SUMMARY OF AWARDS

FISCAL YEAR 1996

Office of Cross-Disciplinary Activities
Directorate for Computer and Information
  Science and Engineering

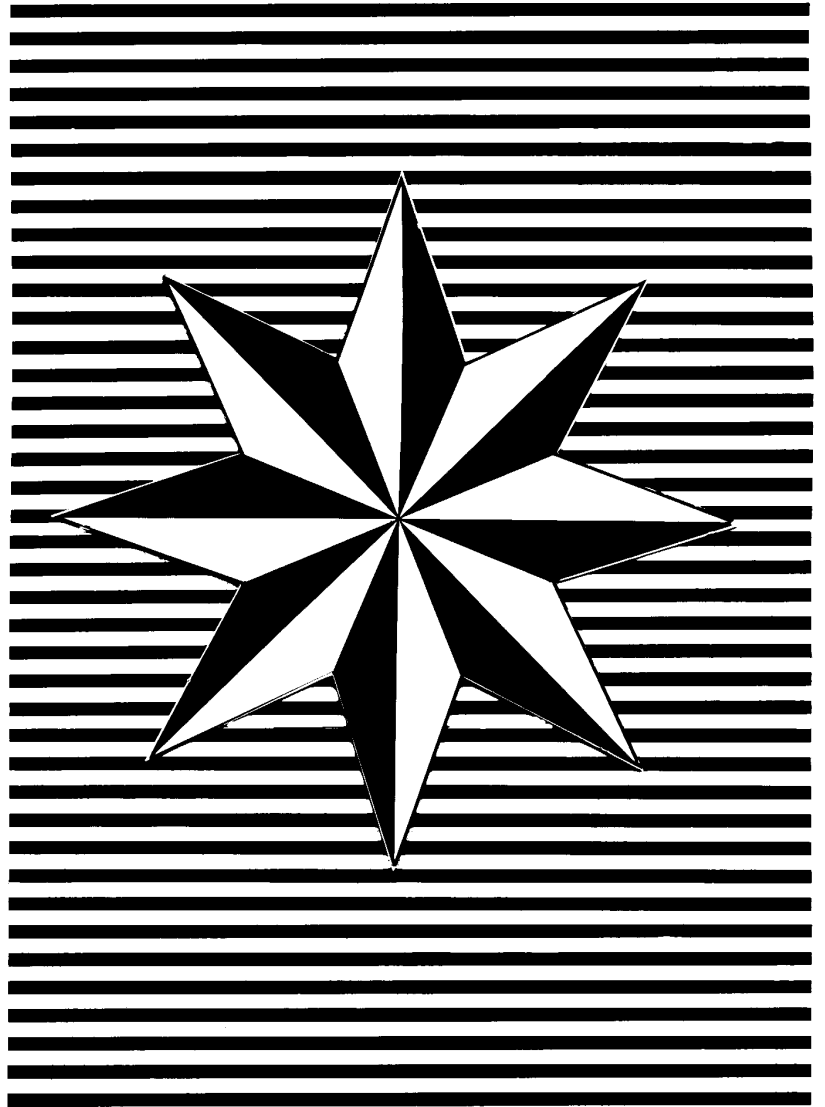NATIONAL SCIENCE FOUNDATION

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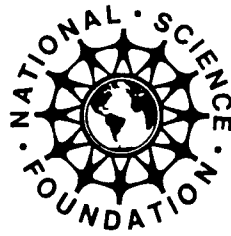Science and Engineering

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VA 22230

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Preface

The Computer and Information Science and Engineering (CISE) Directorate, consists of the following six divisions and office: Advanced Scientific Computing (ASC) Division; Computer and Computation Research (CCR) Division; Cross-Disciplinary Activities (CDA) Office; Information, Robotics and Intelligent Systems (IRIS) Division; Microelectronics Information Processing Systems (MIPS) Division; and the Networking and Communications Research and Infrastructure (NCRI) Division.

The *Office of Cross-Disciplinary Activities (CDA)* supports the building and strengthening of infrastructure in all CISE areas through the CISE Research Infrastructure, the CISE Instrumentation Programs and the Collaborative Research on Learning Technology (CRLT). It also administers various special projects and coordinates activities aimed at directorate-and Foundation-wide goals including increasing the participation of women, minorities, and the disabled in science and engineering, encouraging new investigators to initiate research, developing undergraduate curricula in CISE areas and encouraging the participation of undergraduates in research. The CISE Institutional Infrastructure Program had five components: Institutional Infrastructure-Research Infrastructure, Institutional Infrastructure-Large Scale, Institutional Infrastructure-Small Scale, Institutional Infrastructure-Minority Institutions, and Educational Infrastructure.

The CISE Institutional Infrastructure-Large Scale and Small Scale Programs were discontinued in Fiscal Year 1993 and 1994 respectively and no new awards have been made. However, continuing grants in this program, whose initial awards were made prior to Fiscal Year 1993, are listed in the CISE Research Infrastructure Program in this Summary of Awards.

The purpose of this Summary of Awards is to provide the scientific and engineering communities with a summary of those grants awarded in Fiscal Year 1996 through the Office of Cross-Disciplinary Activities (CDA). This report lists projects including continuing grants funded using Fiscal Year 1996 dollars and hence does not list multi-year standard awards made prior to Fiscal Year 1996.

Awards are grouped together by Programs for reader convenience. However, projects may bridge several programs or deal with topics not explicitly mentioned herein. Thus, these categories have been assigned administratively and for the purpose of this report only.

In this document, award identification numbers, award amounts, and award duration's are identified first. Grantee institutions and award titles are enumerated after the principal investigators' name. Within each category, the awards are listed alphabetically by principal investigator.

Readers wishing further information on a particular project described in this report are advised to contact the principal investigator directly.

John C. Cherniavsky
Head
Office of Cross-Disciplinary Activities

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NATIONAL SCIENCE FOUNDATION DIRECTORATE FOR COMPUTER AND INFORMATION SCIENCE AND ENGINEERING

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Cross-Disciplinary Activities

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Summary—FY 1996

	Number of Projects	Value of Awards
CISE Research Infrastructure	43	$11,573,001
CISE Institutional Infrastructure-Minority Institutions	16	$ 2,693,949
CISE Educational Innovation	11	$ 1,634,405
Collaborative Research on Learning Technology (CRLT)	24	$ 5,586,270**
Academic Research Infrastructure	17	$ 9,490,311*
CISE Postdoctoral Research Associates	11	$ 459,162
CISE Instrumentation	20	$ 1,496,433
CISE Special Projects	6	$ 531,173
CISE Research Experience for Undergraduate-Site Grants	11	$ 397,710
Special Initiatives	3	$ 3,550,000

These data include the totals of the awards listed in this document including special Foundation initiatives and may not agree with official NSF budget records for CDA.

*Funds from the Office of Science and Technology Infrastructure

**Funds from Director's Opportunity Fund

Introduction

This report provides summaries of awards made in Fiscal Year 1996 by the National Science Foundation (NSF) through the Office of Cross-Disciplinary Activities (CDA) of the Computer and Information Science and Engineering (CISE) Directorate. The programs conducted by the Office are:

CISE Research Infrastructure

The Research Infrastructure component of the CISE Institutional Infrastructure program integrates the prior CISE Large Scale and Small Scale components of this program. The Research Infrastructure Program provides support to aid in the establishment, enhancement, and operation of major experimental facilities planned to support research in all CISE areas. It recognizes the emergence of research groups requiring infrastructure strengthening in a variety of environments-those solely within a single academic department, those drawing from several departments in a single institution, and those which may span several different institutions.

CISE Institutional Infrastructure-Large Scale (discontinued in Fiscal Year 1993)

This program has provided support to aid in the establishment, enhancement and operation of major experimental facilities supporting research activities in the areas of computer and information science, computer engineering, or computational science supported in the CISE Directorate. In general, support has been provided for equipment, maintenance, technical support staff, and other appropriate costs.

CISE Institutional Infrastructure-Small Scale (discontinued in Fiscal Year 1994)

This expansion of the Institutional Infrastructure Program was established in Fiscal Year 1988 with the acceptance of proposals for five-year awards to support the establishment, enhancement and operation of experimental research facilities of a smaller scale than those encompassed by the Large-Scale Program. As in the Large-Scale program, awards are made for equipment, maintenance, technical support staff, and other appropriate costs for facilities supporting research activities in the CISE research areas.

CISE Institutional Infrastructure-Minority Institutions

Both one-year planning grants and five-year continuing awards are included in the Minority Institutions program. The program includes both research and educational components and provides funds to aid in the establishment, enhancement, and operation of experimental computing facilities at predominantly minority institutions to support activities in the areas of computer and information science, computer engineering, or computational science supported in the CISE Directorate.

CISE Educational Innovation Program

The objective of the Educational Infrastructure program is to stimulate innovative educational activities at the undergraduate level in CISE disciplines by encouraging the transfer of research results into the undergraduate curriculum.

Academic Research Infrastructure

The Academic Research Infrastructure Program (ARI) is designed to improve the condition of research equipment and facilities in our Nation's academic institutions in all disciplines. This program responds to needs identified by the academic science and engineering community. Funding is provided by the Office of Science and Technology Infrastructure

CISE/EHR/ENG/MPS-Collaborative Research on Learning Technology (CRLT)

The Directorate for Computer and Information Sciences and Engineering (CISE), for Education and Human Resources (EHR), and for Engineering (ENG), and for Mathematical and Physical Sciences(MPS) sponsor and manage the new joint program. The program responds to the national need to improve quality, accessibility and efficiency of learning and education—particularly, science, mathematics, engineering and technology (SMET)—at all levels.

CISE Postdoctoral Research Associates

These awards provide opportunities for recent PhD's to broaden their knowledge and experience and to prepare them for significant research careers on the frontiers of contemporary computational science and engineering, and experimental science. It is assumed that CS&E Associates will conduct their research at academic research institutions or other centers or institutions which provide access, either on site or by network, to high performance, scalable parallel computing systems and will conduct their research in academic research institutions or other institutions devoted to experimental science in one or more of the research areas supported by the CISE Directorate.

CISE Instrumentation

Awards in the CISE Instrumentation program are made for the purchase of special-purpose equipment or software to be used for research programs in the areas of computer and information science, computer engineering, or computational science supported in the CISE Directorate. The instrumentation is to be used by more than one project and is not intended to provide general computing capacity.

CISE Special Projects

The Office of Cross-Disciplinary Activities makes several awards in the Special Projects category and, in addition, coordinates and is responsible for funding cross-directorate projects. Projects include special activities related to women, minorities, and persons with disabilities..

CISE Research Experience for Undergraduates-Site Grants

Research Experience for Undergraduates (REU) provides undergraduates with hands-on training experience in active research in science and engineering. There are two categories of projects: (1) *REU Sites* and (2) *REU Supplements*. *REU Sites* are based on independent proposals to initiate and conduct undergraduate research projects for a minimum of six students. *REU Supplements* are intended to provide research experiences for one or two undergraduate students by adding support for them to existing NSF projects. *REU Supplements* are listed after the ongoing NSF grant they are supplementing.

Additional Information

For additional information on any of the projects, please contact the principal investigators directly.

The Foundation provides awards for research in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for such findings or their interpretation.

In accordance with Federal statutes and regulations and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the National Science Foundation.

The National Science Foundation has TDD (Telephonic Device for the Deaf) capability which enables individuals with hearing impairment to communicate with the Division of Human Resources for information relating to NSF programs, employment, or general information. This number is (703) 306-0090.

Facilitation Awards for Handicapped Scientists and Engineer (FAH) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on an NSF project. See the program announcement, or contact the program coordinator for more information at (703) 306-1697.

The Foundation welcomes proposals on behalf of all qualified scientists and engineers, and strongly encourages women, minorities, and persons with disabilities to complete fully in any of the research and research-related programs described in this document.

Catalog of Federal Domestic Assistance Number 47.070, Computer and Information Science and Engineering.

CISE Research Infrastructure Program

CDA-9625374
$673,312—12 mos.
Aho, Alfred
Columbia University
CISE Research Infrastructure: Scalable Multimedia Information Processing

This award is for the creation of a computer infrastructure that will enable realistic and practical demonstrations for future computing environments. The award will allow researchers at Columbia University to upgrade their storage, networking and processing capabilities to conduct interrelated research projects in four major areas: 1) High Performance Integrated Multimedia Information Systems; 2) Visual Information Processing; 3) Mobile Multimedia User Interfaces; 4) Scalable Systems for Mobile and Portable Computing. The requested research equipment, which is critical to support these research projects and will be treated as a shared resources, includes a data farm, a multimedia/visualization supercomputer, multimedia workstations, high-performance multimedia PC's and high-bandwidth networking hardware.

CDA-9401021
$247,807—12 mos.
Ambler, Allen
University of Kansas
DesignLab

This award provides support for the establishment of the Design Technologies Laboratory, or DesignLab. The laboratory will stimulate experimental research in technologies fundamental to building design support tools. Many such design support technologies are inherently nonprocedural and ill-suited to von Neumann uni-processor architectures. Efficient implementation strategies demand parallel and distributed computing environments with large shared memories and/or ultra high-speed interconnections. The requested equipment includes a 16-processor SGI Challenge and a very high speed network. The research topics to be explored include intelligent information databases for multimedia and 3D drawings; computer vision, modeling and visualization; declarative design specification languages; collaborative multi-agent design; meta-languages for defining reasoning systems; implementation strategies for non-procedural design technologies; and applied design technologies.

MIP-9420397
$250,000—12 mos.
Bajcsy, Ruzena
University of Pennsylvania
Rapid Prototyping of Rehabilitation Aids for the Physically Disabled

The methods of rapid prototyping are ideally suited to rehabilitation devices. Because each person requires unique performance and function in a rehabilitation device, devices specific to each person must be rapidly designed and produced. This project is investigating a completely integrated approach to the design and prototyping of passive mechanical rehabilitation devices. The approach involves: the quantitative assessment of the form and performance of human limbs; the design of the assertive device; evaluation of the device using virtual prototyping; feedback from the consumer and therapist; actual prototyping of the device; evaluation of the function and performance of the device; and redesign based on performance. The contributions of the product include: the development of new computer-based tools for the assessment of human performance; a manufacturing technique for a new class of hyperelastic materials; the integration of tools into a rapid prototyping system for rehabilitation devices; and development of mechanisms for systematic evaluation of the final product.

CDA-9216202
$150,000—12 mos.
Bruno, John
University of California-Santa Barbara
An Infrastructure Facility for Parallel Processing

This Institutional Infrastructure award is for the support of research projects in experimental and implementation aspects of distributed and parallel computing. The funds will support the acquisition of a parallel computer and for the support staff to maintain it. The research supported includes systems and programming issues for parallel machines, parallel algorithms, and dynamic visualization.

The High Performance Computing, Communications and Information Technology initiative recognizes as important to the nations future the development of new architecture computers to solve problems which now cannot be solved on computers. This infrastructure award gives the University of California, Santa Barbara the equipment necessary to participate in this research initiative.

CDA-9401124
$170,127—12 mos.
Campbell, Roy
University of Illinois Urbana-Champaign
Broadband Network Infrastructure and Data Storage for Research and Education

This award provides support for an experimental, high-speed network infrastructure that would interconnect parallel systems, large-capacity secondary and tertiary storage devices, and muli-media workstations capable of supporting high-quality digital audio and video. The network architecture is based on a broadband ISDN backbone of Asynchronous Transfer Mode (ATM) switches and fiber optics links. A high-bandwidth, gigabit/second HIPPI network would interconnect an Intel Paragon distributed memory parallel system and a tertiary storage system. The research spans three basic areas: system software infrastructure for managing high-speed networks, data pre-fetching and staging policies for high-latency, high-capacity secondary and tertiary data stores, and information access and multimedia collaboration software.

CDA-9623865
$372,876—12 mos.
Chen, Marina
Boston University
CISE Research Infrastructure: Research Infrastructure for Parallel and Distributed Systems: Real-Time, Multimedia and High-Performance

This award is for the acquisition of computing and communications resources to support the two primary research thrusts of the Computer Science Department's experimental scientists. The disciplines of both high performance computing and digital multimedia are characterized by their need for distributed computing nodes connected by high-bandwidth interconnections. For high performance computing, distributed architectures are necessary to achieve sufficient price/performance when constructing gigaflops-capable machines. In addition, high-bandwidth interconnects provide the necessary data distribution paths to supply each processor with work. For digital multimedia, distributed systems allow multiple simultaneous users, and high-bandwidth interconnects are needed to supply the demands of multiple video and audio streams per user. The equipment will also enable Boston researchers to apply advances in high performance computing to multimedia, medical imaging research and their three WWW related projects, capitalizing on the unique collective strength of the department.

CDA-9303150
$100,000—12 mos.
Cohen, Jacques
Brandeis University
Parallel Computing and Complex Systems

This award is for the acquisition of a parallel computer and several high performance work stations to support research in the Computer Science Department of Brandeis University. The department is engaged in three major areas of research: Parallelism and Languages, Data Compression, and Artificial Intelligence. The department is part of the Brandeis Center for Complex Systems and the theme of parallelism and the study of large complex systems is common to all three groups. The research topics to be explored by the parallel programming group include the design and analysis of parallel algorithms; and the design and implementation of high level parallel languages which facilitate the rapid construction of programs that can easily be verified to be correct and which can be compiled to run efficiently on MIMD and SIMD machines. Research topics of the data compression group include adaptive vector quantization with variable size vectors, adaptive video compression, issues in coding theory that include error resilient communication, the design of high speed data compression hardware, and context prediction for lexicography. Research topics for the AI group include data extraction from existing databases and text corpora, the role of memory in storing extracted data, and the construction of integrated agents that are data driven and exhibit goal directed behavior.

CDA-9401156
$63,630—12 mos.
Culler, David
University of California-Berkeley
A Next Generation Infrastructure for Integrating Computing and Communications

This award provides support for the development of Titan, a computing system consisting of an integrated ensemble of computing and communication elements, organized to provide the user with a number of services. These services will include multimedia capabilities in delivery vehicles; storage and communication; large computing power; large storage space; innovative parallel languages, debuggers, and libraries; and high accessibility from both mobile and fixed locations. The experimental facilities requested include workstations and servers constituting the backbone of the distributed system providing cycles to the user, ATM switches for linking workstations and servers, a video editing system, a massive storage unit, and equipment for linking the network to the currently available CM-5 parallel computer. The proposed research projects fall into three areas: network and communications; distributed supercomputer projects which are mainly concerned with providing parallel computing to every user through a combined architecture, operating systems, and pro-

gramming language effort; and multimedia services which requires integrating systems support, software support, and artificial intelligence tools to create, store, play, edit, search, input, and output multimedia objects. The networking, multimedia, and computing aspects of Titan form will form the infrastructure for a number of computationally intensive applications.

CDA-9303433
$400,000—12 mos.
DeFanti, Thomas
University of Illinois-Chicago
CISE Research Infrastructure

This award is for the establishment of a laboratory for research on the design, implementation, dissemination, and use of highly interactive computing technologies for the benefit of computational, biomedical and engineering sciences. The application areas share the need for very high-speed data capture and presentation facilities, very high bandwidth communication, and very large information stores. The research topics to be explored by this laboratory include the design and implementation of virtual reality environments; the storage, retrieval, and navigation of very large information stores; the design and evaluation of user-centered domain-specific, multi-media applications; and the remote, shared access to specialized instrumentation resources. The researchers come from the Computer Science Department, the School of Art and Design, the Department of Electrical Engineering, the Department of Bioengineering, and the Laboratory for Biomedical visualization. Extensive collaborations are in place with the National Laboratories. The award provides for the acquisition of instrumentation to match this research. The laboratory consists of the CAVE Virtual Reality Theater, a Database Computing Facility, an Interactive Multimedia laboratory, and a Networked Remote User Facility. The instrumentation provided consists of high performance visualization computers, mass storage devices, and high speed communications equipment.

CDA-9115428
$200,000—12 mos.
Dongarra, Jack
University of Tennessee
An Experimental Research Facility for Parallel Computing

The advanced Computing Laboratory in the Computer Science Department at the University of Tennessee has access to a number of new architecture high performance computers. This award is to upgrade the facility by the addition of a mixed mode Single Instruction Multiple Data (SIMD)/Multiple Instruction Multiple Data (MIMD) computer, increasing the number of processors in a shared memory MIMD computer, and providing partial support for a technician. The research supported by these computers include the design and development of portable, efficient numerical linear algebra algorithms; the development of non-numeric algo-

rithms for parallel architectures; the development of parallel algorithms for genome sequencing; and the development of parallel discrete optimization algorithms using the genetic algorithm method.

CDA-9643288
$416,209—12 mos.
Du, David
University of Minnesota
CISE Research Infrastructure: Collaborative Research Activities over the vBNS

This award is to the University of Minnesota in order to enable collaborative research activities over the vBNS. This is a supplement to a present NSF research grant. Under the existing CISE grant, the University of Minnesota is developing a prototype distributed computing, storage, and scientific visualization facility for the National Information Infrastructure. The vBNS connection will enhance the research projects currently funded under multiple federal grants in high performance computing and high performance networking. The proposed uses of the vBNS connectivity to be established include: distributed computing; visual supercomputing; and collaborative scientific visualization.

CDA-9303152
$174,001—12 mos.
Ehrich, Roger
Virginia Polytechnic Institute
Interactive Accessibility: Breaking Barriers to the Power of Computing

This award provides infrastructure for the support of laboratories for research in interactive computing, especially as it relates to human/computer interface studies. The principal investigators are drawn from the department of Computer Science and the department of Industrial and Systems Engineering. In addition, there are substantial collaborations with the Naval Research Laboratory and the Blacksburg Electronic Village. The laboratories are a Usability Methods Research Laboratory, an Interaction Technology Laboratory, and an Information Access Laboratory. This award is being jointly funded by the Cross Disciplinary Activities (CDA) Office and the Information, Robotics, and Intelligent Systems (IRIS) Division. The Instrumentation for the laboratories is being supported by CDA while the research is being supported by IRIS.

The specific research performed in the laboratories includes: identifying and overcoming usability and conceptional barriers to computing, the development of evaluation methodologies for determining the effectiveness of human/computer interfaces, development of environments for performing human/computer interface experiments, the development of expert-based information systems, the development of systems for access to computers for disabled users, and development of systems for access to computers for disabled users, and

development of several domain based interfaces for large data base systems.

CDA-9501637
$118,950—12 mos.
Fujimoto, Richard
Georgia Technical Research Corporation
CISE Research Infrastructure: Distributed Laboratories

This award provides support for infrastructure at Georgia Institute of Technology in the form of three distributed laboratories where individuals at geographically distinct locations can interact with each other on-line using powerful, distributed computational tools, to solve shared problems. The infrastructure includes a multi-granular compute server and ATM switch, a video server with high-performance multi-media workstations, and network equipment. The research topics explored included interactive steering, distributed simulations, collaborative systems; large-scale community, ATM and wireless networks.

CDA-9624082
$442,409—12 mos.
Fussell, Donald
University of Texas
CISE Research Infrastructure: System Support for a Hierarchy of Distributed Applications

This award provides infrastructure support for the researchers at the University of Texas at Austin to conduct the basic and experimental research necessary to address the problems that lie at the core of the emerging applications. Specifically, the research proposes projects at three levels: (1) core projects that will create an infrastructure for storing, accessing, and transporting large, heterogeneous information objects; (2) exploratory projects that will develop infrastructure which will facilitate the development of the core projects; and (3) realistic and ambitious applications from each of the following three classes. The first class is information retrieval applications, such as digital libraries. These applications will support browsing of large-scale, distributed databases of multimedia information. The second class of applications adds the requirement that the multimedia information be processed, not simply browsed. Finally, the third class of applications adds the requirement of real-time interactivity.

CDA-9401024
$211,469—12 mos.
Grosz, Barbara
Harvard University
Infrastructure for Research towards Ubiquitous Information Systems

This award provides support for the development of a new generation computing facility to support experimental research in ubiquitous information systems. The equipment infrastructure includes Asynchronous Trans-

fer Mode (ATM) networks, file servers capable of handling video, and graphics workstations with advanced human interface capabilities. The research topics to be explored span the development of new technologies that support rapid transmission of large amounts of data between computer systems to the development of more flexible and adaptable systems for human-computer communication.

CDA-9502631
$160,500—12 mos.
Hanrahan, Patrick
Stanford University
CISE Research Infrastructure: High Performance Graphics and Imaging

This award provides support for a high performance giga-flop compute server, a high performance 3D graphics server, a high performance image/video/data server, and a high bandwidth network to couple these machines together. The requested equipment will contribute to the computational infrastructure of a new computer graphics laboratory. Many national challenges such as health care, education, manufacturing, and crisis management, require graphics and imaging technologies. The investigators will be working in the areas of graphics systems and algorithms, involving research in efficient rendering algorithms, high-performance graphics architectures, and coupling compression and graphics; in scientific visualization with research in volume rendering for scientific and medical applications; in vision and graphics with research in the digitization of 3D models; and in imaging and video with a focus on the manipulation of image and video databases.

CDA-9643633
$25,715—0 mos.
Henderson, Thomas C.
University of Utah
Computer Aided Prototyping

This is a supplement to the original infrastructure award and, it enhanced the award by making it more national in scope. ARPA provided the funds to UTAH to develop a test suite of descriptions of physical objects that will be used to validate automated manufacturing systems.

This Institutional Infrastructure award is to support research in the general area of Computer Aided Manufacturing Engineering. The approach taken by the Utah group is computer aided prototyping of objects to be manufactured. The process is broken down into three separate areas of research: design, prototyping, and validation. The design aspect of the research involves enhancing the Alpha 1 computer aided geometric design system. This system is able to mathematically describe objects to be manufactured. It is enhanced by incorporating some commonly occurring manufacturing steps into the model as special elements (e.g., this hole is to be counterbored). The prototyping aspect is to take the

mathematical description of the object (say a gear) and generate the NC codes and the tooling sequences necessary to actually produce the item on a machine center. The University of Utah already possesses a five axis machine center, a CNC turning center, 3-D polymer equipment, and robotics equipment and so can experimentally validate their research. A long term goal is to optimize the tooling sequences and other necessary manufacturing activities in order to have the factory operate without human supervision. This prototyping facility would also be used in collaborative work with Dr. Jacobsen's Center for Engineering Design. This center designs and manufactures many prototype items. The use of computers to aid and guide manufacturing is more common in Japan and the European countries than in the United States. This Institutional Infrastructure award is for the support of an automated manufacturing laboratory that will allow the quick design and prototyping of manufactured items. Once the prototype is deemed acceptable, methods of improving the manufacturing of the item, particularly in small batch numbers, can be explored. The University of Utah has a long history of successful industrial collaborations and it is expected that the results of this research will be widely disseminated to the United States manufacturing industry.

CDA-9643633
$62,891—0 mos.
Henderson, Thomas C.
University of Utah
Computer Aided Prototyping

This supplement is for support of the annual meeting of Institutional Infrastructure grantees. The purpose of the annual meeting is to share research results and to share information regarding acquisition of infrastructure, the management of large facilities, and the management of computer research laboratories in universities.

CDA-9503064
$312,247—12 mos.
Hollan, James
University of New Mexico
CISE Research Infrastructure: Effective Information Access: Computer Science Research Fundamental to Creation of a National Information Infrastructure

This award provides support for visualization facilities, servers to support distributed simulation, and a high-speed cluster network. In addition the University of New Mexico will establish a National Information Infrastructure (NII) Experimental Laboratory in the Science and Engineering Library to serve as a shared research testbed, as well as to facilitate efforts in distributed simulation and research collaborations in Biology, with the Santa Fe Institute and the National Laboratories. The Laboratory equipment will include graphics workstations connected via a high-performance local area network to high-end symmetric multiprocessing systems, an SGI

Power Onyx and Power Challenge, and to remote high-performance facilities at the Maui High Performance Computing Center's IBM SP-2, the Sandia National Laboratory's Intel Paragon, and the Los Alamos National Laboratory's CM-5. The University will build on its existing strengths in adaptive computation, human computer interaction, information analysis, and simulation to focus on adaptive multiscale interfaces; distributed computation, communication, and security for network-based applications; data mining and filtering; and improved access to distributed simulation.

CDA-9616321
$64,803—12 mos.
Horowitz, Ellis
University of Southern California
SCENE: The USC Experimental Networking Environment for Protocol and Database Research

This award is for the acquisition of a network testbed for the experimental networking and distributed database research at the University of Southern California. The primary research activities are concentrated in two main areas: Network Control Protocols and Distributed Databases. The main feature that these two diverse research areas share is a need to (1) solve problems involving multiple nodes, (2) complement existing modeling, simulation, emulation, and small scale implementations with multi-node prototypes, (3) isolate the resulting network from the campus production network, and (4) employ a support staff to maintain and operate the network. The study of distributed networks is important because of the wide availability of inexpensive workstations that can be easily linked together. Not so easy is how to utilize these networks effectively. The study of network protocols is critical to this task as is the study of distributed databases. This award supports both areas.

CDA-9624396
$805,884—12 mos.
Huang, Thomas
University of Illinois
A Shared distributed Facility for Multimedia Signal Processing and Visualization with Applications to Human Computer Intelligent Interaction.

This Infrastructure award supports the acquisition of computational, networking, and human interface equipment for multimedia laboratory for the investigation of human centered information systems. The facility will connect three institutes: the Beckman Institute for Advanced Science and Technology; the Coordinated Science Laboratory; and the Digital Computer Laboratory.

The research supported by this laboratory will include research in multimodal human computer interaction, multimodal imaging and visualization, multiresolution representation and processing, and multimedia storage, networking, and communication.

CDA-9502639
$220,535—12 mos.
Kurose, James
University of Massachusetts @ Amherst
CISE Research Infrastructure: Infrastructure to Support Research on Networked Multimedia Information Systems

This award provides support to equip a networked, experimental testbed to enable research in the development of the operating system, I/O, networking, object management, and information retrieval components of future networked multimedia information systems. The testbed will consist of two shared-memory multiprocessor facilities attached to several parallel mass storage I/O devices and a high-speed ATM network. The research team will be developing several key hardware and software technologies needed to support future networked, multimedia information systems. Specific research areas include operating systems, I/O, networking, object management and information retrieval.

CDA-9401142
$391,406—12 mos.
LeBlanc, Thomas
University of Rochester
Rapid Prototyping of Parallel Robot Vision Systems Using Virtual Reality and Systems Simulation

This award provides support for the establishment of a laboratory that uses two types of simulation technologies in the design of visually controlled robotics systems. The first type of simulation technology is the simulation of sensory interaction with physical environments, popularly known as "virtual reality". Virtual reality can replace the real world in testing and debugging a system. The second is execution-driven simulation of complex parallel algorithms at the level of individual messages and memory accesses, which can address the performance and low-level real-time problems of interacting processes. The experimental facilities requested include a Silicon Graphics Reality (SGI) Engine for scene generation in the simulated world, an upgrade of an existing SGI Challenge multiprocessor for simulation of the virtual world and control software, a computational engine for performing real-time intermediate to high-level vision, a hydraulic robot arm for real-time manipulation, a small-scale multi-processor for device control and medium-level vision, and general purpose workstations. The focus of the proposal is the development of simulations to aid in the development of real-world robotics systems. Research topics to be explored include the development of principles for constructing complex physical autonomous systems; the development of new modes of simulation for virtual reality, and simulation and implementation of robotics control algorithms.

CDA-9624099
$596,131—12 mos.
Li, Kai
Dobkin, David
Princeton University
CISE Research Infrastructure: Network of Symmetric Multiprocessors: An Infrastructure for Research in Scalable Systems and Applications

This award provides support for a research infrastructure based on commodity PC-based Symmetric MultiProcessor (SMP) servers, high-speed networks, and customized network interfaces and communication software. It will enable new research activities, extension of on-going research activities and will generate synergy among the several research efforts. Key research areas which will be enabled by the infrastructure include virtual memory-mapped communication, efficient shared virtual memory, scalable virtual storage servers, efficient message passing, and performance measurement. Application areas include scalable DNA computing simulations, parallel fluid dynamics, particle-based computation in a homogeneous medium and projects in parallel computational biology. The infrastructure consists primarily of stock hardware, but in quantity large enough to investigate the viability of building a large-scale scalable system.

The infrastructure will be constructed in three phases: an initial phase, a building phase, and a large-scale experimental phase. In the initial phase, four PC-based SMP servers will be connected together with a custom-designed network. In the building phase, 16 PC based SMP servers will be connected with a high speed commercial network and a Myricom/Princeton customized network. In the experimental phase, 32 next generation PC-based SMP servers will be connected with a commercially available high-speed network and a Myricom/Princeton customized network. All research projects will utilize the infrastructure to conduct large-scale experiments.

CDA-9318145
$200,000—12 mos.
Messina, Paul
California Institute of Technology
Parallel I/O Methodologies for I/O-Intensive Grand Challenge Applications

The Grand Challenge Application Groups competition provides one mechanism for the support of multidisciplinary teams of scientists and engineers to meet the goals of the High Performance Computing and Communications (HPCC) Initiative in Fiscal Year 1993. The ideal proposal provided not only the opportunity to achieve significant progress on (1) a fundamental problem in science or engineering whose solution could be advanced by applying high performance computing techniques and resources, (2) enabling technologies which facilitate those advances, but also significant interactions between scientific and computational activi-

ties, usually involving mathematical, computer or computational scientist, that would have impact in high performance computational activities beyond the specific scientific or engineering problem areas(s) or discipline being studied. This multi disciplinary project will investigate and develop strategies for efficient implementation of I/O intensive applications in computational science and engineering. Scalable parallel I/O approaches will be pursued by a team of computer scientist and applications scientists who will work together to:

*Characterize the I/O behavior of specific application programs running on large massively parallel computers

*Abstract and define I/O models (templates)

*Implement and test application-level I/O tools on large-scale computations

The Pablo performance analysis environment will provide the foundation for the performance instrumentation and analysis. The application programs are already fully operational on advanced architecture systems and their authors are all co-investigators in this project. The principal computers used will be the Intel Touchstone Delta and Paragon systems at Caltech, each with over 500 computational nodes. Five application areas will be included: fluid dynamics, chemistry, astronomy, neuroscience, and modeling of materials-processing plasmas. The parallel programs for these applications cover a range of I/O patterns and volume, and the techniques that will be developed in this project will be of relevance to a broad spectrum of engineering and science applications. In addition, by overcoming their current I/O limitations, the specific applications targeted in this award will achieve significant new science and engineering results. By the end of the project, sustained teraFlops computers will become available. The project will devise and implement general methods for scalable I/O using today's advanced computers, immediately apply those methods to carry out unprecedented applications in several fields, and use the methods and experience gained in the first half of the project to tackle the I/O issues in future sustained teraFlops computers. This project will be carried out by a team of researchers who have many years of experience in using parallel computers for large-scale applications, in measuring and characterizing the behavior of applications on such computers, and in creating methods and tools that facilitate the use of such systems. Building on this considerable experience, the project will concentrate initially on exploring the I/O behavior of existing applications and on devising ways to get adequate and scalable I/O performance. The five application areas included in this award cover a wide range of I/O needs and behavior, including the use of out-of-core methods, reading data from high-speed instruments, interactive and irregular data flows in modeling, and pipelining of data from distributed computing resources on high-speed networks. A key part of the approach is an integration effort that will concentrate on ensuring close communication and synergy among the components of the project and on inte-

grating the results. The primary objective of the project is to develop methods and insights that are as generally applicable as possible. This award is being supported by the Advanced Projects Research Agency as well as NSF programs in engineering and computer science.

CDA-9415797
$200,000—12 mos.
Messina, Paul
California Institute of Technology
Scalable I/O Initiative

This award supports the infrastructure for the Scalable I/O national project. This national project will investigate many of the issues surrounding the scalability of Massively Parallel Processing (MPP) System input and outputs. The national project consists of 18 application groups involving more than 30 researchers. The equipment provided by this award consists of I/O nodes for an MPP and a small MPP for crashable experimentation. The infrastructure will be available to all of the application groups for their experimental research needs.

CDA-9500991
$198,999—12 mos.
Myers, Eugene
University of Arizona
CISE Research Infrastructure: A Laboratory for Scalable Systems

This award provides support for the research infrastructure necessary to investigate the viability of building scalable systems from commodity components. Hardware components will include workstations and ATM switches. Research topics to be conducted include the design of an operating systems that scales with processor performance; and the design, implementation and experimentation of five different scalable systems: DNA Assembly Server, Scalable Storage Server, Cluster-C* applied to remote sensing, a general computing environment based on an efficient fine-grain parallelism on multiple processors, and a parallel simulator.

CDA-9623632
$434,192—12 mos.
Naughton, Jefferey
University of Wisconsin
CISE Research Infrastructure: MIDSHIP: Managing Image Data for Scalable High Performance

This award is for the acquisition of a cluster of shared-memory processors (SMPs) to support the MIDSHIP project of research into enabling technologies for large-scale mining of image data sets. The equipment will help researchers at the University of Wisconsin to perform research: (1) on the application side: medical image mining using mathematical programming techniques, machine learning techniques applied to image understanding, view synthesis and visual exploration, and querying by image content; and (2) on the systems infrastruc-

ture side: parallel hardware and software systems, performance tools for profiling parallel systems performance and analyzing workload requirements, image storage and compression, and parallel image database management technology. It will also support a wide variety of research projects in such diverse fields as Biological Science, Geology, Materials Science, Medicine, and Space Science.

CDA-9216172
$145,740—12 mos.
Quinn, Michael
Oregon State University
A Laboratory for Joint Research in Artificial Intelligence and Parallel Computing

This Institutional Infrastructure award is for the support of research projects in artificial intelligence and parallel computing. The infrastructure consists of a parallel computer and the staff to maintain the computer. The projects supported by this award include learning algorithms, real time decision making, data-parallel compilers, and parallel programming support environments. Parallel computers are research tools in two senses. The first is that they provide a substantial increase in computational power. The second is that they act as an experimental vehicle for new systems software that needs to be developed in order to use the computers effectively. This award addresses both questions. The artificial intelligence research needs the computing power while the compiler and support environment work needs the experimental vehicle.

CDA-9123502
$330,000—12 mos.
Rice, John
Purdue University
Softlab-A Laboratory for Computational Science

This award is to support the building of Softlab, a laboratory that supports research in computational science and engineering. The facilities provided include:

1. High performance graphics processors for scientific visualization, geometric modeling, and multimedia graphical user interfaces for parallel programming and programming in the large.

2. High-performance computing power, upgrading Purdue's parallel machines.

3. Software and development support staff assisting application researchers in making full use of this facility comprising a rich spectrum of high-performance workstations, powerful parallel machines, and dedicated graphics processors.

4. A teaching laboratory providing exploratory course that migrate cutting-edge research into the curriculum with access to state-of-the-art facilities. This laboratory will be the principal facility of a proposed new interdisciplinary graduate degree program in Computational Engineering and Science.

CDA-9115021
$111,091—12 mos.
Sahni, Sartaj
University of Florida
Laboratory for Parallel Processing

The infrastructure award is for the acquisition of equipment to develop a laboratory for parallel processing. The major acquisition is a 64 processor MIMD (Multiple Instruction, Multiple Data) parallel computer and workstations. Research will be performed in software engineering, parallel algorithms and data structures, networks and simulation, computer vision, and database management systems. The advent of new architecture parallel computers has opened new areas of research related to the effective use of these computers. The MIMD computers work by allowing individual processors to operate on independent data streams. The discovery of algorithms to effectively use this type of architecture is a major research question crossing several disciplines. The parallel processing laboratory at the University of Florida is investigating several research topics ranging from experimental algorithm studies to computer vision applications.

In particular:

1. The software engineering group is developing a parallel programming language environment to be used in the development of parallel programs in conjunction with a knowledge based development and maintenance environment.

2. The parallel algorithms group is concentrating on experimentally determining bottlenecks with both processor communication and input/output devices. The experimental results will be compared with theoretical models of performance.

3. The network and simulation group is using the parallel computer as both an experimental testbed for load balancing and other performance enhancing algorithms and as a computational resource to perform complex situations.

4. The computer vision group is developing algorithms to utilize parallelism. There is a natural match between many vision applications and the MIMD architecture.

5. The database management group is designing algorithms to implement an object oriented semantic database model on a MIMD architecture computer.

CDA-9502956
$286,203—12 mos.
Schnabel, Robert
University of Colorado-Boulder
CISE Research Infrastructure: High Performance Infrastructure for Computational Science

This award provides support for high-speed networking equipment, high-performance multiprocessor workstation servers. a high-speed disk array, and multimedia devices for collaboration, exposition and visualization. The University of Colorado department of Computer Science will be addressing issues of data movement in Grand Challenge and National Information Infrastructure (NII) applications. This in conjunction with the floating point needs of Grand Challenge computations, leads to their request for high-speed computation and communication infrastructure. The research associated with the infrastructure falls into four inter-related projects in the area of scientific computing, distributed systems, and resource discovery. These four projects are data movement in Grand Challenge computing, global optimization algorithms for molecular configuration problems, compiler-assisted network runtime systems, and resource discovery and information sharing.

CDA-9623614
$480,877—12 mos.
Thompson, William
University of Utah
CISE Research Infrastructure: Modeling Complex Physical and Computational Environment

This award is for the creation of a Modeling and Simulation Support Facility, constituting vital infrastructure for work on end user applications in novel computer architectures, manufacturing and design, process control, teleoperations, and medicine; while also serving as a testbed for innovations in machine architecture, hardware, and software systems. The Modeling Facility will use state-of-the-art technology to achieve high-bandwidth, low-latency machine-to-machine communications, resulting in significant computational leverage. The use of multiple heterogeneous and potentially specialized computers in a tightly coupled communication environment permits model builders to explore novel parallel simulation methods that can greatly reduce simulation run times. This increase in capability permits entirely new classes of critical problems to be solved. Modern simulations produce large quantities of data, the interpretation of which may not be immediately apparent. Thus, the second central component of the Modeling Facility is a large capacity storage management system. Finally, the Modeling Facility will be equipped with several special purpose devices that can exploit the communications and data management facilities to tackle large-scale problems that are currently infeasible in a traditional academic computing environment.

CDA-9502645
$75,021—12 mos.
Truszczynski, Miroslaw
University of Kentucky
CISE Research Infrastructure: A Laboratory for Research in High Performance Distributed Computing

This award provides support for the acquisition of a high-performance distributed cluster-based computing system consisting of a number of high-performance multiprocessor workstations interconnected by a high-speed LAN. These LAN-connected clusters will themselves be interconnected by a high-speed ATM backbone network. The Computer Science department will thus build a distributed multicomputer based on a scalable, distributed shared memory paradigm which will facilitate the department s research efforts in distributed and parallel computing, distributed multimedia, vision and scientific computation, and distributed control for manufacturing.

CDA-9401159
$181,384—12 mos.
Turner, Jonathan
Washington University
A Research Infrastructure: A Laboratory for Research in High Performance Distributed Computing

This award provides support for extending and enhancing a broadband multi-media network to support a set of closely related collaborative research activities in the area of distributed imaging and visualization. The network will utilize Asynchronous Transfer Mode (ATM) technology for the fast distribution of high-resolution images, visualizations, studio-quality video and multi-rate data. The research topics fall into two categories: research on enabling technologies such as scalable networks, host/network interfaces supporting multimedia applications, design and analysis of large-scale multimedia information servers, protocols and operating systems, scalable parallel processing and declarative visualization. And secondly, research on the application of these technologies to real distributed imaging and visualization systems.

NCR-9616754
$2,087,515—48 mos.
Turner, Jonathan
Washington University
(Split funded with Office of Cross-Disciplinary Activities for $1,000,000) Total award $3,087,515
Gigabit Network Technology Distribution Program

In recent years research in networking, distributed systems, and high performance computing has been hampered by the research community's limited access to high performance networking equipment, and more importantly, the detailed technical information needed to use it effectively in experimental systems research programs.

This project provides gigabit network technology to US universities for use in research and education. This

technology is distributed in the form of Gigabit Network Kits, each kit consisting of a high performance ATM switch (supporting link speeds of up to 2.4 Gb/s), six network interface cards for workstations or PCs, software (including source), extensive documentation, including hardware design information. The kits are designed to permit flexible use in a variety of different systems research contexts (networking, operating systems, multimedia and high performance computing), and can be modified at both the software and hardware levels.

In addition to the hardware and software, the program provides initial user training in the form of a two week intensive course and ongoing support through a users' group, an electronic mailing list and a WWW site providing access to software, documentation, announcements of contributed research products, bug reports and a FAQ page. Hardware support is also provided. The program also provides for a series of user workshops, (one every six months), allowing users to share experiences and demonstrate results from their work.

CDA-9123483
$120,000—12 mos.
Vitter, Jeffrey
Duke University
SIMD/MIMD Parallel Computing: Computational Theory, Scientific Applications and Systems Research

This proposal supports the acquisition of a parallel computer capable of operating in both Single Instruction, Multiple Data mode and Multiple Instruction, Multiple Data mode. The computer will be used to support research in operating systems, scientific computing, parallel algorithms, VLSI design, and logic programming. Collaborations with other departments, particularly with computational physics and chemistry, will also be enabled by the acquisition of this computer.

CDA-9303181
$318,333—12 mos.
Warren, David
SUNY @ Stony Brook
PROUD: Parallel Resources on User's Desks

This is an award for equipment to investigate the development and scalability of algorithms and systems for parallel computers. The instrumentation to be acquired include a number of high performance parallel workstations, a scalable distributed memory multiprocessor, and a high speed network. The research supported by this infrastructure includes organic chemical synthesis, automated theorem proving, very high speed transaction processing, parallel prolog, 3-D graphics and volume visualization, and simulations of massively parallel computers.

CDA-9624662
$217,499—12 mos.
Weiss, Stephen
University of North Carolina @ Chapel Hill
CISE Research Infrastructure: Infrastructure for Research in Collaboration Systems

This award is to support an established, on-going program of research in distributed, collaborative, and multimedia systems. The infrastructure will enable new basic research in system support for distributed collaboration. Projects include: Multimedia Networking, Hypermedia Systems, Application-Sharing, Collaborative Virtual Environments, and Interoperable Collaborative Environments. In addition, researchers at the University of North Carolina will also work with a group of forensic pathologist, located at the Armed Forces Institute of Pathology to build a digital library of pattern-injuries containing text, images, audio/video sequences, charts, diagrams, and numerical data. This testbed will enable groups of forensic pathologist to consult a large repository of case data as well as consult with one another, and jointly create new cases using conferencing and collaboration tools.

CDA-9422701
$100,000—12 mos.
Weymouth, Terry
University of Michigan
Prototypes for Clinic-Based Collaboration

This award is made in support of the NSF initiative ENG-CISE-IITA94, National Challenges. It is a joint initiative between the Engineering Directorate and the Computer Information and Engineering Directorate. A collaborative test bed will be developed to support consultations between geographically distributed primary care physician and radiological specialists and sub-specialists in tertiary care hospitals. The focus will be on the design, implementation, and the evaluation of a prototype system for synchronous and asynchronous viewing of medical images over a distance. This project will simultaneously address three research issues: adaptation of conventional medical diagnostic practice to remote collaborative technology; creation of a tool kit of computer applications to facilitate adaptation of these practices; and assessment of the impact of remote collaborative technology on medical diagnostic practice. These three aspects of the study reinforce each other through the use of rapid prototyping strategy. A working system will be delivered to physician users early in the project and then maintained on a frequent cycle of user feedback, responsive redesign, and systematic evaluation. To be successful, rapid prototyping approach requires the ability to correctly determine initial user needs, the ability to quickly evolve technology to meet these requirements, and continuously monitor whether deployed technology is satisfactory. Therefore, this project team will be multi-disciplinary, encompassing

physicians who will offer expert input into the design and development process, computer scientists familiar with user-oriented application development, and social scientists trained in the assessment of the impact of technology on work practices and routines.

CDA-9303189
$109,298—12 mos.
Wise, David
Indiana University
An Infrastructure for Conceptualization and Visualization

This award provides infrastructure for the support of Conceptualization and Visualization of Computation. The equipment supported includes high performance graphical workstations, a parallel computer, and high speed networking facilities. The faculty involved in the project are drawn from the department of Computer Science but have substantial collaborations with computational scientists and engineers at Indiana University. The research supported by this infrastructure includes automated theorem proving, circuit validation, parallel functional programming, scientific visualization, visualization of Monte Carl methods, visualization of processor utilization on scalable architectures, visual programming, and visual performance monitoring and analysis.

CDA-9216171
$121,725 —12 mos.
Wolf, Wayne
Princeton University
Experimental Facilities for Application-Directed System Synthesis

This Infrastructure Award provides computational infrastructure for use in the areas of video coding and image understanding and fast-turnaround system synthesis. The former research area requires massive data stores

and special purpose video processors. The latter area requires fast simulations. The infrastructure provided under this award includes both the special purpose computational video equipment and storage devices and the high speed workstations necessary for both research areas. Digital High Definition Television requires massive amounts of memory and substantial processing power. This infrastructure award is providing research equipment for investigations into digital video imaging and processing. The award also provides for a collection of very high speed workstations for the rapid simulation of computer systems. This capability will allow these systems to be much more rapidly developed.

CDA-9502791
$311,737 —12 mos.
Zwaenepoel, Willy
Rice University
CISE Research Infrastructure: Multi-Processor Cluster Computing

This award provides support for the acquisition of a cluster of shared-memory multiprocessor nodes interconnected by a high-speed network to support research in parallel programming systems, and algorithms and applications from a wide variety of disciplines. The infrastructure will be used as a research vehicle for computer systems designers as well as computational scientists. Research projects to be supported include work on compiler and runtimes for multiprocessor clusters, high-performance I/O, and performance visualization; and algorithms and applications in mixed integer programming, molecular dynamics, reservoir simulation, genetic linkage analysis, and seismic modeling. The infrastructure will also be used in new graduate and undergraduate courses in multidisciplinary design optimization, and parallel computing.

CISE Minority Institutions Infrastructure

CDA-9633519
$201,065—12 mos.
Adjouadi, Malek
Florida International University
CISE Minority Institutions Infrastructure:
Multidimensional and Multispectral Information
Processing and Computational Aspects

This grant provides support for graduate students to continue their research with a center serving a strong graduate minority population, the NSF funded Center for Advanced Technology and Education (NSF-CATE). The research areas include real-time applications of computer vision, neural networks, and multidimensional and multispectral signal analysis and modeling, all under a highly distributed and parallel platform. This support provides a strong basis for the development of visual/ sensing techniques in a multi-dimensional and multi-spectral framework to address various dynamic and static phenomena viewed either through real-time confocal microscopy, flow cytometry, or a high-speed motion analyzer. Modeling of dynamic phenomena which integrate time with the three spatial dimensions; real-time image analysis and interpretation; application of the fundamentals of the wavelet theory; and implementations of the functional principles of the hypercolumn theory of the visual cortex constitute key research endeavors under this proposal. The important concepts of parallelism, data compression and high-speed data communication play a significant role in the aforementioned research goals. The existing NSF-CATE infrastructure and the support of this grant allows for a significant impact to be made not only in enhancing the theoretical foundation of the outlined research goals, but in carrying-out key applications with our industrial partners, especially in biomedical diagnostics.

CDA-9522157
$171,001—12 mos.
Alo, Richard
University of Houston
CISE Minority Institutions Infrastructure: Improving
Research and Undergraduate Education in Computer
Science

This award provides for infrastructure designed to substantially increase the numbers of minority students going into and completing degrees in the computing disciplines at the University of Houston-Downtown. The project has three primary components: Students, Academic Program, and Research with strong recruitment, mentoring, curriculum enhancement, and research development activities as parts of the project. Collaboration with Rice University has been established and will be an important part of the overall effort. Community college linkages will be initiated, a Saturday Academy for high school students has been established, research experiences for undergraduates will be expanded, and the faculty research environment will be enhanced. It is anticipated that this project has the potential to become a model for development of programs for minority success at other similar urban universities.

CDA-9522207
$239,888—12 mos.
Bernat, Andrew
University of Texas—El Paso
CISE Minority Institutions Infrastructure: Building
Affinity Groups to Enable and Encourage Student Success
in Computing

This award provides infrastructure support for a program designed to substantially increase the number of minorities, particularly Hispanics, who complete degree programs in the areas of computer and information science and engineering. It involves both the Computer Science and Computer Engineering Departments at the University of Texas at El Paso (UTEP). The project is built around the concept of Affinity Groups, groups which are centered about a research area and which involve both graduate and undergraduate students and one or two faculty members at the center of each group. Within the groups, emphasis is on developing social and communication skills as well as on research and technical skills. A strong evaluation component is built into the project. It is anticipated that the structure developed has the potential to become a model for the success of minority students at a wide range of similar urban, commuter institutions.

CDA-9642542
$5,304—0 mos.
Bernat, Andrew
University of Texas, El Paso
A Center for Excellence for Computer Science

This supplement to CISE II-MI Center of Excellence for Computer Science Education and Research grant supports the expenses incurred for a Research Workshop held within the programmed workshop exploring CS/

CE Curriculum. Its purports to foment collaborative proposals for the NSF-CONACyT initiative, thereby sustaining one of the goals of the original proposal: increase minority research in the academic and research areas supported by the CISE Directorate.

CDA-9215983
$191,519—12 mos.
Ellis, Mary
Hampton University
Hampton University Experimental Laboratory for Promoting Education and Research (HELPER)

This award provides infrastructure support for the development of the research and educational activities of the Hampton University Experimental Laboratory for promoting Education and Research. The support includes computing resources, as well as awards to undergraduate and graduate students. The investigators will be conducting research in the areas of (1) high-speed/parallel computing, (2) software engineering, (3) computer graphics, and (4)artificial intelligence/expert system development.

CDA-9633159
$45,477—12 mos.
Eschen, Elaine
Fisk University
CISE Minority Institutions Infrastructure Grant: Expanding the Minority Pipeline: Computer Science at Fisk University

Fisk University, a small HBCU-MI with 69.8% female students has an outstanding reputation of producing highly qualified graduates in many scientific disciplines. As such, Fisk is excellently situated to be instrumental in the national effort to increase the numbers of African-Americans and women in computer science. The purpose of this project is to design a five-year plan for the development of the human and technological infrastructure necessary for Fisk to be a national model for the attraction and retention of female and African-American computer science students. To attain this goal Bellin and Monroe of North Carolina Agricultural & Technical State University recommend that three main program components be addressed: recruiting, mentoring and graduate study (Computing Research News, Jan. 95). Instead of targeting isolated aspects of the student experience, a broad strategy that manages all stages of student progress from high school to professional career is proposed. Recruitment is addressed by outreach and bridge programs, and expanded computer science specific recruitment efforts. Retention strategies include scholarships and mentoring at all levels. The establishment of a graduate degree program and under-graduate research programs is an integral part of the plan. The enhanced infrastructure supports the expansion of faculty research programs which are the basis for student research activities.

CDA-9417659
$212,046—12 mos.
Espinosa, Ramon
University of Puerto Rico-Mayaguez
Development of a Computer Engineering Research Environment at the University of Puerto Rico-Mayaguez

The ECE Department of the University of Puerto Rico at Mayaguez has a tradition of producing highly qualified Computer Engineering graduates with the necessary skills, knowledge, and expertise to succeed in either graduate school of the industrial environment. Involving undergraduates students in research as; increased their enthusiasm and interest in their studies, provided them with additional knowledge and experience, increased their employment opportunities, and motivated them towards graduate school. Besides continuing this successful undergraduate research program, the major goal of this project is to develop the research environment needed to start a Ph.D. program in Computer Engineering and to increase minority participation in graduate school and research. To maintain an excellent research environment and to accomplish the CISE II-MI program's goal of increasing minority participation the following activities are planned:

- to create a proposal during the first two years to establish a Ph.D. program in collaboration with the Mathematics Departments of the Rio Piedras and Mayaguez Campuses:

- establish a plan to retain and increase minority participation; conduct research and establish a productivity plan for researchers;

- establish a plan for faculty development;

- acquire new research equipment; and

- establish a Computer Engineering Center to administer and coordinate the proposed activities

CDA-9522079
$240,763—12 mos.
Giguette, Marguerite
Xavier University
Minority Institutions Infrastructure: Furthering the Goal of Increasing the Number of Minority Undergraduates and Graduates

This award provides support for a comprehensive program that will make substantial infrastructure changes to the computer science and related disciplines at Xavier University. The goals of the program are 1) to increase the number of majors in CISE disciplines by 50%, 2) to increase the number of CISE majors who go to graduate school by 100%, and 3) to expand the research activities of all of the CISE students and faculty. These goals will be addressed by revising and significantly expanding the current summer outreach programs, expanding the undergraduate research and mentoring programs, and establishing new teaching and research laboratories. This project builds on the very successful simi-

lar efforts in the health sciences at Xavier. It is anticipated that comparable results can be achieved in the computing disciplines as well and that the model developed in this project has the potential to become a national model for minority student success at other similar institutions.

CDA-9313299
$249,823—12 mos.
Harmon, Marion
Florida A&M University

Institutional Infrastructure Minority Institutions Program: Software Engineering Research and Education Laboratory

This award provides infrastructure support for the development of research and educational activities in the area of software engineering in the Department of Computer Information Systems at Florida A&M University. Included in the program is a research productivity enhancement component, a computer facilities enhancement component, an instructional program enhancement component, and a student success assurance component. The program will improve the research productivity and instruction effectiveness of the department resulting in an increase in the number of minority students entering graduate programs and the computer science field.

CDA-9633299
$297,621—12 mos.
Hiromoto, Robert
University of Texas @ San Antonio

CISE Minority Institutions Infrastructure: Building an Academic Pipeline for Minority Scholars

This project builds a pipeline of minority students, focusing on the retention of qualified undergraduate and graduate students by appropriate financial support and mentoring activities. The goal is to involve students directly in ongoing faculty research projects and thus prepare them for graduate studies and research programs. Graduate minority students involved in the program will help faculty in mentoring undergraduates, in addition to their own studies and research obligations. The project encompasses two main thrust designed to improve the pipeline of minority students prepared for graduate programs. The first goal is to aggressively recruit and develop minority students interested in computer science by providing preparatory training, tutoring, and mentoring at the pre-college and lower-division undergraduate levels. The second goal is to provide upper-division and graduate students with funding support and increased involvement in faculty research in order to improve minority retention and graduate enrollment.

Students will be involved in faculty research within five important areas:

1) parallel and distributed algorithm design for applications in high-performance scientific computing;

2) software visualization, and program execution monitoring;

3) parallel compiler technology;

4) network routing and scheduling algorithms;

5) parallel and distributed simulation techniques.

CDA-9633155
$29,715—12 mos.
Karant, Yasha J.
California State University—San Bernadino (CSUSB)

CISE Minority Institutions Infrastructure: Infrastructure Improvement to Increase Access for Minorities to CISE Career

The purpose of this NSF CISE MII planning grant proposal is to provide minority students enrolled in the CISE disciplines of Computer and Information Science at California State University, San Bernadino (CSUSB), with facilities to pursue careers in the CISE fields. To achieve this goal, this planning grant will develop an NSF MII proposal and integrate the NSF funding with existing and newly developed funding sources necessary for the proposed quality instruction and improved minority opportunities. Thee funding sources involve vendor participation and support, including minority owned small business vendors. A number of specific strategic program areas have been identified: improved minority recruitment and retention into the CISE disciplines, using both the pool of students at CSUSB and recruitment of otherwise unsupported minority students; upgrades and innovations in curriculum to produce minority graduates with both an industrial and an advanced degree path open to them; establishment of facilities to teach modern data communications; measures to address the problems faced by minority students with physical disabilities; means to improve minority student access to facilities from remote (home) sites; and, upgrades to general infrastructure in terms of computers and communications to support these programs

CDA-9417362
$134,773—12 mos.
Moreno, Oscar
University of Puerto Rico

Infrastructure for Computer Science Research in Puerto Rico

The Mathematics (and Computer Science) Department of the University of Puerto Rico at Rio Piedras has an excellent record of research accomplishments in the areas of computational and computer science, while the ECE Department at Mayaguez has been producing highly qualified students in the areas of computer engineering. It is expected that the collaboration of these two departments through faculty and student encounters will provide a research environment to substantially increase the number and quality of students. The major goal of this project is thus develop the research environ-

ment needed to start a PhD program n Computer Science and to increase minority participation in graduate school and research. To maintain an excellent research environment and to accomplish the CISE II-MI program's goal of increasing minority participation in the following activities are planned.

- to create a proposal during the first two years to establish a PhD program in collaboration with the Mathematics and ECE Departments of the Mayaguez Campus;

- establish a plan to retain and increase minority participation; conduct research and establish a productivity plan for researchers;

- establish a plan for faculty development;

- acquire new research equipment; and

- establish and strengthen a Computer Science program.

CDA-9633177
$50,000—12 mos.
Larason, Katherine S.
Navajo Community College
CISE Minority Institutions Infrastructure: Computer Information Systems Programs for The Navajo Nation

The goal of the project is to update and expand a two-year computing curricula and courses for Navajo students based on regional employment needs, students' educational experience, and recommendations of the Association for Computing Machinery (ACM). Governmental, educational, health services, and private employers in the Four Corners region will be surveyed to assess current and projected needs for information science employees. Survey results will be presented to high school and college information science educators and employers at a Tsaile meeting. The CS and CIS programs at Navajo Community College will be modified and expanded—based on survey findings, recommendations from the meeting, and ACM suggested curricula for two-year programs in computing—to better prepare Navajo students for further education or to find employment in the information industry. The project is significant for several reasons, such as: including the first survey of information science employment ever done in this area; establishing communications among high school and college computing educators, and employers that do not currently exist; and, enhancing students' educational and employment prospects.

CDA-9633675
$343,000—12 mos.
Narang, Hira
Tuskegee University
CISE Minority Institutions Infrastructure: The Establishment of Infrastructure for High Performance

Computing Program (HPCP) for Teaching and Research at Tuskegee

This minority institution infrastructure grant proposes to establish research infrastructure in High Performance Computing (HPC) involving students and faculty of Tuskegee University with scientists and researchers of Oak Ridge and Argonne National Laboratories. To sustain and invigorate the proposed research infrastructure, three supportive components are proposed: - Computing Facilities Component - Education and Training Component, and - Summer Programs Component. The computing facilities component proposes to provide the high performance computing facilities consisting of workstations and high-end PCs, as well as necessary software tools, to support both appreciative and fundamental research in high performance computing. The Education and Training component proposes to develop students and faculty interests and skills in high performance computing methodology through structured courses, seminars, workshops, and hands-on training in the usage of high performance computing machinery at national laboratories. The Summer Programs Components envisages bringing high school students, from 9th through 12th grade levels in varying periods of summer, and train them in problem solving as well as Internet access and multi-media applications. The additional objective of this component is to intensively involve undergraduate, graduate students and, faculty in high performance computing research through summer programs at national labs.

CDA-9417390
$232,025—12 mos.
Van Cleave, Nancy
Fond du Lac Tribal College
A Cooperative Learning Environment that Fosters the Pursuit of Scientific Careers for American Indians

This project proposes to significantly increase the number of American Indian students attaining four year and graduate degrees in computer science and engineering, FDLTCC and Fond du Lac Ojibwe School (a tribal K-12 institution) will hold summer camps for American Indian youth in grades 5-8, and bridge-to-college camps for grades 9-12, to study interesting, engaging computer science activities and application. They shall also study traditional Native American view of the world—not to abandon standard Western scientific methods, but to examine fresh approaches to problem solving. FDLTCC will create a lower division computer science program designed specifically to support and encourage American Indian students through successful transfer to a four year institution to complete their upper division CISE studies. Formal mentoring and curriculum designed to encourage performance in a cooperative manner will characterize the tribal college program. This model, cultivating interest in CISE work among American Indian youth, supporting the bridge

from K-12 schools to the tribal college, strongly supporting American Indian students in lower division CISE studies, and supporting students through transfer to high quality four year computer science programs, is designed to be attractive and applicable to tribal K-12 schools and colleges governed by sovereign tribal nations which are the key education providers for American Indian youth living on or near tribal lands.

CDA-9612513
$ 49,929—12 mos.
Vasquez, Ramon
University of Puerto Rico, Mayaguez
Special Project: A Proposal for Assistance in Attending: ADMI '96-Building for the Future: The Symposium on Computing at Minority Institutions

This grant provided travel assistance for faculty and students from minority institutions to participate in the 1996 ADMI Symposium. The 1996 Symposium incorporated major new themes:

1) to enable minority faculty to present papers on strategies for increasing the number of CISE-discipline students from underrepresented populations and to share these topics with representatives from major research universities and,

) to provide for inclusion of student participants, giving them valuable experience in presenting research papers and providing for their participation in graduate study workshops.

Participants were chosen by a selection committee following submission of their papers. A conference proceedings is being published containing all of the papers presented at the conference.

CISE Educational Innovation Program

CDA-9643311
$44,742—0 mos.
Cartwright, Robert S.
William Marsh Rice University
CISE Educational Innovation Supplement: Can We Unify the Programming Curriculum?

This project will provide partial support for an investigator from an EI project at another institution to participate in the CISE Educational Innovation project at Rice University. The EI project at Rice is designed to develop curricular materials for a pair of related introductory courses in computer science. The first course introduces students to an algebraic programming language and to the design principles of programming. The second course introduces students to languages that grew out of a hardware-oriented view of computation, e.g. C, C++, and Java. The results of the overall project will consist of courseware including, in particular, lecture notes, problems sets, and programming environments. The work at the second institution involves the use of functional languages and development of a platform-independent programming environment and tools. Support from this supplemental award allows the two sets of EI investigators to work together to enhance both projects, to exchange tools and teaching philosophies and to study ways to expand the transfer of research results to secondary and primary schools.

CDA-9642026
$12,250—0 mos.
Cushing, Judith B.
Evergreen State College
CISE Educational Innovation Supplement: Integrating Computer Science Research Results Into an Interdisciplinary Undergraduate Curriculum

This supplement provides funds to support an expansion of the number of attendees and to support enhancements of the summer workshop sponsored by Evergreen State College in connection with their CISE Educational Infrastructure award. The project is designed to integrate into the undergraduate curricula at Evergreen State recent research results in a number of important research areas being carried out at Oregon Graduate Institute, a partner in the project. These curricular innovations target non-PhD granting institutions and the workshop will involve representatives from such institutions throughout the Northwest.

CDA-9634485
$349,664—0 mos.
Glinert, Ephraim
Rensselaer Polytechnic Institute
CISE Educational Innovation: A Distributed Collaborative Learning Environment for Effective Intellectual Teamwork Across the Curriculum.

This CISE Educational Innovation award supports the integration of research into the undergraduate curriculum through the development of a Distributed Collaborative Learning Environment (DCLE), a hybrid physical and electronic space which will enable teams of students to meet and learn in flexible configurations, across the computer science curriculum. The project will include development and delivery of courses that exploit the new capabilities, formal assessment of the effectiveness of the new learning environment, and wide dissemination of concepts, architecture, and prototype systems developed. In the DCLE environment, the students comprising a team may be in one room, even seated around the same table. At other times, they may be seated around two or more tables, or some may be located elsewhere on campus (even geographically remote). Whatever the physical layout may be, each student's computer is linked to those of all other teammates, and innovative system software provides powerful support for collaborative information development, sharing and exchange, through a variety of flexible and natural interfaces suited to the task and the individual user. This project is part of an overall effort jointly supported by the Office of Cross-Disciplinary Activities (CDA) in CISE and the Division of Undergraduate Education (DUE) in EHR with the DUE funding supporting an emphasis on distance learning, utilizing the developed DCLE in a virtual classroom and with instruction delivered on an experimental basis from University of California/Davis to Rennselaer Polytechnic Institute.

CDA-9642829
$14,490—0 mos.
Haynes, Christopher
Indiana University, Bloomington
Educational Supplement: Tools and Techniques for Use of the Scheme Programming Language in Undergraduate Education

Indiana University received a CISE Educational Infrastructure award in FY93 to develop software and cur-

ricular materials to support a dialect of the Scheme Programming language in undergraduate computer science courses. The project is being conducted in collaboration with Oberlin College. Both institutions are using functional languages within the undergraduate curriculum. Indiana University is developing a platform-independent programming environment and tools. Oberlin College is focusing on improving introductory courses using formal methods and static typing. In the summer of 1996, as critical components of the dissemination process for this award, five one-week workshops are scheduled. This award provides supplemental funding to support an experienced faculty member for one-month to teach in these workshops and to further refine the materials that the project has developed in support of the use of Scheme in introductory courses.

CDA-9641632
$43,725—0 mos.
Jones, Rhys P.
Oberlin College
Educational Supplement: CISE: Enhancement of the Introductory Computer Science Curriculum

This project will provide partial support for a postdoctoral position so as to reappoint an experienced, qualified individual to continue critical work under this Educational Infrastructure grant, originally awarded in 1993. The overall project is designed to significantly enhance the undergraduate curriculum with the introduction of materials from programming language research. Support from this award allows the Postdoctoral Associate to continue his work on the project and to teach classes otherwise assigned to the PIs. The three researchers (the two PIs and the Postdoctoral Associate) will then each devote effectively 1/3 FTE to the Educational Innovation project as it moves through its critical dissemination and evaluation phases. The work will involve setting up websites with materials for instructors at other institutions to use, along with provisions for easily downloading the software and instructional materials.

CDA-9634425
$199,023—12 mos.
Long, Tim
Ohio State University
West Virginia University
CISE Educational Innovation: Development and Dissemination of a New Undergraduate Course Sequence in Software Design and Development

This CISE Educational Innovation award supports the integration of research into the undergraduate curriculum through the development and dissemination of a new sequence in software design and development. The project is a joint effort between Ohio State University and West Virginia University, with OSU as the lead in-

stitution. The project involves the design, development, installation, and evaluation of an innovative three-quarter sequence in software design and development. The sequence is integrated and unified in its philosophical and technical bases. A major part of the effort includes the development of a software composition workbench consisting of an integrated set of software tools. The workbench will be capable of guiding students and software developers in their application of the methodologies taught in the course sequence and it will instill in software developers a particular mental model of software and how to construct it. Dissemination will be facilitated through training workshops for visiting faculty from a number of other institutions. The total project is supported in part also by the Fund for Improvement of Secondary Education (FIPSE) in the Department of Education.

CDA-9634470
$391,565—12 mos.
Ranka, Sanjay
University of Florida
CISE Educational Innovation: Mainstreaming Parallel and Distributed Computing in the Computer Science Undergraduate Curriculum

This CISE Educational Innovation project incorporates the latest research in parallel and distributed computing into core courses in the undergraduate computer science curriculum. It introduces students to important concepts in these areas and demonstrates both theoretically and practically their usefulness in a wide variety of application areas. The basic parallel and distributed computing concepts are integrated into several existing courses including those on simulation, computer vision, operating systems, numerical analysis and databases. Investigators from Research Centers at the University, including the centers on Database Systems, Computer Vision and Visualization, Software Engineering, and Parallel Computing are involved in this Educational Innovation Project.

CDA-9643310
$13,578—0 mos.
Smith, Jonathan
University of Pennsylvania
CISE Educational Innovation Supplement: TeleMentoring A Novel Approach To Teaching Undergraduate Computer Scientists

This project provided funds for acquisition of special hardware items under this Educational Infrastructure grant, originally awarded in 1992. The EI project utilizes the unique Bellcore Video Window as a means of teaching undergraduate computer science laboratory courses and to develop TeleMentoring as a distance learning technique. The Video Window was used in research projects by members of the AURORA Gigabit

Testbed and experimental prototype custom hardware elements were utilized as part of the system. The units acquired under this award will allow the project to attach the Video Window to newly installed commercial ATM equipment, to replace the failing experimental prototypes and hence to preserve the educational value of the system.

CDA-9634462
$184,942—12 mos.
Vemuri, Ranganadha
University of Cincinnati
Innovation in VLSI Systems Education: Integration of High Level Synthesis, Analysis and Test Generation Research Results into Undergraduate Minor Curriculum in VLSI Systems Engineering

This CISE Educational Innovation award supports the integration of research in high-level VLSI synthesis, performance analysis and test vector generation into the undergraduate curriculum in VLSI systems engineering. The model curriculum will contain topics on the development of high-level functional and behavioral modeling of VLSI designs, use of high-level VLSI synthesis techniques and tools, developing and using performance models throughout the design process, and generation of design verification tests. Curriculum support material will include mini-books on these topics, term project modules, and, most importantly, free software tools for high-level synthesis, performance analysis and test generation. All of the curriculum material will disseminated through the Internet and the World-Wide-Web.

CDA-9634333
$329,794—12 mos.
Wulf, William
University of Virginia
CISE Educational Innovation: Research Integration and Dissemination for Undergraduate Computer Science Curriculum.

This CISE Educational Innovation award supports the integration of research into the undergraduate curriculum through the development of three new upper division courses along with establishment of a visiting faculty program and other working relationships with institutions to enhance dissemination of the results of the project. The new courses are in the areas of computer aided design, usability engineering, and translation systems. Dissemination will be accomplished through use of the World-Wide Web, through special relationships with a selected set of diverse schools, and a visiting faculty program in which individual faculty from other institutions will be in residence at the University of Virginia campus so as to become directly involved in the project and to then transport the material back to their home institutions. Development and dissemination of the new courses has the potential to impact curricula widely.

CDA-9643438
$50,632—12 mos.
Zhang, Jianping
Utah State University
CISE Educational Innovation Supplement: Multimedia Computer-Based Computer Literacy Courseware and ID Expert/CS—An Authoring System

This supplement supported a workshop in Salt Lake City, Utah , to evaluate the effectiveness of projects supported by the CISE Educational Innovation program, with a focus on dissemination mechanisms and evaluation methods. The workshop was held in conjunction with the Frontiers in Education Conference, a major annual conference sponsored by the ASEE, the IEEE Education Society and the IEEE Computer Society, with some of the EI workshop participants also making presentations at the FIE Conference. Participants in the workshop were principal investigators of funded EI projects, two invited experts in project dissemination and evaluation, and selected NSF staff. A workshop report contains summaries of the funded EI projects, analysis of the dissemination and, evaluation mechanisms that have been used and are planned and, includes lessons learned that can be applied to future projects.

CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies

CDA-9616373
$237,298—12 mos.
Bailey, Diane
University of Southern California
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies:

Taming the Complexities of Modern Manufacturing: A Network Enabled Virtual Factory to Support the Exploration and Learning in Engineering Education: The University of Southern California has been awarded a 1-year grant of $237,298 to start on the development of a virtual factory on the World Wide Web to present manufacturing complexities in an understandable form for university engineering students. University instructors will use the workspace to illustrate the concepts of factors management in a realistic setting, and students will assume roles of various factory personnel in small team settings. Student teams may span institutional boundaries thus allowing information-sharing among students and professors at a number of institutions.

CDA-9616563
$50,000—12 mos.
Campbell, Thomas
Bell High School
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

Project Technovision X-33, Planning Year: The Los Angeles Unified School District has been awarded funding in the amount of $50,000 for a period of 12 months for a planning grant to study the effect of access to technology on the education of a traditionally underrepresented, culturally and linguistically undeserved student/parent population. The proposed research will lead to the formation of policy and curricular changes which will significantly affect education in urban, low-income communities into the twenty-first century. The project will involve the collaboration of many different entities: K-12, teachers and administrators; university researchers and professors; governmental organizations; and private businesses. During this planning year, approximately 15 specific collaboratively development projects will be tested for feasibility and eventual implementation. Data and analyses gathered from these projects will be disseminated widely, using the full resources of the Internet and the World Wide Web.

CDA-9616410
$50,000—06 mos.
Carraher, David
TERC, Inc.
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies

Visualization Research Center TERC, Inc. has been awarded $50,000 for a 6-month period to plan a research Center for the study of scientific and mathematical visualization.

The goals of the center are:

(1) to undertake interdisciplinary empirical research on the technological development and cognitive interpretation of visualization technologies; and

(2) to improve K-12 math and science education by creating innovative visual curricular tools and

(3) to contribute toward a new conceptual framework on the role of visualization in learning and understanding mathematics and science.

To promote a broad understanding of visualization as historically, culturally, and psychologically grounded, the Visualization Research Center will draw upon expertise not only from the natural and mathematical sciences but also from the humanities and social sciences. Partnerships are being established with the National Academy of Arts and Sciences, the Massachusetts Institute of Technology Media Lab, the CalSpace at University of California-San Diego, Pennsylvania State University, the Boston University Medical Center Hospital, and the Cranbrook Institute, among others.

CDA-9616991
$50,000—06 mos.
Cole, Ronald
Oregon Graduate Institute of Science & Technology
Collaborative Research on Learning Technologies: Conceptualization of a Flagship Center for Collaborative Research in Learning and Human Language Technologies

The Oregon Graduate Institute has been awarded funding in the amount of $50,000 for a period of 06

months to plan a NSF Flagship Center for Collaborative Research on Learning and Human Language Technologies. The mission of the proposed Center is to support basic research on the use of human language technology to create better tools and strategies for learning. Areas of research and tool development will include using speech as an input modality in computer assisted learning; speech training for second language learning or articulation training; speech as a primary input modality for physically challenged individuals; and speech as a context for learning about other things.

CDA-9616441
$215,498—12 mos.
Dev, Pravati
Stanford University
Design-Based Learning of Vertebrate Biology, Comparative Anatomy and Physiology of Virtual Creatures

Stanford University has been awarded $215,498 for a one-year planning grant to help integrate pre-college education implementation and research questions and strategies with an ambitious program of developing advanced computer-based tools for teaching biology at the secondary and undergraduate levels. Prior efforts to create interactive virtual creatures have restricted interaction to viewing selected structures. This project will develop and evaluate for their educational efficacy a small library of transitional creatures that will allow virtual dissection and other simulated physical manipulations on a personal computer.

CDA-9616544
$50,000—12 mos.
Dubinsky, Ed
Georgia State University
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

Incorporating Computers and Group Work to Develop Effective and Efficient Learning Experiences Georgia State University has been awarded funding in the amount of $50,000 for a period of 12 months to initiate a planning effort leading to the creation of a collaborative research program to investigate the effects of using an innovative instructional approach, called ACE Teaching Cycle, on the learning of undergraduate mathematics in relatively large size classes. The ACE Teaching Cycle is based on a cognitive theory of learning and integrates activities of students: writing computer programs and using the programs to represent mathematical concepts, investigating mathematical phenomena using computer tools (both constructed by the student and provided in the form of software packages), and students working in cooperative groups.

CDA-9616992
$50,000—12 mos.
Evans, D. L.
Arizona State University
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program: Planning Grant for Center for Collaborative Research in Learning Technologies based at Arizona State University

Arizona State University has been awarded funding in the amount of $50,000 for a 12 month planning grant for a Center to address the rapid development of two types of delivery systems—integrated software for science, engineering, and mathematics education use, and technology improvements for distributed/distance education. The desired outcomes are to enhance the quality and accessibility of education at all academic levels, K-16, graduate, and extended education. A key role of the Center will be to provide tools for functioning as team and facilitation of team processing. Partners in this planning project include Motorola, Intel, Cox Communications, Peoples Choice, and the Foundation Coalition Schools.

CDA-9616500
$50,000—08 mos.
Ewing, R.
Texas A&M University
Collaborative Research On Learning Technologies: A Center for Collaborative Research in Learning Technologies—Planning Proposal

Texas A&M University has been awarded $50,000 for a period of 08 months to provide support for planning to develop a proposal for a Center for Collaborative Research on Learning Technologies (CRLT) at Texas A&M. The Center would serve as a major focal point for on-going research projects, and would provide leadership and administrative support for large scale collaborative projects involving interdisciplinary teams of researchers and participants from a multiplicity of locations and backgrounds. The Center would also provide for the dissemination of research and newly developed technologies, and serve as a link to the telecommunications and other related hi-tech industries, working actively with private industry to commercialize successful technologies for their introduction into the classroom of the 21st century.

CDA-9616485
$50,000 —12 mos.
Fischer, Gerhard
University of Colorado

CRLT: Making Learning a Part of Life: Theories, Technologies, Practices, and Assessment in Support of Lifelong Learning.

The University of Colorado has been awarded funding in the amount of $50,000 for a period of 12 months to initiate a planning effort to establish a CRLT Center focused on the theme "making learning a part of life: theories technologies, practices, and assessment in support of self-directed life long learning" The Center will build on funded research in computer science, cognitive science, psychology and education. The University of Colorado and its extended community will function as a testbed for the development and evaluation of learning technology tools and approaches. The planning grant will allow current research approaches to be shaped into specific activities that will comprise the collaborative project of the Center.

Partners in this planning grant include MIT, University of Colorado, University of California at Berkeley, University of Wisconsin, Addison-Wesley Interactive, Apple Computer, and Netscape.

CDA-9616478
$372,292—12 mos.
Fontana, Lynn
George Mason University

How Can an Information Environment Support Higher-Order Thinking Skills in Science Education?

George Mason University has been awarded a 1-year grant of $372,292 to examine how emerging information technologies can be integrated to create a learning environment that supports new approaches to science instruction at the college and secondary school levels. Basic research will address how to integrate effectively knowledge about science instruction, higher-order skills acquisition, instructional design, intelligent assessment, and computer networks. A student-centered, interdisciplinary, problem-centered and collaborative information environment to support teaching and learning will be built and field-tested.

CDA-9616396
$49,945—12 mos.
Gilland-Swetland, Anne
University of California—Los Angeles

CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

Digital Portfolio Archives in Learning: Modeling Primary Content Transformation for Science Education The University of California, Los Angeles has been awarded funding in the amount of $49,945 for a 12 month planning grant to develop a process model that (1) transforms primary sources into digital library content; (2) allows teachers to build personalized information systems or "Digital Portfolio Archives" (DPAs) that contain content and associated descriptions derived from the digital library, together with other relevant materials that teachers wish to incorporate; (3) enables students to incorporate components of teachers' DPAs, and (4) facilitates the optional incorporation of these DPAs back into the digital library, but as a distinct layer of user-created content distinguished to provenance. Content for the base digital library will be drawn from the seven archival, manuscript, and museum repositories at UCLA. The development and testing of the DPA process model builds on the work of, and feeds into several educational and technological initiatives underway at UCLA, including cross-disciplinary collaborations with the Smithsonian Institution, the Los Angeles County Museum of Art, and Special Collections at the UCLA University Research Library. This planning grant will generate: (1) generalizable processes for structuring digital libraries and enriching content descriptions that meet the needs of primary content creators, providers, and non-traditional users such as teachers and students; (2) knowledge of how teachers might select primary content and integrate it into classroom activities if it were digitally accessible; and (3) knowledge of how digitized primary sources might contribute to the enhancement of students' understanding of, and engagement in, the health and natural sciences.

CDA-9616990
$684,260—24 mos.
Honey, Margaret
Education Development Center

CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies: The Portal Project

The Education Development Center, Inc. has been awarded $684,260 for a 24-month period to develop computational tools, with access to World Wide Web resources, to support effective learning and integration of computational processes with real-world research problems. This software consists of a suite of computer-based, Web-enabled programs for systematically documenting, examining, and offering feedback on students' project work. The goals of the project are: (1) to develop the Portal Tools; (2) to implement the tools in up to 70 schools in five states; and (3) to evaluate the impact of the tools on student learning, through case studies and analysis of student presentations and process documents.

CDA-9616397
$50,110—12 mos.
Kolodner, Janet
Georgia Tech Research Corporation
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

A Design Education Center: Using Cognitive Science and Technology to Facilitate Learning and Doing Design Georgia Tech has been awarded funding in the amount of $50,110 for a period of 12 months to initiate a planning effort to design a multi-institute, multi-disciplinary, collaborative center to design, develop and evaluate environments (both physical and virtual) for design education at all education levels; to design, develop and evaluate curricula, curriculum guidelines, and classroom practices for learning and doing design. The center will serve as a research center, a forum for issues in design education, a forum for teacher and faculty development, and an agent for pragmatic dissemination of the results of its research. Partners in this planning grant include MIT, University of Colorado, University of California at Berkeley, University of Wisconsin, Addison-Wesley Interactive, Apple Computer, and Netscape.

CDA-9616611
$599,947—25 mos.
Kozma, Robert
SRI International
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies

Building Virtual Places for Collaborative Simulations: A Heterogeneous Network Architecture to Support Distant Learning SRI International has been awarded $599,947 over 25 months for an effort to study collaborative learning within two learning communities: undergraduate chemistry students and science teachers involved in professional development. The results of the research will be used to design and develop a network-based learning environment that supports a range of asynchronous and synchronous collaborative interaction among distributed teams on heterogeneous platforms. The project will involve collaborations between social scientists studying social and task environments in learning, and computer scientists developing collaboration technologies that will support these environments.

CDA-9616532
$589,701—36 mos.
Madigan, David
University of Washington
Use of On-Line Assessment in Forming and Coaching Learning Groups

University of Washington has been awarded a 3-year grant for $589,701 to develop experimental software tools and methodologies to support various on-line assessment activities in both the High School environment and the University environment. Tools will be developed that combine assessment functions with facilities to translate results of assessment into meaningful interventions in both physical and virtual classrooms. The facilities include means of visualizing assessment of information for individual students and groups, means for organizing groups of students for particular activities, electronic mail exchanges, and means to help teachers articulate pedagogical goals and progress within the contexts of these groups. The project experimentation will focus in the subject area of probability and statistics with the aim of enhancing the productivity and effectiveness of teachers in guiding their student groups in mastering the subject matter using Internet-based group discussion.

CDA-9616445
$50,000—12 mos.
O'Keefe, Barbara J.
University of Illinois
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

National Center for Collaborative Research: The University of Illinois, has been awarded $50,000 for a 12 month period to develop the rationale and plan for establishing a virtual National Center for Collaborative Research (NCCR) on Learning Technologies. The proposed NCCR will perform multi-disciplinary research and development in learning technologies. The activities of the proposed center will be directed toward developing and evaluating web-based learning technologies for application domains in which the community of learners is relatively heterogeneous. These application domains include learning in K-12 and College environments, learning for industrial competitiveness, and learning for health care and social services. Partners in this planning grant include BBN, University of Arizona, Southern Illinois University, and the University of Southern California

CDA-9616584
$50,000—12 mos.
Pea, Roy
SRI International
Center for the Integration of Learning Technologies

SRI International has been awarded a 1 year grant for $50,000 to plan for a model center for collaborative research on learning technology. This center will eventually address pressing issues in the integration of research and education, train postdoctoral scholars to work at the intersection of technology and instruction, support a community-wide dialogue about the future of educational technology, and develop or refine methodologies that enable this work. Collaborative partners are SRI International, the University of California at Berkeley, and Vanderbilt University. Teams will share research

approaches and findings in detail, identify commonalties and differences in finding and approach, establish priorities, and commission activities. During the planning year, the team concept will be tried out and evaluated with initial activation of one theme team. Planning year activities include also the design of a system for continuous evaluation and refinement of CRLT activities, development of a plan for postdoctoral interdisciplinary research training, and the establishment of linkages to leverage the intellectual and financial contributions of other investigators and institutions, including university scientists, school systems, industry scientists and groups, think tanks, technology-based corporations and libraries. The World Wide Web will be an integral part of the Center's communication and dissemination activities.

CDA-9616444
$880,658—36 mos.
Resnick, Michael
Massachusetts Institute of Technology
CISE/EHR/ENG/MPS Collaborative Research Learning Technologies

Beyond Black Boxes: Bringing Transparency and Aesthetics back to Scientific Instruments Massachusetts Institute of Technology has been awarded $880,658 over 3 years for a collaborative project between MIT, Wellesley College and the University of Colorado, to develop computational tools and project materials to allow children to create their own scientific instruments, engaging them in designing and building, as well as in observing, measuring and interpreting. It is hypothesized that more students, like scientists of old, will be motivated to participate in scientific activities, and in addition the design process will help them develop critical capacities for evaluation. The project promises to provide students with deeper understanding of the relationships between science and technology, and between science and the real world. The project will develop a family of tiny, fully programmable computational devices (crickets) that students can embed in everyday objects. Crickets can control motors and lights, receive information from sensors and communicate with one another via infrared light. The technologies will be evaluated in a range of settings, including work with teachers in classrooms and a vocational-technical school. In addition to testing their hypothesis, the PI's will evaluate theoretical learning issues of balance between physical and virtual objects, and between "transparent" and "opaque" objects.

CDA-9616434
$50,000—12 mos.
Schank, Roger
Northwestern University
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

Technology Transfer and Development of Transferable Learning Technology: A Center for Collaborative Research on Learning Technologies Based at Northwestern University: Northwestern University has been awarded funding in the amount of $50,000 for 12 months to plan an NSF Center for Collaborative Research on Learning Technologies with the theme of "Technology Transfer and the Development of Transferable Technology." The mission of the Center will be two-fold. The infrastructure mission of the Center will be to transfer learning technologies developed at Northwestern to teachers, and content learning for applications to science, mathematics, and technology education in schools, homes, and workplaces. Its research mission, to be carried out collaboratively with these teachers and content experts, will be to develop and investigate tools and technologies for the design and implementation of education software that truly are transferable—i.e., tools and technologies that teachers and content experts can really use, even if they are not expert programmers, to develop new, high quality educational software applications that meet the needs of their students in science, mathematics and technology.

CDA-9616585
$149,318—12 mos.
Schlager, Mark
SRI International
CRLT: Tapped in MUVES to the Web: A Web-Aware Multi-User Virtual Environment for Studying On-line Collaboration

SRI International has been awarded funding in the amount of $149,318 for a period of 12 months. SRI and several San Francisco Bay Area K-12 science professional development providers (six Lawrence Hall of Science programs, Life Science Program, California Science Project, and the Science Education of the Bay Area) will jointly develop a new vision of on-line professional development activities in a place where teachers with diverse interest, skills, and backgrounds can meet and learn from one another on any given day; where teachers can be exposed to not one but many education reform concepts and approaches; where teachers can find quality resources in minutes rather than hours; and add and annotate resources that they find useful. The goals of this project are to (a) scale up from prototype to implementation and (b) to conduct the research needed to assess the utility of the concept and technology and inform the development of future collaborative on-line learning communities.

CDA-9616564
$50,000—12 mos.
Semper, Robert
Exploratorium
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies Program

Toward the Development of a Center for Collaborative Research on Learning Technologies: The Exploratorium in San Francisco, California has been awarded funding in the amount of $50,000 for a period of 12 months to initiate a planning effort leading to the creation of a Center for Collaborative Research on Learning Technologies. The Center will draw upon the efforts and expertise of a wide ranging group of San Francisco Bay Area participants from industry, research, and education to formulate powerful responses to challenges and opportunities in science, mathematics, engineering and technology education. During the proposed planning period, the Center will initiate reexamination of the basic methods and practices of these fields in light of the pedagogical potential to newly developing learning technologies. At the heart of the Center's activities will be a set of carefully selected projects that address major educational challenges and opportunities. The Center is particularly interested in projects that focus on the convergence of new hybrid technically-augmented learning spaces/situations and new pedagogical theory. By focusing efforts on a specific problem or content area of sufficiently wide interest to the fields, the Center will be able to identify core issues for education as a whole; and thus be able to design generalizable research strategies. It is anticipated that important work will be undertaken by members from primary and secondary school system and by informal education (such as directors of public libraries or broadcasting groups) of different kinds.

CDA-9616565
$858,545—36 mos.
Stanley, Eugene
Boston University
CISE/EHR/ENG/MPS Collaborative Research on Learning Technologies

Teacher Researcher Collaboration in Scientific Modeling: The High School Science Virtual Machine Laboratory Boston University has been awarded $858,545 to establish over 3 years an approach to high school science education by allowing students to model and visualize physical, chemical and biological phenomena of increasing complexity. The project will take advantage of two advances in technology: One is the emergence of JAVA, a platform independent language that enables transmission of applications over the WEB to run locally on any platform. The other is the existence of public domain versions of distributed parallel computing operating systems. One such system, PVM, will be used and modified to enable students to use many computers in a school as a larger parallel computer. The tools and applications will be used by the researchers and teams of high school teachers to develop education-oriented modeling programs that do not sacrifice needed functionality or sophistication.

CDA-9616499
$298,698—12 mos.
Walters, Jim
Maricopa Technical Community College
CISE/EHR/ENG/MPS: Collaborative Research on Learning Technologies: Community-Based Learning Systems: Exploring Models in Use.

Maricopa Technical Community College has been awarded $298,698 for a 1 year planning project that will use the motivational and social learning potential of Multiple User Design environments (MUDs or MUSEs) in conjunction with computational modeling to help students develop conceptual understanding of scientific concepts. The social characteristics of MUDs, which students construct themselves, bring students into environments where they interact with adult mentors, including teachers, who expand student's horizons. While engaging in their current state, MUDs can be transformed into powerful pedagogical spaces. This planning project will develop the technological aspects of MUDs to integrate computational modeling, and define specific pedagogical goals, building on the work of Mari Muse with Longview Elementary School, a Title K-6 school, serving a culturally diverse population of students. The project is a collaboration of Longview Elementary, Phoenix College (part of Maricopa Community College District, and Xerox Parc Alto Research Center.

CDA-9616436
$50,000—12 mos.
Woolf, Beverly Park
University of Massachusetts, Amherst
CISE/EHR/ENG/MPS Collaborative Research On Learning Technologies Program

A Center for Intelligent Multimedia Instructional Systems: The University of Massachusetts, Amherst has been awarded funding in the amount of $50,000 for 12 months to plan a Center for Intelligent, Multimedia Tutoring Systems (IMTS) for science, mathematics, engineering and technology education in higher education and for lifelong learning. ITMSs combine the power of visualization and animation with the student modeling capabilities of intelligent tutors to produce interactive learning environments that are highly effective for conveying complex, dynamic processes. The Center plan will incorporate studies of many existing ITMSs, including a number of systems developed at the University of Massachusetts. This particular corpus of work, combined with new systems that the University has pledged to develop, provides both an accumulated body of experience in IMTS development and an opportunity to submit many of them to the kind of laboratory analysis that will offer new educational insights into their effectiveness.

Academic Research Infrastructure

CDA-9601787
$0—24 mos.
Adeyemi, Hazekiah
Clark Atlanta University
(Funded by Office of Science and Technology Information $250,000) Total Award $250,000
Academic Research Infrastructure: Acquisition of Instrumentation to Provide Scientific and Data Visualization Capability at Clark Atlanta University

This Academic Research Infrastructure award supports the acquisition of a high end visualization computer. The research projects supported by this instrumentation include:

1. Research in the Geographic Information Systems laboratory including health risk assessment, GIS DB improvement, and 3-D Virtual GIS.

2. Research on the synergy of Design, Simulation, and Visualization in Engineering.

CDA-9601602
$0—36 mos.
Bergeron, R. Daniel
University of New Hampshire
(Funded by Office of Science and Technology Information $475,859) Total Award $475,859
Academic Research Infrastructure: Laboratory for Advanced Communications Systems

This Academic Research Infrastructure award supports the acquisition of high speed networking equipment including wireless and wired networking infrastructure and switches. The research projects supported by this instrumentation include research on local electromagnetic field characterization, testing tools for wireless local area data communications standards, model-based network diagnosis, implementation and evaluation of algorithms for ATM Quality of Service policies, and the design, implementation and evaluation of data parallel I/O using high speed networks and heterogeneous workstations.

CDA-9601632
$0—24 mos.
Bramley, Randall
Indiana University
(Funded by Office of Science and Technology Information $1,204,208) Total Award $1,204,208
Academic Research Infrastructure: Acquisition of a Distributed Computation and Immersive Visualization Environment for Complex Systems

This Academic Research Infrastructure award supports the acquisition of a high speed SMD computing system operating at a peak speed of approximately 15 GFLops. The research projects supported by the equipment include:

1. The computational study of gravitational instabilities in realistic protostellar disks.

2. The computational study of collisional stellar systems.

3. Gravitational lensing.

4. Schrodinger equations for molecules.

5. Sedimentary basin and whole planet evolution modeling.

6. Quantum chromodynamics.

7. Global illumination simulations of complete, large scale structures (bridges, etc.).

CDA-9601802
$0—24 mos.
Cuny, Janice E.
University of Oregon
(Funded by Office of Science and Technology Information $444,000) Total Award $444,000
Academic Research Infrastructure: Collaborative Research Between Geological Sciences, Astrophysics, and Computer Science: Infrastructure Support for a Visualization Laboratory

This Academic Research Infrastructure award supports the development of high speed computational, networking, and graphics facility. The research projects supported by the facility include:

1. Geophysical studies of mid-ocean ridges.

2. Kinematic and dynamic modeling of the deformation of the western United States lithosphere.

3. Geological and environmental fluid mechanics.

4. Characterization of fault rupture and the recurrence behavior of large earthquakes: and

5. Retrieving and processing observational astrophysical data by representing it as a virtual N-dimensional universe.

CDA-9601670
$0—36 mos.
Garcia, Oscar N.
Wright State University
(Funded by Office of Science and Technology Information $241,314) Total Award $241,314

Academic Research Infrastructure: Development of Specialized Communications and Terminal Equipment for Research in Information Technology and Education Technology

This Academic Research Infrastructure award supports the acquisition of a]networked human factors experimental facility. The projects supported by this equipment include:

1. Multimodal human-computer dialogue.

2. Computer sensor instrumentation and their integration.

3. Accessibility to large multimodal databases by novel query methodologies.

4. Experimentation with various virtual environments in collaboration with psychologists and educational researchers.

5. Experimentation and development of software engineering environments to support human-computer interaction software development and usability assessment.

CDA-9601861
$0—36 mos.
Hollebeek, Robert
University of Pennsylvania
(Funded by Office of Science and Technology Information $2,000,000) Total Award $2,000,000

Academic Research Infrastructure: Development of a Wide Area Scaleable Infrastructure for Data Intensive Computing: Consortium Proposal

This Academic Research Infrastructure award supports the acquisition of equipment to enhance the National Scaleable Cluster Project. The equipment will be sited at 3 universities to further the development of a national meta computing center. The equipment consists of large fast disk arrays, high performance computer cluster enhancements, ATM network switches to

OC-12 capabilities, network connections, and associated software. The research projects supported by the equipment include:

1. Applications computing that is data intensive including data mining of particle physics data, digital library development of the linguistics data consortium, digital library development of astrophysics, gravitational lenses data maps, galactic large structure simulations, and the development of numerical and statistical digital libraries.

2. Real time computing applications including collecting reduced astronomical data, medical imaging, and telepresence.

3. Parallel compute intensive applications including liquid crystal imaging, phase transition simulations, crystal surface computational studies, and vortex flow studies.

4. High speed network research including network striping and the inclusion of tertiary store in high performance memory hierarchies.

5. Computer science research on scaleable object stores, research on caching, transforming, and replicating data, and software tools for cluster management.

CDA-9601519
$0—12 mos.
Kraimeche, Belkacem
Cooper Union
(Funded by Office of Science and Technology Information $193,000) Total Award $193,000

Academic Research Infrastructure: Acquisition of an Automated VLSI Test Facility

This Academic Research Infrastructure award supports the acquisition of an automated VLSI testing facility to support research in VLSI design and test engineering. The research projects supported by the equipment include ATM switching fabric designs for VLSI implementation, Systolic Array implementations of CODECs using innovative coding algorithms, and speech coding for wireless communications implemented in VLSI circuits.

CDA-9601874
$0—36 mos.
Kriz, Ronald
Virginia Polytechnic Institute
(Funded by Office of Science and Technology Information $850,000) Total Award $850,000

Academic Research Infrastructure: Acquisition of a CAVE: Breaking Research and Education Barriers by Developing 3-D Visualization CAVE Technology

This Academic Research Infrastructure award supports the acquisition of a virtual environment labora-

tory incorporating the CAVE Immersive virtual reality system. The projects supported by this equipment include:

1. User interfaces using Immersive VR.

2. Visualization of scientific phenomena.

3. Molecular modeling applications.

4. General research on human centered systems enabled by Immersive virtual reality.

CDA-9601580
$0—12 mos.
Loh, Eugene C.
University of Utah
(Funded by Office of Science and Technology Information $1,000,000) Total Award $1,000,000
Academic Research Infrastructure: The Purchase of a Scaleable Parallel Computer to Complete the High End Computing Infrastructure

This Academic Research Infrastructure award supports the acquisition of a high speed SMD computing systems operating at a peak speed of approximately 15 GFLops. The research projects supported by the equipment include:

1. Astrophysics research in simulation of cosmic ray cascades.

2. Numerical simulations of strong nuclear interactions.

3. Molecular structure simulations.

4. Quantum chemistry.

5. Applied seismology.

6. Advanced materials including nanostructures and electronic properties of solids.

7. Atmospheric physics.

CDA-9601692
$0—24 mos.
Mediavilla, Ricardo
Inter American University of Puerto Rico Bayamon Campus
(Funded by Office of Science and Technology Information $108,258) Total Award $108,258
Academic Research Infrastructure: Development of Automatic Test Station for Network Synchronization Performance Characterization

This Academic Research Infrastructure award supports the development of an automatic test station for synchronization characterization of telecommunications networks. The research projects supported by the award include:

1. The development of the test station.

2. Development of software for the generation of test signals and for the user interface.

3. Research on better synchronization in synchronous optical networks.

CDA-9601675
$0—36 mos.
Reddy, A.L. Narasimha
Texas A&M University
(Funded by Office of Science and Technology Information $127,450) Total Award $127,450
Academic Research Infrastructure: Development of a Novel Systems Software for Multimedia and High Performance Computing

This Academic Research Infrastructure award supports the development of a distributed network of workstation for multi-media research. The research projects supported by the award include video server applications, distributed circuit simulation, test generation, and device level multimedia scheduling.

CDA-9601804
$0—24 mos.
Scholtz, Robert A.
University of Southern California
(Funded by Office of Science and Technology Information $403,852) (and Engineering $100) Total award $403,952
Academic Research Infrastructure: Acquisition of Instrumentation for Testing of Ultra-Wideband Wireless and Wired Communications and Design of Enabling Instruments

This Academic Research Infrastructure award supports the acquisition of very high speed analysis and test equipment for research on high speed communication networks. The research projects supported by the equipment are:

1. The design and implementation of ultra-wideband wireless and wired computer network systems.

2. An experimental research project on the design of an impulse radio wireless network for Ghz bandwidth base stations.

3. A research program in ultra high-speed circuit and test fixturing.

CDA-9601655
$0—12 mos.
Schwartz, Jacob E.
New York University
(Funded by Office of Science and Technology Information
$578,878 12 mos.) Total Award $578,878
Academic Research Infrastructure: Instrumentation Acquisition for Improvisational Animation Research and Training

This Academic Research Infrastructure award supported by the facility include:

1. Communication (simulated conferences, shared virtual worlds).

2. Education (computer guides and instructors, large-scale simulations), and

3. Entertainment (synthetic performance, role playing games).

This research seeks to bring human participation more fully into a virtual environment.

CDA-9601737
$0—12 mos.
Scott , T. Gordon
Jarvis Christian College
(Funded by Office of Science and Technology Information
$50,600) Total Award $50,600
Academic Research Infrastructure: Jarvis Christian College Science Research Training Equipment Acquisition

This Academic Research Infrastructure award supports the acquisition of computer and laboratory equipment for computer modeling and environmental science. The research projects supported by the award include faculty and undergraduate research on molecular synthesis, environmental science, and molecular modeling.

CDA-9601603
$0—36 mos.
Shapiro, Steven S.
Guilford College
(Funded by Office of Science and Technology Information
$85,500) Total Award $85,500
Academic Research Infrastructure: Acquisition of Computation and Visualization Tools for Disciplinary and Interdisciplinary Research Training of Undergraduates in Astronomy, Chemistry, Geology and Physics.

This Academic Research Infrastructure award supports the acquisition of computation and visualization workstations. The workstations are to be used for faculty and undergraduate research in computational science. The research projects supported by the equipment include projects on astronomy and chemistry using spectral studies of galactic clouds; geology and physics using predictive techniques to determine mantle viscosity

from rebound effects of the glacial age—this research also will involve GIS access and use; interdisciplinary research involving novel uses of computational visualization.

CDA-9601797
$0—24 mos.
Shephard, Mark
Rensselaer Polytechnic Institute
(Funded by Office of Science and Technology Information
$850,000) Total Award $850,000
Academic Research Infrastructure: Developmet of a Distributed High-Performance Computing Environment for Research in Science and Engineering

This Academic Research Infrastructure award supports the acquisition of a high speed network and high speed computational workstations to build a high performance distributed computing environment. The research projects supported by the equipment include:

1. Development of distributed parallel processing techniques for scientific computations.

2. Application of distributed parallel computing to support research in the areas of material processing, multiscale failure analysis, and multiphase flows.

3. Development and application of virtual reality techniques to investigate the results of large scale simulations and to interactively steer the simulations.

4. Research, development, and evaluation of student mobile computing for delivery of anywhere, anytime instruction.

5. Research and development in advanced networking, and the development of an ATM-based network to support all facets of this program.

CDA-9601954
$0—36 mos.
Sugar, Robert
University of California—Santa Barbara
(Funded by Office of Science and Technology Information
$627,392) Total award $627,392
Academic Research Infrastructure: Acquisition of a High-Performance Computing Facility

This Academic Research Infrastructure award supports the acquisition of a high speed SMD computing system operating at a peak speed of approximately 15 GFLops. The research projects supported by the equipment include:

1. Computational materials science in the NSF funded Materials Research Laboratory.

2. Computational cheistry in crystal growth, zeolite properties, and surface chemistry.

3. The computational investigation of electronic microstructures.

4. Simulation of 3-D ground motion in earthquake simulations of the LA basin.

5. Quantum chromodynamics.

6. Fluid mechanics, geophysical fluid dynamics, and free and moving boundary problems.

7. Research at the Institute of Theoretical Physics, the National Center for Ecological Analysis and Synthesis, and the Alexandria Digital Library project.

8. Research in computer science, numerical mathematics, and general scientific computation for SMD architectures.

CISE Postdoctoral Research Associates

CDA-9625577
$46,200—12 mos.
Carroll, John M.
Virginia Polytechnic Institute & State University
CISE Postdoctoral Research Associate: Networks for Collaborative Education in the Blacksburg Electronic Village

This award supports associate Jurgen Koenemann. This project is part of an effort to create and study a virtual physics laboratory for middle and high school students in a rural area of Southwestern Virginia. The virtual laboratory is implemented as a real-time, multi-user domain, integrated with World-Wide Web resources. The postdoctoral work focuses on two technical challenges within this paradigm of network-based collaborative education: (1) supporting the design of virtual laboratory activities and materials by teachers, and (2) evaluating usability and learning outcomes for teachers and students. Regarding (1), a set of software tools will be developed to help teachers locate and incorporate World-Wide Web resources into activities they design for the virtual laboratory. For example, the tool will automatically generate appropriate hyperlinks and manage simulation software. Regarding (2), an evaluation tool will be developed to facilitate the collection and analysis of "critical incident" reports, episodes in which something went very well or very badly for the user. The reports will be linked to portions of the virtual laboratory software that may have been implicated in causing the critical incident to facilitate diagnosis and redesign.

CDA-9625756
$46,191—12 mos.
Colgate, James E.
Northwestern University
CISE Postdoctoral Research Associate: Robust Haptic Display of Dynamical Virtual Environments

This award supports associate Brent R. Gillespie. To provide for direct interaction and to more effectively immerse their users, the designers of virtual environments now have the option to render objects for the haptic (touch) senses, thanks to the new and flourishing field of haptic interface technology. At present, however, the fidelity of haptic display is limited. Restrictions must be placed on the mechanical impedance of the virtual object or exceptional computational power must be demanded of the interface controller lest sustained or even unstable vibrations arise between user and virtual object. This postdoctoral research aims to remove these obstacles by developing simulation and control methods which guarantee the absence of unstable vibrations and other non-physical interactive behaviors. The research begins by noting that the destabilizing effects of sampled-data and computational delays can be fully compensated out if the entire coupled Dynamical system is modeled, including the human limb. On-line system identification of the coupled human limb is integrated into the controller design to allow for active behavior on the part of the human. Concurrent theoretical treatments and hardware/software development efforts are employed to extend the methods to Dynamical objects and objects which are subject to changes in kinematic constraint.

CDA-9625668
$46,200—12 mos.
Davis, Larry
University of Maryland, College Park
CISE Postdoctoral Research Associate: High Performance Computing for Remote Sensing Applications

This award supports CES associate David Bader. The main objective of the proposed training and research plan is to develop innovative computational methods and software for applying high performance computing to fundamental problems arising in the analysis of remotely sensed image data. This work will be conducted at the University of Maryland Institute for Advanced Computer Studies (UMIACS) in close cooperation with Professor Davis (Computer Science), Goward (Geography), Ja'Ja' (Electrical Engineering), and Townsend (Geography), who are pursuing a number of closely related efforts. The application to be developed is a high performance system for estimating net primary production (NPP) using the production efficiency model (PEM) developed at the University of Maryland. The overall aim is to build a family of software modules that make use of a variety of algorithms to carry out geometric correction of images, to eliminate signals from extraneous sources (e.g. atmospheric correction), to sample spatially and temporally, and to generate derived geophysical properties. The modules will be constructed using proven portable and practical high performance programming languages and libraries. Our applications development will be conducted on two high performance computing platforms at UMIACS; a 16-node IBM SP-2 and a Digital Alpha

cluster consisting of 40 Alpha processors networked via a Digital ATM Gigaswitch. The Maryland facility has approximately 300GB of online disk storage and a multi-terabyte tertiary storage system.

CDA-9625816
$46,200—12 mos.
Farin, Gerald E.
Arizona State University
CISE Postdoctoral Research Associate: Approximation of Complex Geometry's and Data Reduction with NURBS

This award supports associate Anshuman Razdan. At a high level, this research aims to develop a methodology for the computer representation of complex objects such as bone surfaces. Anthropologists and bio-medical engineers are restricted for lack of mathematical structure of data that can be analyzed, an example being the surfaces of bones. Computer Aided Geometric Design (CAGD) techniques will be applied to convert this unstructured data into a structured form. Dense point cloud data will be used to describe the discretized surfaces as a smooth parametric NURB (Non Uniform Rational B Spline) surface(s). Data reduction techniques will be developed to reduce the amount of data required to describe the surface(s). 3D tools will be developed to facilitate interrogation and analysis of these surfaces, to quantify measures such as curvature. The research will collaborate with a physical anthropologist at the new inter-disciplinary facility on campus, called PRISM. The surface models will also generate the STL (stereolithography format) files for 3D hard copy outputs on rapid prototyping machines. These can be used as tactile models for research into human morphology and the teaching of comparative anatomy and bio-engineering courses.

CDA-9625755
$46,200—12 mos.
Ginsberg, Matthew L.
University of Oregon, Eugene
CISE Postdoctoral Research Associate: Planning and Scheduling as Constraint Satisfaction Investigating Fundamental Similarities and Differences

This award supports CES Associate David Joslin. Although planning and scheduling are closely related fields, the latter has enjoyed far greater success in recent years. Research in the field of scheduling has benefited greatly from treating scheduling problems as constraint satisfaction problems (CSPs); the application of CSP techniques to planning has been more limited, and has tended to be ad hoc. The Descartes algorithm, introduced by Joslin in 1995, has demonstrated that planning problems can be transformed into dynamic CSPs, allowing CSP techniques to be applied uniformly to all decisions. The CSP formulation also makes it possible to leverage successful scheduling algorithms in the solution of planning problems. The focus of this research is on understanding when and why CSP-based scheduling techniques are (or are not) effective when applied to planning problems. In the first phase, an efficient scheduling algorithm is integrated with the Descartes planning algorithm. The resulting hybrid system is experimentally evaluated on both planning and scheduling problems. In the second phase, differences between planning and scheduling are characterized in terms of a common CSP representation, and these differences are exploited to improve the performance of the planning system.

CDA-9625910
$20,910—12 mos.
Kuh, Ernest S.
University of California, Berkeley
CISE Postdoctoral Research Associate: Research in Computer Aided Design of VLSI Circuits with Emphasis on Deep Submicron Technology

This award supports associate John P. Lillis. With the advent of deep submicron technology, the VLSI community is now faced with many new technical challenges which are currently inadequately addressed by the state of the art in Computer Aided Design for VLSI circuits. Because of the scaling of feature size in the submicron domain, performance of VLSI systems is now largely dominated by interconnect delay. Some powerful techniques for addressing this interconnect dominance are timing optimization by buffer insertion, wire sizing and performance driven routing. We propose that the time during the award period be used to further develop these techniques into a mature, cohesive set of tools. Among the research objectives of the proposals are (1) development of algorithms for routing and buffer insertion to address the problems of electromigration and crosstalk noise, (2) experimental evaluation of gate replication techniques for timing optimization and (3) integration of the optimization techniques at a higher level in the physical layout process which included circuit placement. All of these topics are of great practical importance in deep submicron systems of today and the future.

CDA-9625875
$46,200—12 mos.
Lilja, David J.
University of Minnesota, Twin Cities
CISE Postdoctoral Research Associates: Processor Allocation in Hierarchical Heterogeneous Networks of Workstations

The wide availability and reasonable cost of networks of workstations makes them an attractive alternative to traditional supercomputer systems. However, the low degree of uniformity in the execution and communication times of parallel applications in heterogeneous systems can impose significant constraints on the possible parallel task scheduling solutions. The primary goals of this work are to develop techniques for determining the appropriate number and type of processors to be allocated

to each application in a heterogeneous network of multiprogrammed workstations, and to match the diverse hardware platforms to the computational and communication requirements of the specific application tasks. The proposed "matching factor," which provides a performance indicator for pairing hardware and applications in a dedicated environment, will be extended with scheduling heuristics for a network of multiprogrammed workstations with heterogeneous processor types and interconnection networks. The highly experimental nature of this work will greatly benefit from the interaction with computational scientists and engineers working at the University of Minnesota, and from the availability of the University's unique hardware and software resources.

CDA-9626370
$46,200—12 mos.
Mitchell, Joseph S.
SUNY @ Stony Brook
CISE Postdoctoral Research Associate: Efficient Geometric Algorithms in Support of Virtual Reality Systems

This award supports CES associate Claudio Silva. The goal of this project is to advance the state of the art in virtual environment systems by making use of methods of the field of computational geometry and the power of highly parallel computing architectures. New efficient algorithms are being devised and implemented for critical geometric problems that arise in virtual environments and three-dimensional simulations, including collision detection, visibility/visualization, and mesh simplification. A prototype software system is being written, incorporating new algorithms (sequential and parallel), and a library of efficient code for geometric primitives. Special attention is being given to robustness and efficiency issues of the algorithms and implementations. The impact of the project will be to advance the state of the art in virtual environment simulations, by increasing the complexity of the models that can be handled in real time.

CDA-9625748
$23,100—12 mos.
Sohraby, Khosrow
University of Missouri-Kansas City
CISE Postdoctoral Research Associate: Teletraffic Modeling and Analysis of Communications Network with Parallelizable Algorithms and Their Implementations

Design, dimensioning and control of high-speed telecommunication networks requires a thorough understanding of traffic characteristics of various types of communication services and the ability to use these characteristics for performance assessment. Teletraffic modeling techniques existing in the literature either lead to very large-scale structured Markov chain solution problems for which available algorithmic approaches suffer from huge CPU time requirements, or to models for which, at this time, there are no practically analytical results for queuing analysis. The PIs do Teletraffic modeling consisting of simple, general and systematic algorithms to model building based on D-BMAP's (discrete-time Batch Markovian Arrival Process). The modeling process is desired to capture the first and second order statistics of the original traffic streams that are known to play the dominant role in Teletraffic performance. Moreover, the PIs propose parallel algorithms for modeling as an alternative to techniques based on serial procedures for large-scale nonlinear optimization problems. Such traffic models when fed into single server queues can be analyzed by the paradigm of M/G/1 or G/M/1 type Markov chains. They propose to use matrix sign function based algorithms for the associated invariant subspace computation. These algorithms have high convergence rates (unlike the linear convergence rates of existing algorithms), they are amenable to parallelization and, therefore, it is now possible to efficiently analyze moderately sized M/G/1 and G/M/1 type Markov chains.

CDA-9625898
$45,561—12 mos.
Vardi, Moshe Y.
William Marsh Rice University
CISE Postdoctoral Research Associate: Diagrammatic Reasoning in Hardware Verification

This award supports CES associate Kathryn Fisher. Diagrams are fundamental to hardware design. Designers use them extensively to convey details, to express properties, and to reason informally about designs. Despite this, little attention has been paid to supporting diagrammatic reasoning in verification. As a result, a substantial gap exists between design practice and verification methodology that makes performing verification difficult for designers. The project aims to bridge this gap through a logic developed around common hardware representations. The logic has five syntactic representations: three diagrammatic and two sentential. The inference rules support reasoning with information from multiple representations, thereby providing formal support for how diagrammatic information is used in practice. The practical objective is to investigate whether this logic makes verification easier for designers. A verification tool based on the logic will be implemented and evaluated alongside existing methodologies by both novices and experienced practitioners. The main theoretical objective is to examine how diagrammatic information can help refine the current boundaries between automated and interactive verification methodologies. The integration of these approached will be an important feature of the tool.

CDA-9626318
$46,200—12 mos.
Zwaenepoel, Willy
William Marsh Rice University
CISE Postdoctoral Research Associate: Scalability of Software Distributed Shared Memory

This award supports CES associate Povl Koch. Software Distributed Shared Memory (DSM) architectures strike a balance between the distributed-memory and shared memory architectures by providing an abstraction of shared memory in software on distributed memories. They are built using standard processors/workstations and they are easy to program using a shared address space based on virtual memory pages. DSM systems are suitable for many parallel scientific applications. Although many systems have been designed, only the scalability issues for hardware shared-memory systems have been addressed. For software DSM systems, the focus has been on performance with a moderate number of nodes using relaxed memory consistency models and multiple-writers protocols. Most experiments have been on 8 nodes and a few with 16 nodes. When going from 8 to 64 or more nodes, each may have multiple processors, scalability problems exist with the current size of data structures and their allocation and deallocation. A scalable DSM should only capture actual causality of modifications, minimize space overhead per shared page, and the address space should be dynamically partitioned. We plan to analyze and build a scalable DSM system to run on a distributed-memory machine with 64 nodes and a fast interconnect.

CISE Research Instrumentation

CDA-9529499
$93,180—12 mos.
Bajaj, Chandrajit L.
Purdue University
CISE Research Instrumentation: Repetitive Contact Modeling, Analysis and Visualization

The 3D motion and position measurement system coupled to a high performance graphics workstation is used to model, analyze and visualize the effects of repetitive contact on human joints. It is part of a high performance computational environment for research on human joints and problems caused by repetitive strain. The motion and position measuring system measures and tracks the movement of light emitting diodes mounted on a body with an RMS accuracy of 0.1 mm and a resolution of 0.01 mm. This system enables the measurement of the kinematics of knees and for determining the kinematics in the hand during typing and piano playing activities. The system also has a probe with light emitting diodes that enable the establishment of landmarks and coordinate reference points on bones as well as mapping surface geometry's of the joint surfaces. The high performance graphics permit real-time, interactive visualization and querying of geometric models and stress/strain analyses. The potential payoffs of the research are in clinical diagnostics, surgical techniques and preparation, prosthesis design.

CDA-9529520
$31,051—12 mos.
Barreto, Armando B.
Florida International University
CISE Research Instrumentation: Multiprocessor Workstation for Advanced Digital Signal Processing Research

Emerging Digital Signal Processing techniques are being applied to the solution of challenging problems of signal detection and system modeling: Dynamic neural networks are used as spatio-temporal classifiers for the detection of electroencephalograph (EEG) patterns that can be elicited voluntarily, as part of the process of motion preparation. Reliable detection of these patterns will provide the basis for the development of a new form of computer interface that will be accessible even to individuals deprived of motor execution functions. Similarly, chaotic dynamics analysis is being applied for the detailed study of the three-dimensional propagation of ocean acoustic waves. Indices such as the Lyapunov exponent are numerically estimated using real sound propagation data collected in the North Atlantic to characterize the chaotic properties of the phenomenon. While these emerging DSP techniques hold great promise to increase our capability to obtain useful information from signals and develop accurate models of physical phenomena, they are complex and computationally intensive. The availability of multiprocessor workstations is necessary to shorten the algorithm development and analysis cycles (i.e., large-scale dynamic neural network training, numerical Lyapunov exponent estimation, etc.) to practical levels. Additionally, these systems will familiarize our faculty and students with parallel algorithm development techniques

CDA-9529459
$100,000—12 mos.
Berry, Michael W.
University of Tennessee
CISE Research Instrumentation: High Performance ATM Network for Computational Science

An ATM networked 12 high-performance workstations supports several research projects in the Computer Science Department at the University of Tennessee, including in particular: Scientific Applications in a Distributed Computing Environment, PET Image Reconstruction in a Distributed Environment, Parallel Algorithms and Software for Unstructured Mesh Computations, Fast Checkpointing in Parallel Environments, and Parallel Sparse Matrix Computations. This computing laboratory provides required resources of CPU time, local memory, communication bandwidth and disk storage for the computationally intensive projects. Some of the research tasks require this dedicated laboratory for their exceptionally long runtimes. The systems project requires access to such an environment to run meaningful experiments. In addition, the dedicated laboratory facilities may be reconfigured or subjected to simulated faults without concern about the effects on other users. The research projects will produce public-domain software. Because several government and industrial sites will soon have facilities similar to that which we propose, regular access to such a laboratory is essential for quality software research and development.

CDA-9529462
$36,627—12 mos.
Burleson, Wayne P.
University of Massachusetts-Amherst
CISE Research Instrumentation: Equipment for Real - Time System Protyping

The development of real-time embedded computing systems requires a combination of software simulation and hardware emulation to verify functionality and estimate performance, costs, power consumption and reliability. The requested equipment is for the development of a generic approach to the prototyping of real-time systems as well as specific hardware and software for applying this approach to ongoing research projects in Wireless Networks and Real-time Robotics. The equipment consists of a small network of Personal Computers which run Computer Aided Design tools for software simulations as well as serving as hosts for hardware emulation systems based on microprocessors and digital signal processors. Together , the entire system allows the rapid development, verification and analysis of systems which could not be explored by either simulation or emulation alone. In particular, it allows the statistical study of data-dependent and environment-dependent properties which are difficult to model analytically and too slow using traditional software simulation.

CDA-9529403
$95,167—12 mos.
Chen, Marina
Boston University
CISE Research Instrumentation: Real-Time, Multimedia and High Performance Computing in Distributed Systems

The requested instrumentation is to enhance and support a rapidly growing research group in areas of high performance computing and communication, digital multimedia, and real-time systems. The instrumentation consists of a 12 x 12 ATM switch connecting nodes that serve as compute engines, files servers, and video clients which provide high bandwidth access to the university's supercomputing facility. Five research projects will directly benefit from the requested instrumentation:

1. Parallel compilers,

2. Performance prediction of high-bandwidth networking environments connecting a Heterogeneous set of computers and supercomputers,

3. Efficient multi-threaded shared memory parallel computing on distributed systems,

4. Information dispersal and retrieval protocols to provide for real-time, fault-tolerant communication, and

5. 3D extension on deformable shape modeling for content-based retrieval for video and image databases.

The advancement of these projects depends on emerging technology of high-bandwidth networking environments connecting a heterogeneous set of computers and supercomputers, and the availability of a network that delivers a guaranteed bandwidth and real-time graphics and video I/O capabilities.

CDA-9529530
$76,918—12 mos.
Cohen, Elaine
University of Utah
CISE Research Instrumentation: Layered Manufacturing Machine in Support of Rapid Prototyping and Unmanned Manufacturing

A rapid prototyping machine, Helisys, supports research in computer and information science and engineering, particularly in following projects: (1) Science and Technology Center for Computer Graphics and Scientific Visualization, (2) Concurrent Integrated Design and Manufacturing, (3) Rapid Virtual Prototyping of Mechanical Assemblies, and (4) Sensing Strategies for Advanced Manufacturing. The machine is a Laminated Object Manufacturing (LOM) System which is used to generate visualization models, to help in verification of reconstructed models, and to support a variety of casting operations and other secondary manufacturing operations including vacuum forming and silicon rubber molding. The LOM process in the Advanced Manufacturing Laboratory is used primarily for research in manufacturing and to produce prototype parts for other research programs. The process is also used to offer a variety of experimental manufacturing services over the network. The educational use of rapid prototyping provides strong visualization feedback in solid modeling and shape understanding for undergraduate and graduate level courses as well as for high school students selected from the state of Utah under a National Science Foundation Young Scholars Program.

CDA-9529561
$62,000—12 mos.
Cook, Diane J.
University of Texas—Arlington
CISE Research Instrumentation: Design of a Distributed Computing Environment Using Power PC Micro Kernel

The goal of this project is to investigate, design, and develop a unique distributed computing environment using a cluster of 12 networked PowerPcs. The uniqueness of the proposed research is based on the development of a set of tailor-made, PowerPC micro kernel routines to efficiently manage the overall system for a specific, large-scale AI application: parallel knowledge discovery from large complex databases. The main objectives are: (1) Developing a set of new and unique load balancing schemes for management of distributed systems. The schemes will be tailored for AI applications

and implemented using the PowerPC micro kernel routines. (2) Developing a new distributed system for parallel knowledge discovery from large complex databases. The application will be carried out using the computing facility and proposed load balancing environment.

CDA-9529524
$37,510—12 mos.
Erlinger, Michael A.
Harvey Mudd College
CISE Research Instrumentation: ATM Switch and Workstation

The ARC is a Southern California consortium investigating ATM (Asynchronous Transfer Mode) for suitability as a high speed networking technology for advanced applications such as medicine, teleconferencing, and metacomputing. ATM service is being provided by Pacific Bell and GTE, while the local premise equipment, switches and workstations, is being provided by each ARC member. Using the ATM equipment provided by the CISE grant, experiments in the areas of remote learning, network management, and performance evaluation will be performed by HMC and CGS. In the area of remote learning the ARC network will be used to support real-time interactive courses and seminars between HMC and CGS and other ARC members. During such sessions ARC network performance and management will be investigated by HMC and CGS researchers. Because of the high speed nature of ATM, new paradigms for performance and management will be developed by ARC researchers. A primary goal of the research conducted by HMC and CGS will investigate through experiments the suitability of ATM for supporting advanced network applications. Without NSF support for an ATM switch and workstation, Harvey Mudd College and the Claremont Graduate School would be unable to participate actively in ARC activities

CDA-9529549
$61,300—12 mos.
Fischer, Gerhard
University of Colorado at Boulder
CISE Research Instrumentation: Shared Interaction in Support of Design, Learning, and Planning

Two InterSim (Interactive Simulation) stations are being developed, each composed of a large interactive surface and multiple 3-D interactors. These systems allow us to move beyond the interaction model of single user/single computer—with an emphasis upon shared interaction to mediate social aspects of learning, design, and planning. These paradigms integrate the use of physical objects—to support and encourage face-to-face interaction among the participants—with virtual objects—to provide computational support for the model underlying the simulation. When linked across a network, these systems can allow the interaction with simulations and among individuals at a distance. A two-phase prototyping process is being used: First, an initial version utilizing front-surface projection is being developed, allowing us to deal with some of the software and device-controller issues and demonstrating the applicability of the approach. Subsequent development will utilize newer technology to create a back-imaged system to resolve shadowing problems. To test and guide its development, applications of the technology are underway in the form parallel efforts in the areas of Conflict Resolution, Decision Making and Planning; Learning by Design: Cross-Cultural Science Classroom Interchange; and Human-Centered, Intelligent Agents Supporting Communication and Collaboration.

CDA-9529471
$67,177—12 mos.
Hachtel, Gary D.
University of Colorado
CISE Research Instrumentation: High Performance Computing Environment for Symbolic Synthesis and Verification.

Decision diagrams are data structures that allow the compact representation of very large sets. Problems involving graphs with 10 to the 36th edges and beyond have been solved successfully, thanks to the compactness of decision diagrams and the efficiency of the symbolic algorithms that manipulate them. Such large problems routinely arise in the synthesis and verification of today's digital systems. The requested instrumentation is intended to support the development and experimental validation of a system (called BOLD-HSV) that addresses the aforementioned synthesis and verification problems for the very large digital systems that the continued technological advances will make possible in the near future. The algorithms that are going to be developed require high speed computers and large amounts of memory. Experiments performed at the University of Colorado and elsewhere show that, although one can trade memory for time, the best results are obtained with large memories (over 0.5 GB). The proposed instrumentation will make it possible the study of the performance of the algorithms on realistic test cases, also with respect to new computer architectural features, like sophisticated memory hierarchies.

CDA-9529470
$61,028—12 mos.
Hanson, Eric N.
University of Florida—Gainesville
CISE Research Instrumentation: Research in Parallel and Shared-nothing Database and Storage Systems

The University of Florida Computer and Information Science and Engineering (CISE) department is undertaking the following three research efforts: (1) a project investigating the use of shared-nothing multiprocessors

for fast rule processing in active database systems using a partitioned, parallelized discrimination network, (2) a project to develop and evaluate parallel techniques and algorithms for object-oriented knowledge-base management systems to support data partitioning and distribution, query processing, query optimization and knowledge rule processing using a network-of-workstations (NOW) environment, and (3) a project to develop high performance storage servers to allow storage and processing of data generated by high energy physics experiments. All of these projects are experimental in nature, and involve implementing parallel software prototypes. This experimentation is essential to help validate design proposals and get feedback on the designs to help refine and improve them. The research instrumentation, consisting of four new high-speed workstations and a very-high-speed communication network, allows the construction of a parallel processor to conduct the work described.

CDA-9529529
$31,867—12 mos.
Jacobson, Douglas W.
Iowa State University
CISE Research Instrumentation: Computer System Security Laboratory

A research laboratory in computer system security is supported by this grant. The projects targeted for the laboratory collectively address the problems of denial of service and intrusion detection, two problems of increasing importance as the nation becomes dependent on the computer communication infrastructure. Research has identified several methods of attacks that can render a network unusable. Hardware obtained from this grant will facilitate the establishment of a laboratory with an isolated subnet, a network logic analyzer, and several UNIX-based workstations and personal computers. In this environment, the researchers have full control of all components so that network traffic can be closely monitored, and denial of service experiments can be safely and fully explored. The end goal of the collection of projects outlined in the proposal is to develop an insight into potential countermeasures for intrusion and denial of service attacks.

CDA-9514898
$175,300—12 mos.
Jain, Raj
Ohio State University
CISE Research Instrumentation: ATM Testbed for Multimedia and Distributed Computing

This research proposes to establish an ATM Networking Testbed. The Testbed is targeted to provide networking research infrastructure to enable experimental research in the areas of ATM networking, ATM switch testing, parallel computing, distributed computing, and multimedia. Specifically, the Testbed will be used for the following four research projects: a) Development of performance metrics and benchmarks for various components involved in ATM networked systems including switches, network interface cards, end-system hardware, and operating systems; b) Development of new mechanisms and primitives for communication and synchronization over networks of workstations (NOWs) connected with ATM interconnection; c) Development of an environment for simulation and implementation of computer protocols that are subject to faults, security attacks, and real-time constraints; and d) Reinventing of the familiar spreadsheet paradigm to enable transparent parallel computation and distributed sharing, circumscribed by the simple yet powerful programming and modeling paradigm. The National ATM Performance Test Lab established by this proposal will provide impartial performance measurements using standard benchmarks for equipment from different vendors. This will also allow the creation of a vigorous center for experimental research in high-speed multimedia networking and parallel processing over ATM-connected networks.

CDA-9529304
$46,680—12 mos.
Kaiser, Gail E.
Columbia University
CISE Research Instrumentation: Semantics-based Prefetching for Mobile Computing

This proposal investigates collaborative workflow environments, and previously constructed an infrastructure that assumes conventional high-speed networking. Professor Kaiser is developing new algorithms and techniques to support mobile hosts. The research addresses prefetching based on semantic information on what the user is likely to do next drawn from the workflow definition tailoring the specific environment instance, to permit low-bandwidth and temporarily detached operation by participants in collaborative enterprises. Professor Duchamp is developing operating system support for intelligently prefetching files from a file system or objects from an object base. The goal is to improve performance and automate cache loading prior to disconnecting from the network, via two types of prefetching: The first is performed by the file system, transparent to applications; the file system "learns" file access patterns and uses these patterns to prefetch if/when the patterns recur. The second type of prefetching is application-directed; applications with knowledge of their future data accesses can use a special interface to instruct the operating system what to prefetch. Professor Kaiser's workflow system is the major example application for this type of prefetching. Both the collaborative work and operating systems directions require mobile notebook computers for development, testing, and measurement of the prototype support.

CDA-9529518
$200,000—12 mos.
Kearney, Joseph K.
University of Iowa
CISE Research Instrumentation: Instrumentation for Virtual Environments Integrating Dynamics and Real-Time Interactivity

The equipment for high-speed computation and real-time image generation is used for a coordinated set of research projects attacking the computational requirements of interactive, real-time simulation with rich physical and behavioral interactions. The research focuses on four related areas: (1) Merging geometric analysis, dynamic analysis, and control programming for interactive, real-time multibody simulation; (2) Numerical methods for fast, accurate solution and integration of motion equations; (3) Scenario authoring and behavior modeling for semiautonomous agents; and (4) Distributed, real-time systems. building on existing facilities, the instrumentation provides a combination of compute power, graphics power, interaction hardware, and workstations to support real-time simulation and virtual environments research.

CDA-9529503
$54,187—12 mos.
Ozsoyoglu, Gultekin Z.
Case Western Reserve University
CISE Research Instrumentation: Presentation Languages in Multimedia Databases

Multimedia presentation refers to the concurrent presentation of multimedia data using monitors for text, video or still images, and speakers for audio. Each presentation contains multimedia segments retrieved from a database, and is constructed and played out by a presentation manager software. This research has three components. (a) A prototype system is developed to automate the assembly of presentations from multimedia databases for beginning computer users. The system is then revised and evaluated in different application domains. One example is a Course-Assistant software in education. (b) A presentation construction language for intermediate computer users is implemented and evaluated in different application domains. The language provides control on the number and contents of concurrent segments in a presentation, and has the ability to specify playout-time changes in a presentation, and communication and synchronization among multiple playout managers. (c) For advanced users, a presentation manipulation language is developed and evaluated. The development is carried out on multimedia personal computers with MPEG capture and playout capabilities and on workstations, acquired by the instrumentation grant. The development platforms are Windows NT and UNIX.

CDA-9529463
$55,815—12 mos.
Peshkin, Michael A.
Northwestern University
CISE Research Instrumentation: Robot for Human Workspace

The requested equipment of computer hardware and software for real-time control of robotics systems is used in furtherance of research in computer and information science and engineering in the departments of Mechanical Engineering and Electrical and Computer Engineering. The real time control and computation system is associated with the robot requested under this proposal and other robots in several closely related projects. Specific research tasks are as follows. (1) Research and development of robot-assisted surgical systems. Most immediately, a system for directing linear insertions, such as biopsies and orthopedic pins, under fluoroscopic imaging. These systems require fast dedicated computers for control, and a 6-axis force sensor to facilitate interaction with a surgeon. (2) Research and development of assertive devices to be used in the final assembly of automobiles and light trucks, with General Motors. This project requires a considerable amount of high-speed real-time digital signal processing hardware, and associated software.

CDA-9529541
$51,546—12 mos.
Psarris, Kleanthis
The University of Texas at San Antonio
CISE Research Instrumentation: Research in Parallel Computer Systems Design using Workstation Clusters with High-Speed Networks

This award is for the acquisition of a cluster of four multiprocessor workstations to support several research projects, including the research on the design of architectures and compilers for distributed shared memory multiprocessors and on large-scale applications such as the design and implementation of parallel discrete event simulators. The proposed instrumentation provides a multi-granular parallel and distributed computing platform, where both tightly coupled and loosely coupled systems coexist. It interconnects four Sun workstations with an SCI (scalable coherent interface) based high-speed network. The SCI interconnects will provide low-latency message passing and shared memory support. The SUN workstations with Solaris OS support threads and high precision clocks. The low-latency inter-workstation communication and threads will be used to implement parallel architecture simulators and parallel discrete event simulators. Precise clocks will be used to extract message communication and shared memory traces from applications. These traces in turn will be used to evaluate the new architectural mechanisms through simulations. The shared memory support pro-

vided by the interconnect will be used to run the parallel code generated by a parallelizing compiler. Several benchmark applications will be compiled and run on the equipment to evaluate the effectiveness of various dependence analysis techniques.

CDA-9529418
$86,840—12 mos.
Ibarra, Oscar H.
University of California, Santa Barbara
CISE Research Instrumentation: A Next-Generation High-Performance Network of Commodity PCs

The proposed instrumentation consists of a collection of commodity personal computers (PCs) connected by a commodity ATM network. This computing platform supports four experimental research projects in the area of high performance parallel and distributed systems. The first project investigates efficient communication primitives for cost-effective commodity computing and networking platforms. The objective is to enable important parallel computations to execute efficiently in this computing environment. The second project investigates a new parallelizing compiler technique called commutativity analysis. The objective is to extend the range of parallelizing compilers to include computations that manipulate complex pointer-based data structures. The third project investigates scheduling and run-time supporting techniques for irregular scientific computations. The objective is to understand how to map these computations efficiently onto a modern parallel computing environment consisting of commodity hardware components. The final project investigates issues in developing a scalable WWW server for digital library applications. The objective is to strengthen the server's processing capabilities to match huge expected increases in simultaneous access requests from the Internet. The main research activity in all of these projects is developing, testing and measuring software. The instrumentation provides the hardware platform required to perform these activities.

CDA-9529442
$72,240—12 mos.
Vaidya, Nitin
Texas A&M University
CISE Research Instrumentation: Distributed Computing and Real-Time Networking Research

This proposal requests funding for a homogeneous workstation cluster and ATM-FDDI networking hardware to aid research in distributed computing and real-time networking. The equipment is useful for several projects, including: (1) Real-time communication in heterogeneous networks: This project develops techniques for guaranteeing deadlines in heterogeneous networks popular in mission-critical systems. Requested equipment enables experimentation with a network consisting of ATM and FDDI. (2) Algorithms for distributed systems management: Algorithms are developed for managing performance and faults in distributed systems, using formal analysis and experimentation. Realistic assessment requires a dedicated cluster of homogeneous workstations to allow undisrupted testing and trend prediction. (3) Failure recovery schemes for parallel applications: Design of efficient recovery schemes is necessary to minimize execution time in presence of failures. The requested workstations provide a homogeneous computing environment necessary for quantitative comparison of different recovery schemes. (4) Distributed shared memory (DSM) system design: Requested equipment provides a workstation cluster and high-speed networking for development of an adaptive fault-tolerant DSM capable of achieving high performance.

CISE SPECIAL PROJECTS

CDA-9412718
$149,193—12 mos.
Alo, Richard
University of Houston-Downtown
Special Projects: Visiting Scientist Programs for Minority Institutions and Small Colleges

This project is designed to strengthen the research and related educational activities in computer and information science and engineering at minority institutions without doctoral programs. For the twenty-five selected institutions, it provides funds for Visitation Programs by recognized computer scientists, engineers and educators who can respond to the needs of the program proposal submitted by the institution to the Program Committee and who will establish a working relationship with the institution that is expected to extend beyond the period supported by this grant. The project includes a strong evaluation component that extends throughout the period of the grant.

CDA-9507756
$288,039—12 mos.
Condon, Anne
Special Projects: The CRA Distributed Mentor Project

In an effort to increase the number of women entering graduate school in CISE disciplines, the Computing Research Association (CRA) has been awarded a continuation of the Distributed Mentor Project (Award CDA-9302536) where 20-25 female students are matched with a number of female professors in CISE research areas each of the years 1996-1998, to participate in a summer of research at the mentor's institution. The students will most likely be computer science or computer engineering majors although this is not required. In addition, the PI's have been funded to conduct a longitudinal evaluation of the two projects over the year's 1994-1998. The evaluation will measure how well the projects have met the goal on increasing the number of women in CISE disciplines entering graduate school. The most useful aspect of the mentoring/research will also be assessed on an annual basis in order to provide feedback for improving the remaining years of the project. The CRA is an association of U.S. and Canadian academic departments of Computer Science and Computer Engineering, and Industrial Laboratories engaging in basic computing research. The mission of CRA is to represent and inform the computing research community and to sup-

port and promote its interests. Dr. Weingarten is the Executive Director of CRA. Dr. Anne Condon, the academic leader of this project, is an Associate Professor of Computer Science at the University of Wisconsin

CDA-9642990
$6,000—0 mos.
Cuny, Janice
Computer Research Association
Special Projects: Technical Support in Editing Transcripts from the Workshops on Academic Careers for Women in Computer Science

This supplement to the CRA Special Project CDA 9411983 supports the expenses to be incurred in technically editing the transcripts from the workshops supported by the underlying proposal. Transcripts will be professionally edited into a single, coherent volume to be made available over the net. The workshops, held in conjunction with the Grace Hopper Celebration for Women in Computing, with Supercomputing 1994, and with the ACM Computer Science Conferences of 1995 and 1996, present practical information, advice and, basic information necessary to succeed in academic careers. The workshops are considered "outstanding, useful, invaluable, informative, and practical" by many. CRA is an association of U.S. and Canadian academic departments of Computer Science and Computer Engineering, and industrial laboratories engaging in basic computing research. The mission of CRA is to represent and inform the computing research community and to support and promote its interests.

CDA-9642997
$10,000—0 mos.
French, James C.
University of Virginia
Special Projects: NCSTRL: A National Computer Science Technical Report Library

The two students will work under the direct supervision of the PI. One student will help with the design and deployment of the new software to facilitate polling remote sites for their bibliographic data. The software will also have to ensure the integrity of the bibliographic data, detecting errors and alerting the contributing sites to problems. The other student will participate in the development and deployment of a new advanced browsing mechanism being design at the University of Vir-

ginia. This mechanism will be used after initial keyword searching to help users identify more relevant documents. Since all seniors are required to produce a thesis, these projects will provide an opportunity to expose undergraduates to research "doing" to "writing."

CDA-9634182
$50,000—12 mos.
Harrington, James
NASA Goddard Space Flight Center
Special Projects: 6th Annual MU-SPIN Conference (1996) and Supplemental Support for on-campus Regional Training Workshop

This interagency transfer purpose is to partially support a large conference and supplemental smaller workshops on high performance computing and communications and infrastructure development for minority institutions. NASA, through its National Space Science Data Center, has developed a program called the Minority University Space Interdisciplinary Network (MU-Spin). The program constitutes a major networking and education initiative for minority institutions, and other universities with large minority student enrollments. Connecting these institutions with the NASA Science Network, and promoting the activities such connections provide serve as primary goal of the program.

CDA-9612360
$27,941—12 mos.
King, Willis
IEEE Computer Society
Special Projects: Annual International Workshop on Computer Science and Engineering

This proposal, from the IEEE Computer Society, partially supports an International Workshop on CS and CE accreditation. Selected visitors from foreign countries will be brought to the meeting November 10-11, 1996, immediately following the FIE Conference in Salt Lake City, Utah. Goals include the understanding of educational objectives and standards of different nations, to attempt to form a common set of criteria for accreditation and to work toward mutual recognition of computing degrees among nations. The workshop is an IEEE-CS initiative and the Computer Society will provide 50% of the total cost. Other cooperating societies include ACM, ABET, CSAB, and IEEE.

CISE Research Experiences for Undergraduates—
Site Grants

CDA-9642993
$40,000—12 mos.
Adjouadi, Malek
Florida International University
REU Supplement: Research Experiences for Undergraduates in the NSF Center for Advanced Technology and Education

This REU Supplement to NSF CISE Institutional Infrastructure-Minority Institutions (II-MI) Grant, Establishment of an Institutional Infrastructure: Center for Advanced Technology and Education (CATE), supports the involvement of eight students selected to foment undergraduate research utilizing the infrastructure provided by the grant in the following projects:
  —Image Processing
  —Multimedia
  —Robotics
  —Biomedical Engineering
  —Computer Networking
  —Parallel Processing
Three faculty researchers will continue their involvement in these research areas and would monitor the selected students who will in turn work their graduate colleagues.

CDA-9642997
$10,000—12 mos.
French, James C.
University of Virginia
REU: NCSTRL: A National Computer Science Technical Report Library

The two students will work under the direct supervision of the PI. One student will help with the design and deployment of the new software to facilitate polling remote sites for their bibliographic data. The software will also have to ensure the integrity of the bibliographic data, detecting errors and alerting the contributing sites to problems. The other student will participate in the development and deployment of a new advanced browsing mechanism being design at the University of Virginia. This mechanism will be used after initial keyword searching to help users identify more relevant documents. Since all seniors are required to produce a thesis, these projects provide an opportunity to expose undergraduates to research "doing" to "writing."

CDA-9424075
$41,186—12 mos.
Hodges, Larry
Georgia Tech Research Corporation
REU: Software Development Experimental Quantification, and Application Development for Virtual Reality and Real-time Visualization

This Research Experiences for Undergraduates project will support undergraduates to participate in research projects in the areas of computer graphics, virtual environments and visualization. The goal is to involve junior and senior students in a long term research experience (1-2 years) in which they make real contributions to the research, present papers at academic conferences, and author or co-author papers submitted to journals. The research project will focus on software and algorithm development, experimental quantification, and application development for virtual reality and real-time visualization systems. The student participants will be split into two groups of four each. One group will focus on the development of design tools for 3-D environments, image display techniques and algorithms, and application of virtual reality to exposure therapy. The other group will develop methods and tools for highly-interactive visualization and analysis in scientific applications. The methods and tools will be both for workstation-based and virtual environments and will be based on a common set of principles. Undergraduate participants will work in a state-of-the-art visualization laboratory and will meet weekly with faculty members and graduate students who are also involved in these projects.

CDA-9641023
$10,800—12 mos.
Lawrence, Patricia A.
University of Texas, El Paso
REU Supplement: Effects of Interpersonal and Mass-mediated Messages on Hispanic Undergraduates' Decisions to Pursue Degrees in Computer Science

This REU Supplement will support two undergraduates to work on the grant "Effects of Interpersonal and Mass-mediated Messages on Hispanic Undergraduates' Decisions to Pursue Degrees in Computer Science". The students will participate in tracking random samples of student respondents for the longitudinal survey, collect-

ing and entering data for computerized analyses, conducting statistical tests, and then assisting with writing the research report.

CDA-9531543
$64,000—24 mos.
Miller, W. Thomas
University of New Hampshire
REU: Intelligent Structures Group Research Experiences for Undergraduate Site

This Research Experiences for Undergraduates project will support 17 students per year in programs carried out during the Summers and the academic years for two years. Twelve students will be supported during the Summers and five during the academic years. During each time period the students will be divided into three teams in the areas of analog and digital microelectronics design, intelligent robotics and machine vision, and computer communications. The Intelligent Structures Group, based within the Department of Electrical and Computer Engineering, provides a combination of structure and diversity to enhance the students experience. Group members have active collaborations with several other research units at UNH and the students will participate in these collaborative efforts.

CDA-9531730
$46,400—12 mos.
Murphy, Robin
Colorado School of Mines
REU: Multiple Autonomous Mobile Robots For Search And Rescue Applications

This Research Experiences for Undergraduates project will support ten students per year in programs carried out both during the Summers and the academic years, for two years. Activities will include technical (e.g., hands-on laboratory skills), intellectual (e.g., problem-solving skills), and on professional and personal development (e.g., communication and management skills). The project targets both CSM resident students and students from traditionally minority institutions. In the first year and a half, the students will use two identical mobile robots certified for search and rescue activities in underground mines and will demonstrate and test their results in the CSM Edgar Experimental mine. During the second year, the participants will transfer their software to small robots suitable for SAR work in collapsed buildings. The use of two sets of robots and two variations of the same task will reinforce the development of general purpose solutions and basic software engineering skills. Analysis and design procedures will be emphasized at each step of the project and the project also entails significant written and oral presentations during the year.

CDA-9531535
$37,000—12 mos.
Shirazi, Behrooz
University of Texas, Arlington
REU: Research Experiences for Undergraduates in Software Tools for Concurrent Programming

This Research Experiences for Undergraduates project will support six students in Summer programs each year, for three years. The goal of the project is to continue an already established REU site program so as to continue to provide opportunities for highly talented and qualified upper division women, minority and disabled undergraduate students to participate in research programs in the field of parallel processing. The students will investigate problems related to parallel program development, debugging, scheduling, and performance profiling under the supervision of the principal investigators and faculty mentors and in collaboration with graduate students. The students will be recruited nationally with emphasis on recruitment of students from institutions lacking research facilities and located in the southwest region of the United States.

CDA-9643536
$10,000—12 mos.
Singh, Ambuj
University of California, Santa Barbara
REU Supplement: Broadcasting on ATM Networks

This REU Supplement to NSF CISE Research Instrumentation Grant, 9421978, High Speed Cluster of Workstations, supports the involvement of two undergraduate students chosen to partake in the research concerning the design and implementation of various reliable protocols on the ATM network installed at UCSB. Broadcast protocols with different properties in terms of reliability, delivery order and assumptions about the underlying system synchrony have been proposed recently posing some interesting design issues. These implemented protocols are expected to lay the foundations for future work on building replicated databases on a cluster of foundations connected by an ATM network.

CDA-9527932
$48,000—12 mos.
Truhlar, Donald G.
University of Minnesota
REU: Undergraduate Internship Program in Biophysical Computing and Computational Dynamics

This Research Experiences for Undergraduates project will support nne students per year in programs carried out during the summers, for three years. The program's objective is to promote and help support undergraduate involvement in ongoing and new research in biophysical computing and computational dynamics and new software development efforts for scientific com-

puting and graphics support for such research, as well as to carry out interesting and useful research. Undergraduates will work with faculty on a wide variety of projects. The Supercomputer Institute, an interdisciplinary research program spanning all colleges of the University, provides a focal point for the project and arranges sessions at which the students working on various subprojects share their work, visit each others' labs, and learn about related work.

CDA-9531571
$43,900—12 mos.
Vakakis, Alexander F.
University of Illinois Urbana-Champaign
REU: Undergraduate Symbolic Computations in Engineering and Science (USCES)

This Research Experiences for Undergraduates project will supprt ten students per year in programs carried out during the summer, for three years. The project will promote the emerging field of symbolic computational science as an approach to computational modeling and scientific computing with problems drawn primarily from mechanical and industrial engineering. Specific goals of the project are (a) to introduce the students to modern computational and symbolic methodologies for solving challenging problems, (b) to increase understanding of the qualitative and quantitative nature of these problems, (c) to develop the students' ability to derive and interpret mathematical models, and (d) to provide an integrated educational experience to a selected group of undergraduate students with special emphasis on underrepresented groups. Members of the research team are from the University of Illinois and from Wolfram Research and use of the symbolic manipulation package Mathematica will be a focus of the effort.

CDA-9531321
$46,424—12 mos.
Wiedenbeck, Susan
University of Nebraska-Lincoln
REU: Research in Human-Computer Interaction and Multimedia Interface Design

This Research Experiences for Undergraduates project will support ten students per year in programs carried out during the Summers, for three years. Students will be recruited from institutions across the nation, particularly from predominantly undergraduate institutions and with a maximum of three students per year from the University of Nebraska. The research topics will be drawn from the field of human-computer interaction (HCI) and multimedia interface design. The program will involve seminars, research projects, and academic year follow-up. The central activity will be the students' research projects during which they will conceptualize a specific problem within HCI, design a study to address the problem, instrument the study and run pilot tests. During the follow-up academic year, students will be encouraged to continue with data collection and analysis, with the help of the PI. Students are expected to leave the REU project with an understanding of the research process and the job of a researcher, an appreciation of creativity in science, and a sense of the excitement of scientific discovery.

Special Initiatives

CDA-9640679
$150,000—0 mos.
Spohrer, James C.
Apple Computer, Inc.
Supplement: East-West Consortium: Next Generation Authoring Tools & Instructional Applications

The East-West Consortium is a unique partnership of universities, publishers, a computer software and hardware manufacturer, and the government. The partnership aim is to develop next generation authoring tools to empower non-programmers to develop interactive content, training, and educational software. Since there is no single learning architecture that is appropriate for all situations, the consortium will develop a suite of tools and make them accessible to content and design specialists who are non-programmers. The consortium will build tools that have been pioneered by the university partners and by Apple. These include: cognitive tutor authoring tool (Carnegie Mellow University), knowledge-based tutor authoring tool (University of Massachusetts at Amherst), media-rich CBT authoring tool (Stanford Medical School), simulation with critics authoring tool (University of Colorado at Boulder), and simulation-based learning authoring tools (Apple). These tools will all be cross-platform using Apple-IBM Kaleidas Script X standard and be composed of many parts that can be integrated to build new hybrid tools using Apple, IBM, etc. Open Doc and SOM/DSOM standard. Apple will drive the use of these standards, provide the core tools technology for creating the task specific authoring tools, and provide a commercialization path for these efforts. To ensure that the development effort is responsive to commercial tool needs, the publishers in the consortium, Houghton Mifflin Company and PWS Publishing Company) are building next generation interactive content in the areas of beginning algebra and simulations for real world problem solving. Partnerships with publishers focused on medical application areas are also in place.

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Spohrer, James C.
Apple Computer, Inc.
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$400,000—0 mos.
Winner, Robert I.
The Enterprise Computing Institute
HyperEducation Consortium

The HyperEducation Consortium for NII-Based Education is a partnership of Enterprising Computing Institute, Inc.—a private none profit research center; Digital Equipment Corporation, Digital Learning Services-a developer and distributor of educational courses and training services; and Aimtech—a developer of cross-platform software tools for developing interactive multimedia applications. The Consortium proposes to extend and use Aimtech's authoring system to enable the building of modular educational materials from electronic document forms. The educational modules can be adapted to

a variety of learning styles for computer-based training, instructor led exercises, distance learning, performance support, and computer simulations. The Consortium plans to provide a mechanism that will enable educa- tors to choose modules based on price, quality, use, and supporting materials. The modules can be stored locally or across the National Information Infrastructure. (NII).

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