



## Mission Overview

### STS-107: Providing 24/7 Space Science Research

Space shuttle mission STS-107, the 28th flight of the space shuttle Columbia and the 113th shuttle mission to date, will give more than 70 international scientists access to both the microgravity environment of space and a set of seven human researchers for 16 uninterrupted days.



***The STS-107 crew. Seated in front are astronauts Rick Husband, commander, and Willie McCool, pilot. Standing are (from left) mission specialists Dave Brown, Laurel Clark, Kalpana Chawla, Mike Anderson (payload commander) and payload specialist Ilan Ramon, representing the Israeli Space Agency.***

Columbia's 16-day mission is dedicated to a mixed complement of competitively selected and commercially sponsored research in the space, life and physical sciences. An international crew of seven, including the first Israeli astronaut, will work 24 hours a day in two alternating shifts to carry out experiments in the areas of astronaut health and safety; advanced technology development; and Earth and space sciences.



***The Spacehab Research Double Module is prepared for flight  
at Kennedy Space Center***



When Columbia is launched from Kennedy Space Center's Launch Pad 39A it will carry a SPACEHAB Research Double Module (RDM) in its payload bay. The RDM is a pressurized environment that is accessible to the crew while in orbit via a tunnel from the shuttle's middeck. Together, the RDM and the middeck will accommodate the majority of the mission's payloads/experiments. STS-107 marks the first flight of the RDM, though SPACEHAB Modules and Cargo Carriers have flown on 17 previous space shuttle missions.

Astronaut Rick Husband (Colonel, USAF) will command STS-107 and will be joined on Columbia's flight deck by pilot William "Willie" McCool (Commander, USN). Columbia will be crewed by Mission Specialist 2 (Flight Engineer) Kalpana Chawla (Ph.D.), Mission Specialist 3 (Payload Commander) Michael Anderson (Lieutenant Colonel, USAF), Mission Specialist 1 David Brown (Captain, USN), Mission Specialist 4 Laurel Clark (Commander, USN) and Payload Specialist 1 Ilan Ramon (Colonel, Israeli Air Force), the first Israeli astronaut.

STS-107 marks Husband's second flight into space – he served as pilot during STS-96, a 10-day mission that saw the first shuttle docking with the International Space Station. Husband served as Chief of Safety for the Astronaut Office until his selection to command the STS-107 crew. Anderson and Chawla will also be making their second spaceflights. Anderson first flew on STS-89 in January 1998 (the eighth Shuttle-Mir docking mission) while Chawla flew on STS-87 in November 1997 (the fourth U.S. Microgravity Payload flight). McCool, Brown, Clark and Ramon will be making their first flights into space.



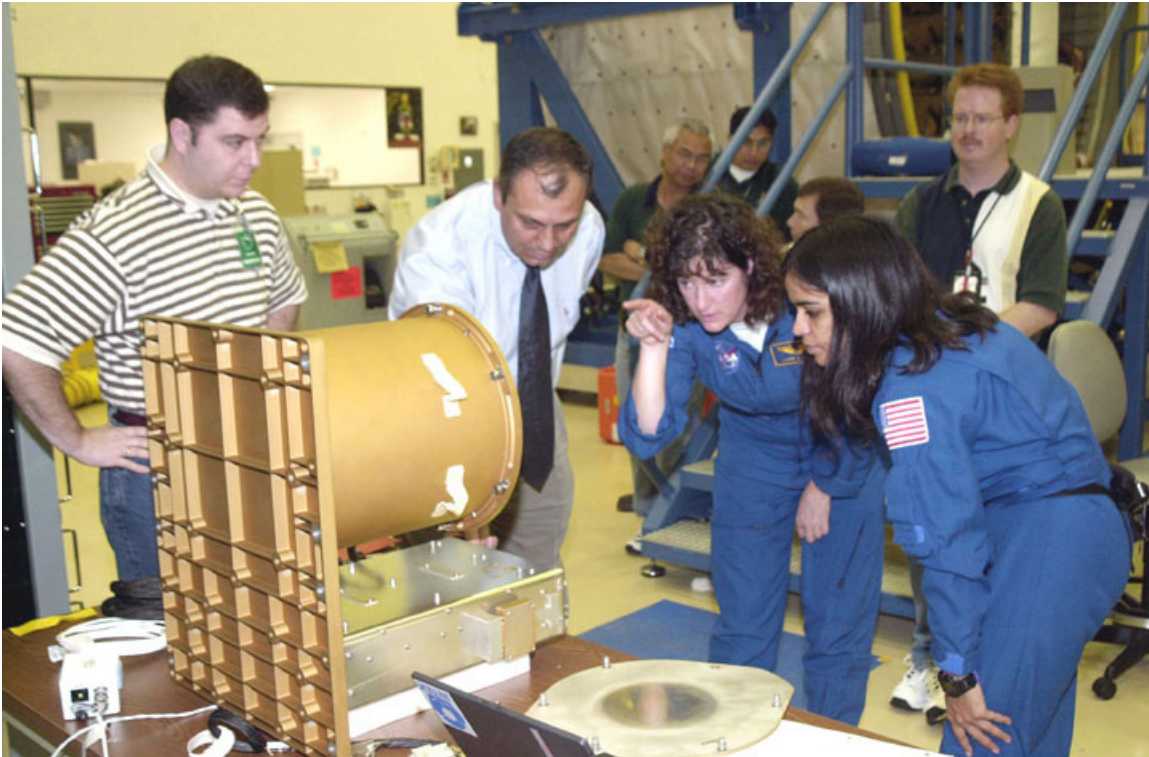
***STS-107 Payload Specialist Ilan Ramon, from Israel, trains on equipment at SPACEHAB, Cape Canaveral, Fla.***



The seven crewmembers will work in two shifts throughout their 16 days in space. The Red Shift will include Husband, Chawla, Clark and Ramon, while the Blue Shift will include McCool, Brown and Anderson. The seven astronauts will work round-the-clock to complete a multidisciplinary research program involving 32 payloads with 59 separate investigations. Under an agreement with NASA, SPACEHAB, Inc. has marketed 18 percent of the module's capacity of 9,000 pounds to international and industry commercial users from around the world – NASA research will utilize the remaining 82 percent of the payload capacity.

Experiments in the SPACEHAB RDM include nine commercial payloads involving 21 separate investigations, four payloads for the European Space Agency with 14 investigations, one payload/investigation for ISS Risk Mitigation and 18 payloads supporting 23 investigations for NASA's Office of Biological and Physical Research (OBPR).

In the physical sciences, three studies inside a large, rugged chamber will examine the physics of combustion, soot production and fire quenching processes in microgravity. These experiments will provide new insights into combustion and fire-suppression that cannot be gained on Earth. An experiment that compresses granular materials, in the absence of gravity, will further our understanding of construction techniques. This information can help engineers provide stronger foundations for structures in areas where earthquakes, floods and landslides are common. Another experiment will evaluate the formation of zeolite crystals, which can speed the chemical reactions that are the basis for chemical processes used in refining, biomedical and other areas. Yet another experiment will use pressurized liquid xenon to mimic the behaviors of more complex fluids such as blood flowing through capillaries.



***At SPACEHAB, Cape Canaveral, Fla., members of the STS-107 crew familiarize themselves with experiments and equipment for the mission. Pointing at a piece of equipment (center) is Mission Specialist Laurel Clark. At right is Mission Specialist Kalpana Chawla.***

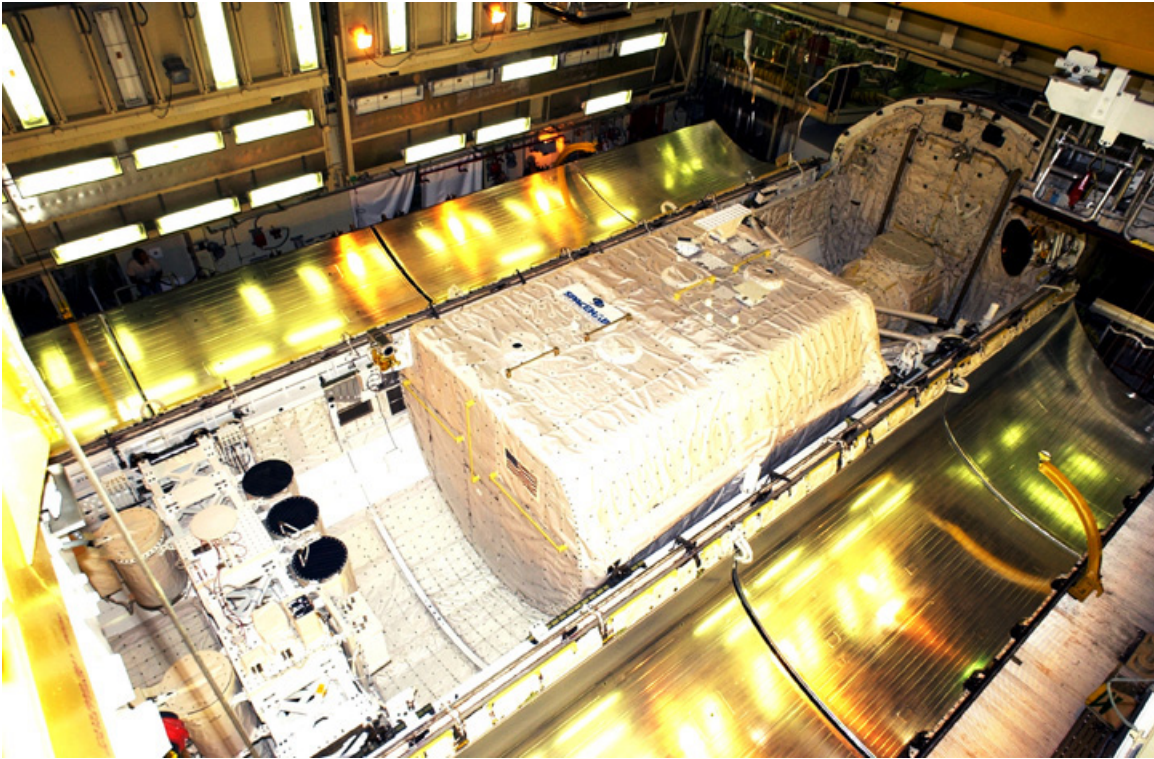
In the area of biological applications, two separate OBPR experiments will allow different types of cell cultures to grow together in weightlessness to enhance their development of enhanced genetic characteristics – one will be used to combat prostate cancer, the other to improve crop yield. Another experiment will evaluate the commercial usefulness of plant products grown in space. A facility for forming protein crystals more purely and with fewer flaws than is possible on Earth may lead to a drug designed for specific diseases with fewer side effects. A commercially sponsored facility will house two experiments to grow protein crystals to study possible therapies against the factors that cause cancers to spread and bone cancer to cause intense pain to its sufferers. A third experiment will look at developing a new technique of encapsulating anti-cancer drugs to improve their efficiency.

Other studies will focus on changes, due to spaceflight, in the cardiovascular and musculoskeletal systems; in the systems which sense and respond to gravity; and in the capability of organisms to respond to stress and maintain normal function. NASA is also testing a new technology to recycle water prior to installing a device to recycle water permanently aboard the International Space Station.



The European Space Agency (ESA), through a contract with SPACEHAB, is flying an important payload focused on astronaut health, biological function and basic physical phenomena in space. These experiments will address different aspects of many of the same phenomena that NASA is interested in, providing a more thorough description of the effects of spaceflight, often in the same subjects or specimens. ESA will perform seven in-flight experiments, and one ground-based, on the cardiopulmonary changes that occur in astronauts. Additional ESA biological investigations will examine bone formation and maintenance; immune system functioning; connective tissue growth and repair; and bacterial and yeast cell responses to the stresses of spaceflight. A special facility will grow large, well-ordered protein and virus crystals that are expected to lead to improved drug designs. Another will study the physical characteristics of bubbles and droplets in the absence of the effects of Earth's gravity.

SPACEHAB is also making it possible for universities, companies and other government agencies to do important research in space without having to provide their own spacecraft. The Canadian Space Agency is sponsoring three bone-growth experiments, and is collaborating with ESA on two others. The German Space Agency will measure the development of the gravity-sensing organs of fish in the absence of gravity. A university is growing ultra-pure protein crystals for drug research. Another university is testing a navigation system for future satellites. The U.S. Air Force is conducting a communications experiment. Students from six schools in Australia, China, Israel, Japan, Liechtenstein and the United States are probing the effects of spaceflight on spiders, silkworms, inorganic crystals, fish, bees and ants, respectively.



***Columbia's payload bay doors are ready to be closed for mission STS-107. Installed inside are the Hitchhiker Bridge, a carrier for the Fast Reaction Experiments Enabling Science, Technology, Applications and Research (FREESTAR) that incorporates eight high priority secondary attached shuttle experiments, plus the SHI Research Double Module (SHI/RDM), also known as SPACEHAB.***

There are also experiments in Columbia's payload bay, including three attached to the top of the RDM: the Combined Two-Phase Loop Experiment (COM2PLEX), Miniature Satellite Threat Reporting System (MSTRS) and Star Navigation (STARNAV). There are six payloads/experiments on the Hitchhiker pallet – the Fast Reaction Experiments Enabling Science, Technology, Applications and Research (FREESTAR), which is mounted on a bridge-like structure spanning the width of the payload bay. These six investigations look outward to the Sun, downward at Earth's atmosphere and inward into the physics of fluid phenomena, as well as testing technology for space communications.

FREESTAR will hold the Critical Viscosity of Xenon-2 (CVX-2), Low Power Transceiver (LPT), Mediterranean Israeli Dust Experiment (MEIDEX), Space Experiment Module (SEM-14), Solar Constant Experiment-3 (SOLCON-3) and Shuttle Ozone Limb Sounding Experiment (SOLSE-2). The SEM is made up of 11 separate student experiments from schools across the U.S. and is the 14<sup>th</sup> flight of a SEM on the space shuttle.

Additional secondary payloads are the Shuttle Ionospheric Modification with Pulsed Local Exhaust Experiment (SIMPLEX) and Ram Burn Observation (RAMBO).