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STATUS OF THE METEOSAT SYSTEM

This Working Paper summarises the status and operations of the Meteosat System, highlighting the main events since the last meeting of CGMS.

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INTRODUCTION

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1 SYSTEM STATUS

1.1 Space Segment

Meteosat-5

Meteosat-5 has been used in support of the Indian Ocean Data Coverage service since the formal start of EUMETSAT support to the INDOEX experiment on 1 July 1998. No DCP or MDD services have been provided via Meteosat-5.

The autumn eclipse season for Meteosat-5 started on the 13th of August and finished on the 2nd of October. Routine East-West station keeping manoeuvres were performed on the 7th of October and on the 2nd of December. An attitude manoeuvre was performed on the 24th of November.

There were gain changes performed on 12th of August and 25th of November. The new gain settings are: IR1 Gain 6, WV2 Gain 8, VIS1 & 2 Gain 5.

The orbital inclination of the satellite at the end of this reporting period was 6.42° and increasing. The remaining hydrazine fuel on board is estimated to be 4.80 kg, of which a 4kg reserve will be required to de-orbit the spacecraft at the end of its useful life. The on-board fuel reserve limit of Meteosat-5 will be re-evaluated towards the end of 2004.

Orbit			Attitude	
Inclination	Longitude	E/W Drift	Right Ascension	Declination
6.4192	62.8325	0.0083	338.6110	83.5220

Meteosat-5 Orbital Parameters for 31st January 2004

The spacecraft configuration status has remained stable since the failure of Power Amplifier 3 in July 1998.

Meteosat-6

Meteosat-6 has been used in support of Rapid Scanning Service, since the formal start on the 18th of September 2001.

The autumn eclipse season for Meteosat-6 started on the 22nd of August and finished on the 7th of October. Routine East-West station keeping manoeuvres were performed on the 23rd of September and on the 17th of November. An attitude manoeuvre was performed on the 20th of October.

There were no gain changes performed during this reporting period. Gain settings remain at: IR1 Gain 5, WV2 Gain 6, VIS1 & 2 Gain 5.

The inclination of the satellite at the end of this reporting period was 3.53° and increasing. The remaining hydrazine fuel on board is estimated to be 6.75 kg, of which a 4kg reserve will be required to de-orbit the spacecraft at the end of its useful life. The on-board fuel reserve limit of Meteosat-6 will be re-assessed during 2005.

Orbit			Attitude	
Inclination	Longitude	E/W Drift	Right Ascension	Declination
3.5328	9.3568	-0.0135	351.8480	86.3790

Meteosat-6 Orbital Parameters for 31st January 2004

The spacecraft configuration status remains stable.

Meteosat-7

Meteosat-7 has been used to provide the nominal 0° operational service.

Black body calibrations are performed once per day on slot 24 outside eclipse season. Up to 4 black body calibrations are performed during eclipse season.

The autumn eclipse season for Meteosat-7 started on the 31st of August, and finished on the 16th of October. The routine reception of DCP messages was transferred to Meteosat-6 during Meteosat-7 eclipses when Power Amplifier 2 was de-configured. This was due to the depth of the eclipse and the available battery capacity.

The Meteosat-7 batteries have been recording low battery voltages in the middle of the autumn 2002 eclipse period. The voltages were approaching the threshold of 18 Volts. As a preventive measure Meteosat-7 was de-configured with only the essential loads and the radiometer left on during the middle of the eclipse period.

A routine East-West station-keeping manoeuvres was performed on the 28th of October. An attitude manoeuvre was performed on the 25th of November.

There were no gain changes performed during this reporting period. Gain settings remain at: IR2 Gain 8, WV1 Gain 11, VIS1 & 2 Gain 6.

The inclination of the satellite at the end of this reporting period was 0.22° and increasing. The remaining hydrazine fuel on board is estimated to be 9.55 kg, of which a 4kg reserve will be needed to re-orbit the spacecraft at the end of its useful life. It is estimated that the fuel available is enough to allow nominal orbit and attitude control until the year 2005.

Orbit			Attitude	
Inclination	Longitude	E/W Drift	Right Ascension	Declination
0.2185	-0.1800	0.0156	14.3280	89.6180

Meteosat-7 Orbital Parameters for 31st January 2004

The spacecraft configuration status remains stable.

Meteosat-8

Meteosat-8 continued to be commissioned during this reporting period. Following the successful Routine Operations Readiness Review, a decontamination of the SEVIRI instrument was performed and Meteosat-8 was then relocated to 3.4°W. Meteosat-8 started a parallel operations phase with MTP on the 29th of January 2004.

The Autumn eclipse season for Meteosat-8 started on the 1st of September and finished on the 18th of October.

Orbit			Attitude	
Inclination	Longitude	E/W Drift	Right Ascension	Declination
0.9251	-3.3520	-0.0131	220.4849	89.2848

Meteosat-8 Orbital Parameters for 28th January 2003

The spacecraft configuration status has remained stable since the failure of Solid State Amplifier in October 2002.

2 OPERATIONS STATUS UPDATE

2.1 Recent key events

The 2004 spring eclipse season for the Meteosat satellites started in February.

Meteosat-5, Meteosat-6 and Meteosat-7 EW station keeping manoeuvres were performed in February and March 2004.

The main events in the period Aug 2003 – Jan 2004 were:

Date	Event
13 - Aug	Start of Meteosat-5 Autumn Eclipse Season.
22	Start of Meteosat-6 Autumn Eclipse Season.
31	Start of Meteosat-7 Autumn Eclipse Season.
01 - Sep	Start of Meteosat-8 Autumn Eclipse Season.
19	Start of the Sun-Meteosat-5-Primary Ground Station Co-linearity
23	Meteosat-6 E-W Station-keeping manoeuvre.
27	Start of the Sun-Meteosat-6-Primary Ground Station Co-linearity
27	End of the Sun-Meteosat-5-Primary Ground Station Co-linearity
01 - Oct	Start of the BRGS scintillation period.
02	End of the Meteosat-5 autumn eclipse season
05	End of the Sun-Meteosat-6-Primary Ground Station Co-linearity
06	Start of the Sun-Meteosat-7-Primary Ground Station Co-linearity
07	End of the Meteosat-6 autumn eclipse season
07	Meteosat-5 E-W Station-keeping manoeuvre.
11	Start of the Sun-Meteosat-8-Primary Ground Station Co-linearity
14	End of the Sun-Meteosat-7-Primary Ground Station Co-linearity
16	End of the Meteosat-7 autumn eclipse season
18	End of the Meteosat-8 autumn eclipse season
19	End of the Sun-Meteosat-8-Primary Ground Station Co-linearity

20	Meteosat-6 Attitude manoeuvre.
25	Meteosat-8 Moon Eclipse
28	Meteosat-7 E-W Station-keeping manoeuvre.
17 - Nov	Meteosat-6 E-W Station-keeping manoeuvre.
24	Meteosat-5 Attitude manoeuvre.
16 - Dec	Meteosat-7 Attitude manoeuvre.
17	Meteosat-5 E-W Station-keeping manoeuvre.
06 - Jan	Start of Meteosat-8 Decontamination
12	End of Meteosat-8 Decontamination
12	Meteosat-6 E-W Station-keeping manoeuvre.
14	Start of Meteosat-8 Station Re-location Manoeuvre to 3.4°W
19	Meteosat-5 Battery Reconditioning Starts.
26	Meteosat-5 Battery Reconditioning Ends.
26	Meteosat-6 & 7 Battery Reconditioning Starts.
27	End of Meteosat-8 Station Re-location Manoeuvre to 3.4°W

2.2 Service Performance

The following tables show the overall performance of the operational services in the period Aug 2003 – Jan 2004. The figures are extracted from the Operations Monthly and Quarterly Reports. All the performance figures are expressed in percentages.

2.2.1 0° Service Performance

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Image Acquisition	98.52%	99.25%	99.03%	99.51%	99.80%	99.66%
Dissemination (Wfx+HR)	99.48%	99.65%	99.79%	99.95%	99.91%	99.89%
FSDR	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
DCP	80.50%	---*	97.86%	99.63%	95.33%	99.39%
MPEF distribution	97.36%	97.56%	98.98%	99.74%	99.52%	99.45%

* statistics not available due to S/W H/W problems

2.2.2 63° Service Performance

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Image Acquisition	98.68%	99.78%	99.26%	99.58%	99.80%	99.26%
Dissemination (HR)	98.56%	99.87%	99.84%	99.92%	99.57%	99.37%
MPEF distribution	96.94%	99.72%	98.93%	99.68%	99.67%	99.57%

2.2.3 Rapid Scanning Service Performance

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Image Acquisition	91.22%	98.82%	99.05%	99.85%	99.92%	97.99%

August's lower performance on all missions – in particular rapid scanning - was due to communication link problems resulting in missing lines and some image loss.

2.2.4 Meteosat-8 Service Performance

The following tables show the end to end performance of the Meteosat-8 operational trial services in the period Nov 2003 – Jan 2004. These figures were generated as part of the MSG System Commissioning and were measured at the user station. All the performance figures are expressed in percentages. The formats or products must be complete and meet timeliness to be counted successfully.

	Nov-03	Dec-03	Jan-04	Remarks
Image Acquisition	99.7%	100%	99.2%	
Image Dissemination (HRIT+LRIT SEVIRI)	94.4%	97.7%	96.3%	
MPEF	97%	95.4%	97.6%	GII not yet available
OSI SAF	N/A	N/A	N/A	not yet available
FSD				
GOES-9	79%	97.7%	99.1%	
GOES-10/W	76%	95.9%	96.8%	
GOES-12/E	79%	96.9%	99.1%	
IODC	N/A	87.6%	94.6%	
DCP	N/A	N/A	N/A	DCP performance numbers not yet available
MDD	97.1%	98.1%	99.1%	

2.2.5 RF Interference

The current level of RF interference observed on the MTP dissemination transponders is very low, with very few High Resolution test format bit errors being reported by the User Station Display Facility in Darmstadt. For the DCP channels, interference was observed on Regional channels R04, R10, R13, R16, R17, R18.

3 Archive and Retrieval Service

3.1 MARF Availability

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Ingestion Availability	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Product Availability	95.97%	98.35%	98.92%	99.70%	99.84%	99.29%
Retrieval Availability	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

3.2 MARF Transcription Status

These figures are the percentages of images that have been transcribed:

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Image files transcribed	95.49%	95.49%	95.49%	97.00%	100.00%	100.00%

Note: The transcription status of products reached 100% already in 2001.

3.3 MARF Customer Enquiries

These figures are actual numbers of customers and numbers of image prints:

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
External Customers	11	13	20	14	28	43
Internal Customers	15	5	10	10	17	8
Image Prints	36	52	85	159	19	8

3.4 Unified Archive and Retrieval Service

3.4.1 UMARF Availability

	Aug-03	Sept-03	Oct-03	Nov-03	Dec-03	Jan-04
Ingestion Availability	100%	100%	100%	100%	100%	100%
Product Availability*	99%	98%	97%	98%	98%	98%
Retrieval Availability	99%	98.5%	100%	98.5%	100%	99.5%

* Commissioning Meteosat-8

3.4.2 U-MARF Customer Enquires

	Aug-03	Sept-03	Oct-03	Nov-03	Dec-03	Jan-04
External Customers	7	8	6	7	7	8
Internal Customers	5	6	7	9	6	12
Image Prints	40	15	60	100	350	5

4 User Helpdesk

4.1 User Enquiries

These figures are the actual number of enquiries:

	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Member State enquiries	184	165	217	175	178	353*
Non-member State enquiries	63	56	75	59	45	78*

*closed enquiries

5 MTP Ground Segment

The availability of the MTP ground segment has mostly been nominal for the reporting period.

5.1 MTP Control Centre

Operations have run without any significant problems from the new MTP control room since the relocation which took place in June. After several weeks of stable performance in the new control room, the equipment in the former room was dismantled.

In the 4th quarter of 2003 the CF System Services servers were upgraded from VAX to ALPHA. It is planned to upgrade the remaining VAX stations to ALPHA during 2004 for better maintainability of the hardware.

5.2 Communication Links

The satellite link suffered from degraded quality during August and this was attributed to extreme ambient temperatures. Since September a nominal operating status has been restored.

The "third link" (a 2Mbit E1 with ISDN backup) was implemented and tested during November and put into operation in December to handle the data for the RSS mission. The third link has been operating nominally.

The terrestrial link was non-operational on 10 consecutive days in January due to a hardware failure on the legacy equipment (Newbridge multiplexer) in the PGS. The satellite link was moved, as planned, from the legacy routers (DECNIS) to state-of-the-art routers (Cicso) in the MCC and the PGS.

5.3 Kourou Ground Station

Both Land-Based Transponders (LBT1 & LBT2) are functioning nominally. LBT1 had an outstanding problem fixed by the local station staff. LBT1 was activated for a short period to confirm 4-way ranging with Meteosat 7. LBT2 had an HPA failure, which was fixed by the local station staff, a spare unit was installed. There was no impact on operations.

5.4 MDD

All MDD stations, including the one relocated from Bracknell to Toulouse and made operational in August, are operating nominally. Redundant equipment from Bracknell has been distributed (mainly to the Météo France site) to supplement spares inventories. MDD maintenance contractor intervention was requested two times for corrective maintenance activities.

5.5 Primary & Backup Ground Stations

An upgrade of the Primary Ground Station (PGS) LAN was successfully implemented at the end of July and has proven to run stably. Routine weekly activations of the Backup Ground Station (BGS) in Cheia, Romania and the Backup Satellite Control Centre (BSCC) in Fucino, Italy continue. The BGS also continues to routinely support the monthly ranging campaigns for Meteosat-6.

5.6 Lannion FSDR

The Lannion uplink station continues to provide the service of uplinking foreign satellite data as expected in a stable manner.

5.7 MARF

Since the last Status Report, the MARF has continued to operate under stable conditions. The transcription of X-ADC data was completed slightly ahead of schedule.

The amount of data requested by users has increased dramatically, with an increase of approximately 50% in part due to the Large Order data policy. We have to date 36 Large Orders on-going, with requests ranging from a few months to 20 years. These large orders will be closed quicker once the switch and migration to the new archive

The Archive Direct service has been widely used with approximately 1 TByte of data being transferred by FTP in the last 5 months.

5.8 MPEF

The new pixel based Scenes and Cloud Analysis that was put in operation in June 2003 has as expected provided more accurate vicarious calibration results. The results confirm the bias that had been observed for the Meteosat-7 satellite as measured against other data like HIRS and ECMWF model. Based on the vicarious calibration results the black-body calibration model was re-tuned. From 1 December 2003, 1200z the operational blackbody calibration was updated with new parameters resulting in a 2% change for IR calibration and a 1% change for WV channel. Further information can be found at:
http://www.eumetsat.de/en/dps/mpef/calibration/bb_calibration_update.html

In order to use the new pixel based classification for Meteosat-5 processing chain required due to the high inclination of the satellite some further development work. The modification have now been tested and the new classification scheme will become operational for Meteosat-5 1 March 2004.

5.9 Rapid Scan Service (RSS) Products

The derivation of meteorological products from Meteosat-6 Rapid Scan data has been operational since July 2002. The service has been continued on a best effort basis however the availability is in general over 96 %.

5.10 Reprocessing

During 2003 the reprocessing of Atmospheric Motion Vectors and Clear Sky Radiances in Support of ERA-40 was completed.

The Meteosat Surface Albedo product was generated for Meteosat-7 for the primary service at 0° mission and for Meteosat-5 for the 63° mission for the years 2000 and 2001. Additionally the MSA product has been generated for Meteosat-7 for 2003.

The calibration of the visible channels of Meteosat-5 and Meteosat-7 has been completed until 2003 and the calibration of Meteosat-4 has been started. Sequentially the other Meteosat satellites will follow.

6 MSG Ground Segment

The availability of the MSG ground segment has been nominal for the reporting period.

6.1 MSG Control Centre

The MSG Central Facility has been stable following the removal of the OTG archiving software and Tape Library. CF reporting and analysis is supported by an in-house developed application – PARDET.

The IMPF has also become stable following the replacement and reconfiguration of the RAID arrays. The IMPF replaced the IQGSE/IDRS temporary image processing system in October 2003 as the operational level 1.5 SEVIRI image feed to the DADF, MPER and UMARF.

There have been no major problems with the DADF. Some reengineering has been performed to accommodate the introduction of EUMETCast.

6.2 Primary & Backup Ground Stations

Routine operations at the Primary Ground Station (PGS) in Usingen, Germany include the weekly activation of the Backup Satellite Control Centre (BSCC). TTC and Ranging alternate between the PGS and the Back-up & Ranging Ground Station (BRGS) in Maspalomas. The CMCS has in both the PGS and BRGS have been upgraded several times leading to a more stable configuration. Antenna 18 at the PGS is still not in operational use due to a feed problem. This is the subject of a redesign and remanufacture.

A scintillation effect is observed at the BRGS in Maspalomas affecting the reception of telemetry and command of the spacecraft. This occurs for several hours per day over a period of several months during the winter. A workaround has been implemented to switch

commanding to the PGS during the hours when the scintillation effect is seen. The effect seems to be less during this winter compared to the last winter season.

System Engineering Verification (SEV) started in January 2004. The main aim is to verify that the ground segment can support a multi-satellite configuration in preparation of the launch of MSG-2.

7 Unified Archive and Retrieval Service

The U-MARF has been in operation since the launch of Meteosat-8 (MSG1) and data ingested solely from this satellite. The U-MARF has continued to operate under stable conditions.

Due to commissioning the amount of orders request by the users has been limited in general to the MSG Principle Investigators, although the number of enquires from other users has increased significantly in recent months and have been dealt with on a case by case basis.

The migration of data from the old archive (MARF) to the U-MARF is scheduled to start in the 2nd quarter 2004.

8 MSG MPEF

8.1 CalVal and Product Validation Test Campaigns

During the second half of 2003, the MSG MPEF supported firstly the Calibration/Validation tests and later was used for the Product Validation tests.

The support to Cal/Val consisted of two processing chains being run in parallel producing the full set of products and sending calibration monitoring data to the image processing system every repeat cycle. One chain was using the calibration coefficients derived by the image processing system from the on-board black bodies as provided, as per the nominal operational scenario. The other chain was being fed back its own calibration values from the monitoring reports, their having been inserted into the image header by the image processing system. Juxtaposing the results derived by these two processing chains provided information about the relative accuracy and stability of the various calibration mechanisms. This activity is planned to be continued during 2004.

The product validation testing was designed to provide an initial assessment of the quality of the MPEF product by comparison with any corresponding MTP MPEF products, comparison with in situ observations and detailed statistical analysis of the products over a period of several months. An initial report will form part of the Image and Product Validation Review in March 2004. Product validation activities will continue for the coming months in order to establish a better assessment of the longer term variability of the data.

Since the start of routine operations of Meteosat-8, the MPEF has been producing, disseminating and archiving the full set of products. These "Day 1" products include the Total Ozone (TOZ), the Cloud Mask (CLM) and the Global Instability Index (GII). Initial feedback from the user community has been encouraging.