Information and Intelligent Systems: Advancing Human-Centered Computing, Information Integration and Informatics, and Robust Intelligence

Program Solicitation
NSF 07-577

Replaces Documents:
NSF 06-572

National Science Foundation

Directorate for Computer & Information Science & Engineering
　Division of Information & Intelligent Systems

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

October 23, 2007

　　for Medium Projects

November 19, 2007

　　for Large Projects

December 10, 2007

　　for Small Projects

REVISION NOTES

In furtherance of the President's Management Agenda, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via Grants.gov or via the NSF FastLane system. In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

The following revisions have been made:

- This solicitation replaces NSF 06-572
- New cross-cutting technical areas: Intregative Intelligence (INT2) and Next-Generation Networked Information (NGNI) (see Section II.2)
- New deadline dates (October 23 - Medium, November 19 - Large, December 10 - Small)
- Anticipated Funding Amount increased

- Budget Size for the large-class Projects increased to $3,000,000 total budget
- Special formatting for proposal titles (see Section V. A. 1.)

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Information and Intelligent Systems: Advancing Human-Centered Computing, Information Integration and Informatics, and Robust Intelligence

Synopsis of Program:

NSF's Division of Information and Intelligent Systems intends to fund science and engineering research and education projects that develop new knowledge in the following **three core technical areas:**

- Human-Centered Computing (HCC);
- Information Integration and Informatics (III); and
- Robust Intelligence (RI).

In addition to the three core technical areas, IIS will support research in **two cross-cutting technical areas:**

- Integrative Intelligence (INT2); and
- Next-Generation Networked Information (NGNI).

The Division also encourages investigators to include in their proposals innovative curricula or educational materials to help advance literacy about and expertise in IIS areas.

To ensure that proposals with roughly comparable scope and objectives are reviewed together, IIS proposals are divided into **three classes by budget size:**

- Small Projects (up to $450,000 total budget);
- Medium Projects ($450,001 to $900,000 total budget); and
- Large Projects ($900,001 to $3,000,000 total budget).

Proposals with budgets that exceed $3,000,000 will be returned without review.

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

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 155   - It is anticipated that up to 155 awards will be funded, with up to 100 awards in the Small class, up to 50 awards in the Medium class, and up to 5 awards in the Large class.

Anticipated Funding Amount: $55,000,000 - Anticipated funding is $55,000,000 in FY 2008, pending availability of funds ($50,000,000 for HCC, III, and RI, and $5,000,000 for INT2 and NGNI).

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- Universities and Colleges: Universities and two- and four-year colleges (including community colleges) located and accredited in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

In response to this solicitation, an investigator may participate as PI, Co-PI, Senior Personnel or paid consultant in no more than two proposals. In order to treat everyone fairly and consistently, we will strictly enforce this rule. In the event that a PI, Co-PI, other Senior Personnel or paid consultant does appear in any of these roles on more than two proposals (whether they are lead or collaborative proposals or subawards), all proposals that include that person will be returned without review. No exceptions will be made.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable

- **Preliminary Proposal Submission:** Not Applicable

- **Full Proposals:**

    - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.

    - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf)

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.

- **Indirect Cost (F&A) Limitations:** Not Applicable

- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

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

    October 23, 2007

        for Medium Projects

    November 19, 2007

        for Large Projects

    December 10, 2007

        for Small Projects

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria apply.

Award Administration Information

Award Conditions: Standard NSF award conditions apply

Reporting Requirements: Standard NSF reporting requirements apply

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I. INTRODUCTION

The Division of Information and Intelligent Systems (IIS) supports science and engineering research and education projects that 1) develop new knowledge about the integration and co-evolution of social and technical systems, especially those that have the potential to transform learning and discovery and enhance quality of life and economic prosperity for all people; 2) increase the capabilities of human beings and machines to create, discover and reason with knowledge by advancing the ability to represent, collect, store, organize, visualize and communicate about data and information; 3) advance knowledge about how computational systems can perform tasks autonomously, robustly, and flexibly; and 4) advance the state-of-the-art in the application of IIS technologies in specific contexts.

II. PROGRAM DESCRIPTION

The IIS Division intends to fund science and engineering research and education projects that address **three core technical areas:**

- Human-Centered Computing (HCC);
- Information Integration and Informatics (III); and
- Robust Intelligence (RI).

In addition to the three core technical areas, IIS will support research in **two cross-cutting technical areas:**

- Integrative Intelligence (INT2); and
- Next-Generation Networked Information (NGNI).

To ensure that proposals with roughly comparable scope and objectives are reviewed together, IIS proposals are divided into **three classes by budget size:**

- Small Projects (up to $450,000 total budget);
- Medium Projects ($450,001 to $900,000 total budget); and
- Large Projects ($900,001 to $3,000,000 total budget).

Proposals that have budgets over $3,000,000 will be returned without review.

It is highly recommended that anyone submitting a Large Project speak with an IIS Program Officer before its submission to insure that it is appropriate for this solicitation.

Expansive creative thinking is encouraged. Funds will be used to support high-risk projects with high-impact potential. In this way, the Division will catalyze exciting new research activities with the potential to achieve significant advances. Interdisciplinary and international collaborations and knowledge exchange in the interest of revealing new, important scientific advances are encouraged. The Division also encourages proposals that include innovative curricula or educational materials that advance literacy about and expertise in IIS areas.

1. **CORE TECHNICAL AREAS**

   IIS intends to fund science and engineering research and education projects that address three core technical areas:

   - ***Human-Centered Computing (HCC)***
   - ***Information Integration and Informatics (III)***; and
   - ***Robust Intelligence (RI)***.

   a. ***Human-Centered Computing (HCC)*** research encompasses a rich panoply of diverse themes in Computer Science and IT, all of which are united by the common thread that human beings, whether as individuals, teams, organizations or societies, assume participatory and integral roles throughout all stages of IT development and use. People design new technologies; people, in teams and organizations, at school and at home, use them; people anticipate and enjoy their benefits; and they learn about the outcomes of use (whether anticipated or not) and translate that knowledge into the next generation of systems. At the same time, new information technologies and human societies co-evolve, transforming each other in the process. As a consequence, the design of IT must be sensitive to human values and preferences.

   HCC will support projects that investigate the use of IT in highly distributed and rapidly changing environments at various levels of granularity to achieve both immediate and long-term goals. It will support bold approaches to improving education, for example, through the integration of research and education in scientific collaboratories, which require new methods for giving the user a realistic experience of doing science and the opportunity to work collaboratively with other students, teachers, and scientists at multiple locations. Human-centered technology will enable all people to take advantage of the full benefits of computing, will empower people with disabilities, young children, seniors, and members of other traditionally under-represented groups to participate fully in the Information Society, and will foster independent aging in the community while maintaining social relationships and autonomy.

   Projects that are supported will, amongst other things, deepen our understanding of the globalization of communications and commerce, expanded value chains and clusters, outsourcing in all its forms, the transformation of knowledge and knowledge generation, and the role of IT in innovation and competition. The study of online interactions that transcend geographical and cultural boundaries, through new community-oriented applications in such areas as Internet voting and other electronic forms of citizenship, collaborative electronic publishing, Blogs, online multi-player games, computer-mediated arts and culture, virtual participatory theater, and ensemble music-making at-a-distance are encouraged. Inquires into the effect of IT on government-citizen interactions and digital democracy and IT-enabled community creation and development are also encouraged.

   HCC researchers will explore unprecedented human-computer and human-human interactions through systems that are aware of their social surroundings, systems that

understand concepts such as location in human terms, realistic immersive and multi-sensory technologies, and direct brain-computer interfaces. HCC research will transform the human-computer interaction experience, so that the computer is no longer a distraction or worse yet an obstacle, but rather a tool that empowers the user at work, in school, at home and at play, and that facilitates natural and productive human-software-device collaboration. HCC research will enhance human insight and creativity through highly interactive visual interfaces coupled with tools and techniques that enable people to synthesize information, to derive insight from massive, dynamic, and often conflicting data, to detect the expected, and to discover the unexpected. HCC encourages research on how humans, in various roles and domains, perceive computing artifacts as they use them.

Human-Centered Computing topics include, but are not limited to:

- Problem-solving in distributed environments, ranging across Internet-based information systems, grids, sensor-based information networks, and mobile and wearable information appliances.
- Multimedia and multi-modal interfaces in which combinations of speech, text, graphics, gesture, movement, touch, sound, etc. are used by people and machines to communicate with one another.
- Intelligent interfaces and user modeling, information visualization, and adaptation of content to accommodate different display capabilities, modalities, bandwidth and latency.
- Multi-agent systems that control and coordinate actions and solve complex problems in distributed environments in a wide variety of domains, such as disaster response teams, e-commerce, education, and successful aging.
- Models for effective computer-mediated human-human interaction under a variety of constraints, (e.g., video conferencing, collaboration across high vs. low bandwidth networks, etc.).
- Definition of semantic structures for multimedia information to support cross-modal input and output.
- Specific solutions to address the special needs of particular communities.
- Collaborative systems that enable knowledge-intensive and dynamic interactions for innovation and knowledge generation across organizational boundaries, national borders, and professional fields.
- Novel methods to support and enhance social interaction, including innovative ideas like social orthotics, affective computing, and experience capture.
- Studies of how social organizations, such as government agencies or corporations, respond to and shape the introduction of new information technologies, especially with the goal of improving scientific understanding and technical design.

It is anticipated that Human-Centered Computing will support computer scientists as well as social and behavioral scientists and economists whose work contributes to the design and understanding of novel information technologies. However, HCC research should primarily advance the computer and information sciences rather than the social, behavioral, or economic sciences. Similarly, algorithms, protocols and hardware to build mobile networks would not be appropriate unless there was a very strong focus on individual or group users.

Human-Centered Computing (HCC) subsumes topics covered by these areas previously supported by the IIS Division: Digital Society and Technologies; Human-Computer Interaction; and Universal Access.

b. ***Information Integration and Informatics (III)*** adopts the view that digital content has various stages of refinement and maturity, which can meet diverse sets of needs and serve many purposes. In this view, the hierarchy of refinement and structure proceeds from data to information to knowledge to understanding and, finally, to decision or action as well as to new applications supported by appropriate and necessary digital technologies. The progression is one from bits to data structures and organization to contextualized information objects and resources that support the creation and use of knowledge and understanding through human reasoning and artificial intelligence. The research focus is on digital content and the relevant processes, technologies, and human involvement in creation, storage, querying, representation, presentation, organization, integration, updating, management, analysis, security, privacy, interaction and preservation at each stage of the hierarchy of technology environments from personal computers to globally-distributed dynamic networked repository systems.

Supported activities include:

- III core research (III-COR), which expands and strengthens the foundations of III

research and education, and broadens its impact in all domains; and

- III contextual research (III-CXT), which explores and extends the potential of III research in specific contexts.

Context is taken in the broadest sense of the term to mean naturally-occurring and human-constructed environments (domains) in which interdependencies and relationships flourish. The goals of III contextual research (III-CXT) are to 1) have a significant impact on the domain in which the advances are made, and 2) illuminate gaps and establish new priorities for research in either III-COR or III-CXT research topics.

For III-CXT research, computer and information scientists and engineers must collaborate with domain users. Domain users may include, but are not limited to: domain scientists or engineers; federal, state, or local governmental agencies; humanities' faculty; clinics or hospitals; and non-governmental organizations. This requirement enables the establishment of context, the generation of interesting computer science problems, and the provision of environments for subsequent validation of the proposed solutions. The proposal must include expertise in the contextual domain and demonstrate that the collaboration is substantive. In addition, each proposal must address the specific question: *What is the innovative computer science, computer engineering, or information science contribution of this proposal?*

Collaborations are not required for III-COR projects, nor do they need to be focused on any particular domain. Instead, new knowledge should be generalizable across domains.

III topics include, but are not limited to:

- Transformation of raw data into information and knowledge.
- Creation of new forms of digital content, representations of digital content, access frameworks, delivery services and presentation and analysis tools.
- Long-term preservation and archiving of valuable data assets.
- Models of information structures in application areas relying on incomplete data, such as is required to reconstruct past events, cultures, objects and places in the fields of archeology, history, paleontology, geology, and ecology.
- Storage, organization, retrieval, updating and mining of data, text, speech, multimedia, multidimensional structures, and streams.
- Extraction of structured information from unstructured sources.
- Information/knowledge discovery, fusion, summarization, and visualization.
- Algorithms for personalizing, organizing, navigating, searching, interpreting, and presenting information of different types, using various modalities.
- Design, management, and governance for information infrastructures, including information flow, adaptive evolution and interoperability.
- Knowledge environments for science and engineering.
- Information integration research that leads to a uniform interface to a multitude of heterogeneous independently developed data sources.
- Information visualization and visual analytics.
- Information integration research in issues arising in natural disaster recovery, such as telecommunications, message passing, and data loss.

Information Integration and Informatics (III) subsumes topics covered by these areas previously supported by the IIS Division: Digital Government; Digital Libraries and Archives; Information, Data, and Knowledge Management; and Science and Engineering Information Integration and Informatics.

c. ***Robust Intelligence (RI)*** encompasses computational understanding and modeling of the many human and animal capabilities that demonstrate intelligence and adaptability in unstructured and uncertain environments. The general goals of this technical area include the study, theory, design, and implementation of general, integrated, intelligent perception, communication, and reasoning capabilities that are not constrained to address only a single problem in isolation or in one particular context. Systems exhibiting Robust Intelligence are able to use a variety of modeling and reasoning approaches, such as analogical, statistical, and logical inference, to deal with open-ended and changing concepts and environments and to integrate possibly heterogeneous knowledge and reasoning methodologies in complementary and supplementary ways. Such systems are able to respond intelligently in novel situations, and to gaps, conflicts, and ambiguities in their data, knowledge, and capabilities with a level of flexibility and generality comparable to that of humans and animals. Robust intelligent systems are able to assess their environment autonomously, construct plans to achieve general goals, learn transferable lessons from their experiences, and communicate their knowledge, conclusions and reasoning to others so that they can evolve and

grow in capability and robustness.

Robust intelligent systems can operate at a variety of levels and synergistically integrate neural, perceptual, motor, reasoning, and communication aspects of intelligence. With respect to modeling the uniquely human ability to communicate using natural language, robust intelligent systems strive to achieve human-level performance in language understanding and generation, succinct rendering or summarization of information, and translation between languages. They strive to achieve the robustness and high level of performance found in visual and motor systems in both humans and animals. Robotic systems exhibiting robust intelligence are able to integrate their multi-modal sensory inputs, learn and reason from past experiences in order to adapt, and operate autonomously in teams or interact cooperatively with humans in dynamic and changing environments. Robust intelligent systems may leverage the computational strategies employed by the neural systems of humans and animals. In all their aspects, robust intelligent systems are capable of harnessing past experiences to solve new problems and to meet new expectations; not only are they able to improve things they are currently tasked with, but they are also, and perhaps even more importantly, able to anticipate and propose new tasks.

RI topics include, but are not limited to:

- Problem solving architectures that integrate reasoning, motor, perceptual, and language capabilities and that can learn from experience.
- Hybrid architectures that integrate or combine different methods, such as deductive, probabilistic, analogical, case-based, symbolic, or sub-symbolic reasoning.
- Computational models of human cognition, perception, and communication for commonsense or specialized domains and tasks, including acquisition and representation of ingredient knowledge.
- Novel approaches to long-standing problems in computer vision, for example concerning the recognition and modeling of contours, shapes, regions, objects, people, scenes, events, activities, in 2D images, 3D images or video.
- Vision systems that capture biological components and capabilities.
- Synergistic and collaborative research of innovative and emerging technologies to improve the intelligence, mobility, autonomy, manipulability, adaptability, and interactivity of robotic systems operating in unstructured and uncertain environments.
- Research on intelligent and assistive robotics, neuro-robotics, multi-robot coordination and cooperation, and micro- and nano-robotics with novel approaches to sensing, perception, cognition, actuation, autonomous manipulation, learning and adaptation, haptics, and multi-modal human-robot interaction.
- Multi-agent systems that control and coordinate actions and solve complex problems.
- Computational approaches and architectures for analyzing, understanding, generating and summarizing speech, text and other communicative forms (e.g., gesture, haptic); interaction of communicative forms; and dialogue, conversation and other less formal genres (e.g., meeting minutes).
- Computational models of meaning, intent, and realization at various levels of language representation with a particular attention to semantics and pragmatics; cognitively and neuro-linguistically informed approaches for model evaluation.
- Novel approaches to longstanding language processing problems such as speaker and language recognition, machine translation, evaluation metrics, and multilingual man-machine communication, including intelligent information delivery.
- Computational approaches to language processing for underrepresented groups such as minority language groups and aging and disabled population groups.
- Functional modeling, theory, and analysis of the computational, representational, and coding strategies of neural systems.
- Neurally-grounded computational approaches to computer vision, robotics, communication, and reasoning, and systems that combine them and embody empirically derived neural strategies.

RI supports projects that will advance the frontiers of disciplines such as computational neuroscience, language, vision, robotics, and artificial intelligence as well as those that integrate different aspects of these disciplines. While it is not necessary for every project to develop complete integrated solutions, projects that focus on advancing a single aspect must lead towards the more general RI goals mentioned above.

Robust Intelligence (RI) subsumes topics covered by these areas previously supported by

the IIS Division: Artificial Intelligence and Cognitive Systems; Computational Neuroscience; Computer Vision; Human Language and Communication; and Robotics.

2. **CROSS-CUTTING TECHNICAL AREAS**

This solicitation supports research in two cross-cutting technical areas. We expect Program Officers across the IIS Division to participate in their cross-disciplinary review.

1. **Integrative Intelligence (INT2).** Many decades of work on building software artifacts that exhibit intelligent behavior have focused on circumscribed computational capabilities, such as in machine learning and knowledge discovery, planning and reasoning under uncertainty, robotics, spoken and written language, and computer vision. We now have significant bodies of results in each of these areas, together with a collection of core methods that reappear across them. However, the development of more broadly competent systems requires facing the challenges that arise in tackling and synthesizing multiple capabilities synergistically. The Integrative Intelligence (INT2) cross-cutting technical area seeks novel approaches that tackle the challenges of creating more broadly capable intelligent systems that master and integrate multiple capabilities at various levels and with various approaches and methods. Efforts that combine researchers with expertise in different areas are especially welcome.

2. **Next-Generation Networked Information (NGNI).** Advances in information systems must occur hand-in-hand with advances in the networking technologies that underlie them. The Next-Generation Networked Information (NGNI) cross-cutting technical area seeks innovative research on information systems that anticipate future distributed networking environments. Examples of questions that NGNI projects might address include: What new information systems are possible in networks with massive numbers of nodes of extreme heterogeneity with respect to capability, mobility, and use? How can vast, heterogeneous, distributed, and uncoordinated sources of data and information be made comprehensible, manageable, and useful for the unforeseen and diverse tasks to which they may be relevant? What new metaphors and models will make it possible to impart coherence to the diverse ways users might access information in the future? How can information be accessed and disseminated based on both content and context (e.g., both as a function of the nature of the information itself and as a function of the current state of the user, device, and network)? How can next-generation networked information systems inform and be informed by the social structures that rely on them? How can we provide timely and coherent access to information when the magnitude of the information flow dwarfs our ability to transport, process, or comprehend the data directly? These questions are meant to be exemplary, not prescriptive. NGNI projects should be clear about the researchers' anticipated future networking environment, as well as the means for evaluating the project's results. Projects that focus primarily on traditional Networking and Distributed Systems research are not appropriate for this solicitation. However, projects that involve partnerships between researchers in Information and Intelligent Systems and Networking and Distributed Systems are especially welcome.

The IIS Division's previous solicitation 06-572 supported research in the cross-cutting technical areas of Human-Robot (and/or Agents) Interaction (HRI) and Information Privacy and Security (IPS). Proposals in these areas are still welcome, but should henceforth be submitted directly to the most appropriate core technical area (HCC, III or RI), depending upon the focus of each project.

CLASSES OF PROPOSALS BY BUDGET SIZE

To ensure that proposals with roughly comparable scope and objectives are reviewed together, IIS proposals are divided into **three classes of budget by size**:

Small Projects (up to $450,000 total budget) are intended to be well-suited to single-investigator projects with a duration of up to three years.

Medium Projects ($450,001 to $900,000 total budget) are intended to be well-suited to many multi-investigator, multi-institutional, and/or multi-disciplinary projects with durations up to four years. Some justification is needed to explain why a budget of this size is required to carry out the research. A Management Plan is required for all medium proposals. (Three additional pages are allowed for the Management Plan. Please see Proposal Preparation Instructions Section V.A.3. for additional information on Management Plans.)

Large Projects ($900,001 to $3,000,000 total budget) are intended to be well-suited to larger multi-investigator and multi-institutional projects with a project duration of up to five years. Projects must be seen to be highly integrated. Additional justification is needed to explain why a budget of this size is required to carry out the research. A Management Plan is required for all large proposals. (Three additional pages are allowed for the Management Plan. Please see Proposal Preparation Instructions Section V.A.3. for additional information on Management Plans.)

Proposals that have budgets over $3,000,000 will be returned without review.

It is highly recommended that anyone submitting a Large Project speak with an IIS Program Officer before its submission to insure that it is appropriate for this solicitation.

III. AWARD INFORMATION

NSF expects to make the following types of award(s): Standard or Continuing Grants.

The estimated number of awards is approximately 155, with up to 100 small awards, 50 medium awards, and 5 large awards. It is anticipated that approximately $55,000,000 will be available for new awards ($50,000,000 for HCC, III, and RI, and $5,000,000 for INT2 and NGNI.)

Estimated funds available, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- Universities and Colleges: Universities and two- and four-year colleges (including community colleges) located and accredited in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

In response to this solicitation, an investigator may participate as PI, Co-PI, Senior Personnel or paid consultant in no more than two proposals. In order to treat everyone fairly and consistently, we will strictly enforce this rule. In the event that a PI, Co-PI, other Senior Personnel or paid consultant does appear in any of these roles on more than two proposals (whether they are lead or collaborative proposals or subawards), all proposals that include that person will be returned without review. No exceptions will be made.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide

(GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

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

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

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

The following information supplements the NSF Grant Proposal Guide (GPG) and the NSF Grants.gov Application Guide.

In addition to the requirements in the GPG or NSF Grants.gov Application, these instructions must be followed:

1. **Proposal Titles:** Proposal titles must begin with an acronym that indicates a core or cross-cutting technical area as indicated below and must also include the budget class size. The acronym and budget class size should be hyphenated and followed with a colon, then the title. For example, if you are submitting to Robust Intelligence and submitting a Medium budget class size proposal, then your title would be **RI-Medium: Title**. If you submit a proposal as part of a set of collaborative proposals, the title of the proposal should begin with the acronym that indicates the core or cross-cutting technical area, budget class size followed by a colon, then "Collaborative Research" followed by a colon, and the title. For example, if you are submitting a Large budget class size collaborative set of proposals to Human-Centered Computing, the titles of each would be **HCC-Large: Collaborative Research: Title.** Information Integration and Informatics proposals must select either **III-COR:** or **III-CXT:** and the budget class size to precede the title.

   Core Technical Area Acronyms:
   Human Centered Computing = **HCC**
   Robust Intelligence = **RI**
   Information Integration and Informatics - Core = **III-COR**
   Information Integration and Informatics - Contextual = **III-CXT**

   Cross-Cutting Technical Area Acronyms:
   Integrative Intelligence = **INT2**
   Next-Generation Networked Information = **NGNI**

2. **Project Summary:** All projects submitted to this competition must provide up to four key words at the end of the Project Summary. These key words should describe the main scientific areas explored in the proposal. Key words should be prefaced with "Key Words" followed by a colon and each key word separated by semi-colons. Key words should be of the type used to describe research in a journal submission. They should be put at the end of the project summary and might appear, for example, as **Key Words: multi-modal interfaces; information visualization; machine translation; information privacy.**

   Proposals that incorporate curriculum development activities should briefly summarize the curriculum development activities in the project summary.

3. **Project Description:** All medium and large class projects must include a Management Plan. Up to three additional pages are permitted in the Project Description for this purpose only, allowing a maximum of 18 pages. The Management Plan must include: 1) the specific roles of the PI, Co-PIs, other Senior Personnel and paid consultants at all organizations involved; 2) how the project will be managed across all the investigators, institutions, and/or disciplines; 3) identification of the specific coordination mechanisms that will enable cross-investigator, cross-institution, and/or cross-discipline scientific integration (e.g., yearly workshops, graduate student exchange, project

meetings at conferences, use of the grid for videoconferences, software repositories, etc.), and 4) specific references to the budget line items that support these management and coordination mechanisms.

Proposals that incorporate curriculum development activities should summarize the curriculum development activities in a separate section of the Project Description entitled "Curriculum Development Activities."

4. **Supplementary Documents:** In the Supplementary Documents Section, include a list of all PIs, Co-PIs, Senior Personnel, paid Consultants, Collaborators and Postdocs to be involved in the project. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

   1. Mary Smith; XYZ University; PI
   2. John Jones; University of PQR; Senior Personnel
   3. Jane Brown; XYZ University; Postdoc
   4. Bob Adams; ABC Inc.; Paid Consultant

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

C. Due Dates

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

  October 23, 2007

  for Medium Projects

  November 19, 2007

  for Large Projects

  December 10, 2007

  for Small Projects

We anticipate similar deadlines in future years.

D. FastLane/Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

  Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

  Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

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

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants. gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document.

The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts with the proposer.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. 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 the reviewer 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, original, or potentially transformative 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?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

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.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

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

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the date of receipt. The interval ends when the Division Director accepts the Program Officer's recommendation.

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or 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 agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

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

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

C. Reporting Requirements

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

Failure to provide the required annual or final project reports will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- William Bainbridge, Program Director, 1125S, telephone: (703) 292-8930, fax: (703) 292-9073, email: wbainbri@nsf.gov

- Amy Baylor, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: abaylor@nsf.gov

- Lawrence Brandt, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: lbrandt@nsf.gov

- Daniel DeMenthon, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: ddementh@nsf.gov

- Douglas H. Fisher, 1125 S, telephone: (703) 292-7356, email: dhfisher@nsf.gov

- Ephraim Glinert, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: eglinert@nsf.gov

- Stephen Griffin, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: sgriffin@nsf.gov

- Le Gruenwald, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: lgruenwa@nsf.gov

- Tatiana (Tanya) Korelsky, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: tkorelsk@nsf.gov

- C.S. George Lee, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: csglee@nsf.gov

- Wayne Lutters, Program Director, 1125 S, telephone: (703) 292-8738, fax: (703) 292-9073, email: wlutters@nsf.gov

- Mary Lou Maher, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: mmaher@nsf.gov

- Frank Olken, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: folken@nsf.gov

- Sylvia Spengler, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: sspengle@nsf.gov

- Kenneth Whang, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: kwhang@nsf.gov

- Maria Zemankova, Program Director, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: mzemanko@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

For Administrative Questions Regarding this Solicitation Contact:

Human-Centered Computing (HCC)

- Sanya N. Clark, Junior Project Specialist, Directorate for Computer & Information Science & Engineering, Division of Information and Intelligent Systems, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: snclark@nsf.gov

Information Integration and Informatics (III)

- Michele Johnson, Junior Project Specialist, Directorate for Computer & Information Science & Engineering, Division of Information and Intelligent Systems, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: mrjohnso@nsf.gov

Robust Intelligence (RI)

- Gloria Strothers, Integrative Activities Specialist, Directorate for Computer & Information Science & Engineering, Division of Information and Intelligent Systems, 1125 S, telephone: (703) 292-8930, fax: (703) 292-9073, email: gstrothe@nsf.gov

Investigators are also encouraged to consult the solicitation FAQ, available from the IIS Division website, for helpful information and clarifications concerning this solicitation.

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, MyNSF (formerly the Custom News Service) is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. MyNSF also is available on NSF's Website at http://www.nsf.gov/mynsf/.

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act

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

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

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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

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

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

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

- **TDD (for the hearing-impaired):**   (703) 292-5090

- **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; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a

party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records, " 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (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 the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

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

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