KDI:
Knowledge and Distributed Intelligence in the Information Age

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Revised Proposal Solicitation
NSF 99-29

DEADLINES

PREPROPOSALS (REQUIRED): FEBRUARY 1, 1999
FULL PROPOSALS: MAY 17, 1999

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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Name: KDI: Knowledge and Distributed Intelligence in the Information Age

Short Description/Synopsis of Program:

Recent advances in computer power and connectivity are reshaping relationships among people and organizations, and transforming the processes of discovery, learning, and communication. These advances create unprecedented opportunities for providing rapid and efficient access to enormous amounts of knowledge and information; for studying vastly more complex systems than was hitherto possible; and, for increasing in fundamental ways our understanding of learning and intelligence in living and engineered systems. NSF's Knowledge and Distributed Intelligence (KDI) theme is a Foundation-wide effort to promote the realization of these opportunities. Proposals are solicited from individuals or groups for research that is inherently multidisciplinary or that, while lying within a single discipline, has clear impact on at least one other discipline. With a budget of approximately $50 million, KDI anticipates funding 40-50 proposals of varying size and duration.

Cognizant Program Officer(s):   Dr. Richard Hilderbrandt, Program Officer, Room 1055S, MPS/CHE, telephone (703)306-1844, e-mail: rhilderb@nsf.gov.

Applicable Catalog of Federal Domestic Assistance (CFDA) Nos.:

> 47.041 Engineering Grants
> 47.049 Mathematical and Physical Sciences
> 47.050 Geosciences
> 47.070 Computer and Information Science and Engineering
> 47.074 Biological Sciences
> 47.075 Social, Behavioral, and Economic Sciences
> 47.076 Education and Human Resources
> 47.078 Polar Programs

ELIGIBILITY

♦   Limitation on the categories of organizations that are eligible to submit proposals: **As described in the NSF Grant Proposal Guide (GPG), NSF 99-2.**

♦   PI eligibility limitations: **As described in the GPG.**

♦   Limitation on the number of proposals that may be submitted by an organization: **None**

AWARD INFORMATION

♦   Type of award anticipated: **Standard Grant**

♦   Number of awards anticipated in FY 99: **40-50 awards**

♦   Amount of funds available: **Approximately $50 million will be available for this initiative in FY 1999**

♦   Anticipated date of award: **September 1999**

PROPOSAL PREPARATION & SUBMISSION INSTRUCTIONS

♦ **Proposal Preparation Instructions**

- Letter of Intent requirements: **None**

- Preproposal requirements: **Preproposal is required.**

- Proposal preparation instructions: **Standard NSF Grant Proposal Guide instructions with exceptions described in announcement**

- Supplemental proposal preparation instructions: **See instructions in announcement**

- Deviations from standard (GPG) proposal preparation instructions: **See instructions in announcement**

♦ **Budgetary Information**

- Cost sharing/matching requirements: **None**

- Indirect cost (F&A) limitations: **None**

- Other budgetary limitations: **Up to $1 million per year for up to 3 years**

♦ **FastLane Requirements**

- FastLane proposal preparation requirements: **FastLane use mandatory for both preproposals and full proposals**

- FastLane point of contact: **FastLane Project Officer, telephone: (703)306-1145, e-mail: fastlane@nsf.gov**

♦ **DEADLINE DATES**

- Preproposal Deadline   **12:00 noon, local time, February 1, 1999**

- Full Proposal Deadline   **12:00 noon, local time, May 17, 1999**

- Note: Local time means time at the submitting institution.

♦ **PROPOSAL REVIEW INFORMATION**

- Merit Review Criteria: **Standard National Science Board approved criteria**

♦ **AWARD ADMINISTRATION INFORMATION**

- Grant Award Conditions

- Special grant conditions anticipated: **None anticipated**

- Special reporting requirements anticipated: **None**

INTRODUCTION

The recent growth in computer power and connectivity has changed the face of science and engineering. The future promises continued acceleration of these changes. The challenge today is to build upon the fruits of this revolution.

This rise in power, connectivity, content, and flexibility is so fundamental that it is dramatically reshaping relationships among people and organizations, and quickly transforming our processes of discovery, learning, exploration, cooperation, and communication. It permits us to study vastly more complex systems than was hitherto possible and provides a foundation for rapid advances in understanding of learning and intelligent behavior in living and engineered systems. Today's challenge is to realize the full potential of these new resources and institutional transformations.

Knowledge and Distributed Intelligence (KDI) is a Foundation-wide effort designed to catalyze this next step.

PROGRAM DESCRIPTION

The National Science Foundation (NSF) aims to achieve, across the scientific and engineering communities, the next generation of human capability to generate, gather, model, and represent more complex and cross-disciplinary scientific data from new sources and at enormously varying scales; to transform this information into knowledge by combining, classifying, and analyzing it in new ways; to deepen our understanding of the cognitive, ethical, educational, legal, and social implications of new types of interactivity; and to collaborate in sharing this knowledge and working together interactively.

The anticipated payoffs of KDI research include:

- Deep, far-reaching scientific discovery
- Increases in scientific productivity, and in the timeliness and quality of the results
- Increased ability to handle problems of greater complexity, scale, and structure
- The creation of new scientific and engineering communities to exploit novel discoveries
- Enhancements in science and engineering education through development of richer learning tools, technologies, and environments, and more universal access to richer resources and tools
- Enhanced understanding of the processes and results of learning and applications thereof
- A more complete understanding of the fundamental processes of distributed intelligence in natural and artificial systems and their application
- An understanding of the legal, ethical, and societal implications of the increased capability to gather and access information
- Enhanced ability to communicate and transfer new understanding and technological innovations to society
- Advances in statistical data reduction, data visualization, data mining, and data organization for retrieval so as to utilize vast stores of data
- Improved methods for expressing, computing with, and evaluating different types of uncertainties in real-world data

To achieve the aims of KDI, proposals are solicited from individuals or groups for research that is inherently multidisciplinary or that, while lying within a single discipline, has clear impact on at least one other discipline. (Throughout, the term *multidisciplinary* is intended to include *interdisciplinary* and *cross-disciplinary* research.) In FY 1999, KDI will have three foci: Knowledge Networking (KN); Learning and Intelligent Systems (LIS); and New Computational Challenges (NCC). This document describes the three KDI foci, and serves as a solicitation for proposals in all three areas. We anticipate that research on many important problems will span the foci of KN, LIS, and NCC.

KN focuses on attaining new levels of knowledge integration, information flow, and interactivity among people, organizations, and communities.

LIS emphasizes research that advances basic understanding of learning and intelligence in natural and artificial systems and supports the development of tools and environments to test and apply this understanding in real situations.

NCC emphasizes new computational approaches to frontier science and engineering problems as well as problems involving data intensive computations and simulations.

More detailed information about the three foci and their particular emphases follows.

- Knowledge Networking (KN)
- Learning and Intelligent Systems (LIS)
- New Computational Challenges (NCC)

Knowledge Networking

Introduction

Knowledge Networking research aims to build the scientific bases for attaining new levels of interactivity and flow of information and knowledge among people, organizations, and communities. Thus, it will enable scientists, engineers, and other members of society to act in concert to address ever more complex scientific and societal problems.

Goals of Knowledge Networking

The goals of Knowledge Networking (KN) are:

- to understand the fundamental processes through which knowledge is created, communicated, validated, and valued in distributed systems of information, both natural and engineered, and
- to improve the technical, social, educational, and economic performance of knowledge generation and use, collaborative computation, and remote interaction.

KN will support multidisciplinary research on developing and employing the next generation of communication networks, associated information repositories, collaborative technologies, and knowledge management techniques to gather, create, distribute, use, and evaluate knowledge in new and secure ways. This explicitly includes research on the human, behavioral, social, and ethical dimensions of knowledge networking.

Anticipated outcomes of Knowledge Networking research include:

- enhanced communication across disciplines, languages, and cultures
- improved processing and integration of knowledge from different sources, domains, and non-text media types
- increased effectiveness of teams, organizations, classrooms, or communities that work together across distances or over time
- deeper understanding of the ethical, legal, and social implications of new developments in connectivity

Research Emphases

KN will emphasize three broad areas of knowledge networking: foundational research; prototype development and research; and ethical, social, and behavioral research. These areas are described more fully below. The examples given below are meant to be illustrative, not limiting.

Foundational Research

The foundations for KN require basic research on organizing, distilling, securing, and collectively acting upon information through dynamic distributed processes; methods for building and linking complex data structures, computations, and knowledge processes; and tools for navigating, gathering, and displaying widely scattered and disparate information. These foundations focus on transforming information into knowledge and broadly disseminating that knowledge. The usage of these tools in transforming and disseminating scientific knowledge will depend critically on the participation of scientists and engineers working in the specific knowledge domains of their expertise and on the processes of scientific research in those domains.

Processes and Dynamics of Distributed Intelligence

- Computational aspects of distributed intelligence: dynamic task allocation, interaction, coordination, process and organization representation, collective learning, consistency management, protocol, negotiation
- Cognition by groups, teams, and organizations
- Dynamics, adaptation and evolution of knowledge networks with particular attention paid to the utilization of domain specific knowledge and processes
- Pathologies in large-scale distributed knowledge systems, such as malicious agents, viruses, overload, "knowledge storms"

Managing Heterogeneity and Achieving Interoperability

Computational and organizational foundations for coupling models, knowledge, functionality, and human activities across scientific disciplines and within different branches of individual disciplines, including:

- Managing heterogeneity and interoperability in dimensions such as syntax, semantics, scale, and structure
- Composition of distributed models and activity
- The use of discipline-specific scientific information and processes in the design of knowledge interoperability criteria within and between disciplines

Computational Infrastructure, Tools and Environments

- Secure and efficient network and communications infrastructures for interactivity, including approaches to resource-limited and real-time interactivity
- Security, validation, authentication, and credibility of information
- Large-scale remote data acquisition, distributed data analysis, experiment and sensor control, and simulation; especially interactive and real-time aspects
- Distributed knowledge: sharable ontologies, processes for distributed classification and taxonomy, collaborative knowledge construction, representation and filtering tools, digital libraries and repositories across disciplines and application domains, and translation of representations

Prototype Development and Research

KN requires basic research and the accumulation of experience in creating, using, and understanding the performance of domain-specific prototype knowledge networks.

- Constructing and using working prototypes of domain-specific, multidisciplinary knowledge networks and collaboratories. Of specific interest are prototypes and experiments that are compatible across networks and disciplines, accessible to outside communities, and inclusive of disaggregated or virtual teams and members of very different disciplines

- Studies of the physical, behavioral, and organizational design of knowledge networks and electronic collaborative work environments, including organizational and decision-making processes and problems specific to individual scientific disciplines
- Development of engineering tools and methods for designing, reproducing, and extending knowledge networks
- Empirical studies of knowledge networks as arenas for scientific experimentation, data gathering, analysis, and decision making

Ethical, Social and Behavioral Research on Knowledge Networks

Knowledge networks create new patterns of information flow, interaction, and organization that require basic research into their social, political, ethical, and economic characteristics. Normative and empirical research are needed to address complex problems raised by the new technologies envisioned under KN.

<u>Knowledge Dissemination and Sustainable Use of Knowledge Networks</u>

- Cognitive and social processes of creating, developing, maintaining, and dismantling knowledge networks
- Intellectual property, privacy, confidentiality and credibility of information and of participants in knowledge networks
- Adapting knowledge networks to human needs, preferences, and abilities, including cognitive, cultural, economic, and educational differences in the access, use, and benefit from knowledge networks

<u>Social Integration and Impacts of Knowledge Networking</u>

- New methodologies, metrics, and investigations of the scientific, technical, economic, and human performance capabilities and the social, organizational, and economic impacts of knowledge networks
- Ethical, social, political, legal, and economic processes that influence the creation, use, ownership, and governance of knowledge networks
- Creation, distribution, life course, and other characteristics of "knowledge capital"

Further description of these and other themes appears on the KDI web page (http://www.nsf.gov/kdi) under KN examples and themes. Address questions regarding the KN focus to kn@nsf.gov.

LEARNING AND INTELLIGENT SYSTEMS

Introduction

Efforts to understand the nature of learning and intelligence, and the realization of these capacities in the human mind, are among the most fundamental activities of science. The goal of LIS is to stimulate research that will advance and integrate concepts of learning and intelligence emerging from theoretical and experimental work in a variety of disciplines, including education, cognitive science, computer science, neuroscience, engineering, social science, and physical science. Accordingly, LIS encompasses studies of learning and intelligence in a wide range of systems, including (but not limited to) the nervous systems of humans or other animals; networks of computers performing complex computations; robotic devices that interact with their environments; social systems of human or non-human species; and, formal and informal learning situations. LIS also includes research that promotes the development and use of learning technologies across a broad range of fields. Development of new scientific knowledge on learning and intelligent systems, and its creative application to education and learning technologies, are integral parts of this solicitation.

There are two parallel and compelling reasons for focusing on the general area of learning and intelligent systems:

First, there has been a convergence of techniques and ideas addressing questions in cognitive science and behavior of intelligent systems. For example, there has been a growing use of neural networks, pattern recognition,

visualization, simulation, nonlinear dynamical systems analysis, and probabilistic and statistical learning theory in these fields. As another example, researchers in many disciplines -- including biochemistry, biophysics, neuroscience, and cognitive science -- are studying how the nervous system changes as a result of experience, at levels ranging from individual synapses, to neural circuits, to brain systems subserving complex perceptual and cognitive functions. Although concepts and methods differ across levels of analysis, a growing integration across levels is creating fruitful theoretical frameworks and rich bodies of data for advancing our understanding of learning and intelligent systems.

Second, as our knowledge and understanding of learning, intelligent systems, and information technologies grows, so does the need to integrate and apply this understanding within a broad social context. Research on associated technologies and systems can and has enabled better understanding of learning and cognition and has led to better classroom practice. Integrating research with prototyping in these critical areas promises rapid advances in both theory and application.

Research Emphases

LIS seeks projects that propose:

1. To identify, investigate, and model the ways natural and artificial systems operate in order to arrive at unifying principles that explain:
   - How learning and intelligent behavior occur in humans, in other natural systems, and in artificial systems
   - The types of learning tasks and decision making that are best suited for each
   - The kinds of information and decisions each characteristically produces or creates
   - The impact of interactions among alternative interactive learning environments, social contexts and experiences

2. To enhance the ability of students and researchers to learn and to create by developing a comprehensive set of learning and research tools, methods and technologies that use biological, behavioral, cognitive, linguistic, social, and educational concepts with interactive, collaborative, and multisensory technologies, and are accessible to people with varied abilities, knowledge, and expectations

3. To further basic research designed to develop fundamental knowledge concerning the nature of learning and intelligence in natural or artificial systems, and to apply such knowledge in a variety of situations such as education, learning technologies, design of robotic devices and smart instrumentation, and networks of computer systems.

Further description of these and other themes appears on the KDI web page (http://www.nsf.gov/kdi) under LIS examples and themes. Address questions regarding the LIS theme to lis@nsf.gov .

NEW COMPUTATIONAL CHALLENGES

Introduction

New Computational Challenges (NCC) focuses on research and tools to discover, model, simulate, display, and understand complex systems or complicated phenomena; to control resources or deal with massive volumes of data in real time, particularly distributed resources or data; to represent, predict, and design complex systems; and to understand their behaviors. NCC builds on the success, but broadens the scope, of prior NSF efforts such as the Grand Challenge initiatives.

NCC aims to enable wide scientific collaboration and effective management of complex systems. This will require significant advances in hardware and software to handle multiple representations, scales, and structures; to enable distributed collaboration among disparate communities; and to facilitate real-time interactions and control.

Many phenomena are too complicated to understand in detail from simple observation or by reduction to isolated components and often require the coupling of disciplinary scientists and engineers and those involved in enabling methods and technologies in order to produce new ways to approach previously intractable problems. The very structure of the problem --- its mathematical, logical, or computational form --- may change as scale, level of resolution, or granularity changes. Many important problems require multiple data types, qualitative information, feedback during the computation to steer it, and a variety of numerical and symbolic computations. Advances in raw computing power have outpaced the effectiveness of existing tools and the degree to which they will scale to large numbers of distributed systems. The development of meaningful simulations that combine disparately structured models into new types of simulations is critical. While understanding complex phenomena is obviously important, predicting their behavior and potentially controlling or changing it, and doing so in real time, alter the fundamental nature of the problem and introduce enormous challenges across a broad spectrum of science and engineering research.

Research Emphases

As noted above, many scientific and engineering problems are encompassed by new challenges in computation. In the first KDI competition, in Fiscal Year 1998, NCC emphasized the first two of the themes shown below. For Fiscal Year 1999 NCC welcomes proposals across the entire spectrum of computational challenges, and five additional themes have been added:

1. Scientific and engineering problems involving interactions between phenomena of different scales or structures;
2. Problems requiring a dynamic interplay between computations and data;
3. Effective modeling and simulation of extremely complex phenomena;
4. Development of enabling technologies for large-scale or widely distributed computing;
5. Effective management and manipulation of data;
6. Amplifying intelligent behavior and dealing with uncertainty;
7. Smart instrumentation.

Several of these research emphases overlap with other areas of KDI. Problems of scale and structure, and interplay between computations and data, are discussed briefly below:

- Problems of Scale and Structure

  Problems involving multiple scales in space or time occur throughout engineering and science. Examples include inferring macroscopic properties of a material from its microstructure; turbulence, which plays a critical role in fluid flows as varied as mixing of fuel and air in combustion engines, airflow around an airplane, and blood flow in the heart; scaling of flow in porous media from the pore level to the field level, which has important applications to oil recovery and environmental issues; and fluid circulation in the oceans and the atmosphere. The brain, a dynamic, highly-connected, multi-level organization, involves both scale and structure. Overlapping sets of complex computational problems are those concerning phenomena that arise from interactions among large numbers of relatively simple objects or elements. Examples include the complex perceptual and cognitive phenomena that arise from interactions among neurons in the brain; the behavior of the immune system in responding to antigens; social behaviors in animals ranging from insects to humans; human economic and social activities; and, the operation of distribution networks such as power grids and communication systems.

- Interplay Between Computations and Data

Better understanding of complex phenomena now requires a dynamic interplay between computations and data, often in real time. Most simulations are entirely initial-value in style: guess at a start, compute, see what happens, then change the guess. Simulations that could adapt to intermediate results or changing data would greatly reduce the number of iterations. In addition, some problems require this adaptive interplay for effective solution. These include command-control problems such as air traffic control, dispatch systems, radar and sonar identification, and other recognize-and-respond problems. Resource management and process control problems, especially with time constraints, are also of this kind.

Data-mining problems are of a different nature. Here the idea is to discover "unusual" items in a large dataset. Examples arise in seismology, high-energy physics, astronomy, credit card fraud, and management and protection of networked resources such as databases or computers.

Another kind of problem is combining different kinds of data. There are difficulties in validating data, assessing the effects of individual errors and their combinations, and in representing and visualizing data; practical methods for a multiplicity of large-scale datasets are needed.

Understanding of complex phenomena often depends on mapping different kinds of data against each other. Examples include tracking any time evolution or spatial evolution of phenomena against a spatial database (GIS, satellite and other map data), such as agricultural data, erosion and floods, epidemics, and other ecological/environmental phenomena; and mapping measurements of a behavior against measurements of physiological change, e.g., speech or vision against brain activity.

The examples given in the preceding paragraphs are meant to be illustrative and not limiting. Further description of these and other themes appears on the KDI web page (http://www.nsf.gov/kdi) under NCC examples and themes. Address questions regarding the NCC theme to ncc@nsf.gov .

ELIGIBILITY

Eligibility requirements are as described in Chapter I, Section D, WHO MAY SUBMIT PROPOSALS, of the NSF Grant Proposal Guide (GPG), NSF 99-2. Multi-institutional arrangements are permitted and partnerships with industry are encouraged.

AWARD INFORMATION

In the FY 1998 KDI competition, NSF received 697 proposals and made 40 awards for a total of approximately $51 million. Individual awards ranged from approximately $300,000 to almost $3,000,000 over three years. A list of the FY 1998 KDI awards is available on the NSF web site at http://www.nsf.gov/kdi.

For the FY 1999 competition NSF solicits proposals for any funding amount up to $1.0 million per year for up to three years, and expects to make grants at a wide variety of award sizes and durations. Based on the results of the FY 1998 competition, NSF expects to fund approximately 40-50 three-year KDI awards in FY 1999, depending on the quality of submissions and the availability of funds. In exceptional cases of compelling justification and promise, awards for up to five years may be considered. All awards will be made as grants subject to specified reporting procedures. Approximately $50 million will be available for KDI in FY 1999.

PROPOSAL PREPARATION & SUBMISSION INSTRUCTIONS

The following section on preproposal submission has been changed since the announcement was originally posted on November 3, 1998

Preproposals

Preproposals are required for KDI in FY 1999. Full proposals will be accepted only from proposers who submit preproposals.

Although all requested information must be provided, NSF recognizes that some details may change as proposers develop full proposals. For example, investigators may be added, tentative budget plans may be modified, or the scope of the project may be altered. Such changes are acceptable.

Submission instructions for preproposals (and full proposals) are below in paragraph B.

A. Preproposal Preparation Instructions

Preproposals, submitted through FastLane, must contain the following information. (All page limits are single-spaced pages prepared in accordance with the proposal format instructions in the Section II.C of the NSF Grant Proposal Guide, NSF 99-2.)

- Cover Page. To insure proper handling of KDI preproposals this page must include:
    1. One of the following choices for the data item "For Consideration by NSF Organization Unit": KDI/KN, KDI/LIS, or KDI/NCC. If the proposed project encompasses more than one focal area, designate the area most closely related to the proposal. (This information will be used only to facilitate assignment of preproposals to review panels.)
    2. The Program Announcement, NSF 99-29.
    3. The Closing Date for preproposals, 02/01/99.
    4. A check in the box marked "If this is a preproposal check here"
    5. In addition to the Principal Investigator (PI) NSF allows up to 4 individuals to be listed as Co-Principal Investigators (Co-PIs) on a proposal. Many KDI preproposals will involve more than 5 researchers, however. In this case the additional researchers can be listed in the Senior Personnel category. (On the FastLane FORM SELECTOR screen, click on 'Add/Modify Non Co-PI Senior Personnel')

- Project Summary Provide a brief description of the project, identifying the scientific research problems to be addressed, and the methodologies to be used, and the potential outcomes.

- Project Description Goals and Objectives (Maximum 5 pages): Discuss the goals, objectives, and anticipated impact of the proposed project. Make clear that the proposed project is a research project, that it is multidisciplinary, and that it fits within the themes contained within this announcement. Note that multidisciplinary, in the KDI sense, implies that research advances will be made in two or more fields, or that cutting-edge research within one discipline will have significant positive impacts on other fields. It is the nature of the work, not the number of investigators or their departmental affiliations that makes a project multidisciplinary.

- Budget Outline: Prepare a one-page cumulative budget for the full duration of the project. The budget need not be detailed, but should be sufficient for reviewers to grasp the intended scale of the proposed project. To create a cumulative budget use the following steps: 1) On the "Budget Selector" screen, click on "New", then "1", and then "Create"; 2) Enter the cumulative budget on the screen provided. FastLane will print the budget data on a Budget Year 1 page, and a cumulative page. The Year 1 page will be ignored by the reviewers.

- <u>Biographical Sketches:</u> For all senior personnel (PI, Co-PI, other senior personnel; see Appendix C of the NSF Grant Proposal Guide (GPG), NSF 99-2, for a definition of senior personnel) provide a brief curriculum vitae including educational background, relevant experience, and up to 5 publications most closely related to the research. **Do not include Conflict of Interest Information**.

B.   Preproposal Submission & Due Date

Preproposals must be submitted to FastLane via the submitting institution's Sponsored Research Office. They must be received at NSF by noon, local time on February 1, 1999. Local time means time at the submitting institution. Upon submission, the Sponsored Research Office may get warning messages about missing forms. These messages can be ignored if the above forms are included in the proposal. It is not necessary to send in a signed Cover Sheet (Form 1207) for preproposals.

C.   Conflicts of Interest.

Ensuring that reviewers do not have conflicts of interest can be difficult when, as for KDI, many proposals involve multiple investigators and multiple institutions. To assist NSF in identifying conflicts of interest, the following information should be sent to kdi-conflicts@nsf.gov with your proposal number included in the following subject line: **KDI Conflict Information for 99#####**

1.   Project Personnel. List all project personnel in alphabetical order, in the form last name, first name, role (e.g., Smith, Jane, consultant).
2.   Institutions. List in alphabetical order all institutions involved in the project.
3.   Potential Reviewers with Conflicts of Interest. List in alphabetical order all persons who have a conflict of interest with any of the project's senior personnel (PI, Co-PI, other senior personnel). In particular, list all persons falling into the conflict of interest categories specified in Section II.D.6.c-e of the GPG. Provide this information in the following format: last name, first name, institution, nature of conflict, project personnel the conflict is with. For example, if Thomas Jones of the University of Michigan recently co-authored an article with Peter Brown, a Co-PI on the proposed project, the corresponding list entry would read as follows: Jones, Thomas, University of Michigan, co-author on article, Brown.

You can obtain the number of your proposal from FastLane as soon as your proposal has been submitted by your Sponsored Projects Office. This e-mail information should be sent immediately after FastLane submission or the processing of your proposal may be delayed.

D.   Preproposal Review

Preproposals will be evaluated through external peer review by multidisciplinary panels. Reviewers will evaluate the potential of the project to be developed into a strong full proposal, in light of the NSF merit review criteria described in the Proposal Review section of this announcement.

On the basis of the review the proposer will receive feedback either encouraging or discouraging submission of a full proposal. The reviewers' written comments and a summary of the panel discussion will also be provided. It is strongly suggested that proposers follow the preproposal review advice.

Full Proposals

A.   <u>Proposal Preparation Instructions</u>

<u>GPG Guidelines</u>

Full proposals submitted in response to this program announcement should be prepared and submitted in accordance with the general guidelines contained in the *Grant Proposal Guide* (GPG), NSF 99-2, except as described below.   The complete text of the GPG is available electronically on the NSF Web site at: <http://www.nsf.gov/>.   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.

Please note carefully the page limits for the various parts of the proposal, as well as the margin and font size limits.

FastLane Submission Required

KDI proposals must be submitted through the NSF FastLane system for electronic proposal preparation and submission. (See FastLane Requirements below.)

Identifying Program Announcement Number on Cover Sheet

Proposers are reminded to identify the program announcement number (nsf99-29) in the program announcement/solicitation block on the NSF Form 1207, "*Cover Sheet for Proposal to the National Science Foundation*."   Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

Project Personnel

In addition to the Principal Investigator (PI) NSF allows up to 4 individuals to be listed as Co-Principal Investigators (Co-PIs) on a proposal. Many KDI proposals will involve more than 5 researchers, however. In this case the additional researchers can be listed in the Senior Personnel category. (On the FastLane FORM SELECTOR screne, click on 'Add/Modify Non Co-PI Senior Personnel')

Additions and Exceptions to GPG Guidelines

- The Conflicts of Interest lists that are required as part of the preproposal (see Preproposal Preparation Instructions) must be revised to reflect any changes occurring since the time of preproposal submission. The revised lists must be submitted via email to kdi@nsf.gov by noon, local time, May 10, 1999.

- The Biographical Sketches submitted with the full proposal need not include the conflict of interest information requested in Section II.D.6.c-e of the GPG.

- On the proposal cover page KDI/KN, KDI/LIS or KDI/NCC must be selected as the NSF organization to consider the proposal.

- The Project Description file uploaded to FastLane must contain the following parts in the specified order (all page limits are single-spaced pages). The Project Description file uploaded to FastLane will be longer than 15 pages. This is acceptable, as long as part (1), the Project Description narrative, does not exceed 15 pages.

    1. Project Description (maximum 15 pages). Follow the GPG instructions about what to include, with the following exception: Results from Prior NSF Support should not be placed here, and should not be counted toward the page limit. Note that KDI does not allow the group proposal format in which the Project Description may exceed 15 pages.

    2. Appropriateness for KDI & Roles of Project Personnel (maximum 1 page). Justify the appropriateness of the proposed project for KDI, making clear that it is a research project, and that it would make substantive contributions to at least two disciplines. Identify the scientific fields encompassed by the project, and explain how the project personnel provide the necessary expertise in these fields. Make

sure that the roles of all Senior Personnel (PI, Co-PIs, and Other Senior Personnel) are clearly described.

3. Results from Prior NSF Support (maximum 2 pages for each PI and Co-PI). See the GPG for instructions.

4. Dissemination of Results, and Institutional Commitment (maximum 2 pages). Describe the plans for dissemination of the results, and the institutional commitment as to space and equipment. The discussion of institutional commitment should include the information provided in standard proposals on the Facilities, Equipment, and Other Resources form (Proposal Section H; see the GPG), as well as a description of any cost-sharing or other special institutional commitments. The Facilities, Equipment, and Other Resources form should not be completed.

5. Performance Goals (maximum 1 page). Describe realistic performance goals for each year.

6. Management Plan (maximum 1 page). Explain how the project will be managed, including arrangements for collaboration across institutions or departments.

7. Letters of Cooperation/Commitment (if any; no page limit) Letters of cooperation from consultants, and letters from participating organizations describing cost-sharing commitments. These letters must be included in the electronic FastLane proposal; hard copies will not be accepted. (Proposers should request letters in electronic form, or scan hard copies to generate an electronic version.)

- The Conflicts of Interest lists that are required as part of the preproposal (see Preproposal Preparation Instructions) must be revised to reflect any changes occurring since the time of preproposal submission. These lists, whether they have been revised or not, must be submitted via email as simple ASCII Text Files to kdi-conflicts@nsf.gov by May 19, 1999. The e-mail message should contain the proposal number obtained from FastLane embedded in the following subject line: KDI Conflict Information for 99#####

B. **Budgetary Information**

Cost Sharing

Cost sharing is optional for proposals submitted in response to this announcement.

Any proposed cost sharing must be shown on line M on the proposal budget (NSF Form 1030). The amount of cost sharing must be shown in the proposal in enough detail to allow NSF to determine its impact on the proposed project. Documentation of availability of cost sharing must be included in the proposal.

Only items that would be allowable under the applicable cost principles, if charged to the project, may be included as the grantee's contribution to cost sharing. Contributions may be made from any non-Federal source, including non-Federal grants or contracts, and may be cash or in-kind (see OMB Circular A-110, Section 23). It should be noted that contributions counted as cost-sharing toward projects of another Federal agency may not be counted towards meeting the specific cost-sharing requirements of the NSF grant.

All cost-sharing amounts are subject to audit. Failure to provide the level of cost-sharing reflected in the approved grant budget may result in termination of the NSF grant, disallowance of grant costs and/or refund of grant funds to NSF.

C. **Full Proposal Due Dates**

Full proposals **MUST** be submitted by 12:00 noon, local time, May 17, 1999. Copies of the signed proposal cover sheet must be submitted in accordance with the instructions identified below.

Revised Conflict of Interest lists reflecting changes since the time of preproposal submission must be submitted by email to kdi-conflicts@nsf.gov by May 19, 1999.

Submission of Signed Cover Sheets. The signed proposal Cover Sheet (NSF Form 1207) must be forwarded to the following address and received by NSF by June 1, 1998:

KDI
National Science Foundation
KDI – FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230

A proposal may not be processed until the complete proposal (including signed Cover Sheet) has been received by NSF.

D. FastLane Requirements.

KDI proposals must be submitted electronically using the NSF FastLane system for electronic proposal preparation and submission. The FastLane system is available through the Web at the FastLane Web site at *http://www.fastlane.nsf.gov*. The Sponsored Research Office (SRO or equivalent) must provide a FastLane Personal Identification Number (PIN) to each Principal Investigator (PI) to gain access to the FastLane "Proposal Preparation" application. PIs that have not submitted a proposal to NSF in the past must contact their SRO to be added to the NSF PI database. This should be done as soon as the decision to prepare a proposal is made.

In order to use NSF FastLane to prepare and submit a proposal, the following are required:

Browser (must support multiple buttons and file upload)
*   Netscape 3.0 or greater
*   Microsoft Internet Explorer 4.01 or greater

PDF Reader (needed to view/print forms)
*   Adobe Reader 3.0 or greater

PDF Generator (needed to create project description)
*   Adobe Acrobat 3.01 or greater
*   Aladdin Ghostscript 5.10 or greater

A list of registered institutions and the FastLane registration form are located on the FastLane Web page.

Proposers are strongly advised to ensure that the required registrations have been completed, and the necessary software is available, well before the proposal submission deadline. The FastLane instructions specify how to obtain help if needed.

PROPOSAL REVIEW INFORMATION

All proposals will undergo external peer review by multidisciplinary panels. Proposals will be assigned to review panels on the basis of the issues addressed in the project. Proposals will not be separated by focal area (KN, LIS, NCC) for review (or funding decisions).

A.   Merit Review Criteria.

Review 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. Special care is taken to ensure that reviewers have no immediate and obvious conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority serving institutions, adjacent disciplines to that principally addressed in the proposal, etc.

Proposals will be reviewed against the following general merit 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 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 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?

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 learner perspectives. PIs should address this issue in their proposal to provide reviewers with the information necessary to respond fully to both NSF merit review criteria. NSF staff will give it careful consideration in making funding decisions.

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. PIs should address this issue in their proposal to provide reviewers with the information necessary to respond fully to both NSF merit review criteria. NSF staff will give it careful consideration in making funding decisions.

B.   Merit Review Process and Associated Customer Service Standard.

Most of the proposals submitted to NSF are reviewed by mail review, panel review, or some combination of mail and panel review. All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. 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. In most cases, proposers will be contacted by the program officer after his or her recommendation to award or decline funding has been approved by his or her supervisor, the division director. This informal notification is not a guarantee of an eventual award. 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 in this category. In those cases where a proposal is being considered for joint funding by separate divisions, directorates, or agencies, NSF will be able to notify applicants within nine months in 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 final programmatic approval has been obtained, the award recommendation then goes 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.

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.

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 Phase III (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.

Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). 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 also is available in paper copy by subscription from the Superintendent of Documents, Government Printing Office, Washington, DC 20402. 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 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 a new electronic project reporting system, available through FastLane, which 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. Reports will continue to be required annually and after the expiration of the grant, but PIs will not need to re-enter information previously provided, either with the proposal or in earlier updates using the electronic system.

Effective October 1, 1998, PIs are required to use the new reporting format for annual and final project reports. PIs are strongly encouraged to submit reports electronically via FastLane. For those PIs who cannot access FastLane, paper copies of the new report formats may be obtained from the NSF Clearinghouse as specified above. NSF expects to require electronic submission of all annual and final project reports via FastLane beginning in October, 1999.

D.   New Awardee Information.

If the submitting organization has never received an NSF award, it is recommended that the organization's appropriate administrative officials become familiar with the policies and procedures in the NSF *Grant Policy Manual* which are applicable to most NSF awards. The "Prospective New Awardee Guide" (NSF 97-100) includes information on: Administration and Management Information; Accounting System Requirements and Auditing Information; and Payments to Organizations with Awards. This information will assist an organization in preparing documents that NSF requires to conduct administrative and financial reviews of an organization. The guide also serves as a means of highlighting the accountability requirements associated with Federal awards. This document is available electronically on NSF's Web site at: <http://www.nsf.gov/cgi-bin/getpub?nsf97100>.

CONTACTS FOR ADDITIONAL INFORMATION

General inquiries should be made to kdi@nsf.gov. For questions related to use of FastLane, contact FastLane Project Officer, (703)306-1145, e-mail: fastlane@nsf.gov.

OTHER PROGRAMS OF INTEREST

The NSF Guide to Programs is a compilation of funding opportunities 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. Beginning in fiscal year 1999, the NSF Guide to Programs only will be available electronically. 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 E-Bulletin, available electronically on the NSF Web site at: <http://www.nsf.gov/>. The direct URL for the E-Bulletin is http://www.nsf.gov/home/ebulletin. 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 (FASED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the 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 regarding NSF programs, employment, or general information. TDD may be accessed at (703) 306-0090 or through FIRS on 1-800-877-8339.

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 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.

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: Reports Clearance Officer; Information Dissemination Branch, DAS; National Science Foundation; Arlington, VA 22230.

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 if 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.