CGMS

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STATUS OF THE EUMETSAT POLAR SYSTEM (EPS)

This document presents the status of the EPS programme as of end of September 2007. CGMS members are invited to take note.

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 was 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 on NOAA 18 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 flying on the NOAA-18, 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 first Metop-A satellite was successfully launched on 19 October 2006. The subsequent Launch and Early Orbit Phase (LEOP) operations were successfully performed on schedule by ESA and control of the Metop-A satellite was formally handed over to EUMETSAT on the evening of Sunday 22 October. The initial Satellite In-Orbit Verification (SIOV) phase was completed in February 2007 and the SIOV Review was held at the end of March 2007. Then, the remaining activities of the Commissioning phase were carried out and the Commissioning and Handover Review (CHR) was held between the 25 April and 15 May 2007. The responsibility of the Metop-A satellite was then transferred to the routine Operations Team.

The co-operation with NOAA is running nominally. Data and services planned in the IJPS are now in place and excellent support is provided by NOAA. NOAA and NASA are working on the future instruments to be delivered for Metop-B and C satellites. EUMETSAT is supporting activities regarding the MHS instrument to be flown in 2009 on NOAA N'.

EUMETSAT and NOAA are currently addressing 2 main topics:

i) The re-introduction of the Space Environment Monitoring Instrument (SEM) on MetOp-C;

ii) The possibility to use the NPOESS Ground Station located in McMurdo (Antarctica) to improve MetOp data timeliness

The co-operation with ESA is also proceeding nominally. Activities are devoted to the analysis of in-orbit anomalies of Metop-A, but also regarding the future plans for Metop B& C.

The co-operation with CNES on IASI and ADCS/ARGOS is running nominally. CNES is providing adequate support for in-orbit follow-up of the instruments.

3 EPS TECHNICAL STATUS

3.1 EPS System activities

Following the launch of the Metop-A satellite in October 2006, the EPS/Metop-A System was validated during a 6-month Commissioning Phase. At the end of this period, the results of the conducted activities were assessed at a combined EPS System Acceptance Review (AR) / Commissioning and Handover Review (CHR), which had the following two objectives:

i) to authorise the formal handover of the EPS System to the Operations Department for the further routine operations;
ii) to verify that the EPS system had been successfully commissioned, including validation against applicable requirements.

The review started on 25 April 2007 with the distribution of a data package to the Review Group and was concluded on 15 May. All partner agencies which contributed to the development of the EPS System, namely ESA, NOAA and CNES, were represented in the Review Group. As conclusion, regarding the first objective of AR/CHR, the formal handover of the system to the Operations Department, it was acknowledged that the major elements for the operations were ready (including Metop-A and NOAA-N data ingestion, product generation and distribution, Metop-A satellite operations and NOAA Blind Orbit support). Regarding the second objective of the Review, the Commissioning of the EPS/Metop-A system, it was concluded that the achieved status was satisfactory. Following the closure of the remaining issues, for which the processes and planning were in place, the AR/CHR could be declared successful.

3.2 Space Segment

Following the hand over of Metop-A from EPS to Operations Department the reporting in this section focuses on activities relevant for Metop B and C. In addition, issues and anomalies arising from Metop-A operations and having an impact on Metop B and C are addressed.

Metop-A satellite Status

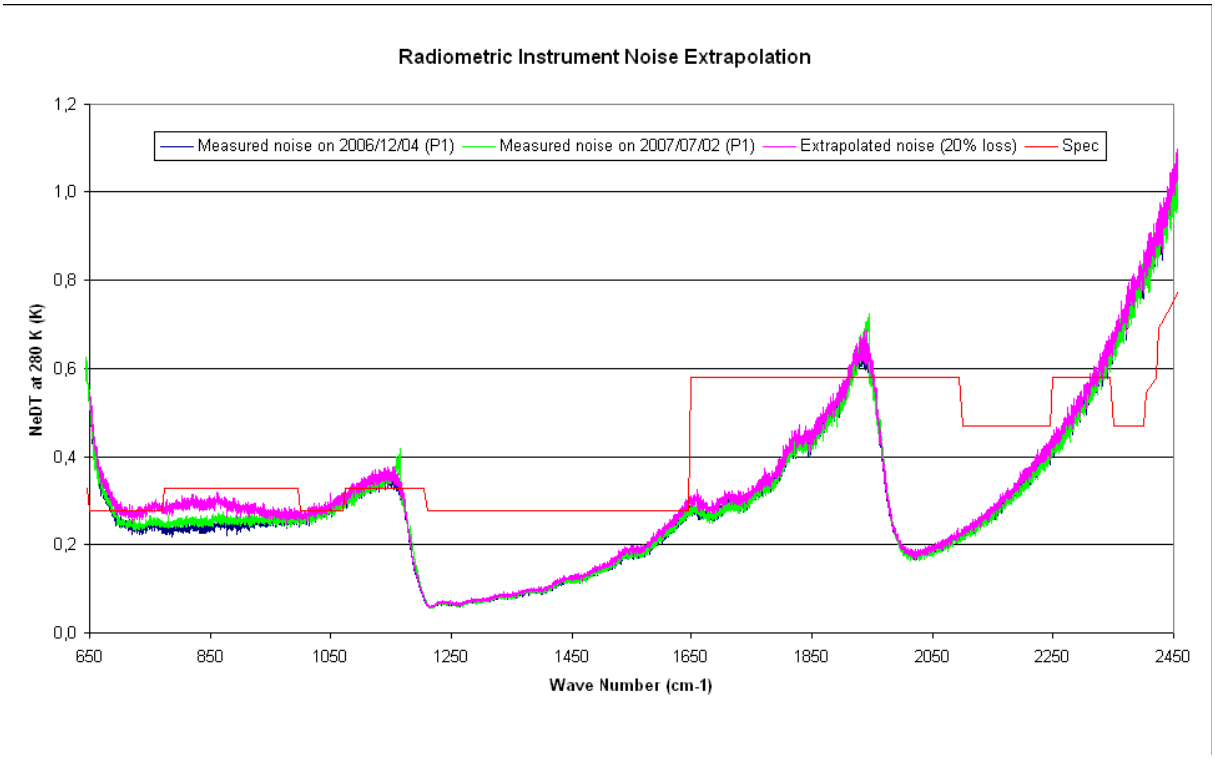
Metop-A, the in orbit satellite continues its operational mission as planned. However one major failure has occurred on the HRPT mission.
On the 4th of July, the nominal A-HRPT autonomously ceased transmitting and EUMETSAT completely deactivated the unit. To date, a series of on-board /Ground tests have been performed. Although no definitive conclusions are available, investigations have thus far concluded that the failure on the nominal A-HRPT- side A is of a permanent, non-correctable nature - most likely a problem with an output transistor in the Solid State Power Amplifier (SSPA) electronics. As such the nominal A-HRPT-side A cannot be used for the remaining operational life-time of the Metop-A spacecraft. The investigations now turn the focus on the root cause of the failure while using engineering analysis and tests performed on a breadboard model of the SSPA. These investigations will continue further for several weeks at least and, given the importance of the A-HRPT, Direct Readout Service to the global User community, the baseline remains that until these investigations are completed it is not intended to commence the activation of the redundant HRPT side B. This in order to avoid damaging the redundant sub-system until its actual robustness is fully assessed.

Payload:

- **Microwave Humidity Sounder (MHS):** the MHS FM3 is operational on board Metop-A. MHS PFM is operational on-board NOAA 18.

- **Infrared Atmospheric Sounding Interferometer (IASI):**

  IASI FM2 is operational on board Metop-A. The Calibration and Validation (Cal/Val) activities on Metop-A have been successfully completed and the IASI Product Validation Board decided on 18 July 2007 on the dissemination of IASI Level 1c products to all users. The detailed analyses conducted during Cal/Val on radiometric, spectral and geometric aspects confirmed that IASI performance is very satisfactory and stable. In particular, the radiometric noise has been very stable (see figure 4.1). The increase in transmission losses due to ice build up on the cold optics has been lower than the initial estimates.



Evolution of the radiometric noise between 4 December 2006 (blue) and 2 July 2007 (green) and extrapolation (purple)

At the end of the Cal/Val a final update of instrument parameters on-board and of the level 1c processor on-ground have been performed beginning of July. The performance of IASI has been stable since then with levels of valid spectra at around 99%.

The interruptions of IASI operations on Metop-A due to HEATER/REFUSE modes have been traced back to Single Event Upsets (SEUs). In all such cases the recovery from the anomaly has been basically a reset of the instrument processing. In one of the occasions the temperature input into the laser control loop was affected. In order to avoid future occurrences of similar anomalies a filter value for this input has been adjusted to a higher level. This will be applied also for IASI on Metop B and C.

Global Ozone Monitoring Experiment (GOME-2): the GOME-203 is operational on board Metop-A.

Advanced Scatterometer (ASCAT): ASCAT FM2 instrument is operational on Metop-A.

Global Navigation Satellite System Receiver for Atmospheric Sounding (GRAS): GRAS FM1 is operational on Metop-A.

NOAA Instruments (AVHRR, HIRS, AMSU-A, SEM): the instruments AMSU-A1 (106), AMSU-A2 (108), AVHRR A305, HIRS H306 and SEM-2 (FM6) are operational on Metop-A.

The Search and Rescue package: the Search And Rescue Repeater (SARR) 121.5 and 243 MHz bands and the Search And Rescue Processor (SARP) 406 MHz band is operational on Metop-A..

Advanced Data Collection System (ADCS- ARGOS): Following the switch to the redundant (B) side in March the A-DCS FM2 on board Metop-A has been working nominally. Investigations of the original anomaly on side A are being conducted by CNES/CLS and the industry involving some laboratory hardware and also flight models designated to NPOESS. A hardware failure at the output First In First Out (FIFO) buffer has been identified as a probable cause. The possibility of some long duration tests on the remaining A-DCS flight models are being considered to determine whether it is a generic problem affecting all flight models.

3.3 Ground Segment

The EPS GS has performed very well since the EPS Launch and no major system issues have been identified over the reporting period. The behaviour of the System is remarkably good in terms of performance, stability and data availability to Users, considering the youth of the System.

4 CONCLUSION

The successful launch and commissioning of the EUMETSAT Polar System/Metop-A satellite are very important milestones for Operational meteorology and for the international cooperation between Europe and the United States on one hand and within Europe on the other hand. In the future, the cooperation will continue for the reminder of the IJPS i.e. NOAA N', Metop B & C and in the definition of the future Joint Polar System capitalising on this success.