

Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES) Course, Curriculum, and Laboratory Improvement (CCLI)

PROGRAM SOLICITATION

NSF 10-544

REPLACES DOCUMENT(S):

NSF 09-529



National Science Foundation

Directorate for Education & Human Resources
Division of Undergraduate Education

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

May 26, 2010

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 27, 2010

For Type 1 proposals from submitting organizations located in states or territories beginning with N through W.

January 14, 2011

For Type 2 and 3 proposals and for TUES Central Resource Project proposals. However, TUES Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

May 26, 2011

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

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For Type 2 and 3 proposals and for TUES Central Resource Project proposals. However, TUES Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

May 28, 2012

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 29, 2012

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January 14, 2013

For Type 2 and 3 proposals and for TUES Central Resource Project proposals. However, TUES Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

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](#).

Revision Summary

The title of the program was changed from "Course, Curriculum and Laboratory Improvement CCLI" to "Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics (TUES)" in order to emphasize the special interest in projects that have the potential to transform undergraduate STEM education. The additional review criteria have been modified to emphasize the desire for projects that (1) propose materials, processes, or models that have the potential to enhance student learning and to be adapted easily by other sites and (2) involve a significant effort to facilitate adaptation at other sites.

The language describing the budget limitation for Type 1 and 2 has been changed.

A statement has been added to the description of the Type 1 project indicating that successful projects should be institutionalized at the investigator's college or university and a question on institutionalization has been added to the additional review criteria.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics Course, Curriculum, and Laboratory Improvement (CCLI)

Synopsis of Program:

The Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics (TUES) program seeks to improve the quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students. This solicitation especially encourages projects that have the potential to transform undergraduate STEM education, for example, by bringing about widespread adoption of classroom practices that embody understanding of how students learn most effectively. Thus transferability and dissemination are critical aspects for projects developing instructional materials and methods and should be considered throughout the project's lifetime. More advanced projects should involve efforts to facilitate adaptation at other sites.

The program supports efforts to create, adapt, and disseminate new learning materials and teaching strategies to reflect advances both in STEM disciplines and in what is known about teaching and learning. It funds projects that develop faculty expertise, implement educational innovations, assess learning and evaluate innovations, prepare K-12 teachers, or conduct research on STEM teaching and learning. It also supports projects that further the work of the program itself, for example, synthesis and dissemination of findings across the program. The program supports projects representing different stages of development, ranging from small, exploratory investigations to large, comprehensive projects.

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.

- Don L. Millard, Lead Program Director, 835 N, telephone: (703) 292-4620, email: dmillard@nsf.gov
- Myles Boylan, 835 N, telephone: (703) 292-4617, email: mboylan@nsf.gov
- Susan Finger, Program Director, 835 N, telephone: (703) 292-4639, email: sfinger@nsf.gov
- Terry Woodin, 835 N, telephone: (703) 292-4657, email: twoodin@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 or Cooperative Agreement

Estimated Number of Awards: 94 to 108 including 70 to 75 Type 1 awards, 20 to 25 Type 2 awards, 3 to 5 Type 3 awards and 1 to 3 TUES Central Resource Project awards

Anticipated Funding Amount: \$35,800,000 through this solicitation for new and ongoing awards, pending availability of funding.

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 Proposal Submission: 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):

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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 vision of the TUES program is excellent STEM education for all undergraduate students. To achieve this vision, the program supports efforts that bring advances in STEM disciplinary knowledge into the undergraduate experience. It also supports the creation and adaptation of learning materials and teaching strategies that embody what we know about how students learn. It encourages projects that develop faculty expertise, promote widespread implementation of educational innovations, and prepare future K-12 teachers. The program supports projects that enhance our understanding of how students learn STEM topics and how faculty members adopt instructional approaches. It invites projects that build capacity to assess learning and evaluate educational innovations. It also supports projects that further the work of the program itself, for example, synthesis and dissemination of findings across the program.

This solicitation especially encourages projects that have the potential to transform the conduct of undergraduate STEM education, for example, by bringing about widespread adoption of classroom practices that embody understanding of how students learn most effectively. Thus transferability and dissemination are critical aspects for projects developing instructional materials and methods and should be considered throughout the project's lifetime. More advanced projects should involve efforts to facilitate adaptation at other sites.

Projects that explore cyberlearning, specifically learning with cyberinfrastructure tools such as networked computing and communications technologies, are of special interest. The program supports projects at all scales and stages of development, ranging from small, exploratory investigations to large, comprehensive projects as described in Section II-C.

The goals of this program reflect national concerns about producing skilled STEM professionals (including K-12 teachers) and citizens knowledgeable about STEM and how it relates to their lives. The program seeks to build on the community of faculty committed to improving undergraduate STEM education. A representative list of resources that describe effective teaching practices, literature about learning, and information about ongoing projects are listed in Section II-D.

II. PROGRAM DESCRIPTION

A. PROJECT COMPONENTS

All proposals must contribute to the development of exemplary undergraduate STEM education. Typically projects include one or more of the components described below and they build on prior knowledge, both in the STEM fields and in undergraduate education. In addition, TUES welcomes proposals describing untested, forward-looking, and unconventional activities that could have a high impact and contribute to transforming undergraduate STEM education. Prospective principal investigators for this kind of project should discuss their ideas with a TUES Program Officer in advance of proposal submission to help gauge the appropriate scope and scale of the proposal.

Creating Learning Materials and Strategies: Projects developing new learning materials and strategies for improving courses, curriculum, and laboratories should be guided by research on teaching and learning and should incorporate and be inspired by advances within the disciplines. Instrumentation and equipment requests are appropriate but should include information relative to their expected impact on student learning. Early stage projects typically carry the development of materials, and assessment of learning, to the stage where judgments can be made about whether further investment in the new materials or approaches is justified. Later stage projects should yield evaluation results sufficiently conclusive and descriptive so that successful products and processes can be adopted, distributed widely or, when appropriate, commercialized.

Implementing New Instructional Strategies: To ensure their broad based adoption, successful instructional strategies should be widely practiced. Therefore, TUES welcomes proposals to change undergraduate STEM courses, curricula and laboratories by implementing strategies to reflect proven or promising pedagogical techniques in ways that encourage widespread adoption. These strategies may come from previous TUES projects, or its predecessor programs, or from other sources in the STEM community.

Instrumentation and equipment requests are appropriate in implementation projects, based on their stated potential impact on student learning, and provided a convincing case is made that the planned effort will contribute to understanding how to achieve widespread adoption of the approach. Implementation projects should contribute to the community's understanding about how new strategies are transferred to diverse settings and about how they impact student learning. Evaluation plans for implementation projects should explore the challenges and opportunities for adapting new strategies in diverse educational settings. Projects that specifically address the challenges to achieving widespread adoption of proven practice are especially welcome.

Developing Faculty Expertise: Using new learning materials and teaching strategies often requires faculty to acquire new knowledge and skills in order to revise their curricula and teaching practices. Projects focused on developing faculty expertise can range from short-term workshops to sustained activities. They should include evaluation efforts to describe the impact on the faculty participants, and in large, later stage projects, on student learning in classes taught by these faculty members. Projects should provide professional development for a diverse group of faculty so that new materials and teaching strategies can be widely implemented.

Assessing and Evaluating Student Achievement: Proposals for designing processes and instruments to measure the effectiveness of new materials and instructional methods are responsive to this solicitation. Some projects may develop and disseminate valid and reliable tests of STEM knowledge; other projects may collect, synthesize, and interpret information about student understanding, reasoning, practical skills, interests, attitudes or other valued outcomes. Projects that apply new and existing processes and instruments to conduct broad-based evaluations of educational programs or practices are appropriate if they span multiple institutions and are of general interest. In discussing these aspects of curricular change, projects should carefully document institutional demographics and characteristics. Projects using established instruments and strategies and likely to have only a local impact are discouraged.

Conducting Research on Undergraduate STEM Education: Results from assessments of learning and teaching as well as from projects emphasizing other programmatic components provide a foundation for developing new and revised models of how undergraduate STEM students learn. Research to explore how effective teaching strategies and curricula enhance learning and attitudes, how widespread practices have diffused through the community, and how faculty and programs implement changes in their curriculum are appropriate. Research results should provide a foundation for creating learning materials, teaching strategies, faculty development approaches, and evaluation methodologies that have the potential for a direct impact on STEM educational practices.

B. IMPORTANT PROJECT FEATURES

Although projects may vary considerably in the approaches they take, the number of academic institutions involved, the number of faculty and students that participate, and in their stage of development, all promising projects share certain characteristics.

Quality, Relevance, and Impact: Projects should address a recognized need or opportunity, clearly indicate how they will meet this need, and be innovative in their production and use of new materials, processes, and ideas, or in their implementation of tested ones.

Student Focus: Projects should have a clear relation to student learning, with definite links between project activities and improvements in STEM learning. Moreover, they should involve approaches that are consistent with the nature of today's students, reflect the student's perspective and, when appropriate, solicit student input in the design of the project.

Use of and Contribution to Knowledge about STEM Education: Projects should reflect high quality science, technology, engineering, and mathematics. They should have a clear and compelling rationale, use methods derived from existing knowledge concerning undergraduate STEM education, build on existing projects of a similar nature, and present evidence supporting the approach. They also should have an effective approach for adding to this knowledge by disseminating their results.

STEM Education Community-Building: Investigators should expect to interact with others in the STEM education community, to enable sharing of knowledge and experience in developing and evaluating STEM educational innovation. These interactions may range from informal contacts with a few colleagues to the establishment of a formal body of scholars. Collaborating networks may involve investigators working on similar or related approaches in the proposer's discipline or in other STEM disciplines and may also include experts in evaluation, educational psychology or other related fields. Central Resource Projects will have significant responsibility for facilitating the development of this community.

Sustainability: The purpose of the TUES program is to bring about lasting improvement in undergraduate STEM education. Proposals should address sustainability and should demonstrate that there is a reasonable expectation of persistent effects of the grant funded work consistent with the aims of the project.

Expected Measurable Outcomes: Projects should have goals that have been translated into a set of expected measurable outcomes that can be monitored using quantitative or qualitative approaches or both. These outcomes should be used to track

progress, guide the project, and evaluate its impact. Expected measurable outcomes should pay particular attention to student learning, contributions to our understanding of STEM learning, and community building.

Project Evaluation: All projects, regardless of the scope or main program component they address, should have an evaluation plan that includes both a strategy for monitoring the project as it evolves to provide feedback to guide these efforts (formative evaluation) and a strategy for evaluating the effectiveness of the project in achieving its goals and for identifying positive and negative findings when the project is completed (summative evaluation). The complexity of the evaluation will depend on the project, and these efforts should be led by knowledgeable individuals who look objectively at the project's progress and outcomes.

C. PROJECT TYPES: SCALE, SCOPE, AND STAGE

The program is accepting proposals under this solicitation for awards at three levels of support, designated Type 1, Type 2, and Type 3, as well as for awards for projects that support the work of the program itself. The types reflect a combination of the scale, scope, and stage of the proposed work. The scale of the work refers to the number of institutions, faculty, and students with whom the work engages. Scope refers to the range of project components involved. Stage refers to the place of the work along a continuum from early conceptual development through deployment of mature, well-tested approaches. Type 2 and 3 projects will typically reflect greater dependence on previous work, supported by the TUES program or by other sources, and may be at a more mature stage of development than Type 1 projects. However, the Types are independent, and the choice should be made based on the resources required to achieve the desired outcomes. In every case there should be the potential for lasting improvement in the quality of instruction.

The descriptions of the types below, and the examples that follow, are intended as guidelines, not prescriptions.

Type 1 Projects: Total budget may not exceed \$200,000 (\$250,000 when four-year colleges and universities collaborate with two-year colleges) for 2 to 3 years.

Results from Type 1 projects are expected to be significant enough to contribute to understanding undergraduate STEM education. Proposed evaluation efforts should be informative with respect to student learning or engagement, based on the project's specific expected outcomes, and consistent with budget limitations and the scope of a Type 1 project. In order to encourage collaboration between four-year colleges and universities and two-year colleges, projects involving such collaboration may request a total of \$250,000. In such partnerships, the distribution of effort and funds between the four-year institution and the community college should reflect a genuine collaboration. At a minimum, the implementation, if successful, should be institutionalized at the participating colleges and universities.

Examples of Type 1 Projects (suggest the scope of a Type 1 project as well as possible topics)

- A project that develops materials that use a new instructional approach based on the current understanding of how students learn, or introduces content from current research into an existing course.
- A project that integrates new instrumentation or equipment into undergraduate laboratories or field work in a way that demonstrably improves student learning.
- A collaborative project between faculty from two-year and four-year schools that develops a model to provide the needed courses for a seamless transfer in an efficient way.
- A pilot project that explores the practical aspects of using remote laboratories or instruction among several institutions.
- A pilot project that integrates current science and pedagogy into the teacher preparation curriculum.
- A pilot study to explore Internet-based approaches for faculty professional development.
- A project that develops an instrument to assess students' knowledge in a particular area, their abilities with certain processes, or their attitude about some aspect of STEM.
- A pilot study to begin understanding how various factors affect how students learn particular content or skills.

Type 2 Projects: Total budget may not exceed \$600,000 for 2 to 4 years.

Type 2 projects will typically address more than one program component, or, if they focus on a single component, will address it at a scale that goes well beyond a single institution. Projects that involve a single institution need to be working toward systemic change across the STEM disciplines. Projects that continue from previous work should include an explicit discussion of the results and impact produced by that work. Type 2 projects should carry the development to a state in which the evaluations of the projects have evidence to support the claim that the projects' efforts are effective. In turn the evaluation results can inform further use, such as in distributing the project widely or seeking commercialization. At a minimum, the implementation, if successful, should be institutionalized at the participating colleges and universities.

Examples of Type 2 Projects

- A project that develops material for a sequence of courses that vertically integrates a conceptual or pedagogical approach at several institutions.
- A project involving several diverse partnerships between community colleges and four-year schools to develop robust models for providing community college courses needed for a true two-plus-two transfer program.
- A project that uses faculty professional development as a part of a widespread beta-testing effort with faculty in several diverse institutions in order to disseminate proven, innovative instructional material or approaches.
- A project that converts an effective, in-person faculty professional development approach to an Internet-based or blended approach in order to improve accessibility and sustainability.
- A project involving several diverse institutions that uses an existing instrument to assess students' knowledge in a particular area or their abilities with certain processes.
- A study involving several diverse institutions to identify what factors and characteristics effect how faculty members and departments adopt innovative approaches.

Type 3 Projects: Budget negotiable, may not exceed \$5,000,000 over 5 years.

Type 3 projects are intended to support large scale efforts. Projects that continue from previous work should include an explicit discussion of the results and impact produced by that work. Proposals for projects that are designed to break new ground at a large scale should discuss evidence that supports the validity of the approach, and must reflect current understanding of how students learn. Type 3 proposals should include a description of evaluation activities that are focused on impact on student learning in a broad spectrum of the population served by the project. Evaluation plans for Type 3 projects should include efforts to describe the impact of the work on the prevailing models of undergraduate STEM education and to include strategies that assist in the implementation of the project's activities in new contexts.

Examples of Type 3 Projects

- A project that involves a regional or national effort to disseminate proven materials or pedagogies.
- A project that develops a self-sustaining model for faculty professional development that introduces new faculty to a field or

- provides retraining for experienced faculty.
- A national or regional level project involving a wide range of diverse institutions that uses an existing assessment instrument to develop a database on students' knowledge in a particular area or their abilities with certain processes.
- A study involving a broad range of diverse institutions that explores how various factors affect how students learn particular content or skills.
- A study involving a broad range of diverse institutions that systematically compares the efficacy and efficiency of several instructional methodologies such as hands-on, remote, and virtual laboratories.

TUES Central Resource Projects: Budget negotiable, depending on the scope and scale of the activity but the total budget may not exceed \$3,000,000.

TUES Central Resource projects assume responsibility for leadership and implementation of activities that sustain the TUES community as it works to transform undergraduate STEM education. TUES Central Resource projects will work to increase the capabilities of and communications among the STEM education community and to increase and document the impact of TUES projects. Since TUES Central Resource projects will work with the TUES program in order to accomplish these goals, they may be supported either as cooperative agreements or as grant awards. The duration of awards will be up to five years. Annual budgets will depend on the scope and scale of the work proposed. Larger TUES Central Resource projects must work across all STEM disciplines at a national scale. Activities will typically be focused particularly on TUES grantees, but possibly more broadly as well, especially in efforts to include other broad communities of NSF grantees. Activities should be directed at the entire STEM community with the twin goals of helping the community discover and use products and ideas generated by the projects supported by the TUES program. Although a focus on material developed within projects is important, applicants are also encouraged to consider including the broadest possible set of innovative curricula and effective teaching and learning strategies

Examples of Central Resource Projects

- Projects that organize and implement meetings of Principal Investigators of projects funded by the TUES program and its predecessors. This includes large scale meetings of all grantees or smaller meetings of interest groups within the program. This activity should include publication of findings from meetings.
- Projects that conduct targeted research or evaluation studies in undergraduate STEM education addressed by CCLI and TUES projects, the impact of CCLI and TUES supported activities or a subset of awards, or those of TUES's predecessor programs. Proposals should state questions to be addressed, describe study design and methodology, and draw on relevant literature.
- Projects that develop an approach for describing or characterizing the portfolio of TUES and other predecessor programs. Proposals should describe strategies for organizing the characterization, for collecting the information, and for reporting and presenting the results. Proposals applying new techniques for presenting large data sets (quantitative and qualitative) are encouraged.
- Projects that provide leadership and implementation in seeing to it that development of the CCLI and TUES community of practice is supported by current cyber tools for communication and collection of resources. Systems should integrate with the National STEM Distributed Learning (NSDL) resources as described in section V-A. A project devoted to this goal may utilize NSDL resources by establishing effective interchanges between CCLI and TUES awardees and the existing NSDL pathways projects, or it may establish a separate entity with connection to the NSDL resources.
- Projects that provide workshops that increase potential and current PI's understanding of various topics such as conducting project evaluations, broadening participation, utilizing cyberinfrastructure, and incorporating engaging pedagogies.

D. SOME RESOURCES FOR PROPOSAL PREPARATION AND PROJECT DESIGN

NSF Resources

- NSF's Quick Search tool allows you to perform full-text searches on the award records, including abstracts, in NSF's database. <http://www.nsf.gov/awardsearch/index.jsp>
- NSF's Fielded Search tool allows you to restrict your search criteria to specific fields in the database, and to use date and numeric ranges. To restrict your search to programs in a specific division: In the "NSF Organization" field, select that division. To restrict your search to a particular program: In the "NSF Program" fields, select Contains from the drop-down list and enter the appropriate four-digit code for the program. <http://www.nsf.gov/awardsearch/tab.do?dispatch=4>
- NSF 98-91: A Guide for Proposal Writing, a booklet prepared by staff in DUE <http://www.nsf.gov/pubs/1998/nsf9891/nsf9891.pdf>
- NSF Grant Proposal Guide, detailed guidance for preparing and submitting a proposal to NSF http://www.nsf.gov/pubs/policydocs/pappguide/nsf08_1/gpg081print.pdf
- Human Subjects: <http://www.nsf.gov/bfa/dias/policy/hsfaqs.jsp>

Resources for Project Evaluation

- NSF 02-057: The 2002 User-Friendly Handbook for Project Evaluation, a basic guide to quantitative and qualitative evaluation methods for educational projects <http://www.nsf.gov/pubs/2002/nsf02057/start.htm>
- NSF 97-153: User-Friendly Handbook for Mixed Method Evaluations, a monograph "initiated to provide more information on qualitative [evaluation] techniques and ... how they can be combined effectively with quantitative measures" <http://www.nsf.gov/pubs/1997/nsf97153/start.htm>
- Online Evaluation Resource Library (OERL) for NSF's Directorate for Education and Human Resources, a collection of evaluation plans, instruments, reports, glossaries of evaluation terminology, and best practices, with guidance for adapting and implementing evaluation resources <http://oerl.sri.com/home.html>
- Field-Tested Learning Assessment Guide (FLAG): This website is designed for Science, Math, Engineering, and Technology Instructors who are interested in new approaches to evaluating student learning, attitudes, and performance. It has a primer on assessment and evaluation, classroom assessment techniques, discipline-specific tools, and resources - all in a searchable, downloadable data base, <http://www.flaguide.org/>
- Student Assessment of Learning Gains (SALG): An on-line survey that measures student perceptions of their learning gains due to any components within a course. Faculty can modify a template to match any and all features of their courses, have their students take the survey on-line, and have the data returned to them as either raw data or with simple statistical analysis, <http://www.salgsite.org/>
- Developing Metrics for Assessing Engineering Instruction: What Gets Measured Gets Improved, a 2007 National Academies Press publication, http://www.nap.edu/catalog.php?record_id=12636
- American Evaluation Association. Online Resources (<http://www.eval.org/resources.asp>)
- Bond, S.L., Boyd, S.E., Rapp, K.A. 1997. *Taking Stock: A Practical Guide to Evaluating Your Own Program*. Chapel Hill, NC: Horizon Research, Inc.
- The Carnegie Foundation for the Advancement of Teaching. August 2008. The Faculty Inquiry Toolkit. (<http://specctoolkit.carnegiefoundation.org/>)
- Cornell Office for Research on Evaluation. 2009. The Evaluation Facilitator's Guide to systems Evaluation Protocol. Ithaca, NY; Cornell Digital Print Services.
- My Environmental Education Evaluation Resource (MEERA). University of Michigan (<http://meera.snre.umich.edu/>)

Pertinent Workshops, Studies and Reports on Undergraduate Education

- *Recommendations for Action in Support of Undergraduate Science, Technology, Engineering, and Mathematics and Recommendations for Urgent Action Project Kaleidoscope 2002, 2006* reports calling for “collective action” to share ideas and materials so that projects build on, connect to, and enhance the work of others. <http://www.pkal.org/documents/ReportonReports.pdf> and <http://www.pkal.org/documents/ReportOnReportsII.cfm>.
- *How Students Learn*, a 2005 NRC report on effective teaching mechanisms (emphasizes the importance of teaching subject matter in depth, eliciting and working with students' preexisting knowledge, and helping students develop the skills of self-monitoring and reflection). <http://www.nap.edu/books/0309074339/html/>
- *Invention and Impact: Building Excellence in Undergraduate Science, Technology, Engineering and Mathematics Education*, a 2004 report from an AAAS organized meeting of CCLI active faculty describing some of the successful efforts supported by the CCLI program and its predecessors (the Course and Curriculum Development (CCD), Instruction and Laboratory Improvement (ILI), and Undergraduate Faculty Enhancement (UFE) programs). http://www.aaas.org/publications/books_reports/CCLI
- *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, Committee on Science, Engineering, and Public Policy*, a 2007 National Academies Press publication. http://www.nap.edu/catalog.php?record_id=11463
- National Academies, National Research Council Board On Science Education. June 30 & October 13 & 14, 2008. Evidence on Promising Practices in Undergraduate Science, Technology, Engineering, and Mathematics (STEM) Education. (http://www7.nationalacademies.org/bose/Promising%20Practices_Homepage.html)
- National Center for Education Statistics. July 2009. *Stats in Brief: Students who study science, technology, engineering, and mathematics (STEM) in Postsecondary Education*
- National Science Board. 2010. *Science and Engineering Indicators 2010*. Arlington, VA: National Science Foundation (NSF 10-01).
- National Science Board. 2010. *Key Science and Engineering Indicator: 2010 Digest*. Arlington, VA: National Science Foundation (NSF 10-02) www.nsf.gov/statistics/digest/
- *Inventions and Impact 2: Building Excellence in Undergraduate Science, Technology, Engineering, and Mathematics (STEM) Education*, a 2008 report from an AAAS organized meeting of CCLI active faculty describing some of the successful effort supported by the CCLI program (http://archives.aaas.org/publications.php?pub_id=1126)
- Labov, J.B., Singer, S.R., George, M.D., Schweingruber, H.A. & Hilton, M.L. (2009). Effective Practices in Undergraduate STEM Education Part 1: Examining the Evidence. *CBE - Life Sciences Education*, 8, pp. 157-161.

E. PROGRAM EVALUATION

The Division of Undergraduate Education (DUE) conducts an on-going program evaluation to determine how effectively the TUES Program and its predecessors are achieving their goals: to stimulate, disseminate, and institutionalize innovative developments in STEM education through the production of knowledge and the improvement of practice. In particular, the program seeks to understand how effectively its projects are using current learning models in developing their innovations, contributing to knowledge on STEM education, and building a community of scholars in undergraduate STEM education. In addition to project-specific evaluations, all funded projects will be expected to cooperate with this third party program evaluation and respond to all inquiries, including requests to participate in surveys, interviews and other approaches for collecting data needed to evaluate the TUES Program and its predecessors.

III. AWARD INFORMATION

NSF anticipates having \$35.8 million through this solicitation for new TUES awards and ongoing CCLI awards, pending the availability of funds. The awards will be made as standard or continuing grants for Type 1-3 projects and as grants or cooperative agreements for TUES Central Resource projects. The number and size of awards will depend on the quality of the proposals received and the availability of funds. Total project budgets encompass all project years. The proposal budget must be commensurate with the project and thoroughly justified in the proposal. The expected number of awards, and duration and range of total NSF/DUE support over the lifetime of a TUES project, including indirect costs, are as follows:

- Type 1 Projects – 70 to 75 awards expected, each with a duration of 2 to 3 years. The total budget may not exceed \$200,000 (\$250,000 when four-year colleges and universities collaborate with two-year colleges).
- Type 2 Projects – 20 to 25 awards expected, each with a duration of 2 to 4 years and a budget that fits the scope of the project. It is expected that the total budget for the majority of awards will be \$300,000 to \$600,000. The total budget may not exceed \$600,000.
- Type 3 Projects – 3 to 5 awards expected, each with a duration of 3 to 5 years and a budget that fits the scope of the project. It is expected that the total budget for the majority of these awards will be \$1,000,000 to \$5,000,000. The total budget may not exceed \$5,000,000.
- TUES Central Resource Projects – 1 to 3 awards expected, each with a budget and duration that fits the scope of the project. For example, small focused faculty professional development workshop projects will have a duration of 1 to 2 years with a total budget up to \$100,000; large scale projects will have a duration of 3 to 5 years with a total budget of \$300,000 to \$3,000,000. The total budget may not exceed \$3,000,000.

For collaborative projects, these limits apply to the total project budget.

IV. ELIGIBILITY INFORMATION

Organization Limit:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the

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.

Additional Full Proposal Instructions:

The following information supplements the GPG:

- Proposers should make sure that their proposals respond to the list of questions provided both in the general review criteria and in the additional program-specific review criteria in Section VI.A below. They should review the discussion of the components, types, and important features in Section II above. Additional information on writing proposals can be found in "A Guide for Proposal Writing" http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04016.
- Principal Investigators are strongly encouraged to match their proposed budgets carefully to the scope and scale of a project. Excessive or poorly justified budgets indicate that the project is not well designed.
- Principal Investigators are strongly encouraged to take advantage of the National STEM Distributed Learning (NSDL) resources for project dissemination. This involves contributing metadata about project sites and individual resources. Guidelines for contribution may be found at <http://nsdl.org/contribute>. NSDL resources also offer an array of technology tools and community support services that may be of utility to TUES projects, including resource cataloging and collection management tools, as well as group workspaces and collaboration, outreach, and professional development opportunities. Inquiries may be submitted via <http://nsdl.org/about/contactus>. PIs may want to include funds in their budgets to cover required cataloging/metadata and/or software engineering expertise. They should contact the NSDL portal directly (<http://nsdl.org/about/contactus/>) to obtain more specific guidance on cost estimates for collection building and contribution to NSDL resources.
- All proposals must comply with the section of the GPG on Proposals Involving Human Subjects (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg). The proposer should mark the Human Subjects box on the cover sheet and then indicate whether the proposed project is exempt, approved, or pending. THE PROCESS IS PENDING IF THE IRB HAS NOT YET APPROVED A SUBMITTED APPLICATION OR IF THE PROPOSER HAS NOT YET SUBMITTED AN APPLICATION. THIS SECTION SHOULD NOT BE LEFT BLANK.
- While all material relevant to determining the quality of the proposed work must be included within the 15-page Project Description or as part of the budget justification, proposers may, as a part of the Supplementary Documentation, include letters showing collaborator commitments and organizational endorsement. In addition, for those projects whose deliverables include a final product, samples of these products (such as excerpts from book chapters, assessment tools, screen shots of software, sample teaching modules and other project deliverables) may be placed within the Supplementary Documentation section. These sample materials should be concise and relevant.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

Other Budgetary Limitations:

- 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.

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;
- vehicles, routine laboratory furnishings such as refrigerators and simple balances, 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 multicomponent instruments--which is an allowable charge).

C. Due Dates

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

May 26, 2010

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 27, 2010

For Type 1 proposals from submitting organizations located in states or territories beginning with N through W.

January 14, 2011

For Type 2 and 3 proposals and for TUES Central Resource Project proposals. However, TUES Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

May 26, 2011

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 27, 2011

For Type 1 proposals from submitting organizations located in states or territories beginning with N through W.

January 13, 2012

For Type 2 and 3 proposals and for TUES Central Resource Project proposals. However, TUES Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

May 28, 2012

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 29, 2012

For Type 1 proposals from submitting organizations located in states or territories beginning with N through W.

January 14, 2013

For Type 2 and 3 proposals and for TUES Central Resource Project proposals. However, TUES Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

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

In reviewing TUES proposals, the standard criteria will be expanded to include the following additional review criteria as appropriate to the type and main component of the proposed work:

Intellectual Merit: Will the project produce exemplary material, processes, or models that enhance student learning and can be adapted easily by other sites? Will evaluation and research projects yield important findings related to student learning? Does the project build on existing knowledge about STEM education? Are appropriate expected measurable outcomes explicitly stated and are they integrated into an evaluation plan? Is the evaluation effort likely to produce useful information? Are the plans for institutionalizing the approach at the investigator's college or university appropriate?

Broader Impacts: Does the project involve a significant effort to facilitate adaptation at other sites? Will the project contribute to the understanding of STEM education? Will the project help build the STEM education community? Will the project have a broad impact on STEM education in an area of recognized need or opportunity? Does the project have the potential to contribute to a paradigm shift in undergraduate STEM education?

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.

In addition, PIs of TUES grants will also be expected to cooperate with data collection associated with the TUES program evaluation conducted by a third party organization supported by NSF.

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:

- Don L. Millard, Lead Program Director, 835 N, telephone: (703) 292-4620, email: dmillard@nsf.gov
- Myles Boylan, 835 N, telephone: (703) 292-4617, email: mboylan@nsf.gov

- Susan Finger, Program Director, 835 N, telephone: (703) 292-4639, email: sfinger@nsf.gov
- Terry Woodin, 835 N, telephone: (703) 292-4657, email: twoodin@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@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.

Proposers are encouraged to contact a DUE Program Director in their discipline:

Biological Sciences

- V. Celeste Carter, Program Director, telephone: (703)292-4651, email: vccarter@nsf.gov
- Kathleen Bergin, Program Director, telephone: (703)292-5171, email: kbergin@nsf.gov
- William Grisham, Program Director, telephone: (703)292-2260, email: wgrisham@nsf.gov
- Jose Herrera, Program Director, telephone: (703)-292-5128, email: jherrera@nsf.gov
- Joan Prival, Program Director, telephone: (703)292-4635, email: jprival@nsf.gov
- Terry Woodin, Program Director, telephone: (703)292-4657, email: twoodin@nsf.gov

Chemistry

- David Brown, Program Director, telephone: (703)292-8831, email: drbrown@nsf.gov
- Joseph Grabowski, Program Director, telephone: (703)292-4653, email: jgrabows@nsf.gov
- Herbert Richtol, Program Director, telephone: (703)292-4648, email: hrichtol@nsf.gov

Computer Science

- Guy-Alain Amoussou, Program Director, telephone: (703)292-8670, email: gamousso@nsf.gov
- Jane Prey, Program Director, telephone: (703)292-4629, email: jprey@nsf.gov
- Victor Piotrowski, Program Director, telephone: (703)292-5141, email: vpiotrow@nsf.gov
- Suzanne Westbrook, Program Director, telephone: (703)292-4640, email: swestbro@nsf.gov

Engineering

- Maura Borrego, Program Director, telephone: (703)292-7855, email: mborrego@nsf.gov
- Louis Everett, Program Director, telephone: (703)292-4645, email: leverett@nsf.gov
- Susan Finger, Program Director, telephone: (703)292-4639, email: sfinger@nsf.gov
- Amy Chan Hilton, Program Director, telephone: (703)292-4623, email: achanhil@nsf.gov
- Don Millard, Program Director, telephone: (703)292-4620, email: dmillard@nsf.gov
- John Yu, Program Director, telephone: (703)292-4647, email: zyu@nsf.gov

Geological Sciences

- Peter Lea, Program Director, telephone: (703)292-4643, email: plea@nsf.gov

Interdisciplinary

- Corby Hovis, Program Director, telephone: (703)292-4625, email: chovis@nsf.gov
- Herbert Richtol, Program Director, telephone: (703)292-4648, email: hrichtol@nsf.gov

Mathematics

- Ron Buckmire, Program Director, telephone: (703)292-5323, email: rbuckmir@nsf.gov
- Michael Jacobson, Program Director, telephone: (703)292-4641, email: [mjacobso@nsf.gov](mailto:mjacobs@nsf.gov)
- Lee Zia, Program Director, telephone: (703)292-5140, email: lzia@nsf.gov

Physics / Astronomy

- Joyce Evans, Program Director, telephone: (703)292-5098, email: jevans@nsf.gov
- Duncan McBride, Program Director, telephone: (703)292-4630, email: dmcbride@nsf.gov
- Gary White, Program Director, telephone: (703)292-4618, email: gwhite@nsf.gov

Research / Assessment

- Connie Della-Piana, Program Director, telephone: (703)292-5309, email: cdellapi@nsf.gov

Social Sciences

- Myles Boylan, Program Director, telephone: (703)292-4617, email: mboylan@nsf.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>.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

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.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

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