The Human Systems Integration Division enables the development of complex aerospace systems through analysis and modeling of human performance and human-automation interactions.

Human-Machine Interaction

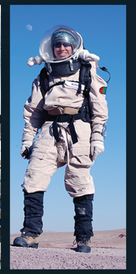
The Human-Machine Interaction Group contributes to the development of measurably better NASA software through careful application of human-computer interaction (HCI) methods. The group follows an iterative process that consists of user research, interaction design, software development, and usability evaluations. This approach enables deployment and integration of mission software with the right functionality and user interfaces for scientists and engineers on some of NASA's largest programs.



Human Performance

The Human Performance Group performs research and technology development to enhance health, productivity, and safety in aerospace environments. The group develops advanced interfaces, human performance models, performance monitoring tools, and countermeasures that mitigate performance deficits. The group includes labs that focus on advanced multi-modal interfaces, auditory displays, performance modeling, psychophysiology, telerobotics, vibration impacts, gaze tracking, virtual environments, vision science, and visuomotor control.

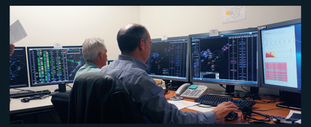




Integration and Training

The Integration and Training Group is committed to improving the efficiency and safety of the Air Transportation System, with emphasis on mid-term and long-term requirements. This group develops and evaluates methods drawn from human factors and related disciplines for the integration of humans as intrinsic to the air transportation system as a whole. The group includes full-mission laboratories associated with air traffic management, flight deck procedures, ground procedures, and surface operations. It also includes labs dedicated to complex systems design, fatigue countermeasures, personnel training, human-automation teaming, and unmanned aerial systems.





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Frequently Asked Questions (FAQ)

What is human systems integration?

Human Systems Integration is a broad domain that focuses on understanding and enhancing human interaction with complex aerospace systems. It encompasses human performance, human-centered design, and human-automation interaction.

How long has the division existed?

A previous incarnation of this division (called the Aerospace Human Factors Research Division) was established in 1984. Human factors research at NASA Ames Research Center dates back to the 1960s.

Where are you located?

The Human Systems Integration Division is located in an expansive two-story building at NASA Ames Research Center in Silicon Valley, California.

How many people are in the Division?

We have about 180 people, including civil servants, contractors and interns.

How many labs are in the division?

We have about a dozen labs. Each is led by a principal investigator and usually has a staff of researchers and programmers.

What is the typical education of division researchers?

Most of the civil servants and many of the contractors hold Ph.D.s in areas such as psychology and engineering. In addition, we have a number of researchers and programmers with bachelor's and master's degrees in fields such as human factors, computer science, and experimental psychology.

Who collaborates with the division?

Collaborators include other NASA centers such as NASA Johnson Space Center in Texas and NASA Langley Research Center in Virginia. In addition, we collaborate with other federal agencies such as the Federal Aviation Administration (FAA) and the Department of Defense (DOD). Also, we work with universities and private industry.

How can I get a job in the division?

Career opportunities at NASA are listed at https://nasajobs.nasa.gov and https://www.usajobs.gov.

Human Systems
integration division

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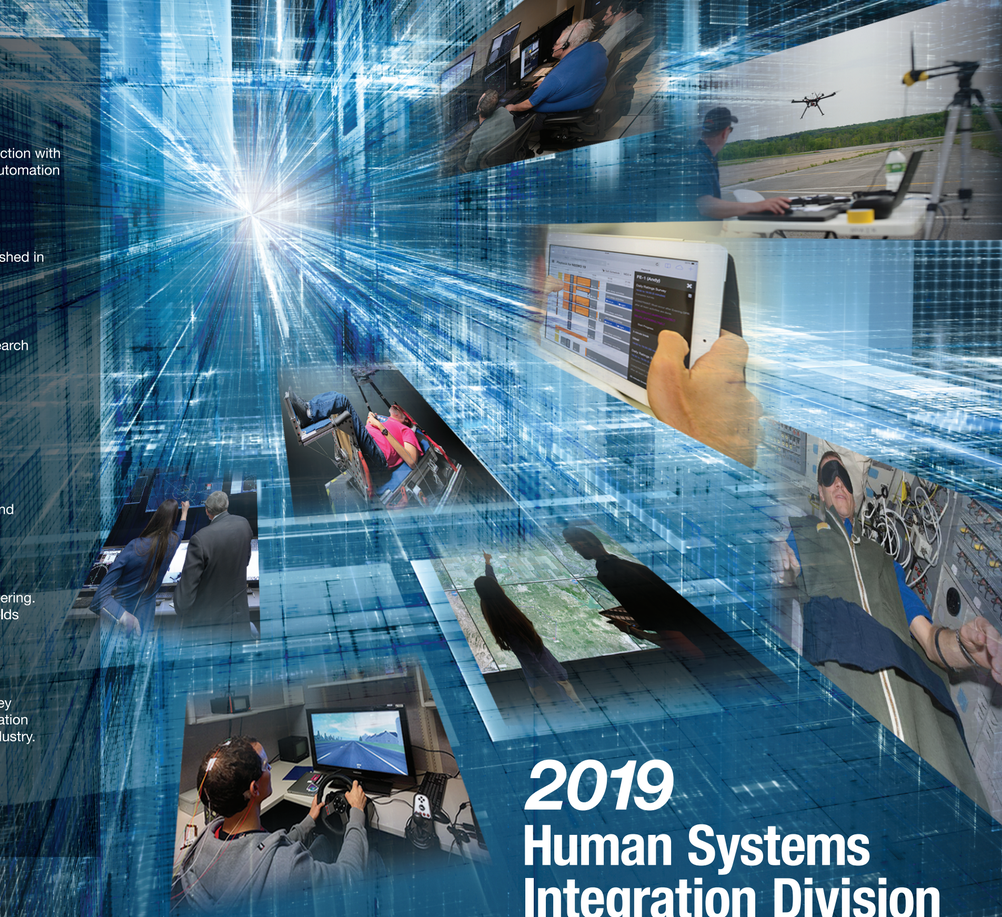

2019
Human Systems Integration Division

NASA Ames Research Center
Silicon Valley, CA

https://hsi.arc.nasa.gov

National Aeronautics and Space Administration

Enabling the Development of Complex Aerospace Systems

Humans are arguably the most critical element in the safety, reliability, and performance of complex systems. Our highly adaptive problem-solving capabilities create resilient operations across aerospace applications, especially with the advent of increasingly intelligent software and hardware systems. Advances in machine learning, adaptive automation, display technologies, and information accessibility create new challenges for human performance and new opportunities for human-automation teaming.

Dr. Alonso Vera, Division Chief

In aeronautics, humans are the backbone of a national aviation system that must handle growing consumer demands. In space, long-duration exploration missions will require revolutionary changes in the roles of the astronauts and mission controllers to support autonomous operations. For both aeronautics and space, the design of hardware and software systems must address the need for safe, efficient and cost-effective operations, both in-flight and on the ground.

The Human Systems Integration Division is creating and applying a new understanding of how individuals and teams assimilate and act on information in pursuit of goals critical to the success of NASA missions.

Strategic Goals

- To enhance aviation safety and performance for manned and unmanned aerial systems by designing human-centered automation, decision support tools, evaluation techniques, and organizational practices.
- To enable functional human-autonomy teaming through the design and development of increasingly intelligent systems and augmentative technologies.
- To enable lunar and deep-space exploration missions by advancing our knowledge of human performance in space environments and developing technologies for effective, safe, increasingly autonomous astronaut operations.

Human-Machine Interaction

Crew Scheduling Software on the International Space Station

The Human-Computer Interaction Group is developing software tools for astronauts to coordinate and plan their own daily activities, something that historically is performed entirely by ground control. The Ames mobile mission-planning tool called Playbook was used by an astronaut onboard the International Space Station to self-schedule her mission day and add task activities. In addition, Playbook enabled the astronaut to update mission activities with one click and easily bring up mission procedures, flight notes, and execution notes, all on a mobile tablet device. Previously, Playbook was implemented on the NASA Extreme Environment Mission Operations (NEEMO) missions where, for the first time, crewmembers successfully planned and re-planned their own extravehicular activities. The Playbook planning tool is based on systems developed by the Ames Human-Computer Interaction Group for the Mars Exploration Rover mission, the Phoenix Mars Lander mission, and the Mars Science Laboratory. Playbook is a notable extension of those previous systems in that it is designed for direct use by the crew with minimal training.

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Integrated Information Systems

The Human-Computer Interaction Group works on the development of highly usable integrated information systems for NASA's major space programs including Orion, Space Launch Systems, and the International Space Station. The 25 systems currently deployed have about 12,000 users and hold over 400,000 records across NASA. The 15 integrated systems for the Exploration Systems Development division, for example, allow for the creation, curation, reporting, and baselining of engineering data sets across NASA human space flight missions. The integrated systems fundamentally change how NASA manages its information through all stages of the mission lifecycle. This capability enables critical systems engineering processes such as continuous evaluation of flight readiness and rapid assessment of anomaly causes and consequences.

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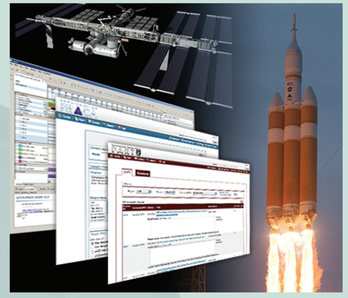

Human Performance

Fatigue Research for Commercial Aviation

Members of the Fatigue Countermeasures Laboratory have been instrumental in determining the effects of pilot fatigue on their performance. While the effects of fatigue within certain other professional environments are well known, it is not clear how crew scheduling and associated fatigue impact the operational performance of pilots while on duty. Fatigue researchers in the Human Systems Integration Division have worked with commercial airlines to collect relevant data of pilots during flight. In support of those studies, they have developed novel tools to assess pilot fatigue in flight and they have combined data from different sources to assess whether an increased number of human errors occur on flights flown by fatigued pilots. Previous studies by lab personnel include analyses of fatigue issues for astronauts on the International Space Station. Research in this lab has been applied to additional environments including mission control and crew quarters.

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NASA Task Load Index (TLX) Workload Tool

NASA Task Load Index (TLX) for iOS is a creative, state-of-the-art solution for the measurement and assessment of operator workload with a newly designed tool for Apple operating systems. The NASA TLX for iOS app implements new usability features and provides an expanded reach for the TLX methodology. NASA TLX for iOS is a dramatic improvement from the previous desktop PC version, and it preserves the original NASA TLX gold standard. The NASA TLX for iOS implements a workload rating scale that uniquely and accurately captures the critical variations of perceived workload while avoiding sources of emotional bias. This tool is the result of a meticulous endeavor to bring this workload measure methodology into the modern age for use by government, academia, and industry.

Contact: **Dr. Brian Gore, brian.f.gore@nasa.gov**

Integration and Training

Unmanned Aircraft System Traffic Management (UTM)

The number of unmanned aircraft system (UAS) vehicles, also known as drones, continues to climb as their cost becomes more accessible. UAS Traffic Management (UTM) systems are designed to enable safe and efficient low-altitude airspace operations by providing services such as airspace design, severe wind avoidance, congestion management, route planning, and separation management. The Airspace Operations Laboratory (AOL) participates in major UAS tests involving the Federal Aviation Administration (FAA) across numerous test sites. The AOL hosts new UTM technologies to enable coordination of traffic management across those sites. UTM and associated services are essential to the accelerated development and use of civilian UAS applications and have drawn considerable media attention.

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Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS)

The Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) team developed a hands-on demonstration of the Ames Detect and Avoid (DAA) system to allow users to operate a simulated UAS. The team developed this capability with the Air Force Research Laboratory for a UAS conference that included participants from all over the country who demonstrated new aircraft technologies. The team provided colleagues with an opportunity to engage with the key personnel involved in cutting edge aircraft, and to spread knowledge about previous and future UAS research. The NASA UAS in the NAS project seeks to enable UAS access to civil airspace through research, development and demonstration.

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