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EPS PROGRAMME AND DEVELOPMENT STATUS

This document presents the status of the EPS programme as of end of September 2003.

EPS PROGRAMME AND DEVELOPMENT STATUS

1 PROGRAMME SCOPE AND COOPERATIONS

The EUMETSAT Polar System (EPS) is the European contribution to the Initial Joint Polar System (IJPS) established with NOAA, and the first European contribution to the follow-up Joint Polar System (JPS) expected to be formed with the US "Converged" NPOESS system. The IJPS and JPS will provide global meteorological and climate data from a series of European and American sun-synchronous polar orbiting satellites, replacing the current NOAA K-L-M series.

EPS is an end-to-end system dedicated to the acquisition, processing and dissemination of observational data from the morning orbit. It provides also capabilities for cross-support and data exchange with the NOAA POES system which covers the afternoon orbit service. The EPS system is composed of a space segment, based on three successive Meteorological Operational (Metop) satellites, and a ground segment. The application component of the ground segment that will generate a variety of level-2 products, is based on the combination of central facilities and a distributed network of satellite applications facilities developed and hosted by several EUMETSAT Member States.

The first Metop satellite is being developed in the framework of the Metop-1 Programme of the European Space Agency (ESA), in co-operation with EUMETSAT. The development and procurement of the three Metop satellites is under the responsibility of a joint ESA-EUMETSAT Single Space Segment Team. In addition, EUMETSAT is directly responsible for the delivery of the MHS, IASI, ARGOS-DCS, AVHRR/3, HIRS/4, AMSU-A and SEM payloads. MHS is directly procured from industry, while the IASI advanced infrared sounder and ARGOS-DCS are procured through Centre National d'Etudes Spatiales (CNES). The other instruments are contributed by NOAA, under the IJPS co-operation agreement, which covers also the establishment and operation of the IJPS and provision of MHS instruments to be flown on NOAA N and N'.

The EUMETSAT EPS Programme is the legal framework for the development and implementation of the EPS System. Its financial envelope covers contributions to the development of the Metop-1 satellite and the IASI-1 instrument, co-funded by ESA and CNES, respectively. It also covers other major procurements including those of the MHS sounders to be flown on the NOAA-N, N' and Metop satellites, two recurring Metop satellites and IASI instruments, three launch services and the EPS Ground Segment. Last but not least, it covers operation of the EPS System over 14 years.

EUMETSAT has established Co-operation Agreements with ESA, for the development and procurement of the three Metop satellites; with NOAA, for the exchange of instruments, data and operation cross-support; and with the CNES, for the provision of IASI and ARGOS-DCS payloads.

2 PROGRAMME STATUS

The ESA Metop-1 Programme and the EUMETSAT EPS Programme, which form the basis for the development, implementation and operations of the EPS System as part of the IJPS, were approved in 1998 and 1999, respectively.

Within EPS, all Cooperation agreements and relevant management implementation documents have been agreed and signed off with the concerned Organisations, namely ESA, CNES and NOAA. **In June 2003, EUMETSAT and NOAA signed off the Joint Transition Activities (JTA) Agreement, which extends the cooperation to the Metop-3 satellite and the NPOESS timeframe.**

The launch period of the first Metop satellite has been set to October-December 2005 with a nominal launch date on 1st October 2005. With an expected 45-month lifetime of NOAA-M, launched in June 2003, and a launch of the first Metop satellite in 2005, there should be no (or little) gap in the morning orbit service.

All major Contracts for the Space Segment, the Launcher and the Ground Segment were signed and respective developments are well underway. The Launch and Early Orbit Phase (LEOP) service Contract was kicked off in December 2002.

3 EPS DEVELOPMENT STATUS

3.1 System

The first part of the EPS System Critical Design Review (CDR-1) was successfully concluded in early Summer 2003. The objectives of the review have been achieved, subject to implementation of the identified actions. The second part of the Critical Design Review (CDR-2) is foreseen for November 2003 and will focus on the definition and planning of the Integration, Verification and Validation (IV&V) activities to be conducted pre-launch and during in-orbit commissioning, including Calibration and Validation.
In July 2003, the newly constructed EPS antenna in Svalbard, the so called CDA-1, was utilised for the first time to command a NOAA satellite. A pair of test commands were uplinked to NOAA-15 while the satellite was visible from the EUMETSAT ground station in Svalbard and the NOAA ground station in Fairbanks at the same time. The NOAA control centre watching the spacecraft through their Fairbanks antenna acknowledged the successful reception of the telecommands via the appropriate telemetry parameters. Then later on, test commands were sucessfully sent to NOAA-15 using the redundant antenna, CDA-2. Further tests will be executed by EUMETSAT as soon as the PSF has been accepted.

The current focus of Operations Preparation activities is on the generation of procedures for the operation of the Metop Service Module (SVM). The generated procedures have been progressively released to Metop industry and reviewed. The procedures will be used during the first Satellite System Validation Test (SSVT-1) starting in November 2003. The version 3 (V3) of the Monitoring and Control System (MCS) delivered to EUMETSAT in August 2003 is currently being used, in

conjunction with the Metop simulator, to exercise and improve the SVM operational procedures before starting the SSVT-1.
Efforts continued in the definition of the development processing baseline i.e. for each processing chain, the Product Generation Specifications (PGS), Product Format Specifications (PFS) and corresponding test data.

3.2 Space Segment

The Metop satellite is a 4.3-ton class satellite carrying a payload of about 900 kg. Its orbit is sun-synchronous with an inclination of 98.7 ^{o} and an Equator local crossing time at 09.30 hrs. It communicates with ground in S, L and X bands, for command and control, local (direct broadcast) dissemination and global acquisition.

The Metop-1 industrial activities started in 1998 and have been proceeding normally since then. EUMETSAT and the Single Space Segment Team (SSST) have formally introduced the revised schedules of the Customer Furnished Instruments to Metop Industry.
Following the MetOp Structural Model programme (SM) concluded in May 2001, several actions were undertaken to ensure the mechanical compatibility of the AVHRR instrument. Characterisation tests of the AVHRR instruments were conducted by NOAA/NASA and local modifications were implemented to ensure compatibility with the Soyuz launcher environment.
During this period, the Metop satellite (and PLM) has successfully completed the Qualification Results Review (QRR). The review did not identify any significant technical issues which would endanger the final qualification status of the Metop Satellite and concurred with the action plans proposed by the SSST to solve the remaining open technical issues.
On the hardware side, the integrated MetOp-1 Payload Module (PLM) successfully completed the pre-delivery test campaign following the replacement of the two CFI instruments (AMSU-A1 and HIRS) affected by anomalies during the TV test performed at the end of 2002. The PLM consent-to-ship took place mid May, resulting in a successful delivery of the module in May 2003.
Metop-1 satellite integration (mating of SVM1 & PLM 1) took place in June 2003. All mechanical and electrical coupling activities completed and initial ‘system’ test (Satellite Limited Functional Test) successfully performed. This is a major step forward for the Metop satellite demonstrating, for the first time, that the two modules communicate with each other as designed.
The environmental testing for the satellite commenced in mid July 2003 with the Conducted EMC campaign, closely followed by radiated EMC/RFC and Vibration testing (November).
In parallel with the PFM satellite activities, the module level integration and test for subsequent PLM and SVM deliveries is progressing (noting the PLM2 & SVM2 will constitute the first Metop to fly).
Extensive iteration of the Metop-Soyuz Interface Control Document (ICD) has been undertaken with Astrium and Starsem and a good level of consolidation has been reached.
Regarding IASI all activities focused on the completion of the activities of the Protoflight model to ensure a timely delivery to Metop. The delivery actually took place at the end of July 2003 hence achieving a major milestone for both the EPS and

Metop programmes. During the Optical Vacuum test of the IASI PFM, some ice contamination problems were encountered. CNES and Industry are currently investigating corrective actions.
Although the IASI Prototype Flight Module (PFM) instrument is suitable to support integration and test activities at Metop-2, its detectors are not flight worthy and, therefore, the PFM needs to be replaced by the Flight Module 2 (FM2) instrument equipped with new detectors. As Metop-2 is the first satellite to be launched, the delay of the IASI FM2 is on the critical path, due between October and December 2004. The problems related to the detectors have been addressed and parallel procurement actions initiated by CNES to preserve two supply options. The decision regarding the final selection of the provider of the detectors is planned to be taken in October 2003.
Both MHS Proto-Flight Model (PFM and FM2) instruments have been integrated to the NOAA-N and N´ satellites and satellite level thermal vacuum tests were completed in Spring 2003. EUMETSAT is currently discussing with NOAA the potential implications of the NOAA-N' accident of 6 September 2003.
The MHS FM3 and FM4 instruments remain integrated onto the Metop-2 PLM and Metop-1 spacecraft, respectively, without any major incidents or anomalies to report. The FM5 instrument delivery remains on schedule for November 2003, and will probably be placed into storage prior to delivery to Metop-3.

3.3 Ground Segment

The EPS Overall Ground Segment (OGS) is composed of the Core Ground Segment (CGS), which performs the acquisition, control, pre-processing and dissemination functions, and additional facilities, including the U-MARF multi-mission archiving facility, the network of Satellite Applications Facilities (SAFs) and external support facilities, e.g. for external calibration / validation.
The CGS is procured as an end-to-end system from a Prime Contractor (Alcatel Space) leading a European industrial consortium. The CGS contract was kicked off in January 2001. The CGS Detailed Design phase was concluded with the formal Critical Design Review (CDR) which was closed out in April 2003. All major architectural issues were resolved, including finalisation of all CGS external interfaces.
The next milestone will be the Verification Readiness Review (VRR) which is due to take place by the end of 2003.
The Polar Site Infrastructure Service in Svalbard was accepted by EUMETSAT in July 2003. For the Polar Station Facility (PSF), the on-site Acceptance and Integration Testing (AIT) activities have progressed well throughout the extended daylight period on Svalbard. EUMETSAT and the CGS Prime Contractor are currently addressing a major change of the CGS development plan to accommodate evolutions in the Data processing requirements and reference test data. Versioning of the CGS has been agreed with Alcatel in order to minimise the impact to the EPS system integration activities.
The contract related to the provision of the Launch and Early Orbit Phase (LEOP) and Telemetry, Tracking and Command (TTC) network service was kicked off in December 2002. The development of the Back-Up Control Centre site infrastructure is underway.