IMPLEMENTATION ACTIVITIES WITHIN THE WMO SPACE PROGRAMME

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ABSTRACT

The Fourteenth WMO Congress held in Geneva in May 2003 established the WMO Space Programme as a new major cross-cutting Programme. The main purpose of the WMO Space Programme is to coordinate environmental satellite matters and activities throughout all WMO Programmes and to give guidance to these and other multi-sponsored programmes on the potential of remote sensing techniques in meteorology, hydrology and related disciplines, as well as in their applications.

In response to the overall guidance given to the WMO Space Programme by the WMO Sixth Long Term Plan, an Implementation Plan was developed to provide a more detailed description of activities by the WMO Secretariat, WMO Members and operational and Research and Development (R&D) satellite operators. This paper will discuss those activities including matters related to the increased use of operational and R&D satellite data streams, regional education and training seminars and regional workshops to identify those R&D data streams that should transition into operational satellite systems.

This paper also describes the current status of the expanded space-based component of the GOS including access by WMO Members to new data streams from R&D space missions and their impacts for operational use.

INTRODUCTION

At the 2003 EUMETSAT User Conference, held in Weimar, Germany, the establishment of the WMO Space Programme as a major cross-cutting WMO Programme was discussed. The WMO Space Programme formally came into existence on 1 January 2004. This paper discusses implementation activities that have occurred since then.

STATUS OF THE SPACE-BASED COMPONENT OF THE GLOBAL OBSERVING SYSTEM

The World Weather Watch's (WWW) Global Observing System (GOS) is comprised of three types of satellites: operational meteorological polar-orbiting and geostationary, and environmental Research and Development (R&D) satellites. With regard to meteorological satellites, both polar-orbiting and geostationary, they continue to prove invaluable to WMO NMHSs through the provision of a multitude of services including imagery, soundings, data collection and data distribution. In particular, the present operational meteorological satellites include the following geostationary and polar-orbiting satellites: GOES-10, GOES-12, NOAA-15, NOAA-16 and NOAA-17 operated by the United States; GMS-5 operated by Japan; GOMS N-1, METEOR 2-20, METEOR 2-21 and METEOR 3-5 operated by the Russian Federation; Meteosat-5, Meteosat-6, Meteosat-7 and Meteosat-8 (formerly MSG-1) operated by EUMETSAT; and FY-2B, FY-1C, FY-1D operated by China. Additional satellites in orbit include GOES-8, GOES-9 and GOES-11 operated by the United States. It should be noted that most space agencies contributing operational polar-orbiting and geostationary satellites have in place contingency plans for satellite systems that guarantee the continued daily flow of satellite data, products and services WMO Members have come to depend on. In this
regard, Japan and the United States of America initiated a back-up operation of GMS-5 with GOES-9 on 22 May 2003. With regard to R&D satellites, NASA’s Aqua, Terra, NPP, TRMM, QuikSCAT and GPM missions, ESA’s ENVISAT, ERS-1 and ERS-2 missions, NASA’s GCOM series, data from Rosaviakosmos’s research instruments on board ROSHYDROMET’s METEOR 3M N1 satellite, as well as on its future Ocean series and CNES’s JASON-1 and SPOT-5, either were, or would be after launch, part of the R&D constellation. Thus, the nominal space-based component of the GOS comprised of three constellations (operational geostationary; operational polar-orbiting; and R&D satellites) is shown in Figure 1.

TOWARDS THE SPACE COMPONENT OF AN INTEGRATED WMO GLOBAL OBSERVING SYSTEM

The fourth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-4) met in Geneva, 27-28 January 2004 and the relevant results of that meeting are contained in this paper. CM-4 recalled that, at earlier Consultative Meetings, the space agency representatives had encouraged WMO to move towards a more integrated framework for the space-based components of the observing systems of the various WMO programmes.

It was pleased, therefore, to learn that the Fourteenth WMO Congress (Cg-XIV) had specifically assigned as an overall objective of the WMO Space Programme “To review the space-based components of the various observing systems throughout WMO Programmes and WMO-supported Programmes, e.g., WWW’s GOS, AREP’s GAW, GCOS, HWR’s WHYCOS, JCOMM’s Implementation of GOOS, etc., with a view towards the development of an integrated WMO global observing system that would encompass all present observing systems.”

CM-4 agreed that the development of an ‘integrated WMO global observing system’ was particularly timely in the context of the initiative now underway, through the ad hoc GEO mechanism to achieve high-level international (intergovernmental and inter-agency) commitment to the implementation, over a ten-year period, of a “comprehensive, coordinated and sustained Earth observation system or systems”. An effectively integrated WMO global observing system covering the atmosphere and those aspects of the ocean and land surface that fall within the WMO mandate would go a long way towards providing the nucleus of the more comprehensive earth observation system that is the goal of the GEO initiative.
CM-4 recognized that the responsibilities of the Consultative Meetings extended only to the space-based component of such an integrated WMO global observing system. It felt satisfied, however, that, given the long history of effective integration of the surface-based and space-based sub-systems of the Global Observing System of the World Weather Watch, a similar level of coordination and integration between the surface-based and space-based components of an integrated WMO Global Observing System would follow naturally from the WMO Processes.

It was considered that the basic architecture of the space-based sub-system of the WWW GOS would extend logically to the space-based sub-system of an integrated WMO global observing system, and it would consist of three constellations and their associated ground segments based on the WWW sub-system of:

- operational meteorological polar orbiting satellites;
- operational meteorological geostationary satellites; and
- environmental Research and Development satellite constellations.

CM-4 agreed that the main challenge for WMO in giving effect to the decision of Cg-XIV would be in putting in place effective coordination and integration mechanisms across the various WMO observing systems serving the needs of the wide range of user communities represented by the individual programmes in areas such as agriculture, water resources, oceanographic and marine meteorological services, weather predication and climate research and so on. It considered, however, that this process would be greatly facilitated by the fact that the WMO Space Programme has been constituted not just as a Major WMO Programme but also as a cross-cutting programme with the resulting requirement to take a comprehensive view of the space aspects of all other WMO programmes.

While recognizing that the detailed arrangements for cross-programme coordination and integration, including those relating to the staffing of the WMO Space Programme Office for this purpose, had still to be worked out, CM-4 lent its support to the concept of the space-based component of an integrated WMO global observing system composed of the space-based components of the observing systems of the various WMO and WMO-cosponsored programmes, grouped in terms of the major user communities they serve.

Given that, while WMO was responsible for almost all aspects of the observation and information/service provision for the atmosphere, it shared the responsibility for the ocean and land surface (including water resources) with many other international agencies and conscious, in particular, of the cross-cutting nature (ocean atmosphere, ocean and land surface) of the observation needs for natural disaster reduction and climate, CM-4 agreed on the importance of careful and sensitive design of the integrated WMO observing system structure. It welcomed the fact that, in line with its long established role in coordination of the WWW GOS, the WMO Commission for Basic Systems (CBS) had been assigned the responsibility of WMO lead Technical Commission for the WMO Space Programme.

CM-4 looked forward, therefore, to CBS development in consultation with all other relevant WMO and co-sponsored bodies, of the space-based component of the integrated WMO global observing system on the basis of space-based observation components for three earth-system domains and two cross-cutting sets of requirements as follows*:

(1) the atmosphere, including sub-components meeting the needs of:

   (a) the operational WWW and the various weather, climate and related applications and services based on it, including those of aviation meteorology (articulated through the Commission for Aeronautical Meteorology) and agricultural meteorology (articulated through the Commission for Agricultural Meteorology);

   (b) weather research such as for the World Weather Research programme as articulated through the Commission for Atmospheric Sciences;

   (c) atmospheric chemistry, such as for the Global Atmosphere Watch, as articulated through the Commission for Atmospheric Sciences;

(2) the ocean, to meet the needs of the Global Ocean Observing System (GOOS) and the oceanographic and marine meteorological services and research based on it, as articulated through the joint WMO-IOC Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM);
the land surface and fresh water, to meet the needs of:

(a) the World Hydrological Cycle Observing System (WHyCOS) and the Hydrology and Water Resource Programme (HWR) as articulated through the Commission for Hydrology (CHy),

(b) the WMO-co-sponsored Global terrestrial Observing System (GTOS),

(c) agricultural meteorology as articulated through CAgM,

(4) climate, incremental to, and integrating across, the domain-based observing systems, as coordinated through the Steering Committee for the WMO co-sponsored Global Climate Observing System (GCOS) to meet the needs of:

(a) climate research, articulated through the WCRP,

(b) climate policy, articulated through SBSTA, COP, based on information from IPCC etc.

(c) climate monitoring and services, articulated through the Commission for Climatology (CCI), (CAgM), (CHy);

(5) natural disaster reduction, incremental to, and integrating across, the domain-based observing systems and composed of those space-based instruments and missions providing geophysical and related information needed to support the WMO Natural Disaster Prevention and Mitigation Programme.

* An alternative “sub-system” structure would be:

(1) Operational meteorology (CBS, CAeM, CAgM ..)
(2) Operational Oceanography (JCOMM)
(3) Operational hydrology (CHy)
(4) Atmospheric Research (CAS-AREP)
(5) Climate (including Climate Research) (GCOS, CCI, WCRP)
(6) Natural Disaster Reduction

CM-4 noted that the practical implementation of the proposed integration would pose significant challenges in matrix management but it was confident that WMO and the entire space-based earth observation stakeholder community would benefit from WMO taking a more integrated and coordinated approach.

CM-4 was also informed of the new initiative by the WMO Secretary-General to establish matrix management within the WMO Secretariat. Furthermore, one potential area for matrix management would be for observations. It was presently intended that the World Weather Watch and WMO Space Programme work together towards the consolidation of all observing systems found in the various WMO programmes into an integrated WMO global observing systems. CM-4 noted that this effort towards consolidation of observations, when coupled with the proposed integration of the space-based components of the various observing systems, and co-led by the World Weather Watch and WMO Space Programme would provide the necessary emphasis on the fusion of in situ and satellite data. CM-4 was strongly in favour of such an approach and urged the WMO Secretary-General to seek measures to implement it. It was an important concept and very timely considering activities related to the ad hoc Group on Earth Observations. The consolidation within the space-based components would help accelerate and align research and development programmes with operational services. With regard to the proposed restructuring of the CBS Expert Team structure, the session strongly supported the core group of satellite expertise approach.

It should be noted that the recommendations of CM-4 towards the space component of an integrated WMO global observing system will be considered by the fifty-sixth session of the WMO Executive Council to be held in Geneva, Switzerland 8-18 June 2004.
WMO SPACE PROGRAMME IMPLEMENTATION PLAN

CM-4 also reviewed and agreed, as further elaborated below, to the WMO Space Programme Implementation Plan for 2004-2007 prepared by the Secretariat. The complete WMO Space Programme Implementation Plan can be found as Annex III to the CM-4 report available at http://www.wmo.ch/hinsman/publications/CM-4_Final_Report.doc.

CM-4 was of the opinion that the WMO Space Programme Implementation Plan for 2004-2007 adequately described the scope and breadth of the new programme. Some sections such as the description of the integrated global data dissemination service were well structured and appropriately detailed although consideration should be given to dissemination services presently operated by NMHSs and other organizations, e.g., ICAO/WAFS. An opportunity now existed to improve data dissemination while integrating existing mechanisms. Other sections could be structured in a similar fashion. Additional emphasis should be made for satellite data collection systems as well as amplification of the role in oceanography. It was also suggested that a project could be developed for inclusion in the Implementation Plan for assimilation of data from present and future R&D environmental satellites. An additional project could also be included in the Implementation Plan covering reanalyses related to retrospective satellite data from both operational and R&D environmental satellites. The Implementation Plan should also be careful to reflect the role of partner agencies when integrating across WMO supported programmes.

CM-4 noted that the last section of the WMO Space Programme Implementation Plan for 2004-2007, entitled “WMO Resource Implications”, outlined specific areas where space agencies contributing to the space-based component of the GOS could complement the existing infrastructure for the WMO Space Programme Office as well as for Education and Training events. In this regard, NOAA has indicated a willingness to second Dr Paul Menzel to the WMO Space Programme Office for a period of two months during 2004.

CM-4 noted the emphasis given by Cg-XIV in the establishment of the WMO Space Programme and additionally resources allocated for training events, workshops and meetings. However, CM-4 felt that WMO should also consider more staff resources for the WMO Space Programme Office as a matter of urgency and high priority. It recognized that a review of staff and priorities may be necessary to identify possible solutions. A review of staff and priorities by WMO has commenced at the direction of the WMO Secretary-General. One immediate result was the designation of the person responsible for the programme as the Head of the WMO Space Programme.

CM-4 noted the use of the WMO Space Programme Trust Fund that had allowed WMO to lead detailed discussions in CGMS with regard to global contingency planning as well as in the preparation of the WMO Space Programme Implementation Plan. CM-4 was of the opinion that the use of the WMO Space Programme Trust Fund for such purposes greatly enhanced the effectiveness of the Space Programme in supporting WMO Members. Thus, CM-4 strongly urged WMO Members and space agencies to consider providing financial resources to the Trust Fund recognizing that such contributions would allow related activities identified in the review of the Implementation Plan as well as for the Plan itself to commence. The WMO Secretary-General has written to all space agencies in March 2004 and suggested that they consider providing an indication of their intent to making a contribution to the WMO Space Programme Trust Fund. In this regard, EUMETSAT made a substantial contribution to the WMO Space Programme Trust in 2004 similar to that done in 2003.

ESTABLISHMENT OF A NEW CBS OPAG IOS EXPERT TEAM ON SATELLITES

CM-4 also recognized in order to provide institutional constituent body support with appropriate satellite expertise for the various space-based components of observing systems throughout WMO Programmes that CBS consider as a matter of urgency the following restructuring:

- The present Open Programme Area Group on Integrated Observing Systems (OPAG IOS) Expert Team on Satellite Systems Utilization and Products should be renamed the Expert Team on Satellite Utilization and Products (ET-SUP) and maintain its present Terms of Reference;
- A new OPAG IOS Expert Team on Satellite Systems (ET-SAT) should be established that would provide the necessary satellite expertise (both for operational and Research and Development satellites) to ensure an integrated WMO global observing system that would encompass all present observing systems. The Expert Team would be comprised solely of representatives from space agencies contributing to the space-based component of the GOS. The Chairman of the new Expert Team would ensure that a member would be designated to represent the Expert Team to each of the
various other WMO Programme expert groups. Representatives from the Expert Team would also serve as regional rapporteurs for the various Implementation and Coordination Teams thus ensuring regional influence reflecting WMO needs as well as those of the space agency. While working within the CBS structure, the new Expert Team would support all WMO Programmes as well as provide for direct feedback through the CBS President to the WMO Consultative Meetings providing overall guidance to the WMO Space Programme. The WMO Space Programme Office would serve as the WMO Secretariat for the new Expert Team as it already did for the present Expert Team on Satellite Systems Utilization and Products. Such a structure would provide the nucleus of satellite expertise towards the integration of the space components described above into a single integrated WMO global observing system.

A letter has been sent to the Acting President of CBS seeking his approval of the establishment of the new Expert Team and draft Terms of Reference (TOR) on an interim basis pending its review and confirmation at the forthcoming thirteenth session of the CBS in 2005. In the meantime, the WMO Secretariat has written to space agencies and satellite operators participating in the WMO Consultative Meetings with regard to nominations of experts for membership of the new Expert Team with a view to constituting the ET. To date, three space agencies have nominated experts for ET-SAT as follows: (ESA – Dr E. Oriol-Pibernat, EUMETSAT – Mr Lorenzo Sarlo, JMA – Mr Yoshiaki Takeuchi). As soon as sufficient experts are identified, the WMO Space Programme will initiate a first planning meeting. With regard to the proposed restructuring of the CBS Expert Team structure, CM-4 strongly supported the core group of satellite expertise approach.

THE ROLE OF SATELLITES IN WMO PROGRAMMES IN THE 2010S

“The Role of Satellites in WMO Programmes in the 2010s”, WMO Space Programme Satellite Report (SP-1), Technical Document WMO/TD No. 1177 authored by Dr G. Asrar, Dr T. Mohr and Mr G. Withee has been prepared and will be distributed at the forthcoming WMO Executive Council to be held in Geneva, 8-18 June 2004. The new TD contains vivid examples of the applications of satellite data, product and services as well as a vision for the near and long-term for the space-based component of the Global Observing System.

IMPLEMENTATION ACTIVITIES

With regard to implementation activities planned during the next two years, there will be two regional symposia towards identification of appropriate research and development data streams that should become operational on future generations of meteorological satellites. There will also be two training events held under the aegis of the Virtual Laboratory for Education and Training in Satellite Meteorology. The tremendous success already achieved by the Virtual Laboratory is discussed in another paper in the User Conference. Finally, WMO will start a project described in the WMO Space Programme Implementation Plan towards the development of an integrated global data dissemination service. Satellite operators contributing to the space-based component of the GOS have been consulted within the context of the recent thirty-second session of the Coordination Group for Meteorological Satellites (CGMS).