



Mission Operations

Success in Space Starts on the Ground

Space research and exploration are increasingly becoming an international collaborative venture. Marshall applies five decades of experience in mission operations to provide turnkey solutions with operations services including payload planning and training and distributed services to remote customers around the globe. Marshall continually advances its capabilities to enhance existing programs such as the ISS and to pave the way for mission operations for future exploration programs.

Marshall is responsible for sustaining ground services to operate ISS payloads and supports preparations to operate the Space Launch System (SLS). Marshall's skilled workforce has resources to define, develop, validate, and train for operating space-based systems and plays a key role in the command and control of the world's most advanced space systems. From ISS payloads and launch vehicles to Earth-orbiting satellites and deep space explorers, Marshall's mission operations capabilities assist users in enhancing the operability of assets.

At-A-Glance

Marshall Space Flight Center applies decades of experience with both customers and hardware to continually advance mission operations capabilities for science and exploration missions. As proven by Marshall's management of the International Space Station (ISS) science operations, the Center explores the implementation of the latest trends and capabilities to continually improve service. The Center's emphasis on customer-focused solutions and international collaboration, in addition to extensive expertise and services, is the foundation for successful mission operations.



Marshall mission operations support provides integrated verification testing with payload rack systems.

Accelerating Space Station Science

The Payload Operations Integration Center (POIC), located within the HOSC at Marshall, is the primary NASA ground system responsible for integrated operational payload flight control and planning for the ISS. It provides payload telemetry processing, command uplink, and planning capabilities for a large number of local Cadre flight controllers and remote ISS payload users and other facilities located throughout the world. The POIC provides a secure integration point for planning all ISS operations.

NASA upgraded the POIC payload operations control room with new capabilities to enhance collaboration and efficiency. Based on Marshall's lessons learned from years of ISS operations and with a user-focused approach, the Center redesigned the control room and upgraded to modern equipment.

The renovated control room features a video wall that allows multiple data and video views related to experiments to be shared by the full team. The upgraded flight control room's new arrangement of flight control positions also improves team communication.

Marshall's upgraded POIC enhances ISS work by planning and coordinating all the research activities on the station. The POIC, integral in making the ISS fully functional, allows crews to make more efficient use of time for scientific research, benefiting space exploration as well as life on Earth. By increasing the total amount of time the crew can conduct scientific research, the POIC both increases the speed of scientific discovery and the return on investment in ISS science operations.



Marshall coordinates experiments, synchronizes payload activities of international partners, and directs communications between researchers and their experiments.

Focus on Users

Marshall provides a wide array of mission operations services and serves a large number of programs. The Center is highly connected with user and mission communities, including international partners. Marshall has strong relationships with users and provides program customers with advanced solution customization and scalability. Services are routinely tailored to meet specific needs — full customer-driven solutions can be provided as well as full-mission operations capability for command and control, mission design, and implementation. The Marshall team puts user needs first and emphasizes users' control of their mission objectives and space activities.

Advancing the Operability of Space Assets

Marshall mission operations is continually advancing and upgrading capabilities to better serve users and adapt to advances in space operations and exploration. Whether it is an ISS payload, a launch vehicle, an Earth-orbiting satellite, or a deep space explorer, advanced capabilities at Marshall assist users in enhancing the operability of their systems;

planning mission operations; training astronauts and users; and rapidly deploying and configuring ground-based command and data systems, mission operations personnel, and mission design capabilities to ensure mission success.

Autonomous Mission Operations (AMO) is on the horizon, focusing on ways to reduce crew dependence on ground-based mission control.

The Virtual Training Unit (VTU) glassrack — a new function for mission operations — provides a rapid and cost-effective environment for creating an ISS payload basic trainer for ground support personnel and astronauts. It also provides a prototyping environment for evaluation of human interfaces for ISS payloads in development.

Disruption Tolerant Networking (DTN) is a new networking technology that is being tested on the ISS. DTN will enable NASA and other space agencies around the world to better communicate with international spacecraft that will be used in future exploration. This technology is evolving into an interplanetary internet.

Current Users and Services

	User Services	Mission Implementation	Data Services
SLS	• Training and simulations • Mission planning	• Supportability engineering • Operability • Operations cost analysis • Discrete event simulation • Ground and on-orbit logistics • Ground support equipment engineering	• Ground data system design • Space network interface connectivity
ISS	• Training and simulations • Mission planning	• On-orbit logistics • Mission command and control research activities	• Ground data system design • Space network interface connectivity • Data flow management
AES	• Training and simulations • Mission planning	• Operability • Mission command and control research activities	• Ground data system design • Space network interface connectivity • Data flow management
Others (Agency, universities, industry, DOD/ DARPA)	• Training and simulations • Mission design • Mission planning	• Supportability engineering • Operability • Operations cost analysis • Discrete event simulation • Ground and on-orbit logistics • Ground support equipment engineering • Mission command and control	• Ground data system design • Space network interface connectivity • Data flow management

Experience and Expertise

Marshall has a deep heritage in providing both space-based and ground-based mission operations capabilities for NASA and the international science community, including the Apollo Program, Skylab, Shuttle/Spacelab, and ISS. In addition to its ISS operations role, the Center manages multiple science facilities that house ISS experiments and the environmental control and life support system that enables humans to live onboard.

Marshall designs and implements custom mission operations systems and support for NASA, DOD, and industry partners. The Center provides interfaces for command and control of space missions. Marshall offers users a broad range of expertise and services including:

- Mission Operations Laboratory, expert training of astronauts and ground controllers
- Ground systems including telemetry, voice, video, information management, data reduction, and payload planning, linking scientists with their experiments
- Huntsville Operations Support Center (HOSC), supporting launches, monitoring a range of propulsion parameters
- Engineering support systems for launch vehicles (Redstone, Atlas, Saturn, shuttle, SLS, Hubble Space Telescope, HEAO, Chandra)
- Mission design for manned and unmanned spacecraft (Spacelab, ISS, HEAO, FASTSAT, and Chandra)
- Science Operations Planning and Execution for manned and unmanned missions (Spacelab, Chandra, ISS, FASTSAT)
- Ground support equipment system engineering and supportability engineering

Exclusive Resources/Facilities

Marshall has extensive mission operations experience in a wide range of operations and ground systems interface disciplines. A varied and extensive network of facilities, tools, and capabilities is available to meet the needs of mission operations customers. These unique resources/facilities include:

- **Systems:** Telescience Resource Kit (TReK)
- **Facilities:** Huntsville Operations Support Center (HOSC)
- **Laboratory Training Complex (LTC):** VTU glassrack that provides a rapid and cost-effective environment for creating an ISS payload basic trainer for ground support personnel and astronauts
- **Payload Operations Integration Center (POIC).**
- The **Physical Science Informatics System** is a data repository for physical science experiments on the ISS. Collecting this data in a single location provides researchers with scientific data from hundreds of NASA experiments. It also helps identify fields where more study is needed.

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Science and Exploration*