REPORT OF THE THIRTIETH MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS XXX

Bangalore, India, 11-14 November 2002

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Please note that this report is published together
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at CGMS XXX.

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FINAL REPORT OF THE PLENARY SESSION

A. INTRODUCTION

A.1 Welcome

CGMS XXX was convened by the CGMS Secretariat at 09:00 a.m. on 13 November 2002 in Bangalore, India. Dr. K.N. Shankara, Director of the Space Application Centre of Indian Space Research Organisation (ISRO), opened the meeting and warmly welcomed the participants to the city of Bangalore.

A.2 Introduction of Members and Address

EUMETSAT introduced the ESA and EUMETSAT participants followed by Russia, Japan, USA, Intergovernmental Oceanographic Commission (IOC), WMO, and India. China was unable to participate in this meeting and requested to be represented by WMO. CGMS agreed to allow China to review the draft report before final approval.

A.3 Inaugural Speeches

Dr. Shankara stated that it was a great honour and privilege to host the CGMS meeting in the same year as the first launch of an Indian dedicated meteorological satellite, METSAT. This was followed by a presentation by Mr. J. Ninan, Director of International Relations, ISRO, on the history and development of ISRO since 1960 up to the present day. (Both presentations are available on the CGMS XXX CD-ROM.)

A.4 Election of Chairmen

Dr. V. Jayaraman was unanimously elected as Chairman and Dr. R.C. Bhatia as Vice-Chairman of CGMS XXX. Chairmen for the working groups had been elected at the previous CGMS meeting; Mr. R. Wolf for Working Group I; Dr. R.C. Bhatia for Working Group II due to the absence of China; Dr. J. Purdom for Working Group III; and Dr. T. Mohr for Working Group IV.

A.5 Adoption of Agenda

The agenda (see Annex 1) was adopted. The meeting recalled that the four working groups had met previously on 11-12 November 2002.

The Secretariat provided a list of working papers submitted to CGMS XXX (see Annex 2), as well as a provisional order of business, which was used as a basis for the subsequent discussions.

A.6 Nomination of Drafting Committee

The drafting of various sections of the Final Report was carried out by the Secretariat based upon summaries of submitted Working Papers and the Reports of the Working Groups.

A.7 Review of Action Items from Previous Meetings

The Secretariat reviewed the outstanding actions from previous meetings, taking into account inputs provided in EUM-WP-01, IND-WP-01, JPN-WP-01, RUS-WP-01, USA-WP-01 &-04 and WMO-WP-02:

(i) Permanent actions

1. All CGMS members to inform the Secretariat of any change in the status or plans of their satellites (to allow updating of the CGMS Tables of Satellites).

Ongoing. Tables were distributed and updated during the meeting.

2. Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin Board, or other means as appropriate.

Ongoing. Tables will be distributed by the Secretariat once all inputs have been consolidated.

3. EUMETSAT, Japan and USA to provide the agreed set of reporting statistics on International Data Collection System (IDCS) performance and report to CGMS Secretariat and WMO on a regular basis.

Ongoing. See USA-WP-09, JPN-WP-08, and EUM-WP-15.

4. CGMS members to update the CEOS/ WMO Consolidated Database as appropriate using the utility tools provided by WMO and to respond directly to WMO following the database update cycle process.

Ongoing. See USA-WP-17.

5. CGMS members to report on anomalies from solar events at CGMS meetings.

Ongoing. See EUM-WP-02 (Meteosat status report) and USA-WP-04.

6. All CGMS satellite operators to review the tables in Appendix A of WMO-WP-03 and provide any updates to WMO, as appropriate, and at every CGMS Plenary meeting.

Ongoing.

7. CGMS members to update their relevant sections of the CGMS Consolidated Report, as appropriate, and to send their updates to the Secretariat at least two months prior to every CGMS Plenary meeting.

Ongoing.

(ii) Actions from CGMS XXIX

ACTION 29.01 USA to provide WMO with a copy of the Principal Components Analysis (PCA) report for the new GOES-12 channels, in order to evaluate the possibility of detecting volcanic ash clouds by 30 November 2001.

Closed*. PCA paper distributed to WMO and all CGMS members, November 2001.*

ACTION 29.02 CGMS members to report at CGMS XXX on discussions within their organisations on the possibility of flying space environment monitoring instruments on next generation geostationary satellites by **30 September 2002**.

Closed. *Completed by USA see* <u>*USA-WP-05*</u> *and by EUMETSAT (no input).*

ACTION 29.03 China to provide details of its future X-band broadcast and to inform CGMS XXX how WMO members would get access to FY-3 satellite data, using either low-cost user stations or alternative dissemination methods by **30 September 2002**.

Closed. *Input provided to WMO.*

ACTION 29.04 CGMS members to provide WMO with updates to Table 1 (<u>WMO-WP-06</u>) – "Coordination of Data Formats and Frequency Planning for Polar-orbiting Satellites", with a view to using this table as a reference in the preparation of discussions on mission planning in the polar-orbit and contingency during the WMO Consultative Meeting on High Level Policy planned in Geneva in February 2002 by **31 December 2001**.

Closed. *Documents provided in view of preparation of CGMS Working Group that met on 20 February 2002 in Geneva. Presentations available on CGMS website.*

ACTION 29.05 EUMETSAT to provide CGMS members with an outline of a discussion paper on mission planning in the polar-orbit and contingency by the **beginning of December 2001**.

Closed. *Paper sent by e-mail to all CGMS members on 10 December 2001.*

ACTION 29.06 CGMS members to respond and provide inputs to this document by mid-January 2002 in view of using this paper as an input to the discussions on mission planning in the polar-orbit and contingency planned during the WMO Consultative Meeting on High Level Policy planned in Geneva in February 2002 by **15 January 2002**.

Closed. *WMO produced the Working Paper for the Consultative Meeting on 18-19 February 2002. See WMO-WP-15.*

ACTION 29.07 USA to provide information on the broadcasts available from its NPOESS Preparatory Project (NPP) satellite to CGMS XXX by **30 September 2002**.

Closed. *See USA-WP-07.*

ACTION 29.08 EUMETSAT to provide details of its ATOVS Retransmission Service to CGMS members by **31 December 2001**.

Closed. *E-mail sent to CGMS members on 8 March 2002 with STG document and PowerPoint Presentation.*

ACTION 29.09 China to provide details of its internal data retransmission system to CGMS members by **31 December 2001**.

Closed. *E-mail sent to CGMS members on 3 June 2002.*

ACTION 29.10 The CGMS Secretariat to make sure that a discussion on a response to Global Climate Observing System (GCOS) requirements for global climate monitoring products from geostationary satellites is included in the discussions of Working Group II: Satellite Products at CGMS XXX by **30 September 2002**.

Closed. *Included in the CGMS XXX draft agenda.*

ACTION 29.11 WMO to host a meeting of the CGMS Working Group on Global Contingency Planning, in February 2002 following the Consultative Meeting on High Level Policy, in preparation for further discussions at CGMS XXX by **28 February 2002**.

Closed. *The meeting was held on 20 February 2002 in Geneva.(WMO-WP-05)*

ACTION 29.12 CGMS members to amend, as necessary, contact information for the CGMS Consolidated Report Drafting Committee, and inform the CGMS Secretariat accordingly by **30 November 2001**.

Closed. *Completed by Russia in an e-mail dated 16 July 2002.*

ACTION 29.13 CGMS members to submit updated sections of the CGMS Consolidated Report relating to their organisations/programmes to the CGMS Secretariat, and the CGMS Secretariat to issue a revised version of the document on-line by **31 December 2001**.

Closed. *See EUM-WP-08.*

ACTION 29.14 CGMS requests member countries participating in the CGMS Virtual Laboratory Focus Group to report on the development of their activities at CGMS XXX by **30 September 2002**.

Closed. Completed b*y Russia, WMO, USA and Japan. Russia e-mail dated 16 July 2002: no activities, WMO-WP-17, USA-WP-37, JPN-WP-11.*

ACTION 29.15 CGMS satellite operators and WMO to coordinate with their responsible frequency administrations to ensure that meteorological experts participate at the meetings of ITU WP 8D (8-14 May 2002, Geneva) and ITU WP 7C (11-15 February 2002, Geneva) to support and defend meteorological applications by **31 January 2001**.

Closed. *R. Wolf, EUMETSAT, J.M. Rainer, WMO, and D. Franc, NWB NOAA attended the WP8D.*

ACTION 29.16 CGMS members to provide information on planned passive sensors using frequency bands above 275 GHz on future meteorological satellite systems by **31 January 2002**.

Closed. *Completed by Russia, USA, and EUMETSAT. See USA-WP-19, and EUM-WP-13.*

ACTION 29.17 EUMETSAT to distribute the final report of the study on "Passive Sensor Requirements Above 275 GHz" to CGMS members by **28 February 2002**.

Closed*. Report sent by e-mail on 6 February 2002 to all CGMS members.*

ACTION 29.18 EUMETSAT to send a letter to Roshydromet explaining the technical details related to the MSG frequency coordination problems by **30 November 2001**.

Closed. *Letter sent by EUMETSAT on 30 October 2001.*

ACTION 29.19 Roshydromet to contact the responsible frequency administration in Russia to address CGMS concerns related to the notification process of MSG by **31 January 2002**.

Closed. *Letter received from Roshydromet and letter of thanks sent by EUMETSAT on 30 April 2002.*

ACTION 29.20 USA to inform CGMS members on the results of the demonstration of its Interference Location System (TLS) by **31 March 2002**.

Closed. *E-mail dated 15 May 2002 to all CGMS members enclosing report.*

ACTION 29.21 CGMS members to further consider a four time-slot scenario and WMO to provide advice on the need for sounding instruments in the 05:30 a.m. and 17:30 p.m. orbits by **30 September 2002**.

Closed. *Included in the CGMS XXX draft agenda. See also WMO-WP-05.*

ACTION 29.22 USA to distribute technical information on low-cost L-band antenna systems to CGMS members by **28 February 2002**.

Closed. *See USA-WP-39.*

ACTION 29.23 CGMS to establish the Terms of Reference (TOR) for an ad hoc Working Group on Integrated Strategy for Data Dissemination from Meteorological Satellites which will meet in Geneva prior to the meeting of the Expert Team on Redesign of the Global Observing System (GOS) by **30 April 2002**.

Closed. *TOR agreed in meeting held on 29 April 2002 in Geneva. See WMO-WP-21.*

ACTION 29.24 CGMS satellite operators to submit proposals for discussion at the ad hoc Working Group on Integrated Strategy for Data Dissemination from Meteorological Satellites by **28 February 2002**.

Closed. *Submissions made in view of the meeting on 29 April 2002. See WMO-WP-21.*

ACTION 29.25 WMO to inform the R&D satellite operators about alternative dissemination methods, at the Second WMO Consultative Meeting, being held in Geneva in February 2002 by **28 February 2002**.

Closed*. Completed at the Second WMO High Level Policy Meeting on 18-19 February 2002 in Geneva.*

ACTION 29.26 Satellite operators to post on the CGMS homepage available relevant papers on satellite radiance (VIS, IR and WV) intercomparisons and to start routine intercomparisons of Low Earth Orbit (LEO) and Geostationary (GEO) calibrations as soon as possible, striving to post results every quarter on their own web pages by **30 June 2002**.

Closed. *Completed by EUMETSAT and Russia.*
http://www.eumetsat.de/en/dps/mpef/calibration/intercalibration.html
link made on the CGMS Satellite Inter-comparison page under EUMETSAT. See EUM-WP-16. Russia portion completed, e-mail 16/07/02: no activities.

Closed*. See EUM-WP-16, JPN-WP-09, and USA-WP-24.*

ACTION 29.27 The Chairman of Open Programme Area Group in Integrated Observing Systems (OPAG-IOS) is asked to bring to the attention of the CBS Management Group, as a matter of urgency, the need for a designated CBS Open Programme Area Group with responsibility for the monitoring of satellite data as well as the need for an expert meeting to discuss associated issues. CGMS members are asked to indicate their willingness, as appropriate, to participate in such a WMO planning meeting by **31 March 2002**.

Closed. *WMO: CBS Management Group discussed the issue but decided to take no action.*

ACTION 29.28 WMO to report on Nowcasting User requirements and observing system capabilities and the statements of guidance resulting from a critical review of these; NOAA/ NESDIS is requested to report on their experiences using GOES sounders for nowcasting applications; and EUMETSAT to report on its process for setting nowcasting requirements to be met by their Meteosat Third Generation by **30 September 2002**.

Closed. *WMO TD No 1052 (SAT-26). See also EUM-WP-18 and USA-WP-25.*

ACTION 29.29 EUMETSAT and USA report on their plans for developing and supporting Direct Broadcast (DB) processing packages for IASI/ AVHRR/ AMSU and CrIS/ VIIRS/ ATMS, respectively, at International TOVS Working Group (ITWG) in March 2002 and CGMS XXX by **30 September 2002**.

Closed. *Completed during the working group sessions at CGMS XXX. See also EUM-WP-19.*

ACTION 29.30 ITWG, at its March 2002 meeting, to (a) summarise the successful characterisation of problems with AMSU-A & B DB data (e.g. humidity profiles derived with AMSU-B) and post these on a website for DB users, (b) characterise the DB profile retrieval packages (three are known to CGMS - ATOVS and AVHRR Processing Package (AAPP), IAPP, Integrated System for the ATOVS Data Processing (ISADP), (c) provide an update on the status of using satellite data over land for retrievals and other products, (d) explore the quantitative use of cloud products, (e) discuss the necessity for CO_2 profile measurements for improving atmospheric temperature profile retrieval, and (f) investigate multi-satellite utilisation for profile retrieval, specifically radio occultation with high spectral resolution infrared radiometers by **31 March 2002**.

Closed. *Completed during the working group sessions at CGMS XXX. See USA-WP-33.*

ACTION 29.31 Satellite operators to report at CGMS XXX on their monitoring procedures and practices for satellite data and products placed on the GTS using CGMS XXIX EUM-WP-15 as an example by **30 September 2002**.

Closed. *Completed during the working group sessions at CGMS XXX. See USA-WP-26 and EUM-WP-15.*

ACTION 29.32 CGMS to invite the EUMETSAT Nowcasting Satellite Application Facility (SAF) to host the next IPWG meeting in 2002 by **31 December 2001**.

Closed. *The IPWG meeting was held in Madrid on 23-27 September 2002.*

ACTION 29.33 CGMS members to propose lists of parameters and data which should be contained in "metadata" to accompany reprocessed data, at CGMS XXX by **30 September 2002**.

Closed. *See EUM-WP-22, JPN-WP-14, and USA-WP-27.*

ACTION 29.34 EUMETSAT to report at CGMS XXX on the progress concerning the production of winds from rapid scans and the relevant feedback from users by **30 September 2002**.

Closed. *EUM-WP-09.*

ACTION 29.35 JMA to report on the progress of the experiment using targeted CMW observations around typhoons and related model impact studies at CGMS XXX by **30 September 2002**.

Closed. *JPN-WP-15.*

ACTION 29.36 The Sixth International Winds Workshop to discuss the compatibility of spatial resolution and image repeat cycle for winds tracking and to provide pertinent recommendations to CGMS satellite operators by **10 May 2002**.

Closed. *EUM-WP-24.*

ACTION 29.37 The Sixth International Winds Workshop to discuss the template size for tracking features in relation to the question whether the displacement vector represents a local wind vector. A pertinent recommendation should be provided to CGMS satellite operators by **10 May 2002**.

Closed. *EUM-WP-24.*

ACTION 29.38 The Sixth International Winds Workshop to discuss and encourage the use of geometric (and other) height allocation methods for comparison with and validation of multi-spectral infrared height assignment methods of wind vectors which are used operationally by **10 May 2002**.

Closed. *EUM-WP-24*.

ACTION 29.39 The Sixth International Winds Workshop to revisit the current concepts of height allocation techniques (e.g. IR-W EBBT, WV intercept, CO2 slicing and WV EBBT) for assigning atmospheric motion vectors to a single level height and to provide relevant results to CGMS satellite operators by **10 May 2002**.

Closed. *EUM-WP-24*.

ACTION 29.40 The Sixth International Winds Workshop to analyse the status of the implementation of quality indicators assigned to wind vectors and to report back to CGMS on current benefit to NWP by **10 May 2002**.

Closed. *EUM-WP-24*.

ACTION 29.41 All CGMS members to provide feedback on the "Integrated Satellite Wind Monitoring Report" to Pauline Butterworth (pauline.butterworth@metoffice.com), with copy to the CGMS Secretariat by 31 March 2002. Comments of general interest should be provided through the CGMS Wind List server at WMO by **31 March 2002**.

Closed. *EUMETSAT portion completed. See also USA-WP-28*.

ACTION 29.42 USA to report on potential plans for a reprocessing of winds at CGMS XXX by **30 September 2002**.

Closed. *See USA-WP-29*.

B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar-orbiting Meteorological Satellite Systems

In PRC-WP-01 China reported on the status of FY-1D, which was launched on 15 May 2002 from TAIYUAN Satellite Launch Centre. The satellite is now operational and operating in a nominal configuration. The instruments are similar to those of FY-1C. FY-1D transmits Chinese High Rate Picture Transmission (CHRPT) to world users and also transmits GDPT and LDPT, which are received only by National Satellite Meteorological Center of CMA (NSMC).

PRC-WP-02 described the current status of FY-1C. FY-1C has been operating for more than three years, exceeding the design lifetime of two years.

Russia informed CGMS in RUS-WP-02 that two satellites are currently in operation. Meteor–3 N5 satellite is operated well beyond its lifetime and has limited capabilities. The first polar-orbiting satellite Meteor-3M N1 of the new series of meteorological satellites was successfully launched from Baikonur by a Zenit–2 launcher on 10 December 2001. The payload included several instruments of which the radiometers MIVZA and MTVZA have limited capabilities due to technical problems related to their scanning mode. Due to the on-board 466 MHz transmitter no longer functioning, the satellite has limited capabilities for MR-2000M and KLIMAT data direct broadcast.

NOAA reported on the USA polar-orbiting meteorological satellite systems in USA-WP-02. The Polar-orbiting Operational Environmental Satellite (POES) spacecraft constellation includes two primary, one secondary, two stand-by and one post-launch spacecraft. These spacecraft are in circular orbits inclined at approximately 98° (retrograde). The primary operational spacecraft, NOAA-16 and NOAA-17, are in sun-synchronous afternoon and morning orbits, respectively. One secondary spacecraft, NOAA-14 provides additional payload operational data. NOAA-12 and NOAA-11 are stand-by spacecraft supporting additional user data requirements. NOAA-17 was launched on 24 June, 2002. NOAA-17 has completed post-launch verification and became the primary morning operational spacecraft in September 2002 replacing NOAA-15. As such, it operates in an orbit with a 10:00 a.m. ascending node (morning orbit) and carries a Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). NOAA-14 is the secondary afternoon satellite and operates in an orbit with a 1:30 p.m. ascending node. The next POES launch, NOAA-N, is slated for launch in June 2004. This spacecraft will be renamed NOAA-18 once it achieves orbit. Over the last three years, the USA has successfully converged the operations of the five Defense Meteorological Satellite Program (DMSP) satellites with that of the NOAA POES. The current DMSP constellation consists of two primary, two secondary, and one back-up operational spacecraft.

Table 1: Current Polar-Orbiting Satellites Coordinated Within CGMS
(as of 22 December 2002)

Orbit type (equatorial crossing times)	**Satellites in orbit** (+operation mode) P=Pre-operational Op=operational B=back-up L=limited availability	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Status**
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	NOAA-17 (Op)	USA/NOAA	10:02 (D) 812 km	6/02	Functional
	NOAA-15 (B)	USA/NOAA	07:04 (D) 810 km	05/98	Functional (problems with AVHRR +HIRS)
	NOAA-12 (B)	USA/NOAA	04:47 (D) 808 km	05/91	Functional (except sounding)
	DMSP-F15 (Op)	USA/NOAA	21:31 (A) 850 km	12/99	Defense satellite. Data available to civilian users through NOAA.
	DMSP-F14 (B)	USA/NOAA	20:14 (A) 852 km	04/97	Defense satellite. Data available to civilian users through NOAA.
	DMSP-F12 (L)	USA/NOAA	18:56 (A) 850 km	8/94	Defense satellite. Non-operational (no on board recorders).
	RESURS-01-N4 (P)	Russia	09:30 (A) 835 km	7/98	Temporarily non-operational
	METEOR-3M-N1 (P)	Russia	9:15	10/12/01	Functional. In commissioning phase till end of 2002.
Sun-synchr. "Afternoon" (12:00 –16:00) (00:00 – 04:00)	NOAA-16 (Op)	USA/NOAA	13:55 (A) 851 km	09/00	Functional, no APT.
	NOAA-14 (B)	USA/NOAA	18:07 (A) 847 km	12/94	Functional, one OBP is not functioning.
	NOAA-11 (B)	USA/NOAA	22:42 (A) 843 km	09/88	SBUV instrument data limited.
Sun-synchr. "Early morning" (4:00 – 6:00) (16:00 – 18:00)	DMSP-F13 (Op)	USA/NOAA	18:18 (A) 850 km	03/95	Defense satellite. Data available to civilian users through NOAA.
Sun-synchr. "morning"	FY-1C (B)	China	7:50 (A) 862 km	5/99	Replaced by FY-1D
	FY-1D (Op)	China	08:40 CHRPT	15/05/02	Replaces FY-1C
Non sun-synchronous or unspecified orbits	METEOR 3-N5 (Op)	Russia	1200 km	08/91	Functional (APT transmissions of visible images).

B.2 Geostationary Meteorological Satellite Systems

EUMETSAT reported in EUM-WP-02 on the status of the Meteosat System. Meteosat-7 was fully operational at 0°, with Meteosat-6 as an in-orbit spare at around 10°E (MSG-1 is now located at around 10°W). Meteosat-5 is located over the Indian Ocean at 63°E and provides the Indian Ocean Data Coverage (IODC) Service.

The inclination of Meteosat-7 at the end of this reporting period was 0.31° and decreasing. The remaining hydrazine fuel on board is estimated to be 16.13 kg, of which a 4 kg 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. In addition to operating as the stand-by satellite, Meteosat-6 continues to provide an operational Rapid Scan Service (RSS) since the formal start on 18 September 2001. Major outages of the RSS can be foreseen before the end of this year for two reasons: the launch of MSG-1 and the associated shift in longitude of Meteosat-6, and the re-engineering of the Meteosat Transition Programme (MTP) Control Centre to accommodate the EUMETSAT Polar System (EPS) Control Centre. The orbital inclination of Meteosat-5 at the end of this reporting period was 5.19° and increasing. The remaining hydrazine fuel on board is estimated to be 5.23 kg, of which a 4 kg 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.

India reported on the status of its Indian National Satellite (INSAT) and METSAT Systems in IND-WP-02. It reported on the technical details and status of currently operational satellites of the INSAT series. The last satellite of INSAT-1 series (INSAT-1D) was deactivated on 14 May 2002 after providing useful service for about 12 years. The last satellite of INSAT-2 series (INSAT-2E) is currently providing useful cloud imagery data in three channels at 1 km resolution. The other communication-based operational services being derived from the INSAT series of satellites were also described in this paper, along with the activities of the Indian Meteorological Department related to training in satellite meteorology. Details of the bilateral collaboration programme with the USA for exchange of INSAT data were also given.

A new dedicated meteorological satellite, METSAT, was launched on 12 September 2002 and was declared operational on 25 September 2002. This satellite has a Very High Resolution Radiometer (VHRR) (VIS, IR and WV) and Data Relay Transponder (DRT) on board and is exclusively dedicated to meteorological services of the country. The imaging mission is working satisfactorily and it continues to be used operationally from 74^{o}E longitude position. Activities, such as image processing, derivation of meteorological products, data archival and dissemination of products to field stations for operational use, are completed on an operational routine basis.

ACTION 30.01

India to provide CGMS with information describing the data communication mission on METSAT, adding Noise Equivalent Delta Temperature (NEDT) values to the tables included in the document by December 2002.

India informed CGMS in IND-WP-03 of the future plans of INSAT satellites for meteorological applications. They described the capabilities of the first Indian satellite for ocean applications (Oceansat-1) launched in May 1999 on-board the IRS-P4 mission. Various data products (total water vapour, sea surface temperature, ocean surface wind speed, and cloud liquid water) derived from the Multi-channel Scanning Microwave Radiometer (MSMR) and the results of the last two years validation studies are presented. MSMR is found to be providing data of good quality and reliability; large-scale features of all the observed parameters and their interlinkages have been well brought out by the data. Derived products are also found to be useful for some meteorological applications. Research work regarding rainfall rate, sea ice extent, and soil moisture are also making good progress with promising results. Answering a question from WMO, India indicated that, currently, no direct broadcast service was planned. This requirement will be taken into account in the design of the satellites planned after INSAT-3D.

Japan reported on the status of GMS-5 in JPN-WP-02. GMS-5, well beyond its design lifetime of five years since the launch in early 1995, will be kept as an operational satellite where the housekeeping monitoring for GMS-5 will be carefully conducted through the GMS-5 operation, taking into account the possibility of unexpected increase of the motor torque. The remaining propellant totalled 8.71 kg on 27 June 2002. At present, the North-South manoeuvre will not be carried out due to lack of fuel, whereas the East-West, Spin rate and Attitude manoeuvres will be operated as scheduled.

In JPN-WP-03, Japan reports on the procedure to back-up GMS-5 with GOES-9. JMA has recently agreed with NOAA to establish a procedure to back-up GMS-5 with GOES-9, in case of malfunction of GMS-5. The procedure was announced on 17 May 2002, on the JMA website under "Establishment of the procedure to back-up GMS-5 with GOES-9". The back-up is foreseen to start in April 2003 and continue till approximately the end of 2003 at the intended start of MTSAT-1R routine operations. During the back-up, GMS-5 will remain stationed at the present position (140°E over the equator) and GOES-9 will be operated at 155°E over the equator to observe the Earth. The GMS-5 functions for data collection from Data Collection Platforms (DCPs) and transmission of Weather Facsimile (WEFAX) signals to users will be continued as they are now. JMA appreciated the continuous cooperation of the USA. USA indicated that they would perform sounding experiment from GOES-9 at 140°E and will inform CGMS of its next session.

In PRC-WP-03, CGMS was informed that FY-2B, the second Chinese geostationary meteorological satellite, was launched on 25 June 2000 by a Long-March 3 vehicle from Xichang Satellite Launch Center. The satellite is spin-stabilised and is stationed at 105° E. With regard to the status of FY-2A, CGMS recalled that on 26 April 2000 FY-2A was moved to the position 86.5°E to make room for FY-2B. On 27 July 2000 the checkout for FY-2A showed that after three years in the orbit the FY-2A satellite system remained in good condition except for the S-band antenna, which can not be allowed to work too long everyday. FY-2A satellite was switched from aboard system A to system B (redundancy) successfully in the process, then system B was checked out thoroughly. The results showed that the system B works as well as system A.

In USA-WP-03, the USA reported on the status of its geo-synchronous meteorological satellites. The current GOES are three-axis stabilised spacecraft in geo-synchronous orbits. The current primary satellites, GOES-8 and GOES-10, are stationed over the east and west coasts of the United States. These satellites are used to provide simultaneous images and soundings of the Western Hemisphere. The GOES-12, GOES-11 and GOES-9 are stored in orbit and are ready for the replacement of the older operational spacecraft if necessary. Plans are for GOES-12 to replace GOES-8 in Spring 2003.

GOES-9 will be removed from storage and readied for movement to 155°E to replace the ageing GMS-5 in April 2003. GOES-7 is currently located over the Pacific to support data relay requirements for the University of Hawaii's Pan-Pacific Educational and Cultural Satellite (PEACESAT) Programme. With a highly inclined geostationary orbit (approximately

13°E), GOES-3 is currently able to support data relay requirements to the South Pole Station for the National Science Foundation (NSF). GOES-3 no longer has any remaining imaging capabilities.

The primary instrument payload for the current series of GOES spacecraft is the imager and sounder. The GOES spacecraft also have Space Environmental Monitor (SEM) systems to measure magnetic fields, solar x-ray flux and high-energy electrons, protons and alpha particles. A data collection system on the GOES spacecraft receives and relays environmental data sensed by widely dispersed surface platforms such as river and rain gauges, seismometers, tide gauges, buoys, ships and automatic weather stations. Platforms transmit sensor data to the satellite at regular or self-timed intervals, upon interrogation by the satellite, or in an emergency alarm mode whenever a sensor receives information exceeding a present level.

Table 2: Current Geostationary Satellites Coordinated Within CGMS

(as of 22 December 2002)

Sector	**Satellites currently in orbit (+type)** P: Pre-operational Op: Operational B: Back-up L: Limited availability	**Operator**	**Loca-tion**	**Launch date**	**Status**
EAST PACIFIC (180°W-108°W)	GOES-10 (Op)	USA/NOAA	135°W	04/97	Inverted, solar array anomaly, DCP interrogator on back-up
WEST ATLANTIC (108°W-36°W)	GOES-8 (Op)	USA/NOAA	75°W	04/ 94	To be replaced by GOES-12 March 2003 Minor sounder anomalies, loss of redundancies on some sub-systems.
	GOES-11 (B)	USA/NOAA	105°W	05/00	In-orbit back-up, 48 hours availability.
	GOES-9 (L)	USA/NOAA	106°W	05/95	Starting January 2003 will be moved to 205°W as limited back-up to Japan's GMS-5 To act as back-up for Japan's GMS-5 from Spring 2003.
	GOES-12 (B)	USA/NOAA	105°W	07/01	Placed in storage mode in December 2001.
EAST ATLANTIC (36°W-36°E)	METEOSAT-6 (B)	EUMETSAT	9.5°	11/93	RSS minor gain anomaly on IR imager.
	METEOSAT-7 (Op)	EUMETSAT	0°	02/97	Functional.
	MSG-1 (P) (METEOSAT-8 when Op)	EUMETSAT	0°	28/08/02	Commissioning phase. First test images expected on 23 October 2002.

Sector	**Satellites currently in orbit (+type)** P: Pre-operational Op: Operational B: Back-up L: Limited availability	Operator	Loca-tion	Launch date	Status
INDIAN OCEAN (36°E-108°E)	METEOSAT-5 (Op)	EUMETSAT	63°E	03/91	IODC, functional but high inclination mode.
	GOMS-N1 (B)	RUSSIA	76°E	11/94	Since 9/98 in stand-by.
	FY-2B (Op)	CHINA	105°E	06/00	Image transmission interrupted in eclipse periods.
	FY-2A (B, L)	CHINA	86.5°E	06/97	
	INSAT II-B (B)	INDIA	111.5°E	07/93	Back-up satellite from an inclined orbit mode of operation. IR channel not available.
	INSAT II-E (Op)	INDIA	83°E	04/99	Imagery data from three channel Charged Couple Device payload (1km resolution) available for operational use. Three channel VHRR not available for use.
	INSAT III-C	INDIA	74°E	24/01/02	No met payload used for dissemination of processed met data in broadcast mode. No WEFAX broadcast capability.
	METSAT (Op)	INDIA	74°E	12/09/02	Dedicated meteorological satellite.
WEST PACIFIC (108°E- 180°E)	GMS-5 (Op)	JAPAN	140° E	03/95	The back-up of GMS-5 with GOES-9 is expected to be ready starting in the boreal Spring (April) of 2003.

B.3 Anomalies from Solar Events

The expanding uses of technology today are resulting in greater vulnerabilities to space weather disturbances. USA-WP-04, reported that Solar Cycle 23 has entered its decline and has proven to be somewhat smaller by several measures when compared to earlier record-breakers. But the proliferation of technological systems affected by solar activity has continued to increase. As a result, the net effects of the solar cycle on our daily lives loom larger than ever, and the potential impact shows every sign of continuing to increase in societal consequence. Two examples of recent increases in susceptibility to space weather impacts include the wider use of Global Positioning System (GPS), and the growing amount of commercial air traffic in polar regions. The USA stated the first of a planned series of Solar X-ray Imagers (SXI) is already in orbit on GOES-12. Once it becomes fully operational, images from SXI will help space environment forecasters anticipate the occurrence of solar flares and the associated radio blackouts, solar radiation storms, and geomagnetic storms. The scientific community has appreciated the great potential for improved space environment forecasts using solar x-ray imaging. That potential will be realised as GOES SXI begins to take data, presently scheduled for a start date in early 2003.

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Future Polar-orbiting Meteorological Satellite Systems

The status of the EUMETSAT Polar System (EPS) was presented in EUM-WP-04. The current EPS schedule results in a launch date for Metop-1 of July 2005. As NOAA launched NOAA-M in June 2002, then with an expected 45-month lifetime of NOAA-M and a launch of the first Metop satellite in 2005, there should be no (or little) gap in the morning orbit service.

All major contracts for the Space Segment, the Launcher and the Ground Segment are signed and respective developments are well underway. The Launch and Early Orbit Phase (LEOP) service contract is planned to start at the end of September 2002. The system Wrap-up Preliminary Design Review took place in March 2002. The review was considered successful, leading to the closure of the programme-level Phase B. The team is now preparing the system Critical Design Review (CDR). Some technical problems have been encountered on the IASI development, leading to a delay in the delivery of the instruments to METOP.

ESA informed CGMS in ESA-WP-01 of the status of ESA's Earth observation missions. Two of them, MSG and Metop have been developed in cooperation with EUMETSAT. The second European Remote Sensing Satellite (ERS), launched in 1995, is currently in operation. ENVISAT and MSG-1 were successfully launched on 1 March and 29 August 2002, respectively. Earth Explorer and Earth Watch missions are undertaken under the so-called Envelope Programme, a rolling programme designed to underpin European efforts in Earth observations from space. The Earth Watch programme includes, since January 2002, the Global Monitoring for Environment and Security (GMES) services element. A detailed presentation was given to CGMS and it is included in the CD-ROM provided with this report.

WMO thanked ESA for making the ENVISAT data available to the global user community through a Joint ESA/WMO Announcement of Opportunity.

In PRC-WP-04, China informed CGMS on the development of the FY-3 series of satellites, its second generation polar-orbiting meteorological satellites. The FY-3 series include seven satellites to be operated during the period 2005-2020. The first two satellites FY-3A and FY-3B and the on-board instruments are now being designed and manufactured. The mission objectives of FY-3 include:

- To provide global three-dimensional atmospheric thermal and moisture structures, cloud and precipitation parameters, in order to support global numerical weather prediction.

- To provide global imagery for monitoring large-scale meteorological and hydrological disasters and biosphere and environment anomaly.

- To derive geophysical parameters to support research activities in study global and regional climate change.

Russia informed CGMS in RUS-WP-03 on future polar orbiting meteorological satellites Meteor-3M. The original Meteor–3M satellite sketching design was revised considerably in 2002. It is planned to develop two Meteor-3M series satellites on the basis of a "Resurs"-type unified heavy platform to provide operational hydrometeorological and heliogeophysical information on the atmosphere, Earth surface and the world ocean. Foreseen launch dates are in 2005 and 2007-2010. The orbital parameters have been clarified and will later be coordinated with CGMS.

USA-WP-06 discussed NOAA's future polar-orbiting meteorological satellite systems. NOAA addressed the current operational system and the planned launch schedule for NOAA-N and N'. Information was provided on the international polar-orbiting satellite programme coordination between EUMETSAT and NOAA. The goal of this cooperation is to provide continuity of measurements from polar orbits, cost sharing, and improved forecast and monitoring capabilities through the introduction of new technologies. An agreement is in place between NOAA and EUMETSAT on the Initial Joint Polar-orbiting Operational Satellite System (IJPS). This programme will include two series of independent but fully coordinated NOAA and EUMETSAT satellites, exchange of instruments and global data, cooperation in algorithm development, and plans for real-time direct broadcast.

The USA discussed the development and implementation plans for the National Polar Orbiting Operational Environmental Satellite System (NPOESS). Beginning later this decade, NPOESS spacecraft will be launched into three orbital planes to provide significantly improved operational capabilities and benefits to satisfy the critical civil and national security requirements for space-based, remotely sensed environmental data. The advanced technology visible, infrared, and microwave imagers and sounders that are being developed for NPOESS will deliver higher spatial and temporal resolution atmospheric, oceanic, terrestrial, and solar-geophysical data. This will enable more accurate short-term weather forecasts, as well as serving the data continuity requirements for improved global climate change assessment and prediction. The NPOESS programme is well along the path to creating a high performance, polar-orbiting satellite system that will be more responsive to user requirements, deliver more capability at less cost, and provide sustained, space-based measurements as a cornerstone of an Integrated Global Observing System (IGOS). These activities represent a sound beginning for achieving the planned national and international operational satellite programs that will ensure continuous support to a variety of users well into the 21st century. In August of this year, the USA awarded a contract to TRW for the engineering, manufacturing and design of the NPOESS system.

USA presented a detailed presentation of NPOESS to CGMS. It is included in the CD-ROM attached to this report.

Responding to a question from WMO, USA indicated that as a follow on, the current IJPS agreement (covering NOAA-N and -N', and Metop-1 and –2), Europe and USA were negotiating a Joint Transition Agreement (JTA), which will cover Metop-3 and first NPOESS satellites. Europe and USA are also envisaging a Joint Polar System (JPS) in the 2020 era. Discussions on this potential JPS have not yet started.

In USA-WP-07, -35 and -39, the USA discussed the development of Direct Broadcast services from NPOESS, including High Rate Data (HRD) and Low Rate Data (LRD) broadcasts. Later this decade, NPOESS spacecraft will begin on-orbit operations and transmit Stored Mission Data (SMD) to globally distributed ground stations. NPOESS will simultaneously broadcast real-time HRD (X-band) and LRD (L-band) datastreams to suitably equipped field terminal systems. The NPOESS prime contractor has begun development of the software for the Interface Data Processing Segment (IDPS) that will run at U.S. Centrals and on HRD/LRD field terminals. During the next three to five years, the Integrated Programme Office (IPO) will be working with the Department of Defense NOAA programme offices responsible for field terminals to develop and begin testing prototype terminals for the HRD/LRD broadcasts. The IPO will continue to investigate developments in antenna/receiver technologies and computer systems capable of running scalable IDPS software to identify "lower-cost" solutions for the mobile, lower capability LRD field terminals.

In response to a question by the WMO, the United States provided information regarding NPOESS data access and data processing software.

The NPOESS IPO will:

- Develop, produce and distribute non-proprietary HRD and LRD Interface Data Processing Segment software
- Release IDPS software to commercial vendors for use on civilian commercial off-the-shelf field terminals
- Provide the HRD/LRD field terminal hardware/software specifications, antenna specifications, and storage requirements necessary to run IDPS software
- Maintain configuration control of the IDPS software through the NPOESS Configuration Control Board (CCB) process, and
- Distribute software changes and program updates for the HRD/LRD field terminals.

Also in response to a question by WMO, the USA clarified that there was no change in its open data policy. The purpose of NPOESS user registration is to allow for the distribution of software updates and to facilitate access by non-adversaries to NPOESS data should situations of crisis or war require the USA to deny data to an enemy through encryption of the data broadcast. During normal situations, the NPOESS broadcast will not be encrypted.

The IPO, in cooperation with NOAA/NESDIS, is also investigating alternative communications capabilities (i.e., rebroadcast of processed imagery and data via the Internet or "commercial" services) that may allow other –than direct real-time satellite readout.

ACTION 30.02

USA to provide CGMS Members with detailed technical information (when available) on NPOESS receiving stations to enable them to prepare their ground segments in advance.

Table 3: Future Polar-Orbiting Satellites Coordinated Within CGMS
(as of 22 December 2002)

Orbit type (equatorial crossing times)	Future additional Satellites	Operator	Planned launch date	Other information
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	METOP-1	EUMETSAT	Mid 2005	(827 km) (9:30) AHRPT
	METOP-2	EUMETSAT	06/2010	(827 km) (9:30) AHRPT
	METOP-3	EUMETSAT	12/2014	(827 km) (9:30) AHRPT
	FY-3A	China	2004	(9:30) series of seven satellites
	FY-3B	China	2006	(9:30)
	METEOR 3M-N2	Russia	2005	(9:15) (10:30) or (16:30) AHRPT
	DMSP S-16	USA/NOAA	05/2003	(19:54 A) (SSMI/S)
	DMSP S-18	USA/NOAA	10/2006	(SSMI/S)
	NPOESS-1	USA/NOAA	04/2009	(833 km) (9:30 D) LRD (AHRPT)
	NPOESS-4	USA/NOAA	11/2015	(833 km) (9:30 D) LRD (AHRPT)
Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)	NOAA-N	USA/NOAA	6/2004	(14:00)
	NOAA-N'	USA/NOAA	03/2008	(14:00)
	NPOESS-2	USA/NOAA	06/2011	(833 km) (13:30 A) LRD (AHRPT)
	NPOESS-5	USA/NOAA	01/2018	(833 km) (13:30 A) LRD (AHRPT)
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-S17	USA/NOAA	10/2004	(SSMI/S)
	DMSP-S19	USA/NOAA	10/2008	(SSMI/S)
	DMSP-S20	USA/NOAA	10/2010	(SSMI/S)
	NPOESS-3	USA/NOAA	04/2013	(833 km) (5:30 D) LRD (AHRPT)
	NPOESS-6	USA/NOAA	~2019	(833 km) (5:30 D) LRD (AHRPT)

C.2 Future Geostationary Meteorological Satellite Systems

EUMETSAT reported in EUM-WP-05 on the status of the MSG programme, the plans for commissioning activities and initial dissemination together with the actual plans for the transition from Meteosat to MSG. The MSG-1 satellite will be relocated to 0° longitude late 2003, and thereafter, routine operations will commence when the name will change to Meteosat-8. Moreover, the transition period with parallel operations of Meteosat-7 and MSG-1, starting from the commissioning of MSG-1 has been extended until the end of 2005. It is planned to continue MTP routine operations from around 10°W (MET 7) and 10°E (MET 6), assuming it will be possible to operate on a non-interference basis, in a similar manner to the IODC service at 63°E. The MSG-2 satellite will be put into storage at the end of the integration and test phase with a pre-storage review planned in Summer 2003. The tentative launch date of MSG-2 has been rescheduled for January 2005, in consideration of the extended lifetime of the Meteosat-7 satellite.

The need for early demonstration of microwave/sub-mm technology in geostationary orbit for the purposes of frequent all-weather temperature/humidity sounding and precipitation has been identified in previous CGMS sessions.

At the invitation of EUMETSAT, Dr. Bizzarri informed CGMS in EUM-WP-25, on the current and planned activities on this matter to enable preparation by the space agencies concerned to receive, in due time, a proposal for an implementation programme. The paper briefly recalls the status of definition of user requirements for future geostationary meteorological satellites in Europe and the USA. Those imply that the use of Microwave (MW) radiometry (all-weather temperature and humidity sounding and precipitation) require a new approach, since the techniques used in LEO would lead to extremely large antennas. The principle of MW sounding applicable from GEO implies the use of very high frequency microwave and sub-millimetre wave, to reduce antenna size. Absorption bands of O_2 and H_2O are used, at several frequencies differently affected by liquid and ice water, hence precipitation. The principle is equally applicable over sea and land, and to convective rain as well as frontal rain, light rain and snowfall. Projects in the USA (GEM) and in Europe (GOMAS) are being closely coordinated. With current state technology, it should be possible to cover an area of about one-twelfth of the disk every 15 minutes. This could be proven through a demonstration mission with a "smallsat" class satellite that can be drifted along the equator for experiencing over more areas. Current activities aim at preparing, within a couple of years, a consolidated proposal for implementing a demonstration mission. There will be technological activity to clear certain critical items, and scientific activity of modelling clouds and rain at these very high frequencies and collecting experimental data by airborne campaigns. Impetus for these activities is expected to come from an advisory working group established within NOAA/NESDIS after the Second GOES Users' Conference, from a MW/Sub-mm Workshop to take place in EUMETSAT on 6-7 November 2002, and from the International Precipitation Working Group (IPWG) definition of its work programme. In conclusion, the initiative of introducing MW/Sub-mm technology in GEO for the purpose of frequent rain observation propagated from the USA to Europe and now is spreading over a worldwide scientific community. A roadmap to prepare a fully supported and consolidated proposal is being defined and certain activities are already underway for presentation to an appropriate space agency.

CGMS thanked Dr. Bizzarri for his presentation and noted with appreciation the information presented in his document and encouraged such developments.

CGMS also recommended that when selecting the wavelengths used for observation, the discussions in ITU should be carefully considered.

India informed CGMS of their future plans of INSAT satellites for meteorological applications in IND-WP-03. They described the capabilities of the first Indian satellite for ocean applications (Oceansat-1) launched in May 1999 on board the IRS-P4 mission. Various data products (total water vapour, sea surface temperature, ocean surface wind speed, and cloud liquid water) derived from the MSMR and the results of the last two years validation studies are presented. MSMR is found to be providing data of good quality and reliability; large-scale features of all the observed parameters and their interlinkages have been well brought out by the data. Derived products are also found to be useful for some meteorological applications. Research work regarding rainfall rate, sea ice extent, and soil moisture are also making good progress with promising results.

Japan provided a report on the future plans for the Multifunctional Transport Satellites in JPN-WP-04. MTSAT-1R and MTSAT-2 will be launched in 2003 and 2004, respectively. MTSAT-2 is planned to remain in stand-by mode for four years and enter operational service in 2008. Japan appreciated the CGMS members' response to Action item 27.11 and 28.19 relating to the cooperation for the international frequency coordination.

China informed the meeting in PRC-WP-05 on the plan for developing the Chinese FY-2C Geostationary Meteorological Satellites. The FY-2 satellite series will be continued with FY-2C to be launched at the end of 2003 or in Spring 2004, to replace FY-2B (at 105°E) in 2004. Its mission will be very similar to that of FY-2B. The number of channels of the Visible and Infrared Spin Scan Radiometer (VISSR) will be increased from three to five. Further changes include an enhancement of the satellite power supply, the cancellation of the S-Fax broadcast, replacement of the WEFAX service with Low Rate Information Transmission (LRIT) and a change in the specification of the VISSR instrument. China added that it planned to launch FY-2D and E satellites if all went well with FY-2C.

Russia informed CGMS in RUS-WP-04 on the continued development of the new geostationary meteorological satellite GOMS/Electro N2. The satellite is planned to be launched in 2005 and will be placed into geostationary orbit at 76°E. The spacecraft will be a three-axis stabilised platform, with payloads consisting of a Data Collection System (DCS), retransmitters, imager MSU-G. In addition, it will be equipped with a Cospas-Sarsat geostationary transponder.

USA-WP-05 briefly reviewed the history of the GOES SEM instruments. It provided a description of what the current instruments measure, discussed changes that are being made for the GOES NO/PQ series, revealed plans for future instruments, provided examples of some of the GOES products, and stated how the data from the instruments benefit society. The GOES SEM consists of several instruments to monitor the Sun and the near-Earth space environment. These instruments include: the Energetic Particle Sensors (EPS), Magnetometer (MAG), Solar X-ray and Extreme Ultraviolet Sensors (XRS and EUV), and the Solar X-ray Imager (SXI). The USA stated that international collaboration greatly benefits the provision of space weather services. The GOES SEM sensors are not carried on any other satellite. Additional measurements by other satellite operators would be welcome and would complement the measurements made by the United States.

USA-WP-08 reported on the current and future GOES system. The follow-on GOES-N series has its first two spacecraft, GOES-N and O in the hardware development and integration phase. The first set of imager and sounder instruments has been successfully integrated with planned launch dates for GOES-N and GOES-O in April 2004 and April 2005 respectively. The new GOES-N series ground system has been delivered to the Suitland Satellite Operations Control Center. The USA expects to exercise options for GOES-P no later than April 2003.

Instrumentation will continue with the present five channel imagers and filter wheel sounders. At least two SXI instruments will fly on the GOES-N series. Horizontal resolution of these imagers will be improved to 4 km in all IR channels, including the 13.3 micrometer channel.

The GOES-R series satellites will each carry a new Advanced Baseline Imager (ABI). The ABI will be an eight to eighteen channel imager. GOES-R will also carry the Hyperspectral

Environmental Sensor (HES), an advanced sounder. The HES will be an interferometer-class instrument with 2000+ spectral bands leveraging technology from NASA's Geosynchronous Imaging Fourier Transform Interferometer (GIFTS). Three contractors were awarded ABI Formulation Phase contracts for system trades and preliminary designs. A single contractor will be awarded the implementation contract by early 2005. Procurement activities for the HES are now being initiated with the formulation phase award scheduled for mid-CY 2003. For the spacecraft, three contractors were awarded accommodation study contracts to provide an understanding of weight and power issues. The spacecraft formulation phase will be initiated in 2004. GOES-R launch readiness is planned for 2012.

WMO underlined that lightning mapping was a very important issue to be considered by CGMS members and therefore requested CGMS members to indicate what their plans were, if any, in terms of flying lightning detectors.

The USA confirmed that there would be a lightning detector from GOES-R onwards. EUMETSAT and India indicated that this requirement is currently being considered in the definition of their future geostationary satellites. Japan also confirmed that they would consider this requirement in designing the follow-on to MTSAT-2. Russia had no particular information on this matter.

In concluding, WMO recalled that this requirement is not only valid for geostationary satellites but also for polar-orbiting satellites, and therefore urged CGMS members to consider it in this context.

Table 4: Future Geostationary Satellites Coordinated Within CGMS
(as of 22 December 2002)

Sector	Future additional satellites	Operator	Planned launch	(Planned location) Other remarks
EAST PACIFIC (180°W-108°W) AND WEST ATLANTIC (108°W-36°W)	GOES-N	USA/NOAA	4/2004	135°W or 75°W
	GOES-O	USA/NOAA	2007	135 W or 75°W
	GOES-P	USA/NOAA	2008	135°W or 75°W
	GOES-R	USA/NOAA	2012	135°W or 75°W
EAST ATLANTIC (36°W-36°E)	MSG-1	EUMETSAT	8/2002	0°
	MSG-2	EUMETSAT	2004	0°
	MSG-3	EUMETSAT	2008	0°
INDIAN OCEAN (36°E-108°E)	GOMS-N2	Russia	2005	76°E
	INSAT 3-A	India	2/2003	Mixed mission. (Similar to INSAT-2E)
	INSAT 3-D	India	2005	Dedicated meteorological mission
	FY-2C	China	2004	Improved FY-2 series, 5 channel VISSR, LRIT
	FY-2D	China	2006	Improved FY-2 series, 5 channel VISSR, LRIT
	FY-2E	China	2009	Improved FY-2 series, 5 channel VISSR, LRIT
WEST PACIFIC (108°E- 180°E)	MTSAT-1R	Japan	Summer 2003	Multifunctional Transport Satellite 140°E
	MTSAT-2	Japan	2004 (FY)	Multifunctional Transport Satellite 140°E. It will be acting as back-up to MTSAT-1R until 2008. MTSAT-1R will be used as back-up.

D. OPERATIONAL CONTINUITY AND RELIABILITY

D.1 Long-term Global Contingency Planning

This matter was discussed in Working Group IV on Global Contigency Planning. The result of this discussion is presented in the relevant section of this report.

D.2 Inter-regional Contingency Measures and Back-up Agreement

This matter was discussed in Working Group IV on Global Contingency Planning and can be found under the relevant section in this report.

D.3 Global Planning, Including Orbital Positions and Reconfiguration of the Space-based Component of the GOS

WMO-WP-18 informed CGMS members of WMO activities related to equator crossing times and reiterated the need for CGMS satellite operators to update Table 5 for polar-orbiting satellite equator crossing times on an annual basis. This table is useful as a reference in mission planning in the polar orbit as well as for contingency planning. WMO-WP-18 reviewed the need to coordinate equator crossing times as was discussed at CGMS XXIX, and confirmed at the WMO Consultative Meetings on High Level Policy on Satellite Matters which met in Geneva in February 2002 (CM-2). CM-2 realised the complexity of the issue and that more in-depth analysis would need to be performed. However, it was unanimous in its belief that an optimised equator crossing time plan based on the totality of user requirements was essential. Such an optimisation would also allow the development of contingency plans for the polar orbit. In June 2002, the fifty-fourth session of the WMO Executive Council (EC-LIV) was informed of the equator crossing time issue and noted that the basic WMO requirement for the polar orbit was for two satellites — one in the AM orbit and one in the PM orbit. In order to meet WMO's requirement for contingency planning a constellation of four polar-orbiting satellites would be required, two in the AM orbit, both capable of serving as back-up to the other and two in the PM orbit, again both capable of serving as back-up to the other. EC-LIV was pleased to note that both Roshydromet and CMA, taking into account their respective national requirements, would be willing to consider the possibility of using the PM orbit for their future Meteor-3M and FY-3 series.

New Permanent Action

CGMS satellite operators to update Table 5 for polar-orbiting satellite equator crossing times on an annual basis.

Table 5: Coordination of Data Formats and Frequency Planning for Polar-orbiting Satellites
(as of 22 December 2002)

Satellite	Service	Start	EOL	Eq. cross -time	Freq (MHz)	BW MHz	Data rate (Mb/s)
METOP-1	LRPT	2006	2011	0930	137.9	0.150	0.072
METOP-2	LRPT	2010	2015	0930	137.9	0.150	0.072
METOP-3	LRPT	2015	2020	0930	137.9	0.150	0.072
METOP-1	AHRPT	2006	2011	0930	1701.3	4.5	3.5
METOP-2	AHRPT	2010	2015	0930	1701.3	4.5	3.5
METOP-3	AHRPT	2015	2020	0930	1701.3	4.5	3.5
METOP-1	GDS	2006	2011	0930	7800	63	70
METOP-2	GDS	2010	2015	0930	7800	63	70
METOP-3	GDS	2015	2020	0930	7800	63	70
NPP	HRD	2005	2009	1030	7750-7850	30.8	20
NPP	SMD	2005	2009	1030	8025-8400	232	300
NPOESS-1	LRD	2009	2015	0930	1702.5/1706.5	3.5	3.5

Satellite	Service	Start	EOL	Eq. cross -time	Freq (MHz)	BW MHz	Data rate (Mb/s)
NPOESS-2	LRD	2011	2018	1330	1706.5 1702.5/1706.5	4.0	4.0
NPOESS-3	LRD	2013	2019	0530	1706.5, 1702.5/1706.5	4.0	4.0
NPOESS-4	LRD	2015	2021	0930	1706.5 1702.5/1706.5	4.0	4.0
NPOESS-5	LRD	2018	2024	1330	1706.5 1702.5/1706.5	4.0	4.0
NPOESS-6	LRD	2019	2025	0530	1706.5 1702.5/1706.5	4.0	4.0
NPOESS-1	HRD	2009	2015	0930	7750-7850	30.8	20
NPOESS-2	HRD	2011	2018	1330	7750-7850	30.8	20
NPOESS-3	HRD	2013	2019	0530	7750-7850	30.8	20
NPOESS-4	HRD	2015	2021	0930	7750-7850	30.8	20
NPOESS-5	HRD	2018	2024	1330	7750-7850	30.8	20
NPOESS-6	HRD	2019	2025	0530	7750-7850	30.8	20
NPOESS-1	SMD	2009	2015	0930	25500-27000	384	400
NPOESS-2	SMD	2011	2018	1330	25500-27000	384	400
NPOESS-3	SMD	2013	2019	0530	25500-27000	384	400
NPOESS-4	SMD	2015	2021	0930	25500-27000	384	400
NPOESS-5	SMD	2018	2024	1330	25500-27000	384	400
NPOESS-6	SMD	2019	2025	0530	25500-27000	384	400
NOAA-15	APT	1998	2001	0730	137.5 137.62	0.034	0.0017
NOAA-15	BTX	1998	2001	0730	137.35 – 137.77		0.00832
NOAA-15	HRPT	1998	2001	0730	/1702..5	2.66	0.665
NOAA-15	GAC	1998	2001	0730	2247.5	5.32	2.66
NOAA-16	APT	2000	2004	1400	Failed	0.034	0.017
NOAA-16	BTX	2000	2004	1400	137.35 – 137.77		0.00832
NOAA-16	HRPT	2000	2004	1400	1698	2.66	0.665
NOAA-16	GAC/LAC	2000	2004	1400	1698//1702.5 (1707 Failed)	5.32	2.66
NOAA-17	APT	2002	2005	1000	137.50 – 137.62	0.034	0.017
NOAA-17	BTX	2002	2005	1000	137.35 – 137.77		0.00832
NOAA-17	HRPT	2002	2005	1000	1698	2.66	0.665
NOAA-17	GAC/LAC	2002	2005	1400	1698//1702.5/1707	5.32	2.66
NOAA-N	APT	2004	2008	1330	137.50 – 137.62	0.034	0.072
NOAA-N	BTX	2004	2008	1330	137.35 – 137.77		0.00832
NOAA-N	HRPT	2004	2008	1330	1698	2.66	0.665
NOAA-N	GAC/LAC	2004	2008	1330	1698//1702.5	5.32	2.66
NOAA-N’	APT	2008	2012	1330	137.50 – 137.62	0.034	0.017
NOAA-N’	BTX	2008	2012	1330	137.35 – 137.77		0.00832
NOAA-N’	HRPT	2008	2012	1330	1698	2.66	0.665
NOAA-N’	GAC/LAC	2008	2012	1330	1698//1702.5/1707	5.32	2.66
FY-1C	CHRPT	1999	2001	0830	1698-1710	5.6	1.3308
FY-1D	CHRPT	2002	2004	0900	1698-1710	5.6	1.3308
FY-3A	AHRPT	2004	2007	1010	1698-1710	5.6	4.2
FY-3B	AHRPT	2006	2009	1010	1698-1710	5.6	4.2
FY-3C	AHRPT	2008	2011	1010	1698-1710	5.6	4.2
FY-3D	AHRPT	2010	2013	1010	1698-1710	5.6	4.2
FY-3E	AHRPT	2012	2015	1010	1698-1710	5.6	4.2
FY-3A	MPT	2004	2007	1010	7750-7850	35	18.2
FY-3B	MPT	2006	2009	1010	7750-7850	35	18.2
FY-3C	MPT	2008	2011	1010	7750-7850	35	18.2
FY-3D	MPT	2010	2013	1010	7750-7850	35	18.2
FY-3E	MPT	2012	2015	1010	7750-7850	35	18.2

Satellite	Service	Start	EOL	Eq. cross -time	Freq (MHz)	BW MHz	Data rate (Mb/s)
FY-3A	DPT	2004	2007	1010	8025-8215 / 8215-8400	120	93
FY-3B	DPT	2006	2009	1010	8025-8215 / 8215-8400	120	93
FY-3C	DPT	2008	2011	1010	8025-8215 / 8215-8400	120	93
FY-3D	DPT	2010	2013	1010	8025-8215 / 8215-8400	120	93
FY-3E	DPT	2012	2015	1010	8025-8215 / 8215-8400	120	93
METEOR-3M N1*	Raw	2001	2004	0915	466.5	3	0.080
METEOR-3M N1*	Raw	2001	2004	0915	1700	2	0.665
METEOR-3M N1*	Raw	2001	2004	0915	8192	32	15.36
METEOR-3M N2	LRPT	2005	2008	1030	137.89 / 137.1	0.15	0.064
METEOR-3M N2	HRPT	2005	2008	1030	1700	2	0.665
METEOR-3M N2	Raw	2005	2008	1030	8192	32	15.36

WMO-WP-25 articulated the need for CGMS members to provide information for the processing level of the S-band direct broadcast service for each polar-orbiting satellite. CGMS satellite operators have already agreed that all satellite operators should provide the global service with near polar-orbiting satellites, and that it should also have comparable data content, with Metop considered as a benchmark. Operational CGMS members should take into account WMO requirements for higher level data, i.e. 0 and 1 that have proved beneficial to the evolution of satellite meteorology in general and to Numerical Weather Prediction (NWP) in particular. Detailed information are needed from each near polar-orbiting satellite operator on its intention to implement these requirements in the S-Band direct broadcast service for the different near-polar systems. In particular, each datastream should be identified as to the level of processing. This information will be consolidated into a CGMS table for the CGMS website and for further distribution in the WWW Operational Newsletter. Table 6 is a sample and should be completed by each near polar-orbiting satellite operator.

Table 6: S-band DB service

Satellite	Eq Crossing time and A/D Node	S-Band Direct Broadcast	Processing Level
Metop		AHRPT	1b

ACTION 30.03

CGMS members to provide information on the data content (incl. processing level) of DB services (including data on equator crossing time) for each polar-orbiting satellite, by CGMS XXXI.

E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

E.1 World Weather Watch

WMO-WP-07 reported on the activities within the WMO Expert Team on Observational Data Requirements and Redesign of the GOS (ET-ODRRGOS) within the WMO Commission on Basic Systems Open Programme Area on Integrated Observing Systems that related to the redesign of the WWW GOS. ET-ODRRGOS noted that the scope of the changes to the GOS coming in the next decade would be so massive that new revolutionary approaches for science, data handling, product development, training, and utilisation will be required. An analysis of user requirements in applications areas within WMO programmes indicates the need for an operational satellite constellation comprising four polar and six geostationary satellites. The geostationary component will provide VIS/IR imagery of improved quality and also advanced infrared atmospheric sounding capability. The polar-orbiting component will provide many capabilities including advanced microwave and infrared atmospheric sounding, high-resolution multi-spectral visible/infrared imagery, microwave imagery, ultraviolet ozone sounding, GPS radio occultation sounding, and information from scatterometers, altimeters and microwave radiometers. These will provide quantitative information on many atmospheric and surface variables such as atmospheric profiles of temperature, humidity and ozone; surface temperature; clouds and precipitation; ice and snow cover; vegetation; and ocean surface wind and waves. Beyond this, data from instruments on R&D satellites will make major new contributions to the GOS including: wind profiles from Doppler wind lidars; precipitation measurements from a constellation of active and passive microwave instruments; GPS radio occultation constellation; ocean colour; soil moisture and air quality.

Expansion of the space-based component of the GOS will require international collaboration. There must be a commitment for adequate resources to sustain research developments necessary for improved utilisation of these measurements, as well as training to ensure that utilisation. ET-ODRRGOS used the results from the Operational System Experiments (OSEs) (as well as conclusions and recommendations of the Toulouse Workshop on Impact of Various Observing Systems on NWP), their estimate of available technologies of the future, and the SoGs to make their recommendations for the evolution of the GOS. An annex containing these recommendations is attached. The Expert Team noted that the future GOS should build upon the existing components, both surface- and space-based, and capitalise on existing observing technologies not presently incorporated or fully exploited into the GOS. In consideration of the surface-based component of the GOS, ET-ODRRGOS made 22 recommendations that include: improved data distribution; enhanced Aircraft Meteorological Data Relay (AMDAR) ascent/descent as well as flight level data, especially over data-sparse areas; optimised radiosonde launches; targeted observations; inclusion of ground based GPS, radars and wind profilers into the GOS WINDS; increased oceanic coverage through expanded automated ship balloon observations, drifting buoys, and ARGO; and the use of unmanned aeronautical vehicles. Regarding the space-based component of the GOS, ET-ODRRGOS made 20 recommendations (nine for operational geostationary and polar-orbiting, 11 for R&D satellites) that build upon the known plans of the operational and R&D satellite operators that call for rigorous calibration of remotely sensed radiances as well as improved spatial, spectral, temporal and radiometric accuracies. In particular, the wind profiling and global precipitation measurement missions were singled out for their importance to the future GOS. Their vision for the GOS of 2015 and beyond is included in Appendix A.

Thanking the Expert Team for its contribution, CGMS members took note of the report for the redesign of the WWW GOS and unanimously supported the recommendations in the document and indicated that the 2015 vision was reflected in their future plans.

In WMO-WP-12, WMO informed CGMS that during the fifteenth session of the RAI Tropical Cyclone Committee for the south-west Indian Ocean held in Moroni, Comoros on 4-10 September 2001, the Committee noted with appreciation the continued coverage by Meteosat-5 over the Indian Ocean. The Committee further reiterated its concern about the absence of any permanent geostationary satellite coverage over the Indian Ocean and requested WMO and CGMS to seek a solution for ensuring geostationary coverage of the Indian Ocean beyond the lifetime of Meteosat-5.

WMO-WP-12 further informed CGMS that during the twenty-ninth session of the WMO/ Economic and Social Commission for Asia and Pacific (ESCAP) panel on tropical cyclones for the Bay of Bengal and the Arabian Sea held in Yangon, Myanmar on 12-18 March 2002, India had informed the panel that a meteorological geostationary meteorological satellite (METSAT) would be launched in September 2002, followed by another geostationary satellite INSAT-3A shortly after and the meteorological payload will be identical to those of INSAT-IIE. In this regard, the members of the panel requested that India supply the specifications for the satellite ground receiving station required to receive the signal broadcast from the satellite once it becomes fully operational.

ACTION 30.04

India, China and the Russian Federation to take into account the Tropical Cyclone Committee's request to consider the possibility of continuing and implementing, on a permanent basis, geostationary coverage of the Indian Ocean, in order to provide the necessary data in support of the national mandates of WMO members in the region and to report by CGMS XXXI.

ACTION 30.05

At CGMS XXXI, all CGMS members to report on planned geostationary and low earth orbiting satellite coverage to support WMO's Tropical Cyclone programme, including distribution mechanisms for those data. For low earth orbiting systems, this includes multi-channel imagery and sounding data and products, as well as other relevant measurements and products including sea surface temperature, altimetry, salinity, ocean surface winds and precipitation.

ACTION 30.06

WMO to provide CGMS members with the requirements of the various Tropical Cyclone/Typhoon/Hurrican Committees and Panels.

E.2 Other Programmes

In IOC-WP-01, IOC informed CGMS of the status of Global Ocean Observing System (GOOS) Regional Alliances up to September 2002. The creation of regional GOOS bodies has substantially increased the number of member states engaged in GOOS. Occurring through three complementary mechanisms: (i) creation of subsidiary bodies within the intergovernmental structure of the IOC (NEAR-GOOS, IOCARIBE-GOOS, Black Sea GOOS, WIOMAP); (ii) creation of regional groups within alternative intergovernmental structures operating on behalf of IOC (PacificGOOS in SOPAC); and (iii) creation of regional associations (EuroGOOS, MedGOOS) in areas where there was no formal IOC structure. All groups are related closely to the regional intergovernmental structures of the United Nations Environment Programme (UNEP) and their Regional Seas Programme and its Conventions and Action Plans, or to pre-existing Conventions (EuroGOOS and OSPARCOM). CGMS took note of the status of the GOOS Regional Alliances.

IOC presented in IOC-WP-02 the Coastal Ocean Observations Panel (COOP) activities in 2001-2002. The COOP met three times in 2001-2002 (COOP II in Trieste on 6-8 June 2001, COOP III in Hanoi on 16-18 Jan 2002 and COOP IV in Cape Town on 24-27 September 2002). The overriding goal for the first four sessions of COOP had been to finalise the integration of the C-GOOS, HOTO and LMR design plans by the end of COOP IV. An outline of the plan and an intersessional action plan were completed at COOP II. A draft was completed during the intersession and discussed at COOP III. The draft was sent out for external review to some 30 marine scientists, coastal managers and programme managers during August 2002. The draft document was revised at COOP IV and the final version is expected to go to print by the end of 2002. CGMS members took note of the COOP Activities for 2001-2002.

In IOC-WP-03, IOC informed CGMS of the status of GODAE and ARGO activities. The IGST met in Gulfport, Mississippi in December 2001 (http://www.bom.gov.au/GODAE/Meetings/6thIGST/index.html). The AST last met in Hobart on 12-14 March 2002; the report of that meeting is on the Argo website (http://www.argo.ucsd.edu/iast4.pdf). In general terms, Argo is making excellent progress and is exceeding expectations in key technical areas such as salinity measurement. Argo continues to develop with strength and is pursuing an ambitious implementation programme. There are some technical challenges but for the most part these challenges are not critical issues. Some innovative solutions are emerging for ice-covered regions that had previously been a problem area. The prospect of additional telecommunication options offers great potential for Argo – improved communication of data (the whole dataset) and two-way communication for adjusting the schedule of floats. Global implementation remains the highest priority. The data management activities are providing innovative solutions that, in part, are providing models for renovation of other *in situ* datastreams. GODAE is progressing well on most fronts. Some aspects, such as the development of the implementation plan, are progressing rather more slowly than is ideal but this does not seem to be a critical weakness. The GODAE Symposium provided an opportunity to assess and advertise progress and to develop some needed links into the applied community. The Argo Pacific Workshop and the second Indian Ocean Workshop also provide excellent opportunities for developing greater impact in the developing regions. The links with Coastal GOOS provide many opportunities for both communities. CGMS members took note of the status of the activities for GODAE and ARGO.

In WMO-WP-16, WMO provided an update on the status of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), including its interactions with satellite operators and CBS concerning oceanographic satellites.

The new JCOMM Ship Observations Team (SOT) is designed to integrate all operational marine observing systems using ships as an observing platform. As such, it incorporates the existing VOS, SOOP and Automated Shipboard Aerological Programme (ASAP) Panels. It held its first meeting in Goa, India in February-March 2002, where the participation of and input from a representative of EUMETSAT was very valuable. Among the issues discussed was that of the costs of observational data collection. At present, most ship-based observations are transmitted via Inmarsat, with only a limited number of ASAP ships using the IDCS. The SOT has set up a small ad hoc task team to study the whole question of the costs of data collection, with a view to making recommendations to operators. It is possible that these recommendations will include an increase in the use of DCPs reporting through the IDCS. The task team is expected to report to the second session of the SOT in September 2003, after which it may be possible to quantify future ship DCP requirements. There are two JCOMM websites http://www.jcomm.net and http://www.wmo.ch/web/aom/marprog/. CGMS took note of the status of JCOMM.

F. COORDINATION OF INTERNATIONAL DATA COLLECTION & DISTRIBUTION

This item was discussed under Agenda item I/3 in Working Group I on Telecommunications, and the relevant discussions are included in the report of that Working Group.

G. COORDINATION OF DATA DISSEMINATION

All Working Papers under this item were discussed in Working Group I on Telecommunications, and the relevant discussions are included in the report of that Working Group.

G.1 Meteorological Data Distribution via Satellite

All Working Papers under this item were discussed in Working Group I on Telecommunications, and the relevant discussions have been included in the report of that Working Group.

G.2 Results of the Discussions of the Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites

This item was discussed in Working Group I on Telecommunications, and the relevant discussions have been included in the report of that Working Group.

H. OTHER ITEMS OF INTEREST

H.1 Applications of Meteorological Satellite Data for Environment Monitoring

EUM-WP-06 presented the status of the network of approved EUMETSAT SAF. Seven SAFs are currently under development in the EUMETSAT member states and address the following topics: Support to Nowcasting and Very Short Range Forecasting; Ocean and Sea Ice; Ozone Monitoring; Climate Monitoring; Numerical Weather Prediction; GNSS Receiver for Atmospheric Sounding (GRAS) Meteorology and Land Surface Analysis. SAFs will use data from Meteosat, MSG and EPS, or other meteorological satellites, where appropriate. Until relevant data become available, information from current satellites will be used for development. The Pilot SAFs on “Nowcasting and Very Short Range Forecasting” and “Ocean and Sea Ice” are entering their Initial Operations Phase (IOP) in 2002. The IOP will present a major opportunity for users to initiate their activities based on SAF products and services. Lessons learnt will benefit the validation process of all other SAFs projects validation processes and will support optimisation of the Operational Phase. Furthermore, the paper provided an updated list of planned products.

H.2 Training

EUM-WP-23 reported on training activities carried out by EUMETSAT over the last year. CGMS members took note.

JPN-WP-10 described the present status and plans for the improvement of the Computer Aided Learning (CAL) systems of JMA and the utilisation of the Satellite Animation and Interactive Diagnosis (SATAID) for training, electronic publications and operational use.

JPN-WP-11 informed CGMS on the activities of JMA concerning Virtual Resource Library (VRL) and the Asia Pacific Satellite Application Training Seminar (APSATS) 2002 workshop. The web page for the VRL was established in May 2002 where SATAID-based material is available from the VRL. APSATS 2002 workshop was a milestone experiment to use Virtual Laboratory (VL) in classes. The success of the experiment proved the usefulness of the activities on VL over the globe.

Japan reported in JPN-WP-12 on the outline of a training plan for MTSAT-1R data utilisation in Asia-Pacific. A further seminar, using the SATAID software, was held in November 2001 and a third one is planned for the beginning of 2003.

In RUS-WP-08 Russia informs CGMS on Roshydromet and SRC Planeta activities on training and education in satellite data application to hydrometeorology and environmental monitoring. An advanced training course on methods of satellite data processing, interpretation and use for operational forecasting and research activities in hydrometeorology and environmental monitoring took place in October/November 2002 for NHNSs of CIS and Baltic States. Furthermore, a Satellite Data Users Directory has been prepared and published and a recently opened SRC Planeta Internet site http://planet.iitp.ru represents a prototype of a Russian virtual laboratory.

USA-WP-17 provided an up-to-date record of the US satellite missions, instruments and frequencies to update the Consolidated WMO/CEOS Database and in USA-WP-18 the USA provided updated tables on the LRIT/ Low Rate Picture Transmission (LRPT) for its current/future geostationary and polar spacecraft.

USA-WP-37 summarises the development activities of the VL. The goals and the initial actions set by the VL Focus Group have been met. Two very successful workshops were conducted in the past two years: at Nanjing, China in December 2000 and the APSATS in Melbourne, Australia in May 2002. The two workshops clearly showed that the goals of the WMO VL could be met. Several milestones were achieved at these workshops, not the least of which was the connecting of instructors at various locations around the world with the participants at the workshops in real-time. Additional WMO workshops are planned in the future and they will continue to expand on the VL approach.

At CGMS XXIX, the proposed structure, goals and implementation plan of the CGMS VL Focus Group, as presented in Appendix 3 of CGMS XXIX, were approved. CGMS XXIX further requested that it be kept informed about the progress and activities of the Focus Group. WMO-WP-17 and USA-WP-37 reported on status and progress within the VL. A number of important milestones that were established by the VL Focus Group have been addressed and are being met. The report further presented the success and status of the various activities including the successful use of the VL to support the APSATS workshop that was cosponsored by WMO, JMA and the Bureau of Meteorology and held at the BMTC in Melbourne, Australia in May, 2002. APSATS 2002 workshop consisted of lectures, hands-on case studies and discussions using real-time satellite data from around the world. Case studies were undertaken using the SATAID programme, with data also available for use under the Menu-driven System for Analysing Digital Satellite Imagery (RAMSDIS) system. VISITview software was linked to the workshop with other "centres of excellence" for some of the real-time discussions. Lecture, case study and resource material will be written to CD-ROMs for the participants to take home on completion of the course. Resource material from APSATS 2002 is available on the VRL for use in future training courses. As noted in the final evaluations, many participants thought this was one of the best, if not the best training course they had undertaken.

WMO thanked all the satellite operators for their active contribution to the VL.

ACTION 30.07

The second session of the CGMS VL Focus Group, to be held in conjunction with 2003 WMO satellite training event in Barbados, to conduct an initial assessment of the VL and report back to CGMS XXXI. Satellite operators to support their participation as well as that of their respective Centres of Excellence at the VL Focus Group meeting.

India presented to CGMS their curriculum of a postgraduate course on Satellite Meteorology and Global Climate of the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), which is affiliated to the United Nations. CGMS took note.

H.3 Other Topics

In EUM-WP-07 EUMETSAT provides a brief account of the EUMETSAT conferences that have taken place since the last meeting of the CGMS. Included are summaries of the Fifth EUMETSAT User Forum in Africa held in Dakar in September/October 2002, and the EUMETSAT Satellite Data Users' Conference held in Dublin, Ireland, in September 2002. An indication of planned user conferences for the next three years are included. In addition, EUMETSAT provided a list of publications as well as a review of its website development. CGMS members took note of EUMETSAT conferences and publications.

EUMETSAT provided an update of the CGMS Consolidated Report in EUM-WP-08. The CGMS Consolidated Report (CR) has been available on-line at http://www.eumetsat.de/en/area2/cgms.html since March 2001.

CGMS members to inform the CGMS Secretariat if the CGMS CR Drafting Committee points of contact have changed, since last reported in July 2002 and, to update sections referring to their organisations/programmes, by 1 December 2002 to enable a new updated version to be available on-line soon after CGMS XXX.

In EUM-WP-10 EUMETSAT gave a brief report from the CEOS Plenary Session that took place in Kyoto, Japan on 6-7 November 2001, as well as presenting the major outcomes of the different CEOS Working Groups and the activities of the Strategic Implementation Team (SIT) in 2001. CGMS members took note of this report.

Japan reported in JPN-WP-06 on the Meteorological Satellite Centre (MSC)/JMA which opened its website in April 2002. It introduced the contents of the website and the plan to provide reports via Internet, instead of sending them by post. The URL is http://mscweb.kishou.go.jp/.

WMO described the latest status of its database for satellite receiving equipment in WMO-WP-01. Since CGMS XXIX, WMO has only added three new records to the database. WMO noted that the next request to WMO members for updates to the database will occur in early 2003 and a new diskette version of the database will be distributed at CGMS XXXI. CGMS members were requested to provide information for the database, as appropriate.

New Permanent Action

CGMS members to provide information for the WMO database for satellite receiving equipment, as appropriate.

In WMO-WP-04, CGMS members were informed of the various list servers used by CGMS Groups, i.e. the Plenary, Wind Subgroup and Frequency Matters. CGMS members were requested to review their contact details on the list servers and update them as necessary.

New Permanent Action

CGMS members to review the list of available list servers used by CGMS groups and update as appropriate.

USA-WP-16 informed the CGMS members that 2002 marks the 20th anniversary of the first Cospas-Sarsat satellite launch and the first documented rescue assisted by Cospas-Sarsat distress alert data. The first launch of a Cospas-Sarsat payload took place in June 1982, and the first rescue took place in Canada in September of 1982. The satellite system was originally developed under a Memorandum of Understanding (MOU) between agencies in Canada, France, the former Soviet Union, and the United States. Since then, an intergovernmental agreement between the four parties has replaced the MOU, and has helped assure the long-term operation of the system. The new agreement has also allowed 32 other States to become formally associated with Cospas-Sarsat, thereby improving services to the end-user in distress. Since 1982, over 14,000 lives have been rescued with the aid of the Cospas-Sarsat system.

A reception to commemorate the 20^{th} Anniversary was hosted by the United States in October 2002, during the 29th Session of the Cospas-Sarsat Council meeting in Washington, D.C. Retired Navy Vice Admiral Conrad C. Lautenbacher, the Under Secretary for Oceans and Atmosphere, provided the keynote address. His address was complemented by speeches from Mr. Alain Bensoussan, President of the French Centre National d'Etudes Spatiales, Ms. Jean Murray, Executive Director of the Canadian National Search and Rescue Secretariat and Dr. Valery Bogdanov, Director General of Morsviazsputnik. Also in attendance were Dr. Tillmann Mohr, Director General of the European Organisation for the Exploitation of Meteorological Satellites, Mr. Sean O'Keefe, Administrator of the National Aeronautics and Space Administration and Admiral Thomas Collins, Commandant of the U.S. Coast Guard.

WMO informed the CGMS members in WMO-WP-06 of the establishment and status of the WMO Space Programme. CGMS noted a series of events that has led to the establishment of a new WMO Space Programme. The new WMO Space Programme will officially become effective on 1 January 2004 with the initiation of the Fourteenth Financial Period based on the WMO Sixth Long-Term Plan (6LTP) for which a draft will be reviewed and approved by the WMO Congress in May 2003. In preparing for the formal start of the WMO Space Programme in 2004, many preliminary activities were underway. The fifty-fourth session of the WMO Executive Council noted that a review clearly demonstrated significant growth during the last decade in all areas for which WMO Satellite Activities had responsibilities. The recent agreement by the Executive Council at its fifty-third session to expand the space-based component of the GOS to include appropriate R&D environmental satellite missions was a landmark decision. The implications of the expansion were immense to WMO members with a corresponding increase in responsibility for WMO Satellite Activities. The Executive Council also noted the tremendous impact resulting from just two sessions of the Consultative Meetings on High-Level Policy on Satellite Matters. It was also convinced that the now established dialogue between WMO and the environmental satellite communities participating in the Consultative Meetings had matured rapidly to the great benefit of all and must now be institutionalised. CGMS noted that the fifty-fourth session of the Executive Council agreed that WMO Satellite Activities had grown and that it was appropriate to establish a WMO Space Programme as a matter of priority. The scope, goals and objectives of the new programme should respond to the tremendous growth in the utilisation of environmental satellite data, product and services within the expanded space-based component of the GOS that now included appropriate R&D environmental satellite missions. It also suggested that the WMO Congress consider ways to institutionalise the Consultative Meetings on High-Level Policy on Satellite Matters in order to establish more formally the dialogue and participation of environmental satellite agencies in WMO matters. In considering the important contributions made by environmental satellite systems to WMO and its supported programmes, as well as the large expenditures by the space agencies, the Executive Council felt it appropriate that the overall responsibility for the new WMO Space Programme should be assigned to CBS and the new "institutionalised" Consultative Meetings on High-Level Policy on Satellite Matters. Since the Consultative Meetings were attended by the Directors of agencies operating environmental satellites, the Council felt that the assignment of joint lead responsibility could be conducive to support for the WMO Space Programme by the satellite operating agencies. Such support on the part of the satellite operators could complement WMO's commitment established by a WMO Space Programme and assist the new Space Office with specific projects and initiatives as appropriate.

In order to complement the WMO Sixth Long-Term Plan with a Long-Term Strategy, the Secretariat has started activities to prepare a draft strategy. In following the recommendation by EC-LIV, i.e. satellite operators could provide support for specific projects, EUMETSAT has agreed to support the WMO Secretariat in the development of a draft Long-Term Strategy under the overall direction of the WMO Satellite Activities Office. A consultant, Dr. Roy Gibson (former Director-General of ESA) is currently assisting in the development of a draft WMO Space Programme Long-Term Strategy and this support by EUMETSAT is greatly appreciated.

It is anticipated that a first draft of the WMO Space Programme Long-Term Strategy will be submitted by the WMO Secretary-General for review at the next session of the Consultative Meetings on High-Level Policy on Satellite Matters tentatively scheduled on 3-4 February 2003 in Geneva, Switzerland. After completion of the Long-Term Strategy, an associated

Implementation Plan will be prepared. The focus of both the Long-Term Strategy and Implementation Plan will be the involvement of the space agencies in a coordinated fashion with WMO's 6LTP and Programme and Budget 2004-2007. CGMS members noted the status in the development of the WMO Space Programme.

WMO provided in WMO-WP-08 a list of the latest status of satellite related WMO publications since the last meeting.

ACTION 30.08

CGMS members to update their contributions to WMO Publication No. 411 by March 2003.

In WMO-WP-15 WMO informed CGMS of matters of relevance arising from the second session of the Consultative Meetings on High-Level Policy on Satellite Matters (CM-2) held in February 2002. In particular, CGMS was informed of the recent expansion of the space-based component of the GOS to include appropriate R&D satellite missions. CM-2 noted that the fifty-third session of the WMO Executive Council (June 2001) had endorsed the "*Guidelines for requirements for observational data from operational and R&D satellite missions"* developed at CM-1 (January 2001). After CM-1, the *Guidelines* had been forwarded to the space agencies and several Research and Development (R&D) space agencies had responded positively. The fifty-fourth session of the WMO Executive Council (EC-LIV) held in June 2002 was pleased to learn that at CM-2 several R&D space agencies responded positively. The National Aeronautics and Space Administration (NASA) of the USA confirmed its commitment to WMO and to the world community to make observations available without restriction. It further indicated that this policy would apply to all relevant missions. Therefore, since data from NASA's Earth Observation (EO) missions were readily available, its satellites can be considered *de facto* as part of the space-based component of the GOS. ESA confirmed that it was establishing a dialogue towards the development of information for WMO members concerning the availability of specific data and products from ESA's EO satellite missions, and in particular from the ENVISAT mission launched in March 2002. ESA further indicated that it would propose to its Programme Board for Earth Observation (PB-EO), to organise jointly a dedicated, specific Announcement of Opportunity to foster the use of ESA EO data by the WMO community. The National Space Development Agency of Japan (NASDA) indicated that its future satellite missions including ADEOS II and the GCOM series were candidate systems to contribute to the new R&D constellation for the space-based component of the GOS. Finally, the Russian Aviation and Space Agency (Rosaviakosmos) confirmed that experimental and R&D instruments on board its operational Meteor-3M N1 satellite as well as on its future Ocean series and other missions could be considered as a potential contribution to the space-based component of the GOS. CGMS noted that the space-based component of the GOS is now comprised of three constellations, operational geostationary, operational polar-orbiting and R&D satellites. CGMS noted the deliberations and results of the second session of the WMO Executive Council Consultative Meetings on High-Level Policy on Satellite Matters and comment as appropriate.

WMO-WP-24 presented a brief summary of some recent developments in the GCOS programme. It reflected on tenth session of the GCOS Steering Committee (GCOS SC-X) which was held in Farnham in the UK on 15-19 April 2002. The SC welcomed the EUMETSAT initiative to establish SAFs and encouraged the development of complementary activities in other parts of the world. The SC recognised the experience and achievements of

CGMS in dealing with satellite related matters and the valuable contributions of Dr. J. Schmetz to the GCOS Atmospheric Observation Panel for Climate. It also suggested that the exchange of information between GCOS and CGMS be enhanced, for example, through reports of this nature, and through the informal liaison of common representatives in appropriate activities of CGMS and AOPC. The paper reported that GCOS will submit a draft resolution for consideration by the WMO Congress in 2003 on GCOS climate monitoring principles, to include satellite related principals. The paper reviewed activities leading up to the "*Second Adequacy Report on Climate Observing Systems*" and invited CGMS to consider i) a review of current practice of satellite operators with regard to the climate monitoring principles from satellite (see Appendix A), and ii) to provide pertinent comments at this and subsequent CGMS meetings. The GCOS Climate Monitoring Principles endorsed by EC-LIV are contained in the Appendix A.

CGMS took note of the document and had the view that the GCOS Climate Monitoring Principles with particular emphasis on satellite matters (Principles 11 to 20) needed some reformulation. Therefore, CGMS suggested creating a drafting committee of Dr. Purdom, Dr. Menzel, and Dr. Schmetz to reword these principles.

Recommendation: CGMS endorsed the interaction between CGMS and AOPC/GCOS through the regular participation of Dr. J. Schmetz in both fora.

ACTION 30.09

In view of the increasing use and importance of operational meteorological satellite data for climate research and monitoring, CGMS is invited i) to consider a review of current practice of satellite operators with regard to the climate monitoring principles from satellites, and ii) to provide pertinent reports at CGMS XXXI meeting.

PARALLEL WORKING GROUP SESSIONS

WORKING GROUP I: TELECOMMUNICATIONS

I/0 Introduction

Mr. Robert Wolf from EUMETSAT was elected Chairman of Working Group I (WG I) on Telecommunications, with Mr. Gordon Bridge from EUMETSAT appointed as Rapporteur. WG I comprised representatives of the satellite operators from India, Japan, Russia, USA and EUMETSAT together with a representative of WMO (see Annex 4 for list of participants).

I/1 Coordination of Frequency Allocations

Preparation of the World Radio Conference (WRC) 2003

The World Radio Conference 2003 (WRC 2003) is scheduled to take place from 9 June to 4 July 2003, in Geneva (Switzerland), after the government of Venezuela withdrew its invitation to host the meeting in Caracas.

The World Radio Conference 2000 (WRC 2000) established the agenda for WRC 2003 and drafted a provisional agenda for WRC 2007. Several items of interest to the meteorological user community have been included in the agenda.

The Conference Preparatory Meeting (CPM) of the International Telecommunication Union (ITU) is scheduled for 18 November to 1 December 2002 and will also be held in Geneva. The CPM establishes the technical baseline for the conference and creates the so-called CPM Report, which will be used during WRC-03 work.

Status of Relevant WRC-03 Agenda Items

Several documents related to the preparation of WRC 2003 have been presented to CGMS XXX: EUM-WP-11, JPN-WP-07, RUS-WP-05, USA-WP-20, USA-WP-38 and WMO-WP-11. Discussions on this topic can be summarised as follows. (Agenda items are listed in numerical order, not by importance to CGMS. The text for the relevant agenda items, as defined by WRC 2000, is indicated in italics).

Agenda Item 1.3 (Identification of harmonised bands for public protection services)

ITU Resolution 645 requests

"to consider identification of globally/regionally harmonised bands, to the extent practicable, for the implementation of future advanced solutions to meet the needs of public protection agencies, including those dealing with emergency situations and disaster relief, and to make regulatory provisions, as necessary, taking into account Resolution 645".

Initially this resolution listed various bands for consideration. One of the bands was 1544-1545 MHz, which is allocated to Earth Exploration Satellite Service (EESS) (active).

Status: Only bands in the range 380–395 MHz are currently under consideration. No proposals have been made for the band 1544–1545 MHz.

Agenda Item 1.5 (Use of the frequency range 5150–5725 MHz)

ITU Resolution 736 (WRC-2000) requests

"to consider, in accordance with Resolution ***736 (WRC-2000)****, regulatory provisions and spectrum requirements for new and additional allocations to the mobile, fixed, Earth exploration-satellite and space research services, and to review the status of the radiolocation service in the frequency range 5150–5725 MHz, with a view to upgrading it, taking into account the results of ITU-R studies"*

Proposals for new primary Mobile Satellite (MS) allocations for RLANs (Radio-LANs) in the bands 5150–5350 MHz and 5470–5725 MHz will be forwarded by several administrations. Studies on the feasibility of sharing between RLANs and EESS (active) indicate that sharing is feasible if RLANs respect the following limitations: indoor use only; 200 mW max Effective Isotropic Radiated Power (EIRP); use of Transmitter Power Control (TCP) and Dynamic Frequency Selection (DFS) features. Outdoor use and higher EIRP appear to be detrimental to the possibility of sharing between the two services.

On the initiative of the administration of France the Conference Européenne des Postes et Télécommunications (CEPT) is presently discussing the extension of the present EESS (active) allocation from 5250–5460 MHz up to 5570 MHz in the European Common Proposal (ECP). This is required to fully protect the required bandwidth of 320 MHz for future operations of JASON. Studies have shown that JASON operations will not constrain existing services in this band.

Agenda Item 1.8 (Unwanted emissions)

"to consider issues related to unwanted emissions:"

"consideration of the results of studies regarding the boundary between spurious and out-of-band emissions, with a view to including the boundary in Appendix S3"

"consideration of the results of studies, and proposal of any regulatory measures regarding the protection of passive services from unwanted emissions, in particular from space service transmissions, in response to recommends 5 and 6 of Recommendation 66 (Rev. WRC-2000);"

It will be necessary to ensure that the boundary between spurious and out-of-band emissions is defined, with a view to including the boundary into Appendix S3 of the ITU Radio Regulations (RR).

Band-by-band studies have been performed to ensure that space science passive systems will be adequately protected. NOAA and EUMETSAT have supported several of these studies which have been forwarded to ITU TG 1/7. Active service proponents dominate Task Group 1/7 proceedings, making progress in this area difficult.

Agenda Item 1.11 (Use of the band 14-14.5 GHz)

"to consider possible extension of the allocation to the mobile-satellite service (Earth-to-space) on a secondary basis in the band 14-14.5 GHz to permit operation of the aeronautical mobile-satellite service as stipulated in Resolution 216 (Rev.WRC-2000);"

The secondary allocation to the Space Research Service (SRS) in this band needs to be protected. Sharing between the aeronautical mobile-satellite and the SRS, on a co-equal secondary basis, should be shown to be feasible prior to any allocation action.

Agenda Item 1.12 (Issues related to the Space Science Service)

"to consider allocations and regulatory issues related to the space science services in accordance with Resolution 723 (Rev.WRC-2000) and to review all Earth exploration-satellite service and space research service allocations between 35 and 38 GHz, taking into account Resolution 730 (WRC-2000)"

There are several different issues covered by this agenda item. Regarding EESS (active) it is requested (mainly by Japan) to remove the footnote RR S5.551A from the RR. The EESS (active) allocation was made by WRC-97 and the footnote was attached to protect existing services in this band. Although the EESS allocation is on a primary level, the footnote practically makes the allocation secondary.

It is unlikely that there will be sufficient support to remove the footnote, which was introduced on the request of many administrations in 1997.

Agenda Item 1.13 (Issues related to High Altitude Platform System (HAPS))

"to consider regulatory provisions and possible identification of existing frequency allocations for services which may be used by high altitude platform stations, taking into account No. S5.543A and the results of the ITU-R studies conducted in accordance with Resolutions 122 and 734 (WRC-2000)"

The objective is to ensure the protection of passive sensors in the band 31.3–31.8 GHz from interference created by Earth-to-HAPS links in the 31–31.3 GHz band, by supporting suitable limitations on HAPS out-of-band emissions in the RR.

WRC-2000 made an allocation to HAPS in the band 31–31.3 GHz for transmissions in the Earth-to-HAPS direction (i.e., similar to a satellite up-link). On the request of the EESS community, this allocation was limited by footnote S5.543A/S5.5RRR to the lower half of the band (31–31.15 GHz) until WRC-2003, due to possible interference to passive sensors operating in the adjacent band from 31.3–31.8 GHz. Studies performed by EUMETSAT indicate that an out-of-band transmitter power density limit on the order of –100 dB (W/MHz) would be required to comply with the protection requirements specified in Recommendation ITU-R SA.1029. The study results were discussed in the relevant ITU working groups and it was agreed to introduce the limit into the RR. The relevant CPM text includes this.

Agenda Item 1.16 (Non-GSO Mobile Satellite Services (MSS) feeder links in bands around 1.4 GHz)

"to consider allocations on a worldwide basis for feeder links in bands around 1.4 GHz to the non-GSO MSS with service links operating below 1GHz, taking into account the results of ITU-R studies conducted in response to Resolution 127 (Rev.WRC-2000), provided that due recognition is given to the passive services, taking into account No. 5.340"

It is necessary to protect EESS (passive) allocations in the band 1400–1427 MHz from unwanted emissions originating from proposed MSS feeder links near 1.4 GHz, The band 1400–1427 MHz is a vital resource for measuring ocean salinity, soil moisture content and other aspects of the Earth and its atmosphere. It is necessary to protect this allocation from interference due to unwanted emissions from active services allocated in nearby bands. Studies within the ITU-R have shown that it may be theoretically feasible for MSS feeder link operations to restrict their emissions in the nearby 1400–1427 MHz band by using advanced modulation and filtering techniques to meet the protection criteria of the passive services in this band. This has not yet been demonstrated in practice and is in significant disagreement with current specifications for out-of-band emissions for the MSS contained in ITU-R Recommendations SM.1541 and M.1343. Studies have shown that it is unlikely that the required out-of-band attenuation levels can be met with the proposed MSS feeder link bands at 1390–1393 MHz and 1429–1432 MHz. It will be necessary to specify appropriate out-of-band power density limits in the RRs for the up-link stations if an allocation to the MSS is made near the 1400–1427 MHz band. Studies indicate that a maximum out-of-band attenuation level of 128 dB would be required. Significant out-of-band attenuation on the space-to-earth transmissions would also be required to protect all passive services in this band.

Agenda Item 1.20 (Non-GSO MSS service links in bands below 1GHz)

"to consider additional allocations on a worldwide basis for the non-GSO MSS with service links operating below 1 GHz, in accordance with Resolution 214 (Rev.WRC-2000)"

This issue has been on WRC agendas since 1992. The MSS seeks spectrum below 1 GHz for so-called "Little LEOs", i.e. low earth orbiting satellites performing mobile services such as paging, data collection etc. Several candidate bands have been identified including parts of the band 401–406 MHz. This band is used for radiosonde operations (MetAids) and part of the band (401–403 MHz) for DCS of meteorological satellites (LEO and GEO). WMO has conducted studies on the future requirements for the band and has submitted documents to ITU and WRC. A dedicated resolution relating to the band 401–406 MHz was deleted during WRC-2000.

In discussions in the ITU as well as in regional groups (CEPT, CITEL, APT etc), there has been no support for new MSS allocations. For the band 401–406 MHz there has been strong opposition to the MSS request. It can be expected that the issue will finally be removed from the agendas of future WRCs.

Agenda Item 1.31 (MSS in the 1-3 GHz band)

"to consider the additional allocations to the mobile-satellite service in the 1–3 GHz band, in accordance with Resolutions 226 (WRC-2000) and 227 (WRC-2000)"

This agenda item specifically has targeted the bands 1518–1525 MHz (down-link) and 1683–1690 MHz (up-link), but is open to examining other possibilities between 1 and 3 GHz.

The band 1675–1700 MHz is allocated to both the MetAids and MetSat services with the MetSat allocation extending up to 1710 MHz, and is vital to the operations of the WMO as well as other meteorological services in many administrations. The band is essential for the programmes of CGMS agencies.

Studies in the ITU-R have shown that MSS (Earth-to-space) cannot reasonably share with the MetSat or MetAids services. For example, three independent studies have shown that sharing between the MSS and MetSat in the 1683–1690 MHz band would be very difficult due to the hundreds of GOES Variable (GVAR)/S-VISSR stations, including a number of mobile GVAR

Earth stations. Earlier studies have proven that sharing is not feasible in the bands 1690–1698 MHz due to hundreds of user stations for geostationary meteorological satellite systems as well as 1698–1710 MHz due to down-link of polar-orbiting meteorological satellites to user stations and main Earth terminals. Therefore, any MSS allocation in the 1675–1710 MHz band was opposed.

An alternative band that may be feasible for sharing is 1670–1675 MHz. This band is presently licensed to the so-called TFTS, a system supporting telephone services between Earth stations and aeroplanes. This service has not been successfully implemented and it is foreseen to withdraw the license. The alternative band is considered suitable but does not fully satisfy the MSS requirement for 7 MHz. There are ongoing discussions whether an additional 2 MHz could be found in the neighbourhood of the band.

The present text for the ITU Conference Preparatory Meeting (CPM) still includes 1683–1690 MHz but also supports 1670–1675 MHz.

CEPT supports 1670–1675 MHz only.

Present draft proposals of CITEL indicate consideration of the removal of MSS allocations in ITU region 2 between 1675 and 1690 MHz.

In all scenarios it is clearly indicated that full protection is given to meteorological services in the band 1–3 GHz.

Agenda Item 1.38 (8.3) (Use of the band 420–470 MHz)

"to consider provision of up to 6 MHz of frequency spectrum to the Earth exploration-satellite service (active) in the frequency band 420–470 MHz, in accordance with Resolution 727 (Rev.WRC-2000)"

The need for such an allocation, at a radio spectrum wavelength of approximately one meter (P-band), is important because experiments have shown good correlation of backscatter radiation with biomass and soil moisture, which are parameters needed for forest monitoring. The need for such forest monitoring was emphasised at the United Nations Conference on Economic Development (UNCED) (Buenos Aires, 1992). Subsequent to UNCED 1992, studies have identified a minimum bandwidth requirement of 6 MHz to satisfy mission objectives.

Additional inputs in ITU-R have identified this band as also being useful for studying Arctic and Antarctic ice. Studies indicate that lower power, lower sidelobe Synthetic Aperture Radar (SAR) designs will enhance the sharing situation in some areas of this frequency range.

There was little support to this new allocation at earlier conferences, but during preparation of WRC-2003 this situation has changed in such a way that a secondary allocation in the band 432–438 MHz is supported by many administrations. It has been concluded that a secondary allocation would be sufficient to operate P-band SAR.

Agenda Item 7.2 (Possible agenda items for future conferences)

"to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, taking into account Resolution 801 (WRC-2000)."

One of the outputs of World Radio Conferences is to establish the agenda for the following WRC. WRC-2003 will therefore discuss and conclude on the WRC-2006 agenda. Already during WRC-2000 there were discussions on some topics, which could not be agreed for the WRC-2003 agenda but were provisionally listed for the agenda WRC-2006. Points of relevance for MetSat and EESS are as follows: WRC-07, Agenda Item 2.3 "*to review studies and consider allocations in the frequency bands above 275 GHz*"

It is necessary to provide suitable frequency allocations for passive sensor atmospheric measurements using EESS (passive) and SRS (passive). There are already spaceborne passive sensors utilising frequency bands above 275 GHz. Planned and existing instruments include Maximal Linear Sequence (MLS) (USA), SMILES (Japan) as well as other sensors which use spectra above 275 GHz.

Protection is presently only given by footnote S.5.565 that was revised by WRC-2000. This footnote states that the band 275–1000 GHz may be used for experimentation and the development of various active and passive services. A list of frequencies is contained in the footnote but this list is not complete. Operations of sensors in such frequency bands are not adequately protected. It is, therefore, necessary to open the table of frequencies to include frequencies up to 1000 GHz.

Two documents on this issue were presented to CGMS XXX, i.e. EUM-WP-13 and USA-WP-19, and only a few replies had been received in response to CGMS Action 29.16.

EUM-WP-13 noted that the study results on the needs of EESS in the band 275–1000 GHz had been forwarded to CEPT and ITU. This study serves as a starting point for modifications to the RRs and supports the necessity to maintain the agenda point for WRC-2007. Presently there is some support to this. Some resistance from active services has also been experienced. This is due to the fact that such services have no firm plans to use the spectrum and would like to keep the table of frequencies in the band 275–1000 GHz open as long as possible.

In USA-WP-19, the USA responded to Action 29.16, and indicated that currently planned passive instruments to be flown on the NPOESS would not contain any bands above 190 GHz; however, the USA does have plans for using frequency bands above 275 GHz prior to 2020. This information was reflected in a paper prepared for the ITU-R in which the USA discussed plans for frequency use above 275 GHz. Sections 27–33 of the paper quoted in this working papers described the USA plans for using the frequency bands above 275 GHz. The USA will continue to review its plans for future, post 2020, passive sensors that may look at frequencies above 275 GHz.

CGMS members should actively support the requirement to keep this item on the agenda of WRC-2006.

ACTION 30.12

CGMS members to coordinate with their national frequency authorities to promote CGMS positions on WRC-2003 and WRC-2007 agenda items.

WRC-07 Agenda Item 2.7 and Agenda Item 2.13

"to consider the potential for sharing at around 4300 MHz between radio altimeters and space-based passive earth sensors"

"to review No. S5.332 in respect of the frequency band 1215–1260 MHz and No. S5.333 in respect of the frequency band 1260–1300 MHz, concerning the Earth exploration-satellite (active) service and other services"

The band 4200–4400 MHz is very important for the continuous monitoring of sea surface temperature in order to study global warming. ITU-R studies have shown that sharing between the aeronautical radio navigation service and the EESS (passive) and the SRS (passive) is feasible in this band. Based on these positive study results, a request for primary allocations of EESS (passive) and SRS (passive) in the band 4200–4400 MHz is foreseen (footnote RR S5.438 may be consequentially suppressed).

Mission objectives for spaceborne SAR such as SIR-C, PALSAR, Light SAR, and TerraSAR which can observe Earth's environment and disasters under all weather and day and night conditions need to be satisfied by new allocations for EESS (active) in the bands 1215–1260 MHz and 1260–1300 MHz.

Other Frequency Management Issues

21st Space Frequency Coordination Group (SFCG) Report

The report of the SFCG meeting was submitted for information (USA-WP-20). Up-to-date information on SFCG activities can be achieved through the SFCG website: http://www.sfcgonline.org.

Introduction of Car Radar Devices (CRD) operating in the frequency band 21–27 GHz

EUM-WP-12 stated a group of car manufacturers had organised themselves under the name SARA (Short-Range Automotive Radar) and have recently published plans to introduce Short-Range Radar (SRR) equipment on cars using Ultra Wide Band (UWB) technology.

The target frequency range for this application is 22.625–25.625 GHz, which includes the band used for very important measurements from passive sensors at 23.6 – 24 GHz. This band is a unique natural resource allowing the correction of "windows" between 1– 40 GHz from the water vapour attenuation bands, and giving the necessary correction for using the 50–60 GHz band for vertical temperature profiling. Due to the importance of this band for passive sensor measurements, the band is protected in the ITU Radio Regulations by FN 5.340 stating "No emissions allowed in this band".

The SARA group has started activities to achieve licenses for their equipment. Several workshops have been conducted under the responsibility of the European Radiocommunication Office (ERO) and European frequency regulatory administrations involving SARA and representatives of so-called "victim services" including the EESS.

The discussion process in Europe has resulted in a situation where a draft standard for SRR devices proposed by the European Telecommunications Standards Institute (ETSI) has been put on hold until compatibility between the new service and the existing protected services in the band has been proofed. Centre National d'Etudes Spatiales (CNES), ESA, and EUMETSAT have submitted compatibility studies. These studies were based on actual ITU Recommendations and input parameters received from SARA as well as parameters quoted in the draft ETSI standard. Present and future instruments were included into the study (conical scanned, cross-track nadir, and push-broom sensors). The studies clearly indicate that operation of the new service is not compatible to EESS applications. Several mitigation techniques have been proposed but so far, these have not resulted in acceptable sharing conditions.

The study within CEPT resulted in the conclusion that sharing between the car radars and EESS (passive) is not feasible. Activities concentrate on finding an alternative frequency band. Nevertheless, SARA claims that they would need to start implementation of the service in the band 21–27 GHz. This is due to the availability of sensors, which were designed for this band. SARA representatives have proposed the development of a new type of sensor, which will operate in a different band and that they intend to depart from the band covering the EESS (passive) allocation. It will now be necessary to find and agree on an alternative band and to develop a committing schedule for introduction and termination of the service. It is foreseen to fix a date after which no new equipment will be installed. Such a committing schedule could be made part of the licensing agreement issued by the frequency regulators. The EESS community could agree on this regulation recognising that:

- in the first years of service implementation there would be only small numbers of cars equipped with these radars, and
- EESS sensors of a new, more sensitive type (as included in the compatibility study) would only be implemented in a few years.

The FCC in the USA have issued a “First Report and Order” (ET Docket 98-153) on 22 April 2002 regarding the use of ultra-wideband transmissions including the use of this technology for “Vehicular Radar systems”. Although this document concludes that no harmful interference will be caused to meteorological satellite measurements, it is expected that the associated spectrum masks and operation values used in this document are not giving the required protection to EESS usage in the band. It has, therefore, to be expected that the introduction of the new service will invalidate measurements of instruments operated on meteorological satellites. Wrong measurement values will be achieved and will invalidate not only the measurements in the 24 GHz band but also all other measurements of these instruments. This could result in a major degradation in meteorological processing based on these measurements.

A phased approach for the introduction of the Vehicle Radar System (VRS) has been proposed by reducing the output power of SRR equipment after certain dates to compensate for the growing number of operating devices and the related cumulative interference from serious high numbers of equipment. Although this could improve the sharing situation, there are still doubts whether this will give the required protection. It is also noted that the equipment will be operated under part 15 of FCC rules, i.e. as unlicensed equipment.

ITU has discussed the issue of UWB and has decided that a Task Group (TG 1/8) be established in Study Group 1 in order to urgently address the compatibility between UWB devices and radio communication services (Q.227/1), the spectrum management framework related to the introduction of UWB devices (Q.226/1), and appropriate measurement techniques for UWB devices.

Considering the criticality of this issue to the space-component of the GOS and to its all-weather sounding capability, CGMS members are invited to express their concerns to their national frequency administrations.

ACTION 30.13

CGMS members are urged to discuss the potential problems caused by car radar systems operating in the band 21–27 GHz with their national frequency administrations.

ISRO distributed an information document on frequency coordination activities for ISRO meteorological satellites.

In WMO-WP-26, CGMS was informed of the recently completed First International Precipitation Working Group Workshop and its activities with regard to frequency matters. At this first workshop held in Madrid, Spain on 23–27 September 2002, the interest of using millimetre and sub-millimetre waves for frequent rain observation from geostationary satellites was recognised. The issue of frequency protection of the appropriate atmospheric windows and O_2 and H_2O absorption bands was identified. One of the action items emanating from the workshop was the preparation of a first draft document looking into possible frequency allocations on the basis of results from recent studies in Europe and the United States. CGMS noted the first draft and provided comments and encouraged IPWG to continue this new and important activity and to continue to keep CGMS informed at its future meetings.

I/2 Telecommunication Techniques

EUM-WP-14 described arrangements for the transition of the Meteorological Data Distribution (MDD) service from Meteosat-7 to MSG, and highlighted the impact upon users wishing to make use of the service. On the basis of current plans, it was recalled that users wishing to continue making operational use of the MDD service in the future would have to have made the transition to MSG by the end of 2005. The document also provided a summary listing of the content of the present MDD service, and provisional procedures for the admission of new content, using the services of WMO.

Responding to the last point, WMO confirmed that the proposed procedure for handling requests for the inclusion of new content in MDD broadcasts was acceptable from its point of view. WG I also recalled that final approval for the inclusion of new content rested with the EUMETSAT Council.

In USA-WP-22, the USA informed the CGMS members that the Phase 2 Proof of Concept demonstration of the applicability of the TLS technology to the NOAA GOES DCS has been completed. The Phase 2 Proof of Concept demonstration was performed on behalf of NOAA at the Wallops Command and Data Acquisition (WCDA) station in Wallops Station, Virginia.

The results of the Phase 2 effort demonstrate that the TLS technology can geolocate fixed DCS platforms within the area of covisibility of the GOES-E and GOES-W satellites with typical accuracies of the order of ten miles. For platforms in motion, either on board maritime vessels or more likely on buoys subject to wave motions, the effect of the wave motion causes the Frequency Difference of Arrival (FDOA) to be poorly determined, resulting in significant errors in the reported geolocation. However, even for these signals the Time Difference of Arrival (TDOA) remains well determined, yielding accurately measured lines of position along which the transmitting platform lies.

Finally, a series of measurements were made on up-link signals (test transmitters) furnished by NOAA as “ground truth” signals. Calculated geolocation coordinates were provided for the measurements of these signals. NOAA evaluated these data against the known locations of the up-link transmitters to assess the performance of the TLS on these “unknown” signal sources.

Interference location in the GOES DCS frequency band was successfully demonstrated using the TLS system. All unknown transmitters were located within the specified boundaries require by NOAA. Understanding the complexities of the DCS environment, NOAA believe the TLS system will benefit the management of its radio frequency resources and help to provide a better service for the DCS users and the GOES family. NESDIS continues to investigate the TLS and evaluate the benefits it has on the DCS service and the GOES system. Implementation of Phase 3 has not been determined. The USA continues to evaluate plans for operating the TLS in the GOES environment.

I/3 Coordination of IDCS and Distribution (ex Plenary item F)

I/3.1 Status and Problems of the IDCS

EUM-WP-15 reported on the performance of the IDCS. In the Meteosat sector, interference to IDCS channels appeared to be mainly limited to channel I12. WG I noted that there had been a significant reduction in the use of channels by the GOES SEAS programme.

WG I endorsed an action on EUMETSAT to provide IOC with read-access to the on-line consolidated list of IDCS allocation, maintained on a EUMETSAT Server.

RUS-WP-06 described Roshydromet plans for the implementation of its DCPs. WG I were informed that in 2002 the first batch of 18 DCPs had been installed at hydrometeorological stations in the European and Ural regions of Russia. DCP tests began at the end of the Summer 2002. DCP signals are transmitted via Meteosat-7 making temporary use of I25 and I26 (with the special agreement of CGMS) on an experimental basis. SRC Planeta using its ground receiving station near Moscow carries out data collection. A network of 600-800 DCPs will be established, which will transmit their data via the GOMS /Electro N2 commencing in 2005.

WG I were pleased to note that GOMS/Electro N2 would support IDCS channels, and the fact that such a capability would significantly improve the reception of IDCS data to the east of the Meteosat field-of-view.

JPN-WP-08 reported upon the status of the GMS IDCS. WG I noted that interference monitoring reports have been regularly sent to the CGMS Secretariat. In July 2001 to June 2002 severe interference, including temporary phenomena were found on 14 of 33 IDCS channels, i.e. Channels 1, 6, 7, 8, 9, 10, 11, 17, 25, 28, 29, 31, 32 and 33, rather similar to the previous year.

Japan commented that some discrepancies between the number of received and sent messages had been noted. Some of the received messages were not in the correct Global Telecommunication System (GTS) code form, such as “DATA BUFFER EMPTY”, “NO MESSAGE” or house keeping data. Some messages had errors caused by the radio telecommunication itself. Some errors were caused by bad transmission, others contained incorrect (or non-registered) call sign information.

WG I was informed that JMA had been exploring methods to increase the number of the IDCS channels by narrowing the bandwidth of each channel from 3 kHz to 1.5 kHz. JMA was studying the possibility of implementing this change as a part of an upgrade of its DCP processing system.

Finally, WG I was informed that since September 2002, some JMA meteorological observing ships and the Marcus Island station were operating Regional DCPs at 300 bps (4.0 kHz bandwidth per channel). This upgrade allows the real-time dissemination of an increased amount of data.

USA-WP-09 reported on the status and problems of the IDCS. With the deployment of the Channel Interference Monitoring System (CIMS), the USA was able to provide a flexible, continuous, automated service for monitoring the international channels. Through better interference detection and monitoring, the USA ensures that authorised transmissions through the GOES IDCS are reliable and efficient. NOAA has awarded a contract for the design and implementation of the next GOES DCS Automated Processing System (DAPS II). DAPS II will fully integrate the CIMS system and functionality, providing real-time data and interference through the Internet as well as archiving the data for long-term statistical analysis. This system will be delivered and tested in mid-2003. Further information regarding DAPS II was provided in USA-WP-13.

I/3.2 Ships, including ASAP

WMO-WP-13 discussed the ASAP. The number of soundings taken in the frame of the ASAP was approximately 5300, similar to the average of most previous years. However, CGMS noted the substantial increase compared to the 4416 soundings obtained in 2000. This increase could largely be ascribed to a large enhancement in the number of soundings carried out by Japan, Germany and the Conference of National Meteorological Services in Europe (EUMETNET). At the same time, two countries (Russia and the USA) have, temporarily at least, ceased their ASAP activities. The total number of ASAP units operated in 2001 was 24; the operators were: Denmark (three units), EUMETNET (two units), France (four units), Germany (three units), Japan (seven units), Spain (one unit), Sweden-Iceland (one unit), United Kingdom (two units) and WRAP (one1 unit). The performance of ASAP operators remained quite stable. However, the communication efficiency of Germany and Spain remains low. EUMETSAT has been informed of this problem.

I/3.3 ASDAR

WMO-WP-09 informed CGMS that although the Aircraft to Satellite Data Relay (ASDAR) programme peaked early in 1998 with 21 operational systems, there had been a substantial reduction in its size following the decommissioning of one more aircraft in November 2001 and two more aircraft are due to be decommissioned by the end of November 2002 leaving eight from the original 21 installed units. Three other aircraft are not reporting for various reasons associated with airline operating constraints but one is expected to return to operational status by the end of 2002. The level of technical support has been reduced further and a major section of support will cease completely in March 2003. Increasing data quality problems, whose cause has not been determined, are also a cause of concern. With eight installed units remaining after November 2002 and noting that there is considerable uncertainty whether the Saudi Arabian units will return to service, only six units will remain operational for the immediate future. It is also noted that the ASDAR Centre will close in March next year. Consequently, the Aircraft Meteorological Data Relay (AMDAR) Panel, which carries responsibility for the ASDAR operational programme, decided at its recent annual meeting that the programme will continue to function in its present form for the next 12 months. CGMS satellite operators will be informed should there be any significant changes in the programme.

I/3.4 Dissemination of DCP Messages (GTS or Other Means)

USA-WP-10 provided an update on USA activities for disseminating IDCS messages over the Internet. The USA provided an update on the planned improvements in the system that will allow users better access to the data. The first is through the Local Readout Ground System (LRGS). This system was developed through a contract with the United States Geological Survey (USGS). Their mission was to develop a network where each node would serve as back-up to its neighbour and would receive all of the IDCS/DCS data. The overall goal is for a network of receive sites located throughout the United States to collect, store data via the Wallops CDA Domestic Telecommunications Relay Satellite (DOMSAT) down-link, and then share data over the Internet. A quality control system was added to monitor the quantity and reliability of the transmissions. The DCS site is public and is updated daily through an automated FTP service.

I/4.1 Dissemination of Satellite Images via Satellite

WMO-WP-03 discussed the latest status for LRIT/LRPT conversion for satellites in polar and geostationary orbit. An analysis of the plans for LRIT conversion indicated in WMO Regions I (Africa) and VI (Europe) that there will be a two year overlap starting in October 2003. WMO Regions II (Asia) and V (south-west Pacific) will have a two year overlap starting in 2003. For WMO Regions III and IV (South, Central and North America including the Caribbean) during November 2002, GOES-East will be converted from WEFAX to LRIT transmission and will cease transmitting WEFAX data. The conversion of GOES-West to LRIT will be based on the needs of the users. The date for the GOES-West conversion will be announced as soon as it is practical. The Indian Ocean area (RA II) appears to have no overlap starting in 2003. It should be recalled that CGMS members have already indicated to WMO their intention to provide for a three year overlap. An analysis of the table for LRPT conversion shows that the morning (AM) satellite will start LRPT in 2006 while the afternoon (PM) satellite will transmit two datastreams (Advanced High Rate Picture Transmission (AHRPT) and X-band) starting in 2010. The FY-3 series will only transmit AHRPT and X-Band starting in 2004. Meteor-3M N2 will transmit LRPT starting in 2005. There will be no transition period for the AM orbit or PM orbit separately and the present combined CGMS satellite operators' plans indicate that it may be necessary to have at least three different receiving stations to receive AM and PM satellite data. WMO also noted with both sadness and pride that NOAA N' will provide the last Automatic Picture Transmission (APT) service starting in 2007. For more than forty years, APT has been one of the best ambassadors the satellite community has had. The transition to digital broadcasts is a necessity but the meteorological community at large, will long remember the workhorse in space called APT.

ACTION 30.14

CGMS members to provide relevant information on frequencies used or planned for use in support of CGMS missions in the Indian Ocean region for triggering a discussion on appropriate coordination by CGMS XXXI.

ACTION 30.15

CGMS members to update the status of LRIT/LRPT conversion as contained in Tables 7 and 8 for satellites in polar and geostationary orbit.

Table 7: Status for LRIT Conversion, Satellites in Geostationary Orbit
(as of 22 December 2001)

Operator	Satellite	Launch (M/Y)	Service	Start	Stop
EUMETSAT	Meteosat-5	03/1991	WEFAX	03/91	
	Meteosat-6	11/1993	WEFAX	11/93	
	Meteosat-7	02/1997	WEFAX	07/97	12/03
	MSG-1	1/2002	LRIT	10/02	2007
	MSG-2	2003	LRIT	2004	2010
	MSG-3	2008	LRIT	2008	2013
India	INSAT I-d	06/1990	None		
	INSAT II-a	07/1992	None		
	INSAT II-b	07/1993	None		
	INSAT II-e	---	None		
Japan	GMS-5	03/1995	WEFAX	06/95	2003
	MTSAT-1R	2003	WEFAX LRIT	2003 2003	2005 2008
	MTSAT-2	2004	LRIT	2008	2013
USA	GOES – 8	04/1994	WEFAX	11/94	
	GOES – 9	05/1995	WEFAX	01/96	
	GOES – 10	04/1997	WEFAX	06/97	
	GOES – 11	05/2000	WEFAX	09/00	
	GOES – M	08/2002	WEFAX	10/02	
	GOES – N	2002	WEFAX/LRIT		
	GOES – O	2005	WEFAX/LRIT		
Russian Federation	Elektro-1	11/94	WEFAX		
	Elektro-2	2003	WEFAX		
	Elektro-3	TBD	LRIT		
China	FY-2B	06/00	WEFAX	01/01	
	FY-2C	2004	LRIT	2004	
	FY-2D	2006	LRIT	2006	
	FY-2E	2009	LRIT	2009	

Table 8: Status for LRPT Conversion, Satellites in Polar Orbit
(as of 22 December 2001)

Operator	Satellite	Launch (M/Y)	Service	Start	Stop
EUMETSAT	Metop-1	12/2005	LRPT	2006	
	Metop-2	12/2009	LRPT	2010	
	Metop-3	06/2015	LRPT	2015	
USA	NOAA-9	12/1984	APT	12/84	08/95
	NOAA-12	05/1991	APT	05/91	
	NOAA-14	12/1994	APT	12/94	
	NOAA-15	08/1997	APT	08/97	
	NOAA-16	09/2000	APT	09/00	
	NOAA-M	04/2001	APT	04/01	
	NOAA-N	12/2003	APT	12/03	
	NOAA-N'	07/2007	APT	07/07	
	NPOESS-1	2010	Tentative: AHRPT and X-band		
	NPOESS-2	2011	Tentative: AHRPT and X-band		
	NPOESS-3	2013	Tentative: AHRPT and X-band		
	NPOESS-4	2015	Tentative: AHRPT and X-band		
	NPOESS-5	2017	Tentative: AHRPT and X-band		
	NPOESS-6	2018	Tentative: AHRPT and X-band		
China	FY-1C	05/1999	No APT or LRPT. CHRPT only		
	FY-1D	05/2002	No APT or LRPT. CHRPT only		
	FY-3A	2004	AHRPT and X-band only		
	FY-3B	2006	AHRPT and X-band only		
Russian Federation	Meteor 2-21	08/1991	APT	08/91	
	Meteor 3-5	08/1991	APT	08/91	
	Resourse-01-N4	---	APT		
	Meteor 3M-1	2001	APT		
	Meteor 3M-2	2003	LRPT	2003	

USA-WP-11 provided an overview of LRIT development and implementation. The USA LRIT system architecture consists of five processing domains (ground processing system) and a user terminal domain interconnected by various communications media. The LRIT ground processing system and five prototype user terminals were completed and have undergone extensive system integration testing. The units were delivered to NOAA in mid-September 2002. In September 2002, the development of the LRIT system was completed and system integration testing was initiated. The USA will employ a user terminal configuration that will allow users to select either a one meter or two meter antenna at 128 kbps data rate. The USA is evaluating alternatives for information elements to be included on the future LRIT datastream. Alternate WEFAX/LRIT transmissions will begin in January 2003 on GOES-East. The transition from current WEFAX to total LRIT services is projected to occur over a one to two year period for the GOES constellation (i.e., GOES East and GOES West). The USA encouraged CGMS members to attend the Direct Readout Conference for the Americas to be held in Miami, Florida on 9–13 December 2002. (See http://noaasis.noaa.gov/miami02/).

USA-WP-12 provided an update on the development of the Code Division Multiple Access (CDMA) overlay system for the GOES IDCS/DCS. The objective of the CDMA Overlay Programme is to demonstrate that satellite-based CDMA carriers can co-exist with the Time Division Multiple Access (TDMA) users on the GOES DCS transponders. The USA contracted Science Applications International Corporation (SAIC) to design a prototype CDMA transmitter, develop a CDMA receive site (hub) and demonstrate the new capabilities at the WCDA station. The CDR was held on 26 February 2002 to review the design of the prototype system and discuss the development activities for using spread spectrum techniques to complement the GOES DCS service. The CDR addressed the specifications for the transmitter and the configuration for the receive site. A CDMA overlay demonstration and evaluation was scheduled at the Wallops CDA for 8–11 July 2002. SAIC performed system installation and checkout of the prototype CDMA processor and transmitters prior to the proof-of-concept demonstration. During the initial station integration testing, it was realised that the transmitters were not operating at the proper power level. The units were returned to the manufacturer for repair. A new date for the demonstration has not been determined.

The USA then provided an overview of the specifications for the LRIT receiver. USA-WP-14 described the technical specifications for operating a LRIT user station to capture the GOES digital broadcast. The USA LRIT receive station is designed to be interoperable with the planned JMA and EUMETSAT systems. The design of the LRIT user station is consistent with the design of the user terminals for using the recommended Consultative Committee on Space Data Systems (CCSDS) standard for packet telemetry. Each user station consists of an antenna, radio receiver, receiving processor and a workstation. The antenna is a parabolic dish antenna with no auto tracking. The down-link signal is received at 1691 MHz. The signal may be filtered to reduce adjacent channel interference and/or amplified by a low-noise amplifier. Then it is down-converted to the receiver IF frequency. The IF signal is then demodulated in a Bi-phase Shift Keying (BPSK) demodulator and the baseband output to the receiving processor is a serial bit stream.

The USA provided an update on the LRIT system transition and test plans in USA-WP-15. The USA has developed a transition and implementation plan for the LRIT that will originate on a GOES I-M spacecraft currently in storage. Tests of the LRIT datastream on the current GOES series were conducted during the last quarter of 2001 and in June 2002. Further tests of the new digital datastream are planned on non-operational satellites. NOAA's transition alternative consists of timesharing between WEFAX and LRIT on individual spacecraft for a limited time period (e.g., one to two years) followed by a total transition. Further, this alternative is described as a period of parallel operations for each of the two GOES satellites where both WEFAX and LRIT services would be simultaneously broadcast (i.e. timeshared GOES I-M transponder) for a specified transition period, followed by a full and permanent transition to full LRIT services.

USA-WP-34 discussed the LRIT system performance and link budgets. Initially, the LRIT will transmit at 128 kbps. Link calculations show the performance for a 1-meter dish and a 1.8-meter dish. The minimum performance goal is a 10^{-8} ber with a 3 dB margin. This is not achieved near the edge of coverage (e.g. low antenna elevation angles) using the smaller antenna. For both antennas the link margin of 3 dB is achieved at elevation angles above 15°. However, for the smaller antenna the performance of 10^{-8} ber is not achieved at 5° because of high scintillation loss. The performance of the LRIT communications link is dependent upon many assumptions concerning the spacecraft, user receiver, and atmospheric losses. In this document, conservative assumptions have been chosen in order to determine the worst-case performance of the communications link. In the link budget, an insertion loss of –1.0 dB is used to account for a front-end filter to reduce interference. User stations with about a 5° elevation angle may not be in an environment that would require the filter. In this analysis, the USA conservatively reduced the ideal coding gain from 9.4 dB to 7 dB. The ability of the concatenated coding to produce the full gain will be tested. If full coding gain is achievable, the link performance will increase by 2.4 dB. This is enough by itself to achieve a full 3 dB margin at 5° elevation during the initial operational phase and increase the margin to +2.3 dB at that range in the final operational phase.

I.5 Results of Discussions by the Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites

WG I was tasked to discuss the technical implications of this topic. Documents JPN-WP-05, WMO-WP-21 and -22, and USA-WP-36 were presented.

In WMO-WP-21, CGMS was informed that the CGMS Ad Hoc Task Force on Integration Strategy for Data Dissemination from Meteorological Satellites had met at WMO Headquarters, Geneva, Switzerland on 29 April 2002 in response to an action item from CGMS XXIX. The primary objective for the meeting was to review the concept, from a CGMS perspective, for data access from the future space-based component of the GOS). The Task Force meeting was held as a joint session with the OPAG IOS Expert Team on Satellite Systems Utilisation and Products, in order to provide the Expert Team with a CGMS perspective on the topic of Alternative Dissemination Methods (ADM).

CGMS reviewed a summary of the Task Force report. In particular, the Task Force had noted that most CGMS satellite operators either had ADM in place or intended to use it in the near future. It was also noted that ADM were unique to each satellite operator and that commonality and coordination between them were very limited. The Task Force also reviewed the proposed WMO concept for ADM, as reported in the Final Report of the OPAG-IOS Expert Team on Satellite System Utilisation and Products (SSUP-4) and was in full agreement with the concept. The Task Force also recommended, in order to avoid uncoordinated proliferation of ADM, that each satellite operator strive to co-ordinate plans towards convergence of planned systems, especially in a WMO region. Such convergence could only occur if CGMS established a dedicated working group to develop an overall strategy for convergence of planned ADM as well as an associated implementation plan. The CGMS Ad hoc Task Force had further recommended that its present draft terms of reference be institutionalised into a standing CGMS working group. The working group should meet on a regular basis and report progress made to each CGMS Plenary. The membership of the working group should include CGMS satellite operators and appropriate WMO CBS Open Programme Area Groups including Integrated Observing Systems and Information Systems and Services. It should address both geostationary and polar orbiting and both operational and R&D satellites. The strategy should take into consideration all users' temporal requirements for data.

ACTION 30.16

CGMS to establish a standing Working Group, chaired by Mr. M. Rattenborg (EUMETSAT) to develop an overall strategy for convergence of planned ADMs as well as an associated implementation plan.

CGMS agreed that the terms of reference for the Ad Hoc Task Force into a standing working group would serve as the terms of reference for the new working group on Integrated Strategy for Data Dissemination from meteorological satellites. The terms of reference for the new standing working group are contained in Appendix B.

In WMO-WP-22, CGMS was informed of WMO activities for ADM. WMO had agreed that access to satellite data and products by its members should be through a composite data access service comprised of both DB from satellite systems and ADM. ADM would be the baseline while DB reception would serve as back-up as well as for those WMO members unable to take advantage of ADM. CGMS noted that ADM branches were open to merging with other meteorological datastreams. For example, it would allow a seamless inclusion of data/product sets from polar and geostationary operational satellites as well as from relevant R&D satellites.

CGMS was also informed that the fourth meeting of the CBS Interprogramme Task Team on Future WMO Information Systems (FWIS) was held in Johannesburg, South Africa on 23-27 September 2002. The Task Team had discussed recent recommendations about satellite data and products distribution, ADM as primary services and DB as back-up services. The Task Team had reviewed current and emerging technologies that could have an impact on development of the FWIS. This included the proposed WMO Core Metadata Standard, Earth System GRID, the EUMETNET UNIDART project, satellite alternative dissemination methods, the Roshydromet CliWare project, the South African METGIS system, and the Unidata Internet Data Distribution (IDD) system. The Task Team felt that all could contribute to FWIS. Taking into consideration the views of WMO Executive Council, the CBS Implementation/Coordination Team on the ISS and others, the Task Team reviewed the FWIS vision that had been developed at previous meetings. It agreed that, while no significant changes to the concept itself were required, much work was needed to clarify and improve the document that described it. It developed a revised vision that included an introduction to clearly define the concept and the reasons for its development as well as an executive summary. It also expanded and improved the text to clarify the relationship with existing centres and improve the figures to ensure they more clearly illustrate the essential features of the concept. Inter alia, the operational and R&D satellite datastreams were integrated through ADM. ETRP (Virtual Laboratory) was also added to FWIS as another programme with growing needs for information exchange.

ACTION 30.17

CGMS satellite operators to reaffirm commitment to the AHRPT format for datastreams from polar-orbiting satellites.

Based on discussions at the Task Team Meeting, CGMS was requested:

- to consider FWIS (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems (after FWIS approval).
- to consider WMO Core Metadata profile within the context of the ISO Standard for Geographic Metadata (ISO 19115). This core provided a general definition for directory searches and exchange that should be applicable to a wide variety of WMO datasets. It did not specify how this metadata should be archived or presented to users and did not specify any particular implementation. E.g. data and product catalogues used by space agencies and WMO have to be interoperable.

CGMS, in noting that the next Task Team meeting (TT-FWIS-5) would occur in the September/October 2003 timeframe in Malaysia, reaffirmed that the recommendations by its

Ad Hoc Task Force on Integration Strategy for Data Dissemination from Meteorological Satellites required urgent action.

ACTION 30.18

CGMS members to consider the FWIS as well as the WMO Core Metadata profile within the context of the ISO Standard for Geographic Metadata (ISO 19115), when changing/implementing processing and dissemination systems (after FWIS approval).

USA-WP-21 provided updates for WMO on the POES and NPOESS data formats and frequencies. The USA is investigating the global distribution of high-resolution imager and sounder data in the GOES-R era. Considering the expected high data rates for the proposed instruments, the USA studied three global distribution options consisting of dedicated lines, GOES-R rebroadcast and commercial communications satellites. USA-WP-36 provided an overview of the each dissemination method and the projected annual cost.

JPN-WP-05 reported the activities on the meeting on the Fourth Session of "Asia-Pacific Satellite Data Exchange and Utilisation (APSDEU)", hosted by JMA, on 13–15 March 2002. The purpose of the meeting was to promote the enhanced utilisation of satellite observation data on Earth's environment in the Asia-Pacific region and to ensure satisfactory data exchange.

WG I took note of the presentations and stressed the importance of standardisation of data formats and protocols to facilitate future interoperability of data from the various satellite systems, and generally endorsed the notion that, where feasible, efforts should be made to coordinate ADM, in particular, within a WMO region.

WORKING GROUP II: SATELLITE PRODUCTS

II/0 Introduction

Working Group II (WG II) on Satellite Products was chaired by Dr. Ramesh Bhatia of IMD and Dr. Paul Menzel of NESDIS assisted as secretary. Twenty-three working papers were discussed. Several of these papers were in response to actions from CGMS XXIX (regarding website reporting of cross-calibration efforts, metadata needed for reprocessing, monitoring practices for satellite radiance data, nowcasting activities with geostationary satellite data, and establishing user requirements for future systems). In addition, the reports from the ITWG and the IPWG were presented and discussed. All past actions were addressed. Eleven new actions were suggested.

II/1 Image Processing Techniques

There were no papers on image processing techniques. However, WG II noted that there remains a need to communicate progress on preparing measurements from multiple detectors into coherent images (e.g. destriping) and the discrimination of features within (e.g. clouds over snow or ice covered regions). Papers on these subjects are encouraged for CGMS XXXI.

II/2 Satellite Data Calibration

EUM-WP-16 reported on a routine cross-calibration established to compare the IR-window and WV channels of Meteosat-7 (at 0°E) and Meteosat-5 (at 63°E) with similar channels of the High Resolution Infrared Sounder (HIRS) instrument on NOAA-14. They note that IR window cross-calibration gives biases (Meteosat-HIRS) of about –1 to –2 K and WV cross-calibration gives biases (Meteosat-HIRS) of about +3 K. Biases are similar for both Meteosat-7 and -5. Sources of the biases may include errors in the operational calibrations, uncertainties in the instrument characterisation, especially in the spectral response functions; investigations on the potential error sources are ongoing with the aim to have a better understanding of all elements impacting the image calibration.

EUM-WP-17 reported on the establishment of a "calibration reference", based on simulated radiances over bright desert targets, for the vicarious calibration of the solar channels of MSG/Spinning Enhanced Visible and Infrared Imager (SEVIRI). Surface characteristics are represented with the Hapke model. The uncertainty characterisation of this "reference" is assessed by comparing modelled data with observations acquired by ERS2/ATSR-2, SeaStar/SeaWiFS and TERRA/MISR. These comparisons show that this "reference" agrees within 5% of observations.

JPN-WP-09 reported on the progress at MSC/JMA with regard to routine intercalibration of GMS-5 and NOAA infrared sensors. Six months of investigation since April 2002, shows that brightness temperatures of GMS IR channels 1 and 2 (11 and 12 microns respectively) are about 0.5 K to 2 K lower than those of AVHRR channels 4 and 5 on NOAA-16 with some fluctuation. More data and intercomparisons will be required to make it clear whether this variation is due to seasonal effects or not. In the future, MSC/JMA will also explore the effect of age on the instruments. MSC/JMA is providing the results via the new web page as a response to Action 29.26 at CGMS XXIX.

USA-WP-23 reviewed the algorithm for LEO-GEO intercalibration and presents results from intercalibrating five geostationary satellites (GOES-8, -10, METEOSAT-5, -7, GMS-5) with a polar-orbiting satellite (NOAA-14 and -15 HIRS and AVHRR) on a routine, automated basis for over 2.5 years using temporally and spatially colocated measurements. Comparisons of 11 µm Infrared Window (IRW) channels and 6.7 µm WV channels have been tabulated in a large dataset. All five geostationary instruments on average are measuring colder temperatures than N-14 HIRS (0.6 to 1.1°C) and AVHRR (0.1 to 0.7°C) in the IRW channel; they measure warmer temperatures on average than HIRS in the WV channel (1.2 to 3.9°C). These results are in good agreement with the intercomparisons of EUMETSAT and JMA. The intercalibration results did not show any seasonal dependence. In addition AIRS was found to be 0.1 K colder than GOES-10 for 3.9 µm (band 2), 1.0 K colder at 6.7 µm (band 3), 0.2 K colder at 11.0 µm (band 4), and 0.3 K colder at 12.0 µm (band 5).

USA-WP-24 presented results from a one year study of intercalibrating all the GEOS with the N-14 AVHRR and HIRS. Homogeneous clear sky collocations at any viewing angle were recursively filtered to produce results for GOES-8 and -10, Meteosat-5 and -7, and GMS-5 in agreement with the other results from USA, EUMETSAT, and Japan reported earlier. The linear fits of GEO radiances to LEO radiances showed scatter of less than 1.0°C.

In response to the action from CGMS XXIX, the IR intercalibration results are being posted routinely (at least quarterly) on the WMO intercalibration web page. However, more work remains for the visible calibration; WG II thus suggested the following action.

ACTION 30.19

Satellite operators should provide a summary of solar calibration approaches for GEO and LEO sensors (research as well as operational) at the next CGMS. The recent results of Moderate Resolution Imaging Spectroradiometer (MODIS) and MERIS visible calibration should be reported and possible opportunities for intercalibration with other less well calibrated sensors should be explored.

II/3 Vertical Sounding and ITWG Matters

USA-WP-33 reported on the activities of the ITWG. The paper summarises the significant conclusions from the March 2002 ITWG meeting. The co-chairs, Dr. Guy Rochard from CMS, Lannion, France and Dr. John LeMarshall from BMRC, Melbourne, Australia, formed working groups to review recent progress and make recommendations in five key areas: Radiative Transfer and Surface Property Modelling; TOVS and ATOVS in Numerical Weather Prediction; TOVS and ATOVS in Climate Studies; Advanced Sounders; International Issues Future Systems; and Satellite Sounder Science and Products. The key findings from the conference include:

- radiative transfer modelling has improved significantly (and various RT codes were documented) but the influence of calibration, surface properties and clouds still require attention;

- applications of ATOVS data to NWP have demonstrated considerable benefits;
- development of community software for ATOVS has been essential to the use of ATOVS data in the meteorological community;
- preparations for advanced infrared and microwave sounders are progressing (the distribution of simulated AIRS facilitated early utilisation and is an example activity for other sensors), and

- easy access to well characterised radiance data (especially after the transition to NPOESS) remains vital.

Rapporteur Dr. Paul Menzel reported on the ITWG responses to the actions suggested by CGMS XXIX.

(a) A summary of the successful characterisation of problems with AMSU-A & B DB data (e.g. humidity profiles derived with AMSU-B) is being posted on the ITWG website.

(b) Description of the DB profile retrieval packages (AAPP, IAPP, ISDAP) is being posted on the same website.

(c) The status of using satellite data over land for retrievals and other products and recent progress in land emissivity models were summarised.

(d) The difficult problem of quantitative use of cloud products was discussed.

(e) The interdependence of CO_2 and temperature and moisture profile measurements were documented and quantitative assessment of the effect on HIRS retrievals was taken.

(f) Retrievals from combined radio occultation with high spectral resolution infrared data were found to be complementary in simulation studies.

This last finding prompted the recommendation that the CHAMP experience be reported to CGMS.

ACTION 30.20

EUMETSAT to invite scientists participating in CHAMP to submit a report on sounding experiences at the next CGMS.

ITWG noted that the TOVS dataset would soon span 25 years and would benefit from a complete audit trail of all TOVS calibration issues and their resolutions. There is a need to develop an official international mechanism for reporting and acting on past calibration issues. The current system is ad hoc. In establishing observing systems for climate, GCOS has identified a number of basic principles that should always be followed. Thus the following actions were recommended.

ACTION 30.21

CGMS should initiate a workshop wherein an inventory of the calibration of all sensors is established (including sensor performance over time, sensor operation, calibration algorithm adjustment, sensor to sensor intercomparisons, collocated radiosonde observations etc.). Moreover, this workshop should help space agencies to make plans to deploy such methods in current and planned operational systems.

ACTION 30.22

Space agencies are invited to report at the next CGMS on their approaches to produce satellite data for climate purposes.

ITWG also noted the increasing importance of direct read-out facilities producing accurate level 1b data. There have been indications that the ATOVS data from central data producers may be different to that derived through DB packages and these may be due to different calibration and navigation algorithms.

ACTION 30.23

Space agencies are invited to establish focal points to ensure that: (a) ingest and pre-processing code for future advanced instruments (in particular sounders and their complementary imagers) is provided, in a form suitable for use with locally-received direct read-out data, and yielding output consistent with global data, and (b) activities are undertaken to integrate this code into processing packages available for international distribution in a timely manner. In addition, these focal points should provide sensor status, navigation and frequently-updated calibration information in a timely manner to users and developers and facilitate efforts to minimise the differences between the global and local calibrated and navigated data.

Satellite data and derived product quality monitoring remains a significant challenge. The ITSC XII recommended that the data provider quality assure all data, including level 1b and level 1d. The quality of the data (including, e.g. navigation) should be monitored at all stages including the final stage, which may have been reformatted. The provider should attempt to identify and flag questionable or poor quality data. Data providers, e.g. EUMETSAT and NOAA/NESDIS are encouraged to use NWP monitoring results to help them in diagnosing data problems.

ACTION 30.24

Data providers are invited to report at next CGMS on their current use of and plans to use NWP monitoring results in their quality monitoring activities.

The ITWG noted progress on establishing the draft specifications for the data records for NPOESS and NPP. The ITWG reaffirmed the value of user feedback on these drafts before they are finalised. ITWG recommends that the user community be provided with and invited to review the draft specifications (content and format) for the raw data records and sensor data records for NPOESS/NPP instruments.

ACTION 30.25

IPO is invited to inform ITWG members, through the ITWG list server, of the location of draft specifications of raw data records and sensor data records for NPOESS/NPP instruments. The ITWG co-chairs will co-ordinate feedback to IPO from ITWG members on the draft specifications (content and format) for the raw data records and sensor data records for NPOESS/NPP instruments.

Finally, the ITWG noted that the geostationary orbit is particularly well suited to observing time-evolving phenomena related to clouds and precipitation, which can develop rapidly and for which frequent measurements are required to support improvements in nowcasting and short-range forecasting. The ITWG supported the concept of an experimental mission to demonstrate this technology and suggested that priority be given to channels suited to sensing precipitation, cloud and humidity.

CGMS was supportive of space agencies pursuing a geostationary millimetre/sub-millimetre radiometer mission as a technology demonstrator, with priority towards measurement of precipitation, cloud water/ice and humidity at high temporal frequency in support of nowcasting and short-range forecasting, and as a potential future contribution to the Global Precipitation Mission (GPM).

EUM-WP-18 provides a summary of the activities undertaken by EUMETSAT to identify user/service needs to be satisfied by measurements taken from the geostationary orbit in the time frame 2015-2025. The approach taken by EUMETSAT and ESA provides an example of a structured framework for the complex process towards new meteorological satellites. WG II welcomed this paper and felt that this approach serves as an example for CGMS members engaged in new system development.

EUM-WP-19 reports on the plans for development of a direct read-out package for IASI and the adaptation of the existing ATOVS and AVHRR Processing Package (AAPP) package, which is maintained by the NWP SAF. Relevant software development will be initiated by EUMETSAT, when the prototype software for global EPS processing has been delivered by contractors and EUMETSAT parties. Such a development will also address other instruments, for example, ASCAT, at the request of EUMETSAT users.

EUM-WP-20 reported on EUMETSAT progress in establishing a satellite data service which will provide the meteorological community with satellite datasets from NOAA polar-orbiting satellites, covering data-sparse sea areas around Europe. This service is called the EUMETSAT ATOVS Retransmission Service (EARS) will provide ATOVS level 1a and 1c data with a timeliness of 30 minutes, thus meeting the requirements of EUMETSAT member states for the use of NOAA sounding data in their NWP systems. EARS will have stations in Tromsø, Norway and Maspalomas, Spain operationally available first. A station in Søndre Strømfjord, Greenland will be added shortly thereafter. Stations in Alaska, Canada and Greece are expected to be added within six months of the start of the Early Operations Phase.

IND-WP-05 reported on the use of real-time data from microwave sounding instruments on board the NOAA-K, L, M and N series of satellites now available with direct HRPT read-out in New Delhi. The raw HRPT data is being interfaced with the recently acquired new AAPP level 1d files to perform temperature and moisture retrievals from AMSU data of NOAA-16; three separate schemes are used: Inversion Coupled Imager (ICI), Neural Network, and statistical regression approach. In an example study, NOAA-16 satellite data over Indian region was used for retrieving temperature and moisture profiles for the months of January and July 2002. The temperature and moisture retrieval results for the months of January 2002 and July 2002 representing winter and summer seasons respectively show that the ICI approach yielded better results for all atmospheric levels, for both the parameters. The temperature profile from ICI agrees generally with Radiosonde Observations (RAOB) temperature profile within 2^{o}C between 700 hpa and 200 hpa with isolated points showing differences up to 3^{o}C.

USA-WP-25 reports on geostationary satellite nowcasting activities. In addition, to fruitful use of rapid scan imaging, hourly GEO sounder derived product images of atmospheric stability and total column water vapour are important contributors to the forecast office database. Several examples are provided. This paper is in response to CGMS Action 29.28.

USA-WP-31 gave an update on the GOES sounding activities. The NOAA/NESDIS operational GOES-8/10 soundings continue to be produced every hour at approximately 50 km resolution (5X5 Fields of View (FOV) in clear skies (research retrievals are routinely generated at single FOV 10 km resolution). Operation is evolving to single FOV retrievals. Derived Product Images (DPI) of Total Column Precipitable Water Vapour (TPW) and atmospheric stability are being used by the National Weather Service forecast offices. Three layers of moisture derived from the GOES soundings are used operationally by regional forecast models over the land and radiances are assimilated directly over ocean. Cloud properties at single FOV resolution (approximately 10 km) are being generated and used in the rapid update cycle with good results. The effects of surface emissivity in profile retrievals from infrared multi-spectral radiances continue to be studied. Finally, GOES-12 performance was successfully checked out during Autumn 2001 and added to the GOES sounder family.

II/4 Other Parameters and Products

EUM-WP-21 provides a summary of the cloud detection and cloud analysis algorithm foreseen for the MSG satellite. The Scenes and Cloud Analysis algorithm uses multi-spectral threshold and scene uniformity tests for accurate cloud detection and cloud analysis for data from different satellites, even in complicated scenes like thin cirrus situations, cold snow/ice surface situations, and low-level warm stratus and fog situations. The algorithm is well prepared to run within the Meteorological Products Extraction Facility (MPEF) of the MSG satellite.

IND-WP-06 reported on the use of Special Sensor Microwave/Imager (SSM/I) water vapour and wind speed products for real-time forecasting of heavy rainfall. With a view to monitor such events during the monsoon season of the current year (2002) for providing guidance to the forecasters during real-time applications, daily maps of wind speed and total integrated water vapour over the Arabian Sea were prepared using SSM/I data. These were examined along with other conventional meteorological data. A case study held on 8–13 June 2002 gives an impressive example.

RUS-WP-07 presents an overview of the Russian meteorological satellite programme including current status, plans for future developments, mission objectives and applications, and ground system capabilities. The main purpose of these weather satellite systems development and the associated operational and research activity in Roshydromet is to use satellite data and derived products in application areas such as operational meteorology, NWP, hydrology and agrometeorology. Some examples of derived Meteor-3M N1 products are presented; especially impressive are the 38 m resolution three visible channel images from MSU-E.

WMO-WP-20 provided information on the utilisation of satellite data by the World Climate Research Programme (WCRP). A recently formed WCRP ad hoc working group is updating and synthesising the needs of the climate scientific community with respect to Earth observation satellite data and products. Its twofold mandate includes: providing guidelines for consideration by space agencies with respect to supporting and preparing a Statement of Guidance on future missions, new missions and gaps in Earth observing systems. The ad hoc working group recognised that the only practical way to obtain the necessary long-term, global observations of the climate system and its variations at weather scales is to use the international constellation of operational weather satellites; but they must be operated as a globally complete and uniform constellation that provides a common core set of measurements over a long time period. To this end, five recommendations were made to CGMS members:

(1) Continue and expand to all operational instruments the routine production of reduced-volume (sampled) versions of all radiance datasets that can be used for long-term climate analyses.
(2) Take steps to make radiance calibration, calibration monitoring and satellite-to-satellite cross-calibration of the whole operational constellation a part of the operational satellite system.
(3) Participate in and support activities to compare old and new data products from weather satellites, as a step towards implementation of the production of long-term and globally uniform products.
(4) Make specific plans to achieve a more rapid convergence of operational satellite measurements to an expanded common core set.

(5) Develop from combined infrared and microwave measurements two new global products: surface skin temperature and upper-tropospheric humidity. WG II felt that the recommendation regarding surface skin temperature was ill-posed and suggested WCRP provide further clarification. In addition, the requirements for climate and ocean should be stated separately.

ACTION 30.26

WCRP is invited to provide further clarification on the requirements for combined infrared and microwave surface skin temperature products and for climate and ocean applications.

WMO-WP-14 provided an update on activities of the IPWG. Its first science workshop was at the EUMETSAT Nowcasting SAF in Madrid, Spain on 23-27 September 2002. The Rapporteur Dr. Jim Purdom noted that the workshop promoted the exchange of scientific and operational information between the producers of precipitation measurements, the research community, and the user community, and developed pathways forward for a variety of activities within the IPWG. Presentations addressed: IPWG and Related International Projects; Operational Estimation of Rainfall; Missions and Instruments; Research Activities; and, Validation. Three working groups on Operational Applications, Research Activities, and Validation Activities discussed activity within their topical area and developed plans for future activities with short-term, intermediate and long-term goals, along with action items and recommendations for CGMS. A full report of the workshop is available on the IPWG web page that is being organised and maintained as part of the existing EURAINSAT project (http://www.isac.cnr.it/~eurainsat/). The provisional URL for the IPWG website is http://www.isac.cnr.it/~IPWG/.

ACTION 30.27

CGMS members to provide an inventory of routinely produced precipitation estimates, either operational or experimental/research, to the IPWG co-chairs, Arnold Gruber and Vincenzo Levizzani. A template for the responses can be found on the IPWG website.

Recommendation: To further algorithm research and development, a complete day's worth of data, one day for each season, from both operational and research satellites be saved and made available by the satellite operators. These datasets would be freely available to registered IPWG website users.

IPWG also noted that better temporal coverage of the Southern Hemisphere (South America). Currently, the GOES-East half-hourly satellite coverage cuts off at 20^{o}S latitude and in periods of rapid-scan operations the refresh rate for South America is reduced to three hours.

II/5 Coordination of Code Forms for Satellite Data

WMO-WP-10 explains the last changes in satellite data NWP Data in Gridpoint Form, Expressed in Binary (GRIB) and Binary Universal Form for Data Representation (BUFR) recommended by the CBS/Implementation Coordination Team on ISS to be approved by the CBS and the Executive Council of WMO for their full operational implementation on 3 November 2003. WG II saw no problems with the suggestions.

II/6 Coordination of Data Formats for Archive and Retrieval of Satellite Data

EUM-WP-22 responds to Action 29.23 which requests "CGMS members to propose lists of parameters and data which should be contained in "metadata" to accompany reprocessed data". The document discusses the ancillary information needed to process geostationary satellite data in support to climate studies in the light of experience gathered during the ongoing reprocessing of Meteosat data from the archive. It suggests that the following ancillary information and its associated error should be delivered.

- **Time**: The definition of the acquisition time of each pixel is quite straightforward for geostationary satellites because of the data acquisition mechanism.
- **Position**: The definition of the location of each pixel requires the accurate characterisation of the spacecraft position and attitude at the time of the data acquisition. The accuracy of the rectification can be assessed by means of ground control points.
- **Observation angles**: The definition of the observation angles requires, in addition, the characterisation of the instrument optics.
- **Sensor spectral response**: This quantity should be observed before launch. Its temporal degradation is difficult to assess, however, means to estimate the degradation should be established.
- **Calibration coefficient and offset**: The evaluation of calibration coefficient, associated error and temporal drift are the most critical information. In the absence of an on-board calibration device, vicarious calibration is required. On-board calibration systems should be fully characterised.

WG II added:

- **Field of size**: The area at the Earth surface wherein the encircled energy is greater than 99 % or the half power points of the received energy.

WG II also suggested that this list represent an agreed upon initial list of essential metadata. The following two working papers supported this.

ACTION 30.28

AOPC is invited to consider the consolidated list of metadata (including time of observation, Earth location, observation angles, spectral channel response, calibration coefficients, and field of view size as well as the associated error in each parameter) and to comment on its adequacy for their applications.

USA-WP-27 presents the NOAA plans for a Comprehensive Large-Array Stewardship System (CLASS). Within the framework of the CLASS, the satellite metadata characterisation project has been established to provide information critical to data discovery, usability, quality, interoperability and automatic processing. The NESDIS scientific data stewardship programme has five goals which are to:

(a) provide real-time monitoring of climate-scale biases in the global suite of satellite observing systems,
(b) document Earth system variability and change on global, regional, and local scales,
(c) provide the necessary algorithms to ensure that understanding of key climate processes can be derived from space-based systems and the combination of space-based and *in situ* systems,
(d) optimise data and information services, in order to make research easier and more effective by ensuring those services are simple, straightforward, direct, and responsive, and

(e) enable and facilitate future research.

WG II felt that more information from the satellite operators on science data stewardship should be presented at subsequent CGMS meetings.

ACTION 30.29

ESA/ESRIN is invited to present a paper at the next CGMS on their approach to science data stewardship.

JPN-WP-14 describes the parameters and data, which JMA feels should be contained in "metadata" to reprocess satellite data. The list is similar to the one presented in EUM-WP-22. Reprocessing of images of GMS and MTSAT series satellites will be able to add these metadata.

II/7 Training

Training papers were deferred to plenary.

II/8 Monitoring

USA-WP-26 describes the monitoring of instrument performance and calibration that takes place in the three main phases of instrument life: pre-launch testing, performed primarily by the instrument manufacturer; post-launch checkout, carried out cooperatively by NOAA and NASA; continuing on-orbit operations, carried out by NOAA. WG II felt that this paper serves as a good summary of activities that data providing agencies should engage in.

JPN-WP-13 reports that MSC has been routinely monitoring the qualities of its satellite products and circulating the monitoring report internally in JMA since early 1986. The targets of the monitoring are not only products exchanged via GTS such as Atmospheric Motion Vectors (AMVs) but also all those that can be checked in one way or another. Various monthly statistics on the products are checked during the monitoring. The monitoring methods for each product have been strictly kept the same since MSC started quality monitoring. The monthly monitoring report has been sent to the relevant sections in JMA by e-mail since April 2002 and the latest report and back numbers have been posted on JMA's intranet for internal use.

II/9 Conclusion

WG II concluded a full agenda noting considerable progress on CGMS actions (GEO-LEO intercalibration, defining metadata, establishment of the IPWG) but also noting the need for more activity in others (calibration inventory of past sensors, direct broadcast packages for new sensors, science data stewardship). WG II further introduced actions in some new areas (geostationary sub-millimetre radiometer, inventory of operational precipitation algorithms) and supported ITWG and IPWG work plans.

WORKING GROUP III: SATELLITE DERIVED WINDS

III/0 Introduction

The Working Group on Satellite Derived Winds (WG III) was chaired by Dr. J. Purdom and Dr. Johannes Schmetz assisted as rapporteur. Ten papers were presented and discussed by WG III under the following headings: i) report and recommendations from the Sixth International Winds Workshop (IWW6) and preparation for IWW7, ii) wind statistics, and iii) derivation of wind vectors.

i) Report and Recommendations from the Sixth International Winds Workshop (IWW6) and Preparation for IWW7

The first paper presented to WG III was EUM-WP-24, providing a summary of and recommendations from the Sixth International Winds Workshop (IWW6) held on 7-10 May 2002 in Madison, Wisconsin, USA.

IWW6 responded to all actions placed by CGMS XXIX and put forward 19 recommendations resulting from in-depth discussions within three working groups. WG III went through all of those actions and highlighted the issues that should be considered as either a recommendation or an action. For the sake of brevity this report records only those actions that were considered to be forwarded to the CGMS plenary, either explicitly or with some modification. If applicable, those recommendations and actions are attached to summary discussion of relevant working papers presented to WG III (e.g. on MODIS winds, height assignment, rapid scans, reprocessing).

IWW6 featured for the first time a session and working group dedicated to mesoscale applications. Discussions led to the following two actions:

ACTION 30.30

NOAA/NESDIS is invited to report on the 'auto-nowcaster' at CGMS XXXI.

ACTION 30.31

The co-chairs of IWW7 are requested to invite representatives of the regional scale modelling community to the next IWW.

As a result of a discussion on height assignment of AMVs and recalling recurrent discussions at previous CGMS meetings, WG III considered it timely to address the problem in a systematic manner. This was seen as a task for the next IWW, which should establish an inventory of all height assignment methods used for low-, medium- and high-level AMVs.

ACTION 30.32

IWW7 is invited to establish an inventory of all height assignment methods used for low-, medium- and high-level AMVs.

A recommendation from IWW6 addressed the need to reconsider the current format of CGMS statistics (Recommendation IWW6-19). WG III did see the point, as the advanced AMV monitoring through the Integrated Satellite Winds Monitoring Report (ISWMR) by the SAF might be more revealing in terms of measuring performance of AMVs. However, it was also noted that the current CGMS wind statistics serve as a tool for measuring improvements of AMVs independently from NWP systems. The recommendation was returned for consideration at IWW7 requesting a qualifying statement.

Finally, Mr. Schmetz informed WG III that the proceedings of IWW6 have been made available on the EUMETSAT website under ‘publications’, then ‘conference proceedings’.

IWW7 will be hosted by the CMA in October 2003, just following the ITSC.

ii) Wind Statistics

USA-WP-28 responded to Action 29.41 commenting on the ISWMR that has been set-up by the SAF of EUMETSAT at the UK Meteorological Office. Currently, this report compiles differences between satellite-tracked winds and analysis winds from two NWP models (ECMWF and UK Met Office). USA-WP-28 noted that the ISWMR provides a path for improving the utilisation of satellite-derived wind observations in NWP and for improved forecasts. The paper brought forward the following recommendations for amendments to the current monitoring reports:

- Encourage participation by NOAA’s National Center for Environmental Prediction (NCEP) / Environmental Modeling Center (EMC) in the ISWMR effort
- Encourage the addition of the GOES three-hourly water vapour winds and low-level visible cloud-drift winds to the ISWMR page as these are being generated operationally at NESDIS
- Encourage the distinction between water vapour clear air and water vapour cloud-top winds and the generation of individual statistics for each
- Encourage the addition of the GOES three-hourly low-level short-wave (3.9µm) infrared cloud-drift winds to the ISWMR page when NESDIS begins operational production of these in late 2002
- Encourage the addition of the new MODIS polar wind products to the ISWMR page, once these products are considered as being routinely available
- The ISMWR should serve as the model for the development of similar reports for other satellite-derived observations used in NWP.

WG III also recalled that other satellite operators had provided comments earlier. A pertinent suggestion from EUMETSAT had been to amend the web page with results from impact studies of AMVs on numerical weather forecasts. This has been taken up and relevant results from impact studies are available on the website.

The ISWMR is available at:
http://www.metoffice.com/research/interproj/nwpsaf/satwind_report

There also is a link to the ISWMR Analysis Report from this website.

The NWP SAF home page is at:
http://www.metoffice.com/research/interproj/nwpsaf

USA-WP-30 offered the traditional summary of the current NOAA/NESDIS operational wind product suite, which includes the high-density cloud-drift winds derived from the GOES imager and water vapour motion winds derived from the GOES sounder. It described the operational wind products, dissemination plans and changes that have been made to the BUFR encoding of the satellite derived winds. NESDIS explicitly thanked EUMETSAT for their help in implementing the BUFR encoding. The newly encoded GOES wind BUFR datasets are being distributed over the GTS with new WMO bulletin headers. The paper continued with summaries of recent operational implementations and research activities. Research work covered rapid scan winds, utilisation of the new capabilities with GOES-12 which features a 13.3 µm imager channel for improved height assignment, and a study on the effect of the first guess model fields used in the derivation and quality control of satellite-derived winds. With regard to the latter, it appears that there is little impact on the overall quality and quantity of the operational NESDIS winds. Last, but not least, the paper discussed polar winds from MODIS (see also the dedicated paper USA-WP-32).

USA-WP-32 presented the new research wind product from the MODIS IR window and water vapour images including model impact assessment. A 30-day case study of winds derived from consecutive MODIS passes over polar regions has been conducted. The 1 km image data from two to four five-minute granules were remapped into polar stereographic projection at 2 km resolution and composited with Man-computer Interactive Data Access System (McIDAS). Winds are then derived from successive image triplets of the water vapour (band 27) and IR window (band 31). In terms of statistics, versus radiosondes results are similar to the CGMS statistics for geostationary satellite-derived winds. Impact studies with the MODIS winds have been performed at ECMWF and NASA DAO. Both centres report positive impacts on forecasts; for instance the ECMWF forecast verification shows improvements over the Arctic region for the anomaly correlation at 1000 and 500 hPa. Impact is also clearly positive over mid-latitudes. The impact is less pronounced, though positive, over the Southern Hemisphere, presumably due to the lower quality of the analysis because of the lack of other data. WG III commended NESDIS, ECMWF and NASA DAO on the undertaking of deriving and utilising MODIS winds and noted that the successful derivation of polar winds from polar orbiting satellites constitutes a milestone in the history of satellite-derived winds. So far, successful wind derivation from image sequences had been confined to winds from geostationary satellites. WG III iterated the potential to extend the processing to MODIS on the Aqua satellite and placed a pertinent action on NESDIS.

ACTION 30.33

NOAA/NESDIS is invited to present a paper on AMVs from both MODIS instruments on Terra and Aqua satellites, respectively, at IWW7.

In view of the tremendous success of the polar winds from MODIS and the fact that the vast majority of the MODIS polar wind vectors come from tracking water vapour imagery, WG III recommended that water vapour channels should be flown on future imagers in polar orbit.

Recommendation: Future imaging instruments on polar-orbiting satellites should have imaging channels within strongly absorbing water vapour bands in order to allow for the derivation of AMVs from successive and overlapping overpasses.

iii) Derivation of Wind Vectors

i) EUM-WP-09 described results for winds from a RSS that had started on 18 September 2001. It provides images from Meteosat-6 every ten minutes for a geographical area that covers a latitude range from approximately 10°N to 70°N. Since April 2002, EUMETSAT has generated wind products every 30 minutes, using non-overlapping triplets of rapid scan images. In comparison, with the operational, three-hourly winds derived from Meteosat-7 imagery the winds from rapid scans show that: rapid scanning produces significantly (i.e. 20% to 30%) more high-quality winds for the high-resolution visible channel;

ii) rapid scanning produces more high-quality (with reference to the quality indicators) winds for the tracking of clouds in the infrared, water vapour and visible channel;

iii) for pure water-vapour features, rapid scanning produces less winds at the 30 minute interval, and

iv) the quality of the rapid scan winds shows less variation, with respect to time, than the quality of the operational 30 minute winds. Those results confirm earlier results from rapid scans.

The positive results reinforce earlier recommendations to satellite operators to perform regular rapid scans, preferably without compromising the data coverage.

Recommendation: Satellite operators should make efforts to perform regular rapid scans, preferably without compromising the data coverage, and derive AMVs from the rapid scans.

IND-WP-04 briefly presented results of improvements carried out during last two years in the CMV derivation scheme in operational use at INSAT Meteorological Data Processing System (IMDPS). Results to August/September 2001 were also presented at CGMS XXIX where the improved quality of the cloud motion winds was noted. Basically, no further changes were incorporated after the last CGMS meeting. Cloud motion winds with good quality were derived up to April 2002. However, from 14 May 2002 operational production of INSAT CMVs was discontinued due to non-availability of any INSAT satellite. Now, after the recent successful launch of METSAT on 12 September 2002, operational production of CMVs will be started soon. As METSAT carries a water vapour channel the height allocation of tenuous clouds can be based on the water vapour intercept method. This will bring the winds from METSAT closer to comparable products from other satellite operators and constitutes another step toward similar processing methods that has been requested especially by the NWP user community. WG III congratulated India upon the successful launch of METSAT and expressed a keen interest in the future wind products from METSAT.

JPN-WP-15 responded to Action 29.25 of CGMS XXIX, describing results of impact experiments of rapid scan AMV on a NWP Model. Forecast experiments up to 72 hours were performed for two typhoon cases in 2002. First, the assimilation was performed with OI assimilation system. Then, a 3D-Var assimilation system, introduced at JMA in September 2001, was used to repeat experiments. Results show improved tracking of the typhoons. However, results are not yet conclusive concerning the best choice of template size for the winds derivation. Furthermore, the study revealed that quality indicators appeared to be inferior for the rapid scans. Discussions confirmed that further investigations on the matter will be made by JMA. WG III expressed a great interest in this work as it demonstrates the potential of rapid scan winds to improve the accuracy of typhoon track prediction.

In JPN-WP-16 JMA informed WG III on the conduct of a research project of long-range reanalysis of global atmosphere, called the "*Japanese Reanalysis 25 Years (JRA-25)*", in cooperation with the Central Research Institute of Electric Power Industry (CRIEPI). In support to this activity, the MSC will reprocess the AMVs from archived GMS VISSR data and provide the JRA-25 project with the reprocessed AMVs. The JRA-25 project started in April 2001 and will be completed in March 2006. In this five year period, the reanalysis will be performed using JMA operational NWP and assimilation system. The period of reanalysis is for 26 years from 1979 to 2004 taking into account the availability of the satellite data because the reanalysis considerably depends on the satellite data. MSC is planning to derive the high-density winds with high accuracy in the reprocessing from the archived GMS VISSR data for the period from March 1987 in which the archived GMS VISSR data are available. The reprocessing will be done over the next two years until March 2004. A sample dataset for 1987 through 1990 has been provided already. Following feedback, MSC plans to process updated AMVs at the beginning of 2003. WG III applauded the initiative of JMA and underlined the value of reprocessed AMVs for reanalyses. It referred to the reprocessing of Meteosat winds at EUMETSAT and the positive impact of those winds on ECMWF reanalyses. It was felt that similar activities are worth while to be pursued by other satellite operators. This would also benefit satellite operators as they strive to learn and solve the general problems associated with archiving and subsequent reprocessing. This led WG III to make a pertinent recommendation.

Recommendation: Satellite operators should conduct reprocessing of AMVs in support of ongoing reanalyses projects at NWP centres.

Discussions also revealed that 'user requirements for reanalyses' seem to be lacking. The WMO OPAG/IOS was considered an appropriate forum to discuss this matter. In view of the presence of the Chair of OPAG/IOS WG III felt it could place an action to be pursued at the next OPAG/IOS meeting.

ACTION 30.34

CGMS invites WMO's OPAG/IOS to establish jointly with the NWP community reanalysis requirements for reprocessing of satellite data and products.

JPN-WP-17 was provided in response to Action 29.40 CGMS XXIX and reported on the status of the preparation of the standardised BUFR encoding for the AMV products with quality indicators at the MSC of JMA. The progress and plans of JMA reflect pertinent discussions at CGMS 29 and at the IWW6. MSC will produce a high-density AMV product with quality indicators. Benefits of appended quality indicators were exemplified as they brought into light deficiencies in the height allocation of clear-sky water vapour winds and low level AMVs. It was underlined that these deficiencies were discovered thanks to the quality indicators. Work is ongoing to resolve those problems.

In summary, MSC will transmit AMV products in Satellite Observation (SATOB) format except for the BUFR-encoded wind products in the vicinity of typhoons. MSC will distribute BUFR-encoded products of the high-density satellite winds from June 2003 onward. SATOB encoded products will continue to be distributed for the user's convenience. BUFR products include Quality Indices (QI) with and without forecast and the RFF as quality indicators. JMA will test the impact on the model using RFF as well as QI. It was noted that the BUFR-isation of AMVs at JMA is a major step forward toward unified AMV products from all satellite operators as requested at previous CGMS meetings and by the International Winds Workshop.

The short paper USA-WP-29 addressed the reprocessing of GOES cloud and moisture tracked winds. A relevant proposal had been presented to the NOAA Council when it discussed long-term observations and received only modest support. Consequently, it has not made it into any of the climate initiatives. The occasional interest in support to the NCEP reanalysis did not put high enough weight on the proposal; therefore, there are no plans for reprocessing GOES derived winds. WG III noted that this is at variance with the perception at JMA and ECMWF/EUMETSAT. It saw no reason to retract from the recommendation made above in the context of discussions on the reanalysis of AMVs at JMA.

iv) Conclusion

WG III concluded with a brief summary of the recommendation and actions. In particular, the work at IWW6 was noted. Progress on various issues such as rapid scan winds and reprocessing were received with appreciation, though it was noted that satellite operators should all make an effort to achieve a somewhat unified approach which would benefit the user community much better as it would provide the desired global coverage. Recent advances in data utilisation (winds from MODIS) and new satellite launches (METSAT by India and MSG-1 by EUMETSAT) were also recognised. The chairman thanked all participants for contributions and the lively and competent discussions.

WORKING GROUP IV: GLOBAL CONTINGENCY PLANNING

Working Group IV (WG IV) on Global Contingency Planning met during CGMS XXX and discussed activities since CGMS XXIX. It discussed matters relevant to global contingency planning including:

- the WMO Executive Council's reaction to results from the CGMS Working Group on Global Contingency Planning meeting held in February 2002;
- a review of the current status of contingency planning for both geostationary and polar-orbits;
- the concept that a set of regional contingency plans would constitute a global contingency plan;
- the need for a "standardised" regional contingency plan;
- the status of CGMS satellite operators' plans for geostationary satellites over the Indian Ocean in the 2005 timeframe; and
- implications of WMO's redesign of the space-based component of the GOS with regard to current contingency planning.

WG IV recalled that CGMS XXIX had agreed that WMO would host a meeting of the CGMS Working Group on Global Contingency Planning in February 2002 following the second session of the Consultative Meetings on High Level Policy on Satellite Matters in preparation for further discussions at CGMS XXX. A meeting of the CGMS Working Group on Global Contingency Planning was held at the WMO Headquarters, Geneva, Switzerland on 20 February 2002. The meeting of the Working Group had reviewed the background to global contingency plans and also had reviewed and discussed geostationary contingency planning; polar-orbiting contingency planning and climate requirements.

WG IV recalled that at the meeting it had requested a report to be made to the fifty-fourth session of the WMO Executive Council (EC-LIV) held in June 2002 concerning CGMS satellite operators' contingency planning for both geostationary and polar-orbiting satellites. WG IV noted that EC-LIV, in response to the results of the February meeting, had agreed that a major milestone had been achieved in the discussions on geostationary contingency planning. Firstly, most CGMS satellite operators had either in place, were developing or would consider when nearing nominal configuration, regional contingency plans. Secondly, the satellite operators would follow the principles of "help your neighbour" and be willing to be "helped by your neighbour". Thirdly, nominal configurations for most satellite operators included either an "in-orbit spare" or an "on-demand launch". EC-LIV had noted that the complete set of regional contingency plans should constitute a global contingency plan in response to the WMO requirements. With regard to polar-orbiting contingency planning, EC-LIV had noted that the CGMS Working Group had first discussed the principles for such plans. The February meeting had noted that the basic WMO requirement for the polar orbit was for two satellites - one in the AM and one in the PM orbit. It had agreed that in order to meet WMO's requirement for contingency planning a constellation of four polar-orbiting satellites would be required, two in the AM orbit capable of serving as back-up and two in the PM orbit, again capable of serving as back-up. EC-LIV was pleased to note that both Roshydromet and CMA, taking into account their respective national requirements, would be willing to consider the possibility of using the PM orbit for their future Meteor-3M and FY-3 series to assure the necessary redundancy in order to meet WMO's contingency requirements.

The February meeting had also suggested that CGMS XXX discuss the set of regional contingency plans that could be consolidated into a global contingency plan. It had indicated that CGMS XXX should consider the development of the outline of the content for a "standard" regional plan. Such an outline should identify all possible aspects of the space and ground segment back-ups to assist the user community in making its necessary preparations. Finally, it had suggested that CGMS XXX consider the issue of geostationary positions especially over the Indian Ocean as the present plans indicated the potential for radio frequency interference between satellites. According to satellite operators' plans, the possibility existed for six geostationary satellites over the Indian Ocean in 2005 (Meteosat, METSAT, INSAT-3A, GOMS N-2, FY-2, and GIFTS/IOMI).

WG IV then reviewed the current status for contingency planning for both geostationary and polar-orbits. With regard to the geostationary orbit, EUMETSAT noted that the long-term geostationary back-up agreement, agreed upon in 1995 with NOAA/NESDIS, was now in effect since both satellite operators are in their baseline configuration. For EUMETSAT, the baseline configuration is one operational satellite at its nominal position and one satellite in an in-orbit spare. For NOAA/NESDIS, the baseline configuration is two operational satellites at their nominal positions and one in-orbit spare. EUMETSAT and NOAA/NESDIS continued to hold regular bilateral meetings to include discussions on contingency planning. JMA described its contingency GMS-5/GOES-9 plan with NOAA/NESDIS. With regard to long-term contingency planning, JMA and NOAA/NESDIS have continued discussions and exchange of information at the technical level. JMA noted that for the short-term GMS-5/GOES-9 plan NOAA/NESDIS would move GOES-9 to 155°E longitude to provide a back-up capability for GMS-5. JMA plans to start back-up operations in mid-April 2003. JMA will announce the details of the back-up arrangements as soon as they have been formalised. NOAA/NESDIS plans that GOES-9 will provide operational geostationary coverage and services (imagery and sounding) for the Western Pacific.

WG IV, together with WMO, thanked JMA and NOAA/NESDIS for this major contribution to WMO members dependent on the space-based component of the GOS and to global contingency planning. EUMETSAT noted the cooperation agreement with Roshydromet and mentioned that it was providing a spare satellite, Meteosat-5, as back-up to the nominal GOMS satellite position over the Indian Ocean. The EUMETSAT Council had already agreed to continue this back-up until at least 2005 with the possibility for further extension depending on the situation with available EUMETSAT satellites at that time. EUMETSAT noted that it expected its Council in March 2003 to review a proposal for further contingency back-up of the nominal Indian Ocean position. WG IV and WMO noted with appreciation this continuing effort beyond its present contribution to maintain the nominal coverage for the Indian Ocean. Roshydromet also discussed the cooperation with EUMETSAT whereby information for some DCS channels were received in Moscow for processing. These data were from DCPs contributing to the World Weather Watch. Once GOMS N2 became operational, it was planned that Roshydromet would assume responsibility for processing those DCPs. Thus the cooperation with EUMETSAT allowed new Russian Federation DCPs to be installed, as well as provided Roshydromet with the experience to establish the required infrastructures to process DCP information. Roshydromet indicated its desire to establish a similar arrangement in the eastern portion of its country with JMA and its GMS-5. NOAA/NESDIS indicated that once the back-up of GMS-5 by GOES-9 had been implemented in April 2003 it also would be possible for Roshydromet to utilise some GOES-9 DCS channels.

ACTION 30.35

Roshydromet, JMA and NOAA/NESDIS to discuss usage of some DCS channels on GMS-5 and/or GOES-9 for processing by Roshydromet with the expectation that the DCPs would be part of the World Weather Watch and processing would eventually be resumed by GOMS N2. WMO to assist. (Deadline: 1 January 2003 for discussions and exchange of information.)

WG IV noted CMA's plan to launch FY-2C by the end of 2003 with plans that it would become operational by March 2004 before the monsoon season. It recalled that CMA, at the February meeting, had indicated it had three registered positions (86, 105 and 123°E longitude) intended for use by the FY-2 series. Meanwhile, FY-2B would remain operational except during the eclipse seasons. CMA's intentions had been to launch a geostationary satellite every three years with the capability to launch a satellite, if required, with only one year's notice. It had noted that this form of contingency was an "on-demand launch" instead of an "in-orbit spare". CMA had noted that if the lifetime of the satellites could be extended, then it planned to maintain a nominal two satellite configuration, one at 86 and one at 105°E longitude with the contingency to use an "on-demand launch" if required. Its ground segment would allow simultaneous operation of two geostationary satellites. Thus, with its present launch schedule, it would be possible that CMA could achieve its full nominal configuration by 2006 or partial nominal configuration by 2003. India reaffirmed that while INSAT and METSAT are primarily domestic systems, currently there are bilateral arrangements for processed data dissemination such as the arrangements with NASA/NOAA. Also, the processed data, in the form of imagery are available on the Internet (http://www.imd.ernet.in/). Derived products such as CMVs are also being disseminated on the GTS.

With regard to polar-orbit, WG IV recalled the WMO requirement for two polar-orbits - one in the AM and one in the PM. In order to meet WMO's requirement for contingency planning four polar-orbiting satellites would be required, two in the AM orbit capable of serving as back-up to the other and two in the PM orbit also capable of serving as back-up to the other. Roshydromet indicated that in accordance with the current Russian Space Programme that continues up to 2005 its revised Meteor-3M programme planned to launch Meteor-3M N2 in 2005. The next satellite in the series, Meteor-3M N3, was proposed to be developed and launched in the 2007–2010 timeframe. Meteor-3M N2 and N3 will be comparable to the NOAA/Metop series. Roshydromet recalled that at the February 2002 meeting of WG IV it had agreed to consider the possibility of using the PM orbit. Thus, it was pleased to inform WG IV that equator crossing times will be coordinated with CGMS members taking into account WMO's requirement for contingency planning. With regard to CMA's plans for the polar-orbit, WG IV agreed to the following action.

ACTION 30.36

CMA to confirm its plans for polar-orbiting satellites and in particular its willingness to consider the possibility of using the PM orbit while taking into account its respective national requirements. (Deadline: 1 January 2003)

WG IV requested that WMO inform both CBS at its 2002 session in Cairns, Australia and the WMO Congress in May 2003 of the recent new developments in contingency planning by CGMS satellite operators.

ACTION 30.37

WMO to inform CBS at its 2002 session in Cairns, Australia and the WMO Congress of the recent new developments in contingency planning by CGMS satellite operators. (Deadline: 7 December 2002 and May 2003, respectively).

WG IV also considered the premise that the complete set of regional contingency plans would constitute a global contingency plan in response to WMO requirements. It noted that a complete set of regional contingency plans did not yet exist, but that CGMS satellite operators were striving to develop such a complete set. However, it felt that the premise was too restrictive as presently defined. In particular, CGMS satellite operators also felt that each regional contingency plan should take into account the needs of the global satellite system as defined in WMO requirements as well as its neighbour's other contingency plans. It requested that this description be included in the report for CGMS XXX and be available for all regional contingency plans. With regard to a "standard" regional contingency plan, WG IV agreed that contingency plans always aimed to achieve complete back-up of all data, product and services. However, there was a multitude of possible back-up scenarios depending on the dynamics of the particular situation and to have a "standard" plan would not be practical. Thus, while a "standard" regional contingency plan was not practical, it would be useful to define the "goal". Therefore, WG IV requested WMO to develop a detailed description of the goal for data, product and services expected from each of the nominal positions for both polar and geostationary orbits.

ACTION 30.38

WMO to develop a detailed description of the goal for data, product and services expected from each of the nominal positions for both polar and geostationary orbits for use in contingency planning. (Deadline: CGMS XXXI).

WG IV then discussed the status of CGMS satellite operators' plans for geostationary satellites over the Indian Ocean in the 2005 timeframe. It recalled that there were tentative plans in the 2005 timeframe for at least six geostationary satellites (Meteosat, METSAT, INSAT-3A, GOMS N-2, FY-2 and GIFTS/IOMI). EUMETSAT noted that if another CGMS satellite operator were to provide coverage over the Indian Ocean in support of WMO requirements, it would not provide Meteosat coverage. WG IV also noted that GIFTS/IOMI was an R&D mission and only a demonstration project and would not be located over the Indian Ocean until 2007. With regard to R&D satellites in general, WG IV noted the proposal by WMO to expand CGMS membership to include appropriate R&D agencies. However, until the expansion was approved and accepted by the R&D agencies, it would be premature to include R&D satellite missions in contingency planning discussions. Additionally, WMO would have to define what the contingency requirements for the R&D constellation would be, if at all.

With regard to WMO's redesign of the GOS, WG IV agreed that it would be appropriate to wait for the approval by the CBS session in 2002 and subsequent review and approval by the WMO Congress. Thus, WG IV agreed to further discuss contingency planning for the redesigned space-based component of the GOS at CGMS XXXI.

J. SENIOR OFFICIALS MEETING

J.1 Reports from the Working Groups and Agreement of the Recommendations of the Working Groups

Reports from the three working groups were presented by Mr. R. Wolf (WG I on Telecommunications), Dr. P. Menzel (WG II on Satellite Products), Dr. J. Schmetz (WG III on Satellite-Tracked Winds) and Dr. Hinsman (WG IV on Global Contingency Planning).

The Senior Officials took note of the reports and thanked the participants, Chairmen and Rapporteurs for their active and fruitful discussions. They endorsed the proposed actions and recommendations formulated by each working group. The senior officials congratulated the four working groups for their comprehensive reports and for their achievements since the preceding meeting of CGMS.

J.2 Summary List of Actions from CGMS XXX

Permanent Actions

1. All CGMS members to inform the Secretariat of any change in the status or plans of their satellites (to allow updating of the CGMS Tables of Satellites).

2. Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin Board, or other means as appropriate.

3. EUMETSAT, Japan and USA to provide the agreed set of reporting statistics on International Data Collection System (IDCS) performance and report to CGMS Secretariat and WMO on a regular basis.

4. CGMS members to update the Committee on Earth Observation Satellites (CEOS)/WMO Consolidated Database as appropriate using the utility tools provided by WMO and to respond directly to WMO following the database update cycle process.

5. CGMS members to report on anomalies from solar events at CGMS meetings.

6. All CGMS satellite operators to review the tables in Appendix A of WMO-WP-03 and provide any updates to WMO, as appropriate, and at every CGMS Plenary meeting.

7. CGMS members to update their relevant sections of the CGMS Consolidated Report, as appropriate, and to send their updates to the Secretariat at least two months prior to every CGMS Plenary meeting.

New Permanent Actions

8. CGMS satellite operators to update Table 5 for polar-orbiting satellite equator crossing times on an annual basis.

9. CGMS members to provide information for WMO database for satellite receiving equipment, as appropriate.

10. CGMS members to review the list of available list servers used by CGMS groups and update as appropriate.

CGMS XXX - ACTIONS

30.01 India to provide CGMS with information describing the data communication mission on METSAT, adding Noise Equivalent Delta Temperature (NEDT) values to the tables included in the document by December 2002.

30.02 USA to provide CGMS Members with detailed technical information (when available) on NPOESS receiving stations to enable them to prepare their ground segments in advance. (Deadline: When available and/or CGMS XXXI)

30.03 CGMS members to provide information on the data content (incl. processing level) of DB services (including data on equator crossing time) for each polar-orbiting satellite, by CGMS XXXI.

30.04 India, China and the Russian Federation to take into account the Tropical Cyclone Committee's request to consider the possibility of continuing and implementing, on a permanent basis, geostationary coverage of the Indian Ocean, in order to provide the necessary data in support of the national mandates of WMO members in the region and to report by CGMS XXXI.

30.05 At CGMS XXXI, all CGMS members to report on planned geostationary and low earth orbiting satellite coverage to support WMO's Tropical Cyclone programme, including distribution mechanisms for those data. For low earth orbiting systems, this includes multi-channel imagery and sounding data and products, as well as other relevant measurements and products including sea surface temperature, altimetry, salinity, ocean surface winds and precipitation. (Deadline: CGMS XXXI)

30.06 WMO to provide CGMS members with the requirements of the various Tropical Cyclone/Typhoon/Hurrican Committees and Panels. (Deadline: 1 February 2003)

30.07 The second session of the CGMS VL Focus Group, to be held in conjunction with 2003 WMO satellite training event in Barbados, to conduct an initial assessment of the VL and report back to CGMS XXXI. Satellite operators to support their participation as well as that of their respective Centres of Excellence at the VL Focus Group meeting. (Deadline: Barbados Training Event)

30.08 CGMS members to update their contributions to WMO Publication No. 411 by March 2003.

30.09 In view of the increasing use and importance of operational meteorological satellite data for climate research and monitoring, CGMS is invited i) to consider a review of current practice of satellite operators with regard to the climate monitoring principles from satellites, and ii) to provide pertinent reports at CGMS XXXI meeting. (Deadline: CGMS XXXI)

30.10 CGMS Secretariat to write to ESA, NASA, NASDA and Rosaviakosmos, inviting them as contributors to the space-based component of the GOS, to become members of the CGMS.

30.11 CGMS Secretariat to review the CGMS Terms of Reference to reflect the new membership.

30.12 CGMS members to coordinate with their national frequency authorities to promote CGMS positions on WRC-2003 and WRC-2007 agenda items. (Deadline: May 2003)

30.13 CGMS members are urged to discuss the potential problems caused by car radar systems operating in the band 21–27 GHz with their national frequency administrations. (Deadline: May 2002)

30.14 CGMS members to provide relevant information on frequencies used or planned for use in support of CGMS missions in the Indian Ocean region for triggering a discussion on appropriate coordination by CGMS XXXI.

30.15 CGMS members to update the status of LRIT/LRPT conversion as contained in Tables 7 and 8 for satellites in polar and geostationary orbit. (Deadline: 1 January 2003)

30.16 CGMS to establish a standing Working Group, chaired by Mr. M. Rattenborg (EUMETSAT) to develop an overall strategy for convergence of planned ADMs as well as an associated implementation plan. (Deadline: CGMS XXXI)

30.17 CGMS satellite operators to reaffirm commitment to the AHRPT format for datastreams from polar-orbiting satellites. (Deadline: 1 January 2003)

30.18 CGMS members to consider FWIS as well as the WMO Core Metadata profile within the context of the ISO Standard for Geographic Metadata (ISO 19115), when changing/implementing processing and dissemination systems (after FWIS approval). (Deadline: CGMS XXXI)

30.19 Satellite operators should provide a summary of solar calibration approaches for GEO and LEO sensors (research as well as operational) at the next CGMS. The recent results of Moderate Resolution Imaging Spectroradiometer (MODIS) and MERIS visible calibration should be reported and possible opportunities for intercalibration with other less well calibrated sensors should be explored. (Deadline: CGMS XXXI)

30.20 EUMETSAT to invite scientists participating in CHAMP to submit a report on sounding experiences at the next CGMS.
(Deadline: CGMS XXXI).

30.21 CGMS should initiate a workshop wherein an inventory of the calibration of all sensors is established (including sensor performance over time, sensor operation, calibration algorithm adjustment, sensor to sensor intercomparisons, collocated radiosonde observations etc.). Moreover, this workshop should help space agencies to make plans to deploy such methods in current and planned operational systems. (Deadline: Before CGMS XXXI).

30.22 Space agencies are invited to report at the next CGMS on their approaches to produce satellite data for climate purposes. (Deadline: CGMS XXXI).

30.23 Space agencies are invited to establish focal points to ensure that: (a) ingest and pre-processing code for future advanced instrument (in particular sounders and their complementary imagers) is provided, in a form suitable for use with locally-received direct read-out data, and yielding output consistent with global data, and (b) activities are undertaken to integrate this code into processing packages available for international distribution in a timely manner. In addition, these focal points should provide sensor status, navigation and frequently-updated calibration information in a timely manner to users and developers and facilitate efforts to minimise the differences between the global and local calibrated and navigated data. (Deadline: CGMS XXXI).

30.24 Data providers are invited to report at next CGMS on their current use of and plans to use NWP monitoring results in their quality monitoring activities. (Deadline: CGMS XXXI).

30.25 IPO is invited to inform ITWG members, through the ITWG list server, of the location of draft specifications of raw data records and sensor data records for NPOESS/NPP instruments. The ITWG co-chairs will co-ordinate feedback to IPO from ITWG members on the draft specifications (content and format) for the raw data records and sensor data records for NPOESS/NPP instruments. (Deadline: Before ITSC-13 in October 2003).

30.26 WCRP is invited to provide further clarification on the requirements for combined infrared and microwave surface skin temperature products and for climate and ocean applications. (Deadline: CGMS XXXI).

30.27 CGMS members to provide an inventory of routinely produced precipitation estimates, either operational or experimental/research, to the IPWG co-chairs, Arnold Gruber and Vincenzo Levizzani. A template for the responses can be found on the IPWG website. (Deadline: February 2003).

30.28 AOPC is invited to consider the consolidated list of metadata (including time of observation, Earth location, observation angles, spectral channel response, calibration coefficients, and field of view size as well as the associated error in each parameter) and to comment on its adequacy for their applications. (Deadline: CGMS XXXI).

30.29 ESA/ESRIN is invited to present a paper at the next CGMS on their approach to science data stewardship. (Deadline: CGMS XXXI).

30.30 NOAA/NESDIS is invited to report on the 'auto-nowcaster' at CGMS XXXI. (Deadline: CGMS XXXI).

30.31 The co-chairs of IWW7 are requested to invite representatives of the regional scale modelling community to the next IWW. (Deadline: October 2003).

30.32 IWW7 is invited to establish an inventory of all height assignment methods used for low-, medium- and high-level AMVs. (Deadline: October 2003).

30.33 NOAA/NESDIS is invited to present a paper on AMVs from both MODIS instruments on Terra and Aqua satellites, respectively, at IWW7. (Deadline: October 2003).

30.34 CGMS invites WMO's OPAG/IOS to establish jointly with the NWP community reanalysis requirements for reprocessing of satellite data and products. (Deadline: December 2003).

30.35 Roshydromet, JMA and NOAA/NESDIS to discuss usage of some DCS channels on GMS-5 and/or GOES-9 for processing by Roshydromet with the expectation that the DCPs would be part of the World Weather Watch and processing be eventually resumed by GOMS N2. WMO to assist.
(Deadline: 1 January 2003 for discussions and exchange of information).

30.36 CMA to confirm its plans for polar-orbiting satellites and in particular its willingness to consider the possibility of using the PM orbit while taking into account its respective national requirements. (Deadline: 1 January 2003).

30.37 WMO to inform CBS at its 2002 session in Cairns, Australia and the WMO Congress of the recent new developments in contingency planning by CGMS satellite operators. *(Deadline: 7 December 2002 and May 2003 respectively).*

30.38 WMO to develop a detailed description of the goal for data, product and services expected from each of the nominal positions for both polar and geostationary orbits for use in contingency planning. (Deadline: CGMS XXXI).

J.3 Nomination of CGMS Representatives at WMO and Other Meetings

In WMO-WP-19, WMO noted that CGMS would be invited to the WMO Fourteenth Congress. The Senior Officials agreed that EUMETSAT would represent CGMS at the Fourteenth Congress of WMO (Cg-XIV).

The Senior Officials also agreed that EUMETSAT would represent CGMS at the coming CEOS Plenary.

J.4 Nomination of Chairperson of Working Groups for CGMS XXXI

Concerning the meetings of the Working Groups at CGMS XXXI, the Senior Officials agreed that:

- Mr. Robert Wolf will chair Working Group I on Telecommunications.
- Dr. Bhatia will chair Working Group II on Satellite Products, with Dr. Paul Menzel acting as Rapporteur.

- Dr. Xu will chair Working Group III on Satellite Derived Winds, with Dr. Johannes Schmetz acting as Rapporteur.
- Dr. Tillmann Mohr will chair Working Group IV on Global Contingency Planning, with Dr. Donald Hinsman acting as Rapporteur;
- Mr. Rattenborg will chair Working Group V on Alternative Dissemination Methodes.

J.5 Any Other Business

In WMO-WP-23 WMO informed the CGMS members on membership expansion and expanded space-based component of the GOS. CGMS noted the recent expansion of the space-based component of the GOS to include appropriate R&D satellite missions, in particular, the confirmed commitments by NASA, ESA, NASDA and Rosaviakosmos. CGMS also recalled WMO's recommendation for increased external coordination. In particular, WMO felt that a means to improve cooperation with both operational meteorological and R&D satellite operators would be through an expanded CGMS. WMO felt that CGMS could act as a principal forum for the necessary dialogue between WMO and the satellite operators as well as for discussions between satellite operators, especially for technical matters concerning data formats, work station configuration, commonality of satellite instruments and missions, coherent and coordinated mission planning, data dissemination systems, etc. WMO also noted that the expansion of the space-based components of the GOS, GAW, GCOS and WHYCOS would be step-wise, i.e., only those R&D satellite system operators that have the potential to contribute to WMO and supported programmes would be considered, and would have the option of following the guidelines. Thus, WMO recommended that NASA, ESA, NASDA and Rosaviakosmos be considered for full membership in CGMS.

All CGMS members supported the expansion of its membership to include ESA, NASA, NASDA and Rosaviakosmos as CGMS members, with the understanding that these agencies will contribute to the space-based component of the GOS by providing access to their R&D satellite mission data.

ACTION 30.10

CGMS Secretariat to write to ESA, NASA, NASDA and Rosaviakosmos, inviting them as contributors to the space-based component of the GOS, to become members of the CGMS.

ACTION 30.11

CGMS Secretariat to review the CGMS Terms of Reference to reflect the new membership.

J.6 Approval of Draft Final Report

The Senior Officials, together with the Plenary, reviewed the Draft Final Report of the meeting. The Secretariat agreed to include amendments received at the meeting in a revised draft version, which would be distributed electronically to CGMS members for final comments by 20 November 2002. It was agreed that CGMS members would submit any further modifications to the Secretariat by 30 November 2002, at the latest, after which time the Final Report will be published and distributed by the Secretariat. It was further agreed that the final version of the report would be provided to participants via electronic mail and via CD-ROM which would also contain all CGMS XXX Working Papers.

J.7 Date and Place of Next Meeting

CGMS was pleased to accept an offer from WMO to host CGMS XXXI tentatively in Ascona (Switzerland). The Russian Federation also offered to host CGMS XXXII in a place still to be decided.

The Chairman thanked all participants for their cooperation and fruitful participation in the Thirtieth meeting of the CGMS, adding that there had been many important and interesting discussions during the Working Group and Plenary sessions. He also thanked the Rapporteurs and Secretariat for preparing the Final Report. The participants thanked India for a very efficient and productive meeting, and for hosting the meeting in such a wonderful environment. The meeting adjourned at 13.00 hours on 14 November 2002.

ANNEXES:

Annex 1	*CGMS XXX Agenda*
Annex 2	*List of Working Papers*
Annex 3	*List of Participants*
Annex 4	*List of Working Group Participants*

CGMS XXX AGENDA
---------- WORKING GROUP SESSIONS ------------

WORKING GROUP I: TELECOMMUNICATIONS

I/0 Introduction
I/1 Coordination of Frequency Allocations
I/2 Telecommunication Techniques
I/3 Coordination of IDCS and Distribution (item F from Plenary)
I/3.1 Status and Problems of the IDCS
I/3.2 Ships, including ASAP
I/3.3 ASDAR
I/3.4 Dissemination of DCP Messages (GTS or Other Means)
I/4 Coordination of Data Dissemination
I/4.1 Dissemination of Satellite Images via Satellite
I.5 Results of Discussions by the Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites

WORKING GROUP II: SATELLITE PRODUCTS

II/0 Introduction
II/1 Image Processing Techniques
II/2 Satellite Data Calibration
II/3 Vertical Sounding and ITWG Matters
II/4 Other Parameters and Products
II/5 Coordination of Code Forms for Satellite Data
II/6 Coordination of Data Formats for Archive and Retrieval of Satellite Data
II/7 Training
II/8 Monitoring
II/9 Conclusion

WORKING GROUP III: SATELLITE-DERIVED WINDS

III/0 Introduction
III/1 Report and Recommendations from the Sixth International Winds Workshop (IWW6) and Preparation for IWW7
III/2 Wind Statistics
III/3 Derivation of Wind Vectors
III/4 Conclusion

WORKING GROUP IV: CONTINGENCY PLANNING

CGMS XXX AGENDA
---------- PLENARY SESSION ------------

A. INTRODUCTION

A.1 Welcome
A.2 Election of Chairperson
A.3 Adoption of Agenda
A.4 Nomination of Drafting Committee
A.5 Review of Action Items

B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar-orbiting Meteorological Satellite Systems
B.2 Geostationary Meteorological Satellite Systems

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Future Polar-orbiting Meteorological Satellite Systems
C.2 Future Geostationary Meteorological Satellite Systems

D. OPERATIONAL CONTINUITY AND RELIABILITY

D.1 Long-term Global Contingency Planning
D.2 Inter-regional Contingency Measures and Back-up Agreement
D.3 Global Planning, Including Orbital Positions and Reconfiguration of the Space-based Component of the GOS

E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

E.1 World Weather Watch
E.2 Other Programs

F. COORDINATION OF INTERNATIONAL DATA COLLECTION SYSTEMS & DISTRIBUTION (discussed in WG I)

G. COORDINATION OF DATA DISSEMINATION
(discussed in WG I)

G.1 Meteorological Data Distribution via Satellite
G.2 Results of the Discussions of the Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites

H. OTHER ITEMS OF INTEREST

H.1 Applications of Meteorological Satellite Data for Environment Monitoring
H.2 Training (discussed in WG II)
H.3 Information

J. CLOSING SESSION

J.1 Reports from the Working Groups and Agreement of the Recommendations of the WG
J.2 Summary List of Actions from CGMS XXX
J.3 Nomination of CGMS Representatives at WMO and Other Meetings
J.4 Nomination of Chairperson of Working Groups for CGMS XXXI
J.5 Any Other Business
J.6 Date and Place of Next Meeting

LIST OF WORKING PAPERS

ESA

WP Number	Title	Agenda Item
ESA-WP-01	Status of the ESA's Earth Observation Missions	C.1

EUMETSAT

WP Number	Title	Agenda Item
EUM-WP-01	Review of Action Items	A.5
EUM-WP-02	Status of the Meteosat System	B.2
EUM-WP-03	Paper cancelled	-
EUM-WP-04	Status of Preparation of EPS	C.1
EUM-WP-05	Status of MSG	C.2
EUM-WP-06	Status of the EUMETSAT Satellite Applications Facilities	H.1
EUM-WP-07	EUMETSAT Conferences and Publications	H.3
EUM-WP-08	Update of CGMS Consolidated Report	H.3
EUM-WP-09	Operational AMV products derived with Meteosat-6 Rapid Scan Data	III/4
EUM-WP-10	Report from the CEOS Plenary 2001	H.3
EUM-WP-11	Status of Preparations for WRC 2003	I/1
EUM-WP-12	Introduction of Car Radar Devices in the Frequency Band 21 to 27 Ghz	I/1
EUM-WP-13	Passive Sensors Using Frequency Band Higher Than 275 GHz	I/1
EUM-WP-14	The Transition of the MDD Service from MTP to MSG	I/2
EUM-WP-15	Status and Problems of the IDCS	I/3
EUM-WP-16	Intercalibration of LEO/GEO Satellite Data over a Full Year	II/2
EUM-WP-17	Solar Calibration of MSG SEVIRI	II/2
EUM-WP-18	Activities Towards User Requirements for Post-MSG	II/3
EUM-WP-19	Direct Broadcasting Processing Packages for IASI/AVHRR	II/3
EUM-WP-20	Status Report on the EARS	II/3
EUM-WP-21	Discrimination of Clouds and Surfaces in Satellite Images	II/4
EUM-WP-22	Metadata Accompanying Reprocessed Data	II/6
EUM-WP-23	Report on EUMETSAT Training Activities	H.2
EUM-WP-24	Report from IWW6	III/1
EUM-WP-25	Microwave Atmospheric Sounding from Geostationary Orbit: the Case for a Cooperative Demonstration Mission	C.2

INDIA

WP Number	Title	Agenda Item
IND-WP-01	Status of CGMS XXIX Action Items	A.5
IND-WP-02	Current Status of INSAT and METSAT Satellites for Meteorological Applications.	B.1/2
IND-WP-03	Future Plans of INSAT Satellites for Meteorological Applications.	C.1/2
IND-WP-04	Results on the Quality of Operational INSAT-CMVs Post CGMS XXIX.	III/4
IND-WP-05	Current Status of Processing of ATOVS Data at IMD and Utilisation of Derived Products	II/3
IND-WP-06	Use of SSM/I Derived Water Vapour and Wind Speed Products for Real-time Forecasting of Heavy Rainfall	II/4

IOC

WP Number	Title	Agenda Item
IOC-WP-01	To Inform CGMS Members of the Status of GOOS Regional Alliances up to September 2002	E.2
IOC-WP-02	To inform CGMS Members of COOP Activities for 2001-2002	E.2
IOC-WP-03	To inform CGMS Members of the status of GODAE and ARGO activities.	E.2

JAPAN

WP Number	Title	Agenda Item
JPN-WP-01	Review of Action Items	A.5
JPN-WP-02	Status of Geostationary Meteorological Satellite	B.2
JPN-WP-03	Backup of GMS-5 with GOES	B.2
JPN-WP-04	Future Plan on Multifunctional Transport Satellites	C.2
JPN-WP-05	Promotion of Satellite Data Exchange and Utilisation in the Asia – Pacific Region	G.2
JPN-WP-06	MSC Web Page	H.3
JPN-WP-07	Radio Frequency Issues	I/1
JPN-WP-08	Status of the GMS IDCS	I/3.1
JPN-WP-09	Preparation of a Web Page for Intercalibration Report	II/2
JPN-WP-10	Improvement of CAL Systems in JMA	H.2
JPN-WP-11	Activities of Virtual Laboratory Group in JMA	H.2
JPN-WP-12	A Training Plan for MTSAT-1R Data Utilisation	H.2
JPN-WP-13	Monitoring Procedure and Practice in MSC	II/8
JPN-WP-14	Reprocessing of Satellite Data and “METADATA”	II/8
JPN-WP-15	Impact Experiments on NWP of Rapid Scan AMVs	III/4
JPN-WP-16	Reprocessing of Atmospheric Motion Vectors	III/4
JPN-WP-17	Quality Control and BUFR Encoding for the Exchange of Cloud Motion Winds	III/4

PEOPLE'S REPUBLIC OF CHINA

WP Number	Title	Agenda Item
PRC-WP-01	FY-1D Meteorological Satellite Meteorological Centre	B.1
PRC-WP-02	Current Status of FY-1C	B.2
PRC-WP-03	Current Status of FY-2B and FY-2A	B.2
PRC-WP-04	Development of FY-3A Meteorological Satellite	C.1
PRC-WP-05	Plan for Developing Chinese FY-2C Geostationary Meteorological Satellite	C.2

RUSSIA

WP Number	Title	Agenda Item
RUS-WP-01	Review of Action Items from Previous CGMS Meetings	A.5
RUS-WP-02	Status of Russian Polar Orbiting Meteorological System	B.1
RUS-WP-03	Future Polar Orbiting Meteorological Satellites Meteor-3M	C.1
RUS-WP-04	Future Geostationary Meteorological Satellite GOMS/Electro № 2	C.2
RUS-WP-05	Roshydromet Activities on Coordination and Protection of Frequency Bands Allocations. Preparation to WRC 2003.	I/1
RUS-WP-06	Roshydromet DCS Current Status and Development Plans	I/3
RUS-WP-07	METEOR-3M N1 Capabilities and Russian Meteorological Satellites Development Perspectives	II/4
RUS-WP-08	Roshydromet/SRC Planeta Training Activities on Satellite Data Application	H.2

USA

WP Number	Title	Agenda Item
USA-WP-01	Review CGMS XXVIII Action Items	A.5
USA-WP-02	Polar Orbiting Operational Environmental Satellite (POES)	B.1
USA-WP-03	Geostationary Operational Environmental Satellite (GOES)	B.2
USA-WP-04	Anomalies from Solar Events	B.3
USA-WP-05	Report on Space Environment Monitoring Instruments on Future Geostationary Satellites	C.2
USA-WP-06	Future Polar Orbiting Meteorological Satellite System	C.1
USA-WP-07	Availability of NPP Direct Broadcast Services	C.1
USA-WP-08	Report on the Status of Future Geostationary Meteorological Satellite System	C.2
USA-WP-09	Status and Problems of IDCS	I.3
USA-WP-10	Dissemination of DCP Messages (GTS or Other Means)	I.3
USA-WP-11	The Current Status of the GOES LRIT Service	G.1
USA-WP-12	Status of the CDMA Overlay on the GOES DCS	G.1

USA-WP-13	Status of the GOES DCS DAPSII Implementation	G.1
USA-WP-14	LRIT Receiver Specifications	G.1
USA-WP-15	LRIT System Transition and Test Plans	G.1
USA-WP-16	SARSAT System Overview and Performance	H.2
USA-WP-17	Updates for the CEOS/WMO Database	H.2
USA-WP-18	Updates for WMO Tables on Satellites Operations and Services	G.1
USA-WP-19	Report on the Use of Frequency Bands Above 275 GHz	I.1
USA-WP-20	Technical Input to the Space Frequency Coordination Group and ITU-R	I.1
USA-WP-21	Update Table 5, Coordination of Data Formats and Frequency Planning for Polar-Orbiting Satellites	I.1
USA-WP-22	Status on the Development and Implementation of a TLS for DCS	I.1
USA-WP-23	Intercalibration of Geostationary and Polar-orbiting Infrared and Water Vapor Radiances	II.2
USA-WP-24	Intercalibration of Geostationary Satellites with a Polar-orbiting Satellite	II.2
USA-WP-25	2001/2002 Report on NOAA/NESDIS GOES Nowcasting Activities	II.3
USA-WP-26	Report on Monitoring Procedures and Practices for Satellite Data and Products	II.4
USA-WP-27	Current and Future Plans for MetaData Files for ReProcessing Geosynchronous Data	II.6
USA-WP-28	Comments on The Integrated Satellite Winds Monitoring Report.	III.2
USA-WP-29	Report on USA Plans to ReProcess Winds Data.	III.4
USA-WP-30	2001/2002 Report on NOAA/NESDIS Satellite-Derived Winds	III.2
USA-WP-31	2001/2002 Report on NOAA/NESDIS GOES Soundings	II.3
USA-WP-32	Cloud Drift and Water Vapor Winds in Polar Regions with MODIS	III.2
USA-WP-33	Report on the ITOVS Working Group	II.2
USA-WP-34	LRIT System Performance and Link Budget	G.1
USA-WP-35	Report on LRD Development	C.1*
USA-WP-36	Report on Alternative Dissemination Methods for GOES-R	G.1
USA-WP-37	Report on the Virtual Laboratory Development	H.2
USA-WP-38	Meteorological Satellite Topics of Interest for WRC 2003	I.1
USA-WP-39	Low Cost Low Rate Data Terminal	C.1

** USA-WP-07&39 contains information about the development of the LRD broadcast.*

WMO

WP Number	**Title**	**Agenda Item**
WMO-WP-01	Satellite Ground Receiving Database	H.3
WMO-WP-02	Review of Actions from Previous CGMS Meetings	A.5
WMO-WP-03	Matters Related to APT/WEFAX and Conversion	I/4.1
WMO-WP-04	CGMS List Servers and Home Pages	H.3
WMO-WP-05	CGMS Working Group on Global Contingency Planning	D.1/D.2

WMO-WP-06	WMO Space Programme	H.3
WMO-WP-07	Redesign of the WWW Global Observing System	E.1
WMO-WP-08	Review of Satellite Related WMO Publications	H.3
WMO-WP-09	ASDAR Status Report	I/3.3
WMO-WP-10	WMO Code Form Changes	II/5
WMO-WP-11	Radio Frequency Matters	I/1
WMO-WP-12	Tropical Cyclone Programme Requirements	E.1
WMO-WP-13	ASAP Status Report	I/3.2
WMO-WP-14	International Precipitation Working Group	II/4
WMO-WP-15	WMO Executive Council Consultative Meetings	H.3
WMO-WP-16	Other Programmes, Joint WMO/IOC Technical Commission	E.2
WMO-WP-17	Virtual Laboratory Focus Group	H.2
WMO-WP-18	Equator Crossing Times	D.3
WMO-WP-19	Nomination of CGMS Representatives at WMO and Other Meetings	J.3
WMO-WP-20	ISCCP Products	II/4
WMO-WP-21	Task Force on Integration Strategy for Data Dissemination from Meteorological Satellites	G.2
WMO-WP-22	Alternative Dissemination Methods	G.2
WMO-WP-23	CGMS Membership Expansion and Expanded Space-based Component of the Global Observing System	J.5
WMO-WP-24	GCOS Principles for Climate	H.3
WMO-WP-25	Comparable Data Content	D.3

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APPENDIX A: ADDITIONAL INFORMATION SUBMITTED TO CGMS XXIX

1) ET-ODRRGOS RECOMMENDATIONS FOR THE EVOLUTION OF THE GOS
2) GCOS MONITORING PRINCIPLES

ET-ODRRGOS RECOMMENDATIONS FOR THE EVOLUTION OF THE GOS
(Ref. Agenda Item E.1)

Recommendations for Evolution of Space-based Component of GOS

The ET-ODRRGOS investigated an appropriate evolution towards the future space-based component of the GOS using the Rolling Review of Requirements (RRR) process and observational requirements for the following applications areas: Global NWP, Regional NWP, Synoptic Meteorology, Nowcasting and Very Short-Range Forecasting, Aeronautical Meteorology, Hydrology, Seasonal to Inter-Annual (SIA) Forecasting, Coastal Marine Services, Ocean Weather Forecasting, and Atmospheric Chemistry. Since the decision by the WMO Executive Council in 2001 to expand the space-based component of the GOS to include appropriate research and development missions, space-based contributions fall in three categories: the operational polar-orbiting, the operational geostationary, and the R&D (research and development) satellites. This considerably extends the range of user requirements that can be addressed and provides the mechanism for R&D demonstrations to evolve into operational systems. Recommendations were founded upon Observing System Experiments (OSEs), operational NWP experience, and evidence from field experiments with enhanced observations from ground-, aircraft-, and space-borne instruments. Operational satellite system evolution requires more than a decade to proceed from plans to demonstration to implementation; the individual satellite operator plans for change in the near-term are already well formed and in place and change is not likely. Thus the ET focussed on comments and suggestions for coordination of these plans in the near-term and recommendations for change in global satellite systems for the longer-term.

As the space-based remote sensing system of the future develops and evolves, four critical areas (all dealing with resolution) will need to be addressed in order to achieve the desired growth in knowledge and advanced applications. They are: (1) spatial resolution – what picture element size is required to identify the feature of interest and to capture its spatial variability; (2) spectral coverage and resolution – what part of the continuous electromagnetic spectrum at each spatial element should be measured, and with what spectral resolution, to analyse an atmospheric or surface parameter; (3) temporal resolution – how often does the feature of interest need to be observed; and (4) radiometric accuracy – what signal to noise is required and how accurate does an observation need to be. Each of these resolution areas should be addressed in the context of the evolving space-based observing system wherein the satellite(s) exist, or will exist.

High priority system specific recommendations for additional capabilities in the space-based component of GOS (in order of priority for each category) are listed below; they are followed by comments on the planned improvements to space-based component of GOS.

High-Priority General Recommendations
Calibration

1 A major issue for effective use of satellite data, especially for climate applications, is calibration. There should be more common spectral bands on GEO and LEO sensors to facilitate intercomparison and calibration adjustments; globally distributed GEO sensors can be intercalibrated using a given LEO sensor and a succession of LEO sensors in a given orbit (even with out the benefit of overlap) can be intercalibrated with a given GEO sensor. The advent of high spectral resolution infrared sensors will enhance accurate intercalibration.

High Priority System Specific Recommendations for Additional Capabilities in the Space-based Component of GOS (in order of priority for each category)

GEO satellites

2 GEO Imagers: Imagers of future geostationary satellites should have improved spatial and temporal resolution (appropriate to the phenomena being observed), in particular for those spectral bands relevant for depiction of rapidly developing small scale events and retrieval of wind information.

3 GEO Sounders: All meteorological geostationary satellites should be equipped with hyperspectral infrared sensors (to be demonstrated by GIFTS) for frequent temperature/humidity sounding as well as tracer wind profiling with adequately high resolution (horizontal, vertical and time).

4 GEO Imagers and Sounders: To maximise the information available from the geostationary satellite systems, they should be placed "nominally" at a 60° sub-point separation across the equatorial belt. This will provide global coverage without serious loss of spatial resolution (with the exception of Polar Regions). In addition, this provides for a more substantial back-up capability should one satellite fail. In particular, continuity of coverage over the Indian Ocean region is of concern.

LEO satellites

5 LEO Data Timeliness: More timely data is needed. Improved communication and processing systems are required to meet the timeliness requirements in some applications areas (e.g. Regional NWP).

6 LEO Temporal Coverage: Coordination of orbits for LEO missions is necessary to optimise temporal coverage while maintaining some orbit redundancy.

7 LEO Sea Surface Wind: Sea surface wind data from R&D satellites should continue to be made available for operational use; six-hourly coverage is required. In the NPOESS and METOP era, sea surface wind should be observed in a fully operational framework. Therefore, it is urgent to assess whether the multipolarisation passive MW radiometry is competitive with scatterometry.

8 LEO Altimeter: Missions for ocean topography should become an integral part of the operational system.

9 LEO Earth Radiation Budget: Continuity of ERB type global measurements for climate records requires immediate planning to maintain broadband radiometers on at least one LEO.

R&D satellites

10 LEO Doppler Winds: Wind profiles from Doppler lidar technology demonstration programme (such as Aeolus) should be made available for initial operational testing; a follow-on long-standing technological programme is solicited to achieve improved coverage characteristics and reduced instrument size necessary for operational implementation.

11 GPM: The concept of the Global Precipitation Measurement (GPM) missions (combining active precipitation measurements with a constellation of passive microwave imagers) should be supported and the data realised should be available for operational use, thereupon, arrangements should be sought to ensure long-term continuity to the system.

12 RO-Sounders: To complement the METOP and NPOESS radio-occultation sounders, the opportunities for a larger constellation should be explored and expanded operational implementation planned. International sharing of ground network systems (necessary for

accurate positioning in real-time) should be achieved to minimise development and running costs.

13 GEO Sub-mm: An early demonstration mission on the applicability of sub-mm radiometry for precipitation estimation and cloud property definition from geostationary orbit should be provided, with a view to possible operational follow-on.

14 LEO MW: The capability to observe ocean salinity and soil moisture for weather and climate applications (possibly with only limited horizontal resolution) should be demonstrated in a research mode (as with ESA's SMOS and NASA's OCE) for possible operational follow-on. Note that the horizontal resolution from these instruments is unlikely to be adequate for salinity in coastal zones and soil moisture on the mesoscale.

15 LEO SAR: Data from SAR should be acquired from R&D satellite programmes and made available for operational observation of a range of geophysical parameters such as wave spectra, sea ice, land surface cover.

16 LEO Aerosol: Data from process study missions on clouds and radiation as well as from R&D multipurpose satellites addressing aerosol distribution and properties should be made available for operational use.

17 Cloud Lidar: Given the potential of cloud lidar systems to provide accurate measurements of cloud top height and to observe cloud base height in some instances (stratocumulus, for example), data from R&D satellites should be made available for operational use.

18 LEO Far IR: An exploratory mission should be implemented, to collect spectral information in the Far IR region, with a view to improve understanding of water vapour spectroscopy (and its effects on the radiation budget) and the radiative properties of ice clouds.

19 Limb Sounders" Temperature profiles in the higher stratosphere from already planned missions oriented to atmospheric chemistry exploiting limb sounders should be made operationally available for environmental monitoring.

20 Active Water Vapour Sensing: There is need for an exploratory mission demonstrating high-vertical resolution water vapour profiles by active remote sensing (for example, by DIAL) for climate monitoring and, in combination with hyperspectral passive sensing, for operational NWP.

Comments on Planned Improvements to Space-based Component of GOS

GEO satellites

1 GEO Imagers: The GEO imagers will evolve in a synergistic way with the GEO Sounders. Depending on the characteristics of the evolved temperature/humidity sounder, the imager can focus on different channels with an emphasis on monitoring rapidly developing small-scale events.

2 GEO Imagers: Future geostationary satellites will have improved capability for observing land surface temperatures and characterising fire size and temperature.

3 GEO Sounders: IR sounding spectrometers from geostationary orbit are unlikely to be able to follow diurnal variations in boundary layer ozone important in air quality and hazard warnings, and thus will not meet the stated requirements of atmospheric chemistry.

LEO satellites

4 LEO Imagers: In the near- and mid-term future, vegetation and surface albedo data from R&D and operational satellites will be available for operational use. In the NPOESS era, continued access will improve small-scale applications.

5 LEO Sounders: The advent of hyperspectral IR sounder on Aqua, METOP, NPP, and NPOESS will improve temperature and moisture profiling; plans for making early hyperspectral IR data available for operational evaluation are being realised.

6 LEO GPS: Radio occultations offer the potential for very stable long-term measurements of upper tropospheric and lower stratospheric temperature and moisture relevant for climate applications.

R&D satellites

7 LEO Imagers: Until the advent of NPOESS, high-quality sea surface temperature data from R&D satellites (e.g. ATSR, AATSR, MODIS) will be made available for operational use, specifically for climate monitoring. Future geostationary satellites will have improved capability of observing sea surface temperatures and their diurnal variation.

8 LEO Imagers: Imagers on future polar satellites will enable trace motion wind determination in overlapping areas at high latitudes, similar to those from geostationary satellites.

9 LEO Imagers: On orbit channel selection for multidisciplinary utilisation is being demonstrated by ENVISAT's MERIS. The MERIS primary mission is ocean related (colour), however, its flexibility allows for definition of spectral bands that can be used to retrieve information on clouds, vegetation, aerosols and total column water vapour.

10 LEO Ocean Colour: In the near- and mid-term future, ocean colour data from R&D satellites will be available for operational use. Even in the NPOESS era, continued access from R&D satellites will be complementary, especially in coastal zones.

Table linking observed parameters with a given system of the space-based component of the GOS. (If space agencies implement their current plans and the recommendations listed above are acted upon, the space-based component of the GOS would have the following characteristics)

System	Improved parameters	Instrumentation
GEOs upgraded	Temperature, humidity, ozone profiles, winds at tracer heights Atmospheric instability index, OLR	Frequent-sounding and imaging IR spectrometer
	Cloud pattern, cover, type, top temp and height, Low stratus / fog Sea surface temp, land surface temp, fires, volcanic ash	Fast VIS/IR imager
LEOs upgraded (post-METOP)	Temp, humidity, & ozone profiles; total columns of key trace gases	IR/MW sounder
	Sea/land/ice surface temperatures, sea-ice cover, NDVI, fires, Aerosol size, Cloud pattern, cover, type, top height, cloud optical thickness, drop size, low stratus/fog, high lat winds at tracer heights	Improved VIS/NIR/IR imager
	Short- and long-wave outgoing radiation at TOA	Broadband imager
	Sea-surface wind and temp, sea-ice cover and surface temp snow cover, snow water equivalent, precipitation	MW radiometer with multipolarisation/ viewing
	Water and ice cloud properties, aerosol properties Ozone LAI, PAR, FPAR (large scale). Ocean colour	Imagers covering parts of UV, VIS, NIR, IR, FIR, & Sub-mm, with multipolarisation
	Wave height, sea level, ocean topography, geoid	Altimeter
R&D GEO SubMM	Cloud water / ice, precipitation	Sub-mm radiometer
R&D LEO for ocean topography	Significant wave height, sea level, ocean topography, geoid. Polar ice thickness and sheet topography	Medium-class altimeter (follow-on Jason)
R&D LEO for wind Profiles	Wind profile in clear air. Aerosol profile (large scale), cloud top and base height	Doppler lidar (follow-on Aeolus)
R&D LEO for land & ocean ice	Wave spectra, ocean ice. Land snow & ice	SAR
R&D LEO for salinity & moisture	Ocean salinity (large scale). Soil moisture (large scale)	Low-frequency MW radiometer
R&D Constellation of mini-sats	UT/LS temperature profile, height of tropopause., LT moisture profile (with ground GPS)	Radio-occultation sounders

Vision of the Space-based Component of the GOS in 2015

The space-based component of the GOS will provide observations crucial to maintaining and improving performance of systems in several application areas – in operational meteorology and in other aspects of WMO programmes. A few examples follow. It will provide multi-spectral images of cloud and water vapour at high spatial and temporal resolution for use in synoptic meteorology, nowcasting, hydrology, and aeronautical meteorology. It will also provide quantitative measurements of key atmospheric variables for assimilation into operational NWP systems. Hyperspectral space-borne measurements will expand the atmospheric chemistry applications. The space-based component of the GOS must also provide long-term stable global measurements of radiation for climate applications.

An analysis of user requirements in applications areas within WMO programmes indicates the need for an operational satellite constellation comprising four polar and six geostationary satellites. The geostationary component will provide visible/infrared imagery of improved quality and also advanced infrared atmospheric sounding capability. The polar-orbiting component will provide many capabilities including advanced microwave and infrared atmospheric sounding, high-resolution multi-spectral visible/infrared imagery, microwave imagery, ultraviolet ozone sounding, GPS radio occultation sounding, and information from scatterometers, altimeters and microwave radiometers. These will provide quantitative information on many atmospheric and surface variables, such as atmospheric profiles of temperature, humidity and ozone; surface temperature; clouds and precipitation; ice and snow cover; vegetation; and ocean surface wind and waves.

Beyond this, data from instruments on R&D satellites will make major new contributions to the GOS including:

- wind profiles from Doppler wind lidars,
- precipitation measurements from a constellation of active and passive microwave instruments,
- GPS radio occultation (RO) constellation,
- ocean colour,
- soil moisture, and
- air quality.

Expansion of the space-based component of the GOS will require international collaboration. There will be efforts to facilitate contributions of single instruments to larger platforms. Replacement strategies of the current or near future GOS satellites by the next generation satellites will proceed with a phased implementation approach. The role of small satellites in the GOS will be expanded. Coordination of international contributions to the polar-orbiting observing system to achieve optimal spacing for a balance of spectral, spatial, temporal and radiometric coverage will be a goal. Operational continuation of research capabilities with proven utility to the GOS will occur as much as possible without interruption of the data flow.

There must be a commitment for adequate resources to sustain research developments necessary for improved utilisation of these measurements. As much as possible, preparation for utilisation of any new measurement will begin prior to launch with distribution of simulated datasets that test processing systems; this will increase the fraction of post-launch lifetime during which the data are used effectively in operational systems. (The current post-launch familiarisation period of 6-24 months will be reduced). International development of data processing and assimilation methods and systems will assure best use of available talent and effort, and it will enhance uniformity in derived products.

The following table summarises the space-based component of GOS in 2015.

GOS (2015)

Six operational GEOs
- all with multi-spectral imager (IR/VIS)
- some with hyperspectral sounder (IR)

Four operational LEOs
- optimally spaced in time
- all with multi-spectral imager (MW/IR/VIS/UV)
- all with sounder (MW)
- three with hyperspectral sounder (IR)
- all with radio occultation (RO)
- two with altimeter
- two with conical scan MW or scatterometer

Plus R&D satellites serving WMO members:
- constellation small satellites for radio occultation (RO)
- R&D LEO with wind lidar
- R&D LEO with advanced altimeter
- R&D LEO with active and passive microwave precipitation instruments
- LEO and GEO with advanced hyperspectral capabilities
- GEO lightning
- GEO microwave

It is envisaged after 2015 that hyperspectral instruments will serve many of the imaging and sounding functions from both LEO and GEO orbit. R&D developments in wind profiling and precipitation monitoring will also be operational. Remote sensing needs for coastal monitoring and boundary layer chemistry will be addressed by R&D missions. Data movement, processing and utilisation will be a large challenge; exploration of ADMs will be necessary to seek new solutions. The opportunity for instruments in L1 orbit to serve as environmental sentinels will be explored.

Recommendations for Evolution of Surface-based Component of GOS

The recommendations below take into account known upgrades to current satellite systems and entirely new space-based instrumentation to be deployed by 2015. Proposed changes in surface-based and *in situ* atmospheric and oceanic observing systems include automation and greater utilisation of existing systems and the development of a few relatively new systems – all designed to complement, and be fully consistent with, future satellite capabilities. The goal is to maximise the benefits of the composite observing system for a variety of operational weather services.

Ten years from now, two things are virtually certain: observations will increase markedly in volume, and they will be stored and transmitted almost entirely in binary formats. It is hazardous to guess what kind of surface and *in situ* atmospheric and oceanic observations will be available beyond ten years merely because new technologies may revolutionise how the atmosphere is measured. For example, ten years ago, few could anticipate the evolution of the AMDAR system or the exploitation of the GPS in meteorology. Therefore, the present strategy is to extrapolate into the future promising trends in observation technology.

The recommendations below address the RRR in a number of applications areas: Global NWP, Regional NWP, Nowcasting and Very Short-Range Forecasting, Synoptic Meteorology, Ocean Weather Forecasting, Coastal Marine Services, Aeronautical Meteorology, Season and Inter-Annual prediction, and Atmospheric Chemistry.
The relevant impact studies that support the recommendation are cited in brackets; often the OSE is just listed by number (see July 2002 report of ET-ODRRGOS for the list).

High-Priority General Recommendations
Data distribution and coding

1. Exchange international observation data not yet centrally collected but potentially useful in NWP, e.g., radar measurements to provide information on precipitation and wind, surface observations, including those from local or regional mesonets, wave buoys. Encourage WMO members in regions where these data are collected to make them available via WMO real-time information systems.

2. Data available at high temporal frequency should be distributed at least hourly. Recent studies have shown that 4D-Var data assimilation system or analysis system with frequent update cycles can make excellent use of hourly data, e.g. from SYNOPs, buoys, profilers, aircraft (AMDAR). [OSE-1]

3. Assure that all sources are accompanied by good documentation including metadata, careful QC, and monitoring.

4. Use coding standards that assure that the content (e.g. vertical resolution) of the original measurements, sufficient to meet the user requirements, is retained during transmission. Some current coding/formatting standards in the character codes degrade potentially useful information in meteorological reports. (Example: lost information at various levels in a rawin sonde sounding in the TEMP code could be retained in the BUFR code). [CBS decision to migrate to table driven and binary codes].

Broader use of ground-based and in situ observations

5. Calibration of measurements from satellites depends on using ground-based and *in situ* observations, such as ozone profiles from sondes. Near real-time distribution of ozone sonde data is required for calibration and validation of newly launched instruments and for potential use in NWP. [Joint ECMWF/WMO expert team meeting on real-time exchange of ground-based ozone measurements, ECMWF, 17-18 October 1996]

Moving towards operational use of targeted observations

6. Transfer into operations the proven methodology of observation targeting to improve the observation coverage in data sensitive areas. This concept is in operational use at the US

Weather Service in the north-eastern Pacific during the winter storm period. EUCOS is planning on field experiments in the Atlantic, possibly in the context of a THORPEX study. Designated major operational centres should share the responsibility for determining the target areas. [FASTEX results and Toulouse report]

High Priority System Specific Recommendations
Optimisation of rawin sonde launches

7. Optimise the distribution and the launch times of the rawin sonde subsystem (allowing flexible operation while preserving the GUAN network and taking into consideration regional climate requirements). Examples include avoiding duplication of ASAP soundings, whenever ships are near a fixed rawin sonde site (freeing resources for observations at critical times) and optimising rawin sonde launches to meet the local forecasting requirements. [EUCOS Studies, OPAG IOS Chairman]

Development of the AMDAR programme

8. AMDAR technology should provide more ascent/descent profiles, with improved vertical resolution. A good way to accomplish this is to extend the AMDAR programme to short-haul commuter flights, business aviation, and air freight. Emphasis should be to expand into areas where vertical profile data from radiosondes and pilot balloons are sparse a well as into times that are currently not well observed such as 11 pm to 5 am local times. [Toulouse report, ECMWF Northern Hemisphere AMDAR impact study, OSEs 4, 5, 8]

9. AMDAR coverage is both possible and sorely needed in several currently data-sparse regions, especially Africa and South America, Canadian Arctic, northern Asia and most of the world's oceans. Moreover, the timing and location of reports, whose number is potentially very large, can be optimised while controlling communications costs. The recommendation is to optimise the transmission of AMDAR reports taking into account, en route coverage in data-sparse regions, vertical resolution of ascent/descent reports, and targeting related to the weather situation. [Toulouse report, ECMWF Northern Hemisphere AMDAR impact study]

10. Lower-tropospheric water vapour measurements are vital in many forecast applications. To supplement the temperature and wind reports from AMDAR, the further development and testing of water vapour sensing systems is strongly encouraged. Example: WVSS-2 employs a laser diode to measure the absorption by water vapour of energy in the laser beam over a short path length. This is an absolute measurement of water vapour content that is expected to be accurate from the ground to flight altitudes. [Toulouse report]

Tropospheric Aircraft Meteorological Data Reporting (TAMDAR)

11. TAMDAR could potentially supplement AMDAR and radiosonde data by providing lower-level en route observations and profiles over additional, regional airports not served by larger AMDAR compatible aircraft. Instrumentation would not necessarily be designed to function in the high troposphere and would therefore be less expensive. The development of the TAMDAR system should be monitored with a view towards operational use. [EUCOS Programme Plans]

Ground-based GPS

12. Develop further, the capability of ground-based GPS systems for the inference of vertically integrated moisture with an eye toward operational implementation. Distribute globally the measurements of total column water vapour from available and emerging ground-based GPS systems for use in NWP. Such observations are currently made in Europe, North America and Japan. It is expected that the global coverage will expand over the coming years. [COSNA/SEG, NAOS, JMA reports]

Improved observations in ocean areas

13. Increase the availability of high vertical resolution temperature, humidity, and wind profiles over the oceans. Consider as options ASAP and dropsondes by designated aircraft. [EUCOS programme plan]

14. Considering the envisaged increase in spatial and temporal resolution of *in situ* marine observing platforms and the need for network management, either increase the bandwidth of existing telecommunication systems (in both directions) or establish new relevant satellite telecommunications facilities for timely collection and distribution. Examples include, drifting buoys, profiling floats, XBTs. [JCOMM Operations Plan]

15. For both NWP (wind) and climate variability/climate change (sub-surface temperature profiles), it is recommended to extend the tropical mooring array into the tropical Indian Ocean at resolution consistent with what is presently achieved in the tropical Pacific and Atlantic Oceans. [JCOMM Operations Plan]

16. Ensure adequate coverage of wind and surface pressure observations from drifting buoys in the Southern Ocean in areas between 40°S and the Antarctic circle based upon adequate mix of SVPB (surface pressure) and WOTAN technology (surface wind). The pressure observations are a valuable complement to the high density surface winds provided by satellite.

17. For ocean weather forecasting purposes, improve timely delivery and distribute high-vertical resolution data for sub-surface temperature/salinity profile data from XBTs and Argo floats. [JCOMM Operations Plan]

18. For NWP purposes, increase coverage of ice buoys (500 km horizontal resolution recommended) to provide surface air pressure and surface wind data. [JCOMM Operations Plan]

Improved observations over tropical land areas

19. Enhance the temperature, wind and if possible the humidity profile measurements (from radiosondes, pilots and aircraft) in the tropical belt, in particular, over Africa and tropical America. There is evidence from recent impact studies with the radiosonde/pilot balloon network over the Indonesian/Australian region that such data give a better depiction of winds in the tropics and occasionally strongly influence the adjacent mid-latitude regions. [OSE-5]

New Observing Technologies

20. Demonstrate the feasibility of ground-based interferometers and radiometers (e.g. microwave) to be an operational subsystem providing continuous vertical profiles of temperature and humidity in selected areas.

21. Demonstrate the feasibility of Unmanned Aeronautical Vehicles (UAVs) to be an operational subsystem.

22. Demonstrate the feasibility of high altitude balloons to be an operational subsystem

Vision of the Surface-based Component of the GOS in 2015

It is envisaged that by 2015 the technical advances will have led to substantial innovations in the surface based components of the GOS. Measurements will be provided by automated systems, manual intervention and the role of humans in the observing chain will have been reduced to a minimum, and may not be required at all.

Automation will facilitate the targeting of data sensitive areas through an optimal operation of the upper air observing components, such as radiosondes, ASAP systems, and data collection from aircraft in flight and vehicles on the road.

Rawin sondes

Automated launches with computerised data processing and real-time data transmission at high vertical resolution. The network will have been optimised to provide the measurements for the calibration of satellite data and to provide the baseline observing system for ground-based vertical atmospheric profiling.

Aircraft observations

Fully automated observing system providing temperature, wind and humidity measurements of high-quality from the majority of the civilian aircraft, both in-flight and ascent/descent data at high temporal resolution. Tropospheric profile data will be available from most aerodromes around the world, including from the currently data void airports in Asia, Africa and South America.

Surface observations

From land and ocean observing platforms all measurements will be provided by automated systems. It is expected that the land areas will be covered by a network of sensors at a high spatial resolution, supporting local applications such as road weather. Such data will be of benefit to global and local NWP applications alike. Over the oceans, an adequate number of platforms (ship, buoys, moorings will be available to complement the satellite measurements.

Radar observing systems

Multiparameter scanning Doppler radars will enable hydrometeor identification and perhaps give information on their size distributions. This, in turn, will improve estimation of precipitation rate and accumulation. It will also assist in the initialisation of cloud physics parameters for NWP. Assimilation of high resolution reflectivity and radial velocity data will have reached the point of resolving the basic mass and wind structures of convective storms. Millimetre-wavelength radars will be able to observe multiple cloud layers, including the altitude of their bases and tops.

Data transmission

The fully automated observing system will produce data volumes which will exceed today's volumes by several orders of magnitude. Data communication technology is expected to have developed accordingly. The technical means to provide the appropriate and affordable communication will have become available. All observational data will be transferred by digital means in a highly compressed form. Data processing will be computerised entirely.

In summary

The rapid development of information technology in all areas of life will continue to give opportunities for obtaining and communicating observations as a by-product of systems installed (and paid for) for other purposes. Currently, AMDAR and GPS observations fall into this category and other examples will emerge and should be exploited in the future. It is likely that such observations will form an important part of a cost effective future GOS.

Table linking observed parameters with a given system of the surface-based component of the GOS. (If agencies pursue recommended actions and encourage indicated developments, the surface-based component of GOS would have the following characteristics)

System	Parameter	Action/Development
AMDAR	Vertical profiles of temperature and wind at airports Flight level data Vertical profiles of humidity	Increase coverage, increase vertical resolution Extend programme to short-haul, commuter and freight flights Study feasibility of adaptive use, demonstrate the need for high frequency data, in particular over Africa, South America Develop capability
TAMDAR	Vertical profiles of temperature and wind at regional airports	Develop the programme (currently undertaken by NASA), suitable for expansion to other regions, such as the Arctic, Siberia, etc.
Radiosondes	Vertical profiles of temperature wind and humidity	Optimise horizontal spacing of RAOBs and vertical resolution of reports and operation of subsystem (launch times, adaptive operation) Increase the availability over the oceans (ASAP, dropsondes, etc.)
Ozone soundings	Vertical profile of ozone	Integrate into GOS
UAVs	Spatial coverage and vertical profile of wind, temperature and humidity	Demonstrate feasibility of an operational subsystem; target areas for operation are the ocean storm tracks (planned in THORPEX)
High-altitude balloons deploying sondes	Vertical profile of temp, wind and humidity	Demonstrate feasibility of an operational subsystem
Drifting buoys	Surface measurements of temp, wind and pressure, SST	Extend coverage especially in SH based on SVPB and WOTAN technology

System	Parameter	Action/Development
Moored buoys	Surface wind, pressure, sub-surface temp profiles Wave height	Improve timely availability for NWP (monthly & seasonal forecasting) Extend coverage into Indian Ocean Provide data
Ice buoys	Ice temp, air pressure, temp and wind	Increase coverage
VOS	Surface pressure, SST, wind	Maintain their availability to provide complementary mix of observations
Ships of opportunity (SOOP)	Sub-surface temperature profiles (XBT)	Improve timely delivery and distribute high vertical resolution data
Sub-surface profiling floats Argo programme	Sub-surface temperature and salinity	Improve timely delivery and distribute high resolution data
Tide gauges (GLOSS)	Sea level observations	Establish timely delivery
SYNOP and METAR data	Surface observations of pressure, wind, temperature, clouds and 'weather' Visibility Precipitation Snow cover and depth Soil moisture	Exchange globally for regional and global NWP at high temporal frequency (at least hourly), develop further automation Ditto Ditto Distribute daily Distribute daily
Wind profiling radar	Vertical profile of wind	Distribute data
Scanning weather radar	Precipitation amount and intensity Radial winds, Velocity Azimuth Display (VAD)	Provide data, demonstrate use in hydrological applications (regional and global NWP) Demonstrate use in regional NWP Ensure compatibility in calibration and data extraction methods
Ground-based GPS	Column Water Vapour	Demonstrate real-time capability
Ground-based Interferometers and other radiometers (e.g. MW)	Time continuous vertical profile of temp/humidity	Demonstrate capability

GCOS MONITORING PRINCIPLES

Presume italic/roman formatting is correct. Also list below begins at 11 – is this taken from another document and parts omitted?

Furthermore, satellite systems for monitoring climate need to

Take steps to make radiance calibration, calibration monitoring and satellite-to-satellite cross-calibration of the whole operational constellation a part of the operational satellite system, *and* take steps to sample the Earth's system in such as way that climate relevant (diurnal, seasonal, and *long-term interannual) changes are distinguishable.*

Thus satellite systems should adhere to the following specific guidelines as much as possible: (old statements to be replaced are in brackets)

11 Strive to maintain constant sampling within the diurnal cycle (minimising the effects of orbital decay and orbit drift)
[Rigorous station-keeping should be maintained to minimise orbital drift.]

12 Determine and define inter-satellite biases (e.g. maintain reference measurements for sensor to sensor intercalibration)
[Overlapping observations should be ensured for a period sufficient to determine inter-satellite biases.]

13 Strive to assure appropriate continuity of satellite measurements (from possibly a variety of orbits) such that their precision can be fully utilised for climate monitoring.
[Satellites should be replaced within their projected operational lifetime (rather than on failure) to ensure continuity (or in-orbit replacements should be maintained).]

14 Assure rigorous pre-launch instrument characterisation and calibration, including radiance confirmation against an international radiance scale provided by a national metrology institute
[Rigorous pre-launch instrument characterisation and calibration should be ensured.]

15 Maintain on-board calibration adequate for climate system observations and monitor the associated instrument characteristics
[Adequate on-board calibration and means to monitor instrument characteristics in space should be ensured.]

16 Sustain operational production of priority climate products and introduce peer-reviewed new products as appropriate
[Development and operational production of priority climate products should be ensured.]

17 Establish and maintain data access systems needed to facilitate user access to climate products, metadata and raw data, including key data for delayed-mode analysis
[Systems needed to facilitate user access to climate products, metadata and raw data, including key data for delayed-mode analysis, should be established and maintained.]

18 Strive to maintain use of functioning baseline instruments that meet the calibration and stability requirements stated above for as long as possible, even when these exist on de-commissioned satellites
[Continuing use of still-functioning baseline instruments on otherwise de-commissioned satellites should be considered.]

19 Work with appropriate agencies to maintain complementary *in situ* baseline observations for satellite measurements
[The need for complementary *in situ* baseline observations for satellite measurements should be appropriately recognised.]

20 Strive to identify both random errors and time-dependent biases in satellite observations and derived products
[Network performance monitoring systems to identify both random errors and time-dependent biases in satellite observations should be established.]

APPENDIX B: GENERAL CGMS INFORMATION

CHARTER FOR THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES (CGMS)

PREAMBLE

RECALLING that the Coordination on Geostationary Meteorological Satellites (CGMS) has met annually as an informal body since September 1972 when representatives of the United States (National Oceanic and Atmospheric Administration), the European Space Research Organisation (now the European Space Agency), and Japan (Japan Meteorological Agency) met to consider common interests relating to the design, operation and use of these agencies planned meteorological satellites,

RECALLING that the Union of Soviet Socialist Republics (State Committee for Hydrometeorology), India (India Meteorological Department) and the People's Republic of China (State Meteorological Administration) initiated development of geostationary satellites and joined CGMS in 1973, 1978, and 1986 respectively,

RECOGNIZING that the World Meteorological Organisation (WMO) as a representative of the meteorological satellite data user community has participated in CGMS since 1974,

NOTING that the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) has, with effect from January 1987, taken over responsibility from ESA for the METEOSAT satellite system and the current Secretariat of CGMS,

CONSIDERING that CGMS has served as an effective forum through which independent agency plans have been informally harmonised to meet common mission objectives and produce certain compatible data products from geostationary meteorological satellites for users around the world,

RECALLING that the USA, the USSR, and the China have launched polar-orbiting meteorological satellites, that Europe has initiated plans to launch an operational polar-orbiting mission and that the polar and geostationary meteorological satellite systems together form a basic element of the space based portion of the WMO Global Observing System,

BEING AWARE of the concern expressed by the WMO Executive Council Panel of Experts over the lack of guaranteed continuity in the polar orbit and its recommendation that there should be greater cooperation between operational meteorological satellite operators worldwide , so that a more effective utilisation of these operational systems, through the coordination and standardisation of many services provided, can be assured,

RECOGNIZING the importance of operational meteorological satellites for monitoring and detection of climate change,

AND RECOGNIZING the need to update the purpose and objectives of CGMS,

AGREE

I. To change the name of CGMS to the Coordination Group for Meteorological Satellites

II. To adopt a Charter, establishing Terms of Reference for CGMS, as follows:

OBJECTIVES

a) CGMS provides a forum for the exchange of technical information on geostationary and polar-orbiting meteorological satellite systems, such as reporting on current meteorological satellite status and future plans, telecommunications matters, operations, intercalibration of sensors, processing algorithms, products and their validation, data transmission formats and future data transmission standards.

b) CGMS harmonises to the extent possible meteorological satellite mission parameters such as orbits, sensors, and data formats and down-link frequencies.

c) CGMS encourages complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning, compatible meteorological data products and services and the coordination of space and data related activities, thus complementing the work of other international satellite coordinating mechanisms.

MEMBERSHIP

d) CGMS Membership is open to all operators of meteorological satellites, to prospective operators having a clear commitment to develop and operate such satellites, and to the WMO, because of its unique role as representative of the world meteorological data user community.

e) The status of observer will be open to representatives of international organisations or groups who have declared an intent, supported by detailed system definition studies, to establish a meteorological satellite observing system. Once formal approval of the system is declared, membership of CGMS can be requested by the observer.

Within two years of becoming an observer, observers will report on progress being made towards the feasibility of securing national approval of a system. At that time CGMS Members may review the continued participation by each Observer.

f) The current Membership of CGMS is listed in an annex to this charter.

g) The addition of new Members and Observers will be by consensus of existing CGMS Members.

ORGANISATION

h) CGMS will meet in plenary session annually. Ad hoc Working Groups to consider specific issues in detail might be convened at the request of any Member provided that written notification is received and approved by the Membership at least 1 month in advance and all Members agree. Such Working Groups will report to the next meeting of CGMS.

i) One Member, on a voluntary basis, will serve as the Secretariat of CGMS.

j) Provisional meeting venues, dates and draft agenda for plenary meetings will be distributed by the Secretariat 6 months in advance of the meeting, for approval by the Members. An agreed Agenda will be circulated to each Member 3 months in advance of the meeting.

k) Plenary Meetings of CGMS will be chaired by each of the Members in turn, the Chairman being proposed by the host country or organisation.

l) The Host of any CGMS meeting, assisted by the Secretariat, will be responsible for logistical support required by the meeting. Minutes will be prepared by the Secretariat, which will also serve as the repository of CGMS records. The Secretariat will also track action items adopted at meetings and provide CGMS Members with a status report on these and any other outstanding actions, four months prior to a meeting and again at the meeting itself.

PROCEDURE

m) The approval of recommendations, findings, plans, reports, minutes of meetings, the establishment of Working Groups will require the consensus of Members. Observers may participate fully in CGMS discussions and have their views included in reports, minutes etc., however, the approval of an observer will not be required to establish consensus.

n) Recommendations, findings, plans and reports will be non-binding on Members or Observers.

o) Once consensus has been reached amongst Members on recommendations, findings, plans and reports, minutes of meetings or other such information from CGMS, or its Working Groups, this information may be made publicly available.

p) Areas of cooperation identified by CGMS will be the subject of agreement between the relevant Members.

COORDINATION

q) The work of CGMS will be coordinated, as appropriate, with the World Meteorological Organisation and its relevant bodies, and with other international satellite coordination mechanisms, in particular the Committee on Earth Observation Satellites (CEOS) and the Earth Observation International Coordination Working Group (EO-ICWG) and the Space Frequency Coordination Group (SFCG).

Organisations wishing to receive information or advice from the CGMS should contact the Secretariat; which will pass the request on to all Members and coordinate an appropriate response, including documentation or representation by the relevant CGMS Members.

AMENDMENT

r) These Terms of Reference may be amended or modified by consensus of the Members. Proposals for amendments should be in the hands of the Members at least one month prior to a plenary meeting of CGMS.

EFFECTIVE DATE AND DURATION

s) These Terms of Reference will become effective upon adoption by consensus of all CGMS Members and will remain in effect unless or until terminated by the consensus of CGMS Members.

MEMBERSHIP OF CGMS

The current Membership of CGMS is:

EUMETSAT	joined 1987, currently CGMS Secretariat
India Meteorological Department	joined 1979
Japan Meteorological Agency	founder member, 1972
China Meteorological Administration of the PRC	joined 1989
NOAA/NESDIS	founder member, 1972
Hydromet Service of the Russian Federation	joined 1973
WMO	joined 1973
IOC/UNESCO	joined in 2001

The table of Members shows the lead Agency in each case. Delegates are often supported by other Agencies, for example, ESA (with EUMETSAT), NASDA (with Japan Meteorological Agency) and SRC Planeta (with Hydromet Service of the Russian Federation).

TERMS OF REFERENCE FOR THE CGMS WORKING GROUP ON INTEGRATED STRATEGY FOR DATA DISSEMINATION FROM METEOROLOGICAL SATELLITES

Terms of Reference

For the CGMS Working Group on Integrated Strategy for Data Dissemination from Meteorological Satellites

***GOAL**:* *To establish an integrated data dissemination strategy which will maximise access to all data from all CGMS satellites, taking into account direct broadcast and alternative dissemination methods, and including appropriate transition strategies.*

In achieving this goal, the Working Group will:

1. *review CGMS satellite operation plans for data dissemination from present and planned satellite systems.*
2. *evaluate the potential volume of data to be disseminated.*
3. *evaluate Alternate Dissemination Methods (ADM) presently in effect.*
4. *consider WMO's requirement for an integrated strategy for data dissemination and ADM.*
5. *propose possible ADM.*
6. *propose interconnectivity between regional ADM.*

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LIST OF ABBREVIATIONS AND ACRONYMS

AboM	Australian Bureau of Meteorology
ABI	Advanced Baseline Imager (GOES-R)
ABS	Advanced Baseline Sounder (GOES-R)
ACARS	Automated Communications Addressing and Reporting System
ACC	ASAP Coordinating Committee
ADC	Atlantic Data Coverage
ADM	Atmospheric Dynamics Mission (ESA)
ADM	Alternative Dissemination Methods
AERONET	Remote-sensing aerosol monitoring network programme
AIRS	Advanced IR Sounder
AHRPT	Advanced High Rate Picture Transmission
AMDAR	Aircraft Meteorological Data Relay
AMS	American Meteorological Society
AMSU	Advanced Microwave Sounding Unit
AMV	Atmospheric Motion Vectors
AOPC	Atmospheric Observation Panel for Climate (GCOS)
APT	Automatic Picture Transmission
ARGOS	Data Collection and Location System
ASAP	Automated Shipboard Aerological Programme
ASCAT	C-band dual swath scatterometer (Metop)
ASCII	American Standard Code for Information Interchange
ASDAR	Aircraft to Satellite Data Relay
ATMS	Advanced Technology Microwave Sounder
ATOVS	Advanced TOVS
AVHRR	Advanced Very High Resolution Radiometer
BBC	Black Body Calibration (Meteosat)
BCCP	Business Continuity and Contingency Plan (USA)
BUFR	Binary Universal Form for data Representation
CAL	Computer Aided Learning
CBS	Commission for Basic Systems
CCD	Charged Couple Device (INSAT-2E)
CCIR	Consultative Committee on International Radio
CCSDS	Consultative Committee on Space Data Systems
CD	Compact Disc
CDMA	Code Division Multiple Access
CEOS	Committee on Earth Observation Satellites
CEPT	Conference Européenne des Postes et Télécommunications
CGMS	Coordination Group for Meteorological Satellites
CHRPT	Chinese HRPT (FY-1C and D)
CIIS	Common Instrument Interface Studies
CIMS	GOES Channel Interference Monitoring System
CIMSS	Cooperative Institute of Meteorological Satellite Studies, Univ. Wisconsin
CIS	Commonwealth of Independent States

CLASS	Comprehensive Large-Array Stewardship System (NOAA)
CLS	Collecte Localisation Satellites (Toulouse)
CMD	Cyclone Warning Dissemination Service
CMS	Centre de Météorologie Spatiale (Lannion)
CMV	Cloud Motion Vector
CMW	Cloud Motion Wind
COSPAR	Committee on Space Research
CPM	Conference Preparatory Meeting (WRC)
CrIS	Cross track Infrared Sounder
CRYOSAT	Polar Ice Monitoring Programme (ESA)
DAPS	DCS Automated Processing System (USA)
DCP	Data Collection Platform
DCS	Data Collection System
DIF	Directory Interchange Format
DMSP	Defense Meteorological Satellite Program (USA)
DOD	Department of Defense (USA)
DOMSAT	Domestic telecommunications relay Satellite (USA)
DPI	Derived Product Images (USA)
DPT	Delayed Picture Transmission
DRS	DCP Retransmission System (Meteosat)
DRT	Data Relay Transponder (INSAT)
DSB	Direct Soundings Broadcast
DUS	Data Utilisation Station (USA) (Japan)
DWS	Disaster Warning System (India)
EARS	ATOVS Retransmission Service
EBB	Electronic Bulletin Board
EC	Executive Council (WMO)
ECT	Equator crossing time
ECMWF	European Centre for Medium-Range Weather Forecasts
EDR	Environmental Data Records (NPOESS)
EEIS	EUMETSAT External Information System
EESS	Earth Exploration Satellite Service (Frequency Management)
ENVISAT	ESA future polar satellite for environment monitoring
EO	Earth Observation
EOS	Earth Observation System
EPS	EUMETSAT Polar System
ERBE	Earth Radiation Budget Experiment
ESA	European Space Agency
ESJWG	Earth Sciences Joint Working Group
ESOC	European Space Operations Centre (ESA)
ET-ODRRGOS	Expert Team on Observational Data Requirements and Redesign of the GOS
EU	European Union
EUMETSAT	European Meteorological Satellite Organisation
FAA	Federal Aviation Authority (USA)

FAO	Food and Agriculture Organisation (UN)
FAX	Facsimile
FWIS	Future WMO Information Systems (CBS Inter-Programme Task Team)
FXTS	Facsimile Transmission System (USA)
FY-1	Polar-orbiting Meteorological Satellite (PRC)
FY-2	Future Geostationary Meteorological Satellite (PRC)
FY-3	Future generation of Polar-orbiting Meteorological Satellite
GCOM	Global Change Observation Mission (NASDA)
GCOS	Global Climate Observing System
GDPT	Chinese Delayed Picture Transmission Format (Global Data) (FY-1C)
GIFTS	Geosynchronous Imaging Fourier Transform Spectrometer (GOES-R)
GIMTACS	GOES I-M Telemetry and Command System
GLOBUS	multichannel scanning radiometer (Meteor-3M N2)
GMES	Global Monitoring for Environment and Security (EU)
GMR	GOES-Meteosat Relay
GMS	Geostationary Meteorological Satellite (Japan)
GNSS	Global Navigation Satellite System
GOCE	Gravity Field and Steady State Ocean Circulation Explorer (ESA)
GOES	Geostationary Operational Environmental Satellite (USA)
GOMS	Geostationary Operational Meteorological Satellite (Russ. Fed.)
GOS	Global Observing System
GSLMP	Global Sea Level Monitoring Programme
GPCP	Global Precipitation Climatology Project
GPS	Global Positioning System
GRAS	GNSS Receiver for Atmospheric Sounding
GRIB	Numerical weather prediction data in gridpoint form, expressed in binary
GTS	Global Telecommunication System
GVAR	GOES Variable (data format) (USA)
HAPS	High Altitude Platform System
HDFS	High Density Fixed Service
HiRID	High Resolution Imager Data
HIRS	High Resolution Infrared Sounder
HR	High Resolution
HRD	High Rate Data (NPOESS, USA)
HRDCP	High Rate DCP
HRPT	High Rate Picture Transmission
HSRS	High Spectral Resolution Sounder (MSG)
ICI	Inversion Coupled Imager (India)
ICWG	International Coordination Working Group (EO)
IDCP	International DCP
IDCS	International Data Collection System
IDN	International Directory Network (CEOS)
IFRB	International Frequency Registration Board
IKFS-2	advanced IR atmospheric sounder
IMT-2000	International Mobile Telecommunication 2000 (before FPLMTS)

INSAT	Indian geostationary satellite
IPO	Integrated Program Office (NOAA)
IPOMS	International Polar-orbiting Meteorological Satellite Group
IPWG	International Precipitation Working Group
IR	Infrared
IRTS	Infrared Temperature Sounder (EPS)
ISCCP	International Satellite Cloud Climatology Project
ISADP	Integrated System for the ATOVS Data Processing
ISWMR	SAF Integrated Satellite Wind Monitoring Report (EUMETSAT)
ISY	International Space Year
ITT	Invitation to Tender
ITU	International Telecommunication Union
ITWG	International TOVS Working Group
IWW	International Winds Workshop
JMA	Japan Meteorological Agency
JRA-25	"Japanese Re-Analysis 25 years " JMA research project of long-range re-analysis of global atmosphere
KLIMAT	scanning Infrared radiometer on Meteor-3M N1 (Russia)
LDPT	Chinese Delayed Picture Transmission Format (Local Data Coverage) FY-1C
LR	Low Resolution
LRD	Low Rate Data (NPOESS, USA)
LRIT	Low Rate Information Transmission
LRPT	Low Rate Picture Transmission
LSPIM	Land Surface Processes and Interactions Mission (ESA)
LST	Local Solar Time
MAP	Mesoscale Alpine Experiment
MARF	Meteorological Archive and Retrieval Facility (EUMETSAT)
MBWG	MSG Biosphere Working Group
MCP	Meteorological Communications Package
MDD	Meteorological Data Distribution (Meteosat)
MDUS	Medium-scale Data Utilization Station (for GMS S-VISSR)
MetAids	Meteorological Aids Service (frequency regulation)
Metop	Future European meteorological polar-orbiting satellite
METEOR	Polar-orbiting meteorological satellite (CIS)
Meteosat	Geostationary meteorological satellite (EUMETSAT)
METSAT	Indian geostationary meteorological satellite
MetSat	meteorological satellite systems (frequency regulation)
MHS	Microwave Humidity Sounder (EPS)
MIEC	Meteorological Information Extraction Centre (ESOC)
MIVZA	microwave scanning radiometer (Meteor 3M N1)
MOCC	Meteosat Operational Control Centre (ESOC)
MODIS	Moderate resolution imaging spectroradiometer
MOP	Meteosat Operational Programme
MODIS	Moderate Resolution Imaging Spectroradiometer (NOAA)
MPEF	Meteorological Products Extraction Facility (EUMETSAT)

MSC	Meteorological Satellite Centre (Japan)
MSC-CAL	Computer Aided Learning system by MSC/JMA
MSG	Meteosat Second Generation
MSMR	Multichannel Scanning Microwave Radiometer (OCEANSAT-1=
MSS	Mobile Satellite Services (frequency regulation)
MSU	Microwave Sounding Unit
MTP	Meteosat Transition Programme
MTS	Microwave Temperature Sounder (EPS)
MTSAT	Multi-functional Transport Satellite (Japan)
MTVZA	microwave scanning radiometer (Meteor 3M N1)
MVIS	Multi-channel VIS and IR Radiometer (FY-1C and D of PRC)
NASA	National Aeronautics and Space Agency
NASDA	National Space Development Agency of Japan
NEDT	Noise Equivalent Delta Temperature
NESDIS	National Environmental Satellite Data and Information Service
NGDC	National Geophysical Data Centre (USA)
NGSO	Non-geostationary systems
NMC	National Meteorological Centre
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service (USA)
NPP	NPOESS Preparatory Project
NSMC	National Satellite Meteorological Center of CMA (PRC)
NTIA	National Telecommunications and Information Agency (USA)
NWP	Numerical Weather Prediction
NWS	National Weather Service (USA)
OCAP	Operational Consortium of ASDAR Participants
OCEANSAT	Indian satellite for ocean applications
OLR	Outgoing Longwave Radiation
OPAG-IOS	Open Programme Area Group in Integrated Observing Systems (successor of CBS WG on Satellites)
OSE	Operational System Experiments (ET-ODRRGOS)
OSSE	Observing System Simulation Experiments (ET-ODRRGOS)
OWSE-AF	Operational WWW Systems Evaluation for Africa
PC	Personal Computer
POEM	Polar-orbiting Earth Observation Mission (ESA)
POES	Polar-orbiting Operational Environmental Satellite (USA)
PRC	People’s Republic of China
PTT	Post Telegraph and Telecommunications authority
QI	Quality Indices (EUMETSAT)
RA	Regional Association of WMO
RAMSDIS	Menu-driven system for analysing digital satellite imagery (McIDAS, USA)
RAOBS	Radiosonde Observations
RASA	Russian Aviation and Space Agency

RDCP	Regional DCP (Japan)
RDR	Raw Data Records (NPOESS)
RMS	Root Mean Square
RMTC	Regional Meteorological Training Centre (WMO)
Rosaviakosmos	Russian Space Agency
RSMC	Regional Specialised Meteorological Centre
RSO	Rapid Scan Operations (NOAA)
RSS	Rapid Scan Service (EUMETSAT)
S&R	Search and Rescue mission
SAF	Satellite Application Facility (EUMETSAT)
SAFISY	Space Agency Forum on the ISY
SAM	Satellite Anomaly Manager
SARA	Short Range Automotive Radar (frequency management)
SARSAT	Search And Rescue, Satellite supported facility
SATOB	WMO code for Satellite Observation
SBUV	Solar Backscattered Ultra Violet (ozone)
SDR	Sensor Data Records (NPOESS)
SEAS	Shipboard Environmental (data) Acquisition System
SEC	Space Environment Center (NOAA)
SEM	Space Environment Monitor
SEVIRI	Spinning Enhanced Visible and Infrared Imager (MSG)
S-FAX	S-band facsimile broadcast of FY-2 (PRC)
SFCG	Space Frequency Coordination Group
SMA	State Meteorological Administration (PRC)
SMD	Stored Mission Data (NPOESS)
SMOS	Soil Moisture and Ocean Salinity (ESA)
SRF	Spectral Response Function
SRR	Short Range Radar (frequency management)
SRS	Space Research Service (frequency regulation)
SSM/I	Special Sensor Microwave/Imager (India)
SSP	Sub-Satellite Point
SST	Sea Surface Temperature
SSU	Stratospheric Sounding Unit
S-VISSR	Stretched VISSR
TD	Technical Document
TIROS	Television Infrared Observation Satellite
TOMS	Total Ozone Mapping Spectrometer
TOR	Terms of Reference
TOVS	TIROS Operational Vertical Sounder
TPW	Total Precipitable Water
TTC	Telemetry Tracking Control
U-MARF	United Meteorological Archive Retrieval Facility (EUMETSAT)
UHF	Ultra High Frequency
UK	United Kingdom
UMTS	Universal Mobile Telecom System
UN	United Nations
UNISPACE	Third United Nations Space Conference

UN-OOSA	UN Office of Outer Space Affairs
USA	United States of America
UTC	Universal Time Coordinated
UWB	Ultra Wide Band
VAS	VISSR Atmospheric Sounder
VHF	Very High Frequency
VIIRS	Visible Infrared Iamging Radiometer Suite
VIRSR	Visible and Infrared Scanning Radiometer (EPS)
VIS	Visible channel
VISSR	Visible and Infrared Spin Scan Radiometer
VL	Virtual Laboratory (USA training concept)
VLSI	Very Large Scale Integrated circuit
WARC	World Administrative Radio Conference
WCRP	World Climate Research Programme
WEFAX	Weather facsimile
WG	Working Group
WGNE	Working Group on Numerical Experimentation
WMO	World Meteorological Organization
WP	Working Paper
WRC	World Radio Conference
WV	Water Vapour
WVMW	Water Vapour Motion Winds
WWW	World Weather Watch
X-ADC	Extended Atlantic Data Coverage
Y2K	Year 2000 compatibility
ZAP	Z-axis Precession Mode (GOES)