

WMO Space Programme	OUTLINE OF THE WMO SPACE PROGRAMME IMPLEMENTATION PLAN FOR 2008-2011	SAT-ST-06 Version 1 8/01/2007
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1. PURPOSE AND SCOPE OF THE PROGRAMME

The mission statement of the WMO Space Programme was defined by Cg-XIV as follows:

“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. PAST ACHIEVEMENTS OF THE PROGRAMME

The following achievements can be mentioned as a result of the activities of WMO Members and their Space agencies, supported by WMO Secretariat, within the space programme

- Fully operational geostationary and Low Earth Orbit (LEO) observing system complemented with advanced R&D satellites;
- Development and on-going implementation of Integrated Global Data Dissemination Service (IGDDS) concept, including DVB-S dissemination services that are now the core of GEONetcast
- Development of the global network of Regional ATOVS Retransmission Systems (RARS);
- Definition and initial implementation of the Global Space-Based Inter-Calibration System (GSICS);
- Establishment of Centres of Excellence, development of the Virtual Laboratory, satellite meteorology training events, High Profile Training Event;
- On-line database of user requirements and observing capabilities;
- Constructive dialogue with space-related organizations (satellite operators and international bodies such as CGMS) and with relevant science groups (ITWG, IWWG, IPWG);

3. STRATEGIC CONTEXT

3.1. WMO

The new WMO strategic framework identifies eleven Expected Results, including the following that WMO SP shall serve in particular:

- *Improved methodologies, accuracy, timeliness and usefulness of NWP and weather forecasting,*
- *Improved technologies, sustainability, inter-operability and cost-effectiveness of the WMO Integrated Global Observing System (WIGOS);*
- *Comprehensively developed and widely implemented new WMO Information System (WIS);*
- *Development and implementation of comprehensive measures for capacity building in developing countries, particularly LDCs, for enhanced weather, climate, water and*

environment-related services.

This does not exclude that the Space Programme also contribute to other Expected Results, directly or indirectly, and namely:

- *Improved methodologies, reliability and usefulness of climate predictions.*

The increasing awareness on satellite capabilities and better visibility of the Space Programme raise expectations from different WMO or co-sponsored programmes (DPM, WCP, AREP, GCOS) providing opportunities for joint actions.

3.2. Group on Earth Observation (GEO)

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

4. TECHNICAL CONTEXT

4.1. Evolution of satellite programmes

- New generations of satellites being prepared for the 2012-2020 timeframe;
- Additional agencies contributing to the GOS.
- Increased resolution;
- Improved timeliness
- Hyperspectral IR sensors in LEO and GEO;
- Development of passive microwave radiometry;
- Active measurements radar/lidar/radio-occultation;
- Different types of platforms and orbits for different missions
- Increased attention paid to space weather for spacecraft status monitoring
- Continuing need for frequency protection and increased need for careful frequency management with the increase of satellites and data rates

4.2. Consequences for the users:

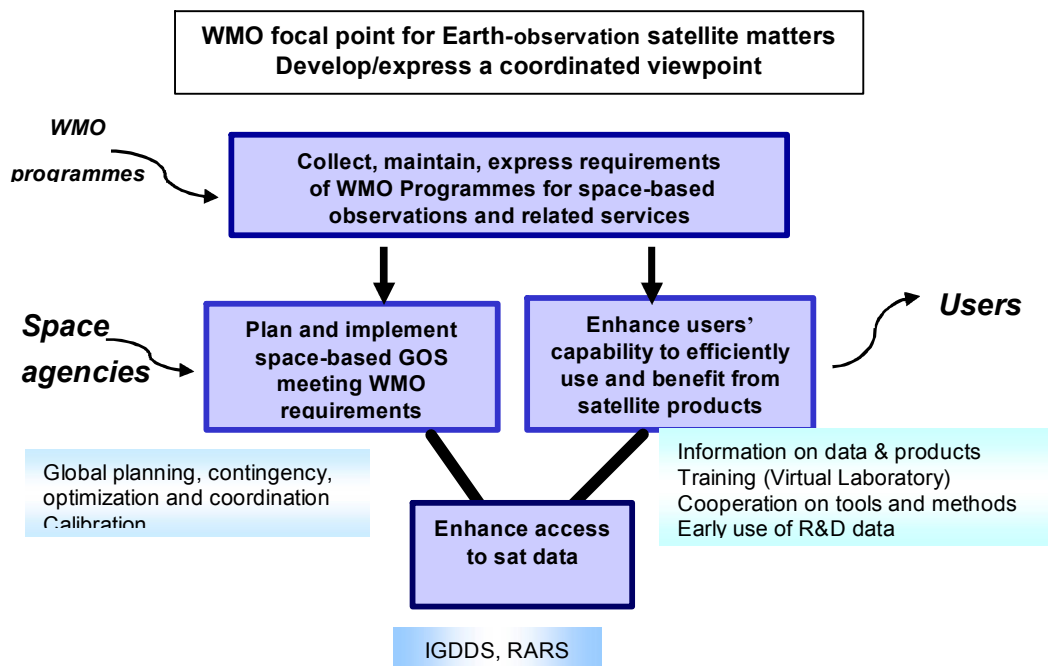
- Order of magnitude increase in volume of space-based observations;
- Use of multiple data sources including operational and R&D satellites;
- Increased reliance on multipurpose telecommunications systems;
- Continuing importance of data collection;
- New types of measurements;
- Increased role of data assimilation;
- Need to optimize development and processing, which suggests to increasingly rely on high-level products generated by specialized centres with high expertise.

5. MAIN PROCESSES AND DELIVERABLES OF THE WMO SP

In summary, the WMO Space Programme should help to 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;
- Collect, maintain and express requirements for space-based observations and related services;
- Plan and 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.



Schematic diagram of the main processes of the WMO Space Programme

Processes corresponding to these broad objectives are detailed below.

- 5.1. Develop and express a coordinated WMO viewpoint on satellite matters:
 - WMO Secretariat to participate in relevant satellite-related fora to keep abreast of on-going 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.

- 5.2. Collect, maintain, update and express 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;
 - Consider requirements generated by space-based observation for surface-based observations (calibration)
 - Collect specifications of space-based observing system capabilities
 - Maintain a database of user requirements and observing system capabilities and coordinate its update;
 - Support the planning and evolution of WMO global observing systems;
 - Contribute to the integration of 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.*

5.3. 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;

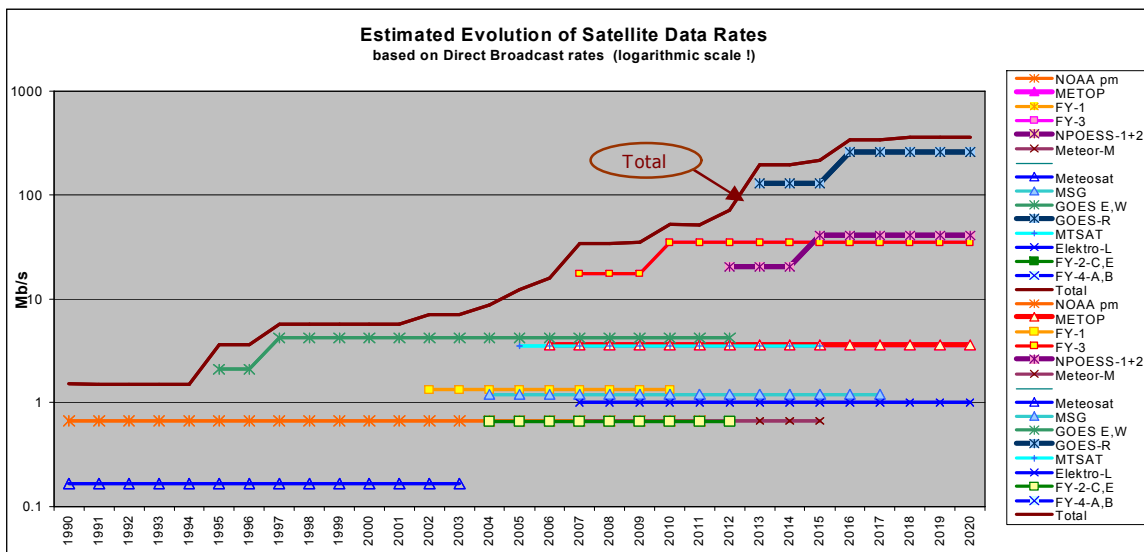
The activities above shall rely as appropriate on the CGMS framework that provides an efficient mechanism for coordination and technical dialogue.

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.

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

Need to allow WMO members to keep up with the rapidly increasing data rates and variety of sources of satellite observations.



This is pursued mainly through the concept of the IGDDS project with particular emphasis on interregional data exchange, efficient dissemination, timely access of operational and R&D data. IGDDS is pursued within the WIS framework and benefits of a synergy with the development of GEOnetcast

Customers: All WMO programmes and WMO users (NMHS), ultimately other 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.

- 5.5. Provide up-to-date and comprehensive information on satellite plans, systems, products:
- WMO Secretariat to develop on-line services to provide information at the global scale on the space-based global observing system, general information on satellite products, training material and related events, and serve as a portal to information from satellite operators and relevant organizations. Ensure updating, accuracy and consistency of information
 - Satellite operators to ensure comprehensive information to WMO users on their systems and services;
 - WMO Secretariat and satellite operators to cooperate towards harmonization of essential information services (e.g. product catalogues)

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.

- 5.6. 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 Centres of Excellence in training on satellite meteorology Centres to cooperate to further develop the Virtual Laboratory and expand the network of competences through "focus groups" ;
 - 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

- 5.7. Support development of data use:
- Stimulate the development of data use in fostering cooperation on methods, publicizing good practices and encouraging the sharing of tools;
 - Support in particular the early use of R&D data in support of operational activities and as a learning opportunity to prepare for their operational exploitation ;
 - Support the definition of core products;
 - Definition and implementation of Regional Specialized Centres (RSMC) volunteering to deliver products satisfying agreed requirements and validation standards.

Customers: WMO users (NMHS)

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

6. Additional processes

- 6.1. Monitoring the progress
- Progress towards the objectives will be monitored in seeking feedback in appropriate manner from the target customers, in particular on following critical issues:
- Expansion of the use of satellite data & products across less advanced WMO Members ;
 - 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.

The principle of the biennial questionnaire has strong limitations. Enquiries should be made in a more flexible and targeted way.

6.2. Interactions with other entities:

- Mandatory reporting to CM, CBS
- Increased interaction with other WMO or co-sponsored programmes;
- Continued 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) in order to facilitate information flow and exchange of ideas.

6.3. Supporting activities

Documentation management ensuring traceability and efficiency in the handling of documentation submitted to meetings or distributed through the web-site.

7. RESOURCES AND ORGANIZATION

- The Space Programme is first conditioned by the major resources involved by satellite operators to develop, implement and operate satellite missions and associated services;
 - Significant resources are also needed by 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;
 - The Space Programme relies to a large extent on the contribution of experts from WMO members, in particular the CBS / OPAG IOS Expert Teams on Satellite Systems (ET-SAT), on Satellite Utilization and Products (ET-SUP) and on the Evolution of the GOS (ET-EGOS); ad-hoc groups are implemented under the joint auspices of WMO and CGMS for activities such as GSICS, RARS, IGDDS.
 - Resources within WMO Secretariat are mainly needed for:
 - o Staffing (Currently one Director, one Professional Officer instead of an initial plan for three posts, one Administrative Assistant) and associated costs;
 - o Staff complement that is required, through seconded experts and targeted consultancy support;
 - o Sponsoring training events and co-sponsoring conferences,
 - o Mission and travel for participants to experts meetings
 - o Mission and travel for Secretariat staff or for experts representing the Space Programme at some meetings.
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