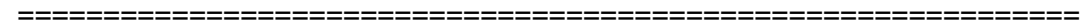


**WORLD METEOROLOGICAL ORGANIZATION**



**COMMISSION FOR BASIC SYSTEMS**  
**OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS**  
**EXPERT TEAM ON SATELLITE SYSTEMS**  
**EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS**

**JOINT FOURTH SESSION**

**LANGEN, GERMANY**

**2-5 SEPTEMBER 2008**

**FINAL REPORT**



## **WMO General Regulations**

### **Regulation 42**

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

### **Regulation 43**

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

## EXECUTIVE SUMMARY

The fourth sessions of the Expert Team on Satellite Systems (ET-SAT) and Expert Team on Satellite Utilization and Products (ET-SUP) met in Langen, Germany from 2 to 5 September 2008. The sessions were held partly in a joint meeting and partly in parallel meetings. In addition, the meeting was attended on 2 September by members of the Virtual Laboratory Management Group.

Primary objectives for the session were to provide guidance on the main activities of the WMO Space Programme from a satellite system and a user's point of view. For this purpose, the session reviewed the status of operational and R&D satellite programmes; Gap Analysis with respect to WMO requirements; user information activities; training strategy; the status of the IGDDS and RARS projects. It discussed satellite products availability; the strategy for transition of R&D instruments to operational missions; and the status and plans for the database on observational requirements and observing system capabilities. It refined the new Vision to 2025 for the space-based component of the GOS. It analyzed the outcome of the 2007 enquiry on the use of satellite data and products;

Among its major outcomes, the session:

- Noted the update presented by space agencies on present and future operational and R&D satellite programmes.
- Reviewed the space-based component of the draft Vision of the GOS to 2025 and considered that this Vision represented a major step towards the sustainable availability of satellite data for weather and climate applications and other WMO needs, reinforcing the role of the GOS within the Global Earth Observation System of Systems. It recommended that the draft Vision, with some proposed clarifications, be submitted to the fourteenth session of CBS in March 2009 for adoption. The meeting however questioned the relevance of listing some applications that are not part of WMO's scope of activity, such as oil spills and earthquakes.
- Considered a set of four documents describing respectively the status of the space-based component of the GOS, instruments characteristics, Gap Analysis and the expected product accuracy. The meeting was convinced that this outstanding technical documentation would be a useful reference for planning purposes and recommended that it is maintained in the coming years.
- Emphasized that the transition from R&D missions and instruments to operational status was a critical process to ensure long-term sustainability of the GOS, highlighted a number of prerequisites for a smooth transition related to three different aspects of this transition: (i) Instrument technology readiness to support operations; (ii) Maturity level of the applications and user preparedness; (iii) Programmatic status and associated commitment on continuity. Subsequently, in response to the Consultative Meetings on High-level Policy on Satellite Matters, the session has derived guidelines for WMO action to facilitate the transition from R&D to operational status.
- Expressed concern that the CEOS-WMO Database on User Requirements and Observing Capabilities cannot be updated because of lack of staff resources within the Space Programme Office; confirmed that the database should be further maintained as it was the basis for the Rolling Review of Requirements and should play an even greater role with WIGOS; recommended to redesign the current database and to secure resources for its further maintenance.
- Was informed on preliminary WMO activities regarding Space Weather, including the report on the potential role of WMO in Space Weather. In response to the request from the Executive Council that CBS and the Commission on Aeronautical Meteorology (CAeM) develop work plans for supporting Space Weather activities, with extra-budgetary resources, the session suggested that an Inter-Commission Team be

established among CBS and CAeM to look after Space Weather matters; the team would include satellite and aeronautical meteorology experts and representatives of the Space Weather Community.

- Reviewed the status of the three candidate IGeoLab initiatives; acknowledged the strong interest expressed for an IR hyper-spectral demonstration mission; was informed of the forthcoming Focus Group meeting for the geostationary microwave initiative (Beijing, 15-16 October 2008); and encouraged agencies to participate in the Focus Group meeting of the Highly Elliptical Orbit candidate initiative tentatively planned in November 2008.
- Developed a draft Virtual Laboratory (VL) Training Strategy for the next five years, aiming at strengthening the VL network of Centres of Excellence, upgrading the Virtual Resources Library, emphasizing a blended learning approach and expanding to new training areas to respond to the evolving training needs of WMO Members.
- Supported the proposed addition of new Centres of Excellence (CoE) in Pretoria (South Africa) and in Moscow and St Petersburg (Russian Federation); welcomed the consideration by ISRO to establish a CoE in India and to co-sponsor with EUMETSAT the existing CoE in Muscat (Oman).
- Recognized the need for a technical support officer for the Virtual Laboratory (VL) to support the planned training and education activities. This additional resource could possibly be located at a CoE and sponsored by satellite operators.
- Recommended that direct follow-up actions be performed in response to the issues and limiting factors raised by WMO Member reports in the biennial questionnaire on the availability and use of satellite data and products certain problems.
- Agreed a way forward to finalize the analysis of the 2008 edition of the questionnaire with the purpose to complete a Technical Document (TD) on the status of the availability and use of satellite data and products by WMO Members in January 2009. The TD will be based on the analysis of responses to the 2008 questionnaire and will be completed with information from satellite operators on the trend of registered users during the last two years and from the CoE on the trend in the number of participants in VL training activities.
- Confirmed the excellent progress achieved in both the RARS and IGDDS projects, in particular towards global coverage. However, expressed some concern as regards South American coverage by a sustainable Digital Video Broadcast Satellite system supporting level 1 data.
- Activities dedicated to improved user information on product availability and to education and training will have an additional focus on data of R&D satellite missions in order to achieve an intensified use of them.
- Welcomed the initiative of the Expert Team on Automatic Weather Stations (ET-AWS) to consider the potential of AWS networks to support calibration of space-based observations and product validation; confirmed the importance of ground-truth data considering that such measurements could support validation or quality monitoring of geophysical products (level 2 or above). Expressed interest in investigating further this opportunity which seemed particularly timely in the context of WIGOS and took action to provide consolidated comments after circulation to ET-SUP and ET-SAT Members.

The session agreed on a list of actions, reviewed the accomplishments with respect to the work plan assigned by the CBS, and proposed a new work plan for each of the two Expert Teams.



*First row (left to right):* Mr A.S. Kiran Kumar, Dr Eva Oriol-Pibernat, Mr Sory Diallo, Mr Leonardo Peres\*, Mrs Fan Hong\*, Mr Tony Mostek

*Second row (left to right):* Mr Wolfgang Benesch (Acting Chair, ET-SUP), Dr Paolo Pagano, Mr Kazuyoshi Yoshimatsu, Mr Joseph Kagenyi\*, Dr Vilma Castro, Dr Alexander V. Nerushev, Dr Volker Gaertner, Dr Luiz Toledo Machado

*Third row:* Mr Zhenhui Wang\*, Mr Andy Kwarteng\*, Mr Akihiro Shimizu, Mr Jérôme Lafeuille, Mr Winifred Joordan\*, Mr Richard Francis, Mr Xiaoxiang Zhu

*Back row (left to right):* Mr Human AlBadi\*, Mr Peter Albert, Dr Lothar Schueller, Mr James Gurka (Acting Chair, ET-SAT), Mr Garba Adamou\*, Mr Roger Deslandes\*, Dr James Purdom.

Not on the picture: Mrs Anna Khokhlova

(\*): Members of the Virtual Laboratory Management Group who attended the first day of ET-SAT/SUP-4.

## **1. ORGANIZATION OF THE SESSION**

### **1.1 Opening of the session**

The joint fourth session of the Expert Team on Satellite Systems and Expert Team on Satellite Utilization and Products was opened at 09h00 on Tuesday, 2 September 2008 at the Conference and Training Facility (BTZ) of the German Meteorological Service in Langen, Germany.

The session was opened by Professor Gerhard Adrian, Vice-President of the Deutscher Wetterdienst (DWD). In his welcome address, Professor Adrian expressed his appreciation for the important activities of both satellite Expert Teams which contribute to increase and make more effective the use of satellite systems and thus make investments in satellite systems more efficient. He informed the participants of the forthcoming inauguration of the new DWD Headquarters; and highlighted the main DWD activities for weather and climate applications, underlining the vital importance of satellite data and the scope for further expanding the use of satellite data in the meteorological community.

On behalf of the WMO Secretary General, Mr Jerome Lafeuille thanked DWD for hosting the meeting and welcomed the participants. He pointed out that the outcome of the session would be an essential input for the Commission of Basic Systems (CBS) to be held in March 2009. He underlined the important role of the Expert Teams for the progress of WMO programmes.

Mr Hans Bauer, principal of BTZ, welcomed the participants and introduced them to the facilities. (The list of participants is attached as Annex I.)

### **1.2 Adoption of the agenda**

The provisional agenda was adopted as contained in Annex II, with the exception of item 9 that was cancelled.

### **1.3 Working arrangements for the session**

It was agreed to conduct the work of the session in a joint meeting for agenda items 1 to 11 and 18 to 22, and in parallel meetings of ET-SAT and ET-SUP for items 12/A to 17/A and 12/B to 16/B respectively, establishing smaller working groups as required.

## **2. CHAIRMEN'S REPORTS**

### **2.1 OPAG IOS Chairman's report**

The Chairman of the CBS Open Programme Area Group on Integrated Observing Systems (OPAG IOS) recalled the activities conducted at the OPAG IOS level. He urged the Expert Teams to develop a proposal for work plans including: 1) proposed tasks; 2) key deliverables; and 3) timelines and responsible parties for the deliverables.

He recalled that the outcome of the meeting would be reported the following week to the Implementation/Coordination Team on Integrated Observing System (ICT IOS) that would consolidate the findings of ET-SUP, ET-SAT and the Expert Team on the Evolution of the Global Observing System (ET-EGOS) and forward recommendations to the fourteenth session of the CBS to be held in March 2009.

The OPAG IOS Chair recalled that the WMO Space Programme was primarily expected to contribute to Expected Results 4, 5 and 9 in the new WMO Strategic Framework, that are related respectively to the integration of observing systems, the implementation of the WMO Information System (WIS) and capacity building in developing countries. He invited the session to

consider potential actions in relation to the pilot projects for the WMO Integrated Observing Systems (WIGOS).

## **2.2 ET-SAT Chairman's report**

On behalf of the former ET-SAT Chairman, the Secretariat gave a brief overview of the progress made on ET-SAT agreed actions during the intersession period. It introduced Dr James Gurka who would be the acting Chairman for this meeting and invited the session to pay particular attention to the following points:

- The implementation of the new Vision of the GOS should be considered in the framework of WIGOS, taking into account the benefits of integrating space and surface-based capabilities when appropriate;
- The importance of R&D missions within the GOS should be emphasized, and one outcome of the strategy of transition from R&D instruments to operational status should be the enhanced use of R&D data;
- Information on data and products availability is essential to expand the use of satellites;
- Particular attention should be given to the situation of developing and less advanced countries and to the ways and means to support greater applicability of satellite data and products for those WMO Members.

## **2.3 ET-SUP Chairman's report**

The ET-SUP acting Chairman gave an overview of past accomplishments and of the outcomes he expected from this meeting, including comments on the new Vision of the GOS, guidance on a new strategy for training, recommendations on enhanced information to users, analysis of the questionnaire replies, and a proposed work plan.

He conveyed a message from the outgoing Chairman who drew the attention of ET-SUP Members to the forthcoming review of WMO Publication 258 related to the contents of education and training of meteorologists, including a section on satellite meteorology training.

**Action ET-SUP-4.1: V. Gaertner and L. Machado, as VLMG Co-chairs, to ensure that VLMG, involving a subgroup as appropriate, provides updated information for the current revision of Document WMO No. 258. Deadline: 30 June 2009**

The session was informed that the subgroup would include R. Deslandes, Fan Hong, W. Joordan and A. Mostek.

## **3. ITEMS OF INTEREST FROM RELEVANT WMO MEETINGS, INCLUDING CONSULTATIVE MEETINGS, EXECUTIVE COUNCIL, AS WELL AS CGMS, CEOS AND GEO MEETINGS**

The session was informed on relevant activities that had occurred at the sixtieth Executive Council, at the eighth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-8), the 35<sup>th</sup> session of the Coordination Group for Meteorological Satellites (CGMS), the Committee on Earth Observation (CEOS), and within the intergovernmental Group on Earth Observations (GEO) to implement a Global Earth Observation System of Systems (GEOSS).

## **4. STATUS OF OPERATIONAL AGENCIES SATELLITE PROGRAMMES**

V. Gaertner presented a summary status of current and future EUMETSAT satellite programmes. He highlighted that in June 2008 the Jason-2 satellite was launched successfully and EUMETSAT is now an operational partner for the ocean surface altimetry mission. The Metop-A satellite is functioning well and the backup HRPT dissemination chain had successfully been tested enabling EUMETSAT to develop an operational scenario for resuming HRPT dissemination to a limited extent. The expansion of the GEONETCast system will allow user communities to distribute

their products globally and will make satellite data available to support GEO/GEOSS. The future systems Meteosat Third Generation (MTG), post-EPS and preparations for Jason-3 are on their way. It is also foreseen that EUMETSAT will be an operator of Sentinel-3 in the frame of the European GMES project.

J. Gurka presented an update on NOAA programmes.

- As concerns current GOES satellites:
  - o GOES-11: operational GOES-West (135 W)  
SEM operational with degraded performance (The X-ray positioner is not operational); the Communications subsystem is operational with limitations (SD transmitter A is not operational);
  - o GOES-12: operational GOES-East (75 W)  
SEM is operational with degraded performance (the X-Ray positioner is not operational; the EPS is operational with limitations; the SXI is not operational the entrance filter is not operational; the high voltage power supply is operational with degraded performance);
  - o GOES-13: On orbit storage at 105 W  
SEM is operational with degraded performance (XRS EUV is operational with degraded performance); SXI is operational with degraded performance (the Charged Coupled Device (CCD) sensor is operational with degraded performance);
  - o GOES-10: operational coverage for South America at 60 W  
SEM is operational with limitations (EPS is operational with limitations); solar array is operational with limitations; communications subsystem is operational with limitations.
  
- As concerns future GOES satellites:
  - o GOES-O: planned launch... February 2009;
  - o GOES-P: planned launch... February 2010;
  - o GOES-R: Launch readiness... 2015;
  - o GOES-S: Launch readiness... 2016.
  
- As concerns current POES Satellites:
  - o NOAA-18 (PM primary): HIRS is operational with limitations (spectral channel 1, 14.95 microns: operational with limitations; Solar Backscatter Ultraviolet Radiometer (SBUV) is operational with limitations (chopper motor);
  - o METOP-A (AM Primary): All systems green except HRPT;
  - o NOAA-17 (AM backup): AMSU A1 not operational (scan motor); communications: operational with limitations;
  - o NOAA-16 (PM secondary): Several systems are operational with limitations (Attitude Determination and Control System (ADACS), AMSU-A1, AVHRR, Data Handling System (DHS), HIRS, Search and Rescue Repeater (SARR), and SBUV);
  - o NOAA-15 (AM secondary): Several systems are operational with limitations (AMSU-A1; AMSU-B; AVHRR; Communications system; HIRS; SARR; and the Thermal control system).
  
- As concerns future NOAA Polar Satellites launches:
  - o NOAA-N': Feb. 2009;
  - o NPOESS Preparatory Project (NPP): 2010;
  - o NPOESS C1 launch readiness: 2013;
  - o NPOESS C2 launch readiness: 2016.



The session expressed its appreciation to NOAA for setting in operation a spare satellite at 60°W, which provided very useful coverage over South America. It was noted that, for the time being, no replacement was planned after this GOES-10 satellite.

A. Shimizu presented an update on JMA programmes. The Multi-functional Transport Satellite 1R (MTSAT-1R), launched on 26 February 2005, has been operating in a geostationary orbit at 140°E since 28 June 2005. MTSAT-2, launched on 18 February 2006, has been on standby in a geostationary orbit at 145° E since 4 September 2006. JMA plans to launch a follow-on satellite to MTSAT-2 (referred to below as *the follow-on*) by 2015 at the latest, and preferably in summer 2014. To ensure a robust satellite observation system, JMA intends to launch a second follow-on for in-orbit standby in 2016. The first follow-on and the second will carry no hyper-spectral sounder, which would have been difficult to manufacture in time for the launch planned for 2014.

On behalf of CMA, J. Purdom and X. Zhu presented an update on the FY-1, FY-2, FY-3 and FY-4 programmes. The new-generation polar orbiting meteorological satellite FY-3 was successfully launched on 27 May 2008. China has now four meteorological satellites on orbit: FY-1D, FY-3A, FY-2C and FY-2D. Both the FY-1D and FY-3A are polar-orbiting on a morning orbit. The FY-1D, launched on 15 May 2002, has exceeded its planned lifetime by two years and all its subsystems are working well. The FY-3-A has 11 instruments: Visible and InfraRed Radiometer (VIRR), InfraRed Atmospheric Sounder (IRAS), MicroWave Temperature Sounder (MWTS), MicroWave Humidity Sounder (MWS), MEdium Resolution Spectral Imager (MERSI), Solar Backscatter Ultraviolet Sounder (SBUV), Total Ozone Unit (TOU), MicroWave Radiation Imager (MWRI), Solar Irradiation Monitor (SIM), Earth Radiation Measurement (ERM), Space Environment Monitor (SEM). It is undergoing on-orbit testing and is expected to be in operation by the end of 2008. The FY-2C and FY-2D are geostationary satellites located at 105°E and 86.5°E, they have a five channel Visible and InfraRed Radiometer. FY-2C/D have two operating modes: a general mode whereby they scan and send 28 full disk images, and a special mode for flood season (from June to August) whereby they furthermore scan and send 20 additional northern hemisphere half-disk images. Thus there are four satellite observations per hour in some northern hemisphere areas covered by FY-2C/D. FY-2E will be launched at the end of 2008. The FY-4 series is the next generation of geostationary meteorological satellites. It is now in the design phase and planned to be launched after 2012. It will fly five or six instruments, such as multi-channels Imager Radiometer, lightning mapper, and CCD.

## 5. STATUS OF R&D AGENCIES SATELLITE PROGRAMMES

A.S. Kiran Kumar presented an update on ISRO programmes. The three-channel VHRR onboard KALPANA is providing half hourly images and the INSAT-3A CCD is providing four images during the day. The next generation meteorological mission INSAT-3D, which will very significantly enhance the observational capability by providing 6-channel imagery and 19-channel sounder data is getting ready for launch in 2009. The Ocean Colour Monitor Ku-band scatterometer and Radio Occultation Sounding of Atmosphere are the instruments being launched on OCEANSAT-2 in early 2009. The current Resourcesat -1 (which is operational since 2003) is being followed up with a Resourcesat-2 mission in 2009. Radar imaging satellite RISAT is also scheduled for a 2009 launch. The MEGHA-TROPIQUES mission which is a ISRO–CNES cooperative endeavour is being readied for a 2009 launch. The SARAL programme is also a cooperative mission of ISRO and CNES; this small satellite will carry a Ka-band altimeter and is also getting ready to be launched. ISRO is planning realization of a high-resolution GEO mission capable of providing ~50 meter multispectral VNIR images and hyper-spectral VNIR/ SWIR along with multispectral TIR images.

E. Oriol presented an update on ESA programmes. In particular, she highlighted the forthcoming launch of GOCE planned on 10 September 2008 [now postponed to early 2009] and the ESA Ministerial Council in November, where MTG, GMES Segment 2 and the “Climate initiative” would be submitted for approval.

L. Machado presented an update on INPE Earth Observation programmes. The CBERS 2B was launched in September 2008. CBERS images are available with no access fee; several hundreds thousands images have been distributed through the web page. The CBERS 3 and 4 will have new channels and spatial resolution will be improved. INPE plans to launch four new satellites in the beginning of the next decade, all based on the multi-mission platform: Amazonia, equipped with a CCD camera; MAPSAR, with a SAR; EQUARS for space studies and a satellite contributing to the GPM constellation.

## **6. PRODUCT AVAILABILITY AND USER INFORMATION**

The Secretariat summarized current activities of the WMO Space Programme Office to support user information on satellite matters, mainly through the WMO Space Programme web pages. It described the scope of the information to be delivered, the current status of the Space Programme web pages and suggested some further developments. In particular, it stressed the need to enhance information on the availability of data and products, noting the complementary roles of satellite operators and the WMO Secretariat in this respect. It presented examples of high-level information on satellite product sources, structured by product areas and geophysical parameters.

The meeting confirmed the importance of enhancing the information for users on the availability of, and the means of access to, data and products. While confirming that such information should primarily be delivered by the satellite operators themselves, it supported the view that WMO could complement this effort in particular in two ways:

- In promoting some harmonization in the way that satellite operators are providing information on satellite data and products; bearing in mind however that data discovery, search and retrieval should be facilitated anyway through compliance to WIS metadata standards and the resulting catalogue interoperability.
- In providing a thematic portal, based on product categories. It was confirmed that such a WMO information tool should not attempt to provide detailed product description but should provide links to the websites of satellite operators or other relevant centres generating satellite-based products along the lines presented. It was furthermore suggested to achieve this goal with the assistance of the CGMS-WMO Virtual Laboratory.

These topics were further discussed in a dedicated ET-SUP meeting under agenda item 16/B.

## **7. NEW VISION OF THE SPACE-BASED COMPONENT OF THE GOS**

The Secretariat introduced the latest update of the Vision for the GOS in 2025 as reviewed by the fourth session of the Expert Team on Evolution of the GOS (ET-EGOS-4). This update had taken into account the guidance received from ET-SAT/SUP-3, the eighth session of Consultative Meetings on High-level Policy on Satellite Matters (CM-8) and the Executive Council. The Council had agreed to the development of a new Vision for the GOS, integrated into WIGOS, with a space-based component fostering new satellite missions in response to global needs. The Council had stressed the need to ensure continuity of altimetry and of surface wind measurements over the oceans, the latter being essential for tropical cyclone prediction. It encouraged the proposed operation of hyper-spectral infrared sounders from low-Earth and geostationary orbits, an operational constellation of radio-occultation sounders, and the plans for a constellation of sensors for global measurements of liquid and solid precipitation. It also emphasized the need to monitor high-latitude regions as an IPY legacy and the potential of Highly Elliptical Orbits. The Council confirmed the high-level goal that there should be no gap in the satellite-based climate records.

In updating the Vision for the GOS in 2025, ET-EGOS had also considered the feedback received from the Committee on Earth Observation Satellites (CEOS), the International TOVS Working Group (ITWG), and the GCOS-WCRP Atmospheric Observation Panel for Climate (AOPC).

The Vision for the GOS in 2025 had now matured to a point where it could be submitted to the fourteenth session of the Commission for Basic Systems (CBS-XIV) for endorsement in March 2009.

In addition, the meeting was informed of the latest update to the space-based part of the Implementation Plan for Evolution of the Space and Surface-based Sub-systems of the GOS (IP-EGOS) as reviewed by ET-EGOS-4. While the recommendations included in this implementation plan have remained unchanged, the progress in implementing these recommendations had been substantial and was reflected by new text and related actions.

The meeting welcomed the updates made to the Vision for the GOS in 2025, while recommending further clarifications or updates with effect to:

- Include geostationary lightning detection in a non-ambiguous manner;
- Include explicitly Water Vapour channel imagery among the core polar-orbiting missions;
- Include some words as a preamble explaining context and scope of this Vision of the GOS in 2025.

Noting the importance of providing a clear recommendation to CBS on this subject, it was agreed to further review the proposed Vision for the GOS in 2025 in a dedicated ET-SAT session under agenda item 15/A.

## **8. R&D TO OPERATIONS STRATEGY**

The Secretariat summarized the issues linked with the transition from relevant R&D instruments to operational status and suggested a potential role of WMO to facilitate the overall transition process. Three dimensions of the transition were emphasized:

- Instrument technology readiness to support operations;
- Maturity level of the applications and user preparedness;
- Programmatic status and associated commitment on continuity

A number of prerequisites were highlighted, including:

- Recognized societal need and demonstration of an expected benefit that provides rationale for long-term funding;
- Identified user community with clear requirements and emerging operational capability though active involvement in preoperational activities;
- Reliability and affordability of the technical concept;
- Implementing agencies, or consortium of agencies, with relevant expertise, mandate, funding and active user relationship.

The meeting welcomed this presentation and tasked ET-SAT to review the issue in more detail. In a parallel session, ET-SAT reviewed the issue and expressed broad support to the document presented by the Secretariat that gave a comprehensive overview of the issues faced, the good practices to encourage, and the potential role of WMO. The Secretariat was encouraged to exploit this document further, with minor corrections (§31: EarthCARE; §41: "when R&D data are precursors"; §45: variational assimilation). It was also suggested to emphasize, in the potential role of WMO, the value of acting in partnership with relevant organizations such as CEOS and CGMS.

The concept of Maturity Level of applications, as developed by NASA and NOAA, was found useful and it was suggested to encourage the adoption of a standard approach based on this type of model.

ET-SAT focused on the formulation of guidelines summarizing the recommended actions. These proposed guidelines are attached as Annex XI.

ET-SAT felt that the relevance of such guidelines could be illustrated by current examples at various stages of transition: the lidar wind profile measurement mission is still awaiting in-orbit demonstration; radio-occultation sounding has been successfully demonstrated; while ocean surface altimetry is entering the operational area.

## **9. RESPONSE TO NEW USER REQUIREMENTS**

No discussion was held on this item.

## **10. REGIONAL/SPECIALIZED SATELLITE CENTRES**

L. Schüller, presented the background and history of the WMO Global Network of Regional/Specialized Satellite Centres for Climate Monitoring (R/SSC-CM) initiative, its implementation plan including planned structure and timeframe and the current status. The aim of the R/SSC-CM is the continuous and sustained provision of high-quality Essential Climate Variables satellite products on a global scale responding to the requirements of GCOS.

The R/SSC-CM are expected to capitalize on existing expertise and infrastructure, thereby providing an opportunity for the transition of R&D activities to operational status. Close liaison with the science community is therefore strongly envisaged. The work will be closely connected with the work of the Global Space-based Inter-calibration System (GSICS).

In a planning meeting which took place in April 2008 in Darmstadt, the participating organizations agreed on five areas for the initial R/SSC-CM activities:

- i) AVHRR based data set of cloud and aerosol properties;
- ii) SSM/I total column water vapour, precipitation and liquid water path;
- iii) Surface albedo, clouds and aerosols from geostationary satellites;
- iv) Atmospheric motion vectors and clear sky radiances;
- v) Upper tropospheric humidity.

The participating organizations have been invited to submit, by November 2008, proposals related to the five identified areas of interest/cooperation. These will be discussed at the first R/SSC-CM Executive Panel (REP) Meeting which is planned for January 2009.

A discussion after the presentation covered the following points:

- i) What is the planned timeframe for the climate datasets to be created? This will be part of the proposals to be submitted until 11/2008, thus the answer cannot be given yet.
- ii) The involvement of CEOS was mentioned but is not visible. CEOS was represented at the Planning Meeting and was invited to forward the call for proposals to additional agencies possibly interested in a participation in the agreed R/SSC-CM activity areas.
- iii) Training activities are not well covered in the current implementation plan. It is actually foreseen for Phase II of the R/SSC-CM Implementation Plan, as part of the User Support; the initial focus of the R/SSC-CM is the production of high-quality ECV satellite products. For example, the CM-SAF, which is expected to contribute to the R/SSC-CM, already provides training opportunities.
- iv) It is currently foreseen to certify climate datasets after their production. Shouldn't the certification take place before the production of a dataset in order to avoid the production of uncertified data? The review process required for the quality indication can only be applied to an existing dataset covering a certain time period and the

associated validation results and quality assessments. It is actually foreseen to repeat this process multiple times thereby enhancing the maturity of the datasets.

- v) The GEWEX radiation panel has already addressed many of the questions. The R/SSC-CM is thus advised to start communication with the radiation panel. This is exactly the recommendation of the last R/SSC-CM preparation meeting, and two members of the radiation panel (J. Bates and J. Schulz) are involved in the R/SSC-CM preparation; good communication is thus ensured.

## 11. SPACE WEATHER

The session was informed on preliminary activities of the WMO Space Programme Office regarding Space Weather and the outcome of the sixtieth Executive Council (EC-LX) in this respect. A report was issued in April 2008 on the potential role of WMO in Space Weather (<http://www.wmo.int/pages/prog/sat/Refdocuments.html#SpaceWeather>) in support of international coordination of Space Weather services. Recognizing the impact of Space Weather phenomena and the potential synergy between meteorological and Space Weather services, EC-LX endorsed the principle of WMO activities in support of international coordination in Space Weather. The Council stressed that this new activity should rely on external resources and urged WMO Members to consider the provision of resources through secondments and Trust Fund donations. The Council noted that Space Weather issues were in the mandate of the NMHSs of some WMO Members, but not the majority of them. It considered that the involvement of WMO could be an opportunity for closer cooperation between NMHSs and other organizations in charge of Space Weather.

It was stressed that since Space Weather events were a threat to meteorological space-based infrastructure, high attention should be paid to monitoring these phenomena. It is however a wide subject and WMO action should focus on the most critical aspects for WMO Members.

The meeting recalled that the Council requested CBS and the Commission on Aeronautical Meteorology (CAeM) to develop work plans for Space Weather. It considered that this issue was beyond the scope of ET-SAT and ET-SUP. Furthermore, given the necessary link with CAeM activities, it suggested that an Inter-Commission Team be established specifically to look after these Space Weather matters. The team would include satellite and aeronautical meteorology experts and be supported by representatives of the Space Weather community.

The initial work plan of such a team could include, as a priority:

- Liaison with the Committee for the Peaceful Use of Outer Space (COPUOS), the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), and the International Telecommunications Union (ITU), in order to seek their requirements, expectations, and potential support;
- Seeking financial and staff resources from interested WMO Members;
- Identification of pilot activities among the areas pre-identified by the Council:
  - o Harmonization of observation requirements, sensors and standards within WIGOS;
  - o Definition of products in interaction with major application sectors;
  - o Exchange and delivery of Space Weather information through the WIS;
  - o Issuance of emergency warnings in the context of multi-hazard WMO activities;
  - o Encouraging dialogue between the research and operational Space Weather communities.

## 12/A STATUS OF OUTSTANDING ACTIONS FROM PREVIOUS ET-SAT MEETINGS

In a dedicated session, ET-SAT reviewed the status of actions agreed at the previous meeting as follows.

*ET-SAT-3.1 Secretariat to update the definition of confidence levels to reflect the case of data of instruments that are no longer active.*

The action has been analyzed and the tables requiring changes have been identified. However, it was considered inadvisable to perform such structural changes to the database while the update procedure, undertaken in coordination with ESA, was in progress. Furthermore, no significant resource can currently be made available at the WMO Secretariat to maintain this database. Action CLOSED, noting that a new set of actions will be considered under item 16/A.

*ET-SAT-3.2 WMO Space Programme to provide ET-SAT members with the Instruments spreadsheet including all instruments included in the database, and with the Missions spreadsheet including the information on mission launch and termination, for review and update. (30 September 2007)*

CLOSED. This has been completed through ESA acting on behalf of CEOS and WMO, in a combined effort with the updating of the CEOS Earth Observation Handbook.

*ET-SAT-3.3 WMO Space Programme to clarify how to enter performance values for instruments that have to be used simultaneously to derive some parameters. (30 September 2007)*

CLOSED, noting that a new set of actions will be considered under item 16/A. This action would require significant structural change. It might be misleading to indicate e.g. a performance value for an instrument if this performance depends on another instrument that is not available. Options exist for a partial implementation, e.g. limiting the approach to the "main contributing instrument" when relevant, and qualifying the entry by a comment that the performance is improved/degraded depending on the simultaneous availability of ancillary instrument data. The need for adequate explanatory text is emphasized.

*ET-SAT-3.4 ET-SAT members to provide updates regarding missions and instruments under the responsibility of their respective agencies. (15 October 2007)*

CLOSED. Agencies have provided input in response to the request issued by ESA. A preliminary outcome was reviewed end of May. The final outcome of this update was received from ESA in July 2008.

*ET-SAT-3.5 WMO Space Programme to prepare an update of the database User Manual. (31 December 2007)*

Not completed but CLOSED, noting that a new set of actions will be considered under item 16/A. Priority has been set on coordinating with ESA to support the call for update; after departure of the key staff resources; all other actions related to the Observing Capabilities Database remained in stand-by.

*ET-SAT-3.6 WMO Space Programme to forward to ET-EGOS Chair the outcome of the review of the draft "Vision to 2025" by ET-SAT/SUP-3 and to invite ET-EGOS to consider OSSEs in order to quantify the proposed elements, in particular the optimal number and orbital configuration of the Radio-Occultation constellation complementing the IR/MW sounding mission. (30 September 2007)*

CLOSED. There has been close coordination between the Space Programme Office and the ET-EGOS Chair. The outcome of ET-SAT was used as an input by ET-EGOS-4 to further refine the Vision. See ET-SAT/SUP-4/Doc. 7. J. Gurka reported that NOAA had completed a survey of requirements for an OSSE of different ROS constellation options.

*ET-SAT-3.7 WMO Space Programme to provide CGMS-35 with an update on the draft Vision to 2025. (November 2007)*

CLOSED. Completed, through CGMS-35 WMO-WP-06.

The Vision was also presented to CEOS Strategic Implementation Team (SIT-21) in April 2008.

*ET-SAT-3.8 All ET-SAT members to further review the Gap Analysis (ET-SAT/SUP-3/Doc. 5(2)), to check in the Appendix and its Annexes the descriptions of missions and instrument under the responsibility of their respective agencies and to report back to WMO Space Programme Secretariat any update needed. (1 October 2007)*

CLOSED. Updated instruments descriptions are available on the web since April 2008. ([www.wmo.int/pages/prog/sat/Instruments\\_and\\_missions/Instruments.html](http://www.wmo.int/pages/prog/sat/Instruments_and_missions/Instruments.html))

A new documentation set including description of programmes, of instruments, and Gap Analysis is submitted as ET-SAT/SUP-4/Docs. 13/A and 14/A for review by ET-SAT-4 and further reference. A new action should be opened to review this new version.

*ET-SAT-3.9 WMO Space Programme to inform ET-EGOS Chair when ET-SAT experts have been designated so that they can assist the focal points to review the updates of the SOG. (15 September 2007)*

CLOSED. Completed by e-mail on 21/09/2007.

*ET-SAT-3.10 The ET-SAT experts (J. Gurka, K. Kumar, L. Sarlo.) designated to support the updating of the SOG will provide a review of the draft updates to be received from the ET-EGOS focal points, for their respective SOGs (when draft updates will be available).*

CLOSED. Several SOGs have been updated in 2008 (See [www.wmo.int/pages/prog/sat/Refdocuments.html#SOG](http://www.wmo.int/pages/prog/sat/Refdocuments.html#SOG)). A new action is agreed to review this new version.

*ET-SAT-3.11 M. King to provide an interface, to be developed by NASA/GSFC, to the [Global Change Master Directory portal](#) in order to facilitate browsing and retrieval of instrument data that have been identified as relevant for FCDRs of GCOS Essential Climate Variables. (End November 2007)*

CLOSED. GCMD has implemented a customized portal page where satellite-based records can be searched for by ECV, thus facilitating the search for fundamental climate data records and ECV records: <http://gcmd.nasa.gov/KeywordSearch/Home.do?Portal=gcos&MetadataType=0>.

Further improvements will be addressed between GCOS and GCMD:

- Datasets from some instruments identified in GCOS-107 are not contained in the GCMD, but GCMD staff agreed to pursue this;

- GCOS is encompassing the entire climate system and should appear on the webpage 'GCMD Portal Collaborations' under 'Atmosphere', 'Oceans', 'Land', 'Cryosphere', or as a separate item.

*ET-SAT-3.12 WMO Space Programme to prepare a draft document on the strategy for transition from R&D missions to operations along the lines discussed by ET-SAT/SUP and circulate it to the ET members for comments. (15 September 2007)*

CLOSED. A draft version was tabled on 7 September 2007 and a revised version sent by e-mail on 3 January 2008 in advance of submission to CM-8.

*ET-SAT-3.13 ET-SAT members to provide WSP with comments on the draft document on the strategy for transition from R&D missions to operations. (1 October 2007)*

CLOSED. Few comments were received and no amendment was proposed to this draft. The issue was addressed in more depth by ET-SAT/SUP-4 under item 8, which has led to a set of proposed guidelines provided in Annex XI.

*ET-SAT-3.14 WMO Space Programme to forward to CGMS-35 and CM-8 the document on the strategy for transition from R&D missions to operations.*

CLOSED. The document was submitted as CM-8/Doc. 8. See also Action ET-SAT 3.13 above and Annex XI.

*ET-SAT-3.15 A. Khokhlova will prepare an inventory of satellite data used, or available for use, in near-real time by NWP centres, with the aim to make this inventory available through the WMO Space Programme web page. (End 2007)*

CLOSED. A draft inventory has been developed by A. Khokhlova in the form of html pages. This was discussed under agenda item 6.

*ET-SAT-3.16 WMO Space Programme to circulate to ET-SAT members the Roshydromet presentation of Arktika given at CM-7.*

CLOSED. An advanced copy of the WMO Bulletin article of Asmus V. et al. was sent on 21 September 2007.



In replacement of Action ET-SAT 3.10, the session agreed the following new action:

**ET-SAT-4.01: J. Gurka (for NWP and aviation meteorology), A.S. Kiran Kumar (for environmental applications), and L. Sarlo/L. Schueller (for Hydrology) will review the updated Statements of Guidance related to these respective application areas and, if relevant, forward their comments to the Chair of ET-EGOS and the Space Programme Office. Deadline: 30 November 2008.**

### **13/A OVERALL STATUS OF THE SPACE-BASED COMPONENT OF THE GOS**

ET-SAT considered the Appendix to document 13/A-14/A that comprised three documents describing respectively the status of the space-based component of the GOS, the instruments characteristics, and the Gap Analysis. The meeting was informed of a fourth document regarding the expected accuracy of products as a function of instrument characteristics.

ET-SAT expressed its high appreciation and commended the author, B. Bizzarri, for this outstanding set of documents that reflected a considerable amount of work and expertise. The meeting underlined the completeness of the information and welcomed the thoughtful and convenient way it was structured. The meeting was convinced that it would be a very helpful reference for a number of experts and recommended that WMO Secretariat ensures that this documentation is maintained in the coming years.

Some detailed remarks were made related to:

- Naming of MTSAT Follow-on (Appendix C p.7)
- Removal of the hyper-spectral sounder on MTSAT Follow-on (Appendix A p.16; Appendix B p. 67-68; Appendix C p. 11 & 43)
- Need date for post-EPS in 2019 (Appendix A p. 35)
- EUMETSAT Membership with 21 Members and 9 Cooperating States (Appendix A p.3)
- GOES launch dates (-14 in 2009; -15 in 2010; -R in 2015; -S in 2016)
- GOES-R and -S payload (ABI, GLM, SUVI, EXIS, SEISS, no GHS )
- References to European Commission (EC) instead of European Union (EU)
- EarthCARE launch date (September 2013).

Further corrections should be forwarded to the Space Programme Office.

**Action ET-SAT 4.02: ET-SAT Members to review the three appendices to document 13/A-14/A and, if necessary, forward to the Space Programme Office any corrections concerning the detailed description of missions and systems under the responsibility of the space agency they are representing. Deadline: 30 September 2008.**

E. Oriol pointed out that GMES satellite missions were joint undertakings of ESA and the EC, and that the availability of GMES data as contributions to the GOS was subject to the agreement of the EC. Being aware that GMES is presented as a European contribution to the Global Earth Observation System of Systems (GEOSS) of the Group on Earth Observation (GEO), and that the GOS is a component of the GEOSS, the meeting anticipated that GMES data could be shared at the global level, however this point needed to be confirmed with the EC. Subsequent action was agreed:

**Action ET-SAT 4.03: WMO Secretariat to seek confirmation from the EC that GMES data would be available to WMO Members as a contribution to the GOS. Deadline: 31 January 2009.**

### **14/A GAP ANALYSIS**

In reviewing the Gap Analysis, ET-SAT recommended to review some wording of the Explanations section in order to clarify the linkage between (i) the user requirements, normally



expressed in terms of geophysical variables; (ii) the specifications of observing capabilities to meet these requirements; and (iii) the gap in implementing these capabilities. The text should indicate the scope of requirements that have been taken into consideration (presumably WMO programmes and co-sponsored programmes, addressing primarily the Weather, Climate, Water Societal Benefit Areas (SBA) in the GEO context). It was furthermore suggested to replace in the header rows of the tables “generic characteristics” by “required characteristics” and to replace “to meet post-2020 requirements” by “to be compliant with post-2020 required characteristics”.

It was felt important to clarify explicitly the scope of the requirements that are taken into account, since one could consider that further versions of the Gap Analysis could include the assessment of additional missions responding to other requirements; in that way this remarkable document could be a useful reference for a wider community beyond WMO.

ET-SAT reviewed the 30 missions; confirmed the proposed observation strategy and supported the indicated recommendations with minor updates or amendments related to the following missions: No. 4 (No hyper-spectral IR sounding on GOES-R and S); No. 5 (Suggest enhancing MIS sounding); No. 6 (Remove the reference to moving a geostationary satellite for demonstration, which is unlikely to happen); No. 20 (ADM-Aeolus is to be launched in December 2010, and available in 2011); No. 30 (Rename “Solid Earth and outer atmosphere” instead of “Some scientific missions”). These updates will be incorporated in a revised version before submission to CGMS.

**Action ET-SAT 4.04: WMO Secretariat to update the Gap Analysis with ET-SAT comments. Deadline: 15 October 2008.**

#### **15/A REFINING THE VISION FOR THE SPACE-BASED COMPONENT OF THE GOS**

ET-SAT reviewed in-depth the draft Vision to 2025 for the space-based component of the GOS, with a view to its finalization for submission to the fourteenth session of CBS in March 2009. The meeting considered that the draft Vision had now reached the proper level of detail, and subject to some minor changes and clarifications would reflect the anticipated needs of the GOS that WMO Members should strive to fulfil. For a consistent presentation of space and surface-based aspects the meeting proposed to add a section on benefits in §4.1 of the Vision. The outcome of this review is included as Annex III to this report.

The meeting underlined that the geophysical variables and applications listed in the table in Section 2 of the Vision included some variables and applications that are not part of WMO’s scope of activity, e.g. “oil spills; other hazards; earthquakes and fault monitoring; [...] damage assessment” as Synthetic Aperture Radar applications. It is of course an advantage that an observation capability can serve different application areas in an integrated approach; furthermore, it is well understood that meteorological activities play an important role in support of the management of such events; however, the meeting questioned the relevance of mentioning these applications in the table and wished to bring this point to the attention of ICT-IOS.

With this only reservation, the meeting recommended that the new Vision, in this revised form, be submitted to the CBS for adoption. It considered that this represented a major step forward towards the sustainable availability of satellite data for weather and climate applications, and other WMO needs for the coming decades, reinforcing the role of the GOS within the Global Earth Observation System of Systems.

**Action ET-SAT 4.05: ET-SAT Chair to forward to the ICT-IOS the outcome of ET-SAT/SUP-4 discussion on the Vision, recommending its endorsement by CBS, however highlighting the questions raised about the relevance of mentioning certain applications that are beyond the scope of WMO activity.**

## 16/A DATABASE OF USER REQUIREMENTS AND OBSERVING CAPABILITIES

The session was informed on the status of the CEOS-WMO Database on User Requirements and Observing Capabilities. This database includes two main components.

The user requirements are regularly updated through the Rolling Review of Requirements (RRR) process led by ET-EGOS. The requirements are technologically free. They refer to geophysical variables and are expressed in terms of horizontal and vertical resolution, accuracy, observing cycle and timeliness, with three values of each of these criteria: the threshold, the breakthrough (necessary to achieve the expected improvement) and the goal. Once validated, requirements are incorporated in the database. The database can be consulted online through the Space Programme website. The current versions of user requirements that are available online are up-to-date for the nine WMO application areas and the three GCOS domains. Requirements from other international organizations and projects are also recorded in this database.

As concerns the Observing Capabilities, they involve both surface-based and space-based observation networks. For the space-based part, in order to collect updated information from space agencies, it was decided to rely on the kind collaboration of the European Space Agency (ESA), who was proceeding with the update of the Earth Observation Handbook on behalf of the Committee on Earth Observation Satellites (CEOS). ESA has agreed to extend its call for updates in order to address all the information required by WMO. Valuable updated information has now been collected by ESA and was made available to WMO in July 2008. ESA was thanked for collecting updates and providing this information to WMO.

Because of the complex status of the Observing Capabilities part of the database, and of the current lack of staff resources within the Space Programme Office, implementing this major update into the database is still an open issue. Similarly, improvements to the structure, layout and user manual of the database that have been suggested by ET-EGOS and ET-SAT are presently on hold.

ET-SAT discussed the way forward regarding this database and agreed that it should be further maintained as it was the main support for the Rolling Review of Requirements and served as a reference for instrument planning purpose. Realizing the difficulty to maintain the database in its present form, and being aware of the considerable technical information on satellite programmes and instruments that has been collected for the Status of the GOS and the Gap Analysis, the meeting recommended the following approach:

- To redesign the current database and convert it into a new database or two interlinked databases, bearing in mind the wider scope of this database in the context of WIGOS;
- To adopt an open standard;
- To convert the tabular information on Status of GOS, Instruments and Gap Analysis into a database format and link it to the database(s) mentioned above;
- To secure resources for further maintenance of the database.

P. Albert volunteered to provide technical advice to the WMO Space Programme Office on this topic. Meanwhile, the WMO Secretariat was invited to insert in the WMO SP web pages a link to the CEOS Earth Observation Handbook. ESA will keep WMO informed of its plans for the future updates of the database.

**Action ET-SAT 4.06: P. Albert to advise the Space Programme Office on the specifications for the development of databases replacing the current CEOS-WMO database in Microsoft Access <sup>TM</sup> and accommodate the Gap Analysis and related information on satellite instruments and missions. Deadline: 31 January 2009.**

**Action ET-SAT 4.07: The Space Programme Office to put on the WMO Space Programme web pages a link to the CEOS EO Handbook.**

**Action ET-SAT 4.08: E. Oriol to inform the WMO Space Programme Office on ESA plans to update the CEOS database.**

#### **17/A IGEOLAB**

The session reviewed the status of the three candidate IGeoLab initiatives.

##### **a) IR hyper-spectral sounder**

The interest in an IR hyper-spectral demonstration mission is confirmed in the light of current plans for operational hyper-spectral sensors in the 2015-2020 timeframe. A recommendation was expressed in May 2008 by the 16<sup>th</sup> International TOVS Study Conference (ITSC-16). However, no decision has been made yet to initiate such a mission. ET-SAT discussed possible scenarios and suggested that the following be investigated further:

- A descoped version of HES to be flown on GOES-S or -T;
- A demonstration flight-qualified version of GIFTS to be flown as an additional payload on one planned geostationary satellite with accommodation capacity (e.g. Elektro-2);
- A demonstration flight-qualified version of GIFTS to be flown on a dedicated platform.

It was emphasized that a demonstration or pre-operational flight of an IR hyper-spectral instrument would be of particular interest if implemented in advance of the operational missions planned for the 2015-2020 timeframe, or if it was a precursor for an operational version.

##### **b) GEO-Microwave**

A fourth GEO-microwave Focus Group meeting was held in April 2007 and action was given to WMO to establish a Task Force, draw a comparative analysis of two technical concepts and propose a way forward in a report to CGMS-35. CMA and CNSA confirmed their readiness to lead the GEO-MW initiative on the basis of the report in cooperation with interested parties. Feasibility studies for FY-4-Microwave are planned to be performed in 2008. A fifth GEO-MW Focus Group meeting is planned in Beijing on 17 October 2008, during the IPWG timeframe. E. Oriol indicated that ESA would be interested to participate in GEO-MW FG-5 if the project baseline was compatible with the ESA recommended option of a synthetic aperture antenna. J. Gurka, and L. Schueller, indicated that NOAA and EUMETSAT, respectively, would be potentially interested to participate in this GEO-MW FG-5. WMO was urged to send out the invitation and agenda without delay.

##### **c) Highly Elliptical Orbit**

The concept of a Highly Elliptical Orbit (HEO) mission based on the Russian Federation's Arktica Project has been discussed in two HEO Focus Group meetings. A third meeting is planned for November 2008 to examine a consolidated set of requirements, identify potential mission architectures and models of collaboration. ET-SAT encouraged agencies to participate in this HEO FG-3 meeting and to support the HEO initiative through bilateral and multi-lateral cooperation on instruments, algorithms and validation, and involvement in the user and ground segments.

#### **12/B STATUS OF OUTSTANDING ACTIONS FROM PREVIOUS ET-SUP MEETINGS**

ET-SUP reviewed the status of actions agreed at the previous meeting, as follows.

**ET-SUP-3.1** WMO to forward to the R/SSC implementation meeting the proposals:

- a) To replace GSICS with CGMS/GSICS in order to maintain the same level of representation with the other organizations. Additionally suggest that the CGMS representative on the R/SSC-CM Executive Panel be from GSICS;
- b) To use consistent acronyms: either RSSC-CM or R/SSC-CM;
- c) To rename the R/SSC-CM Research Group (RRWG) to the R/SSC-CM Science Advisory Group to better reflect their role;

Point 8 of the Terms of Reference for the R/SSC-CM Executive Panel (Annex 1 of the R/SSC-CM IP) to be reworded to "Organize workshops on at least a biennial basis, and sessions at scientific meetings to advance the objectives of the R/SSC-CM and publicize the programme's achievements".

**CLOSED** These proposals were taken into account in the R/SSC-CM Implementation Plan. (See [R/SSC-CM IP](#))

**ET-SUP-3.2** WMO SP to inform GSICS Executive Panel, CGMS and the R/SSC-CM potential participants, of these proposals (end October 2007).

**CLOSED** These proposals were taken into account in the R/SSC-CM Implementation Plan. (See [R/SSC-CM IP](#))

**ET-SUP-3.3** The Chair of the OPAG-IOS to invite CGMS to form a new international science working group on the theme of climate monitoring and calibration to provide an open focus for collaboration and coordination on these important topics. The Terms of Reference for the new working group would be compatible with those from ITWG, IPWG and IWWW.

**CLOSED** at CGMS-35. Action CGMS-35.07 was taken to investigate the issue in a focus group and discuss it within GCOS-WCRP/AOPC. It was concluded at AOPC that there was presently no need to establish a new working group (Item 47 of the conclusions of AOPC-XIV).

**ET-SUP-3.4** The Chair of the OPAG-IOS to propose to CBS that two years after the R/SSC-CM commences as a pilot of the R/SSC concept CBS review the outcomes and benefits of the concept prior to extending it to other areas such as Atmospheric Chemistry.

**OPEN** Chairman OPAG-IOS will report the status of R/SSC-CM to CBS in 2009. However, the ET-SUP work plan includes an activity to review the achievements of the R/SSC-CM during 2009 and to consider recommending extending the concept to other application areas. Any such recommendations will be communicated to the Chairman OPAG-IOS in time for ext-CBS in 2010. (March 2009).

**ET-SUP-3.5** WMO Space Programme will inform ET-EGOS Chair that ET-SUP experts have been designated to assist the focal points to review the updates of the SOG (15 September 2007).

**CLOSED** by e-mail on 21/09/2007.

**ET-SUP-3.6** The ET-SUP experts (ET-SUP Chair) designated to support the updating of the SOG will provide a review of the draft updates to be received from the ET-EGOS focal points, for their respective SOGs (when draft updates will be available).

**CLOSED** The designated expert has changed position and is no longer part of ET-SUP. However several SOGs have been updated in 2008 (See [www.wmo.int/pages/prog/sat/Refdocuments.html#SOG](http://www.wmo.int/pages/prog/sat/Refdocuments.html#SOG)) There is no indication of involvement of ET-SUP experts in this review.

**ET-SUP-3.7** ET SUP members to provide WSP with comments on the draft document on the strategy for transition from R&D missions to operations (1 October 2007).

**CLOSED** Comments were received from the ET-SUP Chair and taken into account.

**ET-SUP-3.8** The Chair of OPAG-IOS is requested to seek clarification through CGMS as to whether the provisions of a Joint Polar System would enable Metop to take advantage of the NPOESS safety net in order to improve timeliness of global data delivery to users.

**CLOSED** at CGMS-35. Action CGMS-35.31 was agreed to investigate the issue in more detail. A preliminary conclusion is that this will not be applicable to METOP-1, 2 or 3 but remains in consideration for the post-EPS timeframe.

**ET-SUP-3.9** WMO SP to send a letter to each CoE PR and each CGMS Satellite Operator VL sponsor thanking them for their active engagement and support of the VL, noting the great success of the HPTE, noting the recommendation of ET-SUP for continuation of the VL, noting the expanded role and responsibilities of the VL partners and requesting that they agree to continue in this role.

**CLOSED** The action was not completed in an appropriate timeframe and so it is closed in its current form. However, the 4<sup>th</sup> meeting of the Virtual Laboratory Management Group (VLMG-4), held immediately before ET-SUP-4, developed an updated strategy for the VL and hence action ET-SUP-3.9 is superseded by new VLMG-4 actions (see section 13/B).

**ET-SUP-3.10** *Mr Anthony Mostek to contact each RFG to identify dedicated focal points and to assist, where necessary, in the establishing of monthly RFG sessions in all regions. In particular Mr Mostek should liaise with CMA and other VL CoEs to facilitate the establishment of an RFG in Asia.*

**OPEN** The action was discussed at VLMG-4 where it was confirmed as still being necessary and was propagated into the updated VL Training Strategy and Implementation Plan (see Section 13/B).

**ET-SUP-3.11** *The VLMG Co-chairs to maintain regular contact with the other members of the VLMG, to coordinate inter-sessional activities and to provide a written annual report of activity within the VL to WMO and CGMS via OPAG-IOS, based on input solicited from each CoE and Sponsoring Satellite Operator at the end of August each year.*

**CLOSED** (for 2008). However the action is considered a permanent activity for the VLMG Co-chairs and is addressed in the updated VL Training Strategy and Implementation Plan (see Section 13/B)

**ET-SUP-3.12** *WMO SP and VLMG to liaise with South American CoEs and other prospective partners to organize a multi-regional satellite training event in South America in 2008.*

**CLOSED** A training event for RA-III and RA-IV is being prepared in Argentina for September 2008, hosted by the Argentina CoE with support of the CoE Brazil, NOAA, EUMETSAT, CIRA, COMET and WMO.

**ET-SUP-3.13** *VLMG Co-chairs and WMO SP to develop guidelines for post training evaluation based on the method used by Brazil for the 2006 HPTE and to encourage CoEs and satellite operators to adopt these guidelines in the evaluation of future training events.*

**OPEN** VLMG will continue to work on this activity in the coming months taking note of the evaluation methods to be used at the two South American training events planned for 2008. The VLMG will then review a generic method of evaluation to be used at all future events and will report their findings to ET-SUP. (ET-SUP-5).

**ET-SUP-3.14** *ET-SUP members to review the DVD of the core HPTE lectures and provide comments to EUMETSAT (Gordon Bridge) with copies to Jeff Wilson and Richard Francis (end-September 2007).*

**OPEN** No comments were received. EUMETSAT confirmed that they will produce the DVDs by end 2008. Furthermore they are arranging for translations into French, Russian and Chinese and they will investigate the feasibility of translations into Arabic, thus addressing the goal of making the DVDs available in all WMO languages by September 2009.

**ET-SUP-3.15** *OPAG-IOS Chairman to take forward to CGMS the application of NSMC to have CMATC, the Beijing component of the Nanjing RTC, become the CoE for the region (November 2007).*

**CLOSED** CGMS strongly supported CMATC becoming a new location of the China CoE, as the Beijing component of the Nanjing RTC. See new action ET-SUP-4.6.

**ET-SUP-3.16** *WMO SP to provide copies of documentation related to the establishment of the CoEs in Argentina and/or Brazil to Russian Federation to be used as indicative templates for similar correspondence for the establishment of a new Russian CoE (end-September 2007).*

**CLOSED** Documentation was provided to Roshydromet.

**ET-SUP-3.17** *VLMG Co-chairs to create and maintain a table of VL related training events and publish this table as appropriate, including on VL web pages.*

**OPEN** The VLMG have an action to develop and maintain web pages containing a variety of VL related information, including news of upcoming training events as well as a means of access to satellite data and product information. These pages will be developed in close coordination with the

<p>WMO SP web pages (End 2009).</p>
<p><b>ET-SUP-3.18</b> <i>The ET-SUP working group on progress monitoring and user feedback to refine their preliminary work programme, timelines and risk assessment and to draft the next edition of the questionnaire with the view of making the questionnaire available to Members by the beginning of January 2008.</i></p> <p><b>CLOSED</b> The working group agreed an approach and a schedule on 5 December 2007. The questionnaire was issued in January 2008. (See ET-SAT/SUP-4/Doc.14/B).</p>
<p><b>ET-SUP-3.19</b> <i>The ET-SUP working group on progress monitoring and user feedback to refine the method of performing the analysis of questionnaire responses, identify alternative sources of data to contribute to the analysis and develop an outline plan for the TD (March 2008).</i></p> <p><b>CLOSED</b> Progress on the questionnaire was reported to ET-SUP Members and OPAG-IOS Chair on several occasions leading up to its publication in January.</p>
<p><b>ET-SUP-3.20</b> <i>The ET-SUP Working Group on Progress Monitoring and UserFeedback to report progress against the plans for the next questionnaire to the OPAG-IOS Chair, at least in January and March 2008.</i></p> <p><b>CLOSED</b> A project plan was developed and regularly maintained from March to August 2008 (See ET-SAT/SUP-4/Doc 14/B).</p>
<p><b>ET-SUP-3.21</b> <i>The ET-SUP Working Group on Progress Monitoring and user feedback to assess all tasks remaining and resources required to analyze responses and generate a TD (April 2008).</i></p> <p><b>CLOSED</b> Within the working group, it was agreed that the Secretariat would enter the data into the database and perform initial statistical processing, while W. Benesch and P. Pagano worked on the interpretation of these statistics. Temporary support through secondment of an officer was essential. However, resources needed were generally underestimated. The processing was complicated since software tools had to be developed and validated under strong time pressure. This also made the interpretation difficult.</p>
<p><b>ET-SUP-3.22</b> <i>WMO SP to meet with EUMETSAT in October 2007 to evaluate the possibility of using their web-based survey product.</i></p> <p><b>CLOSED</b> The tool was not considered fully adequate.</p>
<p><b>ET-SUP-3.23</b> <i>OPAG-IOs Chair to advise the WMO Space Programme Office of the need for strong ongoing support for the activity on monitoring the progress on satellite data use.</i></p> <p><b>CLOSED</b> Temporary support was received through secondment from JMA.</p>

### **13/B TRAINING STRATEGY, INCLUDING VIRTUAL LABORATORY MATTERS**

ET-SUP reviewed Document 13/B describing the Virtual Laboratory (VL) activities in 2008 and presenting a preliminary draft VL Training Strategy for the next five years. The document had been updated shortly before the ET-SUP meeting by the recent VLMG meeting and was further updated by a subgroup during the meeting itself. The latest draft version of the VL Training Strategy and Implementation Plan is attached as Annex VIII.

**Action ET-SUP-4.2: The VL Strategy Task Team to finalize the VL Training Strategy and Implementation Plan for approval by the VLMG (October 2008).**

**Action ET-SUP-4.3: OPAG-IOs Chair to present the final VL Training Strategy for approval by CGMS-36 (November 2008) and thereafter to CBS (March 2009).**

The session noted with pleasure that the outreach of the VL was already very extensive with a large part of the global community being served by a CoE and having access to a Regional Focus Group.

V. Gaertner reported that the formal exchange of letters of commitment between WMO and the South African Weather Service (SAWS) have now been completed opening the way for

ET-SUP to consider recommending the inclusion of Pretoria as a new CoE (sponsored by EUMETSAT). The session was happy to make such a recommendation.

**Action ET-SUP-4.4: OPAG-IOS Chair to seek CGMS-36 endorsement of the ET-SUP recommendation that Pretoria should be recognized as a new Centre of Excellence (CoE) in the South African Weather Service (SAWS) and to carry forward the outcome to CBS (November 2008).**

A. Nerushev reported on progress in satellite training facilities in the Russian Federation. The session noted with satisfaction that during 2008 a primary version of a Russian website aimed at distant training in satellite meteorology was developed and began its operation in the Russian Federation based at the WMO Regional Meteorological Training Centre (RTC). This development makes it possible to initiate the process to consider the WMO RTC together with other Roshydromet organizations on a whole, as a new VL Centre of Excellence (CoE) and sponsoring satellite agency respectively for training Russian-speaking specialists. The group noted that only the formalities of an exchange of letters of commitment between Russia and WMO remain to be achieved and the session felt it worthwhile to anticipate these and to recommend the inclusion of this new CoE and sponsoring agency pending the satisfactory completion of the formalities.

**Action ET-SUP-4.5: OPAG-IOS Chair to report to CGMS-36 the progress with the establishment of a new CoE in the Russian Federation and to seek their endorsement in principle of the ET-SUP recommendation for a new CoE and sponsoring agency in the Russian Federation pending satisfactory completion of the required formalities between the Russian Federation and WMO (November 2008).**

The VLMG Co-chairs reported that there was some uncertainty surrounding the formal situation regarding the CoE in China, in particular whether there are two CoEs (Nanjing and Beijing) or whether there is just one CoE with two components. J. Purdom advised that he would endeavour to clarify the situation by direct contact with the Head of NSMC and report the outcome to the VLMG and the WMO SP.

**Action ET-SUP-4.6: WMO Secretariat to clarify with China the situation regarding the Chinese CoE (whether there are in fact two CoEs (Nanjing and Beijing) or whether there is one CoE with two components) and to inform the VLMG (November 2008).**

A.S. Kiran Kumar informed the session that ISRO expressed an interest in establishing a CoE in India and in supporting the existing CoE in Oman (as co-sponsor with EUMETSAT). Mr Kiran Kumar offered also to take up this subject with colleagues in ISRO and hopes to provide some firm proposals to ET-SUP/VLMG in the future. ET-SUP welcomed this initiative and looked forward to further progress.

**Action ET-SUP-4.7: WMO Secretariat to provide ISRO with background information regarding the establishment of a new CoE, including procedure to be followed, requirements and expectations. Deadline: 30 October 2008.**

The session recalled the discussion that had taken place under agenda item 6 and its relationship to the evolution of the CGMS/WMO VL web pages discussed at the recent VLMG. It was recognized that there are many ways for users to seek information on satellite data and products but that currently none of them are straightforward or intuitive. The session further noted that the VLMG action to develop and maintain new web pages must take this need into account but also that the WMO SP web pages will continue to attract queries of this nature. Hence there will be a need for close liaison between the WMO SP and the VLMG during the coming months to ensure both parties are content with the direction and rate of progress on the subject.

The VL Task Team will investigate whether existing resource libraries could be used to provide the functionalities of the Virtual Resource Library (VRL). W. Benesch queried the section in

Document 13/B in which the VRL is described as being “centralized in one location”. It was clarified by the VLMG Co-chairs that this does not imply all resources are physically collocated but rather that accessing VRL material should be possible via a single route (possibly accessing an underlying set of libraries or data/information portals). It was agreed that some clarification text to this effect would be incorporated in the updated VL Strategy document (a draft of which was completed during the meeting).

ET-SUP discussed the inclusion of text (page 19 of Document 13/B) recommending “... the need for the development of a position within the WMO SP whose sole role is to support satellite training and VL activities”. Whilst recognizing this as an extremely important and long running issue the session agreed that all possible means should be left open to solve the resource shortage. To this end the group spent some time defining the typical tasks for such a person (attached as Annex X) and decided that the subject should once again be brought to the attention of CGMS.

**Action ET-SUP-4.8: OPAG-IOS Chair to draw the attention of CGMS-36 (who are co-sponsors of the VL) to the fact that the WMO Space Programme Office is not currently adequately resourced to properly support the planned training and education activities as elaborated through the VL Strategy and ET-SUP work plan. In addition OPAG-IOS Chair to draw CGMS-36 attention to the example of the Eumetcal initiative which was similarly under-resourced but which achieved a significant breakthrough in effectiveness when a dedicated support officer was appointed (November 2008).**

#### **14/B OUTCOME OF THE QUESTIONNAIRE ON THE USE OF SATELLITE DATA UTILIZATION: ANALYSIS AND RECOMMENDATIONS**

ET-SUP reviewed the draft analysis of WMO Member responses to the questionnaire issued in January 2008 in accordance with an ET-SUP-3 action. An ET-SUP working group on progress monitoring and user feedback was established and a Project Plan was developed to analyze the responses from the questionnaire and generate a draft report.

The questionnaire was distributed in hardcopy and in electronic form, downloadable from the WMO Space Programme website. Users were encouraged to submit responses in electronic form to facilitate easier data collection and import into the existing database. However, many responses were received in hardcopy and substantial effort had to be made to develop new tools and interfaces to process the replies in a semi-automatic way to import the data into a Microsoft Access™ database, and ultimately to adapt existing Microsoft Excel™ tools to provide statistical results. This work would not have been possible without the support of seconded staff within the Space Programme Office.

The initial target date for replies was set for 15 March 2008 but then extended to 15 April to maximize the number of returns. Data import into the database was completed by end of June and statistical results were submitted for interpretation by mid-July. Effort was made to perform the interpretation in the July and August timeframe, however with little opportunity to exchange feedback and check the consistency of the statistical results because of the overall time constraints and limited availability of the key players.

A detailed analysis in the form of a preliminary draft of a Technical Document was reviewed. The draft was formulated following the example of the report of the previous edition (see [WMO-TD N° 1423 \(SP-4\)](#)) and includes a statistical summary of the responses along with some Key Findings and Recommendations, with the assumption that most of the statistical charts would be made available online only.

ET-SUP reviewed the preliminary draft which generated many comments to be incorporated in the update of the report into its final form. The group outlined the next steps to be undertaken as follows:



- Check whether the Excel pivot tables and the underlying data appear correct and sensible (plausibility check). Some corrective action has already been applied and some more may be necessary. It must be ensured that the 'master versions' held by the WMO SP are fully consistent with the final document and that appropriate version control is applied.
- Verify Key Findings and Recommendations in draft report – noting that Key Findings should lead to Recommendations – perhaps add Key Findings and Recommendations if there are any obvious areas that need attention.
- Verify Hypotheses, including adding Recommendations/conclusions if appropriate.
- Obtain complementary information from satellite operators and VL CoEs on the numbers and trend of registered users and of trained persons respectively (if time allows).
- Complete editorial changes and finalize the publication by January 2009.

R. Francis offered to bring the draft to final version and the group expressed its appreciation in accepting this offer.

**Action ET-SUP-4.9: R. Francis to undertake the agreed steps to review in detail the draft technical document and update it to a final version (January 2009).**

**Action ET-SUP-4.10: WMO Space Programme Office to request information from the satellite operators on the number of registered users during the last two years and make these figures available, if possible, to R. Francis (end November 2008).**

**Action ET-SUP-4.11: CoEs to provide information on the number of participants in VL training activities during the last two years and make then available, as far as possible to R. Francis (end November 2008).**

The group recalled that the questionnaire offers an important opportunity for Members to report deficiencies or problems regarding availability or use of satellite data to WMO. Moreover, the analysis of questionnaire responses provides an associated opportunity for WMO to address such issues. The group felt this to be a very important aspect of fully utilizing the questionnaire.

**Action ET-SUP-4.12: WMO Space Programme Office to identify from the questionnaire responses problem areas (either thematic or related to individual Members) and, if resources permit, address these problems (next ET-SUP).**

ET-SUP then turned to considering future editions of the questionnaire and raised the following issues to be considered as part of the preparatory activities for the next edition:

- Whether to combine with other WMO questionnaires (e.g. for *in situ* observations);
- Keep repeat cycle at two years;
- Online (interactive) methods to increase response rate and simplify the process of storing and analysing results;
- Retain or increase focus on questions revealing trends/tendencies;
- Urge only one return per Member in each Region – would be an effort to combine to a single return;
- Follow-up reminders to maximize returns;
- Involve as appropriate the Space Programme Regional Association Rapporteurs.

## **15/B IGDDS AND RARS**

ET-SUP reviewed the status and plans for the related IGDDS and RARS projects as well as the deliberations of the first meeting of the Task Force on Satellite Data Codes.

## IGDDS

ET-SUP recalled that the scope of the IGDDS project is to enhance the circulation and availability of satellite data and products within the WMO Information System (WIS) taking into account all appropriate dissemination means including direct broadcast, DVB-S broadcast, point-to-point transmission over the GTS, and data retrieval via the Internet. Emphasis is however put on DVB-S broadcast, i.e. broadcasting through telecommunication satellites following the Digital Video Broadcast standard, with the specific objective to implement a DVB-S dissemination infrastructure achieving quasi-global coverage for meteorological satellite data and products.

The second IGDDS Implementation Group meeting (IGDDS-IG-2) was held on 21 and 22 May 2008 in Geneva with the participation of current or potential IGDDS operators including CMA, EUMETSAT, JMA, NOAA, Roshydromet, as well as the Asia-Pacific RARS coordinator and the WMO Secretariat. The Implementation Group reviewed and updated the IGDDS Implementation Plan and had an initial discussion on draft IGDDS standards.

IGDDS-IG-2 discussed ways and means to achieve interoperability of IGDDS components and data catalogues, as required within the WIS and in the context of the Group on Earth Observation (GEO) Global Earth Observation System of Systems (GEOSS). It was stressed that data had to be associated with metadata defined along WIS standards, and it was considered that this could be achieved on the basis of the EUMETSAT Product Navigator that will be shared by NOAA and CMA in the context of their joint involvement in GEONETCast. An action was agreed by EUMETSAT to set up an interface to allow the remote query of the Product Navigator in the catalogue "harvesting" process and the standardization of the catalogue information formats.

IGDDS-IG-2 confirmed the following two actions to be addressed in priority:

- Establishing regional data requirements - For this action, it was recommended to actively involve the Space Programme Regional Rapporteurs.
- Implementing quasi-global DVB-S dissemination coverage on a sustainable basis - Quasi-global coverage is available with EUMETCast (Europe, Africa, and America services), FengYunCast and in the future MITRA. However, the coverage of the Americas by EUMETCast is only provided on a temporary basis. The GEONETCast-Americas service provided by NOAA is not counted as an IGDDS component since it is not currently aimed at fulfilling meteorological requirements.

## RARS

ET-SUP took note of the outcome of the second RARS Implementation Group meeting (RARS-IG-2) in May 2008. It was pleased to note the status of the RARS which, as of July 2008, included 10 stations operating in the European RARS, 13 in the Asia-Pacific RARS and five in South America. All together this results in coverage of about 60% of the surface of the globe. According to current RARS project plans, the overall coverage is expected to reach 79% at the beginning of 2009 and 82% in early 2010. With the implementation of additional stations on Pacific islands and coastal areas that are planned in 2009, the coverage will significantly expand over oceanic areas which are of primary importance for the use of RARS data for NWP. Furthermore, contacts have been made with operators of stations in central and southern Africa which could ultimately contribute to the objective of covering 90% of the globe.

Global RARS operations are now monitored on a routine basis by the EUMETSAT SAF for NWP led by the U.K. Met Office with monitoring results published on the NWP SAF website at <http://www.nwp.saf.org/>. Quality monitoring is also provided by the RARS operators themselves, for example on the Japan Meteorological Agency (JMA) website, where comprehensive information on the improvement in timeliness achieved by the RARS with respect to the NWP model cut-off is evident. Access to this information is facilitated by the WMO Space Programme RARS web pages [www.wmo.int/pages/prog/sat/RARS.html](http://www.wmo.int/pages/prog/sat/RARS.html).

The status of RARS was presented at the 16th International Scientific TOVS Conference (ITSC-16) held in Brazil in May 2008 and WMO was strongly encouraged to pursue the implementation of the network as well as to consider the extension of the concept to include advanced sounding instruments.

Discussions have been initiated about the extension of the RARS project to include ATMS and CRIS sounding data from the NPP and NPOESS-C1 sounding missions. Indeed, these missions will not benefit from the SafetyNet and thus cannot guarantee the provision of global sounding data with tight timeliness requirements. It is recognized that the inclusion of these datasets would involve X-band stations and, as concerns CRIS, would require significantly higher bandwidth for data collection and retransmission. The objective would be to identify an optimized subset of stations without aiming at 90% of global coverage.

### **Task Force on Satellite Data Codes**

ET-SUP recalled that a Task Force on Satellite Data Codes was established following an action agreed at CGMS-35. It held its first meeting in February 2008 in Geneva. Only three satellite operators had nominated representatives by then, and only two could participate (EUMETSAT and NOAA). In addition, the Task Force was attended by the Chairman of the Expert Team on Data Representation and Codes, M. Dragosavac from ECMWF, and by the WMO Secretariat.

One of the important issues addressed by the Task Force was the update of Common Code Table 13 for Data Category and Data Sub-category, noting that this categorization which is primarily used for BUFR encoding, would also serve as a reference for the definition of *data type designators* in the GTS bulletin headings and the *data designator* in the *product identifier* section of file names to be exchanged within the WMO Information System (WIS).

The Task Force discussed the possibility of defining categories that would be either based on instruments (i.e. level 1 data associated with these instruments), or on geophysical variables (i.e. level 2 and beyond, possibly multi-instruments), or based on a combination of both. It was further assumed that every 'product' should be associated with a sub-category. As a starting point, it was agreed to define categories based on instrument types, to check whether the existing sub-categories could be accommodated in a meaningful way into these categories and, if needed, to consider additional categories for those sub-categories that cannot easily find a home in the initial categories.

The Task Force noted that the typology of satellite missions and instruments used in the Gap Analysis was a useful starting point for the definition of satellite data categories, subject to some adjustments (e.g. merging the similar categories for LEO and GEO, splitting the IR sounding into classical/hyper-spectral sounding and refining the non-meteorological missions such as gravity measurement, precision orbit, space environment).

### **Conclusions**

ET-SUP took note and expressed its appreciation for the excellent progress that had been achieved in both the RARS and IGDDS projects, in particular towards global coverage. The group noted the essential differences between the data content of the EUMETCast-Americas services and that of the GEONETCast-Americas, insofar as only the former carried level 1 satellite data. The group also noted that the availability of EUMETCast-Americas is time-limited following the decision by EUMETSAT Council to extend the service for a limited period. It was agreed that these concerns should be raised at CGMS.

**Action ET-SUP-4.13: WMO to present a document to CGMS-36 describing the progress achieved in IGDDS and RARS projects, pointing out the significant value of the EUMETCast-Americas service to South American NMHSs and encouraging agencies to find a way to ensure the associated requirements continue to be met in the future (November 2008).**

On the subject of RARS, the group strongly endorsed the suggestion that the project should evolve to include the collection and redistribution of data from hyper-spectral sounders.

ET-SUP expressed its strong encouragement for WMO Members to continue their support to both of these valuable projects.

## **16/B USER INFORMATION**

ET-SUP recalled that this subject had been initially discussed in the joint session (see Section 6) and had also been referenced in the discussions on the VL. The group felt that the approach already identified in these previous discussions had addressed the main elements of the subject but made some observations and recommendations as to how the subject should be taken forward.

The session noted that the responses to successive editions of the questionnaire seem to indicate that there is a problem in ensuring users are adequately informed about the availability and use of satellite data and products. This deficiency should be addressed as follow-up actions to the questionnaire responses themselves (as already described in Section 14/B) but should also be addressed by making the sources of relevant information as effective as possible.

It was agreed that one key to providing an effective source of information for users and potential users is that the information must be easily located, prominently displayed and structured to allow access to a greater level of detail by intuitive navigation.

Furthermore, it was recognized that the natural 'networking' of users through events such as those organized by the VL regional focus groups would be excellent opportunities to publicize the whereabouts of useful sources of information. In addition it was recommended that every appropriate opportunity be used to promote and publicize the availability of information for users (e.g. posters at conferences, simple handouts, etc.).

As previously indicated in Section 14/B it was confirmed by the group that the responsibility to provide the necessary user information is shared between the WMO SP office, the VL partners, and the relevant data and products generating centres; and that their respective web page developments should be well coordinated and inter-linked (e.g. a user should be able to navigate easily to the VRL from the WMO SP web pages and vice versa).

The session recognized that one element not well addressed so far is an effective description of the potential benefits that satellite data and products bring to users. It was suggested that effort to rectify this deficiency would be well spent and to this end. The CGMS Secretariat and Space Programme Regional Association Rapporteurs were identified as potential contributors to the provision of related information.

**Action ET-SUP-4.14: V. Gartner, and the Regional Association Rapporteurs (via the WMO Space Programme Office) to seek input from various areas of the world and various application areas illustrating the benefits of satellite data and products and supply this information to the WMO SP for inclusion on web pages (July 2009).**

## **18. ANY OTHER BUSINESS**

The Secretariat informed the session on the initiative of the Expert Team on Automatic Weather Stations (ET-AWS) to consider the potential of AWS networks to support calibration of space-based observations and product validation. With the expansion of AWS networks across the globe and real time communications the potential has been identified by the ET-AWS to add sensors to an AWS platform which could provide reliable ground-truth observations to contribute to the calibration of remotely sensed observations. Surface stations have a long history in providing measurements traceable to SI. An initial investigation has identified potential in observations such

as total column water vapour, rainfall, (including radar rainfall estimates), sea-surface temperature, snow depth, soil moisture, surface emissivity, land surface temperature, albedo, evaporation and cloud cover.

The ET-AWS recommended to submit to ET-SAT and ET-SUP, for their consideration, preliminary draft requirements for AWS-hosted sensors to contribute directly to the calibration and ground truth of space-based observations.

The session welcomed this initiative and confirmed the importance of ground-truth data for product validation. It expressed interest in investigating further this opportunity which seemed particularly timely in the context of WIGOS. It was agreed that ET-SAT and ET-SUP should both take action on this subject.

**Action ET-SAT-4.09: WMO Space Programme Office to forward to all ET-SAT Members the “Draft requirements for AWS sensors to contribute to the calibration and ground-truth of space-based observations.” Deadline: 30 October 2008.**

**Action ET-SAT-4.10: ET-SAT Members to send comments on these draft requirements to the ET-SAT Chair with copy to WMO Secretariat Deadline: 28 February 2009.**

**Action ET-SAT-4.11: ET-SAT Chair to consolidate these comments and forward them to the ET-AWS Chair, with copy to WMO Space Programme Office. Deadline: 31 May 2009.**

**Action ET-SUP-4.15: WMO Space Programme Office to forward to all ET-SUP Members the “Draft requirements for AWS sensors to contribute to the calibration and ground-truth of space-based observations.” Deadline: 30 October 2008.**

**Action ET-SUP-4.16: ET-SUP Members to send comments on these draft requirements to the ET-SUP Chair with copy to WMO Secretariat. Deadline: 28 February 2009.**

**Action ET-SUP-4.17: ET-SUP Chair to consolidate these comments and forward them to the ET-AWS Chair, with copy to WMO Space Programme Office. Deadline: 31 May 2009.**

## **19. SUMMARY CONCLUSIONS**

ET-SAT and ET-SUP met to inform each other on the relevant findings of each group and agree on modalities for preparing joint conclusions. Each Expert Team prepared a summary review of its accomplishments with regard to the work plan assigned by CBS. The summary reviews of ET-SAT and ET-SUP are attached as Annexes IV and V respectively.

## **20. FUTURE WORK P LAN**

In parallel sessions ET-SAT and ET-SUP prepared proposals for further matters that they should address in the 2009-2012 period for submission to the Implementation Coordination Team for Integrated Observing Systems (ICT IOS) that will be convened one week after the joint fourth session of the ET-SAT/SUP. The proposed detailed ET-SAT and ET-SUP work plans are attached as Annexes VI and VII respectively.

## **21. REVIEW AND ADOPTION OF THE DRAFT REPORT**

The draft report of the meeting, including its annexes, was reviewed and adopted, subject to editorial finalization by the WMO Secretariat, in consultation with the Chairpersons.

## **22. CLOSURE OF THE SESSION**

All agenda items having been addressed, and in view of the substantial achievements of the meeting, the Chairpersons thanked all participants for their contribution. The session was closed at 13h50 on Friday, 5 September 2008.

APPENDIX I

**LIST OF PARTICIPANTS**

*Note: The participants in the ET-SAT and ET-SUP sessions are indicated separately below. The two sessions were held partly as a joint meeting. The first day was also attended by members of the Virtual Laboratory Management Group.*

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**(attending on September 2008)**

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APPENDIX II

**AGENDA**

*First Session (Joint)*

1. **ORGANIZATION OF THE SESSION**
  - 1.1 Opening of the session
  - 1.2 Adoption of the agenda
  - 1.3 Working arrangements for the session
2. **CHAIRMEN'S REPORTS**
  - 2.1 OPAG IOS Chairman's report
  - 2.2 ET-SAT Chairman's report
  - 2.3 ET-SUP Chairman's report
3. **ITEMS OF INTEREST FROM RELEVANT WMO MEETINGS INCLUDING CONSULTATIVE MEETINGS, EXECUTIVE COUNCIL, AS WELL AS CGMS, CEOS AND GEO MEETINGS**
4. **STATUS OF OPERATIONAL AGENCIES SATELLITE PROGRAMMES**
5. **STATUS OF R&D AGENCIES SATELLITE PROGRAMMES**
6. **PRODUCT AVAILABILITY AND USER INFORMATION**
7. **NEW VISION OF THE SPACE-BASED COMPONENT OF THE GOS**
8. **R&D TO OPERATIONS TRANSITION STRATEGY**
9. **RESPONSE TO NEW USER REQUIREMENTS**
10. **REGIONAL/SPECIALIZED SATELLITE CENTRES**
11. **SPACE WEATHER**

*ET-SAT Session (Parallel)*

- 12/A **STATUS OF OUTSTANDING ACTIONS FROM PREVIOUS ET-SAT MEETINGS**
- 13/A **OVERALL STATUS OF THE SPACE-BASED COMPONENT OF THE GOS**
- 14/A **GAP ANALYSIS**
- 15/A **REFINING THE VISION FOR THE SPACE-BASED COMPONENT OF THE GOS**
- 16/A **DATABASE OF USER REQUIREMENTS AND OBSERVING CAPABILITIES**
- 17/A **IGEOLAB**

*ET-SUP Session (Parallel)*

- 12/B **STATUS OF OUTSTANDING ACTIONS FROM PREVIOUS ET-SUP MEETINGS**

- 13/B TRAINING STRATEGY, INCLUDING VIRTUAL LABORATORY MATTERS**
- 14/B OUTCOME OF THE QUESTIONNAIRE ON THE USE OF SATELLITE DATA UTILIZATION: ANALYSIS AND RECOMMENDATIONS**
- 15/B IGDDS AND RARS**
- 16/B USER INFORMATION**

*Final Session (Joint)*

- 18. ANY OTHER BUSINESS**
  - 19. SUMMARY CONCLUSIONS**
    - 19.1 ET-SAT FINDINGS
    - 19.2 ET-SUP FINDINGS
  - 20. FUTURE WORK PLAN**
  - 21. REVIEW AND ADOPTION OF THE DRAFT REPORT**
  - 22. CLOSURE OF THE MEETING**
-

**VISION FOR THE GOS IN 2025**

(As revised by ET-SAT/SUP-4 on 4 September 2008)

[This Vision provides a high-level goal fostering the evolution of the WMO Global Observing System in the coming decades.](#)

**1. General trends and issues**

**Response to user needs**

- The ~~W~~GOS will provide comprehensive observations in response to the needs of all WMO Members and Programmes for improved data products and services, for weather, water and climate;
- It will continue to provide effective global collaboration in the making and dissemination of observations, through a composite and increasingly complementary system of observing systems;
- It will provide observations when and where they are needed in a reliable, stable, sustained and cost-effective manner;
- It will respond to user requirements for observations of specified spatial and temporal resolution, accuracy and timeliness; and
- It will evolve in response to a rapidly changing user and technological environment, based on improved scientific understanding and advances in observational and data-processing technologies.

**Integration**

- The GOS will have evolved to become part of the WIGOS, which will integrate current GOS functionalities, which are intended primarily to support operational weather forecasting, with those of other applications: climate monitoring, oceanography, atmospheric composition, hydrology, and weather and climate research; and
- Integration will be developed through the analysis of requirements and, when appropriate, through sharing observation infrastructure, platforms and sensors.

**Expansion**

- There will be an expansion in both the user applications served and the variables observed;
- This will include observations to support the production of Essential Climate Variables, adhering to the GCOS climate monitoring principles;
- Sustainability of new components of the WIGOS will be secured, with some R & D systems integrated as operational systems;
- The range and volume of observations exchanged globally (rather than locally) will be increased; and
- Some level of targeted observations will be achieved, whereby additional observations are acquired or usual observations are not acquired, in response to the local meteorological situation.

### **Automation**

- The trend to develop fully automatic observing systems, using new observing and information technologies will continue, where it can be shown to be cost-effective;
- Access to real-time and raw data will be improved;
- Observing system test-beds will be used to intercompare and evaluate new systems and develop guidelines for integration of observing platforms and their implementation; and
- Observational data will be collected and transmitted in digital forms, highly compressed where necessary. Data processing will be highly computerised.

### **Consistency and homogeneity**

- There will be increased standardisation of instruments and observing methods;
  - There will be improvements in calibration of observations and the provision of metadata, to ensure data consistency and traceability to absolute standards;
  - There will be increased interoperability, between existing observing systems and with newly implemented systems; and
  - There will be improved homogeneity of data formats and dissemination via the WIS.
-

## 2. The space-based component

Instruments:	Geophysical variables:
<b>Operational geostationary satellites. At least 6, separated by no more than 60-70 deg longitude</b>	
High-resolution multi-spectral Vis/NIR/IR imagers	Cloud amount, type, top height/temperature; wind (through tracking cloud and water vapour features); sea / land surface temperature; precipitation; aerosols; snow cover; vegetation cover; albedo; atmospheric stability; fires; volcanic ash
IR hyper-spectral sounders	Atmospheric temperature, humidity; wind (through tracking cloud and water vapour features); rapidly evolving mesoscale features; sea / land surface temperature; cloud amount and top height / temperature; atmospheric composition
Lightning imager <a href="#">on some geostationary spacecraft</a>	Lightning (in particular cloud to cloud), location of intense convection.
<b>Operational polar-orbiting sun-synchronous satellites distributed within 3 orbital planes (~13:30, 17:30, 21:30 ECT)</b>	
IR hyper-spectral sounders	Atmospheric temperature, humidity and wind; sea / land surface temperature; cloud amount, water content and top height / temperature; atmospheric composition
MW sounders	
High-resolution multi-spectral Vis/IR imagers (including IR Water Vapour absorption channel)	Cloud amount, type, top height / temperature; wind (high latitudes, through tracking cloud and water vapour features); sea / land surface temperature; precipitation; aerosols; snow and ice cover; vegetation cover; albedo; atmospheric stability
<b>Additional operational missions in appropriate orbits (<a href="#">classical polar-orbiting</a>, <a href="#">geostationary</a>, or other orbits)</b>	
MW imagers – at least 3 – some polarimetric	Sea ice; total column water vapour; precipitation; sea-surface wind speed [and direction]; cloud liquid water; sea/land surface temperature; soil moisture
Scatterometers - at least 2 on well separated orbital planes	Sea-surface wind speed and direction; sea ice; soil moisture
Radio occultation constellation – at least 8 receivers	Atmospheric temperature and humidity; ionospheric electron density
Altimeter constellation including a reference mission in a precise orbit, and polar-orbiting altimeters for global coverage	Ocean surface topography; sea level; ocean wave height; lake levels; sea and land ice topography
IR dual-angle view imager	Sea-surface temperature (of climate monitoring quality); aerosols; cloud properties
Narrow-band high-spectral <a href="#">and hyper-spectral</a> resolution Vis/NIR imagers	Ocean colour; vegetation (including burnt areas); aerosols; cloud properties; albedo
High-resolution multi-spectral Vis/IR imagers – constellation	Land-surface imaging for land use and vegetation; flood monitoring
Precipitation radars operated in conjunction with passive MW imagers in various orbits	Precipitation (liquid and solid)
Broad-band Vis/IR radiometer + total solar irradiance sensor - at least 1	Earth radiation budget (supported by imagers and sounders on polar-orbiting and geostationary satellites) and collocated aerosols and cloud properties measurements
Atmospheric composition instruments constellation, including high spectral resolution UV sounder on geostationary orbit and at least a UV sounder on am + pm orbit	Ozone; other atmospheric chemical species; aerosols – for greenhouse gas monitoring, ozone/UV monitoring, air quality monitoring
Synthetic aperture radar	Wave heights, directions and spectra; oil spills; floods; other hazards; earthquake and faults monitoring; sea ice leads; damage assessment; ice shelf and icebergs
<b>Operational pathfinders and technology demonstrators, including</b>	
Doppler wind lidar on LEO	Wind; aerosol; cloud-top height [and base]
Low-frequency MW radiometer on LEO	Ocean surface salinity; soil moisture
MW imager / sounder on GEO	Precipitation; cloud water / ice; atmospheric humidity and temperature
High-resolution, multi-spectral narrow-band Vis imagers on GEOs	Ocean colour
Vis / IR imagers on satellites in high inclination, highly elliptical orbits (HEO)	Winds and clouds at high latitudes; sea ice; high latitude volcanic ash plumes; snow cover; vegetation; fires
Gravimetric sensors	Water volume in lakes, rivers, ground, etc.
<b>Polar and geo platforms / instruments for space weather</b>	
Solar imagery Particle detection Electron density	Solar radiation storms, high-energy particle rain, ionospheric and geomagnetic storms, radio black-out by X-ray photons

## 3. The surface-based component

Station type:	Geophysical variables:
<b>Land – upper-air</b>	
Upper-air synoptic and reference stations	Wind, temperature, humidity, pressure
Remote sensing upper-air profiling remote stations	Wind, cloud base and top, cloud water, temperature, humidity, aerosols
Aircraft	Wind, temperature, pressure, humidity, turbulence, icing, thunderstorms, dust / sandstorms, volcanic ash / activity, and atmospheric composition variables (aerosols, greenhouse gases, ozone, air quality, precipitation chemistry, reactive gases)
Atmospheric composition stations	Aerosol optical depth, atmospheric composition variables (aerosols, greenhouse gases, ozone, air quality, precipitation chemistry, reactive gases)
GNSS receiver stations	water vapour
<b>Land – surface</b>	
Surface synoptic and climate reference stations	Surface pressure, temperature, humidity, wind; visibility; clouds; precipitation; present and past weather; radiation; soil temperature; evaporation; soil moisture; obscuration
Atmospheric composition stations	Atmospheric composition variables (aerosols, greenhouse gases, ozone, air quality, precipitation chemistry, reactive gases)
Lightning detection system stations	Lightning (location, density, rate of discharge, polarity, volumetric distribution)
Application specific stations (road weather, airport / heliport weather stations, agromet stations, urban meteorology, etc)	Application specific observations
<b>Land – hydrology</b>	
Hydrological reference stations	Water level
National hydrological network stations	Precipitation, snow depth, snow water content, lake and river ice thickness/date of freezing and break-up, water level, water flow, water quality, soil moisture, soil temperature, sediment loads
Ground water stations	Ground water measurements
<b>Land – weather radar</b>	
Weather radar station	Precipitation (hydrometeor size distribution, phase, type), wind, humidity (from refractivity), sand and dust storms
<b>Ocean – upper air</b>	
Automated Shipboard Aerological Platform (ASAP) ships	Wind, temperature, humidity, pressure
<b>Ocean – surface</b>	
HF Coastal Radars	Surface currents, waves
Synoptic sea stations (ocean, island, coastal and fixed platform)	Surface pressure, temperature, humidity, wind; visibility; cloud amount, type and base-height; precipitation; weather; sea-surface temperature; wave direction, period and height; sea ice
Ships	Surface pressure, temperature, humidity, wind; visibility; cloud amount, type and base-height; precipitation; weather; sea-surface temperature; wave direction, period and height; sea ice
Buoys – moored and drifting	Surface pressure, temperature, humidity, wind; visibility; sea-surface temperature; 3D & 2D wave spectrum, wave direction, period and height
Ice buoys	Surface pressure, temperature, wind, ice thickness
Tide stations	Sea water height, surface air pressure, wind, salinity, water temperature
<b>Ocean – sub-surface</b>	
Profiling floats	Temperature, salinity, current, dissolved oxygen, CO <sub>2</sub> concentration
Ice tethered platforms	Temperature, salinity, current
Ships of opportunity	Temperature
<b>R&amp;D and Operational pathfinders – examples</b>	
UAVs	Wind, temperature, humidity, atmospheric composition
Gondolas	Wind, temperature, humidity
GRUAN stations	Reference quality climate variables, cloud structure
Aircraft	Chemistry, aerosol, wind (lidar)
Instrumented marine animals	Temperature
Ocean gliders	Temperature, salinity, current, dissolved oxygen, CO <sub>2</sub> concentration



## 4. System-specific trends and issues

### 4.1 Space-based

#### 4.1.1 Benefits

The enhanced space-based observing component defined in this Vision will contribute to the major strategic thrust of *Science and Technology Development and Implementation*, with the Expected Results to enhance the capability of WMO Members to produce better weather forecasts and warnings, to provide better climate predictions and assessments, and better hydrological forecasts and assessments, through integrated observing systems. In doing so, it will support the other Strategic Thrust of *Service Delivery*, in particular as concerns hazard early warning and better Weather, Climate, Water and environmental applications and services.

Higher temporal, spectral and spatial resolution and higher accuracy will increase the possibility to monitor and predict fast evolving small-scale phenomena. Ensuring sustainable monitoring of ocean and land surfaces and atmospheric chemistry will respond to climate and weather modelling requirements while serving applications in a wider range of Societal Benefit Areas as defined by the Group on Earth Observation (GEO).

#### 4.1.2 System features

- There will be an **expanded** space-based observing **capability** both on operational and research satellites;
- There will be an **expanded community** of space agencies contributing to the GOS;
- There will be **increased collaboration** between space agencies, to ensure that a broad spectrum of user requirements for observations are met in the most cost-effective manner, and that system reliability is assured through arrangements for mutual back-up;
- Observational capability demonstrated on **R&D** satellites will be progressively transferred to **operational** platforms, to assure the reliability and sustainability of measurements;
- **R&D satellites** will continue to play an important role in the GOS; although they cannot guarantee continuity of observations, they offer important contributions beyond the current means of operational systems. Partnerships will be developed between agencies to extend the operation of functional R & D and other satellites to the maximum useful period;
- Some user requirements will be met through **constellations** of satellite, often involving collaboration between space agencies. Expected constellations include: altimetry, precipitation, radio occultation, atmospheric composition, Earth radiation budget, land surface imaging and ocean colour;
- **Higher spatial, temporal and spectral resolution** will considerably enhance the information available while increasing the demand on data exchange, management and processing capability;
- **Improved availability and timeliness** will be achieved through operational cooperation among agencies and new communications infrastructure; and
- **Improved calibration and inter-calibration** will be achieved through mechanisms such as GSICS.

### 4.2 Surface-based

**The surface-based GOS will provide:**

- Improved detection of mesoscale phenomena;
- Data that cannot be measured by space-based component;
- Data for calibration and validation of space-based data;
- Enhanced data exchange of regional scale observing data and product from weather radar, hydrological networks, etc.;
- High vertical resolution profiles from radiosondes and other ground based remote-sensing systems, integrated with other observations to represent the atmospheric structure;
- Improved data quality with defined standards on availability, accuracy and quality control; and long-term datasets for the detection and understanding of environmental trends and changes to complement those derived from space-based systems.

**Radiosondes networks will:**

- Be optimized, particularly in terms of horizontal spacing which will increase in data-dense areas;
- Maintain the **GUAN** subset of stations for climate monitoring;
- Include a **GCOS Reference Upper-Air Network (GRUAN)** to serve as a reference network for other radiosonde sites, for calibration and validation of satellite records, and for other applications; and
- Be complemented by the **aircraft (AMDAR)** ascent / descents profiles and other ground-based profiling systems.

**Aircraft observing systems**

- Will be integrated into the broader observing framework;
- Will be available from most airport locations, including those regions not currently well covered (Africa, South America and parts of Asia);
- Flight-level and ascent / descent data will be available at user-selected temporal resolution;
- Will observe humidity, in addition to temperature, pressure and wind; and
- Will also be developed for smaller, regional aircraft with flight levels in the mid-troposphere and providing ascent / descent profiles into additional airports.

**Land-surface observations systems**

- Will come from a wider variety of surface networks (e.g., road networks, mobile platforms) and multi-application networks;
- Will be primarily automated and capable of reproducing or substituting for measurements previously obtained subjectively (weather phenomena, cloud type, etc.);and
- Will include the **GSN** subset of surface stations for climate monitoring.

**Surface marine observations**

- From drifting buoys, moored buoys, ice buoys and Voluntary Observing Ships will complement satellite observations; and
- With improved temporal resolution and timeliness, through reliable and cost-effective satellite data communication systems;

#### **Ocean sub-surface observing technology**

will be improved, including cost-effective multi-purpose in-situ observing platforms, ocean gliders, and instrumented marine animals.

#### **Remote-Sensing observing systems:**

- **Weather radar** systems will provide enhanced precipitation products but with increased data coverage. They will increasingly provide information on other atmospheric variables. There will be much improved data consistency and new radar technology. Collaborative multi-national networks will deliver composite products.
- **Coastal HF Radars** will provide for ocean currents and wave data.
- **Profilers** will be developed and used by more applications. A wider variety of technologies will be used, including lidars, radars and microwave radiometers. These observing systems will be developed into coherent networks and integrated with other surface networks.
- **GNSS** (e.g., GPS, GLONASS and GALILEO) receiver networks, for observing total column water vapour, will be extended.
- These systems will be integrated into “intelligent” profiling systems and integrated with other surface observing technologies.

#### **Lightning detection systems**

- **Long-range lightning detection systems** will provide cost-effective, homogenized, global data with a high location accuracy, significantly improving coverage in data sparse regions including oceanic and polar areas.
- **High-resolution lightning detection systems** with a higher location accuracy, cloud-to-cloud and cloud-to-ground discrimination for special applications.

Surface-based observations of **atmospheric composition** (complemented by balloon- and aircraft-borne measurements) will contribute to an integrated three-dimensional global atmospheric chemistry measurement network, together with a space-based component. New measurement strategies will be combined to provide near real time data delivery.

Surface-based observations will support **nowcasting and very short range forecasting** through the widespread integration of radar, lightning and other detection systems, with extension to continental and global scales of the networks.

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APPENDIX IV

REVIEW OF ET-SAT WORK PLAN FOR 2007-2008 AS AGREED BY ext-CBS 2006

WORK PLAN ITEM	STATUS
<p>a) Review both operational and R&amp;D environmental satellites present capabilities and plans and provide input to relevant OPAG IOS, OPAG ISS Expert Teams and ICT meetings to assist in the integration of WMO-coordinated observing systems;</p>	<p>Yearly review was performed of satellite capabilities and plans, as well as a Gap Analysis evaluating the planned capabilities for the next two decades against user requirements. This was provided as input to ET-EGOS as a reference material to initiate the new Vision of the GOS in 2025.</p>
<p>b) Review Consultative Meetings on High-level Policy on Satellite Matters (CM) recommendations for the relevant period and provide input to OPAG-IOS and ICT work programmes;</p>	<p>CM recommendations were systematically recorded and taken into account. In particular, in response to CM requests, ET-SAT has:</p> <ul style="list-style-type: none"> <li>- addressed the strategy for transition of R&amp;D missions to Operational status and developed a set of guidelines in this matter;</li> <li>- reviewed and supported proposed test cases for cooperative projects on Highly Elliptical Orbit missions for high-latitude monitoring, in the framework of IGEOLAB;</li> <li>- advised on the potential involvement of WMO in Space Weather.</li> </ul>
<p>c) Review Statements of Guidance (SOGs) and plans for GOS evolution and provide input to ET-EGOS towards improvement of system capabilities, particularly with respect to developing countries;</p>	<p>ET-SAT has designated points of contacts who volunteered to assist in the development and update of SOGs through providing advise on satellite-related aspect.</p>
<p>d) Review the implications of expanding the space-based component of the GOS baseline to include namely sustained observations of additional variables as required for climate monitoring, in concert with ET-SUP and ET-EGOS, and report to CBS as appropriate;</p>	<p>ET-SAT has developed the rationale for such an expansion in analyzing the implications of observation requirements deriving from the GCOS Implementation Plan and its Satellite Supplement.</p> <p>In order to assess the response to these requirements, it has reviewed current plans for the coming decades, monitored a detailed Gap Analysis and has identified continuity issues. It has suggested a re-design of the GOS and thoroughly reviewed the space-based part of the new Vision of the GOS to 2025.</p> <p>As a particular implication of this expansion,, attention was paid to the transition from R&amp;D missions and instruments to operational status,</p>

WORK PLAN ITEM	STATUS
	<p>which is a critical and necessary process to achieve sustainability of missions that are currently only undertaken in a R&amp;D framework.</p> <p>ET-SAT, partly in joint sessions with ET-SUP, discussed this issue in detail at its 3<sup>rd</sup> and 4<sup>th</sup> meetings. In response to a request from CM-8, guidelines were developed for WMO in support of such a transition process.</p>
<p>e) Provide input to other WMO sponsored expert group meetings, e.g., JCOMM, GCOS, WCRP and GAW with regard to satellite system capabilities and their requirements;</p>	<p>ET-SAT performed a thorough review of the GCOS Implementation Plan and its Satellite Supplement and subsequently developed a response that triggered a number of actions:</p> <ul style="list-style-type: none"> <li>- new Vision of the GOS</li> <li>- development of R/SSC-CM</li> <li>- new emphasis on calibration activities</li> </ul>
<p>f) Review progress on the Implementation Plan for Evolution of the Space and Surface-based Sub-systems of the GOS, initiate actions as appropriate and coordinate this activity with the ET-EGOS.</p>	<p>ET-SAT is keeping under annual review the space-based part of this Implementation Plan. The outcome is forwarded to ET-EGOS. Actions are allocated to WMO Secretariat or Satellite operators as appropriate.</p>

APPENDIX V

**REVIEW OF ET-SUP WORK PLAN FOR 2007-2008 AS AGREED BY ext-CBS 2006**

WORK PLAN ITEM	STATUS
(a) In following the Rolling Review for the Strategy to Improve Satellite System Utilization, analyze the 2007 biennial questionnaire and other relevant information to prepare a new TD summarizing the current status of the Implementation Plan to Improve Satellite System Utilization;	The 2007 edition of the questionnaire was generated and published in January 2008 with a preliminary analysis of the responses completed in time for review by ET-SUP-4 (2008). The finalization of the analysis of responses and associated Technical Document is expected by January 2009.
(b) Interact with the IGDDS Implementation Group to check that the data requirements including inter-regional exchange, equipment, standards, content and timeliness are such that WMO Members can take full advantage of the ADMs and the inter-regional data dissemination systems;	ET-SUP-3 (2007) reviewed plans and progress of both the IGDDS and RARS projects through the outcomes of the respective Implementation Groups. Regarding IGDDS, it expressed a strong view that there was a primary requirement for "GEO imagery over the region" that should be provided in every region on all components of the IGDDS, including through DVB-S satellite broadcast service. ET-SUP-4 (2008) raised an action to bring to the attention of CGMS the threat to DVB-S coverage for S. America posed by the foreseen withdrawal of the EUMETCast-Americas component of the IGDDS and the limitations of the GEONETCast-Americas component.
(c) In conjunction with ET-SAT, review present and future R&D satellite data and products including their availability and applications towards better utilization by WMO Members;	ET-SUP-4 discussed ways to enhance user information on data and products availability, with particular emphasis on R&D data and products.
(d) Represent WMO Member needs to the CGMS/WMO Virtual Laboratory for Satellite Data Utilization (VL) in relevant areas;	ET-SUP-3 (2007) considered the outcome of the recent Virtual Laboratory Management Group meeting (VLMG-3), including a review of lessons learnt from the HPTE along with other recommendations and actions raised by the VLMG. In particular, the ET-SUP considered the importance of the role of Regional Focus Groups and reviewed progress towards their establishment involving all VL partners. The status of other training activities, both past and planned, was reviewed taking account of the progress towards routine involvement of VL materials, tools and techniques. ET-SUP-4 (2008) took note of further progress with the implementation of the VL, in particular the establishment of Regional Focus Groups (RFG) African CoEs (Niamey, Nairobi) and Oman (Muscat) and regular RFG Activities in Americas and Caribbean. It further noted the expansion of the network of CoEs to include Russia and South Africa. An expression of interest in becoming a CoE

WORK PLAN ITEM	STATUS
	was also received from India (ISRO). The fourth meeting of the VL Management Group (VLMG-4), collocated with ET-SUP-4, generated the draft of a new 5-year Training Plan for review by ET-SUP. ET-SUP revised the Strategy that should allow the VL to better address the needs of WMO in meteorology and other related application areas. The expansion of the VL will allow better addressing the needs of WMO Members in all Regions and all WMO languages.
(e) In conjunction with WSP Secretariat further clarify the Information Needs of WMO Members regarding access to and utilization of satellite data and products and the associated capacity building, and the best way to meet these requirements;	ET-SUP-4 (2008) initiated several actions to address the provision of information for WMO Members both via the WMO Space Programme web pages and also through enhancements to the proposed web pages comprising the Virtual Resource Library (VRL)
(f) Further the concept of Regional/Specialized Centres on Satellite Products;	ET-SUP-3 (2007) reviewed the evolution of the concept of Regional/Specialized Satellite Centres for Climate Monitoring (R/SSC-CM) and the draft Implementation Plan. It proposed that the outcomes and benefits of R/SSC-CM be reviewed after two years prior to extending the concept to other areas such as air quality. ET-SUP-4 (2008) conducted a further review of the progress made towards the implementation of the R/SSC-CM noting the outcome of the Planning Meeting held in Darmstadt, Germany, in April 2008. The extant action to consider extending the concept based on the experiences of the R/SSC-CM – treating that as a pilot project – was confirmed and given a due date of 2009.
(g) Further expand the space-based component of the GOS baseline to include sustained observations of additional variables as required for climate monitoring working jointly with ET-SAT and ET-EGOS;	ET-SUP-3 and ET-SAT-3 (2007) carried out a joint discussion of the re-design of the space-based GOS, which led to the development of a new Vision for the GOS. This action has been actively pursued with ET-SAT lead, and input provided by ET-SUP
(h) Further develop “R&D to operations transition” concept and identify in more detail the role WMO could assume;	ET-SUP-3 and ET-SAT-3 (2007) acknowledged that in the new Vision for the GOS many capabilities currently relying on R & D missions without any long-term commitment would then be required on an operational basis. The Session highlighted several aspects of the transition: technology evolution from demonstration to pre-operational and operational stage, programmatic implications of the change from a research objective to an operational objective, user involvement and preparedness. The role of WMO in this process was emphasized.

WORK PLAN ITEM	STATUS
	In a similar way, the collocation of ET-SUP-4 and ET-SAT-4 (2008) allowed this joint discussion to be pursued. The session agreed on guidelines for the role of WMO to facilitate this transition.
(i) Prepare documents to assist Members, summarizing the results from the above activities.	<p>In reviewing the WMO Space Programme web pages, ET-SUP noted the recent developments in which a large number of documents, covering the full range of WMO Space Programme activities, are now presented for public consumption in a user-friendly layout.</p> <p>The ET-SUP members reviewed the status of the draft technical document on the <i>Status of WMO Members Use of Satellite Data and Products</i> for the years 2004 and 2005. The ET-SUP prepared and published the Technical Document containing the analysis of the 2007 edition of the user questionnaire.</p>



APPENDIX VI

**ET-SAT DETAILED WORK PLAN AND PROPOSAL FOR ALLOCATION OF TASKS FOR 2009-2012**

<b>Task:</b>	<b>Action:</b>	<b>Responsibility:</b>	<b>Deadline for action:</b>	<b>Deliverable(s):</b>
<b>Review capabilities of operational and R&amp;D satellites</b>  <i>(Expected Result 4)</i>	Provide update on current and planned satellite missions	All sat. operators represented at ET-SAT	Every year by the ET-SAT meeting	Tables
	Assist in refining the implications of the Vision for the GOS, as concerns space-based aspects and related observation strategies	ET-SAT Chair and Members	Every year by the ET-SAT meeting	Recommendations to WMO Secretariat (SP) and ET-EGOS
	Identify opportunities for transition of relevant R&D missions to operations	ET-SAT Chair and Members	Every year by the ET-SAT meeting	Report to CBS through ICT-IOS
	Recommendations to prepare the transition of relevant R&D missions to operations and to promote the use of R&D mission data			Recommendations to CBS via ICT-IOS, and to ET-SUP
<b>Assist CBS on coordinating global planning of satellite missions to implement the Vision of the GOS</b>  <i>(Expected Result 4)</i>	Reviewing the status of implementation of the space-based component of the GOS	ET-SAT Chair and Members	Every year by the ET-SAT meeting	Report to CBS through ICT-IOS
	Identify and assess opportunities and/or problem areas concerning plans of relevant satellite operators	ET-SAT Chair and Members	Every year by the ET-SAT meeting	Report to CBS through ICT-IOS
	Support international cooperation on future demonstration missions			Workshops and their reports
	Review and update the Gap Analysis related to the fulfilment of WMO requirements by the space-based component of the GOS	ET-SAT Chair and Members	Every year by the ET-SAT meeting	Report to CBS through ICT-IOS.
	Provide technical advice with respect to both operational and R&D environmental satellites to assist in the integration of	ET-SAT Chair and Members	Every year by the ET-SAT meeting	Report to CBS through ICT-IOS. And ET-EGOS,

	WMO-coordinated observing systems and in particular as concerns WIGOS pilot projects			ET-AWS
<b>Advise CBS on other relevant matters</b>  <i>(Expected Results 4, 5, 9)</i>	Provide response to the WMO Consultative Meetings on High-level Policy on Satellite Matters	ET-SAT Chair and Members		Report to CBS through ICT-IOS
	Assess the capabilities of systems relating to the access and use of environmental satellites and suggest improvements of these capabilities, particularly with respect to developing countries.	ET-SAT Chair and Members		Report to CBS through ICT-IOS
	Advise on other subjects such as radio frequency utilization,	ET-SAT Chair and Members		Report to CBS through ICT-IOS
<b>Coordination and reporting</b>  <i>(Expected Result 10)</i>	Provide relevant input to ET-SUP on education and training and other appropriate capacity-building measures related to satellite meteorology	ET-SAT Chair and Members		Report to ET-SUP
	Coordinate with other relevant CBS teams with a view to making recommendations on relevant matters,	ET-SAT Chair		Inputs to ET-EGOS, ET-SUP, ET-AWS
	Support cooperation with CGMS, CEOS and other satellite-related organizations			
<b>Space Weather</b>	Provide initial contribution to the implementation of an inter-Commission activity related to Space Weather coordination	Chair, ET-SAT	End 2009	Recommendations on tasks, report on related activities of satellite operators

APPENDIX VII

ET-SUP DETAILED WORK PLAN AND PROPOSAL FOR ALLOCATION OF TASKS FOR 2009-2012

Task:	Action:	Responsibility:	Deadline for action:	Deliverable(s):
<p><b>Expand the <u>use</u> of satellite data &amp; products across WMO Members with focus on the needs of less well developed Members</b></p> <p><i>(Expected Result 9)</i></p>	<p>Prepare and distribute a questionnaire on the availability and use of satellite data and products on a biannual basis</p>	<p>ET-SUP members (probably through sub-group) in cooperation with WMO</p>	<p>January 2010 (thereafter every two years)</p>	<p>Published questionnaire (including a web-based online version)</p>
	<p>Gather, record and analyse questionnaire responses and present in published Technical Document (TD)</p>	<p>ET-SUP members (probably through sub-group) in cooperation with WMO Secretariat</p>	<p>Draft TD by Sept 2010 and Final TD by December 2010 (thereafter every two years)</p>	<p>Published WMO Technical Document</p>
	<p>Consider follow-up actions for Key Findings and Recommendations from the analysis of responses.</p>	<p>ET-SUP members and Regional Rapporteurs</p>	<p>At all ET-SUP meetings</p>	<p>Recorded and tracked actions for each Key Finding identified as requiring action.</p>
	<p>Monitor progress of the R/SSC-CM initiative and consider extending the concept to other application areas</p>	<p>ET-SUP members</p>	<p>End 2009</p>	<p>Recommendation to CGMS and CBS</p>
	<p>Promote the wide use of established and standard satellite data formats, processing techniques and tools</p>	<p>ET-SUP members</p>	<p>At all ET-SUP meetings</p>	<p>Workshops and/or published guidance as appropriate</p>
	<p>Monitor enhanced use of R&amp;D mission data, in particular for developing countries, through components of information provision and capacity building tasks</p>	<p>ET-SUP members and Regional Rapporteurs</p>	<p>At all ET-SUP meetings</p>	<p>Increased use of R&amp;D data (evidence from questionnaire responses)</p>
<p><b>Promote and implement harmonized, efficient, timely, enhanced data <u>access</u></b></p>	<p>Monitor and review progress of the IGDDS and RARS projects by review of the respective Implementation Group activities and ensure both projects fulfil their respective objectives</p>	<p>ET-SUP members</p>	<p>At all ET-SUP meetings</p>	<p>Updates to IGDDS and RARS project plans and documents. Achieve 90% global coverage by RARS systems with data content extended to</p>

				include hyper-spectral sounder data
<i>(Expected Result 5)</i>	Ensure the IGDDS and RARS project implementations proceed [in full conformance with the frameworks established by <b>WIS</b> and <b>WIGOS</b> ]. This shall include enhanced access to R&D mission data, in particular for developing countries	ET-SUP members	At all ET-SUP meetings	Global network of regional dissemination systems (following WIS standards)
<b>Provide up-to-date and comprehensive information on satellite plans, systems, products</b>  <i>(Expected Results 4, 5, 9)</i>	Provide support to the development and maintenance of comprehensive descriptive information on satellite data and products (including those from R&D missions) with focus on online Internet based delivery of information	ET-SUP members	At all ET-SUP meetings	Comprehensive, up-to-date and maintained web pages
	Provide support to the development and maintenance of comprehensive information on means of access to satellite data and products (including those from R&D missions) with focus on online Internet based delivery of information	ET-SUP members	At all ET-SUP meetings	Comprehensive, up-to-date and maintained web pages
<b>Maximise exploitation of satellite data through capacity building</b>  <i>(Expected Result 9)</i>	Implement the Virtual Laboratory (VL) Training Strategy with routine management devolved to the Virtual Laboratory Management Group (VLMG)	VLMG	In accordance with VL Implementation Plan	AS defined in the VL Implementation Plan
	Provide support to the VL through regular review of status, progress and plans ensuring the needs of users, especially those from less well developed Members, are addressed	ET-SUP members (in cooperation with VLMG)	Periodically, primarily at ET-SUP meetings	Updated VL plans and actions to address identified problem areas

**FIVE-YEAR STRATEGY FOR  
THE WMO/CGMS VIRTUAL LABORATORY**

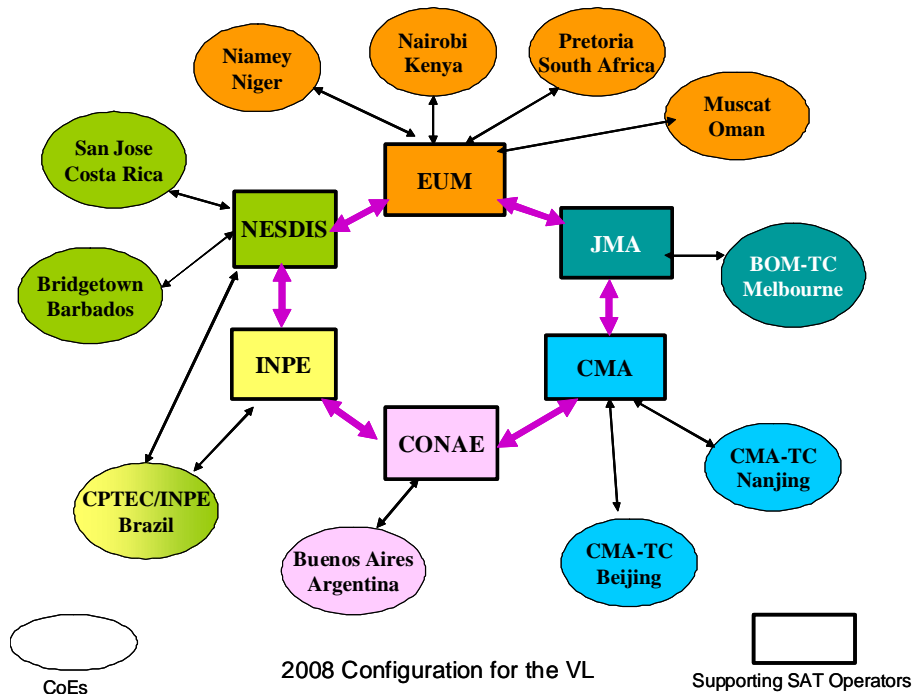
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**1. Introduction**

The WMO/CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VL) was established to help improve the world wide utilisation of satellite data and products by WMO Members. Activity in the VL reflects the three cornerstones of the WMO Strategy to improve satellite system utilization by providing access to (1) case study material and near real time data, (2) training and educational resources, and (3) software and expertise on how to best utilize satellite data and products.

The WMO/CGMS Virtual Laboratory (VL) is a global network of specialized training centres, supported by one or more satellite operators, and created to meet user needs for increased skills and knowledge in using satellite data. At the present time, the VL is collaboration between several CGMS meteorological satellite operators (NOAA, EUMETSAT, JMA, INPE and CMA) and a number of training “Centres of Excellence in Satellite Meteorology (CoE). These CoE, often co-located with WMO Regional Training Centres (RTC), are located at Argentina, Australia, Barbados, Brazil, China, Costa Rica, Kenya, Niger, and Oman. Each CoE is responsible for satellite training within their WMO Region, and supports one or more Regional Focus Groups which are comprised of NMHSs from their region.

The figure below shows the various linkages between CoEs and their supporting satellite operators in September 2008. The continuing growth in the VL community is seen with the addition of INPE and CPTEC in Brazil, CMATC in Beijing, Pretoria South Africa, CONAE and Buenos, Aires, Argentina.



Current top-level strategic goals of the VL are:

- 1) To provide high quality and up-to-date training and supporting resources on current and future meteorological and other environmental satellite systems, data, products and applications;

- 2) To enable the Centres of Excellence to facilitate and foster research and the development of socio-economic applications at the local level by the NMHS through the provision of effective training and links to relevant science groups.

Building upon the experiences and successes of the VL over recent years, this document presents a five year strategy for the VL and an implementation plan to achieve its goals.

## **2. Future Strategy of the VL**

### **2.1. Future trends**

In the coming years there will be significant changes in the user community requiring training, the way teaching and learning is carried out and the subject matter of the training. There will be significant advances in e-learning technology and increased availability of high speed low cost communications across the globe. Increased satellite capabilities will lead to new data and product applications areas, over and above the traditional weather forecasting, which will become increasingly important. For example, the impacts of climate change and the ability of the human race to respond are a global priority. Through their routine online training and discussion sessions Regional Focus Groups will play an increasingly important role in meeting these expanding training needs.

#### **2.1.1 The Users**

As more NMHSs take advantage of automated services, weather forecasters will require regular training to meet the needs of a wider range of users, including environmental scientists, software engineers and developers of new user-driven services. It is clear that with new satellite technologies advanced training will become an imperative to ensure full utilization of this valuable resource.

#### **2.1.2 The Techniques**

A key component of the advanced training will be greater use of blended learning, a training concept successfully implemented in recent years by a number of training centres. Blended learning combines online and traditional methods for training and is a very cost effective means of expanding the access to training materials while preserving many of the benefits of traditional training approaches: its wider use should be regarded as a key goal of the VL. Conferencing and audio/video-supported training tools are now emerging and these developments will be assessed and incorporated by VL partners in their training programmes, as appropriate.

The course management system [Moodle](#) and distance learning tools like CENTRA are being adopted among the VL partners. The progression to new “tools” for use by trainers is important to the growth of the VL.

Increasingly, it is necessary to demonstrate the tangible benefits coming from human and financial resource investments in training. In particular, how training leads to an improvement in services provided by the NHMS. The VL will develop systematic feedback and reporting mechanisms that will lead to continuous improvement ensuring that this key objective is met.

#### **2.1.3 Effective Networking and Interactions**

For the VL to realize its potential and become a global provider of training, the Regional Focus Groups (RFG) established by each CoE will need to be strengthened so that they can meet the expanding mandate of training requirements within their regions of responsibility. This will include the regular organisation of Regional Training Events (RTE) that utilise blended learning methods that bring together and benefit all members of the Group.

The quality of Internet connectivity is very important to support the use of video, voice and other high quality training tools in the VL environment. To provide effective training, CoEs

need to have an Internet connection with a **minimum** data rate of 1 Mbs **specifically dedicated** to CoE training activities. Such a data rate is the absolute minimum needed.

#### 2.1.4 The Virtual Resource Library

The Virtual Resource Library is a key asset of the VL, a key goal is to ensure that this valuable repository of training resources is secured, maintained and configured in such a way that effectively supports both the contribution and use of resources. To this end, it is proposed that the VRL should be accessible through a centralised Web portal. The host of such a portal must have experience in maintaining and managing such a system. Examples of such sites might be the Environmental Satellite Resource Centre (ESRC) hosted by COMET and the CEOS Educational Resources Portal maintained by EUMETSAT.

### 3 Training Areas

First of all, the VL will provide training that exploits the full potential of satellite data and products from both operational **and** several R&D satellites and, in so doing, prepare the various user communities for the next generation of space-borne Earth observing systems.

Secondly, and bearing in mind the ongoing establishment of various elements of the GEOSS and the emphasis now being placed upon GEO capacity building efforts, especially for the developing countries, VL training activities may in future have to address the training needs of some of the GEO Societal Benefit Areas (agriculture, biodiversity, climate, [disasters](#), ecosystems, [energy](#), health and [water](#)).

The training programmes of the CoEs and satellite operators comply with the principles and recommendations described in the satellite meteorology component of WMO publication 258 "Guidelines for the education and training of personnel in meteorology and operational hydrology". This document places major emphasis on the training of trainers and sets the standard for competence training. Therefore, VL training activities will have to closely follow any evolution in WMO Publication 258 to meet new training needs.

Building upon the currently available expertise within the VL network, training activities should first focus upon:

- i) Satellite Remote Sensing
  - Satellite capabilities
  - Spectral bands and their applications
  - Cloud analysis and image interpretation
  - Microwave applications
  - Products – Precipitation, Winds, Soundings
- ii) Meteorology
  - Severe convective systems
  - Floods
  - Winter storms
  - Tropical storms
  - Transportation Impacts (land, aviation, water, space, etc.)
  - Other natural disasters (fire, wind, volcano, etc.),
- iii) Climate

Where satellite observations are of benefit, and there is a user requirement, then the focus of VL activities could be widened to support training related to:

- iv) Ocean applications
- v) Land applications
- vi) Hydrology and water management
- vii) Atmospheric chemistry, air quality
- viii) Environmental Quality

Applications and Service-based training will increasingly involve the use of satellite data ***in combination*** with other data sets such as Weather Radar, NWP, lightning, precipitation, land information, etc., and may well be carried out in partnership with other Institutes where the relevant expertise exists.

#### **4 Securing and enhancing the VL network**

As noted earlier, the long term effectiveness of the VL relies on the long-term commitment of the CoEs and the Satellite operators to meet training requirements coming from their various user communities. In turn, the effectiveness and success of the CoEs is highly dependent on five factors; the support from their sponsoring satellite operator, the support from local management, the availability of trained personnel, the quality of the training technical infrastructure and political stability.

While the VL has existed for less than a decade, both its growth and positive impacts have been dramatic: this was recognized by WMO Congress. We expect the growth of the VL to continue with sponsorship from additional satellite agencies and inclusion of more CoEs. This growth will ensure that all countries in a particular Region can benefit from VL training activities. These additional CoEs will also facilitate inter-continental cooperation in training and the development and exchange of training resources in additional languages, as well as provide a risk reduction measure should a nearby CoE need assistance.

The Eumetcal Project of EUMETNET is addressing the meteorological training needs of much of WMO Region VI. It is reasonable to consider that the network of the VL could take advantage of the satellite related training activities of Eumetcal in that region. The expansion of the VL network in this manner will be carried out in partnership with established European Training Centres and others in RA VI such as Russia with its WMO Training Centres in Moscow and St. Petersburg.

#### **5 Plan of Action in response to the VL Strategic needs**

To implement the VL Strategy in the coming years, the following three fundamentals of the VL have to be fully supported by the partners through a clear action plan:

- commitment = by all the partners to put effort and resources into the VL
- cooperation = building relationships, e.g. via the set up of RFGs
- collaboration = jointly developing, delivering and exchanging training resources.

The key elements of the Plan of Action for the next 5 year period are as defined in the following table.



APPENDIX IX

**DETAILED VLMG WORK PLAN AND PROPOSAL FOR ALLOCATION OF TASKS FOR THE NEXT 1, 2 AND 5-YEAR PERIODS**

<b>Task</b>	<b>Action</b>	<b>Responsibility</b>	<b>Deadline for action</b>	<b>Deliverable(s)</b>
1. Completion and approval of the VL Strategy by time of WMO CBS in 2009.	Strategy task team to finalize the draft of VL Strategy and Implementation Plan for approval by VLMG and CGMS_36 meeting. WMO Document then for CBS	Strategy task team for draft document for VLMG/CGMS. WMO SP doc. For CBS.	1 October 2008 (WMO doc for CGMS)	Approved VL Strategy and 5-year Implementation Plan
2. VL Outreach – inform all WMO Members about the existence of the VL and its capabilities.	Create flyer on the VL and its VRL for the WMO SP site and the CoE sites. SPO to distribute plus other methods as appropriate	EUMETSAT , INPE, NOAA, Costa Rica CoE & WMO Sect	1 Feb 2009 in time for WMO CBS (initial distribution)*	Digital flyer in multiple formats
3. Bringing the physical infrastructure of the VL network up to a universally agreed minimum standard that is necessary for the effective delivery of training.	WMO Sect.. to draft a letter, for review by VLMG Co-chairs, Tony Mostek and OPAG Chair and send it to all COE Principles and sponsoring satellite agencies. Include updated VL Strategy document.	WMO Sect, VLMG and CoEs and the satellite operators	Preparation and mailing of letter by 15 December 2008..	Updated infrastructure achieved by end 2009..
4. Improving the inter-regional effectiveness of training events through the global coordination of the Regional Focus Groups (RFG).	All COEs to provide their RFG focal point to VLMG. Participate in regularly scheduled RFG coordination meetings.	All COEs and VLMG and satellite operators	1 October 2008 for the focal points.	1 <sup>st</sup> coordination meeting of RFG in December 2008.
5. Establish centralised VRL portal with unified web access to its content, and long term commitments for hosting, managing and quality controlling is resources.	VRL Task Team to evaluate possibilities to transfer the current (distributed) elements of the VRL to a centralised site, for example, the ESRC, hosted by COMET and CEOS. Report to VLMG. .	VRL Task team	Initial report to VLMG by 15 March 2009. Then, report to ET/SUP-next in Sept 2009.	Recommendation and demonstration for evaluation by VLMG (virtual) meeting.
6. Enhancing and securing the network of the VL, to include new CoEs and addressing the needs of other WMO	VLMG to evaluate the need and feasibility of enhancing and securing the network through the analysis of annual CoE	VLMG and CoEs through regular meeting	next regular meeting of VLMG in	Evaluation of CoE reports sent to ET-SUPnext and CGMS.

Regions not currently well covered.	reports.	agenda item.	2009.	
7. Each Regional Focus Group should have its own (common design and functionality) web pages which should include a schedule of Regional Focus Group Meetings with application areas being addressed through training. These pages will be linked to the centralised VL website:	Website task team to recommend format for common design and functionality RFG website	Website task team	October 2009.	Document and demonstration for consideration by VLMG
7.5 Standardised annual reporting to VLMG.	To prepare a template for the CoE annual reports to VLMG.	VLMG Chairs and Tony Mostek	For discussion at virtual VLMG in March 2009.	Document template for reports to VLMG from CoEs
8. Noting the need to maintain a centralised VL website and tremendous growth in VL activities as noted by WMO Congress, additional human resources (fulltime VL Support Officer) are essential;	Chair OPAG to bring to the attention of CGMS-36 for implementation. VLMG to supply supporting information to OPAG Chair. The central VL website will be dynamically maintained by this Officer who will also act as a comprehensive focal point for all VL activities.	Chair OPAG and VLMG	VLMG by 4 Sept 2008. OPAG Chair by November 2008 (CGMS meeting).	Job description, recruitment and placement of VL Technical Support Officer.
9. Regional Focus Groups will manage their own training activities and information exchange systems, within the context of an agreed Course Management System, such as Moodle;	Refer to action 4 above. RFG focal points to become familiar with, and regularly use the course management tool Moodle,	CoEs, RFGs and supporting satellite operators	Report progress to VLMG meeting, Sept 2009.	COEs and their RFG become familiar with the use of Moodle.
10. The CoEs will strive to have more people actively involved in the development, review and incorporation of local training material within the VRL	Refer to action 7.5. CoEs to report on the level of effort available for the development, review and incorporation of local training material.	CoEs	Report progress to VLMG meeting, Sept 2009.	Part of new style of annual report to VLMG
11. Effort should be spent on trying to achieve VISITview and CENTRA lessons, webcasts, or similar, with	Refer to action 7.5. COEs and supporting satellite operators to carry out training event covering the use of training tools	COEs and supporting satellite	Report successful completion of	COEs and their RFG receive at least one training course in the

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audio capability, either for real-time presentation, or recorded for later re-use and/or translation	such as VISITView, CENTRA lessons, webcasts, or similar with audio capability, either for real-time presentation, or recorded for later re-use and/or translation	operators	training to VLMG in Sept 2009.	use of VISITView CENTRA lessons, webcasts, or similar with audio capability.
12. Periodic review of VL. .	Conduct periodic reviews of the VL performance and achievements against goals. Look for remedies and enhancements, as appropriate,	ET-SUP	Every 2 years commencing 2008.	ET-SUP provide report for use at CGMS and CBS.

## THE NEED FOR A TECHNICAL SUPPORT OFFICER FOR THE VL

### 1. Background to the need for additional support

The Virtual Laboratory for Education and Training in Satellite Meteorology (VL) started with four satellite operators and five CoE. As of 2008 the numbers have increased to 6 satellite operators and 11 CoE. A global High Profile Training Event (HPTE) proved that training can reach a large number of countries with participants from a variety of entities such as forecasters and meteorologists from NMHSs, university students and lecturers, scientists in private and state water management organizations; a population beyond the target of WMO “train the trainers” strategy.

When the WMO Space Program opened two positions in 2005/6 it was envisaged that one of the positions was intended to support user activities including the VL. In the event only one position was filled due to budget constraints. The VL has proved to be a very dynamic concept and it is still growing, but it will not be able to subsist and continue growing without a person solely dedicated to support VL activities. For example, the HPTE required a large amount of time from people who contributed as much time as they could afford in addition to their normal work. However some planned actions did not take place as it was not possible to secure all the effort necessary by utilizing such part-time resources in a somewhat uncoordinated way.

Taking into account the dynamic expansion of the VL, in terms of new CoEs, future Regional Focus Groups, wider scope of applications covered, and larger audiences, there is a clear need for a strong project coordination. Given the decentralized nature of the VL, this coordination can only be effective if ensured by a dedicated person assigned to this function. Experience shows that previous VL activities, especially the HPTE, whilst acknowledged as a clear success, could have brought even greater benefits with increased coordination of the efforts of all the contributing parties. Further training events will be conducted in the near future in Argentina in September 2008 and in Brazil in December 2008, and it is planned for these and other events to capitalize on the efforts and maximize the benefits in recording lectures, retransmitting them to remote students to enlarge the outreach, finalizing lecture material for further usage and possible translation in multiple languages. However, the full potential benefits of these valuable initiatives will only be achieved with appropriate level of resources allocated to the coordination of the efforts of individual participating organizations and efficient project management.

### 2. Main tasks of the person in the position to assist the VL

#### 2.1 High level areas of responsibility are as follows:

- Work with the establishment of Regional Focus Groups
- Work with the planning of regional training events by
  - o Ensuring that these events have a virtual component
  - o Ensuring that the proper material is distributed prior and after the events
  - o Interacting with participants prior and after the event
- Undertake follow-up actions related to the analysis of the questionnaire.

This person could be collocated with one of the co-chairs and occasionally spend some time at a specific CoE.

**2.2 Some typical specific tasks are as follows:**

1. Monitor CoE activities
2. Support CoE activities
3. Assist in the establishment of Regional Focus Groups (RFG) and the building up of user communities
4. Assist the existing RFGs
5. Coordinate activities between RFGs
6. Assist technically in the set up and use of tools such as MOODLE, VisitView, CENTRA, webcasts
7. Keep continually updated regarding evolving training technologies
8. Take care of regular newsletter
9. Establish constant communication with people involved
10. Assist the RFG coordinator with the distance sessions
11. Maintain a centralized web page
12. Maintain the training schedules
13. Assist the VLMG Co-chairs monitoring activities
14. Produce relevant reports for use by VLMG, CGMS, ET-SUP
15. Help in the organization of training events in coordination with WMO
16. Produce assessments based on the annual reports of the CoEs
17. Help in the analysis of the personnel (the training component)
18. Assure that relevant materials are in the VRL
19. Stay up-to-date with new materials for the VRL
20. Report to VLMG Co-chairs
21. Ensure that training events have a virtual component for people who want to participate and cannot travel
22. Take care of the evaluation of training events
23. Provide advice on future developments

**Guidelines TO WMO**  
*For facilitating the transition of relevant R&D missions  
or instruments to operational status*

- Support the user requirements process
  - **Organize a rolling review of user requirements**
  - **Update and document the user requirements**
- Foster a “Vision for the GOS”
  - **Define an observation strategy**
  - **Propose a high-level architecture**
  - **Perform a Gap Analysis**
  - **Identify complementary roles for international partners**
- Identify opportunities for transition
  - **Highlight required improvements**
  - **Monitor emerging capabilities**
- Support user readiness
  - **Raise user awareness**
  - **Facilitate near real- time data access**
  - **Encourage early use of R&D data, product development and mechanism for user feedback**
  - **Facilitate partnerships on development of new products**
  - **Encourage training on new systems and products**
  - **Encourage integration into operational applications**
- Promote the case at policy level
  - **Highlight the needs and benefits (business case)**
  - **Advocate weather/climate issues**
  - **Support OSSEs to quantify benefits**
  - **Assist in assessments of need for transition**
  - **Recommend institutional framework (mandate/expertise/user interaction)**
- Value and support partnership
  - **Among R&D and Operational agencies**
  - **Among agencies and pilot users**
  - **Among international players including CEOS, CGMS and WMO**

**SUMMARY LIST OF ACTIONS FROM ET-SAT**

**ET-SAT-4.01: J. Gurka (for NWP and aviation meteorology), A.S. Kiran Kumar (for environmental applications), and L. Sarlo/L. Schueller (for Hydrology) will review the updated Statements of Guidance related to these respective application areas and, if relevant, forward their comments to the Chair of ET-EGOS and the Space Programme Office. Deadline: 30 November 2008.**

**Action ET-SAT 4.02: ET-SAT Members to review the three appendices to document 13/A-14/A and, if necessary, forward to the Space Programme Office any corrections concerning the detailed description of missions and systems under the responsibility of the space agency they are representing. Deadline: 30 September 2008.**

**Action ET-SAT 4.03: WMO Secretariat to seek confirmation from the EC that GMES data would be available to WMO Members as a contribution to the GOS. Deadline: 31 January 2009.**

**Action ET-SAT 4.04: WMO Secretariat to update the Gap Analysis with ET-SAT comments. Deadline: 15 October 2008.**

**Action: ET-SAT 4.05: ET-SAT Chair to forward to the ICT-IOIS the outcome of ET-SAT/SUP-4 discussion on the Vision, recommending its endorsement by CBS, however highlighting the questions raised about the relevance of mentioning certain applications that are beyond the scope of WMO activity.**

**Action ET-SAT 4.06: P. Albert to advise the Space Programme Office on the specifications for the development of databases replacing the current CEOS-WMO database in Microsoft Access™ and accommodate the Gap Analysis and related information on satellite instruments and missions. Deadline: 31 January 2009.**

**Action ET-SAT 4.07: The Space Programme Office to put on the WMO Space Programme web pages a link to the CEOS EO Handbook.**

**Action ET-SAT 4.08: E. Oriol to inform the WMO Space Programme Office on ESA plans to update the CEOS database.**

**Action ET-SAT-4.09: WMO Space Programme Office to forward to all ET-SAT Members the “Draft requirements for AWS sensors to contribute to the calibration and.... ....” Deadline: 30 October 2008.**

**Action ET-SAT-4.10: ET-SAT Members to send comments on these draft requirements to the ET-SAT Chair with copy to WMO Secretariat Deadline: 28 February 2009.**

**Action ET-SAT-4.11: ET-SAT Chair to consolidate these comments and forward them to the ET-AWS Chair, with copy to WMO Space Programme Office. Deadline: 31 May 2009.**

## SUMMARY LIST OF ACTIONS FROM ET-SUP

### Outstanding actions from previous meetings

**ET-SUP-3.4** *The Chair of the OPAG-IOS to propose to CBS that two years after the R/SSC-CM commences as a pilot of the R/SSC concept CBS review the outcomes and benefits of the concept prior to extending it to other areas such as Atmospheric Chemistry.*

**ET-SUP-3.10** *Mr Anthony Mostek to contact each RFG to identify dedicated focal points and to assist, where necessary, in the establishing of monthly RFG sessions in all regions. In particular Mr Mostek should liaise with CMA and other VL CoEs to facilitate the establishment of an RFG in Asia*

**ET-SUP-3.14** *ET-SUP members to review the DVD of the core HPTTE lectures and provide comments to EUMETSAT (Gordon Bridge) with copies to Jeff Wilson and Richard Francis (end-September 2007).*

**ET-SUP-3.17** *VLMG Co-chairs to create and maintain a table of VL related training events and publish this table as appropriate, including on VL web pages.*

### New actions

**Action ET-SUP-4.1:** V. Gaertner and L. Machado, as VLMG Co-chairs, to ensure that VLMG, involving a subgroup as appropriate, provides updated information for the current revision of Document WMO No.258. Deadline: February 2009.

**Action ET-SUP-4.2:** The VL Strategy Task Team to finalize the VL Training Strategy and Implementation Plan for approval by the VLMG (October 2008).

**Action ET-SUP-4.3:** OPAG-IOS Chair to present the final VL Training Strategy for approval by CGMS-36 (November 2008) and thereafter to CBS (March 2009).

**Action ET-SUP-4.4:** OPAG-IOS Chair to seek CGMS-36 endorsement of the ET-SUP recommendation that Pretoria should be recognized as a new Centre of Excellence (CoE) in the South African Weather Service (SAWS) and to carry forward the outcome to CBS (November 2008).

**Action ET-SUP-4.5:** OPAG-IOS Chair to report to CGMS-36 the progress with the establishment of a new CoE in the Russian Federation and to seek their endorsement in principle of the ET-SUP recommendation for a new CoE and sponsoring agency in the Russian Federation pending satisfactory completion of the required formalities between the Russian Federation and WMO (November 2008).

**Action ET-SUP-4.6:** WMO Secretariat to clarify with China the situation regarding the Chinese CoE (whether there are in fact two CoEs (Nanjing and Beijing) or whether there is one CoE with two components) and to inform the VLMG (November 2008).

**Action ET-SUP-4.7:** WMO Secretariat to provide ISRO with background information regarding the establishment of a new CoE, including procedure to be followed, requirements and expectations. Deadline: 30 October 2008.

**Action ET-SUP-4.8:** OPAG-IOS Chair to draw the attention of CGMS-36 (who are co-sponsors of the VL) to the fact that the WMO Space Programme Office is not currently adequately resourced to properly support the planned training and education activities as elaborated



through the VL Strategy and ET-SUP work plan. In addition OPAG-IOS Chair to draw CGMS-36 attention to the example of the Eumetcal initiative which was similarly under-resourced but which achieved a significant breakthrough in effectiveness when a dedicated support officer was appointed (November 2008).

**Action ET-SUP-4.9:** R. Francis to undertake the agreed steps to review in detail the draft technical document and update it to a final version (January 2009).

**Action ET-SUP-4.10:** WMO Space Programme Office to request information from the satellite operators on the number of registered users during the last 2 years and make these figures available, if possible, to R. Francis (end November 2008).

**Action ET-SUP-4.11:** CoEs to provide information on the number of participants in VL training activities during the last 2 years and make then available, as far as possible to R. Francis (end November 2008).

**Action ET-SUP-4.12:** WMO Space Programme Office to identify from the questionnaire responses problem areas (either thematic or related to individual Members) and, if resources permit, to formulate a means to address these problems (next ET-SUP).

**Action ET-SUP-4.13:** WMO to present a document to CGMS-36 describing the progress achieved in IGDDS and RARS projects, pointing out the significant value of the EUMETCast-Americas service to South American NMHSs and encouraging agencies to find a way to ensure the associated requirements continue to be met in the future (November 2008).

**Action ET-SUP-4.14:** V. Gartner, and the Regional Association Rapporteurs (via the WMO Space Programme Office) to seek input from various areas of the world and various application areas illustrating the benefits of satellite data and products and supply this information to the WMO SP for inclusion on web pages (July 2009).

**Action ET-SUP-4.15:** WMO Space Programme Office to forward to all ET-SUP Members the "Draft requirements for AWS sensors to contribute to the calibration and ground-truth of space-based observations" Deadline: 30 October 2008.

**Action ET-SUP-4.16:** ET-SUP Members to send comments on these draft requirements to the ET-SUP Chair with copy to WMO Secretariat. Deadline: 28 February 2009.

**Action ET-SUP-4.17:** ET-SUP Chair to consolidate these comments and forward them to the ET-AWS Chair, with copy to WMO Space Programme Office. Deadline: 31 May 2009.