical skills to industry scientists and tradespeople who wish to teach. Evaluation should demonstrate use in the classrooms and sustainable changes in practice of participating faculty and teachers. Changes in student learning outcomes as well as students' perceptions of technical careers should be measured.

Leadership Capacity Building for Faculty: The vitality and growth of the ATE community is closely linked to industry trends and needs as well as the acumen of the PIs and their institutions who educate technicians. As such, faculty must: 1) work with their institutional administration, 2) effectively manage both programs and project/center activities, 3) maintain industry connections that include local, statewide, and national economic development efforts, and 4) maintain and cultivate networks with other grantees across funding agencies. Activities that foster these skills might include:

- Mentoring programs that link experienced ATE PIs with new grantees. Activities are expected to lead to new PIs acquiring skills needed to successfully manage, complete, evaluate, disseminate and sustain their projects as well as fostering leadership skills such that they may become mentors at a future time;
- Identifying and mentoring faculty and their administrators for the purpose of developing and implementing a new curriculum in an advanced technological area to educate technicians for local industry needs; and
- Outreach activities that reach faculty and their institutions to educate them about the value and potential impact of working with the ATE Program and its community. These efforts could include providing information on funding opportunities, developing effective proposal writing skills, providing guidance on ways of surveying area industry to determine industry needs as well as finding and working with local workforce investment boards and other entities.

Teacher Preparation: The foundation for advanced technological education is grounded in strong mathematics, science, and technology education in K-12 schools. The preparation of future teachers who will facilitate student learning in mathematics and science and cultivate an interest in technological careers is an important component of the ATE program. ATE teacher preparation projects help prepare a future K-12 teaching workforce that is skilled in teaching science and mathematics, understands the technological workplace, and can prepare students to use a variety of approaches to solving real world technology related problems using design processes and principles (See Standards for Technological Literacy, ITEA, <http://www.iteea.org>)

Teacher Preparation projects must involve both two-year and four-year institutions and should aim to increase the number, quality,

and diversity of prospective K-12 science, mathematics, or technology teachers in pre-service or paraprofessional programs. These projects are expected to improve the prospective teachers' technological understanding; provide them with experiences to use in engaging students in real world technological problems; improve their understanding of the modern workplace; and strengthen their preparation in science and mathematics. These projects are expected to build on the extensive research literature on teacher preparation. Two-year colleges have the unique advantage of having technology faculty, connected with the high performance workplace, who can work with mathematics and science faculty in developing and teaching these programs.

The project's evaluation plan must measure the effectiveness of efforts to recruit prospective K-12 teachers, transfer those students into four-year teacher preparation programs, enhance their understanding of advanced technologies used in the workplace, and enhance their ability to improve the technological literacy of their students. Project leaders should also be prepared to contribute to longitudinal studies that track students beyond the grant period, in order to measure the number who graduate with teaching credentials, find positions in K-12 schools, and demonstrate successful performance in the classroom.

Business and Entrepreneurial Skills Development for Students: In addition to technical skills and disciplinary content, students entering the industry environment need skills that allow them to understand and work effectively in a business environment. Many companies have a global presence, and students need to understand that the global economy affects them as employees. Another sector of the industry is comprised of small start-up companies, and these have different attributes than large established firms. Students need to understand these attributes and differences to be effective employees.

Employers often expect employees to possess knowledge, skills and competencies in a specific technical area and to demonstrate professional, industry related, and entrepreneurship acumen. Entrepreneurship skills can be developed in students in technician education programs by having them take selected business courses, by engaging students in problem-based learning using projects of interest to local industry, working with local economic investment organizations and by developing incubator programs that provide experiences for students to interact with entrepreneurs. Projects are encouraged that:

- Educate traditional students and returning learners to develop and apply technical, professional, industry-related, and entrepreneurship knowledge, skills, and competencies;
- Incorporate global issues and international technological and business practices into technical programs; and
- Introduce technical program students to business plans, marketing strategies, networking and interviewing skills, and characteristics of successful entrepreneurs within the context of the program.

Small Grants for Institutions New to the ATE Program: This category seeks to increase the incentive and opportunity for community colleges that have little or no previous experience with the ATE program to undertake projects to improve science and engineering technician education programs or teacher preparation programs that focus on technological education. This small grants opportunity is designed to stimulate implementation, adaptation, and innovation in all areas supported by the ATE program and to broaden the base of community colleges participating in the program. Proposers are strongly encouraged to utilize resources developed by other ATE or other NSF awardees and to include people from these projects and centers.

It is expected that some of the funded projects in this category will serve as a prototype or pilot for an idea that may be expanded in a future proposal for an ATE project. The ATE program is particularly interested in projects addressing issues in rural technician education.

Only community college campuses that have not had an ATE award within the past 10 years may be the "performing organization" on a proposal in this category. It is acceptable for a system administrative office or other governing organization to submit the proposal and be the "awardee organization," even if that organization has received a previous ATE award. But the campus that is the "performing organization" must not have been the performing organization on an ATE award within the past 10 years and must be geographically distinct and have its own chief academic officer. (Note: Community colleges that have had an ATE award within the past 10 years and other institutions may still submit a proposal for a small project under the other categories of ATE Project grants.)

Conferences and Workshops: The ATE program supports a small number of conferences, workshops, and special projects that lead to a better understanding of issues in advanced technological education. These efforts must be related to the mission of the ATE program. Budgets for conferences and workshops are expected to be consistent with the duration of the event, and the number of participants, but the cost will normally not exceed a total of \$250,000. It is expected that the conferences and workshops will be outcome based, and that the final report should contain a statement of the impacts of the event 12-18 months after completion of the event(s). Proposals for conferences and workshops may be submitted at any time during the year, but the proposers should plan on at least a 10 month lead time to allow for review and processing of the proposal.

2. ATE CENTERS

The ATE program supports three types of centers: national, regional, and resource. All centers are larger in size and scope than projects. Proposals for centers must clearly articulate a vision of technological education and must describe a workable plan for achieving that vision during the period of NSF funding. ATE centers provide models and leadership and act as clearinghouses for educational materials and methods. They are cooperative efforts in which two-year colleges work with four-year colleges and universities, secondary schools, business, industry, and government. Typically, the centers are recognized as leaders in a particular field or technology based on significant prior efforts. Proposals for ATE centers must build upon prior efforts of both project personnel and others in the field. A center proposal must clearly describe the impacts of center activities on the industry and technician education programs at the national, regional, and local levels as well as institutional impacts. It is expected that a center will seek a variety of sources of financial support including (1) NSF, (2) the proposing educational institution or consortium, and (3) employers. Proposals for centers are expected to include a letter from the president or chief academic officer of the host institution documenting the institution's commitment to the center.

Centers have a carefully articulated mission that advances the ATE program's mission. Typical features of a center include:

- national or regional systemic reform, broad outreach, community-building, and leadership development among educational institutions, employers, professional and trade associations, educators, and practicing technicians leading to high visibility and support at the collaborating educational institutions;
- a realistic plan for achieving sustainability and institutionalization of key center functions following the period of NSF funding;
- development of resources, such as high-quality programs and curricula, that reflect the modern technological workplace, and dissemination of the center's materials and services through commercial publishers, journals, conferences, workshops, electronic networks and tools, and other means including professional development for educators to support the utilization of these resources;
- mentoring of PIs and projects within the same and related technological fields;
- attention to core STEM courses that provide a foundation for technical degree programs as well as articulation of courses and programs between two-year colleges and secondary schools and between two-year colleges and four-year colleges and universities;
- specific strategies for recruiting, retaining, and placing students (especially students from groups underrepresented in STEM fields), and effective mechanisms for measuring gains in recruitment, retention, and placement;

- mechanisms for counting students and incumbent workers who are recruited; achieve competencies; receive industry certifications (when relevant); participate in internships; find appropriate employment; complete institutional certificates and associate degrees, and transfer to institutions for upper division work; and
- evaluation of the center's materials and services and their impact on student learning, and of the center's impact on employers and on the institutions that manage the center including longitudinal studies that examine students' performance in the workplace and measure employers' satisfaction with graduates.

The ATE program also offers planning grants for centers. (See Section III. Award Information and Section V. Proposal Preparation and Submission Instructions for further information.)

Both regional and national centers are usually funded for four years, after which they are eligible for a competitive grant renewal for another three years. In the second year of the renewal, the progress of the regional and national center will be reviewed to determine whether the center should be terminated, be renewed for another three years or become a resource center. This cycle continues as long as there is a need for the center and the center continues to perform up to expectations. A resource center is usually funded for four years with the possibility of a competitive grant renewal at the end of the third year.

National Centers: National centers focus on the comprehensive reform of technological education in fields that are central to maintaining the economic competitiveness of the United States. National centers must have major national impact and visibility in the technological fields that they address. A national center should catalyze a broad national network of academic institutions and industrial entities that are interested in a particular area of technology. The evaluation plan for a national center is expected to provide evidence of impacts relating to its disciplinary focus, and should provide evidence to support the extent to which the claims that the center makes about its effectiveness and impact on technological education are justified. Partnerships may be national and/or regional, and all collaborate to improve technological education. National centers are also responsible for establishing collaborations with existing and new ATE projects in the same or related technological fields across the nation.

Regional Centers: Regional centers focus on a particular field of technology and have a clear, measurable impact on the workforce and economy in a logically defined geographic region. The center's activities should be coordinated with local, regional, and statewide economic development strategic plans, and, if appropriate, any other ATE funded center that is in a related technological field. Although a regional center may have national impacts, the mission, structure, activities, and products of a regional center should be carefully designed to fit the region's particular characteristics and needs in the relevant field of technology. As a result, the scope and scale of work of a regional center will be less than a national center. For example, a regional center may need to collect, adapt, and implement existing exemplary materials to ensure technological educational reform in a region but not develop new curriculum. Or, the regional center may work with industry to develop a course that is responsive to the regional industry needs. It is expected that a regional center will sustain relationships with local industry and economic development entities.

Resource Centers: A resource center, within a technological area or combination of areas, constitutes a highly visible source of educational materials, ideas, and contacts, research and evaluation, and provides mentoring to increase leadership capacity on a national level. Resource centers may focus on a particular field of technological education or cut across several technology fields to promote best practices in areas such as recruitment, retention, curriculum development, teaching practices, and industry partnerships. Resource centers are typically funded for four years to work with the large network of partners including business, industry, governmental agencies, professional activities, and academic institutions originally developed over several years while a national or regional center. A resource center can also originally come from a project that demonstrated it could provide a specific service or services useful to ATE funded centers or projects or the larger community. Although an institution is eligible to submit a resource center proposal without having had a project award, or any other type of center award, generally, only ATE national or regional centers and exemplary ATE projects that have already completed their original grants are well-positioned to become resource centers. Leaders of these centers must demonstrate that they have already made substantial, high-quality contributions to technological education. As such it is common for resource centers to take a greater leadership role in:

- Providing support and mentoring for prospective PIs that wish to start or improve educational programs in a particular field of technology;
- Providing services to projects;
- Establishing and supporting additional industry, business and academic partnerships;
- Promoting technician careers and visibility and the public image in the field(s) on which the Center is focused;
- Addressing technician knowledge, skills, and competencies needed for the evolving, converging, and emerging technical workplace; and
- Screening, validating, updating, and broadly distributing exemplary materials, curricula, and pedagogical practices adapted or designed by ATE centers and projects and other appropriate sources.

3. Targeted Research on Technician Education

The ATE program supports targeted research on technician education, the changing role of technicians in the workplace, and other topics that advance the knowledge base needed to make technician education programs more effective and more forward-looking. Project proposals should pose a research question or outline a topic of broad interest and importance to the PIs of ATE projects and centers. The project should describe how it builds upon previous research and scholarship on the issue. The theoretical model and research methodology to be used for conducting the research, gathering and analyzing data and developing conclusions should be described. Evaluation should determine that the research methodology is appropriate to the topic and the research protocols are being followed. The proposal should describe how the results can inform practices in technician education programs and how the practitioners will learn of the results. The results must be broadly disseminated to researchers and practitioners. Projects must represent a true collaboration--reflected in the activities, the leadership, and the budget--between well-qualified researchers and two-year college educators and, when appropriate, participants from four-year colleges and universities, secondary schools, business and industry, professional societies, and other non-profit organizations.

Within specific high-technology fields supported by the ATE program (e.g., biotechnology, cybersecurity, nanotechnology), the following are examples of targeted research questions in which the ATE program is particularly interested:

- What are the future trends of the roles of technicians, and how can technician education stay abreast of rapid advances in the field?
- How can stakeholders in technician education (e.g.; community colleges in collaborations with business and industry, government, economic development groups, four-year institutions, secondary schools, and professional societies) develop meaningful and mutually beneficial partnerships?
- Which educational strategies have proven most effective in improving student learning within these specific high technology fields? Across multiple technology fields, what impacts have strategies such as project-based learning, particular recruiting and retention strategies, and remote laboratories had on the effectiveness of technician education programs? What are the reasons for these impacts? Can these strategies be translated to other fields of technology?
- Which components of technician education programs work (or don't work), with whom, why, and under what circumstances?
- What model educational programs and industry partnerships prepare students for sustained success in a technician career (as opposed to training for a specific job)? What are the characteristics of the employees who adapt most readily to an

evolving technological work environment? What educational strategies develop such characteristics? What model educational programs and industry partnerships prepare students for sustained success in a technician career (as opposed to training for a specific job)?

The list above is not intended to be exhaustive. Investigators who are interested in conducting a targeted research project are strongly encouraged to discuss their plans with a program officer prior to submission.

B. INFORMATION ABOUT PREVIOUS AWARDS

- NSF's web site (<http://www.nsf.gov>) provides an Awards Search feature that allows customized searches of NSF's award database. Proposers are also encouraged to search <http://atecentral.net/> and contact PIs of previous awards.

III. AWARD INFORMATION

NSF anticipates that approximately \$64.0 million will be available for new and continuing awards in this program in FY2012. Funding in all years is subject to the availability of funds. The program expects to make 75-90 new awards per year. Grants may be awarded in a wide variety of sizes and durations, as summarized below. The categories below are expected to encompass most of the activities supported through the ATE program; however, additional activities and mechanisms may be proposed after consultation with an NSF program officer. The actual number of awards and the award sizes are subject to the availability of funds and the quality of proposals received.

Anticipated number, size, and duration of new awards:

- ATE Projects: approximately 45-60 new awards, ranging from \$25,000 to \$300,000 per year and having a duration of up to three years, except for Large Scale Materials Development (LSMD) projects, which are limited to \$500,000 per year for four years.
 - ATE small grants for institutions new to the ATE program: approximately 15-20 awards for up to \$200,000 (each) typically spread over three years. It is expected that the budget request will match the scope of the project.
 - National Centers of Excellence: up to 2 new awards for up to \$5 million (each) spread over four years, with the possibility of a competitive grant renewal, normally at a lower level of annual funding, for an additional three years.
 - Regional Centers of Excellence: up to 3 new awards for up to \$3 million (each) spread over four years, with the possibility of a competitive grant renewal, normally at a lower level of annual funding, for an additional three years.
 - Resource Centers: up to 4 new awards for up to \$1.6 million (each) spread over four years with the possibility of a competitive grant renewal.
 - Planning Grants for Centers: up to 4 new awards for up to \$70,000 (each) to develop well-formulated plans for future national or regional centers (see Section V.A ["Proposal Preparation"] for additional information).
 - Targeted Research on Technician Education: approximately 5 to 8 new awards, ranging from \$100,000 to \$300,000 per year for up to 4 years.
- Limitations on funding for the purchase of equipment are discussed under Budgetary Limitations in Section V.B.

IV. ELIGIBILITY INFORMATION

Organization Limit:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program 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/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-

mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

The following instructions for particular sections of the proposal supplements the guidance found in the GPG and the NSF Grants.gov Application Guide.

Cover Sheet: In FastLane, take special care to select the correct "Program Announcement/Solicitation No.": this number can be found at the beginning of this document. For Grants.gov users, the program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page. If the proposal is for a planning grant, begin the project title with the words "Planning Grant for...." (See information on planning grants below.)

Project Data Form: The information on this form is used to direct the proposal to appropriate reviewers and to determine the characteristics of NSF-supported projects. Take special care to identify the proper track for your proposal in Item 1 on the form. For any audience code(s) marked in Item F (e.g., women, minorities, persons with disabilities), include in the Project Description a substantive discussion of the specific strategies that the project will employ to affect the audience(s). Note: In FastLane, the Project Data Form will show up in the list of forms for your proposal only after you have (1) selected the correct Program Announcement/Solicitation No. on the Cover Sheet and (2) saved the Cover Sheet. Grants.gov users should refer to Section VI.5. of the NSF Grants.gov Application Guide for specific instructions on how to submit the DUE Project Data Form.

Project Summary: The one-page Project Summary should clearly indicate, in the first few sentences, the disciplinary focus (or foci) of the proposed project, the kinds of activities to be undertaken (e.g. educational materials development, adaptation and implementation, professional development for educators), and the primary audience to be affected by those activities (e.g., two-year college students, secondary school students, two-year college faculty members, secondary school teachers). This information is used to assign the proposal to a panel for review. Proposers are reminded that the Project Summary must explicitly address, in separate statements, both NSF-approved merit review criteria; the statements must contain the phrases "intellectual merit" and "broader impacts." Full proposals that do not separately address both merit review criteria within the one-page Project Summary will be returned without review.

Project Description (beginning with Results from Prior NSF Support):

While the minimum font size allowed in GPG for some fonts is 10 point, the ATE program strongly recommends that proposers use an 11 or 12-point standard font (for example, Times New Roman, Computer Modern family of fonts, or Arial) to ensure readability.

The length of the full proposal is limited to 15 pages (single-spaced). The Project Description must begin with the subsection on Results of Prior Support, and this subsection should only cover awards pertaining to education; describe research awards only if they have a direct bearing on the new proposal. This subsection must contain specific outcomes and results including metrics to demonstrate the impact of the activities undertaken including evidence of the quality and effectiveness of the project's deliverables. (Supplementary documents may also be used to illustrate prior work subject to the constraints indicated below.) Then the Project Description must explain the project's motivating rationale, goals, objectives, deliverables, and activities; the timetable; the management plan; the roles and responsibilities of the PI, co-PI(s), and other senior personnel; the plan for sustainability after the period of NSF funding; the evaluation plan; and the dissemination plan. For information about effective approaches to evaluation, see the following resources:

The 2002 User-Friendly Handbook for Project Evaluation ([NSF 02-057](#))

Online Evaluation Resource Library for NSF's Directorate for Education and Human Resources (<http://oerl.sri.com/>)

Field-Tested Learning Assessment Guide (FLAG) for Science, Math, Engineering, and Technology Instructors (<http://www.flaguide.org/>)

The Evaluation Center at Western Michigan University (<http://www.evalu-ate.org/>) expands the use of exemplary practices in the evaluation of ATE projects and centers.

References Cited: A references cited page must be included in the proposal. Literature cited should specifically relate to the proposed project, and the Project Description should make clear how each reference has played a role in the motivation for or design of the project. Relevant literature on research in teaching and learning as well as relevant literature on technical education efforts should be cited. If no references are cited the page should state that no references were cited.

Budget: A Budget Justification of up to three pages must accompany the budget forms and provide details about budget line items. This includes justification for the subawards. Proposals that involve subawards should include subaward budgets. If consultants are involved in the budget, the justification must include what they are to do, the length of time they will be working, and the rate of pay. Note: Proposers are advised not to include any cost-sharing on Line M of the proposal budget. Line M of the FastLane budget should be "0". The budget must include funds to support travel to the annual ATE PI Conference.

Special Information and Supplementary Documentation: These are optional **except** for: 1) a listing of all of the known people (aside from participants and students) who will receive compensation from the project and their affiliation, 2) a postdoctoral researcher mentoring plan, if funding is requested to support postdoctoral researchers, and 3) a data management plan.

Reviewers do want to see documentation of the commitments described in the proposal including, for centers, a letter from the president or chief academic officer of the host institution describing the commitment of the institution to the center. If included, these sections must be concise and relevant. Reviewers will be strongly encouraged to disregard any supplementary documentation

material in excess of 30 pages. These sections might include, for example, letters of commitment, a sample of previously developed (relevant) materials, a published review of such materials, or a draft of a proposed unit or module. Letters of commitment should document collaborative arrangements or pledge resources of significance to the proposal. Letters that merely endorse the proposal or offer nonspecific support for project activities should not be included. FastLane's Supplementary Documents function should be used to upload these sections as one or more PDF files. Note that any letters must be obtained in or converted to electronic format; if necessary, electronically scan paper documents and convert them to PDF. Hard copy letters mailed to NSF will not be provided to reviewers. (Proposers should not send videotapes, computer diskettes, CD-ROMs, slides, books, etc., as appendices or supplements to a proposal.)

Because proposals submitted in response to this solicitation will be reviewed by panel review instead of mail review, there is no need for proposers to submit a list of suggested reviewers unless an NSF program officer specifically requests it.

Planning Grants: Planning grants are reserved for planning for a center. A proposal for a planning grant should clearly describe the activities that will take place during the planning period. It should also provide details about the workforce demands that the planning grant will address, the organizations and departments that will be (or will likely be) partners in the project, the core faculty members or administrators who will manage the project, and the criteria that will be used to judge the proposer's readiness to form an ATE center at the end of the planning period. The proposal should also outline plans for identifying and enlisting faculty from two- and four-year institutions and representatives from business, industry and public sector agencies to provide leadership for the various activities of the project or center.

Planning-grant proposals need not present elaborate plans for evaluation and dissemination.

Certain special types of proposals described in the GPG--i.e., Grants for Rapid Research Response (RAPID) proposals and EARly Grants for Exploratory Research (EAGER) proposals (see GPG, Chapter II, Section D.1 and 2), Equipment Proposals (see GPG, Chapter II, Section D.5), and Accomplishment-Based Renewal (ABR) proposals (see GPG, Chapter V, Section B)--are not appropriate for the ATE program. Collaborative Proposals (see GPG, Chapter II, Section D.4) should in most cases be submitted as a single proposal. Under unusual circumstances, Collaborative Proposals involving the simultaneous submission of proposals from different organizations will be accepted in the formal proposal cycle. The collaborating organizations must exactly follow the instructions for electronic submission specified in GPG, Chapter II, Section D.4.b. The project titles of the related proposals must be identical and must begin with the words "Collaborative Project," and the combined budgets of the related proposals should conform to the typical award sizes specified in this solicitation. These simultaneous Collaborative Proposals must be submitted via FastLane and will be treated as a single proposal (with a single Project Summary, Project Description, and References Cited) during the review process.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

Other Budgetary Limitations:

Funds requested for equipment and instrumentation (computers, computer-related hardware, software, laboratory or field instrumentation, and scientific or industrial machinery) normally may not exceed \$200,000 for the duration of the grant. Exceptions for this limit will be considered when a single piece of equipment costs in excess of the maximum allowable request, and the need for the equipment is justified in terms of student use and learning outcomes. NSF funds may not be used to support expenditures that would normally be made in the absence of an award, such as costs for routine teaching activities (including curriculum development) and laboratory upgrades (supplies and computers).

NSF project funds may not be used for:

- equipment or instrumentation that is not mainly for use in the project;
- replacement equipment or instrumentation that does not significantly improve instructional capability;
- teaching aids (e.g., films, slides, projectors, "drill and practice" software);
- vehicles, laboratory furnishings, or general utility items such as office equipment (including word-processing equipment), benches, tables, desks, chairs, storage cases, and routine supplies;
- maintenance equipment and maintenance or service contracts;
- the modification, construction, or furnishing of laboratories or other buildings;
- the installation of equipment or instrumentation (as distinct from the on-site assembly of multi-component instruments--which is an allowable charge).

Professional Development Workshops: In proposals that involve professional development workshops, it is generally expected that the home institutions of the participants will bear the cost of travel to and from the workshop. However, some travel costs may be included in project budgets. Costs for subsistence (lodging and meals) during the workshop may be included. In addition, funds may be requested for a reasonable stipend per workshop day for participants; requests for such stipends must be specific to the target audience and must be fully justified--for example, to assure participation by faculty with few professional development opportunities or from resource-poor institutions.

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. Note that indirect costs may not be charged on participant support costs.

Extra Compensation Above Base Salary. ATE provides for extra compensation above base salary only for special situations such as teaching evening or weekend classes or workshops. Further, the extra compensation shall be computed at a rate not in excess of the monthly rate of the base academic year salary. Awardees must disclose the intention to pay extra compensation above the base salary in the Budget Justification section of the grant proposal. This extra compensation above the base salary must still be approved by NSF. Permission to charge extra compensation, if granted, will be included by specific clause in the grant award letter.

National Visiting Committee: For centers, the budget should include provisions for a National Visiting Committee (NVC) to visit the center at least on an annual basis. An NVC is a group of experts who provide advice to the project staff, assess the plans and progress of the project (and make reports both to the project leadership and to NSF), and enhance the dissemination of the project's products. Typically, ATE Centers enlist eight to ten members. The proposal should only include names of NVC members who have agreed to serve should an award be made. After an award is made, an NSF program officer will work with the grantee to finalize NVC membership. But the proposal should address how the NVC will be used in the project. (Additional information describing the role of NVCs can be found at, <http://www.wmich.edu/evalctr/ate/piresources.htm>.)

Evaluation: All projects and centers carry out evaluative activities. The funds to support an evaluator independent of the project or center must be requested, and the requested funds must match the scope of the proposed evaluative activities.

ATE PI Conference: The budget must include funds to support travel to the annual ATE PI Conference.

C. Due Dates

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

October 20, 2011

October 18, 2012

October 17, 2013

D. FastLane/Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: <https://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 solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

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. Further instructions regarding this process are available on the FastLane Website at: <https://www.fastlane.nsf.gov/fastlane.jsp>.

- **For Proposals Submitted Via Grants.gov:**

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as [Exhibit III-1](#).

A comprehensive description of the Foundation's merit review process is available on the NSF website at: <http://www.nsf.gov/bfa/dias/policy/meritreview/>.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in [Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years \(FY\) 2011-2016](#). These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the core strategies in support of NSF's mission 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 variety of learning perspectives.

Another core strategy in support of NSF's mission is broadening opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which 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.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. ([GPG Chapter II.C.2.d.i.](#) contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including [GPG Chapter II.C.2.d.i.](#), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

For the ATE program, questions such as the following are often relevant to evaluating proposals in terms of NSF's merit review criteria.

Intellectual Merit

- Does the project have potential for improving student learning in science or engineering technician education programs?
- Are the goals, objectives, and outcomes and the plans and procedures for achieving them, worthwhile, well-developed, and realistic?
- Is the rationale for selecting particular activities or components for development or adaptation clearly articulated and informed by the research literature? Does and the work build on that base and the work of others?
- Is the evaluation plan clearly tied to the project outcomes? Does the project provide for effective assessment of student learning? Is the evaluation likely to provide useful information to the project and others?
- Is the evidence of institutional support clear and compelling, and have plans for long term institutionalization been addressed?

Broader Impacts

- Has an assessment of workforce needs for technicians been conducted? Does the project work with employers to address their current and future needs for technicians?
- Will the project's results be widely disseminated and will its products be distributed effectively and commercialized when appropriate?
- Will the project evaluation inform others through the communication of results?
- Are the results and products of the project likely to be useful at other institutions?
- Are other educational institutions involved in project activities?
- Does the project promote diversity in the technical workforce?

B. Review and Selection Process

Proposals submitted in response to this program 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.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for 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 deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's 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 Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

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 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.B. 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 (GC-1); * or Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the *NSF Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. 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. Such reports provide information on activities and findings, project participants (individual and organizational), 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. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

There is one special ATE reporting requirement. To assist NSF in evaluating the ATE program and meeting other reporting requirements the PI must respond annually to a survey that requests information about the number and characteristics of students and educators that have been affected by the project; the retention, graduation, and placement rates for students; the project's impact on workforce needs; awards and other measures of the quality of the project's products and activities; and other indicators of the project's effect on the quality and quantity of technicians being educated for the high-tech workplace. NSF will provide guidelines for the collection and reporting of data. (NSF may use an external evaluator to gather and analyze the data.)

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- V Celeste Carter, Lead Program Director, 835 N, telephone: (703) 292-4651, email: vccarter@nsf.gov
- Duncan E. McBride, Associate Lead Program Director, 835 N, telephone: (703) 292-4630, email: dmcbride@nsf.gov
- David R. Brown, Program Director, 835 N, telephone: (703) 292-8831, email: drbrown@nsf.gov
- David B. Campbell, Co-Lead Program Director, DRL, 885 S, telephone: (703) 292-5093, email: dcampbel@nsf.gov
- Connie K. Della-Piana, Program Director, 835 N, telephone: (703) 292-5309, email: cdellapi@nsf.gov
- R. C. Hovis, Program Director, 835 N, telephone: (703) 292-4625, email: chovis@nsf.gov
- Don L. Millard, Program Director, 835 N, telephone: (703) 292-4620, email: dmillard@nsf.gov
- Victor P. Piotrowski, Program Director, 835 N, telephone: (703) 292-8670, email: vpiotrow@nsf.gov
- Gerhard L. Salinger, Lead Program Director, DRL, 885 S, telephone: (703) 292-5116, email: gsalinge@nsf.gov
- Zhanjing (John) Yu, Program Director, 835 N, telephone: (703) 292-4647, email: zyu@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.
- Antoinette T Allen, Information Technology Specialist, Division of Undergraduate Education, 835 N, telephone: (703) 292-4646, email: duelf@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming

NSF Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the [NSF web site](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at <http://www.grants.gov>.

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NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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- **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: nsfpubs@nsf.gov
or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

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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 or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; 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," 69 Federal Register 26410 (May 12, 2004), and [NSF-51](#), "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

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