W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

CONSULTATIVE MEETINGS ON HIGH-LEVEL POLICY ON SATELLITE MATTERS

SEVENTH SESSION

GENEVA, SWITZERLAND

19-20 JANUARY 2007

FINAL REPORT

Participants at the seventh session of the
WMO Consultative Meetings on High-level Policy on Satellite Matters

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session *(agenda item 1.1)*

1.1.1 The seventh session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-7) was held at the WMO Building from 19 to 20 January 2007 under the chairmanship of the President of WMO, Dr A.I. Bedritsky. The session was opened at 09h30 on Friday, 19 January 2007.

1.1.2 In the President's opening remarks, Dr A.I. Bedritsky, welcomed new participants to the WMO Consultative Meetings from the Centre National d'Etudes Spatiale (CNES), the Canadian Space Agency (CSA), the Japan Meteorological Agency (JMA), the Korean Meteorological Administration (KMA), the United States Geological Survey (USGS) and the Permanent Representative of France with WMO. He noted that the session was the fourth meeting of the WMO Consultative Meetings since it was formally established by a resolution of the Fourteenth WMO Congress and that the Fifteenth Congress will meet in May this year to consider recommendations from the session. He briefly reviewed some of the accomplishments that had occurred in the WMO Space Programme since its establishment such as: the expansion of the space-based component including a new Research and Development (R&D) constellation; the evolution of the Integrated Global Data Dissemination Service (IGDDS) which now provides near global coverage at megabyte speeds with plans for more complete coverage in the coming years; the Global Space-based Inter-calibration System (GSI*CS*) which will achieve initial operating capability in 2007 and will be a major contributor to the GOS. In concluding, he noted the valuable contributions made to WMO Members by space agencies and that WMO Members were deeply indebted for such a commitment.

1.1.3 In the WMO Secretary-General's remarks, Mr M. Jarraud noted that WMO Members continually stressed the growth in importance and use of satellite data, products and services in their National Meteorological and Hydrological Services. In particular, data access which has been greatly enhanced through the Integrated Global Data Dissemination Service. Data utilization has also experienced explosive growth and its potential is still considerable, in part because of the Virtual Laboratory for Education and Training in Satellite Meteorology as exemplified by the High Profile Training Event held last October that reached out to more than 2,000 participants worldwide in more than 120 WMO Member countries. He further noted that during the coming years WMO would be embarking upon major changes in the areas of observations and telecommunication systems. The WMO Strategic Plan for 2008 through 2011 contains eleven specific Expected Results. Within the strategic thrust area of Science and Technology Development and Implementation, one of the Expected Results is the establishment of a WMO Integrated Global Observing System (WIGOS) and another is the implementation of the WMO Information System (WIS) in which satellite systems would play a vital and pivotal role. He also noted that since the last session of the Consultative Meetings, a number of new operational and R&D satellites had been launched successfully, including ALOS, Cloudsat, CALIPSO, MTSAT-2, GOES-13, Metop-A, Resurs-DK and FY-2D. In concluding, he thanked the space agency organizations in their continuing efforts to support the objectives of the WMO Space Programme, for the benefit of all Members.

1.2 Adoption of the agenda *(agenda item 1.2)*

1.2.1 The agenda for the session was adopted and is reproduced in Annex I. The list of participants for the session is reproduced in Annex II.

1.3 Working arrangements for the session (*agenda item 1.3*)

1.3.1 The working arrangements for the session were agreed upon. It was also agreed that the work of the session would be conducted mainly in Plenary. The working languages of the session were English and Russian, and the documentation and report were in English only. The session

noted that documentation would follow the new format utilized by the WMO Executive Council, i.e. for agenda items there would be documents and reports. Reports would be background material (referred to as "BG" in the CM documentation) and would neither be presented nor discussed in the session. However, reports would be published (unedited) electronically on the WMO Space Programme web site. Thus, the session would only discuss agenda items 1, 6, 7, 8, 9, 10 and 11.

2. ACTIONS DERIVING FROM CM-6

2.1 The seventh session (CM-7) noted that all actions deriving from CM-6 with regard to the WMO Space Programme had been completed as indicated in BG. 2. BG. 2 is included in the CM-7 background material on the WMO Space Programme web site.

3. REVIEW EXPANSION OF THE SPACE-BASED COMPONENT OF THE GLOBAL OBSERVING SYSTEM AND STATUS SPACE-BASED GLOBAL OBSERVING SYSTEM AND EXPANDED MEMBERSHIP

3.1 CM-7 was informed on the status of activities to expand the space-based component of the Global Observing System as indicated in BG. 3. Appendix B of that document listed the status of satellites either contributing or with the potential to contribute to the GOS. BG. 3 is included in the CM-7 background material on the WMO Space Programme web site.

4. WMO SPACE PROGRAMME IMPLEMENTATION ACTIVITIES

4.1 CM-7 was provided an overview of recent and ongoing activities conducted for implementing the WMO Space Programme Implementation Plan for 2004-2007 as indicated in BG. 4(1). CM-7 noted with pleasure that there had been increased collaboration amongst the WMO Space Programme, the Coordination Group for Meteorological Satellites (CGMS) and the Committee on Earth Observation Satellites (CEOS) including a coordination of actions initiated by the three groups in response to the GCOS Implementation Plan. CM-7 was also informed on relevant GCOS and related climate matters as indicated in BG. 4(2). BG. 4(1) and BG. 4(2) are included in the CM-7 background material on the WMO Space Programme web site.

5. GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS)

5.1 CM-7 was informed of the status of WMO activities related to GEOSS as indicated in BG. 5. BG. 5 is included in the CM-7 background material on the WMO Space Programme web site.

6. OPTIMIZATION OF OPERATIONAL LOW EARTH ORBIT (LEO) SATELLITES

6.1 Optimization was understood as "how to best make use of available resources to achieve the goal". While the space-based GOS was initially designed with a focus on operational support for weather forecasting, it should now aim at wider goals in support of climate, atmospheric chemistry, and hydrology. With the increasing contribution of research and development (R&D), there was a compelling justification to review the system and seek optimization from a wider point of view, including a valuable and relevant role for the R&D space agencies.

6.2 Since a single space agency, whether operational or research-based, would not have the capability to address all of the WMO requirements, each agency normally defined and optimized its own missions according to its requirements and available resources. CM-7 agreed that the WMO Global Observing System (GOS) could satisfy more of the WMO observation requirements if the operational and R&D LEO satellite operators took into consideration the overall WMO satellite constellation as part of their planning process. In order to achieve global optimization, WMO must ensure that individual contributions are well coordinated, complement each other and provide a comprehensive response to overall needs. It is expected that in doing so the overall system will be sound and cost-effective. Optimization should include not only maximizing the benefits from already planned missions, but also adapting future plans.

6.3 As a prerequisite for relying on each other's missions, CM-7 agreed that data should be widely available and with consistent quality.

6.4 A striking example of an opportunity for optimization was that most of the future operational satellite sounding missions were either mid-morning (typically 9:30 to 10:30 Local Solar Time [LST], descending node) or early afternoon (typically 13:30 to 14:00 LST, ascending node) sun-synchronous orbits. Some adjustment of plans could allow a more efficient sampling of the atmosphere and better respond to WMO requirements, improving overall benefits. CM-7 noted that the missions to be fulfilled extended well beyond the core observations of cloud imagery and temperature/humidity profile and thus the required instrumentation would be distributed over a number of different platforms with different orbit types. As a result, optimization should also address which instrumentation could be flown on what orbit to ensure that both operational and research objectives are being met on all three orbits.

6.5 In order to address specific factors related to optimization of the space-based observing capability in LEO, CM-7 considered the following aspects: number and distribution of low Earth orbits; system robustness; and instrument performances. It reviewed recommendations and agreed on the following with respect to the particular types of instruments:

(i) A sounding package with a high priority on an Early Morning orbit - It is recommended that a mission initially planned for a mid-morning be moved to an early morning orbit.

(ii) Confirming the need for continuity of altimetry missions - CM-7 noted several valuable initiatives in this respect. European plans for GMES would include an altimetry mission aboard Sentinel-3 to be operated by EUMETSAT; ISRO and CNES were planning the SARAL mission in 2009 with the Altika altimeter; the Russian Federation was considering flying an altimeter on Meteor-M3 in 2010; furthermore NOAA and EUMETSAT had taken the initiative to provide continuity for high precision altimetry measurements beyond Jason-2 as part of the CEOS "Virtual Constellation" of ocean surface topography missions, in cooperation with other agencies. CM-7 supported the concept of a Virtual Constellation for ocean surface topography and encouraged space agencies to participate and contribute to its implementation.

(iii) Earth Radiation Budget measurements continuity was essential - CM-7 noted that CMA planned to fly ERBU on FY-3A with possible continuity on the follow-on spacecraft.

(iv) The need for sea surface wind observation by scatterometers should be partially met by the scatterometer aboard ISRO's Oceansat-2 which is planned to be launched in 2007 in addition to ASCAT on METOP.

(v) Radio Occultation Sounding (ROS) has a strong role to play as a complement to passive IR or MW sounding for the stratosphere and the high troposphere and showing significant potential lower in the atmosphere, as demonstrated with the operational use of data from the COSMIC constellation - CM-7 noted that GRAS would soon be operational on METOP, and that there were plans for similar instruments on Meteor-M (Radiomet) and on Oceansat-2 (ROSA) to be launched in 2007. CM-7 confirmed the recommendation to plan for continuity of ROS constellations.

6.6 CM-7 stressed that global optimization could only be achieved if data were openly available in a timely manner. It recognized that near-real time availability would not only benefit operational users but also research programmes relying on near-real time data assimilation. Areas of optimization should include improving data access, data dissemination, data formats, and coordinated operation of ground segment.

6.7 Harmonized data quality was another prerequisite for global optimization, and this should be achieved through precise and globally consistent calibration, continuity, and reliability standards for processing. Consistent calibration is addressed in the framework of the Global Space-based Inter-calibration System (GSICS) and would also benefit CEOS Cal/Val activities.

6.8 CM-7 strongly supported the proposal to convene a second workshop on optimization, with participation of both operational and R&D agencies, in order to assess scenarios in more details and refine the recommendations. CM-7 was informed of the recent outcome of a decadal survey on NASA, NOAA and the USGS Earth Observation missions that would provide input to the analysis.

6.9 The role of the WMO Space Programme was particularly important in facilitating such discussions that have potentially a large impact on the overall efficiency of the space-based observation investment to meet global requirements.

6.10 CM-7 stressed the need to raise these issues at the highest level of WMO and to seek commitments from WMO Members to address the recommendations in their actual mission planning.

7. INTERNATIONAL GEOSTATIONARY LABORATORY'S FUTURE MISSIONS (IGEOLAB)

7.1 CM-7 noted that the thirty-fourth session of the Coordination Group for Meteorological Satellites (CGMS-XXXIV) had discussed the status for the development of the IGeoLAB concept taking into consideration the request by CM-6 to the WMO Space Programme to consider further advancements. CM-7 recalled that two test cases had been selected:

- GIFTS (Geostationary Imaging Fourier Transform Spectrometer), for frequent profiling of atmospheric temperature, humidity, and wind through infrared spectroscopy;

- GOMAS (Geostationary Observatory for Microwave Atmospheric Sounding), for frequent observation of precipitation by sounding in the millimetre and submillimetre wave ranges.

7.2 CM-7 noted several meetings related to GIFTS and GOMAS had taken place, and scientific and technical work had made considerable progress.

7.3 However with regard to GIFTS, a considerable amount of funding was required to upgrade the EDU to a flight model. Although high-level exchange of correspondence had taken place amongst ROSCOSMOS, NASA/NOAA and WMO, and in spite of great interest manifested at CM-6 in Buenos Aires, so far the situation of financial resources to upgrade the EDU into a flight model had not been solved.

7.4 With regard to GOMAS (now called "GEO-Microwave"), the basic issue of identifying a 'lead space agency' has not been solved, since GOMAS had failed to be selected by ESA as a candidate for the next Earth Explorer core mission. As a consequence of the absence of any plan to actually implement a space mission, funding of airborne campaigns and scientific studies to accumulate evidence in support of pressing for a space mission was virtually impossible. A Focus Group meeting (FG-3), held in Geneva on 29 August 2006, focused uniquely on identifying a new 'lead space agency' and defining a new roadmap. It was noted that, for the time being, the only known consideration for a MW radiometer in GEO was in China, with the next generation of geostationary satellites, FY-4, specifically the 'M' (microwave) series to be parallel to the 'O' (optical) series. However, the FY-4 planning was currently at a very early stage of defining objectives and instrument types.

7.5 CM-7 also noted CGMS-XXXIV had considered new test cases to be introduced, following GIFTS and GEO-Microwave. In noting document CGMS-XXXIV ROSC WP-04 ("Space monitoring of earth high-altitude regions by Electro-L type satellites in Molniya orbit"), CGMS-XXXIV recalled a proposal aiming to place an IR imager with water vapour channels for high-latitude winds determination following the experience carried out with MODIS. The discussion that followed recorded that at least ROSCOMOS, ROSHYDROMET and EUMETSAT were interested in investigating the possible applications of Molniya orbits.

7.6 CM-7 was informed on ROSCOMOS and ROSHYDROMET preliminary plans for the Arctica project that would involve two satellites on highly elliptical orbit with an inclination of 63° and an orbital period of 12 hours. This configuration would allow a quasi permanent coverage of high-latitude areas for weather, ice and snow monitoring as well as for telecommunications and data collection. Based on its own experience, ROSCOMOS and ROSHYDROMET were convinced of the interest of this concept which could be implemented in a cost-effective way if sufficient support could be mobilized through international cooperation.

7.7 The following four recommendations were submitted to CM-7 for consideration, the outcome of these discussions being recorded after the list.

1) Relevant CM-7 satellite operators to indicate activities that could be undertaken to unblock the situation enabling upgrading the GIFTS EDU to flight model and thus also unblocking several CGMS members willing to contribute to the project once the core space segment issue is resolved.

2) CM-7 satellite operators that are considering or may consider microwave missions in geostationary orbit to accelerate their decisional process and identify a 'lead space agency' as soon as possible; and invites all Members, including user-oriented ones, to prepare contributions to the IGeoLab GEO-Microwave initiative following the identification of the 'lead space agency'.

3) CNSA/CMA to confirm their intention to organize the 4th IGeoLab GEO-Microwave Focus Group meeting (FG-4) in China, with a goal to review scientific and technological elements in support of a possible Chinese undertaking in respect of FY-4M.

4) ROSCOSMOS/ROSHYDROMET to confirm their intention to convene a Task Group to determine the interest of CM space agencies for an IGeoLab mission based on Molniya orbits.

7.8 CM-7 reaffirmed the value of the IgeoLab concept, which is to share resources for demonstration flights of advanced payload on geostationary missions, known to be particularly expensive. CM-7 confirmed the importance of pursuing demonstration missions for advanced geostationary sounders, both hyperspectral infrared and microwave.

7.9 Regarding hyperspectral sounding from geostationary orbit, CM-7 requested the WMO Space Programme to convene a new discussion with all potential partners in following the established IgeoLAB process.

7.10 As concerns GEO microwave, CMA recalled that FY-4M was at an early stage of definition and that such a challenging project would benefit broad international cooperation. CMA thus confirmed its intention to organize the 4th IgeoLab GEO-Microwave Focus Group meeting (FG-4) in China, tentatively from 12 to 13 April 2007. CM-7 welcomed this offer, encouraged all interested agencies to facilitate participation of the relevant experts in FG-4, with the expectation that this meeting would allow *inter alia* to identify a lead space agency for the IgeoLab GEO-Microwave initiative.

7.11 CM-7 expressed a strong support to the idea of expanding the scope of IgeoLab in order to use the IgeoLab framework for a demonstration mission based on Molniya orbit. Initiating such a project seemed particularly appropriate in the context of the International Polar Year (IPY) as it would pave the way for possible long-term sustained missions providing quasi-permanent coverage of the polar regions. The Russian Federation and the Space Programme were thus urged to rapidly convene a Task Force to review the possible scope of a cooperative undertaking around this concept before April 2007, and CM-7 noted that NOAA, EUMETSAT and CSA expressed preliminary interest to participate.

8. WMO'S ROLE IN THE TRANSITION FROM RELEVANT R&D INSTRUMENTS TO OPERATIONAL MISSIONS

8.1 CM-7 recalled that previous WMO Consultative Meetings had addressed the importance of the participation of research and development (R&D) space agencies in WMO's Space Programme. There would be many benefits of this participation including timely access to data from research missions for WMO Members in support of WMO goals. Participation of the R&D space agencies could also benefit the WMO planning process, by including, where appropriate, space agency plans for research and development missions and plans for the migration or transition of these missions into operational missions.

8.2 CM-7 noted that Earth-directed research and development missions from space were funded for a variety of reasons, including the development and demonstration of new technologies, the pursuit of basic research, and the demonstration of operational utility. CM-7 agreed that its discussion on the transition from relevant R&D instruments to operational missions would focus on the demonstration of operational utility. In doing so, CM-7 wished to highlight the advantage for research programmes to identify operational requirements as one of the reasons to fund research missions and to plan, with their operational counterparts, for the transition of those research missions into operational missions.

8.3 CM-7 noted that there were several outcomes associated with the transition of satellite research into operations that would be relevant to WMO programmes. The first outcome would be to advance the state of traditional weather analyses and forecasting on the part of the operational meteorological centres in the WMO system by improving the observations, as well as the science, modelling capabilities, etc.

8.4 In many cases, the improvement of satellite observations would be a major contributor to overall operational centre improvements. Satellite observation improvements could be achieved through hardware improvements on new spacecraft or by investing in algorithm development in existing satellite data streams. While operational agencies already invested in the latter, operational satellite operators did not usually have the resources or the mandate to fund new research space missions or the components of these missions, such as the instruments.

8.5 Therefore, CM-7 agreed without space agency R&D programmes, there would be only limited advances in operational programmes. This relationship between research and operational space agencies had worked fairly well in the last decade or two for more traditional meteorological instruments placed on satellite missions in the low earth orbit. For example, new atmospheric sounders and imagers had been developed such as EUMETSAT's SEVIRI and IASI. However, in that same time period the geostationary meteorological research programme had lagged. For example, investments in geostationary atmospheric sounders and microwave instrumentation have been lacking.

8.6 Another outcome of transitioning appropriate research into operations relevant to WMO programmes would be to address the several disciplines within WMO, but outside the primary weather forecast programmes - including climate, ocean, atmospheric chemistry, and hydrology - that benefit from improvements to satellite observations. While each of these disciplines had

satellite and *in situ* components, without advances in satellite observing, the goals and objectives of these WMO programmes could not be met.

8.7 CM-7 noted that there were challenges in transitioning research into operations for these disciplines. First, operational users had found it difficult to finance research satellite missions as well as to work with non-operational data streams. In some cases, such funding had been possible to identify. Consequently, for such observations, there were limited operational advocates because there were only partial demonstrations of their value in an operational forecast setting. Second, research sponsors of observing systems may not be mandated to fund satellite ground systems - although may do so on a best effort basis and working together with operational agencies' infrastructure - to allow timely data availability of satellite observations to operational centres so that their value to operational services could be assessed. Making such connections between research and operations could be facilitated by the exchange of staff between research and operational centres and/or instituting training programmes to show how new sources of data could be utilized operationally.

8.8 CM-7 then discussed a number of issues that should be addressed and could help plan for the eventual transition of valuable research missions into operational missions:

8.8.1 **Research Agency**

- Before justifying a research mission, there should be a close collaboration between the operational users and the research agency to be sure the research agency addresses some research missions of relevance to the operational users - taking into consideration the relevance for one-of R&D missions that should not necessarily transition to operational systems. In doing so, operational space agencies should have the opportunity to inform the requirement setting process.

- Implement the research mission:
  - Demonstrate the technology – show that it *works;*
  - Retrieve geophysical products – *It is noted that there is a need for data formats that will be compatible with operational systems once they become operational;*
  - Demonstrate scientific utility – show that the products are *useful. This should have operational user involvement where appropriate;*
  - For some operational demonstrations, the use of R&D instruments or their derivatives should be a central consideration.

8.8.2 **Research & Operational Agencies**

- Conduct demonstrations in a setting to entrain operational users:
  - Supply access – timely down-linking and product generation;
  - Provide knowledge of, and tools for, using those products:
  - Demonstrate real and potential benefits – satisfy operational user needs and show value.

- Encourage access to data for research use in order to facilitate the development of improved operational products.

8.8.3 **Operational Agency**

- Justify an operational mission based on costs and benefits.

- Implement the new or modified systems with a means to ensure continuity and data access based on user requirements. New data dissemination systems should be considered from the very beginning, e.g. IGDDS.

- Optimize the performance of the operational system.
  - Maintain scientific community involvement to validate operational products.

8.9 CM-7 discussed various aspects in the transition from relevant R&D instruments to operational missions. CM-7 felt that an impediment to a well-structured and mutually agreed transition was the question of participation by operational agencies in the early R&D decision process and shortly thereafter. CM-7 noted that financial challenges and institutional mandates compounded the issue and were common to many organizations represented by the space agencies.

8.10 Despite the impediments, CM-7 agreed that improvements were possible. It further suggested that WMO could help facilitate enhanced cooperation in the transition from relevant R&D instruments to operational missions by preparing guidelines on the transition. It recalled a set of guidelines for the participation of appropriate R&D missions in the space-based component of the GOS had been developed by a previous session of the Consultative Meetings and that it had proven especially helpful. It agreed that the guidelines should describe the benefits for transition by addressing issues that should be considered early in the transition process including data access, transition principles of operation, timetables and the need for user input.

8.11 With regard to NWP, CM-7 discussed facilitating the pre-operational use of R&D instrument data in NWP centres world-wide, particularly ones located in less developed countries. Such NWP centres should be encouraged to improve assimilation of derived products from R&D missions into NWP models. Data users at such centres could also benefit from more participation in relevant conferences and seminars. WMO could facilitate such interactions by supporting working level scientists at the NWP centres and by also facilitating the availability of data and products to NWP users in near real-time.

8.12 CM-7 also noted the suggestion that the WMO Space Programme review and consider Action C-16 from the CEOS report prepared in response to the GCOS Implementation Plan to facilitate and ensure appropriate coordination and cooperation.

8.13 Thus, CM-7 requested the WMO Space Programme to support a Task Force with a representative from an operational meteorological space agency and a representative from a R&D space agency that would develop draft guidelines for the transition from relevant R&D instruments to operational missions. EUMETSAT and NASA agreed to contribute to the Task Force. CM-7 expressed the desire to develop and approve the guidelines by correspondence by mid-summer 2007 with the expectation that the GEO Summit in November 2007 could be informed.

9. INTERNATIONAL CHARTER ON SPACE AND DISASTERS

9.1 CM-7 recalled that the sixth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-6) had discussed the International Charter on Space and Major Disasters to include the potential for WMO Members to serve as an authorized triggering national authority. CM-6 had agreed that the issue of access to the International Charter by NMHSs of WMO was complex and that more information was required before an appropriate response could be formulated by the WMO Consultative Meetings. Thus, CM-6 had requested the WMO Space Programme to further research all relevant and related issues and provide the next session with a discussion paper and a proposed WMO approach with regard to the International Charter.

9.2 CM-7 noted an analysis made by the WMO Secretariat on the effectiveness of the International Charter on Space and Major Disasters based on Charter Executive Secretariat Annual Reports for 2004 and 2005. The analysis of the activations for 2004 and 2005 indicated that there were normally two types of major disasters, hydro-meteorological (hurricanes, floods,

etc.) or seismic (earthquake, tsunamis, etc.). For those related to hydro-meteorological, the activating authority had been either a national civil protection authority, a Charter member itself, or the United Nations normally through either the United Nations Office on Outer Space Affairs (UNOOSA) or the UN-OCHA. It was readily apparent that the activation process was well-established, effective, timely and efficient. Thus, CM-7 agreed that the Natural Disaster Prevention and Mitigation Programme Office (DPM) should inform WMO Members of the existence and purpose of the International Charter on Space and Major Disasters and its utilization of civil protection agencies as national focal points; and that the WMO DPM Programme should inform the International Charter on Space and Major Disasters Executive Secretariat on issues relevant to the Charter as they emerge.

9.3 CM-7 also noted that the 2006 Annual Report by the Charter Executive Secretariat would be available soon and that two commercial high resolution data providers (GeoEye and Digital Globe) had expressed a willingness to provide data for natural disasters. CM-7 agreed that cooperation in the provision of disaster support data was essential and that the International Charter played an essential role. CM-7 expected that the WMO Space Programme would continue to support all WMO Programmes in meeting their needs for disaster risk management.

10. REGIONAL SPECIALIZED SATELLITE CENTRE ON CLIMATE MONITORING

10.1 CM-7 discussed a proposal (see Annex III) by EUMETSAT for a high-level concept of a global network of Regional Specialized Satellite Centres as specific Centres of Excellence on the thematic area of operational climate monitoring (RSSC-CM). CM-7 noted that the concept would directly address the requirements of the Global Climate Observing System (GCOS) for products and services initiated and endorsed by a WMO constituent body. The network would be largely based on and exploit existing infrastructure and operational activities. It would utilize both environmental R&D and operational meteorological space agencies' data, as well as operational activities of the Global Space-based Inter-calibration System (GSICS). The goal of a global network of RSSC-CMs would be the sustained and operational provision of high-quality data for the Essential Climate Variables (ECV products) on a global scale which are specified in the GCOS Implementation Plan and its satellite supplement.

10.2 CM-7 was informed that GCOS expressed its appreciation for the strong response to the satellite component of the GCOS Implementation Plan made by space agencies through CEOS and CGMS, as well as through the WMO Space Programme. GCOS welcomed in particular the high-level concept of a global network of RSSC-CMs proposed by EUMETSAT, and looked forward to participating in refining this concept.

10.3 Thus, CM-7 noted the high-level concept and thanked EUMETSAT for the proposal. Although the proposed timetable was ambitious, CM-7 strongly urged all participants to work towards development and approval of an Implementation Plan before the forthcoming GEO Summit. Such approval could be achieved through correspondence by the WMO Space Programme to CM participants in the global network of RSSC-CMs. CM-7 also agreed that the course of actions in developing the Implementation Plan would help to clarify specifics for the various roles for the global network and its new potential components. CM-7 agreed that in order to take advantage of existing centres, the global network could include virtual centres, each of them having several or many physically distinct components.

10.4 CM-7 was convinced that based on the anticipated success and value-added by a RSSC-CM Network, satellite operators contributing to the space-based component of the WWW GOS should consider "Centres of Excellence" in other application areas such as ocean monitoring and atmospheric chemistry monitoring.

11. DRAFT WMO SPACE PROGRAMME IMPLEMENTATION PLAN FOR 2008-2011

11.1 CM-7 considered a draft WMO Space Programme Implementation Plan for 2008-2011. CM-7 recalled that WMO Space Programme activities were currently pursued in the framework of the WMO Space Programme Implementation Plan for 2004-2007 that had been adopted by its fourth session (CM-4), and of the WMO Space Programme Long-term Strategy approved by the fifty-sixth Executive Council and included in the Fourteenth WMO Congress approved Sixth Long-term Plan (6LTP).

11.2 CM-7 was informed that the fifteenth WMO Congress in May 2007 would discuss the future WMO Strategic Plan for 2008 onwards. It noted that the WMO Space Programme Implementation Plan for 2008-2011, described the main proposed activities by which the WMO Space Programme would be expected to contribute to the WMO Strategic Plan in this timeframe. CM-7 also noted that it would also be used as strategic guidance to develop and implement the Space Programme Operating Plan.

11.3 CM-7 reviewed the proposed outline of the Implementation Plan and expressed guidance in particular on the relevance of proposed objectives and activities, in view of the expected benefit for WMO Members, priorities to be assigned, if relevant, among these objectives and activities; and the adequacy between activities and resources.

11.4 CM-7 discussed the need for the WMO Space Programme to continue its efforts to enhance data access through further development of the Integrated Global Data Dissemination Service (IGDDS). CM-7 recalled that IGDDS, as a component of the WMO Information system (WIS), had been declared by WMO Members as a contribution to the Global Earth Observation System of Systems (GEOSS). To date, NOAA, EUMETSAT and CMA were contributing to IGDDS through interconnected DVB dissemination systems and these dissemination systems were now opened to other Societal Benefit Areas under the GEONETCast initiative. CM-7 strongly encouraged other space agencies, including those from Canada, Japan and the Russian Federation, to considered participation in IGDDS and GEONETCast in order to achieve a truly global system capable of greatly enhanced access for not only data relevant to WMO Members but also other GEO Societal Benefit Areas. CM-7 was pleased to be informed that an IGDDS Implementation Plan had been developed and had served as the basis for a GEONETCast Implementation Plan. It suggested that the Space Programme Implementation Plan should include a reference to the Implementation Plans of the various related projects.

11.5 CM-7 noted that the draft WMO Space Programme Implementation Plan included space weather in support of space agencies' requirements. CM-7 noted that several space agencies were already involved in space weather in response to national mandates including energy, aviation and spacecrafts although there was not an identified intergovernmental body with responsibility for space weather. Thus, it requested the WMO Space Programme to consider the appropriate scope and breadth for space weather within the WMO Space Programme. It suggested the WMO Space Programme utilize the services of a consultant to evaluate space weather in a WMO context and propose an appropriate role for the WMO Space Programme. The future role for the WMO Space Programme with regard to space weather could be reviewed by the Consultative Meeting at its next session. CM-7 considered it appropriate to establish an ad hoc Working Group headed by Dr Tillmann Mohr with participation by NOAA, ROSHYDROMET, CMA and other NMHSs of satellite operators to elaborate recommendations on this particular matter.

11.6 CM-7 expressed its strong agreement that the WMO Space Programme had been extremely effective during 2004-2007. Since its establishment, the WMO Space Programme had provided ample proof of the value added by the new major Programme as evidenced by its many achievements. In particular, CM-7 noted: the strengthened space-based component of the GOS including GSICS; the initial data access capability now available from IGDDS including ATOVS data through the RARS; and the tremendous success of the High Profile Training Event

that reached out to more than 2,000 participants worldwide in more than 120 WMO Member countries. The many accomplishments were also a strong indication that the Programme was well-focussed and provided WMO Members with the ability to enhance utilization of satellite data, product and services. CM-7 also agreed that the draft WMO Space Programme Implementation Plan for 2008-2011 was again well-balanced with appropriate priorities to respond to the anticipated advances in the space-based component of the GOS.

11.7 However, CM-7 was strongly of the opinion that available staff resources were significantly below that required to meet the expected results for the Programme. Thus, it strongly encouraged the Secretary-General to consider increasing staff resources in the Space Programme Office.

12. ANY OTHER BUSINESS

12.1 International Polar Year (IPY) 2007-2008

12.1.1 CM-7 considered recommendations from the IPY Space Task Group (STG). It noted that STG was a body tasked with addressing how to meet the space observation requirements for IPY. STG was comprised of nominated representatives of space agencies, and WMO provided the IPY Secretariat. The basis of the work had been consolidation of observational requirements as defined through individual Space Agency Announcement of Opportunities, the IGOS-P Cryosphere Theme, WCRP CliC and other institutional requirements obtained via an IPY survey.

12.1.2 CM-7 noted that IPY STG was well posed to finalizing the concept of an effective space component of an observing system for the polar regions during IPY. This would deliver a series of "firsts", including:

- For the first time, pole to coast multi-frequency InSAR measurements of ice-sheet surface velocity;
- For the first time, repeat fine-resolution SAR mapping of the entire Southern Ocean sea-ice cover for sea ice motion;
- For the first time, one complete high resolution visible and thermal IR (Vis/IR) snapshot of circumpolar permafrost; and
- For the first time, pan-Arctic high and moderate resolution Vis/IR snapshots of freshwater (lake and river) freeze-up and break-up.

12.1.3 In terms of how these "firsts" would be delivered, space agencies had introduced the concept of IPY data portfolios. Each space agency will identify data that will be made available to IPY scientists as part of its portfolio. The intention is to provide open and easy access to these portfolios for scientific use. The content of the portfolios will evolve through STG coordination of planning, acquisition, downlink and processing during IPY and beyond, as a legacy.

12.1.4 One of the key issues discussed by STG was how to secure the legacy of a long term observing system. This legacy should include high-level products resulting from the science of IPY, e.g. high spatial resolution digital terrain maps of the polar regions. One approach that could be considered for long term security of the IPY legacy would be to establish a link to GEO.

12.1.5 CM-7 endorsed a number of STG Actions and Recommendations as follows:

- STG Rec 3: WMO Space Programme to coordinate ground receiving station activities for polar orbiters through CGMS, to ensure that we have guaranteed full polar coverage, as appropriate, at 1km res. for AVHRR during IPY;

- STG Rec 4: WMO Space Programme to extend polar region coverage of geophysical products to maximum extent possible, generated from geostationary data;

- STG Rec 5: WMO Space Programme, GEO, CGMS and CEOS to advance the use of Molniya orbit, to provide pseudo GEO (high resolution spatio-temporal) polar coverage. (CM-7 recalled that it had agreed, as a new test proposal for IGEOLAB, to pursue a potential Russian "Arktica" mission.); and

- STG Rec 8: WMO-ICSU Joint Committee for IPY to decide how to interact with GEO to develop long-term perspective on implementation of a sustained observing system for the polar regions, as a legacy of IPY.

12.1.6 With regard to STG Rec 5, CM-7 agreed that an announcement for use of the Molniya orbit as a new test proposal for IGEOLAB in pursuing a potential Russian "Arktica" mission should be made during opening ceremonies for IPY. Such a future mission could be an IPY legacy observing system.

12.2 Frequency of Consultative Meetings

12.2.1 CM-7 considered the interval between sessions of the Consultative Meetings. In particular, it considered if the nominal interval of one year between sessions should be extended to two or three years. Some CM-7 participants proposed that a two-year interval, starting immediately in order to remain in sequence for subsequent sessions of the WMO Congress, was appropriate. Other CM-7 participants proposed that the present one-year interval was appropriate due to need for coordination and oversight afforded through the CMs. The Chairman suggested since the Fifteenth WMO Congress would be making decisions of relevance to the WMO Space Programme that it could provide further guidance.

13. CLOSURE OF THE SESSION

13.1 In closing, the Chairman reviewed the many accomplishments made during CM-7. He stressed the importance of international coordination and cooperation prevalent during CM-7 discussions. He was confident that CM-7 recommendations would be valuable input to the Fifteenth WMO Congress. He then closed the session at 13h30 on Saturday, 20 January 2007.

ANNEX I

AGENDA

1. ORGANIZATION OF THE SESSION
   - 1.1 Opening of the session
   - 1.2 Adoption of the agenda
2. ACTIONS DERIVING FROM CM-6
3. REVIEW EXPANSION OF THE SPACE-BASED COMPONENT OF THE GLOBAL OBSERVING SYSTEM AND STATUS SPACE-BASED GLOBAL OBSERVING SYSTEM AND EXPANDED MEMBERSHIP
4. WMO SPACE PROGRAMME IMPLEMENTATION ACTIVITIES
5. GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS)
6. OPTIMIZATION OF OPERATIONAL LOW EARTH ORBIT (LEO) SATELLITES
7. INTERNATIONAL GEOSTATIONARY LABORATORY'S FUTURE MISSIONS (IGEOLAB)
8. WMO'S ROLE IN THE TRANSITION FROM RELEVANT R&D INSTRUMENTS TO OPERATIONAL MISSIONS
9. INTERNATIONAL CHARTER ON SPACE AND DISASTERS
10. REGIONAL SPECIALIZED SATELLITE CENTRE ON CLIMATE MONITORING
11. DRAFT WMO SPACE PROGRAMME IMPLEMENTATION PLAN FOR 2008-2011
12. ANY OTHER BUSINESS
13. CLOSURE OF THE SESSION

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ANNEX II

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ANNEX III

EUMETSAT Proposal for a global network of Regional Specialized Satellite Centres on Climate Monitoring (RSSC-CM)

The setup of a distributed global network of Regional Specialized Satellite Centres on Climate Monitoring (RSSC-CM) was recommended to contribute to the requirements of GCOS in a cost-effective manner. CM-7 noted that a single RSSC-CM could be an organization (Operational Agency, Met Service), a Research Institute, a Data Centre, or a newly formed entity as well as a network of those elements. Each RSSC-CM would be represented by a RSSC-CM Manager; and the group of managers would form the RSSC-CM Board. The global network of RSSC-CMs would also include a Secretariat, tasked with the overall coordination and management of the RSSC-CM activities, and a Steering Group being responsible for monitoring and evaluation of the Global Network of RSSC-CMs.

The main tasks of each RSSC-CM as proposed would be to:

- Process satellite data to high-level derived climate products (Thematic Climate Data Records) related to Essential Climate Variables (ECV) in the assigned area of responsibility (geographical area, theme, data record) with consistent and high quality, applying state of the art algorithms and bearing in mind GCOS Climate Monitoring Principles,
- Deliver the products in agreed definition formats,
- Conduct validation studies,
- Conduct necessary research for continuously improving algorithms and to develop new products,
- Develop infrastructure to contribute to reanalysis and reprocessing of historical satellite data records,
- Document the algorithms, datasets and validation results, and
- Support the overall RSSC-CM Network Management.

Further elements of the global network as proposed would be:

- Exchange of information, data and algorithms among the centres and with users,
- Standardization (formats, projections, definitions),
- Archiving and dissemination (distributed archive, centralized archive of meta data),
- Interaction with other bodies (most importantly with the WMO Space Programme, GCOS, GSICS, satellite operators, research institutes),
- Involvement of users (end users, climate research community), and
- Capacity building.

The expected benefits and value-added from a global network would be:

- Monitoring of the evolving coverage in terms of space and climate relevant parameters (ECVs),
- Facilitate the identification of gaps and mechanism to close them,
- Effective generation of derived climate products due to exchange of data, information, tools and algorithms,
- Prevention of duplication of efforts,
- Maximum exploitation of existing expertise and infrastructures through a synergetic approach,
- Coordinated re-processing and re-analysis activities,
- Combined efforts to achieve global coverage,
- Consistent and high quality of derived climate products,
- Continuous research and operations,
- Coordination of validation activities,

- Capture the needs through direct involvement of users and the climate research community,
- Strengthening of national and international infrastructures,
- Facilitating cost-effective exploitation by ensuring responsibilities and activities are distributed in the most appropriate way.

CM-7 noted with appreciation that EUMETSAT was willing to contribute to the setup of the global network of RSSC-CMs on the basis of the assets available from its operational programmes, including the Satellite Application Facilities (SAF) Network. In particular, the main elements that would contribute to the setup of the RSSC-CMs of WMO Region VI would be:

- The products and activities of the EUMETSAT Central Facilities and of the Satellite Application Facilities on Climate Monitoring, to be seen in conjunction with the activities relevant to climate monitoring and the products operationally generated by other SAFs (Ocean and Sea Ice SAF, Ozone and Atmospheric Chemistry Monitoring SAF, Land Surface Analysis SAF, GRAS SAF and later for a SAF on Support to Operational Hydrology and Water Management). The SAF network is committed to the generation of high-quality dataset for specific climate application areas, through the exploitation of satellite measurements with state of the art algorithms.
- Organizational support based on experience with distributed research and operations (Coordinated EUMETSAT Central Facilities and SAF Network activities).

CM-7 noted that the following timetable had been proposed to move toward an implementation of the RSSC-CM Network:

1. January 2007: Review the RSSC-CM high-level concept by the CM-7;
2. March 2007: Workshop to refine the high-level concept and further elaborate global network description to be convened by WMO (proposed location at EUMETSAT) with potential contributors;
3. Summer 2007: 1st Meeting of supporting space agencies (R&D and operational) with GCOS and WMO with the objective to describe the implementation process;
4. November 2007: Implementation Plan to be agreed and contributors identified;
5. Presentation of the Implementation Plan at the GEO Ministerial Meeting, 30 November 2007 in Cape Town.