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

SIXTH SESSION

BUENOS AIRES, ARGENTINA

16-17 JANUARY 2006

FINAL REPORT

PHOTOGRAPH

1. ORGANIZATION OF THE SESSION

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

The sixth session of the Consultative Meetings on High-level Policy on Satellite Matters (CM-6) was held at the Argentine Air Force Club in Buenos Aires, Argentina from 16 to 17 January 2006 under the chairmanship of the President of WMO, Dr A.I. Bedritsky. The National Meteorological Service of Argentina was the local host. The session was opened at 09h30 on Monday, 16 January 2006.

In Dr Bedritsky's opening remarks, the President noted that the session would be an excellent opportunity to accomplish two important tasks, each of equal importance. First, the session should review and evaluate the progress made to date in WMO's new and cross-cutting major programme, the WMO Space Programme. Secondly, the session should provide guidance and direction to the WMO Space Programme for its next four-year budget and eight year long-term plan. He was of the opinion that the tremendous amount of growth that had occurred in the Space Programme had direct impacts in improving WMO Members' capabilities to meet their national mandates through better exploitation of satellite data, product and services.

He encouraged the session to be forward thinking and envision the space component of the World Weather Watch Global Observing System in 2015. New capabilities were not only incredible but also achievable. He suggested that the session should outline a plan for the WMO Space Programme that will be capable of meeting those new capabilities.

In concluding, he thanked all the space agencies and organizations for their contributions made over the years and was confident that they would continue to support the objectives of the WMO Space Programme, for the benefit of all nations. He also expressed his gratitude to the Government of Argentina, for hosting this session.

In remarks by the WMO Secretary-General, Mr M. Jarraud noted that the relocation of the session was an excellent opportunity to illustrate the global nature of WMO's objectives and programmes. He expressed the opinion that the annual sessions of the Consultative Meetings had served as a unique forum between WMO and the satellite operators to ensure a better understanding of the issues involved and to agree on important recommendations that have assisted WMO Members in better appreciating the potential benefits that can be derived from satellite systems.

He also recalled that new operational satellites had been recently launched, with MTSAT-1R in February 2005, NOAA-18 in May and MSG-2 last December. Several satellites were currently on the launch pad such as ALOS, or in a final stage of preparation such as Calipso and Cloudsat and MTSAT-2, or METOP-A a few months later. He also noted that through recent developments in data dissemination and data collection, WMO was moving steadily towards an Integrated Global Data Dissemination Service which will provide enhanced access in near-real time to a wide range of data in all WMO Regions. Another area in which progress had been substantial was of training, relying on the now seven Centres of Excellence operating the Virtual Laboratory, with a planned High Profile Training Event (HPTE) to be held later this year. He looked forward to a new Centre of Excellence in the Regional Meteorological Training Centre (RMTC) Buenos Aires.

He also cited issue of the transition from R&D missions to operations. The potential and actual contributions of R&D satellites and missions to the WMO Global Observing System were among the primary reasons for the Consultative Meetings. From a wider perspective, the complementarity of R&D and operational missions was crucial in order to meet the requirement for long-term sustainability of observations in the context of climate change. The importance of these issues was reinforced in the context of the Global Earth Observation System of Systems (GEOSS). He reminded the session that WMO hosts the GEO Secretariat and WMO's activities, in particular,

WMO's Space Programme, will contribute directly to GEOSS activities in many aspects, such as observations, data dissemination and capacity building.

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

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*)

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, Spanish, and Russian, and the documentation and report were in English only.

2. ACTIONS DERIVING FROM CM-5 (agenda item 2)

2.1 The session was informed on actions deriving from CM-5, as well as discussions and decisions of the fifty-seventh session of the WMO Executive Council (EC-LVII) with regard to the WMO Space Programme.

2.2 The session noted that all action items contained in the report from CM-5 were either addressed by EC-LVII or addressed in the documentation for CM-6. With regard to the GCOS Implementation Plan, the session was informed that it was the subject of a dedicated agenda item at the first session of the CBS Open Programme Area Group on Integrated Observing Systems (OPAG IOS) Expert Team on Satellite Utilization and Products (ET SUP-1) held 17-21 October 2005 and the Expert Team on Satellite Systems (ET SAT-1) held 5-9 December 2005. The next sessions for ET SUP and ET SAT were tentatively schedule to be a joint session and held in mid-2006 where the GCOS Implementation Plan would be a dedicated agenda item. Meanwhile, GCOS held a three-day meeting (9-11 January 2006) organized by GCOS, WCRP and CEOS, through its Strategic Implementation Team (SIT), with input from the WMO Space Programme and CBS OPAG IOS Expert Teams to further review the requirements of its Implementation Plan with a view to provide guidance as to specific needs from space observations and the required space-based component of the GOS. Some 25 experts attended the Geneva meeting and made significant progress in developing additional detailed requirements for producing the 20 or so Essential Climate Variables and/or integrated climate products that had been identified in the GCOS Implementation Plan as being strongly dependent on satellite observations. Simultaneously, the GCOS requirements document would be further developed and made available for open review by the climate community during the second quarter of 2006, leading to a final version by August 2006.

Discussions and Decisions at EC-LVII

2.3 EC-LVII agreed that the WMO Consultative Meetings on High-level Policy on Satellite Matters had matured into a most effective mechanism for a dialogue between WMO and space agencies.

Education and Training

2.4 EC-LVII welcomed the offer by Oman to host a new “Centre of Excellence” in noting that there was a preliminary offer to co-sponsor it by EUMETSAT. EC-LVII also noted activities by the Russian Federation, supported by WMO and EUMETSAT, to hold regional training events in Moscow in satellite meteorology for members of the Commonwealth of Independent States (CIS) and Baltic States. EC-LVII agreed that such activities were vital to improve the utilization of satellite data and products and suggested that the Russian Federation consider further development of its activities with the possibility to eventually join the VL and thus fill a gap for a “Centre of Excellence” where the Russian language would be the basis for training events.

Integrated Global Data Dissemination Service (IGDDS)

2.5 EC-LVII noted that the EUMETSAT ATOVS Retransmission Service (EARS), utilizing an Advanced Dissemination Method (ADM), had increased real time access (within 30 minutes) to ATOVS data three- to four-fold in much of the Northern Hemisphere. Near real time access to ATOVS data was important for WMO Members with NWP capability. The Council recalled that the WMO Space Programme Implementation Plan contained a description of an Integrated Global Data Dissemination Service (IGDDS) that would connect regional ADMs into a global service. The Council noted that IGDDS had the potential to be one of the core components of GEOSS.

IGeoLab

2.6 EC-LVII agreed that the IGeoLab was of importance to space agencies, and the NMHSs and user communities of WMO Members, as well as to the further growth and enhancement of the space-based component of the Global Observing System (GOS). Such further growth would also increase the WMO Space Programme's importance to WMO Members.

WMO Space Programme as one of the core contributors to GEOSS

2.7 EC-LVII noted that the fifth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-5) had reviewed a discussion paper on how the WMO Space Programme can be one of the core contributors to the space component of GEOSS. With regard to the GEOSS space component, the Council agreed that the similarities of objectives of GEOSS and WMO fully justified the willingness of WMO, through its recently established WMO Space Programme, to make a significant contribution in the GEOSS process. The Council agreed that the WMO Space Programme was well placed to participate in GEOSS activities and that WMO should strongly support actions that address the following four axioms:

- With the creation of GEOSS, efforts should be made to minimize the risk of duplication with pre-existing similar (although less ambitious) initiatives and, eventually, of superposition of systems capabilities. Due, in particular, to its strong links with a user community and its focused approach, WMO, through its Space Programme, should play a significant role in order to establish and maintain strong coordination with the various stakeholders and users of GEOSS and to strengthen the coordination needed to warrant the interoperability of existing systems and the progressive integration of future ones;

- GEOSS should benefit from WMO's experience of the space-based component of the GOS as a model for integrating independent space observation capabilities into a single system. The following actions initiated through the WMO Space Programme should be further supported in order to be progressively migrated into GEOSS:

    - Integration of the space-component of the various observing systems throughout WMO Programmes and WMO-supported Programmes;
    - Contingency planning;
    - Integrated Global Data Dissemination Service;

- The multiple benefits gained from the integration of a space-based component in the Global Observing System of the World Weather Watch (global, fair, cost-effective) should be used to promote the potential benefits that GEOSS will bring to society;

- The most straightforward means of including the space component of the integrated WMO Global Observing System as a core contributor to the space

component of GEOSS will be to assist the GEO Secretariat in the implementation of actions and activities identified in the GEOSS Implementation Plan, i.e., agreements to make systems interoperable and to share data; collective optimization of the observation strategy; cooperative gap filling; commitments to observational adequacy and continuity; data transfer and dissemination; collaboration on capacity building; and harmonization of methods and application of observation standards. The co-location of the GEO Secretariat on the premises of WMO in Geneva should greatly facilitate this effort.

3. & 4 REVIEW EXPANSION OF THE SPACE-BASED COMPONENT OF THE GLOBAL OBSERVING SYSTEM AND STATUS SPACE-BASED GLOBAL OBSERVING SYSTEM AND EXPANDED MEMBERSHIP *(agenda items 3 & 4)*

3.1 The session was informed of the status of the space-based component of the Global Observing System and activities that had occurred as a result of the expansion of the space-based component of GOS, including the participation of R&D space agencies, as well as related actions occurring at the thirty third session of the Co-ordination Group for Meteorological Satellites (CGMS-XXXIII), the Thirteenth session of the Commission for Basic Systems (CBS-XIII) and recent sessions of the CBS Open Programme Area Group on Integrated Observing System (OPAG IOS) Expert Teams.

Thirteenth session of the Commission for Basic Systems (CBS-XIII)

3.2 CBS-XIII recognized the substantial work carried out in drafting the Implementation Plan for Evolution of Space- and Surface-Based Subsystems of the GOS. The Plan included twenty recommendations addressed to the space-based sub-system of the GOS. They built upon known plans of the operational and R&D satellite operators and called for rigorous calibration of remotely sensed radiances as well as improved spatial, spectral, temporal, radiometric accuracies. The wind profiling and global precipitation measurement missions were singled out for their importance to the GOS. Implementation of most of these recommendations would be realized through the WMO Space Programme working with space agencies, via CGMS. The session noted that CBS was very active in responding to the GOS Implementation Plan. CBS-XIII had agreed to establish three Expert Teams relevant to space activities within the Open Programme Area Group on Integrated Observing Systems, namely ET SUP, ET SAT and ET EGOS. Those Expert Teams were assigned specific tasks to be completed prior to the next session of CBS (CBS Ext 2006) tentatively planned for November 2006 in Seoul, Korea.

CGMS-XXXIII

3.3 CGMS-XXXIII felt the need for close coordination of the current and emerging satellite systems. It was agreed that WMO would organize a two-day Workshop in Geneva in the 2nd quarter of 2006 to facilitate regional discussions for optimized operations of geostationary (1 day) and polar-orbiting satellites (1 day), including discussions on close cooperation on instruments for future satellite missions. The scope of this optimization is to ensure complementary sampling of atmospheric measurements as well as to facilitate potential back-up arrangements as a risk reduction measure.

3.4 Satellite inter-calibration: CGMS agreed to establish a Task Force on the Global Space-based Inter-calibration System (GSICS) building on the experience of ISCCP and CGMS satellite operators and led by NOAA (Mr Mitch Goldberg) with participation by EUMETSAT (Dr Johannes Schmetz), JMA (Mr Toshiyuki Kurino), CMA (Academician Xu Jianmin) and assisted by the WMO Space Programme to prepare a draft Implementation Plan for GISICS by 1 July 2006.

3.5 A number of recommendations were adopted regarding new products and new sensors in order to fulfil the requirements of GCOS and WMO programmes, namely: aerosol products,

enhanced cloud products including cloud microphysics, climate data set from hyper-spectral IR instruments, long-term surface albedo data set, lightning observation.

3.6 CGMS-XXXIII had also agreed that it should become a Participating Organization within the Group on Earth Observations (GEO) and make a contribution to the space component of the Global Earth Observation System of Systems. CGMS had agreed that the CGMS Secretariat (EUMETSAT) should contact the Director, GEO Secretariat by correspondence. GEO-II had agreed to consider the offer by CGMS to become a Participating Organization.

CBS OPAG IOS Expert Teams

3.7 The CBS OPAG IOS Expert Team on Satellite Systems held its first session on 5-9 December 2005, (ET SAT-1) and prepared a consolidated set of recommendations and status in the progress for the implementation for the space-based component of the GOS (see Annex III). The session noted that Annex III contained a summary of activities by WMO Members and space agencies towards the full implementation plan for the evolution of the space component of the GOS. It should be noted that Annex III contains two new concerns as a result of the review and two new tasks (S21 - (Lightning and S22 – Formation Flying) have also been added to the GOS Implementation Plan. The session noted that Annex II represented a "living" document and that as new progress was made the Implementation Plan would be updated to always reflect its current status.

Expansion of the Space-Based Component of the GOS

3.8 The session noted with pleasure the letter sent by the Administrator of the China National Space Administration (CNSA) to the WMO Secretary General confirming its intention to contribute to the space-based component of the WMO's GOS by providing remote sensing data from HY-1A (launched in 2002) and HY-1B (to be launched in 2006) to WMO and CGMS Members. HY-1B's instruments included a 10-wave band ocean colour imager and a 4-wave band CCD camera. Data from HY-1B would be available free and unrestricted to WMO Members. The session noted that the CGMS Secretariat would be immediately informed in order that CNSA could become a full CGMS member.

3.9 The session also noted with pleasure the plans by NOAA to move GOES-10 to enhance coverage of the Americas. By significantly improving satellite detection of such natural hazards as severe storms, floods, drought, landslides, and wildfires, the move would help protect lives and property in North, Central, the Caribbean and South America. The move would further strengthen the WMO's World Weather Watch Global Observing System. It would allow for improved prediction, response and follow-up and expanded understanding of how the Earth system works. Such initiatives were vital. Nearly half the disasters in South America, for instance, were caused by flooding. The session recalled that the request to improve the coverage over South America had originated at a High-Level Meeting of Permanent Representatives from RA III held in June 2005. The request had highlighted the need to improve the satellite coverage over the Southern Hemisphere and RA III was very appreciative of the shift in the position of GOES-10 planned by NOAA. GOES-10, once operational in its new position, would provide for imagery data as frequently as every 15 minutes. The session noted with the move of GOES-10 and its increase in temporal resolution over South America that the space-based component of the GOS would now meet the full set of WMO global requirements.

Status of the Space-based Component of the GOS

3.10 The session was informed by several space agencies of recent activities. In particular, JMA informed the session that MTSAT-1R had been launched and became operational in 2005. It was anticipated that MTSAT-2 would be launched on 15 February 2006. JMA acknowledged with deep appreciation the backup provided by GOES-9 to GMS-5 noting that it had provided continuity of data and service over the Western Pacific. Additionally, JMA noted the signing of a long-term

contingency agreement with NOAA. ROSHYDROMET informed the session of its recent acquisition of a receiving station for EUMETSAT's Meteosat-8 and that its data would be utilized operational by the NMHS. ROSHYDROMET and ROSCOSMOS also described the Russian Federation's new national long-term (10-year) and approved plans to improve satellite systems including goals and objectives. The Russian Federation confirmed that the satellite systems would provide benefits to the meteorological community as part of its contribution to WMO. The plans included two geostationary satellites (14E and 76E in the 2007-2010 time frame), three Meteor 3M class polar orbiting satellites and other satellites for monitoring the environment such as RESURS-B. ROSHYDROMET recalled that Meteor 3M N1 had NASA instruments as part of its payload. EUMETSAT noted the recent launch of Meteosat-9 on 21 December 2005 and that it was presently positioned at 6.5 W while in its commissioning phase. It was anticipated that Meteosat-9 would take over operational responsibilities for Meteosat-8 in mid-2006. Meteosat-8 would be utilized as a back-up after the transition. CMA noted that FY-2C had become operational in 2005 and would also be a core contributor to GEOSS. CMA also informed the session that FY-2D was scheduled to be launched in October 2006. NOAA noted that it had launched NOAA-18 in May 2005 and although NPOESS had experienced some complications in its development, it was anticipated that a way forward would be identified by mid-2006. GOES-N is now tentatively scheduled for launch in March 2006 and planning for the next generation GOES series (GOES-R) was making good progress. Additionally, other satellites including Jason-2 were progressing within its established partnership with NASA, CNES and EUMETSAT. The Republic of Korea confirmed its commitment for COMS to be part of the space-based component of the GOS with its expected launch in 2008.

Other related space activities

3.11 Iran noted that it had recently commissioned SINA-1 with assistance by the Russian Federation for the launch. SINA-1 was a micro-satellite intended for observing the Earth with medium resolution (50M) and (250m) cameras. Its main functions included observation of Albedo to identify cloud features as well as environmental monitoring tasks such as inventories of agricultural areas. ESA informed on its recent Ministerial Conference and the now approved GMES programme first phase, including a gap-filler GMES-1 before the sentinels. Additionally, the Ministerial Conference had identified a process that would lead to a new CYROSAT-2 to replace CYROSAT-1 lost on launch. INPE indicated it was fully prepared to support activities within the space-based component of the GOS. NASA announced that it intended to launch Cloudsat and Calipso satellites as soon as possible (no earlier than March, 2006). NASA also reported that it has confirmed three missions during the past year (Orbiting Carbon Observatory, Aquarius, and Glory). NASA also completed a process to prioritize among possible mission extensions, and used that information to commit to extensions for several (including TRMM, QuikScat, Jason, and Terra), but to lead to termination decisions for others (ERBS, UARS). Recent technical developments had resulted in the termination of operations of Topex/Poseidon.

5. WMO SPACE PROGRAMME IMPLEMENTATION ACTIVITIES (*agenda item 5)*

Integrated Global Data Dissemination Service (IGDDS)

5.1 The session was informed on progress made concerning the definition and implementation of an Integrated Global Data Dissemination Service (IGDDS) since CM-5.

5.2 The session recalled that the concept of an Integrated Global Data Dissemination Service (IGDDS) was addressed in the WMO Space Programme Implementation Plan (WSP-IP), which was endorsed by WMO EC-LVI: "*In order to ensure that [the ADM] initiatives result in a dissemination system that is optimized with respect to the needs of the global user community, it is appropriate to consider the possible shape of an Integrated Global Data Dissemination Service (IGDDS) which builds on the ADM concept.(…) The concept of IGDDS is seen as central to the vision of an integrated space-based component of the Global Observing System as it will facilitate access to the complete range of data and products from this component of the GOS."* The WSP-IP

furthermore suggested an outline architecture and a way forward with detailed recommendations to refine the definition and implement the IGDDS in cooperation between WMO and satellite operators, under the auspices of both the CGMS and the WMO Consultative Meetings.

5.3 The session was informed that the necessary articulation between IGDDS and the WMO Information System (WIS) was addressed at WMO EC LVII: [the EC] *"emphasizing the important role of satellite-based data-distribution systems and noting with appreciation their extensive implementation and the significant technological upgrades (e.g., DVB-S) that were achieved, urged CBS to pursue the coordinated integration of these systems, in particular, the new Integrated Global Data Dissemination Service (IGDDS), into the GTS/WIS as components for the distribution of a large volume of information.* "

RARS and IGDDS activities since CM-5

5.4 Since CM-5, the session noted that there had been a series of relevant meetings and workshops that had further progressed the RARS and IGDDS concepts and its implementation. In particular, regional discussions had occurred at APSDEU-6, RA III, ET SUP-1, CGMS-XXXIII, the 2nd RARS Global Workshop, ET EGOS-1 and GEO-II.

Regional discussions on RARS (June and September 2005)

5.5 The session was informed that at the Sixth Asia-Pacific Satellite Data Exchange and Utilization (APSDEU) meeting held in Seoul, Republic of Korea in June 2005, the architecture of the Asia-Pacific RARS was further consolidated, an Asia-Pacific RARS coordinator was nominated and an implementation plan was sketched. Advanced Dissemination Methods would be a prerequisite if the scope of the system were to be expanded to include additional products, such as AVHRR data, with its more diverse user community. JMA informed CM-6 that it would provide data from two HRPT stations one in Japan and the other in Antarctica.

5.6 A WMO RA III RARS Workshop was held in Buenos Aires, Argentina, 6-7 September 2005. The purpose of this workshop was to further define the proposal for a South American RARS that had been tentatively outlined at the CGMS/WMO RARS workshop held in Darmstadt, 16-17 December 2004. At this workshop in Buenos Aires, a further 11 HRPT stations (2 in Argentina, 6 in Brazil and 3 in Chile) were identified for possible inclusion within the RA III RARS collection network. Argentina, in addition to the HRPT stations of Falda del Carmen, Còrdoba and Buenos Aires mentioned above, offered a future HRPT station in Marambio, Antarctica as part of the RA III RARS network. Also, Brazil offered to host a RARS data collection and products centre. CM-6 noted that the offer by the Brazilian representative at the 6-7 September meeting had been fully coordinated and agreed upon by all relevant Brazilian agencies including INPE and INMET.

CBS/OPAG/Expert Team discussions on IGDDS (October 2005)

5.7 The first session of CBS/OPAG IOS/Expert Team on Satellite Utilization and Products (ET SUP-1) reviewed RARS activities and addressed the wider issue of the Integrated Global Data Dissemination Service (IGDDS). ET SUP-1 reviewed the definition of IGDDS and clarified that it should integrate all the aspects of satellite data collection, exchange and dissemination required by WMO programmes. This would include in particular ADMs as primary dissemination methods, and RARS as a specific arrangement to access polar-orbiting instrument data in a timely fashion. Annex IV contains a summary description of IGDDS.

5.8 ET SUP-1 recognized that the dissemination function should be provided primarily via ADMs over regional dissemination areas. The satellite operators of operational geostationary and polar satellite systems within a region, being the main data and product providers were expected to take responsibility for implementing and operating regional dissemination services, relying in most cases on commercial service providers. They would thus play the role of Data Collection and Product Centres (DCPC) with reference to the WMO Information System (WIS). The session

considered that, for the implementation of the IGDDS dissemination function, four discrete dissemination service areas might be sufficient. It considered that each dissemination service area coverage should be defined with reference to the location of the primary users of geostationary services, and thus be consistent with the field of view of the different geostationary meteorological satellite systems.

5.9 ET SUP-1 emphasized the need to proceed with the implementation of the regional ADMs. Since Europe, Africa and North Atlantic were already covered by the EUMETCast service operated by EUMETSAT, it was highly advisable to aim for an operational implementation of the remaining ADMs for the other regions by January 2007. The implementation of an ADM in the Asia-Pacific Region was seen as the next priority for implementation because in that area different satellite systems existing or were planned (e.g., FY-2, MTSAT, Korean COMS). A single dissemination system would be a distinct advantage to RA II and RA V Members, where a large user community could take benefit of these different systems at minimum cost and effort.

CGMS-XXXIII discussions on IGDDS (November 2005)

5.10 The session was informed that CGMS had noted that, within the WMO Information System (WIS) structure, data collection and products provision would be implemented in dedicated Data Collection and Products Centres (DCPC). An inherent feature of the IGDDS would be its interconnectivity and the ease by which data can be relayed from one region to another.

5.11 The Advanced Dissemination Methods used for the dissemination of the satellite and other data would be implemented in regional areas by the operators of operational geostationary and polar satellite systems within that region, or consortia including such operators. CGMS considered that the globe could be covered by ADM in the following regions: the Americas, Europe and Africa (EUMETCast), Indian Ocean and Asia-Pacific.

5.12 At CGMS-XXXIII, the WMO representative had stressed that the implementation of the regional ADMs should proceed without further delay. The WMO representative concluded by stating that the implementation of the IGDDS would constitute an important component of the WIS. Responding to this topic, ESA informed CGMS Working Group IV that ERS and ENVISAT data were disseminated through a DVB system to Europe and Africa, with a trial planned for South America. Other dissemination methods are Internet, FTP services and physical media.

5.13 CGMS recalled that one clear benefit of establishing a regional ADM was the fact that the geostationary meteorological satellites in the region would save onboard fuel if they were no longer subject to the strict inclination control requirements necessary for direct broadcast, and, in the case of EUMETSAT, an increase in the lifetime of a satellite by some 2 years could be expected as a result. Another benefit was the significant enlargement of the user community making use of the satellite data.

5.14 The session noted that CGMS had agreed to the following action regarding Asia-Pacific:

> *"Within the context of the WMO December 2005 RARS Workshop, WMO to invite China, Japan, Korea and Australia, together with other interested CGMS partners, to specifically discuss possibilities for supporting a regional ADM Service for the Asia-Pacific Region."*

RARS discussions at the Second Global RARS workshop (December 2005)

5.15 The session was informed that a second global RARS Workshop was held in Geneva on 1-2 December 2005, and was extended to a RARS-ADM workshop in response to a CGMS request. Major steps were taken towards the implementation of a RARS in South-America and in the Asia-Pacific area.

South-American RARS

5.16 As concerns the South American RARS, both the architecture and the implementation schedule for the South American RARS starting with a pilot RARS in 2006 and a fully operational RARS by the end of 2007 had been agreed.

Asia-Pacific RARS

5.17 During the December 2005 Workshop, a target implementation schedule was adopted with a pilot RARS established by April 2006 and an operational RARS by June 2006.

ADM discussions at the second RARS global workshop (December 2005)

5.18 The session recalled that in response to a CGMS request, the scope of the RARS Global Workshop had been extended to address ADM issues. The second RARS Global Workshop had felt that annual workshops were too infrequent and the scope of the workshops would evolve into implementation aspects, especially to cover IGDDS and therefore agreed that a 3rd RARS/IGDDS Workshop be held in Geneva in the middle of 2006 in order to assess progress in the planned activities in each of the regions (Europe/Africa, Asia-Pacific and South America) and that in order to coordinate the implementation of the rapidly-evolving global RARS network and Integrated Global Data Dissemination Service (IGDDS), it was recommended that a RARS/IGDDS Implementation Group be formed by CGMS at its next session (CGMS-XXXIV).

GEOSS discussions on GEONetcast (December 2005)

5.19 The session noted that the draft GEOSS Work Plan for 2006 contained explicit reference to IGDDS in describing the GEO-Netcast concept. In particular, Task WE-06-04, as part of the Weather Societal Benefit Area, is to "support the development of Advanced Dissemination Methods (ADM) as part of an operational Integrated Global Data Dissemination Service (IGDDS) as a component of the WMO Information System (WIS) and a contribution of the WMO Space Programme to GEO-Netcast".

5.20 The session noted that during the GEO-II meeting held on 14-15 December 2005, action was taken to investigate the possibility to establish a GEONetCast covering GEOSS needs, building upon the existing WMO IGDDS. The session noted the potential for GEONetCast to provide a data dissemination mechanism in support of GEOSS's nine societal benefit areas. It also noted that WMO's IGDDS would be relevant to many but not all of those societal benefit areas and the GEONetCast should build upon IGDDS in meeting GEO needs for data dissemination. It should be recalled that the WMO Executive Council, at its 56th session, agreed that IGDDS within WIS would be a core component of the data dissemination function necessary for GEOSS. GEO-II's agreement followed a presentation made by EUMETSAT and NOAA and was supported by a White Paper authored by NOAA and EUMETSAT with substantial input from WMO. At GEO-II, it was agreed that such investigations be assigned to and monitored by the GEOSS Architecture and Data Committee.

IGDDS Summary

5.21 The session strongly agreed that substantial and rapid progress had been made during the last months on issues related to RARS, ADM and IGDDS implementation, thanks to the very active contribution of WMO Members and satellite operators (both in expertise as well as to the WMO Space Programme Trust Fund) as well as close interactions with other relevant WMO Programmes and Secretariat Departments. ADMs were now operational in Europe, Africa and soon parts of South America through EUMETCast. ESA informed the session that ERS and ENVISAT data were disseminated through a DVB system to Europe and Africa, with a trial planned for South America. The session was pleased that a test phase was planned for early 2006 in the Asia Pacific region. Plans were in place for ADM to be established in North, Central and South

America by NOAA with initial operational capability in 2006/2007 and full operational capability by the end of 2007. WMO has established a goal for full global coverage by the beginning of 2007. Implementation and coordination groups are in place to develop standards and data exchange requirements, and a commitment exists to establish a global system. The session was informed that ROSHYDROMET will investigate the possibility to realize an ADM service through MITRA dissemination systems (based on commercial TV satellite) as part of IGDDS.

5.22 The session agreed that the specific role of the WMO Space Programme in respect of IGDDS will continue to be the following:

- to assist in the planning and to monitor and facilitate the implementation of the various components of IGDDS;
- to ensure that IGDDS addresses global and regional data access requirements from all WMO Regions and for all WMO and supported Programmes;
- to support harmonization and the adoption of standards as appropriate towards achieving a globally coordinated system, to ensure in particular that IGDDS serves in the broader framework of the WMO Information System.

5.23 The session also requested the WMO Space Programme Office to prepare a description of IGDDS for distribution to all WMO Members as a matter of urgency to inform them of this new and rapidly emerging manner for data access to satellite data and products.

International Geostationary Laboratory concept (IGeoLab)

5.24 The session was informed on the evolution of the initiatives framed in the International Geostationary Laboratory concept (IGeoLab), specifically on GIFTS (Geostationary Imaging Fourier Transform Spectrometer), an IR temperature-humidity sounder, and on GEO-Microwave, a demonstrative mission for frequent precipitation observation from geostationary orbit by millimetre-submillimetre wave radiometry.

Report of the 1st meeting of the IGeoLab GIFTS Focus Group

5.25 Following CM-5, the WMO Space Programme, with the help of two consultants (the two Principal Investigators for GIFTS and GOMAS, respectively) had organized the first meetings of the two Focus Groups that were facilitated by NOAA/NESDIS in Washington DC, sequentially on 6 and 7 June 2005. The first meeting of the IGeoLab Focus Group on GIFTS was held on 6 June 2005 in Washington DC.

5.26 The IGeoLab GIFTS test proposal achieved considerable progress at the 1st Focus Group meeting. Specifically, the importance of a GIFTS space mission for the development of the next generation satellite component of the WMO World Weather Watch Global Observing System, particularly in the context of the GEOSS, was reaffirmed by all space agency participants. Moreover, considerable progress had been made in the GIFTS instrument completion, with ground tests of the instrument soon to be underway to demonstrate the radiometric measurement capabilities of this revolutionary remote sensing technology.

Recent GIFTS activities

5.27 The session noted that after GIFTS FG-1, the GIFTS Project Team and ROSKOSMOS, with the assistance of WMO, had intensified dialogue aimed at establishing the feasibility of flying GIFTS on the Elektro-L spacecraft. Specifically, the technical discussions culminated with a meeting held in Moscow on 12-13 October 2005 between personnel of the Space Dynamics Laboratory (responsible for the instrument) and representatives from the Russian Federation's RosKosmos, TSNIIMash, Planeta Science and Research Center and Lavochkin Association. The

meeting concluded that, from a technical viewpoint, it was feasible to accommodate GIFTS on Elektro-L, provided that a number of activities were embarked soon. In addition to working on the platform, work was also necessary on the payload since the currently available Engineering Demonstration Unit (EDU) was not suitable for flight. Funding has been identified as the main critical item.

5.28 At CGMS-XXXIII, held in Tokyo, 1-4 November, the USA and Russian delegations undertook to explore all possible ways to secure the necessary funds. Soon after, ROSHYDROMET and ROSKOMOS sent a letter to NASA (Dr Cleave) and NOAA/NESDIS (Mr Withee) conveying an offer to provide a launch and spacecraft for GIFTS.

5.29 However, on 13 December 2005 WMO received a letter (dated 18 November 2005) from NASA (Dr Mary Cleave, Associate Administrator for Science Mission Directorate) that noted:

> "…, the GIFTS activity needed to be terminated following the breakdown of the partnership that was to provide the platform and launch for the GIFTS instrument. NASA does not have any money now in its budget that can be applied to funding these needs, and given our budget situation I see no likelihood of the significant funding required becoming available in the foreseeable future.
>
> Given the interest in GIFTS by the participants in IGeoLab, NASA would be willing to entertain offers from our international partners who might be willing to provide access to space and secure the significant resources necessary to upgrade the GIFTS instrument from its present state as an Engineering Development Unit (EDU) to a fully space-flight-qualified instrument. Such opportunities would have to be on a "no exchange of funds basis" in which the international partner would cover all subsequent costs; NASA's investment would be the appreciable one we have made to date in the construction of the EDU instrument. Please note, however, that any international request for use of the GIFTS hardware would have to satisfy all U.S. requirements associated with the International Traffic on Arms Regulations, which may be very serious for a high technology instrument such as GIFTS."

5.30 Subsequently, the WMO Space Programme was informed that a second letter was sent to NASA (Mr Griffin) on 10 January 2006 and signed by the Director Generals for ROSHYDROMET and ROSKOSMOS confirming the offer made to Dr Cleave and Mr Withee in November. CM-6 was informed by NASA that the letter from ROSHYDROMET and ROSKOSMOS had been received and a response would be prepared. However, it was anticipated that the response would be similar to that sent to WMO by Dr Cleave.

5.31 The Chairman, Dr Bedritsky, informed the session that the Russian Federation fully understood the financial implications of the GIFTS Project made to NASA. He also noted that the Russian Federation would be the host to the next G-8 meeting to be held in July in Moscow and that it was the Russian Federation's intention to include GIFTS within an IGEOLAB Partnership as a discussion item between Presidents Putin and Bush. He expressed his wish that a positive solution could be found since it would result in a positive contribution to the world-wide community.

Report of the 1st meeting of the IGeoLab GEO Microwave Focus Group

5.32 The session noted that the first meeting of the IGeoLab GEO Microwave Focus Group had been held in Washington DC on 7 June 2005. At the first meeting, WMO, EUMETSAT and NOAA had identified a strong requirement for frequent precipitation observation, in the framework of their respective process of defining the WMO observational data requirements, and the Meteosat Third Generation and GOES-R missions.

Report of the 2nd meeting of the IGeoLab GEO Microwave Focus Group

5.33 The session noted that the 2nd meeting of the GEO Microwave Focus Group had been held on 24-25 October 2005. GEO-microwave FG-2, sponsored by the WMO Space Programme and the International Precipitation Working Group (IPWG), was hosted by the "Istituto di Scienze dell'Atmosfera e del Clima" (ISAC) of the Italian "Consiglio Nazionale delle Ricerche" (CNR), in Rome. CM-6 was informed by ESA that GOMAS was an Earth Explorer candidate and final selection amongst all the candidates would be made in mid-2006. CM-6 encouraged ESA to give positive consideration to GOMAS as an important new instrument for demonstration in geostationary orbit that would help meet very important WMO observational requirements.

Position of CGMS-XXXIII in Tokyo, 1-4 November 2005 on GEO Microwave

5.34 The session was informed that CGMS-XXXIII noted the satisfactory progress of the scientific aspects of GEO-Microwave and the concern for the lack of financial support for continuing studies until a leading space agency materializes. Therefore CGMS encouraged its Space Agency Members to provide continuity of funding for the scientific studies, pending the establishment of a consolidated study programme once a space agency has accepted the role of the lead space agency in the implementation of the IGeoLab GEO microwave project.

5.35 The session noted that preparation had started for the next meeting of the IGeoLab GEO Microwave Focus Group, FG-3, to be held in April-May 2006. It will continue to focus on scientific aspects, specifically on user requirements from other interested CGMS and CM members not yet involved.

5.36 The session agreed that the two test proposals had made considerable progress. It asked the WMO Space Programme to continue to consider further high priority test proposals within the IGeoLab concept.

Global Space-based Inter-calibration system (GSICS)

5.37 The session was informed on the planned implementation of an operational Global Space-based Inter-calibration System (GSICS). The goals for an operational GSICS were to:

- improve the use of space-based global observations for weather, climate and environmental applications through operational inter-calibration of the space component of the WWW's GOS and GEOSS; and

- provide for the ability to retrospectively re-calibrate archive satellite data using the operational inter-calibration system in order to make satellite data archives worthy for climate studies.

5.38 The session noted that a proposed GSICS objective would be to quantitatively relate the radiances from different sensors viewing the same target to allow consistent measurements to be taken over the globe by all elements of the space-based observing system. The establishment of an operational global space-based inter-calibration system would also provide a means to retrospectively inter-calibrate satellite data.

5.39 GSICS would be part of an end-to-end capability consisting of: on-board calibration devices (e.g., black bodies, solar diffusers); in situ measurements of the state of the surface and atmosphere (e.g., the Cloud and Radiation Test-bed (CART) site, aircraft instruments with NIST calibrations); radiative transfer models that enable comparison of calculated and observed radiances; and assimilation systems that merge all measurements into a cohesive consistent depiction of the Earth-atmosphere system.

5.40 The session agreed that there was a compelling need for a global space-based inter-calibration system endorsed and implemented by space agencies with guidance from the WMO Space Programme. Here, the purpose of inter-calibration was to quantitatively relate the radiances from different sensors viewing the same target to allow consistent measurements to be taken over the globe by all elements of the space-based observing system.

5.41 The session noted that CGMS-XXXIII had reviewed the concept and strategy for an operational GSICS. CGMS Members agreed that an Implementation Plan for GSICS should be developed and made available for review by CGMS Members well before the next session of CGMS. CGMS-XXXIII established a Task Force led by NESDIS with participation by EUMETSAT, JMA, CMA and assisted by the WMO Space Programme to prepare a draft Implementation Plan for GISICS by 1 July 2006 for review by CGMS Members by 1 August 2006 and approval at CGMS XXXIV. The session noted that a first meeting of the Task Force was planned for 15-16 March to be hosted by EUMETSAT. At CM-6, Argentina offered to increase radiosonde launches in support of calibration activities from its station in Antarctica if a source for the provision of radiosondes could be identified.

5.42 The session agreed that GSICS was a very important system relevant to many WMO applications and Programmes and that considerable and rapid progress had already been achieved. In view of its importance, the session encourage the WMO Space Programme Office to accelerate the development of the GSICS Implementation Plan and to bring it to an operational status as soon as practical. The use of specific focused inter-calibration areas would be very useful in demonstrating to WMO Members the new capabilities to be gained. CM-6 space agencies agreed to support the GSICS Implementation Plan and activities necessary for its accelerated timetable.

Virtual Laboratory for Satellite Data Utilization and High Profile Training Event

5.43 The session was informed on the progress of training activities on the use of satellite data, including the implementation of new Centres of Excellence (CoE) and the expansion of the Virtual Laboratory (VL) as coordinated by the Virtual Laboratory Management Group (VLMG). The session was also briefed on the preparation for a High-profile Training Event (HPTE) planned for October 2006.

5.44 The session recalled that CM-5 had strongly supported the WMO Space Programme activities and urged space agencies and WMO Members to consider possible funding sources and opportunities towards the purchase of 200 notebooks for the HPTE scheduled for 2006.

Current status of the VL

5.45 The session recalled that the Virtual Laboratory was currently a collaboration between five operational satellite operators and seven training centres (of whom five are WMO Regional Meteorological Training Centres). Two research and development satellite agencies were also members of the VL. Each of the partnership arrangements was different reflecting the resourcing, capabilities and outlook of the two or more partners.

5.46 The activities and direction of the Virtual Laboratory were overseen by the Virtual Laboratory Management Group composed of at least one representative from each partner. VLMG elected two Co-chairs, one from a satellite operator and one from a Centre of Excellence. VLMG reported to CGMS on an annual basis and to WMO Members via the WMO Space Programme and the CBS Open Programme Area Group on Integrated Observing Systems (CBS/OPAG IOS). The relevant expert team, the Expert Team on Satellite Utilization and Products (ET SUP), was kept informed of the activities of the VL through the common membership of both groups and through participation in the Implementation Coordination Team of the OPAG-IOS.

5.47 The session noted two recent and important activities: the creation of regional focus groups and the Electronic Notebook initiative.

Regional Focus Groups

5.48 The session was informed that regional focus groups developed out of the December 2003 Regional Training Seminar in Barbados. Since approximately March 2004, this group of trainers and seminar participants from Central and South America had met online on a notional three weekly basis. These online meetings had consolidated and extended the training from the December 2003 Barbados, and March 2005 Costa Rica, seminars and helped people examine current real-time weather situations as well as building a community of trainers across this large region.

5.49 The session noted the power of the Regional Focus Groups when recently RA IV participants had called for several extraordinary sessions to discuss the formation and movement of what became Hurricane Wilma. The aim of the regional focus groups was training, but it was clear from this example that the WMO Members in the regional focus were able to benefit from the expertise, networking and capabilities of the training infrastructure to assist them in making operational assessments.

Electronic Notebooks

5.50 The session was informed of activities related to the first trial of the VL Electronic Notebook computers. Through a funding grant from NOAA, CIRA was able to provide electronic notebooks and the VRL content for use by participants of the Regional Training Course on the Use of Environmental Satellite Data in Meteorological Applications for RA III and RA IV Costa Rica in February 2005. Electronic notebooks were provided to the VL trainees for their use during the training course and for their subsequent use in training, technology transfer and communication within the newly formed Costa Rica Training VL focus group upon their return to their home countries. All training materials, tools and presentations delivered during the training event were placed onto the electronic notebooks, along with a number of stand-alone tutorials, which represents more than 20 Gbytes of material, as well as Internet links to product and digital satellite data. It was envisioned that in the future such electronic notebooks will be the primary tool used during VL training events and will return with the participant to his/her country for further education and training activities.

5.51 The session noted that during the months following the Costa Rica training event, electronic notebooks were provided to the RMTCs at Barbados, Niamey and Nairobi, and the sponsoring agency NSMC. Copies of the electronic notebook contents were also provided to other VL participants: EUMETSAT, the WMO Space Programme and the ABoM Training Centre (BMTC). It is anticipated that at least some of the participants in the APSATS training course (Melbourne, Australia, October 2006) will also be able to take VL notebooks back to their Member countries, and that for the global High Profile Training Event electronic notebooks, portable hard drives, DVDs or web access to contents will be made available. Additionally, at CGMS-XXXIII, China advised that it was prepared to translate the training resources on the notebook into Chinese. Recently, China informed WMO that it would donate 15 electronic notebooks for the HPTE.

Proposed new Centres of Excellence

5.52 The session was informed that the WMO Space Programme had received a proposal from the Permanent Representative of Argentina to establish a CoE in Buenos Aires for training in satellite meteorology in Spanish. The CoE would be based on the Buenos Aires RMTC in partnership with the University of Buenos Aires. NOAA/NESDIS has agreed to co-sponsor this CoE and the proposal was supported by RA III. The proposal was reviewed by the CBS /OPAG IOS Expert Team on Satellite Utilization and Products (ET-SUP) at its first session, in accordance with the normal procedure. ET SUP-1 recommended its approval by CBS, provided that Argentina

confirms its agreement to the requirements for CoEs. Argentina confirmed its agreement to the requirements for CoEs. The session deeply appreciated the offer by Argentina and recommended that the WMO Executive Council and CBS accept and agree to the designation of the RMTC in Buenos Aires, Argentina as a Centre of Excellence within the Virtual Laboratory for Education and Training in Satellite Meteorology.

5.53 The session also noted the intention of Roshydromet to propose a CoE in Moscow and of preliminary considerations by Brazil to propose a CoE to serve Portuguese-speaking WMO Members. The formation of VL Centres of Excellence in Argentina and the Russian Federation would cover all WMO Regions and all WMO languages. The additional formation of a VL Centre of Excellence in Brazil would also provide excellent support for training activities across the whole of Central and South America.

5.54 The session was informed that the RMTC in Tehran, Iran, offered potential to be a Centre of Excellence for non-Arabic-speaking countries in the western part of RA II. The session encouraged Iran to work with the WMO Space Programme in following the established process towards designation as a Centre of Excellence.

High Profile Training Event

5.55 The session noted that firm plans have been developed for the HPTE to be held in October 2006, in conjunction with the APSATS 2006 in Melbourne, and the Regional Training Seminar in Nanjing.

5.56 Conceptually the HPTE will work on three levels:

- providing a focus for a number of face to face training events around the globe;
- Linking the face to face events for some sessions (global image discussion and key presentation(s);
- providing a mix of face to face and online training with the NMSs in the area of each Centre of Excellence

5.57 The HPTE was expected to strengthen the networking between the various Centres of Excellence around the globe. It aimed to not only involve the VL partners but also the three science groups (IWWW, ITWG and IPWG) and other interested parties. An IPWG Workshop will be running in Melbourne at the same time as the APSATS 2006 and joint sessions were being considered. A Project Development Plan had been elaborated by the VLMG, reviewed by ET SUP-1 and brought to the attention of CGMS.

5.58 CGMS-XXXIII had strongly endorsed and supported the specific recommendations for HPTE, in particular the requests for assistance in the development and translation of the core lectures, and implementation of the foundation VISITview server software. JMA indicated that it was willing to provide support and will cooperate with the Australian Bureau of Meteorology to establish an on-line lecture for the HPTE.

5.59 The session agreed that considerable progress had been made in education and training in satellite meteorology especially through the VL. It also recalled that GEO would address capacity building efforts through several approaches including education and training. The session was pleased to be informed by Brazil - a GEO Member, member of the GEO Executive Committee and GEO Committee for Capacity Building – that WMO's VL was a role model for future GEO activities in capacity building through education and training.

5.60 The session also encouraged the WMO Space Programme to take into consideration new and emerging training needs that would be made possible by the new IGDDS data dissemination service.

WMO Space Programme within WMO's 7LTP

5.61 The session was informed on the current status of staffing within the WMO Space Programme Office, and in the development of the WMO Space Programme within WMO's Seventh Long-term Plan (7LTP) to be discussed at the fifty-eighth session of the WMO Executive Council.

WMO Space Programme Staffing

5.62 The session noted that during 2005, the Permanent Representative of China with WMO had nominated Professor Liu Jian, Professor at China's National Satellite Meteorological Center, as a senior seconded expert. Professor Liu Jian started work in the Space Programme Office in June 2005. Since CM-5, Mr Jérôme Lafeuille has been seconded by Météo-France to the WMO Space Programme Office for a one year period. Mr Lafeuille started work in September 2005. During 2005 the Government of Switzerland, as part of its intern programme, provided Dr Natália Archinard to assist the Director of the WMO Space Programme. Dr Archinaud completed her one year term on 3 January 2006. The P.5 post for the Head of the WMO Space Programme was reclassified at a D.1 level and Dr Donald Hinsman was promoted by a Special Staff Selection Board to serve as the first Director of the WMO Space Programme. The post of Senior Secretary to the WMO Space Programme Office was also reclassified as Administrative Assistant and Mrs Valerie Clément was promoted by a Special Staff Selection Board to serve as the Administrative Assistant to the WMO Space Programme. Additionally, the fifty-seventh session of the WMO Executive Council agreed to a proposal for the 2006-2007 Budget that included new posts for the Chief, Space-based Observing Systems and Chief, Satellite Data Utilization Division, both reporting to the Director of the WMO Space Programme. Vacancy announcements for the two posts have been advertised and closed in November 2005. There were 85 applications for the two posts. Staff selection is in the final stages.

WMO 7LTP

5.63 The session was informed of the WMO Long-term Planning process. The WMO Long-term plan is an embodiment of the Members' desire for an Organization that is more responsive, proactive and relevant. The plan enables a better understanding of the role of WMO in promoting and coordinating the international cooperation needed to develop and improve the provision of weather, climate and water-related services worldwide for the benefit of society. The plan also serves to provide broad guidance for Members to assist them in formulating their own development plans pertaining to the contribution of, and support to, meteorology, hydrology and related disciplines as well as their application. Members can then use the plan as a basis for planning their various relevant activities, particularly those of their National Meteorological and Hydrological Services, to ensure the provision of pertinent products and services to their people.

5.64 The long-term plan framework provides the strategic direction, which facilitates the identification of key areas for emphasis in the 7LTP (2008-2015) that are crucial to the realization of the WMO vision, desired outcomes and strategies. The proposed key areas for the 7LTP are:

(a) improvement in weather, climate and water-related forecasts, predictions and assessments;

(b) the WMO Integrated Global Observing System (WIGOS);

(c) the new WMO Information System (WIS);

(d) natural disasters;

(e) applications and services;

(f) advocacy; and

(g) capacity building, particularly for Least Developed Countries (LDCs).

5.65 The session reviewed the draft WMO Space Programme contribution towards several of the key areas and Expected Results. The session supported the present draft and agreed that it represented a well-balanced approach to enable WMO Members to benefit from the space-based component expected in the 2015 time frame. It noted that by 2015 the space component of the GOS would be vastly changed with tremendous new capabilities. However, the session also noted that the present CM-6 agenda contained new areas that were not yet part of the draft WMO Space Programme contribution to the 7LTP. In particular, areas including improvements for climate, GPM, Regional Specialized Satellite Centres and the transition from R&D instruments to operational missions would be very valuable and should also be included in the contribution towards WMO Expected Results.

5.66 The session was also informed that the Chairman of the EC Working Group on LTP intended to bring the potential contribution for space systems to the attention of the Working Group.

Global Precipitation Measurements (GPM) Concept

5.67 The session recalled that one aspect of the WMO Space Programme was its responsibilities for the WWW Global Observing System's Implementation Plan as approved at the thirteenth session of CBS in St Petersburg, Russian Federation in February 2005 (CBS-XIII). With regard to precipitation measurements from space, the session also recalled that CBS-XIII had approved the concept of the Global Precipitation Measurement Missions (combining active precipitation measurements with a constellation of passive microwave imagers) that should be supported and the data realized should be available for operational use, thereupon, arrangements should be sought to ensure long-term continuity to the system.

Present status and WMO Space Programme activities

5.68 The session was briefed by the JAXA representative and informed that the Global Precipitation Measurement (GPM) mission was an Earth Observation satellite programme mainly initiated by NASA, JAXA and NICT (National Institute of Information and Communications Technology of Japan). Building on the successful heritage of the Tropical Rainfall Measurement Mission (TRMM), the GPM programme was a follow-on and an expansion of the TRMM mission. Its overall goal was to measure precipitation in near-real time with near-global coverage.

GPM overview

5.69 The session noted that the GPM mission was planned to be implemented in the 2010-2015 timeframe. One specific goal was to deliver 3-hourly global precipitation maps over more than 90% of the globe.

5.70 The session agreed that GPM was expected to bring an essential contribution to WMO and supported Programmes, as a follow-on and a considerable expansion and improvement of the successful TRMM mission. The GPM system will include a "core spacecraft" carrying a precipitation radar (TRMM follow-on) complemented by a constellation of microwave imagers flying on various satellites on polar or other orbits. The core spacecraft will be on a 407 km and 65 degrees inclination orbit, it was currently planned for launch in December 2010.

5.71 The session noted that the GPM constellation was still open and could include: one NASA spacecraft, 3 NPOESS, plus a few "partner satellites". ESA informed the session that a proposal for an Earth Explorer mission to contribute to the GPM constellation could not be confirmed. In this regard, the session urged ESA to give positive consideration to an European contribution to the GPM constellation. Other satellites such as China's FY-3 or India's Megha-tropiques will fly microwave imagers that could have the potential to contribute to GPM objectives.

5.72 GPM was expected to achieve a considerable progress with respect to TRMM for several reasons:

- the higher inclination orbit will provide wider coverage by the core spacecraft;
- the constellation of microwave imagers will allow to extend this coverage to near-global domain;
- the dual-frequency radar is expected to have better performance than the TRMM single frequency radar in high and low layers with increased capability for rain/snow discrimination.

5.73 The JAXA representative suggested WMO should encourage participation in the GPM by other WMO Members, as well as encourage WMO Members to utilize GPM data and products. NASA described the new channel capabilities on the GPI and also encouraged WMO Members to participate in GPM. CMA confirmed its intention to support GPM activities. JMA noted that it has a close relationship with JAXA as an operational user of GPM.

5.74 The session discussed national challenges in the transition of a research mission such as GPM into operational use. It agreed that a smooth transition was essential both from a programmatic viewpoint as well as for data utilization by WMO Members.

5.75 Furthermore, the session agreed GPM offered tremendous new capabilities of benefit to WMO Members in several vital application areas and that WMO should act as a catalyst to encourage GPM implementation and to support user interaction with a view to ensure a wide awareness of the user community, with the expectation that GPM will become part of the WMO's Global Observing System and that suitable means will be identified to allow near-real time data availability for operational applications. International cooperation should be encouraged to allow the timely implementation of a robust GPM constellation.

Transition from Relevant R&D Instruments to Operational Missions

5.76 The session was informed on the issue of Transition from relevant R&D satellite instruments to operational missions.

5.77 It recalled that CM-3 had agreed that "Facilitation of the transition from research to operational systems" was identified as one [important] element of the WMO Space Programme Long-term Strategy. It is [also] one of the eight main elements of the WMO Space Programme adopted by the Fourteenth WMO Congress (Cg-XIV) in May 2003 and described in the WMO Sixth Long-term Plan."

5.78 Additionally, CM-5 had noted "the need to provide for transition of appropriate missions R&D missions to operational. It was also strongly of the opinion that WMO through its Space Programme should act as a catalyst in working with the space agencies to develop a concept that would lead to a process whereby transition from R&D mission to operational could be facilitated.

Recent CBS discussions

5.79 The session recalled that during the last quarter 2005, there had been three sessions of Expert Teams in the CBS Open Programme Area Group on Integrated Observing Systems (OPAG IOS), including ET SAT-1 that proposed an approach for transition from R&D satellite instruments to operational missions.

5.80 The session was informed that ET SAT-1 had noted that a number of recommendations of the Implementation Plan for the Evolution of the Global Observing System were related to the development of demonstration missions, to the availability of data from such missions, and to their operational follow-on. ET SAT-1, based on its own experiences and expertise, confirmed the interest of operational users for early use of R&D instrument data in an operational context, and noted the expectation of the operational user community that, once an instrument was successfully demonstrated, continuity should be ensured by an operational follow-on without any gap if possible.

5.81 ET SAT-1 also noted that a number of recommendations of the Implementation Plan for the Evolution of the Global Observing System were related to the development of demonstration missions, to the availability of data from such missions and to their operational follow-on. It welcomed the interest of operational users for early use of R&D instrument data in an operational context, while bearing in mind the technical conditions and data policies for data access. It further noted the expectation of the operational user community that, once an instrument was successfully demonstrated, continuity would be ensured by an operational follow-on without any gap if possible.

5.82 ET SAT-1 had stressed however the need for a careful planning of the transition between demonstration missions and operational ones and recommended the following approach:

- Since an operational mission is only confirmed, normally, after the successful outcome of a demonstration phase, and taking into account the lead time for mission approval and implementation, there may be a significant gap between availability of demonstration data and operational data, unless a transition phase can be implemented;

- Distinction should thus be made between purely *R&D demonstration missions*, aiming at a proof of concept from a science and technology point of view, and *transition (or preparatory) missions*, aiming at initiating and evaluating potential applications of proven instrument concepts;

- Transition missions may be implemented for selected relevant instruments after successful proof of concept. They require appropriate mechanisms ensuring quasi-operational data availability and strong user involvement in data and products validation activities;

- There are different possible frameworks to implement transition missions. It can be through dedicated missions (such as the NPP risk-reduction mission as a precursor for NPOESS) or e.g., through the decision to extend the operations of a demonstration mission if the spacecraft remains functional beyond its planned lifetime, and provided that sufficient financial resources are available. Transition missions offer a particular scope for cooperative projects, namely through the provision of flight opportunities for pre-operational instruments. To this end, it is recommended that plans/requirements for new operational satellite systems include spare capabilities to accommodate such instruments;

- The concepts of demonstration and transition missions should be taken into account in future updates of the Statement of Guidance and of the Implementation Plan of the Evolution of the GOS. Advantage shall be taken of dedicated R&D to Operations Transition workshops to express specific needs and priorities for transition missions;

- When planning for new operational satellite systems, operational agencies shall timely prepare utilization plans involving users from preparatory activities onwards. This would help reducing the gap between the optimal users learning curve and their actual readiness to make full use of the new data.

5.83 ET SAT-1 had suggested that the WMO Space Programme should pursue the following activities related to the transition from R&D to operational use of new instruments:

- To refine priority user requirements in terms of data and products, taking into account status of maturity (proof of concept, or demonstrated) and availability schedule of the relevant instruments;

- Review status of availability of these required data and products and explore the possibility of additional or improved mechanisms for data access if necessary;

- Identify needs and priorities for new preparatory missions and support cooperation towards implementing such missions if necessary.

5.84 These activities should be conducted in cooperation with satellite operators, with the support of Expert Teams and through dedicated workshops that will help to provide a wider requirements basis and increase user awareness on the potential use of R&D satellite and instruments data in a pre-operational or operational context.

Transition approach

5.85 The session recalled its discussions on GPM and the challenges for a smooth transition from R&D instruments to operational missions. Those challenges included different national institutions and funding priorities. Challenges could also be viewed in terms of 3 issues, (1) how to increase funding for meteorological missions or reduced mission costs, (2) what would be the increased value and benefit from availability of new observational data, and (3) what new communities could be engaged in supporting new missions. The session agreed that WMO could play an important role in the latter two of these issues. The session clearly agreed that the transition issue was a difficult topic. The session was also optimistic in noting that there were already examples of the successful transition of research to operation such a Topex-Poseidon to Jason-1 and Jason-2. Additionally, it also recalled the challenges initially faced within IGEOLAB and that a general concept had been developed by the WMO Space Programme in collaboration with space agencies in CGMS. It noted that the CGMS membership now included all relevant national R&D and operational space agencies (including the intergovernmental ESA and EUMETSAT). Therefore, it should be possible to develop a general concept taking into consideration the challenges outlined during the discussion.

5.86 Thus, the session requested the WMO Space Programme to develop a discussion paper that could be further discussed by CGMS Members with a goal to develop a general concept with a more structured approach including identification of WMO's role that would add value for the transition of R&D instruments to operational missions.

6. GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS) *(agenda item 6)*

6.1 The session was informed on activities since CM-5 towards the implementation of a Global Earth Observation System of Systems.

Activities since CM-5

GEO-6 and EOS-III

6.2 The session was informed that GEO-6 and the Third Earth Observation Summit (EOS-III) were held in Brussels in February 2005. At this meeting the 10-Year GEOSS Implementation Plan was endorsed at the Ministerial level.

GEO-I

6.3 The session noted that in May of 2005 the first meeting of the Group on Earth Observations (GEO-I) was hosted by the WMO in Geneva. At this first meeting, delegates elected a new Executive Committee to oversee the administrative workings of GEO. The Executive Committee consists of twelve members representing various regions of the world from which 4 Co-chairs were chosen. The members chosen are: Brazil, Germany, Italy, Honduras, Japan, Morocco,

Russian Federation, Thailand, and the Co-chairs are from China, European Commission, South Africa, and the United States of America.

6.4 The session was informed that WMO was providing office space for 10 staff of the Secretariat and will enter into a special Service Level Agreement to support the operation of the GEO Secretariat and for the administration of the GEO Trust Fund. The GEO Secretariat is in place housed in the WMO building in Geneva and the new Director, Prof. José Achache, has been in office since September 2005.

EC-LVII (June 2005)

6.5 The session noted that Vice-Admiral Lautenbacher, the Under-Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator in his capacity as a Global Earth Observation Co-Chair had highlighted to EC-LVIII his perspective on the status and plans for the Global Earth Observation System of Systems (GEOSS). Council Members were appreciative for the information on the potential socio-economic benefits that were expected to result from the implementation of GEOSS. EC-LVII agreed that GEOSS activities had the potential to greatly contribute to capacity building efforts throughout WMO Members and especially in developing countries. It also noted that existing and planned WMO systems' capabilities, such as the WMO Information System (WIS), would greatly enhance GEOSS as well as facilitate the interoperability with other systems participating in GEOSS. EC-LVII, as requested in the EOS-III Resolution, agreed to endorse the GEOSS Implementation Plan as contained in Resolution 18 (EC-LVII) Global Earth Observing System of Systems (GEOSS).

GEO-II

6.6 The session was informed that the second Plenary session, GEO-II, was held 14-15 December 2005. GEO II had accepted a process for additional revisions to the draft 2006 Work Plan within the budget of know contributions. The Rules of Procedures for GEO were also approved including Terms of Reference for 4 Committees (Architecture and Data; Science and Technology; Capacity Building; and User Interface) and a Working Group on Tsunamis.

6.7 GEO-II agreed on the following process for the way forward: The Secretariat would by 20 December 2005 redistribute the draft 2006 Work Plan with task lists. Members and Participating Organizations would have until 31 January 2006 to provide comments and proposals for their contributions to the 2006 Work Plan. Contributions could be in the following ways:1) a request to lead a Task; 2) to participate in a Task; and /or 3) a specification of a relevant "user" organization outside of GEO that has committed to assisting with the task in some way. Each Task has been assigned to one of the Committees. Between 31 January and 15 March 2006, the Committees will be set up and asked to review and recommend on the proposed task matrix, or to approve proposed task sheets. The GEO Secretariat will collect the finalized task sheets and produce a new draft 2006 Work Plan and Budget and submit this to the Executive Committee for approval. A GEO Executive Committee meeting is planned for early April 2006. The GEO Executive Committee will report to Plenary by April 7 with the final plan.

6.8 The session noted that WMO continues to be a major contributor to the GEO process, both through its Members and through the coordination role of the WMO Secretariat. Input into the first version and comments on subsequent versions of the 2006 GEO Work Plan were made by WMO including a special session of the Commission on Basic Systems Expert Team on GEOSS Matters held to review and provide detailed comments on Version 1. WMO was appointed to Co-chair the Committee on Architecture and Data and it could also have representation on the 3 other Committees and the Working Group. WMO is also an active participant in GEOSS within the broader UN context and is working with other UN Specialized Agencies, i.e., FAO, UNESCO, UNEP and WHO, to develop coordinated mechanisms for participation in the GEO activities.

6.9 The session strongly agreed that GEOSS would be a major and important initiative, especially in the nine identified societal benefit areas (SBA) in which WMO's mandate, vast experience and expertise would be a significant contribution for four SBAs, in particular weather, water, climate and natural disasters. The session also strongly agreed that GEO should build upon existing WMO systems as components of GEOSS in order to avoid duplication or conflict with WMO activities. In recalling CM-6 discussions for IGDDS, the session agreed that GEONetCast should build upon IGDDS, a component of the WMO Information System (WIS). It recognized that GEONetCast would serve a broader community than WMO's when serving SBAs outside of WMO Members' mandates. NOAA indicated that it was ready to immediately start work with EUMETSAT, China and the WMO Space Programme in the implementation of IGDDS and in the context of GEONetCast with the expectation that data dissemination services could be delivered to many WMO and GEO Members in the very near future.

6.10 The session recalled that while CGMS had already applied for membership in GEO as a Participating Organization, GEO had not yet finalized the process. In this regard, WMO as a member of CGMS agreed to provide the CGMS plenary members with all relevant information concerning input into the 2006 GEO Work Plan in order to harmonize the commitments made by space agencies with those of WMO. ESA informed the session that CEOS SIT was also preparing an input into the 2006 GEO Work Plan and that it was already sharing information and had received information from WMO.

6.11 The session was informed of the declaration of principles made by the Russian Federation at GEO-II with regard to the need for the 10-Year GEOSS Implementation Plan to be adopted at a ministerial level in 2007 to allow it to make financial contributions to GEO. At present, the session noted that the GEO 10-Year Implementation Plan was endorsed as a basis for future development.

6.12 The session was appreciative of WMO activities to keep Members informed and engaged in the GEO process. This included identification of Rapporteurs in the Technical Commissions and Regional Associations.

6.13 CBS noted that a Special Session held in November 2005 had discussed Version 1 of the 2006 GEO Work Plan. In order to reduce costs, accelerate development and ensure success, the CBS meeting had suggested to GEO that the GEONetcast initiative should be based on and build upon the WIS (WMO Information System) programme. CBS was prepared to fully support GEO by inviting GEO participation in the WIS programme and particularly in the WIS implementation during 2006 and beyond. The CBS meeting had also indicated that the text describing GEONetcast of Version 1 of the 2006 GEO Work Plan was somewhat vague and subject to various interpretations. CBS had proposed that the GEO 2006 Work Plan focus on two specific activities: assessing the current data transfer & dissemination requirements and systems in all societal benefit areas; preparing a detailed high level description of what GEONetcast would be and would do, as an extension of the WIS programme. CBS also proposed that GEONetcast become one of the tasks under the Data and Architecture task area. The session noted that Version 2 of the 2006 GEO Work Plan had contained a revised description of GEONetCast that contained amendments suggested by CBS. It also was informed that Version 3 was the latest edition released on 9 January 2006 for further revision.

6.14 CBS has also stressed the need for GEO to prepare technical documentation for new GEOSS components in the language utilized by the various GEO Members. Finally, CBS had noted the need for a balanced approach in the 2006 GEO Work Plan.

6.15 The session also noted the importance of capacity building activities in GEO. It suggested that GEO should take advantage of WMO's considerable experience and expertise in capacity building. In doing so, GEO would greatly assist developing countries through the utilization of already established "best" practices and procedures that would maximize impacts in the SBAs. The session also suggested that GEO should discuss data policies aimed at enhancing capacity building.

7. INTERNATIONAL CHARTER ON DISASTERS *(agenda item 7)*

7.1 The session was informed on WMO activities to participate in the International Charter on Space and Major Disasters including the potential for WMO Members to serve as an authorized triggering national authority. Additionally, the session was also informed of a recent Memorandum of Agreement between WMO and UNOSAT to provide WMO Members with GIS products in support of disaster relief activities.

International Charter on "Space and Major Disasters"

7.2 The session noted some background related to the International Charter on Space and Major Disasters. Following the UNISPACE III conference held in Vienna, Austria in July 1999, the European and French space agencies (ESA and CNES) initiated the International Charter "Space and Major Disasters", with the Canadian Space Agency (CSA) signing the Charter on 20 October 2000. In September 2001, the National Oceanic and Atmospheric Administration (NOAA) and the Indian Space Research Organization (ISRO) also became members of the Charter. The Argentine Space Agency (CONAE) joined in July 2003. The Japan Aerospace Exploration Agency (JAXA) became a member in February 2005. The United States Geological Survey (USGS) also joined the Charter as part of the U.S. team.

7.3 The International Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users. Each member agency has committed resources to support the provisions of the Charter and is thus helping to mitigate the effects of disasters on human life and property.

7.4 The International Charter was declared formally operational on 1 November 2000. An Authorized User can now call a single number to request the mobilization of the space and associated ground resources (RADARSAT, ERS, ENVISAT, SPOT, IRS, SAC-C, NOAA satellites, LANDSAT, and others) of the member agencies to obtain data and information on a disaster occurrence.

7.5 A 24-hour on-duty operator receives the call, checks the identity of the requestor and verifies that the User Request form sent by the Authorized User is correctly completed. The operator passes the information to an Emergency On-Call Officer who analyzes the request and the scope of the disaster with the Authorized User, and prepares an archive and acquisition plan using available space resources. Data acquisition and delivery takes place on an emergency basis, and a Project Manager, who is qualified in data ordering, handling and application, assists the user throughout the process.

7.6 The United Nations Office on Outer Space Activities in Vienna serves as a coordinating point for requests to activate the Charter by the United Nations. However, at present members of the United Nations system, such as WMO Members, are not eligible to serve as an authorizing agent.

7.7 In this regard, the UN Office on Outer Space Affairs (UNOOSA) sent a letter dated August 2005 (through coordination with WMO) and requested the International Charter "Space and Major Disasters" to determine if regional and national focal points of the United Nations entities could request and receive, through the Office for Outer Space Affairs, space-based data from the Charter, in case of major disasters. The letter envisioned that during this first phase between 10-15 WMO national focal points would be trained and provided with the URF and the UNOOSA hotline number. WMO has been informally notified that a response is in preparation by the Charter Secretariat but no formal response has yet been received. ESA informed the session that a draft response had been prepared and further clarification to UNOOSA will be given during the next annual review meeting foreseen in the cooperation agreement. The session also suggested that the benefits of Charter would be improved if it could be extended to provide data required for disaster prevention as well as mitigation.

7.8 The session 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, the session 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.

Cooperation between WMO and the UNITAR's UNOSAT

7.9 The session was informed that on 25 October 2005, a Memorandum of Understanding between the World Meteorological Organization (WMO) and the United Nations Institute for Training and Research Operational Programme on Satellite Applications (UNOSAT) was signed.

7.10 The goal of UNOSAT is to make high-resolution satellite imagery and geographic information easily accessible to the humanitarian community and to experts worldwide working to reduce disasters and plan sustainable development. To do this, UNOSAT acquires high-resolution satellite images from commercial providers. UNOSAT is a unique cooperation initiative between the UN, science and satellite industry that ensures low-cost and high quality solutions.

7.11 In accordance with the Memorandum, both Organizations will exchange information and documents concerning matters of joint interest, in particular disaster reduction. WMO, through its Regional Specialized Meteorological Centres, such as the European Centre for Medium-range Weather Forecasts (ECMWF), will arrange to provide relevant warning information in a timely manner and as much in advance as possible to UNOSAT. UNOSAT will use the information to provide relevant information to WMO Members and in particular to the National Meteorological and Hydrological Services concerned and to other users.

7.12 During relief efforts for victims of the earthquake in Pakistan and in light of the then impending onset of winter, the provisions of the MOU were invoked. In particular, ECMWF made digital snowfall information available to UNOSAT. UNOSAT was able to include the snowfall data into their GIS system and resulting charts. The charts were provided to agencies in Pakistan including the NMHS. The process to make data available was implemented in less than 24 hours.

7.13 The session noted that Information related to the MOU was provided to all WMO Members in a letter from the Secretary-General dated 5 December 2005.

8. REGIONAL SPECIALIZED SATELLITE CENTRES *(agenda item 8)*

8.1 The session was informed on a proposal to identify specific centres of excellence in thematic areas that could be designated Regional/Specialized Meteorological Centres for Satellite Products (Regional Specialized Satellite Centres). The purpose of the proposal was to seek reactions from the session to see if further elaboration would be appropriate.

8.2 The session recalled that Chapter 5 in "The Role of Satellites in WMO programmes in the 2010s, 2003", Technical Document WMO/TD No. 1177 (SP-1) contained a "Vision for the Future: A 2020 Perspective". Several challenges were outlined for WMO including an initiative that would provide the basis for a global approach to product development. It should be based on emerging technologies such as being demonstrated by the Virtual Laboratory for Education and Training in Satellite Meteorology. WMO should embrace the development of institutionalized programmes dedicated to producing specific and globally accepted products needed by NMHSs, and national and international decision makers for all appropriate application areas. The goal would be universally accepted products that can be prepared at designated processing centres. This development initiative would be the research component of another initiative, a system of global processing centres for satellite products.

Regional/Specialized Meteorological Centres

8.3 The session noted that the concept for Regional/Specialized Meteorological Centres evolved in the 1980s with the procedure for the designation of Regional/Specialized Meteorological Centres (RSMC) being approved by the Commission for Basic Systems in Recommendation 1 (CBS-IX) in 1988. At that time, RSMCs were mostly involved as Global Data Processing Centres although the concept has been extended to centres with tropical forecasting responsibilities. Subsequently, the procedure was formalized in the Manual on the Global Data Processing and Forecast System, WMO No. 485, Part I, Appendix I-2. In order to be designated as a RSMC, certain criteria must be met: 1) there must be a statement of requirements for product and services initiated and endorsed by a WMO constituent body; 2) identification of a centre capable to meet the requirements; 3) determination of the need to establish the centre; 4) a formal commitment by a Member or a group of co-operating Members to fulfil the required function; 5) demonstration of the capabilities; 6) recommendation by CBS; and 7) acceptance by either Congress or Executive Council.

8.4 Thus, if a Consultative Meeting satellite operator (including EUMETSAT and/or ESA) had a centre, such as the SAF Network, with a capability to produce a product or service required by a WMO constituent body, such as a Regional Association or Technical Commission, it could be designated a Regional/Specialized Meteorological Centre for Satellite Products within the framework of WMO (or Regional/Specialized Satellite Centre (RSSC)).

8.5 The session agreed that the initial description of the possibility to establish Regional/Specialized Centre on Satellite Products had the potential to be of value to WMO Members. The concept provided for the establishment of centres in developing countries and not necessarily in a space agency.

8.6 The session agreed that the proposal offered many appealing benefits and suggested that the proposal should be further elaborated to identify in more detail its components and structure including responsibilities, financial implications and value-added. The session requested the WMO Space Programme Office to prepare a more detailed description for Regional/Specialized Centres on Satellite Products through a Task Force with participation by interested CM space agencies and WMO Members. In developing the proposal, the session also felt confident that many issues would be clarified including the need for approval by governing bodies responsible for existing centres, the role of R&D space agencies with regard to operational products, product standardization, and data sharing. The session agreed to review the proposal at its next session.

9. ANY OTHER BUSINESS

9.1 The session was briefed by Dr Tillmann Mohr, member of the ICSU/WMO Joint Committee for IPY, on recent activities for the International Polar Year 2007-2008. The session noted that the activities planned in IPY project proposals in many cases were closely related to the WMO Space Programme and to satellite operators. The session felt that IPY would provide a good opportunity to improve global observing systems and their space-based components in Polar Regions through implementation of IPY projects. This was particularly important because at present, according to WWW monitoring results, the observational data coverage in Polar Regions, especially by in-situ systems, was still far from what was required by users.

9.2 The session urged the satellite operators to provide significant contributions for IPY preparation and implementation. It agreed that in order to extend and better coordinate these activities it was desirable to establish a mechanism where the interests of satellite operators to IPY would be well represented. Noting that the IPY Joint Committee established a Sub-committee on Observations that had to evaluate the observational requirements contained in the IPY full proposals and ensure that space-based and in situ observing systems were to their maximum potential optimized and used for IPY purposes, the session welcomed the decision by the IPY Joint

Committee to establish a Space Task Group for IPY under the umbrella of the IPY JC Sub-committee on Observations.

9.3 Argentina informed the session that the five stations in Antarctica were available for support to IPY in terms of increased observations if required, access to considerable climate data sets as well as the ability to host IPY equipment, experiments and institutional support.

10. CLOSURE OF THE SESSION

In closing, the Chairman noted that the session had addressed a demanding agenda within a time-constrained schedule. Additionally, the venue had brought several participants great distances. Notwithstanding those challenges, he was of the opinion that considerable progress had been achieved in a review of the WMO Space Programme and in providing guidance and recommendations to further strengthen the benefits to be derived by WMO Members from satellite data, products and services. He was also of the opinion that the dialogue between the WMO Bureau participants and Directors of space agencies and associated Permanent Representatives has continued to flourish to the mutual benefit of all. He then closed the session at 18h20 on Tuesday, 17 January 2006.

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-5

3. REVIEW EXPANSION OF THE SPACE-BASED COMPONENT OF THE GLOBAL OBSERVING SYSTEM

3.1 Changes in GOS since CM-5
3.2 Changes in Space Agency Plans since CM-5

4. STATUS OF THE SPACE-BASED GOS AND EXPANDED MEMBERSHIP

5. WMO SPACE PROGRAMME IMPLEMENTATION ACTIVITIES

6. GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS)

7. INTERNATIONAL CHARTER ON DISASTERS

8. REGIONAL SPECIALIZED SATELLITE CENTRES

9. ANY OTHER BUSINESS

10. CLOSURE OF THE SESSION

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ANNEX III

CONSOLIDATED SET OF RECOMMENDATIONS FOR THE EVOLUTION OF THE SPACE-BASED SUB-SYSTEM OF GOS PREPARED BY THE FIRST SESSION OF THE OPAG-IOS EXPERT TEAM ON SATELLITE SYSTEMS (ET-SAT-1)

REVIEW OF PROGRESS AND ACTIONS ON EVOLUTION OF THE SPACE-BASED SUB-SYSTEM OF THE GLOBAL OBSERVING SYSTEM (GOS)

1. This document provides a summary of progress and actions concerning the evolution of the space-based sub-system of the GOS, through an update of relevant sections of the Implementation Plan (IP) for the Evolution of the GOS.

2. The IP was updated by ET-ODRRGOS at its meeting 12-16 July 2004 and, following minor revision by ICT at its meeting 6-10 September 2004, was endorsed by CBS-XIII in February 2005. The section of the IP covering the space-based sub-system of the GOS was reviewed in October 2005 in discussions involving Dr P Menzel, Dr J Eyre and the WMO Space Programme ET-SAT-1. This version of the updated IP for the space-based component of the GOS was reviewed by the ET-EGOS and ET-SAT in a joint session on 7 December 2005. Two new concerns are included as a result of the review and two new tasks (S21 - (Lightning and S22 – Formation Flying) have been added to the Implementation Plan.

RECOMMENDATIONS FOR THE EVOLUTION OF SPACE-BASED SUB-SYSTEM OF GOS

A balanced GOS

Concern 1 – LEO/GEO Balance

There has been commendable progress in planning for future operational geostationary satellites. In addition to the plans of China, EUMETSAT, India, Japan, Russian Federation and USA, WMO has been informed of the plans of the Republic of Korea to provide geostationary satellites. The Republic of Korea has made a formal declaration to WMO and is now considered part of the space-based component of the GOS. These developments increase the probability of good coverage of imagery and sounding data from this orbit, together with options for adequate back-up in case of failure. Additionally, it would be appropriate to have regional discussions for optimized operations of geostationary and polar-orbiting satellites comprising the operational space-based component of the GOS including close cooperation on instruments for future satellite missions.

Concern 2 – Achieving Complementary Polar Satellite Systems

EUMETSAT has recently initiated planning for the post-EPS era (i.e., first element in orbit in ~2019) through a thorough assessment of the user requirements for all observations that might usefully be made from low earth orbit. This is to be complemented with a remote sensing assessment of the missions needed to meet these requirements. It is expected that some of these missions will be implemented through satellite missions/systems provided by EUMETSAT, whilst other “missions” may be achieved by cooperation with other partners (e.g., NOAA/EUMETSAT Joint Polar System, complementary with GMES requirements, or acquisition of data in partnership with other space agencies). Through this process, the goals of GEOSS could be greatly advanced. WMO Space Programme Office is encouraged to consider how this process might best be facilitated, to discuss any obstacles to progress, and to identify short-term opportunities for engagement with this process. In addition, noting the polar plans of China and Russia, WMO Space Programme should also extend coordination efforts to include these agencies.

Calibration

S1. Calibration - There should be more common spectral bands on GEO and LEO sensors to facilitate inter-comparison and calibration adjustments; globally distributed GEO sensors should be routinely inter-calibrated using a given LEO sensor and a succession of LEO sensors in a given

orbit (even with out the benefit of overlap) should be routinely inter-calibrated with a given GEO sensor.

Comment: A major issue for effective use of satellite data, especially for climate applications, is calibration. The advent of high spectral resolution infrared sensors (AIRS, IASI, CrIS) will enhance accurate intercalibration. Also regarding visible intercalibration, MODIS offers very comprehensive onboard shortwave solar diffuser, solar diffuser stability monitor, spectral radiometric calibration facility, that can be considered for inter-comparison with geosynchronous satellite data at visible wavelengths. MERIS appears to have merit in this area due to its programmable spectral capability, if implemented. GOES-R selected ABI channels have been selected to be compatible with VIIRS on NPOESS. This only deals with optical sensors, and other sensor types (e.g., active, passive, MW) should be considered.

Progress: CGMS-XXXI (2003) discussed GCOS Climate Monitoring Principles, inter-calibration of visible sensors, and inter-calibration of IR sensors on all GEOs with HIRS and AVHRR (reporting on the last item remains as a permanent action of CGMS). CGMS-XXXII (2004) considered improved infrared inter-calibration capabilities using AIRS data; the implications for GCOS Climate Monitoring Principles were discussed. The WMO Space Programme hosted a workshop in July 2005 in Darmstadt, Germany where a strategy for a global space-based inter-calibration system was drafted; it will be presented to space agencies for consideration, endorsement, and possible implementation. It was noted that the building blocks for a calibration / validation system include (1) on-board calibration devices (e.g., black bodies, solar diffusers), (2) in situ measurements of the state of the surface and atmosphere (e.g. the Cloud and Radiation Testbed (CART) site, aircraft instruments with NIST calibrations), (3) radiative transfer models that enable comparison of calculated and observed radiances, and (4) assimilation systems that merge all measurements into a cohesive consistent depiction of the earth-atmosphere system. A strategy was drafted. The WMO Space Programme presented at CGMS in November 2005 a strategy for achieving operational intercalibration of the space component of the global observing system that addresses the climate and weather forecasting needs.

Next Actions: Discussion and planning with space agencies will be continued via CGMS. CGMS will continue inter-calibration activities with current sensors (e.g., AVHRR, HIRS, MODIS, AIRS) and expand to IASI in 2006.

GEO satellites

S2. 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.

Progress: The following geostationary satellite operators have reported at CGMS that they will have at least SEVIRI-like capability by 2015: NOAA (2012), EUMETSAT (present), Russian Federation (2007), and CMA (2012).

Next Actions: WMO Space Programme will continue discussions with space agencies, via CGMS, especially with IMD and JMA.

S3. GEO Sounders - All meteorological geostationary satellites should be equipped with hyper-spectral infrared sensors for frequent temperature/humidity sounding as well as tracer wind profiling with adequately high resolution (horizontal, vertical and time).

Comment: This was to be demonstrated by GIFTS. However, for budgetary reasons, NASA has recently curtailed the GIFTS mission to assemble and vacuum test an Engineering Design Unit; realization of a GIFTS demonstration in geostationary orbit is a task to be undertaken by the international community, possibly within the International Geostationary Laboratory (IGeoLab).

Progress: All operators reported plans at CGMS in 2004: NOAA has firm plans including this capability for the GOES-R series; EUMETSAT has it under consideration for the MTG series; China and India have plans for capability similar to current GOES sounder before 2010. CGMS endorsed the concept of the International Geostationary Laboratory (IGeoLab) that would be a joint undertaking to provide a platform for demonstrations from geostationary orbit of new sensors and capabilities. GIFTS is one of two systems being considered for IGeoLab. Roshydromet and Roskosmos are negotiating with the USA regarding the possibility to install GIFTS on board of the subsequent geostationary satellite "ELEKTRO". A task team evaluating two test instrument proposals for IGeoLab met in early June 2005 in Silver Spring, MD. This meeting was the outgrowth of an action from the Consultative Meetings on High-level Policy on Satellite Matters (CM) hosted by WMO in January 2005, where the Space Agencies endorsed the concept of IGeoLab and requested that the two proposals (the Geostationary Imaging Fourier Transform Spectrometer – GIFTS and the Geostationary Observatory for Microwave Atmospheric Sounding - GOMAS) be further explored. Instruments of this type in geosynchronous orbit are high priority enhancements to the Global Observing System (GOS) for meeting existing user requirements in numerical weather prediction (NWP), nowcasting, hydrology and other applications areas. In September 2005 thermal vacuum testing of the GIFTS Engineering Design Unit (EDU) was started in Logan, Utah. This will demonstrate several key technologies working together (active cooling, Focal Plane Array detectors (FPA), Fourier Transform Systems (FTS), high speed Analog to Digital converters (A/D), lightweight optics, operation at cryogenic temperatures). Information from the GIFTS TV will be shared with international community to help with instrument performance specifications.

Next Actions: WMO Space Programme is continuing pursuit of a GIFTS demonstration on IGeoLab with space agencies. See note in Next Action for S-13. Additionally, plans from all space agencies for hyperspectral geostationary sounding should be in place by CGMS 2006.

S4. GEO System Orbital Spacing - To maximize the information available from the geostationary satellite systems, they should be placed "nominally" at a 60-degree 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 backup capability should one satellite fail. In particular, continuity of coverage over the Indian Ocean region is of concern.

Comment: In recent years, contingency planning has maintained a 5-satellite system, but this is not a desirable long-term solution.

Progress: WMO Space Programme continues to discuss with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, the strategy for implementation towards a nominal configuration with attention to the problems of achieving required system reliability and product accuracy.

Next Actions: This issue will be addressed at a two-day optimization workshop to be held at WMO in second quarter of 2006.

LEO satellites

S5. LEO data timeliness - More timely data are needed to improve utilization, especially in NWP. Improved communication and processing systems should be explored to meet the timeliness requirements in some applications areas (e.g. Regional and Global NWP).

Progress: The successful EUMETSAT ATOVS Retransmission Service (EARS) has been renamed the EUMETSAT Advanced Retransmission Service and will carry AVHRR and ASCAT products in addition to ATOVS. EARS ATOVS data are now available with a delay of less than 30 minutes; the data are used operationally at some NWP centres and planned at others. Planning has begun for other Regional ATOVS Retransmission Systems (RARS) in Asia, Australia, and South America with a goal for an Integrated Global Data Dissemination Service (IGDDS). WMO hosted a global RARS Workshop in 1-2 December 2005 with participation by Europe, Canada, Americas and Asia-Pacific. WMO Space Programme is planning, with Members and CGMS, the development of Advanced Dissemination Methods (ADMs) and an Integrated Global Data Dissemination Service (IGDDS), to include: (1) the extension and enhancement of EARS; (2) the implementation of similar systems, with a goal of achieving timely retransmission of local data sets covering the globe; (3) an equivalent system for NPP data; (4) expansion of EARS and equivalent systems to include IASI data; and (5) establishment of equivalent systems for the LEO data from satellites of other agencies.

NPOESS plans are for data delivery in less than 30 min and are thus consistent with the stated timeliness requirements for NWP.

Additionally, ERS-2 GOME and scatterometer data are now available in near real time (within 30 minutes) in the coverage region of ESA (e.g., Europe and North Atlantic) and cooperating ground stations.(e.g., Beijing, Perth,..).

Next Actions: WMO Space Programme to pursue further actions to implement IGDDS and RARS.

S6. LEO temporal coverage - Coordination of orbits for operational LEO missions is necessary to optimize temporal coverage while maintaining some orbit redundancy.

Progress: This is now the subject of a permanent action of CGMS. WMO Space Programme will collaborate with space agencies, via CGMS, on a target system that will be implemented and to take steps towards achieving it. Matters related for contingency planning in the AM and PM polar-orbits will be included.

Next Actions: Target system agreed upon by CGMS in 2006.

S7. LEO Sea Surface Wind - Sea-surface wind data from R&D satellites should continue to be made available for operational use; 6-hourly coverage is required.

Comment: QuikScat scatterometer data have been available to the NWP community since 1999, and will continue through the life of QuikScat (NASA has no current plans for a successor SeaWinds scatterometer). ERS-2 scatterometer will be followed by ASCAT on METOP. Oceansat-2 has scatterometer capability that may be made available to the world community (this availability needs to be confirmed).

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 multi-polarisation passive MW radiometry is competitive with scatterometry.

Progress: 3 months of data has been made available to Windsat science team. Windsat data have been distributed to several NWP centres in 2005. Early assessments of its polarimetric capabilities to provide information on sea surface wind direction suggest that, while good information is available at high wind speed, this technology will not be competitive with scatterometry at low wind speed.

Next Actions: WMO Space Programme to take note of recent WindSat performance studies to assess implications to the GOS and provide feedback to NOAA by February 2006.

S8. LEO Altimeter - Missions for ocean topography should become an integral part of the operational system.

Progress: Agreement has been reached to proceed with Jason-2 (2008). TOPEX/Poseidon and Jason-1 continue to provide global ocean topography data to the NWP community. ESA has plans for a Sentinel-3 ocean mission that will include an altimeter.

Next Actions: WMO Space Programme to discuss with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, the continuity of operational provision after Jason-2. Plans for operational follow-on should be reported at CGMS in 2006.

S9. 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 satellite.

Comment: Plans for ERB-like measurements after Aqua remain uncertain. There are also concerns about the continuity of absolute measurements of incoming solar radiation. This is a high priority item in the GCOS implementation plan.

Progress: WMO Space Programme to discuss with space agencies, via CGMS. The second NPOESS satellite is scheduled to carry the CERES instrument (likely launch in 2013), but NPOESS program is currently under review and likely to be re-configured. FY-3A will have a proto-type Earth radiation budget instrument in 2007.

Next Actions: WMO Space Programme should advise CGMS of these developments and lead a discussion of possible gaps in coverage at CGMS in 2006.

R&D satellites

S10. LEO Doppler Winds - Wind profiles from Doppler lidar technology demonstration programme (such as Atmospheric Dynamics Mission - Aeolus) should be made available for initial operational testing; a follow-on long-standing technological programme is solicited to achieve improved coverage characteristics for operational implementation.

Comment: Plans for Aeolus demonstration are proceeding on schedule, but there are no plans for operational follow on.

Progress: EUMETSAT is considering the requirements for observations of the 3D wind field as part of their planning for post-EPS missions. ESA plans to work with ECMWF to prepare for the assimilation of Doppler winds into NWP model and to give feedback as to their impact.

Next Actions: WMO Space Programme will discuss with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, to assure demonstration with Aeolus and initiation of operational systems for wind profile

measurement. Plans for continuity of a Doppler Winds capability following Aeolus should be discussed by CGMS satellite operators in 2006.

S11. GPM - The concept of the Global Precipitation Measurement Missions (combining active precipitation measurements with a constellation of passive microwave imagers) should be supported and the data realized should be available for operational use, thereupon, arrangements should be sought to ensure long-term continuity to the system.

Progress: TRMM continues to provide valuable data for operational use. Early termination of TRMM after 2004 was averted after user community appeals for its continuation. NASA has assured continued operation into 2009. At CGMS-XXXII, NASA, ESA and JAXA reported plans for a GPM mission in 2008 (now 2010). In 2005, ESA's European GPM was not selected as the next Earth Explorer Mission. At the fifth International planning workshop WMO expressed it support and its readiness to facilitate partnerships to expand the GPM constellation. It was recognized that ISRO's Megha-tropique has a passive microwave capability that is not yet part of the GOS but could be useful in the GPM constellation (availability needs to be confirmed). Other R&D and operational satellites in polar orbit may contribute to the constellation with their microwave radiometers.

Next Actions: WMO Space Programme is continuing discussions with space agencies, via CGMS and at CM, regarding plans for GPM.

S12. RO-Sounders - The opportunities for a constellation of radio occultation sounders should be explored and operational implementation planned. International sharing of ground support network systems (necessary for accurate positioning in real time) should be achieved to minimize development and running costs.

Progress: CHAMP and SAC-C data have been available to some centres but not in near real time (NRT). NWP OSE has shown positive impact with small number of occultations. Climate applications are being explored. Near real time dissemination of CHAMP data is planned for 2006. Plans for near real time distribution of METOP/GRAS and COSMIC data are also in place.

Next Actions: Plan for operational follow-on to COSMIC should be drafted by CGMS in 2006. Plans for a shared ground support network should also be drafted by CGMS in 2006

S13. 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.

Progress: EUMETSAT, NESDIS and WMO prepared a paper for CGMS on the International Geostationary Laboratory (IGeoLab) that would be a joint undertaking to provide a platform for demonstrations from geostationary orbit of new sensors and capabilities. Geo sub-mm is one of two systems being considered for IGeoLab. A task team evaluated the IGeoLab possibilities for a Geostationary Observatory for Microwave Atmospheric Sounding (GOMAS) as well as other possible instruments. This type of instrument in geosynchronous orbit is high priority for meeting existing user requirements in numerical weather prediction (NWP), nowcasting, hydrology and other applications areas. The task team is pursuing definition of feasible options for a geo sub mm instrument; the WMO Space Programme will seek partners for development of the recommended Geo sub mm instrument with space agencies and will report progress at CGMS. An IGeoLab Focus Group meeting was held on 24 October 2005 and the results were reported to CGMS-XXXIII where the concept was endorsed.

GOMAS is a candidate for an ESA Explorer core mission, to be determined in mid-2006.

Next Actions: WMO Space Programme will continue dialogue with space agencies, via CGMS.

S14. LEO MW - The capability to observe ocean salinity and soil moisture for weather and climate applications (possibly with limited horizontal resolution) should be demonstrated in a research mode (as with ESA's SMOS and NASA's Aqua and Hydros, and NASA/CONAE Aquarius/SAC-D) 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.

Progress: ERS scatterometer data sets have provided monthly global soil moisture maps since 1991 at 50 km resolution. WindSat and AMSR-E are being studied for possible utility of 6 and 10 GHz measurements for soil moisture for sparsely vegetated surfaces. SMOS is scheduled for launch in late 2007. Aquarius is scheduled for launch in 2008 and Hydros in 2009.

Next Actions: WMO Space Programme will discuss at CGMS progress and options for provision of soil moisture and salinity products including real time delivery of soil moisture products for NWP.

S15. 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.

Progress: The wave spectra from ENVISAT are available in near real time from an ESA ftp server. CSA's RADARSAT data are used in deriving ice products by the National Ice Center.

Next Actions: WMO Space Programme to discuss with space agencies, via CGMS, (1) broader access by WMO Members to ENVISAT SAR data, (2) availability of SAR data from other agencies, and (3) continuity of such missions. Assessment of status and plans should completed by CGMS in 2006.

S16. LEO Aerosol - Data from process study missions on clouds and radiation as well as from R&D multi-purpose satellites addressing aerosol distribution and properties should be made available for operational use.

Comment: Terra and Aqua carry the MODIS sensor that is providing global aerosol products over ocean and most land regions of the world at 10 km spatial resolution. Additional R&D satellites currently providing aerosol optical thickness and optical properties include Terra/MISR, PARASOL, EP-TOMS, and Aura/OMI, CALIPSO will carry an R&D lidar for monitoring the vertical distribution of aerosols along the orbital ground track of the spacecraft, which is in the A-train orbit along with Aqua, PARASOL, CloudSat, and Aura. NASA's Glory mission (2008) as well as NPOESS has added APS, an aerosol polarimetry sensor. ESA and JAXA are preparing the Earthcare (cloud/aerosol mission) for launch in 2012.

Next Actions WMO Space Programme will continue discussions with space agencies, via CGMS and at CM, regarding availability of these data for operational use.

S17. 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.

Comment: GLAS data are currently able to determine vertical distribution of cloud top altitude along the nadir ground track of ICESat, but this spacecraft operates in ~100 day epochs and is not continuous. CALIOP on CALIPSO should make these data routinely available in the A-train orbit (Aqua, PARASOL, CloudSat, and Aura).

Next Actions WMO Space Programme will discuss with space agencies, via CGMS and at CM, near real time operational use of these data and operational follow-on planning.

S18. 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.

Next Actions WMO Space Programme to discuss with space agencies, via CGMS.

S19. 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.

Progress: MIPAS and SCIAMACHY data are available in near real time from the ESA ftp server. NPP is scheduled to carry OMPS with ozone limb sounding in 2009.

Next Actions: WMO Space Programme will discuss with space agencies, via CGMS, progress/plans for distribution of data from MIPAS and SCIAMACHY on ENVISAT, from MLS and HIRDLS on Aura, and from similar instruments.

S20. 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 hyper-spectral passive sensing, for operational NWP.

Next Actions: WMO Space Programme will discuss with space agencies, via CGMS.

S21. Lightning Observation – There is a requirement for space borne lightning observations. Several initiatives for operational implementation exist. These should be encouraged to fruition.

Comment: NASA's observations of lightning from OrbView-1/OTD and TRMM/LIS has demonstrated that 90% of lightning occurs over land, and that it is heavily tied to deep convection. In addition to its importance in severe storms and warnings for safety, lightning is an importance source of NO_X and thus contributes to elevated levels of tropospheric ozone. The vision for the space-based component of the GOS approved by the Extraordinary session of CBS in 2002 included GEO lightning under the need for "Several R&D satellites serving WMO Members".

Progress: The dynamics of lightning occurrence and its importance for nowcasting has been recognized by NOAA that plans to include a lightning sensor on GOES-R, and under consideration for MTG and FY-4, in the future.

Next Actions: WMO Space Programme will discuss with space agencies, via CGMS.

S22. Formation Flying – Advantages of formation flying need to be investigated.

Comment: NASA has already demonstrated both a morning constellation (involving Landsat 7, EO-1, SAC-C, and Terra) and an afternoon constellation (Aqua, PARASOL, and Aura, soon to be joined by CloudSat (2006), CALIPSO (2006), and OCO (2008)). These multi-agency and multi-country constellations demonstrate the added value of coordination

of Earth observations to make a polar orbiting system greater than the sum of the parts, but able to launch when sensors and spacecraft are ready and available.

Next Actions: The utility of data from sensors flying in formation need to be assessed. WMO Space Programme will discuss with space agencies, via CGMS

ANNEX IV

1. CURRENT DESCRIPTION OF THE IGDDS

IGDDS definition and goal

The Integrated Data Dissemination Service (IGDDS) defines the satellite data and products circulation scheme that is expected to meet the needs of WMO Programmes, within the WMO Information System (WIS), in accordance with the WMO Space Programme Implementation Plan 2004-2007 agreed by WMO EC LVI.

IGDDS approach and objectives

IGDDS is stemming from a vision that was developed within the CBS/OPAG IOS Expert Team of Satellite Systems, Utilization and Products and subsequently endorsed by CBS, CM and CGMS, in order to meet growing needs to provide cost-efficient access to large data volumes in near real time.

Unlike an industrial project with a top-down global architectural design with detailed interface specifications, IGDDS is implemented in a pragmatic and incremental way by satellite operators in cooperation among themselves and with WMO.

IGDDS shall aim at the following particular features:

- Integrated: the service shall offer unified access to the various sources of data, including operational GEO or LEO satellites, R&D satellites, or higher level products. It should be sufficiently open to be able to deliver other types of data if appropriate, thus allowing non-satellite data to benefit from the service as well.

- Global: in view of increasing needs to access data from the whole globe IGDDS shall provide a mechanism for inter-regional data exchange in such a way that observational data from any region could be also available in any other region.

- Data: the IGDDS shall address the communication segments supporting data transfer at any level, i.e., raw data originating from data sources, higher level data disseminated to the users, as well as low or high level data exchanged between production centres within a region or at inter-regional scale. Although not explicitly mentioned in the acronym, IGDDS may thus include data collection and data exchange networks in addition to data dissemination means.

- Dissemination: a core functionality of the IGDDS is routine dissemination of satellite data in real time. A preferred method for this routine dissemination is to use commercially available technologies such as Digital Video Broadcast via satellite (DVB-S). This is referred to as Advanced Dissemination Methods (ADM). In order to serve the needs of different user communities and regions having different contexts, IGDDS may have to rely on different and complementary data access mechanisms. Interactive access will complement the routine dissemination by ADM.

- Service: each satellite operator within the IGDDS shall manage user requests, ensure and monitor a high quality of service.

IGDDS shall be part of the overall WMO Information System. This will imply in particular an harmonized approach of data and metadata management ensuring interoperability with the Global Information Service Centres (GISC). Having regard to the large volumes of data they are responsible for, it is expected that satellite operators will act within the WIS as Data Collection and Product Centres (DCPC) and satisfy the DCPC requirements as defined within the WIS.