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COMMISSION FOR BASIC SYSTEMS

OPAG ON INTEGRATED OBSERVING SYSTEMS

**IMPLEMENTATION/COORDINATION TEAM ON INTEGRATED
OBSERVING SYSTEMS (ICT-IOS)**

EIGHTH SESSION

(ICT-IOS-8)

Geneva, Switzerland, 7 – 10 April 2014

FINAL REPORT



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CONTENTS

Agenda		p. 5
Executive Summary		p. 7
General Summary		p. 10 - p. 45
Annex I	List of Participants	p. 46
Annex II	Action sheet from ICT-IOS-8	p. 49
Annex III	Proposed changes to the Terms of Reference of IPET-WIFI	p. 52
Annex IV	Proposed topics for NWP impact studies relevant to the evolution of global observing systems	p. 53
Annex V	Proposed split of responsibility within WMO for the management of OSCAR	p. 55
Annex VI	ICT-IOS recommendations to CBS Ext.(2014) regarding the implementation of observing systems in the regions	p. 57
Annex VII	Proposed changes to the Terms of Reference of ET-SAT	p. 59
Annex VIII	Proposed text for inclusion in the Manual on WIGOS regarding WIGOS Station Identifiers	p. 60
Annex IX	Draft CBS Ext.(2014) Recommendation on Enhancement and Expansion of Aircraft-based Observations and AMDAR in line with the global actions of the EGOS-IP	p. 61
Acronyms		p. 62

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AGENDA

1. ORGANIZATION OF THE SESSION

- 1.1 Opening of the meeting
- 1.2 Adoption of the agenda
- 1.3 Working arrangements

2. REPORT OF THE CHAIRMAN

- 2.1 Report of the Chairman
- 2.2 Review of actions items from ICT-IOS-7

3. WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)

- 3.1 Status of WIGOS Implementation
- 3.2 WIGOS Implementation Plan (WIP), and status of WIGOS Implementation Plan
- 3.3 Support of ICT-IOS to WIGOS implementation
- 3.4 OSCAR leadership
- 3.5 WIGOS Observing Station Identifiers

4. STATUS OF THE SURFACE BASED COMPONENT OF THE GOS

- 4.1 Regional Basic Synoptic Network (RBSN) and Regional Basic Climatological Network (RBCN)
- 4.2 GCOS Surface Network and Upper-air Networks (GSN/GUAN/GRUAN)
- 4.3 Marine and Oceanographic Observations
- 4.4 CryoNet of the Global Cryosphere Watch (GCW)

5. STATUS OF THE SPACE-BASED COMPONENT OF THE GOS

- 5.1 Operational Component
- 5.2 Research Component
- 5.3 Global satellite intercalibration
- 5.4 Satellite data accessibility

6. REPORTS OF THE OPAG-IOS EXPERT TEAMS AND RAPPORTEURS

- 6.1 Report of IPET-WIFI
- 6.2 Report of IPET-OSDE
- 6.3 Report of ET-SBO
- 6.4 Report of ET-SAT
- 6.5 Report of ET-SUP
- 6.6 Report of ET-ABO
- 6.7 Report of the Rapporteur on Marine Observing Systems (R-MAR)
- 6.8 Report of the Co-Rapporteurs on Scientific Evaluation of Impact Studies undertaken by NWP Centres (R-SEIS)
- 6.9 Radiofrequencies matters (SG-RFC)

7. OBSERVING SYSTEM DESIGN AND EVOLUTION

- 7.1 Development of observing systems network design principles and guidance
- 7.2 Status of actions of the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP)
- 7.3 New vision for the global observing system(s)

8. PREPARATION OF OPAG-IOS INPUT FOR CBS-Ext(2014)

- 8.1 Terms of Reference of the Expert Teams
- 8.2 Terms of Reference of Rapporteurs
- 8.3 Work Plans
- 8.4 Input and Recommendations for CBS-Ext(2014)

9. ANY OTHER BUSINESS

10. CLOSURE OF THE SESSION

EXECUTIVE SUMMARY

The Eight Session of the Implementation/Coordination Team on Integrated Observing Systems (ICT-IOS) of the Commission for Basic Systems (CBS) Open Programme Area Group (OPAG) on Integrated Observing Systems (OPAG-IOS) was held at the WMO Headquarters in Geneva, Switzerland from 7 to 10 April 2014 and was chaired by the Chair of the ICT-IOS, Mr Jochen Dibbern (Germany).

The chair of the OPAG-IOS summarized the activities of the OPAG since the seventh Session of the ICT-IOS in June 2012 including, feedback from the CBS-15 Session in Jakarta, Indonesia, September 2012, and recommendation on how to better respond to WMO Integrated Global Observing System (WIGOS) and other WMO high priorities requirements. The meeting was briefed on a status of implementation of WIGOS, including WIGOS Framework Implementation Plan and its Key Activity Areas, and guidance from the Inter Commission Coordination Group on the WIGOS (ICG-WIGOS). The Team agreed that OPAG-IOS needs to better work with WIGOS implementation in the regions in order to monitoring the regional implementation of WIGOS.

The chairpersons of the OPAG-IOS Expert Teams reported on the present and future activities of their teams in support of WIGOS implementation. The Team discussed the role that the ICT-IOS and OPAG-IOS Expert Teams should be playing in WIGOS Framework Implementation phase with regard to the integration of the core observing systems of WMO. The meeting particularly considered how specific components such weather radars, and surface- and space-based atmospheric chemical observations shall become operational and particularly address the requirements for climate services and air quality services. The Team noted that all Technical Commissions will be consulted as part of the review process for WIGOS Regulatory Materials. As far as CBS (and OPAG-IOS) is concerned in that review, the Team requested the OPAG-IOS Chair to distribute the relevant regulatory materials to ICT-IOS members for their review.

The ICT-IOS provided feedback and recommendations to the ICG-WIGOS.

The meeting discussed what Expert Team or Group should be responsible for overseeing the functional specifications, and development of the Observing System Capability Analysis and Review Tool (OSCAR). The meeting reviewed the proposal from the CBS Inter Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) in this regard, and agreed with the responsibilities proposed in **Annex V**, and to be submitted to CBS and the ICG-WIGOS. The Team also agreed that the technical specifications of OSCAR ought to be coordinated by the OPAG-IOS Inter-Programme Expert Team on WIGOS Framework Implementation Matters (IPET-WIFI) in close liaison with the Secretariat during the requirements engineering phase. Meanwhile, the ICT-IOS requested the OPAG-IOS Expert Teams to reflect OSCAR¹ related activities in their respective workplans. In particular, the Team agreed that the Expert Teams had a role to play with regard to the maintaining the quality of the OSCAR database. The Team also invited its members to review the OSCAR functional specifications document and to provide feedback if necessary to the Secretariat.

The meeting discussed the ICG-WIGOS proposal for WIGOS Observing Station Identifiers, and particularly addressed the political implications of that proposal. The Team concurred with the proposal, and proposed some minor modifications. In addition the Team proposed text describing the WIGOS Station Identifier issuing authority, for inclusion in the WIGOS Manual as part of the review of WIGOS Regulatory Materials by the Technical Commissions.

The meeting reviewed the status of the surface-based component of the Global Observing System (GOS), namely the Regional Basic Synoptic Network (RBSN), the Regional Basic Climatological Network (RBCN), Global Climate Observing System (GCOS) surface (GSN) and upper-air (GUAN) networks, as well as on the status of the Marine and Oceanographic observing systems, and Cryonet of the Global Cryosphere Watch (GCW). The Team also reviewed written reports from the Regions, and noted with appreciation the quality of these reports, their level of details, and the list of

1 Observing Systems Capability Analysis and Review Tool – www.wmo.int/oscar

issues reported. The summary of the ICT-IOS recommendations to CBS Ext.(2014) regarding the implementation of observing systems in the regions is provided in **Annex VI**.

Pertinent issues related to the implementation of the surface-based component were brought to the attention of the meeting. The Team recommended that the Technical Regulations should be updated to become consistent with the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP).

The meeting advised on quantity and quality monitoring of the GOS, performance criteria and presentation of performance reports. The Team requested the Secretariat to make a proposal at the next ICT-IOS meeting regarding new suites of monitoring tables, which ought to be produced to reflect modern NWP observation monitoring systems (e.g. consider including statistics on the hourly reporting in the monitoring report).

The meeting discussed coordination of activities between OPAG-IOS and GCOS to improve quality and availability of climatological data, and reviewed the status of the CBS Lead Centres for GCOS, and the implementation of GCOS Reference Upper-Air Network. The Team concurred with the recommendations of the CBS Lead Centres for GCOS (CBS-LC-GCOS) Coordination Meeting (Santiago, Chile, 8-10 October 2013), and proposed an OPAG IOS response to some of them. The Team recommended that the sections on GCOS, the Global Upper Air Network (GUAN), and the Global Atmosphere Watch (GAW), within the Manual on the GOS, should be cross-checked against the material in the draft WIGOS Manual. The Team requested the ICT-IOS Chair to propose a new CBS representative in the Atmospheric Observation Panel for Climate (AOPC) Working Group (WG) on the Global Reference Upper Air Network (GRUAN). The new representative will be tasked to pass the recommendation that WIGOS and GRUAN should actively pursue GRUAN expansion in the tropics and in Africa and South America to the AOPC.

The meeting reviewed the status of Polar Observations, namely the Antarctic Observing Network (AntON) of surface and upper air observations, and GCW development. The Team agreed on the necessity for Members to start reporting snow conditions immediately (including in the situations where there is no snow). The Team agreed to submit a formal Recommendation to CBS Ext.(2014) in this regard.

The meeting reviewed the status of the operational and research Space-based component of the GOS as well as latest development of the Global Satellite Intercalibration System (GSICS). The Team noted the long list of present and planned Earth Observation missions reported by space agencies to the WMO Space Programme, and it commented that data from some of these missions were not available or planned to be available to WMO Members. The Team asked the Chairperson in his report to CBS to remind Members that, for a space-based observing system (incl. operational and Research and Development (R&D) satellites) to be a contributor to WIGOS, it is essential that its data are made available to the WMO community and in a timely manner.

The Chairpersons of the CBS-IOS Expert Teams, and the Rapporteurs reported on their respective activities, namely: (a) achievement (in relation to the Terms of Reference), (b) issues that need to be reported to ICT-IOS, (c) recommendations to ICT-IOS-8 and specifically to the 2014 Extraordinary Session of the CBS (CBS-Ext(2014)). The Chairpersons also provided the meeting with the status of their respective Work Plans for 2013-2016. The Team decided to submit changes to the Terms of Reference of the IPET-WIFI, and the OPAG-IOS Expert Team on Satellite Systems (ET-SAT) to the CBS Ext. (2014).

Through the review of the Expert Teams and Rapporteur reports and discussion, the Team agreed to submit the following Recommendations to CBS-Ext(14):

- Enhancement and expansion of aircraft-based observations and Aircraft Meteorological Data Relay (AMDAR) in line with the global actions of the EGOS-IP;

- That the proposed 2015 edition of the Manual on the GOS (to be consistent with Manual on WIGOS) be endorsed and submitted to Congress;
- Support of Members to the implementation of marine meteorological and oceanographic observing systems in support of Numerical Weather Prediction (NWP) (i.e. to the barometer drifters, the tropical moored buoys essentially); and
- Radio-frequencies for meteorological and related environmental activities.

The Team concurred with the recommendation from the IPET-OSDE and the R-SEIS to organize a sixth International Workshop on the impact of various observing systems on NWP in April or May 2016. The Team noted that the organizing committee for the workshop ought to be decided by the CBS Management Group in consultation with the ICT-IOS, and related activities within Commission for Atmospheric Sciences (CAS). The Team requested the Co-Rapporteurs on Scientific Evaluation of Impact Studies undertaken by NWP Centres (R-SEISs) and the Chair IPET-OSDE to consult as needed and to make a proposal regarding organization of the next Impact workshop to the ICT-IOS Chair

The meeting reviewed the status of the development of observing systems network design (OSND) principles and guidance, including draft OSND principles, and road map for developing OSND guidance as proposed by the IPET-OSDE. The Team noted this new version of the Principles with appreciation, concurred with the Principles proposed, and agreed that they should be presented to the CBS Ext.(2014) for its information. The Team also concurred with the roadmap proposed by the IPET-OSDE-1 for further development of the OSND Principles and associated Guidance material, and reflected in the final report of IPET-OSDE-1. In particular, the Team agreed that a second Observing System Design Workshop (OSDW) should be organized prior to ICG-WIGOS-4.

The Team reviewed the recommendations of the IPET-OSDE regarding the need to monitor the status of actions of new EGOS-IP per feedback from Members. The Team supported the proposal from IPET-OSDE for nominating a lead team to report on each Action in EGOS-IP.

The meeting discussed the need to develop a new vision for the global observing system(s), possibly in 2040, to replace the current Vision for the GOS in 2025, and take into account WIGOS requirements. The Team agreed that realistically, progress could be made with regard to the WIGOS component observing systems only, and therefore proposed that the name of the Vision should be "Vision for WIGOS component observing systems in 2040". The Team also agreed that, even when the new Vision in 2040 is adopted, the Vision for the GOS in 2025 should continue to be kept in force until 2025 as it will continue to serve as a baseline for several activities.

The meeting discussed the need to review the OPAG IOS structure, including the Terms of Reference of the Expert Teams, and Rapporteurs. The Team agreed that some of the changes required could wait until the CBS sixteenth Session in 2016. However, the Team agreed to propose changes to the Terms of Reference of the IPET-WIFI (i.e. to reflect the coordinating role with OSCAR development) and ET-SAT (i.e. for clarifying the existing Terms of Reference, and the Expert Team to be focusing on operational requirements, and not to overlap with the Coordination Group for Meteorological Satellites (CGMS)).

GENERAL SUMMARY

1. ORGANIZATION OF THE SESSION

1.1 Opening of the meeting

1.1.1 The Eight Session of the Implementation/Coordination Team on Integrated Observing Systems (ICT-IOS) of the Commission for Basic Systems (CBS) Open Programme Area Group (OPAG) on Integrated Observing Systems (OPAG-IOS) opened at 10.00 hours on Monday, 7 April 2014, at the WMO Headquarters in Geneva, Switzerland.

1.1.2 Dr Wenjian Zhang, Director, WMO Observing and Information Systems Department, addressed the meeting on behalf of the Secretary-General of WMO, Mr Michel Jarraud. He welcomed the participants to Geneva and recalled that this is the last opportunity for the ICT-IOS to meet before Cg-17 in mid-2015. He emphasized that the current session should carefully review the implications of the last Congress decisions regarding the WMO Strategic Planning for 2012 to 2015 in the context of the activities to be carried out within the CBS OPAG IOS, and propose relevant actions to be taken and recommendations to be adopted by the Extraordinary Session of the CBS this year, CBS Ext. (2014).

1.1.3 Dr Zhang also recalled the decision of Congress to implement the WMO Integrated Global Observing System (WIGOS) as one of the five priority-funded activities together with the Global Framework for Climate Services (GFCS), Aviation meteorological services, Capacity-development for the developing and least developed countries, Disaster risk reduction, and implementation of and the WMO Information System. All those priorities are relevant to the activities of the ICT-IOS.

1.1.4 Dr Zhang also recalled that we are now in the last stages of the WMO Integrated Global Observing System (WIGOS) Framework Implementation, and that actions undertaken under the OPAG IOS in this regard will have to be reported to Cg-17. Yet, substantial developments remain to be achieved before Cg-17 taking into account the guidance from the Inter-Commission Coordination Group on WIGOS, which met for its third Session in Geneva from 10 to 14 February 2014. In particular, the ICT-IOS is expected to advise on the CBS contribution to the ten Key Activity Areas (KAAs) of the WIGOS Framework Implementation Plan, which was updated by the last Executive Council (EC-65), and further reviewed by ICG-WIGOS-3.

1.1.5 Dr Zhang wished the session to make comprehensive recommendations for the upcoming CBS Ext. (2014) on further development of both the surface and space-based components of the Global Observing System and on the implementation of WIGOS. He wished the participants every success in their deliberations and looked forward to seeing productive results of the meeting.

1.1.6 The Chair of the ICT-IOS, Jochen Dibbern (Germany) thanked Dr Zhang for his kind words and invited participants to contribute effectively to the deliberations of the meeting on various agenda items to ensure a valuable input to the forthcoming CBS Extraordinary Session later this year.

1.1.7 The Team acknowledged apologies from Team members Candyce Clark (USA), Gilles Fournier (Canada), Jack Kaye (USA), Anthony Mostek (USA), Russell Stringer (Australia), and Jun Yang (China) for not being able to attend the meeting. Jack Kaye and Russell Stringer were planning to attend the meeting via teleconference. The list of participants is given in ***Annex I***.

1.3 Adoption of the agenda

1.3.1 The ICT-IOS adopted the Agenda for the meeting, which is reproduced at the beginning of this report.

1.4 Working arrangements

1.4.1 The ICT-IOS agreed on its working hours and adopted a tentative work plan for consideration of the various agenda items.

1.4.2 The Team established the following working groups for the duration of this ICT-IOS Session (working group leads are underlined):

- **GOS Manual (reviewing text, identifying issues to be reported back to R. Stringer)**
Anthony Rea, John Eyre, Stuart Goldstraw, Frank Grooters
Secretariat: Dean Lockett, Lars Peter Riishojgaard
- **Review of regional monitoring reports (incl. Antarctica), and recommendations to be passed by ICT-IOS to the CBS**
Henry Karanja, Jose Arimatea, Yoshi Sato
Secretariat: Etienne Charpentier
- **Identification numbers and corresponding Recommendation to be submitted by ICT-IOS to the CBS**
Stuart Goldstraw, Erik Andersson, Jochen Dibbern, Frank Grooters, and Jose Arimatea
Secretariat: Steve Foreman, Etienne Charpentier
- **Guidance material to the ET-SUP meeting:**
Anthony Rea, and Jochen Dibbern
Secretariat: Stephan Bojinski

2. REPORT OF THE CHAIRMAN

2.1 Report of the Chairman

2.1.1 The Chair of ICT-IOS, Mr Jochen Dibbern (Germany) summarized the activities of the OPAG since the seventh Session of the ICT-IOS in June 2012 including, feedback from the CBS-15 Session in Jakarta, Indonesia, September 2012, and recommendation on how to better respond to WIGOS and other WMO high priorities requirements

2.1.2 The Team noted the decision of the CBS Management Group to propose Jochen Dibbern as acting chair of the ICT-IOS, in replacement of the former ICT-IOC Chair, Lars Peter Riishojgaard, who was recruited by the WMO Secretariat as WIGOS Project Management. The nomination of Mr Dibbern is expected to be confirmed by CBS Ext.(2014). The new Co-chair of OPAG-IOS is Anthony Rea in addition to his function as Chair of the OPAG-IOS Expert Team on Satellite Utilization and Products (ET-SUP).

2.1.3 At the 15th CBS Session in Jakarta, September 2012, a number of decisions regarding the work of OPAG-IOS were made, and particularly the following ones:

- The Commission noted with satisfaction the actions taken by OPAG-IOS toward the implementation of WIGOS, in particular its engagement in the development of the WIGOS Framework Implementation Plan (WIP). The OPAG-IOS was restructured to contribute to the GOS related components of the different Key Activity Areas of the WIGOS Implementation Plan.
- The Commission also emphasized that the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) will be an important contribution to the WIGOS Implementation. The implementation monitoring of EGOS-IP is one of the major activities of IPET-OSDE. At its first meeting IPET-OSDE reviewed the progress of EGOS-IP actions and made proposals for facilitating the process.
- The Commission noted with appreciation the involvement of OPAG-IOS in initiating the development of Architecture for Climate Monitoring from Space.

- The Commission considered and endorsed specific actions to be undertaken by CBS as its contribution to the WIGOS Framework Implementation Plan (WIP), taking into account a decision of Cg-16 of the leading role of CBS in the WIGOS implementation. The leading role of CBS is reflected through IPET-WIFI Sub Groups on Regulatory Material, Metadata and Quality Management; all working close with ICG-WIGOS.
- The Commission further recognized that there is a need for a holistic approach to unite the various databases (e.g. standards, observational user requirements, observing systems capabilities, and platform metadata) required for WIGOS implementation and operations into a WIGOS Information Resource (WIR).
- The WMO Space Programme, Secretariat staff and IPET-OSDE developed the WIR so that it gained enormous visibility and it should be promoted as the unique repository of observation requirements.
- The Commission acknowledged the value of the database of space- and surface-based capabilities as a key building block of the WIGOS Rolling Requirements Review (RRR) process, and the pivotal role of OSCAR database and its analysis tool in support of global coordination of observing systems planning. OSCAR is well developed for the space based component, but further efforts are needed to compile the data for the surface based observing systems and observing system capabilities. The management of OSCAR will be moved from the WMO Secretariat to MeteoSwiss, so that the continuous further development and support of the databases will be secured.
- The Commission noted with concern that the regional working groups dealing with observing systems and respective implementation aspects are not active in some Regions. Due to a revised structure of the Regional Associations there is no “Rapporteur” existing any more having an overview about the regional networks, their quality and reliability. OPAG-IOS has proposed to invite the chairs of the regional working groups for observing systems to the ICT-IOS and CBS Sessions. The interaction between Regions and OPAG-IOS on observing system development should be revised. The Team agreed that OPAG-IOS needs to better work with regional WIGOS Task Teams in order to monitoring the regional implementation of WIGOS.
- The Commission recognized the efforts made by Members operating AMDAR programmes to increase the coverage of AMDAR observations over data sparse areas, such as the African continent, through AMDAR programme expansion and enhancement and encouraged its continuation in line with the associated actions in the EGOS-IP. The OPAG-IOS Expert Team on Aircraft-Based Observing Systems (ET-ABO) has developed a Strategic Implementation Plan to increase coverage of AMDAR observation in data sparse areas and in addition is developing Regional SIPs to improve the cooperation with Regional Associations.
- The Commission agreed on the necessity to organize the Workshop on the Regional and Global Exchange of Weather Radar Data with the goal to provide clear guidance to Members on the requirements for exchange of Doppler radial winds and reflectivity data. The Workshop has been organized under the responsibility of the OPAG-IOS Expert Team on Surface-Based Observing Systems (ET-SBO). A number of recommendations have been developed during the workshop and CBS Management Group accepted that a new ET-SBO Task Team on Weather Radar Data Exchange is set up.
- The Commission recognized, that the gap analysis performed by ET-SAT had specifically highlighted gaps in early morning orbit sounding coverage, geostationary hyperspectral infrared sounding, the transition to operations of global precipitation measurements, Earth radiation budget, and limb sounding.
- The Commission confirmed the need to monitor the progress of satellite data access and use by WMO Members and requested that CBS Members respond to the 2012 survey on this matter.
- The Commission recognized that there are now various tools which are available to perform impact studies on a relatively cost-effective basis, and encouraged the operators of the observational programmes to propose specific questions on the impact of observations on NWP through the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE). IPET-OSDE organized a workshop on Observing System Design in November 2013. The outcome of the meeting was material to form the basis for a set of WIGOS

“principles” for Observing System Network Design and also high-level guidance elaborating these principles. The document was presented at ICG-WIGOS and received positive and will be further elaborated at IPET-OSDE-1 and presented to ICT-IOS-8.

2.2 Review of action items from ICT-IOS-7

2.2.1 The meeting reviewed the action items from the seventh Session of the ICT-IOS (Geneva, Switzerland, 2012), and updated their status. It noted that all action items have been taken into account or completed. Pending or ongoing action items will be reflected in the list of action item arising from this ICT-IOS meeting (see *Annex II*).

3. WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)

3.1 WIGOS Implementation Plan (WIP), and status of WIGOS Implementation

3.1.1 The Secretariat briefed the meeting on the status of implementation of WIGOS, including WIGOS Framework Implementation Plan and its Key Activity Areas of the WIP (v.2.0, see website², Table 2), and guidance from the Inter Commission Coordination Group on the WIGOS (ICG-WIGOS).

3.1.2 The meeting noted the following summary of the main issues/concerns as provided by ICG-WIGOS:

- ICG-WIGOS agreed that the development of the Guide to WIGOS and WIGOS Functional Architecture under 1.1.1, as well as activities under 4.1.1 and 6.1.1 cannot meet the original implementation deadlines of 2015; new target dates for their completion were suggested. The corresponding proposals are reflected in the updated WIP, v.2.8 to be submitted to EC-66 for consideration and approval.
- Regarding 3.1.1 (RRR process), ICG-WIGOS noted that the RRR process had been GOS/CBS centred in the past; when broadening the scope to encompass all of WIGOS, it has to be updated accordingly to take into account the respective characters and requirements of the other component observing systems. ICG-WIGOS recognized that the RRR documentation produced by the IPET-OSDE Chair had been used as a basis for the RRR related regulatory materials under development by the ICG-WIGOS Task Team on WIGOS Regulatory Materials (TT-WRM) for consistency with the current RRR process and terminology. ICG-WIGOS thanked the IPET-OSDE Chair for its contribution to this work, and agreed that such material could indeed be used. ICT-IOS was invited to consider how the scope of the RRR can be broadened and whether the existing framework of IPET-OSDE, Rapporteurs and regular WMO Impact Workshops provides a sufficiently broad base for this, the Team noted that the scope of the RRR process has effectively been wider than the GOS in the past, and thereby expressed a different perspective than the ICG-WIGOS in this regard. The Team agreed that the quality of the RRR in some other areas than the GOS could be improved.
- ICG-WIGOS recommended that the Observing System Network Design (OSND) Principles developed under the auspices of IPET-OSDE should be incorporated into the Manual on WIGOS and guidance on Observing Systems Network Design should be incorporated into the Guide to WIGOS. The TT-WRM was requested to take this into account. Regarding the draft OSND principles themselves, ICG-WIGOS noted that long term/medium term funding must be assured for sustained observing systems.
- With regard to 5.1.1 (WIGOS Quality Management), ICG-WIGOS noted that some confusion still prevailed on the scope and purpose of WIGOS Quality Management (QM). ICG-WIGOS agreed that a realistic Task Team on WIGOS QM (TT-WQM) work plan should be developed urgently with a clear indication of what can be achieved by Cg-17 and by Cg-18, respectively. It was proposed that the CIMO Guide (Part III, Chapter on QM) could be used as a starting point for the development of corresponding guidance material needed for the regional and national WIGOS implementation.

2 http://www.wmo.int/pages/prog/www/WIGOS-WIS/meetings/ICG-WIGOS-3/Doc-5.1_Implementation-Status.doc

- When considering 7.1.1 (WIR³), the importance of WIR/OSCAR⁴ was stressed, and ICG-WIGOS noted that the launch of the OSCAR will mark the first time that all the information regarding requirements and observing systems are available in the same place (surface capabilities are missing for the time being). ICG-WIGOS agreed that the OSCAR should be the repository of a sub-set of the WIGOS metadata; in particular those on observing system capabilities that are required for the RRR process, and those which are requirement for operational use such as the planned evolution of WMO No. 9, Volume A. Most of the remaining metadata will have to be collected, maintained, and archived by Members. ICG-WIGOS requested the TT-WMD to clarify what metadata shall be included in the OSCAR, and which ones shall be mandatory. See also agenda items 3.4 and 6.1.
- Regarding 9.1.1 (CD), ICG-WIGOS agreed that one or more specific and concrete Capacity Development (CD) projects should be specified as soon as possible (dedicated specifically within RA I in the first instance) in order to provide a model path that will show members how to undertake WIGOS implementation in a practical/tangible way.
- A need to create an open dialog with PRs and senior management of National Meteorological and Hydrological Services (NMHSs) on WIGOS implementation progress and related issues was recognized. A WIGOS standard presentation, different examples of achievements and benefits, success stories, dedicated workshops, can all be used as tools. ICG-WIGOS welcomed the initiative of the Commission for Instruments and Methods of Observation (CIMO) to renew the International Conference on Experiences with Automatic Weather Stations (AWS) (ICEAWS) covering all aspects of the life cycle of AWS and suggested that these could be 'WIGOS Conferences'. There was a consideration that organization of such a conference would be more effective and appropriate at a regional rather than at a global level. It was agreed that attention could be raised concerning such WIGOS Conferences at EC-66, to encourage resourcing and/or hosting offers.
- Lightning is a concern for Regional Association (RA) IV (RA-IV), and yet no requirements for lightning detection are captured within the WIGOS RRR databases. This had been brought to the attention of IPET-OSDE and ICT-IOS.

3.2 Support of ICT-IOS to WIGOS implementation

3.2.1 The chairpersons of the OPAG-IOS Expert Teams informed the meeting on present and future activities of their teams in support of WIGOS implementation. The meeting discussed the role that the ICT-IOS and OPAG-IOS Expert Teams should be playing in the WIGOS Framework Implementation phase with regard to the integration of the core observing systems of WMO, i.e. the Global Observing System (GOS), the Global Atmosphere Watch (GAW), the observing component of the Global Cryosphere Watch (GCW), and the WMO Hydrological Observing System (WHOS).

3.2.2 The meeting particularly considered how specific components such as weather radars, and surface- and space-based atmospheric chemical observations shall become operational and particularly address the requirements for climate services and air quality services.

3.2.3 The meeting noted that the focus of the OPAG-IOS with regard to WIGOS implementation is given to contributions different Key Activity Areas of the WIP by IPET-WIFI, IPET-OSDE, and all other teams of OPAG-IOS, such as developing a set of WIGOS "Principles" for Observing System Network Design (OSND), input to the development of WIGOS relevant Technical Regulations, WIGOS metadata development, and several achievements under the AMDAR programme. For example, a recently published WIGOS Technical Report "The Benefits of AMDAR Data to Meteorology and Aviation⁵" is available at the WIGOS web page⁶. The intersections with other WMO priorities, such as DRR and GFCS are also being considered.

3.2.4 The Team noted that all Technical Commissions will be consulted as part of the review process for WIGOS Regulatory Materials. As far as CBS (and OPAG-IOS) is concerned in that review,

3 http://www.wmo.int/pages/prog/www/WIGOS-WIS/meetings/ICG-WIGOS-3/Doc-5.1_KAA-7-WIR.doc

4 <http://www.wmo.int/pages/prog/www/WIGOS-WIS/meetings/ICG-WIGOS-3/OSCAR.pdf>

5 http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/publications/Benefit_of_AMDAR_Data_to_Meteorology_and_Aviation.pdf

6 www.wmo.int/wigos

the Team requested the OPAG-IOS Chair to distribute the relevant regulatory materials to ICT-IOS members for their review (**action; Chair; ASAP**).

3.2.5 The meeting further noted that ICG-WIGOS reiterated its concern about the sustainability of the observing systems/networks, especially in a developing and less developed countries. In particular, there should be insistence on donors taking an end-to-end approach when projects are considered so that initial investments in acquisition, installation etc. are supplemented with maintenance, training and operational funds to ensure the sustained operation of observing systems and supporting activities. In order to maximize sustainability, ICG-WIGOS recommended that the Resource Mobilization Office of the WMO Secretariat should pay appropriate attention to this critical issue when considering any donation from major development partners as investment in observing systems of WMO Members. Sustainability of such an observing system should be guaranteed by the donors.

3.2.6 ICG-WIGOS recommended the development of a Vision for the WIGOS in 2040, and requested CBS to take the initial lead on it, with involvement of the other Technical Commissions. The target for approval should be Cg-18. ICT-IOS was invited to discuss how to approach this task, taking into consideration the recommendations made by IPET-OSDE and to take this forward to CBS (Ext)14. See agenda item 6.8 for the Team's discussion in this regard.

3.2.7 Discussions of the Team with regard to the organization of the next WMO Workshop on the impact of various observing systems on NWP are reflected under agenda item 6.8.

3.3 OSCAR Leadership

3.3.1 The meeting noted that the ICG-WIGOS noted and welcomed the recent proposal to move the management of the RRR database (OSCAR) from the WMO Secretariat to MeteoSwiss. The RRR databases are an important component of WIGOS and have gained enormous visibility through the excellent work of the Secretariat. They are becoming very popular and they should be promoted as the unique repository of observation requirements. The need for a diligent and effective hand-over process from the Secretariat to MeteoSwiss was emphasised, so that the continuous further development of the databases should not be interrupted through the transition process. The RRR databases are one of the tangible and visible "successes" of WIGOS to date and therefore continuous support has to be secured.

3.3.2 The meeting discussed what Expert Team or Group should be responsible for overseeing the functional specifications, and development of the Observing System Capability Analysis and Review Tool (OSCAR). The meeting reviewed the proposal from the IPET-OSDE in this regard, and agreed with the responsibilities proposed in **Annex V**. The Team also agreed that the technical specifications of OSCAR ought to be coordinated by IPET-WIFI in close liaison with the Secretariat during the requirements engineering phase. Meanwhile, the ICT-IOS requested the OPAG-IOS Expert Teams to reflect OSCAR related activities in their respective workplans (**action; ETs; ASAP**). In particular, the Team agreed that the Expert Teams had a role to play with regard to the maintaining the quality of the OSCAR database. The Team also invited its members to review the functional specifications document of OSCAR/Surface and to provide feedback if necessary to the Secretariat (**action; ICT-IOS members; 7-May 2014**).

3.3.3 The Team requested the Secretariat to regularly communicate with the IPET-WIFI on the status of the development of the OSCAR Project (**action; Secretariat; Ongoing**).

3.3.4 The Team agreed that the above proposal with regard to OSCAR should be submitted to the CBS and ICG-WIGOS.

3.4 WIGOS Observing Station Identifiers

3.4.1 The meeting recalled that the current five digit World Weather Watch (WWW) station identifiers for land stations do not provide a large enough range to allow all stations to be issued with an

identifier. Limitations in the traditional alphanumeric code forms mean that the range cannot be increased unless the table driven code forms are used for reporting observations, and even then many application programs are written to assume the five digit identifiers.

3.4.2 The meeting reviewed the ICT-WIGOS proposal for WIGOS station identifiers, and agreed that providing a single numbering system that would allow a globally unique identifier to be issued to a station/platform regardless of the observing system to which it contributed would assist with management of observation networks and the metadata associated with observations.

3.4.3 The Team recognized that although it would be advantageous that any station/platform should only be issued with only one WIGOS station identifier, enforcing this would be challenging. In addition to the lack of WWW station identifiers, in some regions of the world it is difficult to exchange observations because WWW station identifiers are not being issued even when there are enough spare identifiers to accommodate the requirement.

3.4.4 The Team agreed that it would be strongly desirable to use an allocation system for station identifiers that would allow any observing station/platform to be issued with an identifier (such as those being run by amateurs whose observations are being collected by the Met Office (UK) and the Australian Bureau of Meteorology through web-based tools), regardless of the quality of observations, ownership of the station or the management of the observing network. This would allow metadata about such stations to be recorded, and facilitate discussions about their suitability or otherwise for use by WMO Programmes. Information about quality, ownership etc would then be found in the metadata records rather than being implied by the station identifier.

3.4.5 The Team encouraged ICG-WIGOS to implement a system whereby any operator of an observing station or platform could be granted a WIGOS station identifier for that platform provided that they committed to supplying and maintaining WIGOS observation metadata associated with the observations from that station/platform.

3.4.6 The Team agreed that one should make sure that in the process of allocating identifiers, any allocated identifier could not be assigned twice to the same station. Also as a general rule, the PR is responsible to allocate identifiers, and issuing numbers should not undermine the ability of Members to control the observing systems contributing data to WMO. It was proposed that in some cases, the PR could delegate his authority at the national level to specific organizations. However, the Team agreed that it should be the sole decision of the PR to allocate identification numbers to volunteer observing stations and to stations belonging to the private sector. The Team also proposed that in some conditions (non private, non volunteer, non GOS, more than one country involved), the WMO Secretary General, following consultation with relevant actors, could assign identification numbers to international projects that fulfill WMO strategy and contribute to the goals of the WMO;

3.4.7 After discussion, the Team agreed with the following:

- a) The principles proposed by ICG-WIGOS for station identifiers are acceptable, but the following minor modifications to the ICG-WIGOS proposal was suggested by the group:
 - a. The first principle is an introductory statement rather than a principle itself
 - b. The final bullet point (all stations contributing must have an identifier)
 - c. Language of "issuer" – the "authority that allocates"
- b) In addition proposed text for the WIGOS Manual describing the WIGOS Station Identifier issuing authority was developed. It was recommended this text should be included in the WIGOS Manual as part of the review by Technical Commissions. The recommended text on the responsibilities for issuing identifiers is provided in **Annex VIII**.

3.4.8 The Team requested the chair to make sure that the proposed regulatory material on WIGOS station identifiers (**Annex VIII**) will be submitted to the WIGOS Regulatory Material review process of the Technical Commissions and the CBS (**action; ICT-IOS chair; end May 2014**).

4. STATUS OF THE SURFACE BASED COMPONENT OF THE GOS

4.1 Regional Basic Synoptic Network (RBSN) and Regional Basic Climatological Network (RBCN)

RBSN/RBCN

4.1.1 The Team recalled that each WMO Regional Association once in four years draws up a Regional Basic Synoptic Network (RBSN) and a Regional Basic Climatological Network (RBCN) to meet the collective needs of its Members. Together, these Regional networks form an integrated global network that facilitates performance monitoring over the globe. Generally, surface synoptic stations are expected to report every six hours for global exchange and every three hours for regional exchange, while upper-air stations are required to report at least twice per day. The details of the observational programmes provided by these stations operated by WMO Members are given in *Weather Reporting* (WMO-No. 9, Volume A), and is available on the WMO website⁷.

4.1.2 The Team noted that the level of implementation of the RBSN stations in 2014 that make 8 observations per day (complete observational programme) varied from 29% in Region IV (performs 55% of observations at only the 4 main standard hours) to 98% in Region VI, with a global average increase from 72% (in 2012) to 74%. In Regions II, IV and VI there has been an appreciable increase in the number of stations resulting from the Regional Association sessions being held during the period 2012-2013. Globally, there has been a significant increase of around 10% in the number of RBSN stations continuing the positive trend witnessed during the previous intersessional periods. The percentage of stations not yet established or otherwise not recorded or non-operational (silent) has remained unchanged at 2%.

4.1.3 Nearly 90 percent of all established upper-air stations are included in the RBSNs. During the intersessional period the number of radiosonde stations has also shown a positive increase from 753 (in 2012) to 764 stations (in 2014). Also the overall implementation of stations (making 2 observations per day) in almost all regions remained unchanged with a marginal increase of around 1% globally in 2014. The percentage of stations not yet established or otherwise not recorded or non-operational (silent) has decreased to 2% (18 stations) globally compared to 3% (23 stations) during the same period.

4.1.4 All regions comprise a total of 2863 (2840 in 2012) CLIMAT reporting stations in the RBCN as of March 2014. A few stations have been deleted or added from the approved list of RBCN stations during the intersessional period, with an increase in CLIMAT reporting stations mainly in Regions IV and VI which revised their list of stations following the respective Regional Association sessions. Overall implementation globally of climatological stations reporting CLIMAT increased by 5% to 89% with almost all regions showing a positive increase.

4.1.5 The number of automatic stations in the RBSN according to information provided by Members in *Weather Reporting* (WMO-No. 9) Volume A, reached 1120 in 2014, compared to 916 stations in 2012, an increase of over 22% within the intersessional period. All Regions excluding Regions II and III show an increase in the number of automatic stations (Figure I), with the most significant increase recorded in Region IV. Out of the current globally established stations (11000+ recorded in Volume A) a total of 4712 stations are listed as automatic stations, of which 25% of all surface synoptic automatic stations are in the RBSN.

4.1.6 The existing National Focal Points for WMO on operational matters related to Volume A; the Regional Basic Synoptic Network (RBSN); and for GCOS and related climatological data monitoring issues has significantly facilitated the collection of detailed information on national specifications and also serves as an informal channel for exchange of information between the WMO Secretariat, NMHSs and CBS Lead Centres. The respective lists of focal points are available on the WMO website

⁷ <http://www.wmo.int/pages/prog/www/ais/volume-a/vola-home.htm>

(see website⁸). Prompt notifications of changes and updated information from members on a regular basis are encouraged to facilitate communication.

Performance Monitoring Results

4.1.7 ICT-IOS was presented with a report on performance monitoring results of the World Weather Watch Quantitative Monitoring exercises. It noted that while there had been some improvements in recent years, notably in RA III surface observations, the availability of upper air reports from RA-I remained a problem. Nevertheless, the Team was overall satisfied with the results of the monitoring exercise. The Team noted some discrepancies in the report (e.g. Brazil), which he requested the Secretariat to fix in future performance monitoring reports (**action; Secretariat; ICT-IOS-9**).

4.1.8 ICT-IOS noted that, in addition to the normal challenges of operating observing stations and maintaining the flow of information through the Global Telecommunications System (GTS), a substantial number of upper air reports are unlikely to be recorded in the WWW (World Weather Watch) monitoring statistics because they are not reported as being valid at one of the main synoptic hours. ICT-IOS identified a need to review the reporting requirements for upper air stations in the Regional Basic Synoptic Networks in the light of this information, taking into account the ability of numerical weather prediction models to assimilate information that is not at the main synoptic hours. The Team requested the Secretariat to make a proposal at the next ICT-IOS meeting regarding new suites of monitoring tables, which ought to be produced to reflect modern NWP observation monitoring systems (thereby to consider including statistics on the hourly reporting in the monitoring report)(**action; Secretariat; ICT-IOS-9**).

4.1.9 The Team noted some discrepancies with the current Technical Regulations advising Members to report data at 3h and 6h intervals, and with the EGOS-IP, where there is an action inviting Members to report data every hour. The Team recommended that the Technical Regulations should be updated to become consistent with the EGOS-IP (**action; IPET-WIFI; ASAP**).

4.1.10 The Team agreed that in the future, once OSCAR is fully implemented, operated, and includes appropriate metadata, the kind of monitoring that the WMO is doing for the RBSN/RBCN should take a different form, and could be achieved on the basis of OSCAR information content to a large extent. However, there will be an increased need for status reports on the implementation of WIGOS at the national level.

4.1.11 The Team requested the Secretariat to invite the regional representatives for WIS and WIGOS to attend future CBS Session (including CBS Ext.(2014)), and regional WIGOS Focal Points to attend ICT-IOS meetings, in order for them to report on the status of WIGOS implementation in the region, including AMDAR (**action; Secretariat; ongoing**).

STATUS OF SURFACE-BASED COMPONENT OF THE GOS IN THE REGIONS

4.1.12 The Team reviewed the status of surface-based component of the GOS in the regions (see ICT-IOS-8 documents 4(1) to 4(6) for details). The Team noted with appreciation the quality of these reports, their level of details, and the list of issues reported.

REGIONAL ASSOCIATION I (RA-I)

4.1.13 For RA-I, the Team noted the complete and excellent report provided by Mr Henry Karanja (Kenya). The Association noted that problems existed in the mechanism for updating the designated National Focal Points (NFP) of both the RBSN/RBCN (GSN and GUAN) and Weather Reporting Publication, No. 9, Volume A (Observing Stations). Members were urged to ensure the timely and regular update of their designated National Focal Points (NFPs) and to ensure that Volume A correctly describes respective national observing stations. Members are urged to comply fully with the global and regional coding procedures and data collection standards in accordance with procedures laid

8 www.wmo.int/pages/prog/www/FocalPoints.html

down in the WMO Technical Regulations and the Manuals on the GOS, on Codes, and on the GTS when operating the RBCN stations.

REGIONAL ASSOCIATION II (RA-II)

4.1.14 for RA-II, no report had been submitted to the meeting.

REGIONAL ASSOCIATION IV (RA-III)

4.1.15 For RA-III, the Team noted the relative stability of the RBSN and RBCN, and that there are exchange of hourly observations from a significant number of stations. A significant number of CLIMAT stations are disseminated using BUFR. While improvements were observed in last years, there is a need to increase density of the upper air network, as many areas of RA III are not covered. A regional project is envisaged and the issue will be discussing in the coming Session of RA III in Asunción (September 2014). The RA III GUAN comprises 18 stations (67% of which meeting the GCOS minimum requirements). There has been a significant increase in the number of Automatic Weather Stations. A regional WIGOS-related activity is underway to inventory the meteorological radars operating in RA III and search agreement on a common format and procedures for regional dissemination of radar data. Few RA III Members are collecting AMDAR observations. Several attempts were made to bring regional NMHSs and airlines to participate in the AMDAR program. One country is planning to considerably improve AMDAR data collection. The Regional Telecommunication Hub (RTH) of Brasilia is injecting a number of AMDAR data into the GTS.

REGIONAL ASSOCIATION IV (RA-IV)

4.1.16 For RA-IV, the Team noted with interests efforts of the Association to increase the length of the climate record.

REGIONAL ASSOCIATION V (RA-V)

4.1.17 For RA-V, the Team noted the report⁹, which has been prepared and submitted to the session RAV-16 to be held in Jakarta, Indonesia, from 2 to 8 May 2014.

REGIONAL ASSOCIATION VI (RA-VI)

4.1.18 For RA-VI, the Team noted the status and further improvement of the EUMETNET¹⁰ EIG¹¹ Observations Programme. While the status is satisfactory, there are some noted deficiencies in some areas (e.g. East and Southeastern part of Europe). The priorities for the EUMETNET EIG Observations Programme during the phase 2013-2017, included fostering OPERA, further expanding AMDAR, extending the remit of the EUMETNET EIG operational network of wind profilers (E-WINPROF), and improving the user consultation process with data users from the Climate and Forecasting Programmes and Members via the central Observation Programme and its Scientific Advisory Team. The Association is looking at providing a real integrated regional basic observing network (RBSN and RBCN together), including weather radars, wind profilers, etc. The Team noted the following issues: (i) there are still deficiencies in the implementation and operation of the RBSN and RBCN in some areas of the Region as revealed by the WMO Secretariat monitoring exercises; (ii) for some Members, the migration to Table Driven Code Forms (TDCF) is an issue, because they do not have the necessary resources for the migration process; and (iii) under the current working structure of RA-VI and their Working Group on Technology Development and Implementation there is no "Rapporteur or focal Point" being responsible to report on the status of the surface based component of the GOS.

9 <https://docs.google.com/a/wmo.int/file/d/0B8DhC1GSWSmxZ0VJeUtwUDhzWkk/edit?usp=drivesdk&pli=1>

10 Grouping of European Meteorological Services.

11 Economic Interest Grouping

4.1.19 The Team recommended to organize and conduct a regional WIGOS Workshop to support the WIGOS implementation in RA VI at national level, as well as to continue supporting the migration to Table Driven Code Forms.

Antarctica

4.1.20 The Team noted the status of the Antarctic Observing Network (AntON). The integration of all Antarctic networks (former ABSN/ABCN) into an Antarctic Observing Network (AntON) comprising of all operational stations, all of which should produce climate messages, form an integrated surface-based basic network that facilitates synoptic and climate monitoring over the Polar Regions in particular the Antarctic.

4.1.21 During the intersessional period, the level of implementation of the surface synoptic stations in the AntON (within Antarctica only) that make 8 observations per day (complete observational programme) increased to 82% (87 stations) out of 106 stations in total. The number of non-established or non operational stations decreased by one station. The remaining 17 stations (16%) perform observations at the 4 main standard hours per day, unchanged as in 2012. The number of automatic weather stations (AWSs) in the AntON also remained unchanged at 84 stations out of 106 stations.

4.1.22 The level of implementation of the number of upper-air stations that make 2 observations per day also increased to 40% (6 stations) from a total of 15 stations (unchanged since 2012) in the AntON. The remaining 9 stations (60%) perform at least one or more observations per day. There are no non established upper-air stations in the AntON.

4.1.23 The overall implementation of climatological stations in the AntON (within Antarctica only) reporting CLIMAT is 100% out of 106 stations in total. The maximum percentage is possibly due to the formation of AntON comprising of all operational stations in the Antarctic, all of which should produce climate messages.

4.1.24 The Antarctic Task Team Meeting (ATT) meeting (Wellington, New Zealand, February 2014) concluded that the experience with the AntON suggests that it is very useful to have a comprehensive list of stations, but it does also require a dedicated monitoring centre to pick up when stations drop out and to give feedback on any issues that arise. WIS/WIGOS could help with regular RTH monitoring of the reception of data.

4.1.25 The summary of the ICT-IOS recommendations to CBS Ext.(2014) regarding the implementation of observing systems in the regions is provided in ***Annex VI***.

4.2 GCOS Surface Network and Upper-air Networks (GSN/GUAN/GRUAN)

4.2.1 The Team noted that GCOS is organizing a review meeting on the dedicated GCOS Surface and Upper-Air Networks, GSN and GUAN in Ispra, Italy from 7 to 8 April 2014 (same week as this ICT-IOS-8 meeting). This GCOS network review meeting is focusing on the design, scientific principles, performance and data use of the GSN and GUAN. It is recognized that these networks were initiated some 20 years ago, when observing systems were very different and GCOS is taking the opportunity to review the requirements, in light of changes in both technology and data needs. The two-day meeting is about scoping the need for change and presenting this to AOPC, and as such, experts for specific, operational networks, monitoring and archive centres, and data users have been invited.

4.2.2 If given a mandate from AOPC, it is expected that further meetings will be required to design the future GCOS networks, in collaboration with the WMO Integrated Observing System (WIGOS), and it is at this stage, that experts from all the Regions shall be consulted and asked to contribute. The primary topics of the network meeting are as follows:

- Are the GSN/GUAN networks still fit for purpose, given current requirements; action on silent stations; priority within the network?

- Atmospheric Essential Climate Variables (ECVs) and products (requiring in-situ observation) where are the gaps, both in observing capability and data availability/quality from current networks?
- Monitoring – availability versus content of report (i.e., Quality requirement, vertical coverage for radiosonde reports, TEMP versus BUFR)?
- Other networks (i.e., GPS Water Vapour, Aircraft, Radar's); and
- Overlap with other domains (Ocean Observations Panel for Climate and Terrestrial Observation Panel for Climate).

CBS Lead Centres for GCOS

4.2.3 The Team noted that the CBS Lead Centres for GCOS (CBS-LC-GCOS) Coordination Meeting (Santiago, Chile, 8-10 October 2013) agreed on a number of recommendations that will be provided to various WMO and GCOS bodies through the WMO and GCOS Secretariats¹². Issues with relevance to ICT-IOS are the following:

- It was shown in Region V that there are a significant number of GSN stations which are reporting a SYNOP but not the CLIMAT message. This was mainly due to a lack of training and availability of suitable software. The CBS-LC-GCOS for Region V agreed to investigate the possibility for a CLIMAT workshop in Australia.
- The GSN Monitoring Centre (GSNMC) will expand their monthly monitoring to all CLIMAT messages of the Regional Basic Climatological Network (RBCN) and the CBS-LC-GCOS for RA VI will distribute these results to all Lead Centres via e-mail. It was recognized that this would increase the work load for the Lead Centre but the Team requested the Chair of ICT-IOS to invite CBS Ext.(2014) to request the CBS Lead Centre for GCOS to distribute the extended monitoring on climate messages, noting that the GSN remains the priority (**action; Chair ICT-IOS; ASAP**).
- The meeting agreed, subject to funding, that the 5th CBS Lead Centre for GCOS Meeting should be arranged for October 2015; the venue to be decided (**action; Secretariat; Oct. 2015**).

Migration to Table Driven Codes

4.2.4 The Team agreed that the communication of the BUFR message, according to WMO regulations, should become a mandatory requirement for the GUAN and GSN stations, allowing the global access to the improved metadata and higher resolution data. However, the Team recognized that it is accepted, and a concern, that many of the global monitoring centers, are not as yet able to handle the BUFR message. The Team agreed that GCOS needs to work with WMO, in particular CBS and CIMO, to ensure that this transition is well understood and is completed with minimal risk to the networks.

Status of implementation of the GCOS Surface Network (GSN) and the GCOS Upper-Air Network (GUAN)

4.2.5 The Team recognized that it is increasingly more evident that technical issues, failures in hydrogen generators and re-supply of consumables are resulting in significant downtimes for many of the GUAN stations. These issues are primarily due to lack of finance and often the long lead-times needed to get spend approval even for relatively small amounts of money. This is of particular relevance to a number of the Pacific Islands stations. GCOS is supporting where it can, both with funding from the GCOS Cooperation Mechanism (GCM) and working with industry for a speedy resolution, but immediate contact with the GCOS Secretariat when the issue is identified could help to lessen the downtime of the system. The Team agreed that it is important that Members formally report

¹² The full meeting report is available under:
http://www.wmo.int/pages/prog/gcos/Publications/CBS-LC-GCOS-4_Final-Report_2.0.pdf

to WMO and GCOS at the earliest opportunity on station closures or changes in practices which have an impact on the GSN and GUAN.

4.2.6 The Team recalled that in 2010, GCOS updated the minimum requirements for a GUAN station, to report temperature and wind to 30hPa and humidity to the tropopause, on at least 25 days each month. The Team recommended that Members should note that the balloon size and how it is handled, has a significant impact on the burst heights achieved and thus every effort should be made to ensure the minimum requirement is reached for all GUAN stations.

Implementation of the GCOS Reference Upper-Air Network (GRUAN)

4.2.7 The sixth Implementation - Coordination Meeting (ICM-6) was held in Beltsville, USA from 10 - 14 March 2014. The annual GRUAN meetings afford an opportunity for the Working Group on GRUAN (WG GRUAN), the GRUAN Lead Centre, Task Teams, and representatives from initial and prospective GRUAN sites and other stakeholders to review progress, highlight issues and exchange views. The meeting's main goals were to update participants on GRUAN progress and to discuss new developments, with a focus on (i) maximizing the utility of GRUAN activities and measurements to benefit the Global Observing System; (ii) progress on site certification; (iii) progress on network expansion; (iv) establishing links with the scientific and meteorological communities; (v) review and progress of the work plans for the GRUAN Lead Centre, the WG-GRUAN, and GRUAN task teams; and (vi) consideration of new data streams to include in coming years as called for in the current GRUAN Implementation Plan.

4.2.8 The aspect how to shape the interface between GRUAN, GUAN and the wider upper-air network of the Global Observing System (GOS), hence how the wider network can benefit from GRUAN practices and expertise, is also being discussed at the network review meeting (see above). A number of operating procedures being implemented at GRUAN sites cannot be feasibly implemented in the wider GUAN network; however, the lessons learned at GRUAN sites should be transferred to GUAN sites with the support of the appropriate mechanisms. The lessons from change management procedures, which are required at GRUAN sites, may be applied at GUAN sites without requiring the same rigor of change management. This is meant to reach out to GUAN and to offer the lessons that GRUAN may be able to provide. Besides this, the cooperation between CIMO and GRUAN during the last radiosonde intercomparison campaign was seen as highly beneficial for both sides and ICM-6 recommended maintaining this cooperation in upcoming radiosonde intercomparisons.

4.2.9 Concerning the current shape of the network with stations predominately located in northern hemispheric mid and high latitudes, it is hoped that concerted effort can be made to expand GRUAN, especially in the tropics and in Africa and South America (WMO region III). WIGOS and GRUAN should actively pursue this issue collaboratively.

4.2.10 The Team recalled that GRUAN data is flowing through NOAA¹³'s National Climatic Data Centre (NCDC) to data users and the GRUAN metadata database has been operational for the past 5 years. This database contains information about the sites, the measurement systems, instrument and sensor level information. One important aspect is that the database also contains information to handle change management, which requires some level of traceability over time. To make sure that metadata can be used interoperably between data centers, the climate and forecast convention has been chosen. With the use of these metadata, GRUAN data can be accessed through the WMO Information System (WIS) via Global Information System Centers (GISCs). Arnoud Apituley (the Netherlands) serves as the GRUAN liaison to the WIGOS metadata Task Team.

4.2.11 The Team noted that a GRUAN-side event is planned for WMO Seventeenth Congress in 2015, which will focus on the importance of reference observations for climate science, services, monitoring, and possibly on network expansion.

¹³ US National Oceanic and Atmospheric Administration

GCOS recommendations to CBS

4.2.12 Based on the above discussion, the Team agreed to promote the following GCOS recommendations through CBS Ext. (2014):

- Members to formally report to WMO and GCOS at the earliest opportunity on station closures or changes in practices which have an impact on the GSN and GUAN; and
- Members to ensure the minimum requirement, i.e., to report temperature and wind to 30hPa and humidity to the tropopause, on at least 25 days each month, is reached for all soundings at GUAN stations.

4.2.13 The Team also recommended that the section on GCOS, GUAN, and the GAW, within the Manual on the GOS, should be cross-checked against the material in the draft WIGOS Manual (**action; Chair ET-SBO; ASAP**). There may be an opportunity to remove the GAW material from the GOS Manual if it is covered in the WIGOS Manual. A number of other minor revisions were suggested.

4.2.14 The Team requested the ICT-IOS Chair to propose a new CBS representative in the AOPC WG on GRUAN (**action; Chair ICT-IOS; ASAP**).

4.2.15 The Team requested the CBS representative in the AOPC Working Group on GRUAN to pass the recommendation that WIGOS and GRUAN should actively pursue GRUAN expansion in the tropics and in Africa and South America to the AOPC (**action; CBS rep. in AOPC WG on GRUAN; ASAP**).

4.2.16 The Team noted and agreed with the recommendation of GCOS that CIMO and GRUAN should maintain close cooperation in the upcoming radiosonde intercomparison exercises; and agreed that no action from CBS was necessary in this regard. However, it was noted that the CBS Lead Centres could take part of the intercomparison exercises.

4.3 Marine and Oceanographic Observations

4.3.1 The Secretariat reported on the status of marine and oceanographic observations, which implementation of the corresponding observing platforms is coordinated through the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). Details, which included performance targets for the various observing networks managed by JCOMM or associated to JCOMM are provided in ICT-IOS-8 preparatory document no. 4.3.

4.3.2 The Team agreed on the following key issues to be reported to the CBS, and to be considered under agenda items 6.7 and 8.4:

- Concerns regarding the percentage of completion of the initial composite ocean observing system, which has not increased substantially in the last few years, and remained at the level of about sixty-two percent;
- Concerns regarding the funding of barometers on surface drifters;
- Concerns regarding the substantial decrease of data availability from the tropical moored buoy array, particularly in the Tropical Pacific Ocean, due to vandalism on data buoys, acts of piracy in certain areas, and the limited resources available for ship time to allow the appropriate maintenance of the arrays.

4.4 CryoNet of the Global Cryosphere Watch (GCW)

4.4.1 Mr Raymond Le Bris (Secretariat) reported on the development of the Global Cryosphere Watch (GCW), and particularly on its observations component. One of the immediate priorities in the Global Cryosphere Watch (GCW) development and implementation is to establish the core network of GCW surface measurement sites – CryoNet. CryoNet is one part of the whole GCW observing system, which is, in turn, a component observing system of the WMO Integrated Global Observing

System (WIGOS). CryoNet covers all components of the cryosphere (glaciers, ice shelves, ice sheets, snow, permafrost, sea ice, river/lake ice) through an extensive approach of in-situ observations. CryoNet will build on existing cryosphere observing programmes and promote the addition of standardized cryospheric observations to existing facilities in order to create more robust environmental observatories.

4.4.2 The meeting noted that being a CryoNet site means being part of an international, operational, global observing system and thus providing observations of known quality for research and knowledge beyond a site's local region. Satellite agencies, particularly through the WMO Polar Space Task Group (PSTG), and NWP centres such as the European Centre for Medium-Range Weather Forecast (ECMWF) will provide guidance in the development of the surface observing network, given the importance of in situ observations for the validation of satellite products and model parameterization.

4.4.3 The Team noted that the GCW Steering Group (GSG) agreed that while CryoNet is a core network it needs to be global and an effort should be made to identify suitable sites which would provide appropriate global representation. GSG also agreed that there may be a regional extension to CryoNet, such as CryoNet-Asia and this development will be driven by respective regional groups that may be established according to WMO Regions, as appropriate. To meet different user-needs and because of the spatially distributed nature of different components of the cryosphere, the CryoNet network of in-situ observations is structured into three different classes of sites: Baseline, Reference, and Integrated sites. All sites make measurements according to GCW agreed practices.

4.4.4 The Team noted the outcome of several GCW meetings, including (i) the first meeting of the GCW Steering Group (GSG) (Reykjavik, Iceland, 23-24 January 2014), (ii) the first Asia CryoNet meeting in Beijing, China, 2-5 December 2013, which was focusing on snow and ice measurements in the "Third Pole" (Himalaya) region, (iii) the "CryoNet" Team meeting (Reykjavik, Iceland, 20-22 January 2013), (iv) the Fifth Session of the Executive Council Panel of Experts on Polar Observations, Research, and Services (EC-PORS) (Wellington, New Zealand, 25-28 February 2014). EC-PORS approved the process for the establishment of CryoNet, including its initial sites and criteria for inclusion of the candidate sites into CryoNet. GSC approved several activities to move CryoNet forward; notably, the GSG:

- Revised and approved "Requirements for Site Inclusion in CryoNet".
- Reviewed the Site Questionnaire elaborated by the CryoNet Team that is to be completed by the candidate sites to show their intention to become a part of CryoNet and to provide necessary metadata allowing an assessment to be done for a selection of appropriate sites.
- Discussed in detail the CryoNet network structure of different site types.
- Approved an initial list of fourteen sites for inclusion in CryoNet. The evaluation of other candidate sites is underway and it is expected that many more sites will be included in CryoNet when submitted for approval by WMO Congress in 2015 through an appropriate resolution. By this act, the CryoNet will enter into an operational phase.
- Noted that CryoNet does not include all of the observing stations and networks that would contribute to GCW.
- Noted that the practices related to CryoNet will be developed by the CryoNet Team complemented by best practices to be developed by the GCW Infrastructure and Practices Team.

4.4.5 Also, the Team noted the following planned events:

- A Joint CryoNet and Portal Teams meeting to be held in June 2014 in Davos, Switzerland. The emphasis for this meeting is to have the CryoNet questionnaire available via the portal/website of GCW and to address several aspects of data management. A case study of one CryoNet station (or a few stations) will be performed during the meeting. This requires both the CryoNet and the Portal teams to work together.
- A South America CryoNet meeting to be held in late 2014 in Santiago, Chile in order to fill the gap in the CryoNet representation (spatial distribution of stations in Southern Hemisphere) and to bring together the South American community involved in CryoNet.

4.4.6 The Team expressed satisfaction with regard to the development of the GCW and its Cryonet.

4.4.7 The Team noted that a BUFR template is being proposed for the reporting of snow and no-snow conditions, and for consideration by the OPAG-ISS¹⁴ Implementation Coordination Team on Information Systems and Services (ICT-ISS) Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM, College Park, USA, April 2014). The Team agreed on the necessity for Members to start reporting of snow conditions immediately (including in the situations where there is no snow). Assuming adoption of the new BUFR template by CBS, the Team agreed to submit a Recommendation to the CBS Ext. (2014), which should include the requirements of Members to report snow and no snow condition, and to use the new BUFR template in their reporting. The Team requested the Chair and the Secretariat to develop a formal Recommendation to CBS Ext.(2014) in this regard (**action; Chair ICT-IOS; End May 2014**).

4.4.8 The Team noted that GCW is planning to conduct an analysis of the sub-applications of GCW and to identify which ones are new and should be considered in the WIGOS RRR process as new Application Area(s).

4.4.9 The Secretariat also reported on the quantitative monitoring of the WWW for the Polar regions including percentages of reports received from stations in the Arctic and Antarctic. In both cases more reports are received in the summer months than in the winter ones.

5. STATUS OF THE SPACE-BASED COMPONENT OF THE GOS

5.0 The Secretariat reported on the status of the space-based component of the Global Observing System (GOS) including: Operational geostationary satellites (GEO), Operational low-Earth orbit satellites (LEO), Research and Development (R&D) satellites, and the Global Space-based Intercalibration System (GSICS). It recalled that the status of current and planned satellites is available on the WMO website¹⁵.

5.1 Operational Component

OPERATIONAL GEOSTATIONARY SATELLITES

5.1.1 The Team noted that thirteen geostationary satellites were currently performing an operational mission, two satellites were supporting an operational satellite (Meteosat-8 supporting Meteosat-10 for rapid-scan imagery, MTSAT-1R supporting MTSAT-2 for telecommunications) and three other are in stand-by for back-up purposes.

5.1.2 In terms of the distribution of these satellite locations around the globe, the Team noted that 5 satellites only (MTSAT, GOES-W, GOES-E, Meteosat, Meteosat/IODC) were covering 80 % of the geostationary ring, while the other 8 are concentrated in the remaining 20 % between 65°E and 136°E.

5.1.3 Following the termination of the GOES-12 operation over South America in August 2013, due to satellite aging, the frequency of coverage of the South American continent has been a matter of concern, since only 3-hourly full disc imagery is normally provided by the GOES system when a severe meteorological situation is requiring rapid scan over the continental United States. In response to a request from WMO, and in consultation with the RA III /RA IV Coordination Group on Satellite Requirements, NOAA have studied an optimization of the scanning pattern of GOES-East which, in such situation, will secure at least hourly provision of two windows covering most of the South American continent. This mitigation scenario is being tested and will be implemented very soon by NOAA, thus responding to the users' requirements in an exemplary way.

¹⁴ CBS OPAG on Information Systems and Services

¹⁵ <http://www.wmo.int/pages/prog/sat/satellitestatus.php>

5.1.4 The Team noted that the INSAT-3D spacecraft, launched by India in July 2013 and declared operational in January 2014, provided for the first time a geostationary sounding capability over the Indian Ocean, significantly enhancing the capability of Insat-3A and Kalpana-1. Imagery and products are on line¹⁶. The near-real time availability of full resolution data is however subject to bilateral agreement with the India Meteorological Department.

5.1.5 The Team also noted that the geostationary constellation was entering a phase of transition to new generation systems that would start with the launch of Himawari-8 in late 2014 by Japan, then GOES-R by the USA in 2016, FY-4A by China in 2017, GEO-KOMPSAT-2A in 2018, GOES-S and MTG-I1 in 2019. Each of these satellites will carry an advanced imaging payload of at least 16 channels, and other sensors for most of them. This new generation will provide considerably enhanced capabilities in support of nowcasting, severe weather forecasting, volcanic ash cloud monitoring, and wind observation for NWP. It will generate high data rates and require significant updates of the user infrastructure and operational chains. It is thus critical for the users to be prepared for this major change. An on line resource named SATURN (for Satellite User Readiness Navigator) is being implemented by WMO to provide a centralized entry point to technical information from satellite operators on these new systems.

OPERATIONAL SUN-SYNCHRONOUS LOW-EARTH ORBIT SATELLITES

5.1.6 The Team noted that seventeen meteorological spacecraft were currently functional in sun-synchronous orbit. The primary ones for the provision of atmospheric sounding are:

- METOP-A and METOP-B, from EUMETSAT, operated in tandem on the mid-morning orbit (21:30 ECT), with a comprehensive payload including in particular an advanced sounding package (hyperspectral infrared sounder, microwave sounder, radio-occultation sensor) and a scatterometer;
- Suomi NPP, from the United States, which also includes a hyperspectral infrared sounder and a microwave sounder, and an advanced imager, is on the afternoon orbit (13:30 ECT).

5.1.7 The FY-3 programme from China is currently deployed on morning (FY-3A,-3C) and afternoon (FY-3B) orbits. The newly launched FY-3C spacecraft features an enhanced payload with improved performances and new sensors e.g. a radio-occultation sounder. Following discussions held within the Coordination Group for Meteorological Satellites, China has studied the possibility to place future satellites FY-3E and FY-3G on an early morning orbit (6:00 ECT) in order to best respond to WMO requirements. These plans are still subject to confirmation.

5.1.8 The United States have raised the attention to the risks linked to the transition schedule between Suomi NPP and its follow-on mission JPSS-1.

5.1.9 Details on data access and pre-processing tools for currently-flying low-Earth orbit satellites are collected on a WMO webpage¹⁷ that is under ET-SUP responsibility.

OPERATIONAL DRIFTING ORBIT SATELLITES

5.1.10 The Team recalled that Jason-2 was pursuing the high precision ocean surface topography mission, to be continued by Jason -3 in 2015.

5.2 Research Component

5.2.1 The Team noted that several R&D satellites had been used operationally for an impressive number of years, e.g.: TRMM (17 years), Terra (15 years), Aqua (12 years), and Aura (10 years). This illustrates how R&D programmes are not only supporting research and technology development but bring a substantial contribution to sustained observation of weather, climate and the environment.

¹⁶ <http://www.imd.gov.in/section/satmet/dynamic/insat.htm>

¹⁷ http://www.wmo.int/pages/prog/sat/accessandtools_en.php#LEO_Access_Tools

5.2.2 The COSMIC-1/Formosat-3 constellation has provided radio-occultation data that have been extensively used operationally in NWP assimilation over the past seven years. Once fully implemented (tentatively in 2018) the follow-up COSMIC-2/Formosat-7 programme will enhance this capability and appropriately supplement the operational radio-occultation sensors operated in sun-synchronous orbit by the METOP, FY-3 and Meteor-M/MP series.

5.3.3 GCOM-W1 launched in 2012 by Japan provides near-real time microwave imagery, which is available from a JAXA server and distributed onward by EUMETCast, through an agreement between JAXA and EUMETSAT. GPM-core, launched in February 2014, a cooperation mission between the USA and Japan, will enhance the global precipitation measurement mission successfully initiated with TRMM.

5.3.4 The Team recalled that a number of other Earth Observation missions of interest for WMO were planned in the coming years. Though some of them have applications in several domains, they could be classified as follows:

- Ocean monitoring: [Oceansat-3](#) (ISRO), [HY-1C,D](#) (SOA), [HY-2B](#) (SOA), [Sentinel-3A](#) (EC/ESA/EUMETSAT), [Sentinel-3B](#) (EC/ESA)
- Atmosphere monitoring: [OCO-2](#) (NASA), [SMAP](#) (NASA), [ADM-Aeolus](#) (ESA), [Sentinel-5P](#) (ESA, NSO)
- Land monitoring: [Sentinel-1A](#) (EC/ESA), [ALOS-2](#) (JAXA), [Sentinel-2A](#) (EC/ESA), [ALOS-3](#) (JAXA), [Sentinel-1B](#) (EC/ESA), [Sentinel-3A](#) (EC/ESA/EUMETSAT), [Sentinel-3B](#) (EC/ESA);
- Polar Regions monitoring: [Arctica-M N1](#) (Roshydromet, Roscosmos).

5.3 Global satellite intercalibration

5.3.1 The Team recalled that the new “Vision for GSICS in the 2020s”¹⁸ clarified the scope and priorities of GSICS. GSICS is a collaborative framework among satellite operators and science teams to develop, implement and share community-agreed best practices and standards, procedures and tools in order to monitor, improve and harmonize the calibration of environmental satellites within the Global Observing System. It focuses on in-orbit inter-calibration to generate *corrections* to be applied to the individual calibration of Level 1 satellite data. The status and description of available *correction products* (demonstration, preoperational or operational) are given in an on line catalogue on the GSICS portal¹⁹.

5.4 Satellite data accessibility

5.4.1 The Team noted the long list of present and planned Earth Observation missions reported by space agencies to the WMO Space Programme, and recalled that satellite missions were only contributing to the WMO Global Observing System to the extent that data were available in a timely manner and that the user community was informed on how to access it. It is generally the case for operational meteorological missions (See however paragraph 5.1.4). It is also increasingly the case for R&D missions, although there is a diversity of situations depending on the agencies and the type of missions and applications considered. 5.4.2 The Team commented however that data from some of these missions were not available or planned to be available to WMO Members. The Team asked the Chairperson in his report to CBS to remind Members that, for a space-based observing system (incl. operational and R&D satellites) to be a contributor to WIGOS, it is essential that its data are made available to the WMO community and in a timely manner (**Action; ICT-IOS Chair; Sep. 2014**).

5.4.3 The meeting welcomed the EUMETSAT initiative to disseminate third party data in near real time via EUMETCast in the framework of bilateral agreements with different R&D agencies including ISRO, JAXA or SOA. Information on data access is provided The meeting further noted that the Space Programme Office provided data access information through different channels : (i) the data access web page²⁰ ; (ii) the Product Access Guide (currently at prototype stage); and (iii) the OSCAR Space module, in addition to SATURN which is specifically designed for new missions. The meeting was

18 http://www.wmo.int/pages/prog/sat/documents/GSICS_Vision-for-GSICS-in-2020s.pdf

19 <http://gsics.wmo.int>

20 http://www.wmo.int/pages/prog/sat/accessandtools_en.php#LEO_Access_Tools

informed that the Secretariat had taken an action to review and streamline this information, and encouraged all satellite operators to contribute to this initiative.

6. REPORTS OF THE OPAG-IOS EXPERT TEAMS AND RAPPORTEURS

6.0 The Chairpersons of the CBS-IOS Expert Teams reported on progress attained by each Expert Team, namely: (a) achievement (in relation to the Terms of Reference), (b) issues that need to be reported to ICT-IOS, (c) recommendations to ICT-IOS-8 and specifically to CBS-Ext(2014). The Chairpersons provided the meeting with the status of their respective Work Plans for 2013-2016.

6.1 Report of IPET-WIFI

6.1.1 The Chair of the Inter-Programme Expert Team on WIGOS Framework Implementation Matters (IPET-WIFI), Jochen Dibbern (Germany), reported on behalf of the IPET-WIFI. The first session of the IPET in June 2013 focused on refining the work plan, assigning tasks and responsibilities, and commencing work on the major topics under IPET-WIFI responsibility: namely drafting of GOS-related WIGOS Regulatory Material, provision of GOS-related input for the WIGOS Core Metadata Standard, and initial discussion on the GOS-related contribution to WIGOS Quality Management guidance. The second session of IPET-WIFI was held (primarily by teleconference) in Geneva in March 2014. At that session the IPET's progress against each task was reviewed, the Work Plan was updated, and work commenced on updating the Manual on the GOS to harmonize it with the WIGOS Regulatory Material.

6.1.2 In relation to its Terms of Reference, the IPET-WIFI made significant achievements, as detailed below:

- The contribution which had been made to preparation of the WMO Technical Regulations, Volume 1, Part 1 and the draft WIGOS Manual. Each of IPET-WIFI Sub Groups: the Sub Group on Regulatory Material (SG-RM), the Sub Group on MetaData (SG-MD) and the Sub Group on Quality Management (SG-QM), provided significant contributions to the Technical Regulations. Detailed timelines had been prepared which will enable submission of the updated WMO Regulatory Material to Cg-17.
- SG-MD contributed on behalf of CBS to the work of ICG-WIGOS TT-WMD, specifically in the development of the semantic standard for WIGOS Core Metadata.
- Terms of Reference for TT-WQM were proposed to ICG-WIGOS by the Chair and Co-Chair of IPET-WIFI, as requested.
- The Feedback which had been provided by IPET-WIFI to the WIR development team on the draft WIR Functional Specification.
- That work of the IPET on internal and external cooperation should focus on collaboration at the national and regional levels, and in cooperation with WIGOS Project Office, regional workshop session planned for RA III should be conducted to develop a more detailed regional concept.

6.1.3 The meeting noted the following issues raised by the IPET-WIFI:

- The ICT-IOS noted that there is currently no mechanism for ensuring CBS input and advice is directly available to the team developing the WIR, in particular OSCAR (WMO/MeteoSwiss).
- ICT-IOS discussed in respect of the IPET-WIFI contribution to the WIGOS Capacity Development and Outreach, that there was a need to put that strategy into action. IPET-WIFI required further guidance from ICG-WIGOS on how best to contribute to that action.
- ICT-IOS noted the continuing lack of a satellite expert in SG-MD and its WIGOS Metadata activities. The Secretariat was requested to continue to pursue the nomination of an appropriate expert.
- ICT-IOS discussed and concurred with the key steps and timeline for preparation of regulatory material. Also, it was noted that some new provisions emerging from IOS experts/teams

destined for WIGOS regulatory material will need to follow the WRM steps and timeline rather than the Manual on the GOS steps and timeline (OSND principles and specifications of the RRR process are examples).

6.1.4 The meeting concurred with the following recommendations from the IPET-WIFI:

- The ICT-IOS concurred with the following recommendations from IPET-WIFI (to be included in the OPAG-IOS document to the CBS-Ext(14)):
 - IPET-WIFI to take responsibility for provision of GOS input and advice to the team developing OSCAR (WMO/MeteoSwiss), in consultation with other CBS ETs.
 - Considering the requirement for member states to have access to a process to submit and maintain WIGOS metadata, IPET-WIFI recommends that ISS take responsibility for the technical implementation of the WIGOS Core Metadata Semantic standard in consultation with IPET-WIFI and TT-WMD.
- ICT-IOS considered some small changes to the Terms of Reference of IPET-WIFI and will submit these to CBS-Ext(14) for consideration. These are provided in **Annex III**.
- The ICT-IOS concurred with the updated Work Plan of the Expert Team on WIGOS Framework Implementation Matters (IPET-WIFI) for the period 2014-2016.

Revision of the Manual on the GOS

6.1.5 Russell Stringer informed the meeting by teleconference of progress made by the IPET-WIFI Sub-Group on Regulatory Material (SG-RM) in drafting the proposed 2015 edition of the Manual on the GOS (WMO-No. 544). Firstly, the key steps and timeline were noted with particular reference to the need to submit the final version to CBS-Ext(14) in September:

- Any further input for the 2015 edition needs to be available to SG-RM by Friday 16th May
- All input received after that date will be held as input for the next update of the 2015 edition
- IPET-WIFI SG-RM will process the feedback and produce an updated draft for the ICT-IOS Chair by Friday 30th May

6.1.6 The Team noted that this Manual must maintain close synchronisation with the proposed new Manual on WIGOS, even though that manual follows a different approval pathway (through all Presidents of Technical Commissions to ICG-WIGOS for submission to Congress). The main changes proposed for the Manual on the GOS are summarized below:

- The Introduction has a new reference to the proposed Manual on WIGOS which explains that the two manuals must be read in conjunction with each other, and that the Manual on WIGOS will eventually completely replace the Manual on the GOS;
- Part II on Requirements for Observational Data is mostly deleted, while Part IV on the Space-Based Subsystem and Part V on Quality Control are both deleted, in each case replaced by a cross-reference to new material in the Manual on WIGOS;
- Remaining text in Part II is problematic because it describes two very special situations. Further consideration will be need on what, if anything, to do with this in future regulatory material;
- Attachment III.1 defines metadata for automatic weather stations – this will be redundant in the future once the WIGOS metadata standard is well established. For now a note has been added advising readers to consult the Manual on WIGOS for the standard set of metadata for all WIGOS observations;
- The Definitions section has been updated and some terms removed to avoid repetition with the Manual on WIGOS. A note has been added advising readers to also consult the Manual on WIGOS;
- A new entry has been made for GRUAN (GCOS Reference Upper Air Network) however the provisions are yet to be completed. This will be done soon with the assistance of Tim Oakley (GCOS Implementation Manager);
- A number of small, specific changes are included throughout Part III on the Surface-Based Subsystem, however these have been kept to a minimum to avoid interrupting the logical flow

of the existing material and recognising that a large effort will be needed to undertake a more complete update in the future.

6.1.7 The Team considered the revisions to the Manual on the Global Observing System proposed by the Chair of TT-WRM, Russell Stringer. ICT-IOS commended Mr Stringer on a job well done. The group decided that the changes proposed by ET-SBO had all been considered and where appropriate incorporated. The material on Volcanic Ash, it was agreed, would be reviewed by ET-SUP. The Team agreed to submit a Recommendation to CBS-Ext(14) that the proposed 2015 edition of the Manual on the GOS be endorsed and submitted to Congress. The Team requested the Chair and Secretariat to develop a formal Recommendation to CBS Ext.(2014) (**action; Chair ICT-IOS; End May 2014**).

6.1.8 Regarding WIGOS Regulatory Materials, and the Manual on the WIGOS in particular, the Team noted that the Presidents of the Technical Commissions have just been requested to review the materials drafted by the ICG-WIGOS Task Team on Regulatory Materials for their feedback. The ICT-IOS Chair will discuss with the CBS President to make sure that the OPAG IOS has an opportunity to provide its feedback.

6.2 Report of IPET-OSDE

6.2.1 The Chair of the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE), John Eyre (United Kingdom), reported on behalf of the IPET-OSDE.

6.2.2 In relation to its Terms of Reference, the IPET-OSDE made significant achievements, including in particular:

- Points of Contact for Application Areas in the Rolling Review of Requirements (RRR) have continued to provide the Secretariat with updates to observational data requirements²¹ held in the OSCAR database. Progress was reviewed at IPET-OSDE-1 and a set of Actions for further updates to the database was agreed.
- The Secretariat has continued to maintain and update the space-based capabilities side²² of the OSCAR database. Work on the surface-based capabilities side will be conducted as part of the transfer of the database management to MeteoSwiss. The procedures and responsibilities associated with these activities were reviewed by IPET-OSDE-1.
- RRR Points of Contact have continued to review and, where necessary, revise the gap analyses (Statements of Guidance²³, SoGs) for their respective Application Areas. Progress was reviewed at IPET-OSDE-1. Several new draft SoGs were provided for the meeting and these will now be reviewed by the Chair with support from the Team.
- The Report on the 5th WMO Workshop on “The impact of various observing systems on NWP” (May 2012) was completed and made available on the WMO website²⁴. See agenda item 6.8 for more detail on these activities.
- IPET-OSDE-1 reviewed progress on Actions in EGOS-IP. The Team proposed, for each Action in the EGOS-IP, the name of an OPAG-IO Team or other body who would be responsible for providing a summary of progress. It is planned to collate this information and to provide a first report on progress later in 2014. Attention will also be given to the provision of baseline information against which future progress will be judged.
- The Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) has been made available in English, French, Spanish and Russian on the WMO website²⁵. The Team expressed its gratitude to Dr Wenjian Zhang for his considerable personal efforts in translating EGOS-IP into Chinese.

21 <http://www.wmo-sat.info/oscar/requirements>

22 <http://www.wmo-sat.info/oscar/spacecapabilities>

23 <http://www.wmo.int/pages/prog/www/OSY/GOS-RRR.html#SOG>

24 <http://www.wmo.int/pages/prog/www/CBS-Reports/IOS-index.html>

25 <http://www.wmo.int/pages/prog/www/OSY/gos-vision.html#egos-ip>

- A list of proposed updates to the Vision for the GOS in 2025 is maintained on the WMO website²⁶.
- The IPET-OSDE has elaborated WIGOS “Principles” for Observing System Network Design (OSND) and also high-level guidance elaborating these principles.). The OSND Principles were developed further by IPET-OSDE-1 and submitted for inclusion in the draft WIGOS Manual. See agenda item 7.1 for details, including consideration of the roadmap for further development of the associated Guidance material.

6.2.3 The meeting noted the following issues raised by the IPET-OSDE:

- Global Framework for Climate Services (GFCS) observational user requirements. The Team has been tasked to work with GFCS on these requirements and the WIGOS response to them. The Team has been awaiting detailed input from GFCS in order to start this work. However, at IPET-OSDE-1, the Team was pleased to hear the plans of GCOS for an update of its Adequacy Reports and Implementation Plan over the next few years, and also for plans to work closely with GFCS in order to expand the observational user requirements of GCOS to respond to service requirements of GFCS. IPET-OSDE would therefore expect to receive from GCOS detailed updates on observational user requirements for climate monitoring and for other climate applications in support of GFCS. The Team agreed to review the new material from GCOS as it becomes available. Regarding the Climate Application area, the IPET-OSDE encouraged the CCI to consolidate its discussion with GCOS and the GFCS so that the activities required for the RRR process are complementary.
- Lessons learnt from the African Monsoon Multidisciplinary Analyses (AMMA). The experiences of the AMMA observation network are interesting in several respects: (i) they show how it is possible to make substantial improvements to an observational network in a group of developing countries with an input of resources which (at least by the standards of developed countries) is comparatively modest; (ii) they show the importance of providing support and coordination, and of the effectiveness of appropriate support; (iii) they show the dangers of withdrawing coordination and support, in terms of the subsequent degradation of the network; and (iv) they provide a very good illustration of the type of problems that WIGOS is attempting to solve. The Team noted that new quantity and quality monitoring tools are planned under WIGOS, and these should help to identify problems to find ways to address them. Substantial improvements should be realized with relatively small investments. The Team agreed that efforts should be made through ICG-WIGOS and appropriate Teams to identify more precisely what is needed in order to achieve those improvements. IPET-OSDE is ready to assist if needed. The ICT-IOS noted that there are regional workshops for Africa, which are planned, and where organizing sustained support in Africa could be discussed for some observing sites that had been set up under AMMA. If better monitoring is available, information can be used to include other experts outside of the region. WMO Voluntary Cooperation Programme (VCP) project(s) could also be set up to assist in this regard. The Team agreed that the Regional WIGOS Implementation Plans should also capture the lessons learned from AMMA.
- The OSCAR Platform, its move to MeteoSwiss, plans to ensure the continued support for and availability of the databases during the transitional period, and the continued development of their content. Progress on this activity was considered by IPET-OSDE-1, including plans to ensure the continued support for and availability of the databases during the transitional period, and the continued development of their content. The procedures and responsibilities associated with these activities were also reviewed and proposed for the ICT-IOS to consider (see also item 3.4);
- Atmospheric chemistry/composition. Noting that the SoG for Atmospheric Chemistry has not been updated for 10 years, there was significant progress at IPET-OSDE-1 to clarify the way forward. Whilst there are a number of Atmospheric Composition applications that the GAW Programme is mandated to support, there are others, e.g. operational air quality forecasting, that fall outside its area of responsibility. As a consequence an essential first step is the clear identification of those Atmospheric Composition application areas that fall under the mandate

26 <http://www.wmo.int/pages/prog/www/OSY/Documentation/Vision2025.html>

of the GAW Programme and those that do not. GAW is forming a Task Team to support the establishment and evaluation of observational requirements for application areas under the responsibility of the GAW Programme. A first activity of this Task Team is expected to be a clear identification of those application areas to be addressed. In the specific case of operational Air Quality Forecasting, which is not covered by GAW, the Team noted that this area of activity is under the formal responsibility of the CBS OPAG on Data-Processing and Forecasting System (OPAG-DPFS), and agreed to raise the issue to the attention of CBS Ext.(2014) in order to invite the OPAG-DPFS to propose an Application Area and to nominate a Point of Contact. It is then expected that the practical details would be set up through the CBS Management Group. A similar approach will be needed for other Atmospheric Composition application areas that are not being addressed by the GAW programme.

- Global Cryosphere Watch (GCW). Interaction with GCW moved forward at IPET-OSDE-1. The Team noted and concurred with the following recommendations from GCW:
 - GCW will identify application areas for each variable in the Integrated Global Observing Strategy (IGOS) Cryosphere list. New application areas for RRR may be suggested, noting that GCW itself is not an application area as it is too broad.
 - Requirements for non-cryosphere variables will be identified for some application areas, as appropriate.
 - GCW may engage the cryosphere community to update the IGOS Cryosphere requirements (although this would be a major endeavour).
 - GCW will work with the application areas and the PSTG to clarify their needs and to resolve any ambiguities and inconsistencies in cryosphere requirements.
- Global Terrestrial Observing System (GTOS). The Team noted that, although the relationship between WMO and GTOS has evolved, with some aspects now considered by GCOS, there has been no progress in establishing other sub-applications or user requirements for this area. In an attempt to make progress on some terrestrial applications, the Chair proposed to contact leaders of the Global Land/Atmosphere System Study of the Global Energy and Water Exchanges Project (GEWEX/GLAS).
- Land transport. The WMO Secretariat reported to IPET-OSDE-1 on recent WMO efforts to address requirements for land transportation. WMO intends to pursue an integrated approach to the meteorological services to transport sector, based on experience in specific sub-sectors such as aviation and marine. The Team noted that the anticipated services for land transportation will probably require input from NWP and other existing Application Areas. Before deciding whether there is a need for a new Application Area for the land transportation sector, one would have to assess whether there is a direct need for observations by these applications. IPET-OSDE invited the group in charge of elaborating a strategy for land transportation requirements to consider these points.
- EGOS-IP. EGOS-IP, responding to the Vision for Global Observing Systems in 2025, represents a major achievement under the umbrella of WIGOS. One of the roles of IPET-OSDE is to monitor progress against the Actions in EGOS-IP, and this will be done. The Team supported the proposal from IPET-OSDE for nominating a lead team to report on each Action in EGOS-IP. However, this is not sufficient; it should be the role of IPET-OSDE, with the support of OPAG-IO and WIGOS as a whole, not only to monitor progress but actively to promote it (see also agenda 7).
- Cost-benefit studies. IPET-OSDE-1 discussed cost-benefit studies for observing systems. It reviewed a proposed strategy from the Chair for assessing the cost-effectiveness of observing systems. The elements of the “cost-benefit chain” are described in the strategy. Two elements of this chain are the assessment of costs of observing systems and the assessment of the impact of observations on a given application. Together they allow the impact per cost of observations for this application to be assessed. This process is illustrated in the draft strategy using an example in which impact per cost is evaluated for global NWP. The extensions of this general approach to other applications areas and to other elements of the cost-benefit chain are also discussed in the strategy. IPET-OSDE-1 considered how the suggestions in this draft strategy might be taken forward, and suggested actions (i) to improve the estimates/guesses of observing system costs and to generalize the results to more than one NWP centre; (ii) to promote the development of appropriate metrics for other Application Areas; and (iii) to extend beyond impact per cost assessments to other parts of the cost-benefit chain, and eventually to an integrated assessment of cost-benefit over many applications and services. The ICT-IO strongly supported efforts in this

regard, and agreed that its ideas should be promoted at the ICG-WIGOS level and a presentation made at ICG-WIGOS-4 in 2015. The ICT-IOS also requested the Secretariat to invite IPET-OSDE Chair to present cost-benefit studies at the forthcoming ICG-WIGOS meeting in 2015 (**action; Secretariat; Jan 2015**). It was noted that there are plans to organize a Social Economical Benefits conference during the next WMO financial period, and that would also be an opportunity to present the work of CBS in this regard.

6.3 Report of ET-SBO

6.3.1 The Chair of the Expert Team on Surface-Based Observing Systems (ET-SBO), Stuart Goldstraw (United Kingdom), reported on behalf of the ET-SBO. He noted the team was a mix of both Experts with great experience of WMO work and Experts who were new to the work of WMO. Such a mix of expertise provides the opportunity to build understanding across the WMO community.

6.3.2 In relation to its Terms of Reference, the ET-SBO made significant achievements, as detailed below:

- In support of the activities of IPET-WIFI and ICG-WIGOS, ET-SBO reviewed draft regulatory material and provided written feedback, including positive feedback relating to the Core Metadata Profile being developed for WIGOS.
- As an activity of ET-SBO, expected to be undertaken in collaboration with IPET-WIFI and its SG-QM, an outline proposal for a WIGOS Observations Quality Information System (OQIS) was being developed and was submitted to ICT-IOS-8 for review.
- In 2013, ET-SBO finalized and activated a questionnaire of WMO Members on their utilisation of radar wind profilers systems. A mature draft of the report on the results of the survey had been compiled by ET-SBO and was submitted to the ICT-IOS session for review. The review of the outcome of the questionnaire highlighted the progressive adoption of this technology for upper air observing by Members with 17 respondees operating WPRs. The questionnaire highlighted 16 Members intend to introduce WPR networks in the coming years.
- ET-SBO had considered the best methodology to assist CBS in progressing EGOS-IP actions and a sub group of the team had agreed to review the range of relevant surface based actions and make recommendations to ET-SBO as to which could be progressed within the confines of ET-SBO resources.
- In April 2013 the UK Met Office hosted a WMO Workshop on the Regional and Global Exchange of Weather Radar Data. This workshop was triggered by G48 in the EGOS-IP. The report of the workshop can be found on the CBS reports website at: <http://www.wmo.int/pages/prog/www/CBS-Reports/documents/>. The outcomes of the workshop were communicated by Dr Daniel Michelson through the presentation of a paper at AMS Radar Conference. A significant outcome of the workshop was the clear need to develop the data model and protocols for regional and global data exchange and a Task Team, as approved by the CBS Management Group, has been formed to address these issues.
- Advice was provided by ET weather radar experts on the content of a concept paper that was presented by the Malaysian delegation at the 35th Meeting of ASEAN Sub-Committee on Meteorology and Geophysics (SCMG) held in Indonesia, 2-4 July 2013. The paper related to the Establishment of Effective ASEAN Weather Radar Composite Imageries for Near Real Time Operations.
- ET-SBO was represented at Workshop on Observations Monitoring organized jointly by ECMWF and the EUMETNET EUCOS Management Team. The thrust of the meeting was to address the need to refine the observations monitoring procedures undertaken by Members on behalf of WMO. This workshop led to the development of the WIGOS OQIS proposal as mentioned above.
- In light of the need for cost effective satellite based telecommunications infrastructure to support effective access ET-SBO representation at the Argos Joint Tariff Agreement meeting in Paris in late September 2013 was arranged.

- The report produced by Daniel Michelson from attendance at the AMS Radar Conference highlighted the emergence of phased array Radars as a potential operational system of the future.

6.3.3 The meeting agreed on the following actions and recommendations in relation the report of ET-SBO:

- A revised version of the proposal for the Development of a WIGOS Monitoring and Fault Management System should be presented to the ICG-WIGOS SG-QM meeting on the 23rd to 24th of April for consideration and further development (**action; ET-SBO Chair; April 2014**).
- The Team requested the ET-SBO to consider the revision of the content of Volume A and the associated regulatory material, taking into consideration the developments of the observing system surface capabilities database of OSCAR and also the responsibilities of the Regional Associations (**action; ET-SBO Chair; ASAP**). The Regional Associations should also be invited to review and provide the list of weather radars and wind profilers operated in their regions.
- Progress with EGOS-IP actions was discussed and the success of the Workshop on Global and Regional Weather Radar Data Exchange was noted. The Team requested the new CBS Task Team on Weather Radar Data Exchange to start its work at the earliest opportunity to ensure this technology makes a greater contribution to the global observing systems (**action; Chair TT-WRDE & Secretariat; ASAP**)
- The Team requested the Chair of ET-SBO to consider possibilities for joint meetings and collaboration with CIMO teams as appropriate (**action; ET-SBO Chair; Ongoing**).
- The Team requested the Secretariat to publish wind profiler radar survey report as a WIGOS technical document after final review by ET-SBO (**action; Secretariat; end June 2014**).
- The Team requested the ET-SBO to prioritize EGOS-IP G10, to review the potential to improve the global radiosonde network to take account of all application areas. Given the potential impact of changes to the radiosonde network, the Team recommended a systematic approach to gathering information to enable this action to progress. Nevertheless the Team agreed this action was important and should be a priority for ET-SBO (**action; ET-SBO; ASAP**).

6.4 Report of ET-SAT

6.4.1 The Chair of the Expert Team on Satellite Systems (ET-SAT), Jack Kaye (USA), reported on behalf of the ET-SAT via teleconference.

6.4.2 In relation to its Terms of Reference, the ET-SAT made significant achievements, as detailed below:

- ET-SAT was introduced to OSCAR, which is the main tool used by the WMO Space Programme to record the status of the space-based observing system and to perform a gap analysis. The meeting expressed support to the further development plan and updating procedure of OSCAR. The meeting recommended seeking convergence between OSCAR and the CEOS database of Missions, Instruments and Measurements (MIM). A meeting dedicated to updating the gap analysis was scheduled before ICT-IOS-8 but had to be postponed. The gap analysis update thus remains outstanding.
- ET-SAT discussed the development of the Architecture for Climate Monitoring from Space, in particular the definition of the physical view of this architecture. It emphasized the requirement for continuity of climate observations, which entails not only avoiding gaps between consecutive measurement series but also ensuring compatibility between these series, which may be a challenge with the evolution of measurement technology. It recommended extending the inventory of Essential Climate Variables to Fundamental Climate Data Records (FCDRs). This recommendation was supported by CGMS at its 41st meeting (Tsukuba, Japan, July 2013).
- The Secretariat undertook a study to characterize the FCDRs potentially provided by the CGMS planned satellite missions, as an input to the physical architecture. ET-SAT reviewed

the progress and the outcome of this study, which was then presented to the joint CEOS-CGMS working group on climate (Darmstadt, Germany, 5-7 March 2014). The CEOS-CGMS working group however was not prepared to deviate from the work plan initially defined by CEOS which focuses on the inventory of ECV products and excludes for the moment any activity regarding the observing system design.

- ET-SAT noted the suggestions already collected regarding updates to be brought to the Vision for the GOS in 2025 and recommended that a new Vision be developed for the space-based component, looking towards 2040.
- ET-SAT was informed on the progress of the Global Space-based Inter-calibration System (GSICS).
- ET-SAT provided guidance on the finalization of the draft new material proposed for inclusion in the new version of the Guide to Instruments and Methods of Observation (CIMO Guide, New Part on Satellite Observation).

6.4.3 The meeting concurred with the following recommendations from the ET-SAT:

- The Team agreed to propose new Terms of Reference to the ET-SAT to CBS Ext.(2014) in order to simplify and clarify them, and to make it more explicit that the ET-SAT is building on the outcome of CGMS & CEOS. The new proposed Terms of Reference were further reviewed during ICT-IOS-8 discussion as provided in **Annex VII**. The Team noted that the existing ET-SAT work programme will be consistent with the new proposed ToR.
- Regarding the funding of the ET-SAT, the Team noted that this could be possible if ET-SAT meetings were organized side by side with CGMS meetings with reduced membership and limited (DSA) funding for core members, and with ToR focusing on operational issues. The Team agreed to submit such a proposal to CBS Ext.(2014) (**action; Chair ICT-IOS; End May 2014**).

6.5 Report of ET-SUP

6.5.1 The Chair of the Expert Team on Satellite Utilization and Products (ET-SUP), Anthony Rea (Australia), reported on behalf of the ET-SUP

6.5.2 In relation to its Terms of Reference, the ET-SUP made significant achievements, as detailed below:

- The seventh session of the Expert Team on Satellite Utilization and Products (ET-SUP) was convened in Geneva, Switzerland from 27 to 30 May 2013. A key area of focus for the meeting was the Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) for Nowcasting (SCOPE-Nowcasting) initiative; the pilot projects were reviewed and refined across the broad application areas defined within the concept including basic nowcasting, volcanic ash products for aviation, precipitation and dust products. SCOPE-Nowcasting was also discussed in the joint session with the Expert Team on Satellite Systems (ET-SAT) composed of satellite agency representatives, which provided some guidance on refinement of the pilots. The meeting also considered the results of the WMO 2012 Survey on the Use of Satellite Data, making a number of recommendations for future surveys and setting goals for analysis of the survey results by the team. This analysis will form guide the future work of the Team, in particular around training and capacity development efforts. The meeting recognised the value of regional efforts to gather satellite data requirements and also acknowledged the complementary nature of these efforts to the globally-focused activities of ET-SUP. The Team made a number of recommendations to ensure that regional and global efforts are coordinated to provide the best possible outcome.
- Arising from the recommendations of ET-SUP-7 a meeting of the ad hoc SCOPE-Nowcasting Working Group was held on 19-22 November 2013 at WMO, Geneva. The session achieved its major goals, which were to: review the SCOPE-Nowcasting concept; review and refine each of the pilot projects with regard to the criteria established at ET-SUP-7; and prepare an action plan for the next 3-5 years for each of the pilot projects.

- ET-SUP has attempted to drive increased user awareness of satellite capabilities and, through the VLab Centres of Excellence, has supported a number of capacity-building initiatives. The 2012 User Survey identified training as a significant impediment to uptake of satellite data.

6.5.3 The meeting noted the following issues from the ET-SUP:

- ET-SUP noted that getting real-time access to satellite data remains a challenge for many users. ET-SUP has been addressing the need for improved information on the technical details of how to access satellite data from new satellites, including early information in advance of the launch or during commissioning phase, as well as software pre-processing tools. There remains a significant gap for some users around the dissemination of data in near-real time, handling of different data formats/metadata, and the visualisation of these data.
- In view of the effectiveness of regional satellite requirements coordination mechanisms, ET-SUP recommended that these be strengthened by collocating region-based satellite user conferences, regional training events (covering satellite systems, data utilization, software and tools), and meetings of regional satellite data requirements groups. Maintaining these mechanisms in all Regions requires additional support by Members, satellite operators and WMO secretariat.

6.5.4 The meeting made the following recommendations in relation the report of ET-SUP:

- The Team requested the ET-SUP to undertake revision of the Manual on GOS, and related WMO guidance material, in relation to volcanic ash, taking into consideration especially practices and procedures related to use of satellite products (**action; ET-SUP; mid. 2015**).
- The Team requested the ET-SUP to consider the development of a mechanism and associated standards and procedures that will allow Members to be able to seek high temporal resolution satellite information from the satellite operators, leading up to and in the event of emergency situations such as Typhoon Hiyan (**action; ET-SUP; June 2014**).

6.6 Report of ET-ABO

6.6.1 The Chair of the Expert Team on Aircraft-Based Observing Systems (ET-ABO), Frank Grooters (the Netherlands), reported on behalf of the ET-ABO.

6.6.2 In relation to its Terms of Reference, the ABO made significant achievements, as detailed below:

- ET-ABO worked together with the Secretariat to successfully establish the new programmatic structure for aircraft-based observations that was endorsed by CBS (2012). Under this structure, which includes responsibility for management and operation of the AMDAR Trust Fund, the CBS OPAG-IO8 Expert Team on Aircraft-based Observing Systems (ET-ABO) and the CIMO OPAG-SI Task Team on Aircraft-based Observations (TT-AO) together are referred to as the Aircraft-Base Observations Programme (ABOP).
- The ET-ABO held its first meeting in September 2013 and approved the ET-ABO Work Plan 2013-2014 and the supporting budget for use of the AMDAR Trust Fund.
- In 2013, the team completed the development of the document, the ABOP Strategy and Implementation Plan to 2025, including Development and Expansion of AMDAR, which incorporates a global strategy and plan for undertaking the action of the EGOS-IP relevant to aircraft-based observations.
- Initial work on review and update of AMDAR regulatory material including specifications for quality control and quality management of ABO data and metadata had commenced.
- Plans for and actions related to the development of a requirements specification and the distribution of a Request for an Expression of Interest for the establishment of an ABO Global Data Center had also commenced in 2013;

- In 2013, ET-ABO assisted the CIMO TT-AO in the finalization of the standard: AMDAR Onboard Software Functional Requirements Specification (AOSFRS), which was published as CIMO IOM Report 114.
- Over 2013 and early 2014, ET-ABO coordinated and contributed to the production of several very significant reports and guidance materials relating to AMDAR:
 - A study and publication of report on AMDAR Coverage and Targeting for Future Airline Recruitment;
 - WIGOS Technical Report TR 2014-1 on the Benefits of AMDAR Data to Meteorology and Aviation;
 - WIGIS Technical Report TR 2014-2 on Guidance and Requirements for the Implementation and Operation of an AMDAR Programme;
- In line with its strategy to work with the WMO Regional Associations on aircraft-based observations and AMDAR expansion, ET-ABO commenced the development of six ABOP Regional Implementation Plans (A-RIPs), expected to eventually be incorporated into the respective Regional WIGOS Implementation Plans.
- ET-ABO, through continued to undertake outreach activities in support of AMDAR development including:
 - Publication of 2 further volumes of the WMO AMDAR Observing System in 2013; and,
 - Commenced communications and initial action towards organization of ABO workshops in Qatar and northern Africa;
- ET-ABO provided support to the Chairperson of the OPAG-IOS on the Implementation of the WIGOS Framework and its Operational Aspects, including representation to TT-WMD.

6.6.3 The meeting concurred with the following recommendations from the ET-ABO:

- In relation to the adopted approach to aircraft-based observations and AMDAR development through collaboration with WMO RAs, the Team agreed to submit a Recommendation to CBS Ext.(2014) on the enhancement and expansion of aircraft-based observations and AMDAR in line with the global actions of the EGOS-IP. A draft of the Recommendation is provided in **Annex IX**. The Team requested the Chair and Secretariat to finalize the draft Recommendation for its submission to CBS Ext.(2014) (**action; Chair ICT-IOS; End May 2014**).

6.6.4 The meeting made the following recommendations in relation the report of ET-ABO:

- The Team requested the Chair of ET-ABO to consider opportunities for joint meetings to be held with CIMO Task Team (to become Expert Team next CIMO inter-sessional) (**action; ET-ABO & Secretariat; Ongoing**);
- The Team requested the ET-ABO to consider how to improve and optimise data coverage taking into consideration the low impact of observation in some areas and at some airports due to oversupply of redundant data (**action; ET-ABO; Ongoing**); and
- The Team requested the ET-ABO to work with the Secretariat to ensure that the ABOP Strategy and Implementation Plan is incorporated (or referenced by) the WIGOS framework Implementation Plan, and references made in the R-WIPs (**action; ET-ABO Chair; 2015**).

6.7 Report of the Rapporteur on Marine Observing Systems (R-MAR)

6.7.1 The Secretariat presented a report on JCOMM progress related to the OPAG IOS activities on behalf of the Rapporteur on Marine Observing Systems (R-MAR), Candyce Clark (USA).

6.7.2 In relation to its Terms of Reference, R-MAR noted the following:

- A report on the current status on marine meteorological and oceanographic observing systems was provided under agenda item 4.3;
- The Rapporteur is also acting as JCOMM Observations Programme Area (OPA) Coordinator, and Chair of the JCOMM Observations Coordination Group (OCG), and as such is providing

optimal liaison with the relevant JCOMM Expert Team and associated programmes. The marine observation related actions of the EGOS-IP are being considered by JCOMM in its OPA;

- JCOMM input to the OPAG-IOS is through the representation of JCOMM at the IPET-OSDE and ICT-IOS meetings;
- R-MAR is liaising on an *ad hoc* basis with the RRR point of contact for Ocean Applications, Ms Guimei Liu (China), concerning user requirements and gap analysis;
- JCOMM is contributing to the Key Activity Areas (KAA) of the WIGOS Framework Implementation Plan (see details in Appendix C of ICT-IOS-8 doc. no. 6.7);
- JCOMM contributed to the GFCS compendium of projects. For WIGOS-related aspects, JCOMM through IOC and other GFCS participating agencies continues to seek ways to emphasize the need for sustained ocean climate observations;
- JCOMM quality management is aligned with the WMO Quality Management Framework . Details of JCOMM contribution to WIGOS KAA#5 on Quality Management are provided in Appendix C of ICT-IOS doc. no. 6.7.
- The WIGOS implementation needs are strongly reflected in the implementation of all Programme Areas of JCOMM. See details of JCOMM contribution to WIGOS KAA#9 on Capacity Development in Appendix C of ICT-IOS doc. no. 6.7.

6.7.3 The meeting noted the following difficulties that JCOMM is facing with regard to the implementation of marine meteorological and oceanographic observing systems:

- Completion of the global ocean observing system compared to agreed JCOMM targets is stalled at the level of 62%, will require substantial additional yearly investment by the Members/Member States;
- To address the abrupt decline in the performance of the Tropical Atmosphere Ocean (TAO) array of moored buoys (due to vandalism on the data buoys, and difficulties to assure maintenance due to the cost of ship time, and piracy) and the need for a broad engagement in the design and implementation of the Tropical Pacific Observing System (TPOS), the GCOS-GOOS-WCRP Ocean Observing Panel for Climate (OOPC), in coordination with JCOMM OPA, is leading a process to evaluate the broad requirements for sustained observations, and how existing and new technologies can be used in combination to meet these needs. This process was kicked off with a TPOS 2020 workshop (January, 2014, La Jolla, USA), and will serve as a model for future planning and evaluations of global ocean observations.
- While SLP cannot be observed adequately from space with current technology, SLP from drifters complement observations made through other means (ships, moored buoys and satellites), is cost effective, and allows to build on synergies between research/operational and oceanographic/meteorological communities (e.g. by using the DBCP barometer upgrade scheme). Most of the barometers installed in drifting buoys are currently funded by research, and such funding is currently at risk of being substantially reduced. The operational community should be invited to better contribute to the funding of the barometers on drifters.

6.7.4 The Team agreed that the impact of marine meteorological and oceanographic data on NWP should be taken into account in the list of science questions to be addressed by the CBS, and the International Workshop in the Impact of Various Observational Systems on NWP.

6.7.5 The Team stressed that support of NMHSs to marine meteorological and oceanographic observations should be enhanced, noting that NMHSs don't necessarily have to contribute infrastructure, but can contribute resources to such programmes. This should be highlighted in the reporting to WMO Executive Council and Congress. Also, the Team agreed that monitoring data (by Country, and with trends) about such data ought to be included in the reporting documents to EC and Cg.

6.7.6 Despite the noted issues, the Team acknowledged with appreciation the overall success of JCOMM in implementing the marine meteorological and oceanographic observing systems. The Team concurred with the following recommendations from the Rapporteur:

- *CBS is invited to raise WMO Members' attention to the JCOMM Observations Programme Area Implementation Goals and the need to achieve the implementation targets, and to sustain the marine meteorological and oceanographic observing systems as a top priority. In particular, efforts should be made to fund and install barometers on newly deployed drifters, and to improving the tropical moored buoy array data availability through enhanced partnerships. Such partnerships could for example allow to increase the ship time required to maintain and operate the array.*

6.7.7 The Team noted that (a) the influence of buoy surface pressure observations is particularly large on a per-observation basis and their Observing System Experiment (OSE) impact extends from the surface throughout the troposphere in mid-latitudes (see final report of the 5th NWP Obs. Impact workshop²⁷), and (b) the higher impact per cost of such data compared with other observing systems, including space- and surface-based observing systems, per the UK study presented by the Chair of IPET-OSDE at the IPET-OSDE-1 meeting (see website²⁸).

Automated Shipboard Aerological Programme (ASAP)

6.7.8 Regarding ASAP, the Team recalled that the vast majority of the ASAP profiles are produced and delivered to end users thanks to the EUMETNET ASAP Programme (E-ASAP) in the North Atlantic. Noting the impact of ASAP profiles on NWP, and that the cost of ASAP soundings is similar to those made from land surface, and in light of the success of the E-ASAP, the Team agreed that other regional programmes should be encouraged to contribute to the ASAP programme. The Team also invited the Chair of the IPET-OSDE to request the MetOffice to undertake a revision and update of the observing system economic value assessment with a view to reassessing the impact and value of the ASAP programme and to determine possible recommendations to be made to CBS (2014) (**action; IPET-OSDE Chair; End Apr. 2014**).

6.7.9 The Team also agreed that further studies should be made to clarify the impact of ASAP, and thereby to better understand the impact per cost of the ASAP measurements in relation to other systems (**action; IPET-OSDE; 2016**).

Recommendation to CBS for marine observations in support of NWP

6.7.10 The Team agreed that it was important to raise awareness of Members with regard to the profile of ocean observations to address WMO applications observational user requirements, and to the issues outlined by JCOMM. It also agreed that the impact of drifters on NWP, and its cost-effectiveness should be brought to the attention of CBS, and decided to submit a formal Recommendation to CBS Ext.(2014) on Support of Members to the implementation of marine meteorological and oceanographic observing systems in support of NWP. The Recommendation should stress on the following points:

- There are risks of reduced funding for the barometer array;
- SLP cannot be observed adequately from space;
- SLP from drifters has a high impact on NWP on a per observation basis;
- Drifter technology is cost-effective, and provisional estimates suggest that the impact/cost is higher than for all other observing systems;
- Tropical moored buoys also provide valuable surface meteorological observations but data availability has dropped in the last two years due to vandalism on the data buoys, and difficulties to assure maintenance due to the cost of ship time, and piracy;
- Pending redesign of the Tropical Pacific Observing System by 2020, it is needed to maintain the tropical moored buoy array, and assure data availability to an acceptable level; and
- Depending on the results, if available in due course, of the forthcoming Met Office (UK) study on observing system economic value assessment, the impact and value of the ASAP programme should be highlighted.

27 http://www.wmo.int/pages/prog/www/OSY/Meetings/NWP5_Sedona2012/Final_Report.pdf

28 <http://www.wmo.int/pages/prog/www/OSY/Meetings/IPET-OSDE1/documents/IPET-OSDE1-Doc-8.4-Cost-benefit-studies.pdf>

6.7.11 The Team requested the Chair and Secretariat to develop a formal Recommendation to CBS Ext.(2014) (**action; Chair ICT-IOS; End May 2014**).

6.8 Report of the Co-Rapporteurs on Scientific Evaluation of Impact Studies undertaken by NWP Centres (R-SEIS)

6.8.1 The Co-rapporteurs on Scientific Evaluation of Impact Studies undertaken by NWP Centres (R-SEIS), Erik Andersson (ECMWF), and Yoshiaki Sato (Japan), summarize recent progress on impact of the several observing systems in terms of benefit to Numerical Weather Prediction. The main results from recent Observing System Experiments (OSE) are presented with emphasis on the future evolution of the GOS. The status of the Joint Observing System Simulation Experiment and other OSSE initiatives is also given. Recommendations and priorities for future studies are provided.

6.8.2 Per their Terms of Reference, the Co-Rapporteurs noted the following achievements:

- A summary of reviews of Observation System Experiments (OSEs), Observation System Simulation Experiments (OSSEs) and other observational data impact studies undertaken by various Numerical Weather Prediction (NWP) centres around the globe (see Appendix B of ICT-IOS-8 doc. No. 6.8).
- The Sixth Workshop on the Impact of Various Observing Systems on NWP is planned to be held in 2016. The Co-rapporteurs agreed on organizing the Sixth Workshop with similar size and set as in the Fifth Workshop, which was a four-day long workshop with 56 experts including 30 invited speakers. Place and organizing committee for the Sixth Workshop are under consideration. As in the past workshops, WMO is invited to provide support to invited speakers and/or other participants within the available resources to be allocated for this event in the next financial period.
- Through their participation at OSDW1, IPET-OSDE-1 and ICT-IOS-8, the Co-Rapporteurs provided input to the ICT-IOS and the IPET-OSDE regarding the evolution of the WIGOS observing system components, as well as advice and support to the Chairperson of OPAG on IOS on implementation of WIGOS.

6.8.3 The meeting noted the following issues raised by the Co-Rapporteurs:

- There are several studies tackling the themes proposed in the current EGOS-IP, for example, GNSS-RO saturation or regional radiosonde network study. Appropriate impact studies for new observations are also being conducted, for example, soil moisture assimilation and chemical parameter assimilation.
- Because of the chaotic nature of the atmosphere, making an accurate long range forecast is very difficult. Therefore, it is also difficult to evaluate the observation impact on the long range forecast, e.g. for seasonal forecasts. Although "Impact of observations on extended range forecasts" has been established as one of the themes in the proposed topics for NWP impact studies, it is hard to identify any studies addressing this issue.
- Although data denial experiments are conducted frequently in the world, impact studies specifically on observational data quality degradation is hardly found. To recognize the importance of the data quality standardization, it might be appropriate to add this theme to the topic list.
- There are a lot of studies addressing the importance of the ground based observations especially on the data sparse regions. This information should be noticed to the developing countries to be identified for their contribution.

- The EUMETNET Observations programme has demonstrated the value of OSEs and FSO/FEC (adjoint sensitivity) for the optimisation of complex observation networks at regional scale (Europe). Studies of similar type are required also for other parts of the world to help guide decisions on the relative cost effectiveness of the individual components of the regional observation networks.

6.8.4 The meeting decided to invite CBS-Ext.(2014) to recommend enhanced contribution of Members to impact studies, including for:

- Members to continue the development and research of adjoint-based observation impact assessment tools, as a complement to traditional OSEs,
- Members to undertake OSEs for the optimization of regional composite networks,
- NMHSs to conduct OSEs and OSSEs to address the specific science questions listed in the Annex 1 to the proposed Recommendation;

6.8.5 The proposed list of topics for NWP impact studies relevant to the evolution of global observing systems to be submitted to the CBS Ext.(2014) for its consideration is provided in **Annex IV**.

6.8.6 Regarding the next International Workshop on the Impact of various observing systems on NWP, the Team concurred with the IPET-OSDE and R-SEISs recommendations to organize it in April or May 2016 prior to ICT-IOS-9.

6.8.7 Noting the potential offers from China and Germany, the Team requested the Secretariat (WIGOS PM) to work towards finding and establishing relevant agreements with a Member to host the next "Impact" Workshop, and to subsequently ensure a host organising committee is formed (**action; WIGOS PM; Sep. 2014**). An offer is expected to be made at CBS Ext.(2014).

6.8.8 The Team noted that the organizing committee for the workshop ought to be decided by the CBS Management Group in consultation with the ICT-IOS, and related activities within CAS. The Team requested the R-SEISs to work with Secretariat (WIGOS PM & D/OBS) to establish a programme committee for the organisation of the 6th Workshop on Impact of Various Observing Systems on NWP (2016) in consultation with the WWRP DAOS WG (**action; R-SEIS; Sep. 2014**).

6.9 Radiofrequencies matters (SG-RFC)

6.9.1 The chair of the Steering Group on Radio-Frequency Coordination (SG-RFC), Jose Arimatea de Sousa Brito (Brazil), presented a progress report on Radiofrequencies matters.

6.9.2 In relation to its Terms of Reference, the SG-RFC made significant achievements, as detailed below:

- Prepared and distributed to relevant WMO and International Telecommunication Union (ITU) bodies the WMO Preliminary Position on WRC-15 Agenda (updated recently).
- Members of SG-RFC and/or Staff from the Secretariat followed several meetings of ITU-R groups presenting and defending WMO Position.
- Development of the WMO Strategy on Radio Frequency Protection for
- Meteorology submitted to EC-65.
- Continued support to GEO in realizing Task IN-01-C4-Radio Frequency Protection as an important contribution from WMO to GEOSS.
- Provided support to Members facing specific threats to some bands through letters, discussions or providing relevant information.

6.9.3 The meeting concurred with the following recommendations from the SG-RFC:

- The Team requested the SG-RFC to propose CBS Recommendation for Cg-17 on radio-frequencies for meteorological and related environmental activities. The Team requested the Chair of the SG-RFC and the Secretariat to develop a formal Recommendation to CBS Ext.(2014) in this regard (**action; Chair SG-RFC & Secretariat; end May 2014**).
- The Team requested the Secretariat to assist for the organization of the SG-RFC meeting to be held in November 2014 in preparation for CPM15-2 (**action; Secretariat; Nov. 2014**).

7. OBSERVING SYSTEM DESIGN AND EVOLUTION

7.0 The Team recalled that the new Implementation Plan for the Evolution of the Global Observing Systems (responding to the Vision of the GOS in 2025) has been approved by CBS-XV in 2012, and EC-65 in 2012. It is now available in English, Chinese, French, Spanish and Russian (see website²⁹, except for the Chinese version, which will be posted soon).

7.1 Development of observing systems network design principles and guidance

7.1.1 The IPET-OSDE Chairperson reported on the status of the development of observing systems network design (OSND) principles and guidance, including draft OSND principles, and road map for developing OSND guidance.

7.1.2 An ad hoc workshop on Observing System Design (OSDW1) was held, under the auspices of the CBS OPAG-IO8 Inter-Programme Expert Team on the Observing System Design and Evolution (IPET-OSDE), at the WMO Headquarters in Geneva, Switzerland from 12-14 November 2013 and was chaired by the Chair of the IPET-OSDE, Dr John Eyre (United Kingdom). A full report on the workshop is available on the WMO website³⁰.

7.1.3 Following the workshop, work on developing OSND Principles and associated guidance material has proceeded according to the plan proposed by the Workshop, and draft OSND materials drafted and structured as following (parts B and C below are intentionally incomplete - it is intended as a future task for IPET-OSDE and other groups to expand these and to develop them further):

- A. Proposed (12) Observing System Network Design (OSDN) Principles.
- B. The OSND Principles and, for each Principle, points that amplify or explain them, or that indicate how appropriate guidance material could be developed for each.
- C. Additional material related to guidance on observing system design, but not network design.

7.1.4 The version of the draft OSND Principles was presented to the third session of the ICG-WIGOS (Geneva, 10-14 February 2014). ICG-WIGOS noted the progress on the draft OSND Principles.

7.1.5 IPET-OSDE-1 revised the draft OSND principles reflected in an annex of the IPET-OSDE-1 final report. IPET-OSDE-1 prepared and delivered a version by the deadline set by ICG-WIGOS (4 April 2014). It will form part of the draft WIGOS Manual that will be considered by the Presidents of Technical Commissions.

7.1.6 The Team noted this new version of the Principles with appreciation, concurred with the Principles proposed, and agreed that it ought to be presented to the CBS Ext.(2014) for its information.

7.1.7 The Team also concurred with the roadmap proposed by the IPET-OSDE-1 for further development of the OSND Principles and associated Guidance material, and reflected in the final report of IPET-OSDE-1. In particular, the Team agreed that a second OSDW workshop should be organized prior to ICG-WIGOS-4, and requested the Secretariat to assist in this regard (**action;**

29 <http://www.wmo.int/pages/prog/www/OSY/gos-vision.html#egos-ip>

30 <http://www.wmo.int/pages/prog/www/CBS-Reports/IO8-index.html>

Secretariat; Jan. 2015).

7.2 Status of actions of the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP)

7.2.1 The Chairperson of the Inter Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) informed the meeting of the status of actions of new EGOS-IP. The first meeting of the IPET-OSDE (IPET-OSDE-1, Geneva, Switzerland, 31 March - 3 April 2014) was the first opportunity to monitor progress against the new EGOS-IP, and this is an important task for IPET-OSDE, at this and subsequent meetings. At IPET-OSDE-1, the Team proposed, for each Action in the EGOS-IP, the name of an OPAG-IO8 Team or other body who would be responsible for providing a summary of progress. It is planned to collate this information over the next few months and to provide a first report on progress later in 2014. Attention will also be given to the provision of baseline information against which future progress will be judged.

7.2.2 The Team agreed that monitoring will not be sufficient; it should be the role of IPET-OSDE, with the support of OPAG-IO8 and WIGOS as a whole, not only to monitor progress but actively to promote it. Experience with the old EGOS-IP (responding to the old Vision for the GOS in 2015) was that response to EGOS-IP Actions was good in several areas, including space-based observations (via the WMO Space Programme), ocean observations (via JCOMM) and aircraft observations (via the AMDAR Programme). However progress was relatively slow in areas dependent on action by WMO Members and Regions. A network of National Focal Points (NFPs) was established to facilitate reporting by Members against the Actions in EGOS-IP. This network could also be used to facilitate the necessary activity, but it needs support. A mechanism to do this could be developed, if supported by adequate resources. This proposal was considered by IPET-OSDE-1. Following discussion, it was decided not to proceed with the suggestion as presented to IPET-OSDE-1 but to pursue other means of facilitating EGOS-IP Actions, including more active promotion through Regional structures and the implementation of improved observation monitoring procedures and more active pursuit of the problems that they identify. A series of Actions was also agreed by IPET-OSDE to improve interactions with NFPs.

7.2.3 The Team requested the IPET OSDE Chair and the Secretariat to define and draft description of the role and responsibilities within their organizations of the NFPs for the RRR, including for the monitoring of actions of the EGOS-IP (**action; IPET-OSDE Chair; ASAP & ongoing**).

7.2.4 The Team considered the recommendations of the IPET-OSDE, and agreed that the WIGOS PO should take a coordinating role with NFPs to monitor action of the EGOS-IP. On a related matter, the Team noted that the WIGOS PO was about to write to Members to provide them with information on progress of WIGOS implementation, and invite them to nominate WIGOS NFPs. The Team agreed that the WIGOS NFPs could also possibly play the role of providing feedback regarding the implementation of EGOS-IP actions. The Team requested the WIGOS PO to write to Members to request them to nominate someone who will also be tasked to provide feedback on status of actions of the EGOS-IP (**action; WIGOS PO; ASAP**). The latter person could be the same person as the WIGOS NFP, or a separate person, and the Team agreed that it should be up to the Members to decide. The letter should also remind Members about the need to implement EGOS-IP actions and to monitor status of actions.

7.3 New vision for the global observing system(s)

7.3.1 The meeting discussed the need to develop a new vision for the global observing system(s), possibly in 2040, to replace the current Vision for the GOS in 2025, and take into account WIGOS requirements. The Team recalled that the "Vision for the Global Observing System in 2025", to which the new EGOS-IP responds, was completed in 2009, Recommended by the fourteenth Session of the CBS (Dubrovnik, Croatia, April 2009) through Recommendation 1 (CBS-14), and approved by the Executive Council through Resolution 6 (EC-61). Since then various updates to the Vision have been

suggested and recorded on the WMO website³¹.

7.3.2 The Team noted that the timing of an update to the Vision needs careful consideration. It may be argued that an update is needed soon because the space-based components of the global observing systems are planned on long lead times. In fact, some components are already planned to ~2040. On the other hand, 2025 is quite a distant Vision for many aspects of the surface-based observing system, for which the current Vision remains fully appropriate. Moreover, any efforts to update the Vision are likely to distract from other activities, and notably from activities to implement the new EGOS-IP, as discussed in 7.2 above.

7.3.3 For these reasons the most appropriate timing for the next update to the Vision is not obvious.

7.3.4 The Team noted the outcome of the IPET-OSDE-1 discussions in this regard. IPET-OSDE-1 agreed that it was important to retain the 2025 Vision as a baseline for several activities. However, it would also be helpful to develop an extended Vision to 2040, and that preparation of such Vision should be possible with a modest amount of work. It is proposed to start this work by: (a) requesting RRR PoCs to identify important requirements for their Application Areas that will not be met by the 2025 Vision and (b) requesting Teams responsible for particular observing technologies to indicate observing system developments that may be possible during the period 2025-2040. Based on this information, IPET-OSDE, with assistance from other Teams, would then prepare a proposed "Vision to 2040", in time for presentation to CBS in 2016.

7.3.5 The Team considered the recommendations of the IPET-OSDE, discussed the scope of the new Vision, and agreed that the definition of the Vision ought to be clarified. For example the following perspectives could be considered:

- (i) Vision for the WIGOS, i.e. with its broader scope (i.e. beyond the component observing systems themselves, e.g. taking into account all WIGOS Key Activity Areas), and
- (ii) Vision for the WIGOS component observing systems.

7.3.6 The Team agreed that realistically, progress could be made with regard to the WIGOS component observing systems only, and therefore proposed that the name of the Vision should be *Vision for WIGOS component observing systems in 2040*. The Team also agreed that, even when the new Vision in 2040 is adopted, the Vision for the GOS in 2025 should continue to be kept in force until 2025 as it will continue to serve as the baseline for several activities.

8. PREPARATION OF OPAG-IOS INPUT FOR CBS-Ext(2014)

8.0 The meeting was briefed on the on-going preparations of the CBS Extraordinary Session in late 2014.

8.1 Terms of Reference of the Expert Teams

8.1.1 The meeting discussed the need to review the OPAG IOS structure, including the Terms of Reference of the Expert Teams, and Rapporteurs. The Team agreed that some of the changes required could wait until the CBS sixteenth Session in 2016. However, the Team agreed to propose changes to the Terms of Reference of the IPET-WIFI (i.e. to reflect the coordinating role with OSCAR development) and ET-SAT (i.e. for clarifying the existing Terms of Reference, and the Expert Team not to overlap with the CGMS and CEOS). The proposed changes to the Terms of Reference of IPET-WIFI are provided in **Annex III**. The proposed Terms of Reference of the ET-SAT are provided in **Annex VII**.

8.2 Terms of Reference of Rapporteurs

³¹<http://www.wmo.int/pages/prog/www/OSY/Documentation/Vision2025.html>

8.2.1 No changes were proposed to the Terms of Reference of the Rapporteurs.

8.3 Work Plans

8.3.1 The ICT-IOS noted the draft workplans provided by the Chairs of the Expert Teams for their respective Teams.

8.3.2 The list of action items arising from this Session is provided in *Annex II*.

8.4 Input and Recommendations for CBS-Ext. (2014)

8.4.1 Taking into account major results of OPAG-IOS activities, and following the outcome of the discussion on reports of the Expert Teams (agenda item 6) together with the results of deliberations on other issues during this meeting, the ICT-IOS agreed on the following Recommendations to be submitted to the upcoming CBS-Ext.(2014) session:

- Enhancement and expansion of aircraft-based observations and AMDAR in line with the global actions of the EGOS-IP (see item 6.6);
- Members to report the snow and no snow conditions, and to use the new BUFR template in their reporting (assuming that the IPET-DRMM will propose the BUFR template to CBS in parallel) (see item 4.4);
- That the proposed 2015 edition of the Manual on the GOS (to be consistent with Manual on WIGOS) be endorsed and submitted to Congress (see item 6.1);
- Support of Members to the implementation of marine meteorological and oceanographic observing systems in support of NWP (i.e. to the barometer drifters, the tropical moored buoys essentially) (see item 6.7); and
- Radio-frequencies for meteorological and related environmental activities (see item 6.9)

8.4.2 The meeting requested the Chair and the Secretariat, on the basis of the outcome of this ICT-IOS Session, to prepare the first draft of the text to be included in the General Summary of the CBS session, including summary of activities, updated work plans with status for the Expert Teams, and recommendations to the CBS (*action; ICT-IOS Chair; May 2014*).

9. ANY OTHER BUSINESS

9.1 There was no other business to discuss under this agenda item

10. CLOSURE OF THE SESSION

10.1 The Chair of the ICT-IOS, Mr Jochen Dibbern (Germany) thanked all participants for their valuable contributions during the intersessional period, and during this meeting, as well as the Secretariat for its support during the meeting. The session closed at 16:45 hours on Thursday 10 April 2014.

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ACTION SHEET RESULTING FROM ICT-IOS-8

No.	Ref.	Action item	By whom	Deadline
1	3.2.4	to distribute the relevant regulatory materials to ICT-IOS members for their review	Chair	ASAP
2	3.3.2	to reflect OSCAR related activities in their respective workplans	ETs	ASAP
3	3.3.2	to review the functional specifications document of OSCAR/Surface and to provide feedback if necessary to the Secretariat	ICT-IOS members	7-May 2014
4	3.3.3	to regularly communicate with the IPET-WIFI on the status of the development of the OSCAR Project	Secretariat	Ongoing
5	3.4.8	to make sure that the proposed regulatory material on WIGOS station identifiers (Annex VIII) will be submitted to the WIGOS Regulatory Material review process of the Technical Commissions and the CBS	ICT-IOS chair	end May 2014
6	4.1.7	to fix noted discrepancies (e.g. Brazil) in future performance monitoring reports	Secretariat	ICT-IOS-9
7	4.1.8	to make a proposal at the next ICT-IOS meeting regarding new suites of monitoring tables, which ought to be produced to reflect modern NWP observation monitoring systems (thereby to consider including statistics on the hourly reporting in the monitoring report)	Secretariat	ICT-IOS-9
8	4.1.9	to update the Technical Regulations to become consistent with the EGOS-IP	IPET-WIFI	ASAP
9	4.1.11	to invite the regional representatives for WIS and WIGOS to attend future CBS Session (including CBS Ext.(2014)), and regional WIGOS Focal Points to attend ICT-IOS meetings, in order for them to report on the status of WIGOS implementation in the region, including AMDAR	Secretariat	ongoing
10	4.2.3 (ii)	to invite CBS Ext.(2014) to request the CBS Lead Centre for GCOS to distribute the extended monitoring on climate messages, noting that the GSN remains the priority	Chair ICT-IOS	ASAP
11	4.2.3 (iii)	to arrange for organization of the 5 th CBS Lead Centre for GCOS Meeting in October 2015 (venue to be decided)	Secretariat	Oct. 2015
12	4.2.13	to cross check the sections on GCOS, GUAN, and GAW within the Manual on the GOS against the material in the draft WIGOS Manual	Chair ET-SBO	ASAP
13	4.2.14	to propose a new CBS representative in the AOPC WG on GRUAN	Chair ICT-IOS	ASAP
14	4.2.15	to pass the recommendation that WIGOS and GRUAN should actively pursue GRUAN expansion in the tropics and in Africa and South America to the AOPC	CBS rep. in AOPC WG on GRUAN	ASAP
15	4.4.7	to develop a formal Recommendation to CBS Ext.(2014) regarding the reporting of snow and no snow conditions	Chair ICT-IOS	End May 2014
16	5.4.2	to remind Members, in his report to CBS, that for a space-based observing system (incl. operational and R&D satellites) to be a contributor to WIGOS, it is essential that its data are made available to the WMO community and in a timely manner	ICT-IOS Chair	Sep. 2014
17	6.1.7	to develop a formal Recommendation to CBS Ext.(2014) that the proposed 2015 edition of the Manual on the GOS be endorsed and submitted to Congress	Chair ICT-IOS	End May 2014
18	6.2.3(9)	to invite IPET-OSDE Chair to present cost-benefit studies at the forthcoming ICG-WIGOS	Secretariat	Jan 2015

ICT-IOS-8, Final report

No.	Ref.	Action item	By whom	Deadline
		meeting in 2015		
19	6.3.3(1)	to present a revised version of the proposal for the Development of a WIGOS Monitoring and Fault Management System to the ICG-WIGOS SG-QM meeting on the 23 rd to 24 th of April for consideration and further development	ET-SBO Chair	April 2014
20	6.3.3(2)	to consider the revision of the content of Volume A and the associated regulatory material, taking into consideration the developments of the observing system surface capabilities database of OSCAR and also the responsibilities of the Regional Associations	ET-SBO Chair	ASAP
21	6.3.3(3)	to start its work at the earliest opportunity to ensure the Weather Radar Data technology makes a greater contribution to the global observing systems	Chair TT-WRDE & Secretariat	ASAP
22	6.3.3(4)	to consider possibilities for joint meetings and collaboration with CIMO teams as appropriate	ET-SBO Chair	Ongoing
23	6.3.3(5)	to publish wind profiler radar survey report as a WIGOS technical document after final review by ET-SBO	Secretariat	end June 2014
24	6.3.3(6)	The Team requested the ET-SBO to prioritize EGOS-IP G10, to review the potential to improve the global radiosonde network to take account of all application areas.	ET-SBO	ASAP
25	6.4.3(2)	to submit such a proposal to CBS Ext.(2014) for organizing ET-SAT meetings side by side with CGMS meetings with reduced membership and limited (DSA) funding for core members, and with ToR focusing on operational issues.	Chair ICT-IOS	Sep. 2014
26	6.5.4(1)	to undertake revision of the Manual on GOS, and related WMO guidance material, in relation to volcanic ash, taking into consideration especially practices and procedures related to use of satellite products	ET-SUP	mid. 2015
27	6.5.4(2)	to consider the development of a mechanism and associated standards and procedures that will allow Members to be able to seek high temporal resolution satellite information from the satellite operators, leading up to and in the event of emergency situations such as Typhoon Hiyon	ET-SUP	June 2014
28	6.6.3	to finalize the draft Recommendation for its submission to CBS Ext.(2014) on the enhancement and expansion of aircraft-based observations and AMDAR in line with the global actions of the EGOS-IP	Chair ICT-IOS	End May 2014
	6.6.4(1)	to consider opportunities for joint meetings to be held with CIMO Task Team (to become Expert Team next CIMO inter-sessional)	ET-ABO & Secretariat	Ongoing
29	6.6.4(2)	to consider how to improve and optimise data coverage taking into consideration the low impact of observation in some areas and at some airports due to oversupply of redundant data	ET-ABO	Ongoing
30	6.6.4(3)	to work with the Secretariat to ensure that the ABOP Strategy and Implementation Plan is incorporated (or referenced by) the WIGOS framework Implementation Plan, and references made in the R-WIPs	ET-ABO Chair	2015
31	6.7.8	to request the Met Office (UK) to undertake a revision and update of the observing system economic value assessment with a view to reassessing the impact and value of the ASAP programme and to determine possible recommendations to be made to CBS (2014)	IPET-OSDE Chair	End Apr. 2014
32	6.7.9	to undertake further studies to clarify the impact of ASAP, and thereby to better understand the impact per cost of the ASAP measurements in relation to other systems	IPET-OSDE	2016

ICT-IOS-8, Final report

No.	Ref.	Action item	By whom	Deadline
33	6.7.11	to develop a formal Recommendation to CBS Ext.(2014)	Chair ICT-IOS	End May 2014
34	6.8.7	to work towards finding and establishing relevant agreements with a Member to host the next "Impact" Workshop, and to subsequently ensure a host organising committee is formed	WIGOS PM	Sep. 2014
35	6.8.8	to work with Secretariat (WIGOS PM & D/OBS) to establish a programme committee for the organisation of the 6th Workshop on Impact of Various Observing Systems on NWP (2016) in consultation with the WWRP DAOS WG	R-SEISs	Sep. 2014
36	6.9.3(1)	to develop a formal Recommendation to CBS Ext.(2014) for Cg-17 on radio-frequencies for meteorological and related environmental activities	Chair SG-RFC & Secretariat	end May 2014
37	6.9.3(2)	to assist for the organization of the SG-RFC meeting to be held in November 2014 in preparation for CPM15-2	Secretariat	Nov. 2014
38	7.1.7	to organize a second OSDW workshop prior to ICG-WIGOS-4	Secretariat	Jan. 2015
39	7.2.3	to define and draft description of the role and responsibilities within their organizations of the NFPs for the RRR, including for the monitoring of actions of the EGOS-IP	IPET-OSDE Chair	ASAP & ongoing
40	7.2.4	to write to Members to request them to nominate someone who will also be tasked to provide feedback on status of actions of the EGOS-IP	WIGOS PO	ASAP
41	8.4.2	to prepare the first draft of the text to be included in the General Summary of the CBS session, including summary of activities, updated work plans with status for the Expert Teams, and recommendations to the CBS	ICT-IOS Chair	May 2014

**PROPOSED CHANGES TO THE TERMS OF REFERENCE OF THE EXPERT TEAM ON WIGOS
FRAMEWORK IMPLEMENTATION MATTERS (IPET-WIFI)**

Last updated: 21/03/2014

(To Be Submitted for Approval by CBS-XVI)

The Inter Programme Expert Team on WIGOS Framework Implementation Matters (IPET-WIFI) shall:

- (a) Address integration aspects of WIGOS as defined in the WIGOS Framework Implementation Plan, **based on advice from ICG-WIGOS**;
- (b) Provide technical advice, guidance, practices and procedures for WIGOS Framework Implementation, in collaboration with CIMO; with priorities to be given to **the GOS-related component of:**
 - (i) WIGOS Regulatory Material (such as WIGOS Manual, GOS Manual and Guide), in collaboration with the relevant WMO Programmes and TCs;
 - (ii) Standards for basic WIGOS metadata (e.g., those agreed for international exchange and for WIGOS Operational DB), including the access to WIGOS metadata;
 - (iii) WIGOS Quality Management, including monitoring;
 - (iv) WIGOS Information Resource **in collaboration with other OPAG-IOS Expert Teams**;
 - (v) , WIGOS standards and best practices;
 - (vi) Capacity development, education and outreach strategy;
- (c) The IPET WIFI is envisaged to encompass three sub-groups (SGs), each to be activated as/when required:
 - (i) Sub-group on Regulatory Material;
 - (ii) Sub-group on Metadata;
 - (iii) Sub-group on QM.

**PROPOSED TOPICS FOR NWP IMPACT STUDIES RELEVANT TO THE EVOLUTION OF
GLOBAL OBSERVING SYSTEMS**

(as approved by ICT-IOS-8, 10 April 2014)

Short name: Full name	Science question
Surface-based	
S1MarinePs: Surface pressure over ocean	What density of surface pressure observations over ocean is needed to complement high-density surface wind observations from satellites
S2AMDAR: Coverage of AMDAR	What are the priorities for expansion of the AMDAR network? How does the impact vary over the globe? Provide guidance for AMDAR optimisation.
S3Radar: Radar observations	What are the impacts of current radar observations, including radial winds and reflectivities?
S4Strat: In situ observations of the stratosphere	What network of in situ observations is needed in the stratosphere to complement current satellite observations (including radio occultation)? What about the tropics?
S5PBL: Observations of the PBL for regional and high-resolution NWP	What should be the focus of improvements for observations of the planetary boundary layer (PBL) in support of regional and high-resolution NWP? Which variables and what space-time resolution?
Space-based	
S6SatLand: Satellite sounding over land and ice	What is the impact of new developments in the assimilation of radiance data over land and sea ice?
S7Sounders: Impact of multiple satellite sounders	What benefits are found when data from more than one passive sounder are available from satellites in complementary orbits, e.g. the current unprecedented availability of four hyper-spectral sounders?
S8AMVs: Atmospheric Motion Vectorss	Based on evidence from current AMV impacts, which AMV characteristics should be enhanced for the next generation of GEO satellites? What are the impacts of recent new types of AMVs such as MISR-AMV?

General

S9UA: Regional upper-air network design studies	Upper-air network design studies such as those that have been performed for the European composite observing system (EUCOS) are required also in other regions, especially in Region I where the basic networks are under pressure.
S10AdjEns: Application of adjoint and ensemble methods	What insights can be gained from adjoint and ensemble-based impact measures tailored for applications such as severe weather, aviation and energy? Specific impact metrics may be required.
S11Ocean: Impact in ocean-coupled assimilation	Which ocean observations are particularly important for NWP? Investigate the role of ocean observations in coupled atmosphere-ocean data assimilation with a focus on the 7-14 day range.
S12Land: Impact in land-coupled assimilation	Which land-surface observations are particularly important for NWP at all time ranges? Investigate the role of surface observations in coupled atmosphere-land data assimilation with a focus on the 7-14 day range.
S13 Time frequency	What is the required time frequency of observations? Consider AMDAR, GEO satellites and ground-based remote sensing observations (such as Doppler radar, wind profiler, ground based GNSS receivers) for regional and global NWP.
S14 Atmospheric composition	Study observation impact in atmospheric composition and air quality applications.
S15 OSSEs	Observing system simulation experiments are encouraged in support of satellite system design criteria such as orbit configurations..

PROPOSED SPLIT OF RESPONSIBILITY WITHIN WMO FOR THE MANAGEMENT OF OSCAR

1. The Eighth Session of the ICT-IOS concurred with the recommendations of the First Session of the Inter-Programme Expert Team on the Observing System Design and Evolution (IPET-OSDE-1, Geneva, Switzerland, 31 March - 3 April 2014) regarding the ownership, overall coordination mechanisms, as well as reporting requirements concerning the development and operations of OSCAR.

2. The ICT-IOS agreed to propose the following split of responsibilities within WMO to the CBS and other appropriate bodies such as the ICG-WIGOS:

WMO Group or Team	Role	Reporting to
ICG-WIGOS	High level guidance	EC/Cg
ICG-WIGOS TT-WMD	Definition of WIGOS core metadata	ICG-WIGOS
ICG-WIGOS TT-WRM	Related Regulatory Materials	ICG-WIGOS
ICG-WIGOS TT-QM	Related quality management	
ICT-IOS	Owner	ICG-WIGOS
IPET-WIFI	1) Overall coordination and leadership at the technical level 2) Regulatory Materials and metadata required in liaison with ICG-WIGOS and its dedicated Task Teams	ICT-IOS
IPET-OSDE	1) Functional requirements with regard to the tools required for the RRR process 2) Review content required for the RRR process	IPET-WIFI
ET-SAT ¹	1) Space-based observing systems capabilities	IPET-WIFI
ET-ABO ²	Aircraft-based observing systems capabilities	IPET-WIFI
ET-SBO	Surface-based observing systems capabilities	IPET-WIFI
CIMO	Instrument metadata	ICG-WIGOS
JCOMM OCG	Ocean observing systems capabilities	IPET-WIFI

Table 1: Proposed split of responsibilities regarding OSCAR

2. ICT-IOS-8 also reviewed the role and responsibilities of the WMO with regard to OSCAR project development and long term maintenance and operations as foreseen in the MoU with MeteoSwiss, and agreed to recommend the following reporting mechanism to the CBS and ICG-WIGOS (Tables 2 and 3 below):

Role and responsibility	Reporting to	IPET-OSDE comment
Collaborate with MeteoSwiss in further specifying the project goals and functional requirements of OSCAR (lead: WMO)	IPET-WIFI	

¹ ET-SUP and IPET-OSDE have a role of reviewing OSCAR content proposed by ET-SAT

² if necessary, the ET-ABO will consult with the CIMO TT on Aircraft Based Observations (TT-ABO)

Provide human resources, including project lead and requirements engineer, in support of the project;	WMO Secretariat	
Establish the necessary conditions and WMO-internal support for the migration of the "Requirements", "Space" and "Vol A" components of OSCAR to MeteoSwiss;	IPET-WIFI	Quality should be maintained during migration.
Establish agreements with the data owners and/or operators of external data sources regarding operational delivery of metadata needed for OSCAR	IPET-WIFI	
Inform MeteoSwiss on milestones achieved and major deviations from the project plan	WMO Secretariat	

Table 2: WMO responsibility and proposed reporting mechanisms for the OSCAR project development

Role and responsibility	Reporting to	IPET-OSDE comment
WMO shall seek contributions from WMO Members to the WIGOS Trust Fund for OSCAR; such contributions shall then be earmarked to OSCAR	ICG-WIGOS	
WMO shall establish a line item into the WIGOS Trust fund dedicated to the operations, maintenance, and future evolutions of OSCAR.	ICG-WIGOS	
Recognizing that the cost of operating, maintaining, and evolving OSCAR will be directly supported by MeteoSwiss, the WMO shall contribute financially to such cost through a contract to be established with MeteoSwiss in due course	WMO Secretariat	
Maintain the content of the OSCAR system [overall data owner] and provide human resources for quality monitoring of the system, coordination with Members contributing information to the system, reporting, and liaison with MeteoSwiss regarding maintenance, and future evolutions of the system	IPET-WIFI in consultation with IPET-OSDE	
Ensure the cooperation of the external (machine-to-machine) data providers	WMO Secretariat	
Propose future evolutions of the system	IPET-WIFI	
Inform MeteoSwiss on any issues concerning this collaboration	WMO Secretariat	

Table 3: WMO responsibility and proposed reporting mechanisms for the long term maintenance and operations of OSCAR

ICT-IOS RECOMMENDATIONS TO CBS EXT.(2014) REGARDING THE IMPLEMENTATION OF OBSERVING SYSTEMS IN THE REGIONS

RA-I

- Highest priority should be given for each Member in the Region to: (a) Improve and restore surface and upper-air observational capabilities of the RBSN/RBCN; and (b) To improve data quality, regularity, and coverage of surface observations of the RBSN/RBCN. The high cost of running upper air stations was cited as a reason for the low number of upper air stations which are operational. Enhanced support to the GUAN network should be included in the R-WIP as a high priority matter, and PRs should allocate more resources towards this activity. Results of impact studies should be highlighted.
- Urging Members to comply fully with the global and regional coding procedures and data collection standards in accordance with procedures laid down in the WMO Technical Regulations and the Manuals on the GOS, on Codes, and on the GTS when operating the RBCN stations.
- Urging members to continue their efforts to install ground weather radar stations for detecting precipitation, including heavy rain, hail and other severe weather phenomena, and to exchange on a bilateral or multi-lateral basis the meteorological information so obtained using the appropriate WMO code form (e.g., FM 94-IX Ext. BUFR).
- Mechanism should be proposed and established for following up regarding those sites, which are routinely providing suspect observations.
- To encourage Members in the region to participate in the AMDAR programme following the proposal made in the Regional Implementation Plan for AMDAR.

RA-II (pending issues from ICT-IOS-7)

- Focus should be put on quality control procedures, metadata availability, integration of observational data and products, and improving traceability of the instruments in the region
- Active cooperation with all Members in the region is needed on the issue of silent stations;
- The integration of observing systems especially, radar and ground-based lightning detection networks etc. is required.

RA-III

- There is a need to increase density of the upper air network, and CBS encourages initiation of a regional project to address this issue.
- To further develop AMDAR in the region, and engage more countries.
- Engage more countries in the regional and international real-time exchange of AWS data.
- To continue the effort for exchanging at the national and regional level the surface weather radar data.
- Real-time monitoring of operational observational data should be promoted in the region.
- Improve the exchange of high resolution upper air observations.

RA-IV

- Continue and improve regional exchange of surface weather radars data
- Further develop and exploit web services for climate data, and promote international agreements for data sharing, as well as undertake efforts for surface data collection under the auspices of the International Surface Temperature Initiative in order to increase the daily periods of record for surface stations and the number of station records that can be routinely updated.

- Optimize AMDAR network in the region

RA-V

- Greater efforts by Members should be made in ensuring that their operational observing stations compile and transmit the climate-related messages according to existing WMO regulations
- Continue and strengthen the integration of the RBSN & RBCN and other networks; and improve the data sustainability and availability performance of RBSN & RBCN to a satisfactory level to meet service requirements
- To clarify the contribution of the region in GCW
- In order to protect present and future services provided by NMHSs for timely warning of impending natural and environmental disasters, accurate climate prediction and detailed understanding of the status of global water resources, it is essential that RA V Permanent Representatives ensure that national positions on radio-frequency matters recognized the results of studies related to sharing of frequency bands allocated for meteorological and related environmental activities with other radiocommunications systems and especially that IMT/RLAN systems are made available to the wider radio-frequency management community.

RA-VI

- Organize and conduct a regional WIGOS Workshop to support the WIGOS implementation in RA VI at national level.
- Continue supporting the migration to Table Driven Code Forms

Antarctica

- There is a need for a dedicated monitoring centre to pick up when AntON stations drop out and to give feedback on any issues that arise.
- For surface synoptic stations and upper air stations, continued support is required for long term monitoring of basic meteorological parameters.
- Attention should be given to the issue of surface CLIMAT stations, where (i) AWS often only measure a limited range of parameters, and (ii) CLIMATs for AWS are often not available until data is downloaded and quality controlled (this may be after mid-month or more).

PROPOSED NEW TERMS OF REFERENCE OF THE EXPERT TEAM ON SATELLITE SYSTEMS (ET-SAT)

The Expert Team on Satellite Systems (ET-SAT) shall:

1. Assess and document, in the framework of the WMO Rolling Review of Requirements, the actual and planned capabilities of operational and R&D satellites constituting the space-based component of WIGOS and their adequacy to meet the WMO requirements for satellite data and products. This will be achieved in considering the information provided by participating agencies as well as the outcome of CGMS and CEOS, including e.g. the progress of CEOS constellations; the feedback from WMO should be communicated to CGMS and CEOS.
2. Provide technical advice on implementation of integrated satellite observing systems.
3. Assess progress of R&D and demonstration satellite systems, and identify opportunities and/or problem areas concerning satellite technology and plans
4. Coordinate with ET-SUP and other relevant CBS teams on satellite related matters.

**PROPOSED TEXT FOR INCLUSION IN THE MANUAL ON WIGOS REGARDING
WIGOS STATION IDENTIFIERS**

Members shall issue WIGOS station identifiers for observing stations and platforms within their geographic area of responsibility that contribute to a WMO or co-sponsored programme and shall ensure that no WIGOS station identifier is issued to more than one station.

Note. Members may issue WIGOS station identifiers for observing stations and platforms within their geographic area of responsibility that do not contribute to a WMO or co-sponsored programme, provided that the operator has committed to providing and maintaining WIGOS metadata.

Before issuing a station identifier, Members should ensure that the operator of a station or platform has committed to providing and maintaining WIGOS metadata for that station or platform and to conforming to relevant Technical Regulations.

Note. In circumstances when a WIGOS identifier is required for a station or platform to support a WMO or co-sponsored programme and no Member (e.g. Antarctica) is able to issue a WIGOS identifier, the Secretary General may issue a WIGOS station identifier for that station or platform provided that its operator has committed to:

- a) providing WIGOS metadata and
- b) conforming to relevant Technical Regulations.

Note. In circumstances when a WIGOS identifier is required for a station or platform to support a WMO or co-sponsored programme and a Member is not able to issue a WIGOS identifier, the Secretary General will work with the Member concerned to issue a WIGOS station identifier for that station or platform provided that its operator has committed to:

- a) providing WIGOS metadata and
- b) conforming to relevant Technical Regulations.

DRAFT RECOMMENDATION NO. ??? (CBS-EXT.(2014))
**ENHANCEMENT AND EXPANSION OF AIRCRAFT-BASED OBSERVATIONS AND AMDAR IN
LINE WITH THE GLOBAL ACTIONS OF THE CBS IMPLEMENTATION PLAN FOR EVOLUTION
OF THE GOS**

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

- (1) The operational status of the AMDAR observing system, as a component of the Global Observing System and the World Weather Watch Programme;
- (2) The overall significant and positive impact of the increasing availability of aircraft-based observations on the GTS;
- (3) The great potential to address deficiencies in upper air data coverage over many WMO Regions through further development and expansion of AMDAR and aircraft-based observations; and
- (4) The justification for the expansion and enhancement of aircraft-based observations based on the relevant global actions within the CBS Implementation Plan for the Evolution of the Global Observing System.

Considering that:

- (5)) The CBS Expert Team on Aircraft-Based Observing Systems (ET-ABO) has undertaken a study that identifies many airlines that can be targeted by Members for participation in the AMDAR programme to address gaps in upper air data coverage;
- (6) ET-ABO has consolidated and updated standards and guidance material that can assist Members in the development of new AMDAR programmes; and,
- (7) Efficiencies in use of Member resources and more optimal data coverage can be achieved through regional collaboration on the planning and development of national aircraft-based observations programmes.

Recommends that:

- (8) CBS encourages Regional Associations and WMO Members to consider further and new development of aircraft-based observations, primarily through wider implementation of the AMDAR programme; and,
- (9) CBS endorses a process whereby Regional Associations and Members collaborate with CBS to develop, maintain and implement regional plans for the enhancement and expansion of aircraft-based observations and AMDAR, which might be maintained under the respective Regional WIGOS Implementation Plans of each Regional Association.

Requests CBS to request that the Secretariat provides support for the coordination of the development and maintenance of these planning and implementation activities through appropriate promotion to Members and at each Regional Association Session.

ACRONYMS

AMDAR	Aircraft Meteorological Data Relay
AMMA	African Monsoon Multidisciplinary Analyses
AntON	Antarctic Observing Network
AOPC	Atmospheric Observation Panel for Climate
ASAP	Automated Shipboard Aerological Programme
ATT	Antarctic Task Team Meeting
AWS	Automatic Weather Station
CAS	Commission for Atmospheric Sciences
CBS	Commission for Basic Systems
CBS-LC-GCOS	CBS Lead Centres for GCOS
CD	Capacity Development
CEOS	Committee on Earth Observation Satellites
Cg	Congress
CGMS	Coordination Group for Meteorological Satellites
CIMO	Commission for Instruments and Methods of Observation
CMA	China Meteorological Administration
DoD	US Department of Defense
E-AMDAR	EIG EUMETNET AMDAR programme
E-ASAP	EIG EUMETNET Automated Shipboard Aerological Programme
EC	Executive Council
ECMWF	European Centre for Medium-Range Weather Forecast
EC-PORS	Executive Council Panel of Experts on Polar Observations, Research and Services
ECV	Essential Climate Variable
EGOS-IP	Implementation Plan for the Evolution of Global Observing Systems
EIG	Economical Interest Group
E-PROFILE	EIG EUMETNET Radar Wind Profilers and Backscatter Lidars programme
E-SURFMAR	EIG EUMETNET Surface Marine observation programme
ET-ABO	OPAG-IOS Expert Team on Aircraft-Based Observing Systems
ET-SAT	OPAG-IOS Expert-Team on Satellite Systems
ET-SBO	OPAG-IOS Expert Team on Surface-Based Observing Systems
ET-SUP	OPAG-IOS Expert Team on Satellite Utilization and Products
EUMETNET	EIG Grouping of European Meteorological Services
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
E-WINPROF	EIG EUMETNET Operational Networking of Wind Profilers in Europe
FSO	Forecast Sensitivity to Observation
GAW	Global Atmosphere Watch
GCM	GCOS Cooperation Mechanism
GCOS	WMO-IOC-UNEP-ICSU Global Climate Observing System
GCW	Global Cryosphere Watch
GEO	Group on Earth Observations
GEO	Operational geostationary satellites
GEWEX	Global Energy and Water Exchanges Project
GFCS	Global Framework for Climate Services
GLAS	GEWEX Global Land/Atmosphere System Study
GNSS	Global Navigation Satellite System
GOS	Global Observing System
GPS	Global Positioning System
GPSRO	GPS Radio Occultation
GRUAN	Global Reference Upper Air Network
GSG	GCW Steering Group
GSICS	Global Satellite Intercalibration System
GSN	GCOS Surface Network
GSNMC	GSN Monitoring Centre
GTOS	Global Terrestrial Observing System

GTS	Global Telecommunications System
GUAN	Global Upper Air Network
IBCS	Intergovernmental Board on Climate Services
ICG-WIGOS	Inter-Commission Coordination Group on WIGOS
ICT-IOS	OPAG-IOS Implementation Coordination Team on Integrated Observing Systems
ICT-ISS	OPAG-ISS Implementation Coordination Team on Information Systems and Services
IGOS	Integrated Global Observing Strategy
IPET-DRMM	OPAG-ISS Inter-Programme Expert Team on Data Representation Maintenance and Monitoring
IPET-OSDE	OPAG-IOS Inter-Programme Expert Team on the Observing System Design and Evolution
IPET-WIFI	OPAG-IOS Inter-Programme Expert Team on WIGOS Framework Implementation Matters
ITU	International Telecommunication Union
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
KAA	Key Activity Area
LAM	Limited Area Model
LEO	Operational low-Earth orbit satellites
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Centre
NCEP	NOAA National Centers for Environmental Prediction
NFP	National Focal Points
NMHSs	National Meteorological and Hydrological Services
NOAA	US National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
OCG	JCOMM Observations Coordination Group
OOPC	Ocean Observations Panel for Climate
OPA	JCOMM Observations Programme Area
OPAG	Open Programme Area Group
OPAG-DPFS	CBS OPAG on Data-Processing and Forecasting System
OPAG-IOS	CBS OPAG on Integrated Observing Systems
OPAG-ISS	CBS OPAG on Information Systems and Services
OPERA	EIG EUMETNET Operational Programme for the Exchange of Weather Radar Information
OQIS	WIGOS Observations Quality Information System
OSCAR	Observing Systems Capability Analysis and Review Tool – www.wmo.int/oscar
OSE	Observing System Experiment
OSND	Observing system network design
OSSE	Observing System Simulation Experiment
PoC	Point of Contact
QM	Quality Management
R&D	Research and Development
RA	Regional Association
RBCN	Regional Basic Climatological Network
RBON	Regional Basic Observing Networks
RBSN	Regional Basic Synoptic Network
R-MAR	OPAG-IOS Rapporteur on Marine Observing Systems
RRR	Rolling Review of Requirements
R-SEIS	OPAG-IOS Co-Rapporteur on Scientific Evaluation of Impact Studies undertaken by NWP centres
RTH	Regional Telecommunication Hub
R-WIP	Regional WIGOS Implementation Plan
SG-RFC	OPAG-IOS Steering Group on Radio-Frequency Coordination
SoG	Statement of Guidance

TDCF	Table Driven Code Form
TPOS	Tropical Pacific Observing System
TT-WQM	ICG-WIGOS Task Team on WIGOS Quality Management
TT-WRM	ICG-WIGOS Task Team on WIGOS Regulatory Materials
USA	United States of America
VCP	Voluntary Cooperation Programme
WHOS	WMO Hydrological Observing System
WIGOS	WMO Integrated Global Observing System
WIP	WIGOS Framework Implementation Plan
WIR	WIGOS Information Resource
WIS	WMO Information System
WWW	World Weather Watch

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