

## **WMO SPACE PROGRAMME**

*(Submitted by WMO)*

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### **Summary and purpose of document**

This paper summarizes the activities of the WMO Space Programme since GCMS-XXXIII and informs on the preliminary planning of activities considered for 2008-2011

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**Appendix:** WMO Space Programme Implementation Plan 2008-2011 – Draft Outline

## PROGRESS/ACTIVITY REPORT

### Background

The main thrust of the WMO Space Programme Long-term Strategy is to make an increasing contribution to the development of the WWW Global Observing System (GOS), as well as to the other WMO-supported Programmes and associated observing systems through the provision of continuously improved data, products and services, from both operational and R&D satellites, and to facilitate and promote their wider availability and meaningful utilization around the globe. The WMO Space Programme Implementation Plan for 2004-2007 is organized according to the eight elements of the WMO Space Programme Long-term Strategy, i.e.: increased involvement of space agencies contributing, or with the potential to contribute, to the space-based component of the GOS; promotion of a wider awareness of the availability and utilization of data, products – and their importance at levels 1, 2, 3 or 4 - and services, including those from R & D satellites; more attention paid to the crucial problems connected with the assimilation of R&D and new operational data streams; closer and more effective cooperation with relevant international bodies; additional and continuing emphasis on education and training; facilitation of the transition from research to operational systems and improved integration of the space component of the WMO's various observing systems; and increased cooperation amongst WMO Members to develop common basic tools for utilization of research, development and operational remote sensing systems.

### Major events

1. Several important WMO Space Programme events have occurred since CGMS-XXXIII:
  - On 7-8 November 2005, the WMO Space Programme participated in the 5<sup>th</sup> International Global Precipitation Measurement (GPM) Planning Workshop in Tokyo. The importance of GPM for WMO was stressed and international cooperation was encouraged for the GPM constellation. The GPM topic was subsequently addressed at the 6<sup>th</sup> Consultative Meetings on High-level Policy on Satellite Matters (CM-6);
  - On 1-2 December 2005, WMO hosted in Geneva the 2nd CGMS-WMO Global Workshop on RARS and IGDDS. Plans were initiated for RARS in the Asia-Pacific regions and in South-America, as well as for an ADM trial in Asia. More details can be found in WMO WP-20 and WP-28;
  - In January 2006, CM-6: reviewed the status and expansion of the space-based component of the GOS; WMO Space Programme Activities; the Global Earth Observation System of Systems (GEOSS); the International Charter on Natural Disasters; and the concept for Regional Specialized Satellite Centres. Noteworthy at CM-6 was the formal commitment by the Administrator of the China National Space Administration (CNSA) to the WMO 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. CM-6 noted that the CGMS Secretariat would be immediately informed in order that CNSA could become a full CGMS member. (It should be noted that subsequently at ET-SAT-2, held in Geneva 4-8 September 2006, CNSA extended the commitment of satellite missions to include CBERS 1 and 2 and HJ-series missions. More detailed information concerning results and recommendations from CM-6 can be found in WMO WP-16;
  - Also in January 2006, the planning process for the WMO Budget for 2008-2011 provided sufficient resources for only one of the two advertised posts in the WMO Space Programme Office. It was thus decided to fill the post for Chief, Satellite Data Utilization at a later date;

- In February 2006, the WMO Secretary-General and Director, WMO Space Programme attended the inaugural ceremony for the new Centre of Excellence in Muscat, Oman that is co-sponsored by EUMETSAT and IMD. Oman will participate in the High-Profile Training Event (HPTE) (see WMO WP-18 for more details);
- On 15-16 March 2006, EUMETSAT hosted a WMO/CGMS GSICS meeting to develop a draft GSICS Implementation Plan. Dr Mitch Goldberg (NOAA/NESDIS) chaired the meeting and Dr Tillmann Mohr (Special Advisor to the WMO Secretary-General on Satellite Matters) and Mr Jérôme Lafeuille (WMO Space Programme Office) attended (see WMO WP-27 for more details);
- In March 2006, the WMO Secretary-General selected Mr Jérôme Lafeuille as the new Chief, Space-based Observing System Division. Mr Lafeuille continued his secondment from Météo-France in the WMO Space Programme Office and formally assumed his duties on 25 September 2006;
- On 3-5 May 2006, Mr. Jérôme Lafeuille attended the North America Data Exchange Meeting hosted by NOAA/NESDIS in Silver Spring, USA. Mr. Lafeuille represented WMO as an observer at the meeting (see WMO WP-20 for more details);
- On 23 June 2006, WMO hosted a meeting of CGMS satellite operators to review the GSICS Implementation Plan. NOAA, EUMETSAT, CMA, JMA and the Russian Federation agreed to support the GSICS Implementation Plan that established a GSICS Executive Panel (see WMO WP-27 for more details);
- On 20-30 June 2006, the 58<sup>th</sup> session of the WMO Executive Council reviewed major implementation accomplishments of the WMO Space Programme including the status of the space-based sub-system of the Global Observing System (GOS), the Integrated Global Data Dissemination Service (IGDDS), the International Geostationary Laboratory (IGeoLab), the operational Global Space-based Inter-Calibration System (GSICS) and the High Profile Training Event (HPTE) within the Virtual Laboratory for Education and Training in Satellite Meteorology (VL). With regard to guidance and recommendations to further strengthen the WMO Space Programme, the Council reviewed matters related to IGDDS, GSICS, the transition for relevant R&D instruments to operational satellite missions, the International Charter "Space and Major Disasters and the concept for Regional/Specialized Centres on Satellite Products;
- On 28-29 August 2006, WMO hosted a CGMS Optimization Workshop in Geneva (see WMO WP-4 for more details);
- On 10-14 July 2006, the WMO Space Programme Office supported the Expert Team on Evolution of the Global Observing System (ET-EGOS) to review and update the Implementation Plan for Evolution of the space and surface subsystems of the Global Observing System (IP EGOS), as concerns the space subsystem. An update is provided in WMO WP-6;
- On 30 August 2006, WMO hosted a CGMS Meeting on Frequency Coordination in Geneva (see WMO WPs 10, 11 and 12 for more details);
- On 31 August through 1 September 2006, WMO hosted the 3<sup>rd</sup> IGDDS and RARS Workshop in Geneva (see WMO WP-20 for more details). The outcome of these meetings was reported at the meeting of the Inter-Commission Group on the WMO Information System (ICG-WIS) in Beijing on 5-8 September 2006;
- On 4-8 September 2006, The Expert Teams on Satellite Systems (ET-SAT) and on Satellite Utilization and Products (ET-SUP) held their second sessions, partly as a joint

meeting and addressed most of the activities of the WMO Space Programme. The outcome of these two meetings were reported at the 4<sup>th</sup> meeting of the Implementation/Coordination Team for Integrated Observing systems (ICT-IOS) on 11-15 September 2006;

- On 20-22 September 2006, the WMO Space Programme was represented as an observer by Dr David Griersmith (Bureau of Meteorology, Australia) at the 7<sup>th</sup> Asia-Pacific Data Exchange and Utilization Meeting;
- On 4-10 October 2006, the WMO Space Programme reported on its overall activities and in particular on the global RARS project at the International ATOVS Study Conference;
- On 10-12 October 2006, the WMO Space Programme reported to the GCOS Steering Committee on its activities in support of GCOS implementation;
- On 16-27 October 2006, the CGMS VL Management Group with sponsorship by WMO held the High-Profile Training Event (HPTE) (see WMO WP-18 for more details).

### **Future activities**

The Implementation Plan for the WMO Space Programme in 2008-2011 is being prepared as part of the WMO planning process that will namely include a WMO Strategic Plan and a WMO Operating Plan. A draft outline of the WMO Space Programme Implementation Plan for 2008-2011 is provided in the Appendix to this working paper.

## **WMO SPACE PROGRAMME IMPLEMENTATION PLAN 2008-2011**

### **DRAFT OUTLINE**

#### **1. PURPOSE AND SCOPE OF THE WMO SPACE PROGRAMME**

Recall the Mission statement of the WMO SP as established by Cg-XIV:

“To make an increasing contribution to the development of the WWW GOS, as well as to the other WMO-supported Programmes and associated observing systems (such as AREP’s GAW, GCOS, WCRP, HWR’s WHYCOS and JCOMM’s implementation of GOOS) through the provision of continuously improved data, products and services, from both operational and R&D satellites, and to facilitate and promote their wider availability and meaningful utilization around the globe”

#### **2. WMO CONTEXT OF THE SPACE PROGRAMME**

##### **2.1. Achievements:**

- Requirements database;
- Training, virtual laboratory;
- IGDDS and RARS;
- GSICS;
- Representing the WMO user community in space-related for a.

##### **2.2. WMO overall strategy and its 11 expected results, including the following that WMO SP shall serve in particular:**

- improving methods, accuracy, timeliness and usefulness of weather forecast,
- achieving integration of WMO global observing systems;
- implementing the WMO Information System (WIS),
- capacity building.

Potential for serving also the other expected results indirectly.

#### **3. EXTERNAL ENVIRONMENT**

##### **3.1. Outlook on future programmes and satellite operators’ context:**

- New generations of satellites being prepared for the 2012-2020 timeframe;
- Expansion of the number of agencies contributing to the GOS.

##### **3.2. Trends in satellite technology:**

- Hyperspectral IR sensors in LEO and GEO;
- Passive microwave radiometry;
- Active measurements radar/lidar/radio-occultation;
- Increased resolution;
- Improved timeliness.

##### **3.3. Consequences for the users:**

- Dramatic increase in volume of space-based observations, multiple data sources including operational and R&D programmes, new measurements;
- Increased role of data assimilation;
- Need to optimize development and processing suggests to rely on high-level products.

3.4. Other technical aspects:

- Frequency protection and management;
- Multipurpose telecommunications systems;
- Continuing importance of data collection;
- Space weather for spacecraft status monitoring.

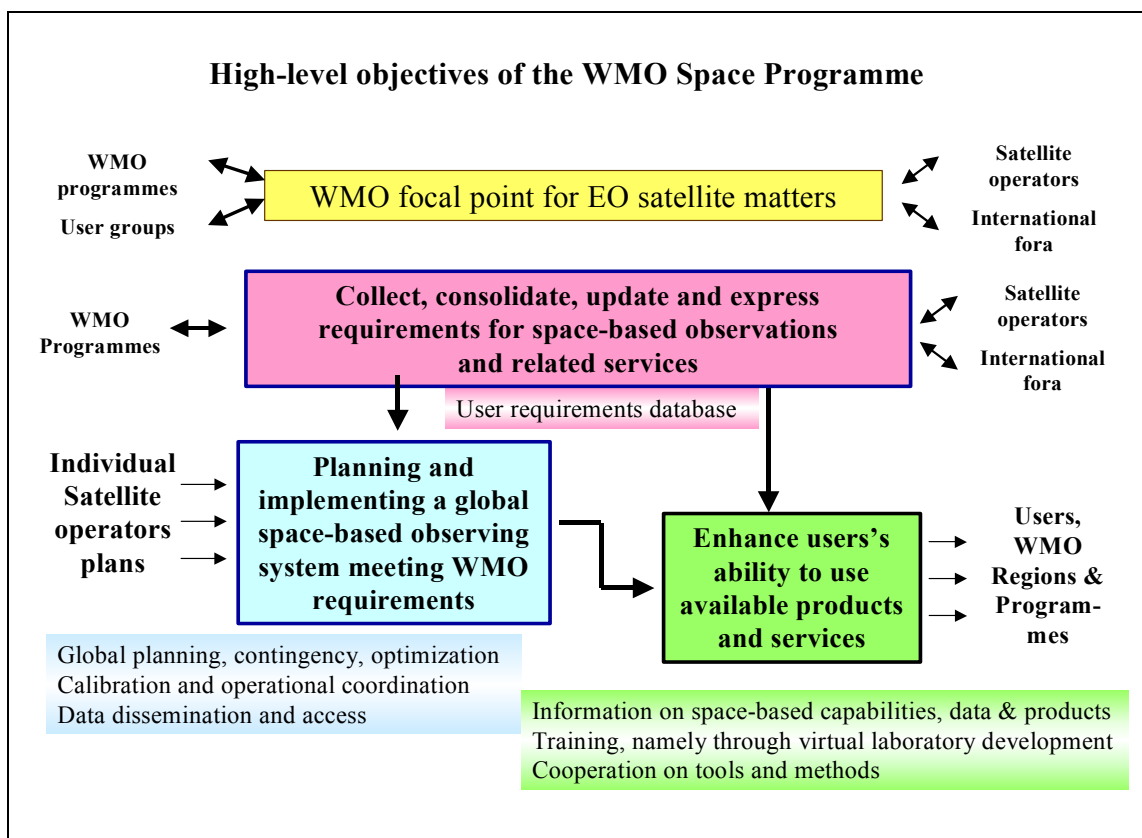
3.5. GEO framework:

- GEO reinforces political and public visibility on the need for Earth Observation;
- provides additional incentive for cooperation and interoperability;
- facilitates data use across different societal benefit areas;
- GOS and WIS as contributions to the GEOSS.

4. MAIN PROCESSES AND DELIVERABLES OF THE WMO SP

In summary, the WMO Space Programme should coordinate and combine the efforts of satellite operators, WMO Members in general, and the WMO Secretariat in order to:

- Develop a coordinated viewpoint of the WMO user community on satellite matters and express it in relevant satellite-related fora;
- Formulate requirements for space-based observations and related services;
- Implement a space-based observing system and associated ground systems responding to these requirements;
- Enhance users' capability to efficiently use space-based data products and services.



Processes corresponding to these broad objectives are detailed below.

4.1. Coordinated WMO viewpoint on satellite matters:

- WMO Secretariat to participate in relevant satellite-related fora to keep abreast of ongoing and planned developments as well as policy issues for space-based observation;
- WMO Secretariat, assisted by experts from WMO Members and satellite operators, to represent the interests of WMO in relevant satellite-related international organizations;
- WMO Secretariat (Space Programme Office) to contribute to information flow with other WMO Programmes on satellite-related matters and requirements.

4.2. Collect, consolidate, update and voice user requirements for space-based observations and related services:

- Collect and consolidate observational requirements from WWW and other programmes including climate monitoring, disaster prevention, applications (marine, aviation, agriculture, public services), hydrology and atmospheric research;
- Possibly include also satellite operators' requirements for space weather;
- Collect specifications of space-based observing system capabilities
- Maintain a database of user requirements and observing system capabilities and coordinate its update;
- Propose and support the evolution of WMO global observing systems;
- Contribute to the WMO Expected Result to integrate all WMO observing systems.

*Customers: primarily the WMO Programmes, then space agencies for mission design;*

*Target: detailed and quantified observational requirements available at least for WWW, WCRP, AREP and GCOS, DPM, HWRP, JCOMM. Database updated on a yearly basis.*

4.3. Implement a globally coordinated space-based observing system:

- Satellite operators to develop and implement plans responding to operational and/or sustained observation requirements;
- WMO Secretariat to contribute with satellite operators to the optimization of satellite plans through initiatives to review these plans and foster international cooperation and partnerships;
- Develop a coordinated approach of transition from R&D to operational status for relevant space-based instruments and missions;
- Develop and implement contingency plans among satellite operators;
- Develop and implement a comprehensive approach of global satellite instrument calibration and cross-calibration;
- Support operational coordination and harmonization as appropriate for overall efficiency and to facilitate utilization;

The activities above shall be mainly conducted through the CGMS framework.

*Customers: WMO programmes and users, and satellite operators;*

*Target: Full geostationary coverage by 6 operational spacecraft with redundancy and contingency plans. Plans for LEO coverage consistent with requirements for operational meteorology, climate monitoring and key applications. Operational calibration and cross-calibration through GSICS. Appropriate R&D missions in support of "sustained" observations for climate monitoring and complementary observations for operational use.*

4.4. Promote and implement harmonized, efficient, timely, enhanced data access.

This is mainly through implementing the concept of an IGDDS: data exchange, dissemination, timeliness of access to operational and R&D data.

IGDDS is developed within the WIS framework and coordinated with the development of GEOnetcast

*Customers: All WMO programmes and WMO users (NMHS), ultimately all potential user categories.*

*Target: Observational data requirements identified in every WMO Region and updated at least on a 2-year basis. Efficient dissemination means such as telecommunication-satellite based DVB broadcast providing global real-time access to data and products of several satellites in response to the requirements.*

*Global RARS coverage for all sounding data.*

4.5. Support development of data use:

- Cooperation on methods, encourage sharing of tools;
- Support operational use of R&D data;
- Facilitate definition of basic products (with quality standards) and organize their processing;
- Definition and implementation of Regional Specialized Centres (RSMC).

*Customers: WMO users (NMHS)*

*Target: A set of validated and recognized core satellite-based products accessible in every WMO Region.*

4.6. Provide up-to-date and comprehensive information on satellite plans, systems, products:

- Satellite operators to ensure comprehensive information to WMO users;
- WMO Secretariat to develop on-line user information services, forwarding information from individual satellite operators, and complementing this information as appropriate with information at WMO global scale and on other issues of relevance for WMO users;
- Ensure up-to-date information.

*Customers: primarily the WMO users (NMHS), then satellite operators*

*Target: Harmonized on-line access to up-to-date information on satellites, products, data access as well as background information on space-based observation and WMO Space Programme.*

4.7. Organize, and implement training

- target audience: NMHS staff, with priority on developing countries;
- WMO Members and WMO Regional Training Centres to implement and operate Centres of Excellence in Satellite Meteorology with the support of Space agencies
- Space agencies and WMO Regional Training Centres to cooperate to develop the Virtual Laboratory;
- WMO Secretariat to monitor the development of the Virtual Laboratory, the implementation and activity of Centres of Excellence and sponsor training events.

*Customers: WMO users (NMHS) and WMO RTCs (CoE)*

*Target: One Centre of Excellence (at least) active for each WMO working language*

4.8. Cross-cutting process:

Monitoring the progress towards the objectives (seeking feedback in appropriate manner from the target customers)

Monitor in particular the progress on following critical issues:

- Expanding the use of satellite data & products across less advanced WMO Members (questionnaire being one way among other to seek feedback);
- Integration of various observing systems;
- Transition from R&D demonstrations to operational missions with continuity;
- Global and timely access to satellite data and products;



- Efficient and up-to-date user information on product availability, characteristics and use;
- Sustainable training strategy.

4.9. Interactions between WMO Space Programme and other entities:

- Role of CM, CBS and associated Expert Teams;
- Interaction with other WMO or co-sponsored programmes;
- Relationship with other international bodies (CGMS, CEOS, SFCG, GEOSS, UN-organizations, ITWG, IPWG, IWWG..);
- Relationship with national (or regional) organisations, Individual users (incl. Commercial entities).

**5. RESOURCES AND ORGANIZATION**

- Major resources needed from satellite operators to develop and implement satellite missions and associated services;
- Significant resources needed from WMO Members for processing satellite data, and in particular for data assimilation and generation of fields of geophysical variables incorporating data from multiple satellite sources;
- Resources within WMO Secretariat for:
  - o Staffing, consultancy,
  - o Procured services,
  - o sponsoring training events and symposia,
  - o mission and travel for Secretariat and to support meeting participants,
- Quality management framework.