In Brief

On 22 December 2006, Space Shuttle Discovery landed at Cape Canaveral, bringing back ESA astronauts Christer Fuglesang and Thomas Reiter, and after completing one of the most complex assembly missions to the International Space Station to date.

The STS-116 mission delivered a new Truss segment to the ISS as well as supplies and equipment. For ESA, it marked the completion of two manned missions: Fuglesang, the first Swede in space, had travelled into orbit on 10 December with Discovery to carry out his Celsius mission, and Reiter had just set a new European record for days spent in space, on his Astrolab mission.

Astrolab and Celsius were the first in a series of ESA missions to the Station, as Europe fulfils its obligations as a fully-fledged ISS partner, contributing to maintenance and assembly, with European modules set to be delivered. Astrolab began on 4 July 2006 with the launch of Reiter on the preceding Discovery flight. Two days later, he reported for duty aboard the ISS as flight engineer, reopening the third permanent crewmember slot that had been discontinued 38 months earlier after the tragic loss of Columbia in February 2003.

Reiter carried out numerous operational and maintenance activities for both the US and Russian segments of the ISS. He also conducted a programme of European experiments in human physiology and psychology, microbiology, plasma physics and dosimetry. He also performed technological demonstrations as well as industrial and educational experiments for universities and schools.

During his stay, Reiter tested a 3-D camera and a high-definition camera, vividly capturing life aboard the Station. In future, such cameras will allow us all to share the unique feel of living and working in space. (A set of 3-D imagery is planned for publication in the May issue of the Bulletin.) On 3 August, during his 6-hour spacewalk with NASA astronaut Jeffrey Williams, he installed new equipment in preparation for future assembly work and to mount a number of instruments and experiments outside the Station. Reiter and Williams finished the EVA ahead of schedule and completed several extra tasks, speaking well of European astronauts’ physical conditioning and preparation.

On Astrolab, Reiter spent over 171 days in space which, when added to his previous 179 days on Euromir-95, makes him the new European record-holder for the longest cumulative time in space. ESA colleague Jean-Pierre Haigneré held the previous record of 209.5 days.

Fuglesang spent 13 days in space, with a very dense schedule. His role as a Mission Specialist on the NASA crew included securing the Shuttle’s docking with the ISS, assisting the retraction of one of the Station’s 34 m-long solar wings, transferring equipment between the Shuttle and the ISS, and releasing three microsatellites from the Shuttle’s cargo bay after undocking.

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Reiter on his spacewalk in August 2006
Reiter works with the Passive Observatories for Experimental Microbial Systems in Micro-g (POEMS) payload in the MELFI cryogenic freezer.

Reiter returns inside the Quest airlock following his first spacewalk, 12 December 2006.
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Christer at the galley on the middeck of Space Shuttle Discovery continued from a 67 Curbeam. The first two included attaching a new segment to the Station Truss, rewiring power lines and thermal control loops and, replacing a camera to prepare for the arrival and assembly of a new Truss segment.

The third spacewalk was a bonus. After difficulties in retracting the solar wing remotely, Fuglesang and Curbeam ventured outside and manually freed it.

Reiter and Fuglesang both collected data on the amount of radiation they were exposed to while working inside and outside the ISS. These data will help to assess the radiation risks of future long-duration missions and flights beyond low-Earth orbit.

The Astrolab and Celsius missions also provided an opportunity to broaden the Station’s food supply. In late November, Reiter and crewmates Michael Lopez-Alegria and Mikhail Tyurin tasted a space meal prepared by famous French chef Alain Ducasse as part of a programme to improve the quality of life on long missions.

Later, Fuglesang brought some traditional Swedish food, including elk sausages and toffees, to add a Scandinavian flavour to his stay.

Despite being an experienced astronaut, Reiter was still enthralled by the view of the Earth from space, as well as seeing the many sunrises and sunsets every day. “We can see parts of continents and are amazed by this variety of colours and forms created by the combination of land, sea and clouds. It’s something that leaves you breathless.”

One of the high points of his 8 months in space was the spacewalk. “Working outside the station means clambering around the exterior at an altitude of 400 km and a speed of 27 000 km/h – this is an amazing and unforgettable feeling,” said Reiter.

Fuglesang was impressed by the views of Europe from space. “I didn’t have as much opportunity so I would have liked to – we were very, very busy – but I was particularly pleased the first time I saw Sweden. We also saw the aurora over Sweden – that was beautiful,” he said. “One of the best passes was on the very last day. It was nighttime over Europe. We came in over Ireland and England. I could see London. You could clearly see the Netherlands because there was so much light. Then I saw all of the Scandinavian countries, even the southern coast of Norway. I could see clouds covering Oslo lit up. I could see up to the middle of Sweden and Finland. On the opposite side of the gulf, Tallinn and St. Petersburg, it is just like flying over a map. The light tells you where the cities are, and then just the complete darkness over the water – it was a beautiful pass. All of Europe in one glance,” said Fuglesang.

“Both Thomas and Christer have demonstrated that Europe now plays a major role in the ISS operations and assembly. This is the dawn of a new era for ESA’s manned space missions. We are no longer visitors in orbit; we are now among the propiters, which means we take on our responsibilities and benefit from the advantages,” said Daniel Sacuto, ESA’s Director for Human Spaceflight, Microgravity & Exploration.

“Celsius marks a further step forward in the development of our international infrastructure in orbit. Thanks to Christer and all the crewmembers of STS-116, the ISS is now ready to receive the new solar wings that will power the new modules, including ESA’s own Columbus laboratory and the Automated Transfer Vehicle, two of ESA’s highlights for 2007.”

This year, ESA plans to fly at least two more astronauts to the ISS on assembly missions. It is also negotiating a flight opportunity for a third, with a view to a second European astronaut being assigned a permanent crewmember slot. Approved contributions include the flights of Paolo Nespoli (I) on the STS-122 mission to deliver the Node-2 module this summer, and Hans Schlegel (D) on STS-125 to accompany ESA’s Columbus laboratory in the autumn. The long-duration flight of Leopold Eyharts (F) is under discussion with NASA.
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The northern lights as seen from STS-116 by Christer Fuglesang.

In Brief

...continued from p.22

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In Brief
ISS News

ISS Reviewed by Heads of Agency

The International Space Station partners met at ESA Headquarters on 23 January to review the status of ISS cooperation. The Heads of Agency noted the significant accomplishments in the assembly sequence endorsed at their last meeting in March 2006.

The milestones include reinstating three-person crews; restarting Station assembly; three extremely challenging Shuttle missions; outstanding spacecrafts by US, Russian, Canadian and European partners; continued exceptional performance of Canadarm2 (including operation by a Canadian astronaut); and the uninterrupted flow of Russian Soyuz and Progress vehicles that provide essential crew and cargo delivery and return.

The ISS Heads of Agency met in Paris to review the status of ISS development, configuration and operations across the partnership. The critical issue of transportation was discussed, including ESA’s ATV, Japan’s H-IIV, Russia’s Soyuz and Progress, and the US Shuttle, Commercial Orbital Transportation and Crew Exploration Vehicle. The timely introduction of six-person crews and completion of Station assembly were reviewed.

Artemis First

ESA’s Artemis satellite achieved a world-first in early December when it established optical laser links with an aircraft. The connection was made across 40 000 km during two aircraft flights at altitudes of 6000 m and 10 000 m. Six 2-way laser links were achieved between a Mystere 20 carrying the LOLA (Liaison Optique Laser Aéroporté) unit and the SILEX payload of Artemis in geostationary orbit.

The tests were made by Astrium SAS (F), the prime contractor for LOLA and SILEX, as part of the airborne laser optical link programme of the DGA (the French defence procurement agency) from its Flight Test Centre at Istres (F). ESA’s ground station at Redu (B) managed the SILEX operations.

Optical links can provide high data rates using lightweight, low-power terminals. Earth observation satellites will particularly benefit from this new technique of transmitting data around the planet.

Solar Storm Disrupts Satellites

A powerful solar storm in December showered several ESA satellites, including Integral, Cluster and Envisat, with energetic particles, highlighting the need for the Agency’s development of space weather forecasting tools.

The ESA/NASA SOHO solar observatory imaged a large flare on 13 December. The LASCO instrument detected a powerful coronal mass ejection (CME; a stream of fast atomic particles) directed towards Earth. The flare also generated X-rays. The CME arrived at Earth on 14 December between 12:00 UT and 18:00 UT, when it produced a strong geomagnetic storm. Another peak came during the night of 14 December, and ground controllers reported varying effects on their satellites.

Cluster’s four satellites were among the most affected. “We saw three anomalies on 13 December. Cluster 1 had a minor instrument anomaly, while Cluster 2 and 4 had onboard systems affected,” said Juergen Volpp, Spacecraft Operations Manager for Cluster at ESOC.

“The Attitude and Orbit Control unit on Cluster 2 lost power and autonomously switched over to its redundant unit, while the High-Power Amplifier on Cluster 4 switched itself off. This was a new occurrence,” he said.

“Operation of the Envisat Payload Module Computer was autonomously suspended, causing all payload instruments to be switched off. It happened around 19:00 CET, just before the particle peak on the 13th,” said Frank Diekmann, Spacecraft Operations Manager for Envisat.

Controllers working on Integral had perhaps the best sense of the solar activity: the JEM-X and IBIS instruments are sensitive to X-rays and charged particles, respectively. Controllers had to take action to avoid damage to the sensitive sensors. “JEM-X automatically switched itself into safe mode twice, and we manually switched IBIS off to avoid over-exposure,” said Michael Schmidt, Spacecraft Operations Manager for Integral.

ESOC’s Advanced Mission Concepts and Technologies office is working with UNIOVA (Institute for the Development of New Technologies), an academic institute in Caparica (P), and Deimos Engenharia, a private company, in Lisbon (P), to develop automated tools that can assess and eventually forecast space weather.

MIRAVI Site

ESA has created a website that gives access to the most recent images from the world’s largest Earth observation satellite, Envisat. The ‘MIRAVI’ (MERIS Images RApid Visualisation) site tracks Envisat around the globe, generates images from the raw data collected by Envisat’s MERIS instrument and provides them online within 2 hours. MIRAVI is free and requires no registration.

“ESA designed MIRAVI so that the public could have access to daily views of Earth. Seeing the most recently acquired images of the planet will allow people to witness the magnificent beauty of Earth and become more knowledgeable about the environment,” said ESA’s Director of Earth Observation Programmes, Volker Liebig.

To enjoy the service, simply visit http://www.cnes-tv.com/corot/ and either search by date. Images are available in grid or view a specific location by either selecting an area on the world map or entering its geographic coordinates. MIRAVI also provides archived images since May 2006, searchable by date.

COROT on its Way

The unique COROT astronomy satellite is poised to begin detecting planets orbiting other stars and probing the mysteries of stellar interiors. Launched by a Soyuz-Fregat on 27 December 2006 from Baikonur Cosmodrome, COROT is a CNES-led mission with ESA and other European contributions.

COROT will monitor the light variations of some 120 000 stars with its 30 cm-diameter telescope. Since the discovery in 1995 of an exoplanet, more than 200 others have been detected by ground-based observatories. COROT promises to find many more during its 2.5-year mission, expanding our knowledge towards ever-smaller planets. Many are expected to be ‘hot Jupiters’ but some could be rocky planets little larger than Earth. It would be a breakthrough in the search for other worlds like ours.

COROT can also measure acoustic waves generated deep inside a star that send ripples across its surface, altering its brightness. The exact nature of the ripples reveal the star’s mass, age and chemical composition.

ESA’s crucial role covered the telescope optics at the heart of the satellite, payload testing and the onboard data processing units. As a result, scientists from ESA’s Member States will have access to COROT data.

Further information on COROT is available at http://www.cnes-tv.com/corot/.
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**In Brief**

The first Automated Transfer Vehicle (ATV) has passed its stringent thermal testing at ESTEC with flying colours. For 21 days, “Jules Verne” demonstrated its flight software and hardware under the toughest conditions of vacuum, freezing temperatures and burning Sun.

ATV, the most complex spacecraft yet developed in Europe, is due to make its inaugural flight atop an Ariane-5 in July 2007 to resupply the International Space Station. “Started on 22 November, the test campaign, with different cycles of cold and hot, has been performed according to schedule and the behaviour of this complex spacecraft has been generally as expected,” said Bastiaan Dore, the ESA ATV Manager of Assembly Integration & Verification. “The successful completion of this test campaign represents a major milestone for the ATV programme.”

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**ESA News**

**Mars Express Reveals Old Mars**

With results that the Principal Investigator of the Mars Express MARSIS radar, Giovanni Picardi, describes as unprecedented, Mars is showing that it has an older, cragger face buried beneath its surface. The discoveries were made by MARSIS, the pioneering sounding radar aboard Mars Express, and they provide important new clues about the mysterious geological history of Mars.

Observations by MARSIS, the first subsurface radar to explore another planet, strongly suggest that ancient impact craters of 130–470 km diameter lie buried beneath the smooth, low plains of the northern hemisphere of Mars. “With MARSIS, it’s almost like having X-ray vision,” said Thomas Watters of the National Air & Space Museum’s Center for Earth and Planetary Studies, Washington DC, USA, and lead author of the results published in the 14 December 2006 issue of Nature. “Besides finding previously unknown impact basins, we’ve also confirmed that some subtle, roughly circular, topographic depressions in the lowlands are related to impact features.”

The new findings bring planetary scientists closer to understanding one of the most enduring mysteries about the geologic evolution and history of Mars. In contrast to Earth, Mars shows a striking difference between its northern and southern hemispheres. Almost the entire southern hemisphere has rough, heavily cratered highlands, while most of the northern hemisphere is smoother and lower in elevation.

Since the impacts that cause craters can happen anywhere on a planet, the areas with fewer craters are generally interpreted as younger surfaces where geological processes have erased the impact scars. The surface of Mars’ northern plains is young and smooth, covered by vast amounts of volcanic lava and sediment. However, the new MARSIS data indicate that the underlying crust is extremely old. “The number of buried impact craters larger than 200 km we have found with MARSIS tells us that the underlying crust in the northern lowlands must be very old, dating to the Early Noachian epoch (lasting from the planet’s birth to about 4000 million years ago),” said Jeffrey Plaut, MARSIS Co-Principal Investigator, from the Jet Propulsion Laboratory, California, USA. The Early Noachian was an era in which impact cratering was very intense across the Solar System.

The results suggest that the northern lowlands crust is as old as the oldest exposed southern highlands, also dated to the Noachian epoch, and that the dichotomy between the hemispheres probably formed very early in the history of Mars. “These results are truly unprecedented,” added Giovanni Picardi, MARSIS Principal Investigator, from the University of Rome ‘La Sapienza’. “MARSIS can contribute to understanding the geology of Mars through the analysis of the surface and subsurface morphology. In addition, with a detailed analysis of the instrument’s data, we can also obtain valuable indications about the composition of the materials.”

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**New Director**

Meeting on 12 December, the Agency’s Council appointed Ludwig Kronthaler, of German nationality, as Director of Resources Management for a 4-year term.

Mr Kronthaler obtained a PhD in Law from the University of Augsburg in 1991. He began his career with the Bavaria Finance Ministry’s tax administration. From 1993 to 1997, he was Regierungsdirektor (Bavarian representation) in Bonn and, from 1995, Kander of Munich Technical University, responsible in particular for resources, administration and organisation, human resources, controlling, procurement, legal affairs and facility management. Since 2005, Mr Kronthaler has been Federal Judge at the Bundesfinanzhof in Munich (German High Court for tax and customs duty affairs).

Mr Kronthaler will take up his ESA duties in April 2007, succeeding Hans Kappler, who will end his mandate on 31 May 2007.

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**SME Web Launch**

ESA has launched a new website to encourage Small- and Medium-sized Enterprises (SMEs) to become involved in its space programmes. The site at http://www.esa.int/sme provides SMEs with up-to-date information on business opportunities, training, achievements and expert support, for example.

The website is an integral part of the Space Intelligence, Engineering and Quality Network (SineQuaNon), the latest initiative from ESA’s SME Unit. SineQuaNon was launched in November 2005, in cooperation with DG Research of the European Commission. The network is planned to become a structuring tool for SMEs already operating in, or wishing to enter, the space business, by offering them support in engineering and industrial processes.

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**Asteroid for a Star**

Heidi Graf retired as Head of the ESTEC Communications Office at the end of 2006, after 30 years with ESA. An enthusiastic supporter of space activities, Heidi was always looking for new ways to draw the attention of the public to the wonders of astrophysics and space science; she was a driving force behind the creation of the Space Expo at Norderstedt (N.).

To mark Heidi’s contributions, the International Astronomical Union has named asteroid 10252 after her. This object was discovered on 26 March 1971 by Dutch astronomers C.J. van Houten and I. van Houten-Groeneveld on Palomar Schmidt plates taken by T. Gehrels, and will be now known as ‘Heidipra’.

The name was suggested by Prof. Frank Israel of the Leiden Observatory, University of Leiden.
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With results that the Principal Investigator of the Mars Express MARSIS radar, Giovanni Picardi, describes as unprecedented, Mars is showing that it has an older, craggy face buried beneath its surface. The discoveries were made by MARSIS, the pioneering sounding radar aboard Mars Express, and they provide important new clues about the mysterious geological history of Mars.

Observations by MARSIS, the first subsurface radar to explore another planet, strongly suggest that ancient impact craters of 140-470 km diameter lie buried beneath the smooth, low plains of the northern hemisphere of Mars. “With MARSIS, it’s almost like having X-ray vision,” said Thomas Watters of the National Air & Space Museum’s Center for Earth and Planetary Studies, Washington DC, USA, and lead author of the results published in the 14 December 2006 issue of Nature. “Besides finding previously unknown impact basins, we’ve also confirmed that some subtle, roughly circular topographic depressions in the lowlands are related to impact features.” The new findings bring planetary scientists closer to understanding one of the most enduring mysteries about the geologic evolution and history of Mars. In contrast to Earth, Mars shows a striking difference between its northern and southern hemispheres. Almost the entire southern hemisphere has rough, heavily cratered highlands, while most of the northern hemisphere is smoother and lower in elevation.

Since the impacts that cause craters can happen anywhere on a planet, the areas with fewer craters are generally interpreted as younger surfaces where geological processes have erased the impact scars. The surface of Mars’ northern plains is young and smooth, covered by vast amounts of volcanic lava and sediment. However, the new MARSIS data indicate that the underlying crust is extremely old. “The number of buried impact craters larger than 200 km we have found with MARSIS tells us that the underlying crust in the northern lowlands must be very ancient, dating to the Early Noachian epoch (lasting from the planet’s birth to about 4000 million years ago),” said Jeffrey Plaut, MARSIS Co-Principal Investigator, from the Jet Propulsion Laboratory, California, USA. The Early Noachian was an era in which impact cratering was very intense across the Solar System.

The results suggest that the northern lowlands crust is as old as the oldest exposed southern highlands, also dated to the Noachian epoch, and that the dichotomy between the hemispheres probably formed very early in the history of Mars. “These results are truly unprecedented,” added Giovanni Picardi, MARSIS Principal Investigator, from the University of Rome ‘La Sapienza’. “MARSIS can contribute to understanding the geology of Mars through the analysis of the surface and subsurface morphology. In addition, with a detailed analysis of the instrument’s data, we can also obtain valuable indications about the composition of the materials.”

**New Director**

Meeting on 12 December, the Agency’s Council appointed Ludwig Kronthaler, of German nationality, as Director of Resources Management for a 4-year term. Mr Kronthaler obtained a PhD in Law from the University of Augsburg in 1991. He began his career with the Bavaria Finance Ministry’s tax administration. From 1993 to 1997, he was Bürgermeister (Ravarian representation) in Bonn and, from 1995, Kandere of Munich Technical University, responsible in particular for resources, administration and organisation, human resources, controlling, procurement, legal affairs and facility management. Since 2005, Mr Kronthaler has been Federal Judge at the Bundesfinanzhof in Munich (German High Court for tax and customs duty affairs).

Mr Kronthaler will take up his ESA duties in April 2007, succeeding Hans Kappler, who will end his mandate on 31 May 2007.

**SME Web Launch**

ESA has launched a new website to encourage Small- and Medium-sized Enterprises (SMEs) to become involved in its space programmes. The site at http://www.esa.int/sme provides SMEs with up-to-date information on business opportunities, training, achievements and expert support, for example. The website is an integral part of the Space Intelligence, Engineering and Quality Network (SineQuaNon), the latest initiative from ESA’s SME Unit. SineQuaNon was launched in November 2005, in cooperation with DG Research of the European Commission. The network is planned to become a structuring tool for SMEs already operating in, or wishing to enter, the space business, by offering them support in engineering and industrial processes.

**Asteroid for a Star**

Heidi Graf retired as Head of the ESTEC Communications Office at the end of 2006, after 30 years with ESA. An enthusiastic supporter of space activities, Heidi was always looking for new ways to draw the attention of the public to the wonders of astronomy and space science; she was a driving force behind the creation of the Space Expo in Noordwijk (NL).

To mark Heidi’s contributions, the International Astronomical Union has named asteroid 10252 after her. This object was discovered on 28 March 1971 by Dutch astronomers C.J. van Houten and I. van Houten-Groeneveld on Palomar Schmidt plates taken by T. Gehrels, and will be now known as ‘Heidigraf’. The name was suggested by Prof. Frank Israel of the Leiden Observatory, University of Leiden.