SPACEHAB

Payload Bay

Overview

U.S. and Russian hardware for the International Space Station will be carried in the SPACEHAB logistics double module, a pressurized laboratory in the shuttle's cargo bay that is connected to the middeck area of the orbiter. The seven-member crew will transfer more than 2,700 pounds of U.S. supplies and more than 2,200 pounds of Russian supplies from the module to the Unity and Zarya modules of the ISS.

The logistics include clothing and personal hygiene articles, health care supplies, exercise equipment, food, TV and movie equipment, a fire detection and suppression system, computers, and sensors. The hardware is stowed in SPACEHAB's numerous lockers and Soft Stowage bags and is mounted to the fronts of stowage racks and the module floor.

In addition to the logistics and maintenance cargo, SPACEHAB is carrying a commercial payload, the Self-Standing Drawer--Morphological Transition and Model Substances.

Designed to augment the shuttle orbiter's middeck, the SPACEHAB double module has a total cargo capacity of up to 10,000 pounds and contains systems necessary to support astronauts, such as ventilation, lighting, and limited power. Crew access to SPACEHAB is through a tunnel system located between the orbiter middeck and the SPACEHAB module.

Generally, two crew members are required for SPACEHAB operations. The SPACEHAB environmental control system is designed to nominally accommodate two crew members on a continuous basis. Additional crew members can be accommodated for brief periods at the expense of reduced cabin air heat rejection capability.

Microgravity Research Program

Working in partnership with the scientific community and commercial industry, NASA's Microgravity Research Program strives to increase understanding of the effects of gravity on biological, chemical, and physical systems.

Using both space flight- and ground-based experiments, researchers throughout the nation, as well as international partners, are working together to benefit economic, social, and industrial aspects of life for the United States and the entire Earth. U.S. universities, designated by NASA as commercial space centers, share these space advancements with U.S. industry to create new commercial products, applications, and processes.

Under the NASA Headquarters' Office of Life and Microgravity Sciences and Application, the Microgravity Research Program supports NASA's strategic plan in the Human Exploration and Development of Space Enterprise.

Microgravity research has been performed by NASA for more than 25 years. The term *microgravity* means a state of very little gravity. The prefix micro comes from the Greek word *mikros* ("small"). In metric terms, the prefix means one part in a million (0.000001).

Gravity dominates everything on Earth, from the way life has developed to the way materials interact. But aboard a spacecraft orbiting the Earth, the effects of gravity are barely felt. In this microgravity environment, scientists can conduct experiments that are all but impossible to perform on Earth. In this virtual absence of gravity as we know it, space flight gives scientists a unique opportunity to study the states of matter (solids, liquids, and gases) and the forces and processes that affect them.

Marshall Space Flight Center in Huntsville, Ala., is the lead center for NASA's Microgravity Research Program. The program manages Microgravity Science and Applications Project Offices at the Lewis Research Center in Cleveland, Ohio, and the Jet Propulsion Laboratory in Pasadena, Calif., and project offices at Marshall.

Under the project offices, the Microgravity Research Program is divided into nine major areas: five science disciplines, three research infrastructure programs, and the Space Products Development Office.

The science disciplines include biotechnology, fluid physics, materials science, combustion science and fundamental physics. The infrastructure activities include acceleration measurement, advanced technology, and the Glovebox Flight Program.

Marshall manages the Biotechnology Program and Material Science Program as well as the Glovebox Flight Program and the Space Products Development Office. Lewis Research Center manages the Fluid Physics, Combustion Science and Acceleration Measurement programs, while the Jet Propulsion Laboratory manages the Fundamental Physics and the Advanced Technology Development Program. As an element of the Biotechnology Program, Johnson Space Center manages bioreactor research in cell tissue growth.

In addition to the U.S. and Russian hardware for the International Space Station carried within the SPACEHAB module, additional unpressurized equipment for transfer to the space station will be carried on the new SPACEHAB integrated cargo carrier. The ICC, a cross-bay carrier that can accommodate 6,000 pounds of cargo, will be carrying parts of the Russian cargo crane known as Strela, the SPACEHAB Oceaneering Space System box, and DTO 700-21.

History/Background

Early in the shuttle program, it became evident that the orbiter middeck is the best place to conduct crew-tended experiments in space. Each shuttle orbiter has 42 middeck lockers, but most are used to stow crew gear for a typical seven-day mission, leaving only seven or eight for scientific studies. But SPACEHAB, the first crew-tended commercial payload carrier, has initiated a new era of space experimentation.

The basic SPACEHAB module, which takes up a quarter of the orbiter's payload bay, is like a second middeck. The 10-foot-long pressurized module adds 1,100 cubic feet of pressurized work space that can hold 61 lockers or experiment racks or a combination of the two. The lockers are sized and equipped like those in the shuttle middeck so that experiments can be moved from one location to the other. The lockers accommodate up to 60 pounds of experiment hardware in about 2 cubic feet. A rack, which can be single or double, takes the space of ten lockers. Double racks are similar in size and design to those planned for the space station so that they can serve as test beds for future projects. A single rack can carry 655 pounds of hardware in 22.5 cubic feet.

A new double module, developed specifically for shuttle missions to Mir, will be used on STS-96. The double module, which can accommodate nearly 10,000 pounds of cargo, was created by joining two single modules.

The astronauts enter the module through a modified Spacelab tunnel adapter. SPACEHAB can accommodate two crew members on a continuous basis, but additional crew members can work in the module for brief periods. Power, command and data services, cooling, vacuum, and other utilities are supplied by orbiter crew cabin and payload bay resources.

SPACEHAB was privately developed and is privately operated by SPACEHAB, Inc., of Arlington, Va. STS-101 is the 14th flight of SPACEHAB.

Benefits

Using both space- and ground-based experiments, researchers throughout the nation, as well as international partners, are working together to develop economic, social, and industrial benefits for the United States and the entire Earth. U.S. universities, designated by NASA as commercial space centers, share these space advancements with U.S. industry to create new commercial products, applications, and processes.
