Human-Computer Interaction and Information Management

<table>
<tr><td>**Definition of HCI&IM PCA**</td></tr>
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The activities funded under the NITRD Program's HCI&IM PCA increase the benefit of computer technology to humans through the development of future user interaction technologies, cognitive systems, information systems, and robotics. Current systems overwhelm the user with information but provide little in the way of adaptable access, necessitating adaptability on the part of the user. The HCI&IM research vision is to provide information that is available everywhere, at any time, and to everyone regardless of their abilities; to increase human use of this information by providing customized access including the ability to interact using a variety of devices and to meet varied needs for manipulation, analysis, and control; and to provide comprehensive management of vast information environments. HCI&IM research focuses on developing systems that understand the needs of the users and adapt accordingly.

Broad Areas of HCI&IM Concern

- Usability and universal accessibility
- Interaction
- Cognitive systems, learning, and perception
- Information management and presentation
- Autonomous agents and systems

Technical Goals

- Foster contributions from different branches of science and engineering that are required to address the problems in this multidisciplinary field and encourage the needed technological convergence through communication and coordination

- Develop a deeper scientific understanding of both human and machine cognition, linking the various parts of human-computer interaction and information management together

- Enable development of machines and systems that employ the human senses of perception to their full potential, maximizing the information-flow bandwidth between people and their tools

- Discover new and better ways to achieve information integration across a wide range of different modalities, media, and distributed resources

- Develop tools that are increasingly able to take on planning, aid in decision making, learn from experience, and develop knowledge from raw data, in order to tie together information management and human needs

- Develop flexible systems of control that manage the degree of autonomy exhibited by machines according to the constantly changing needs of humans, especially in that broad and valuable area where HCI and IM unite for the benefit of people

Illustrative Technical Thrusts

- Fundamental science and engineering on human-computer interfaces for stationary, mobile, and ubiquitous computing and communications environments

- Multi-modal, speech, gesture, visual, language, haptic, and physical interactions

- Efforts to improve the collection, storage, organization, retrieval, summarization, analysis, and presentation of

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HCI&IM Agencies

NSF	NASA	EPA	**Participating Agency**
NIH	AHRQ	NOAA	
DARPA	NIST		FAA

HCI&IM PCA Budget Crosscut

FY 2004 estimate	FY 2005 Request
$469.2 M	**$419.5 M**

information of all kinds in databases, distributed systems, or digital libraries

- An understanding of the use of multiple modalities and their relation to information content

- Information management and access that adapts to the needs and preferences of a diverse population including young, old, and disabled users as well as expert and novice users and in complex, multi-person, collaborative and distributed systems

- Research and technology development related to perception, cognition, and learning by machines and by human beings interacting with machines

- Mobile autonomous robots

- Remote or autonomous agents

- Collaboratories

- Visualizations

- Web-based repositories

- The semantic web

- Information agents

- Evaluation methodologies and metrics for assessing the progress and impact of HCI&IM research

HCI&IM PCA: Coordination and Activities

HCI&IM Highlights

Early in FY 2004, the HCI&IM Coordinating Group released its "Human-Computer Interaction and Information Management Research Needs" report. This document identifies and illustrates the challenges underlying HCI&IM R&D to achieve benefits such as:

- Changing the way scientific research is conducted

- Expanding the science and engineering knowledge base

- Enabling a more knowledgeable, capable, and productive workforce

The report places agency HCI&IM R&D investments within a conceptual framework that illuminates the broader social context in which the need for "human-computer interaction and information management" arises. The framework's four main categories are:

- Information creation, organization, access, and use

- Managing information as an asset

- Human-computer interaction and interaction devices

- Evaluation methods and metrics

The CG is using the report to identify and assess current agency investments, research gaps, and a wish list of possible FY 2005 activities, including refining plans in new R&D areas such as cognition, robotics, and devices and identifying and coordinating activities in areas of shared interests with other CGs, such as:

- With LSN on moving the bits in distributed data

- With SEW on the impact of distributed data on organizations and groups sharing data

- With LSN in middleware

- With SDP in automatic software design and integration

- With SEW in universal accessibility and the use of multiagent systems

The following is a sampling of FY 2004 activities in which more than one NITRD agency participates (other agencies involved in these efforts are not cited):

DARPA – Improving Warfighter Information Intake Under Stress Program, with NSF; Translingual Information Detection, Extraction, and Summarization (TIDES), with NIST, NSA; Effective, Affordable, Reusable Speech-to-Text (EARS), with NIST, NSA

NASA – High-end modeling and simulation, with DOE/SC; global climate modeling, with DOE/SC and NOAA; automated vehicle cockpits and air traffic management and risk, with FAA

AHRQ – Considering funding proposals submitted to AHRQ's Health Information Technology (HIT), with NIH/NLM; developing standards for improving patient safety, as part of the Patient Safety Task Force, with NIH/NLM; developing a U.S. health data standards landscape model and application, with NIST; developing data standards critical to improving patient safety in the use of prescription drugs, with FDA; invites experts from other agencies to participate in peer reviews of its grant proposals

NIST – Human Language Technology and Interactive Systems Technology Programs, with DARPA and NSA

HCI&IM R&D PROGRAMS BY AGENCY

SELECTED FY 2004 ACTIVITIES AND FY 2005 PLANS

HCI&IM	**NSF**	HCI&IM

The bulk of NSF's FY 2004 HCI&IM R&D investments are in its Directorate for Computer and Information Sciences and Engineering (CISE), in the Division of Information and Intelligent Systems (IIS). Other HCI&IM activities are funded under the NSF-wide Information Technology Research Program (ITR).

CISE/IIS Division

IIS goals are to:

• Increase the capabilities of human beings and machines to create, discover, and reason with knowledge

• Advance the ability to represent, collect, store, organize, locate, visualize, and communicate information

• Conduct research on how empirical data lead to discovery in the sciences and engineering

HCI&IM-related research is funded across IIS's three clusters:

Systems in Context – research and education on the interaction between information, computation, and communication systems, and users, organizations, government agencies, and the environment. This cluster integrates the following programs:

• Human-Computer Interaction

• Universal Access

• Digital Society and Technologies

• Robotics

• Digital Government

Data, Inference, and Understanding – basic research with the goal of creating general-purpose systems for representing, sorting, accessing, and drawing inferences from data, information, and knowledge. Integrates the following programs:

• Artificial Intelligence and Cognitive Science (AI&CS) – focuses on advancing the state of the art in AI&CS. Includes research fundamental to development of computer systems capable of performing a broad variety of intelligent tasks and computational models of intelligent behavior across the spectrum of human intelligence

• Computer Vision

• Human Language and Communication

• Information and Data Management

• Digital Libraries

Science and Engineering Informatics – includes:

• Collaborative Research in Computational Neuroscience that will continue as a collaborative program

• Science and Engineering Information Integration and Informatics (SEI), which focuses on development of IT to solve a particular science or engineering problem and generalizing the solution to other related problems

• Information Integration, to provide a uniform view to a multitude of heterogeneous, independently developed data sources including reconciling heterogeneous formats, Web semantics, decentralized data-sharing, data-sharing on advanced cyberinfrastructure (CI), on-the-fly integration, and information integration resources

ITR Program

Other NSF HCI&IM investments are in the NSF-wide ITR Program, which involves all NSF directorates and offices including Biological Sciences; Engineering; Geosciences; Mathematical and Physical Sciences; Social, Behavioral, and Economic Sciences; Office of Polar Programs; and Education and Human Resources.

NSF HCI&IM plans for FY 2005 include:

• *Research to develop computer technology that empowers people with disabilities, young children, seniors, and members of traditionally under-represented groups, so that they are able to participate as first-class citizens in the new information society, including for example work on how blind people can benefit from the information communicated when other people gesture or exhibit facial expressions.*

• *Information Integration – special emphasis will be placed on domain-specific and general-purpose tools for integrating information from disparate sources, supporting projects that will advance the understanding of technology to enable scientific*

discovery, and that will creatively integrate research and education for the benefit of technical specialists and the general population

• *Intelligent robots and machine vision technology* — *research to develop intelligent robots and machine vision technology that will help people do what they cannot or would rather not do; protect critical infrastructure and monitor the environment, and continue to explore extreme environments*

• *Projects to push the frontiers in human-computer communication* — *automatic multilingual speech recognition toolkits, systems to recognize spontaneous speech despite disfluencies and multiple speakers, and development of information infrastructure to enable cutting-edge research and development about spoken, written, and multimodal communication*

HCI&IM   **NIH**   **HCI&IM**

Illustrative of NIH HCI&IM activities is the Joint NIH Bioengineering Consortium/NIH Biomedical Information Science and Technology Initiative Consortium (BECON/BISTIC) 2004 Symposium on Biomedical Informatics for Clinical Decision Support: A Vision for the 21st Century held June 21-22, 2004. The symposium involved 15 NIH Institutes seeking to gain consensus about standards for reducing medical errors and variability in patient information by reviewing software tools and approaches to deliver the benefits of biomedical information technologies to patients at the time and place of decision making regarding risk, diagnosis, treatment, and follow-up. Specifically, the meeting provided a scientific vision of the health care information technologies that may be more fully deployed in the workflow to improve efficiency and outcomes.

NIH FY 2005 plans in HCI&IM R&D include:

• *Curation and analysis of massive data collections* – *a focus that has emerged as a critical element for advances in biomedical and clinical research in the 21st Century. NIH is making substantial new investments in tools for management and use of the massive new databases that will permit their use by researchers throughout the country. Specific R&D topics include:*

– *Tools for building and integrating ontologies*
– *Software tools for visualizing complex data sets*
– *Curation tools*
– *Support for standard vocabularies, nationwide*
– *Information integration tools*

HCI&IM   **DARPA**   **HCI&IM**

DARPA's FY 2004 HCI&IM investments involve four programs that fall within the agency's Information Processing Technology Office (IPTO). IPTO's mission is to create a new generation of computational and information systems that possess capabilities far beyond those of current systems. The programs are:

Compact Aids for Speech Translation (CAST) – developing rapid, two-way, natural-language speech translation interfaces and platforms for the warfighter in the field that overcome the technical and engineering challenges limiting current multilingual translation technology; goal is to enable future full-domain, unconstrained dialog translation in multiple environments, replacing the DARPA RMS (one-way) translator. The two-way capability will greatly improve the ability of operators to converse with, extract information from, and give instructions to a foreign-language speaker encountered in the field. Major research

thrusts are:

• Core research

• DARPA 1+1 Way

• DARPA Two-Way

• Evaluation and data collection

Improving Warfighter Information Intake Under Stress – (formerly Augmented Cognition) R&D to extend, by an order of magnitude or more, the information management capacity of the human-computer warfighting integral by developing and demonstrating quantifiable enhancements to human performance in diverse, stressful, operational environments. The goal is to empower one person successfully to accomplish the functions currently carried out by three or more people. The research aims to enable computational systems to dynamically provide:

- Real-time assessment of warfighter status (phase one)

- Real-time maximization of warfighter potential (phase two)

- Autonomous adaptation to support warfighter performance under stress (phase three)

- Operational demonstration and test (phase four)

Warfighters are constrained in the amount of information they can manage. Adaptive strategies will mitigate specific information processing roadblocks impeding increased performance and information flow. Strategies include:

- Intelligent interruption to improve limited working memory

- Attention management to improve focus during complex tasks

- Cued memory retrieval to improve situational awareness and context recovery

- Modality switching (i.e., audio, visual) to increase information throughput

Technical challenges and goals for IT capabilities that can improve performance include:

- Demonstrating enhancement of warfighter performance (assess warfighter status in less that two seconds with 90 percent accuracy; adapt information processing strategies in less than one minute, with no performance degradation)

- Overcoming information processing bottlenecks (500 percent increase in working memory throughput; 100 percent improvement in recall and time to reinstate context; 100 percent increase in the number of information processing functions performed simultaneously; 100 percent improvement in successful task completion within critical time duration)

Translingual Information Detection, Extraction, and Summarization (TIDES) – seeks to enable military personnel to operate safely and effectively around the globe by:

- Developing advanced language processing technology to enable English speakers to find and interpret critical information in multiple languages without requiring knowledge of those languages

- Developing sophisticated statistical modeling techniques for human language

- Taking advantage of substantial increases in electronic data and computational power

- Developing and testing technology using speech and text from English, Arabic, and Chinese news sources

TIDES has the following military impact:

- Enhancing the ability of U.S. forces to operate safely and effectively around the globe

- Enabling commanders and policymakers to know what is being said in a region by and to the local population

- Less dependence on scarce linguists

- Potential customers throughout the military and intelligence communities

Effective Affordable, Reusable Speech-To-Text (EARS) – developing automatic transcription technology whose output is substantially richer and more accurate than current methods. Research goals are to:

- Automatically transcribe and extract useful metadata from natural human speech

- Develop powerful statistical techniques for modeling variability of speech

- Take advantage of substantial increases in electronic data and computational power

- Develop and test technology using broadcasts and conversations in English, Arabic, and Chinese

The military impact of the EARS program includes:

- Substantial increases in productivity and situation awareness

- Enabling analysts to read transcripts rapidly (in lieu of listening to audio slowly)

- Many potential customers throughout the military and intelligence communities

In FY 2005, work will continue on the following DARPA efforts:

- *Compact Aids for Speech Translation (CAST)*

- *Improving Warfighter Information Intake under Stress*

- *Translingual Information Detection, Extraction and Summarization (TIDES)*

- *Effective, Affordable Reusable Speech-to-Text (EARS)*

HCI&IM	**NASA**	HCI&IM

NASA HCI&IM investments include fundamental research in:

- Human information processing and performance

- Multimodal interaction

- Human-robotic systems

- Automation and autonomy

- Software engineering tools

- Knowledge management and distributed collaboration

- Computational models of human and organizational behavior

In the aviation domain, for example, HCI&IM investments include:

- Human-computer interaction for highly automated vehicle cockpits (aviation/shuttle flight control systems; system health management systems; International Space Station [ISS] interfaces)

- Human-computer interaction for air traffic management applications (air traffic control; cockpit display of traffic information; distributed air-ground collaboration)

- Proactive management of system risk (air traffic management; onboard flight-recorded data; human and organizational risk)

- Human-computer interfaces for mission control and ground control applications (shuttle and ISS mission control; remote interactive automation for near-Earth and planetary missions)

In the information management domain, NASA missions require R&D in:

- Data mining and scientific discovery

- Interactive visualization of complex systems for analysis, design, and evaluation

- High-end modeling and simulation (vehicle geometry, functions, and behavior; climate, weather, and terrain; science planning and operations with automation support; homeland security)

In FY 2005, NASA plans to address the following technical challenges in HCI&IM:

- *Multimodal interaction*

- *Data visualization and understanding*

- *Human-in-the-loop supervisory control (the design of intelligent and intelligible automation; human-robotic interaction)*

- *Knowledge engineering and capture*

- *Risk management and technology (aerospace, Earth science, space flight, biological and physiological research, and space science)*

HCI&IM	**AHRQ**	HCI&IM

FY 2004 HCI&IM R&D investments are for improved patient safety and health quality. Specifically, these investments support the Patient Safety Health Information Technology (HIT) Initiative. They will support HCI&IM-related work for transforming health care quality (for example, promoting and accelerating the development, evaluation, adoption, and diffusion of IT in health care) and establishing health care data standards (e.g., development, evaluation, and adoption of information standards and technology to support patient safety). A major goal is to support the development of an NHII that includes an Electronic Health Record System (EHRS). The EHRS will be a longitudinal collection of electronic health information for and about persons. It will allow electronic access to person- and population-level information by authorized users. The

system will provide knowledge and decision support that enhances the quality, safety, and efficiency of patient care. An EHRS will support more efficient health care delivery processes.

In the area of transforming health care quality, AHRQ provides:

- Planning grants to rural and small communities for health care systems and partners to implement HIT to promote patient safety and quality of care

- Implementation grants for rural and small hospitals to evaluate the measurable and sustainable effects of HIT on improving patient safety and quality of care

- Assessment grants to increase the knowledge and

understanding of the clinical, safety, quality, financial, organizational, effectiveness, and efficiency value of HIT. Practice-based research networks are encouraged to apply.

AHRQ envisions the establishment of a center that will coordinate the vast amounts of HIT information that results from these grants. Potential duties include coordinating and assisting grantees, supporting outreach and dissemination, and hosting meetings.

In health data standards, AHRQ provides:

- Funding for expert consensus on EHR functions

- Funding for standards development

- Funding for mapping between standards

- Funding for developing a metadata health data registry

- Coordination of U.S. standards developing organizations and standards users

- Consensus of U.S. positions on international health data standards issues

"Making the Health Care System Safer: The 3rd Annual Patient Safety Research Conference" is scheduled for September 26-28, 2004, in Arlington, Virginia. The goal of this conference series is to improve patient safety and health quality by:

- Increasing awareness of Patient Safety Events (PSEs) by supporting information systems that collect and analyze (including classification, root cause analysis, failure mode and effects analysis, probabilistic risk assessment) a large body of medical error data and by disseminating scientific findings that are translated into a useful decision-making context

- Understanding the organizational, cultural, human, and IT capabilities needed to guide the development of a network for the collection and analysis of PSEs and build capacity for patient safety research

- Developing informatics standards for uniform reporting, storage, and retrieval of comparable PSE data

HCI&IM DOE/SC HCI&IM

National Collaboratories Program – goal is to support end-to-end scientific discovery processes. Petabyte-scale experimental and simulation data systems will be increasing to exabyte-scale data systems. The sources of the data, the computational and storage resources, the scientific instruments, and the scientists who are consumers of the data and users of the instruments and computation are seldom collocated. DOE/SC uses planning workshops to develop its programs, including those reported in the HCI&IM PCA.

DOE/SC is developing pilot collaboratories for the high-energy nuclear physics, supernovae, and cell biology research communities. These pilot collaboratories are early implementations of virtual laboratories that:

- Are focused on a problem of national scientific or engineering significance clearly related to DOE mission and having high visibility

- Involve geographically separated groups of personnel and/or facilities that are inherently required to collaborate or be used remotely for success of the project

- Have implementations to test and validate that scientific research programs can integrate unique and expensive

DOE research facilities and resources for remote collaboration, experimentation, simulation, and analysis through use of middleware technologies to enable ubiquitous access to remote resources – computation, information, and expertise

- Demonstrate capabilities that make it easier for distributed teams to work together over the short term and long term

Developing such collaboratories involves creating partnerships among researchers in scientific disciplines and R&D personnel in middleware, networking, and computational science. DOE/SC's middleware research has two HCI&IM efforts:

- Information integration and access that address:
  - Mechanisms for seamless interface to multiple storage systems and mechanisms for replication management
  - Open issues such as data provenance, metadata standards, and mechanisms to resolve global names into access mechanisms

- Services to support collaborative work that address:
  - A wide variety of community services such as the Access Grid

– Open issues such as scalable, easy-to-use primitives to support multiple modes of secure wide-area collaboration

A potential benefit is speeding up the multidisciplinary research process. Today data resulting from research in one field must be validated and published, then be discovered and understood by people in other fields. DOE/SC is looking to improve data pedigree and communications between groups of researchers.

The DOE/SC National Collaboratories Program activities reported in the HCI&IM PCA in FY 2004 have been moved to the LSN PCA for FY 2005 because this R&D is more aligned with LSN concerns.

HCI&IM   **NIST**   HCI&IM

Information Technology Laboratory (ITL)

The mission of ITL's Information Access Division (IAD) is to accelerate the development of technologies that allow intuitive, efficient access, manipulation, and exchange of complex information by facilitating the creation of measurement methods and standards. IAD achieves the objectives by contributing to R&D in these technologies; enabling faster transition into the commercial marketplace; and enabling faster transition into sponsors' applications (performance metrics, evaluation methods, test suites, and test data; prototypes and testbeds; workshops; and standards and guidelines). IAD works in collaboration with industry, academe, and other government agencies. HCI&IM-related programs and activities are:

Human Language Technology Program – includes the following FY 2004 efforts and evaluations:

- TREC (for Text Retrieval Conference) – work on novelty Web and Q&A, add robust retrieval, High Accuracy Retrieval from Documents (HARD), and genomics (retrieval within that domain)

- AQUAINT – continue dialogue testing, "what is" and "who is" questions

- TIDES/DUC – continue evaluations and add cross-language Arabic summarization

- TIDES/TDT – continue evaluations

- EARS – speech-to-text (STT) and metadata evaluations

- ACE – evaluations for foreign languages

- TIDES/MT – continue evaluations

- Meeting Transcription – implement STT evaluation and work with ARDA's Video Analysis and Content Extraction (VACE) program

- Speaker/Language Recognition – continue evaluations

Biometrics Technology Program – FY 2004 efforts include:

- Tests of FBI's Integrated Automated Fingerprint Identification System (IAFIS) on DHS and other data

- Tests to support conversion of US VISIT to more than two fingers (US VISIT is the entry/exit system being implemented by DHS at airports, seaports, and land border crossings to secure the Nation's borders)

- Integration of face recognition and multi-vendor verification into US VISIT

- Fingerprint vendor technology evaluation (FpVTE) testing and analysis

- Data and performance standards development

- Development of Multimodal Biometric Accuracy Research Kiosk

- ANSI and ISO standardization of the Common Biometric Exchange File Format (CBEFF) and the Biometric Application Programming Interface (BioAPI)

- Chair International Committee for IT Standards (INCITS) Committee on Biometrics (M1) and the ISO Committee on Biometrics (SC37)

Multimedia Technology Program – multimedia standards, video retrieval, and visualization and virtual reality for manufacturing. FY 2004 efforts include:

- Work with industry on use of MPEG-7 (the metadata standard for accessing video information) Interoperability Test Bed

- Development of "light-and-simple" profiles for existing industry-wide formats

- Video-retrieval evaluations, with a new story segmentation task and more high-level features to extract; process and ship 120 hours of new data

- X3D and Human Animation (H-ANIM) standardization

- Seek medical applications within Web3D and for human modeling

Interactive Systems Technology Program – activities include:

- Webmetrics – seek additional opportunities with World Wide Web organizations

- Industry Usability Reporting (IUSR, a standard by which software development companies can test results and provide results to potential customers) – extend Common Industry Format (CIF) to hardware and finalize CIF requirements

- Voting – R&D for developing usability and accessibility tests for certifying voting systems

- Novel Intelligence for Massive Data (NIMD) – experiment with glass box data and develop NIMD roadmap

- Human Robot Interaction (HRI) – develop a user interface for robotic mobility platform

- Digital Library of Mathematical Functions (DLMF) – usability study for DLMF web site and animation of Virtual Reality Modeling Language (VRML) worlds

- Accessibility standards – develop a prototype incorporating new architecture from the INCITS Committee on Accessibility (V2)

Smart Space Technology Program – includes a smart space testbed for human interaction in an environment that includes microphones and video cameras. FY 2004 work includes:

- New version of NIST's Smart Flow (a system that allows large amounts of data from sensors to be transported to recognition algorithms running on a distributed network) that is easier to use, provides better performance, and is more stable, portable, and scalable

- Upgrade Meeting Room with new capabilities (originally for speech, Meeting Room is now being used to analyze videos)

- INCITS V2 collaboration

- Provide data-acquisition services and analysis methods to NIST's Chemical Science and Technology Lab (CSTL) and Physics Lab and upgrade real-time processing systems

Manufacturing Engineering Laboratory (MEL)

MEL Manufacturing Systems Integration Division (MSID) – promotes development of technologies and standards that lead to implementation of information-intensive manufacturing systems that can be integrated into a national network of enterprises working together to make U.S. industry more productive. HCI&IM R&D includes work in system interoperability, based on ontologies (knowledge bases that provide the meaning of information held in databases, whether structured or unstructured, in ways that can be understood across systems and also by humans). Ontologies are important to the development of software systems in general, partly because such systems are often created today by integration of existing systems and partly because they can improve software engineering by carefully and formally defining the requirements in ways that can save money over the software life cycle and avoid hidden mistakes. In commerce, ontologies can address such problems as communication within machine shops, the distribution of higher level information both between factories and between factories and front offices.

MEL Intelligent Systems Division (ISD) – conducts the following HCI&IM activities:

- Development of test arenas for robotics competitions, particularly for urban search and rescue applications. Sites of 2004 competitions are New Orleans, Osaka, Lisbon, and San Jose.

- Study of methods and metrics for evaluating performance of intelligent systems. ISD hosted 5th annual workshop on Performance Metrics for Intelligent Systems (PerMIS) on August 24-26, 2004. Included new "Information and Interpretation and Integration Conference" (I3CON) centering on testing tools for alignment of different but overlapping ontologies.

In FY 2005, NIST plans to continue the following HCI&IM R&D activities:

- *Human Language Technology Program*

- *Biometrics Technology Program, including new work in:*
  - *Biometrics, used singly and in combinations, for forensics and security*

- *Multimedia Technology Program*

- *Interactive Systems Technology Program*

- *Cooperation with NIH in biomedical informatics and related areas*

- *MEL programs in manufacturing systems integration and intelligent systems*

NOAA

HCI&IM

NOAA's current HCI&IM work involves digital libraries. The R&D is developing methods of cataloging, searching, viewing, and retrieving NOAA data distributed across the Web. Researchers are exploiting Geographical Information Systems (GIS) and XML technologies to display and describe data and are developing methods for distributing model data. Recent results include:

- Fisheries-oceanography GIS with 3D presentations
- Prototype tools for analyzing and integrating hydrographic

data for a multi-server distribution system

- Using Really Simple Syndication (RSS) for service registration and information discovery

In FY 2005, planned NOAA work in HCI&IM will include:

- *Developing improved access to current National Weather Service (NWS) model data subsets*
- *Remote collaborative tools development*

EPA

HCI&IM

EPA's HCI&IM programs are focused on tools to facilitate sound science using information management, analysis, and presentation. These programs enable relevant, high-quality, cutting-edge research in human health, ecology, pollution control and prevention, economics, and decision sciences. They facilitate appropriate characterization of scientific findings in the decision process and convey important information in such a way that researchers and policymakers can better understand complex scientific data. These programs are performed in-house and as problem-driven research. FY 2004 activities cover a broad spectrum of areas, including:

- Integrating data analysis and decision making across physical, chemical, biological, social, economic, and regulatory influences and effects
- Finding significant relationships, phenomena, differences, and anomalies with multiple data techniques
- Integrating search and retrieval across multiple digital libraries containing environmental and health information
- Enabling efficient management, mining, distribution, and archiving of large data sets
- Creating services to enable and support collaborative science across geographically distributed laboratories and offices including data and computational grids
- Developing interactive visualizations of complex systems for analysis, design, and evaluation
- Generating knowledge engineering and capture

FY 2004 HCI & IM activities have enabled the following pilot projects:

Metabonomics Pilot – a collaborative framework to enable shared access to data and results, joint use of computational applications and visualization tools, and participatory analysis across scientific boundaries. Metabonomics data will be harmonized with both proteomics and genomics data in order to better understand and predict chemical toxicity and support risk assessment. Activities on this pilot continue during FY 2005.

Air Quality Model Pilot – investigating tools and approaches to explore potential linkages between air quality and human health. Assessments include impacts of regulatory and policy decisions through exploration of relationships between regulations, emission sources, pollutants, and ecosystems.

Tools and techniques developed in this pilot will be transferred to states and applied to solve real problems such as enhancing states' abilities to predict and evaluate various control strategies, expanding state-level forecasting capabilities to include more pollutants, enhancing the states' abilities to explore potential linkages between air quality and human health, and improving states' abilities to assess the impact of regulatory and policy decisions. During FY 2005 HCI & IM activities will continue to enable this pilot.

FY 2005 EPA plans in HCI&IM R&D include:

- *Evaluation of tools and models through the EPA Grid*
- *Evaluation and investigation of distribution, management and archival of large data sets*
- *Investigation of significant relationships, phenomena, differences, and anomalies in data*