



International Space Station: Payload Operations Center

The Payload Operations Center at NASA's Marshall Space Flight Center in Huntsville, Ala., houses the International Space Station (ISS) Payload Operations Integration Center, the Laboratory Training Complex and simulation rooms used to prepare for ISS expeditions. The center has the capabilities and space for the creation of additional mission operations laboratory control rooms. Most recently, a control room was created to support the Fast, Affordable, Science and Technology SATellite (FASTSAT) mission. This two-year mission successfully demonstrated a capability to build, deploy and operate a science and technology flight mission at lower costs than previously possible.

NASA's Payload Operations Integration Center at the Marshall Center

The ISS is used to study the impact of microgravity and other space effects on several aspects of our daily lives. Astronauts conduct science daily across a wide variety of fields, including human life sciences, biological science, human physiology, physical and materials science, and Earth and space science.

The Payload Operations Integration Center is the heartbeat for International Space Station research operations. As NASA's primary space station science command post, the payload operations team coordinates all U.S. scientific and commercial experiments on the station, synchronizes payload activities of international partners, and directs communications between researchers around the world and their onboard experiments.



NASAfacts

The ISS Payload Operations Integration Center's role has become ever more important since space station assembly was completed in the fall of 2011. Since 2001, more than 1,600 investigations have been completed, and now that assembly is completed, more and more crew time is devoted to science. To help the crew as they conduct record-amounts of science, the operations center is staffed around the clock, 365-days a year by three shifts of flight controllers.

The payload operations team integrates research requirements, planning science missions and ensuring that they are safely executed. The team integrates crew and ground team training, and research mission timelines. During each six-month, space station research expedition, they manage space station payload resources, handle science communications with the crew, and manage commanding and data transmissions to and from the orbiting research center.

Coordinating research operating schedules across Canada, Europe and Japan, as well as remote tele-science workstations in the United States, the Payload Operations Integration Center processes hundreds of payload commands in support of investigations operating each day. From the center, the cadre continuously monitors the health and status of scientific instruments deployed on the space station.

Since the payload operations team works around the clock, they even conduct and monitor experiments remotely while the crew is sleeping. In this manner, science on the station continues even when the crew is busy with other activities, such as spacewalks or doing crew handovers. By serving as virtually an extra space station crew member, this team of ground-based flight controllers increases experiment efficiency, which saves precious crew time for operations that require a human touch. The Payload Operations Integration Center can send commands to the space station as fast as eight per second. It's

the Payload Operations Integration Center's mission to ensure each crew and payload operations team member has the knowledge and the resources to assist the scientists in achieving the highest possible science results.

Led by the Payload Operations Director, each payload operations center team member performs critical functions that maximize science return:

Payload Operations Director (POD)

The Payload Operations Director (POD) manages day-to-day operations of payloads aboard the space station. This position is the single point-of-authority to the International Space Station Mission Control Center flight director at the Johnson Space Center in Houston for all of NASA's payload operations. The POD oversees team members who manage payload mission planning, ground commanding of space station payloads, communications with the crew, and use of the payload support system, the video system and the data systems. The POD ensures compliance with established safety requirements, flight rules and payload regulations. The POD leads the review and approval of all change requests to the timeline.

Operations Controller (OC)

The Operations Controller (OC) ensures scheduled research activities are accomplished safely and on time, and manages and tracks available resources. The OC monitors troubleshooting of onboard systems to identify possible impacts to payload operations, and coordinates resolution of anomalies.

Timeline Change Officer (TCO)

The Timeline Change Officer (TCO) assesses change requests for impacts to the current science timeline, payload hardware assets and resources required for science, such as crew time and electrical power. The TCO evaluates requests by scientists for changes to the experiment timeline, and then implements changes to the science operations plan aboard the station.

Payload Rack Officer (PRO)

The Payload Rack Officer (PRO) provides real-time command and control for these NASA facilities: EXpedite PROcessing of Experiments to the Space Station (EXPRESS) Racks, Window Observational Research Facility (WORF), Minus Eighty-degree Laboratory Freezer for ISS (MELFI), and EXPRESS Logistics Carriers, regardless of location aboard the U.S. Orbital Segment portion of the station. PRO coordinates and monitors use of Payload Support Systems resources, which includes power, water flow, vacuum and nitrogen gas usage for all NASA payload facilities and sub-rack payloads.

The PRO also is responsible for managing payload Multiplexer/Demultiplexer (MDM) computer operations and services for all payloads, including any services used by international partner payloads. Once the space station crew installs a new payload, the PRO configures the rack interfaces to properly support the payload and begins monitoring the health and status of the payload and the NASA facility. If a NASA payload facility and/or sub-rack payload were to experience an anomaly during onboard operations, the PRO would be heavily involved in the planning and execution of troubleshooting activities and would collaborate with the payload developer to help diagnose any interface problems with the facility racks.

In addition, the PRO manages all ground commanding of U.S. payload systems and experiments on the station. The PRO manages the command link, receives and sends command files to the mass storage device, and configures the system to allow flight controllers in the Payload Operations Integration Center and remote users to send commands to their equipment on the space station.

Data Manager Coordinator (DMC)

The Data Management Coordinator (DMC) is responsible for command, control, data handling, communications and tracking for science payloads

on the space station. The DMC manages the integrated high-data-rate Ku-band communications link between the ground and the station. This position manages data system traffic, downlink video, ensures ground data quality with NASA users, and assesses data system change requests. The DMC ensures that the data system is properly configured to support payload operations. The DMC manages video coverage of research activity on the station. The DMC monitors, configures and coordinates the use of the video system.

Payload Communications Manager (PAYCOM)

The Payload Communications Manager (PAYCOM) using the call sign, "Huntsville," is the prime communicator with the International Space Station astronaut crew regarding science operations. The PAYCOM enables researchers around the world to talk directly with the crew about their experiments, and for managing payload conferences. Additionally, the PAYCOM reviews requests for changes to payload activity to assess their impact on the crew.

Lead Increment Science Representative (LIS Rep)

The Lead Increment Science Representative (LIS Rep) provides research priorities to the Payload Operations Integration Center cadre for its planning and implementation of the research mission. Working with the Lead Increment Scientist at the Johnson Space Center, payload mission integration teams, remote research teams and other users, the LIS Rep tracks payload status and accomplishments, and manages research-related issues.

Stowage

The Stowage position evaluates onboard stowage and inventory every day, ensuring the crew can find parts and materials they need for their research and experiment activities. Additionally, Stowage recommends locations where the crew should put hardware when not in use, and helps maintain a database of the location and configuration of all payload science equipment.

Laboratory Training Complex

The Laboratory Training Complex provides a hands-on training environment for cadre members to support science operations for U.S. payloads aboard the International Space Station.

Physical mock-ups and glass rack models replicate station facilities, and functionally or physically simulate flight and ground interfaces. Inside the complex, flight controllers practice station experiment operations before missions. During a mission, controllers can use

the complex as an aid for resolving issues encountered while station astronauts perform experiments in space.

The Laboratory Training Complex provides opportunities for the station cadre at Marshall to train and familiarize themselves with flight facilities and experiments, including numerous new experiments that are added for each station expedition. Much of the mock-up hardware was built through a program with regional high schools called HUNCH, or High Schools United with NASA to Create Hardware.



Laboratory Training Complex

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