CGMS-XXVII EUM-WP-04 + Annex
Prepared by EUMETSAT
Agenda Item: C.2

STATUS OF PREPARATION OF MSG

This paper reports on the current MSG programme development status including plan for transition to the new services.

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1 INTRODUCTION

In previous papers (Reference (1): CGMS-XXV EUM-WP-04, and Reference (2): CGMS-XXVI EUM-WP04) an overview of the mission objectives and basic capabilities of the MSG system was presented and subsequently the development status in May 1998 was addressed. The status of the development programme in September 1999 and actual plans for preparing the transition from Meteosat to MSG are presented in this report.

2 MSG - MISSION OBJECTIVES AND CAPABILITIES

The programme is under full development in line with the Mission Objectives already highlighted in Ref. (1) and summarised in the Annex. The associated End Users Requirements have been recently updated to embed results of the Requirement and Architectural Design Reviews of the Satellite Application Facility on the Support to the Nowcasting and Very Short Range Forecasting.

After the Global Earth Radiation Budget (GERB) scientific mission was established, EUMETSAT's Council approved in June 1999 the procurement of two additional instruments to fly on MSG-2/3.

A plan for early evaluation and enhanced use of MSG data was also developed, and a Research Announcement of Opportunity was jointly released by EUMETSAT and ESA. The objective is to involve the research community in the use and evaluation of the innovative capabilities of the MSG system.

3 STATUS OF SPACE SEGMENT

The cooperation with ESA for the procurement of the space segment is governed by a Programme Implementation Plan (PIP) which was signed in December 1997.

The status of the spacecraft development schedule is that all platform subsystem Critical Design Reviews (CDRs) have been completed. The Critical Design Review of the satellite has also been held in the last quarter of 1998.

All Engineering Models of the subsystems and the SEVIRI (Spinning Enhanced Visible and InfraRed Imager) EM have been delivered to the Satellite Prime Contractor. The Satellite Integration and Test activities on the EM will be completed in November.

The subsystems Flight Models have also been delivered and SEVIRI FM is close to delivery to the Satellite FM Integration and Test campaign.

The MSG structural thermal model (STM) has completed the environmental test programme, showing compliance to the specified requirements. The separation shocks introduced by the Launcher are subject of on going analyses aimed at finding the necessary attenuation.

The overall programme schedule, although very tight, is still compliant with an October 2000 launch-date for MSG-1. MSG- 2 and MSG-3 will be ready for launch at 18 months intervals, but it is planned to store MSG3 a few years before launch.

The satellite mass at launch is slightly above 2000 kg.

The SEVIRI EM test campaign has indicated very promising results regarding performances that need to be confirmed for the flight models.

Table 1 below presents the expected in-orbit radiometric performances at SEVIRI End Of Life (EOL) i.e. including ageing of hardware and contamination effects. The EOL estimations of Table 1 are based on SEVIRI EM test results complemented by analyses allowing to predict the in-flight performances by extrapolation from on-ground testing. The impact of Electro-Magnetic Compatibility (EMC) effects on the estimated radiometric performances in-orbit at EOL is not included, as the current estimations need to be confirmed by testing at spacecraft level.

Channel	**Noise specification**	**In-orbit, EOL performance estimate without margin**
HRV	1.07 $Wm^{-2}sr^{-1}rd^{-1}$	0.42 $Wm^{-2}sr^{-1}rd^{-1}$
VIS0.6	0.53 $Wm^{-2}sr^{-1}rd^{-1}$	0. 16 $Wm^{-2}sr^{-1}rd^{-1}$
VIS0.8	0.49 $Wm^{-2}sr^{-1}rd^{-1}$	0.14 $Wm^{-2}sr^{-1}rd^{-1}$
IR1.6	0.25 $Wm^{-2}sr^{-1}rd^{-1}$	0.06 $Wm^{-2}sr^{-1}rd^{-1}$
IR3.9	0.35 K	0.14 K
IR6.2	0.75 K	0.26 K
IR7.3	0.75 K	0.28(*) K
IR8.7	0.28 K	0.10 K
IR9.7	1.50 K	0.23 K
IR10.8	0.25 K	0.09 K
IR12.0	0.37 K	0.15 K
IR13.4	1.80 K	0.31K

(*) Note: this is not based on EM results, as the detector of this channel is replaced by a dummy detector in SEVIRI EM

Table 1. Radiometric performance estimate

In general, the predicted EOL in-orbit radiometric performances are better than specified. This is largely due, at least in the IR band, to a high transmission of the cold optics. It is worth to recall that (i) EMC perturbation is not included, (ii) the EOL in-orbit performances are extrapolated based on models. This does not endanger the compliance with the specified requirements, but leads to some degradation of the values in Table 1.

The SEVIRI EM performance test campaign has also shown compliance of the SEVIRI design with spectral requirements, with Modulation Transfer Function (MTF) requirements.
Another promising aspect of the EM test results is related to the good pointing stability showed by the instrument when submitted to temperature variation. This will improve the quality of images acquired during eclipses.

The GERB-1 flight instrument, after a complete calibration campaign, has been delivered to the MSG spacecraft for integration. The GERB ground segment has passed its CDR between May 1999 and August 1999. After approval by the EUMETSAT Council of the other two GERB instruments (and related services) to be embarked on MSG-2 and MSG-3, the GERB-2/3 activities were kicked-off beginning of July 1999.

4 STATUS OF GROUND SEGMENT, SYSTEM ENGINEERING AND OPERATIONS PREPARATION

The ground segment system design and the procurement of Ground Segment (GS) Facilities is well progressing. All MSG GS facilities have been kicked off and have subsequently gone through the Requirement Reviews, the Architectural Design Reviews and the Critical Design Reviews. The Unified Meteorological Archive and Retrieval Facility, which is common to the MSG and EPS Programmes, has been kicked off in December 1998 and is presently progressing towards its CDR. The GS CDR was successfully held between December 1998 and February 1999.

Pre-Deliveries of the Central Facility (CF), of the Meteorological Product Extraction Facility (MPEF), of the Image Processing Facility (IMPF) and of the Data Acquisition and Dissemination Facility (DADF) are available in EUMETSAT allowing start of Pre-integration activities of the Ground Segment. Consoles have been installed in the control area. A Pre-delivery of the Space and Ground Simulation Facility (SSF) is available in ESOC to start preparatory activities for the LEOP phase.

Final delivery of the facilities will occur after the system tests and acceptance tests phases in the period December 1999 – March 2000, allowing for GS final hand-over to Operations Preparation in July 2000. The compatibility tests between Satellite and GS will be in the first half of year 2000.

Following Satellite and Ground Segment CDRs, system engineering activities are progressing in preparation of the System CDR, planned around end of year. Readiness for the system validation phase will be evaluated together with status of actions from segment level CDRs. The System Integration Validation and Verification plan will be evaluated together with initial versions of the Operational System Validation Plan and the Commissioning Plan.
Progress on the service contract for the Launch and Early Orbit Phase (LEOP), assigned to ESOC, is nominal.

5 USER STATIONS AND TRANSITION OF SERVICES

The detailed design and development phase has progressed as part of the DADF development. The design documentation for the user stations has been made available for potential manufacturers beginning of 1999 on the MSG Web. An update is currently under delivery (it will be also available on the Web Page) following successful tests of the MSG Users Station Baseband Module (part of the DADF development). The updated version of the MSG LRIT/HRIT Global Specification is presented under Agenda item G.1.

The transition period with parallel operations of Meteosat-7 and MSG-1 allows for an overlap of about three years, from the commissioning of MSG-1 at the beginning of 2001 until the end

ANNEX: Overview of MSG Mission Objectives

Mission	Characteristics	Note
Imaging For basic imagery, airmass analysis and high-resolution imagery	Channel Spectral band Radiometry HRV Broad Vis.* SNR>4.3 @ 4.59 $Wm^{-2}sr^{-1}im^{-1}$ VIS0.6 0.56-0.71 SNR>10.1 @ 5.33 $Wm^{-2}sr^{-1}im^{-1}$ VIS0.8 0.74-0.88 SNR>7.28 @ 3.57 $Wm^{-2}sr^{-1}im^{-1}$ IR1.6 1.50-1.78 SNR>3 @ 0.75 $Wm^{-2}sr^{-1}im^{-1}$ IR3.9 3.48-4.36 0.35 K @ 300 K WV6.2 5.35-7.15 0.75 K @ 250 K WV7.3 6.85-7.85 0.75 K @ 250 K IR8.7 8.30-9.10 0.28 K @ 300 K IR9.7 9.38-9.94 1.50 K @ 255 K IR10.8 9.80-11.80 0.25 K @ 300 K IR12.0 11.00-13.00 0.37 K @ 300 K IR13.4 12.40-14.40 1.80 K @ 270 K	
	Imaging area Visible and infra-red channels: Full earth disc from geostationary orbit High-resolution visible: full North-South scan of earth disc; (adjustable) half earth disc in East-West	
	Sampling distance (at sub-satellite point) Visible channels: 3 km Infra-red channels: 3 km High-resolution visible: 1 km	
	Image repeat cycle 15 minutes full earth disc	
Data Dissemination	High Rate Information Transmission (HRIT) 1000 kbps of full image data, products, DCP and foreign satellite data etc.; lossless compression envisaged; encryption possible Reception with dedicated user station of minimum 12 dB/K	

Mission	Characteristics	Note
	Low Rate Information Transmission (LRIT) 128 kbps of reduced image data, products, DCP and foreign satellite data etc.; lossy compression envisaged; encryption possible Reception with dedicated user station of minimum 5 dB/K	
Data Collection	210 regional channels (high band) 40 international channels up to 210 regional channels in the band of neighbouring satellite systems (as contingency; low band)	received and processed received and processed satellite relay only
Product Extraction	Key products extracted centrally, e.g. - Atmospheric Motion Vectors (AMV) - Cloud Analysis (CLA) - Cloud Top Height (CTH) - etc.	Further products developed and extracted in de-central facilities
Secondary Payloads	Scientific GERB instrument Global earth radiation coverage in three bands every 2.5 min; full data set to noise spec. every 15 min GEOSAR message relay Reception of distress signals at 406 MHz from most of the earth disc and downlink on 1544.5 MHz	Accommodation approved Accommodation approved