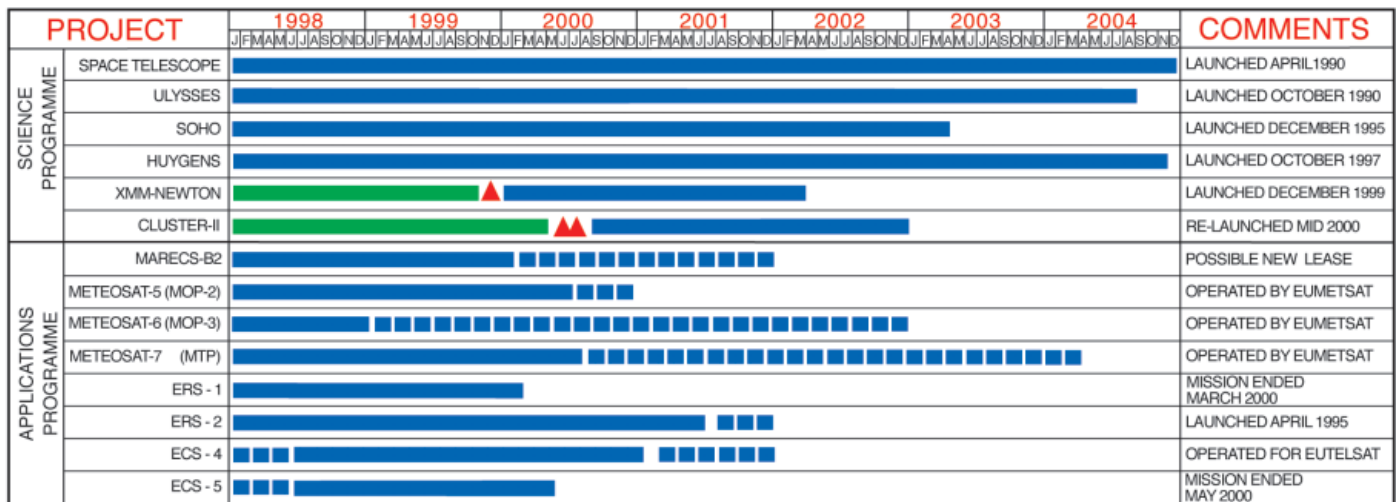


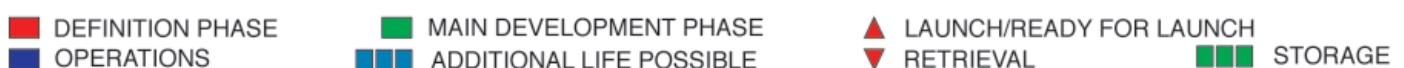
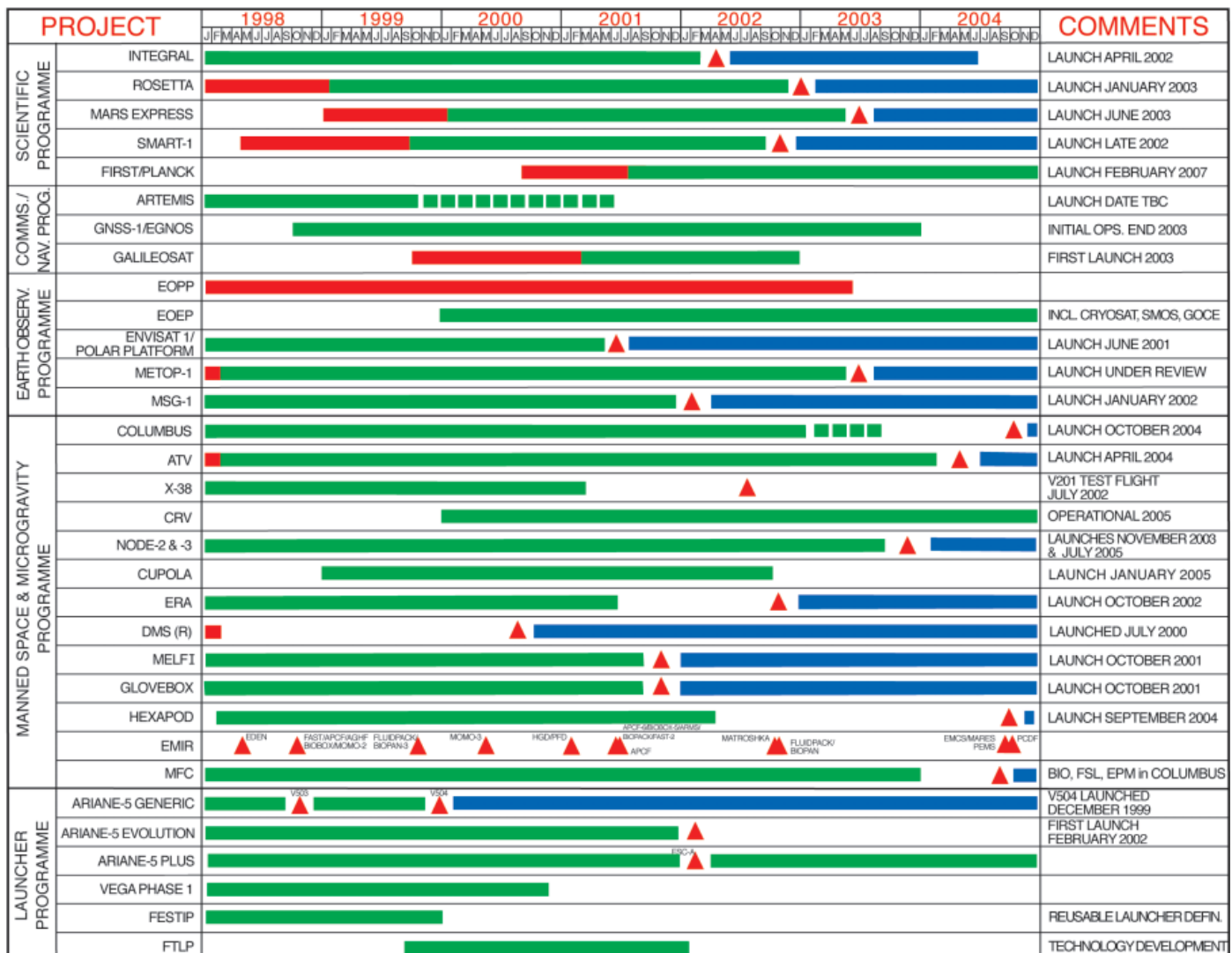
# Programmes under Development and Operations

(status end-September 2000)

## In Orbit



## Under Development



## XMM-Newton

The XMM-Newton observatory has entered its routine observation phase, and the emphasis in the observing programme is gradually shifting towards executing observing proposals selected from an open invitation to the astronomical community, which was issued in January 1999.

The observatory is working according to expectations, and the most notable events were the two major solar flares that took place during the summer. The change in instrument performance as a direct effect of these solar flares was also as expected from the pre-launch predictions, and constitutes a minor change in instrument performance.

The most important change in the observatory has been the failure of two CCDs in the Reflection Grating Spectrometer (RGS) cameras, in January and in September. As the RGS instrument consists of two identical cameras each containing 9 CCDs, and as the two failing CCDs do not cover the same spectral range, the full scientific performance can still be achieved, albeit at the cost of some observing time. Following an operating-efficiency review, a number of changes and upgrades to the ground segment were agreed and implemented, which will result in more efficient use of the observing time available.

After the execution of all observations constituting the so-called XMM-Newton performance-verification phase, a large team of scientists from all over Europe, and from the USA, have submitted more than 50 high-quality scientific articles for a special issue of the magazine 'Astronomy and Astrophysics' in January 2001. Regular updates on the most striking results obtained by the XMM-Newton observatory can be found at:

<http://sci.esa.int/xmm>.

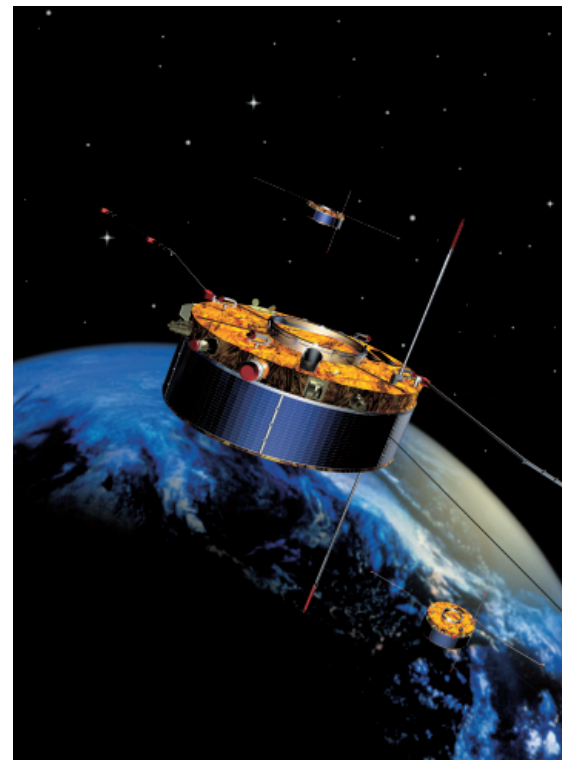
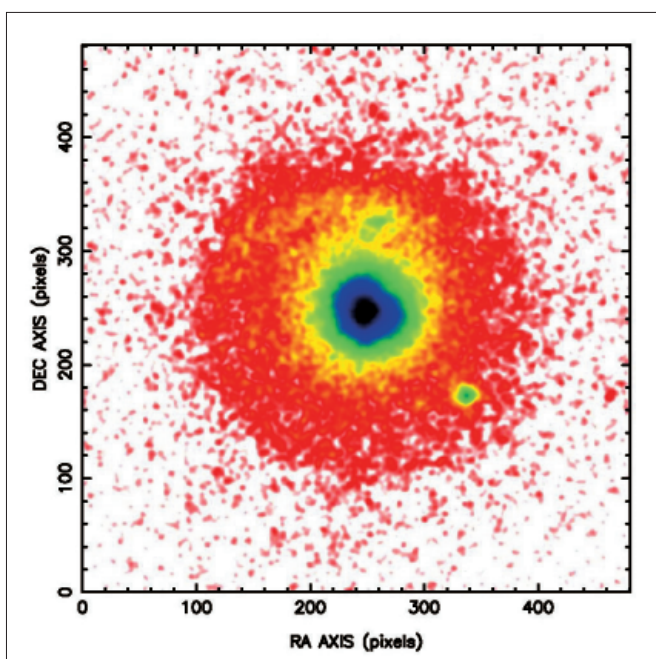
## Cluster

After the two very successful launches on 16 July and 9 August, all four Cluster spacecraft have been performing in an excellent manner. All system units have been tested and commissioned and exhibit nominal performance. The four spacecraft have undergone two long eclipses (3 h 8 min to 3 h 42 min) and a short one (1 h 11 min to 1 h 23 min), exhibiting very good thermal and power characteristics.

Commissioning of the scientific payload started on 22 August and is ongoing. Commissioning activities have been successfully completed on spacecraft 2 (Salsa) by ASPOC, on spacecraft 3 (Samba) and 4 (Tango) by CIS, Peace and Rapid. FGM has completed all activities on all four spacecraft. The remaining experiments are completing commissioning on spacecraft 1 (Rumba) and 2 (Salsa). The four wire booms have been successfully deployed to a total length of 88 m on two spacecraft.

All commissioning activities are currently planned to be completed by 23 December.

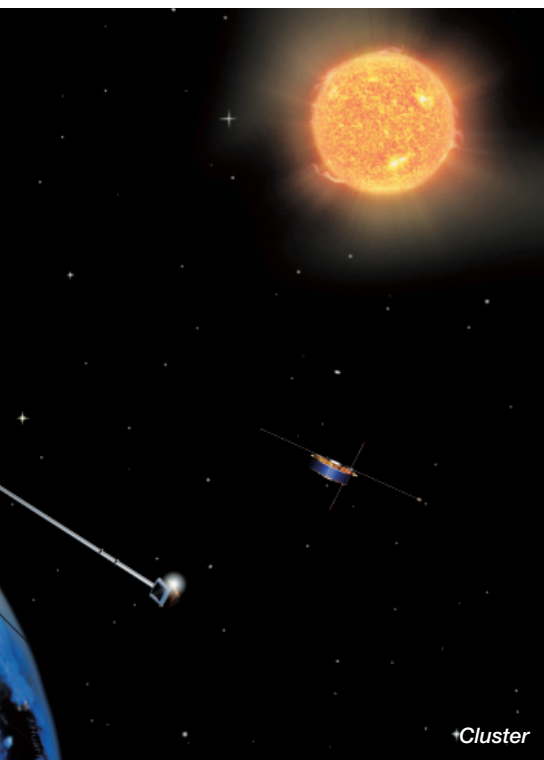
*EPIC MOS image of supernova remnant G21.5-09*



## Rosetta

The Electrical Qualification Model (EQM) programme is now progressing at Alenia in Turin (I). All of the payload units have been delivered and integrated onto the Payload Support Module (PSM). The power and data handling equipment is functioning satisfactorily on the Bus Support Module (BSM), together with some Attitude and Orbit Control System (AOCS) units. The PSM and BSM have been successfully assembled together and their integrated testing has just started. Various teething problems have been encountered which have necessitated double-shift working to ensure completion of the EQM programme before starting work on the flight model in March 2001. Some equipment items (transponder, star tracker and software) have encountered





problems during development and contingency plans have had to be put in place for their late delivery.

Most of the attention regarding the payload has been directed towards the EQM. However, the Experiment Final Design Reviews (EFDRs) are now taking place, lasting until November, in order to provide inputs for the mission's Critical Design Review (CDR).

The EQM Lander has completed its integration, and an end-to-end interface and data flow test has been successfully performed. It has been delivered to Alenia and the Lander elements that are mounted on the Orbiter have been successfully integrated. The development of the landing gear and some experiments for the flight model are running behind schedule and are being given maximum attention in order to ensure timely delivery.

The interface control document for the Ariane-5 launch vehicle has been finalised, and the final contract is expected to be signed before the end of the year.

The development of the ground system is progressing satisfactorily. The site activities for the construction of the new 35 m antenna in New Norcia (Aus.) are going according to plan. The Ground Segment Design Review was held successfully in September, with no 'show stoppers' being identified.

## Integral

The spacecraft, payload, launcher and ground-segment activities are progressing as planned. A payload review in early October concluded that the four scientific instruments for Integral have overcome their development problems, and the planned April 2002 launch was confirmed.

The spacecraft Service Module flight model is now practically complete. The integration of the flight models of the scientific instruments with the Payload Module is due to take place at Alenia Spazio's facilities in Turin between October 2000 and May 2001. The spacecraft environmental test campaign at ESTEC will follow immediately thereafter, in the second half of 2001.

Preparations for the third part of the System Validation Test (SVT C) are in progress. The test is to be completed in December 2000. The scope of SVT C covers the verification of spacecraft contingency recovery and instrument flight operations procedures.

The scientific community has shown great interest in the Integral project by submitting a large number of observing proposals and by actively participating in the 4th Integral Workshop, held in Alicante (E) in September.

## Earth Observation Envelope Programme (EOEP)

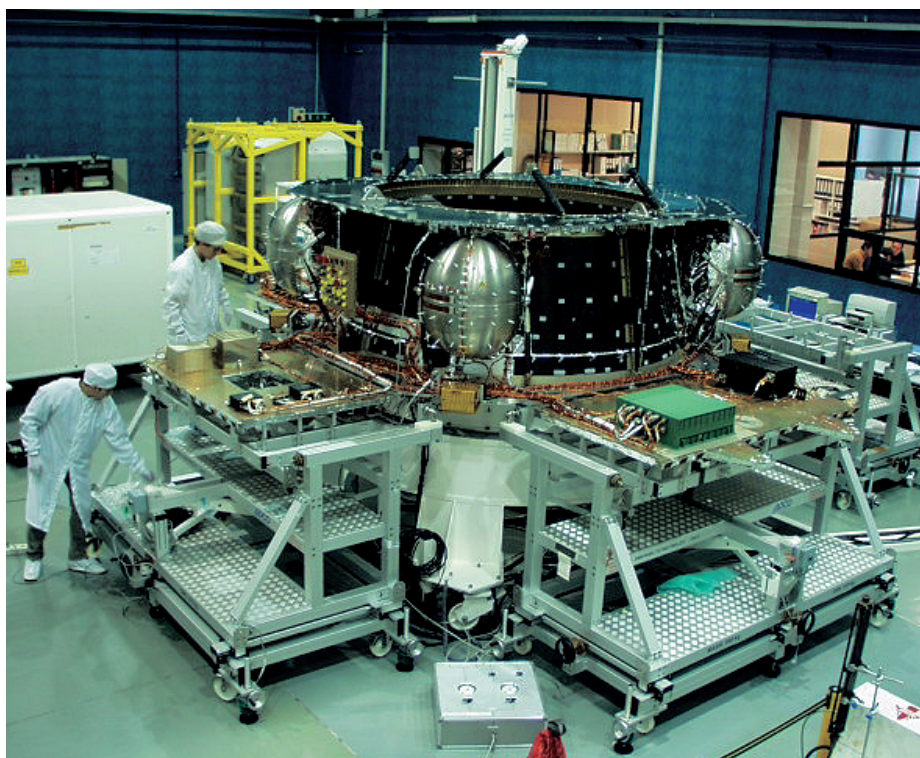
After the review of the Phase-A results, the Cryosat Phase-B was started in August.

For the GOCE mission, the proposal received in July 2000 for Phase-B/C/D/E1 has been evaluated and a contract proposal will be submitted to the October meeting of ESA's Industrial Policy Committee (IPC). In addition, it has been agreed to include Level-2 data processing within the scope of the GOCE project activities. This activity will be performed by the European GOCE Gravity Consortium (EGG-C), with the participation of the main scientific institutes involved in the GOCE project.

The SMOS Extended Phase-A was kicked-off in September. Activities on mission-performance simulation are about to start. Preparations are starting for a salinity data-processing study for SMOS.

The activities related to the ADM/Aeolus instrument pre-development design are progressing nominally, with a view to design selection and implementation next year.

*The Integral Service Module flight model in the Alenia Spazio clean room, in Turin (I)*



The analysis of the large number of proposals (81) received as a result of the 'Call for Ideas for Market Development' resulted in the identification of 26 'short-term' initiatives to be started as a priority. Six of these activities have already been kicked-off in September. An Invitation to Tender (ITT) for 'long-term' market-development activities has been generated.

## Earth Observation Preparatory Programme (EOPP)

Ten proposals have been received in response to the 'Call for Mission Ideas' for the second cycle of Earth Explorer Core Missions. Their evaluation has been started and will be finalised by the Earth Science Advisory Committee in October, with the recommendation of a shortlist of candidates for further assessment. The Director of Applications will propose the implementation plan for these recommendations to the Earth Observation Programme Board (PB-EO).

The preparations for Earth Watch have continued, with a number of supporting studies being undertaken.

## Meteosat Second Generation (MSG)

The MSG-1 Spacecraft underwent its Flight Acceptance Review (FAR) in August 2000 as planned. Final tests will be executed in order to ready it for the Pre-Storage Review (PSR) planned for the end of this year. Removal from storage is presently planned for mid-2001, in line with an anticipated launch in January 2002 on an Ariane-4 using a dual-launch configuration.

*The Alcatel/ESA/Eumetsat Project Managers during the Flight Acceptance Review at ESTEC in August 2000, with the MSG-1 model on the right and the smaller model of the first Meteosat generation on the left*

A shock-test programme is being elaborated to qualify MSG-2 and 3 (and potential follow-on models MSG-4 and 5/6) for the shock environment experienced during an Ariane-5 launch.

## MetOp

The arrival of the combined Search & Rescue and Data Collection subsystem at the Payload Module (PLM) AIT site and its subsequent integration in the PLM engineering model represents another important achievement in the MetOp Assembly, Integration and Test (AIT) programme. This step completes the electrical/mechanical and functional interface verification of a first group of instruments providing services similar to an instrument package presently operated by NOAA within the Tiros satellite programme. The engineering-model results provide confidence that MetOp's avionics have the correct interface for the accommodation of this instrument group.

Payload Module integration of the second group covering new-generation European instruments is now imminent and will start with pre-integration of the engineering

model of the improved Global Ozone Monitoring Experiment (GOME-2).

The qualification of the satellite structure is running in parallel. The structural-model AIT programme at Service Module and Payload Module level is nearing completion with the evaluation of their respective static load tests. The shipment of the models to ESTEC is anticipated towards the end of this year, leading up to a satellite-level test campaign covering acoustic and vibration tests now planned for early in the second quarter of 2001. This test campaign will be adapted to cover the satellite's compatibility with both the Soyuz-ST and Ariane-5 launcher environments.

Work continues in the meantime to catalogue all launcher-induced changes for the MetOp satellite programme, and iterations with the launcher authority have intensified from September onwards.

September also marked the start of MetOp flight-model activities at the PLM AIT site, having confirmed the test readiness of the PLM for flight-avionics integration. The alignment of the overall schedule and integration logic of this first flight model with the customer-furnished-instrument delivery dates continues.



# Envisat

## System

The system activities have been focusing on:

- performing the Ground Segment Overall Verification (GSOV) tests to verify interface compatibility between the satellite and the ground segment (PDS and FOS) as well as the mission-planning interfaces between the FOS and PDS
- progressing the in-orbit switch-on phase definition
- progressing preparation of the commissioning phase, with the payload calibration and validation teams, and defining a data-circulation test campaign to be performed in October 2000
- starting preparation of the Flight Acceptance Review, data-package definition and activation of mini-teams for the different disciplines to prepare the documentation for this review.

## Satellite and payload

Major progress has been achieved this summer in the flight-model satellite verification programme, with two major environmental tests, the acoustic and the sine-vibration tests, being successfully concluded. These two tests have verified the compatibility of the flight-model satellite with the flight loads induced by the Ariane-5 launcher.

The acoustic environmental test was performed in the LEAF (Large European Test Facility) at ESTEC with the complete flight-model satellite in its launch configuration. Prior to this test, the solar array was integrated on the satellite and a test, including release of the solar-array pack and partial deployment of the arm, was performed under the control of the satellite Service Module software.

The satellite was then installed on the ESTEC HYDRA facility for the sine vibration tests. HYDRA is a new three-axis large shaker and Envisat was the first satellite to use this facility. Thanks to the timely availability and extremely good behaviour of the shaker, the test was carried out for all three axes without interruption and was satisfactorily concluded at the end of August, ahead of schedule. Following this test, Arianespace has confirmed that Envisat has been exposed and qualified to loads well above the expected launch-phase environment.



The post-mechanical-test verifications are now in progress to ensure that all deployment mechanisms and all satellite functions are still operating nominally. During this phase, the second Solid State Recorder will be integrated onboard, the ASAR antenna will be deployed, and phase-2 of the satellite functional tests will be completed. The new release of the Payload Module Computer (PMC) software required for these tests is currently under validation. Several validation platforms have been activated in parallel to speed up this effort and to minimise its potential negative impact on the schedule. The satellite tests will include execution of a realistic payload operation scenario commanded and monitored from the Flight Operation Control Centre (FOCC) at ESOC in Darmstadt (D). This phase will also include retrofitting of the ASAR antenna to install the six tiles that are still missing and to obtain a complete operating 20-tile antenna for the coming Radio Frequency Compatibility (RFC) test.

*The Envisat flight-model satellite installed on the HYDRA test facility at ESTEC (NL)*

Before the end of the year, the last major test will be initiated: it will consist of verifying the electromagnetic and radio-frequency auto-compatibility between all payload instruments and service subsystems. For this test, the complete flight-model satellite, with antennas deployed, will be operated nominally, with radars (ASAR and RA-2) radiating, telemetry/telecommand links operating, and radiometer/spectrometer instruments in their operational receiving modes.

The AIT programme has progressed well over the last quarter and the coming tests, in particular with the PMC software, merit special attention in order to maintain the target launch date of end-June 2001.

## Ground segment

The FOS element is nominally on schedule. Flight Operation Procedures

(FOP) are in production and a joint ESA-Industry working group has been formed to go into the details of the LEOP recovery procedures. Use of the Svalbard (N) station is in preparation, nominally for S-band telemetry/telecommanding (TM/TC) for the Kiruna-blind orbits, but also with an X-band option as a backup for the data dumps nominally foreseen via Artemis.

Upgrading of the PDS to version V3 is currently in progress. This upgrade includes some updating of the processing algorithms to install the last updates from the Expert Support Laboratories. It reflects all data format changes registered while integrating the flight-model instruments on board the satellite, as well as integrating up to date and more powerful computers. Installation of PDS V3 version is already in progress at ESRIN for the Payload Data Handling Station.

The groups that will support the in-orbit Calibration and Validation activities have been established and commissioning-phase preparation activities are in progress. A rehearsal data-circulation campaign is planned in October, with all Principal Investigators (PIs) involved in validation campaigns; the participants will also have access to the Envisat User Service Facilities.

To prepare the users for the exploitation of the Envisat data products, which will be delivered by the PDS in near-real-time and offline, a suite of simulated PDS products is being released on CD-ROM. These CDs are supported by ENVVIEW software, which provides an online description as well as a data-product handling capability. They will be distributed to all of the scientists participating in the ERS-Envisat Symposium in Gothenburg (S) in mid-October, as well as being made available on request from the Envisat Help Desk: eohelp@esrin.esa.it.

## International Space Station

### ISS Overall Assembly Sequence

Following the Service Module's launch on 12 July and the successful docking with Zarya/Unity on 26 July, the ESA-provided DMS-R continues to provide guidance, navigation and control of ISS. Two further missions to the ISS have been completed since then, a Russian re-supply mission in



August and an American logistics mission in September. Revision-F of the ISS Assembly Sequence was approved in August, confirming a Columbus launch date of October 2004 and including the first ATV mission in April 2004.

Preparations for the next logistics flight to the ISS in the first half of October (Flt.3A) continued on schedule, clearing the way for the first Expedition Crew launch at the end of October. Informal inputs from RSC-Energia indicate that if funding for the Russian Science Power Platform (SPP) becomes available in early 2001, which is not certain, the earliest launch date for the SPP would be in 2004.

### Columbus Laboratory

The delay to the integration schedule of the flight unit related to the quality problems associated with fibre-optic cables has been minimised, as sufficient quantity of the available cable has passed revised acceptance tests. The Flight Unit acceptance Modal Survey Test is underway, and offline mechanical integration has been initiated. Testing on the Electrical Test Model is proceeding, with all manually commanded functions having been completed. The PICA Critical Design Review (CDR) has been completed, and the System CDR/Safety Review-II cycle has been initiated.

*Photograph of the ISS, taken by the STS-106 crew. From top to bottom: the Russian 'Progress' re-supply ship, the Russian Service Module 'Zvezda', the Russian FGB 'Zarya', and the US Node 'Unity'*

Progress on the Rack Level Test Facility and the Crew Trainers is in accordance with the required schedule.

### Columbus Launch Barter Nodes-2 and -3

The schedule for the Node-2 delivery is in jeopardy due to contractual problems between the prime and the secondary structure subcontractor. ASI, which (at the request of NASA) has been delegated by ESA to manage the project, has requested help from ESA to resolve this problem. The Structural Test Article manufacturing is complete and it has been mounted in the test facility ready for the pressure/inertia loads test campaign. The flight-unit Node-2 structure has been finished and is being integrated for the modal-survey test. The Node-2 CDR is planned for early next year, assuming that the above contractual problem is resolved.

### Cryogenic Freezer Racks

The deadline for Phase-B/C/D proposal submission by Industry has been extended to December 2000.

### **Crew Refrigerator / Freezer**

Phase-B0 has been completed and will be followed by a Phase-B/C0, which should start at the end of November.

### **Cupola**

The machining of the dome and ring for the qualification model has been finished, and the sub-elements were delivered to the Prime Contractor this summer, ready for welding. Problems that related to the change from one-crew to two-crew EVAs have been satisfactorily resolved.

Manufacturing of the equipment for the Qualification Model (QM) is well advanced; the (NASA-provided) window glass has been delivered and inspected, and integration into the window frames will soon begin. Problems with the Shutters subcontractor have been resolved and the Shutters also are in QM manufacturing. Preparations for the Neutral Buoyancy Testing early next year are underway.

### **Automated Transfer Vehicle (ATV)**

A top-level Industrial committee has been formed to recommend the necessary recovery activities for the project, following the initial assessment of the Preliminary Design Review (PDR) results. Their managerial and technical recommendations are under consideration for implementation. Resolution of the key issues resulting from the PDR is in work with the Prime Contractor, RASA and NASA. In particular, solutions to the power/thermal and guidance/navigation/rendezvous problems are converging. The final review board is expected to be held before the end of the year.

Following the decision to launch ATV on the Ariane-5 Plus configuration, an evaluation of the impacts of the launch environment on the standard Russian flight hardware is being performed. The manufacturing and welding of the primary structure of the Dynamic Test Model has been completed.

### **X-38/CRV and Applied Re-entry Technology (ART)**

Further X-38 deliveries and activities continue, and integration of the orbital flight test vehicle (V201) is underway at Johnson Space Center (JSC). The flight has been delayed until July 2002, as a result of revision of the Shuttle manifest. The next series of Drop Tests, this time of the updated aerodynamic shape corresponding to that of the operational CRV, and with European parafoil guidance

and control software on board, will take place in the fourth quarter of this year.

The additional Declaration for the ESA participation in the operational CRV was approved by the 35th Manned Space Programme Board, and the corresponding Phase-1 RFQ was subsequently released. Further negotiations with NASA have taken place, with good progress, with respect to the potential Barter. Selected early tasks of ESA CRV activities in the areas of aero-/thermodynamics, avionic analyses and Man Machine Interface (MMI) display requirements and developments are underway and proceeding nominally.

### **Ground-segment development and operations preparation**

Work continued on agreeing the approach to, and documentation of, the Columbus Control Centre facility-level design and development. The next major milestone is the Columbus-CC System Requirements Review (SRR), which is planned for January/February 2001.

Near-term activities concerning ATV Control Centre design and development definition have been discussed with CNES during the first Progress Meeting of the Phase-B2 extension contract period. Special measures in terms of advancing Phase-C/D procurements are being contemplated in order to meet the ATV launch date of April 2004. The next major milestone is the ATV-CC System Requirements Review (SRR), which is planned for March/April 2001.

The two competitive ATV trainer Phase-B studies are progressing as planned and initial prototyping has started. The contractual issues, relating to the ATV Integration Contract with the RSC-Energia/Gagarin Cosmonaut Training Center (GCTC), have been discussed and an agreement has been reached. A Joint Integrated Simulation Workshop will be held with International Partner, EAC and ATV-CC representatives on 6 - 8 November.

The development of ATV Cargo integration software tools (CARAT) is proceeding as planned. The ITT for the database procurement will be issued to industry in the near future.

### **Utilisation**

#### **Promotion**

Preparations are continuing for the global utilisation conference 'ISS Forum 2001', which will be held in Berlin in June 2001. It has been agreed between the partners that greater emphasis should be placed on 'business' aspects, and the programme planning has been adjusted to reflect this.

In the area of Microgravity Applications Promotion (MAP), 44 MAP projects have been approved and significant progress towards completing contract signature for these projects has been made.

*The X-38 Orbital Test Vehicle V201 in the Space Shuttle*



On 8 September, the International Space Station Virtual Campus was inaugurated. During the coming six months a series of lectures on selected topics relating to the utilisation of the ISS will be held and delivered to a Europe-wide viewing public, via both direct television satellite broadcasting and the Internet.

**Accommodation hardware development**

The consolidation of the five external payloads to be flown on the starboard side of the ISS as part of the ESA Express Pallet Payload (E2P2) Programme has continued, and work on the five ESA payloads (ACES, SOLAR, EXPORT, EUTEF and FOCUS) is progressing. Due to the delays that NASA is experiencing in its Express Pallet development programme, the first baseline of the user interface is now only expected in early-2001. Following the receipt of an acceptable industrial offer, it is now planned to initiate the Phase-C/D for the European Drawer Rack (EDR) in November 2000.

**Astronaut activities**

The European Astronaut Centre (EAC) participated in the 'German Space Day', held in Cologne on 24 September, which attracted more than 60 000 visitors. Dr. Uwe Thomas, State Secretary of the German Ministry for Education and Research, visited EAC and delivered an official address.

An amendment to the 1992 Mission Specialist Training Agreement was agreed with NASA in July, extending its duration

until July 2001. In recent weeks: EAC and its Russian partners (RSC-Energia and GCTC) agreed on an ATV training concept, with important elements and facilities of ATV training located at EAC, Cologne; ESA and CNES together with their Russian counterparts are in a process of elaborating possible new flight opportunities for European Astronauts on Russian carriers; and ESA Astronaut Thomas Reiter received the 'Space Award 2000' from the Discovery Channel and the 'Verein zur Förderung der Raumfahrt'.

**Early deliveries**

**MPLM Environmental Control and Life Support Subsystem (ECLSS)**

Contract closeout is nearing completion. The first two sets of equipment are already integrated into the MPLMs ('Leonardo' and 'Rafaello'), which are at Kennedy Space Center (KSC). The third set is under integration, with the system acceptance and transportation of MPLM-3 ('Donatello') planned for January 2001. The first MPLM flight to the ISS will be in February 2001, to provide subsystems and payload racks for the US Lab 'Destiny', the launch of which is planned for January 2001.

**Data Management System for the Russian Service Module DMS-R**

The fault-tolerant computer complex installed in the Russian Service Module 'Zvezda' has performed nominally since its launch on 12 July, with the exception of an unexpected event just prior to Service Module docking with 'Zarya'/'Unity'. Investigation of this anomaly by RSC-

Energia engineers prior to the actual docking concluded that the problem was in the RSC-Energia applications software.

On flight-day 20 (31 July), the DMS-R computers of 'Zvezda' were successfully integrated with the computers of 'Unity' and 'Zarya', and they took over data-bus control for the entire station. During the subsequent two orbits, NASA and RSC-Energia flight controllers performed a series of tests to verify the end-to-end command capability of the ISS and, since that time, the DMS-R computers, together with the Russian application software, have been responsible for the guidance, navigation and control of the entire ISS.

**European Robotic Arm (ERA)**

The ERA flight model has been assembled, and delivered to ESTEC in Noordwijk (NL) for structural-qualification and EMC tests. In the meantime, the ERA engineering model is continuing with a programme of functional testing on the Fokker 'flat floor'. Problems with delivered components will necessitate some refurbishment on the flight model following these tests. Although this will not affect the tests' validity, it will delay ERA flight-model delivery.

Hardware for prototype ERA Mission Preparation & Training Equipment (MPTE) has been delivered to ESTEC, and installation and checkout of its software has commenced. Completion of the MPTE and its delivery to Russia is planned for the second quarter of 2001.

The ERA flight model will be ready for delivery in mid-2001. This is consistent with the formally announced launch date for the SPP, on which ERA will be mounted, of October 2002. However, recent information from the Russian Space Agency indicates a further substantial delay in SPP development, and the consequences of this delay are currently being assessed.

**Laboratory Support Equipment (LSE)**

The qualification testing of all major subsystems for MELFI (-80°C Freezer Laboratory) is in progress.



*Dr. Uwe Thomas (centre) in discussion with ESA Astronauts Gerhard Thiele and Reinhold Ewald (in overalls), Jörg Feustel-Büechl (right, Director of ESA's Manned Spaceflight and Microgravity Programme), and Prof. Walter Kröll (left, Chairman of the Board of DLR)*



Qualification of the electrical subsystem has been completed and system-level testing started in August and is still ongoing.

Manufacture of critical flight-unit parts of the Microgravity Science Glovebox (MSG) and the integration of the engineering unit are ongoing. The software Interface Control Document (ICD) was finalised in July and the Training Unit was delivered in August.

The data package for the CDR for the Hexapod Pointing System was delivered in July and CDR completion is planned for November.

### ISS Exploitation Programme

The Preliminary Authorisation To Proceed (PATP), which is the contractual framework for carrying out the Exploitation Programme Preparatory Phase activities, has been signed off by both Industry and the Executive. An Engineering Change Request (ECR) for the Operations Preparation Definition Phase was released to Industry and a proposal subsequently received. This is currently under evaluation. The RFQs for the Early Activities and overall Operations Contract are in preparation. Issues related to the Executive's proposals for contracting of tasks to the User Centres via the main industrial operations contract, and the roles and tasks of national agency centres in the Exploitation Programme, have been resolved via two separate agreements between the parties involved.

In response to its Call for Interest for commercial-utilisation business developers, the Agency has so far received 14 replies involving circa 40 companies whose interests range from space development, R&D, technology and education, to innovative fields such as media and entertainment. Twelve of the replies contained, albeit often in preliminary fashion, a business proposal either as overall business developer, or as a specific development of a commercial project or sector; the other two were generic manifestations of interest. The evaluation and negotiation of the various propositions is still in progress with a view to generating high-level commitments from companies to support the Executive's proposal on commercial-utilisation policy to the December Council.

Work is continuing in the context of a multilateral ISS Partner working group to agree on common access rules and policies for commercial utilisation throughout the ISS. In addition, pathfinder projects are being set up, each designed to test one or more specific facets of the environment.

## Microgravity

### EMIR programmes

On 17 September, a contract was signed with Rosaviakosmos for the flight of a 355 kg payload on the Foton-M1 flight in October 2002. On 27 September, the Programme Board for Microgravity (PB-MG) approved the inclusion of the United Kingdom in the EMIR-2 Extension Programme.

Preparations for an ESA parabolic aircraft flight campaign in November 2000 and the Maxus-4 sounding rocket flight in April 2001 have continued. Preparation of the payloads, weighing in excess of 500 kg, to be flown on STS-107 in June 2001 also continued. The facilities being flown on

this flight include the Advanced Protein Crystallisation Facility (APCF), the Advanced Respiratory Monitoring System (ARMS), Biobox (a biological incubator), Biopack (a facility for performing biological experiments in microgravity), ERISTO (for research with mammalian cell cultures), and the Facility for Adsorption and Surface Tension studies (FAST - fluid sciences). Preparations have also continued for the launch, also in June 2001, of the first microgravity payload (APCF) to the US Lab.

### Microgravity Facilities for Columbus (MFC)

Integration of the system engineering model of the Biolab has been completed. System testing will start in November. Subsystems for the Material Science Laboratory (MSL) and Fluid Science Laboratory (FSL) have been manufactured and the system engineering models will be integrated before the end of 2000. The CDR for the Biolab and the PDR for the European Physiology Modules (EPM) have been successfully completed. The CDRs for the FSL and MSL will be completed by end-2000. Phase-A/B for the Materials Science Laboratory using Electro-Magnetic Levitator (MSL-EML) technology will start by end-2000.



*The Biolab system engineering model, with ESA Astronaut Claudie Andre-Deshays in attendance*

## Ariane

### Ariane-5 Evolution

One of the most critical elements in the Ariane-5 Evolution Programme is the development and the qualification of the Vulcain-2 engine. So far, three engines have been fired on the test stands in Vernon (F) and Lampoldshausen (D), accumulating 15 400 sec of running up to the end of September. The fourth engine of the six planned started its test on 27 September. The tests so far have shown positive results in terms of solving several problems related to the oxygen turbopump and the nozzle.

The planning has been revised for the first flight of Ariane-5 Evolution from December 2001 to February 2002 due to a soldering problem with the tank bulkhead.

Several reviews of the booster's front and aft skirts have been successfully conducted, confirming the initial technical choices.

### Ariane-5 Plus

#### ESC-A (Cryogenic Upper Stage)

Industry is mainly concentrating its efforts on the integration of the first test model, the so-called 'Modèle Dynamique' or MD,

due to start in October 2000. The delivery of the main hardware items is progressing. With the oxygen tank now ready, the hydrogen tank is undergoing final insulation after its structural integration during August.

The Ariane-4 HM7 engine hot-firing-test campaign results have shown that the engine is capable of withstanding the prolonged and more severe working conditions of ESC-A.

The Critical Design Reviews (CDR) for the equipped lines and the hydrogen tank have started. During their corresponding reviews, the designs of the oxygen tank, the oxygen tank damping system and ground coupling plates for ESC-A have shown no major difficulties.

#### ESC-B (Cryogenic Upper Stage)

An integrated Agency-Industry Working Group is currently elaborating the ESC-B stage architecture, with the aim of meeting the tough performance and cost objectives of the Ariane-5 Plus Programme. The development of the ESC-B Vinci engine has been re-oriented to a purely European development effort following the June ESA Council decision not to pursue the trans-Atlantic co-operation initiative. The first prototype of, and development hardware items for the engine are currently being manufactured.

#### EPS-V (Versatile Upper Stage)

A hot-firing-test campaign covering the extended utilisation domain and the new nozzle extension for the Aestus engine was successfully performed during the summer.

### Vega

The Vega launcher configuration has been updated to include a high-performance, filament-wound solid motor, P80, as the launcher first stage. This change has the dual objective of improving the Vega performance to about 1500 kg into a circular polar orbit at 700 km altitude, and of preparing the technologies required for the

next generation of Ariane-5 boosters, using a composite case.

The P80 development is proposed as an additional slice to the Vega Small Launcher Development Programme. Declarations and Programme Proposals for both Vega and the P80 stage are being finalised with a view to subscription by the Member States in November 2000.

The first test firing of the P80 motor is planned for 2003, and the first Vega launch for 2005.



Artist's impression of a Vega launch