

STS-101

EVAs

STS-101 EVA

Overview

Mission Specialists James Voss and Jeffrey N. Williams will emerge from Space Shuttle Atlantis on Flight Day 4 of the second logistics mission to the International Space Station and make the last planned equipment changes prior to the arrival of the ISS's third element, Russia's Service Module Zvezda.

During the planned 6 1/2 hour space walk, they will complete the assembly of a Russian crane, test the integrity of a U.S. crane, replace a faulty communications antenna, install handrails, set up a camera cable and thus make ready for Zvezda's launch scheduled between July 8-14.

Mission Specialist Mary Ellen Weber will assist the two astronauts in maneuvering around the ISS as she operates the shuttle's robotic arm from inside Atlantis.

When Voss and Williams step from Atlantis' airlock, their first job will be to set up the foot restraints, tethers and other gear essential for safely executing activities in space. Then they can go to work.

First they will head to a workstation fixture on pressurized mating adapter (PMA) -1, the passageway connecting U.S. module Unity and Russian-built control module Zarya. The objects of their attention will be the fixture itself and a small, 209-pound U.S. space-walker-operated crane. Mission Specialists Tamara E. Jernigan and Daniel T. Barry placed it there during the first logistics mission (May 27-June 6, 1999: STS-96/2A.1).



Astronaut Tamara E. Jernigan totes part of Russian-built Strela ("Arrow") crane during first logistics mission STS-96/2A.1

The crane is not mounted to the fixture as tightly as expected. Although it poses no hazard to ISS components, Voss and Williams will inspect it and its fixture to ensure that neither is damaged or otherwise compromised. They will attempt to secure the crane in its housing, or relocate it to another, identical housing elsewhere on Zarya.

The two mission specialists will return to the airlock to get the spare Early Communications antenna and pick up a grapple fixture for the Russian crane Strela. From there they will go to the SPACEHAB Integrated Cargo Carrier (ICC) in the shuttle's cargo bay and obtain the rest of the components and tools required to complete assembly of Strela, begun by Jernigan and Barry on STS-96.

Finishing the assembly job will require about 100 different actions, steps and processes from the time Voss and Williams arrive at the ICC to get the crane's 45-ft telescoping boom to the completion of its assembly at its workstation on PMA-2. Strela, which is an updated version of the crane used on Mir, will be moved to Zarya during the August logistics mission, STS-106/2A.2b.

Next, Voss and Williams will replace an Early Communications (ECOMM) System antenna mounted on the port side of the common berthing mechanism at Unity's forward end-cone. It is one of two used for crew videoconferences, command activities and telemetry backup. The job of swapping out the device is relatively straightforward. It essentially involves

disconnecting four cable connectors, releasing the antenna from its mount, installing and reconnecting the new antenna, and checking its alignment.

Only two more tasks remain to be completed: installation of the centerline camera cable and attachment of eight handrails on Unity. The equipment is in a bag Jernigan and Barry left behind for Voss and Williams. Williams will retrieve the bag, then move to the connecting module's starboard side to meet Voss and give him the cable.



Handrails assist space-walking Astronauts in safely maneuvering around Unity

Installation of the cable will simply require that Voss secure it with wire ties to handrails already attached to Unity. Williams at the same time will use a power tool to securely bolt the new handrails to the module's forward, mid- and aft sections. When those tasks are completed, the EVA mission will be accomplished.

EVA Phase Elapsed Timeline for STS-101 EVA

Time	Event
0:00	Airlock Egress
0:15	EVA Sortie Setup
0:45	OTD Activities
1:30	EVA Sortie Setup continued
1:45	Strela Install
3:45	Early Comm Antenna
4:45	Node Handrail Install - Centerline Camera Cable
5:15	EVA Sortie Cleanup
6:15	Airlock Ingress
6:30	Repress - End of EVA

Updated: 04/04/2000

Payloads

BioTube Precursor Experiment

Payload Bay

Prime:

Principal Investigator: David Cox

Backup:

Overview

The BioTube Precursor Experiment will test newly developed technologies involved in the BioTube Magnetic Field Apparatus, a device for growing seeds in microgravity that will be flown on STS-107. This precursor experiment, which occupies half of a locker in the middeck of Atlantis, will evaluate the MFA's water delivery system and seed germination substrates.

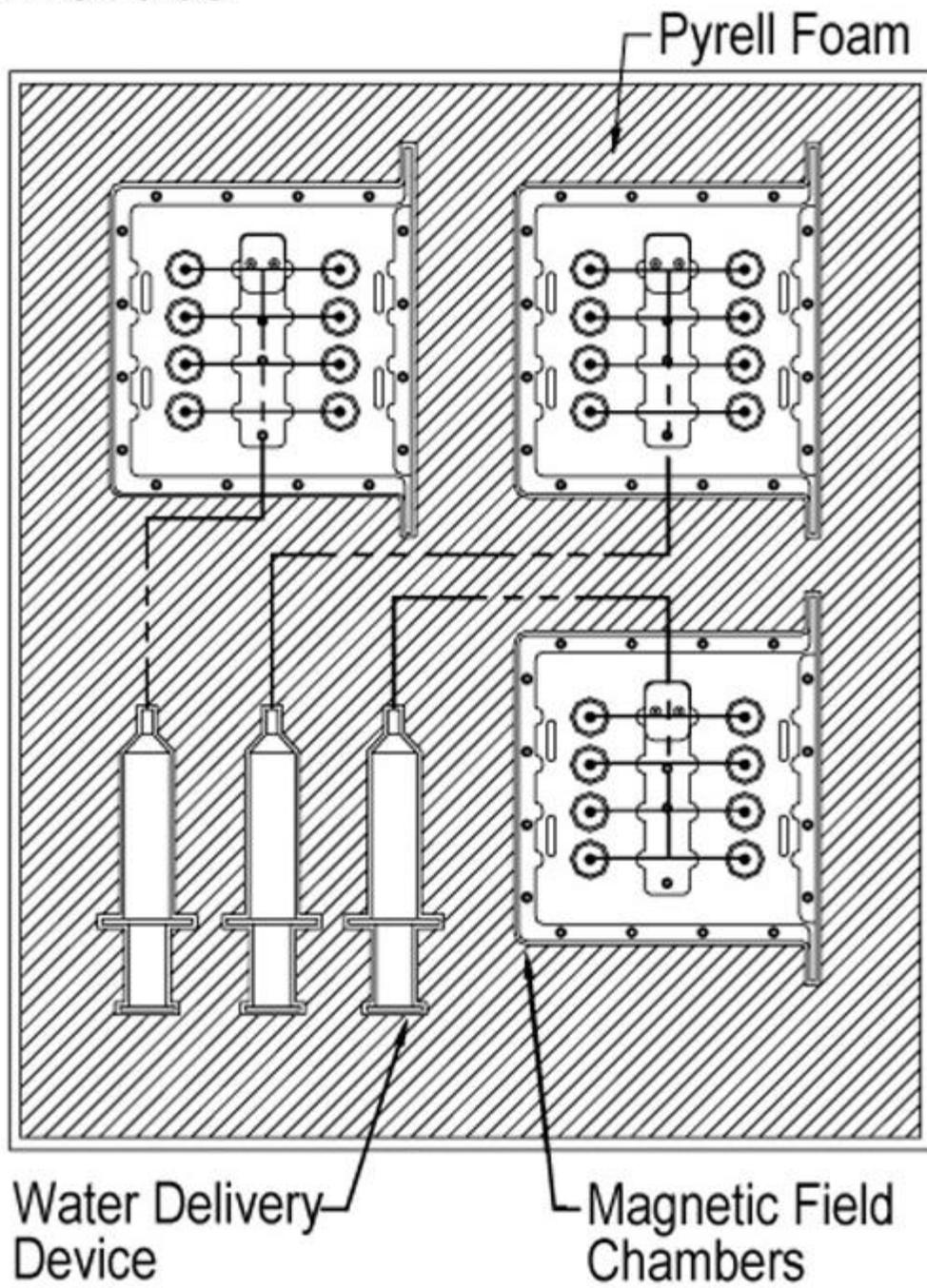
In plant growth experiments, a wicking material, such as germination paper, is sometimes used as a liquid distributor and temporary reservoir for germinating seeds. For the precursor experiment, wicking materials other than the standard germination paper will be tested for their ability to absorb, distribute, and retain water in microgravity without pooling around the seeds.

The flight will also demonstrate seedling growth as a function of temperature in the limited volume of the sealed growth chambers.

The payload consists of 24 seed cassettes housed in three Magnetic Field Chambers (MFCs), three syringe/tube mechanisms to deliver water, and three passive temperature-recording devices. The MFCs will be used on the BioTube MFA payload to expose plant materials to a magnetic field. For the precursor flight, aluminum blanks will be flown instead of magnets, so the precursor experiment will have no magnetic field.

Twice during the flight, a crew member will turn cranks on the three syringes to deliver water to the seed cassettes. The first watering will occur 30 to 36 hours before landing, the second 12 to 20 hours before landing.

BioTube



History/Background

When seeds are grown in the microgravity of space, the surface tension of water can cause excess water to pool on the surface of the seeds, which blocks oxygen transport around the seed. If the barrier forms before the seeds germinate, they will die.

Benefits

This investigation will enable researchers to develop devices for successfully growing plants in space to supply oxygen and food on long-duration space flights.

Updated: 04/06/2000

Payloads

HTD 1403 Micro Wireless Instrumentation System (Micro WIS)
HEDS Technology Demonstration
In-Cabin

Prime:

Backup:

Overview

HTD1403 will demonstrate the operational utility and functionality of the micro WIS on orbit, initially in the crew cabin of the Shuttle orbiter and then on the International Space Station.

The micro WIS consists of autonomous, tiny sensors for data acquisition. Two versions have been developed—a sensor/transmitter and a sensor/recorder. This HTD is designed to demonstrate the micro WIS transmitter and recorder.

The micro WIS sensor/recorder was first flown on STS-96 as part of the Integrated Vehicle Health Monitoring payload. This DTO will document requirements for the micro WIS sensor/recorder when it is not part of the IVHM.

One of the objectives of this HTD is to obtain meaningful real-time measurements for use in the orbiter's environmental control and life support system (ECLSS) operations. The micro WIS sensor/transmitter's simultaneous real-time measurements of air cabin temperatures in many interior compartments of the orbiter will help ECLSS operations personnel address issues encountered on STS-88 and early International Space Station flights. Currently, only one temperature reading in the aft flight deck of the orbiter is available for adjusting model predictions for real-time environments.

Micro WIS will also reduce the time it takes the crew to obtain on-orbit temperature measurements and will increase the capability to monitor temperatures over long periods. On busy Space Station assembly flights, the distances traveled and the time required to make the measurements can be prohibitive.

Micro WIS data will also be used to validate cabin air temperature models that are used for critical predictions of the dew point on early ISS missions, where orbiter cabin air exerts a significant influence on the entire station volume. Although the physical configuration of orbiter cabin air ducting has been changed significantly, the sensors have remained the same and some temperature data has never been available.

History/Background

In the past, space missions have been limited by the penalties associated with weight and integration costs. However, breakthroughs in the miniaturization of very low power radio transceivers have led to the introduction of a 1-inch-diameter micro wireless instrumentation system that can send temperature measurements to a laptop computer for five months.

Benefits

This breakthrough in miniaturization means significant cost, weight, and power savings for current and future space vehicles and ground test facilities and should revolutionize system design of future spacecraft. The micro WIS on-orbit demonstration should also increase the flexibility, reliability, and maintainability of data acquisition systems for spacecraft and lead to a reduction in vehicle turnaround time and increased reliability by eliminating cable connectors and by providing near-real-time reconfigurable data paths.

Updated: 04/06/2000

Payloads

Integrated Cargo Carrier

Payload Bay

3,700 pounds lbs.

Prime:

Backup:

Overview

Astronauts use the SPACEHAB Integrated Cargo Carrier to accommodate and support the transfer of exterior cargo from the shuttle orbiter to the International Space Station and from the station to work sites on the truss assemblies.

The ICC provides sufficient surface area in the orbiter cargo bay to carry approximately 8,000 pounds of cargo, which would otherwise have to be carried in the shuttle's cabin.

The ICC is an unpressurized flatbed pallet and keel yoke assembly housed in the orbiter's payload bay. Constructed of aluminum, it is 8 feet long, 15 feet wide and 10 inches thick, and is capable of carrying cargo on both faces of the pallet, both on top and below. There are no active interfaces (thermal, electrical or data) to the shuttle.

On Mission STS-101, the ICC will carry three cargoes: parts of the Russian Strela crane, the Space Integrated Global Positioning System/Inertial Navigation System (SIGI) Orbital Attitude Readiness (SOAR) payload, and the SPACEHAB-Oceanering Space System (SHOSS) box.

Strela is a Russian crane that will be mounted on the Zarya module to transport orbital replacement units and serve as a translational aid for extravehicular crew members on the Russian segment of the station. The Strela grapple fixture adapter and base were installed on STS-96; STS-101 will deliver the boom, ring and extension to complete the crane assembly.

SOAR is designed to be space station's primary global positioning source and the crew return vehicle's primary navigation source. (DTO 700-21 describes the SOAR test on STS-101 to demonstrate that SIGI can determine GPS attitude in space.)

The SHOSS is a trunk mounted on the ICC that can carry up to 400 pounds of tools and flight equipment. On STS-101, it will contain space-walking tools and logistics items to be transferred and stowed in the U.S. Unity module for use in future missions.

History/Background

This is the second flight of the Integrated Cargo Carrier. It last flew on STS-96.

Related Links: <http://spartans.gsfc.nasa.gov/>

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