

# Programmes under Development and Operations

## Programmes en cours de réalisation et d'exploitation

(status end-March 2000)

### In Orbit / En orbite

PROJECT	1998		1999		2000		2001		2002		2003		2004		COMMENTS											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F		M	A	M	J	J	A	S	O	N	D	
SCIENCE PROGRAMME	SPACE TELESCOPE	[Green bar]																								LAUNCHED APRIL 1990
	ULYSSES	[Green bar]																								LAUNCHED OCTOBER 1990
	SOHO	[Green bar]																								LAUNCHED DECEMBER 1995
	HUYGENS	[Green bar]																								LAUNCHED OCTOBER 1997
	XMM-NEWTON	[Green bar]																								LAUNCHED DECEMBER 1999
APPLICATIONS PROGRAMME	MARECS-B2	[Green bar]																								POSSIBLE NEW LEASE
	METEOSAT-5 (MOP-2)	[Green bar]																								OPERATED BY EUMETSAT
	METEOSAT-6 (MOP-3)	[Green bar]																								OPERATED BY EUMETSAT
	METEOSAT-7 (MTP)	[Green bar]																								OPERATED BY EUMETSAT
	ERS - 1	[Green bar]																								BACKUP TO ERS-2
	ERS - 2	[Green bar]																								LAUNCHED APRIL 1995
	ECS - 4	[Green bar]																								OPERATED FOR EUTELSAT
ECS - 5	[Green bar]																								OPERATED FOR EUTELSAT	

### Under Development / En cours de réalisation

PROJECT	1998		1999		2000		2001		2002		2003		2004		COMMENTS											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F		M	A	M	J	J	A	S	O	N	D	
SCIENTIFIC PROGRAMME	CLUSTER-II	[Green bar]																								RE-LAUNCH MID 2000
	INTEGRAL	[Green bar]																								LAUNCH APRIL 2002
	ROSETTA	[Green bar]																								LAUNCH JANUARY 2003
	MARS EXPRESS	[Green bar]																								LAUNCH JUNE 2003
	SMART-1	[Green bar]																								LAUNCH LATE 2002
COMMS./ NAV. PROG.	ARTEMIS	[Green bar]																								LAUNCH DATE TBC
	GNSS-1/EGNOS	[Green bar]																								INITIAL OPS. END 2003
	GALILEOSAT	[Green bar]																								FIRST LAUNCH 2003
EARTH OBSERV. PROGRAMME	EOPP	[Green bar]																								
	EOEP	[Green bar]																								INCL. CRYOSAT, SMOS, GOCE
	ENVISAT 1/ POLAR PLATFORM	[Green bar]																								LAUNCH JUNE 2001
	METOP-1	[Green bar]																								LAUNCH MID-2003
	MSG-1	[Green bar]																								LAUNCH OCTOBER 2000
MANNED SPACE & MICROGRAVITY PROGRAMME	COLUMBUS	[Green bar]																								LAUNCH OCTOBER 2004
	ATV	[Green bar]																								LAUNCH DECEMBER 2003
	X-38	[Green bar]																								V201 TEST FLIGHT MARCH 2002
	CRV	[Green bar]																								OPERATIONAL 2005
	NODE-2 & -3	[Green bar]																								LAUNCHES FEBRUARY 2003 & SEPTEMBER 2004
	CUPOLA	[Green bar]																								LAUNCH MAY 2004
	ERA	[Green bar]																								LAUNCH JUNE 2002
	DMS (R)	[Green bar]																								LAUNCH JULY 2000
	FREEZER	[Green bar]																								LAUNCH AUGUST 2001
	GLOVEBOX	[Green bar]																								LAUNCH AUGUST 2001
	HEXAPOD	[Green bar]																								LAUNCH OCTOBER 2003
	EMIR	[Green bar]																								
	MFC	[Green bar]																								BIO, FSL, EPM in COLUMBUS
LAUNCHER PROGRAMME	ARIANE-5 DEVELOP.	[Green bar]																								V504 LAUNCHED DECEMBER 1999
	ARIANE-5 PLUS	[Green bar]																								FIRST LAUNCH APRIL 2002
	FESTIP	[Green bar]																								REUSABLE LAUNCHER DEFIN.
	FTLP	[Green bar]																								TECHNOLOGY DEVELOPMENT

- DEFINITION PHASE
- MAIN DEVELOPMENT PHASE
- OPERATIONS
- LAUNCH/READY FOR LAUNCH
- ADDITIONAL LIFE POSSIBLE
- ▼ RETRIEVAL
- STORAGE

## Cluster-II

All testing and refurbishment activities on all four spacecraft have been successfully completed. The first two spacecraft to be launched (FM6 and FM7) are ready for shipment at Dornier's premises in Friedrichshafen (D), whilst the second pair (FM5 and FM8) are ready to be shipped from IABG in Munich.

The Flight Acceptance Review, which included co-location of the review team at Dornier during 20-24 March, culminated with the Review Board meeting in Paris on 28 March. The Review Board expressed full satisfaction with the status of the four Cluster-II spacecraft and endorsed the review team's positive findings. The Board also shared the Project's concerns over a general problem with the type of spacecraft propulsion system used, which is currently affecting several programmes, both in-orbit and about to be launched. The course of action proposed by the Project, and fully endorsed by the Board, will lead to a final decision concerning the suitability of the system for the Cluster mission. It was decided to delay shipment of the four spacecraft to the Baikonur Cosmodrome until investigations are completed.

The Ground-Segment Readiness Review (GSRR) was successfully held on 15 March. The flight simulation programme was started at ESOC and several simulations were performed in March with Project and Industry participation. The programme will be resumed at the end of April after a short interruption due to the delay in shipment of the spacecraft.

The science data system functional testing has been completed and has proved the

system ability to support experiments through remote commanding by Principal Investigators and data distribution via the Data Centres. A successful Science Data System Readiness Review on 14 March confirmed system readiness.

Two successful qualification launches of the new Fregat upper stage for the Soyuz launch vehicle took place on 9 February and 20 March. The very good accuracy achieved in all orbital parameters confirmed the ability of the launch vehicle and upper stage to launch the Cluster mission successfully.

The Baikonur Launch Facilities Acceptance took place on 15-18 March. The fuel for the four spacecraft arrived in Baikonur on 19 March after sea transport from the UK to St. Petersburg and subsequent shipment by train to its final destination. It is currently stored in the hazardous-goods storage facility.

The launch dates of June and July are presently affected by the delay in the shipment of the spacecraft to Baikonur. The exact impact is currently being assessed, but a postponement of the two launch dates by at least three weeks can be envisaged.

## Integral

The spacecraft, launcher and ground-segment activities have continued to follow the recommendations from the Critical Design Review held in December 1999.

The first part of the System Validation Test (SVT) was successfully completed in March. The SVT demonstrates the ability

of the Mission Operations Centre (MOC) to control and monitor the spacecraft. It also confirms the basic functionality of the spacecraft Service Module.

For this first SVT phase, the emphasis was on validation of the functions needed to handle the telemetry and telecommand data for the Service Module. The next phase will also include the execution of real operational scenarios, such as the Launch and Early Orbit Phase (LEOP), to validate the relevant flight procedures. At a later stage, when the payload has been integrated, similar tests will be conducted to ensure that the MOC will also be able to control the instruments on board Integral correctly.

The status of the four scientific instruments making up the Integral payload was reviewed in April. A revised completion schedule leading to launch in April 2002 has now been agreed.

## Rosetta

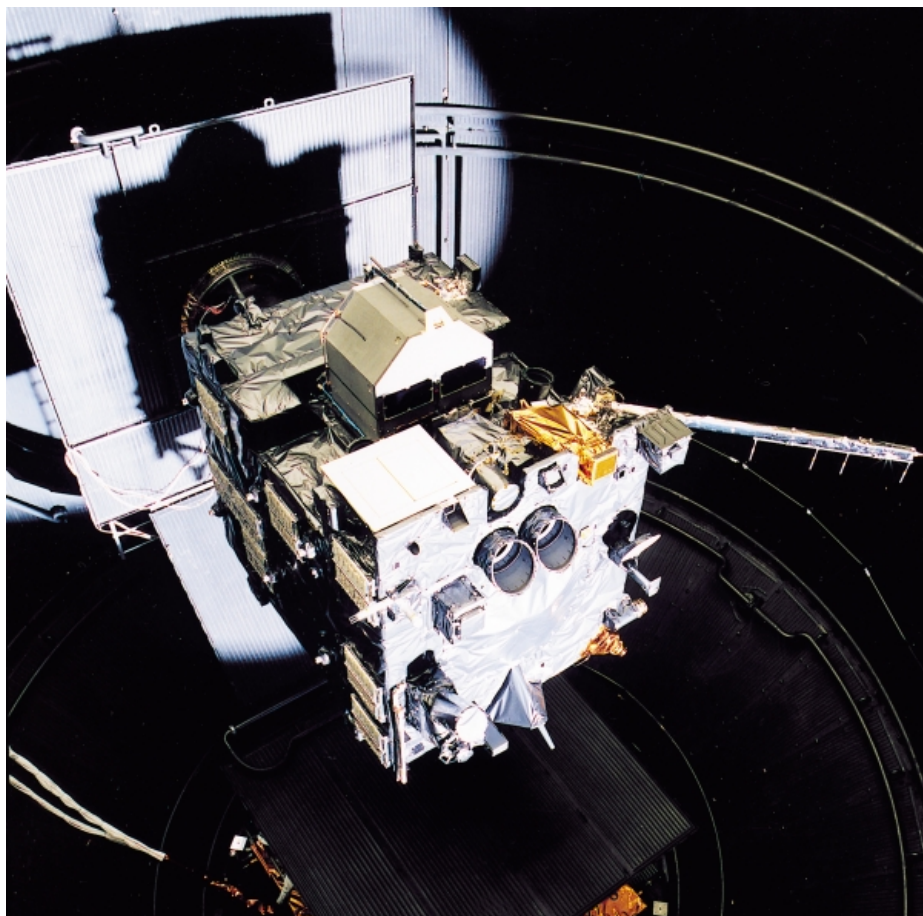
The Rosetta Structural and Thermal Model (STM) testing has been completed, which is consistent with the planned schedule. The structural tests were completed in February and it was demonstrated that the primary structure can withstand the expected launch loads. In addition, the expected environment for all subsystem and payload units was below the specifications to which they have been designed.

The thermal-balance testing was also very successful. It demonstrated that the spacecraft can withstand the extreme thermal conditions that it will encounter during its long voyage, at distances from the Sun of between one and more than five times the distance from the Earth to the Sun. This is one of the most challenging features of the Rosetta mission and this successful demonstration is therefore a major milestone in the programme.

The Electrical Qualification Model (EQM) programme has also started in mid-April. Although this was one month behind schedule, contingency planning has ensured that it can still be completed by



*The Integral System Validation Test (SVT) in progress at ESOC*



*The Rosetta Structural and Thermal Model (STM), under test at ESTEC (NL)*

mid-March 2001, before the flight model starts its integration. During this time, full functional testing of all spacecraft and payload units will take place, ending with the electromagnetic compatibility (EMC) test. The subsystem units have started to be delivered and integrated, as well as the first version of the onboard software, which will be incrementally updated according to the functional requirements of the tests to be performed.

The Hardware Design Review (EMR) held in November 1999 had identified various areas of the system design that were still insufficiently defined. These areas have been actively addressed with the prime contractor and the major subcontractors, resulting in positive closure of most of the resulting actions.

Development of the scientific payload is also proceeding according to plan, with delivery of all the EQM units expected before the end of June, in time for integration on the spacecraft EQM. Pre-shipment reviews have been held at all of the participating institutes. For the Rosetta lander, a major effort has been made to consolidate the system design, resulting in solutions being found for most critical areas.

Work is progressing satisfactorily in all areas of the ground-segment development. In particular, the foundation stone has been laid for the new ESA 35 m Deep Space Antenna at New Norcia in Western Australia, and construction is planned to be completed by the end of 2001.

## Mars Express

The implementation of the Mars Express mission has continued to progress at a rapid pace. The final meeting of the Preliminary System Design Review Board took place on 11 January. The Board, co-chaired by ESA Directors R.M. Bonnet and J.-J. Dordain, heard presentations on all aspects of the missions, including a detailed technical assessment of the spacecraft design compiled by an independent Science and Engineering Review Team. The Board concluded that the current spacecraft design allows the formal starting of Phase-C/D, i.e. the building of the spacecraft. The Board also issued eight recommendations that the Project has accepted and already incorporated into the spacecraft design. The International Mars Exploration

Working Group, coordinating the international aspects of all Mars missions, met on 26 and 27 January in London. The Working Group was debriefed on the then available facts relating to the NASA investigations into the loss of the Climate Orbiter and Polar Lander missions. These results are of high interest for ESA, as every effort will be made to take NASA's 'lesson learnt' into account for Mars Express.

The new Fregat upper stage of the Soyuz launcher has been successfully test-flown twice. Its performance was outstanding and it should therefore be able to inject Mars Express onto a very precise cruise trajectory to the planet.

The Prime Contractor Matra Marconi Space (F) has organised a meeting of all of their subcontractors. During this industrial day, the companies also exchanged views on ESA's new approach to the procurement of the spacecraft. The new management approach seems well appreciated, as it allows, inter alia, quicker decision making and faster financial payments.

Preparation of the ground segment at ESOC is in full swing and the team is being expanded as planned to cope with the increasing workload.

## EOEP

The Earth Observation Envelope Programme (EOEP) was formally initiated on 1 January although, as previously reported, considerable effort had already been devoted to ensuring a smooth start-up. The programme covers the two types of Earth Explorer mission, 'Core' and 'Opportunity'. The first mission of each type has already been initiated into Phase-B, namely GOCE and CRYOSAT, respectively. In addition, a second mission of each type is currently under preparation, namely ADM/AEOLUS, for which instrument pre-development has started, and SMOS, which is entering Phase-A.

As well as these new satellite missions, the programme is funding the continuity of



the ERS-2 mission and a new Market Development activity, aimed at the development of new information products derived from existing satellite data. It is also planned to utilise EOEP resources in the future for the preparation of Earth Watch programmes.

## EOPP

Following the agreed selection and initiation of the first two Earth Explorer Core missions, the Executive, with advice from the Earth Observation Science Advisory Committee (ESAC), is preparing for the next candidate mission selections. The first step will be an open invitation to the science community in the programme's Participating States to propose new missions. This invitation should be issued in June.

With the agreed implementation of the first two Opportunity missions, CRYOSAT and SMOS, and the continued support to ACE as a 'hot standby' in the event of problems, the Executive has been investigating opportunities to implement other recommended missions by proposing them to NASDA and NASA as payloads on GCOM and NPP, respectively. NASDA has selected three – SWIFT, COALA and GRAS – for further study.

EOPP is also continuing various activities aimed at supporting the establishment of an Earth Watch strategy.

## Meteosat Second Generation

One of the final tests on the engineering model has been the end-to-end spin test, in which the satellite was spun at its actual in-orbit rate of 100 rpm. In this test, a target was imaged and the data transmitted successfully via the spacecraft's electronically despun antenna.

The MSG-1 flight-model satellite has successfully undergone mechanical and

thermal environmental testing and is currently in the indoor Compact Test Range for antenna verification and electromagnetic compatibility testing, soon to be followed by optical vacuum tests to test the optical performance of the cold channels of the SEVIRI instrument.

The MSG-2 flight-model satellite's integration has started and most of the equipment for the MSG-3 flight model, and spares, have been delivered to the prime contractor Alcatel Space in Cannes (F).

The Qualification Results Review is still in progress due to the late availability of engineering-model test results and reports. It is now scheduled to be completed in May.

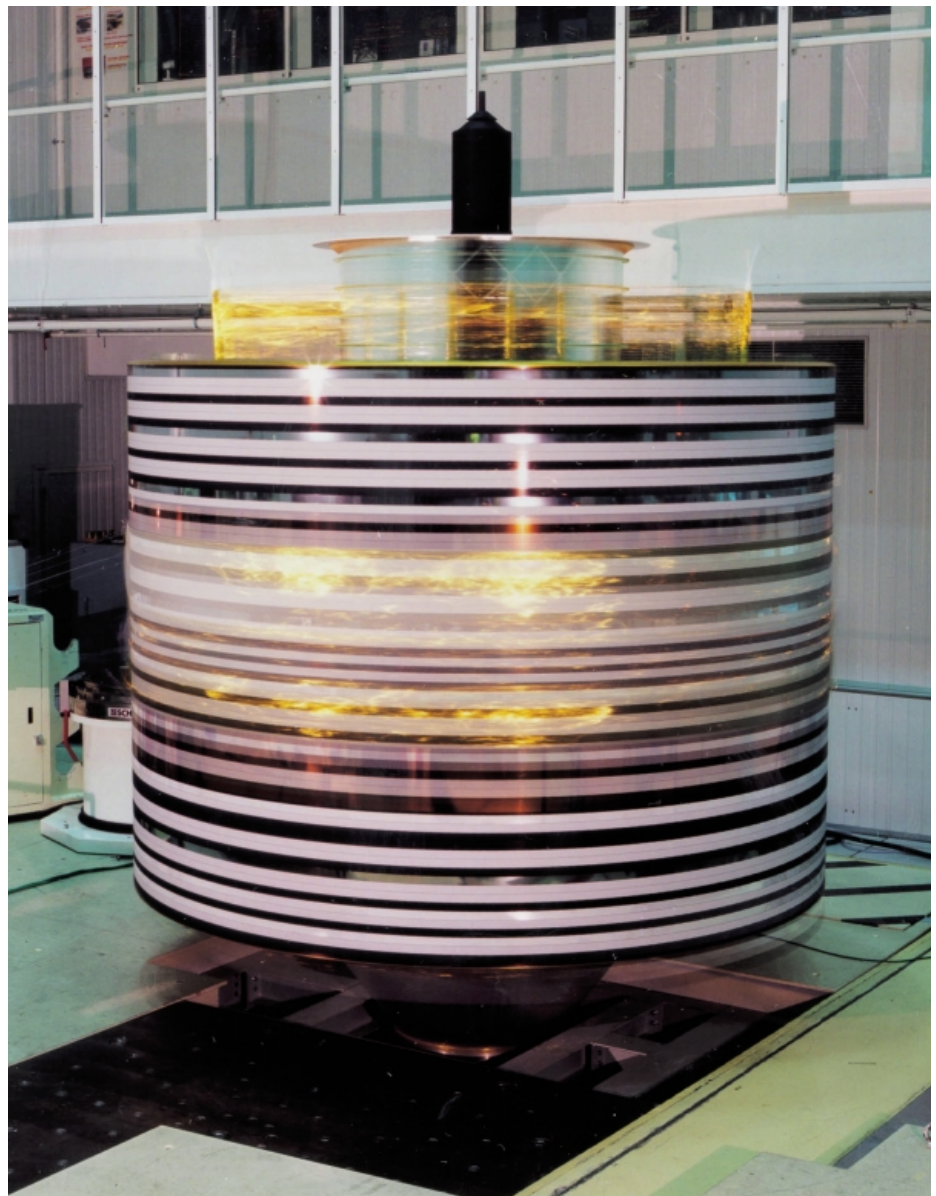
The Flight Acceptance Review (FAR) is confirmed for August as planned, which

means that the predicted launch date for MSG-1 could remain October 2000, although Eumetsat, the satellite system operator, is presently contemplating a launch delay in consultation with its delegate bodies.

The recent successful Ariane-505 launch (in March) will provide important data for solving the Ariane-5-related shock problem and will hence help in the final selection of the launcher for MSG-1, i.e. Ariane-4 or Ariane-5.

## Metop

Following completion of the technical and contractual baseline for the GOME-2 contract, the contract signature took place at a ceremony on 3 March in the Palazzo



*The MSG engineering model undergoing spin testing at Alcatel Space, Cannes (F)*



Vecchio in Florence (I), attended by ESA's Director of Application Programmes, Mr C. Mastracci, the Director of Eumetsat, Dr T. Mohr, and the Head of Alenia Difesa's Avionics System and Equipment Division, Mr G. Grasso. The signing coincided with a round-table press event on the topic 'Ozone, A Problem for Europe?'

Meanwhile, the satellite design and development activities are proceeding nominally. Initial integration of the instruments provided by NOAA/NASA with the Interface Unit on the Payload Module (PLM) engineering model has been completed. Despite one or two interface problems being identified by this test campaign, the results still represent a very positive achievement and allow the PLM engineering-model integration to be started with good confidence. The major interface problem identified, namely with the synchronisation of the US HIRS instrument, which does not operate correctly with the agreed interface definition, is under investigation.

The overall schedule and integration logic of the PLM and satellite programmes has been examined in depth together with the prime contractor, Matra Marconi Space (F), to take into account the realities of the Customer Furnished Instrument delivery schedules. These efforts are aimed at optimising the resulting revised approach.

## Envisat/Polar Platform

### Envisat system

The system activities have focused on the following key activities:

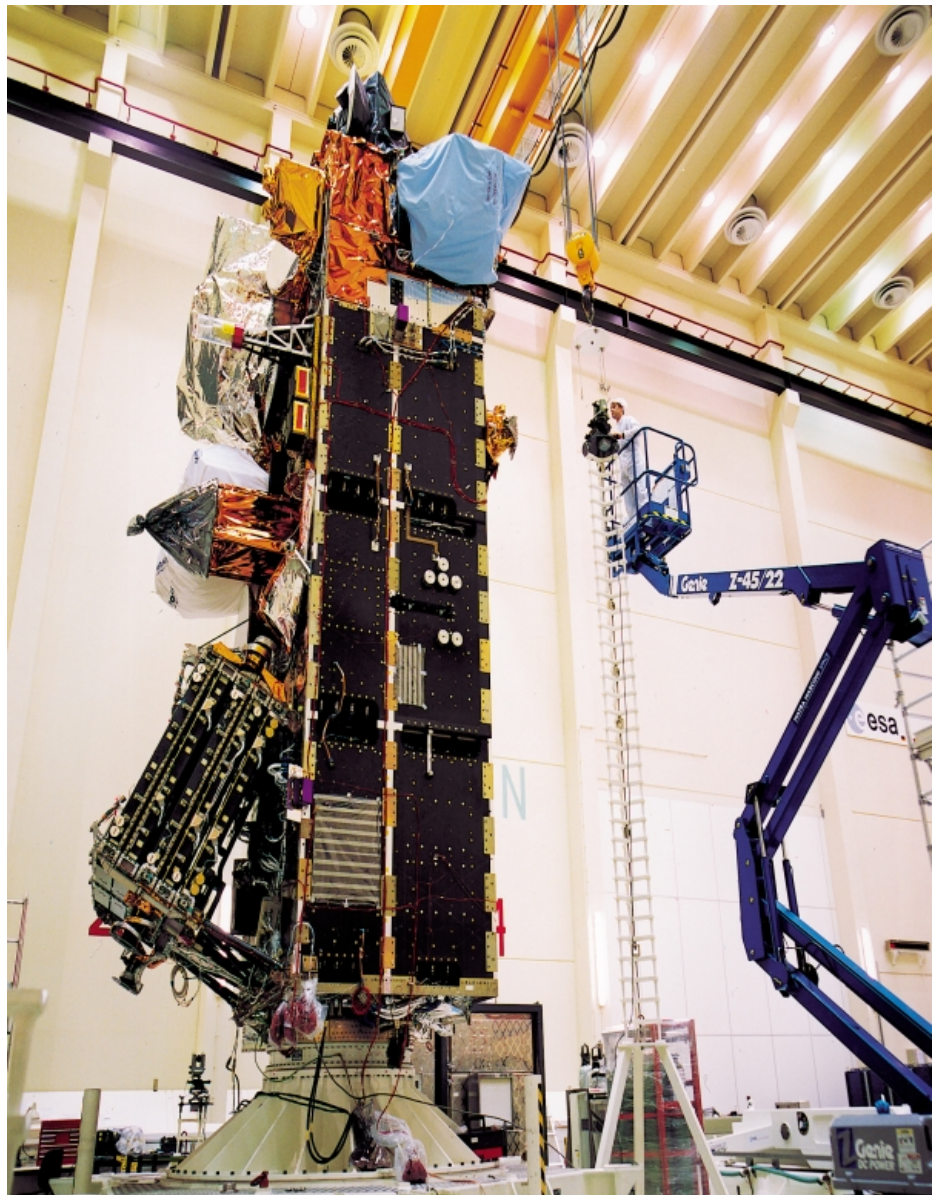
- preparation for the satellite system tests
- preparation for the Ground Segment Overall Verification (GSOV) and initialisation of some of the corresponding compatibility tests between the satellite and the ground segment (PDS and FOS)
- preparation for the in-orbit commissioning, in particular the setting up of payload calibration/validation teams and the definition of corresponding activities.

### Envisat satellite and payload

With the delivery of SCIAMACHY, the return of the ASAR central electronics



*Signature of the Metop GOME-2 contract. From left to right: Mr G. Grasso (Alenia), Mr C. Mastracci (ESA) and Dr T. Mohr (Eumetsat)*



*Envisat flight-model spacecraft in the ESTEC test facilities*

(CESA), and delivery of the ASAR antenna, the flight-model payload is now completely integrated on the flight-model Payload Module.

The flight-model Service Module has been submitted to the shock tests simulating the Ariane-5 launch (shock generator and clamp-band release). The post-test analysis has confirmed that the Service Module and all of its critical subsystems successfully passed this test.

The Service Module and Payload Module are now being re-mated together in preparation for the satellite system tests planned for the second quarter of 2000.

The satellite assembly, integration and test (AIT) schedule is being regularly scrutinised and optimised to ensure compatibility with the target launch date of end-June 2001.

#### **Envisat ground segment**

The Flight Operations Segment (FOS) is being prepared for the Satellite Verification Tests (SVT-2) to be executed as part of the satellite system testing. SVT-2 will be a key test in the demonstration of compatibility between the satellite and the Flight Operation Control System and Satellite Operation Planning implemented at ESOC.

The acceptance of the Payload Data Segment (PDS) Version 2 has been completed. The PDS version V3 Critical Design Review has been conducted and the go-ahead given for implementation of the time-critical upgrades. PDS V3 will cope with the improved mission-management strategy provided by the use of the two on-board solid-state recorders, modifications identified in the flight-model payload-telemetry data streams, and improvements in some data-processing algorithms for level-1B and level-2 products.

The Processing and Archiving Centre (PAC) implementation activities are in progress. Iterations are ongoing between ESA and the PAC providers to ensure compatibility between their PDS Generic Element procurements and the ESA PDS V3 evolution.

The commercial distributors' offers in response to the ESA Invitation to Tender (ITT) are currently being evaluated.

## **International Space Station**

### **European participation in the ISS Exploitation Programme**

A High-Level Commitment was signed by Industry on 3 March. The target price for the complete Exploitation Phase Operations Contract amounts to 2.6 BEuro and the Firm Fixed Price commitment for Early Activities and ceiling price offer for Phase-1 are both within ESA targets. On 22 March, the ESA Council approved the proposed approach to industrialisation and commercialisation and also approved entrusting the Operations Preparation and Early Activities to the same industrial group. A procurement proposal for the entire operations contract and preparatory activities is being prepared.

### **ISS Overall Assembly Sequence**

Following the Proton launch failures in 1999 and their impact on the Service Module launch date, NASA decided to launch a Shuttle logistics mission to the ISS in March. The aim was to carry out a number of necessary maintenance actions on Zarya's systems, and to exchange a number of limited-life hardware items in order to re-certify Zarya's service life to end-2000.

A General Designers' Review (GDR) was held in Moscow on 11 February, at which the proposed planning for returning Proton to flight, and the status and future planning for the preparation of the Service Module for launch, were discussed. This resulted in the endorsement of the proposed planning for Proton and a launch window of 8–14 July for the Service Module.

In March, an interim update to Revision E of the ISS Assembly Sequence was approved, but is limited to assembly flights up to and including UF1. All subsequent assembly flights remain under review, but delays of approximately 8 months can be expected, leading to a Columbus launch date around October 2004. The next Assembly Sequence update is expected in June/July.

### **Columbus laboratory**

Revised project planning taking into account the significant overall ISS assembly delays has now been completed, and project activities are being realigned accordingly. A full-scale mock-up of Columbus, with all external features incorporated, has been tested in the

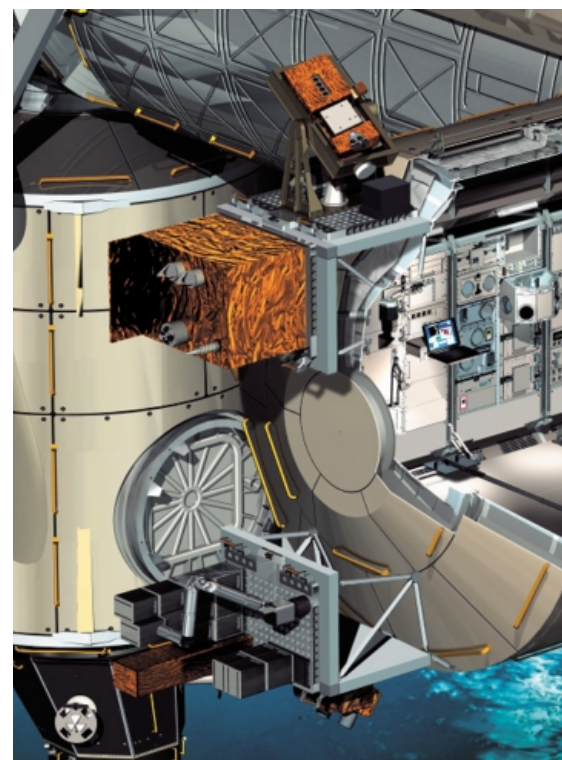
NASA/JSC Neutral Buoyancy Facility, and astronauts have verified that all planned and contingency EVA activities can be carried out. The system Electrical Test Model phase-2 testing preparation is complete, and the Data Management subsystem software integration has been performed. All low-level Critical Design Reviews (CDRs) have been completed, except for the video equipment, the high-rate multiplexer and the DMS subsystem. The system CDR will now be conducted in the fourth quarter of 2000. Manufacture of the flight-unit primary structure is complete and the first phase of proof pressure testing has been successfully performed.

### **Columbus Launch Barter**

#### *Nodes-2 and -3*

Discussions have been held with ASI (to whom management of the Nodes-2/3 project is delegated by ESA) and NASA, to address the impact of the multiplicity of design changes, which have affected the Nodes design quite fundamentally and which were introduced in response to NASA requirements changes. The impact of these changes significantly alters the industrial cost of the Nodes and therefore also the balance of the Columbus Launch Barter, and the discussions have been aimed at redressing this balance.

Meanwhile, the Node-2 flight-unit primary structure welding has been completed and that of the Structural Test Article is well advanced. Updating of the Node-3





design baseline is underway in preparation for a System Review in Summer 2000.

#### *Cryogenic Freezer Racks*

The negotiation of NASA's requirements is still ongoing. However, following an end-March agreement on guidelines to solve the residual conflicts, it is hoped that the final specification can soon be agreed and the project started.

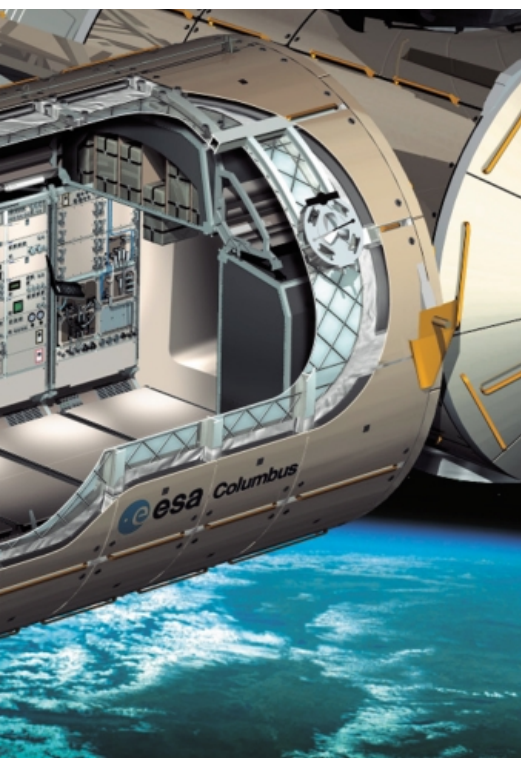
#### **Cupola**

The Design Consolidation Review has been successfully completed. Forgings for the primary structure of the Structural Test Article (STA) have been delivered and are being machined to final dimensions. Manufacturing-tool design activities have been completed, Mechanical Ground Support Equipment (MGSE) manufacturing release has been granted, and procurement of the STA and flight-unit window frames has been initiated.

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

Technical agreement has been reached to use the Ariane-5 Versatile configuration with a restartable upper stage for ATV launches. An agreement on the total price and associated payment conditions for a batch order of nine ATV launches with this Ariane-5 configuration was concluded on 31 March.

The ATV/Russian Segment Integration Preliminary Design Review (PDR) has been completed.



Negotiations with RSC-Energia on the procurement of Russian hardware for the ATV are well advanced, but with some important issues still to be resolved. Agreement has been reached on the baseline to be used for relative GPS navigation.

The System PDR was kicked-off on 14 March and should be completed by mid-June.

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

Flight-hardware manufacture and delivery is continuing on schedule. Flight rudders were delivered to Johnson Space Center in December, and manufacturing of all critical components of the CMC leading edges has been completed, as has the manufacturing of the landing-gear system. The nose primary structure is in final manufacturing, and qualification of the TPS thermal blankets has started.

The first test of V132 was performed successfully on 30 March.

Selected critical CRV Phase-1 tasks were initiated with European industry in December under the running X-38 contract.

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

The Columbus Control Centre Phase-B2 studies have been extended to allow more time for the detailed definition of the system architecture. The ATV Control Centre system-definition studies are continuing in line with agreed planning. Phase-C/D kick-off for the Control Centres will now take place in the first quarter of 2001.

The Phase-A study for the ATV Trainer has been completed, and the Phase-C/D for the Columbus Functional Crew Trainer has been initiated.

#### **Utilisation**

##### *Promotion*

At its January meeting, the Industrial Policy Committee (IPC) endorsed a first group of Microgravity Application Projects (MAP). The individual contracts were negotiated in February and March. New

life-science MAPs were approved by the Microgravity Programme Board in March.

Due to the delays in the Space Station Programme, the Organising Committee of the Global Utilisation Symposium initially planned for June 2000 in Berlin, has decided to postpone the Symposium by one year, to 5 – 7 June 2001.

##### *Preparation for commercial utilisation*

The European Utilisation Board (EUB), meeting in February, discussed the commercialisation of ISS utilisation and the issue of the variable cost-contribution scheme. The Executive continued to refine its ideas regarding the composition and terms of reference of the Space Station User Panel (SSUP) with a view to finalising them by mid-2000, and with an emphasis on ISS utilisation by industry.

The Industry Space Station Advisory Committee (ISSAC) met in March and also discussed commercialisation issues.

The Executive has further developed its approach to utilisation commercialisation and was aided in this task by the delivery of final reports of parallel studies by consultants Battelle/Cranfield/AccessMatrix on ISS commercialisation. The studies conclude that industry is not yet prepared to pay the full ISS utilisation costs for research and development, but R&D sponsorship has been identified as a possible source of income.

The course of further action proposed by the Executive was endorsed by the Manned Space Programme Board (PB-MS), reported to the IPC and approved by the Council in March. A definitive approach is to be finalised by end-2000.

A Call for Interest to undertake ISS commercialisation will be sent out in mid-June to industrial/commercial entities.

##### *Accommodation hardware development*

The conversion proposal from industry covering Phase-C/D of each the European Drawer Rack (EDR) and the European Stowage Rack (ESR) was received on 4 April and is under evaluation. Extensive negotiations are anticipated due to a significant overrun on the ceiling price. It is planned to negotiate the proposal with a kick-off of Phase-C/D in September.

The final report on the ACES Express Pallet Phase-B2 was delivered in February

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*ESA's general-purpose Columbus laboratory is scheduled for launch in about October 2004.*  
(ESA/D. Ducros)

and is currently under review. A dedicated Special Atomic Clock Ensemble in Space (ACES) session was held during the European Frequency & Time Forum (EFTF). ESA's and CNES's ACES activities will be synchronised by the autumn, enabling instrument Interface Control Documents (ICD) to be agreed prior to the start of Phase-C/D.

*Columbus payload integration and operation*

The Columbus Payload Integration (CPI) has been implemented in the form of a Contract Change Notice (CCN) to the Phase-C/D contract for the Columbus laboratory. The starting of initial tasks was authorised in January. Negotiation of the full CCN is planned to start once the changes in the Columbus schedule have been approved.

**Astronaut activities**

F. De Winne joined the European Astronaut Corps on 1 January as its 16th member. He is currently supporting the X-38/CRV Project at ESTEC.

G. Thiele participated as a Mission Specialist in the Shuttle Radar Topography Mission STS-99, which achieved three-dimensional mapping of most of the Earth's land surface.

As part of their basic training, three NASDA astronaut candidates, together with their ESA colleagues A. Kuipers and F. De Winne, attended a course at EAC on ESA and its programmes.

The Manned Space Programme Board has unanimously endorsed the principles of co-operation for the EAC operations, and in particular the build-up of an EAC Team under full ESA responsibility. This team will be composed of ESA staff and personnel seconded from national entities (DLR, CNES, ASI). The ESA/DLR Arrangement started on 1 April with 23 DLR staff seconded as training-infrastructure and medical support to EAC, and will run until end 2003, with the intention for further continuation.

**Early deliveries**

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

Integrated testing of DMS-R with Service Module avionics systems has been completed at Baikonur as an integral part of Service Module launch preparations. The latter are on schedule for an 8-14 July launch slot.

All initial flight spares have been delivered to RSC-Energia, and manufacture of the first operational spares is in progress.

*European Robotic Arm (ERA)*

Testing of the Engineering/Qualification Model of ERA on the Fokker Space Flat Floor Facility is in progress and electrical-bench testing on the ERA flight-model joints has been completed.

The Mission Preparation and Training Equipment (MPTE) is being integrated in readiness for delivery to ESTEC in June 2000.

Assembly of the ERA system flight model is held up pending delivery of the end-effector flight units. ERA flight-model delivery has now moved to the second quarter of 2001. However, this delivery remains non-critical as the Science Power Platform Flight has also been postponed to September 2002 at the earliest, due primarily to budget shortfalls.

*Laboratory Support Equipment (LSE)*

The MELFI (Minus 80°C Freezer Laboratory) Training Unit will be delivered to NASA in May. All major subsystems have been manufactured and are undergoing qualification testing. The electrical subsystem has been qualified and system-level testing is planned to start in June.

The manufacture of critical flight-unit parts for the Material Science Glovebox has started and integration of the engineering unit is in progress.

The dedicated Safety Review caused by the modified re-entry configuration of the Hexapod Pointing System took place from 14 to 18 February. Following the indications of the Safety Panel Structural Working Group, the linear actuators were modified to include locking systems for landing. The High-Fidelity Mechanical Interface Simulator was delivered to NASA in March. Preparation of the data package for the Critical Design Review (CDR) is in full swing and expected to be completed in May.

## Microgravity

**EMIR programmes**

In a common approach with CNES and DLR, the conditions for a Foton-13 flight in

the second half of 2002 were negotiated with Rosaviakosmos at ESA Headquarters in Paris, on 2 March. The results were reported at the Programme Board meeting on 29-30 March and led to the approval of the Foton-13 mission with 355 kg of CNES, DLR and ESA payload. The CNES (IBIS) and DLR (AGAT) elements still need to be confirmed, as national approval procedures will only be completed in June.

The Texus-37 sounding-rocket flight carrying one ESA-funded experiment, the capillary flow experiment of Dr. Dreyer, was successfully launched and retrieved on 27 March, after a 4-day delay due to strong winds. Texus-38 with a 100% ESA-funded payload was successfully launched on 2 April. All three experiments performed well and sent back interesting scientific results, telemetry and video data. Unfortunately, Texus-38's main parachute did not deploy and the payload itself was badly damaged on landing. This was the first such Texus recovery-system failure in approximately 45 missions.

The proposal for the main development (Phase-C/D) of Matroshka was received on 29 February from DLR and its evaluation has started.

For the running projects, a number of Preliminary and Critical Design Reviews (PDRs and CDRs) and Safety Reviews are in progress or about to be initiated, for the Materials Science Laboratory (MSL), the Fluid Science Laboratory (FSL), the Biolab and the Protein Crystallisation Diagnostics Facility (PCDF).

**Microgravity Facilities for Columbus (MFC)**

The engineering models for Biolab, FSL and MSL in the US Laboratory are well advanced and the subsystem Critical Design Reviews (CDRs) have been initiated. Engineering-model integration has started for Biolab. Breadboarding activities for some of the European Physiology Modules have been initiated.

The MFC Commercialisation Study – Phase 1 final presentation has taken place, with the MFC prime contractors explaining the role that they can play in ISS commercialisation.