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STATUS OF PREPARATION OF MSG

This paper reports on the current MSG programme development status including status of the Global Instability Product and plan for transition to the new services. CGMS members are invited to take note.

STATUS OF PREPARATION OF MSG

1 INTRODUCTION

An overview of the mission objectives and basic capabilities of the MSG system was presented in a previous paper (Reference (1): CGMS-XXV EUM-WP-04). The development status was also presented and kept updated in the successive releases of this paper. The status of the development programme in August 2001, the development status of the Global Instability Product and the 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 table 1 (see annex). The End Users Requirements Document (EURD) has been updated in 1999 to include requirements covering the products and deliverables developed by the Satellite Application Facility (SAF) on Support to Nowcasting and Very Short Range Forecast (VSRF). Also the Data and Information Services Chapter has been extensively modified to remove items To Be Defined following the Architectural Design Review of the Unified Meteorological Archiving and Retrieval Facility. Further EURD updates will capture MSG products and services offered by other SAFs.

At its 42nd meeting in June 1999, the EUMETSAT Council approved the procurement of two additional instruments Global Earth Radiation Budget (GERB) instruments for flight on MSG-2/3 and provision of the related operational data service by the Rutherford Appleton Laboratories, UK. Capitalising on the GERB development carried out by RAL in response to an ESA Announcement of Opportunities, this decision ensured continuity of the GERB mission beyond MSG-1, securing an important contribution of MSG to Climate Monitoring.

In parallel, a world-wide MSG Research Announcement of Opportunity (MSG RAO) was jointly released by EUMETSAT and ESA in 1999. This MSG RAO provides a structured framework for demonstrating the value of the MSG mission to innovative research in various Earth Sciences disciplines and for investigating the potential implications for the evolution of the operational services. ESA and EUMETSAT jointly selected 43 projects in November 1999, following a peer evaluation process initiated in February of the same year. The first MSG PI Workshop was held in Bologna, Italy, in May 2000, starting the dialogue between the Investigators, ESA and EUMETSAT.

3 STATUS OF SPACE SEGMENT

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

Following the Critical Design Review (CDR) of the Satellite held in the last quarter of 1998, the Qualification Result Review (QRR) was held in the first half of 2000. Some actions remained open and were dealt with as part of the Flight Acceptance Review (FAR) process. The FAR was in fact re-planned in two phases. A phase 1 comprising the largest part of the activities due by the original FAR date (in 2000) has been completed early in 2001. A FAR phase 2 including a satellite storage period, parallel work on open items from phase 1, de-

storage and execution of remaining tests to be performed before the shipment to the Launch site, will be concluded by a Readiness to Ship Review, in the first quarter of 2002.

The Engineering Model of the Satellite has successfully ended the testing programme including additional tests, which confirmed the resolution of open QRR issues. The fist part of compatibility tests with the MSG Ground Segment (System Validation Test–1) has also been completed.

The integration of the MSG-2 satellite is well advanced. The SEVIRI FM 2 has been delivered and integrated. The integration of MSG-3 satellite has started, with the SEVIRI FM-3 expected to be delivered this year. GERB-1 and GERB-2 have been delivered, GERB-3 is under assembly. A procurement of obsolete items has been agreed by EUMETSAT Council to protect against unexpected problems at the MSG-3 de-storage and in support to a possible future start of production of a fourth MSG satellite (MSG-4).

Ariane-4 has been baselined for the launch of MSG-1 in July 2002, whilst Ariane-5 remains the baseline for MSG-2 and MSG-3. Further tests are planned to confirm and document the compatibility of the MSG-2/3 satellites with the second batch of Ariane-5 launchers. The Engineering Model has started a refurbishment to perform an additional shock test campaign for proving the compatibility with the Ariane 5 Launcher, since Ariane 4 will not be anymore available for MSG-2/3.

The MSG-1 satellite mass at launch is slightly above 2030 kg.

The on ground tests of the Satellite Flight Model have confirmed the very promising results of the SEVIRI performances measured at instrument level. Table 2 below presents the expected in-orbit radiometric performances. The short term error (or noise) requirement includes all factors affecting the radiometry during one nominal repeat cycle (15 minutes duration). It applies to in-orbit conditions at End Of Life (EOL), based on satellite tests (on ground) complemented by a prediction of in-flight performances at EOL on a “worst case” basis.

Channel	**Short term radiometric error performances**	**Short term radiometric error requirements**
HRV	0.63 at 1.3 W/(m² sr µm)	1.07 at 1.3 W/(m² sr µm)
VIS0.6	0.27 at 5.3 W/(m² sr µm)	0.53 at 5.3 W/ (m² sr µm)
VIS0.8	0.21 at 3.6 W/(m² sr µm)	0.49 at 3.6 W/(m² sr µm)
NIR1.6	0.07 at 0.75W/(m² sr µm)	0.25 at 0.75 W/(m² sr µm)
IR3.9	0.17K at 300K	0.35K at 300K
WV6.2	0.21K at 250K	0.75K at 250K
WV7.3	0.12K at 250K	0.75K at 250K
IR8.7	0.10K at 300K	0.28K at 300K
IR9.7	0.29K at 255K	1.5K at 255K
IR10.8	0.11K at 300K	0.25K at 300K
IR12.0	0.15K at 300K	0.37K at 300K
IR13.4	0.37K at 270K	1.80K at 270K

Table 2: EOL Noise equivalent radiances and temperatures for the channels of the SEVIRI instrument on MSG-1 compared with the requirements. Values are obtained from testing at satellite level complemented by a prediction of in-flight performances at EOL. For the thermal IR channels they refer to a focal plane temperature of 95K.

The results presented in the above Table are generally better than the ones presented in the past reflecting the instrument stand alone tests. The main reason for these differences, especially for the visible channels, is that at satellite level more realistic ElectroMagnetic Compatibility (EMC) perturbations have been considered with respect to the tests at SEVIRI level, where the maximum specified EMC perturbations were used. In all cases measured performances exceed specifications.

4 STATUS OF GROUND SEGMENT, SYSTEM ENGINEERING AND OPERATIONS PREPARATION

The ground segment development has experienced important delays for critical facilities, which caused the postponement of the Ground Segment integration and consequently of the MSG-1 launch date. Currently the Meteorological Product Extraction Facility, the Data Acquisition and Dissemination Facility, the Space and Ground Simulation Facility have been delivered by contractors and provisionally accepted. The Back-up and Ranging Ground Station has also been declared ready for service. The Central Facility has been delivered very recently in the version to be used for preparation of the final system validation tests, and provisional acceptance is planned before end of this year. The Primary Ground Station is currently performing acceptance tests planned to last until end of this summer. The Image Processing Facility is still in the integration phase and preparing for the start of facility level system tests: it is actually the most critical item of the programme in terms of schedule. It is not an essential element to reach the readiness for the MSG-1 launch, but is nevertheless an essential element for conducting the commissioning activities after launch: further delay of this facility will therefore cause the need to store MSG-1 in orbit after launch, before starting commissioning.

The overall programme situation made it impossible to launch in October 2000 as originally planned. After having analysed various options, aimed at optimising the selection of the postponed launch date with respect to the MSG-1 lifetime, EUMETSAT came to the conclusion that January and July were optimum. The launch slot of July 2002 was recently confirmed with Arianespace, leading at the end of August 2001 to the decision to de-store the MSG-1 satellite.

5 STATUS OF THE GLOBAL INSTABILITY PRODUCT

Within the Meteorological Product Extraction Facility (MPEF) for Meteosat Second Generation (MSG), the derivation of Global Instability Indices (GII) is envisaged as an experimental operational product. The indices ought to be useful to forecasters issuing warnings of occurrence of severe weather. The approach draws on the positive experience of NESDIS with the operational production of a ‘Lifted Index’ from GOES. The MSG MPEF system will use a statistical regression scheme, based on a neural network approach, to relate the observed brightness temperatures in 6 thermal channels and some additional parameters concerning observation time and location to atmospheric instability indices. The alternative of using a physical retrieval method is also being studied, however the excessive run time for a global product inhibits an operational application prior to full optimisation of the algorithm and prototype software. Although the product is initially derived at pixel level, the product delivered to the meteorological community will be averaged over typically 10*10 MSG pixels. Optimum ways of presenting the product to the users are being studied. The prototype algorithm is currently tested and refined using GOES sounder data. The actual implementation of the product may have to be postponed after MSG system commissioning,

in order to preserve the stability of the Ground Segment baseline and avoid further slippage of the launch date of MSG-1.

6 USER STATIONS AND TRANSITION OF SERVICES

The detailed design, development and tests phase has been completed as part of the DADF development. The design documentation for the user stations has been made available for potential manufacturers starting from beginning of 1999 on the MSG Web. It has then been updated in various steps to reflect the successful tests of the MSG Users Station Baseband Module (part of the DADF development) and finally the DADF baseline at provisional acceptance. Discussions with EUMETSAT Council let to revisit the High Rate Information Transmission–Low Rate Information Transmission data streams contents, increasing the overall data disseminated and making the two data streams more complementary, whilst keeping the LRIT service attractive. The baseline is shown in table 3 attached, it is unchanged with respect to the one presented in the year 2000 report (CGMS-XXVIII EUM-WP-04).

Users have been informed about these possible changes, as HRIT users may wish to procure Users Stations with both HRIT-LRIT receiving capability.

Currently the transition period with parallel operations of Meteosat-7 and MSG-1, starting from the commissioning of MSG-1 in 2002, extends until the end of 2003. It is technically possible to further extend the overlap until 2005 assuming continued nominal operations of Meteosat-7. Further decisions will be proposed in 2002 to the EUMETSAT Council in order to increase the agreed overlap period and, thus, to enable users to smoothly transition to the use of the MSG system, whilst preserving the continuity of their operational applications.

Annex

Mission	Characteristics	Note
Imaging For basic imagery, airmass analysis, high resolution imagery	Channel — Spectral band HRV — Broad Vis.* VIS0.6 — 0.56-0.71 VIS0.8 — 0.74-0.88 IR1.6 — 1.50-1.78 IR3.9 — 3.48-4.36 WV6.2 — 5.35-7.15 WV7.3 — 6.85-7.85 IR8.7 — 8.30-9.10 IR9.7 — 9.38-9.94 IR10.8 — 9.80-11.80 IR12.0 — 11.00-13.00 IR13.4 — 12.40-14.40	
	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 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 25 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

Table 1: Mission Objectives Overview

Annex

Table 3: Baseline for HRIT and LRIT dissemination

The current baseline can be summarised as:

- HRIT containing the full set of SEVIRI image data (lossless – apart from HRV);
- LRIT containing the full set of Foreign Satellite Data (lossless), a subset of lossy SEVIRI image data, DCP data, MDD data and meteorological products.

In more detail the data content of LRIT and HRIT is:

LRIT		**HRIT**
SEVIRI 1.5		**SEVIRI 1.5**
VIS (0.6)	lossy (30 mins)	All channels lossless (apart from HRV) full Earth disk, 15 mins
IR (6.2) WV	lossy (30 mins)	
IR (10.8)	lossy (30 mins)	
[NIR (1.6)	lossy (30 mins)]*	
[IR (3.9)	lossy (30 mins)]*	
Foreign Satellite Data Lossless 3-hourly Images (full set)		
Meteorological Products** MPEF AMV MPEF CTH MPEF CLAI		
DCP** All DCP data		
MDD** All MDD Data		

Summary of differences with respect to previously agreed baseline:

HRIT

- SEVIRI 1.5 data: no change (just more space for uncertainty in compression factor)
- FSD: moved to LRIT
- Meteorological Products: moved to LRIT
- DCP: moved to LRIT
- Bulletins from GTS (i.e. MDD): moved to LRIT

LRIT

- SEVIRI 1.5 data: 3 of original 5 channels unchanged / 2 of original 5 channels to be included if space available
- FSD: now full set and lossless (transferred from HRIT)
- Meteorological Products: augmented set from HRIT
- DCP: no change
- MDD: no change

* Denotes channels to be included if space is available

** DCP, MDD and Meteorological Products could be moved back to HRIT if the 3 core SEVIRI channels on LRIT cannot be accommodated