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National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL)

Program Solicitation

NSF 04-542

Replaces Document NSF 03-530



National Science Foundation

Directorate for Education and Human Resources

Division of Undergraduate Education

Letter of Intent Due Date(s) (*optional*):

March 14, 2004

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

April 14, 2004

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL)

Synopsis of Program:

Building on work supported under the multi-agency Digital Libraries Initiative, this program aims to establish a national digital library that will constitute an online network of learning environments and resources for science, technology, engineering, and mathematics (STEM) education at all levels. In FY2004, the program will accept proposals in three tracks: (1) *Pathways* projects are expected to provide stewardship for the content and services needed by major communities of learners. (2) *Services* projects are expected to develop services which support users, collection providers, and the Core Integration effort and which enhance the impact, efficiency, and value of the library. (3) *Targeted Research* projects are expected to explore specific topics that have immediate applicability to collections, services, and other aspects of the development of the digital library.

Cognizant Program Officer(s):

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

- 47.076 --- Education and Human Resources

Eligibility Information

- **Organization Limit:** None Specified.
- **PI Eligibility Limit:** An individual may serve as the Principal Investigator (PI) on no more than one proposal, including collaborative proposals, submitted in the FY2004 competition, but may serve as a co-PI on multiple proposals.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant or Cooperative Agreement
- **Estimated Number of Awards:** 30
- **Anticipated Funding Amount:** \$11,500,000 (approximately) in FY2004, subject to the availability of funds

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is optional. Please see the full text of this solicitation for further information.
- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

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

C. Due Dates

- **Letters of Intent (*optional*):**
March 14, 2004
- **Full Proposal Deadline Date(s)** (due by 5 p.m. proposer's local time):
April 14, 2004

Proposal Review Information

- **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:** Standard NSF reporting requirements apply.

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I. INTRODUCTION

The **National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL)** program seeks to create, develop, and sustain a national digital library supporting science, technology, engineering, and mathematics (STEM) education. Collectively, its projects form a network of STEM learning environments and resources. The resulting digital library is intended ultimately to meet the needs of students and teachers at all levels -- pre-K to 12, undergraduate, graduate, and lifelong learning. It will serve both the individual learner seeking understanding and groups of learners engaged in collaborative exploration of concepts; and it will support formal and informal modes of learning.

The NSDL (<http://www.nsd.org>) will provide the premier path to a rich array of current and future high-quality STEM educational content and services, and also function as a forum where resource users may become resource providers. For example, users might contribute their expertise to produce new teaching modules from resources such as real-time experimental data or visualization software available through the network. Or they might evaluate and report on improvements to student learning due to specific digital learning objects (such as images, Java applet simulations, Flash animations, or interactive electronic notebook modules).

In addition to services such as customized retrieval of relevant information, indexing and online annotation of resources, and archiving of materials, the digital library will offer users access to virtual collaborative work areas, tools for analysis and visualization, remote instrumentation and/or observation platforms, large databases of real-time or archived data, simulated or virtual environments, and other new capabilities as they emerge. The digital library will enable the dynamic use of these materials and tools that are supplied by cooperating providers of resource collections and services. For example, relatively small self-contained digital components that capture both geometry and behavior can be combined to model more complex scientific and engineering phenomena. More specifically, component models of transportation subsystems from one site might interoperate with structural and geotechnical models from other collections to simulate dynamic loading within a complex bridge and tunnel environment. Numerically generated data from a computational model at yet another site could then be compared to data from physical observations obtained via access to remote instrumentation. The learning environment of the digital library will thus increase the impact and accessibility of all resources, by giving users tools to search for and discover content, to assemble curricular and learning modules from component pieces in a flexible manner, and to communicate and collaborate with others.

Through its distributed digital library building strategy, the NSDL program is fostering the creation and development of a comprehensive cyberlearning infrastructure. Features include practices and policies for community-based review and other mechanisms that assure the quality and usability of resources. Likewise, practices and policies are under development for collections management issues such as archiving, preservation, and deaccessioning. Other aspects of this infrastructure address: i) digital rights management systems, ii) effective ways to handle intellectual property issues that focus on maximizing the value of content, iii) the articulation of standards that promote stability, interoperability, and reusability of a wide variety of learning objects, and iv) login and authentication systems. For a list of all NSDL projects with links to abstracts see <http://www.ehr.nsf.gov/ehr/du/awards/nsdl.xls>. Each abstract also has contact information for the project's principal investigators. A summary of program developments is available at <http://www.ehr.nsf.gov/ehr/du/programs/nsdl/NSDL-summary.asp>. To follow the current state of collaborations within the growing NSDL community and to join the ongoing exploration and discussion of key issues, see the NSDL Communications portal for developers at <http://comm.nsdl.org>. The list of NSDL Groups at this site organizes the workspaces into three sections: Library Building, Committees, and Task Forces. Covered areas include, Accessibility and Diversity, Communities of Practice, Community Services, Content, Educational Impact, K-12, Publishers, Technology, and Sustainability.

This program builds on work supported under the multi-agency Digital Libraries Initiative (DLI) Phase I and Phase II (see <http://www.dli2.nsf.gov>). The program is intended to multiply the impact of efforts supported by NSF and sister government agencies, the private sector, professional societies, and others working to improve education in science, technology, engineering, and mathematics nationwide. New NSDL projects are expected to coordinate their work with those of current NSDL projects and other educational digital library projects, such as the U.S. Department of Education's Gateway to Educational Materials (<http://www.thegateway.org>) or projects supported by the Institute of Museum and Library Services (<http://www.imls.gov>). The impact of the NSDL program will depend largely on how well funded projects can leverage related efforts and demonstrate value to significant audiences so as to achieve sustainability after the period of NSF funding.

The concept of a national digital library for STEM educational resources has been developed through a series of workshops and related publications supported by NSF (see <http://www.ehr.nsf.gov/ehr/du/programs/nsdl/reports.asp>). Further information may be found at <http://www.ehr.nsf.gov/ehr/du/programs/nsdl/>, including links to abstracts of current and previous projects. It is important that new NSDL proposals be well informed about and distinguished from relevant activities already funded under DLI and the NSDL program.

Although the purpose of the NSDL program is to support improvements in STEM education in the United States, the impact of the program has an increasingly important international dimension. Conversely, international digital library efforts may help achieve the goals of the NSDL program. Consequently, proposals to this program may be part of a larger effort that includes international elements funded by sources in this or other countries. (See <http://www.dli2.nsf.gov/intl.html> for further reference to potential international aspects.)

II. PROGRAM DESCRIPTION

In recent years, innovative projects supported by NSF and many other organizations have developed numerous examples of rich, learner-centered educational materials and environments. Features include the use of sophisticated graphics tools for animation and visualization of scientific, engineering, and mathematical concepts; computational tools for modeling and simulation; remote access to scientific equipment; analysis of large, real-time or archived data sets; and network-supported collaboration. During this time the World Wide Web has shown great potential for supporting and enabling access to the very best of these new learning materials and environments. The highly linked, dynamic information architecture of the Web mirrors the interconnected nature of knowledge, promotes the integration of research and education, enables the inclusion of new high-quality materials and practices, and encourages learners to become active participants in expanding their educational experience. More recently, advances in grid and mobile Internet technologies are challenging the traditional social constructs and contexts of learning.

However, the many Web-based collections of resources and other educational material do exhibit shortcomings. For example, from a lengthy list of links it is often difficult to determine how appropriate an individual item is for a particular learner's needs. When resources are located, they can exhibit uneven reliability or stability particularly if they incorporate additional software elements for animations, audio, or video. Furthermore, interoperability and reusability of learning resources are more promise than reality; and the construction of new learning objects with executable content from "building block" component pieces (e.g., Java applets or application software macros) demands additional coordination requirements for seamless performance.

Through the NSDL program, NSF seeks to enable the discovery, collection, organization, and delivery of quality learning and teaching resources appropriate for educators and learners at all levels. The resulting network of learning environments and resources will be managed actively to promote reliable "anytime, anywhere" access to content and services. In particular, the digital library should provide reusable, shareable, and interoperable resources that enable learners at all levels to access and use materials suited to their needs, both within and across traditional STEM disciplinary boundaries. Such materials should also include assessment and evaluation tools and findings, and should harness new understandings about pedagogy and the processes of learning that are founded on a solid research base. The collections, services, and core infrastructure of NSDL (<http://www.nsd.org>) will facilitate the development and dissemination of both new and tested materials and methods, thereby promoting continual improvements in STEM education at all levels.

To realize this vision, the NSDL program is currently supporting projects focused on development of collections, implementation of digital library services, and a small set of targeted research investigations. In addition, the program supports a Core Integration activity that coordinates distributed resource collection and service providers to ensure reliable and extensible access to and usability of the resulting network of learning environments and resources. For more details see a summary of the current state of development at <http://www.ehr.nsf.gov/ehr/duel/programs/nsdl/NSDL-summary.asp>. To follow the activities and online discussions within the current community of NSDL collection and service developers, see the NSDL Communication Portal at <http://comm.nsd.org>. A list of all projects funded by the NSDL program with links to abstracts is available in spreadsheet form at <http://www.ehr.nsf.gov/ehr/duel/awards/nsdl.xls>. Each abstract also has contact information for the project's principal investigators.

These efforts are distinct from original content development supported by other NSF programs such as the Course, Curriculum, and Laboratory Improvement program, the Instructional Materials Development program, and similar curriculum and materials development programs funded by NSF or other agencies. NSDL projects start from the assumption that materials, resources, modules, and other digital learning objects are already available. Similarly, proposals that are primarily digitization or conversion projects are not appropriate for the NSDL program. Prospective proposers who have questions are encouraged to contact the NSDL program at due-nsdl-program@nsf.gov.

The NSDL architecture supports several metadata record formats, with Dublin Core recommended at a minimum, see <http://dublincore.org/>. All new and continuing content contributors are expected to supply records for harvesting via the Open Archives Initiative (OAI) protocol, see <http://www.openarchives.org/OAI/openarchivesprotocol.html>. To help provide better educational context for NSDL users, item-level metadata should include information corresponding to *Audience* and *educationLevel* (the elements in Dublin Core) and developers should use a currently available controlled vocabulary for *Subject* or be willing to expose their vocabulary publicly. For K-12 focused collections, it is recommended that, where possible, resources be correlated to state or national standards and that information be mapped to the *conformsTo*

refinement for *Relation* in Dublin Core. Finally, since Qualified Dublin Core carries this information most effectively, it is recommended that projects expose Qualified Dublin Core for harvesting via OAI in addition to the OAI mandated Simple Dublin Core. The NSDL Metadata Primer (<http://metamanagement.comm.nsd.org/outline.html>) and the Institute of Museum and Library Services document, "A Framework of Guidance for Building Good Digital Collections," (<http://www.ims.gov/pubs/forumframework.htm>) both provide additional information.

In FY2004, the NSDL program will accept proposals in three tracks: (1) **Pathways**, (2) **Services**, and (3) **Targeted Research**. These tracks are described below. Projects may have features that address more than one track. For expected award amounts, duration, and anticipated numbers of awards in the three tracks, see Section IV ("AWARD INFORMATION") below. Partnerships or collaborations are strongly encouraged among digital library stakeholders, such as pre-K to 12 schools, two-year colleges, four-year colleges, universities, professional societies, public or community libraries, museums, industrial and business concerns (including commercial publishers), and other non-profit and for-profit organizations.

Proposals for pathways and services should describe prospects for continuing to make project capabilities available beyond the period of NSF funding. This description should include a long-term management plan, and proposed projects should have a tangible, long-term commitment from a stable organization. Cost recovery and for profit models are welcome. Sustainability is also often fostered through partnerships involving academic, business, government, and other organizations. The evaluation of a project's long-term management plan will be strongly informed by the goal of making the full library's resources available to potential users at a cost that will not limit their use.

The success of the NSDL program will depend, to a large extent, on the development of a collective sense of identity and common cause by all the projects. New awardees are expected to collaborate with one another and with previously funded projects, particularly the Core Integration effort. Likewise, the Core Integration effort has been charged to work with new and existing projects to cooperatively develop technical standards and organizational processes for including resource collections and services in the network. NSF expects that the results and approaches of projects in the Pathways, Services, and Targeted Research tracks will influence the tasks of the Core Integration effort and how they are accomplished throughout the duration of the NSDL program and beyond. To facilitate interaction and establish linkages, regular Principal Investigator (PI) meetings and workshops are held throughout the course of the NSDL program. Representatives of related projects not funded by the NSDL program may also be invited to these meetings.

Prospective applicants are strongly encouraged to follow the current state of collaborations within the growing NSDL community and to join the ongoing exploration and discussion of key issues, see the NSDL Communications portal for developers at <http://comm.nsd.org>. The list of NSDL Groups at this site is organized into three sections covering Library Building, Committees, and Task Forces. Workspaces include: Accessibility and Diversity, Communities of Practice, Community Services, Content, Educational Impact, K-12, Publishers, Technology, and Sustainability. Threaded and archived mailing lists are provided along with links to relevant technical documents and white papers. An early stage, operational digital library is also now available for use (<http://www.nsd.org>). New releases and updates are planned over the next several years to expand and enhance the evolving digital library's services and impact.

Pathways Track

A project supported in this track will assume a stewardship role for the educational content and/or the services needed by a broad community of learners. Projects will typically aggregate the efforts of existing resource providers that fall within the needs of the community that is targeted. Responsibilities include: maintaining criteria and mechanisms to identify, select, annotate, and generate metadata for high-quality and relevant digital content as it continues to become available; providing all item-level metadata to the NSDL core metadata repository; sustaining the currency of the aggregated educational resources, either by acquiring/linking, or deaccessioning; active archiving that preserves the usability of digital content as the underlying information technology systems evolve; and anticipating and providing value-added services that may be specific to the targeted learning community. Furthermore, it should be evident that the resources under stewardship support the very best STEM education that is inquiry-driven, active, and engaging.

Potential audiences include: the users of subjects and concepts within a broad STEM domain; the educational community associated with a grade band; or users and providers of professional expertise in areas such as assessment or evaluation.

Proposals to address audiences formed by the intersection and/or combination of the preceding examples are also possible, as well as proposals that identify other broad audiences defined by a coherent set of content and user needs. In all cases projects should indicate clearly the attributes of the audience(s) being targeted and the most pressing needs and areas of stewardship to be addressed.

Pathways providers are expected to marry the potential of information technology advances and digital library research with the best practices of human expertise to fulfill their stewardship responsibilities. It is anticipated that projects will primarily adapt and implement existing services and approaches, rather than develop new technologies. Opportunities to leverage technologies across the projects will be particularly important to exploit. Evaluation of the effectiveness of the project in carrying out its stewardship role should be informed by the degree to which users can consistently find appropriate pathways or connections to the resources that meet their specific learning needs. Moreover, a project's stewardship should contribute to the overall value of NSDL, as it serves to facilitate the development and dissemination of both new and tested materials and methods supporting continued improvements in STEM education.

Projects in this track are expected to cooperate closely, and to coordinate their collective work with the NSDL core integration effort. Furthermore, they are expected to participate with other NSDL projects in the continued development and adoption of basic standards for interoperability, reusability, reliability, and stability of resources and services. It is important that proposals provide evidence of familiarity with and understanding of the current state of development of NSDL. In addition, proposers should describe the expertise and experience that will be brought to bear on the effort and how the project will interoperate with the NSDL core integration activity.

Services Track

This track supports projects to increase the impact, reach, efficiency, and value of the digital library in its fully operational form. Services that will have a broad impact across an array of other NSDL projects are particularly encouraged. To understand the present state and level of NSDL services and to place their proposed efforts within the needs of the larger NSDL community of users, prospective applicants in this track should review the current set of NSDL Services projects at <http://www.ehr.nsf.gov/ehr/duel/awards/nsdl.xls>. Projects that propose to use a web services framework should expect to provide web service definitions (e.g. WSDL) and appropriate web service interfaces (e.g. SOAP or REST) to aid in service discovery and use.

In FY2004 the NSDL program is particularly interested in encouraging two specific types of services proposals: 1) Selection services, and 2) Usage development workshops. However, other types of services may also be proposed and examples are described below.

Selection services

The aim of this type of services project is to increase the amount of high-quality STEM educational content known to NSDL. These resources may vary from individual learning object items such as images or simulation applets to an entire set of digital content available as a web site. A project in this track is expected to use existing criteria and mechanisms for identifying and selecting content within a particular domain. Similarly, projects that seek primarily to develop new technology are not appropriate. While such processes do not necessarily have to be associated with expanding existing NSDL projects, it would be important for proposals to demonstrate familiarity with these efforts. Selection services providers would also be expected to coordinate their efforts with new projects in the Pathways track once the funding period commences.

The selection process assumes that materials, resources, modules, and other digital learning objects are already in existence. The task of the selection services provider is to select and tag this content, with placement of the associated item-level metadata into the NSDL central metadata repository and, as appropriate, other repositories. Building on these selection efforts, other providers may then develop and offer more extensive and value-added annotation and review of the suitability of the digital resources for particular user audiences. Furthermore, support for personalization of finding aids and other discovery tools is enabled.

Usage development workshops

These projects will support workshop series that promote the use of NSDL and its resources by various communities of learners. Examples of possible workshop emphases include development of leadership teams of faculty and librarians seeking joint expertise in the use of digital libraries that would in turn be shared with a local institutional or organizational audience; or assistance for teachers and students at K-12 schools or colleges having limited computer capability and technical support; or experiences to increase the library's usability for special populations such as young children or other users having limited experience with computer technology; or engagement of users of digital resources within a specific STEM domain.

Simultaneous with the development of a user base for NSDL the workshops will permit the study of user information-seeking behavior and user interaction with specific NSDL content. Projects should report feedback from these observations to guide further development of NSDL. Workshops should seek to improve both the capacity of individual users and the capacity of the larger community of learners. Such capacity would inform research on building and sustaining user communities within the context of the digital library, and research on uses of digital libraries to improve learning by students at all levels.

While it is expected that the majority of funds in project budgets will be directed towards participant support costs, development of resources to be used by workshop participants may be requested. In all cases such materials should be made available via NSDL for use in subsequent workshops or by interested individuals or groups seeking to develop an understanding of the capabilities of NSDL. Furthermore, any materials and other resources developed by workshop participants should be suitably described with appropriate metadata and contributed to NSDL. Projects are expected to provide models for how their approaches can be applied to other learning communities sharing similar characteristics.

Other services

Services supporting *users* might include:

- synchronous and asynchronous mechanisms to exploit collaborative learning environments using shared resources;
- mechanisms to help content developers combine resources by different authors and from different collections; and
- "push" or "pull" processes that present users with specialized content.

Services supporting existing *collection providers* or *Pathways projects* might include:

- reliability and/or interoperability testing across different platforms for Java applets or other software-based resources ;
- "middleware" to support acquisition and incorporation of content from different sources;
- audio, image, and video search capabilities;
- mechanisms to associate commentary and other annotations with resources; and
- methods to determine usage patterns to inform design and evaluation of the collection.

Services supporting the *Core Integration* effort might include:

- specialized content-based searching;
- maintenance of personal user profile systems that respect privacy issues;
- provision of user reports and other commentary associated with content;
- community feedback mechanisms; and
- development and analysis of digital library evaluation metrics.

As in the Pathways track, Service track projects are expected to cooperate closely, both among themselves and with the core integration activity.

Targeted Research Track

Projects supported in this track should have direct applicability to one or both of the other two tracks or to the core integration

activity. Additionally, they may explore other aspects of NSDL including its impact on educational practice, changes in user behavior, and development of new learning environments. Examples include, but are not limited to:

- automated annotation of audio, image, or video resources;
- user interface implementation issues;
- identification and usage of principles of information architecture design;
- use of expert system principles to capture human librarians' experience, knowledge, and practice;
- research on hybrid systems that marry human and automated expertise to provide user services; and
- applications of simulation or virtual world technology for virtual assistants.

Proposals for basic digital library research or basic research in the use of technology in education may be supported by the multi-agency Digital Libraries Initiative (<http://www.dli2.nsf.gov>), the Information Technology Research (ITR) program (<http://www.itr.nsf.gov>), or other programs. In addition, programs such as Research on Learning and Education (<http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf03542>), emerging opportunities within the Science of Learning Centers program (<http://www.nsf.gov/home/crssprgm/slc/>), and the Human and Social Dynamics priority area (<http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf03552>) may support investigations that are relevant to NSDL's development. Prospective proposers are encouraged to contact the NSDL program at due-nsdl-program@nsf.gov if they have questions about the match between their interests and the goals of NSDL versus these related programs.

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the *Grant Proposal Guide* (see [Chapter I, Section C](#)) are eligible to submit proposals under this program solicitation. An individual may serve as the Principal Investigator (PI) on no more than one proposal, including collaborative proposals, submitted in the FY2004 competition, but may serve as a co-PI on multiple proposals.

IV. AWARD INFORMATION

NSF anticipates that approximately \$11.5 million will be available in FY2004 for awards made through this solicitation. The program expects to make approximately 30 awards, depending on the quality of proposals received. The anticipated distribution of awards in the program's three tracks is as follows:

- *Pathways*: 3 to 4 new awards, up to \$3,000,000 each;
- *Services (Selections)*: 4 to 6 new awards, up to \$1,000,000 each;
- *Services (Workshops)*: 4 to 6 new awards, up to \$750,000 each;
- *Services (Other)*: 6 to 8 new awards, up to \$750,000 each;
- *Targeted Research*: 4 to 6 new awards, up to \$500,000 each.

Awards in the Pathways track may have a duration of up to 48 months and will be made as cooperative agreements. Awards in the remaining tracks may have a duration of up to 36 months and will be made as standard or continuing grants as appropriate. The estimated program budget, number of awards, and average award size and duration are subject to the availability of funds.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (optional):

A brief letter of intent (sent via e-mail to due-nsdl-program@nsf.gov) is requested, but not required, by March 14, 2004. Please use "NSDL Letter of Intent" as the Subject line. Please provide the name of the Principal Investigator and the submitting organization, and indicate clearly the track of the program that the prospective proposal will address.

Full Proposal Instructions:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Website at: <http://www.nsf.gov/cgi-bin/getpub?gpg>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

FastLane (<http://www.fastlane.nsf.gov>), NSF's system for conducting business over the Internet, must be used to prepare and submit proposals. Paper proposals will not be accepted. Proposers should carefully follow the detailed instructions (<http://www.fastlane.nsf.gov/a1/newstan.htm>) on the FastLane Web site. PIs who have not used FastLane before are reminded to make sure that their organization is a registered FastLane organization (see <http://www.fastlane.nsf.gov/a0/about/registration.htm>) and to contact the organization's Sponsored Research Office (SRO) to be added to the NSF PI database. (All co-PIs listed in the proposal must also be in the NSF PI database.) PIs who intend to use subawards in their proposal (see GPG, Chapter II, Section C.2.g.vi(e)) are reminded that the subawardee organization(s) must also have an NSF Institution ID Number (or be a registered FastLane organization) before FastLane can be used to prepare the subaward budget(s). *New FastLane users should acquaint themselves with the system as early as possible--well before the proposal deadline.*

For full information about the NSF Proposal Review process including a discussion of the two NSF merit review criteria, *Intellectual Merit* and *Broader Impacts*, see section VI of this solicitation. Proposers are reminded that they must address both merit review criteria in separate statements within the one-page Project Summary in accordance with Chapter II, Section C.2.b of the GPG.

The Project Description contains most of the information that determines whether or not a proposal is funded. Project descriptions should include:

- **Statement of Need.** For *Pathways* projects describe clearly the stewardship needs for the educational resources and services of the community of learners being addressed. Likewise for *Selection services* projects what content areas are being expanded or enhanced and why? For *Usage development workshops* what are the particular user needs of the anticipated participants and why are these critical to NSDL? For other services or targeted research projects, state clearly the demand for the proposed service, or the problems or issues being researched.
- **Target Audience.** Describe clearly the community or communities of learners whose needs will be addressed by the project. What aspect(s) of the user's experience with NSDL will be enhanced and/or extended by the project outcomes? For targeted research what is the context, and what users will be affected and how? What is the setting of the project: informal or formal education, life-long learning, and why is this vital to NSDL?
- **Project Goals.** State the overall goals and objectives for the project and how progress towards these goals and objectives will be assessed.
- **Project Design.** Describe the overall approach and components of the project. How will the intended learners use the resources or services? How will the understanding gained from targeted research enhance the digital library's operation or its impact on learners? Where appropriate, applicants are strongly encouraged to provide links to examples or a prototype web site that illustrate any proposed functionality.
- **Key Staff.** Provide a description of the roles, responsibilities, and qualifications of key personnel, consultants, and/or advisors. These should be tied to major project goals and objectives.
- **Timeline.** Where appropriate, include a timeline for development indicating major points of progress that are expected.
- **Dissemination.** Describe, as appropriate, how the outcomes and lessons learned from the project will be communicated broadly.
- **Evaluation.** Describe, as appropriate, the plans for evaluation, including the name and qualifications of any evaluator

(s). Information about the evaluation strategy, process, and methods should also be provided. What evidence will be sought to inform the progress towards project goals and why is this of value?

- **Sustainability.** For *Pathways* and *Services* projects, describe the plans to promote and sustain the project beyond the grant period.

In preparing this narrative, proposers should ensure that both the intellectual merit and broader impacts of the project are addressed equally.

A Project Data Form must be submitted (via FastLane) as part of all proposals. The information on this form is used to direct proposals to appropriate reviewers and to determine the characteristics of projects supported by the Division of Undergraduate Education. In FastLane, this 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. Take special care to identify the proper track for your proposal in Item 1 of the form.

A Budget Justification of up to three pages *must* accompany the budget forms and provide details about budget line items. Proposals that involve subawards should include a Budget Justification of up to three pages for each subawardee organization.

If Special Information or Supplementary Documentation is included with the proposal (see [GPG, Chapter II, Section C.2.j](#)), this section should be submitted as one or more PDF files using FastLane's "Supplementary Documents" function. (Paper documents should be electronically scanned and converted to PDF.) This optional section may include *only* the sorts of items listed in the GPG.

Organizations intending to submit simultaneous Collaborative Proposals (as described in [GPG, Chapter II, Section D.3](#)) must alert an NSDL program officer by e-mail (due-nsdl-program@nsf.gov) prior to the submission and must follow the instructions for electronic submission specified in [GPG, Chapter II, Section D.3.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 anticipated individual award sizes specified for the program's three tracks in Section IV ("AWARD INFORMATION") above. These simultaneous Collaborative Proposals will be treated as a single proposal (with a single Project Summary, Project Description, and References Cited) during the review process.

Proposers are reminded to identify the program announcement/solicitation number (04-542) in the program announcement/solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

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

Other Budgetary Limitations:

Anticipated maximum award sizes for the program's three tracks are specified in Section IV ("AWARD INFORMATION") of the program solicitation.

C. Due Dates

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

Letters of Intent (*optional*):

March 14, 2004

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

April 14, 2004

D. FastLane Requirements

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

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

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

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

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

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

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

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

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

What is the intellectual merit of the proposed activity?

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

What are the broader impacts of the proposed activity?

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

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

Integration of Research and Education

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

Integrating Diversity into NSF Programs, Projects, and Activities

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

Additional Review Criteria:

Evaluation of NSDL proposals will also include consideration of:

- **Impact.** Is the need for the project convincingly argued? Does the project fill a definable gap for NSDL? Is the target audience clearly identified, and what is the potential for the project to make a significant impact on that audience? Does the potential exist for the project to model a particularly creative approach to the provision of digital library services or to the stewardship of a usable body of digital resources?
- **Plan.** Is there a sound implementation plan that links clear project goals and objectives to roles and responsibilities of project personnel? Does the project demonstrate an understanding of the current state of technical development of NSDL relevant to the proposed work, e.g. metadata harvesting protocols, standards for interoperability, or authentication protocols? Does the plan describe adequately how collaboration and integration with the ongoing activities of relevant grantees or other projects will be

accomplished? Where applicable, what is the potential for project capabilities to remain available beyond NSF support?

- **Personnel.** Does the project team represent an appropriate mix of expertise and experience to accomplish the project goals? What is the evidence of the commitment and involvement of senior personnel in the project and its activities? Are the roles of various other personnel clear? If there are project partners, contributors, or other collaborators, what is the nature and strength of their commitment?
- **Outcomes.** Does the project offer access to expanded or enhanced capabilities not previously available through NSDL? Or is the project enabling a new user audience to access NSDL? Can this serve as a model for other user audiences? Does the project have a reasonable plan to scale up this access? Where applicable, is the project providing an opportunity for a new sector of the educational community to take part in selecting or otherwise contributing to NSDL's collections or providing a service?
- **Contribution.** How will the project's activities complement and add value to the growing NSDL community of users and developers? Is there potential for the project to bring new perspectives and approaches to solutions related to shared issues of digital library development, e.g. needs and requirements of learners, new technical specifications, intellectual property concerns, or plans for sustainability? What is the potential for the project to engage new participants in achieving the goals of NSDL, e.g. business or industry, or the non-profit private sector?
- **Evaluation.** Where appropriate, has the project presented a reasonable plan to assess progress towards its goals and to evaluate the impact of the project on the intended audience? Are there innovative approaches proposed for evaluating learners' usage of networked digital resources? Do these have the potential to be applied in new settings, e.g. for resources in other disciplines, or for user audiences beyond that originally targeted by the project? If applicable, does the project offer an opportunity to understand the potential applicability to NSDL of new information technologies?

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals will be reviewed by a panel; however, panel review may be supplemented by mail review, if necessary .

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

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

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 202-7827 or by e-mail from pubs@nsf.gov.

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

C. Reporting Requirements

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

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

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

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- Dr. Lee L. Zia, Division of Undergraduate Education, telephone: 703-292-8671, email: lzia@nsf.gov

- Dr. Theodore W. Hodapp, Division of Undergraduate Education, telephone: 703-292-4640, email: thodapp@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188, email: fastlane@nsf.gov
- Ms. Antoinette Allen, Division of Undergraduate Education, telephone: 703-292-4646, email: duefl@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF *E-Bulletin*, which is updated daily on the NSF Website at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's *Custom News Service* (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become available.

The Division of Undergraduate Education has compiled a short list of other funding opportunities for undergraduate science, technology, engineering, and mathematics education, which can be found on the Web at http://www.ehr.nsf.gov/ehr/ue/links/other_programs.asp.

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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

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

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230

- **For General Information** (NSF Information Center): (703) 292-5111

- **TDD (for the hearing-impaired):** (703) 292-5090 or (800) 281-8749

- **To Order Publications or Forms:**

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

or telephone: (703) 292-7827

- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.



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