



Oliver Botta, 4. Mai 2011

Fact Sheet

STS-134: The final flight of *Endeavour*

The objectives of the 25th and final flight of Space Shuttle *Endeavour* (OV-105) include the delivery, installation and activation of the **Alpha Magnetic Spectrometer (AMS)-02** experiment on the International Space Station (ISS). The six-person crew, led by veteran astronaut Mark Kelly, will also deliver and install a platform (ELC-3) with additional spare parts for the ISS and perform four space walks (Extravehicular Activities or EVAs) from the Station's airlock. The flight will include the on-orbit meeting of two ESA astronauts of Italian nationality: Roberto Vittori as a crew member on board *Endeavour* and Paolo Nespoli as a long-term resident of the ISS as part of Expedition 27. Launch is foreseen for 16 May 2011, with a docking two days later. The Shuttle will undock from the Station after 10 days followed by its final landing at Kennedy Space Center 2 days later.

Mission Description

After liftoff from launch complex 39A at NASA's Kennedy Space Center in Florida *Endeavour* will ride its combined thrust of its three main engines and two massive solid rocket boosters (SRBs) for a nine minute climb to orbit. Once settled into orbit, the crew will transform the Orbiter from a rocketship to a spacecraft and will start preparations for its rendezvous with the International Space Station two days later. Using small thrusters to fine tune its orbit the Shuttle will slowly approach the ISS from below and glide into a docking with the station from the front side to Pressurized Mating Adapter (PMA)-2, linked with the Node-2 *Harmony* module. After a short welcome ceremony between the Shuttle and Station crews, including the rendezvous of two European Space Agency astronauts of Italian nationality, Paolo Nespoli and Roberto Vittori on board the ISS, the astronauts will swiftly move into their work schedule with their first task, the transfer and installation of the EXPRESS Logistics Carrier (ELC)-3, a platform carrying external spare parts for the ISS, from the payload bay

(see Image 1) onto the truss structure of the ISS. For these tasks they will be using both the robotic arm of *Endeavour* as well as the Station's robotic arm. The following day the AMS-02 experiment will also be unloaded from the Shuttle's payload bay and installed at the other end of the ISS truss structure. After power and data connections have been established remotely, the AMS-02 science experiment will start its measurements that are expected to last throughout the lifetime of the ISS until 2020. Its scientific objectives are to search for the missing anti-matter and exotic particles, which can shed new light onto the theories describing the beginning and evolution of our Universe. AMS-02 was integrated at CERN in Geneva, and the AMS-02 control center will be located there throughout the duration of the mission. Upon completion of these robotic activities the crew will prepare for four Extravehicular Activities (EVAs), which will be conducted every second day starting on flight day 5. Each EVA will be conducted by a pair of *Endeavour's* astronauts who will have under-

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taken many hours of special training in simulators and in a special pool practicing the performance of these tasks. The astronauts will primarily carry out maintenance on different ISS systems, including the giant rotary joints that allow the rotation of the solar arrays that provide power to the Station; secondary tasks include the installation of a small material science experiment on the ISS exterior while retrieving a similar experiment for return to Earth (the experiments are called MISSE for Materials International Space Station Experiments). On the final EVA they will install a special boom on the ISS that was used in the past to perform inspections on the Shuttle's thermal protection system before its reentry. The boom will be left on the ISS as an additional asset for robotic activities. Throughout the docked operations the crews will also transfer equipment and spare parts from Endeavour's middeck area to the ISS.



Image 1: Graphical overview of the payload bay configuration of Space Shuttle Endeavour for STS-134 with the Orbiter Docking System (ODS) in the front, the EXPRESS Logistics Carrier (ELC)-3 in the middle and the Alpha Magnetic Spectrometer (AMS)-02 in the rear (Credit: NASA).

After the Shuttle crew has bid farewell to the ISS crew, the hatches between the two vehicles will be closed. The Shuttle will undock the next day and perform a flyaround of the ISS after which it will separate from the orbital complex by firing its maneuvering engines. The final day in orbit will be used to check out *Endeavour's* flight control and hydraulic systems as well as to stow the crew compartment. A final inspection of the thermal protection system will be carried out using only the Shuttle's robotic arm (without the boom). Provided weather conditions are favourable the Orbiter will return to Earth the following day during the first landing attempt at Kennedy Space Center in Florida, bringing to an end the final flight of *Endeavour*.



Image 2: Space Shuttle Endeavour rolls out of the Vehicle Assembly Building (VAB) on 10 March 2011 on its way to launch complex 39A. The Shuttle stack, composed of the Orbiter, the orange External Tank and two Solid Rocket Boosters, stands on its launcher platform, which itself is carried by one of the Crawler Transporters.

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STS-134 Facts

- 134th flight of the Space Shuttle Programme
- 36th Shuttle flight in support of construction, exploitation and utilization of the ISS
- Vehicle: Space Shuttle Endeavour (OV-105), 25th flight
- Crew:

CDR	Mark Kelly (4th flight)
PLT	Gregory Johnson (2 nd flight)
MS1	Mike Fincke (3 rd flight)
MS2	Roberto Vittori (ESA Astronaut, 3 rd flight)
MS3	Andrew Feustel (2 nd flight)
MS4	Gregory Chamitoff (2 nd flight)
- Payload: AMS-02, ELC-3, MISSE-8, MISSE-7 (return).

Launch date (expected) : 16 May 2011

Docking: Launch date + 2

Undocking: Laun ch date + 12

Landing: Laun ch date + 14

Space Shuttle *Endeavour* History

Endeavour is named after the Royal Navy research vessel HMS Endeavour used by Captain James Cook during his voyages in the late 18th century. Cook sailed into the South Pacific to observe the passage of Venus between the Earth and the Sun. HMS Endeavour was the first seagoing vessel to anchor at the east coast of Australia. The name also honors the name of the Command and Service Module of the Apollo 15 mission to the Moon.

Endeavour was constructed from spare parts following the loss of Space Shuttle Challenger on 28 January 1986.

Important dates

Approval for construction: 1 August 1987

Delivery to NASA: 7 May 1991

First flight: STS-49, 7-16 May 1992, in-flight repair of Intelsat VI (F3), first and only three-person EVA.

Highlights:

- STS-57: Retrieval of the European Reusable carrier (EURECA) satellite
- STS-61: First Hubble Space Telescope Servicing Mission, first mission with five EVAs
- STS-67: ASTRO-2 mission: Longest Shuttle flight to date (16 d, 15 h, 8m, 48 s)
- STS-89: Docking with Russian Space Station *Mir* (only one for *Endeavour*)
- STS-88: Delivery to orbit of the first US element of the ISS (Node-1 *Unity*), docking with the Zvezda module, beginning of Space Station construction.
- STS-100: Delivery of the Space Station robotic arm.
- STS-130: Delivery of the Node-3 module *Tranquility* and the European-built *Cupola*.

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Image 1:



Graphical overview of the payload bay configuration of Space Shuttle Endeavour for STS-134 with the Orbiter Docking System (ODS) in the front, the EXPRESS Logistics Carrier (ELC)-3 in the middle and the Alpha Magnetic Spectrometer (AMS)-02 in the rear. (Credit: NASA)

Image 2:



Space Shuttle Endeavour rolls out of the Vehicle Assembly Building (VAB) on 10 March 2011 on its way to launch complex 39A. The Shuttle stack, composed of the Orbiter, the orange External Tank and two Solid Rocket Boosters, stands on its launcher platform, which itself is carried by one of the Crawler Transporters.