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STS-68
Endeavour/Space Radar Laboratory-2

The second flight of the Space Radar Laboratory (SRL-2) will build on the extensive data gained on its debut mission in April, yielding a better understanding of how the Earth's environment is changing.

Liftoff of the Space Shuttle Endeavour on the 65th Shuttle flight is scheduled from Kennedy Space Center's Launch Pad 39A. OW-105 will be launched at a 57-degree inclination to the equator into a 120-nautical-mile orbit. The low orbit will facilitate Earth observation and data collection.

This will be the second launch attempt for STS-68. The first try on Aug. 18 was automatically halted 1.9 seconds before scheduled liftoff when a high pressure oxidizer turbopump turbine discharge temperature on Shuttle Main Engine No. 3 exceeded accepted limits, causing all three engines to shut down. Endeavour was returned to the Vehicle Assembly Building, where the three engines on the orbiter were replaced.

Endeavour's seventh spaceflight is scheduled to last ten days and conclude with a landing at the KSC Shuttle Landing Facility.

Mission commander is Michael A. Baker (Capt., USN), who will be making his third trip into space. The pilot is Terrence W. Wilcutt (Maj., USMC), a space rookie. Payload commander for the mission is Thomas D. Jones (Ph.D.), whose first flight was as a mission specialist on the first SRL flight. The three mission specialists are Daniel W. Bursch (Cmdr., USN), making his second spaceflight; Steven L. Smith, also a space rookie; and Peter J. K. "Jeff" Wisoff (Ph.D.), for whom STS-68 will be his second trip into space.

SRL-2

The SRL Earth observation flights are one element of NASA's Mission to Planet Earth. NASA will distribute the data collected during the mission to the international scientific community, so that this essential research is available worldwide to people who are trying to make informed decisions about protecting their environment.

SRL-2 includes two scientific instruments. The Spaceborne Imaging Radar-C (SIR-C)/X-band Synthetic Aperture Radar (X-SAR) is mounted on a Spacelab pallet in the orbiter payload bay. Mounted separately on a Mission Peculiar Experiment Support Structure (MPESS) is the other instrument, the Measurement of Air Pollution from Satellites (MAPS).

SIR-C is the third generation of imaging radars to be flown on the Shuttle, preceded by SIR-A in 1981 and SIR-B in 1984. One of the most important technological advances achieved with SIR-C is its capability to provide multi-frequency, multi-polarization imagery. The improvement in imagery is akin to the differences between black and white and color television. Vegetation imagery will particularly benefit, with researchers able to determine types of crops growing in fields and even estimate the volume of trees contained under the canopy of a forest.

SIR-C is the most massive piece of flight hardware ever built at the Jet Propulsion Laboratory,

weighing 16,100 pounds (7,300 kilograms) and measuring 39 by 13 feet (12 by 4 meters). It includes two radar frequencies, L-band and C-band. Ball Communications Systems Division is the prime contractor.

The X-SAR radar instrument was built by the Dornier and Alenia Spazio companies for the German space agency, DARA, and the Italian Space Agency, ASI, respectively. X-SAR is a single-polarization radar operating at the X-band wavelength. It is a follow-on to the Microwave Remote Sensing Equipment that flew as part of the Spacelab-1 mission in 1983.

SIR-C and X-SAR can be operated individually or in conjunction. The ground swath they can image varies from 9 to 56 miles (15-19 kilometers) depending on the orientation of the antenna beams. The data can be processed at a resolution varying from 33 to 656 feet (10-200 meters), with the image of the ground swath varying from 9 to 56 miles (15-90 kilometers), depending on the imaging mode and incidence angles of the SRL-2 radar beams.

Imaging radar is useful for its ability to collect data over any region at any time, regardless of weather or sunlight conditions. The radar signals can penetrate clouds, and under certain conditions, through vegetation, ice and dry sand. In certain instances, spaceborne imaging radar is the only way scientists can explore remote and inaccessible regions of the Earth.

During the 11-day flight of SIR-C/X-SAR earlier this year, the radar antennas imaged the equivalent of 20 percent of the Earth's surface, or about 25.6 million square miles (66 million square kilometers) over 44 countries, and achieved 100 percent of the mission's science objectives.

SIR-C/X-SAR will provide images and geophysical measurements of the following: vegetation (type, extent and deforestation); water storage and flux; ocean dynamics, wave fields and wind fields; volcanism and tectonic activity; soil erosion and desertification; and topography. During STS-68, the same 19 supersites studied on STS-59 will once again undergo the intensive scrutiny of the SRL radars, allowing investigators to make comparative measurements during a different season.

MAPS, flying for the fourth time on the Shuttle, will help increase understanding of the role of carbon monoxide in global tropospheric chemistry. MAPS measures the global distribution of carbon monoxide — a gas produced by the burning of gasoline and other carbon-based fuels — in the lower atmosphere between the altitudes of 2 and 10 miles (4-15 kilometers). Significant differences in distribution patterns are expected between the STS-59 MAPS data and that collected on STS-68, due to anticipated increases in vegetation burning and shifts in the global wind patterns.

High rate data recorders located in the crew compartment will store SRL data, with the crew responsible for changing out the tapes. SRL imaging processes will once again be controlled by the Payload Operations Control Center (POCC) in the Mission Control Center at Johnson.

Additional Payloads

Also located in the payload bay will be three Get Away Special (GAS) payloads containing eight experiments and stored in GAS cans attached to the cargo bay wall. G-316 is a North Carolina A&T payload including an arthropod development experiment and a crystal growth experiment. G-503 is sponsored by the University of Alabama and features five experiments covering biology, materials processing and cosmic rays. G-541 is sponsored by the Swedish Space Corporation and is a materials processing experiment.

Also located in the payload bay will be two GAS postal payload canisters being flown to commemorate the 25th anniversary of Apollo 11. Each canister contains 250,000 moon landing stamps.

In the middeck will be the Chromosome and Plant Cell Division in Space (CHROMEX) experiment designed to study plant growth in microgravity; the Commercial Protein Crystal Growth (CPCG-Block I), aimed at growing larger-size protein crystals to study their molecular structure and to understand the dynamics of protein crystallization; the Biological Research in Canisters (BRIC), which on STS-68 will focus on the effects of microgravity on wild gypsy moth eggs; the Military Applications of Ship Tracks (MAST) payload to obtain high resolution imagery of ship tracks and analyze wake formation and dissipation; and the Cosmic Radiation Effects and Activation Monitor (CREAM) experiment, which is collecting data on the dynamics of cosmic ray energy.

KSC Processing

Following STS-59, the SRL underwent the fastest turnaround of any payload to fly on the Space Shuttle. The radars were removed from Endeavour's payload bay on May 7 and returned to the Operations and Checkout Building. Following completion of preparations for the re-flight, SRL-2 was taken to Orbiter Processing Facility Bay 1 and once again installed in Endeavour's payload bay. SRL-2 has remained in Endeavour's cargo bay during the interval between the first and second launch tries of STS-68, undergoing routine monitoring and periodic charging of the X-SAR battery.

Endeavour

Endeavour is the newest of the four orbiters, and made its maiden flight into space in May 1992, the INTELSAT VI (F-3) satellite rescue mission. OV-105 also was used in December 1993 for the STS-61 mission to carry out the first servicing of the Hubble Space Telescope.

Endeavour is named after the first ship commanded by James Cook, the 18th century British explorer, navigator and astronomer.