Programmes in Progress

Status end-September 2007
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**Definitions:**
- DEFINITION PHASE
- MAIN DEVELOPMENT PHASE
- STORAGE
- ADDITIONAL LIFE POSSIBLE
- LAUNCH READY FOR LAUNCH
- OPERATIONS

**Abbreviations:**
- EDR: Environmental Dynamics Research
- EUTEF: European Union for the European Space Agency
- SOLAR: Solar and Heliospheric Observatory
**HST**

HST is operating normally after recovery from the safing event on 31 August. It entered the ‘Zero Gyro Sun Point’ safe mode following the failure of gyro-2, which had accumulated more than 57 000 h of run time – well above average. Gyro-6 was successfully turned on, and scientific operations resumed. The observing efficiency remains high, at about 54%.


A Workshop is being planned in Bologna (I) on 29–31 January 2008 to raise awareness of the expanded scientific capabilities of HST after SM4. The goals of the workshop are: to inform the general astronomical community of the exciting scientific opportunities of the refurbished HST for UV to near-IR imaging and spectroscopy; to provide insight into the refurbished HST for UV to near-IR imaging; to inform the general astronomical community about initial calibration characteristics as well as general information on the new HST imaging and spectroscopic capabilities and characteristics as well as general information about the mission; to provide more detailed information about initial calibration observations, the Cosmic Origins Spectrograph (COS) Guaranteed Time observing programmes and plans for Early Release observations and Early Release Science with both COS and Wide-Field Camera-3; to provide future guest observers with details of observation planning, data reduction and data products and archiving. The workshop is being sponsored by INAF, in collaboration with ESA and NASA (STScI and ST-ECF).

Additional information on this Workshop can be found at [http://www.iasfbo.inaf.it/bawhst/](http://www.iasfbo.inaf.it/bawhst/).

**Ulysses**

A recent analysis of an unusual energetic particle event in September 2004, observed both at Ulysses (then 5.4 AU from the Sun) and at 1 AU, provided new insights into the role played by complex solar wind structures in shaping the time-intensity profiles of such events. This has implications for the commonly-used models of particle propagation that are based on diffusion and convection. A ‘roadmap’ of solar wind/magnetic field data acquired during the recent perihelion passage was compiled by the Project Scientists to assist the other Principal Investigator teams in interpreting their observations. The latest science results from the current pole-to-pole transit were discussed at the 58th Ulysses Science Working Team meeting, held at the University of New Hampshire (USA) on 9–10 October.

**SOHO**

With more than 1350 comet discoveries already to its credit, SOHO for the first time found a rare periodic comet. Only around 190 of the thousands of comets seen by astronomers are classified as periodic. The credit for discovery and recovery of the comet goes to Terry Lovejoy (Australia, 1999), Kazimieras Cernis (Lithuania, 2003) and Bo Zhou (China, 2007).

Comet P/2007 KS (SOHO): for the first time, SOHO’s LASCO instruments has found a periodic comet, which flies by the Sun at regular intervals. While many SOHO comets are believed to be periodic, this is the first one that has been conclusively proved and officially declared as such. (ESA/NASA/SOHO)

Two very successful SOHO workshops were held over the summer: SOHO-19 on ‘Seismology of Magnetic Activity’ at Monash University, Melbourne (AUS); and SOHO-20 on ‘Transient Events on the Sun and in the Heliosphere’ in Ghent (B). The papers will be published in special issues of Solar Physics and Annales Geophysicae, respectively.

A SOHO/EIT image was prominently featured on the cover of the 13 August issue of Newsweek magazine.

**Cassini-Huygens**

Repeated observations of Titan’s surface at northern latitudes by the Cassini radar led to the interpretation that the position of Titan’s pole is changing and the moon’s spin is varying owing to the variation of the momentum exchange between its atmosphere and surface. These results give further evidence of an ocean layer of liquid water/ammonia under the icy crust of Titan that decouples the crust from Titan’s core. It affects the precise knowledge of the coordinates of the Huygens landing site in an as-yet unknown way.

A mosaic of Titan high northern latitude radar images was released in mid-October. In recent months, Cassini has been moving progressively over Titan’s southern hemisphere. During the Titan flyby of 2 October 2007, Cassini’s radar imaged the surface at southern latitudes. The next few radar passes should bring the craft closer to the south pole. These future observations are expected to reveal whether lakes or seas of liquid hydrocarbons are as prevalent there as they are at the north pole.

Spectacular observations of Saturn’s moon Iapetus were obtained during a low-altitude flyby in early September. High-resolution images of the boundary between the dark and the wide areas were obtained. The observations are expected to provide clues as to the origin of the dark material on the surface of Iapetus.

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Double Star

A recent study using Cluster and Double Star TC-2 data showed that the source of the aurora could be much closer to Earth than previously expected. This study showed that magnetic reconnection and its competing process, the current disruption, could happen at the same place, about 80 000 km from Earth.

Integral

GR J22517+2218 was just another unidentified object discovered with the Integral imager, IBIS. However, this time the quest for an identification turned out to be particularly rewarding. Follow-up observations with NASA’s Swift Observatory identified its optical counterpart in MG3 J225155+2217, a quasar with a redshift of 3.668, the farthest object so far detected by Integral.

The image shows the detection of this new source by IBIS in the 20–100 keV band. The zoom refers to a Swift observation covering the entire Integral uncertainty region. The brightest object detected in the 2–10 keV band is indeed the high-redshift quasar. Superimposed on the image is the combined Integral/Swift spectrum over the 0.4–100 keV band (or 2–500 keV in the source rest frame).

XMM-Newton

About 130 scientists participated in the ‘XMM-Newton: the Next Decade’ workshop, which helped to identify important future topics to be addressed by XMM-Newton. The proceedings will be published as a regular issue of Astronomical Notes/Astronomische Nachrichten.

The second XMM-Newton Serendipitous EPIC Source Catalogue, 2XMM, was released on 24 August. Constructed by the XMM-Newton Survey Science Centre on behalf of ESA, it contains 247 000 X-ray source detections, which relate to 192 000 unique X-ray sources, making it the largest catalogue of astronomical X-ray sources ever produced. The net sky area coverage is about 360 square degrees. This catalogue and associated products are supported by a new version of the XMM-Newton Science Archive.

Cluster

The Cluster mission continues to show new facets of the Earth’s magnetic environment and its interaction with the solar wind. J. Rae published an article in Journal of Geophysical Research showing that ultra low-frequency waves are shaking the whole magnetosphere after a geomagnetic storm. A subsequent article, in Geophysical Research Letters, by Q. Zong showed that these waves can accelerate particles to very high energies.

Mars Express

The recent dust storms had strong adverse effects on the quality of the HRSC and OMEGA science data. This has a very significant science impact as these dust storms took place during conditions that were otherwise highly favourable for HRSC and OMEGA.

Mars Express Data Workshops are foreseen at ESAC (E) in 2008 to address atmospheric, ionospheric and radar data (ASPERA, PFS, SPICAM, MaRS and MARSIS). Preparations for "The European Mars Science and Exploration Conference – Mars Express & ExoMars" (12–16 November 2007 at ESTEC) are well underway. A total of 271 accepted abstracts has been received, resulting in 125 oral presentations and 146 posters.

The latest major Mars Express papers concern OMEGA results, and are available in a special issue of the Journal of Geophysical Research (112, E9, 2007).

Rosetta

In preparation for the flyby of asteroid 2867 Steins in September 2008, a 3-day scientific workshop was held in Athens (GR), 23–25 October 2007. The workshop provided the opportunity for the PI teams and other representatives of the Rosetta Science Working Team to get together with other scientists of the asteroid community for the detailed scientific preparation from which the science operations requirements will be derived.

As the Rosetta target Comet 67P/Churyumov-Gerasimenko will again approach the inner Solar System in 2008/09, a workshop was arranged on 7 October 2007 to coordinate the efforts of observing the comet with ground-based telescopes during its approach. The 35 participants discussed the observational plans of various groups from Europe and the US, and collaborations were initiated. The workshop was held in conjunction with the DPS Annual Meeting to ensure that interested comet scientists from all over the world could attend and contribute.

Venus Express

Spectacular images and movies of the dynamics of the south polar vortex were produced and several very different regions with distinctly different dynamic characteristics were found, mainly by the VIRTIS and VMC instruments. The structure of the atmosphere with respect to...
temperature and density is being characterised by SPICAV and VERA (radio science), which complement each other well in terms of altitude. Maps of surface temperature, based on measurements by VIRTIS in the 1 μm spectral window, are being compared with synthetic maps based on Magellan altimetric maps and a constant lapse rate, and a programme for search of hotspots (volcanic activity etc.) started. Many minor species are being characterised at different levels of the atmosphere. SPICAV identified a new absorption line not known or in any catalogue; after a long investigation, this turned out to be an isotope of carbon dioxide, namely C16O18O. This has implications on the degree of greenhouse effect on Venus, and to some extent also on Earth.

At the time of Venus maximum elongation from the Sun, during May-June 2007, a dedicated space- and ground-based observational campaign was held, during which 16 teams of scientists around the world made coordinated studies of Venus. At the same time (5 June), the Messenger spacecraft made a swingby of Venus and took coordinated measurements with most of its instruments. A special workshop on these results will be held in ESTEC in December 2007.

Venus Express views of the southern polar region, from the polar vortex (at the top) to the mid-latitude region of the lower atmosphere. The images were taken at 1.74 μm from about 60 000 km. The first three were taken at short intervals and allow detailed determination of the windfield by tracking of features. The fourth show the same region a day later, highlighting the variability in the region.

Akari exhausted its cryogen on 26 August 2007, reaching the pre-launch expectation of 550 days. More than 90% of the sky was covered twice by the all-sky survey. European astronomers obtained 400 pointings, i.e. exactly 10%, as in the cooperation agreement. As planned, testing of the near-IR IRC camera is underway, in view of its planned operation at non-cryogenic temperatures, in Phase-3. As requested by JAXA, support from the ESA Kiruna station continues until the planned end date of 31 October. ESAC continued to contribute to the testing of the instruments’ processing pipelines, and released updated Instrument Data User Manuals, in June and September 2007. A hands-on data reduction workshop was held at ESAC 18–19 September, when seven experts from Japan helped European scientists in reducing their data with Akari processing toolkits. The mass processing with the pointing reconstruction software started at ESAC on the basis of datasets consistently pre-processed at ISAS.

Hinode (Solar-B)

Hinode has already made several fundamental discoveries (e.g. direct observations of Alfvén waves in the Sun’s chromosphere; detection of ubiquitous horizontal magnetic fields in the photosphere; observations of KG fluxtubes at the Sun’s poles). These and other results will be published in a special issue of Science magazine, to which 16 articles have been submitted. In addition, there will be a special issue in PASJ comprising some 40 early results papers from Hinode.

On the occasion of the 1st Hinode Science Meeting, at Trinity College Dublin (IRL) 20–24 August, ESA released the news item ‘Hinode helps unravel long-standing solar mysteries’ (http://www.esa.int/esaCP/SEMKOOWZK5F_index_0.html)

CoRot

The first long planetary observation ended on 15 October, followed by a repointing of CoRot towards the galactic anti-centre. CoRot is essentially photon noise-limited over the whole magnitude range, from +11.5 to +16. The rate of appearance of new hot pixels is now stabilised. At this rate, at the end of the nominal 2.5-year mission, 11% of pixels will suffer from charges in excess of 300 e–, 2.2% from charges >1000 e– and 0.015% from charges >10 000 e–. It is estimated that this should result in the loss of less than 3% of asteroseismology data, well within the <5% specifications.
Three further new planets were confirmed, ten planetary candidates are being followed up and six new stellar binaries were identified. About a dozen refereed articles are in preparation; until these are accepted, all results on exoplanets are embargoed.
Asteroseismological results are also excellent and papers are being prepared. A press conference is planned at the Paris Observatory (F) for end-October, following the completion of the first long look. CNES is also organising a CoRoT conference to be held in Paris in November 2008.

Herschel/Planck

Good progress has been made on both spacecraft with the completion of the final integration steps and the preparation of the first satellite functional and performance tests.

Another Herschel major milestone was achieved: the cryostat was mated to the service module. The instruments completed their final calibration and test campaign, so now all three instruments have been delivered. The three focal plane units were integrated onto the optical bench in the cryostat. Electrical connection and check-out with the electronic units mounted on the service module is ongoing. The preparation and debugging activities for the spacecraft functional test are under way in parallel.

The activities on the Planck spacecraft continue in line with the flight model plan. The step-by-step electrical integration and functional testing of the two instruments continues as planned, in parallel with the preparation and debugging activities for the functional tests. The qualification model of the telescope was used for the end-to-end verification using a novel measurement method at the operational frequencies with a representative instrument. With this method now validated, the same verification of the telescope will be carried out on the flight model spacecraft.

The progress on the ground segment elements is well in line with the spacecraft achievements.
LISA Pathfinder

The challenging SMART-2/LISA development is proceeding largely according to schedule. The main activity in the reporting period was the consolidation of the spacecraft design, in preparation for the spacecraft CDR. In parallel, most of the subsystems had their own CDRs. The flight models of a few units have already been delivered, including the primary structure of the science module, the digital Sun sensors and the separation mechanism device, while other units have been manufactured and tested (gyro package, low- and medium-gain antennas and batteries) and are ready for shipment. The propulsion module is being manufactured. The static test on the science module FM structure has started and will be followed by the separation and shock test and by the propulsion module static test.

The hardware design review to confirm the start of the real-time test bench (electrical tests of various Engineering Model units connected together on a bench) is under way.

The two European micropropulsion technologies (needle indium thrusters and slit caesium thrusters) continue their challenging development to prove their readiness. Despite many hiccups, good progress was made in both. The first controlled priming was achieved with the slit-technology thruster and progress is being made in the needle emitter production. The technology better suited to LISA Pathfinder will be selected in the spring of 2008.

For the LISA Technology Package (LTP), most of the subsystem CDRs have taken place and the system CDR documentation, delivered by the LTP Architect, is under review at ESTEC. Many of the electrical units have been built and delivered to Astrium GmbH for the Real-Time Test Bench. Progress has been made on all critical subsystems, including the inertial sensor vacuum enclosure, the electrostatic suspension front-end electronics and the caging mechanism. In particular, the caging mechanism will undergo a second breadboard test before the end of the year to confirm the design of the delicate interface between the gold-platinum Test Mass and the mechanism ‘fingers’ holding it during launch.

The launch is expected to take place in the first half of 2010.

Microscope

Phase-C/D of the accelerometer development has started. The Engineering Model of the Sensor Unit was assembled and is undergoing electrical tests. ONERA will soon begin further tests aimed at proving that the test mass will not stick when released from the caging mechanism, that its surface integrity will be preserved and that no significant amount of deposit will be produced.

To assess the potential use of cold gas as for micropropulsion, a detailed analysis was performed by CNES and all potential perturbations (outside the intrinsic noise) were found to be within the limits imposed by the drag-free specifications. However, this analysis should be confirmed before end-2007 by characterisation of the cold-gas propulsion in the nanobalance test facility recently commissioned at Thales Alenia Space, Turin (I). Taking account of the tests still to be performed on both cold-gas and FEEP technologies, the final selection of which technology to use has been delayed to April 2008.

Gaia

The spacecraft PDR was held before the summer and completed with the Board meeting at the end of June. The review process identified a number of critical issues that required specific attention by the Prime Contractor. Nearly all of these issues were resolved over the summer break. The few remaining open items will be closed before the end of the year.

Radiation testing continued during the summer and provided further evidence that understanding the performance of the ASTRO CCD irradiated with almost twice the mission dose has progressed well, further confirming the selected strategy (in-orbit characterisation/calibration and charge injection).

Meetings were held with the Gaia Data Processing and Analysis Consortium (DPAC) and agreements were reached on all points regarding management and interfaces between the ESA project and DPAC. The relevant documents have been agreed and form the basis for the formal Multilateral Agreement between ESA’s Executive and the Member States involved in the funding of DPAC.

The last meeting of the Gaia Science Team in its old composition was held in September. Ways on how to preserve the accumulated experience of these members were discussed and a way forward agreed. The first meeting with the new members will be held later this year.

JWST

The Director of the NASA Goddard Space Flight Center (GSFC) visited the MIRI integration facilities at Rutherford Appleton Laboratory (UK), where the Verification Model was ready to start the testing campaign.

The Integrate Science Instrument Module structure scale model (2:1) completed testing, confirming that the cryogenic deformations are within specifications. The preparation for the Mission PDR is under way; the review date is confirmed for April 2008.

Following the successful completion of NIRSpec’s FORE mirror polishing and the subsequent alignment in the Three-Mirror Anastigmat configuration, ‘first light’ was seen with the qualification model of the silicon carbide FRED optics assembly. The measured wavefront error is within specification. This is a major milestone in NIRSpec’s development.
The start of the instrument-level CDR was confirmed for April 2008, allowing sufficient time to close out the subsystem CDRs. First deliveries of the Data Analysis Electrical Ground Support Equipment and the Mechanical Ground Support Equipment passed their Delivery Review Boards.

NASA has successfully manufactured 10 flight-quality Micro shutter subarrays. Four sub-arrays are required for the flight model. The quality of the array has improved significantly and the associated programme risk was retired at JWST mission level.

MIRI’s Verification Model is integrated and has undergone warm alignment and gravity release test successfully. The preparation for the first cryogenic test campaign is under way.

A bottom-up qualification review campaign is being performed. Those for the Cleanliness Control Cover mechanism and the Cryogenic Harness were already successful.

Flight detector chips have already been down-selected for the MIRI imager. The selection of for the spectrometer is, however, pending the upgrade of the screening facility. The anomalies on the Focal Plane Electronics for the Verification Model were resolved by the Jet Propulsion Laboratory (US) and all the acceptance tests were run successfully.

**BepiColombo**

Following closure of the spacecraft System Requirements Review, the equipment procurement started and competitive Invitations to Tender for the first 16 items were issued. The first offers were received by the Prime Contractor’s Core Team and the Agency, and are under evaluation. In parallel, the system design is being consolidated.

The work on key technologies continues in anticipation of the selection of contractors for, in particular, multi-layer insulation, radiator, blocking diodes, solar array, high-temperature rotary joint and high-gain antenna. Micrometeoroid hypervelocity impact tests were conducted on two candidate electric propulsion grids, showing that the damage remains local.

The Science Working Team conducted its meeting in Berlin with participation by the international scientific community involved in the European and Japanese payload. The meeting concentrated on scientific subjects and working groups were formed to work on Mercury’s interior and geodesy, surface and atmosphere and magnetosphere. Routine progress meetings and delta Instrument Requirements Reviews are being conducted during September to November.

Work at Japan’s JAXA space agency on the Mercury Magnetospheric Orbiter design is progressing nominally. The PDR for the scientific instruments and spacecraft equipment has begun.

**LISA**

The Mission Formulation activity performed by Astrium (D) is proceeding in its Phase-3, which includes trade-off of the In-Field of View (IFOV) architecture with different positions of the test masses. The latest activity concentrated on the IFOV two-active-test-mass configuration. The main challenge consisted in achieving an architecture that uses a telescope that can be easily procured whilst retaining a compact and lightweight design.

A novel approach was devised with a crossed-telescope configuration. Its advantage is the containment of the diameter, which is beneficial for the spacecraft size and ultimately on the overall mass. The drawback is the need for a highly stable mechanism to steer the light beam within the telescope field of view, as opposed to steering the whole telescope, as in the baseline configuration.

The cooperation with NASA proceeds very well on all fronts. The review for the prioritisation of the NASA ‘Beyond Einstein’ programme initiated by NASA headquarters and performed by the National Research Council (BEAPAC) was completed and the draft report published on 5 September. Whilst not being recommended as the first mission to be implemented within ‘Beyond Einstein’ (mainly for programmatic reasons tied to the need to wait for the results of LISA Pathfinder), scientifically LISA received the highest rating from the review committee. To quote from the report: “On purely scientific grounds LISA is the mission that is most promising and least scientifically risky. Even with pessimistic assumptions about event rates, it should provide unambiguous and clean tests of the theory of general relativity in the strong field dynamical regime and be able to make detailed maps of space time near black holes. Thus, the committee gave LISA its highest scientific ranking.”

This corroborates the standing of LISA as a candidate for the first large mission (L1) of ESA’s Cosmic Vision Programme.

**GOCE**

The Gradiometer Core Proto-Flight Model passed its acceptance testing, confirming the good health of the six Accelerometer Sensor Heads (ASHs). In addition, the acceptance testing of a seventh ASH, the spare model, was completed.

Following the completion of its acceptance test campaign in Quinetiq (UK), the Ion Propulsion Assembly (IPA) was transported to Thales Alenia Space in Turin for integration on the satellite. With this, the satellite reached the complete configuration in mid-July. Subsequently, testing activities continued in double shifts, 6 days a week until the middle of August. The satellite was then shipped to ESTEC, where it arrived on 23 August, ready to start the environmental test campaign. This was a very important milestone for the GOCE programme.

The satellite Qualification Review was completed on 20 July. The first part of the GOCE Ground Segment Overall Validation test was completed, proving that the ground segment elements are correctly working together in closed loop. The second part will
A feature of the satellite is a novel gyro based on MEMS (micro electro-mechanical structures) technology, which is under development and will be given a flight opportunity on CryoSat-2. The measurements from this passenger will not be used by the onboard software, but should provide useful data during the early stages of the mission.

Almost all of the contracts to upgrade the ground segment facilities, required to cope with some changes in the satellite compared to CryoSat-1, have been placed, in time for the start of extensive system testing during 2008.

SMOS

After delivery and formal hand-over to Thales Alenia Space (Cannes, F) of the SMOS payload at the end of June 2007, integration with the Proteus platform and satellite electrical verification was completed. The satellite is being readied for sine vibration testing.

An overall Ground Segment CDR was successful. Components of the Flight Operations Ground Segment were delivered and are being validated and configured for operations. Components of the Data Processing Ground Segment are still under development. Prototype Level-1 and -2 Data Processor modules are being finalised. Preparation for operations continues with an update of Payload Module flight procedures and joint operations preparation with CNES.

For the launcher, a Final Mission Analysis Review was completed in June 2007. Work is progressing nominally for the submission of the Safety Data Package Phase-2, in the definition of the telecommunications requirements for the launch campaign and the Launch and Early Orbit (LEOP) phase and in the preparation of the launch campaign logistics.

ADM-Aeolus

Successful operation of the first flight model of the transmitter laser master oscillator was demonstrated. However, detailed visual inspection of the mirror assemblies showed defects on some of the mirror surfaces. Since they were considered too risky for flight, a decision was taken to replace these mirrors. Life-time tests on representative samples of mirrors in the UV section showed a potentially marginal end-of-life damage threshold of the high-reflectivity coatings against laser-induced damage. A sufficient number of mirrors using a different, more robust, coating technology is available and was used to replace the marginal mirrors.

Measurements of the output beam characteristics after the refurbishment of the master oscillator showed an unexpected variation of the beam profile. Investigations on the root cause of this effect are under way.

The Mie Spectrometer (MSP) was repaired and retested. A small non-compliance in the optical characteristics of the unit could be accepted, because it was found to have only a negligible impact on the overall instrument be run in autumn after an update of the Payload Data Segment processors.
September, several major concerns were identified, in particular a significant increase of the mass of the satellite owing to the structure and the intrinsic specific impulse (ISP) of the gas selected for the mission. A test campaign by Marotta for Cryosat showed that the ISP of the freon is 10% less than expected, leading to a satellite mass increase of 15 kg. Although a result of the structure PDR was to reinforce the structural design in order to meet the performances, these corrective actions lead to a mass increase of 6 kg.

Mitigation solutions had to be implemented in order to maintain the compatibility of Swarm with at least two launchers. Therefore, the semi-major axis of the orbit of the two lower-altitude satellites was increased for the beginning of the mission. This measure allows the saving of the propellant necessary for orbit maintenance in the previous orbit scenario and is enough to resolve the mass issue. This point was discussed with the Mission Advisory Group members and it was agreed there is no impact on the mission.

The procurement activity is under way with the selection of subcontractors for the solar cells, harness, thrusters, S-band antenna, cold-gas propulsion feed assembly and magnetorquers and the preparation of the specifications for the structure and level-1b processor.

A consolidation of the level-1b algorithms for the magnetic package and the EFI instrument is under way with industry. The level-2 algorithms were initiated, with the kick-off of four studies pertaining to processing architecture, ionospheric current, mantle conductivity and air density.

As part of a cooperative effort between NOAA and Eumetsat, the Initial Joint Polar Satellite System (IJPS), MetOp is designed to work in conjunction with the NOAA satellite system, whereby MetOp occupies the ‘morning’ orbit and the NOAA satellite takes the ‘afternoon’ shift.

MetOp-A has completed its first year in orbit, thereby offering a data flow of unprecedented accuracy and resolution from its 11 instruments. It recently experienced an anomaly on HRPT-A, which is now under investigation. As the redundant HRPT-B will not be switched on until the root cause of the anomaly is found, the HRPT service to users is in the meantime provided by NOAA-17, which is the backup for the morning orbit in the IJPS. The MetOp-A instrument performance is excellent.

The service and payload modules of MetOp-B and MetOp-C are being kept in hard storage at the contractor’s premises, waiting for the restart of assembly, integration and testing activities in 2009 for a planned MetOp-B launch in 2011.

The major elements of the mission are in progress. The engineering models of the Accelerometer instruments are on the manufacturing path. The ‘Teaser’ precursor accelerometer instrument, due to fly on a Russian satellite, was tested by VZLU. A failure of the hold and release mechanisms occurred during the vibration test. Remedy design actions are being studied for Swarm.

The procurement and design of the structure with Astrium remains a major concern for the project as it is on the critical path; the satellite structure is identified as a risk for the mass budget of the satellite.

During the progress meeting in mid-September, several major concerns were

**Swarm**

The satellite platform was shipped from Astrium Friedrichshafen (D) to Astrium Stevenage (UK). The mechanical and electrical setup was completed and reconfiguring of the satellite ground support equipment was performed. The integration of the propulsion hardware was completed with the installation of the spacecraft thrusters. The integrity of the propulsion system was proven in a ‘box leak test’.

The ground campaign of the Aladin Airborne Demonstrator (A2D) was successfully completed in July 2007 at DLR’s Lindenberg (D) test site. Because of constraints in the availability of the test-aircraft, the first Aeolus flight campaign will not start until November 2007.

The Announcement of Opportunity for the Aeolus calibration and validation activities was released on 1 October 2007; the deadline for the submission of proposals is 15 December 2007. All pertinent information is accessible through the web-based portal at http://eopi.esa.int/AeolusCalVal

**MetOp**

As part of a cooperative effort between NOAA and Eumetsat, the Initial Joint Polar Satellite System (IJPS), MetOp is designed to work in conjunction with the NOAA satellite system, whereby MetOp occupies the ‘morning’ orbit and the NOAA satellite takes the ‘afternoon’ shift.

MetOp-A has completed its first year in orbit, thereby offering a data flow of unprecedented accuracy and resolution from its 11 instruments. It recently experienced an anomaly on HRPT-A, which is now under investigation. As the redundant HRPT-B will not be switched on until the root cause of the anomaly is found, the HRPT service to users is in the meantime provided by NOAA-17, which is the backup for the morning orbit in the IJPS. The MetOp-A instrument performance is excellent.

The service and payload modules of MetOp-B and MetOp-C are being kept in hard storage at the contractor’s premises, waiting for the restart of assembly, integration and testing activities in 2009 for a planned MetOp-B launch in 2011.

**MSG**

**Metosat-8/MSG-1**

On 22 May, Meteosat-8 was hit by an object that raised its orbit by about 130 m. Apart from the bent R1 thruster and some multi-layer insulation damage, no vital damage occurred. The unaffected redundant propulsion system thruster branch became
the nominal one. The thermal behaviour has somewhat changed, but is stable and manageable.

Since then, the satellite’s passage through the more demanding eclipse season has confirmed that performance was unaffected by the hit. Performance continues to be excellent.

**Meteosat-9/MSG-2**

Meteosat-9 is now Eumetsat’s nominal operational satellite at 0º longitude. Satellite and instrument performance are excellent.

**MSG-3**

It is planned to move MSG-3 from intermediate storage in the Thales Alenia Space cleanroom into long-term storage before the end of 2007. Launch is foreseen for early 2011.

**MSG-4**

After its pre-storage review, MSG-4 will also be prepared for long-term storage. Launch is planned for no earlier than 2013.

### Human Spaceflight, Microgravity & Exploration

**Highlights**

The Foton-M3 spacecraft was launched from Baikonur Cosmodrome, Kazakhstan, on 14 September. In total, it carried 43 scientific and technological payloads supplied by ESA, Germany, Belgium, France, Italy and Canada, plus a number of Russian experiments. Foton-M3 spent 12 days in orbit, during which time the experiments were exposed to microgravity and, in some cases, to the harsh environment of open space, before landing safely on the steppes near the Russian-Kazakh border on 26 September.

The mission was an important opportunity for European researchers to conduct a wide variety of experiments under microgravity and partially space radiation conditions prior to the availability of ESA’s Columbus module Columbus on the International Space Station.

On 13 July, the culmination of more than 11 years of development and production, ATV-1, *Jules Verne*, was transported from ESTEC by lorry and barge to Rotterdam harbour. Once safely loaded aboard the *MN Toucan*, it began its transatlantic crossing to the European Space Port in Kourou, French Guiana. On 31 July the 400 t of spacecraft and equipment arrived at Pariacabo harbour and was trucked to Kourou to begin final integration. All functional qualification testing has been completed, as have the final interface verification tests, in preparation for the planned launch by Ariane-5 at the end of January 2008.

On 24 July, ESA and the Italian space agency (ASI) announced the name chosen for the mission of ESA astronaut Paolo Nespoli (I), a member of the Shuttle STS-120 crew for launch in October 2007. The mission was dubbed ‘Espéria’ from the Ancient Greek name for the Italian peninsula.

The 1st Lunar Architecture Requirements Review was held on 18 July with with almost 100 participants from industry, the science community, national agencies and various ESA Directorates. The first version of the European lunar reference architecture will be available by the end of 2007.

Preparations for the ‘International Space Exploration Conference’, which will take place in Berlin on 8–9 November are well underway. The programme is largely defined and invitations have been dispatched and more than 100 participants have already registered.

**International Space Station**

Space Shuttle *Endeavour* (STS-118) launched from Kennedy Space Center (KSC) on 8 August carrying a Spacehab Single Cargo Module, the third starboard truss segment (SS) and External Stowage Platform 3 (ESP3). Inside the Spacehab were ESA’s ANITA and the Multigen-1 experiment. The mission saw four EVAs, the last of which was cut short due to the possible necessity to shut down Mission Control in Houston with the approach of Hurricane Dean. It was decided to bring STS-118 back a day early; *Endeavour* landed safely at KSC on 21 August. Damage to an Orbiter tile from External Tank foam loss, did not impair the
Utilisation

Having been transported in the Spacehab module aboard flight STS-118/13A.1, the Multigen-1 (sustainable plant growth in space) experiment was started in the European Modular Cultivation System (EMCS) aboard the ISS on 24 August. The experiment will continue for a nominal 75 days with the aim of growing several generations of plants in orbit to examine the possibility of sustainable plant growth for long-duration space exploration.

ANITA, the Analysing Interferometer for Ambient Air, is now deployed in the ISS ‘Destiny’ laboratory. The on-orbit commissioning and short-duration science part during the STS-118/13A.1 flight were successful. ANITA will continue an extended operational period as an ISS systems device.

ESA’s further Increment-15 research programme (Matroshka-2, Altcriss, Immuno, CardioCog-2) is being executed by the Russian cosmonaut aboard the ISS.

At KSC, all Columbus payload facilities are ready and will be launched together with the module on STS-122/1E. The first set of related experiment units will be activated in close conjunction with the overall module commissioning during the 1E Stage.

Astronauts

After 15 years as a member of the European Astronaut Corps, and having spent more than 350 days in orbit, Thomas Reiter will...
The next major milestone for the project is the November Programme Board, when the completion of the Implementation Review process is foreseen, clearing the way for a Phase-B2 start early in 2008. Mars Sample Return (MSR) Phase-A2 work concluded the revision of MSR architecture, and system work proceeded on precursor mission concepts. System work has been used to guide and focus technology activities in critical fields, including soft-precision landing, autonomous rendezvous and bio-containment, with many activities approaching breadboard testing.

Concepts for the Next Exploration Science and Technology (NEXT) mission opportunity, in preparation for MSR, were studied and evaluated, with recommendations coming from the Exploration Science & Technology Advisory Group on 4 September, to proceed with two types of mission concepts at Phase-A level: Mars Orbiter with Network Science and Rendezvous demonstration; and Lunar Soft-Precision Lander with Mobility. These studies will be implemented through to the end of 2007 or early 2008.

Contacts with NASA were established to discuss possible cooperation schemes for an international MSR Mission. As part of the International Mars Exploration Working Group (IMEGW), a dedicated MSR working group was established under European leadership to coordinate the approach to MSR of the major space agencies and converge on a consolidated mission concept.

Exploration
The ExoMars project passed important milestones in this period, including the transition to a bridging phase in anticipation of the start of Phase-B2 in 2008. Ongoing work in the Phase-B1 bridging activities has consolidated the design of the system and continued to push forward technology developments in critical areas such as the Rover drill and sample-preparation systems as well as Airbag technology. The Airbag Breadboard testing facilities were verified and several important tests were completed using the ‘vented’ airbags. In the Enhanced Baseline mission configuration, the Pasteur/Geophysics Environment Package (GEP) Payloads will accommodate the selection of the 16.5 kg Pasteur along with the 8.5 kg of instrumentation for the GEP.

Discussions on cooperation with NASA and Roskosmos continued in the period, with progress on the specific cooperation between ExoMars and the Russian Phobos-Grunt mission.

Good progress was made in the area of Planetary Protection, with an agreed text for an ESA/NASA Letter of Agreement allowing a good exchange of information on the subject.
In Progress

Centre. In September, it passed its vibration tests mounted on a shaker while some 400 accelerometers and 40 strain gauges measured the movements and deformation of the structure. Acoustic tests are scheduled for mid-October.

The qualification test of the Zefiro-23 forward skirt was successful on 22 September. The test plan at the component level to characterise the skirt mechanical characteristics is under way.

The Zefiro-9 performance recovery plan was concluded. A slight modification of the propellant formulation and an increase in the expansion ratio were proposed. The modifications were reviewed in the Zefiro-9 CDR that began in September.

The composite structure for the P80 Demonstration Model firing test arrived in French Guiana during July, and the propellant casting was successful in August. Integration of the nozzle, igniters and sensors is proceeding according to schedule. The first firing test is planned for end-November.

Temporary facilities such as offices, changing rooms and catering facilities, were erected around the site. The stone crusher was erected and put to work, allowing the rock debris from the flame chute excavation to be used elsewhere. The foundations of the Launch Operation Centre and for the air-conditioning facility were laid. Hoisting equipment is being installed around the building construction sites.

The excavation of the flame chute is proceeding at a good pace, although problems have been encountered. It was discovered that the rock layer where the pillars of the launch table would have rested is not uniform. Instead, the construction company is building a concrete pillar, 8 m in diameter and 8 m deep, to reach the rock ceiling. The impact on the planning is being analysed and measures will be taken to regain the time needed for this unforeseen activity.

The CDR for the Launch System is scheduled for late October. The next industrial CDR for the Russian deliveries will be held in three steps, one for each major industrialist involved. The first began in late September, with the other two before the end of the year.

An Authorisation To Proceed (ATP) was awarded to industry in July for the Vinci Expander Demonstrator first contract, funded by FLPP-2. The NGL ELV and Building Blocks system concept studies began after national agencies agreed on the Launcher System Workshop conclusions. The first set of industrial activities for the Intermediate eXperimental Vehicle (IXV) was completed. The second set began, while IXV activities to be funded by FLPP-2 are upcoming, with the Statement of Work being finalised.

For the consolidated FLPP contract with NGL, all technical and contractual clarifications were received and contract signature is planned in October. Pending finalisation of negotiations, industrial activities were launched by ATP.

generally good and indicated that the recent increase in funding had boosted the motivation and output of the industrial team.

In cooperation with the EAC Training Team, the Eurobot Project and industry, the Eurobot Weightless Environment Test model underwent an underwater cooperation test campaign with ESA astronaut J. Clervoy at EAC’s Neutral Buoyancy Facility, ending on 4 July.

For the Crew Space Transportation System (CSTS), European industrial activities were launched and exchanges with Russian industry were held before the summer break. At the beginning of September, Russian and European industry started the joint system engineering work, where progress is being made in collocation in Moscow.

An exchange of Letters covering coordination on CSTS between ESA and Japan’s JAXA space agency was finalised and signed by JAXA’s President and ESA’s Director General Le Bourget on 19 June.

Vega

The qualification test campaign for the launcher’s upper composite started at the beginning of August in the ESTEC Test Centre. In September, it passed its vibration tests mounted on a shaker while some 400 accelerometers and 40 strain gauges measured the movements and deformation of the structure. Acoustic tests are scheduled for mid-October.

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Soyuz at CSG

The construction site has changed considerably in the past few months.

FLPP

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