NASA Facts

National Aeronautics and
Space Administration

**Marshall Space Flight Center**
Huntsville, Alabama 35812

# International Space Station

## Marshall Space Flight Center's Role in Development and Operations

NASA's Marshall Space Flight Center in Huntsville, Ala., is continuing its historic roles in the development, design and operations of the International Space Station. Current roles are highlighted by the management of science operations on Space Station, development and design of the Environmental Control and Life Support System and science experiment facilities, development of connecting Nodes and management of the Multi Purpose Logistics Modules. NASA fuels discoveries that make the world smarter, healthier and safer.

From the Apollo Program, to Skylab, to Spacelab, Marshall Center engineers and scientists have collaborated to provide both space-based and ground-based science research facilities for the NASA and global civil science community. The Marshall Center payload operations role in Space Station is a logical continuation of its key roles both in previous manned space programs, as well as in International Space Station manufacturing and testing. That heritage led to creation of the Payload Operations Center, NASA's command post for the science expeditions to the International Space Station.

### Space Station Science Operations

The Payload Operations Center is responsible for real-time Space Station science operations, including day-to-day communication with the crew, management of data and video, remote command and control of on-board computers and hardware and operations coordination for NASA's science payloads and experiments.

On a daily basis, Payload Operations Center Flight Controllers develop plans, timelines and procedures that maximize the use of valuable on-orbit Space Station resources to accomplish NASA's research plans. These research experiments include human life science research, crystallography, fluid physics

and materials science. Human life sciences experiments are particularly critical to NASA's Vision for Space Exploration, as NASA is making preparations to send humans to the Moon, Mars and beyond.

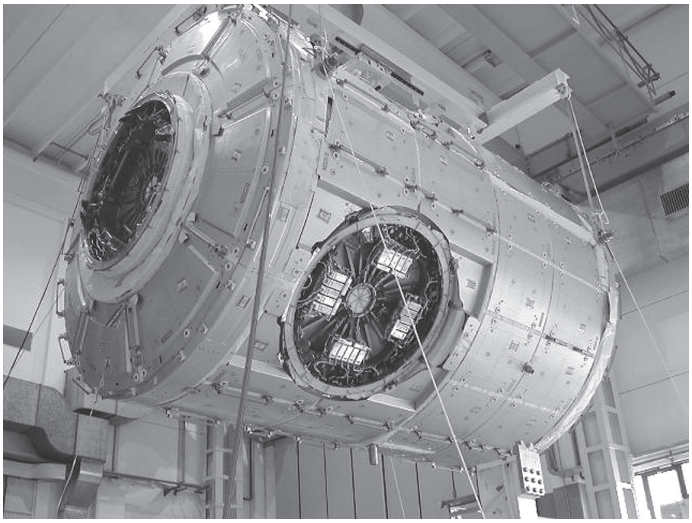
Space Station astronauts and cosmonauts follow the direction of the Payload Operations Center as they accomplish research tasks on-orbit. The team at the Payload Operations Center works directly with both the crew and remote ground-based researchers, allowing close interaction in a laboratory-style environment. Often scientists can track their experiment results in real-time, using data, audio and video, and can provide feedback and instruction to the crewmembers onboard through the Flight Control Team at the Payload Operations Center. This interaction helps investigators achieve the greatest possible science return.

## Environmental Control and Life Support System

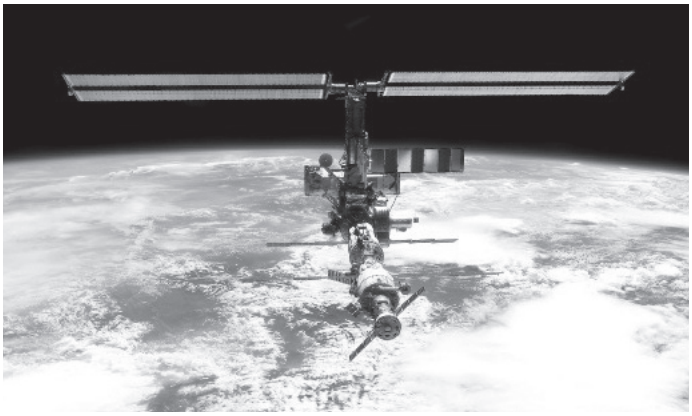
The Marshall Center is working on the next generation of life support systems for the Space Station — systems that will allow more crewmembers to live on-board and eliminate the need to resupply thousands of pounds of water and oxygen for the crew each year. In a specialized facility at Marshall, researchers conduct exhaustive tests on air conditioning, atmospheric pressure and air and water purification systems planned for future Space Station use.

### Nodes

The Marshall Center managed development of Node 2 —the next pressurized module to be attached to the International Space Station – for the Space Station Program at Johnson Space Center. Attaching Node 2 to the Destiny lab will allow several key science facilities to be attached to the Station. Additionally, the Node 2 will accommodate crew quarters for four astronauts. The



Weighing approximately 30,000 pounds, Node 2 is the second of three connectors between International Space Station modules. International contractor Alenia Spazio built Node 2 at its facility in Torino, Italy. Workers there prepared the Node for shipment to NASA's Kennedy Space Center in Florida on June 1, 2003. Node 2 is more than 20 feet long and 14.5 feet wide.



Marshall Center also continues to support the development of Node 3 — another pressurized module for the Station. The Node 3 is designed to house the Environmental Control and Life Support System racks and the crew's Waste and Hygiene compartment. The Node 3 also will allow for any growth of the Station by providing the capability to support future attached pressurized modules. Each of these pressurized modules is being manufactured by Alenia Spazio in Torino, Italy.

## Multi Purpose Logistics Modules

The Marshall Center manages three Italian Space Agency-built Multi Purpose Logistics Modules for the Space Station Program. The pressurized modules serve as the International Space Station's "moving vans," carrying laboratory racks filled with equipment, experiments and supplies to and from the Space Station aboard the Space Shuttle. The modules are named Leonardo, Raffaello, and Donatello, representing some of the great engineers in Italian history: Leonardo da Vinci; Donato di Niccolo di Betto Bardi; and Raffaello Sanzio. Each un-piloted, reusable module functions as both a cargo carrier and a space station module. Mounted in the Space Shuttle's cargo bay for launch and landing, the modules are transferred to the station using the Shuttle or Station's robotic arm after the Shuttle has docked. While berthed to the station, racks of equipment and stowage items are unloaded from the module and racks and equipment may be reloaded to be transported back to Earth. The module is then detached from the station and positioned back into the Shuttle's cargo bay for the trip home. The cylindrical module is approximately 21 feet long and 15 feet in diameter, weighing almost 4.5 tons. It can carry up to 10 tons of cargo packed into 16 standard space station equipment racks. Of the 16 racks the module can carry, five can be furnished with power, data and fluid to support refrigerators or freezers.

## Remote Control Research

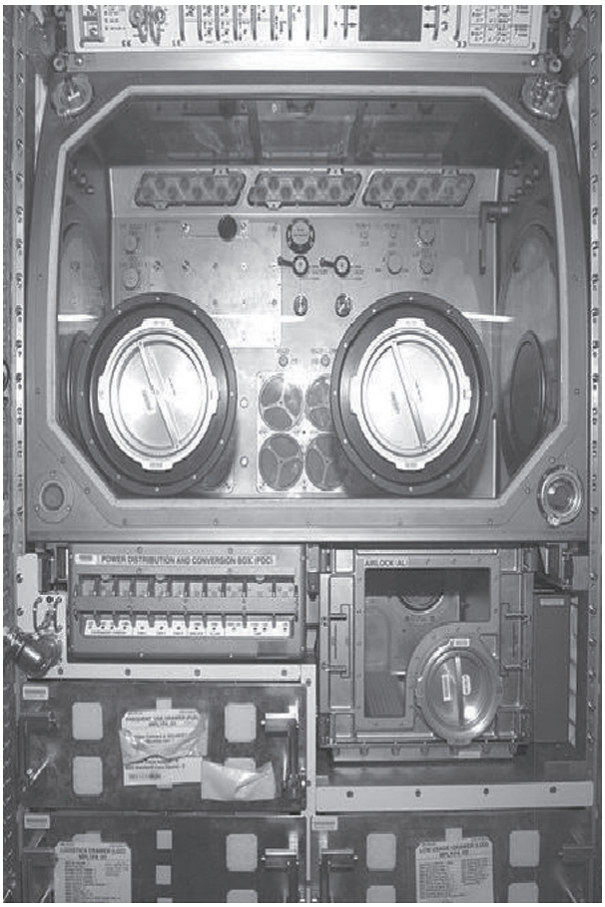
The International Space Station, as a long-duration program, has allowed the innovation of new technologies to make science operations easier and more convenient. Specialists at the Marshall Center have developed computer software to enable researchers to actively monitor, control and interact with their experiments and the crew onboard the Space Station.

The Telescience Resource Kit, or TReK, is a PC-based system that gives a remotely located specialist the capability to receive telemetry data and send commands to configure on-orbit payload hardware using the Internet. Another innovative tool, called the Internet Voice Distribution System, or IVoDS, allows researchers to communicate with the Payload Operations Center team, and even to speak directly with astronauts and cosmonauts conducting their experiments. Outfitted with a TreK computer and the IVoDS software, scientists can conduct research aboard the Space Station conveniently and inexpensively from almost anywhere, including university laboratories and other NASA centers.

## Microgravity Sciences

The Marshall Center operates the Microgravity Development Laboratory, which is used for the development of microgravity science experiments for both the International Space Station and the Space Shuttle. The laboratory oversees all aspects of microgravity research payloads, including development, testing, integration and operations of those payloads.

The first major facility on Space Station dedicated to microgravity research is the Microgravity Science Glovebox — an enclosed experiment facility accessible through airtight "glovedoors." This complex rack is over 7 feet tall and 3 feet wide, and provides services to payloads, including power, cooling, data and video. The crew uses gloves to interact with the experiments



installed and operating inside the Glovebox, providing a barrier against chemicals and gases that might otherwise be potentially hazardous. In keeping with the international flavor of the Space Station program, the Glovebox rack was built by the European Space Agency, but is managed and operated by specialists at the Microgravity Development Laboratory.

Another major facility being developed for Space Station is the Materials Science Research Rack, designed to house materials science experiments aboard the Station. This facility is being designed, developed and tested at Marshall. Experiments conducted in the facility will focus on the process that occurs as materials change from a liquid to a solid state. Results of these experiments will be important to improving materials processes on Earth.

## Other Space Station Developments

The Marshall Center continues to play an important role in International Space Station hardware development. In the late 1990s, many modules currently on-orbit were manufactured at Marshall by the Boeing Company, including the Unity connecting node, the Destiny laboratory module and the Quest airlock module.

## Track the Space Station

Anyone with access to the Internet can keep track of the Space Station as it orbits the Earth and grows larger during construction. Marshall Space Flight Center software developers have developed the J-Pass to allow users to determine when the Station might be visible from their locations. J-Pass is part of the "Science @ NASA" site at:
http://science.nasa.gov/Realtime/

or you can visit Johnson Space Center's Skywatch site at:
http://www.spaceflight.nasa.gov/
**realdata/sightings/index.html**

For more information please contact Steve Roy of the Marshall Media Relations Department at (256) 544–0034 or visit our web site at:

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