

EXPLORATORY RESEARCH ON ENGINEERING THE TRANSPORT INDUSTRIES (ETI)

Program Solicitation

NSF 00-42

DIRECTORATE FOR ENGINEERING

DEADLINE: April 13, 2000

Non-Binding Letter of Intent requested by March 10, 2000



NATIONAL SCIENCE FOUNDATION



The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants 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 Web Site at:

<http://www.nsf.gov>

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information (NSF Information Center):** (703) 306-1234
- **TDD (for the hearing-impaired):** (703) 306-0090
- **To Order Publications or Forms:**
Send an e-mail to: pubs@nsf.gov
or telephone: (301) 306-1234
- **To Locate NSF Employees:** (703) 306-1234

SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: EXPLORATORY RESEARCH ON ENGINEERING THE TRANSPORT INDUSTRIES (ETI)

Synopsis of Program:

The Engineering Directorate of the National Science Foundation (NSF) announces a research initiative on Engineering the Transport Industries. Transport is one of the most vital services in modern society, and is essential to most of the other functions of society. Nations depend upon transport systems that are reliable, efficient, safe and environmentally sustainable. In the broadest sense, the creation of wealth depends upon the transport of people, goods, energy and information, and it is these modes of transport that are addressed in this initiative. The initiative includes systems as diverse as highways, railways, air transport, shipping, gas-, fuel-, and water-distribution pipelines, electrical power distribution grids, and communication networks. The primary objective is to foster the development of a science base for the transport industries.

Cognizant Program Officers:

- Dr. Clifford J. Astill, Program Director, Civil and Mechanical Systems, telephone: 703-306-1362, e-mail: castill@nsf.gov.
- Dr. Marija Ilic, Program Director, Electrical and Communication Systems, telephone: 703-306-1339, e-mail: milic@nsf.gov.
- Dr. Lawrence M. Seiford, Program Director, Design, Manufacturing and Industrial Innovation, telephone: 703-306-1395, e-mail: lseiford@nsf.gov.

Applicable Catalog of Federal Domestic Assistance (CFDA) Number:

- 47.041 --- Engineering Grants

ELIGIBILITY INFORMATION

- **Organization Limit:** Proposals may be submitted by U.S. academic institutions.
- **PI Eligibility Limit:** None
- **Limit on Number of Proposals:** A Principal Investigator may submit only one proposal, and may be a co-Principal Investigator on no more than three other proposals.

AWARD INFORMATION

- **Anticipated Type of Award:** Standard Grant
- **Estimated Number of Awards:** 15 - 25
- **Anticipated Funding Amount:** \$3 million in FY 2000

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Guidelines

- **Proposal Preparation Instructions:** Standard Preparation Guidelines
 - Standard GPG Guidelines apply.

B. Budgetary Information

- **Cost Sharing Requirements:** None
- **Indirect (F&A) limitations:** None

- **Other Budgetary Limitations:** None

C. Deadline/Target Dates

- **Letter of Intent Deadline:** Non-Binding Letter of Intent requested by March 10, 2000.
- **Preproposal Deadline:** None
- **Full Proposal Deadline:** Submission via FastLane by 5:00 pm, local time, April 13, 2000

D. FastLane Requirements

- **FastLane Submission:** Full Proposal Required.
- **Fast Lane Contact:**
 - FastLane User Support at 703-306-1142, or fastlane@nsf.gov.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** Standard NSF Merit Review Criteria apply.

AWARD ADMINISTRATION INFORMATION

- **Grant Award Conditions:** Standard NSF grant conditions apply (GC-1 or FDP III).
- **Reporting Requirements:** Standard NSF reporting requirements apply.

I. INTRODUCTION

The Engineering Directorate of the National Science Foundation (NSF) announces a research initiative on Engineering the Transport Industries. It addresses a broad class of complex engineering systems in the modern service industry, focusing on one of the most vital services in modern society, namely transportation. The transport of people, goods, energy, and information -- in systems as diverse as highways, railways, air transport, shipping, gas-, fuel-, and water distribution pipelines, power distribution grids, communication networks and the Internet -- is an increasingly important component of an economy based on rapid response, wide geographical coordination, and inter-linking of physical distribution networks with information networks.

This initiative is intended to encourage the development of new engineering principles, methods of analysis, simulation, design, experiments and field studies of key transport systems. Proposals are encouraged to integrate the modeling of physical distribution and transport networks with the analysis and design of information networks that support sensing, decision-making and real-time control. Proposals that address only the routing and flow of information in conventional communications networks will not fully meet the intent of this initiative.

The initiative encourages cooperative and interdisciplinary activities, particularly the direct involvement of applications-domain experts and industry participants, as well as the use of shared facilities, of advanced experimental and computational facilities, and access to federally-supported laboratories and experimental facilities.

Researchers are encouraged to visit the ENG web-site (www.eng.nsf.gov/programs/nsf00-42.htm) for information related to this initiative.

II. PROGRAM DESCRIPTION

BACKGROUND

As reported by the U.S. National Research Council, the service industry now accounts for more than 70% of the U.S. economy and a similar share of the workforce, and that share is growing. The diversity of these services is large and includes aspects of transport, trade, retail, finance, health care, entertainment, communications, education and training, and government. The service industry is of tremendous economic and social importance to the nation. It is an area in which engineering methods and tools can have a critical impact on the development of transport systems that are reliable, efficient, safe and environmentally sustainable.

The traditional distinction between service and product is blurring. Modern production methods entail much more than the physical steps involved in the manufacture of products or the processing of materials. Managing production becomes a global enterprise-wide process in which the distribution of goods and the conveyance of information are tightly interwoven. Similarly, in other forms of transport and infrastructure systems, goods distribution and network information flow are increasingly tightly linked, and the improvement of system performance depends on the careful coordination of sensing, decision-making and real-time control.

Innovations in supply-chain management introduced by large wholesale vendors have revolutionized retail sales on a nation-wide basis, and are based on the careful linking of real-time information systems tracking inventory, delivery, manufacturing, and sales. Related developments in "e-commerce" have coupled Internet-based customer access to dynamic control of inventory and delivery systems. Similar innovations in airline flight scheduling, in railway goods distribution, and in pipeline flow control are changing those industries as well. The move toward deregulation of the electric power industry in the U.S. will result in information-based real-time networks that provide control of power distribution grids in a way that is quite different from traditional power generation scheduling and allocation methods.

PROGRAM DESCRIPTION

Major developments taking place in the transport of people, goods, energy, and information require corresponding advances in knowledge and original approaches that draw upon concepts and methodologies from all engineering disciplines. Transport systems need to be flexible in order for them to adapt to changes in the operating environment. Achieving this flexibility requires knowledge of how the system operates, the development of technologies specific to each system, and the consideration of phenomena resulting from interactions between system components. The focus here is on engineering the transport industries, not engineering in the transport industries. This initiative is designed to support fundamental engineering research that will enable the development of high-performance transport systems. It addresses specific needs of reliability, robustness, uncertainty, flexibility of performance, scalability, and dynamic performance. Proposals in support of the following research themes are invited:

1. Investigation of new methods of modeling, analysis and design of transport systems, with particular emphasis on the coupling between physical distribution systems and information networks, especially the use of information networks to coordinate the distribution of goods.
2. Development of effective computational tools and simulation methods to study and design transport systems. Integration of component systems with network simulations is of special interest.
3. Investigation of new architectures (e.g., pipeline, grid or hub-based), decision tools, optimization and control methods in transport systems, based on the integration of advanced transport systems linked with advanced sensor systems, monitoring techniques, and information networks.
4. Investigation of specific applications and transport systems through the analytical, computational, and experimental studies of real and simulated systems. Cooperation with industry and the use of government resources is strongly encouraged. Examples of important transport systems are: advanced highway systems, air traffic systems, goods distribution systems, pipeline systems, and electric power grids.

Proposed research projects should: (a) contribute substantially to one or more of these basic research themes; (b) address the integration of basic research, modeling methods, and domain-specific knowledge; and (c) contribute to the advancement of a basic scientific understanding in support of transport systems. Models may be based partially upon empirical information. Proposals must include a statement indicating how the research will contribute to the improved understanding, development, and/or operation of next-generation transport systems.

Proposals should be exploratory in nature. It is expected that the specific projects proposed will suggest future directions for this initiative; that is, ways to foster the development of a science base for the transport industries. The long-term goal is to use the lessons learned with regard to the transport industries to assist with the more general objective of developing a science base for other service industries. Approximately a year after the initiation of the exploratory awards, a workshop is planned which will focus on the development of a science base for the service industry, focusing especially on the transport industries. Progress reports by grantees will provide a balance and a focus to the discussions. Funds to support participation in a two-day workshop to be held in the Washington, DC area should be included in the proposal budget. Further details on the workshop as they become available will be posted on the ENG website (www.eng.nsf.gov/programs/nsf00-xx.htm).

III. ELIGIBILITY INFORMATION

Proposals may be submitted by U.S. academic institutions in support of individual investigators or small groups. Synergistic collaboration among researchers, and collaboration or partnerships with industry or government laboratories is encouraged when appropriate; however, NSF funding will be limited to U.S.

academic institutions. A Principal Investigator may submit only one proposal, and may be a co-Principal Investigator on no more than three other proposals.

IV. AWARD INFORMATION

NSF anticipates funding up to 25 exploratory 12-month awards, at levels up to \$100,000 for individual investigators, and up to \$200,000 for small groups involving integrated collaborative efforts. The number of awards will be subject to the availability of funds and the quality of the proposals. Awards are expected to be made in September 2000.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letter of Intent: It is requested that the prospective PI submit a letter of intent, to include the following information: the PI and co-PI's names, a list of possible participating institutions, a possible title, and not more than 500 words to describe the work -- sufficient to permit NSF to make an intelligent choice of reviewers. Letters of intent are not required and will not be evaluated or used to decide on funding. They are requested in order to assist NSF in planning the review process, and to begin choosing panelists before the proposal submission deadline. Letters of intent should be received at NSF (by e-mail eti-loi@nsf.gov) by March 10, 2000.

Proposal Information: 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) (NSF 00-2). The complete text of the GPG (including electronic forms) is available electronically on the NSF Web Site at: <http://www.nsf.gov/pubs/2000/nsf002/start.htm>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone 301.947.2722 or by e-mail from pubs@nsf.gov. Proposals must include a statement indicating how the research will contribute to the improved understanding, development, and/or operation of next-generation transport systems.

Proposers are reminded to identify the program solicitation number (NSF 00-42) in the program announcement/solicitation block on the proposal Cover Sheet (NSF Form 1207). Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Funds to support participation in a two-day workshop to be held in the Washington, DC area should be included in the proposal budget.

C. Deadline/Target Dates

A non-binding Letter of Intent requested to be submitted by March 10, 2000. The proposal must be submitted via FastLane by 5:00 PM, local time, April 13, 2000.

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>.

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

ETI Solicitation
Division of Civil and Mechanical Systems
National Science Foundation
4201 Wilson Blvd., Suite 545
Arlington, VA 22230

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.

Proposals will be reviewed against the following general review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal and for which he/she is qualified to make judgements.

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?

Principal Investigators should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to both of the above-described NSF merit review criteria. NSF staff will give these elements careful consideration 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.

A summary rating and accompanying narrative will be completed and signed by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are mailed 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.

B. Review Protocol and Associated Customer Service Standard

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

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. A Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation. NSF will be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 95 percent of proposals. The time interval begins on the proposal deadline or target date or from the date of receipt, if deadlines or target dates are not used by the program. 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 Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with an NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants Officer does so at its 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 (DGA). Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies or reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator.

B. Grant Award Conditions

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

*These documents may be accessed electronically on NSF's web site at <http://www.nsf.gov/>. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone 301.947.2722 or by e-mail from

pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, (NSF 95-26) available electronically on the NSF web site. 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 web site 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 a grant, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane, that PIs are required to use (unless otherwise specified) to prepare and submit 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 should be made to the EXPLORATORY RESEARCH ON ENGINEERING THE TRANSPORT INDUSTRIES Program:

Dr. Clifford J. Astill, Program Director, Civil and Mechanical Systems, telephone: 703-306-1362, e-mail: castill@nsf.gov.

Dr. Marija Ilic, Program Director, Electrical and Communication Systems, telephone: 703-306-1339, e-mail: milic@nsf.gov.

Dr. Lawrence M. Seiford, Program Director, Design, Manufacturing and Industrial Innovation, telephone: 703-306-1395, e-mail: lseiford@nsf.gov.

For questions related to the use of FastLane, contact FastLane User Support at 703-306-1142, or fastlane@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. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter. Many NSF programs offer announcements concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices listed in Appendix A of the GPG. Any changes in NSF's fiscal year programs occurring after press time for the Guide to Programs will be announced in the NSF Bulletin, available monthly (except July and August), and in individual program announcements. The Bulletin is available electronically via the NSF Web Site at <http://www.nsf.gov>. The direct URL for recent issues of the Bulletin is <http://www.nsf.gov/od/lpa/news/publicat/bulletin/bulletin.htm>. Subscribers can also

sign up for NSF's Custom News Service to find out what funding opportunities are available.

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

NSF welcomes proposals 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 (unless otherwise specified in the eligibility requirements for a particular program).

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 program announcement or contact the program coordinator at (703) 306-1636.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 306-0090, FIRS at 1-800-877-8339.

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

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.

Pursuant to 5 CFR 1320.5(b), 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, Information Dissemination Branch, Division of Administrative Services, National Science Foundation, Arlington, VA 22230, or to Office of Information and Regulatory Affairs of OMB, Attention: Desk Officer for National Science Foundation (3145-0058), 725 - 17th Street, N.W. Room 10235, Washington, D.C. 20503.

YEAR 2000 REMINDER

In accordance with Important Notice No. 120 dated June, 27, 1997, Subject Year 2000 Computer Problem, NSF awardees are reminded of their responsibility to take appropriate actions to ensure that the NSF activity being supported is not adversely affected by the Year 2000 problem. Potentially affected items include: computer systems, databases, and equipment. The National Science Foundation should be notified in an awardee concludes that the Year 2000 will have a significant impact on its ability to carry out an NSF funded activity. Information concerning Year 2000 activities can be found on the NSF web site at <http://www.nsf.gov/oirm/y2k/start.htm>.

Catalogue of Federal Domestic Assistance (CFDA) No.: 47.041 – Engineering Grants

OMB No.: 3145-0058

NSF 00-42 (Electronic Dissemination Only)