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STATUS OF PREPARATIONS FOR METOP B

The document describes the status of preparations for the launch of the EPS Metop-B satellite, foreseen for April 2012. Preparation activities include the satellite AIT, LEOP and launcher procurement, ground segment upgrades, system integration and V&V and operational preparations.

Status of preparations for Metop B

1 INTRODUCTION

This document describes the status of preparations for the launch of the EPS Metop-B satellite, foreseen for April 2012 from Baikonur with a Soyuz launcher. Preparation activities include the satellite AIT, LEOP and launcher procurement, ground segment upgrades, system integration and V&V and operational preparations.

2 SATELLITE

Satellite activities are managed by a joint ESA/EUMETSAT team, the Single Space Segment Team (SSST). The SSST is currently implementing the agreed Metop B and C development and AIT schedule with Industry, to meet the launch date of Metop-B in the 2nd quarter of 2012.

A major satellite milestone was reached in July 2010 with the successful completion of the Metop-B Payload Module (PLM) Thermal Vacuum test in ESA/ESTEC. Activities on Metop-C PLM are now started according to plans and Metop-B satellite level activities will start in mid 2011. The objective is to progress significantly on the Metop-C satellite and to ensure a fast readiness to re-launch the satellite in case of a launch failure of Metop-B.

2.1 Platform Activities

A number of anomalies have been found, either during Metop-A AIT and operations or Metop-B AIT, and are being addressed with industry. This concern:

Central Communication Unit (CCU)
Flow Control Valves (FCV)

An anomaly on the original Metop-A CCU was found, leading to the CCU being changed out and put on Metop-C. This CCU will be used as much as possible in the anomaly configuration during Metop-C AIT, running at maximum rate and trying to reproduce the anomaly and confirm the suspected cause. It does not affect the Metop-B preparation activities.

Some FCVs were found leaking in cold temperature during the Metop development phase and since that time investigations are running at EADS Astrium. The seal production process was modified; new seals have now been produced and successfully passed ageing and life cycling tests.

2.2 Payload Module (PLM) Activities

Following the failure of Metop-A transmitters in-orbit, attributed to heavy ions radiation, the sensitivity of the Metop transistors to proton radiation was also analysed and tested. The results were that the CLY38 power transistors (as on Metop-A) are sensitive to protons and

this sensitivity increases dramatically with the RF power resulting in component failure. Proton sensitivity testing of power modules equipped with MITSUBISHI transistors were performed as well in April 2010 and it was confirmed that they are suitable to operate under Metop environmental conditions.

Retrofitting of the SSPA's is underway and industrial activities are being followed closely by ESA and SSST.

At PLM level, a major milestone was reached in July 2010 with the successful completion of the Metop-B Payload Module (PLM) Thermal Vacuum (TV) test in ESA/ESTEC, with support from all Instrument Partners (NOAA, CNES, and Industry). AIT activities on Metop-C PLM have now started according to the defined plans, and Metop-B satellite level activities will start in mid 2011.

The TV test started on the 1 July and lasted 20 days. The Metop-B PLM and all instruments passed the test successfully (cold and hot plateaus and thermal control hardware verification), with only minor anomalies being observed

The Metop-B PLM has been re-transported to Astrium Friedrichshafen at the beginning of August 2010 and will be prepared for a soft storage up to summer 2011 during the Metop-C PLM activities.

2.3 Instrument Activities

2.3.1 Microwave Humidity Sounder (MHS)

The MHS FM4 instrument is integrated on the Metop-B PLM. During the Metop-B PLM TV Test some instability and slight exceedance of the NEdT performance were observed in channel 2. Investigations are under way to establish more clarity about the nature of this behaviour. Otherwise, the performance of the instrument was satisfactory.

2.4 Infrared Atmospheric Sounding Interferometer (IASI)

The IASI instrument is integrated on the Metop-B PLM. During the Metop-B PLM TV Test the IASI instrument performance was satisfactory with very similar results to the Optical Vacuum test performed at instrument level in 2006. In addition, the special test adapters and cryogenic test equipment functioned flawlessly.

The analyses on the drift of the focal plane temperature of the Integrated Imager (currently 0.13 K/year on Metop-A) is completed with the conclusion that the potential impacts on the performance of the Metop-B IASI PFM model are negligible.

2.5 Global Ozone Monitoring Experiment (GOME-2)

The GOME-201 instrument is now integrated on the Metop-B PLM to support the integration and test activities. It was confirmed that contamination found on GOME instruments during their incoming inspections affecting the alodyned surfaces was not a blocking point for the Metop-B PLM TV Test.

An independent Working Group has been created under the leadership of ESA to address a GOME-2 throughput degradation issue which has been observed on Metop-A in-orbit.

An element of urgency is arising from the fact that the next GOME-2 instrument will be calibrated and readied for launch in autumn. This calibration programme has already been adjusted to support the investigations on the throughput issue and additional elements might be identified by the Working Group. SSST and EUMETSAT plan to repeat the same on-ground calibration campaigns as the ones conducted on Metop-A.

During the Metop-B PLM TV Test, the performance of the instrument was satisfactory. Some additional tests were performed to support the investigations on the "throughput issue". However, due to limitations inherent to such a test (instrument temperature was not stable long enough) these tests did not reveal any additional information which could be used.

2.6 Advanced Scatterometer (ASCAT)

The ASCAT PFM and FM3 instruments remain integrated on the Metop-1 and -3 PLMs, respectively. The performance of the instrument during the Metop-B PLM TV Test was satisfactory with similar results as the TV test conducted in 2004.

The full calibration campaign involving all three ground transponders has been successfully performed. The initial evaluation show that results are in line with the previous campaign and any issues which might affect the instruments for Metop-B were not identified.

2.7 Global Navigation Satellite System Receiver for Atmospheric Sounding (GRAS)

The GRAS FM2 and FM3 instruments remain integrated on the Metop-1 and -3 PLMs, respectively. During the Metop-B PLM TV Test no issues were identified regarding the functioning and performance of the instrument.

2.8 NOAA Instruments (AVHRR, HIRS, AMSU-A, SEM)

The instruments AMSU-A1, AMSU-A2, AVHRR, HIRS and SEM-2 are all operational on Metop-A with the exception of channel 7 of AMSU-A1 which has become unusable due to excessive noise. Final conclusions of the investigations are not yet available, however it is not expected that the instruments on Metop-B will be affected.

On Metop-B, the AVHRR, HIRS, AMSU-A1, AMSU-A2 and SEM instruments are presently integrated on the Metop-1 PLM. The AVHRR and SEM instruments will be disintegrated and shipped back to the manufacturer in the US for a planned re-calibration prior to the Metop-B launch campaign.

During the Metop-B PLM TV Test the performances of the NOAA instruments were satisfactory, except for the SEM instrument where a potential issue of the detector has been identified which will be examined during the planned re-calibration of this instrument.

2.9 ARGOS Advanced Data Collection System (A-DCS) and Search & Rescue (SAR)

The Metop-B PLM contains the A-DCS upgraded Engineering Model (EM), the Search and Rescue package consisting of the Search and Rescue Repeater (SARR) FM13 for 121.5 and

243 MHz bands and the Search &Rescue Processor (SARP) FM4. During the Metop-B PLM TV Test no issues were identified regarding the functioning and performance of the A-DCS instrument and the Search & Rescue Package.

Potential interference of A-DCS of the US Alarm Industry by an A-DCS transmitter on NOAA-19 has led to the switch-off of the A-DCS transmitter on board NOAA-19. This issue is being addressed by an Operations Committee (OPSCOM) composed of NOAA, CNES and EUMETSAT.

In the mean time EUMETSAT has also been formally notified by the FCC about an interference issue claimed to be originating from the A-DCS instrument on Metop-A. EUMETSAT has requested more information and clarifications in order to analyse the situation.

3 LAUNCHER

Technical interactions are taking place with Starsem and EUMETSAT is currently analysing both Launcher and launch site infrastructure evolutions implemented since Metop-A launch. No major issues have been identified so far.

4 LAUNCH AND EARLY OPERATIONS PHASE (LEOP) SERVICE

The Metop-B LEOP service will be performed by ESOC, as part of the same contract for the Metop-A LEOP service. The corresponding Kick-Off meeting was held with ESOC in March 2010.

Since the Metop-B launch is taking place from Baikonur (as for Metop-A), the approach taken is to use exactly the same mission analysis and LEOP ground station network as for Metop-A. Operational restrictions on Metop-A during the LEOP (due to potential interference between the two satellites) are being defined.

5 GROUND SEGMENT

The existing EPS Ground Segment was designed to handle two Metop satellites, in parallel with a NOAA satellite; however proper adaptations, configuration and testing of the Ground Segment still need to be performed before the launch of Metop-B.

A Ground Segment Design and Implementation Review (GSDIR) was successfully held in July 2010. The main issue resulting from the Metop-B tests is a throughput problem on the network, impacting higher level product generation. This item is under investigation.

6 SYSTEM AND OPERATIONS PREPARATION ACTIVITIES

6.1 Meteorological Product Evolutions

Since the launch of Metop-A, a number of so-called "Day-2" products have been developed, and are either operational or in trial dissemination to users. The Day-2 products include Global Soil Moisture derived from the ASCAT instrument, a Global Normalised Differential Vegetation Index, and Polar Cap Winds derived from AVHRR.

Furthermore, there are two other on-going developments:

> GRAS Product Processing Facility (PPF) is currently being further developed to allow open loop / wave optics processing of the occultation data, necessary to reach deeper into the troposphere. The configuration of the prototype revealed a number of shortcomings and bugs and made more sophisticated work on the implementation of the raw sampling and the open loop processing necessary, and some remaining biases and bugs are being investigated. However, the prototype is now able to track profiles close to the surface. In September it is also planned to investigate the processing of longer term data sets for the application testing by partners (ECMWF). The implementation into the operational environment will follow.
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> Validation of the IASI L2 CO product revealed a discrepancy between retrieved CO amounts in an individual pixel, which could be traced back to the Gibbs effect causing noise in some spectral areas in the IASI L1 processing. Work is being performed by CNES to correct for this effect in the IASI L1 PPF. The update is expected to be available in October 2010.

All of these evolutions are expected to be included in the Metop-B product baseline.

6.2 Operations Preparation

A Metop-A and -B operations concept has been prepared, defining all operational scenarios to operate Metop-A, Metop-B, NOAA-18 and NOAA-19, during the different programme phases. This includes the preparation for Metop-B operations and the transition from Metop-A to Metop-B as prime operational satellite, as well as the introduction of the Antarctic Data Acquisition (ADA) service from the McMurdo station.

Taking the operational experience with the Metop-A satellite into account, the Metop satellite procedure set is currently being rationalised and will form the baseline for Metop-B procedure development. The revised Metop procedure tree definition and infrastructure database is in place.

The Metop procedures will be revised and under configuration control for the System Integration Verification and Validation Readiness Review (SIVVRR) in November 2010.

6.3 System Integration, Verification and Validation (SIVV)

System Integration Verification and Validation activities are necessary to ensure that the complete EPS system can operate two Metop satellites (Metop-A and –B) in parallel, as well

as supporting at least one NOAA satellite. Test scenarios are currently being defined to check that the system performances will support 2-satellite control and corresponding data processing, and that the operations team can safely perform 2 satellite operations.

These system tests will include all relevant partners, such as NOOA, CNES and ESA.

The System Integration, Verification and Validation test specifications will be revised and under configuration control for the System Integration Verification and Validation Readiness Review (SIVVRR) in November 2010.

6.4 Main System Milestones in the Launch to Metop-B

The main system milestones in the launch to the Metop-B satellite are as follows:

System Milestone	Date
System Integration, Verification and Validation Readiness Review	November 2010
System Integration, Verification and Validation Review	August 2011
Launch and Operations Readiness Review	December 2011
Launch of Metop-B	April-June 2012 (Nominally 2nd April)

7 CONCLUSION

Preparation activities for the launch of the EPS Metop-B satellite in April 2012 are proceeding as planned. Although “normal” development and AIT problems have been found, none of these are anticipated today to impact the launch date or preparations.