ISS Flight Engineer 2 Tasks

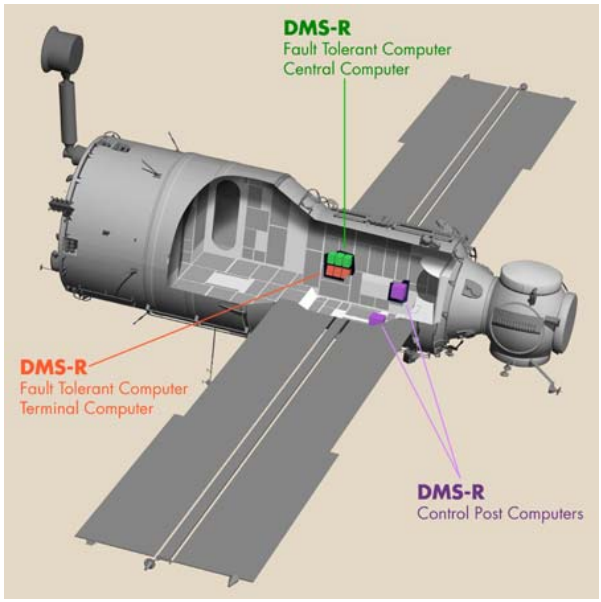
In addition to his work in connection with the Astrolab mission, Thomas Reiter will be Flight Engineer 2 of the ISS increment 13 and 14 crews during his stay on the ISS before returning on the STS-116 Shuttle mission. As such he has a trained in order to be able to carry out many functions, which utilise ISS systems and scientific hardware in both the US and Russian segments of the ISS. During the course of his mission, Reiter's responsibilities will involve carrying out any number of these tasks as and when required. These not only involve the utilisation of the relevant systems but also the reconfiguration and repair of them using specially designed tools configured to the relevant equipment in the two sections of the ISS. These include:

Docking/Undocking
Operating the Russian docking mechanism. The Russian docking mechanisms are used on both the Soyuz TMA spacecraft for bringing crewmembers to and from the ISS, or the unmanned Progress supply spacecraft for bringing regular supplies and

Progress 17 supply spacecraft approaching the ISS on March 2005. (Image: NASA)

scientific equipment to the ISS and removing waste from the ISS. Reiter is also trained as Flight Engineer 2 for the Soyuz TMA spacecraft, which act as an emergency escape vehicle for the Expedition Crews.

ISS Guidance and Control
Operating the onboard computer and equipment control systems in the Russian section of the ISS. At the heart of these systems is the ESA-developed Data Management System (DMS-R). This is used for control of the entire Russian section of the ISS and can be used for reconfiguring equipment. Reiter is also trained in the command and data handling systems in the US section of the ISS.



The European developed Data Management System (DMS-R) computer provides Command and Control for Zvezda and the entire Russian segment of the International Space Station. In addition it provides Guidance, Navigation, Control and mission management to the whole station. (Image: ESA/D. Ducros)

Operating the guidance, navigation and motion control systems for the Station in the Russian section of the ISS. As such Reiter could undertake tasks such as adjusting the attitude of the ISS, or undertaking debris avoidance manoeuvres. Reiter is also trained in the Motion Control Systems in the US segment of the ISS. These two systems interact with each other and receive information from GPS, GLONASS and ISS Control moment gyroscopes in order to determine the position, velocity and attitude of the ISS and any point in time.

Environment Control
Operating the US and Russian Environmental Control and Life Support Systems, and the thermal control systems. Environmental Control and Life Support will cover areas such as water recycling and purification, oxygen generation and

ISS Flight Engineer 2 Tasks

Astronaut Donald Pettit, completes a Water Resource Management and Contingency Water Container function on the ISS on 22 January 2003. (Image: NASA)

purification, air conditioning, atmospheric pressure, and even fire detection and suppression. Thermal control systems not only help to help to maintain a comfortable working environment for astronauts in the ISS, it helps to remove heat from equipment in order to prevent overheating. This includes air filters, water loops and radiators on the external surface of the ISS.

Photo of ISS taken during the STS-114 mission on 6 August 2005. Solar arrays are clear to see running in approximate left to right direction. Two sets of radiators that form part of the thermal control systems are clear to see running underneath and perpendicular to the largest set of solar arrays. (Image: NASA)

Electrical Power

Operating US and Russian electrical power systems. The equipment is used for power generation (via solar arrays attached to the ISS), energy storage, power management, and distribution. These kind of operations can be used for distribution of electrical power between different experiment facilities or ISS systems.

Crew Health and Safety

Operating systems in the Russian and American sections of the ISS such as the Crew Health Care System (CHeCS) in the American Destiny Laboratory, the Flight Crew System covering House keeping and trash management and the ISS food supply.

Maintenance Operations: Expedition 12 Commander Bill McArthur preparing to remove the Avionics Air Assembly from the Crew Health Care System (CHeCS) rack on 9 December 2005. (Image: NASA)

Communication

Operating of the ISS onboard communication and tracking systems and the onboard audio and video equipment. This provides two-way audio and video communications among ISS crew, between crew and Mission Control, and between crew and Earthbound scientists via Ku-band, S-band, and UHF frequencies.

ESA astronaut Thomas Reiter (centre) during training with the Expedition 12 Crew, Valery Tokarev (left) and Bill McArthur. 3 June 2005. (Image: NASA)

EVA Operations

This includes undertaking generic EVA operations in both sections of the ISS as well as using EVA-related hardware such as airlock systems for depressurisation and repressurisation and Russian and American EVA suits.

ISS Flight Engineer 2 Tasks

Scientific Hardware

Reiter is Specialist qualified in many of the experiment facilities that are or will be on the ISS including the European Modular Cultivation System dedicated to biological experiments, the European-developed Microgravity Science Glovebox (MSG) for materials, combustion, fluids

ESA astronaut Pedro Duque works on the PROMISS experiment inside the Microgravity Science Glovebox during the Cervantes mission in October 2003. (Image: ESA/P. Duque)

and biotechnology experiments including the protein crystallisation facility PROMISS which runs inside the MSG, and the Minus Eighty-degree Laboratory Freezer for the ISS (MELFI).

ESA astronaut Thomas Reiter during Human Research Facility training at the Johnson Space Center on 1 June 2005. (Image: NASA)

He is also specialist qualified in various elements of the Human Research Facility including the Pulmonary Function System, which was jointly developed by ESA and NASA, the Crew Earth Observations/Earth Science Toward Exploration Research (CEO/ESTER), the Microgravity Acceleration Measurements System, the Passive Observatories for Experimental Microbial Systems, the Space Acceleration Measurement System II as well as Express Rack 1-5. Reiter is also trained in the operation of the ALTEA device.

Emergency Operations

Each crewmember needs to be capable of reacting correctly and expeditiously to emergency situations. These situations are trained over and over again during the years of preparation and include crew responses to fire, depressurisation and to toxic atmosphere. In such cases it has to be decided, if the cause of the problem can be located and properly handled, in order to ensure the crew's survival on-board the ISS. However, if there is either insufficient time to fight the problem or the emergency cannot be confined, the crew might have to abandon the station and perform an emergency reentry using the Soyuz-capsule as a rescue vehicle.

The five crewmembers on the ISS go through the usual contingency evacuation drill. ESA astronaut André Kuipers is out of frame. 21 April 2004. (Image: ESA)