ISO

Operations of ISO continue to go very smoothly, with all satellite and ground-segment systems continuing to perform excellently. On 11 December, a third station-keeping manoeuvre was successfully carried out with performance matching plans to within 0.27%. On the same day, the third direct measurement of the amount of liquid helium remaining on-board was made. The results were consistent with the earlier measurements, with indications that the lifetime will be at the upper end of the predicted range of 10 April 1998 ± 2.5 weeks.

During much of September and early October, ISO’s orbital geometry in the extended mission was such that it underwent eclipses with durations of up to 166.5 min, compared with the design value of some 80 min. Additionally, during early September, marginal violations of the Earth constraint on the pointing direction could not be avoided for some minutes each day as ISO went through perigee. Special operational measures were therefore put in place for this period, including restrictions on pointing directions and on the number of instruments that could be used. ISO successfully came through this difficult period with better-than-expected battery and pointing performance and less-than-expected impacts from the unavoidable violation of the pointing constraints.

Some of the closest and best-studied star factories in our Galaxy sprawl across the Orion and Taurus constellations. Without the extension of its life, ISO could never have looked safely in that direction in the sky as the cold telescope must always remain averted from the intense infrared glow of both the Earth and the Sun. The first chance to look at these areas came in August-September and, despite the necessary operational restrictions described above, many scientific observations were performed. With its lifetime currently predicted to last until April 1998, ISO will even have a second chance to observe these exciting regions in the Spring.

The International Astronomical Union (IAU) holds a General Assembly once every three years. At last Summer’s meeting a full day was devoted to the presentation and discussion of ISO results. Some of these results dealt with ISO’s unmatched ability to explore and analyse many of the universal processes that made our existence possible. Taking just one example, impressive ISO data were presented of the Trifid Nebula (see below), a region in which a new generation of massive stars are forming. Seen by visible light, hot young stars light up a large cloud of gas. It is criss-crossed by dark dust clouds which divide the bright nebula and give it its name. The ISO image shows a remarkable change in appearance. The dark clouds become luminous and the bright regions are dark. By penetrating the dust, ISO reveals dense regions inside the obscuring clouds where new stars are forming.

Cluster-II

The contract with the Prime Contractor Dornier has been successfully negotiated and agreed by both parties. The procurement of all spacecraft and payload equipment has been initiated, consistent with the delivery of four Cluster spacecraft for launch in mid-2000. For most equipment, this involves a rebuilding of the Cluster-I units, the exceptions being the high-power amplifiers and the solid-state recorders.

The high-power amplifiers for the original mission were delivered by NASA, but those for Cluster-II will now be procured in Europe. For the solid-state recorders, the non-availability of the original components and the technological developments that have taken place in the meantime have made a new design appropriate. Minor modifications to shorten the experiment-carrying radial booms are also required to allow the Cluster-II spacecraft to fit inside the Soyuz launch vehicle’s fairing.

The partial funding of the payload has also been successfully initiated, with contracts signed between the Prime

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![ISO image](image1.png)

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The partial funding of the payload has also been successfully initiated, with contracts signed between the Prime
Contractor and the national funding agencies and specific institutes.

After completion of a feasibility study that demonstrated that there are no major problems involved in launching with the Soyuz vehicle, the Agency has signed an initial contract with Starcem for the preliminary mission analysis. This study will examine the launch trajectories and resulting mechanical and thermal loads in full detail.

For the ground segment, the implications of using only one ground station (Villafranca) instead of the original two (Odenwald and Redu) are being addressed. The Joint Science Operations Centre is studying software updates for processing the scientific data.

**XMM**

The system-level Critical Design Review was held in September and October. It was concluded on 30 October, when the Review Board members unanimously confirmed that the spacecraft design is mature and that integration of the flight satellite could commence.

Integration of the engineering model of the spacecraft is complete and a series of tests have been successfully conducted at Dornier (D). The satellite is currently undergoing integrated system testing. By the end of April, the final tests on this model, namely the electromagnetic compatibility tests, will have been completed.

The environmental test campaign at ESTEC in Noordwijk (NL) on the Structural and Thermal Model (STM) is continuing. The Dornier (D) and Comet teams have succeeded in maintaining their respective schedules and the test results obtained to date have reinforced confidence in the overall system design.

Flight equipment is currently being delivered in time for the integration of the flight satellite to start early in 1998, as foreseen.

The tests on the third flight mirror module confirmed a performance significantly better than specified. Media Lario (I) is now working on the spare model, which will be delivered at the beginning of April 1998. At Centre Spatial de Liège (B), the mirror modules are being tested together with the X-ray baffles. Initial results confirm that the baffles are effective in their task of preventing off-axis X-rays from entering the mirror system, without reducing the on-axis performance.

After a short facility calibration period in late November, the third flight mirror module is now being tested at Max-Planck Institute (D), together with a flight model of the Reflection Grating Assembly (RGA).

Delivery of the flight-model experiments, originally foreseen for early January 1998, has been rescheduled for the March–July period to allow the necessary calibration tests to be conducted at Orsay (F). This planning modification can be accommodated into the overall integration schedule without impacting on the spacecraft delivery date.

The ground-segment development work has progressed according to plan with the detailed design phase.

Following the successful launch of Ariane-502, the detailed flight parameters are being evaluated by CNES in order to confirm the specified interface and performance parameters. The project has formally confirmed to ArianeSpace that the scheduled launch date remains 2 August 1999.

**Integral**

The main event recently was the signature of the Arrangement between ESA and the Russian Space Agency (RSA) concerning cooperation on Integral, whereby RSA will provide a Proton launcher in exchange for a share of the scientific data. The signature formalises the launcher baseline to which the project had been working for the past several years and opens clearer channels of communication for further interface work with the Proton launch authorities.

The spacecraft development work is progressing nominally. Some ground-support equipment and parts of the Structural and Thermal Model (STM) are being delivered by the subcontractors, in preparation for the STM test campaign planned for April. Payload-instrument development is also progressing, despite there being manpower shortages at some institutes. All teams should, nevertheless, be ready with the models of their instruments to support the STM campaign.

The entire ground segment, which will command the satellite in orbit and analyse the scientific data back on the ground, has been reviewed. The Review Board’s report recommended clarification of the ground-segment management structure in order to define better the contribution of the instrument teams to the Integral Science Data Centre (ISDC) and to review further ground-station scenarios in order to guarantee full ground coverage for the mission.

**Rosetta**

The Phase-B has continued with the official kick-offs of activities by the platform major subcontractor, Matra Marconi Space UK, and the avionics major subcontractor, Matra Marconi Space France. The offer received from the remaining subcontractor for Assembly, Integration and Verification (AIV) is still in progress.

The preparation of the Invitations to Tender (ITTs) and Requests for Quotation (RFQs) for equipment suppliers has been progressing in parallel.

The spacecraft design is currently being refined, with attention focussing at this early stage on its thermal and mass aspects. The qualification of the low-intensity, low-temperature solar cells is in process. Definition of the instrument designs is also in process.

Definition of the ground segment is proceeding on schedule, with attention currently focussed on release of the Rosetta Mission Implementation Plan and on the development of the 32 m deep-space antenna to be located in Perth, Western Australia.

**Artemis**

Flight-model integration is continuing with nearly all payload equipment now integrated onto the flight spacecraft panels. The Silex optical data-relay terminal has also been delivered to Alenia Aerospace in Rome. Final integration of
the spacecraft is awaiting delivery of the last items from subsystem testing.

Development of the operations ground segment is in full swing, with integration of the prime telemetry, tracking and command (TTC) station due to commence shortly.

**Silex Low Earth Orbit (LEO) terminal**
The Silex LEO terminal has completed its test programme on the Spot-4 platform, which will be shipped to the launch site in January for a March 1998 launch.

**EOPP**

**Future strategy**
Various meetings of the Earth-Observation Strategy Task Force and the Industrial Ad-Hoc Working Group have taken place since the end of August. These meetings, together with the outcome of the Industrial Workshop held on 23/24 October, have resulted in clear recommendations for the draft future Earth-Observation Strategy. This strategy is now to be discussed in a series of bilateral meetings with individual ESA Delegations and with the Earth-Observation Programme Board before being forwarded to the Council Working Group preparing for the 1998 Ministerial Meeting.

In parallel, a Call for Outline Earth-Watch Proposals has been prepared for sending to industry and the European Commission and Eumetsat have been requested to identify their requirements.

**Future programmes**
Following agreement, already reported in the previous issue of ESA Bulletin, to exceptionally initiate some Extension 2 activities, the twelve Participating States reviewed and agreed the revised Programme Declaration and Work Plan in October. This has resulted in the release of Invitations to Tender for four Earth-Explorer Phase-A studies, as well as the initiation of a number of supporting activities.

**Campaigns**
The final POLRAD Workshop results have recently been published (ESA WPP-135), and the plans for the Cloud Lidar and Radar Experiment, CLARE 1998, have been presented to the User Community, at a Workshop on 12-14 November.

**Polar Platform/Envisat**

**Envisat-1 system**
Resolution of most of the issues raised at the Envisat Mission System Critical Design Review (EMS-CDR) has progressed well. The Data Policy document, elaborated by the Data Policy Task Force, is still awaiting the approval of the Earth Observation Programme Board. The Announcement of Opportunity (AO) for scientific data exploitation and pilot projects is awaiting the approval of the Programme participants prior to its release. The High-Level Operations Plan (HLOP) is well advanced, and discussions with DOSTAG are focussing on the ASAR operation strategy.

**Polar Platform (PPF)**
The Polar Platform engineering-model (EM) activities have continued with the execution of several functional tests involving the instruments and the PPF payload support functions. Future activities involve the integration of the ASAR EM and satellite-level tests (integrated system tests and EMC).

The flight-model (FM) Payload Module structure has been refurbished and integration of the FM harness is in progress at Matra Marconi Space in Bristol (UK).

The FM Payload Equipment Bay integration has been completed, with the exception of the tape recorders, delivery of which has been delayed by several problems. Following the recommendation of the EMS-CDR Board, a Solid-State Recorder (SSR) is under development to replace one of the four tape recorders. This SSR will be provided by DASA/DSS (D) following selection through an industrial competition. Other EMS-CDR issues have been progressed satisfactorily, except the compatibility of the Service Module with the Ariane-5 generated shock loading, which remains a concern. The Ariane-502 in-flight results will be exploited in a forthcoming analysis.

**Flight model of Envisat’s MWR instrument**
Modelé de vol de l’instrument MWR d’Envisat
**Envisat-1 payload**
The instrument engineering-model programme is now nearly completed and the overall test results have confirmed the validity of the instruments’ designs. Following the Envisat Mission System Critical Design Review (EMS-CDR), a detailed reassessment of the predicted instrument in-flight performance has been carried out by the Project Team and Industry. It has shown that the expected performances are well within specification. An extensive presentation on the EMS-CDR results has been given to the Earth-Observation DOSTAG.

Relatively minor design changes recently had to be introduced into the MERIS instrument to correct for ghost images, and into the MIPAS interferometer electronics to compensate for strong nonlinear behaviour of the beam-splitter material, which has recently been discovered to occur in the instrument’s lower operating temperature range (1800 K). An additional filter has also been introduced into the transmit and receive modules of the ASAR antenna to eliminate an RF interference problem from the RA-2 instrument (a problem identified during the EMS-CDR). These design changes have now been validated and their implementation in the instruments’ FM hardware is proceeding without delay.

The assembly and testing of the flight-model instruments is progressing well overall. With the MWR already delivered, the planned staggered delivery of the other FM instruments is expected to begin in the first quarter of 1998.

**Envisat-1 ground segment**
For the Flight Operations Segment (FOS), the flight control software and satellite simulator software versions integrated at ESOC in Darmstadt (D) are ready to support the first compatibility test with the Service Module of the Polar Platform planned for early 1998.

Integration of the Payload Data Segment (PDS) facilities onto the Reference Platform is progressing well. A data chain representative of an ESA Payload Data Handling Station (PD-HS) is being assembled with a complete ASAR processor. All other instrument processing facilities are under development, with the MIPAS level-1b processor due for factory acceptance testing before the end of 1997.

As far as the Processing and Archiving Centre (PAC) activities are concerned, the French PAC (F-PAC) development effort is still the only one that has been formally kicked-off. Detailed discussions with the other PACs are still in progress, and several of them will hopefully be ready for development kick-off shortly. Good progress has been achieved in terms of the use of generic elements developed within the framework of the PDS contract.

**Meteosat Transition Programme (MTP)**
Following its successful launch in September, Meteosat-7 has now been fully commissioned in orbit by Eumetsat and shown to be capable of totally satisfying the operational mission. Carrying sufficient fuel for five years, the spacecraft should be capable of operating beyond 2002.

The integration of Meteosat-7 was started in the early Summer of 1996 and completed with the environmental acceptance tests in early 1997. The Flight-Readiness Review was held on 10 July 1997 and the launch campaign started immediately thereafter. It was a classical recurrent spacecraft programme, but special difficulties were introduced by the advance of technology in the ten-year period between the building of Meteosats-4, 5 and 6 and that of Meteosat-7. Industry is to be congratulated for the fact that the images produced during the MTP commissioning tests were more equal to any produced by the earlier spacecraft. It is expected that the MTP spacecraft will enter into commercial service in the Spring.

Nearly 20 years after the launch of the first European Meteosat spacecraft, Meteosat-7 is the last spacecraft of this “first generation” design. Beyond 2002, the European weather services will receive data from the Meteosat Second Generation spacecraft, currently being developed under ESA contract, which will provide many more channels and more frequent images.

**Metop**
The offer for the main development phase for Metop-1, -2 and -3 was received in early September. Evaluation was completed by mid-October and a fixed-price deal, which settled all outstanding issues revealed by the Tender Evaluation Board, was achieved before the end of that month. This was a very significant achievement and enabled a Contract Proposal to be prepared in time for the necessary legal processes within both ESA and Eumetsat.

Programmatically, major progress has been made on the ESA side, with the approval of the Contract Proposal and more than 90% of the expected subscription now having been received. Only one subscription is now outstanding. The ESA programme can be considered conditionally approved, depending on the Eumetsat commitment and the remaining subscription. A special Council Meeting is foreseen in January 1998, at which it is hoped the final programmatic commitment can be obtained.

Integration of the MTP (Meteosat-7) into the lower fairing on the Ariane launcher (V99)

[Intégration du modèle de vol du satellite MTP (Météosat-7) à la partie inférieure de la coiffe du lanceur Ariane (V99)]
Meteosat Second Generation (MSG)

The Preliminary Design Review (PDR) for the SEVIRI (Scanning Enhanced Visible and Infrared Imager) scanning assembly is still in progress and the SEVIRI scheduling remains on a critical path.

The satellite primary structure for the Structural and Thermal Model (STM) has been delivered to the prime contractor Aerospatiale in Cannes (F), where the various subsystems and equipment items will be integrated.

At equipment level, various critical design reviews are in progress which should ultimately release the flight hardware manufacturing. Some STM items are being used for equipment qualification, such as the Refocussing Mechanism shown in the accompanying photograph.

ERS

The ERS-2 satellite has continued to support the mission, providing both high-quality data and very good availability.

Some symptoms of equipment ageing have been detected in the AMI instrument that could degrade the data quality in the future. An investigation is in progress to devise operational measures that could slow the ageing process and maintain the current high data quality for as long as possible.

Close monitoring of the spacecraft’s gyroscopes has shown that their performances are stable, and that the satellite’s pointing is within specification.

ERS-1 is being maintained as an operational backup and periodic check-outs show that all of its essential performance levels are being maintained.

International Space Station Programme

ISS overall assembly sequence

Through the intensive reassessment of the launch sequence conducted by NASA and the International Partners, all problems related to the International Space Station Assembly Sequence have been resolved. This has resulted in an October 2002 launch date for the Columbus Orbital Facility (COF), fully meeting ESA’s objective of a launch before the end of 2002.

The Russian Service Module, containing the ESA-furnished Data Management System (DMS-R), will be launched in December 1998 and the Russian Science and Power Platform, including the European Robotic Arm (ERA), will be launched in July 2000.

The launch date for Node 3 appears in the updated Assembly Sequence for the first time and is set for July 2002, which is just seven months after the “earliest delivery date” shown in the COF Launch Barter Agreements.

The NASA Habitation Module is still included in the Assembly Sequence, but the launch date has been delayed to December 2003.

Columbus Orbital Facility (COF)

The COF System Preliminary Design Review (PDR) started on schedule in October. The review has gone well to date, and the provisional conclusions are that the concerns identified are quite normal for this stage of the programme, and are properly covered by agreed actions. The major concern relates to the fire-suppression scenario, where there are some areas within the module which do not enable fires to be put out with the ISS standard portable fire extinguisher. Design modifications will be required to resolve this. In parallel, NASA has conducted an independent Safety Review Phase 1, the initial conclusions of which are also encouraging.

The implementation of COF Attachment Points for external payload accommodation has been proposed by ESA to fulfill the user’s requirements for external utilisation. Discussions are in progress with Delegations on the possibility of funding this additional COF capability.

COF launch barter

The ESA/NASA COF Launch Barter Arrangement was signed on 8 October and the ESA/ASI Arrangement on the Node 2/Node 3 project was signed on 12 December.

The initial system configuration and primary structure design activities related to Nodes 2 and 3 have been completed. The RFQs for the European item procurements have been released and the initial selection of subcontractors has been made, with the exception of the ECLSS components which await the final definition of the items available from NASA free of charge. Activities related to RFQs to US suppliers for Node 3 items and possible alternative European suppliers for some items are underway.

With regard to the Software Deliveries, DMS-R items and associated Sustaining Engineering for NASA, the engineering-support personnel have started work at Houston. The first hardware deliveries, namely those of the Fault-Tolerant Computer (FTC) development models, have been made to NASA.

MPLM Environmental Control and Life Support Subsystem (ECLSS)

All Engineering Models and Ground Support Equipment have been delivered to the Prime Contractor. All subsystem-level qualification test reports have been approved by the Agency. The Prime Contractor is proceeding with the generation of the MPLM System Qualification Review. Equipment qualification and acceptance testing is underway and Equipment Qualification Reviews have started in November and will proceed through January 1998. Delivery of the first set of flight hardware took place in December.

Automated Transfer Vehicle (ATV)

The Phase-C/D proposal was received late in October and complemented by the detailed prices a month later. The proposal for the Production Phase-E was also received at the end of October.

During the proposal evaluation some significant deficiencies became apparent and the ATV contract proposal is not now expected to be submitted to the Agency’s Industrial Policy Committee (IPC) before June 1998.

Agreements in Principle have been reached with RSA on urgent work to be undertaken by RSC-Energia, in particular for the definition and verification of interfaces and the elaboration of an acceptable demonstration-flight scenario.
ATV Rendezvous and Pre-development (ARP) activities
Flight Demonstration no. 3 on Shuttle flight STS-86 (25 September-4 October) was successfully performed for both RVS and GPS during the approach and docking to Mir. The flight data are under evaluation.

Crew Transport Vehicle (CTV)
The Manned Space Programme Board, meeting in December, fully endorsed a proposal presented by the Executive for a reduced-cost programme for an applied re-entry technology programme. The proposal covers the continuation of the X-38 ESA/NASA cooperative activities until completion of this programme in mid-2000, and includes activities for the detailed design and development of the orbital flight vehicles of the X-38 programme, in areas of particular European technological interest.

It is the intention to implement the proposed cooperative activities within the framework of the existing dedicated arrangements (Exchange of Letters) between ESA and NASA on the X-38 cooperation.

Atmospheric Reentry Demonstrator (ARD)
Following the successful Ariane-502 launch, it is planned to reactivate ARD activities as soon as the launch preparation schedule is known. Given the encouraging results of flight 502, flight 503 is currently expected to take place in late Spring 1998.

Operations and Ground Segment
Following a Multilateral Operations Technical Interchange Meeting (TIM) in mid-1997, a series of multilateral teleconferences were conducted to update the 10 volumes of the Station Programme Implementation Plan (SPIP), with the intention of baselining these documents at the occasion of the next Multilateral Operations and Utilisation Control Board (MO&UCB) scheduled for 8-10 December 1997 in Houston.

The definition study of the COF/ATV Operations Control Functions and Facilities successfully passed its Implementation Review in September and the Final Review was successfully completed at the end of November.

The definition study of the COF/ATV Operations Support Functions and Facilities is experiencing some delay. The Implementation Review is now tentatively planned for January 1998, with completion of the study not now expected before end-March 1998.

The study related to the Implementation Definition of the associated Ground Communications Infrastructure successfully passed its Implementation Baseline Review, and the Final Review was conducted in mid-November.

Utilisation
The Announcement of Opportunities for External Payloads has, as a first intermediate output, led to the occupancy of six Express Pallet Adapters with top-quality experiments to be flown in the framework of the Early Space Station Opportunity. Supporting studies of different payload groupings have been carried out, concentrating on mechanical, geometrical, interface and resource assessments. Payloads for Physical and Life Sciences, Earth Observation, Space Science and Technology are envisaged.

For projects that are envisaged in later phases of the programme, studies are ongoing for Space Science (Large X-Ray Facility) and for Earth Observation (Wind Lidar Facility). A feasibility study for the assembly of a large X-Ray Facility at the Space Station has been approved by ESA’s Science Programme and Industrial Policy Committees (SPC and IPC). The release of the Invitation to Tender (ITT) was foreseen for December. Likewise an ITT for the Phase-A of the Wind Lidar Facility is in preparation, for which IPC and Earth-Observation Programme Board (PB-EO) approval has also been obtained.

EUROMIR-E mission status
Due to the damage to the Russian Spectr module in which the EUROMIR equipment is located, an agreement has been reached with the Russian side terminating EUROMIR-E activities and replacing them with an experiment mounted externally on the Russian Segment of the ISS (mounted on the Service Module during a Russian EVA).

Astronaut activities
An analysis has been made of the future assignments for ESA Astronauts presently training in the USA vis-a-vis a number of missions of interest to ESA. It has shown that the present ESA Astronaut Corps will not be able to meet all of the requirements of the upcoming missions. In particular, it will be unable to provide sufficient astronauts for the International Space Station operations after the COF launch, particularly as only experienced astronauts will be eligible for this phase. Recruitment of a number of new astronaut candidates has therefore been initiated, at the same time incorporating as many national astronauts as possible into the...
European Astronaut Corps. In the context of this new recruitment effort, both the medical criteria and the selection procedure itself are being reviewed, and a Basic Training Programme is being prepared, which is scheduled to start in the second quarter of 1998 at the European Astronauts Centre (EAC) near Cologne, in Germany.

**Early deliveries**

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

The DMS-R Qualification Review was successfully concluded at the end of September, with the flight-unit Acceptance Review for the first flight-unit Fault-Tolerant Computer (FTC) deliveries in early October. The first two FTCs were delivered to RSA/RSC-Energia on 11 and 27 October, respectively. It is worth mentioning that this first DMS-R flight hardware, fully compliant with the technical specifications, was delivered on schedule and within its financial envelope. The remaining flight units were delivered in December.

The technical definition of the DMS-R long-term engineering support to be provided by European industry to the Russian Service Module contractor has been discussed and agreed with RSC-Energia. This definition will be used as an input to the planned barter negotiations between ESA and RSA, due to be finalised in early 1998.

In the meantime, an interim agreement has been endorsed by ESA and RSA to initiate urgent DMS-R work in Europe in exchange for urgent work to be performed by RSC-Energia for the integration of the Automated Transfer Vehicle (ATV) with the Russian Segment.

**European Robotic Arm (ERA)**

A revised date of July 1999 for the delivery of the ERA flight model to Russia has been agreed with RSA. This date is one year before the scheduled launch of ERA on the Science and Power Platform (SPP), thereby allowing sufficient time for integration of the ERA on the SPP in Russia and the subsequent processing of the SPP at the NASA launch site.

A revised industrial schedule, compatible with the new launch date, has been derived by the Prime Contractor and a significant effort is underway to bring subcontractor work in-line with the revised schedule.

The Electrical Interface Model has been shipped, this being the first substantial ERA delivery to Russia. It will allow RSC-Energia to verify the electrical interface between ERA and the Russian Segment.

The next major deliveries - the Geometric Model (GEO) and the Weightless Environmental Model (WET) - remain scheduled for December 1997/January 1998. They are to include the changes required by the new launch configuration.

**Laboratory Support Equipment (LSE)**

The Preliminary Design Reviews (PDRs) for the Early Deliveries, the MELFI and the Material Science Glovebox (MSG), were successfully completed in October and preparations for their Critical Design Reviews (CDR) are in progress. The initial Phase-C/D proposal for the Hexapod was unacceptable both technically and financially and the subsequent updated proposal has been received and is currently being evaluated.

The Phase-B final presentation for the Coarse Pointing Device (CPD) took place at the end of October and negotiations on the start of Phase-C/D are ongoing. The ITT for the European Drawer Rack (EDR) has been prepared and is ready for release. The procurement proposal for the Technology Exposure Facilities (TEF) has been submitted to the Adjudication Committee.

Development of the Standard Payload Outfitting Equipment (SPOE) for SPLC, RPDA and AAA is in progress.

**Microgravity**

**EMIR-1 and EMIR-2**

The launch of the Russian Foton-11 recoverable capsule, carrying the ESA microgravity payloads Biobox-3 and Biopan-2 and three Autonomous Experiments, took place successfully on 9 October. The Biobox carried experiments to measure the effects of microgravity on skin and bone cell development. The three Autonomous Experiments were designed to investigate the impact of the same effects on the biological clocks of beetles, algae and fruit flies. The Biopan was dedicated to experiments in the fields of exobiology, radiobiology and material science, to study the effects of microgravity, cosmic and ultraviolet radiation, vacuum and extreme temperatures. The investigators included scientists from Belgium, France, Germany, The Netherlands, Spain and Russia.

Foton-11 landed in Kazakhstan on 23 October. The ESA payload was retrieved and transported to ESTEC, where the experiments were handed-over to the respective scientists. Eleven of the 12 ESA experiments on board had worked nominally but, due to an electrical fault, one experiment in Biobox had not been activated.

Preparations for the three sounding-rocket flights Maser Technology, Mini-Texus-5 and Maser-8 continue, with launches foreseen in the first quarter of 1998.

The ESA-developed experiments for Neurolab (EDEN) have been installed in the Neurolab Spacelab. Final testing is proceeding and the launch is planned for April 1998. This will be the last flight of a Spacelab module and will bring the Spacelab Utilisation era to a close after approximately 15 years of activities. NASA has introduced “gap filler missions” to cover the period between the end of the Spacelab missions and the operation of the International Space Station. For the first of these missions, STS-95, scheduled late in 1998, ESA's Microgravity Programme will participate with a significant payload contribution which includes experiments relating to metallurgy and crystal growth (Advanced Gradient Heating Facility (AGHF) and Morphological Transitions in a Model Substance (MOMO)), crystal growth of proteins (Advanced Protein Crystallisation Facility (APCF)), microgravity effects on cells (Biobox), and adsorption and surface-tension studies (Facility for Adsorption and Surface Tension (FAST)).

Studies on a number of instruments for the early utilisation of the International Space Station have been completed and some equipment development has started. These instruments include an Advanced Respiratory Monitoring System (ARMS), a Muscle Atrophy Research and
Exercise System (MARES), the Hand-Grip and Pinch-Force Dynamometers (HGD/ PFD), the Space Exposure Biological Assembly (SEBA), the Protein Crystallisation Diagnostics Facility (PCDF) and the Modular Cultivation System (MCS).

Microgravity Facilities for Columbus (MFC)
The Biolab Phase-C/D industrial proposal was received at the end of September and, following successful negotiations, the contract was signed at ESTEC on 5 December.

The Fluid Science Laboratory’s Phase-B has been concluded and the Request for Quotation (RFQ) for its Phase-C/D was issued at the end of December. The Phase-C/D contract will be initiated in April 1998.

A preliminary agreement has been reached to fly the Material Science Laboratory (MSL) in the US Lab, with a planned launch date of September 2001. The industrial Phase-B for MSL, scheduled for completion in March 1998, is progressing, with the breadboarding tests nearly complete. The Phase-C/D is planned to start by mid-1998.

Two parallel Phase-A studies for the European Physiology Modules (EPM) facility, each lasting eight months, were initiated in November.

Ariane-5

The Ariane-502 launcher preparation campaign continued at the Guiana Space Centre in parallel with the numerous qualification activities in Europe, culminating in the successful launch on 30 October, as reported in the previous issue of ESA Bulletin.

A major milestone had been achieved in early September with the launcher countdown rehearsal, involving the filling of the main stage with liquid hydrogen and liquid oxygen on the launch pad and performing actual countdowns up to H0 minus 3 seconds. Integration of the upper stage (the Maqsat H&B and Teamsat payloads, Speltra structure and fairing) then followed in the Final Assembly Building, leading to the filling of the upper stage and the attitude-control system during the second half of October.

Qualification work was still continuing in parallel in Europe in several areas, including:
- combined rupture tests on the mechanical structure of the vehicle’s upper part
- main-stage control loop
- validation of the last modifications on the flight programme.

The first phase of flight-data analysis (level zero) after the successful 30 October launch showed that:
- the two solid boosters behaved highly symmetrically throughout their flight, and propulsion of the Vulcain and Aestus engines was also nominal
- the navigation, guidance and control system was stable at all times, and demonstrated its ruggedness and its reactive capability, with no anomalies identified in any part of the flight programme
- the analysis does, however, show some non-conformances, which can be traced back to a single source, namely a higher than expected roll torque in the Vulcain engine; the flight programme correctly diagnosed and counteracted this torque using the vehicle’s attitude-control system; this roll movement induced a slightly early shutdown of the Vulcain engine, and a loss in orbital velocity of 210 m/s.

A group of experts is currently investigating the cause of this roll torque.

On 25 November, ESA handed the ELA-3 Ariane-5 launch complex at the Guiana Space Centre over to Arianespace for operational exploitation, following the qualification of the facilities during the first two Ariane-5 launch campaigns. This facility represents an investment of over 800 million ECU and is by far the largest installation built by ESA as part of the Ariane-5 Development Programme. CNES was responsible for its design, construction and operation during cryogenic main stage testing and the first two qualification flights, in its capacity as prime contractor for the development of the Ariane-5 launcher and launch facilities.

Preparations for the hand-over of ELA-3 management responsibility to Arianespace had been under way for some years, with the progressive integration of Arianespace engineers and technicians into the CNES teams, to ensure that personnel training was properly completed following the first two Ariane-5 qualification flights.

Future launchers
Continuation of FESTIP, the Future European Space Transportation Investigation Programme, was approved in September, and the associated programme of work has therefore been resumed.

In-Orbit Technology Demonstration Programme

STOF (Slosh Test Orbital Facility)
Industry is continuing to work on post-Critical Design Review (CDR) issues, before Phase-D can start. ESA expects to conclude the CDR early next year. A study has been started to assess how the ESA-developed Advanced Crew Terminal can be used to gather and store experiment data from Sloshsat experiments. NASA experts are currently studying any implications for Shuttle operations. Hardware is currently being manufactured and critical components like the Marmon clamp band and pyrotechnic separation bolts have been ordered. ESA and Verhaert are currently working on an update to the Fracture Control Plan, which is required to conclude the CDR.

TPX-II (Two-Phase Flow Experiment II)
A problem occurred during assembly and component acceptance testing, with a failure of the capillary wick of the evaporator. Recovery actions involving a local redesign were immediately started and have already shown good results. Due, however, to the already very tight schedule, caused mainly by the different interpretations of Shuttle safety requirements and the additional design and analysis activities incurred, NASA has been informed that the planned early-January delivery date cannot be met. A new launch date has not yet been identified, but the current planning foresees having the TPX-II experiment ready for delivery to NASA by May/June 1998.