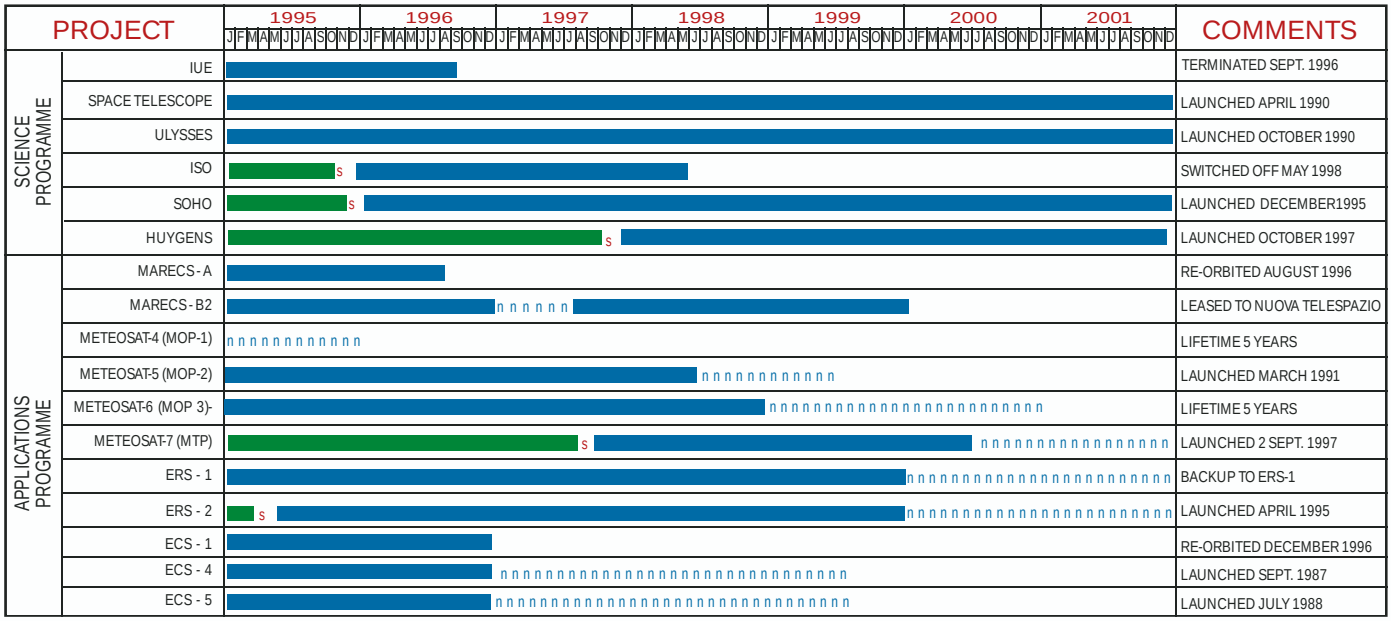
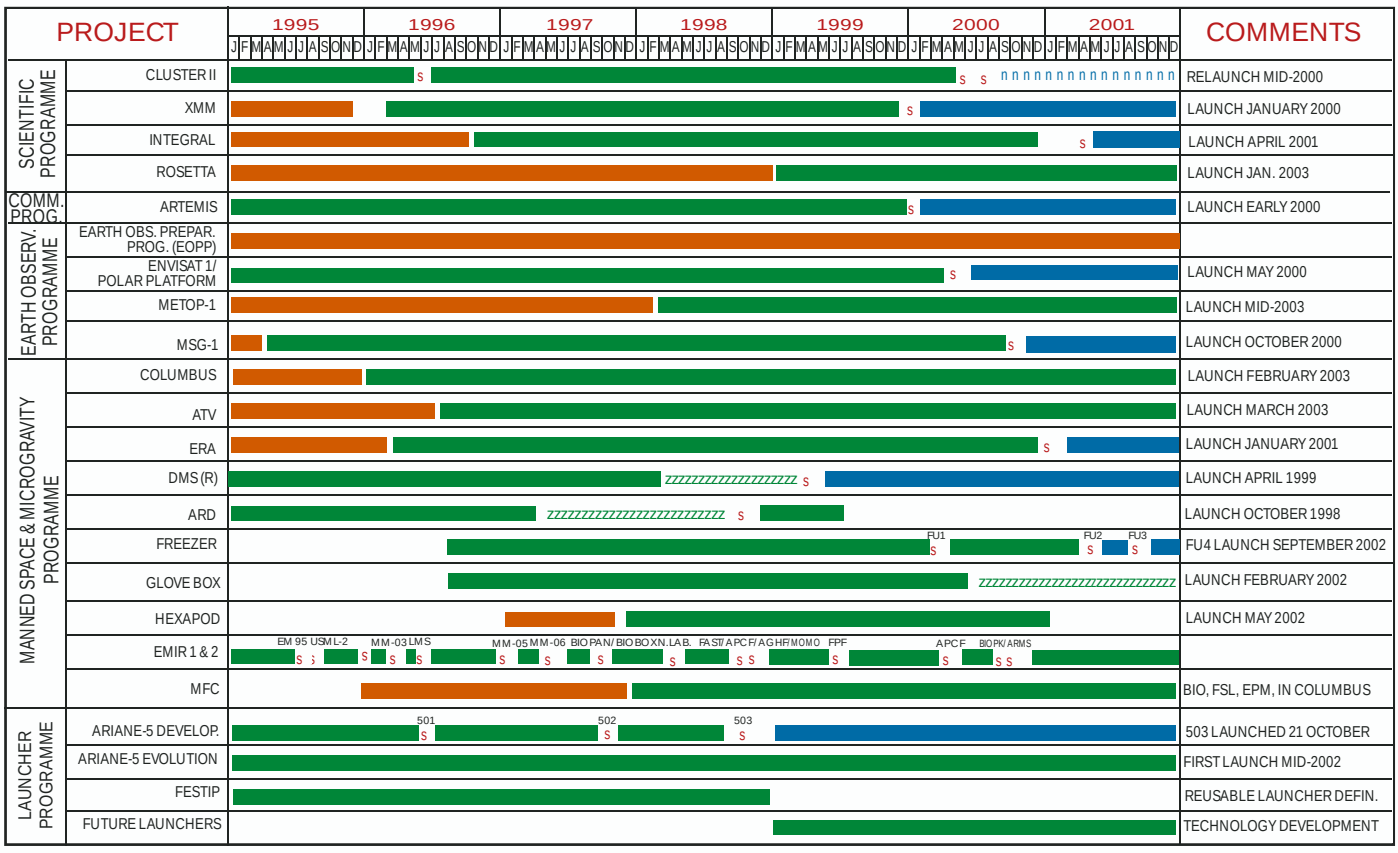
Programmes under Development and Operations
Programmes en cours de r alisation et d'exploitation
(status end September 1998)

In Orbit / En orbite



Under Development / En cours de r alisation



DEFINITION PHASE
MAIN DEVELOPMENT PHASE
s LAUNCH/READY FOR LAUNCH
OPERATIONS
ADDITIONAL LIFE POSSIBLE
t RETRIEVAL
STORAGE

Ulysses

Mission and spacecraft status
The Ulysses spacecraft, heading progressively further south of the Sun's equator, reached its maximum distance from Earth (6.35 astronomical units, or 951 million km) at the end of August. This also marked the sixth conjunction period of the mission, when the Earth, the Sun and Ulysses are in close alignment. Because the Sun-Ulysses-Earth angle becomes small (0.9 deg during this particular conjunction), careful spacecraft manoeuvring was needed to keep the Solar Aspect Angle (the angle between the spin axis and the spacecraft-Sun vector) within the predefined operational limits. Data recovery during the conjunction period has been somewhat reduced, both because of expected loss in performance of the downlink as a result of the proximity of the line-of-sight to the Sun, but also due to the non-availability of ground stations caused by the SOHO recovery operations. All spacecraft subsystems and experiments continue to perform well.

Science highlights
The surge of solar activity at the end of 1997 was followed by a more extended outburst in April and May of this year. As in the earlier case, the effects were clearly observed both at 1 AU and at the location of Ulysses, five times further away. A comparison of data obtained by the instruments onboard Ulysses and data acquired at 1 AU formed one of the themes of the Ulysses Aphelion Workshop, held at the end of October in Oxnard, California. Other topics included a general discussion of the scientific questions to be addressed by Ulysses during the solar-maximum phase of the mission, and a detailed examination of new insights gained into shock physics as a result of Ulysses' observations.

As in past years, Ulysses results featured prominently at the recent COSPAR Scientific Assembly. Highlights included further developments of the heliospheric magnetic-field model first proposed by Fisk to explain the persistence of recurrent increases in the flux of energetic particles at high heliographic latitudes observed by Ulysses. Recent work has shown that magnetic reconnection in the streamer belt at low latitudes, a necessary element of the Fisk model, could provide a natural way of opening up closed magnetic-field loops, thereby allowing loop material to flow out into the heliosphere as the slow solar wind.

Ulysses' slow transit of the equatorial regions at a radial distance of 5 AU around aphelion, coupled with the very quiet solar conditions existing during much of 1997, have provided a unique opportunity to measure the true radial variation of the anomalous cosmic-ray component in the inner heliosphere, free from latitudinal effects. ACRs are interstellar neutrals that become ionised in the solar wind, and subsequently gain energy in the distant heliosphere to become part of the cosmic-ray flux. This measurement, made in collaboration with SOHO and of importance for cosmic-ray transport theories, was not possible during the in-ecliptic phase of the mission (prior to Jupiter encounter) because of the high level of solar activity that masked the ACR component.

Archive
The ESA Ulysses archive is accessible via the World Wide Web at URL:

http://helio.estec.esa.nl/ulysses/archive/.

The data from the Ulysses Jupiter Encounter (February 1992) have been archived via the NASA Planetary Data System, and have recently been issued on CD-ROM.

Hubble Space Telescope

HST continues to operate very smoothly and successfully. The deadline for the 8th Cycle of HST observations expired on 11 September and the proposals received will be reviewed in November/December.

During the summer, the NICMOS instrument was heavily used in view of its approaching end-of-life. The mass flow of cryogen through the capillary tube has been monitored and found to remain constant. The exhaustion date prediction is therefore unchanged (December '98 / early January '99), but the formal end to science operations for NICMOS has been set at 15 November 1998. After that date, three calibration proposals will be run to monitor the instrument's behaviour during the warm-up period.

The preparatory work for the next complex Maintenance and Refurbishment Mission (Spring 2000) continues: a number of subsystems will be space-validated during the flight of the Hubble Space Telescope Orbiting Systems Test (HOST) platform aboard the STS-95 Shuttle mission, due to be launched on 7 November 1998. Of these, the NICMOS Cooling System will allow zero-g verification of a Reverse Turbo Brayton Cycle Cooler, which should give new life to NICMOS. The possible installation of the cryocooler will be critically reviewed, both scientifically and technically, in the following months. ESA representatives will participate in the review process.

The Shuttle Crew for the next Maintenance and Refurbishment Mission has been selected and includes ESA Astronaut Claude Nicollier, who participated in the first M&R Mission in December 1993.

A new 'HST 2nd Decade Committee' has been formed (with ESA participation) and met for the first time this summer: its charter is to provide indications for the best scientific exploitation of HST in the next second decade of operations, taking into account the interrelationship with other projects like NGST, VLT, Keck, Gemini, etc. The second meeting will take place at the Space Telescope European Coordination Facility (ST-ECF) next November.

The possibility of installing a redundant imaging capability during the last M&R Mission to HST is being studied by an ad hoc Committee (again with ESA participation).

A data set of WFPC2 images taken over the last 4 years are being analysed at the Space Telescope Science Institute (ST-ScI) with the aim of monitoring the camera's photometric stability.

Similarly, the entire data set of the FOS Instrument has been analysed by the ST-ECF in order to assess possible improvements in the calibration. It was found that a better correlation with the magnetometer readings can substantially improve the wavelength calibration, particularly for the red channel. The new calibration scheme has been agreed upon between the ST ScI and the ST-ECF and will be implemented within the frame-work of the new Memorandum of Understanding (MOU) agreement .

As part of the same agreement, the ST-ECF is participating in the production of the Guide Star Catalogue II, which will be used operationally by new instruments such as the Advanced Camera for Surveys.

The concept of 'on-the-fly calibration', which has been successfully implemented and run at the ST-ECF for more than two years, is being considered for implementation in the ST-ScI Archive as well.

Recent scientific highlights include the detailed study by a European group of a dense cluster of young stars in the Small Magellanic Clouds. This study is providing insight into the stellar evolution in a metal-poor environment, similar to the one prevailing in the early cosmic ages. Results and pictures can be found at:

http://ecf.hq.eso.org/stecfpubrel.html.

Huygens

Spacecraft status
The Cassini/Huygens spacecraft flies with its High-Gain Antenna (HGA) continuously pointed at the Sun to shade the whole spacecraft, and the Huygens Probe in particular. The in-flight activities are proceeding very smoothly.

An off-Sun turn (by 12°) was executed on 28 May in order to perform a special Huygens test (see below).The spacecraft will remain in the HGA-to-Sun attitude until 28 December, whereafter the alignment of Cassini with the Sun-Earth line on 9 January 1999 will allow the HGA to be used to communicate with the Earth, in addition to still being used as a Sun shield. By allowing off-Sun pointing by up to 12°, the HGA will be kept pointing at Earth from 28 December to 21 January. During that period, Huygens will be slightly exposed to the Sun, but the detailed thermal predictions that have been made show that the interior of the Probe will remain well within acceptable temperatures for the batteries.

The high data rate that will be available through the use of the HGA will allow a thorough, month-long, in-orbit checkout of the Orbiter payload to be conducted. This activity could not be carried out before due to the limitations on the downlink data rate imposed by the Low Gain Antenna (40 bps most of the time).

Science operations
In spite of operational limitations, three engineering/science activities were carried out during the Venus-1 flyby. The Radio and Plasma Wave Science (RPWS) instrument conducted a several-hour-long search for radio signals caused by lightning in the Venusian atmosphere. A preliminary analysis indicates that, primarily because of the data-return limitation, the observations are inconclusive because strong plasma effects were predominant below 80 kHz. The Radar instrument conducted an engineering test near closest approach. It allowed the full functionality of the radiometric part of the instrument to be verified. The unfavourable geometry did not allow successful acquisition of a signal 'bounced' from Venus' surface. Finally, during the portion of flyby when the spacecraft flew behind Venus (as seen from the Earth), atmospheric occultation data were obtained.

Planning has started for conducting an optimised set of science observations during the Venus-2 encounter (24/06/99) and the Earth flyby (18/06/99), within the restricted operational capability of Cassini at that time.

Huygens flight operations
The second in-flight checkout of the Huygens Probe was conducted on 27 March 1998. All six payload instruments reported excellent results, as did all Probe electrical subsystems that were tested. The change in the signal level of the Probe-to-Orbiter umbilical radio link, which had already been observed during the first in-flight checkout, was again detected. It was hypothesised that this change was caused by solar radio noise picked up by the Sun-pointing HGA. A special off-Sun test, with the HGA de-pointed by 12° for a short period, was carried out on 28 May. The results of this test confirmed the solar-noise hypothesis, and allowed the excellent health of the Huygens radio receivers in a noise-free environment to be established.

Currently, the Probe command sequence to be used for the next checkout is being validated using the flight-representative Probe engineering model located at ESOC in Darmstadt (D). This command sequence will subsequently be sent to JPL for uploading to the spacecraft.

The next Huygens in-flight checkout will be carried out on 22 December 1998. This test is scheduled just a few days before the HGA opportunity (see above). The Huygens checkout data will be played back during the first day of the HGA opportunity on 28 December, i.e. five days after the checkout, to allow the Probe to cool down before it is exposed to the Sun.

Cluster-II

The Pre-Integration Review for the first new flight spacecraft (FM 6) has been successfully held. This releases the start of integration of the subsystems and payload. The structure has already been delivered and the harness integrated. The deliveries for the rest of the units are still going according to schedule. Some problems have occurred with respect to the manufacturing of the memory packages of the solid-state recorder. It is believed that these have now been resolved and work-around solutions for the integration and testing of the first unit, which is not completely flight standard, have been agreed.

Most of the first payload elements are now undergoing final calibration and will then be ready for integration into the spacecraft.

The contract between Starsem and ESA for the launch of the four Cluster-II spacecraft using two Soyuz launch vehicles has been signed. The two launches are planned to take place approximately one month apart in the middle of 2000.

Preparations are underway for moving the antenna originally foreseen for use with Cluster from Odenwald (D) to Villafranca (E), which will then be the primary ground station during the Cluster-II main operations phase.

XMM

Work on the flight satellite is progressing at Dornier (D). The service module of the

satellite is fully integrated and will be delivered for testing at ESTEC by mid-October 1998. The focal-plane assembly which houses the X-ray instrumentation is re-scheduled to arrive at ESTEC in February 1999, after integration and testing of the remaining X-ray instruments.

At Centre Spatial de Liège (CSL), combined testing of the spare mirror module with the associated X-ray baffle and reflection grating is reaching completion. The validation of the stray-light behaviour of the complete optical path has been completed with wide-angle stray-light tests, conducted during the summer at DASA in Munich. These tests yielded excellent results.

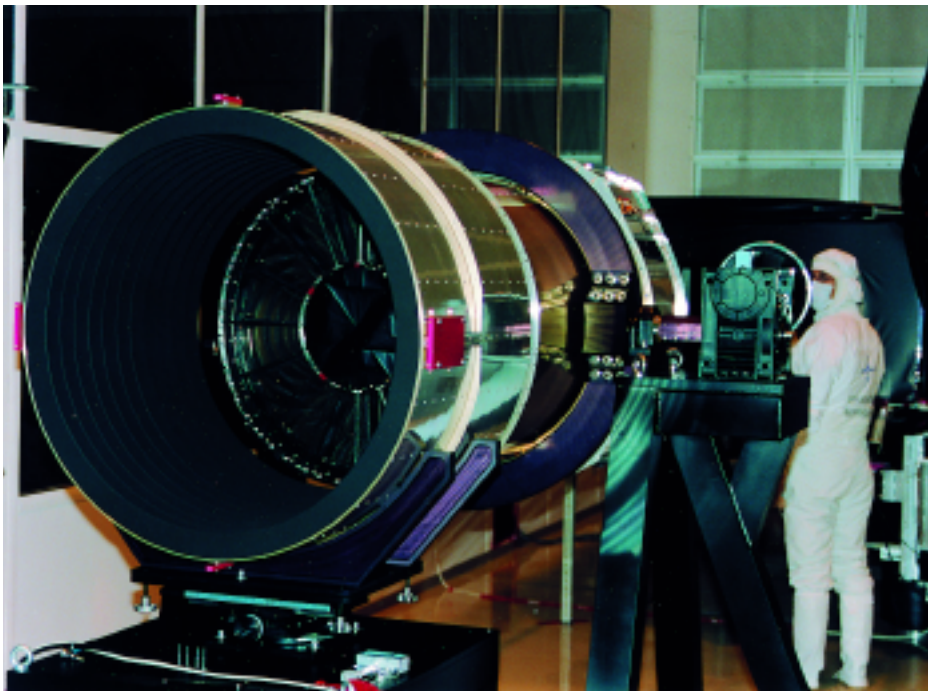
During the summer, efforts on the scientific-instrument side were concentrated on testing and analysing the behaviour of the imaging cameras. This process has been slowed by a number of difficulties, which took time to analyse. The results of this work now show that these instruments will have very good performance. The deliveries of the instruments have been re-scheduled for October 1998. Based on these new dates and the ensuing re-arrangements of the assembly, integration and verification (AIV) schedule, the Flight Acceptance Review will now be held in October 1999. The launch will then take place in January 2000.

The ground-segment implementation review has been completed and the baseline documentation is being updated. In the meantime, the deliveries of mission-control software elements continue as planned. A first combined test linking the mission-control software and the spacecraft will be conducted in October.

Integral

After many years of planning, design and analyses, Integral is now definitively in the hardware phase: the testing programme for the Structural Thermal Model (STM) is nearing completion and the Engineering Model (EM) programme has started.

The STM test programme is proceeding according to plan. The Service Module, received from XMM after completion of their mechanical/thermal qualification, had to undergo a few planned modifications (i.e. thruster locations, antenna positioning, interface to Payload Module (PLM), various subsystem boxes, thermal hardware configuration). The instruments have been integrated for the first time on the PLM. No particular problems have been encountered.



An XMM mirror assembly (flight model no. 3) on a test bench at DASA in Ottobrunn (D)

Ensemble du miroir d'XMM (modèle de vol no. 3) sur banc d'essai chez DASA à Ottobrunn (D)

As a result of a major effort by the industrial team, the crucial start date for the thermal-balance test was met. After successful completion of that test and the mass-properties measurements, the mechanical qualification tests (modal survey, acoustic and shock separation) have started. The STM programme is planned to end in October 1998 with the vibration test at IABG (D).

Rosetta

The selection of equipment suppliers is nearly complete after a long evaluation process which has involved the assessment of more than one hundred proposals. The Rosetta industrial consortium, under the leadership of Dornier (D), is now well consolidated and good progress is being made on all technical aspects of the spacecraft design.

The spacecraft configuration has been frozen and work in industry is now focussed on detailed technical design and on finalising the first round of mechanical and thermal analysis in time for the System Design Review (SDR) planned for October-November 1998.

A severe mass-reduction exercise, which has affected both the spacecraft's and the instrument's design, is nearly complete. Together with the thermal design of the spacecraft, this remains one of the major concerns for the project and will require constant attention.

Design Reviews are also being implemented on the payload side at experiment level, and for the ground segment where the first Requirements Review is under way.

The contract for the procurement of the new 34 m antenna destined for the Perth (Aus.) ground station has been awarded to the Canadian company SED.

Artemis

The Artemis satellite arrived at ESTEC for its system-level test campaign on 30 June. After some final integration activities, it has been successfully subjected to a full series of electrical tests, including electromagnetic compatibility testing.

The satellite is now proceeding into the environmental test campaign, starting with a solar-simulation phase.

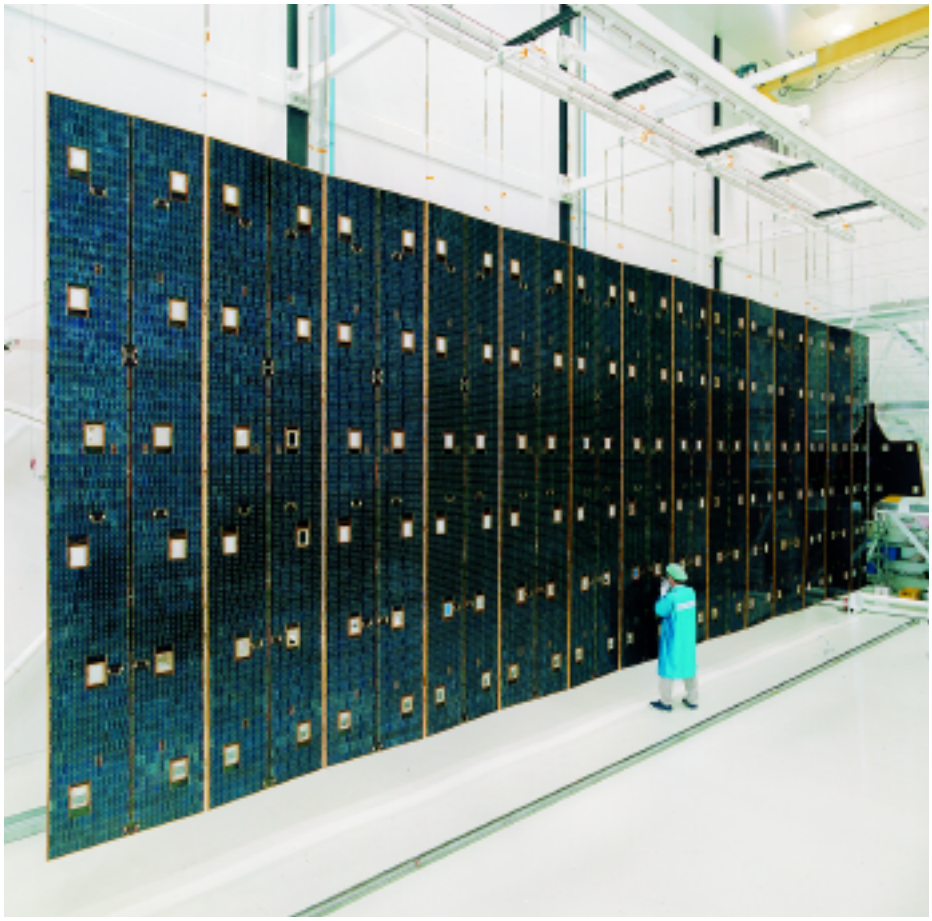
EOPP

Strategy and future programmes
Activities leading up to and at the June meeting of the ESA Council have resulted in two very significant developments in terms of the implementation of the ESA Earth Observation Strategy. Under the title of EOPP Special Extension, as a transitionary measure before the next Council Meeting at Ministerial level, Delegations have agreed to an initial implementation of the Earth Observation Envelope Programme. At the same Council, the subscription and participation to EOPP Extension 2 was raised to the critical level to allow the start of the first four Phase-A studies for the Earth Explorer Core Missions.

Future missions
In the context of the Earth Explorer element of the proposed Earth Observation Envelope Programme, the Phase-A studies for four candidate core missions were kicked-off in early July. Following the seminar on the Land Surface Processes and Interactions mission, two further seminars have been held in connection with the Earth Radiation mission and the Gravity Field and Steady State Circulation mission, with Delegate, scientist and industry participation. The Call for Proposals by lead investigators for the first opportunity mission was released by mid-July.

During this same period, the assessment of the Call for Outline Earth Watch Proposals was also completed. The results of this assessment will now be put forward for discussion with the Delegations, together with the initiation of parallel technical activities.

Campaigns
Preparations for the CLARE 98 (Cloud Lidar And Radar Experiment) have advanced through experimenter review and implementation preparations.
In August, a small-scale campaign in support of the Land Surface Processes and Interactions mission took place in Spain. This was a precursor to a possible large-scale campaign in 1999.



Envisat/Polar Platform flight-model solar-array deployment during acceptance testing at Fokker Space (NL)

Déploiement du générateur solaire du modèle de vol de la Plate-forme polaire d'Envisat pendant les essais de recette chez Fokker Space (NL)

Envisat/Polar Platform

Envisat system
The Announcement of Opportunity (AO) for scientific data exploitation and pilot projects has attracted very high interest in the Earth Observation user community. The more than 700 proposals received are currently being evaluated and the results of the selection process will be published before the end of the year.

System activities are now focusing on the preparations for the system verification. A verification plan for the integrated ground segment has been defined and initial testing will start by the end of 1998. The major flight-model (FM) system tests are under definition, such as the FM Thermal Balance/Thermal Vacuum (TB/TV) test scheduled for March 1999 at ESTEC.
A satellite-level qualification review is planned for the first half of 1999.

ENVISAT payload
The ASAR engineering-model (EM) antenna has been delivered, thereby completing the delivery of the EM instruments. In accordance with the split-delivery approach, the EM ASAR is now under instrument-level testing on the Polar Platform at Matra Marconi Space in Bristol (UK). The FM ASAR antenna active tiles have started to be delivered for higher level integration and all show good performance.

The RA-2 FM testing is nearing completion. All tests performed so far (performance on one chain, EMC, I/Fs) have shown excellent results.

The Laser Retro Reflector FM has been accepted and is ready for shipment to Matra Marconi Space (UK). Testing of GOMOS has been completed at CSL (Liège) and preparatory work for delivery has been initiated.

An internal mechanical-vibration problem on the AATSR instrument has been identified and potentially resolved by a modification to the instrument's Focal-Plane Assembly. This solution still needs to be validated and implemented on the flight model.

Polar Platform and satellite activities
The Envisat satellite engineering-model programme has progressed with the completion of the EM ASAR antenna integration. This finalises the EM Payload Module configuration. This Module has then to be reassembled with the FM Service Module so as to constitute a complete EM satellite, which will then undergo system testing, and in particular the radio-frequency compatibility test. For this test, a complete RF enclosure must be built around the satellite, and this is now almost finished.

The flight-model Payload Module is taking shape with the integration of all the electronics of the payload equipment bay with the payload carrier structure and harness.

In parallel, the development of the remaining flight units has progressed. A memory manufacturing problem has occurred which will have an impact on the delivery of the solid-state recorder; workarounds are being investigated. The flight-model solar array is undergoing final acceptance tests (see accompanying picture).

The issue of shock compatibility with Ariane-5 has progressed with the proposal by ESA to implement a shock attenuator on the launcher. This solution still needs to be consolidated technically and programmatically.

Envisat ground segment
The Payload Data Segment (PDS) validation phase has started with the successful completion of the first Test Readiness Review (TRR). While integration of the PDS facilities is progressing well on the reference platform at Datamat (I), integration of the first equipment items is about to start.

The Flight Operation Segment (FOS) development and integration is progressing according to plan, the next major milestone being the Satellite Verification Test 1, planned for end-1998.

Meteosat

Meteosat operations
Meteosat-7 is operating nominally and should continue to function until the launch of the Meteosat Second Generation spacecraft, scheduled for October 2000.

Meteosat Second Generation
The satellite STM (Structural and Thermal Model) has now been prepared for mechanical testing. To this end the SEVIRI thermal dummy has been replaced by the actual SEVIRI STM. The accompanying picture shows the SEVIRI Engineering Model (EM), which is presently under integration at Matra Marconi Space (F) prior to being delivered to Alcatel Space in Cannes (formerly Aerospatiale) at the beginning of 1999 for integration into the EM satellite.

As in the previous phase, Critical Design Reviews (CDRs) at equipment and subsystem level are continuing with the aim of releasing flight-hardware manufacture. The System CDR is still planned for October 1998.

The development of the MSG-1 spacecraft and the procurement of MSG-2 and MSG-3 are on schedule, with engineering-model and some flight-model production in progress at equipment and

Integration of the engineering model of the SEVIRI instrument for Meteosat Second Generation (MSG) at Matra Marconi Space (F)

Intégration du modèle technologique de l'instrument SEVIRI destiné au Météosat de seconde génération (MSG) chez Matra Marconi Space (F)

subsystem level. The SEVIRI instrument, together with the mission communication subsystem, remains on a critical path for the first flight model.

The launch of MSG-1 remains on schedule for October 2000, with MSG-2 to be launched in 2002 and MSG-3 to go into storage in 2003.

Metop

Design consolidation and the freezing of the satellite configuration has now been very largely achieved. Some uncertainties remain, especially in so far as the Customer Furnished Instruments (CFIs) are concerned. However, good progress has been made in this area also, with the US-supplied instruments' interfaces now essentially finalised. The design envelopes for the less well established CFIs (TASI, GOMB-2) are also in place and, although some detailed iteration has still to be expected, this should not adversely impact the satellite development.

The Preliminary Design Review (PDR) cycle is thus now underway, with unit-level PDRs being held, leading up to the satellite system PDR, which is scheduled for mid-1999. Equipment design is now substantially frozen and the hi-rel parts procurement, for example, is now well underway. Manufacturing has started in some areas.

The GOME-2 and GRAS proposals have been received, and evaluation, selection and negotiation should be completed in time to start the main development effort (Phase-C/D) for these instruments by the end of the year.

On the programmatic side, a major step forward has been achieved within Eumetsat, in that a special meeting of their Council has authorised the start of the EPS programme, including a full commitment to the ESA Metop-1 Programme. The Eumetsat approval process is not quite complete, however, in that 14 States (representing 83% of the required funding) have fully agreed to the programme, whilst 3 States have still to complete their national procedures and thereby lift their current 'ad referendum' votes.

This very positive step now permits the full release of the Metop industrial activities and should allow the finalisation and signature of the joint ESA/Eumetsat contract with the Prime Contractor (Matra Marconi Space) in the near future.

ERS

ERS system operations are continuing to run very smoothly, with excellent performances from both the space and ground segments. The ERS-2 payload is providing high-quality data with very good availability.

After the gyroscope failure on 3 June, satellite pointing is stable and within specification. The performance monitoring of the attitude and orbit control system has been increased and new mechanisms to reinforce this system are being set up.

ERS-1 is in hibernation, but the periodic checkouts show that the payload's performance level is being maintained.

To maintain the performance of ERS-1's batteries, the satellite's SAR image mode is activated once per day. This routine switch-on is being exploited to perform ERS-1/2 SAR interferometry by planning the acquisition of SAR image pairs.

In-orbit Technology Demonstration Programme

DDE
The Discharge Detector Experiment (DDE) will be delivered to NPO PM at the end of November 1999. There it will undergo the final test campaign and be integrated on the Espress-14 spacecraft. The software and electrical interfaces with the spacecraft were successfully tested at ESA's Moscow Office in May. The flight units for the experiment are presently being completed.

PROBA
The recent space-segment System Design Review showed that good progress has been with PROBA (Project for On-Board Autonomy). The structural model and mass dummies are being manufactured and assembled prior to mechanical and thermal qualification early in October. Hardware-unit manufacture has been released in order to have the data-handling engineering model ready by the end of the year for integration together with the other EM equipment due to arrive thereafter.

A new and more advanced type of solar cell has been selected, featuring 200 µm-thick, 4 cm x 4 cm gallium-arsenide cells on a germanium substrate with integrated diode (integral diode) protecting the cell against reverse breakdown under, for example, shadow conditions.

The SDR highlighted the criticality of the software development and it was decided to co-locate the software development team at ESTEC, thereby providing good facilities and easy access to in-house expertise. The Qualification Design Review (QDR) is planned for the second quarter of 1999, leading up to a mid-2000 launch.

FEEP
The payload-accommodation requirements for the FEEP (Field-Emission Electric Propulsion) system for using a Get-Away-Special (GAS) cannister on the Shuttle (G-752) have been forwarded to NASA, which is currently evaluating the request. The preliminary safety data package is in preparation. Models of the experiments are nearly complete and will allow modal analysis as well as dimensioning and positioning forecasts. FEEP thrusters have been assembled – two methods of nickel deposition have been used – and the test activities will begin soon.

All in all, the FEEP programme is proceeding according to plan.

International Space Station Programme

ISS overall assembly sequence
As a result of the worsening financial situation in Russia, the launch of the Service Module will have to be further delayed from April to June/July 1999. In addition, there is a clear indication that RSA will be financially unable to support the launch of the number of Soyuz/Progress vehicles foreseen for 1999 in Revision D of the ISS Assembly Sequence. A series of meetings is scheduled for end-September to address the consequences

on the overall ISS Assembly Sequence and potential actions to safeguard against further problems on the Russian side. A Space Station Control Board (SSCB) is scheduled for early October.

Columbus Laboratory (COF)
Further meetings with NASA have taken place addressing the proposed joint NASA/ESA bilateral test and verification agreements, the Command and Data Management software verification, the launch-to-activation timeline, agreement on the incorporation of the NASA PEHG (Payload Ethernet Hub/Gateway) in the Columbus module, the loan from NASA of an International Standard Payload Rack (ISPR) and secondary structures for test and launch purposes, and common display/graphics standards.

ESA and NASA have reviewed the implementation of the External Payload Facility (EPF) and the fire-suppression modifications. Discussions with NASA safety authorities indicated that they are satisfied with the principles of the Columbus revised approach to fire suppression. The initial design of the NASA Express Pallet has been simplified, thereby making it easier for ESA to maintain a degree of inter-changeability for the payloads.

The system Electrical Ground Support Equipment (EGSE) deliveries have started, and the system Electrical Test Model assembly has begun. Problems have occurred with the Data Management Software, and its delivery will be some months later than originally planned. Equipment-level qualification tests have started, and preparations are underway for the first integrated-subsystem-type tests.

COF launch barter
Design changes to Node 2, to accommodate crew quarters and revised internal configuration layouts, have been performed. As a result of these changes, a shift in the delivery date to NASA, from August to October 2000, has been agreed. The re-engineering principles for Node 3, to make it the crew accommodation quarters until the Habitation Laboratory is launched, were agreed with NASA and a Reference Design Review was conducted in July. Formal ASI/NASA agreement on the re-engineering has not yet been achieved. In the context of Software Deliveries/ DMS-R items / Associated Sustaining Engineering for NASA, final hardware deliveries have been completed to NASA and Software Verification Facility (SVF) support at Johnson Space Center continues.

The start of Phases-B,C,D for the Crew Refrigerator/Freezer Racks (CR/FR) has been delayed because NASA is reviewing where the CR/FR will be installed in the Station. Transhab has been suggested as a new location, but its utilisation has not yet been approved. An initial contract to study and breadboard critical design areas has been started with industry to ensure timely delivery of the system. Phase-A for the Cryogenic Freezer Racks was completed at the end of June and the release of the Invitation to Tender (ITT) for Phases-B/C/D/E is scheduled for end-October.

Cupola 1 and 2
Following intensive technical discussions with NASA on the implementation of the Barter Arrangement (under which ESA will supply two Cupolas for the ISS), ESA is now responsible for the overall Cupola Segment and its verification. This led to modifications to the ITT that was subsequently released. Industrial proposals are due at the end of September.

Automated Transfer Vehicle (ATV)
A dedicated working group supported by ESA, NASA and Aerospatiale has been investigating a possible back-up scenario with the ATV being berthed on the Node 3 nadir port (on the US Segment) of the Space Station. This scenario is considered technically and operationally feasible and a decision on whether to chose this option is expected in September.

Following an ESA/RSA Level-1 meeting in July at which RSA stated that they were not ready to barter RSA/RSC-Energia activities required for integrating the ATV with the Russian Segment against long-term DMS-R support needed from ESA, it was decided to provide RSA with the ESA financial targets for the ATV integration work, as well as the targets for the procurement of Russian hardware needed for the ATV.

At the Level-1 meeting, ESA informed RSA about the parallel activities being undertaken with NASA to investigate an alternative scenario under which the ATV would berth to the US Segment. RSA provided an initial letter of response to the ESA targets in mid-August, and further negotiations are planned for early-September to try and reach a firm agreement on all technical, programmatic and contractual aspects.

Negotiations of the Phase-C/D contract were concluded in July. However, taking into account the uncertainty regarding the ATV location at the Station, a Preliminary Authorisation to Proceed (PATP), covering the period until end-September, was signed at the end of July. Signature of the contract is now expected at the end of September.

Negotiations with Arianespace have started to establish a frame contract for the procurement of Ariane-5 launch vehicles for ATV flights. It is worth mentioning that the missions covered by the ISS Exploitation Programme represent Europe's prime means to trade-off its share of the ISS Common Operations Costs.

Crew Transfer Vehicle and CRV/X-38 co-operation
All of the 13 ESA subsystems/major elements of the X-38 V-201 spacecraft are now in the detailed design, development and manufacturing phase.

Discussions on the current X-38 co-operation, on ESA's future involvement in the CRV programme, and on ESA's early commitment for ESA-furnished essential elements of the operational CRV (Crew Rescue Vehicles based on the X-38 concept) have led to a good understanding between NASA and ESA. A corresponding Protocol concerning the formal CRV/X-38 co-operation has been established for signature in September.

In August, the Request for Quotation (RFQ) for the new ART (Applied Re-entry Technology) programme was issued, and a proposal from industry was received and evaluated. Assuming that the Agency's Industrial Policy Committee (IPC) approves the contract proposal in September, it is planned to award the contract in early October.

Atmospheric Re-entry Demonstrator (ARD)
Since June, the ARD itself has been stored at CSG (Centre Spatial Guyanais) in Kourou. The final mission-analysis and flight-readiness review for Ariane-503 and its payload, including the ARD, took place

successfully during July and August. The validation of the communications links between CSG, the Libreville station, the Toulouse Control Centre, the ARIA aircraft and NASA Goddard Space Flight Center (GSFC) was also successfully completed.

Ground-segment development and operations preparation
With respect to the Control Centres, the study with CNES/DLR to define the facilities at DLR in Oberpfaffenhofen (D) and CNES in Toulouse (F) for controlling the Columbus Laboratory and the ATV has been extended. In parallel, definition studies of the Columbus Laboratory control centre, the ATV control centre and a combined control centre at ESOC are being conducted.

Comments on the ESA/NASA/RSA Trilateral ATV Demonstration and Nominal Operations Flight Plan were received from RSC-Energia at the end of July. The RSC-Energia-proposed changes to the ESA/NASA operations concept are under review. The latest version of the NASA Display and Graphics Commonality Standard (DGCS) has been reviewed and requires further clarification.

With regard to the COF/ATV Operations Support Functions and Facilities, the ASI-study addressing the centralised implementation of the operations-support functions at ALTEC has not produced a result acceptable to the principal contractors involved. An ESA proposal to break the deadlock by assigning major roles to both Italian industry and the ALTEC facility has been submitted to ASI for further consideration.

Utilisation
Promotion
A Working Group has been set up with Eurospace to elaborate schemes for increasing the support and engagement of industry in Utilisation Promotion.

Preparation
The kick-off meeting on the forest-fire detection payload FOCUS took place in August. This is a partnership project for Phase-A funding between ESA, DLR and industry. Concerning the Cupola barter with NASA for the offsetting of launch costs for ESA external payloads, NASA has indicated informally its preference for FOCUS and TEF (Technology Exposure Facility) as the payloads for ESA/NASA co-operation.

The Invitation to Tender (ITT) for the Technology Exposure Facility (TEF) has been released and proposals are due in early October. The ITT for the COF launch payload integration has been issued and proposals are due in mid-October.

Hardware development
The contract for Phases-B/C/D of the European Drawer Rack (EDR) and European Storage Rack (ESR) for COF was placed with a consortium led by Alenia. The Critical Design Review of the Standard Payload Computer (SPLC) has been successfully concluded and the recurring production initiated.

Astronaut activities
In accordance with the Council decision in March 1998 to create a single European Astronaut Corps, ASI performed a pre-selection of Italian astronaut candidates and presented – after formal acceptance by ESA – Paolo Nespoli and Roberto Vittori on 31 July 1998 as new members for the European Astronaut Corps. The former national astronauts Jean-Pierre Haigneré (CNES), Léopold Eyharts (CNES), Umberto Guidoni (ASI), Hans Schlegel (DLR) and Gerhard Thiele (DLR) have also been integrated into the European Astronaut Corps.

In order to provide the appropriate coverage for the new members, a further interim 'Shuttle Mission Specialist Training Agreement' has been concluded. This agreement will be incorporated shortly into a single comprehensive Agreement covering the Shuttle-related training arrangements for all members of the European Astronaut Corps residing at NASA/Johnson Space Center.

A new COF training catalogue has been published in the Astronauts Training Database (ATD) and is currently available via the EAC web-based training pages.

Early deliveries

Data Management System for the Russian Service Module (DMS-R)
After successful completion of testing, the Fault Tolerant Computer (FTC) delta software has been delivered to RSC-Energia for installation in the Service Module. Further software changes have to be approved by the joint software control board and will become a formal change to the baseline.

The schedule for all outstanding DMS-R hardware and software deliveries has been agreed with RSC-E and is compatible with the current Service Module schedule. ESA has taken the appropriate measures to ensure the procurement of additional spares. This is necessary to fulfil ESA's obligations for repair or replacement of failed computers during the engineering-support period. A binding agreement between RSA and RSC-E on the long-term sustaining engineering support and spares requirements is pending.

MPLM ECLSS Environmental Control and Life Support Subsystem
Design modifications for the Duct Smoke Detector are under discussion, and those for the Line Shut-off Valves are under way. As a result of these two items, the finalisation of qualification of the overall MPLM/ECLS will be delayed until early next year. The flight hardware, which is installed in the MPLM flight model 'Leonardo', already delivered to NASA/Kennedy Space Center, will have to be removed and replaced with upgraded items (they are readily accessible).

Due to the open qualification items, the closure of acceptance of the hardware cannot be completed yet by ESA. However, ASI have assumed custodianship of all delivered items in the meantime. Flight Unit 2 equipment has been delivered to the MPLM Prime Contractor, as have almost all items for Flight Unit 3.

European Robotic Arm (ERA)
RSA has been requested to accept a six-month delay in the delivery of ERA (and the training equipment), in-line with the revised SPP launch date (Assembly Sequence Revision D). If ratified, this will result in a need date for delivery of January 2000.

As the current subsystem delivery schedules result in delivery of the ERA flight model in mid-December 1999, and problems exist with two of the contractors, the ERA schedule is critical. It is now expected that the ERA Critical Design Review will have to be rescheduled for January 1999, with the final Board meeting in February. The EQM model of the On-Board Computer (OBC) and the first EQM End-Effector have been shipped to Fokker (NL), as have the EQM

Manipulator Limb System (MLS) and the Camera and Lighting Units (CLUs). This enables the initiation of the System EQM AIT (Assembly, Integration and Test) programme with the commencement of the Electrical Bench testing.

Microgravity

EMIR-1 and EMIR-2
The ESA Advanced Gradient Heating Facility (AGHF), Advanced Protein Crystallisation Facility (APCF), Facility for Adsorption and Surface Tension (FAST) and Morphological Studies on Model Systems (MOMO) payload facilities are scheduled for launch in the Spacehab module on Shuttle flight STS-95 on 29 October. APCF, Biobox and FAST will be delivered only days before the launch for last-minute installation in Spacehab on the launch pad, in order to be able to prepare and install sensitive samples as late as possible.

After installation of the AGHF rack into the Spacehab module at the end of July, the facility successfully passed the final Integrated Verification Test (IVT) and is now ready for launch.

The refurbishment work on both APCF flight models is nearing completion and day-by-day planning for the protein filling in Europe, hardware transport to the Spacehab Payload Processing Facility (SPPF), final integration and test work at the SPPF and late installation in Spacehab are being performed.

Refurbishment activities on Biobox are underway, including both hardware and software modifications to improve performance and to adapt to Spacehab interfaces. Final assembly of the flight model and closure of all verification items with Spacehab is planned for early-September.

The Interface and Verification Testing of FAST with Spacehab has been successfully completed. The facility controller and both experiment cells are now integrated and all software has been verified and tested. A key milestone will be the scientific verification during a long experiment functional test in September.

The Morphological Transitions in a Model Substance (MOMO) refurbishment has been completed, including the improvement and full validation of the MOMO control software. MOMO has been shipped to Cape Canaveral (USA), where it was tested before hand-over and then integrated into the Spacehab.

Microgravity Facilities for Columbus (MFC)
The Biolab Prime Contractor started conducting subcontractor Preliminary Design Reviews (PDRs) in June. The system PDR will start in October and should be completed in January 1999. It is planned to release the ITT for the Experiment Preparation Unit (EPU) for Phases-B/C/D in October 1998.

The Fluid Science Laboratory (FSL) consortium is working to schedule and breadboarding activities are currently in progress. Subcontractor PDRs will start in the last quarter of 1998. Technical exchanges are continuing with the Canadian Space Agency (CSA) to investigate the possibility of introducing their Microgravity Vibration Isolation Mount (MIM) system inside the Fluid Science Laboratory (FSL) in order to improve the microgravity environment for the experiments. A decision will be taken by end-1998.

The Preliminary Authorisation to Proceed (PATP) for the Phase-C/D contract for the Material Science Laboratory (MSL) in the US module has been extended to 30 November. The RFQ for the complete Phase-C/D was sent out to industry in mid-July and the contract is expected to be awarded in November. Co-operation with NASA concerning the Material Science Laboratory (MSL), which will be accommodated in the US Lab, is ongoing.

Two parallel Phase-A study contracts for the European Physiology Module (EPM) are In progress and the final presentations will be held in September. The ITT for the Phases-B/C/D procurement will be released by end-1998. Discussions with NASA concerning the joint operation and co-location of the EPM with the Human Research Facilities are progressing. A final agreement should be reached by end-1998.