

Human-Computer Interaction and Information Management (HCI&IM)

NITRD Agencies: NSF, NIH, DARPA, NASA, AHRQ, NIST, NOAA, EPA

Other Participants: AFRL, FAA, ONR

HCI&IM R&D aims to increase the benefit of computer technologies to humans, particularly the science and engineering R&D community. To that end, HCI&IM R&D invests in technologies for mapping human knowledge into computing systems, communications networks, and information systems and back to human beings, all for the benefit of human understanding, analysis, and use. Specific R&D areas are user interaction technologies, cognitive systems, information systems, and robotics.

Highlights of the President's 2006 Request

Strategic Priorities Underlying This Request

- Key national priorities – including national defense, national and homeland security, large-scale scientific research, air-traffic control, emergency planning and response, health care, space exploration, and weather and climate prediction – typically require advanced HCI&IM technologies. Current NITRD work includes:
 - Technologies for multimodal language recognition and translation, multimodal user interfaces, and biometric identification and verification
 - IT capabilities that enable people rapidly to access and understand information that may come from many sources and in many forms (signals and audio, video, and text in diverse languages). Integrating heterogeneous, multimodal data quickly into useful formats remains a major R&D challenge.
 - Robotic vehicles and devices – such as those deployed in Afghanistan, Iraq, space exploration, urban search-and-rescue operations, and human assistive equipment
 - Cognitive systems – those able to “learn,” adapt to changing circumstances, and self-heal. HCI&IM agencies’ R&D in systems that can adjust to keep functioning under duress is vital for battlefield conditions and for deployability of robotic devices in hazardous or life-critical environments.
- In the information integration area, the NITRD agencies and the weather and climate modeling community are achieving a notable advance that will provide a model for other data-intensive research fields. The unprecedented national ESMF effort to build an interoperable infrastructure of data standards and reusable, user-friendly software tools is enabling all researchers to access and work collaboratively with the vast stores of U.S. climate data. Efforts such as GEOSS (EPA, NASA, NOAA, NSF) will link together strategies and systems, including ESMF, for Earth observation across multiple scientific boundaries. Measurements of air, water, and land made on the ground, from the air, or from space will be fused, manipulated, and mined.

Highlights of Request

- **NSF, other HCI&IM agencies:** National workshop on information integration – will identify key issues such as privacy, security, interoperability, and standards in advancing the utility of heterogeneous, multimodal information environments; goal will be to target R&D areas for coordinated NITRD efforts.
- **NSF:** Continue support for R&D in information integration across scientific disciplines and domains; machine vision, speech recognition, and other robotic technologies
- **DARPA, with NSF:** Continue cognitive-systems work – research supported by NSF and DARPA is used in DARPA’s Improving Warfighter Information Under Stress program
- **NASA:** Exploration Systems Mission Directorate will initiate research on mobile agents (human-robotics collaborations)
- **AHRQ:** Continue funding multiagency initiatives to develop critical health data standards (with NLM on medical terminology standards; with NIST on developing a U.S. health standards model and application; with FDA on prescription drug data standards, such as an electronic labeling system)
- **EPA, NOAA, NSF, and other agencies:** Continue work on HCI&IM aspects of ESMF (e.g., data management and interoperability standards; reusable, user-friendly modeling tools and utilities for researchers)

Planning and Coordination Supporting Request

- **NSF, with other HCI&IM agencies:** Planning meeting to develop agenda and structure for 2006 information integration workshop

- **DARPA, NIST, NSA:** Multiyear collaboration on Effective, Affordable, Reusable, Speech-to-text (EARS) and Translingual Information Detection, Extraction, and Summarization (TIDES) programs
- **NASA, AFRL, FAA:** Collaborative work in aviation and aviation safety (NASA projects with FAA on automated vehicle cockpits and air traffic management and risk will continue in 2006)
- **AHRQ, EPA, NIH, NIST, NSF:** Regular information exchanges and R&D collaborations in biomedical research and health care data and information summarization, curation, analysis, and retrieval
- **EPA, NASA, NOAA, NSF:** Ongoing collaboration in climate, weather, and environmental modeling and simulation

2005 and 2006 Activities by Agency

NSF: Supports university-based research on intelligent robots and machine vision technologies to help people of all ages participate as first-class citizens in the information society; automatic multilingual speech-recognition toolkits; systems to recognize spontaneous speech despite disfluencies and multiple speakers; information infrastructure to enable spoken, written, and multimodal communications R&D; information integration, especially domain-specific and general-purpose tools for integrating information from disparate sources; projects to advance understanding of technology to enable scientific discovery and integrate research and education to benefit technical specialists and the general public; SEIII program – an outgrowth of ITR; planning for 2006 workshop on information integration. Participates in IWGEO, the Interagency Working Group for US_GEOSS; planning for NSF observations data to be part of GEOSS.

NIH: Curation and analysis of massive biomedical and clinical research data collections; tools to manage and use massive new databases; tools for building and integrating ontologies; software tools for visualizing complex data sets; curation tools; building nationwide support for standard vocabularies; information integration

DARPA: CAST; EARS; Improving Warfighter Information Intake Under Stress; TIDES

NASA: 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; projects in human-centered computing and intelligent data understanding end in 2005

AHRQ: Implement health information technology in rural and small communities and evaluate impact; assess clinical, safety, quality, financial, and organizational effectiveness and efficiency; establish health care data standards to support patient safety technologies; further develop a National Health Information Infrastructure (NHII) that includes an Electronic Health Record System to support health care decisions by allowing authorized users to access patient-level information and appropriate medical knowledge; state and regional demonstration projects of electronic health information exchange using clinical data standards

NIST: Improved performance and measurement in evaluation of technologies for text retrieval, question and answer, EARS, TIDES, TREC, document understanding, topic detection, automatic content extraction, machine translation, meeting transcription, speaker recognition, and language recognition; fingerprint and face recognition standards, interoperability; multimedia standards, video retrieval, visualization and virtual reality for manufacturing, video analysis and content extraction, motion image quality; software usability reporting standard; usability and accessibility of voting systems; roadmap for novel intelligence from massive data; user interface and test arenas for mobile robots; digital library of mathematical functions, accessibility standards; PerMIS conference; testbed for human interaction in smart space environment with microphones and video cameras

NOAA: Methods for cataloging, searching, viewing, and retrieving Web-based NOAA data; exploit geographic information system (GIS) and XML to display and describe data and develop methods to distribute model data; improve access to NWS model data subsets

EPA: Explore potential linkages between air quality and human health; develop collaborative frameworks for shared access to data and results, joint use of applications and visualization tools, and participatory analysis across scientific communities; evaluate distribution, management, and archiving of large data sets and the analytical tools that illuminate the causal relationships among environmental phenomena

ONR: Focus on team collaborative behavior in IT-enabled environments and on the impact of IT on the structure and function of teams. Other areas include: developing low-cost, easy-to-use applications of cognitive models during system design and implementation, information visualization formats to maximize human use of content, and developing user IT support strategies and methods to aid users when interruptions interfere with their work.