NATIONAL SCIENCE FOUNDATION

FY 2001 REPORT

NSF COMMITTEE OF VISITORS (COV)

Experimental and Integrated Activities Division
Directorate for Computer and Information Science and Engineering (CISE)
Held May 1-2,2001

April 12, 2004

FY 2001 REPORT
of
NSF COMMITTEE OF VISITORS (COV)

Directorate for Computer and Information Science and Engineering (CISE)

Division of Experimental and Integrative Activities (EIA)

I. Division Report

A. EIA Evolution and Current Structure

The Division of Experimental and Integrative Activities (EIA) was created in 1998 by combining the Division of Cross-Disciplinary Activities (CDA) with several programs previously managed by other CISE divisions. In essence, EIA combined the infrastructure, instrumentation and workforce programs of CDA with a portfolio of broad-based research programs (CISE Challenges, Experimental Systems, Experimental Software Systems, etc.). With the start of the Information Technology Research (ITR) Program, EIA began targeting its research funding towards enabling interdisciplinary research in new areas where IT research interfaced with other research areas such as biology, education, social science, and government, and where new IT research could be informed by application-specific needs and constraints.

EIA manages a large portfolio of programs; some are managed as base programs for the Division, some are collaborative with other directorates where EIA may represent the Division's interests or those of CISE as a whole, and some are cross-NSF programs in which EIA participates on behalf of CISE or, in a few cases, only on behalf of the Division. The total number of programs for which EIA is responsible exceeds *fifty*. EIA has organized its programs into four areas: Multi-Disciplinary Research; Instrumentation and Infrastructure; Education and Workforce; and Symposia, Travel, Studies and International Activities. Each of these categories includes base, collaborative and cross-NSF programs.

The Multi-Disciplinary Research programs include base programs covering research at the interface of biology and information technology, research in IT-enabled education and learning, research in digital government and governance, and research in application systems and software. This area also encompasses EIA activities related to the NSF priority areas: Information Technology Research, Nanoscale Science and Engineering, Biocomplexity and the Environment, and Learning. In the first two, EIA is one of several CISE divisions participating, while in the latter two EIA is the primary CISE participant. EIA also manages the Science and Technology Centers grants assigned to CISE.

Within Instrumentation and Infrastructure are the programs EIA (and CDA before it) has managed for the longest period. These programs are being restructured and folded into two primary programs: CISE Research Resources and CISE Research Infrastructure. In the former, EIA emphasizes providing the necessary resources (hardware, software, instruments, data, communications, support, services) to expand the capacity for CISE research with special attention to emerging groups, departments, and scientific areas and to under-served regions and institutions. Resources are provided to groups of individual researchers, to larger synergistic groups, to departments, to multi-institutional groups and to enable the establishment of national and international shared resources. The Infrastructure program focuses on enabling significant CISE-related research projects of realistic scale and complexity. EIA also participates in and manages the NSF-wide Major Research Instrumentation program for CISE.

The Education and Workforce programs represent a large and diverse portfolio. The Information Technology Workforce program is an EIA base program that supports research into the underlying causes of the low participation of women and under-represented groups in the IT workforce. The Educational Innovation program and its companion, the Combined Research and Curriculum Development Program (with ENG), support the rapid transfer of research into new CISE-related curricula. EIA supports a number of community-initiated projects addressing workforce and education issues within the EWF Special Projects. EIA provides substantial staff resources to coordinating, for CISE, the many Education and Workforce programs of the foundation. These include Graduate Research Fellowships, the GK-12 Program, Advance, POWRE, REU Sites, IGERT, RUI/PUI, Louis Stokes Alliances, Distinguished Teaching Fellows, SBIR/STTR, and many others.

Finally, EIA supports symposia, travel grants, studies and international activities of interest to CISE.

EIA manages the more than 50 programs in its portfolio with eight full-time program managers, six part-timers, and six support staff. The purpose of grouping the programs within the four areas and, within the areas, coalescing the existing programs into smaller, broader programs, is to bring the whole into a more manageable format. Still EIA is a division in transition, with developing research programs that require substantial cross-NSF and cross-agency coordination. It also has seen the number of NSF-wide programs requiring representation and coordination grow substantially from a few dozen to more than 30.

B. Executive Summary of the CoV

The many programs in EIA were logically partitioned into Clusters and each Cluster was reviewed by a CoV subpanel. The seven Clusters are listed below.

Cluster #1 Education
Educational Innovation (EI)
Combined Res. and Curriculum Development (CRCD)
Cluster #2 Instrumentation & Infrastructure
CISE Adv. Distr. Resources for Experiments (CADRE)
CISE Advanced Resources for Experiments (CARE)
CISE Instrumentation
CISE Research Infrastructure
Major Research Infrastructure (MRI)
Cluster #3 Digital Government *(DG)*
Cluster #4 Experimental Systems *(ES)*
Cluster #5 Next Generation Software *(NGS)*
Cluster #6 Workforce Programs
Minority Institution Infrastructure (MII)
CISE Postdoctoral Research Associates
ITWF and Other Workforce Projects
REU Sites
Cluster #7 NSF-Wide & Other Programs
Professional Opportunities for Women in Research and Education (POWRE)
Increasing the Participation of Women in Academic Science and Engineering Careers (ADVANCE)
Integrative Graduate Education and Research Training (IGERT)
Science and Technology Centers (STC)
Biocomplexity (BE)
Nanoscale Science and Engineering
Presidential Faculty Fellowship Awards (PFF)
Interagency Educational Research Iniative (IERI)
Information Technology Research (ITR)
Conselho Nacional Desenvolvimento Cientifico Tecnologico (CNPq)
Consejo Nacional de Ciencia y Tecnología Collaborative Research Opportunities -- with Mexico (CONACyT)
Special Projects and International Programs

Each subpanel reviewed the programs in their Cluster to judge how well the programs were meeting the NSF goals. This Executive Summary summarizes the CoV findings. The EIA Division met all goals except Efficiency (time to decision) for the Digital Government Program and the Implementation of merit review criteria by reviewers for the Instrumentation & Infrastructure and Next Generation Software Programs. The CoV recommends that EIA move quickly to put into place procedures to address these problem areas. Detailed reports for each Cluster are contained in the Appendix to this CoV Division Report.

B.1. Integrity and Efficiency of the Program's Processes and Management

The CoV's summary evaluation of EIA programs with respect to the integrity and efficiency of processes and management are given in Tables 1, 2, and 3. In the tables in this Division Report, an **S** indicates the Division was judged *Successful* in meeting the goal and an **NS** indicates the Division was judged *Not successful*. Some of the goals were not applicable (**NA**) for certain programs due to the nature of the program and/or goal. Some programs were not evaluated against the GPRA goals because their review is included in other COVs.

Table 1. Effectiveness of the program's use of merit review procedures

Indicators	Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits)	Effectiveness of program's review process;	Efficiency; time to decision	Completeness of documentation making recommendations;	Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
Education	**S**	**S**	**S**	**S**	**S**
Instrumentation & Infrastructure	**S**	**S**	**S**	**S**	**S**
Digital Government	**S**	**S**	**NS**	**S**	**S**
Experimental Systems	**S**	**S**	**S**	**S**	**S**
Next Generation SW	**S**	**S**	**S**	**S**	**S**
Workforce	**S**	**S**	**S**	**S**	**S**
NSF-Wide & Other	**NA**	**NA**	**NA**	**NA**	**NA**
Overall EIA	**S**	**S**	**S**	**S**	**S**

Very few proposals submitted to EIA are traditional individual investigator research proposals. Instead they run the gamut from revolutionary hardware and software systems research and development proposals submitted to Experimental Systems and Next Generation Software, respectively, to proposals that impact government information flow and productivity submitted to Digital Government, to proposals seeking to advance education in computer science and engineering and to use the computer science and engineering technology in the most effective way in the classroom, to proposals focused on enhancing the diversity of people in the discipline. Thus, he vast majority of proposals submitted to EIA are panel reviewed, often with the proposals mailed to panel members before the panel meeting with a request that an individual review of the proposal be done prior to panel discussions. Some of the panels were charged with reviewing proposals covering such a wide range of topics that there were times when no one on the panel was an expert in a particular proposal area. This also seems to be in the nature of many of the EIA programs and may be inevitable without having impractically large panels.

Some panel reviews are augmented with ad-hoc reviews and a few with site visits. In another case, the Cluster recommended that site visits be made prior to funding decisions (i.e., for RI and CADRE). Individual reviews of proposals submitted to EIA are rare, partially due to the nature of the programs in EIA and partially due to the workload of the program directors. The only problem area was Efficiency (time to decision) for the Digital Government Program. The CoV recommends that EIA move quickly to put into place procedures to improve the proposal dwell time for this program.

Table 2. The program's use of the NSF Merit Review Criteria

Indicators	Implementation of merit review criteria by reviewers (intellectual merit and broader impacts)	Implementation of merit review criteria by program officers (intellectual merit and broader impacts)
Education	**S**	**S**
Instrumentation & Infrastructure	**NS**	**S**
Digital Government	**S**	**S**
Experimental Systems	**S**	**S**
Next Generation SW	**NS**	**S**
Workforce	**S**	**S**
NSF-Wide & Other	**NA**	**NA**
EIA Overall	**S**	**S**

For the most part, review panels did an effect job of reviewing proposals, providing careful reviews and justifying their discussions. Most of the Clusters found the program's use of NSF's merit review procedures to be followed by both the panel reviewers and the program directors with, perhaps, more attention to the intellectual merit of the proposed research than to the broader impacts. The exception was in the Implementation of merit review criteria by panel reviewers for the Instrumentation & Infrastructure and Next Generation Software Programs. The CoV recommends that EIA move quickly to put into place procedures to address the reviewer problems in these two programs.

Program officers seemed to be more sensitive to the issues of broad impact than reviewer panels. An introductory discussion with the panel members led by the program director was an important factor in getting panels to address the merit review procedures and also to give special attention to high risk, but high payoff proposals.

Table 3. Other program management issues

Indicators	Reviewer selection				Resulting portfolio of awards					
	Adequate # for balanced review	Appropriate expertise/qualifications	Balance among characteristics	Conflicts of interest	Overall quality	Scope, size, and duration	Emerging opportunities	Openness	Integration of R&E	Balance
Education	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
Instrumentation & Infrastructure	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
Digital Government	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
Experimental Systems	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
Next Generation SW	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
Workforce	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
NSF-Wide & Other	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
EIA Overall	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

While it was evident in most clusters that attempts were made by the program officers to balance the representation on review panels it is not always possible in a discipline with less than 5% of the population from underrepresented groups and less than 20% women. Most proposals received between three and five reviews plus a panel summary. Material in the proposal jackets appears to be well managed and thorough.

However, in most clusters the time to decision has increased during the last few years with this increase seen most dramatically in the last year as the workload on program directors grew significantly with the influx of ITR proposals.
Most clusters were pleased with the resulting portfolio of awards. In some clusters (e.g., Education) there was a shortage of proposals from smaller institutions. Cluster members speculated that this was due to the requirement for a 50% cost sharing, an amount that is hard for small institutions to provide. Diversity of investigators is an issue (as it is for review panel membership) once again mostly due to the under representation of women and minorities in the computer science and engineering research pool and not due to prejudice in the system or in review panels. Additionally, the effectiveness of the program director in working with submitters of declined proposals helping to guide them in revising and resubmitting their proposals seems variable across clusters with some program directors being applauded for their efforts.

B.2. Outputs and Outcomes of NSF Investments

The CoV's summary evaluation of EIA programs with respect to the outputs and outcomes of NSF investments are given in Tables 4, 5, and 6.

People Outcomes

Research in this area focuses on the development of a diverse, internationally competitive, and globally-engaged workforce of scientists, engineers, and well-prepared citizens.

Table 4. People - Development of "a diverse, internationally competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens."

Indicators	Improved mathematics, science, and technology skills for U.S. students at the K-12 level and for citizens of all ages.	A science and technology and instructional workforce that reflects America's diversity.	Globally engaged science and engineering professionals who are among the best in the world.	A public that is provided access to the benefits of science and engineering research and education.	Overall Rating For Goal by COV
Education	**S**	**S**	**S**	**NA**	**S**
Instrumentation & Infrastructure	**S**	**S**	**S**	**S**	**S**
Digital Government	**NA**	**S**	**S**	**S**	**S**

Experimental Systems	**S**	**S**	**S**	**S**	**S**
Next Generation SW	**S**	**S**	**S**	**S**	**S**
Workforce	**S**	**S**	**S**	**S**	**S**
NSF-Wide & Other	**NA**	**NA**	**NA**	**NA**	**NA**
EIA Overall	**S**	**S**	**S**	**S**	**S**

Due to the nature of EIA programs, the primary indicator of success in the **PEOPLE** strategic outcome goal is the education of globally engaged science and engineering professionals and, in this, all Clusters demonstrated success. Some programs contributed at the undergraduate level (e.g., Education and NSF-Wide cluster programs) and essentially all in the education of graduate students. Often students (both undergraduate and graduate) were involved with the development, experimental evaluation, and delivery of large-scale software and hardware artifacts in addition to the research. There were numerous examples where research ended up also being integrated into the classroom curricula even in programs where that was not a required outcome. Some programs also contributed to this outcome goal by providing professionals with world-class instrumentation needed to perform the research (i.e., programs in the Instrumentation and Infrastructure cluster).

Examples of People Outcomes

Select research, organized by CISE division, illustrating **PEOPLE** outcomes includes the following:

NSF Award Number: EIA00-90043
PI Names: Jane Margolis, Jeannie Oakes
PI Institutions: University of California Los Angeles
Relevant Performance Goals: Improved mathematics, science, and technology skills for U.S. students at the K-12 level and for citizens of all ages, so that they can be competitive in a technological society. A science and technology and instructional workforce that reflects America's diversity
Relevant Area of Emphasis: Broadening Participation
Source for Report: Information Technology Workforce Program Report

Jane Margolis, a researcher in gender issues in computer science, and Jeannie Oakes, an Education researcher--both at the University of California, Los Angeles--are conducting a project that is investigating why so few male and female African American and Latino students study computer science at the high school level. Three urban public high schools in the Los Angeles Unified School District, each with large numbers of under-represented minority students, are participating in the research study. Each school is designated as a “digital high school” and each has received a California Education Technology Grant to fully integrate computers, networks, training, and software. The outcome goal is to achieve computer literacy in all pupils and faculty and to improve overall academic achievement. The UCLA research team is interviewing and observing 9th and 10th grade African-American and Latino students over a three-year period, and will explore physical surroundings, dynamics among teachers, students, and peers as well as psychosocial and cultural factors confidence and racial identity that may influence the study of computer science.

Preliminary data shows that low numbers of under-represented minorities and women are enrolling in CS beyond the introductory level, and that mathematics is acting as a gatekeeper. However, some counter-intuitive events have occurred. For example, participation in the robotics after school club at one of the schools is largely Latina, a phenomenon requiring further study.

NSF Award Number: EIA95-22207; EIA00-80940
PI Names: Ann Q. Gates, Andrew Bernat, David G. Novick, Sergio D. Cabrera, Patricia J. Teller
PI Institution: University of Texas El Paso
Relevant Performance Goal: A science and technology and instructional workforce that reflects America's diversity
Relevant Area of Emphasis: Broadening Participation
Source for Report: CISE Minority Institutions Infrastructure Program Report

With support from two EIA-MII awards, University of Texas El Paso researchers are addressing retention and participation of traditionally underrepresented groups in computing. Developing a framework involving undergraduate and graduate students in research, they have created laboratories to support research in neuro-fuzzy systems, parallel and distributed systems, signal processing and communication systems, software engineering, and theoretical applications.

Students involved in this study include: 73 graduate students (12 Ph.D. students); 102 undergraduate students; 136 students from underrepresented groups (38 female); 61 students graduated with BS; 38 students graduated with MS; two students graduated with a Ph.D.; 31 undergraduate students continued to graduate school. The breakdown of publications, talks, and awards over the five years is as follows: over 150 research publications; over 100 research publications (journal and conferences) with students as co-authors; 23 publications and talks on the Affinity model; 66 student presentations at student conferences; 25 student awards and recognition.

One notable research contribution was made by two undergraduate students, Michael Maxwell and Luis Rauda, whose work resulted in the design of a performance-friendly system for monitoring the integrity of software during runtime. Although the value of checking for correct behavior of programs is beyond dispute, runtime software monitoring has not been widely adopted because of the degradation of performance caused by adding monitoring code. The students investigated an approach that, through snoopy hardware, delegates monitor responsibilities to a process other than the one executing the application program. Their paper describing this work, "An Initial Design of a Coprocessor/Snoopy Hardware Integrity Constraint-Checking Simulator" won the Best Student Paper Award at the 1998 International Test and Evaluation Workshop on Modeling and Simulation. In addition to the cash award that they received, the conference donated money to the scholarship fund in the College of Engineering.

NSF Award Number: EIA 01-19532
PI Names: Paul A. Fishwick, Jane Douglas, Timothy A. Davis
PI Institutions: University of Florida
Relevant Performance Goal: A public that is provided access to the benefits of science and engineering research and education.
Relevant Area of Emphasis: Addressing near-term workforce needs; broadening participation
Source for this Report: Educational Innovation Program Report

The goal of "Digital Arts and Sciences," being developed by Paul Fishwick and his colleagues at the University of Florida, is to train students to acquire a hybrid-knowledge of computer engineering and the arts, enabling them to understand the formalism of visualization and the practicality of human communications that deal with aesthetic interpretation. This will enable students to work effectively in production-oriented teams focused on education, interactive games, scientific and engineering visualization, software engineering, and video production. Research will be integrated in an Aesthetic Computing course and a series of Digital World Production Studio courses to the curriculum. Both Fine Arts as well as CISE students will take these courses, and the PIs will team-teach the studio course. "Aesthetic Computing" uses genres and styles in fine art as metaphors for formal and diagrammatically rendered model structures commonly found in computing, including automata, data flow graphs, data models, and the comprehensive Unified Modeling Language (UML). This work involves areas generally regarded outside the sphere of computer science, including semiotics, linguistics, analogy, metaphor, and the arts.

The project has a strong arts component to help personalize and enrich the user's modeling interface. For example, representation of a finite state machine can be crafted through metaphor mapping to a scale or virtual model of a building. The building's style can be based on a substantial variety of existing architectural traditions without limiting its representation to abstract entities. Elements of music and story schemata can be simultaneously mapped onto the architecture, further personalizing the interface.

Ideas Outcomes

Research in this area focuses on enabling discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.

Table 5. Ideas -- Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."

Indicators	A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning	Discoveries that advance the frontiers of science, engineering and technology	Partnerships connecting discovery to innovation, learning, and societal advancement	Research and education processes that are synergistic	Overall Rating For Goal by COV
Education	**S**	**NA**	**S**	**S**	**S**
Instrumentation & Infrastructure	**S**	**S**	**S**	**S**	**S**
Digital Government	**S**	**S**	**S**	**S**	**S**
Experimental Systems	**S**	**S**	**S**	**S**	**S**
Next Generation SW	**S**	**S**	**S**	**S**	**S**
Workforce	**S**	**S**	**S**	**S**	**S**
NSF-Wide & Other	**NA**	**NA**	**NA**	**NA**	**NA**
EIA Overall	**S**	**S**	**S**	**S**	**S**

Essentially all EIA programs demonstrated significant success in the **IDEAS** strategic outcome goal by growing the fundamental knowledge base, by making discoveries that advance the frontiers of computer science and engineering, and by connecting their discoveries to innovation, learning, and, less frequently, society advancement. This CoV report contains many specific examples of research “nuggets” illustrating the above. Many of the award portfolios showed a good balance of multidisciplinary projects. However, given budgetary constraints and the conservative nature of panel reviews, high risk, high payoff projects were not in great evidence.

Examples of Ideas Outcomes

Select research, organized by CISE division, illustrating **IDEAS** outcomes includes the following:

Title: COPLINK
NSF Award Number: EIA99-83304 [prior award IRI9411318; PI: B. Schatz, University of Illinois]
PI Name: Hsinchun Chen
PI Institution: University of Arizona
Relevant Performance Goal: Partnerships connecting discovery to innovation, learning, and societal advancement.
Relevant Area of Emphasis: Appropriate balance of high risk, multidisciplinary or innovative research
Source for this Report: Digital Government Annual Report; Alan D. Fischer "COPLINK nabs criminals faster," *Arizona Daily Star*, Tucson, Arizona, Sunday, January 7, 2001.

Hsinchun Chen of the University of Arizona's Artificial Intelligence Lab (Digital Government: COPLINK Center: Information and Knowledge Management for Law Enforcement), in collaboration with the Tucson Police Department, has developed an integrated justice information database available over a secure intranet through a cost-effective remote graphical interface. The COPLINK Connect system has been deployed at the Tucson Police Department. The system, used by over 300 law enforcement professionals, has gained overwhelming success and acceptance. COPLINK Detect is still in the deployment phase with 32 law enforcement professionals currently using this system. Consortia are being formed within the state of Arizona to share information via COPLINK with over 15 agencies participating statewide. Plans are being developed to deploy COPLINK in Texas, Michigan, California, Washington DC, Arlington County Virginia, and South Carolina.

COPLINK is an excellent example of multi-agency efforts supported under the Digital Government program. The fundamental research that led to COPLINK (a subcontract under an award to Bruce Schatz at the University of Illinois) was supported by NSF and DARPA under the Digital Library 1 initiative. The technology was developed at the UA Artificial Intelligence Lab with a $1.1M grant from the National Institute of Justice (NIJ). In cooperation with NIJ, the Digital Government program provided $1.6M for further development and the initial evaluation of the COPLINK technology. Knowledge Computing Corporation, new start-up company, entered into an exclusive licensing agreement with the University of Arizona to develop and market the technology, and the company received further support from NIJ and $2.6 million from private investors to launch its business.

Title: CISE Research Infrastructure: Asymmetric Bandwidth Channels: Applications to Real-Time Computing and Robotics
NSF Award Number: EIA97-03220
PI Names: R. Vijay Kumar Kumar, Insup Lee, David J. Farber, Jonathan M. Smith
PI Institution: University of Pennsylvania
Relevant Performance Goals: A robust and growing fundamental knowledge base that enhances progress in all science and engineering

areas including the science of learning; Discoveries that advance the frontiers of science, engineering and technology.
Relevant Area of Emphasis: Appropriate balance of high risk, multidisciplinary or innovative research across all NSF programs
Sources for this Report: 2001 EIA Committee of Visitors Report; CISE Research Infrastructure Program Report; Leslie J. Nicholson, "Walking wheelchair within Penn's GRASP," *The Philadelphia Inquirer*, February 12, 1998. Seife, "Freewheeling," *Scientific American*, January 1996.

Vijay Kumar and his colleagues at the University of Pennsylvania are developing advanced techniques for the communications, coordination, and vision of autonomous multi-robot systems. This inter-disciplinary team of computer science, electrical engineering, and mechanical engineering researchers is focusing on areas such as multi-robot co ordination, cooperative sensing, and efficient wireless transmission techniques. They developed cooperative control algorithms that allow robots to coordinate with each other in varying environments. When obstacles are presented in their path, the multiple robots can re-arrange themselves to navigate around the object and then return to their original formation. Researchers also developed techniques allowing multiple robots to coordinate the sensing and execution of basic tasks. For example, three small robots can coordinate themselves to sense, coordinate, and move a large object that could not be moved by a single robot. They developed efficient transmission techniques for power-aware medium access control to maximize the life of the robot and the quality of the data transmitted between the robots.

One of the many applications of this important basic research is robotic support for the disabled. Kumar has built a motorized chair that consists of a conventional wheelchair fitted with a two 2 degree of freedom manipulators/legs. The design incorporates a number of desirable features to make this chair as versatile and general purpose as possible. The chair is compact with a width less than 30 inches so that it can fit in a conventional doorway and weighs less than 70 kilograms so it can operate indoors. Safety is the most important concern, so the chair is a statically stable machine.

Title: Next Generation Software: A Collaborative Problem Solving Environment for Modeling of Broadband Wireless Communication Systems
NSF Award Number: EIA99-74956
PI Names: Theodore S. Rappaport, Layne T. Watson, Clifford A. Shaffer, Naren Ramakrishnan
PI Institution: Virginia Polytechnic Institute and State University
Relevant Performance Goal: Discoveries that advance the frontiers of science, engineering, and technology
Relevant Area of Emphasis: Appropriate balance of high risk, multidisciplinary or innovative research
Source for this Report: Next Generation Software Program Report

Theodore S. Rappaport, Layne T. Watson, Clifford A. Shaffer, Naren Ramakrishnan of Virginia Tech have formed an interdisciplinary group of electrical engineers and computer scientists to work on wireless communication systems of the future. Their goal is to design a comprehensive design and support system, called `Site-Specific System Simulator for Wireless Communications' (S4W). The S4W project is a collaboration between the Mobile and Portable Radio Research Group (MPRG) of the Electrical and Computer Engineering Department and the Computer Science Department at Virginia Tech.

Broadband wireless systems are essential for the success of the Next generation Internet and future generations of portable multimedia communicators. However, adequate design and analysis tools for supporting these environments do not exist. This project is aimed to support fundamental problem-solving in broadband wireless communications systems, and will be used not only for the design of wireless systems, but also to validate new wireless communications modeling approaches. It is also expected to serve as a test bed to develop collaborative, problem-solving environments. The broader impact of the project is that final composition environments will serve as a central test bed for wireless systems design engineers and scientists and as a tool for the entire mobile communications community, allowing scientists and engineers to achieve increased levels of interactivity to address new kinds of technologies. Such technologies have a ubiquitous presence and need for scaling to very large numbers of entities. For this reason, the ability to performance-engineer such systems will be ever more important.

Title: Classroom 2000 project
NSF Award Number: EIA98-06822
PI Names: Irfan Essa, Gregory D. Abowd, Christopher G. Atkeson, Umakishore Ramachandran
PI Institution: Georgia Institute of Technology
Relevant Performance Goal: Discoveries that advance the frontiers of science, engineering and technology
Relevant Area of Emphasis: Appropriate balance of high risk, multidisciplinary or innovative research
Source for this Report: 2001 EIA Committee of Visitors Report; Experimental Systems Program Report

The objective of this research is to substantially reduce the human input for creating and accessing large collections of multimedia, particularly multimedia created by capturing what occurs in an environment. The existing software system used as the starting point for this investigation is Classroom 2000, which is designed to capture what happens in classrooms, meetings, and offices. Classroom 2000 integrates and synchronizes multiple streams of captured text, images, handwritten annotations, audio, and video. In a sense, it automates note-taking for a lecture or meeting. The research challenge is to make sense of this flood of captured data. The project explores how the output of Classroom 2000 can be automatically structured, segmented, indexed, and linked. Machine learning and statistical approaches to language are employed to understand the captured data. Techniques from computational perception are used to find structure in the captured data. An important component of this research is an experimental analysis of the software system being built. It is expected that this research will have a dramatic impact on how humans work and learn, as the developed technology will aid humans by capturing and making accessible what occurs in an environment.

Title: Commonwealth Project
NSF Award Number: EIA97-06685
PI Names: Azer Bestavros, David J. Yates, Mark E. Crovella
PI Institution: Boston University
Relevant Performance Goal: Discoveries that advance the frontiers of science, engineering, and technology.
Source for this Report: 2001 EIA Committee of Visitors Report; CISE Research Infrastructure Program Report

The phenomenal growth of the World Wide Web imposes considerable strain on Internet resources and Web servers, prompting concerns about the Web's continued viability. The success of high-performance Web servers in alleviating these performance problems is ultimately limited unless Web services are inherently scalable. Azer Bestavros and his colleagues at Boston University founded the Commonwealth Project to design, implement, and evaluate a prototypical architecture and a set of associated protocols for scalable Web services. The Commonwealth architecture for hosting scalable Web services allows scalability through parallel processing on tightly-coupled nodes within a Web site, and load distribution across loosely-coupled Web sites. Commonwealthís underlying philosophy is to achieve a wealth of performance through the use of common components, and to do so along an incremental upgrade path.

Bestavros and his colleagues have filed for two provisional patents on Web caching and scalable web services. SURGE, a scalable URL reference generator, was developed and is being distributed. Over 100 labs, including major telecom companies and universities, have put SURGE into use. BRITE, the Boston University Representative Internet Topology Generator, has been developed and is being distributed via the World Wide Web. Two start-up companies--InfoLibria, Inc. and Commonwealth Network Technologies, Inc.--have been formed as a result of the infrastructure. The latter has been purchased by WebManage, which in turn, was purchased by Network Appliances, Inc.

Tools Outcomes

Research in this area focuses on providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

Table 6. Tools - Providing "broadly accessible, state-of-the-art information-bases and shared research and education tools."

Indicators	Shared-use platforms, facilities, instruments, and databases that enable discovery and enhance the productivity and effectiveness of the science and engineering workforce	Networking and connectivity that take full advantage of the Internet and make science, mathematics, engineering and technology information available to all citizens	Information and policy analyses that contribute to the effective use of science and engineering resources	Overall Rating For Goal by COV
Education	**S**	**S**	**NA**	**S**
Instrumentation & Infrastructure	**S**	**S**	**NA**	**S**
Digital Government	**S**	**S**	**S**	**S**
Experimental Systems	**S**	**S**	**NA**	**S**
Next Generation SW	**S**	**S**	**NA**	**S**
Workforce	**S**	**S**	**NA**	**S**
NSF-Wide & Other	**NA**	**NA**	**NA**	**NA**
EIA Overall	**S**	**S**	**NA**	**S**

The majority of the EIA programs also demonstrated success in the **TOOLS** strategic outcome goals. In many clusters most, if not all, of the funded projects had as an objective to make available results in the form of courseware, software, databases, and netware. Many of the projects had established web sites for disseminating information and tools to the wider community.

Examples of Tools Outcomes

Select research, organized by CISE division, illustrating **TOOLS** outcomes includes the following:

Title: Statistical Information (?)
NSF Award Number: EIA98-76640
PI Names: Gary J. Marchionini, Carol A. Hert, Ben Shneiderman, Elizabeth D. Liddy

PI Institutions: University of North Carolina Chapel Hill, University of California at Berkeley, Syracuse University, the University of Maryland, Textwise, Inc.
Relevant Performance Goal: Shared-use platforms, facilities, instruments, and databases that enable discovery and enhance the productivity and effectiveness of the science and engineering workforce.
Relevant Area of Emphasis: New types of scientific databases and tools for using them.
Source for this Report: Digital Government Program Report

Government statistical information is essential to the day-to-day lives of all citizens. The importance of such data is illustrated by the efforts of multiple federal government agencies to create the National Statistical Information Infrastructure. Data from agencies such as Bureau of Labor Statistics, Census Bureau, and Bureau of Economic Analysis determine costs of everything from apples to zinc, the locations of new businesses, and the indexes for all government programs and payments. Web-based technologies offer citizens broader access to the vast array of statistical data so that they may make better personal decisions. Examples include baby-boomers planning for retirements, unemployed or underemployed individuals looking to relocate, school children exploring careers.

For broader segments of the population to take advantage of government statistical information, however, the data must both be easy to find and easy to interpret and use. Sites that provide government statistics cannot assume users access the data frequently enough to learn arcane codes and complex search strategies, nor that users have high levels of statistical literacy. Ease of search in this setting depends on helping users articulate needs, on distributing these articulations to different datasets across the Federal government, unifying the results, and presenting them in forms most useful to user needs. Gary Marchionini and his colleagues have successfully completed work on graphical representation, manipulation, browsing, and usability over the Web for Federal statistical (tabular) data. As the system becomes commercially available to the users of Federally collected and archived statistical data, the primary challenge is to ensure it will improve the usefulness of data in establishing, for example, the Consumer Price Index, the unemployment rate, and the determination of Federal congressional districts.

Title: EVL Research
NSF Award Number: EIA97-20351; EIA98-02090; EIA01-15809
PI Names: Thomas A. DeFanti, Ugo A. Buy, Boaz J. Super, Maxine D. Brown, Milos Zefran, Pat Banerjee, Thomas G. Moher, Robert V. Kenyon, Andrew E. Johnson, Robert L. Grossman, Barbara DiEugenio, Francis Quek, Nong Ye, Rhonda Franklin Drayton, Stellan Ohlsson
PI Institution: University of Illinois Chicago
Relevant Performance Goal: Shared-use platforms, facilities, instruments, and databases that enable discovery and enhance the productivity and effectiveness of the science and engineering workforce.

Networking and connectivity that take full advantage of the Internet and make science, mathematics, engineering and technology information available to all citizens
Relevant Area of Emphasis: Major Research Instrumentation
Additional Strategic Outcome: People
Additional Performance Goal: Improved mathematics, science, and technology skills for U.S. students at the K-12 level and for citizens of all ages, so that they can be competitive in a technological society.
Source for this Report: 2001 EIA Committee of Visitors Report; CISE Research Infrastructure Program Report

Thomas DeFanti leads the Electronic Visualization Laboratory (EVL) at the University of Illinois Chicago whose projects have included Deep Learning and Visualization Technologies; CISE Research Infrastructure: CAVERN: The CAVE Research; MRI: Development of Instrumentation for AGAVE: The Access Grid Autostereo Virtual Environment. Since the 1970s, the EVL's research has focused on the developing tools, techniques and hardware to support real-time, highly interactive visualization. Current efforts continue through the development of virtual reality (VR) devices, software libraries/toolkits and applications for collaborative exploration of data over national and global high-speed networks - called "tele-immersion." After building first and second-generation VR devices (the CAVE in 1991 and the ImmersaDesk in 1995) to support tele-immersion applications, EVL is now conducting research in "third-generation" VR devices to construct variable resolution and desktop/office-sized displays. EVL continues to develop and refine a robust and VR-device-independent software library, as well as the software tools for building tele-immersion applications. This software infrastructure supports collaboration in design, training, scientific visualization, and computational steering in VR. Through advanced networking techniques, researchers can access distributed computing, storage and display resources more efficiently than ever. Some of the outcomes of this project thus far include:

CAVERNsoft G2 -- a system for the development of highly reusable tele-immersion service,
Data Space Transfer Protocol -- a data-mining tool that enables the correlation of data from disparate sources located on the network,
LIMBO -- an application framework for building tele-immersion applications, and
QoS Internet Monitoring Tool (QoSIMoto) -- a Cave-based Netlogger visualization tool for monitoring and visualizing network flows in applications that use network QoS.

EVL is extensively involved in education using the toolsets they have developed. One example is NICE, a project that applies virtual reality to creating a family of educational environments for young users. Their approach is based on constructionism, where real and synthetic users, motivated by an underlying narrative, build persisting virtual worlds through collaboration. This approach is grounded on established paradigms in contemporary learning and integrates ideas from such diverse fields as virtual reality, human-computer interaction, CSCW, storytelling, and artificial intelligence.

B.3. Program Areas Needing Improvement

Several of the clusters commented on the proliferation of programs in EIA. Some clusters (e.g., Education, Instrumentation and Infrastructure) had recommendations for programs that could be combined/merged to streamline the system. Also, most commented on the excessive workload of the program directors especially since the launch of the ITR initiative. Several Clusters recommended that support for program directors and assistants be enhanced. A few of the clusters (e.g., Workforce and Experimental Systems) were concerned about the rapid turn over of program directors resulting in long proposal dwell times and a loss of continuity in the program. “Without directorship stability, it is difficult to sustain an effective program.”

B.4. Meeting Program-Specific Goals and Objectives

The Digital Government cluster made specific recommendations for increasing the number of proposals, for improving the review process, and for increasing the success rate of proposals in this program. Because of the unusual characteristics of DG grants (i.e., most projects are applied, involve test beds, and require partnerships with other government agencies) NSF needs to continue to be aggressive in reaching out to the research communities and the government agencies to help in building partnerships.

B.5. Feedback on the COV Review Process

The two most common comments were that the CoV review was rushed - “two full days are needed for the CoV review process” - and that the “template needs revision.” Several clusters complemented the program directors for helping to make the task manageable by assisting them in finding the information needed.

One Cluster recommended that the award portfolio include an overall roadmap, crafted by the program manager, of how the various projects fit together. This “big picture” would help the CoV evaluate how well the program met its goals.

C. Cluster 7's General Observations About NSF-Wide Programs in EIA

The CoV Cluster 7 group reviewed a good deal of information that did not fit within the report formats included in the Appendix. As a result, the group had several recommendations for streamlining the reviewing process; for cutting down the confusion caused by the very large number of programs in CISE, and for making sure that CISE receives funding and benefits from cross-division NSF programs in reasonable proportion to the dollars and efforts that it contributes to these programs.

Observations of concern to the panel

1. CISE has 52 programs, many of them very small. For some programs the total number of submissions is on the order of five per year. It is difficult to manage these programs efficiently, since each requires some overhead in handling and advertising the program; each requires a budget; and each needs its own review process. In addition, it is difficult for proposers to comprehend all the available programs for which they might be eligible. Nonetheless this panel is of the opinion that the programs that it reviewed were all are worthwhile.

2. Scientists spend far too much time writing proposals for funding. This problem is exacerbated by the long lag time before responses for regular proposals, the plethora of special RFPs, and the need to keep generating proposals until one receives funding. Far more actual science would be accomplished if the proposal-writing process could be streamlined; the quality of the proposals submitted would also be improved. Proposers could write one base 15-page proposal – to be reviewed by disciplinary peers – and accompany it with a cadre of short affiliated proposal supplements for collaborative or special funding (e.g. REU, international collaborators, post-docs, POWRE/ADVANCE fellows, and other cross-cutting initiatives).

3. CISE participates in many cross-directorate initiatives, e.g. in biocomplexity, nanoscale systems, IGERT, STC, etc. However CISE has seldom been successful in getting its proposals funded, regardless of their merit from the CISE point of view. For example, there were no CISE-related STCs in the most recent selections, while some 5-6% of pre-proposals were relevant to CISE. The panels are typically dominated by other divisions, e.g. biology, physics or engineering, both in numbers and seniority of panelists, who may not have understood the significance of CISE-related research. This situation represents a kind of taxation without (effective) representation and works against funding important, worthy CISE proposals. In addition it is demoralizing for the participating Program Officers and for CISE proposers. Indeed, fewer CISE researchers have chosen to submit to these cross-directorate initiatives since the first HPC competitions in which strong CISE proposals were submitted but not funded.

4. The current system forces a multi-stage ad hoc reviewing that is wasteful of the scarce reviewing resources of the community, and creates additional tracking demands on NSF program officers. The reviewing process for programs with special eligibility requirements (e.g., POWRE and ADVANCE) disseminates personal information about a proposer's special circumstances to colleagues and peers. Additionally, the requirements for the ADVANCE Fellows program are so restrictive that they prevent many worthy candidates from qualifying.

5. Promising proposals that fall short because of inexperience with the proposal writing process (e.g., poor presentation; inadequate budget submissions; failure to properly follow submission requirements; insufficient detail) are simply declined.

6. Staff support is inadequate for CISE program officers. Assistants to Program Officers have only high school-level training. Program Officers are saddled with a heavy burden of clerical work that could easily be delegated, and much of which is menial and unrewarding at their level. This problem affects the ability of NSF to retain qualified Program Officers.

Summary of recommendations

1. Eliminate separate proposals to the many small programs by providing check-off boxes on the standard CISE submission cover form. Each check-off box can list the name of the program and provide pointers to information on the program. Proposals would be given regular scientific evaluation. Worthy proposals can qualify for other specialized programs at the discretion of a program officer, either without further review, or based on a shorter supplementary proposal or other information solicited by the Program Officer. "Passing through" proposals to special programs will reduce the dwell time, the overhead of administering these programs, and researcher effort to submit to these programs. It will provide the maximum protection for the personal information of applicants, while assuring the scientific quality of proposals.

2. Following merit review, Program Officers should have the following spectrum of available options:
   - Award
   - Award <u>and</u> refer to another program for supplementary funding. This could include inviting a PI to submit a 2 page supplementary proposal.
   - Refer to a special program for consideration. The PI may be invited to submit a supplementary document.
   - Fund as a small planning grant and possibly refer to another program for supplementary funding without the demand for a new proposal.
   - Decline

All actions should be reported promptly to the PIs (including declinations and proposals being held for further deliberation).

3. If a directorate provides resources for a cross-directorate initiative (e.g. biocomplexity, nanoscale systems, IGERT, ADVANCE, STC), then at least one proposal/preproposal from that directorate should be funded/encouraged. For example, CISE Program Officers could be given "wild cards" with which to fund one or more CISE proposals, if no CISE proposals are accepted by an interdisciplinary panel on which they participate. Interdisciplinary panel reviews/rankings on all CISE proposals/preproposals should be returned to CISE for the selection a "wild card" proposal/preproposal to fund/encourage. In the case of an encouraged proposal, CISE program offices could coach the PIs on development of the full proposal.

4. Much of the work conducted by EIA Program staff could be handled by a person with some collegiate training. NSF should consider using college juniors and seniors to aid EIA program officers. Such students need not be Computer Science majors, but might be majors in any physical science, social science or engineering.

Appendix to COV Summary Report

NATIONAL SCIENCE FOUNDATION

FY 2001 REPORT
of
NSF COMMITTEES OF VISITORS
(COVs)

Directorate for Computer
and
Information Science and Engineering
(CISE)

Division of Experimental
and
Integrative Activities
(EIA)

October 11, 2001

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FY 2001 REPORT of NSF COMMITTEES OF VISITORS (COVs)

Directorate for Computer and Information Science and Engineering (CISE)

Division of Experimental and Integrative Activities (EIA)

I. Division Report

A. EIA Evolution and Current Structure

The Division of Experimental and Integrative Activities (EIA) was created in 1998 by combining the Division of Cross-Disciplinary Activities (CDA) with several programs previously managed by other CISE divisions. In essence, EIA combined the infrastructure, instrumentation and workforce programs of CDA with a portfolio of broad-based research programs (CISE Challenges, Experimental Systems, Experimental Software Systems, etc.). With the start of the Information Technology Research (ITR) Program, EIA began targeting its research funding towards enabling interdisciplinary research in new areas where IT research interfaced with other research areas such as biology, education, social science, and government, and where new IT research could be informed by application-specific needs and constraints.

EIA manages a large portfolio of programs; some are managed as base programs for the Division, some are collaborative with other directorates where EIA may represent the Division's interests or those of CISE as a whole, and some are cross-NSF programs in which EIA participates on behalf of CISE or, in a few cases, only on behalf of the Division. The total number of programs for which EIA is responsible exceeds *fifty*. EIA has organized its programs into four areas: Multi-Disciplinary Research; Instrumentation and Infrastructure; Education and Workforce; and Symposia, Travel, Studies and International Activities. Each of these categories includes base, collaborative and cross-NSF programs.

The Multi-Disciplinary Research programs include base programs covering research at the interface of biology and information technology, research in IT-enabled education and learning, research in digital government and governance, and research in application systems and software. This area also encompasses EIA activities related to the NSF priority areas: Information Technology Research, Nanoscale Science and Engineering, Biocomplexity and the Environment, and Learning. In the first two, EIA is one of several CISE divisions participating, while in the latter two EIA is the primary CISE participant. EIA also manages the Science and Technology Centers grants assigned to CISE.

Within Instrumentation and Infrastructure are the programs EIA (and CDA before it) has managed for the longest period. These programs are being restructured and folded into two primary programs: CISE Research Resources and CISE Research Infrastructure. In the former, EIA emphasizes providing the necessary resources (hardware, software, instruments, data, communications, support, services) to expand the capacity for CISE research with special attention to emerging groups, departments, and scientific areas and to under-served regions and institutions. Resources are provided to groups of individual researchers, to larger synergistic groups, to departments, to multi-institutional groups and to enable the establishment of national and international shared resources. The Infrastructure program focuses on enabling significant CISE-related research projects of realistic scale and complexity. EIA also participates in and manages the NSF-wide Major Research Instrumentation program for CISE.

The Education and Workforce programs represent a large and diverse portfolio. The Information Technology Workforce program is an EIA base program that supports research into the underlying causes of the low participation of women and under-represented groups in the IT workforce. The Educational Innovation program and its companion, the Combined Research and Curriculum Development Program (with ENG), support the rapid transfer of research into new CISE-related curricula. EIA supports a number of community-initiated projects addressing workforce and education issues within the EWF Special Projects. EIA provides substantial staff resources to coordinating, for CISE, the many Education and Workforce programs of the foundation. These include Graduate Research Fellowships, the GK-12 Program, Advance, POWRE, REU Sites, IGERT, RUI/PUI, Louis Stokes Alliances, Distinguished Teaching Fellows, SBIR/STTR, and many others.

Finally, EIA supports symposia, travel grants, studies and international activities of interest to CISE.

EIA manages the more than 50 programs in its portfolio with eight full-time program managers, six part-timeers, and six support staff. The purpose of grouping the programs within the four areas and, within the areas, coalescing the existing programs into smaller, broader programs, is to bring the whole into a more manageable format. Still EIA is a division in transition, with developing research programs that require substantial cross-NSF and cross-agency coordination. It also has seen the number of NSF-wide programs requiring representation and coordination grow substantially from a few dozen to more than 30.

B. Executive Summary of the CoV

Integrity and Efficiency of the Program's Processes and Management

The vast majority of proposals submitted to EIA are panel reviewed, often with the proposals mailed to panel members before the panel meeting with a request that an individual review of the proposal be done prior to panel discussions. Some panel reviews are augmented with ad-hoc reviews and a few with site visits. In another case, the cluster recommended that site visits be made prior to funding decisions (i.e., for RI and CADRE). Individual reviews of proposals submitted to EIA are rare, partially due to the nature of the programs in EIA and partially due to the workload of the program directors. Very few proposals submitted to EIA are traditional individual investigator research proposals. Instead they run the gamut from revolutionary hardware and software systems research and development proposals submitted to Experimental Systems and Next Generation Software, respectively, to proposals that impact government information flow and productivity submitted to Digital Government, to proposals seeking to advance education in computer science and engineering and to use the computer science and engineering technology in the most effective way in the classroom, to proposals focused on enhancing the diversity of people in the discipline. Some of the panels were charged with reviewing proposals covering such a wide range of topics that there were times when no one on the panel was an expert in a particular proposal area. This also seems to be in the nature of many of the EIA programs and may be inevitable without having impractically large panels.

For the most part, panels did an effective job of reviewing proposals, providing careful reviews and justifying their discussions. All clusters found the programs use of NSF’s merit review procedures to be followed by both the panel members and the program directors with, perhaps, more attention to the intellectual merit of the proposed research than to the broader impacts. Program officers seemed to be more sensitive to the issues of broad impact than reviewer panels. An introductory discussion with the panel members led by the program director was an important factor in getting panels to address the merit review procedures and also to give special attention to high risk, but high payoff proposals.

While it was evident in most clusters that attempts were made by the program officers to balance the representation on review panels it is not always possible in a discipline with less than 5% of the population from underrepresented groups and less than 20% women. Most proposals received between three and five reviews plus a panel summary. Material in the proposal jackets appears to be well managed and thorough. However, in most clusters the time to decision has increased during the last few years with this increase seen most dramatically in the last year as the workload on program directors grew significantly with the influx of ITR proposals.

Most clusters were pleased with the resulting portfolio of awards. In some clusters (e.g., Education) there was a shortage of proposals from smaller institutions. Cluster members speculated that this was due to the requirement for a 50% cost sharing, an amount that is hard for small institutions to provide. Diversity of investigators is an issue (as it is for review panel membership) once again mostly due to the under representation of women and minorities in the computer science and engineering research pool and not due to prejudice in the system or in review panels. Additionally, the effectiveness of the program director in working with submitters of declined proposals helping to guide them in revising and resubmitting their proposals seems variable across clusters with some program directors being applauded for their efforts.

Outputs and Outcomes of NSF Investments

Due to the nature of EIA programs, the primary indicator of success in the **PEOPLE** strategic outcome goal is the education of globally engaged science and engineering professionals and, in this, all Clusters demonstrated success. Some programs contributed at the undergraduate level (e.g., Education and NSF-Wide cluster programs) and essentially all in the education of graduate students. Often students (both undergraduate and graduate) were involved with the development, experimental evaluation, and delivery of large-scale software and hardware artifacts in addition to the research. There were numerous examples where research ended up also being integrated into the classroom curricula even in programs where that was not a required outcome. Some programs also contributed to this outcome goal by providing professionals with world-class instrumentation needed to perform the research (i.e., programs in the Instrumentation and Infrastructure cluster).

Essentially all EIA programs demonstrated significant success in the **IDEAS** strategic outcome goal by growing the fundamental knowledge base, by making discoveries that advance the frontiers of computer science and engineering, and by connecting their discoveries to innovation, learning, and, less frequently, society advancement. This CoV report contains many specific examples of research “nuggets” illustrating the above. Many of the award portfolios showed a good balance of multidisciplinary projects. However, given budgetary constraints and the conservative nature of panel reviews, high risk, high payoff projects were not in great evidence.

The majority of the EIA programs also demonstrated success in the **TOOLS** strategic outcome goals. In many clusters most, if not all, of the funded projects had as an objective to make available results in the form of courseware, software, databases, and netware. Many of the projects had established web sites for disseminating information and tools to the wider community.

Program Areas Needing Improvement

Several of the clusters commented on the proliferation of programs in EIA. Some clusters (e.g., Education, Instrumentation and Infrastructure) had recommendations for programs that could be combined/merged to streamline the system. Also, most commented on the excessive workload of the program directors especially since the launch of the ITR initiative. Several clusters recommended that support for program directors and assistants be enhanced. A few of the clusters (e.g., Workforce and Experimental Systems) were concerned about the rapid turn over of program directors resulting in long proposal dwell times and a loss of continuity in the program. "Without directorship stability, it is difficult to sustain an effective program."

A collection of observations and recommendations that cut across a number of clusters are summarized in section VII of this CoV report.

Meeting Program-Specific Goals and Objectives

The Digital Government cluster made specific recommendations for increasing the number of proposals, for improving the review process, and for increasing the success rate of proposals in this program. Because of the unusual characteristics of DG grants (i.e., most projects are applied, involve test beds, and require partnerships with other government agencies) NSF needs to continue to be aggressive in reaching out to the research communities and the government agencies to help in building partnerships.

Feedback on the COV Review Process

The two most common comments were that the CoV review was rushed - "two full days are needed for the CoV review process" - and that the "template needs revision." Several clusters complimented the program directors for helping to make the task manageable by assisting them in finding the information needed.

One cluster recommended that the award portfolio include an overall roadmap, crafted by the program manager, of how the various projects fit together. This "big picture" would help the CoV evaluate how well the program met its goals.

The organization of EIA programs for COV review is shown in Appendix IX: EIA COV Clusters.

II. Cluster 1 -- Education

Program: CISE: EI and CRCD

A. EI and CRCD: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
a. These proposals are reviewed via panels – the panel size has increased each year, while the number of proposals has gone down. The percentage of accepted proposals has gone up – is this an artifact of panel workload or funding? The panels are made up of reviewers from across the nation but the representation from the West Coast is limited (around 10%). Could the panels be virtual panels using videoconferencing to address the travel disruption issue? Could panels be moved from the DC area? There was only 1 woman from a RU1 institution; efforts should be made to increase this. Representation from among all other sections of academic institutions is well distributed.

b. If effectiveness means that the process permitted awards to be made or enabled awards to be made, then we can say that our review indicates panels provided careful reviews and justified their discussions and were typically uniform in their report and, yes, it was effective. If effectiveness means that the process picked the most effective proposals or the 'best' ones, we cannot tell without more time to review the proposals in detail.

c. The data seem to show that the reviews are getting out in less than (or just about equal to) 6 months. However, the trend is beginning to indicate a shift to longer review times. This is even more troubling in the face of fewer proposals but more awards. Is this the result of additional workload for the NSF staff?

d. There is variable presentation in the reports and documentation. In some cases in the sample we reviewed there was very little documentation. In fact, often in reporting or commenting beyond the first few questions, reviewers answered with a simple “yes”. In general, the review template is complete and promoted a level of consistency amongst the reports. Moreover, the material maintained in the proposal jackets is extremely well managed and thorough, including such items as entire histories of PI proposal applications. This material is not shared with the panels but maintained in the jackets.

e. The award rate is roughly 38%. Is this within the target idea for the program?

Proposals that suggest the application of research results to improve instruction, as opposed to incorporation of research materials into course content, might not be expected based on the call for proposals, but they are presented and awarded. In fact in the EI program, there were content and implementation (delivery of instruction) and just delivery awards and many fewer of these in CRCD. In fact, most CRCD awards were research content into courses.

The open question is what happens to awards that are declined. The conventional wisdom is that a resubmit will be awarded – this is borne out by the data (of the 6 resubmits, 4 were funded) but there are few resubmits. That begs the question as to whether it is too difficult to prepare this proposal, including the 50% cost sharing required, to go for it again.

Furthermore, there is a lack of success based on a lack of proposals from smaller institutions – the 50% cost sharing must be a part of this. It could also be that the RFP does not indicate strongly enough that the research to be integrated into the curriculum does NOT have to be original research for the PI. Additionally, there are relatively few new proposals submitted though the success rate for a new proposal is good. Only 19/83 proposals were listed as new – is this a large enough pool to sustain new thinking or is there jeopardy of creating an ‘old boy/girl network’. Again, very few (6 of the 78) ever resubmitted a proposal.

There appears to be a decline in the number of proposals per year from a high of 35 to a recent 22. This could be indicative of PIs seeking other venues or lack of information.

2. ***The program’s use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

b) *Performance Goal: Implementation of Merit Review Criteria by Program Officers:*

NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comment to 2c – Questions arise as to how to educate reviewers to respond in more depth to intellectual merit and especially questions of broader impact potential for proposals. While we know from our own panel experience that program officers try to describe the process and the review templates list a variety of questions addressing these two areas, it is not clear that reviewers totally understand these issues, despite the systems in place to help them. The question remains how to make the areas more clear for deeper responses.

Comments:
a)
1. ***Did reviewers adequately address the intellectual merit criterion in their reviews?***

The reviewers struggle to define intellectual merit – 22 of the 23 reviewers observed in one sample addressed intellectual merit in some manner, most often as a restatement of the proposal intent. They used words like 'important' or "PIs were well qualified". Some reviewers attempted a value judgment on the intellectual merit of the area in limited ways such as "given the demand for human interfaces, the proposal." or "given the importance of the security overarching principle in many systems at many levels…"

2. ***Did reviewers adequately address the broader impacts criterion in their reviews?***

It seems, based on our sample, more difficult for reviewers to address in detail the concept of broader impact. However, broader impact is more subjective and speculative than assessing technical grounds. Reviewers do comment on partnerships, outreach and dissemination as examples of impact.
b)
1. ***Did program officers adequately address the intellectual merit criterion in their decisions?***

Given our small sample, we noted that one program officer tended to use a consistent multi-paragraph form for concisely summarizing the panel discussion and oversight. In the case of another program officer there seemed to be an attempt to synthesize written and oral panel comments to arrive at an independent decision. Given the extreme workload, this is not a criticism, just a comment.

2. ***Did program officers adequately address the broader impacts criterion in their decisions?***

Program officers often are more sensitive to the issues of broader impact than the reviewer panels. They cited opportunities to network among institutions or adjust the content of a project to make it more inclusive of learning populations as ways of providing broader impact.

3. ***Reviewer selection:***

a) Use of adequate number for balanced review;
b) Use of reviewers having appropriate expertise/qualifications;
c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. There were between 3 and 5 reviewers per proposal, most with 4 reviewers. While 3 is a marginal number, 4 seems to be workable and permits room for discussion and opinions to coalesce.

b. How would we know this? The discipline listed in the reviewer overview does not make it clear whether the area is the current research/teaching area for the reviewer or the graduate degree research area. However, based on our review of a few recognizable names on reviewer panels, there seems to be appropriate coverage.

c. Comments for this section are addressed in comments for Question 1a.

d. This was exceptionally well done in both areas indicating that inquiry was made concerning conflict of interest and in descriptions of attempts to rectify COI by either removing the reviewer from one proposal or even changing panel makeup.

4. ***Resulting portfolio of awards:***

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as
- *High-risk*
- *Multidisciplinary*
- *Innovative*

Comments:

a. Without reading each award carefully, it appears that the panelists attempted to make awards to high-quality science and engineering proposals. Based on a sample of 6 rejected proposals, the consistency of evaluation of the merits of proposals indicate a commitment to make awards only for high-quality science.

b. 3 years seems to be an appropriate minimum. The program is too new to know whether many PIs will ask for no-cost extensions. In reality 3 years may not give the PIs time to organize and plan the curricular events, implement them, evaluate the impact and then revise the materials. As with any learning opportunity, reflection time is key.

c. The awards that were made did appear to take advantage of opportunities that were available because of research outcomes or the availability of leading-edge technology.

d. Only 4 of the 31 awards went to "new" PIs. There doesn't seem to be a lack of openness in the process but there may be a limit of "new" applications. In the data reviewed, 19 of 83 submissions were "new". 20% of these new-timers were awarded grants but only 12% of all awards went to newtimers. The outreach to potential new awardees could be improved as well as the effort to get PIs to re-apply. While it is not known how strong these attempts were made, it is known that only 6 PIs ever resubmitted proposals and of them 4 were awarded.

   It is also suggested that the RFP make it clearer that the proposed research to be integrated into the curriculum does not have to have been done by the writing PI nor even at the PI's institution.

e. All proposers purport to be doing this. There is a difference between research being incorporated as content in a course and research supporting instructional delivery. The solicitation and awards reflect the open-ended nature of what integration means.

f. There is no evidence of increased numbers of proposals or awards from minorities (only 1 has been submitted and was awarded). There may be other programs that are more appropriate to this group of educators or programs that are considered by them to provide a more appropriate success rate. They may also be discouraged by the high (50%) cost-sharing requirement.

g. Based on our review of the abstracts for EI and CRCD awards and 6 jackets from examples of awarded proposals, we felt there were no examples of high-risk areas. There were few, very few, that could be termed multidisciplinary, and even fewer where the disciplines extended widely beyond computer science and its close cousins within engineering. Only one comes to mind that reaches beyond to new content areas. There were few innovative projects, even though by definition all projects should be innovative. Most confined their impact to bringing research content into a course curriculum. Some proposals did intend to shake up the curriculum, for example one proposal sought to establish an undergraduate education research center and on was directed at preparing a flexible, new curriculum in computer science that could easily incorporate advances in research and/or educational technology.

B. EI and CRCD Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally-competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens.

***FY 2001 Performance Goal:* The program is *successful* when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:**

a) *Improved mathematics, science, and technology skills for U.S. students at the K-12 level;*
b) *Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;*
c) *A science and technology and instructional workforce that reflects America's diversity;*
d) *Globally engaged science and engineering professionals who are among the best in the world; and*
e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. In general, this indicator is not relevant for the EI program, which is aimed exclusively at undergraduate education. However, there can be incidental or unplanned fallouts from an EI program that benefit K-12 education. For example, a project at the University of Massachusetts at Amherst (9812589, W. Burleson, University of Massachusetts, "Multimedia Instructional Modules") developed a low-cost course management system that is easy to use and suitable for use in K-12 courses. Another project (9872454, Boriello Gaetano, University of Washington, "Computing Appliances: A Context for Integrating Research and Education in Embedded Systems Design) videotaped capstone project presentations and showed the videotape at a meeting of the Seattle Teachers Association in order to help keep the teachers informed of cutting-edge technology.

b. Again, the EI program involves only undergraduate education, so it does not contribute to improving skills for citizens of all ages. However, all awards are intended to improve SMET education and therefore to improve the skills of the undergraduates who take courses affected by the awards. The skills obtained are based not only on factual content presentation but also on the development of hands-on laboratory skills and deep engagement in projects.

c. Although the program announcement encourages all proposals to include components that address diversity issues, very little achievement in this area was found in the reports that were reviewed.

d. The EI program is designed to improve the education that produces science and engineering professionals, and improved education should maintain the quality of the scientists and engineers who are produced as among the best in the world. But the program is not intended to contribute to the global involvement of the students in any way.

e. The EI program addresses undergraduate education only, so this indicator is not applicable to the EI program.

6. IDEAS Strategic Outcome Goal:

Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

Comments:

a. All of the projects are making their results freely available to others, thus contributing to a knowledge base that can be used for educational improvement. Specific examples include a project (9872516, James Lehman, Purdue University, "Integration of Computer Architecture and Parallel Programming Tools into

Computer Science and Engineering Curricula Through Network Computing Hubs") at Purdue that used the SIGMICR portal to make the web-based tools that it produced readily available to the specific wider community that would be most interested in them. Also, a project at RPI (9634485, Ephraim Glinert, Rensselear Polytechnic Institute, "A Distributed Collaborative Learning Environment for Effective Intellectual Teamwork") assembled the largest-known database identifying and measuring student learning styles.

b. This indicator is not relevant for the EI program because it involves no research that would advance the frontiers of science, engineering, or technology.

c. Many of the EI proposals include significant partnership and cooperative activities, but little activity in this area was reported in the annual reports of the EI projects. An exception was an award to the University of Colorado at Boulder (9980334, Ronald Cole, University of Colorado, Boulder, "An Interactive Curriculum in Human Language Technology for Undergraduate and Graduate Education") where a partner at Stanford University had an industry day conference at which his students presented their projects to more than 80 representatives from local industries that were involved in related work.

d. By the nature of the EI program, research results are used to stimulate and improve education. However there is, in general, no “feedback loop” in which the experience of incorporating research results into education is used to stimulate further research, so there is no true synergism here. One project (9712929, David Cordes, University of Alabama at Tuscaloosa, "Integrating Software Architecture into an Interdisciplinary Software Engineering Curriculum") did find the need to develop further research results that were needed prior to their incorporation into the intended courses.

The example above does raise an issue about the appropriateness of conducting research as part of the award project. In at least one other project (9700828, Sudhir Aggarwal, SUNY Binghamton, "High Speed Local Area Networks: Systems and Applications") conducting research was the major activity of the project. The program announcement appears to exclude support for conducting research, so this evidently needs to be made clearer to the PIs. Perhaps also there should be a mechanism whereby PIs can request support for additional research that is stimulated by the incorporation of previous results into education.

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. All of the funded projects had as an objective to make available all courseware, software, databases, etc., to the education community for use wherever they might be beneficial. The reports from projects that were not essentially complete understandably did not report having done so, but those that were at or near completion had indeed made project materials widely available to others.

b. The EI program addresses undergraduate education only, so this indicator is not relevant.

c. Just as in (b), this indicator is not relevant for the EI program.

d. The EI program does not involve policy analyses, so this indicator is not relevant.

8. Areas of Emphasis:

For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People
- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
  - *Advanced Technological Workforce program (ATE)*

Comments: All awards in the EI program appear to be contributing to the improvement of undergraduate education in science and engineering. Results from these projects can contribute to the resources in CLTs, and the students who graduate from the improved educational programs will be better prepared to function effectively in the workforce.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments: We have previously noted that there is not much (if any) high-risk activity. The ITR may be an example of program proliferation, and there could be confusion because of possible overlap between the EI and ITR programs.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments: This is not relevant for the EI program.

9. Please comment on program areas that the COV believes need improvement.

Comments:

a. The proliferation of programs appears to be a serious problem. It would appear that many programs could be combined, which would allow more flexibility and efficiency in proposal processing. In particular, the EI and CRCD programs should be combined. The name of the CRCD program appears more appropriate than the name of the EI program, because there are many good educational innovations that do not involve the incorporation of research into education. There also may be some overlap (and confusion) between the EI and ITR programs.

b. There should be interaction among the PIs of the awards, preferable combining the EI and CRCD PIs. This could be in the form of mini-conferences or workshops for idea and outcome sharing. Such a venue might encourage PIs to attempt riskier activities, if they knew that there were opportunities for brainstorming and analysis in a 'friendly' environment.

c. The high cost-sharing requirement for the EI program could be a deterrent for smaller institutions, especially those without significant funded research activity, and it should be reconsidered.

d. When there is high risk or real innovation, failures should be expected. The reporting of failures or unanticipated events should be encouraged because they are often at least as valuable as the results from projects that proceed as planned (see b).

e. PIs should be strongly encouraged to involve someone with significant expertise in educational delivery and evaluation in each project unless there are clear reasons why this would not be beneficial. In general, proposals that included a named person with such expertise at proposal time showed strong educational outcomes.

f. It may be that it is not well understood that the research that is to be incorporated into the curriculum need not be from the same institution as the EI proposal. This could inhibit the submission of proposals from institutions that are teaching oriented.

g. Some of the EI awards are for projects that apply existing "research results" (which may be only leading-edge technology) to mechanisms for content delivery, course management, or student involvement. This may be desirable, but it is not clear that this is included in the intent of the program as described in the announcement.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:
The program clearly has stimulated efforts to incorporate research efforts into education, and it seems likely that most of the projects would not have been done without external funding. However, many, if not most, of the projects, although interesting and beneficial, were not really innovative.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:
Two full days are needed for the review process. Less time makes the process too rushed and decreases the quality of the result.

Some additional prior reading would be beneficial. If the abstracts of the awards and other public information could be provided in advance, it would expedite the processing of the information that is needed for the report and make better use of the time on site.

For this cluster, the working group size (2) and the workload was well matched.

A review of the template questions during the first working lunch (after some time has been spent in looking at the materials and formulating answers) would be beneficial. Alternately, this could be done at the beginning of the second day.

The template needs revision. Many of the questions have qualifiers (such as “Globally engaged” in B.5.d) that seem to unnecessarily exclude the program to which they are being applied. Similarly, many of the questions address the K-12, workforce, and general public populations but seem to unnecessarily exclude higher education.

COV Members:

Dr. Rachelle Heller
Dr. Joe Turner

III. Cluster 2 -- Instrumentation and Infrastructure

Programs: CADRE/CARE (CISE Advanced Distributed Resources for Experiments/CISE Advanced Resources for Experiments), RI (Research Instrumentation), RIN (Research Infrastructure), MRI (Major Research Instrumentation)

A. Instrumentation and Infrastructure: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:

a. Panels are efficient but lack the broad expertise achieved with ad hoc reviews.

For the most part, the programs have been panel-based for the review process. It seems that panels are one of the most effective ways to evaluate such proposals. The reviewers seem to be handling 12 proposals each, with each proposal receiving at least three written reviews before the panel meeting. There is a question if the number of proposals handled by each reviewer is a heavy load or not.

Typically, four panelists reviewed each proposal. There were no site visits when proposals were considered for funding, although site visits were made for grants with certain uncertainties, which need to be checked at the end of the second year. The overall design, including review mechanism, for these types of proposals seems appropriate.

b. RIs that have two panel reviews are effective but use a lot of NSF resources.

MRIs should include a site visit.

For RIN, each individual written review seems to have been effective in identifying the strengths and the weakness of each proposal.

The effectiveness of CADRE's review process can be improved by incorporating site visits to those worthwhile proposals with certain doubts for funding. There is no need for site visits for those proposals that have been identified clearly as poor or very good.

c. The time to decision for RI is too long due to the two panels that must be convened. However, the dwell time is justified due to the use of two panel reviews and a site visit.

   For RIN, there seems to be a 7 months review process time for proposals. This seems to be a reasonable turnaround time.

   For CADRE, the time to decision has increased during the past three years. The major reason for the increasing delay is due to the assignment of NSF staff to handle additional workload, such as ITR.

d. The documentation is superb for RI, MRI, and CADRE.

   For the RIN program, better explanations seem to be needed for panel recommendations when the aggregate evaluation of individual reviewers is not closely related to the panel decision.

e. For RI, there does not seem to be much attention to achieve full participation of under-represented groups. This is especially true for persons with disabilities.

   The criteria defined to solicit proposals for RIN were used as guidelines to evaluate each proposal. However, the guidelines for this program need to be clearer on the type of proposals that they accept or aimed at. There seems to be some confusion on the interpretation of "Particular emphasis should be given to those unique or new scientific or engineering capabilities that will ensue from the proposed acquisitions." It was unclear if it referred to the individual projects on the proposal or there should be integration among them.

   The CADRE program is consistent with priorities and criteria stated in the program's solicitations, announcements and guidelines.

2. ***The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

b) *Performance Goal: Implementation of Merit Review Criteria by Program Officers:*

NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:
a. *1) Did reviewers adequately address the intellectual merit criterion in their reviews?*
2) Did reviewers adequately address the broader impact criterion in their reviews?

In the RI program, only a small fraction of the reviewers addressed both generic review criteria. The RIN reviewers did, however.

For CADRE, the shortage of time for panel meetings and lack of pre-meeting time were probably the main reasons for many panelists not addressing the merit criterion and broader impacts criterion adequately. Many of the panelists addressed the intellectual merit criterion in their reviews adequately. The broader impacts criterion was usually not adequately addressed by panelists.

b. 1) Did program officers adequately address the intellectual merit criterion in their decisions?
2) Did program officers adequately address the broader impact criterion in their decisions?

In the RI program, of the jackets we reviewed, only about half of the program officers adequately addressed both generic review criteria. RIN program officers, however, did adequately address both issues.

In CADRE, program officers in forming their decisions on the proposals normally addressed the intellectual merit criterion adequately. The broader impacts criterion was normally not adequately addressed by program officers.

The RI proposals we reviewed don't seem to pay adequate attention to the criterion on broader impacts.

In RIN, it could be inferred that the program officer addressed the merit criteria by using the recommendations of the panel.

For all programs in this cluster, the panelists should receive the proposals with sufficient time in advance and be asked to complete a preliminary evaluation form before the panel meeting. The panelists should be grouped so that each panelist will receive no more than ten proposals for pre-meeting evaluation.

For CADRE, better panel evaluation is essential to help program officers identify the strength and weakness of each proposal and make better decisions on selecting excellent proposals for funding.

3. Reviewer selection:

a) Use of adequate number for balanced review;

b) Use of reviewers having appropriate expertise/qualifications;

c) se of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;

d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. Yes.

It seems that the number of proposals assigned to each RIN reviewer in this program was relatively heavy.

b. Excellent and highly qualified - for RI, RIN, and MRI.

There is no document on any specific effort in selecting panelists according to certain criteria. The most important factor to successfully satisfy panelist selection criteria is to have a big pool of qualified panelists from various universities and research centers/labs for selection. This can been improved through the following mechanism: NSF program officers should ask the chairs of Computer Science/Computer Engineering Programs and programs closely related to the program area in universities with substantial research activities in the program area to suggest their qualified and interested faculty members or researchers to serve as panelists. The requests should also be sent to directors of research centers of these universities. COV members received such requests in the past from other NSF program officers, and the number of our faculty members serving as reviewers/panelists has increased drastically during the last three years.

c. For RI and MRI, it is difficult for us to evaluate this criterion but it appears that the NSF program director is aware of the need and is making a serious attempt to achieve adequate balance.

In RIN, there is a good representation of the research academic population that is different from the general population in terms of women and minority representation. Reviewers were selected from different geographical areas (the Northwest and Southeast were not represented in the 2000 Panel); good cross-section of Carnegie Classifications (with heavy concentration from RU-I Institutions and a lack of representation from Minority Institutions) and National Labs. There was no representation from Industry.

d. Very good.

There is no evidence that conflict of interest was not properly handled.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as
- *High-risk*
- *Multidisciplinary*
- *Innovative*

Comments:

a. Great. The overall quality of the awarded proposals seems to be very good.

b. For RI and RIN, there is a gap in the range between $200K and $1 million.

c. Very good.

For RIN, a good spectrum of emerging scientific and engineering areas were awarded, including broadband wireless communication, embedded systems, parallel and high performance computing, data intensive applications and knowledge discovery, interactive visualization, virtual reality applications over wireless networks, as well as human computer interface for biomedicine.

Due to the strong promotion of many new initiatives in CADRE, this program has suffered from decreasing number of submitted proposals. This serious situation certainly affects the effectiveness of identification of and support for emerging opportunities.

d. Very good. Initial PI success rate is higher than the overall NSF success rate.

15 out of the 18 applying States received awards. The overall success rate for the program was around 58% (RIN program).

e. Only a small fraction (RI program); not applicable (RIN program); yes, among the funded projects (CADRE).

f. Small.

In RIN, the application pool seems to be a good representative of the research academic community, which again does not represent the general population. There seems to be around 12% women applicants and 5% minorities. However, the data that we have is not conclusive. Further, the documentation does not indicate how the program is trying to attract underrepresented groups.

No (CADRE).

g. High risk: low: this is contrary to the NSF value system, and there are few examples in this category;
Multidisciplinary: fine
Innovative: excellent (RI and CADRE)

This objective seems not to be applicable to the RIN program.

B. Instrumentation and Infrastructure Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples that demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;

d) Globally engaged science and engineering professionals who are among the best in the world; and
e) A public that is provided access to the processes and benefits of science and engineering research and education.

Comments:
a. Not applicable.
b. Not applicable.
c. Not applicable.
d. The research projects funded by the RIN program increased the level of competency of science and engineering professionals by providing them with world class instrumentation to perform research and advance science and engineering knowledge.

e. Boston University/M. Betke and S. Sclaroff (0101251, "CISE Research Infrastructure: SENSORIUM: Research Infrastructure for Managing Spatio-Temporal Objects in Video"): development of methods for tracking and recognizing human motion that can provide computer access to people with severe disabilities, such as those with severe cerebral palsy or traumatic brain injury.

University of Illinois, Chicago (9802090, Thomas Defanti, University of Illinois, Chicago, "CAVERN: The CAVE Research"): The development of CAVERNsoft allows the development of "Virtual Harlem" with the University of Missouri in virtual reality in order to supplement an African-American literature class taught simultaneously at UM and UIC.

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:
a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

Comments:

a. T. Huang's (9623396, T. Huang, University of Illinois, Urbana, "A Shared Distributed Facility for Multimedia Signal Processing and Visualization with Application to Human Computer Intelligent

Interaction") development of a Proactive Computer that senses the users' emotional state and that makes appropriate responses.

Duke University (0082912, Amin Vahdat) developed quality of service (QOS) and reliability tradeoffs for Internet services.

Duke University (9972879, Chase, "Data-Intensive Computing for Spatial Models") developed a prototype storage system that uses new virtualization techniques to produce a unified "virtual storage appliance" capable of handling massive data sets.

The University of Kentucky (9818332, Jaynes, "Video Analysis and Reconstruction in a Distributed Environment") developed a front projection system that removes shadows.

The University of Colorado developed multiple autonomous robots and marsupial robots.

The joint project by the University of Pennsylvania and Boston University (9809209, Dimitris Metaxashas, "CARE: National Center For Sign Language & Gesture Resources") established a national center for sign language and gesture resources. The goal of this project is to make available several different types of experimental resources and analyze the data to facilitate linguistics and computational research on sign languages and gestural component of the spoken languages. This includes a facility for collection of video-based language data with synchronized digital camera to capture multiple views of the subject. A substantial corpus of American Sign Language video data from native signers and made available in both compressed and uncompressed form. The database will be linguistically annotated and is made publicly available along with applications needed to access the database. The combination of linguistic and computational expertise in this project will ensure scientific integrity of data collections, and will result in useful data for researchers in a variety of fields.

b. Dartmouth (9802068, David Nicol, "Systems Science for Physical Geometric Algorithms") development of a new class of signal processing algorithms for nuclear magnetic resonance (NMR) structural biology, based on time-frequency analysis of chemical shift dynamics.

The proposals funded by the CADRE program integrates research projects that look at the frontier of science and engineering in such areas as broadband wireless communication, embedded systems, parallel and high performance computing, data intensive applications and knowledge discovery, interactive visualization, virtual reality applications over wireless networks, as well as human computer interface for biomedicine.

c. Boston University (9706685, /Mark Crovella and Azer Bestavros, "COMMONWEALTH: Architecture and Protocols for Scalable WWW Service) obtained four patents (three licensed to Cisco and Commonwealth Technologies) on Internet traffic analyses and characterization.

d. The outcome of these research projects were used to increase the training pipeline of undergraduates and graduate students in the areas of large scale software artifacts coordination, and experimental evaluation in areas such as Web based protocols and architectures, large-scale storage for imaging, video processing, and speech processing that will play a very important role on the every day use of networks such as the Internet on day-to-day societal needs such as commerce, education, and entertainment. Some of these research activities have found their way to software and hardware industry such as HP, Eaton Corporation, Motorola, Texas Instruments, and Thomson Consumer Electronics.(RIN program)

7. TOOLS Strategic Outcome Goal: Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators:

a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. Princeton (9624099, K. Li, "Network of Symmetric Multiprocessors: An Infrastructure for Research in Scalable Systems and Applications.") involved construction of three clusters of SMPs that allow multiple faculties to study shared memory architectures, collaborative research, and an end-to-end data visualization system.

Cornell University (9972853,Tony Ingraffea, "A Two-tier Computation and Visualization Facility for Multiscale Problems") developed clusters of Windows processors for finite element analysis of gas turbine engine components.

University of Pennsylvania (9703220, Vijay Kumar, "Asymmetric Bandwidth Channels: Applications to Real-Time Computing and

Robotics") developed experimental hardware to control a team of robots in formation.

A remote parallel processing and computational biology facility at the University of California at Santa Cruz (9905322, Richard Hughey, "The UCSC Kestrel Server: Remote Parallel Processing and Computational Biology") is focused primarily on the sequence analysis needs of the human genome project and the general field of computational biology. It is also a general-purpose parallel processor and is programmed with neural network, floating point, computational chemistry, and image compression applications. A Web-based user interface is developed to allow computational biology research community easy access to this facility.

b. Northwestern University's (9703228, "A Distributed High-Performance Computing Infrastructure") NSF purchased equipment was vital to obtain $6M of DARPA grants.

In many cases, facilities and instruments supported by these grants were used effectively to increase productivity of science and engineering workforce. For example, the INTERSIM Project at the University of Colorado at Boulder (0080146, "The Digital Commonspace") has developed a system for shared interaction to support design, learning and planning. The system integrates 3D gaming with simulation approaches to decision-making and learning on demand.

c. The University of California at Santa Barbara (0080134, A. Singh, "Digital Campus: Scalable Information Services on a Campus-wide Wireless Network") implemented a digital classroom with feedback to instructors. It has been used to host a Nobel Laureate's lectures to elementary school students.

Some of the projects have used the platforms to facilitate public access for education and outreach programs.

d. Cornell University developed research to evaluate and monitor users for a classroom and public space wireless infrastructure.

8. Areas of Emphasis:

For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People

- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  -Centers for Learning and Teaching (CLT)
  -Graduate Teaching Fellows in K-12 Education

- *Broadening participation*
  - *-Tribal Colleges*
  - *-Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
  - *-Advanced Technological Workforce program (ATE)*

Comments:

None (RI program)

The project on Intelligent Assistance for Multiple Robots at Colorado School of Mines/University of South Florida was used effectively to motivate k-12 students interested in sciences.

The project at the University of Colorado at Boulder has established partnership with New Vista High School for applying the tools developed under the research grant to understand concepts and issues in social sciences.

Some of the projects sponsored by this program have broadening the participation in innovation by fostering strong partnerships with industry. An example is the project at Michigan State University on clustered symmetric multiprocessors in partnership with Eaton Corporation, Motorola, Texas Instruments, and NASA.

In the CADRE program all the funded projects have the goal of educating and training of various groups of people, such as K-12 children and researchers at the undergraduate, graduate, and post-docs levels, and senior scholars. The following two projects are excellent examples: The University of Colorado is helping deaf children to learn to speak, the University of Boston project is training K to senior citizens to improve learning and sign language skills.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:

The programs strike a good balance between advancing knowledge in the field and supporting tool developments and information dissemination. A few of the projects are multidisciplinary and involve PIs from different departments. About half of the projects involve innovative research that is conducted in conjunction with other projects.

All the projects funded can be classified under ITR.

None of the projects represent non-initiative fundamental research.

None (RIN program)

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
    - *Terascale Computing System*
- *Continuing investments:*
    - *Major Research Instrumentation Program (MRI)*
    - *Science and Engineering Information/reports/databases*
    - *New types of scientific databases and tools for using them*

Comments:

Investments in MRI led to the development of tools and platforms that benefit many. A notable project is the Proactive Computer in the multimedia laboratory funded at the University of Illinois.

The tools developed in most of the RIN projects were made available to the research community and the public via WWW.

9. Please comment on program areas that the COV believes need improvement.

Comments:

The program needs to consider funding of projects in the range between $200K and $1 million. Currently, such projects need to compete in a Foundation-wide manner.

The programs in the EIA division are too diversified and confusing. Some consolidation should be made to offer fewer projects and more coherent solicitations.

The processing procedure needs to be streamlined. Support for program assistants are minimal and should be enhanced. Currently, program assistants as well as program directors are overloaded with proposals. Additional support needs to be provided in order for program directors to focus on project solicitation and evaluation.

The use of panels should be reconsidered. Panels are good for reducing the processing time but may not be the best means for obtaining balanced reviews of proposals, especially those in high-risk areas. A hybrid approach that allows independent reviews and panel reviews should be considered.

Program areas appear appropriate. However, due to the shortage of NSF staff and due to increasing distributed applications of information technology in various research areas, the CADRE program can be managed more effectively by combining it with other research infrastructure/instrumentation programs.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:

The RI and CADRE programs have met fully the program-specific goals and objectives.

The RIN program is effective in meeting the program specific goals and objectives. One point that should be considered is that, when this program is integrated with the new Research Resources program, special consideration should be given to cover the different instrumentation needs that researchers in this area have. For example, the void between instrumentation needs between 200K and 800K is important to be filled. At this time, researchers falling into that range can only get funding from the NSF wide initiative of Major Research Instrumentation. It will be appropriate that the new Research Resources program covers the need of researchers from the $30K need to the $2 Million.

Another point that should be taken into consideration, as the RIN program is integrated with the Research Resources program, is that the research projects sharing the instrumentation within a grant need to present a plan for integration at certain level. They should explain how the facilities provided by the grant would facilitate collaboration and integration among the research projects. It should be made clear that it is not sufficient that the research projects will use the facilities and instruments but that they will achieve something greater than the sum of the parts.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:

The process is rushed and does not provide enough time for COV visitors to fully understand the merit of the program evaluated. Without proper guidance from the program director, it is very hard to find the right information in the time allowed for the process.

COV Members:

CADRE/CARE: S. Yau
RI (Research Instrumentation): Pena-Mora and A. Hurson
RIN (Research Infrastructure) and MRI: E. Swartzlander and B. Wah

IV. Cluster 3 -- Digital Government

A. Digital Government: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) *Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);*
b) *Effectiveness of program's review process;*
c) *Efficiency; time to decision;*
d) *Completeness of documentation making recommendations;*
e) *Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.*

Comments:

a. Merit review procedures for this program follow conventional NSF protocol, with a couple of exceptions. (1) In addition to the two primary merit criteria, several additional criteria are emphasized in the review process. These additional criteria all involve the character of the research/development partnership between the proposing team and the organizations in which the work will be done. This is very appropriate, since the success of Digital Government projects depends crucially on the viability of this partnership. (2) Some proposals are reviewed by representatives of public sector agencies rather than researchers. These proposals, for workshops and planning grants, would ordinarily not require peer review due to their goals and budgets (they fall within the program officer's area of discretion), but since their target audience will be drawn from public sector organizations it is very helpful to have their feedback about the project. This also involves the user community more directly in the Digital Government program. Again, this is an appropriate departure from normal procedure.

b. The review process has been effective. We closely analyzed twelve jackets, including skimming the proposals. We found that in general the reviews were thoughtful, objective, and thorough. For every proposal, there was at least one review of adequate depth and demonstrable expertise. A strength of this program is the way the review process helps researchers to build projects, through an effective feedback and resubmission process and a hands-on process of negotiation and reshaping even after the award is made. In this program, projects often require additional nurturing to strengthen the core partnerships, including negotiating with the partner organization about budget issues.

c. This program clearly falls short of NSF goals for time to decision and efficient processing of applications. In part, the unusually long time to decision can be explained by the nurturing process many proposals are subject to. We believe that over time, as the program matures, there will be less need to nurture proposals (they will be submitted at a more mature point in their development) and when that happens, processing time (and program officer workload) should decrease. One specific change that would help is to shift the proposal deadline from July to October, which would facilitate interagency budget coordination.

d. Documentation of the review process and decisions is quite good. Minutes of the panel meetings are detailed and in almost every case clearly document the rationale for decisions. The program officer's summary provides a straightforward rationale for the decision and appropriate guidance for the proposing team.

e. Decisions made were consistent with the program's review criteria. A strong emphasis is placed on partnership issues (see above), as this area is critical to the feasibility of the project.

2. The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):

a) Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?

b) Performance Goal: Implementation of Merit Review Criteria by Program Officers:
NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:

a) 1) Did reviewers adequately address the <u>intellectual merit</u> criterion in their reviews?
2) Did reviewers adequately address the <u>broader impacts</u> criterion in their reviews?

- This program is unusual in that reviewers and program officers give strong weight both to the scientific merit and the broader impact of proposed projects. This is a program that really demands a strong commitment to relevance and impact, and the review process reflects that in an appropriate way.

b) 1) Did program officers adequately address the intellectual merit criterion in their decisions?
2) Did program officers adequately address the broader impacts criterion in their decisions?

- The program officers, like the reviewers, gave strong weight to both the scientific merit and the broader impact of the proposed projects.

3. Reviewer selection:
a) Use of adequate number for balanced review;
b) Use of reviewers having appropriate expertise/qualifications;
c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. Although in a few cases there were only two reviews for a proposal, in the great majority there were 3-5 reviews. This is an adequate number for balanced review.

b. The reviewers and panelists had appropriate expertise and qualifications.

c. The demographic composition of the panels was fairly typical, which means it reflected the usual imbalance toward white men. There are some odd geographic imbalances—for example, Ohio is a large state but relatively underrepresented among the panelists.

d. Management of conflicts-of-interest has been diligent, and potential conflicts and their resolution have been thoroughly documented.

4. Resulting portfolio of awards:
e) Overall quality of science/engineering;
f) Appropriateness of award scope, size, and duration;
g) Effective identification of and support for emerging opportunities;
h) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
i) Evidence that proposers have addressed the integration of research and education in proposals;

j) Evidence of increased numbers of applications from underrepresented groups;

k) Balance of projects characterized as

- *High-risk*
- *Multidisciplinary*
- *Innovative*

Comments:

a. Because this program involves development of applications for ongoing test-beds, the intellectual challenges are distinctive and complex. Almost every project involves a mix of social/organizational science and computer or information science, and every project involves applying knowledge to produce workable solutions. Consequently, the problems addressed may not always be on the cutting edge of the contributing disciplines (although the methods employed in general seem to be rigorous and appropriate). On the other hand, we have the opportunity to learn things from these projects that can't be learned in more conventional research. To take full advantage of the distinctive character of this program, it would be helpful to have an explicit program goal to systematize and report lessons learned about the process and outcomes of application and technology transfer.

b. It is difficult to provide an overall judgment of the appropriateness of the size and duration of awards, because this depends so heavily on the nature of the partnership. If the partnership is already strong, then a three-year duration might be reasonable. If the partnership must be nurtured, three years is probably too short a duration. These kinds of projects are more expensive than ordinary projects, because when working "in vivo" there are additional costs (e.g., refinement of user interfaces, software documentation, user training) that are not incurred with "in vitro" research. If the partnership makes a substantial contribution, then budgets at the larger end ($300-$500K per year) are probably doable. But many of the awards struck us as inadequate to support the work.

c. The program has been aggressive in organizing workshops to promote participation by both agencies and the research community. This outreach is critical to forming effective partnerships around problems of interest to the CISE research community. One suggestion for improvement might be to mount a greater proportion in the DC area to facilitate interaction with agency personnel. It would also be helpful to have more documentation on all workshops, similar to the very good presentation we saw on the annual program workshop. The program has also made good use of planning grants to help investigators turn good ideas into viable partnerships and build proposals.

d. Workshops and other mechanisms clearly promote openness in the system. However, for reasons that are intrinsic to the program, it is more likely to attract and support senior researchers who can afford to move to work at the boundaries of their disciplines.

e. In general, projects support a cadre of graduate students, who are receiving training in multidisciplinary teams.

f. This program is really too new to show increases in involvement by underrepresented groups. The profile of awardees resembles other programs in CISE.

g. Among the awardees, one sees a range of projects from very high risk/high reward (e.g., the project on confidentiality of statistical data) to projects that are less risky. Virtually all of them involve multidisciplinary teams—it is almost a necessary condition for doing the sort of work this program supports. The work is quite innovative from the standpoint of changing the application context, although the actual contribution to basic science varies dramatically across proposals.

B. Digital Government Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:

Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;
d) Globally engaged science and engineering professionals who are among the best in the world; and

e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. and b.
This program has little impact on k-12 or adult science, math, and technology skills. It could have some impact on statistical literacy across the life span, although it has yet to do so.

c. This program has the potential to draw individuals from fields with a more diverse membership (e.g., social sciences) into research partnerships with computer scientists—which could, in turn, draw a more diverse student body into CS research. It is still too early to tell whether this outcome will be achieved.

d. This program has demonstrated an ability to draw the attention of eminent senior researchers to significant problems involving technology application. We saw many examples of this in our evaluation of proposal jackets.

e. This program is specifically designed to provide public access to the benefits of science and engineering research, and it appears to be paying off. A good example of this can be seen in the Archimedes project, led by Cliff Nass from Stanford. This project developed a universal interface to permit easy accommodation of persons with disabilities throughout the government; but it also was immediately useful to the Census Bureau in creating a new voice and vision based interface; this new interface produced a threefold increase in data entry productivity.

6. IDEAS Strategic Outcome Goal:

Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

a) *A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;*
b) *Discoveries that advance the frontiers of science, engineering, and technology;*
c) *Partnerships connecting discovery to innovation, learning, and societal advancement; and*
d) *Research and education processes that are synergistic.*

Comments:

a. With programs like this one, which fund demonstration projects, there is a danger of compiling an inventory of successful projects but little real transmittable knowledge. This concern is being addressed by the Digital Government program through a plan to create a journal for research of this type. But part of the problem is precisely that this kind of work tends to produce case studies, and we still need to figure out how to generalize from case studies to useful knowledge. There is clearly the potential for this program to help develop a knowledge base about partnership, technology transfer, and technology application. However, to help this knowledge base grow we need more synthetic and theory-building efforts that use Digital Government projects as data points and identify best practices and well-founded generalizations. Workshops organized specifically to encourage such theory building might be one mechanism for doing this.

b. This program is still quite young, and it is not yet clear what discoveries will be made, although enough risky, potentially high-payoff projects have been funded to make it likely that important results will emerge.

c. The core of this program is partnerships connecting discoveries to innovation, learning, and social advancement. Each project is an instance of this performance goal. A good example of this is the partnership created among the federal statistical agencies and their willingness to work with a research team on the very significant problem of providing access to statistical data while protecting privacy. However, the program needs to reach out more effectively to industry and more effectively engage issues of technology transfer. This is the next frontier for this program, and one that the management are ready to tackle.

d. The program is designed to promote synergy through the interactions of cross-institutional and multidisciplinary communities. Again, despite the youth of the program, examples of synergy are beginning to emerge. PI's from three GIS projects funded by Digital Government met and interacted through program workshops and meetings, found key problems they could usefully tackle together, and have developed a proposal together, which is under review for ITR.

7. TOOLS Strategic Outcome Goal:

Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

<u>FY 2001 Performance Goal:</u> The program is <u>successful</u> when, in the aggregate*, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators:*

a) Shared use platforms, facilities, instruments, and databases that enable discovery;

b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;

c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and

d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. Many of the projects funded by this program involve the development of either shared databases or new strategies for integrating and providing access to databases. In particular, the work with federal statistical agencies to resolve problems of integrating and accessing statistical data will be important for social science researchers.

b. Similarly, the Archimedes project (described above) promises to provide access to information systems more broadly via its ability to support multiple input and output devices in a universal interface.

c. Each project receiving an award under this program is required to have a website that documents the design and results of the project; all the projects we examined had built effective and useful sites. Many projects have the explicit aim of providing access to information via the Internet. For example, some projects involve the integration of data and management tools for environmental systems, which could be broadly useful in science education as well as public decision-making.

d. We saw no projects that identified policy as an outcome, but changes in policy and practice should emerge from the kinds of research synthesis that should accompany and frame this program.

8. Areas of Emphasis:

For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People

- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
  - *Advanced Technological Workforce program (ATE)*

Comments:

The comments made under People, above, respond to this area. We see limited applicability for K-12 education or teacher preparation. But this program should be able to develop in directions that address issues of access for diverse populations and workforce training.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:
We saw an appropriate balance among risky and less risky research, with a strong emphasis on multidisciplinary teams. There is harmony between this program and many parts of ITR, although ITR-type programs are unlikely to fund research with the kind of strong application focus that Digital Government promotes.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments:
The primary tools outcomes of Digital Government programs, so far, have involved advances in database integration, access, and user interfaces. This seems to be a fertile area for future development within this program.

9. Please comment on program areas that the COV believes need improvement.

Comments:
We noted the long dwell times in this program, and made suggestions above about how they might be ameliorated. We noted the lack of diversity among PI's, but feel that this program may attract a different profile than others. The multi-disciplinarity of projects should be a framework for bringing more young researchers, women, and minorities into the CISE program.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:
The program has done an excellent job of compiling demonstration projects to help guide technology strategy and planning across many types and levels of government organizations.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:
We felt that the time provided for the review was not really adequate to the task. We used all the time available to review one program, and others had much more complex tasks. There was very little time for discussion across the different program teams.

The staff support for this review process was excellent.

COV Members:
Dr. Don Prosnitz
Dr. Barbara O'Keefe

V. Cluster 4 -- Experimental Systems

Program: Experimental Systems and Experimental Partners

A. Experimental Systems: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
Six proposal folders were reviewed (three awards and three declines, one each from 1998, 1999, and 2000). All annual and final reports were reviewed from these years.

a. Most of the proposal reviews included both panel and reviewer mechanisms. This seemed an appropriate review mechanism due to the complexity and size of the proposals. However, one of the proposals was reviewed but not via a panel setting, which appeared to be due to a changing environment (program director changes).

b. The review process appeared to be adequate in terms of the number of awards presented. The sample of proposals showed a structured review process that was followed to ensure consistency and completeness within and across proposal submissions. While the review process itself is quite well structured, the depth and breadth of comments made by reviewers varies tremendously. Efforts should be made to the process to encourage, elicit and facilitate more consistent reviews, e.g., web-based forms, such that reviewers are more responsive to the NSF Merit Review Criteria.

c. The time to decision, in 1998, was very reasonable with 53% of all submissions being acted on within six months. Both 1999 and 2000 showed a significant increase in the dwell time. There were two program director changes during this time, which may account for this change.

d. Overall, the documentation associated with a recommendation was complete. The program director, in all proposal folders reviewed, had summarized the reviewer recommendations. The reviewer recommendations were complete in that the folder contained reviewer comments or a reason for no reviewer comments (e.g., conflict of interest). While the depth and breadth of reviewer comments may have varied widely, in all proposals folders reviewed, at least some of the reviewers clearly addressed the NSF Merit Review Criteria.

e. The merit review procedures used during the proposal review process appear to be consistent with the priorities and criteria state in the program solicitations, announcements, and guidelines. All proposal folders reviewed reflected the consistent use of a process for tracking information flow among all parties inclusive of the program director, reviewers, and proposal author.

*2. **The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

b) Performance Goal: Implementation of Merit Review Criteria by Program Officers:
NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:
a. *1) Did reviewers adequately address the <u>intellectual merit</u> criterion in their reviews?*
2) Did reviewers adequately address the <u>broader impact</u> criterion in their reviews?

Several of the proposal folders contained reviewer comments that were quite thorough in addressing both the program's and NSF's criteria. In one of the funded proposals, the reviewers identified a reduction in pollution as being a positive side effect of the proposed research. This is a reflection that the reviewers took into account a societal perspective when reviewing proposals.

However, there were also reviewer comments that did not address the intellectual merit or the broader impacts criteria. This inconsistency may be a reflection of the reviewer templates that were used during the review time period. Of the proposal folders reviewed, there was in fact one reviewer who only provided a "letter-grade" for the proposal and provided no comments whatsoever concerning the Merit Review Criteria. The typical reviewer, however, would provide significant comments on the technical and intellectual aspects of a proposal, and perhaps a few comments on the broader impacts.

b. 1) Did program officers adequately address the intellectual merit criterion in their decisions?
2) Did program officers adequately address the broader impacts criterion in their decisions?

The program director's review analysis typically summarized the reviewers' comments regarding the strengths and weaknesses of a proposal. It appeared that if the reviewers' comments did not specifically address the NSF criteria, then the program director did not address them separately. Most often, the contents of the review analysis document inherently addressed the NSF criteria in discussing the strengths and weaknesses of the proposal from a program perspective. That is to say, in reviewing proposal folders, successful ones typically had multiple technical strengths that were clearly identified. Unsuccessful proposals, on the other hand, sometimes left the reviewers and the program officer "groping" for some intellectual merit. Less time was spent in the analysis on the Broader Impacts criterion, but this is harder to assess due to its speculative nature.

3. Reviewer selection:
a) Use of adequate number for balanced review;
b) Use of reviewers having appropriate expertise/qualifications;
c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. The number of reviewers for each proposal review was adequate. The number of reviewers was 5 or 6 for all proposals.

b. It appeared that all reviewers were qualified from academia, industry, and government agencies. They had computer science, computer engineering, or other related scientific or engineering backgrounds.

c. In most cases, the reviewer pool reflected geographic dispersion. Only researchers in the Northeastern US reviewed one of the proposals. In all cases, there was gender and institutional diversity.

d. The recognition and resolution of conflicts of interest was well documented. This reflected that a procedure was followed consistently during the review process.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as
  - *High-risk*
  - *Multidisciplinary*
  - *Innovative*

Comments:

a. Overall, quality of science & engineering appears to be adequate. For the three award folders evaluated, the proposals were sound and proposed to make advancements in science and engineering. Likewise, for the three declined folders evaluated, the proposals offered less innovative and incremental advancements.

b. The appropriateness of the award scope, size, and duration appeared adequate. In one particular case, the award was significantly reduced to reflect a more realistic scope of work that focused on a more immediate proof of concept rather than committing to hardware fabrication.

c. Emerging opportunities appeared to be a focal point when making final award decisions. One case in particular was quite impressive in that undergraduate, honor students were funded to develop a whiteboard-based system. A side effect of this work was a reduction in pollution.

d. There is insufficient evidence to evaluate whether there was openness in the system. Of the three proposal folders that were awards, none were new investigators. In fact, all of the proposals had identified current funding from NSF and/or other agencies (e.g., DARPA). While a senior PI's "track record" may be a good indicator of the potential for success, some mechanism should be in place to encourage new investigators. This can be either (1) explicitly offering "new investigator" awards, or (2) explicitly requiring proposals from senior investigators to "apprentice" new investigators.

e. Student participation occurred in all of the awards primarily at the graduate level. One of the funded proposals was for undergraduate funding only in order to get them involved in research activities.

f. Insufficient evidence to support the identification of a trend. However, there is gender diversity as reflected in one of the three funded projects.

g. The projects that have been funded appear to be quite innovative and of moderate risk. Shortening the project scope and reducing the number of deliverables/outcomes reduced the risk of the scaled back project. In this case, it appeared to be a sound decision. There is insufficient information to assess whether there is a balance of multidisciplinary projects based on the proposal folders reviewed.

B. Experimental Systems Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:

Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;
d) Globally engaged science and engineering professionals who are among the best in the world; and
***e)** A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:
a. This goal is not applicable to the EP and ES programs.

b. This goal is not applicable to the EP and ES programs.

c. The proposal folders reviewed do indicate gender, institutional and geographic diversity. There is insufficient evidence to determine if the involvement by minorities is statistically adequate.

d. The award portfolio contains a wide variety of organizations across the nation, including some of the most highly respected research institutions. While the rate of publication varies from project to project (presumably correlated to level and duration of funding), the high average level of publication in well-known international workshops and journals is a excellent indicator of a globally engaged workforce. Several of the annual and final reports indicated international collaboration with other research institutions.

e. The vast majority of awarded proposals maintained websites that offered public access to the project's publications, and also in many cases to the software and tools developed.

Nugget: Principal Investigator: Essa, Irfan. Award ID: 9806822
Organization: Georgia Institute of Technology

As a result of investigating multimedia capture and playback facilities, this project produced the Classroom 2000 system for capturing lectures. This system is now in use at Georgia Tech, Kennesaw State University and McGill University. Besides capturing lectures, this same technology is applicable to capturing, editing, and playback of any collaborative space for geographically distributed teams.

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:
a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

Comments:
a. The ES and EP projects made significant progress on many fundamental aspects of science and engineering. An example is a highly available, large-scale video server. This is an enabling

technology for distance learning and a large commercial market for video-on-demand.

b. Advances on all fronts of science, engineering and technology were served by research into highly cost-effective cluster computing as illustrated by work on adaptive communication and computation control in clusters and a virtual memory mapped communication protocol for Myrinet.

c. While almost all projects had significant documentation of discoveries related to the proposed research, some projects also produced multiple patents and promoted graduate and undergraduate involvement. A large number of the projects listed industry involvement.

d. At the graduate level, there is a clear synergy between research and education. This is evidenced by a significant number requests for supplements to support graduate (and undergraduate) involvement.

Nugget: Principal Investigator: Tyagi, Akhilesh. Award ID: 9703702
Organization: Iowa State University

The major contribution is the evaluation of branch decoupling to expand ILP. Branch decoupling along with branch prediction appears to be the best choice for resolving branches based on our results. Intel seems to have begun evaluating branch decoupling as a result of our research.

7. TOOLS Strategic Outcome Goal:

Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

<u>FY 2001 Performance Goal:</u> The program is <u>successful</u> when, in the aggregate*, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators:*

a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. While many projects were cross-institutional and made shared use of resources, progress on primary research goals is often made in core teams. Once key progress had been made and a system or tool developed, collaborators would then evaluate its benefit. This was the case for the ZPL compiler that was subsequently used for scientific applications in the departments of astronomy, mechanical engineering, civil engineering, applied mathematics and oceanography.

b. As noted above, many projects were cross-institutional and made shared use of resources. Some projects, however, were explicitly investigating technologies to facilitate resource sharing, e.g., the sharing of electronically captured lectures and meeting. This particular project included Compaq CRL, Microsoft Research, IBM Research, BellSouth, and NIST.

c. Almost all projects made documents and tools available on their web sites. While this is not technically SMET information, it still takes full advantage of the Internet for the rapid dissemination of information to all interested citizens.

d. Many projects explicitly involved industrial collaborators or contacts where the goal was to evaluate the impact of research results and experimental tools.

Nugget: Principal Investigator: Bestavros, Azer. Award ID: 9706685
Organization: Boston University

This project produced three patents in the areas of "Distributed Packet Rewriting", "Statistical Rate Monotonic Scheduling", and "Task Load Balancing Among Multiple Servers in a Computer Network." Two software tools related to this work are being made available to the public. One of these tools, Surge (Scalable URL Reference Generator) is being adopted by the World-Wide Web Consortium (W3C) standard benchmarking tool for evaluating extensions to the Hyper Text Transfer Protocol (HTTP).

Nugget: Principal Investigator: Snyder, Lawrence. Award ID: 9710284
Organization: University of Washington

The ZPL and the Advanced ZPL design supported by this grant are the first parallel programming language systems that have demonstrated high performance and full portability across all parallel platforms. This claim is true including commercial compilers.

8. Areas of Emphasis:

For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

In FY 2000, the latest year available, five awards were made. The likelihood of strong future performance is based here on the potential for these five relatively new awards.

a) Strategic Outcome: People

- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  -Centers for Learning and Teaching (CLT)
  -Graduate Teaching Fellows in K-12 Education
- *Broadening participation*
  -Tribal Colleges
  -Partnerships for Innovation (PFI)
- *Addressing near-term workforce needs*
  -Advanced Technological Workforce program (ATE)

Comments: The current awards are not applicable here.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments: One award involves speculative multithreading which is an important concept for future, high-performance processor architecture.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments:
Since an explicit goal of ES and EP is building experimental systems, tool building is more represented. Two awards involve the development of distributed, interactive systems, e.g., interactive video teams.

9. Please comment on program areas that the COV believes need improvement.

Comments:
There needs to be long term stability in program directorship in order to maintain an acceptable dwell time, provide timely feedback regarding proposal submissions, and offer guidance to resubmitted proposals. Without directorship stability, it is difficult to sustain an effective program.

While the review process itself is quite well structured, the depth and breadth of comments made by reviewers varies tremendously. Efforts should be made to the process to encourage, elicit and facilitate more consistent reviews, e.g., web-based forms, such that reviewers are more responsive to the NSF Merit Review Criteria.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:
Overall, the program has been effective in meeting the program-specific goals and objectives. There have been significant outcomes from a large number of the funded projects in terms of new tools, technologies, and methods (e.g., Aristotle, ZPL compiler, XMC specification/verification tool). One project, in particular, had applied for three patents as a direct result of the funded work. A large percentage of the funded projects included both undergraduate and graduate student researchers. Several of the funded projects were integrated into a classroom environment. Approximately a third of the funded projects collaborated with industry in product development, experimental design, and data gathering and reporting activities. This is significant in that industry support reflects a strong interest in the funded work.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:
Overall, the COV review process was well defined and effectively implemented. There was a support staff readily available for answering questions and providing additional information. The review process would be made more efficient by providing the objectives and goals of the program under review. Too much time was spent trying to read the documentation to determine what were the objectives and goals of the program over the three year time period.

Minor comments:
Acronyms should be supplemented with a definition or not be used in the report template (e.g., SMET).

Some of the summary data, provided in the "Panelists and Reviewers" G section, appeared to be inconsistent.

COV Members:
Dr. Shirley Becker
Dr. Craig Lee

VI. Cluster 5 -- Next Generation Software

Program: Next Generation Software

A. Next Generation Software: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
This cluster reviewed 77 proposal actions.

a. The program used panels augmented with ad hoc reviews (e.g., mail reviews) to evaluate the intellectual merit and broader impact of the submitted proposals. Each proposal examined was evaluated by at least four reviewers and some proposals were evaluated by as many as eight reviewers. The average number of reviews per proposal examined was five.

b. Our assessment was that the review process was more than adequate. The panel consisted of 27 experts in the areas covered by the program solicitation. The experts consisted primarily of researchers from category RU-I institutions. Additional reviewers were from National Laboratories (e.g., Los Alamos and Livermore). The program manager solicited and received an additional 47 reviews via mail.

c. Submitted proposals were received January 12, 1999. The panel convened March 30-31, 1999. The program officer completed nearly all the recommendations and negotiations for additional funding from other governmental agencies (NASA, NSA, DARPA, and DOE) by the June of 1999. Most award letters were sent in early August of 1999. Because of funding shortages, some actions, particularly declinations, were delayed until September by the division director.

d. The rationale for the funding recommendation for each proposal examined was thoroughly documented. Each proposal included a summary of the panel's recommendation, individual panel reviews, and an analysis of the reviews by the program manager.

e. The examined reviews were consistent with the priorities and criteria stated in the program's solicitations, announcements, and guidelines.

2. The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):

a) Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?

b) Performance Goal: Implementation of Merit Review Criteria by Program Officers:
NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:
We examined twelve proposals (six funded proposals and six declined proposals) to evaluate whether the reviewers and Program Officers implemented the NSF Merit Review Criteria.

a) 1) Did reviewers adequately address the intellectual merit criterion in their reviews?

Inspection of the proposal jackets found that 93 percent of the individual panel reviews explicitly addressed the intellectual merit criterion stated in the review guidelines. One hundred percent of the panel summaries addressed the intellectual merit criterion.

2) Did reviewers adequately address the broader impacts criterion in their reviews?

Inspection of the proposal jackets found that 47 percent of the individual panel reviews adequately addressed the broader impacts criterion stated in the review guidelines. Interestingly, only 33 percent of the panel summaries adequately addressed the broader impacts criterion.

b) 1) Did program officers adequately addressed the <u>intellectual merit</u> criterion in their decisions?

Inspection of the proposal jackets found that the program officers adequately addressed the <u>intellectual merit</u> criterion stated in the review guidelines. Tabulation showed that 100 percent of the program officer proposal analyses addressed the intellectual merit criterion.

2) Did program officers adequately address the <u>broader impacts</u> criterion in their decisions?

Inspection of the proposal jackets found that the program officers adequately addressed the <u>broader impacts</u> criterion stated in the review guidelines. Tabulation showed that 83 percent of the program officer proposal analyses addressed the <u>broader impacts</u> criterion.

3. Reviewer selection:

a) Use of adequate number for balanced review;
b) Use of reviewers having appropriate expertise/qualifications;
c) se of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. A total of 27 panelists were convened for 2 panels. The 77 proposals each received at least 4 panelist reviews, as well as 3 outside (ad hoc) reviews solicited from an additional 47 external reviewers. The COV believes that more than an adequate number of reviews and reviewers were used in this program.

b. Reviews were technically competent and covered all scientific areas represented by the proposals. In many cases, this required the use of outside, ad hoc, reviews when application areas of a proposal were esoteric or not widely represented in the proposal pool.

c. The reviewer and panelist pool was geographically well distributed and included academic, industrial and government people. Underrepresented groups were represented in the review process.

d. COI issues were adequately handled according to standard NSF policy and properly documented.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;

e) *Evidence that proposers have addressed the integration of research and education in proposals;*
f) *Evidence of increased numbers of applications from underrepresented groups;*
g) *Balance of projects characterized as*
   - *High-risk*
   - *Multidisciplinary*
   - *Innovative*

Comments:
In addition to the 12 proposals (six awards and six declinations) studied in detail, the COV had access to all the other proposal jackets (both awards and declinations).

a. The 17 PI groups in the program are highly visible and productive researchers but it appears that some weight was given to factors not considered in the review process in determining which proposals were selected for funding. Specifically, some proposals selected for awards were not as positively evaluated as others that were not selected. The rationale for selecting some projects over others was not clearly documented although some negative panel remarks about some awards were addressed by the program manager. From the perspective of the COV, some awards are not obviously in the scope of the program as described by the solicitation, and the rationale of the overall program award portfolio is not documented. This is a concern if such rationale was a factor in selecting some of the awards.

   At the COV meeting and in follow-up discussions, the program manager gave an overview of the technical aspects of the program, and the technical and budgetary rationale for the selection of the awarded proposals. The program manager also stated that she had provided her management a memo containing explanation on the rationale of the portfolio of the awards, but it was not included in the proposal jackets. Such rationale can play an important role in communicating the overall structure of the program to future COV's and/or future NSF personnel who will have to deal with the program.

b. The award portfolio in this program has a significant breadth of award sizes (ranging from $200,000 per year to over $2,000,000 per year) corresponding to the wide variation in size of submitted proposals. Some projects have been funded for 3 years, others for only one and the rationale for the variation in award duration is not clear to the COV from the documentation. Discussion with the program manager revealed that some shorter duration awards were made based on funds that became available after initial funding decisions had been made.

c. Most awards would be considered "safe" in terms of the PI's and proposed areas of research, as extrapolated from current and previous research in this area. The program solicitation described ambitious technical goals while submitted proposals and subsequent awards tended to have incremental, evolutionary ideas for achieving those goals. No high-risk awards appear to have been made.

d. The explicit goal of supporting new investigators was not documented in the program award portfolio or program solicitation. However, two awards in the portfolio were to new investigators (in one of these awards, the co-principal investigator is also a new investigator).

e. The integration of research and education was not uniformly addressed by the proposals.

f. The NGS COV cluster notes that awards were made to members of underrepresented groups.

g. The awards do represent multidisciplinary and innovative ideas but the COV did not conclude that high-risk projects were funded.

B. Next Generation Software Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;
d) *Globally engaged science and engineering professionals who are among the best in the world; and*
e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. Not applicable to this program.

b. Many of the projects have substantial training aspects in the program area. Some illustrative projects include:

(9975019, Constantine Polychronopoulos, "An Integrated Framework for Performance Engineering and Resource-Aware Compilation"): The project has involved extensively graduate students, postdoctoral students, and a research programmer working with the PIs to carry out the research. The group is working as a cohesive team, with frequent meetings for discussions of the relative merits of particular research directions. Several of the project students, because of their experience in the project, were particularly sought after by industry. The group has an extensive list of publications including recently submitted papers and, in several of them, include graduate students as co-authors. In addition the PI in the project has interactions with industry (Intel).

(9975057, Susan Eggers, "A Staged Compilation Architecture for Program Optimization"): All graduate students on the project learned research skills in compiler optimization and experimental methodology. In addition all gave several presentations on their research in several forums, including the department's affiliates meeting which is heavily attended by industry representatives. One student upon graduation was offered a position at Transmeta.

(9974960, Valerie Taylor, " A Performance Modeling Framework for the Analysis of Complex Applications and Systems"): The Prophesy Project is a significant project requiring team collaboration, and it has provided the opportunity to provide team with training in performance analysis, relational DB design, compilers and optimization methods. The researchers in the project made presentations on the project and established interactions with other research teams, like the HTMT project and the performance modeling capabilities established in the project were used in analysis included in a subsequent proposal to NSF by another PI for a Terascale computing

(9975018, Lawrence Rauchwerger, "SmartApps: Smart Applications for Heterogeneous Computing"): The project provides exceptional capabilities for students in Texas A&M to work on state-of-the-art systems research, and the multifaceted nature of this project exposes students in collaborative research. Since the project has also established connections with industry (IBM Research) this provides an additional opportunity and exposure for students from Texas A&M.

c. The COV notes that 24 percent of the awards were made to underrepresented groups. Of the 17 awards, three awards were made to women principal investigators (one of whom is Black) and one award to a Hispanic. Additionally, many of the co-principal investigators on the several large multi-institutional grants were from underrepresented groups.

d. The portfolio of awards includes some of the best-known researchers in the area of high-performance computing. The funded principal investigators include Ken Kennedy of Rice University, Constantine Polychronopoulos of the University of Illinois at Urbana-Champaign, and James Browne of University of Texas at Austin.

e. The COV notes that of the 17 awards, 13 are to public universities.

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*
a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) *Partnerships connecting discovery to innovation, learning, and societal advancement; and*
d) *Research and education processes that are synergistic.*

Comments:
a. The goals of the NGS Program are to develop new science and technology to improve the performance of scientific and engineering computations significantly over the present state-of-the-art. As the program matures, results from the supported projects should contribute to the knowledge base supporting all science and engineering.

b. The program is early in its lifecycle but several research accomplishments are already evident. Technology demonstrating the effective automation of highly distributed GRID-type computations has been reported by Kennedy (Rice U.) and significant speed-ups in automatically generated distributed visualization applications have been observed by Li (Princeton).

Also research fostered by the NGS program has demonstrated technology transfer.
- PI Polychronopoulos (UIUC) founded ByteMobile.com a start-up providing scalable wireless services.
- PI Rauchwerger (Texas A&M) has established interactions with research groups at IBM on operating systems and the Blue Gene project.
- PI Gerasoulis (Rutgers) founded Teoma.com. This research was funded by a related program (on performance technology) that the program manager had started at DARPA a few years ago.

c. Most of the funded projects are multi-institutional and multi-disciplinary and all involve graduate education in areas of great national need. The PI's involved in the program have solid track records of advising highly competent and successful students and postdoctoral researchers.

d. The synergy between different disciplines, graduate and postgraduate education is evident in the awards and subject matter of all awards.

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators:*
a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:
a. Several of the NGS projects are sharing both equipment and facilities. The multi-institutional Grid Application Development Software (Rice University) project is using the Globus platform from CalTech, the AppLes software from UCSD, and the AutoPilot software from UIUC. Similarly, the Supporting Complex Application Requirements in MetaSystems project (University of Virginia) shares use of the Centurion Hardware cluster.

b. All of the NGS projects include substantial support for graduate students and postdoctoral students. The training of these students on software systems being developed by the NGS program will significantly enhance the productivity of the science and engineering workforce in the area of systems software and high-performance computing.

c. Not applicable to program.

d. Not applicable to program.

8. Areas of Emphasis:
For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People

- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*

Advanced Technological Workforce program (ATE)

Comments:
The program and its constituent awards do not address K-12 activities explicitly. There is a significant professional development component, represented by postdoctoral training and graduate student education. The NGS COV cluster was pleased to see the involvement of the University of Puerto Rico and a significant number of underrepresented minorities in the program. The program is address the well-known national need for highly skilled workers in the computer and networking areas.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:
The program award portfolio has a good balance of multidisciplinary projects. However, given the budgetary constraints imposed on the program, it is not evident to the NGS COV cluster that high risk or highly innovative projects were funded at any significant level. Many of the projects represent solid evolutionary work by well-known PIs or younger PIs who are working with established senior researchers. This limitation may have been imposed by the funding constraints, requiring a "conservative" portfolio selection with low risk.

The program's technical area is highly relevant to the Information Technology Research (ITR) initiative and one project was related to nanoscale science and engineering, specifically modeling work on crack propagation. Several projects have mathematical sciences research components, through both using advanced applied mathematics ideas and through offering the potential for improving mathematical computing by making large numerical computations more efficient.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
- *New types of scientific databases and tools for using them*

Comments:
Several projects are currently using major, national-scale research facilities such as DOE/NASA GRID, NPACI and DOE ASCI facilities. Several projects have the potential for developing software tools that would become resources for the national scientific and engineering communities in exploiting such national scale facilities.

9. Please comment on program areas that the COV believes need improvement.

Comments:
The NGS COV cluster also observes that the NGS research area has the potential for tremendous commercial impact. Therefore, the program should constantly strive to be aware of the latest commercial activity and encourage efforts to transfer program research into the commercial domain.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:
The NGS COV cluster was pleased with technical progress of the funded projects. Indeed, given that most of the projects are only a year old this is a very encouraging sign.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:

It would be helpful to see a completed sample COV report. This would provide the COV members an idea as to the appropriate level of detail that should be provided.

To obtain the most useful feedback, NSF should consider adding an "anonymous" component to the COV. That is, part of the COV review of a program should be handled and coordinated by NSF officers not affiliated with the program under review.

While the NSF staff did an admirable job of providing information to the COV, additional statistics required to complete the report (numbers and percentage of underrepresented PIs and reviewers, geographical distribution of reviewers) should be provided to the COV.

It would be helpful the award portfolio included an overall roadmap by the program manager of how the various proposals fit together. This "big picture" would help the COV evaluate how well the program met its goals.

COV Members:
Dr. George Cybenko
Dr. Jack Davidson

VII. Cluster 6 -- Workforce Related Programs

As part of the Committee of Visitors (COV) meeting on May 1 and 2, Cluster 6 members reviewed the following programs in the Experimental and Integrative Activities Division (EIA):

- Minority Institution Infrastructure (MII)
- CISE Postdoctoral Research Associates
- Information Technology Work Force (ITWF)
- Special Projects
- Research Experience for Undergraduates (REU) sites

The COV members for Cluster 6 were:

Mary Lou Soffa, chair, University of Pittsburgh
Herman Hughes, Michigan State University
Patrick Otoo Bobbie, Southern Polytechnic State University
Jennifer Preece, University of Maryland Baltimore County
Rhys Price Jones, Rochester Institute of Technology
Nancy Hastings, Dickinson College

The Cluster 6 COV members (referred to as COV6 members in this report) first met briefly together to discuss the charge and then dispersed into four different groups to review the programs (the MII program and the Postdoctoral Program were reviewed by the same team of COV members).

This is the summary report of the cluster; each program was reviewed individually and a separate review was written of each program. The five individual reports are attached to the end of this report.

In this report, the review process of Cluster 6 programs is discussed first followed by a general discussion of the outcomes of the programs.

Review Process
In general, the COV6 members felt the review process was successful and efficient. Some of the programs used only panels while others used both panels and site visits. From the jackets examined, the COV6 members think the right decisions were made. However, there is a concern for those programs where the research topics in the proposals are broad that there may not be a panelist who understands the proposed research. This could occur, for example, in the post doc program and the MII. A recommendation is made that, in such cases, an external reviewer who is an expert write a written mail-in review.

The time to notification, which is at most 6 months according to a general NSF policy, is also a concern. The time to notification has been increasing over the last 3 years. In 1997, 82% of the PI's were notified in

6 months but that number fell to about 42% in year 2000. The increase in time seems to be due to vacancies among the Program Director positions, and thus the Directors were overloaded by having to direct more than just their programs. A more important problem was that notifications for some of the programs went out too late in the year to be effective; that is, the project was not able to start at the beginning of the grant. For example, the COV6 members reviewing the REU sites program felt that notifications have to be done by December in order for the schools to recruit students for the REU site. Another example is the Postdoctoral program. The COV6 members found in some cases, the funding notification went out in September, which was too late to hire a post doc for the academic year.

The COV6 members for all 6 programs found the documentation for the funding decisions to be complete with the information easy to find.

In most cases, the COV6 members found the panels to be well balanced in terms of geography, diversity and institutional type. About 50 % of panelists were women, except in 1999 when only approximately 33% of panelists were women. From the data provided the COV6, it was not possible to discern racial representation of the panelists. There were only a few cases that the distribution of panelists was troublesome. First, a large percentage of panelists (approximately 45%) over the total three-year period were drawn from Carnegie 1 institutions, with fairly even representation from the other Carnegie classes. Approximately 75% of the Carnegie 1 panelists were men. Another isolated problem was one panel had 3 panelists from the same school, with 2 of the panelists coming from the same center in the school. This panel was certainly not well balanced. The conclusion is that as far as the COV6 members could tell the diversity of panelists is broad apart with a small in balance due to there being more representation from Carnegie 1 institutions.

In the reviews themselves, the broader impact of the proposed work was typically not addressed at all by the reviewers, and if addressed, was not well addressed. The program directors also did not fully spell out the broader impacts.

In terms of appropriate size of grants, the COV6 members felt the stipends for the REUs and the post doc's were too low to attract high quality students and researchers, respectively. Both of these stipends should be increased to be competitive and attract high quality students and researchers.

Data was not provided to answer one of the questions asked in the COV Report Template dealing with the percentage of PIs who come from underrepresented groups.

Thus, in terms of the review process, the recommendations are:

1. Increase the stipends of the REU students and the post doc's.

2. In programs where research topics are broad, try to acquire ad hoc reviews (mail in reviews) as well the reviews from the panelists. The panels should have access to these reviews. An example is the post doc program.

3. Data should be provided to answer the question about whether the number of PI's from under-represented groups is increasing.

4. Both the Post doc and the MII program should be more fully evaluated. The number of proposals being submitted is decreasing, and it is not clear why.

Outcomes:

There were different types of outcomes from these projects, which is to be expected given the scope of the projects. In some cases the goal was to increase the participation of women and minorities in CISE. In some programs, the goal was to increase the number of students interested in CSE and CISE research. In the Post Doc program, the goal was to increase the number of particular type of scientists (e.g., the goal of the Post doc is to produce strong experimental scientists). Another goal of these projects is to have technical research contributions.

In general, the COV6 members found that the programs were achieving their goals. More women, minorities and students were engaged in CISE as a result of the projects being funded. The particular research was also a contribution in many cases. Also, these programs have a wide impact both in terms of the work force but also in terms of research.

For example, in one research project from the Post Doctoral program, research was being directed at modeling walking from motion capture data from three populations: young, old, and visually impaired. The results of this research would be used for physical rehabilitation and sports medicine, where images of variation movement may indicate a problem in a muscle or tendon.

In research supported by the MII program, Florida International University (FIU), in collaboration with Miami Children's Hospital (MCH), is attempting to understand the EEG-based brain activities using different sensory modalities employing both clinical means and non-invasive procedures. The long-term objective is to feed knowledge on brain research in the development of new signal processing algorithms that are time varying and multidimensional in nature that extend beyond diagnostics. The critical research issue is to mathematically model the transfer functions that formulate the attenuation process of signals as the sub-dural recordings and the external recordings using ESI recordings are analyzed in an integration fashion. Current contributions include (1) non-invasive EEG analysis using the ESI-256 machine for the detection of interictal spikes in children with severe epileptic seizures and (2) development of a new approach to understanding EEG activities using visual stimuli with the ESI-256 machine.

Results from a few projects whose primary goal is to increase the representation of women and minorities in CISE follow:

One project dealt with the evaluation of the CRA Distributed Mentoring Program (9813290, William Aspray, " Evaluation and Institutionalization of the CRA Distributed Mentor Project"). The primary goal of this project is to increase the number of women entering graduate school in Computer Science and Engineering (CS&E) by involving them in research at a university with a female mentor. Each year, approximately twenty undergraduate women have participated in the research and mentoring activities of the Distributed Mentor Project (DMP). The students are involved in research and learn how a research university operates, meet graduate students and professors, and get a chance to observe a successful female researcher first hand. A longitudinal evaluation study of the project is being conducted by the LEAD Center of the University of Wisconsin. The longitudinal evaluation shows the DMP project to be spectacularly successful at meeting its goal of increasing the number of women entering graduate school in CS&E. Using a Baccalaureate & Beyond study conducted in 1994 as a comparison, the best male CS&E graduates were 10 times more likely to enter graduate or professional school within one year of graduation than the best female CS&E graduates; the figure for men being 29.19% of graduates, for women being 2.53% of graduates. Of the DMP participants, over 50% were enrolled in graduate or professional school the year following their graduation. In both cases the surveys considered only graduates with GPA’s greater than or equal to 3.5.

Another project (9812240, W. Asprey and P. Freeman, "Demand for Information Workers from the Perspective of Core Producers") supported a series of Career Mentoring Workshops that bring graduate students about to enter academia and junior faculty women, together with senior established women in CS&E. The established professionals provide practical information, advice, and support to their younger colleagues. Each of the workshops is associated with a major professional meeting, providing many participants with the opportunity to attend technical talks and make contacts in their research areas. In 2000, CRA-W published a Career Mentoring Workshops booklet, which is also available on the Web at: http://www.cra.org/Activities/craw/pubs.html. The participant evaluations of the workshops have been overwhelmingly positive, and established faculty members encourage their graduate students and junior colleagues to attend.

Another project addressed the demand for IT workers from the Perspective of Core Producers. Peter Freeman and William Aspray, in collaboration with five other major computing professional societies and with the assistance of a study group of experts, produced a report, entitled The Supply of Information Technology Workers in the United States (CRA, April 1999). The report identifies and evaluates the major sources of data, suggests a new way to define IT workers, and gives a detailed description of the extensive system that exists for training and educating IT workers. Other issues covered include the political context, types of demand, international considerations, and limitations on action by academia, government, and industry. Questions about women, underrepresented minorities, and older workers are raised, as well as the "seed-corn" issue (whether the flight of faculty and graduate students to industrial jobs is harming the nation's ability to train the next generation of IT workers). A series of recommendations targeted to five groups: government, higher education, industry, professional societies, and individuals, are provided. They covered data collection practices, industry-academic cooperation, industry hiring and training practices, certification of educational and training programs, broadening the supply pipeline, improving the research and teaching environment to retain and recruit faculty, and curriculum development.

And lastly, William Aspray of CRA and Andrew Bernat of the University of Texas at El Paso, in collaboration with the Coalition to Diversity Computing (CDC) and with funding from this Special Project Award and from the Education, Outreach and Training Partnership for Advanced Computational Infrastructure (EOT-PACI), (9522207, Bernat, "Building Affinity Groups to Enable and Encourage Student Success in Computing produced a report entitled Recruitment and Retention of Underrepresented Minority Graduate Students in Computer Science. The report offers 25 practical suggestions for graduate departments to consider. These suggestions cover specific recruitment tactics, means to facilitate early success in graduate school, retention methods, and organizational issues such as best ways of providing financial support.

Program: ITW

A. ITW: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
The members of this cluster reviewed 85 proposal actions.

a. The 85 proposals were reviewed by 34 panelists in 2000, giving an unusually good average of 2-3 proposals per panelist. The proposals were equally distributed across all the criteria (list from report), with approximately one sixth of all proposals in each category. The majority of panelists were from state universities, with 3 from corporate or government sector laboratories, 2 from high schools and a good representation from private universities. There was a good spread across departments (science, CS, engineering, Math, and Social Sciences). There were also a few panelists from academic departments specializing in gender issues.

b. There were 19/85 competitive proposals in 2000, 12/85 highly competitive and 54/85 deemed not competitive.

   A proposal from UCLA (a west-coast major institution) was reviewed and ranked as highly competitive and was funded. 3 females and 2 males were drawn from institutions on the east-coast and west coast. Strong positive comments were written about the proposals and concerns, which the PI responded to satisfactorily. Several email communications were exchanged between the PI and the program officer regarding the concerns, opinions rendered by the panelists during the review indicate a thorough discussion of the issues. Of the 85 proposals reviewed in fiscal year 2000 for ITW, there were 27 panelists, organized into 6 sub-panels with moderators from across NSF-wide Directorates.

The review process that led to the ranking of this proposal as highly competitive was the result of an effective review process.

Another proposal from the same batch from a medium sized institution on the east-coast was reviewed using the same procedure but was not funded. The panel comprised 1 female and 5 males. The proposal was placed in the competitive category but it was not funded because it ranked lower in that group. The reviewer's comments were *very* mixed. This suggests that it was not an outstanding proposal. On this panel there was evidence of serious consideration given to conflicts of interest and one panelist had to withdraw. In general the panelists comments were balanced and described both positive and negative attributes of the proposal. The comments therefore helped the program officer to make a fair decision.

We conclude from this sample that the review process was effective.

c. Overall the majority of proposals were reviewed within a 9 month period.

d. We reviewed sample jackets and there were several letters of communication between PIs and the Program Officer and other NSF Officials in each jacket. There were also the public domain proposals and the original reviewers comments. Tables of summarized data were also provided.

e. The titles of the proposals that we reviewed indicate that they were responding to the issues raised in the ITW program announcement. They were definitely program-specific.

2. ***The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

b) *Performance Goal: Implementation of Merit Review Criteria by Program Officers:*

NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) *Discuss any concerns the COV has with respect to NSF's merit review system.*

The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:
a)
1. Did reviewers adequately address the intellectual merit criterion in their reviews?

The panelists provided detailed written comments on the intellectual merit of the proposals.

2. Did reviewers adequately address the broader impacts criterion in their reviews?

The panelists did not specifically address this issue, however the intent of the program is to do this.

b)
1. Did program officers adequately address the intellectual merit criterion in their decisions?

There were letters of recommendation by the Program Officers on the merit and indications of the relevance or overall impact of the projects. This statement could be made a little more detailed, as it should be in the reviewers' recommendations. Of the proposals that we have reviewed it appears that intellectual merit was a prime criterion.

2. Did program officers adequately address the broader impacts criterion in their decisions?

Of the proposals that we have reviewed it appears that those which were funded focus on broader impacts criterion.

3. Reviewer selection:
a) Use of adequate number for balanced review;
b) Use of reviewers having appropriate expertise/qualifications;
c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:
a. The reviewers comprised 16 women and 5 underrepresented minorities, from academic departments in the relevant areas.

b. The reviewers came from both high-end and mid-tier research institutions and academic departments in the specialized/topical areas of the proposals.

c. The reviewers came from 16 states and all parts of the country.

d. COI announcements and indications were in compliance.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;

The proposals that were submitted under this program do not constitute traditional science/engineering research *per se*, however, they all seem to have proposed using (social) scientific methods to study, evaluate, research the questions that respond to the program announcement.

b) Appropriateness of award scope, size, and duration;

Most awards are for 36 months, with a few for 24 or 12 months. The requested amounts range from $65k to around $750k. As far as we can tell the actual awards appear to be appropriate. Several that are funded appear to be in the range of $200k per year.

c) Effective identification of and support for emerging opportunities;

From the list of proposals submitted it appears from the titles that they will benefit women ‘s contribution to the IT workforce.

d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;

An important observation is that this program encourages non-traditional IT researchers to refocus on IT-related gender issues. We observed proposals that have been submitted in response to this solicitation coming from academic education departments, social science, and gender-studies. In addition there are proposals from minority schools and small schools. These investigators would not normally have submitted proposals to CISE.

e) Evidence that proposers have addressed the integration of research and education in proposals;

Yes, there is evidence that research and education are being integrated. For example, many of the proposals are aimed at access, retention, IT education of women and minorities.

f) Evidence of increased numbers of applications from underrepresented groups;

There are 16 proposals that focus on equity barrier longitudinal studies and 13 related to women’s issues. A large number of the proposals focused on minorities and gender disparities.

g) Balance of projects characterized as

- *High-risk*

12 /20 proposals funded were highly competitive and therefore not risky. The remaining 8/20 are a little more risky. However, technically none of these are high-risk proposals.

- *Multidisciplinary*

These proposals are inherently multi-disciplinary as they bring together social scientists and IT research scientists.

- *Innovative*

The whole program is new and tackles a new area of research, which in itself is innovative and an important contribution to this previously under-researched area.

We recommend that the support for this new program will be continued beyond this initial phase of funding, leading to traditional (design, implementation, and evaluation) IT research for minorities and women with the goal of increasing their presence in the IT workforce. In the past women and minority involvement in CISE-related programs has not focused on understanding the fact that limit the success of these groups.

Comments: As above

B. ITW Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:

Development of a diverse, internationally-competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens.

***FY 2001 Performance Goal:* The program is *successful* when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:**

a) *Improved mathematics, science, and technology skills for U.S. students at the K-12 level;*

b) *Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;*

c) *A science and technology and instructional workforce that reflects America's diversity;*

d) *Globally engaged science and engineering professionals who are among the best in the world; and*

e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:
This is the first year of program so there are no reports on which to base this answer.

(a) – (d) are not directly applicable.

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;

Not directly applicable.

b) Discoveries that advance the frontiers of science, engineering, and technology;

The expected results will elucidate the extent of, or lack of, the involvement of women and other underrepresented groups.

c) Partnerships connecting discovery to innovation, learning, and societal advancement; and

The ITW program is focused on partnerships between IT and social science investigators, and in itself, makes the program novel in the approach and emphasis.

d) Research and education processes that are synergistic.

The synergism is evident in the complementary strategies of the IT and social science investigations.

Comments:

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

a) Shared use platforms, facilities, instruments, and databases that enable discovery;

b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

For (a) and (d), the ITW program is new and the outcomes are yet to be reported. However, if all the studies funded are successfully completed this will produce a large information base that can be a shared research resource.

8. Areas of Emphasis:

For <u>each</u> *relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.*

a) Strategic Outcome: People

- *K-12 systemic activities*
  In a few cases, including a currently funded highly competitive project, there is a focus on K-12. A future program could focus more strongly on this target group. However, even as currently proposed this group is not excluded.

- *Enhancing instructional workforce/professional development*
  -Centers for Learning and Teaching (CLT)
  -Graduate Teaching Fellows in K-12 Education

- *Broadening participation*
  -Tribal Colleges
  -Partnerships for Innovation (PFI)

  There are already proposals from or focus on tribal colleges but we cannot yet tell if this will result in partnerships for innovation.

- *Addressing near-term workforce needs*
  -Advanced Technological Workforce program (ATE)

Comments:
This program will help to address near-term workforce needs by encouraging more women and minorities into IT-related professions. In addition this program will reveal impediments to women and minorities so that they can be removed. Once attended to there will be additional near-term workforce benefits.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:
For the balance, and as indicated earlier, the ITW is intended for collaboration. The program has elements of high-risk, novelty, and inherently multidisciplinary. Again, studies into IT workforce issues in the specialized areas like, Bio or Nanoscale, will be worth investigating.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments:
The resultant reports, booklets, data, citations, etc. Of the currently funded projects will serve as info-bases at the NSF.

9. Please comment on program areas that the COV believes need improvement.

Comments:
This program appears to be much needed and very successful in its first year. As far as we can see there is no need for immediate improvement. After the research results from existing projects, we recommend extending the program to include IT research at an increased level of funding with additional $10+ million for an effective payoff of the ITW initiative.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:
We have no comments. As statistics are compiled for different programs it would be helpful to distinguish between the different groups of interest to ITW – e.g., women, and different minority groups. Also, it would be useful to distinguish between US nationals/residents and non-residents.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:
The review process is good for the following reasons:

- We are permitted to review a wide variety of original data sources (i.e., program announcement, sample proposals, reviewers verbatim comments, communications between program officers and PIs, sample results etc.)
- The wide range of data enables us to be a unbiased as possible in our judgements.
- The format is also appropriate.

The questions raised in the COV report sometimes appear repetitive and therefore there is a feeling of redundancy. It would be helpful to have more program-specific questions because there is a large volume of material to work through. We have also observed some inconsistency among different sources of data. For example, it was unclear whether the demographic data for panelists refers only to ITW or to groups of programs in EIA.

COV Members:

Dr. Patrick Otoo Bobbie
Dr. Jennifer Preece

Program: Minority Institutions Infrastructure Program (MII)

A. MII: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:
a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
This committee reviewed 12 proposal actions.

a. The design of the merit review procedure typically consisted of an initial panel, site visit and a final panel. This design is appropriate for this program.
b. The program review process was effective in that the decisions made were appropriate. In one case of the 12 folders, the program director indicated that she wanted to fund the proposal but was not able to because of the lack of available funds.
c. We do not have data on this; we only have aggregate data for the entire cluster; however, in the folders that we examined, the time to decision was less than the 6 month rule; in fact, it appears to be more like 3 months.
d. The documentation was very complete and information was easy to find.
e. The reviews and decisions consistently support the goals of the program.

*2. **The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

b) *Performance Goal: Implementation of Merit Review Criteria by Program Officers:*

NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.

The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:

a) 1) Did reviewers adequately address the intellectual merit criterion in their reviews?

Overall, the reviewers did address the intellectual merit which is whether the research-component is reasonable for the students.

2) Did reviewers adequately address the broader impacts criterion in their reviews?

Yes, the broader impacts are addressed.

b) 1) Did program officers adequately address the intellectual merit criterion in their decisions?

The program director's report did adequately address the intellectual merit.

2) Did program officers adequately address the broader impacts criterion in their decisions?

The program directory did address the broader impacts in their decisions.

3. Reviewer selection:

a) Use of adequate number for balanced review;

b) Use of reviewers having appropriate expertise/qualifications;

c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;

d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. The number of reviewers was adequate.

b. The reviewers have the appropriate expertise and qualifications.

c. There is an excellent balance in the panel including geography, type of institutions, gender and ethnic background.

d. We saw nothing in the data to suggest a problem with conflict of interest.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as
- *High-risk*
- *Multidisciplinary*
- *Innovative*

Comments:

a. A goal of this program is to establish an infrastructure for high quality research and the current research quality of the awardees is sufficient to build this infrastructure.

b. The award scope, size and duration are appropriate for both the grant and planning grant.

c. For the mission of this program, the identification of opportunities for increasing the representation of minorities in technical fields is evident from the proposals.

d. New investigators are being funded by this program who would not typically be funded by NSF.

e. The integration of education and research is described in the proposals.

f. The number of applications has decreased.

g. Overall, the projects have elements of both high risks and innovation.

B. MII Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant *or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.*

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally-competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens.

***FY 2001 Performance Goal:* The program is *successful* when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:**

a) *Improved mathematics, science, and technology skills for U.S. students at the K-12 level;*
b) *Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;*
c) *A science and technology and instructional workforce that reflects America's diversity;*
d) *Globally engaged science and engineering professionals who are among the best in the world; and*
e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. A number of the programs had outreach activities to the high schools in order to attract students in CSE and feed the pipeline.

b. This program certainly improved the technical skills of undergraduate and graduate students.

c. The major goal of this program is to increase minority participation in computer science and engineering, and thus a more diverse workforce is being created. The projects have been successful in this respect.

d. not applicable

e. not applicable

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

Comments:

a. The research done in the research projects is increasing the fundamental base; in addition, information about the results of the projects can significantly increase the participation of minorities.

b. One notable discovery was the technique to check the correctness of the behavior of a program by monitoring through a snoopy cache. A paper on this won the best student-paper award at a workshop on Modeling and Simulation.

c. There was evidence of partnerships with high schools, industry and major research universities.

d. The integration of research and education is a major focus in these projects and thus this is addressed.

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. One example of shared facilities was the development of a non-invasive EEG analysis using the ESI-256 machine for the detection of interictal spikes in children with severe epileptic seizures. There is evidence of shared resources between the MII institutions and majority universities, industry and national laboratories.

b. See a.

c. A heterogeneous database was used to develop the TerraFly, a tool that allows users to fly via the Web over geo-spatial data, such as satellite imagery, aerial photography, and geographic points of interest. Their TerraFly technology is a step toward on-demand visualization of such data using Next Generation Web techniques.

d. not applicable

8. Areas of Emphasis:
For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People

- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
  - *Advanced Technological Workforce program (ATE)*

Comments:
Many of the funded projects support outreach programs to K-12 to increase the pipeline. The program does address the workforce problem by providing more qualified workers in CSE, and in particular minority workers.

One of the MII institutions, FIU, supported in one year, 5 doctoral, 10 masters and 5 undergraduate students.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:
There is balance in the projects proposed among high risk, innovation and multidisciplinary. There is an investment being made in ITR by many of the proposed research programs.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments:

9. Please comment on program areas that the COV believes need improvement.

Comments:
This program needs a complete evaluation to determine if it is still an effective program. The number of applications has been decreasing in recent years and it is not clear why. There was also an indication that in one year, if more funding had been available, another school would have been funded.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:

More time should be given for evaluating these programs.

COV Members:
Dr. Mary Lou Soffa
Dr. Herman Hughes

Program: Postdoctoral Research Associates

A. Post Docs: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal ***actions*** **completed within the past three fiscal years,** *please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.*

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
Six Postdoc actions were reviewed.

a. The overall design of the review procedures is to have panel of experts read the proposals, write a review and then meet to make an overall recommendation. Although this design is adequate, it can be improved by also having at least one ad hoc reviewer per proposal (mail review) because of the diversity of topics of the post doc proposals.

b. Generally speaking, the final decision as to whether to fund or not seemed to be justified, given the panel's recommendation and the goals of the program.

c. The time from the receipt of the proposal to the notification to they PI of the action taken was about 9 months. This time is longer than the 6-month rule and longer than it had been in the past. This delay seems to be caused by the high workload of the Program Director.

d. The documentation was very complete and information was easy to find.

e. The reviews and the action were consistent with the goals of the program.

2. ***The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers:*

NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?

b) *Performance Goal: Implementation of Merit Revie**w Criteria by Program Officers:***
NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) *Discuss any concerns the COV has with respect to NSF's merit review system.*
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:

a) *1) Did reviewers adequately address the intellectual merit criterion in their reviews?*
In the cases that we examined, the reviews were sketchy with respect to the intellectual merit of the proposed work.
2) Did reviewers adequately address the broader impacts criterion in their reviews?
The reviewers in general did not adequately address the broader impacts of the proposed work or the potential impact on the post doc.

b) *1) Did program officers adequately address the intellectual merit criterion in their decisions?*
The program officer addressed the intellectual merit of the proposed work as well as could be expected, given the panelist's written reviews. In general, the program director justified his/her decision for awarding or declining an award based on intellectual merit.
2) Did program officers adequately address the broader impacts criterion in their decisions?
In general, the program officers did not address the broader impact.

3. Reviewer selection:

c) *Use of adequate number for balanced review;*
d) *Use of reviewers having appropriate expertise/qualifications;*
e) *Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;*
f) *As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.*

Comments:

a. The number of reviews was adequate.

b. The reviewers did have appropriate expertise; however due to the broad range of topics covered, it is difficult to have experts in the many areas covered by the proposals.

c. There was a good balance among the panelist such as geography, type of institution and gender. There was little evidence of minority participation serving on the panels. However, one year had three panelists from the same university, which certainly was not balanced.

d. There was no evidence of a problem with conflict of interest.

4. Resulting portfolio of awards:

g) Overall quality of science/engineering;
h) Appropriateness of award scope, size, and duration;
i) Effective identification of and support for emerging opportunities;
j) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
k) Evidence that proposers have addressed the integration of research and education in proposals;
l) Evidence of increased numbers of applications from underrepresented groups;
m) Balance of projects characterized as
  - *High-risk*
  - *Multidisciplinary*
  - *Innovative*

Comments:

a. The overall quality of science and engineering was high and worthy of funding.

b. The size of the award needs to be increased. The duration was appropriate based on current conditions of attracting postdoc's in computer science and engineering.

c. A number of the awards did support emerging opportunities from a variety of research areas.

d. We do not have the data to answer this question.

e. Certainly the integration of research and education is evident in the experience for the post doc fellow.

f. No evidence of increased application from any underrepresented group or any group. In fact the number of proposals has declined.

g. Since the PI does not have to name the post doc, and we have no information as to who will be the post doc, we are interpreting these characteristics based on the research and not the work force. In this case, there was evidence that all three characteristics were present in the proposals.

B. Post Doc Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

n) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
o) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
p) A science and technology and instructional workforce that reflects America's diversity;
q) *Globally engaged science and engineering professionals who are among the best in the world; and*
r) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. Not applicable.

b. The postdoc's did improve their experimental skills through the research. The projects also included for the most part undergraduate and graduate students and thus their experimental skills were improved.

c. From the reports, a number of the post doc's were women which does increase the diversity of the workforce. However, we had no specific figure to come to this conclusion. Data for ethnicity and gender were not included.

d. The PIs are generally established researchers and were engaged in these projects.

e. not applicable.

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) *Discoveries that advance the frontiers of science, engineering, and technology;*
c) *Partnerships connecting discovery to innovation, learning, and societal advancement; and*
d) Research and education processes that are synergistic.

Comments:
a. The topics of the research projects were broad and made significant contributions to the science through publications. Also, knowledge about experimental processes was enhanced through the projects.

b. Evidence of the discoveries that were made in the projects was published in conferences and journals. For example, work on robotics and the modeling of walking and running was part of the research results.

c. One example was the work on modeling walking form motion for young, old and visually impaired. The results are expected to be used in physical rehabilitation and sports medicine, where images of variation may indicate a problem in muscle or tendon.

d. Because the research in most projects involved undergraduate and graduate student, research and education were integrated, with respect to training in experimental studies.

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

e) Shared use platforms, facilities, instruments, and databases that enable discovery;
f) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
g) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and

h) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. A number of tools were developed in the projects, including a simulator for architectures, model of a visually impaired cane user and a theorem-proving tool.

b. We could not find evidence of shared uses of platforms from the final reports.

c. not applicable.

d. not applicable.

8. Areas of Emphasis:
For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People

- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
- *Advanced Technological Workforce program (ATE)*

Comments:
The postdoc project addressed workforce needs by strengthening the experimental research capabilities of the post docs as well as the undergraduates and the graduate students involved in the projects.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:
There appears to be a balance of the high risk, multidisciplinary and innovative research in the projects.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments:
There were tools that were developed from the projects. A database was produced of optimal capture data involving one subject performing different trials. The database contains 32 processed motions in a database. This database will be made available to other researchers.

9. Please comment on program areas that the COV believes need improvement.

Comments:
This program needs to have more effective follow up as to impact of the program. For example, in order to determine the impact on the diversity of the workforce, information about who took the post doc position is needed and the subsequent placement of the post doc.

The area of expertise in the program should be broadened to include more than just experimental research.

The program should be better advertised as the existence of the program is not well known.

More attention has to be paid to the selection of panelists to ensure the appropriate balance. For example, one panel had 3 members out of 8 from the same institution and 2 of these members came from the same center within the institution.

More funding for the post docs may be needed because of the competitive job market.

This program should be more fully evaluated.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:

The program is meeting its goals which is to enhance the pool of experimental researchers.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:
The questions on this form did not match the goals and outcomes of this program in many cases. Also, more time should be provided to do reviews.

Program: Special Programs

A. Special Programs: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal ***actions*** **completed within the past three fiscal years,** *please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.*

1. *Effectiveness of the program's use of merit review procedures:*
   a) *Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);*

Nine program actions were reviewed. Overall the review process was thorough. There were 5 reviewers in one of the proposals we sampled, 3 men and two women from major institutions even though this was a fiscally small proposal of only $25k. The second proposal was a large one of $625k and was reviewed with the same thoroughness. There were 4 reviewers, 3 men and 1 woman. We observed extensive email discussions between the PI and Program Managers about the content of the proposal. Each reviewer wrote extensive review comments on the two evaluation criteria.

The Program Officer has made a special effort to support the communities who might submit proposals or benefit from the work of others by attending various functions – e.g., the Grace Hopper Conference, workshops etc. She would do more if she had the time.

b) *Effectiveness of program's review process;*

The standard appears high and to be consistent across proposals. The volume of proposals is small and the success rate is high. There is considerable support for proposal writing provided by the Program Director.

c) *Efficiency; time to decision;*

These projects are not subject to a specific call and they are reviewed as they are received. The average review time is very short, often as little as a week, although some take 3-6 months.

d) *Completeness of documentation making recommendations;*

Extensive reviewers' comments are provided and the recommendations to the Program Officer are consistently good.

e) *Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.*

There are no specific calls but all the proposals fall within the broad remit of CISE.

2. The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):

f) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

The reviewers thoroughly addressed both criteria. The quality of the proposals was high and the proposals that we reviewed have broad impact on both criteria. The reviewers were constructive in their comments about the impact of the proposed work.

g) Performance Goal: Implementation of Merit Review Criteria by Program Officers:
NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

The email communication strongly indicates that the Program Officers addressed both criteria.

h) Discuss any concerns the COV has with respect to NSF's merit review system.

The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:
a) 1) Did reviewers adequately address the intellectual merit criterion in their reviews?

Yes, from the proposals that we have examined it is clear that intellectual merit is of prime importance.

2) Did reviewers adequately address the broader impacts criterion in their reviews?

Yes, please see the comments under 2(a) above.

b) 1) Did program officers adequately address the intellectual merit criterion in their decisions?
2) Did program officers adequately address the broader impacts criterion in their decisions?

Please note the comments in A.1 and A.2(a) and A2(b) above.

3. Reviewer selection:

a) Use of adequate number for balanced review;

Several jackets (9) were reviewed and there is a clear balance in the number of women, men, and underrepresented minorities on various panels.

b) Use of reviewers having appropriate expertise/qualifications;

All the panelists have the appropriate backgrounds.

c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;

E.g., we found 8 women and 4 minorities in a pool of about 20 panelist on 6 of the proposals that were funded. Their institutions cover the four-corners of the country – well balanced, and we also noted the appropriateness of panelist from research and teaching institutions.

d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

The COI issue appears to have been raised at the proposal review process.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as
   - *High-risk*
   - *Multidisciplinary*
   - *Innovative*

Comments (a-d):
The projects are diverse. For example we have seen proposals for travel, for workshops, for IT workforce studies and for mentoring. The proposals are not for traditional core research. However, they address important CISE-related issues.

Funding levels appear appropriate for the scope and size of the projects proposed.

In the fiscal years 1998-2000, 9 of the awards went to under-represented groups or investigators whose work would support these groups.

Special projects provide opportunity for new investigators to submit their ideas, which might normally not fit into any of the existing or mainstream CISE programs.

B. Special Programs Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;
d) *Globally engaged science and engineering professionals who are among the best in the world; and*
e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. The DMP project (from a U of Wisconsin) is one that has a significant bearing on K-12 students in science and mathematics.

b. This does not apply to these proposals

c. Yes. Several proposals review the state of diversity in the IT workforce. The results have been highly significant. For example, one project focused on the evaluation and institutionalization of a distributed mentor project that has expanded into a major resource center. Another project sponsored graduate students, junior faculty, women and senior women in CS and engineering to attend a national career-mentoring workshop. Another significant accomplishment is a comprehensive study of IT workers in the USA resulted in a bound book, which is widely available. Another project was done on the recruitment and retention of under-represented minority graduate students in CS also resulted in a bound booklet which available for others to read. Yet another project sponsored the Grace Hopper Celebration of Women in Computing Conference. Combined, these projects illustrate the impact of this program on diversity in IT.

(SEE THE ATTACHMENTS FOR SPECIFIC ACCOMPLISHMENTS)

d. not directly applicable to this program

e. not directly applicable to this program

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

Comments:

(b) and (c) do not directly apply, however (a) and (d) are affected by the achievements of the DMP project as well as the CAU mentor-workshop project in terms of career mentoring and helping students to learn about and getting attracted to IT-related fields, in general.

This question is not directly applicable to this program. However, the program provides opportunities for new ideas and questions to be raised.

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

a) *Shared use platforms, facilities, instruments, and databases that enable discovery;*
b) *Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;*
c) *Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and*
d) *Information and policy analyses that contribute to the effective use of science and engineering resources.*

Comments:
(c) and (d) do not directly apply, however, the publications, reports, data, etc resulting from the Special Project and summarized in Section 5(c) above, demonstrate significant progress.

8. Areas of Emphasis:
For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) *Strategic Outcome: People*
   - *K-12 systemic activities*
   - *Enhancing instructional workforce/professional development*
     - *Centers for Learning and Teaching (CLT)*
     - *Graduate Teaching Fellows in K-12 Education*
   - *Broadening participation*
     - *Tribal Colleges*
     - *Partnerships for Innovation (PFI)*
   - *Addressing near-term workforce needs*
   - *Advanced Technological Workforce program (ATE)*

Comments:

For (a), the CRW results on K-12 do impact K-12 systemic initiatives. Collectively, these special projects do impact mentoring, awareness, participation and knowledge of IT and the IT profession in diverse ways.

b) *Strategic Outcome: Ideas*

   - *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
   - *Investment in three initiatives:*
     - *Information Technology Research (ITR)*
     - *Nanoscale Science and Engineering*
     - *Biocomplexity in the Environment*

- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments:
So far the special projects that we have reviewed have not targeted these areas, but this could change in the future. Because special projects could focus on ideas that may or may not work, but worth trying, they provide some balance in the high-risk, NSF-wide value system. The other areas of ITR, Nanoscale, Bio, etc. all open to special projects, but none of the proposal focused on them.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments:
None of these projects have as yet resulted in tools.

9. Please comment on program areas that the COV believes need improvement.

Comments:
There is nothing in particular that we can identify for improvement. The special projects appear to offer unique opportunities for investigators to propose new ideas of scientific and social value that do not easily fit into other programs.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:
It could be beneficial to obtain more detailed statistics on the breakdown of proposals and investigators from different minority groups.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:
We acknowledge the help, cooperation and thoughtful planning of the Program Officer.

ATTACHMENT:

Evaluation and Institutionalization of the CRA Distributed Mentor Project.

NSF CISE Special Projects Grant # EIA-9813290
Mary Jean Harrold (Ohio State University), William Aspray (Computing Research Association) and Anne Condon (University Wisconsin)
Computing Research Association (CRA).

The primary goal of this project is to increase the number of women entering graduate school in Computer Science and Engineering (CS&E) by involving them in research at a university with a female mentor. Each year, approximately twenty undergraduate women have participated in the research and mentoring activities of the Distributed Mentor Project (DMP). The students are involved in research and learn how a research university operates, meet graduate students and professors, and get a chance to observe a successful female researcher first hand. A longitudinal evaluation study of the project is being conducted by the LEAD Center of the University of Wisconsin.[1]

The longitudinal evaluation shows the DMP project to be spectacularly successful at meeting its goal of increasing the number of women entering graduate school in CS&E. Using a Baccalaureate & Beyond study conducted in 1994 as a comparison, the best male CS&E graduates were 10 time more likely to enter graduate or professional school within one year of graduation than the best female CS&E graduates; the figure for men being 29.19% of graduates, for women being 2.53% of graduates.[2] Of the DMP participants, over 50% were enrolled in graduate or professional school the year following their graduation. In both cases the surveys considered only graduates with GPA's greater than or equal to 3.5.

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[1] "Distributed Mentor Project: Comprehensive Participant Survey Analyses for 1994-1999", The LEAD Center, University of Wisconsin-Madison, Preliminary Report, March 2000.

[2] "Baccalaureate and Beyond; Longitudinal Study", National Center for Educational Statistics, 1994.

Travel Support for CRA-W FCRC Super-Mentoring Workshop: Atlanta, GA.

NSF CISE Special Projects Grant # EIA-9820471

Francine Berman (University of Oregon) and William Aspray (Computing Research Association)
Computing Research Association (CRA).

CRA-W has sponsored a series of Career Mentoring Workshops that bring graduate students about to enter academia and junior faculty women, together with senior established women in CS&E. The established professionals provide practical information, advice, and support to their younger colleagues. Each of the workshops is associated with a major professional meeting, providing many participants with the opportunity to attend technical talks and make contacts in their research areas.

CRA-W workshops have been held in conjunction with Supercomputing '94 and the 1993, 1996, and 1999 Federated Computing Research Conference. In addition, CRA-W has been involved with Mentoring Sessions at the Grace Murray Hopper Celebration of Women in Computing, Supercomputing '94, 1996 Design Automation Conference and the Computer Science Conference.

The super-mentoring workshop expanded the previous (primarily junior and academic) mentoring workshop target audience to include women involved in research careers at National Laboratories and within the industrial sector, as well as senior (post-tenure) women who may be beginning to deal with impediments to further promotion.

In 2000, CRA-W published a Career Mentoring Workshops booklet that is also available on the Web at:
http://www.cra.org/Activities/craw/pubs.html.
The participant evaluations of the workshops have been overwhelmingly positive, and established faculty members encourage their graduate students and junior colleagues to attend.

Scholarship and Travel Grants for the Grace Hopper Celebration of Women in Computing 2000.

NSF CISE Special Projects Grant # EIA-0084788
Denise Gurer (3Com Corporation)
Association for Computing Machinery (ACM)

Grants have been made for students and junior faculty individuals to attend and participate in the Grace Hopper Celebration of Women in Computing (GHC) since its inception. GHC has the specific goals of exposing women undergraduates, graduate students and individuals early in their professional careers to significant technical topics, to provide for establishment of networks of women in the field, for development of role models and mentoring activities, and to celebrate achievements of women in computing. The first conference was held in 1994 in Washington, D.C. and was attended by 450 computing students and professionals. The second GHC was held in 1997 in San Jose, California with 650 in attendance. The third conference was held in 2000 in Cape Cod, Massachusetts with 552 in attendance. Speakers have included outstanding women representing the major technical computing disciplines as well as the academic, government and industrial communities.

Demand for Information Workers from the Perspective of Core Producers.

NSF CISE Special Projects Grant # EIA-9812240
William Aspray (Computing Research Association) and Peter Freeman (Georgia Institute of Technology)
Computing Research Association (CRA).

Peter Freeman and William Aspray, in collaboration with five other major computing professional societies and with the assistance of a study group of experts, produced a report, entitled The Supply of Information Technology Workers in the United States (CRA, April 1999). The report identifies and evaluates the major sources of data, suggests a new way to define IT workers, and gives a detailed description of the extensive system that exists for training and educating IT workers. Other issues covered include the political context, types of demand, international considerations, and limitations on action by academia, government, and industry.

Questions about women, underrepresented minorities, and older workers are raised, as well as the "seed-corn" issue (whether the flight of faculty and graduate students to industrial jobs is harming the nation's ability to train the next generation of IT workers). A series of recommendations targeted to five groups: government, higher education, industry, professional societies, and individuals, are provided. They covered data collection practices, industry-academic cooperation, industry hiring and training practices, certification of educational and training programs, broadening the supply pipeline, improving the research and teaching environment to retain and recruit faculty, and curriculum development.

William Aspray of CRA and Andrew Bernat of the University of Texas at El Paso, in collaboration with the Coalition to Diversity Computing (CDC) and with funding from this Special Project Award and from the Education, Outreach and Training Partnership for Advanced Computational Infrastructure (EOT-PACI), produced a report entitled Recruitment and Retention of Underrepresented Minority Graduate Students in Computer Science. The report offers 25 practical suggestions for graduate departments to consider. These suggestions cover specific recruitment tactics, means to facilitate early success in graduate school, retention methods, and organizational issues such as best ways of providing financial support.

Program: REU

A. REU: Integrity and Efficiency of the Program's Processes and Management

*Based on the COV's study of proposal **actions*** **completed within the past three fiscal years,** *please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.*

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

Comments:
The committee reviewed 38 actions.

a. From our study of the panelists' reviews and their influence on program officers' recommendations, it is clear that NSF is very well served by the panel review process.

b. Panelists obviously are extremely diligent and conscientious and produce thorough and scrupulously fair assessments of proposals. The standard of reviews reflects the value of the discussions and interactions that occur when reviewers gather together.

c. The nature of the REU program is such that successful proposals need to receive a formal letter of notification no later than the December preceding the first summer. Otherwise, recruitment – especially of students from other institutions – will suffer, and this may well have a negative impact on the morale of the PIs and the success of the program, particularly in the crucial first year. Award 9732062 from the University of Florida explains: "Had we been able to recruit people prior to March 1998, I believe we would have been able to recruit real top notch students from around the country. We had applicants from the SE US with 4.0 GPA that we were not able to recruit because by March 1998 the best students already had summer plans. I want to start recruiting for 1999 immediately." If it is not possible for NSF to ensure delivery of formal award letters by December, then we recommend that NSF consider bringing forward the closing date of the REU program from September 15 to June 15. On the average, over the last three years letters of notification have mostly been sent out within a six-month time frame.

d. We're not sure what this item is referring to. We assume it is in regard to the completeness of the proposal jackets. In general, jackets contain all the panelist output and the program manager's recommendation.

e. There are REU Site awards and there are REU Supplement awards. From the announcement of the program Site proposals should have "well defined common focus." For example, Proposal 9912247 from Augsburg College offers diverse projects all under the umbrella of Robot Navigation.

Our understanding is that requiring a "common focus" should preclude *cafeteria*-style proposals that make no serious efforts to provide a common experience for undergraduate participants. Some successful projects do, indeed, offer a variety of research projects; but those that conform to the program guidelines will strenuously seek ways to provide a common experience and mutual reinforcement for all the participants. Proposal 9911626 from Depauw University is a good exemplar of this: They offer several areas for individual research in a variety of endeavors, while still providing common research experiences and opportunities. Proposal 9876942 from the University of Michigan at Dearborn, on the other hand, although it was funded as a REU site, does not, in our opinion, meet the goal of providing a well-defined common focus. There are many and disparate research projects, but very little activity is proposed to provide participants with a shared learning experience. Such proposals are more appropriately funded as a series of individual REU Supplement awards.

*2. **The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

*b) Performance Goal: Implementation of Merit Revie**w Criteria by Program Officers:***

NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) Discuss any concerns the COV has with respect to NSF's merit review system.

The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:

a) 1) Did reviewers adequately address the intellectual merit criterion in their reviews?

Yes

2) Did reviewers adequately address the broader impacts criterion in their reviews?

Unlike other programs that have a dissemination requirement and are expected to have national impact, the main objective of REU is to provide meaningful research experiences for undergraduates. Consequently, reviewers were not, explicitly, asked to evaluate such potential impact. We were pleased to note that many proposals did indeed have a significant outreach component, be it to K-12, tribal colleges, etc., and often times reviewers commented on such components as positive features. There is a case to be made for including a specific question addressing such desiderata on the review sheets provided for panelists.

b) 1) Did program officers adequately address the intellectual merit criterion in their decisions?

Yes.

2) Did program officers adequately address the broader impacts criterion in their decisions?

The program officers' remarks closely reflected those of panelists. See 2.a.2.

c) Discuss any concerns the COV has with respect to NSF's merit review system.

We believe the letters sent to unsuccessful PIs could be more informative and helpful. Currently, the last sentence from the Division Director reads "Even though we are unable to support this proposal, we would be pleased to consider other proposals which you might wish to submit." In some cases, this advice is not entirely consistent with the thrust of the reviewers' comments and the program manager's review analysis. A more carefully selected sentence in the Division Director's letter could remedy this. For example the Division Director might choose from among:

- The current sentence
- You are encouraged to discuss the reviewers' comments with the program officer, with a view to submitting a revised proposal for the next round.
- Other intermediate exhortations.

We believe attention to this detail would encourage resubmission by first-time applicants.

3. Reviewer selection:

d) Use of adequate number for balanced review;

e) Use of reviewers having appropriate expertise/qualifications;
f) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
g) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

Comments:

a. Seems ok, but variable. Five panelists reviewed eleven proposals in 1997; six reviewed twelve in 1998; but nine reviewed fifteen in 1999.

b. This is fine.

c. Our concern here is the balance in type of institution. Historically undergraduate institutions involve students in joint research with faculty to a greater degree than do larger institutions with graduate students. Thus we were surprised to observe how few panelists represented primarily undergraduate schools. In 1998 five panelists out of six were from large institutions, the sixth represented a corporation. In 1999 one out of nine panelists was from a four-year college.

d. Propriety is conscientiously and scrupulously observed.

4. Resulting portfolio of awards:
a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as
- *High-risk*
- *Multidisciplinary*
- *Innovative*

Comments:

a. Excellent.

b. Scope and duration are fine. CISE disciplines differ from many others in that their majors are in high demand in the marketplace, even for summer employment. Consequently, REU programs must compete for their participants with organizations that are able to tempt the best candidates with remuneration far in excess of typical REU stipends. We noted projects that addressed this issue by decreasing the number of participants in order to increase the stipend level. Project

9820147 from University of Alabama Huntsville reported: “Because of the strong economy and the summer job opportunities available to undergraduate students, we were unable to attract high quality students at a stipend of $4000 for a 10 week period. Even in Huntsville, undergraduate students were being paid as much as $6000 during summers by the high technology industrial concerns. During summer 2001, we will increase the stipend to $4500 per student. This will reduce the number of stipends from 7 to 5 [sic]. However, we feel that it is better to attract fewer good students than not to attract any.” We note that the guidelines at the time of this proposal recommended a stipend of $5000 per student. We understand that the program officer would contemplate proposals requesting funds for stipends exceeding the guidelines. We further note that the latest guidelines will increase the recommended amount to $6000. Proposals will likely continue to come in requesting less than this. We urge the program officer to consider revising proposal budgets **upwards** so that the REU site can successfully compete for the best and brightest students.

c. This question is not really applicable to this program. REU opportunities follow existing research directions.

d. We don’t really have the information necessary to answer this question. It would be helpful were the next COV provided with statistics from NSF’s database on this topic.

e. Absolutely.

f. See d) above.

g. The nature of this program does not lend itself to submission of high-risk proposals. Multidisciplinary proposals are rare, but we note Award 9527932 from the University of Minnesota – Twin Cities as a program that involves faculty from several departments as well as students majoring in various disciplines.

B. REU Results: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV’s should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*

a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;
***d)** Globally engaged science and engineering professionals who are among the best in the world; and*
***e)** A public that is provided access to the processes and benefits of science and engineering research and education.*

Comments:

a. It is not the intention of REU programs to directly address the improvement of K-12 SMET skills. However, we note that several projects have outreach components that generate enthusiasm for SMET among these age groups. For example, for Award 9619957 from the University of Iowa students worked on a driver simulation project. Their report states: “During the summer, the simulator was used by researchers from the Department of Psychology to conduct tests of children’s bicycle riding behavior in traffic. Thirty-one twelve- and fourteen-year-olds rode an instrumented stationary bike through a virtual town. The experiment required the children to cross twelve intersections marked by Stop signs. At the intersections, children faced cross traffic and were instructed to wait for gaps they judged to be adequate to allow safe crossing.” Some participants in REU project 9732062 at University of Florida visited an elementary school on a weekly basis to help middle-schoolers perform experiments with an autonomous robot.

b. This goal is also indirectly addressed because the nature of the program is to produce projects that stimulate enthusiasm. Again Award 9619957 is an exemplar of this: Two weeks after the end of the REU summer session several participants demonstrated the virtual bike town at the Iowa State Fair in Des Moines for approximately 12 hours per day for 10 days. More than 1000 fair goers rode the bicycle through virtual Iowa City.

c. There is no doubt that those projects that actively pursue applicants for their summer REU do attract women and minorities and encourage their pursuit of scientific careers. Award 9619861 from Depauw University reports that the 28 participants who attended sessions over three years comprised 15 women, 6 African Americans and 1 Hispanic. An exit survey asked participants to answer on a scale of 1-

5 if they were more likely to attend graduate school as a result of their REU experience. The average response was 4.5/5.0. Wayne State University's Award 9619900 attracted fifty applicants in its second year. Of the six who were accepted three were African-American. The University of Iowa's Award 9619957 attracted eighty-one applicants and accepted fourteen. Only one was a University of Iowa student. Six were women, five were African-American and eight were from small colleges.

We stress the importance of timely and active recruitment. Award 9732522 University of Central Florida reports that 1 out of their 10 students was female; perhaps due to a shortage of available recruitment time.

d. This goal is beyond the scope of the REU program.

e. Our response in part b. above addresses this. Many of the funded projects could well be put in the public eye as was Award 9732062 University of Florida whose report includes: "The LawnShark and its predecessor LawnNibbler (robotic lawnmowers) were featured in the NBC Today show on September 13 1998 with one of the female REU participants as one of the two engineers featured. A special report was also done in WJXX Channel 25 (out of Jacksonville FL) on the lawnmowers." Three REU students also demonstrated their projects at Disney's Ride & Share facility in November 1998. In connection with Award 9619805 at the University of North Dakota in their 1998 summer session, students had managed to control robot navigation and object detection. The robot was tested and debugged at two public concerts held in the local art museum.

6. IDEAS Strategic Outcome Goal:

Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

Comments:

a. It is beyond the purview of this COV to address the quality of the research of the mentors.

b. As above

c. As above

d. This is the crux of the REU program. With very few exceptions, it appears that students work closely with faculty engaged in meaningful research. They develop an appreciation and often a thirst for scientific pursuits. This surely enhances the quality of their undergraduate education and generates enthusiasm to continue scientific endeavors at the graduate level and beyond. The process of explaining their work and ideas while they mentor students helps researchers gain better focus on their own research and its societal contributions and effects.

   Student-faculty papers and presentations by students abound. Award 9527932 from the University of Minnesota – Twin Cities – describes six multi-author papers that have been accepted for publication in respectable scientific journals. The Annual Report for Award 9619805 at the University of North Dakota states: "After eight weeks working on the robot entry, seven of the students and several other UND students participated in a one week trip to the 1998 American Association for Artificial Intelligence Conference held in Madison WI. This was an excellent opportunity for the students to meet other students and researchers in the field. Students were initially awed by the equipment and expertise of the other robot teams, but were very proud when their entry received both first place honors in the competition".

7. TOOLS Strategic Outcome Goal:

Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

Comments:

a. It is beyond the purview of this COV to address the production of such deliverables by the mentors.

b. As above
c. As above

d. As above

8. Areas of Emphasis:
For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People
- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
  - *Advanced Technological Workforce program (ATE)*

Comments: Pro-active recruitment can broaden participation in the sciences. See our comments in reply to 5.c. above. It will be interesting to note in future annual reports for Award 9912247 how successfully the participation of the Fond du Lac Tribal and Community College will affect participant recruitment in Augsburg's REU project. Their proposal indicates that they are well positioned to achieve good results.

Near-term workforce needs: See our comments in response to 6.d. above.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*
  - *Cognitive neuroscience*

Comments: Leading edge researchers are less likely to have the time or inclination to suggest REU participation at early stages in their endeavors. As a result, the REU program is unlikely to include high risk, innovative research and will probably not address areas such as Functional

Genomics and Biocomplexity for some time. Aspects of Cognitive studies attractive and accessible to undergraduates, such as robotic design, manipulation and navigation, have been successfully represented in the REU portfolio.

c) Strategic Outcome: Tools

- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

Comments: Not applicable to REU program.

9. Please comment on program areas that the COV believes need improvement.

Comments:

- Student stipends. These need to be increased and program officers may need to revise budgets upwards since many PIs do not foresee the difficulties of attracting the best and brightest in competition with industry.
- Timeliness of award letters. For effective recruitment, REU sites need to be able to announce their programs early in the January preceding the summer session.
- Encouragement of first-timers to resubmit revised proposals. The letters of declination from Divisional Director could be tailored to this end.
- Panel selectors might consider more reviewers from primarily undergraduate institutions for this REU program.
- If proposal review will depend on "broader impact" issues, the program announcement should urge proposals to address these issues.
- NSF might consider arranging showcase student presentations of exemplary projects at appropriate professional meetings.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

Comments:

- We believe that this program provides valuable experience in research for undergraduate students.
- To attract talented undergraduates we recommend more timely notification of PIs and more competitive stipends.
- It would be valuable to conduct follow-up surveys to discern the extent to which students continue into graduate studies or research careers in science, mathematics and engineering.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

Comments:

- Data for questions like A.4.d. and A.4.f. can be collected before the COV.
- Clarify question A.1.d.
- Time is short for the COV members. Descriptions of the history of the Division and overview of materials sent out to participants prior to the meeting should be circumspectly trimmed in view of the short time available for program evaluation and report preparation.
- All the NSF staff were responsive and helpful to the highest degree. No request or enquiry was too trivial – all received courteous and timely attention.

COV Members:
Dr. Rhys Price Jones
Dr. Nancy Hastings

VIII. Cluster 7 -- NSF-Wide Programs, CONACyT, CNPq and Special Projects

General Observations About NSF-Wide Programs in EIA

The COV Cluster 7 group was asked to investigate and report on a wide range of programs, and prepared regular reports on several of them. However, the group also reviewed a good deal of information that did not fit within the report formats. This report captures this information. In addition, the group has several proposals for streamlining the reviewing process; for cutting down the confusion caused by the very large number of programs in CISE; and for making sure that CISE receives funding and benefits from cross-division NSF programs in reasonable proportion to the dollars and efforts that it contributes to these programs.

Observations of concern to the panel

1. CISE has 52 programs, many of them very small. For some programs the total number of submissions is on the order of five per year. It is difficult to manage these programs efficiently, since each requires some overhead in handling and advertising the program; each requires a budget; and each needs its own review process. In addition, it is difficult for proposers to comprehend all the available programs for which they might be eligible. Nonetheless this panel is of the opinion that the programs that it reviewed were all are worthwhile.

2. Scientists spend far too much time writing proposals for funding. This problem is exacerbated by the long lag time before responses for regular proposals, the plethora of special RFPs, and the need to keep generating proposals until one receives funding. Far more actual science would be accomplished if the proposal-writing process could be streamlined; the quality of the proposals submitted would also be improved. Proposers could write one base 15-page proposal – to be reviewed by disciplinary peers – and accompany it with a cadre of short affiliated proposal supplements for collaborative or special funding (e.g. REU, international collaborators, post-docs, POWRE/ADVANCE fellows, and other cross-cutting initiatives).

3. CISE participates in many cross-directorate initiatives, e.g. in biocomplexity, nanoscale systems, IGERT, STC, etc. However CISE has seldom been successful in getting its proposals funded, regardless of their merit from the CISE point of view. For example, there were no CISE-related STCs in the most recent selections, while some 5-6% of pre-proposals were relevant to CISE. The panels are typically dominated by other divisions, e.g. biology, physics or engineering, both in numbers and seniority of panelists, who may not have understood the significance of CISE-related research. This situation represents a kind of taxation without (effective)

representation and works against funding important, worthy CISE proposals. In addition it is demoralizing for the participating Program Officers and for CISE proposers. Indeed, fewer CISE researchers have chosen to submit to these cross-directorate initiatives since the first HPC competitions in which strong CISE proposals were submitted but not funded.

4. The current system forces a multi-stage ad hoc reviewing that is wasteful of the scarce reviewing resources of the community, and creates additional tracking demands on NSF program officers. The reviewing process for programs with special eligibility requirements (e.g., POWRE and ADVANCE) disseminates personal information about a proposer's special circumstances to colleagues and peers. Additionally, the requirements for the ADVANCE Fellows program are so restrictive that they prevent many worthy candidates from qualifying.

5. Promising proposals that fall short because of inexperience with the proposal writing process (e.g., poor presentation; inadequate budget submissions; failure to properly follow submission requirements; insufficient detail) are simply declined.

6. Staff support is inadequate for CISE program officers. Assistants to Program Officers have only high school-level training. Program Officers are saddled with a heavy burden of clerical work that could easily be delegated, and much of which is menial and unrewarding at their level. This problem affects the ability of NSF to retain qualified Program Officers.

Summary of recommendations

1. Eliminate separate proposals to the many small programs by providing check-off boxes on the standard CISE submission cover form. Each check-off box can list the name of the program and provide pointers to information on the program. Proposals would be given regular scientific evaluation. Worthy proposals can qualify for other specialized programs at the discretion of a program officer, either without further review, or based on a shorter supplementary proposal or other information solicited by the Program Officer. "Passing through" proposals to special programs will reduce the dwell time, the overhead of administering these programs, and researcher effort to submit to these programs. It will provide the maximum protection for the personal information of applicants, while assuring the scientific quality of proposals.

2. Following merit review, Program Officers should have the following spectrum of available options:
   - Award

- Award and refer to another program for supplementary funding. This could include inviting a PI to submit a 2 page supplementary proposal.
- Refer to a special program for consideration. The PI may be invited to submit a supplementary document.
- Fund as a small planning grant and possibly refer to another program for supplementary funding without the demand for a new proposal.
- Decline

All actions should be reported promptly to the PIs (including declinations and proposals being held for further deliberation).

3. If a directorate provides resources for a cross-directorate initiative (e.g. biocomplexity, nanoscale systems, IGERT, ADVANCE, STC), then at least one proposal/preproposal from that directorate should be funded/encouraged. For example, CISE Program Officers could be given "wild cards" with which to fund one or more CISE proposals. If no CISE proposals are accepted by an interdisciplinary panel on which they participate. Interdisciplinary panel reviews/rankings on all CISE proposals/preproposals should be returned to CISE for the selection a "wild card" proposal/preproposal to fund/encourage. In the case of an encouraged proposal, CISE program offices could coach the PIs on development of the full proposal.

4. Much of the work conducted by EIA Program could be handled by a person with some collegiate training. NSF should consider using college juniors and seniors to aid EIA program officers. Such students need not be Computer Science majors, but might be majors in any physical science, social science or engineering.

A. CONACyT, CNPq and Special Projects: Integrity and Efficiency of the Program's Processes and Management

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide comments on each of the following aspects of the program's review processes and management. COVs are encouraged to provide comments for each program being reviewed. Constructive comments indicating areas for improvement are encouraged.

1. Effectiveness of the program's use of merit review procedures:

a) Overall design, including appropriateness of review mechanism (panels, ad hoc reviews, site visits);
b) Effectiveness of program's review process;
c) Efficiency; time to decision;
d) Completeness of documentation making recommendations;
e) Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines.

CONACyT and CNPq Comments:

a. Th program requires that both NSF and Program Managers in Mexico (CONACyT) or Brazil (CNPq) each approve a proposal by usual processes before funding can be released by this program. There are problems in synchronizing, especially since fiscal years differ. Even with electronic communication it is sometimes difficult to match up proposals from both ends. The problems will be exacerbated by the proposed addition of comparable programs for Argentina and Chile. See comments below on how the goals of this program could be better achieved.

b. Proposals are submitted to program officers in EIA. They are few in number and then are distributed to disciplinary program officers to sustain the regular reviewing processes (not special for this program). If regular reviews are favorable, consultations must then proceed with the international funding agency. If reviews in both countries are favorable, funding under this program is essentially automatic. The process is extremely unwieldy and needs revision. See below.

c. Time and efficiency are a major problem. Time delays are introduced by the individual timetables of the various disciplinary programs within the two different countries and by subsequent interagency deliberations.

d. Very little physical documentation is available. This report summarizes the results of our deliberations following the reports of the Division Director and the Program Director.

e. As far as this Cluster 7 can determine, these programs are administered according to program guidelines.

Special Projects Comments:
This cluster reviewed 8 proposal actions.

a. The review mechanism in each case suited the size and scope of the proposal.

b. The review process proceeded smoothly.

c. Decisions were reached in a timely fashion (typically, 3-4 months).

d. The decisions, the decision-making process, and the reasons for the decisions were fully documented.

The decisions all appeared consistent with the priorities and criteria of Special Projects.

2. ***The program's use of the NSF Merit Review Criteria (intellectual merit and broader impacts):***

a) *Performance Goal: Implementation of Merit Review Criteria by Reviewers: NSF performance in implementation of the merit review criteria is successful when reviewers address the elements of both generic review criteria. Did reviewers adequately address the elements of both generic review criteria?*

b) *Performance Goal: Implementation of Merit Review **Criteria by Program Officers:***
NSF performance in implementation of the merit review criteria is successful when program officers address the elements of both generic review criteria. Did program officers adequately address the elements of both generic review criteria?

c) *Discuss any concerns the COV has with respect to NSF's merit review system.*
The COV should keep track of the percentage of reviewers and program officers who address the merit review criterion regarding the broader impacts of the proposed activity.

Comments:
a. 1) Did reviewers adequately address the intellectual merit criterion in their reviews?
2) Did reviewers adequately address the broader impacts criterion in their reviews?
b. 1) Did program officers adequately address the intellectual merit criterion in their decisions?
2) Did program officers adequately address the broader impacts criterion in their decisions?

This **CONACyT and CNPq** panel had no basis for responding to these questions.

The **Special Projects** Panel felt that items a) and b) were satisfied. In addition, many of the projects are funded primarily for their broad impact:

- Allow students to attend professional meetings, especially women and minority students.
- Career development activities for underrepresented students.
- Demographic studies and research on issues that affect diversity
- Workshops to assess state-of-the-research and identify needed research directions for the future

3. Reviewer selection:

a) Use of adequate number for balanced review;
b) Use of reviewers having appropriate expertise/qualifications;
c) Use of reviewers reflecting balance among characteristics such as geography, type of institution, and underrepresented groups;
d) As appropriate, recognition and resolution of conflicts of interest by NSF staff and adequacy of documentation justifying actions taken.

CONACyT and CNPq Comments:

a. No basis for comment.
b. No basis for comment.
c. No basis for comment.
d. No basis for comment.

Special Projects Comments:

a. The number of reviews was adequate (3-10 reviewers for all proposals that required reviews; some workshop proposals were at the discretion of the program director)
b. The projects were reviewed by appropriate NSF directors and by qualified CS researchers.
c. Data is not available to determine the balance among characteristics.
d. We saw no evidence of conflict of interest.

4. Resulting portfolio of awards:

a) Overall quality of science/engineering;
b) Appropriateness of award scope, size, and duration;
c) Effective identification of and support for emerging opportunities;
d) Appropriate attention to maintaining openness in the system, for example, through the support of new investigators;
e) Evidence that proposers have addressed the integration of research and education in proposals;
f) Evidence of increased numbers of applications from underrepresented groups;
g) Balance of projects characterized as

- *High-risk*
- *Multidisciplinary*
- *Innovative*

CONACyT and CNPq Comments:
Extremely few proposals have been submitted for these two initiatives. We do not have access to these proposals, but the small numbers suggest that no valuable conclusions could be drawn. We believe that the goal of encouraging International collaborations between scientists in the United States and those in Central and South American is a laudable one, but that the process of so doing must be revised. Please see item 9 below.

Special Projects Comments:
a. Special projects emphasized education, professional and career development, and identification of strategic directions for research.
b. Scope, size, and duration of the funded projects were appropriate.
c. There appear to be a wide range of investigators.
d. Most of the proposals support development of people (students, faculty).
e. Data not available to assess increase in applications from under represented groups.
f. One project cut across education and computer vision; another involved bio-information processing and systems; a third involved a collaboration among computer scientists, psychologists, and education researchers.

B. CONACyT, CNPq and Special Projects: Outputs and Outcomes of NSF Investments

Strategic Outcome Goals: For each of the strategic outcome goals listed below comment on the following: Has the program demonstrated success in achieving the outcome goal? (NOTE: COV's should separately address each of the indicators listed under the strategic outcomes.) Provide NSF-supported examples which demonstrate your judgement, and explain why they are relevant or important to the outcome goal. If performance is not successful, comment on the steps that the program should take to improve performance. It is important to note if the outcome goal is not relevant to the program and provide a brief explanation.

5. PEOPLE Strategic Outcome Goal:
Development of a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.

FY 2001 Performance Goal: The program is successful when, in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:*
a) Improved mathematics, science, and technology skills for U.S. students at the K-12 level;
b) Improved mathematics, science, and technology skills for citizens of all ages, so that they can be competitive in a technological society;
c) A science and technology and instructional workforce that reflects America's diversity;

d) *Globally engaged science and engineering professionals who are among the best in the world; and*

e) *A public that is provided access to the processes and benefits of science and engineering research and education.*

CONACyT, CNPq Comments:

a. Not Applicable
b. Not Applicable
c. There were minority students involved in the one proposal we reviewed.
d. This is a goal of this program, but the rate of success is questionable.
e. Not Applicable

Special Projects Comments:
The main outcome of many of the special projects was to improve diversity and international competitiveness of our science and engineering workforce.

- Special projects have supported CRA-W, a subcommittee of the Computing Research Association, whose mission includes increasing the numbers, successes, and status of women and minorities in computing research. This project has produced a Careers Booklet targeting K-12 women and minorities and a Graduate Information Booklet targeting undergraduates to encourage them to pursue a graduate education and targeting graduate students to help them succeed in graduate school. It has run the highly successful Distributed Mentoring Program, which provides summer research and mentoring experiences for undergraduates. It has organized regular Faculty Mentoring Workshops to help women and minority junior-faculty succeed in an academic career. It has developed an on-line database of women with CS&E Ph.D. which can be queried for lists of potential hires, program committee members, speakers, etc.
- Special projects regularly support students to travel to national and international professional meetings to present their research and to learn of the latest research in their areas of specialization.
- "The Story of Computer Graphics" (9911033) produced a movie that describes the impact of computer graphics research to a general audience. It is a fabulous introduction to computer graphics, and motivates the student to want to learn more by seeing how previous graphics researchers had to overcome a variety of obstacles to advance the science. It has been shown at a number of festivals, where it was extremely well reviewed.

6. IDEAS Strategic Outcome Goal:
Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Goal: The program is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:

a) A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
b) Discoveries that advance the frontiers of science, engineering, and technology;
c) Partnerships connecting discovery to innovation, learning, and societal advancement; and
d) Research and education processes that are synergistic.

CONACyT, CNPq Comments:
Not Applicable

Special Projects Comments:
Many of the projects were not concerned so much with IDEAS as with PEOPLE (see 5). Some projects that contributed to advancement of ideas include:

- A project called "Deep Learning and Visualization Technologies" (9720351) introduced a new hypothesis for how learners acquire new central concepts in light of prior (and potentially conflicting) knowledge. It also represents the most extensive documented experience of young children with advanced virtual reality technologies in support of learning.
- "Workshop to Establish a Research Agenda in Learning and Science Technology" (0004280) contributed to an overall effort by NSF to foster the development of the Learning Federation (LF). The LF goal is to achieve a critical mass of projects by providing long-term, stable "large-grain" funding for interdisciplinary teams. The workshop funded by this project developed a research agenda needed for internal planning and program development at NSF.

7. TOOLS Strategic Outcome Goal:
Providing broadly accessible, state-of-the-art information-bases and shared research and education tools.

FY 2001 Performance Goal: The program is successful when, in the aggregate, as a result of its investments, results reported in the period demonstrate significant progress in achieving one or more of the following indicators

a) Shared use platforms, facilities, instruments, and databases that enable discovery;
b) Shared use platforms, facilities, instruments, and databases that enhance the productivity and effectiveness of the science and engineering workforce;
c) Networking and connectivity that takes full advantage of the Internet and makes SMET information available to all citizens; and
d) Information and policy analyses that contribute to the effective use of science and engineering resources.

CONACyT, CNPq Comments:
Not Applicable

Special Projects Comments:
Many of the Special projects were not concerned so much with TOOLS, as with PEOPLE (see 5). Special Projects with outcomes supporting tools include:

The CRA-W project produced an on-line database of women with CS&E Ph.D.s. This database can be queried for lists of potential hires, program committee members, speakers, etc.

8. Areas of Emphasis:
For each relevant area of emphasis shown, determine whether the investments and available results demonstrate the likelihood of strong performance in the future? Explain and provide NSF-supported examples that relate to or demonstrate the relevant strategic outcomes.

a) Strategic Outcome: People
- *K-12 systemic activities*
- *Enhancing instructional workforce/professional development*
  - *Centers for Learning and Teaching (CLT)*
  - *Graduate Teaching Fellows in K-12 Education*
- *Broadening participation*
  - *Tribal Colleges*
  - *Partnerships for Innovation (PFI)*
- *Addressing near-term workforce needs*
- *Advanced Technological Workforce program (ATE)*

CONACyT, CNPq Comments:
Not Applicable

Special Projects Comments:
The major outcomes of Special Projects have traditionally fallen into this area. We expect the excellent track record in this area to continue into the future.

b) Strategic Outcome: Ideas

- *Appropriate Balance of Portfolio (high risk, multidisciplinary, or innovative research) for each NSF program*
- *Investment in three initiatives:*
  - *Information Technology Research (ITR)*
  - *Nanoscale Science and Engineering*
  - *Biocomplexity in the Environment*
- *Investments in non-initiative fundamental research:*
  - *Mathematical Sciences Research*
  - *Functional Genomics*

   - *Cognitive neuroscience*

CONACyT, CNPq Comments:
Not Applicable

Special Projects Comments:
We do not expect major outcomes from future Special Projects in the ideas category, as proposals to advance scientific ideas would be funded out of regular programs.

c) *Strategic Outcome: Tools*
- *Investments in Major Research Equipment:*
  - *Terascale Computing System*
- *Continuing investments:*
  - *Major Research Instrumentation Program (MRI)*
  - *Science and Engineering Information/reports/databases*
  - *New types of scientific databases and tools for using them*

CONACyT, CNPq Comments:
Not Applicable

Special Projects Comments:
We do not expect major outcomes from future Special Projects in the tools category, as proposals to advance scientific databases and tools would be funded out of regular programs.

9. Please comment on program areas that the COV believes need improvement.

CONACyT, CNPq Comments:
The COV CONACyT, CNPq Cluster 7 believes strongly that it would be far better to advertise and administer this program differently. Rather than require a separate submission to this program, the committee recommends that all cover sheet forms for NSF CISE proposals list these programs (as well as other special initiatives) at the bottom, with pointers to places were information about each program can be obtained, and check-off boxes where proposers can designate their intent to apply for supplementary funds under the checked programs. Evaluations could then proceed normally, and consideration for funding under this program could be initiated AFTER the proposal has received a favorable regular review.

10. Comment as appropriate on the program's performance in meeting program-specific goals and objectives (non-GPRA outcomes).

CONACyT, CNPq Comments:
There were six students who went onto graduate schools. Also, many students involved were minority students.

Special Projects Comments:
The program serves the broader community, the research community, and CISE very well.

11. NSF would appreciate your feedback on the COV review process, format and core questions.

CONACyT, CNPq Comments:
The process is necessary, and is effective only if the proposals made by the COV members are considered when implementing changes.

COV Members:

David Waltz (chair)
Laura Dillon
Diane Souvaine
Larry Reeker
Mahadran Velauthapillai

IX. Appendix: EIA COV Clusters

Cluster		Program	Program Announcements	Number of visitors	Cluster Chair	Salutation	First Name	Last Name	Title	Department
1. Education	1.1	***Educational Innovation (EI)***	***nsf9741 nsf9844 nsf9980 nsf0033***	**2**		Dr.	Rachelle	Heller	Professor	Department of EECS
	1.2	***Combined Res. and Curriculum Development (CRCD)***	***nsf9636 nsf9838 nsf9972 nsf0066***			Dr.	Joe	Turner	Professor Emeritus	
2. Instrumentation and Infrastructure	2.1	***CISE Adv. Dist. Resources for Experiments (CADRE)***	***nsf988 nsf98127***	**2**						
	2.2	***CISE Advanced Resources for Experiments (CARE)***	***nsf985 nsf98127***			Dr.	Stephen	Yau	Professor and Chair	Department of Computer Science and Engineering
	2.3	***CISE Instrumentation***	***nsf96113 nsf98132***	***1***		Dr.	Feniosky	Pena-Mora	Co-Director, Intelligent Engineering Systems Laboratory	Civil and Environmental Engineering Department
			RR			Dr.	Ali	Hurson	Professor	Department of Computer Science and Engineering
	2.4	***CISE Research Infrastructure***	***nsf97146 nsf98159 nsf005***	**2**		Dr.	Earl	Swartzlander	Schlumberger Centennial Chair Professor in Engineering	Electrical and Computer Engineering Department
			RR		*	Dr.	Benjamin	Wah	R. T. Chien Professor of ECE	Coordinated Sciences Laboratory
	2.5	***Major Research Infrastructure (MRI)***	***nsf9816 nsf9934 nsf99168 nsf017***							
3., 4., 5. Research Related	3	***Digital Government (DG)***	***nsf98121 nsf99103***	**2**		Dr.	Don	Prosnitz	Chief Scientist & Technology Advisor	
						Dr.	Barbara	O'Keefe	Dean	School of Speech
	4	***Experimental Systems (ES)***	***nsf985 nsf988 nsf127***	**2**		Dr.	Shirley	Becker	Professor	Department of Computer Science
						Dr.	Craig	Lee		
	5	***Next Generation Software (NGS)***	***nsf9762 nsf998 nsf00134***	**2**		Dr.	George	Cybenko	Dorothy and Walter Gramm Professor of Engineering	Thayer School of Engineering
						Dr.	Jack	Davidson	Professor	Engineering Computer Science

Organization	Address 1	Address 2	City	State	Zip	e-mail 1	e-mail 2	Telephone 1	telephone 2	fax
USMA	Thayer Hall, Building 601	Swift Road	West Point	NY	10996	sheller@seas.gwu.edu		1-800-497-6468 X2193		
Clemson University	2024 Westview Point		Seneca	SC	29672-2436	turner@cs.clemson.edu		864-882-7509		
Arizona State University	Mail Box 875406		Tempe	AZ	85287	yau@asu.edu		480-965-3190		480-965-2751
Massachusetts Institute of Technology	77 Massachusetts Avenue	Room 1-253	Cambridge	MA	02139	feniosky@mit.edu		617-253-7142		617-253-6324
Penn State University	230 Pond Lab		University Park	PA	16802	hurson@cse.psu.edu		814-234-2523		404-894-7883
University of Texas at Austin			Austin	TX	78712	e.swartzlander@compmail.com		512-471-5923		512-471-5907
University of Illinois	1308 West Main Street		Urbana	IL	61801	b-wah@uiuc		217-333-3516		217-244-7175
US Department of Justice	950 Pennsylvania Ave N.W.	Room 7241	Washington	DC	20530	Donald.Prosnitz@usdj.gov		202-353-8879		202-353-8881
Northwestern University	633 Clark Street		Evanston	IL	60208	b-okeefe@northwestern.edu				
Florida Institute of Technology	150 West University Boulevard		Melbourne	FL	32901	becker@cs.fit.edu		321-674-8149		
The Aerospace Corp	2350 E. El Segundo Blvd.		El Segundo	CA	90245-4691	lee@aero.org		310-336-1381		
Dartmouth College			Hanover	NH	03755-8000	gvc@dartmouth.edu		603-646-3843		603-646-2277
University of Virginia	PO Box 400740	Thornton Hall	Charlottesville	VA	22904-4740	jwd@virginia.edu		804-982-2209		804-982-2214

				6	*	Dr.	Dave	Waltz	President	
7. NSF-Wide	7.1	Professional Opportunities for Women in Research and Education (POWRE)				Dr.	Diane	Souvaine	Professor	Department of Electrical Engineering & Computer
	7.2	Increasing the Participation of Women in Academic Science and Engineering Careers (ADVANCE)				Dr.	Laura	Dillon	Professor	Department of Computer Science
	7.3	Integrative Graduate Education and Research Training (IGERT)				Dr.	Mahe	Velauthapillai	Professor	Department of Computer Science
	7.4	Science and Technology Centers (STC)				Dr.	Larry	Reeker		Information Technology Laboratory Office
	7.5	Biocomplexity (BE)				Dr.	Bill	Decker	Associate Vice President	Vice President for Research
	7.6	Nanoscale Science and Engineering								
	7.7	Presidential Faculty Fellowship Awards (PFF)								
	7.8	Interagency Educational Research Iniative (IERI)								
	7.9	Information Technology Research (ITR)								
	7.10	Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (CNPq)								
	7.11	Consejo Nacional de Ciencia y Tecnologia Collaborative Research Opportunities -- with Mexico (CONACyT)								
	7.12	Special Projects and International Programs								

NEC Research Institute	4 Independence Way		Princeton	NJ	08540	waltz@research.nj.nec.com		609-951-2500		609-951-2480
Tufts University	161 College Avenue		Medford	MA	02155	dls@eecs.tufts.edu		617-627-2486		617-627-3220
Michigan State University	Room 3132	Engineering Building	East Lansing	MI	48864	ldillon@cse.msu.edu		517-353-4387		517-432-1061
Georgetown University	225 Reiss Science Building		Washington	DC	20057	mahe@cs.georgetown.edu		202-687-5936		202-687-1835
National Institute of Science and Technology	100 Bureau Drive, Stop 8970		Gaithersburg	MD	20899-8970	larry.reeker@nist.gov		301-975-5147		
University of Iowa	Gilmore Hall		Iowa City	Iowa	52242	decker@blue.weeg.uiowa.edu		319-335-3899		

X. Appendix: EIA COV Agenda

NATIONAL SCIENCE FOUNDATION
Computer and Information Science and Engineering (CISE)
Division of Experimental and Integrative Activities (EIA)
4201 Wilson Boulevard
Arlington, VA 22230
(703) 292-8980

AGENDA

Experimental and Integrative Activities Division (EIA)
Committee of Visitors (COV) Meeting

Tuesday and Wednesday, May 1st and 2nd, 2001
8:30Am - 5:00 PM

COV Members

General Chair

Dr. Mary Jane Irwin
Professor, Department of Computer Science and Engineering
Penn State University
220 Pond Lab.
University Park, PA 16802
mji@cse.psu.edu
1-814-865-1802 814-865-3176 (FAX)

Cluster 1. Education

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Professor, Department of EECS
USMA
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West Point, NY 10996
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1-800-497-6468 X2193

Dr. Joe Turner
Professor Emeritus
Clemson University
2024 Westview Point
Seneca, SC 29672-2436
864-882-7509

NSF Resource Person: Anita La Salle

Cluster 2. Instrumentation and Infrastructure (Cluster Chair -- Dr. Benjamin Wah)
2.1 CADRE Program
2.2 CARE Program
[and 2.5 Major Research Infrastructure]

Dr. Stephen Yau
Professor and Chair,
Department of Computer Science and Engineering
Arizona State University
Mail Box 875406
Tempe, AZ 85287
yau@asu.edu
480-965-3190 480-965-2751 (FAX)

NSF Resource Person: Mita Desai

2.3 CISE Instrumentation Program

[and 2.5 Major Research Infrastructure]

Dr. Feniosky Pena-Mora
Co-Director, Intelligent Engineering Systems Laboratory
Civil and Environmental Engineering Department
Massachusetts Institute of Technology
77 Massachusetts Avenue Room 1-253
Cambridge, MA 02139
feniosky@mit.edu
617-253-7142 617-253-6324 (FAX)

Dr. Ali Hurson
Professor, Department of Computer Science and Engineering
230 Pond Lab
Penn State University
University Park, PA 16802
Hurson@cse.psu.edu
814-234-2523

NSF Resource Person: Tse-yun Feng

2.4 CISE Research Infrastructure

[and 2.5 Major Research Infrastructure]

Dr. Earl Swartzlander
Schlumberger Centennial Chair Professor in Engineering
Electrical and Computer Engineering Department
University of Texas at Austin
Austin, TX 78712
e.swartzlander@compmail.com
512-471-5923 512-471-5907 (FAX)

Dr. Benjamin Wah
R. T. Chien Professor of ECE Coordinated Sciences Laboratory
University of Illinois
1308 West Main Street
Urbana, IL 61801
b-wah@uiuc
217-333-3516 217-244-7175 (FAX)

NSF Resource Person: Tse-yun Feng

Research and Related Programs

3. Digital Government

Dr. Don Prosnitz
Chief Scientist & Technology Advisor
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950 Pennsylvania Ave N.W.
Room 7241
Washington, DC20530
Donald.Prosnitz@usdj.gov
202-353-8879 202-353-8881 (FAX)

Dr. Barbara O'Keefe
Dean School of Speech
Northwestern University
633 Clark Street
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b-okeefe@northwestern.edu

NSF Resource Person: Larry Brandt

4. Experimental Systems

Dr. Shirley Becker
Professor, Dept. of Computer Science
Florida Tech.
150 West University Blvd.
Melbourne, FL 32901
becker@cs.fit.edu
becker@cfl.rr.com
321-674-8149 321-674-7046 (FAX)

Dr. Craig Lee
The Aerospace Corp
2350 E. El Segundo Blvd.
El Segundo, CA 90245-4691
lee@aero.org
310-336-1381

NSF Resource Person: Carl Smith

5. Next Generation Software

Dr. George Cybenko
Dorothy and Walter Gramm Professor of Engineering
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gvc@dartmouth.edu
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jwd@virginia.edu
804-982-2209 804-982-2214 (FAX)

NSF Resource Person: Frederica Darema

6. Workforce Related Programs (Cluster Chair -- Dr. Mary Lou Soffa)

6.1 Minority Institution Infrastructure

[6. 2 CISE Postdoctoral Research Associates]

Dr. Mary Lou Soffa
Professor, Computer Science Department
University of Pittsburgh
307 MIB
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soffa@cs.pitt.edu
412-624-8425 412-624-5249 (FAX)

Dr. Herman Hughes
Professor, Dept. of Computer Science
Michigan State University
2132 Engineering Building
East Lansing, MI 48824-1027
hughes@msu.edu
517-353-5152 517-432-1061 (FAX)

NSF Resource Person: Harry Hedges

6.3 ITWF and Other Workforce Projects

Dr. Patrick Otoo Bobbie
Professor, Department of Computer Science
Southern Polytechnic State University
1100 S. Marietta Parkway
Marietta, GA 30060
pbobbie@spsu.edu
770-528-4284

Dr. Jennifer Preece
Chair and Professor, Information Systems Department
University of Maryland Baltimore County
1000 Hilltop Circle
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preece@umbc.edu
410-455-6238 410-455-1217 (FAX)

NSF Resource Person: Caroline Wardle

6.4 REU Sites

Dr. Rhys Price Jones
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70 Lomb Memorial Drive
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Dr. Nancy Hastings
Professor, Mathematics and Computer Science
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717-243-512

NSF Resource Person: Carl Smith

7. NSF-Wide Programs (Cluster Chair -- Dr. David Waltz)

Dr. Dave Waltz
President, NEC Research Institute
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609-951-2500 609-951-2480 (FAX)

Dr. Laura Dillon
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Dr. Diane Souvaine
Professor, Dept of Electrical Eng. & Computer Sci.
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Dr. Mahe Velauthapillai
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Georgetown University
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202-687-5936 202-687-1835 (FAX)

Dr. Larry Reeker
Information Technology Laboratory Office
National Institute of Science and Technology
100 Bureau Drive, Stop 8970
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larry.reeker@nist.gov
301-975-5147

NSF Resource Person: Julia Abrahams

NSF Representatives
(Note: All NSF representatives can be reached at (703) 292-8980)

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Abrahams, Julia	(Program Director)	jabrahams@nsf.gov
Baker, Beverly	(Senior Program Assistant)	bbaker@nsf.gov
Brandt, Lawrence	(Program Manager)	lbrandt@nsf.gov
Darema, Frederica	(Sr Science & Tech. Advisor)	darema@nsf.gov
Davis, Cornell	(Program and Tech. Spec.)	cdavis@nsf.gov
Desai, Mita	(Program Director)	mdesai@nsf.gov
Feng, Tse-yun	(Program Director)	tfeng@nsf.gov
Gregg, Valerie	(Program Manager)	vgregg@nsf.gov
Hedges, Harry	(Program Director)	hhedges@nsf.gov
Hickman, James	(Program Director)	jhickman@nsf.gov
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La Salle, Anita	(Program Director)	alasalle@nsf.gov
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Smith, Carl	(Program Director)	chsmith@nsf.gov
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Thompson, Joneka	(Program Assistant)	jthompso@nsf.gov
Walston, Helen	(Senior Program Assistant)	hwalston@nsf.gov
Wardle, Caroline	(Program Director)	cwardle@nsf.gov

COV Coordination:
Cornell Davis, Barbara Palmer, Anita La Salle

Tuesday May 1, 2001			
(Open Meeting)			
8:00 - 8:30 AM	Refreshments		Room 375
8:30 - 8:40 AM	Greetings	Ruzena Bajcsy, AD, CISE	
8:40 - 10:00 AM	Introduction, Purpose, Plan, Expectations		
	Logistics, COI and Confidentiality Overview	Rick Adrion, DD, EIA	
	Review of Division and Program Data	John Lehmann	

(Closed Meetings)

10:00 - 10:30 AM Cluster Meetings:

10 minutes for reports from Program Officers
Devise Plan for Cluster Reports

Cluster #1	Education	Room 1175.01
Cluster #2	Instrumentation & Infrastructure	Room 320
Cluster #3	Digital Government	Room 365
Cluster #4	Experimental Systems	Room 1105.17
Cluster #5	Next Generation Software	Room 130
Cluster #6	Workforce Related	Room 330
Cluster #7	NSF-Wide and Other Programs	Room 390

10:30 - 12:30 AM COV Program Breakout rooms to Review Data and Jackets

Cluster #1 Education
1.1 Educational Innovation (EI)
1.2 Combined Res. and Curriculum Development (CRCD) } Room 1175.01
EIA Coordinator: Anita La Salle

Cluster #2 Instrumentation & Infrastructure
2.1 CISE Adv. Distr. Resources for Experiments (CADRE) } Room 1175.11
2.2 CISE Advanced Resources for Experiments (CARE)
2.3 CISE Instrumentation Room 1175.15
2.4 CISE Research Infrastructure Room 320
[2.5 Major Research Infrastructure (MRI)]
EIA Coordinator: Tse-yun Feng

Cluster #3
3.0 Digital Government (DG) Room 365
EIA Coordinators: Larry Brandt, Valerie Gregg

Cluster #4
4.0 Experimental Systems (ES) Room 1105.17
EIA Coordinator: Carl Smith

Cluster #5
5.0 Next Generation Software (NGS) Room 130
EIA Coordinator: Frederica Darema

	Cluster #6 Workforce Related	
	6.1 Minority Institution Infrastructure (MII)	Room 330
	[6.2CISE Postdoctoral Research Associates]	
	6.3 ITWF and Other Workforce Projects	Room 1122.12
	6.4 REU Sites	Room 1175.23
	EIA Coordinator: Caroline Wardle	
	Cluster #7 NSF-Wide and Other Programs	Room 390
	7.1 Professional Opportunities for Women in Research and Education (POWRE)	
	7.2 Increasing the Participation of Women in Academic Science and Engineering Careers (ADVANCE)	
	7.3 Integrative Graduate Education and Research Training (IGERT)	
	7.4 Science and Technology Centers (STC)	
	7.5 Biocomplexity (BE)	
	7.6 Nanoscale Science and Engineering	
	7.7 Presidential Faculty Fellowship Awards (PFF)	
	7.8 Interagency Educational Research Iniative (IERI)	
	7.9 Information Technology Research (ITR)	
	7.10 Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (CNPq)	
	7.11 Consejo Nacional de Ciencia y Tecnología Collaborative Research Opportunities -- with Mexico (CONACyT)	
	7.12 Special Projects and International Programs	
	EIA Coordinator: Julia Abrahams	
12:30 - 1:30 PM	WORKING LUNCH (and ITR overview)	Room 375
1:30 - 1:45 PM	Clusters reconvene for reality check and feedback	
	Cluster #1 Education	Room 1175.01
	Cluster #2 Instrumentation & Infrastructure	Room 320
	Cluster #3 Digital Government	Room 365
	Cluster #4 Experimental Systems	Room 1105.17
	Cluster #5 Next Generation Software	Room 130
	Cluster #6 Workforce Related	Room 330
	Cluster #7 NSF-Wide and Other Programs	Room 390
1:45 - 3:00 PM	Return to Program Breakout rooms to Review Data and Jackets	
3:00 - 5:00 PM	Prepare reports on Process and begin Outcomes discussions	

Wednesday May 2, 2001		
(Closed Meetings)		
8:30 - 8:45 AM	Refreshments	Room 380
8:45 - 10:30 AM	Prepare Reports on Outcomes	(Same rooms as Monday afternoon)
10:30 - Noon	Cluster Meetings to Prepare Composite Cluster Reports	
	Cluster #1 Education	Room 1175.01
	Cluster #2 Instrumentation & Infrastructure	Room 320
	Cluster #3 Digital Government	Room 365
	Cluster #4 Experimental Systems	Room 1105.17
	Cluster #5 Next Generation Software	Room 130
	Cluster #6 Workforce Related	Room 330
	Cluster #7 NSF-Wide and Other Programs	Room 390
12:00 - 1:30 PM	WORKING LUNCH Cluster Reports (5 minutes each)	Room 380
1:30 - 2:30 PM	Full COV -- Discussion of Findings for Final Report	Room 380
2:30 - 3:00 PM	Full COV -- Discussion of Future Directions Full COV -- Discussion of logistics of report completion and distribution	Room 380