

Programmes under Development and Operations

(status end-December 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	J	F	M	A	M	J	J	A	S	O
SCIENCE PROGRAMME	SPACE TELESCOPE	[Blue bar from 1998 to 2004]																												LAUNCHED APRIL 1990					
	ULYSSES	[Blue bar from 1998 to 2001]																												LAUNCHED OCTOBER 1990					
	SOHO	[Blue bar from 1998 to 2002]																												LAUNCHED DECEMBER 1995					
	HUYGENS	[Blue bar from 1998 to 2004]																												LAUNCHED OCTOBER 1997					
	XMM-NEWTON	[Green bar from 1998 to 2000, then blue bar from 2001 to 2004]																												LAUNCHED DECEMBER 1999					
	CLUSTER	[Green bar from 1998 to 2000, then blue bar from 2001 to 2004]																												RE-LAUNCHED MID 2000					
APPLICATIONS PROGRAMME	MARECS-B2	[Blue bar from 1998 to 2001]																												POSSIBLE NEW LEASE					
	METEOSAT-5 (MOP-2)	[Blue bar from 1998 to 2001]																												OPERATED BY EUMETSAT					
	METEOSAT-6 (MOP-3)	[Blue bar from 1998 to 2003]																												OPERATED BY EUMETSAT					
	METEOSAT-7 (MTP)	[Blue bar from 1998 to 2004]																												OPERATED BY EUMETSAT					
	ERS - 1	[Blue bar from 1998 to 2000]																												MISSION ENDED MARCH 2000					
	ERS - 2	[Blue bar from 1998 to 2001]																												LAUNCHED APRIL 1995					
	ECS - 4	[Blue bar from 1998 to 2001]																												OPERATED FOR EUTELSAT					
	ECS - 5	[Blue bar from 1998 to 2000]																												MISSION ENDED MAY 2000					

Under Development / En cours de r alisation

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	J	F	M	A	M	J	J	A	S	O
SCIENTIFIC PROGRAMME	INTEGRAL	[Green bar from 1998 to 2002, then blue bar from 2003 to 2004]																												LAUNCH APRIL 2002					
	ROSETTA	[Red bar from 1998 to 1999, green bar from 1999 to 2002, blue bar from 2003 to 2004]																												LAUNCH JANUARY 2003					
	MARS EXPRESS	[Red bar from 1999 to 2000, green bar from 2000 to 2003, blue bar from 2004 to 2005]																												LAUNCH JUNE 2003					
	SMART-1	[Red bar from 1998 to 1999, green bar from 1999 to 2002, blue bar from 2003 to 2004]																												LAUNCH LATE 2002					
	HERSCHEL/PLANCK	[Red bar from 2000 to 2001, green bar from 2001 to 2007]																												LAUNCH FEBRUARY 2007					
COMMS./ NAV. PROG.	ARTEMIS	[Green bar from 1998 to 2001]																												LAUNCH DATE TBC					
	GNSS-1/EGNOS	[Green bar from 1998 to 2003]																												INITIAL OPS. END 2003					
	GALILEOSAT	[Red bar from 1999 to 2000, green bar from 2000 to 2003]																												FIRST LAUNCH 2003					
EARTH OBSERV. PROGRAMME	EOPP	[Red bar from 1998 to 2002]																																	
	EOEP	[Green bar from 2000 to 2004]																												INCL. CRYOSAT, SMOS, GOCE					
	ENVISAT 1/ POLAR PLATFORM	[Green bar from 1998 to 2001, then blue bar from 2002 to 2004]																												LAUNCH JULY 2001					
	METOP-1	[Red bar from 1998 to 1999, green bar from 1999 to 2005]																												LAUNCH 2nd HALF 2005					
	MSG-1	[Green bar from 1998 to 2002, then blue bar from 2003 to 2004]																												LAUNCH JANUARY 2002					
MANNED SPACE & MICROGRAVITY PROGRAMME	COLUMBUS	[Green bar from 1998 to 2004]																												LAUNCH OCTOBER 2004					
	ATV	[Red bar from 1998 to 1999, green bar from 1999 to 2004]																												LAUNCH APRIL 2004					
	X-38	[Green bar from 1998 to 2001]																												V201 TEST FLIGHT SEPTEMBER 2002					
	CRV	[Green bar from 2000 to 2007]																												OPERATIONAL 2007					
	NODE-2 & -3	[Green bar from 1998 to 2003, then blue bar from 2004 to 2005]																												LAUNCHES NOVEMBER 2003 & JULY 2005					
	CUPOLA	[Green bar from 1999 to 2002]																												LAUNCH JANUARY 2005					
	ERA	[Green bar from 1998 to 2001]																												LAUNCH JANUARY 2004					
	DMS (R)	[Red bar from 1998 to 1999, green bar from 1999 to 2000, then blue bar from 2001 to 2004]																												LAUNCHED JULY 2000					
	MELFI	[Green bar from 1998 to 2002, then blue bar from 2003 to 2004]																												LAUNCH FEBRUARY 2002					
	GLOVEBOX	[Green bar from 1998 to 2002, then blue bar from 2003 to 2004]																												LAUNCH FEBRUARY 2002					
	HEXAPOD	[Green bar from 1998 to 2004]																												LAUNCH SEPTEMBER 2004					
	LAUNCHER PROGRAMME	EMIR	[Red triangles: EDEN, FAST/APCF/AGHF/BIOBOX/MOMO-2, BIOPAK-3, MOMO-3, HGD/FPD, APCF, APCF-6/BIOBOX-5/ARMS/BIOPACK/FAST-2, BIOPACK/BIOBAN, MATROSHKA, EMCS/MAPES, MSL/PEMS]																																
MFC		[Green bar from 1998 to 2004]																												BIO, FSL, EPM, PCDF in COLUMBUS					
ARIANE-5 DEVELOP.		[Green bar from 1998 to 2004]																												V504 LAUNCHED DECEMBER 1999					
ARIANE-5 PLUS		[Green bar from 1998 to 2004]																												FIRST LAUNCH APRIL 2002					
FESTIP	[Green bar from 1998 to 2001]																												REUSABLE LAUNCHER DEFIN.						
FTLP	[Green bar from 1999 to 2001]																												TECHNOLOGY DEVELOPMENT						

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

XMM-Newton

The first public data from the XMM-Newton observatory have been made available on the World Wide Web, together with the associated analysis software (see: http://xmm.vilspa.esa.es/public/xmm_sas_sv_top.html). The software was developed jointly by the XMM-Newton Science Operations Centre (SOC) and the Survey Science Centre (SSC), a consortium, led by Dr. Mike Watson of Leicester University (UK), selected to routinely process all XMM-Newton data.

A Workshop on the radiation effects experienced by ESA's XMM-Newton and NASA's Chandra missions was held at ESA's Vilspa station, near Madrid (E), on 29 November (see <http://sci.esa.int/xmm>).

XMM-Newton's instruments are performing nominally, with no further problems being encountered. The ground segment has continued preparations for the inclusion of a third antenna (in

Santiago, Chile) in the mission's day-to-day operations. This additional antenna will close an existing gap in data reception around spacecraft apogee.

A special issue of Astronomy and Astrophysics magazine containing 56 high-quality papers based on XMM-Newton data has been published, and another similar special issue is already planned.

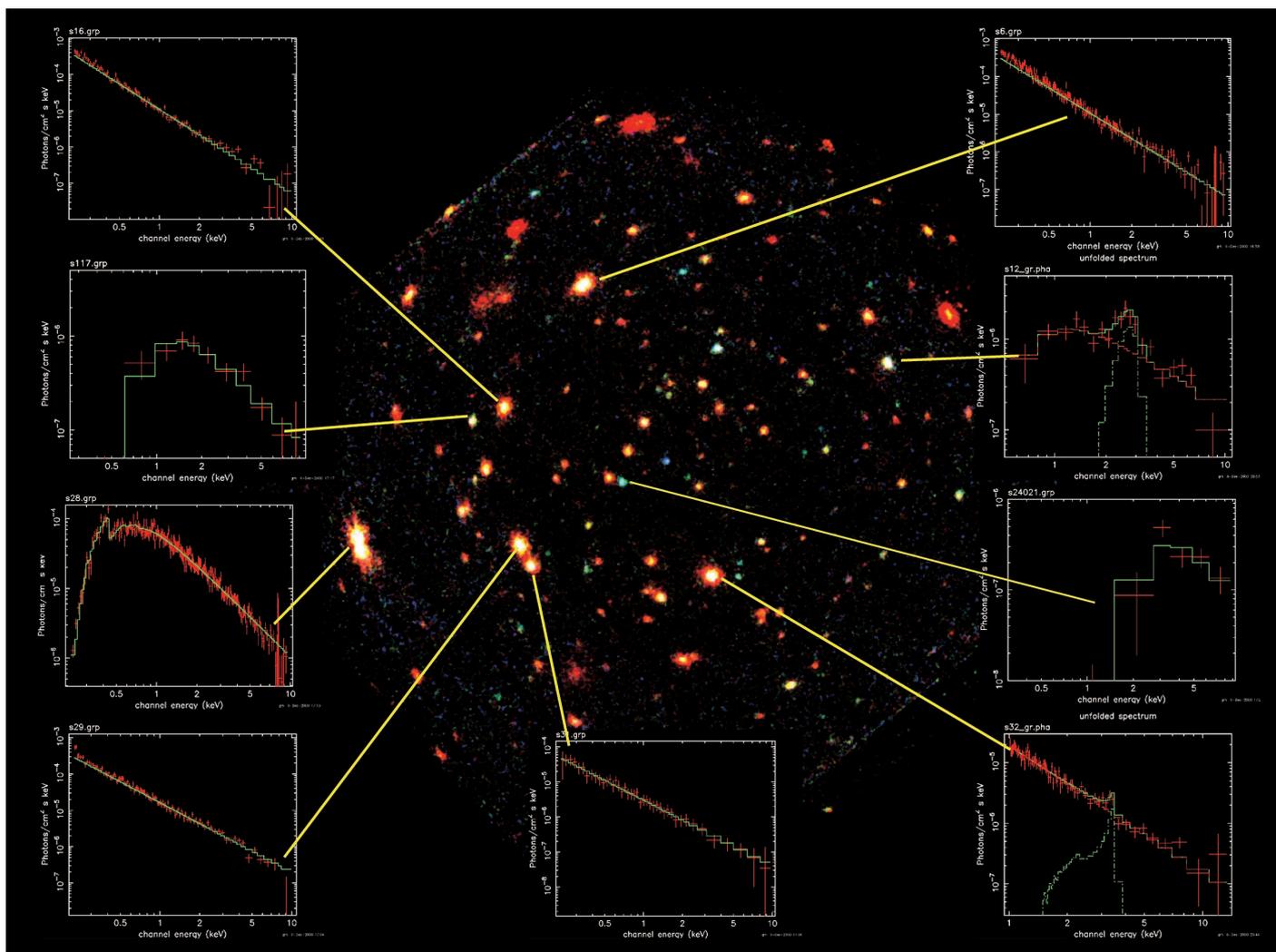
One of the highlights of the XMM-Newton mission is the combination of high-throughput and imaging X-ray spectroscopic capabilities. The accompanying image is from a 100 ksec observation of an area called the 'Lockman Hole'. This false-colour X-ray image shows hundreds of so-called 'serendipitous sources', and the overlaid X-ray spectra illustrate the quality and capabilities of XMM-Newton in this field for a few randomly selected sources. Regular updates on the most striking results obtained by the XMM-Newton observatory can be found at <http://sci.esa.int/xmm>.

Cluster

The Cluster quartet successfully completed the instrument-interference campaign on 22 December. It involved two weeks of intensive checks to ensure that the 11 scientific instruments on each spacecraft do not adversely affect each other's measurements. A few minor difficulties involving one or two instruments have been experienced, as expected, but by no means can they be considered show-stoppers.

The potential operational conflict is largely due to the complexity of the instrument

XMM-Newton false-colour X-ray image of a 100 000 sec observation of the Lockman Hole. Colour indicates temperature, with red being cold (around 1 million K) and blue being hot (a few million K) objects. The overlays show X-ray spectra (decomposition of X-ray light into its constituent 'colours'; as with a prism for visible light) for a limited number of randomly selected sources in the image. This clearly illustrates that XMM-Newton can routinely derive detailed information for many sources within its field-of-view (courtesy of Prof. G. Hasinger, AIP/MPE)



set on each spacecraft. Most experiments are 'passive' and simply measure the space environment through which the spacecraft is passing, but some experiments (EDI, WHISPER, EFW, ASPOC) actively probe near-Earth space. All of these active instruments were designed to be compatible with their neighbours. It was not possible, however, to precisely forecast, or test for, all of the possible interference effects until the spacecraft were actually in orbit and the experiments had been commissioned. During the interference campaign, the scientists investigated 'worst-case scenarios' by looking for any unforeseen effects that could perturb the space plasma and so adversely affect the rest of the science payload. Once these were found, the challenge was to determine how to operate the instruments in question successfully whilst limiting the impact on the overall science data return. Careful global scheduling of the scientific measurements ensured that the Cluster science programme could be started in early January and that it will produce top-quality scientific data.

Meanwhile, after some small 'constellation manoeuvres', the Cluster quartet are now in the correct orbits to form a perfect tetrahedron for the cusp crossings next February. At that time, the spacecraft will be almost exactly 600 km apart. Taking advantage of this spatial spread, the suite of instruments on each satellite will gather a unique three-dimensional set of data as they sweep through the cusp regions over the Earth's magnetic poles.

Integral

The flight model of the Integral Service Module is now practically completed. A significant milestone was achieved with the delivery last October of the Optical Monitoring Camera (OMC), which was the first flight-model scientific instrument to be delivered and integrated on the spacecraft.

The current project-completion schedule remains extremely tight due to the technology-development difficulties that some instrument teams have recently encountered. The plan is to integrate the remaining flight-model instruments into the spacecraft during the first half of 2001 at Alenia Spazio's facilities in Turin (I). The

environmental test campaign at ESTEC (NL) will follow immediately thereafter, allowing the Flight-Acceptance Review to be held in early 2002.

The third round of System Validation Tests (SVT-C) was successfully completed in December and included the verification of spacecraft contingency recovery and instrument flight-operations procedures. The ground-segment activities are progressing according to plan.

There have been some delays in adapting the design of the Proton launch vehicle and facilities, but overall progress is presently sufficient to allow launch according to the current schedule in April 2002 from the Baikonur Cosmodrome in Kazakhstan. The next major launch-related milestone is the Mission Critical Design Review (MCDR), planned for April 2001.

Rosetta

The Electrical Qualification Model (EQM) continues its testing at Alenia in Turin (I). All of the payload units have been integrated and the bus and payload modules have been mated. The integrated system tests have been performed on the power and data-handling subsystems, as well as for most of the experiments. The first phase of EQM testing is still foreseen to be completed by the end of March 2001.

The spacecraft Proto-Flight Model (PFM) programme has also just started. The structure, propulsion and thermal subsystems have been delivered and mechanical integration has commenced.

The Integral flight model ready for payload integration



There is still some concern regarding the delivery schedule for the flight models of some critical equipment items (star tracker and transponder), owing to their development programmes running late due to technical problems. The engineering model programmes for these items have, however, been brought to a successful conclusion, demonstrating that these problems are now under control. The complex nature of the software has also given rise to development problems. An incremental delivery approach compatible with the system test requirements has now been agreed with all parties.

The Experiment Final Design Reviews (EFDRs) have all taken place successfully, with no show-stoppers being identified. The payload institutes are now busy integrating and calibrating their experiment flight models for delivery in the second quarter of 2001. For most, the schedule is still very critical, particularly for the scientific camera (Osiris).

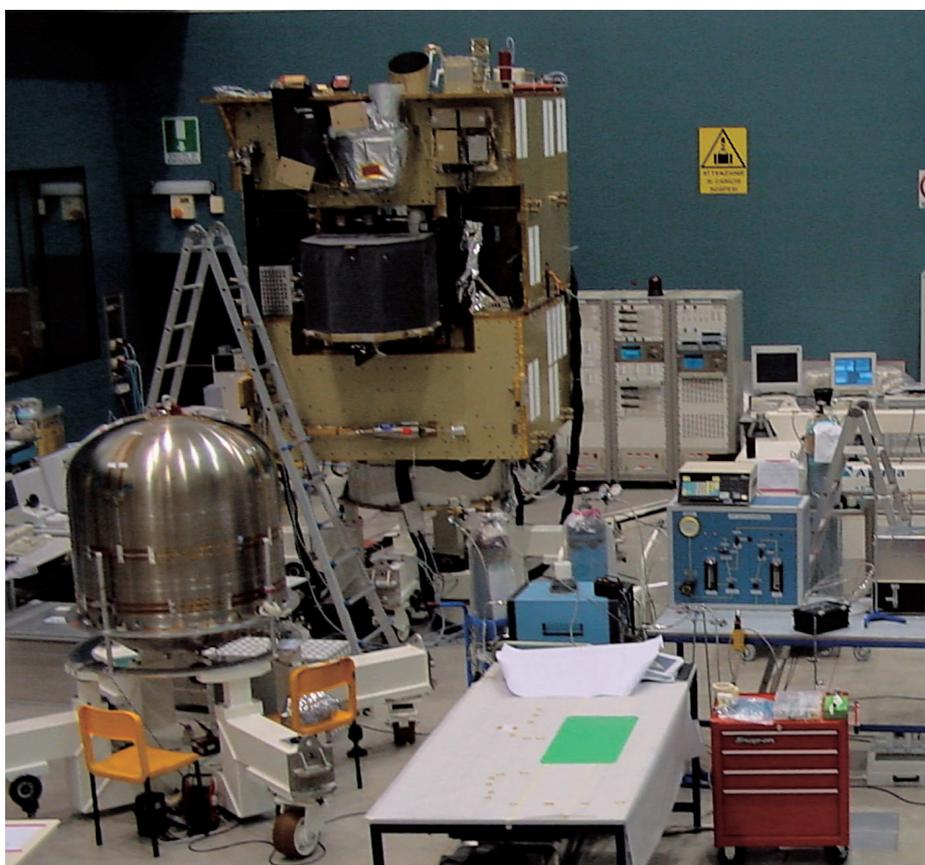
The EQM lander has also been integrated on the EQM spacecraft and compatibility testing successfully performed. Assembly of the flight-model lander has also started, but there are still some critical units, in particular the landing gear and some experiments, which are receiving maximum attention in order to ensure timely delivery.

The development of the ground segment is proceeding according to plan. The pedestal for the new 35 m antenna in New Norcia, Australia, has now been completed, and the complete ground station should be ready in early 2002, which is compatible with the mission requirements.

Mars Express

The spacecraft programme continues to progress according to plan, and the overall workload is currently reaching its peak. Engineering-model testing is in progress at Astrium SAS in Toulouse (F). Production of the flight-model structure is nearing completion at Contraves in Zurich (CH) and qualification testing will follow.

The Critical Design Reviews of the scientific instruments have started, as has delivery of the instrument engineering models. The first instrument delivery to



Astrum's site took place just before Christmas.

The Rosetta Electrical Qualification Model at Alenia in Turin (I)

Beagle-2, the Mars Express lander, has been reviewed by an independent group of experts, led by J. Casani, a former NASA/JPL project manager. It concluded that the Beagle-2 project is 'eminently doable', but certain activities require more attention than initially planned. The review group's conclusion led the United Kingdom to formally request ESA's Science Programme Committee (SPC) to support the Beagle-2 project. During its November meeting, the SPC approved 16 MEuro for ESA participation in the Beagle-2 consortium. ESA will primarily be involved with the entry, descent and landing system, and will participate in the lander's assembly, integration and verification (AIV) programme. In addition, ESA will procure the lander/orbiter relay system, and will provide access to its expertise and facilities.

The Ground-Segment Design Review was completed successfully on 31 October. The Fifth Meeting of the Mars Express Science Working Group took place in December. Discussions focussed extensively on the scientific aspects of mission operations, and data analysis and archiving.

Smart-1

Since the start of the main development phase (Phase-C/D) in November 1999, work has proceeded on all mission elements: spacecraft, payload instruments, electric-propulsion subsystem, and ground segment.

The spacecraft, under the responsibility of the Swedish Space Corporation (SSC) and its industrial consortium, has been designed according to the system requirements down to subsystem and equipment level. All of the subsystem and equipment Preliminary Design Reviews (PDRs) have been successfully closed. A few subsystems - primary structure, some mechanisms, solar arrays, transponder, star tracker - have already undergone their Critical Design Reviews, allowing flight-model production to start. The electrical tests on breadboard and engineering-model units started towards the end of 2000 and will continue throughout 2001. The On-board Software contract has recently been awarded and the Architectural Design Review is planned for February 2001.

The six payload instruments are being developed in parallel by various European institutes and industries. Four of them – the Electric-Propulsion Diagnostic Package (EPDP), the Smart-1 Infrared Spectrometer (SIR), the Demonstration of Compact X-ray Spectrometer (D-CIXS) and the X/Ka-band Transponder Experiment (KaTE) – are being developed under ESA TRP contracts, whilst the other two – the Asteroid and Moon Imaging Experiment (AMIE) and the Spacecraft Potential Electron and Dust Experiment (SPEDE) – are nationally funded. All instruments have undergone their PDRs successfully. The Critical Design Reviews (CDRs) are planned for April 2001. The structural and the electrical models will be delivered for integration into the spacecraft models in the February-March time frame.

The electric-propulsion subsystem is being procured separately directly by ESA from SNECMA and its subcontractors, and will be delivered to the SSC as customer-furnished equipment. The CDR was held in December and close-out of all open actions is expected by March 2001. A complementary engine-lifetime qualification test will start in January.

The ground segment is being designed and built by ESOC, based on the existing infrastructure and facilities. The mission-control system is based on the SCOS-2000 (Spacecraft Control Operating System) kernel, the dedicated control room is shared with the Huygens mission, and the ESA ground stations will be used on a time-availability basis. Extensive work has been done on optimising the low-thrust trajectory to the Moon, to cope with Arianespace's launch-window requirements for an auxiliary payload like Smart-1.

The Science and Technology Operation Coordination will take place from ESTEC and will include the science and technology operation planning, technology data distribution and exploitation, and data archiving. This will ensure that the results of this preparatory mission will be directly transferred to the technology and project offices of the future science missions, such as BepiColombo.

Herschel/Planck

The Far-Infrared and Submillimetre Telescope (FIRST) mission was renamed

the 'Herschel Space Observatory' at the end of last year, in honour of William Herschel, the famous Anglo-German astronomer who discovered infrared light exactly 200 years ago, in 1800.

The industrial Invitation to Tender (ITT) for the Herschel/Planck mission had been issued to European industry by 1 September 2000 as planned, and the proposals were received in early December. Evaluation of those offers is underway. The start of development activities (Phase-B) with industry is planned for June 2001, which is in line with the foreseen launch of the two spacecraft in February 2007.

The development of the three Herschel instruments and the two Planck instruments is proceeding according to plan. A major instrument-development milestone is the second formal Instrument Design Review. A first review meeting for the Herschel SPIRE instrument took place in November. The next review meetings, for Planck's LFI and HFI instruments, will take place in February 2001.

The co-ordinated parts procurement that has been initiated to support scientific-instrument development is progressing nominally. The activities together with the Danish Space Research Institute for preparing the Invitation to Tender (ITT) for the Planck telescope's reflectors are also progressing. Release of the ITT to European industry is planned for early 2001.

Earth Observation Envelope Programme (EOEP)

The Cryosat Phase-B activities are proceeding nominally; all Invitations to Tender (ITTs) relating to the procurement of the various spacecraft equipment items have been issued. Evaluation of the offers received will take place early in 2001.

Negotiation of the GOCE space-segment Phase-B/C/D/E1 industrial proposal has been successfully completed. The GOCE Phase-B activities were kicked-off on 19 December under a Preliminary Authorisation to Proceed (PATP). Completion of the GOCE Phase-B is expected by the end of 2001.

The detailed design of the ALADIN instrument for the ADM/Aeolus mission is nearing completion. The ITT package for the second phase of the predevelopment programme (hardware manufacturing) is being prepared.

The ITT package for the Prodex-funded instrument Phase-C/D is in preparation. Finalisation of the specifications is being supported by a scientific study. The procurement proposal for the provision, under EOEP funding, of short-wave infrared (SWIR) focal planes to APEX has been approved by ESA's Industrial Policy Committee (IPC). The relevant contractual actions have been initiated.

In the market-development area, 14 short-term contracts have been started. Six proposals for longer-term contracts are under evaluation, with the objective of selecting two or three for a start in the first quarter of 2001.

ESA's plans for Earth Watch's ORSA-3, including preparatory activities under EOEP, have been fully aligned with Eumetsat's post-MSG/EPS plans.

Earth Observation Preparatory Programme (EOPP)

From the ten proposals received in response to the Call for Mission Ideas for the second cycle of Earth-Explorer Core Missions, five missions were selected for further assessment: ACE, EarthCARE, SPECTRA, WALES and WATS. This selection was endorsed by the Earth-Observation Programme Board (PB-EO) in November. The proposals for pre-Phase-A studies of these missions are currently being evaluated, and these studies are expected to be kicked-off early in the first quarter of 2001.

The 'End-to-end Mission Performance Simulation' study for SMOS has been kicked-off.

Meetings were held with NASDA on the potential joint EarthCARE Earth-Explorer core mission, ESA's possible participation in the NASDA/NASA Global Precipitation Mission (GPM), and implementation of ESA's SWIFT Earth-Explorer Opportunity Mission on the Japanese GCOM mission.

Intensive work within the Agency and consultations with Delegations are taking place in the framework of the Earth-Watch Task Force, created at the PB-EO's November meeting. The objective is to arrive at a consolidated proposal for future Earth-Watch programmes.

Meteosat Second Generation (MSG)

The MSG-1 launch delay from October 2000 to January 2002 announced by Eumetsat means that all of the spacecraft – MSG-1, EM, MSG-2 and MSG-3 – will now have to be stored for in the order of 15 to 21 months. The revised and extended MSG programme planning is under review in order to minimise the resulting costs.

The Pre-Storage Review (PSR) for MSG-1 took place as planned at the end of 2000, and a PSR Board meeting is planned in the March 2001 time frame.

The need to add a shock-test programme in order to qualify MSG-2, MSG-3 and follow-on models for an Ariane-5 launch is still under investigation.

MetOp

An important milestone was achieved with the completion and delivery of the Advanced Scatterometer instrument (ASCAT) and the GPS Receiver for Atmospheric Sounding (GRAS) for the engineering-model Payload Module (PLM). With these instruments now successfully integrated, the EM PLM is complete, and has started its system-level testing. The thermal-balance/thermal-vacuum test in ESTEC's Large Space Simulator (LSS) is planned for the second quarter of 2001.

A major change is now being discussed with industry, to re-align the assembly, integration and verification (AIV) programme for MetOp-1, -2 and -3 to be in line with the delivery schedule for customer-furnished instruments, specifically IASI, A-DCS and SARP. This re-alignment results in a thinning out of activities in 2001 (reduced parallel working on the EM PLM and MetOp-1 PLM) and an interleaving of work on MetOp-1, -2 and -3 thereafter. Work is continuing on the MetOp-1 PLM, but at a somewhat reduced pace, with the first instrument integration starting in February.

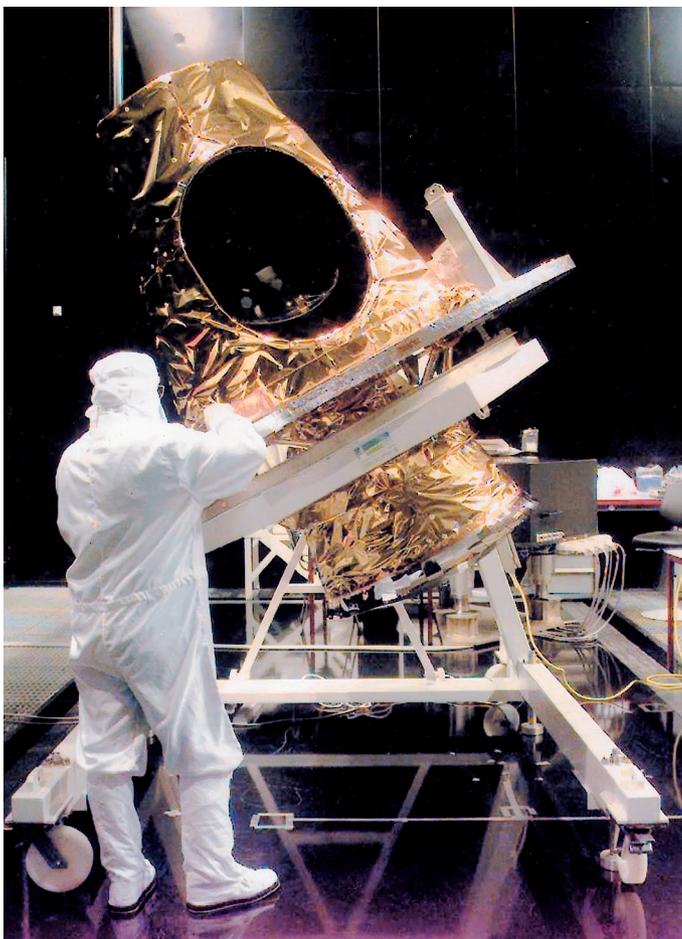
In the meantime, the elements of the MetOp structural model have been delivered to ESTEC for final integration and then vibration/acoustic testing.

Eumetsat has finalised its approval procedures for the core ground segment, allowing the kick-off with Alcatel (F) to take place in January 2001. Eumetsat was also able to finalise the contract with Starsem for the provision of the Soyuz-ST launch vehicle, which is now the baseline for MetOp. Negotiations for this change are underway with the MetOp industrial partners.

Following a programmatic review, Eumetsat has determined that ground-segment system readiness will not be achieved before the second half of 2005, and so the launch of the MetOp satellites would be correspondingly delayed. Under the realigned AIV programme, the first MetOp satellite will be ready at the

The MSG-1 SEVIRI optical instrument during integration at Astrium in Toulouse (F)

The integrated MetOp structural model at ESTEC in Noordwijk



beginning of 2004. The consequences of this launch delay are being assessed in the context of the ESA/Eumetsat Co-operation Agreement.

Envisat

System

The system activities have focussed on:

- preparing and conducting the satellite functional tests and analysing the results
- progressing the Ground Segment Overall Verification (GSOV) tests
- defining the LEOP nominal and contingency procedures
- progressing the Commissioning Phase preparations with the calibration/validation teams, and performing a data-circulation rehearsal involving all of the main players
- preparation of the Flight-Acceptance Review (FAR) and the Ground-Segment Readiness Review (GSRR).

Satellite and payload

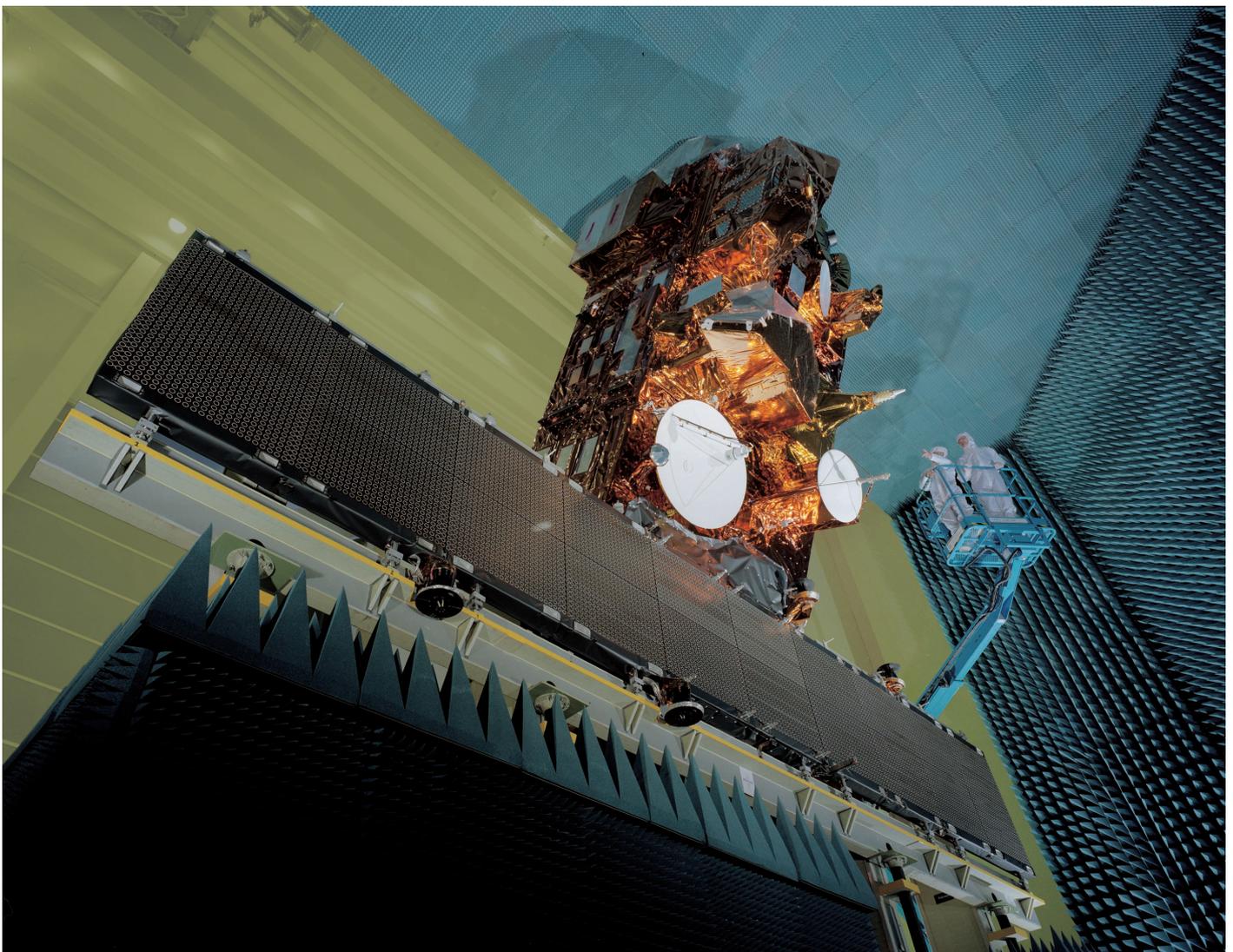
All of the flight-model satellite-verification-programme goals set in February 2000 have been met. Following the successful environmental tests carried during the summer, deployments of the solar array and of the ASAR antenna were performed and confirmed the good health of these two subsystems. Retrofitting of the ASAR antenna was then undertaken. The six repaired transmit/receive tiles were integrated and an overall antenna-operation and performance-stability verification was performed, confirming overall antenna integrity with respect to reference data sets. The ASAR Central Electronics (CESA) was also retrofitted with flight PROMs carrying the updated flight software and antenna coefficients. Functional tests demonstrated the integrity of this subsystem. The second solid-state recorder was successfully integrated. Special Performance Tests (SPTs) specific to each instrument, and designed to verify the instrument's functionality and

performance stability, were successfully performed.

The satellite functional tests, including the Integrated Satellite Tests (ISTs) and System Verification Tests (SVTs), constituted the most critical activities in the last quarter of 2000. Thanks to the very good progress achieved with Payload Module Computer (PMC) software validation, the full suite of ISTs and SVTs was successfully completed before Christmas, allowing preparations for the last major testing exercise, namely the Radio-Frequency Compatibility (RFC) tests, to start.

During the SVTs, the satellite was controlled from the Flight Operations Control Centre (FOCC) at ESOC in Darmstadt (NL). Sustained satellite and payload operations generated by the

The Envisat Radio-Frequency Compatibility (RFC) test configuration



ESOC mission-planning system were successfully commanded and executed for two eight-consecutive-hour periods. These tests provided very good confidence in the satellite software, particularly in terms of validation of the on-board PMC software, which had been schedule-critical, as well as enhancing confidence in the validation of the FOCC and mission planning at ESOC.

The configuring of the satellite for the RFC tests is presently in progress, including the installation of a specially built RF protective enclosure around the spacecraft. These tests, due to start at the end of January 2001, will verify electromagnetic and radio-frequency compatibility between all payload instruments and service subsystems. For this test, the complete flight model satellite, with antennas deployed, is nominally operated with the ASAR and RA-2 radars radiating, telemetry/telecommand links operating, and radiometer/spectrometer instruments in their operational receiving modes.

The AIT programme is on schedule and the Envisat launch has been confirmed for the second half of July 2001. The Ground-Segment Readiness Review (GSRR) and the satellite Flight-Acceptance Review (FAR) are scheduled for the first quarter of 2001 to allow shipment of the satellite to Kourou (Fr. Guiana) for the launch campaign by April 2001.

Ground segment

The FOS part of the ground segment is nominally on schedule and the latest SVT test results are providing high confidence in its validation. Production of the Flight Operation Procedures (FOP) has progressed well and the simulation campaigns, to train operators and to verify the correctness and completeness of the procedures, will start by early February 2001.

As far as the Payload Data Segment is concerned, version V3 integration is in progress. The ESRIN Payload Data Handling Station's formal acceptance testing is in progress. PDS version V3 is currently also being installed at the Kiruna station.

The integration of the Payload Data Control Centre (PDCC) is being finalised, with acceptance testing planned to start in January 2001.

Ground Segment Overall Validation

(GSOV) is currently focusing on the validation of the mission-planning interfaces between FOS and PDS, using realistic operational scenarios to exercise the various functions.

Most of the Processing and Archiving Centres (PACs) are preparing for compatibility testing with the ESA PDS, which is due to start in May 2001.

The calibration and validation groups have been very active during the latter part of 2000, and a rehearsal data-circulation campaign, involving use of the Envisat User Service Facilities, has been performed. Based on these test results and the comments received from the participants, the necessary modifications are being implemented. Workshops are being planned for spring 2001 to present and review the calibration/validation plans with participants outside the calibration/validation teams proper.

International Space Station

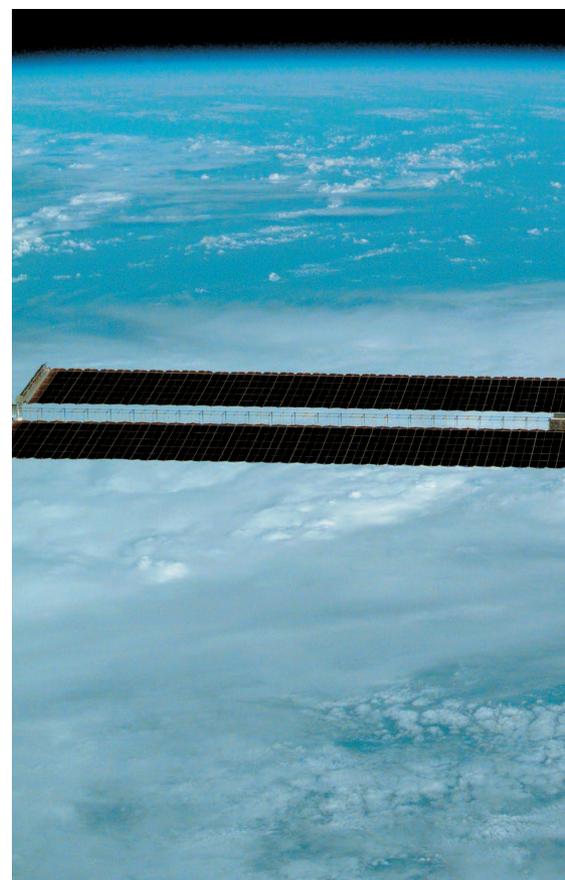
ISS Overall Assembly Sequence

During the reporting period there were three flights to the ISS. Two were primarily assembly flights, but the third flight, on 31 October carrying the 1st ISS Expedition crew (Shepherd, Krikalev and Gidzenko), marked the beginning of a permanent human presence on the Station. The mission objectives set for each of these flights were fully achieved.

On 16 November, the Government of the Russian Federation formally decided to implement controlled de-orbiting of the Mir space station at the end of February 2001.

Columbus Laboratory

The system Critical Design Review (CDR) is underway as planned and will be completed by a Final ESA/NASA Joint Board in mid-January 2001. In parallel, independent NASA Safety Review II has been conducted. No showstoppers have been discovered, although many action items have been generated as a result of the reviews. Following successful completion of the launch and on-orbit Modal Survey Tests on the flight model, the test configuration has been disassembled and integration of the flight harnesses, ducting and plumbing has started.



Columbus Launch Barter

Nodes-2 and -3

Pressure testing on the Structural Test Article (covering ultimate pressure and leak tests) has been successfully completed, and the Modal Survey Test campaign has been initiated.

Crew Refrigerator / Freezer (RFR)

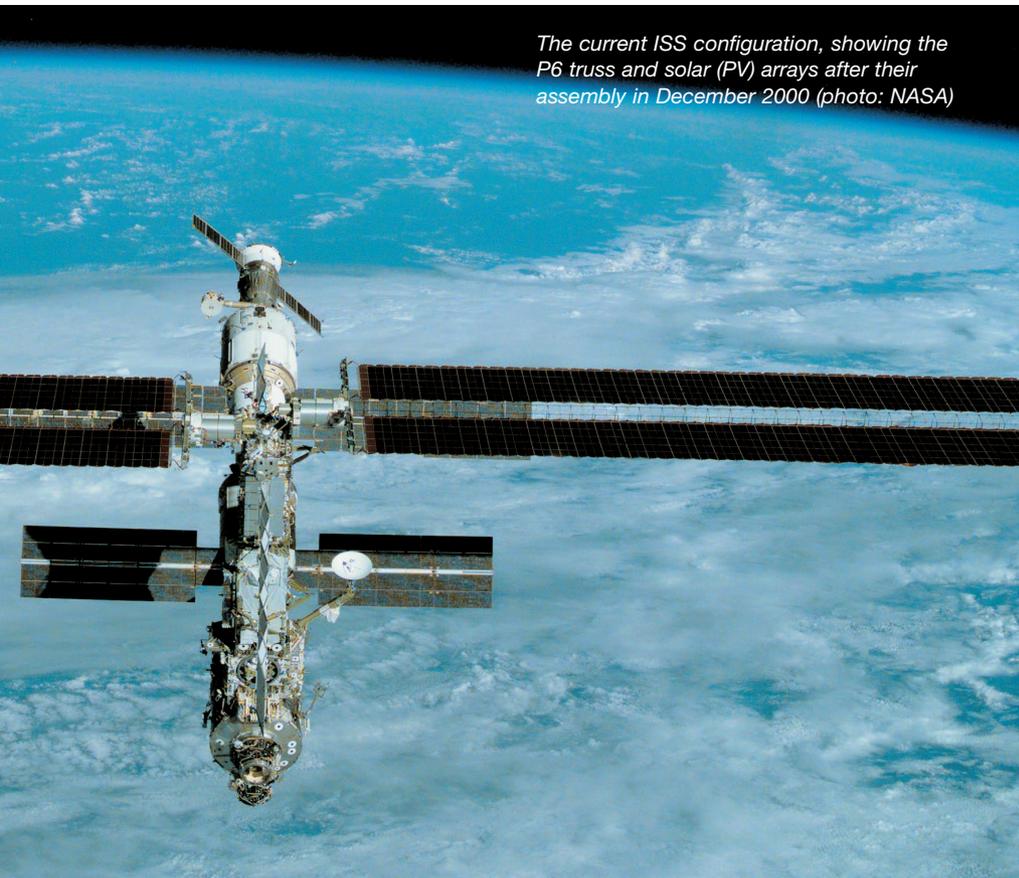
A consolidated set of requirements for accommodation of the RFR in the NASA Habitation Module has been agreed, and industry has been authorised to proceed with Phase-B/CO, covering the detailed design, manufacture and qualification of the first RFR.

Cupola

The Cupola Structural Test Article (STA) dome and ring forgings machining has been completed and the two parts successfully welded together. Pressure testing on the STA is imminent.

Automated Transfer Vehicle (ATV)

Industry has completed an internal evaluation/recovery plan for the ATV project. Technical teams have closed various issues identified in the Preliminary Design Review (PDR) Recovery Plan and the PDR Board endorsed the results in December. An overall schedule review has been performed to successfully establish



The current ISS configuration, showing the P6 truss and solar (PV) arrays after their assembly in December 2000 (photo: NASA)

top-level planning compatible with the April 2004 launch date, and work is underway to ensure that the 'bottom up' planning is compatible with this top-level schedule. Assembly of the Dynamic Test Article is well advanced.

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

The first V131R drop test was completed. Owing to some failures in the control system, the vehicle did not drop as predicted and the parafoil did not fully deploy as planned. Thanks in part to the ESA Parafoil Guidance, Navigation and Control (GN&C) system, vehicle control was recovered and the flight ended successfully, albeit with quite a high landing speed but little/no resulting damage. Wind-tunnel tests are underway to determine the cause of the unpredicted behaviour.

The CRV Phase-1 Request for Quotation (RFQ) has been released to industry and the proposal has been received and is under evaluation.

Ground-segment development and operations preparation

Preparation of the Columbus (COL-CC) and ATV Control Centre (ATV-CC) System Requirements Reviews (SRR) planned for February to April 2001 has continued, as

have preparation activities to support the ESA payload on Zvezda, the Global Timing System (GTS).

Utilisation

Promotion

Preparations for the global Space-Station utilisation conference 'ISS Forum 2001', to be held in Berlin in June 2001, are continuing. A workshop on the European Research Strategy for Life and Physical Sciences in Space, organised by the European Science Foundation (ESF) from 28 to 30 November, was attended by some 50 participants from both space and non-space disciplines.

Two Announcements of Opportunity (AOs) have been released, one in the area of physical sciences and the other specific to exobiology and exposure experiments for the flight of the Biopan and Stone facilities on the next Russian Foton flight.

Most of the 24 projects in the first batch for the Microgravity Applications Promotion programme have been, or are about to be, kicked-off. In parallel, activities have already been initiated for a further batch of 20 projects, finalisation of which is planned during 2001.

X-38 Vehicle V131R in free flight



Hardware development

Both the Phase-C/D contract for the European Drawer Rack and the Columbus Payload Integration contract have been negotiated, and the Phase-C/D contract for the Coarse Pointing Device was signed in October. The Bridging Phase of the European Technology Exposure Facility (EuTeF) has been closed, and the PDR-2 was successfully completed. However, the start of Phase-C/D has been put on hold due to uncertainties regarding the Express Pallet Programme.

Astronaut activities

In October, a 'Delta' Basic Training Course was started at the European Astronaut Centre (EAC) in Cologne-Porz (D) to provide updated ISS System training to experienced ESA astronauts. This is necessary to meet the certification requirements of International Space Station Basic Training.

Astronaut Claudie André-Deshays and the Head of EAC's Astronaut Division, Jean-Pierre Haigneré, were both decorated in October by the President of the Russian Federation, Mr Putin, receiving the Ordre de Courage.

Mission-preparation support is being provided at Johnson Space Center (JSC) for the STS-100/MPLM flight, scheduled for April 2001, with ESA astronaut U. Guidoni. A new flight opportunity involving member of the European Astronaut Corps – Claudie André-Deshays – has been identified on the CNES-sponsored so-called 'Taxi Flight', using the Russian Soyuz/Progress complex, to the Space Station in October 2001. Mrs André-Deshays will start astronaut training at Star City early in 2001 to prepare for this flight.

Early deliveries

MPLM Environmental Control and Life-Support Subsystem (ECLSS)

The contract with industry has been closed following the successful completion of all activities.

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

The fault-tolerant computer complex installed in the Russian Service Module (Zvezda) has continued to perform nominally since its launch on 12 July, except for a few anomalies caused by a problem in the RSC-Energia application software. The problem, which is not

mission-critical, will be fixed together with the planned software update associated with the US Lab launch and docking.

The Control Post Computer (CPC) and laptop computers were unpacked, installed and activated by the Station's first crew on 3 November. Although the CPC has operated flawlessly, some difficulties, now under investigation by RSC-Energia, have been encountered with the two laptops.

European Robotic Arm (ERA)

The ERA flight model has undergone environmental qualification testing (EMC and structural) in the ESTEC facilities. The EMC test was successfully completed and structural qualification has been partly achieved, with some static load tests still outstanding. The flight model has been re-integrated on the Flat Floor and will be used together with the engineering qualification model to continue the functional test programme. Many of ERA's subsystems have been successfully qualified; the remainder will undergo qualification reviews early in 2001. The ERA flight model will be ready for delivery to Russia towards the end of 2001, which is still consistent with the delayed Russian Scientific Power Platform (SPP) schedule.

Laboratory Support Equipment (LSE)

Hardware for the -80 degC Freezer (MELFI) has been pre-accepted for integration into the first MELFI flight unit, and agreement has been reached with NASA for the delivery of MELFI integration products. Agreement has also been reached with NASA for the Microgravity Science Glovebox (MSG) to be carried on Space Shuttle flight UF-2 in February 2002. The Hexapod Critical Design Review (CDR) has taken place successfully.

ISS Exploitation Programme

The Operations Preparation Detailed Definition Study has been kicked-off with industry, and an engineering change request for the Exploitation Programme Early Activities has also been released to industry. The evaluation and negotiation of the proposal that was subsequently received is complicated by the revised Manufacturing, Assembly, Integration and Test (MAIT) concept of the ATV development programme, which requires early procurement of a first production model. Preparation of the Request for Quotation (RFQ) for the Exploitation

Programme Operations Contract has continued and it is intended to release it to industry early in 2001.

The ISS image-promotion concept has been defined, identifying target segments and phasing of promotion campaigns and Pathfinder projects for commercial utilisation have been evaluated and are close to commitment. Co-ordination with the International Partners has continued specifically in the areas of sponsorship, merchandising and advertising, and ESA's Council has approved the approach to the implementation of commercial utilisation.

Microgravity

EMIR programmes

The 29th parabolic-flight campaign took place from 20 to 24 November 2000. A mixed payload of physical- and life-sciences and student experiments was successfully completed. The 30th ESA campaign is planned for mid-May 2001, with both physical- and life-sciences experiments onboard.

Preparations continue for Shuttle/Spacehab mission STS-107, for which ESA has a number of multi-user facilities designated for flight covering both the life- and physical-sciences. That mission is scheduled for August 2001.

Microgravity Facilities for Columbus (MFC)

Testing of the Biolab engineering model started in December, and manufacture of the flight model will start in May 2001. Some delays have occurred in Materials-Science Laboratory (MSL) and Fluid-Science Laboratory (FSL) subsystem manufacturing. Their Critical Design Reviews will be completed by end-April 2001. The MSL using Electro-Magnetic Levitator (MSL-EML) technology Phase-A/B will start early in 2001.

An agreement with the Canadian Space Agency (CSA) for the provision of the Microgravity Vibration Isolation System (MVIS) for the Fluid-Science Laboratory (FSL) has been concluded, and the provision of Cardiolab by CNES/DLR for the European Physiology Module (EPM) has been approved.