W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

COMMISSION FOR AERONAUTICAL METEOROLOGY

MANAGEMENT GROUP
2016

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FINAL REPORT

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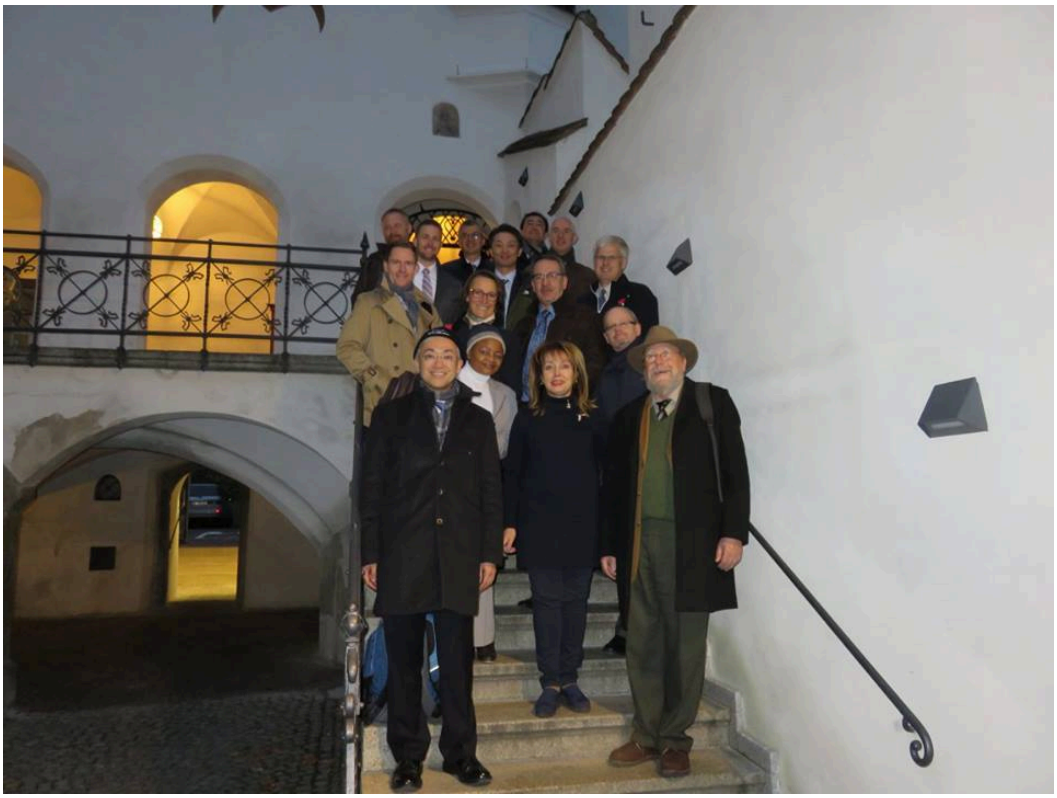

1. OPENING OF THE MEETING

1.1 The meeting was opened by Mr Chi Ming Shun, President of the Commission for Aeronautical Meteorology (P/CAeM). In his opening remarks, Mr Shun emphasized that there had been in excess of 20 meetings on aeronautical meteorology since the last CAeM Management Group (MG) meeting held in May 2015, in particular those on the WMO side and on the ICAO side, and that there was a considerable amount of activity and progress to report, including the recent outcomes of the Second Meeting of the ICAO Meteorology Panel (METP/2) held in Montreal in October 2016. Mr Shun indicated that the MG meeting now served as an opportune moment to take stock of the recent progress and to plan ahead, particularly in view of the CAeM-16 Session to be held in 2018 where major decisions on the future of aeronautical meteorology would be made and a milestone where WMO could provide a strong position on the issues. Mr Shun alluded to the fact that, as a president of a WMO technical commission (TC), he was engaged in regular dialogue with other TC presidents and others concerned regarding a restructuring of the WMO constituent bodies. Mr Shun closed by noting that issues such as public-private partnerships (PPP) and so-called 'Big Data' were deserving of considerable attention by WMO now and going forwards.

1.2 Dr Xu Tang, Director of the Weather and Disaster Risk Reduction Services Department (D/WDS), welcomed participants on behalf of WMO and expressed thanks to the government of Austria and to the municipality of the town of Hall-in-Tirol for hosting the meeting. Dr Tang also expressed appreciation to Dr Herbert Puempel of AustroControl for his assistance in the logistical arrangements for the meeting. In his opening address, Dr Tang emphasized five major current developments in WMO that were of relevance to the CAeM, namely: acknowledging that CAeM is efficient and highly focussed, thus encouraging its active engagement in the ongoing effort of WMO to enhance effectiveness and efficiency of all its bodies (including the technical commissions), the development of a new vision for the future global data processing and forecasting system (GDPFS), the role of science and its application especially the joint CAeM and CAS effort in applying nowcasting science to benefit ATM operations, the expected contribution of the work of CAeM ET-GOV to the ongoing public-private partnership discussion within WMO, and the long-term stepwise planning of AeMP for ICAO Global Air Navigation Plan (GANP) and aviation system block upgrade (ASBU) methodology will serve as a good reference for WMO strategic planning process. Dr Tang closed by noting that, with these five key messages, the CAeM should be fully aligned with the WMO on-going priority tasks, especially given that aviation meteorology is one of the priority areas of the current (2016-2019) WMO Strategic Plan.

1.3 Dr Herbert Puempel proudly welcomed participants on behalf of the hosts. Dr Puempel alluded to his long working relationship with WMO, with his first interaction with WMO in 1982 and with the CAeM in 1990. Dr Puempel indicated that the way forward in aeronautical meteorology would be an interesting one, including from the traditional State-oriented approach to service provision to emulating the private sector approach in many instances. In this regard, Dr Puempel sounded a note of caution that while the private sector may be comparatively better today at the packaging and outreach of products and services to the customers than the traditional approach, the increasing commercial pressures on such private entities can sometimes lead to compromised quality which was a concern. Dr Puempel therefore emphasized that WMO and its Members deserve the trust of ICAO and other partners, particularly in the provision of credible, fit-for-purpose information, which was a huge responsibility and one that was critical for continued safe and efficient aviation operations on the ground and in the air.

1.4 The meeting adopted the agenda as shown in **Annex 1**. The list of participants was as shown at **Annex 2**.

2. REVIEW OF ACTION LIST (Doc. 2)

2.1 The MG recalled that the last full meeting of the CAeM-MG was held from 12 to 14 May 2015 in Cape Town, South Africa, and that the MG had formulated an action list comprising 10

actions. The MG reviewed the action list accordingly and updated the status of actions as shown in **Annex 3**.

2.2 The MG recalled that it had conducted teleconferences on 18 December 2015, 2 February 2016 and 14 April 2016 principally to review the status of follow-up of actions arising from the previous full meeting and teleconference(s), to assist and oversee the progression of the work of the MG and the CAeM expert teams (ETs), to exchange information on recent meetings/events and prepare for upcoming meetings/events, and to address coordination needs including with ICAO. The MG appreciated that a summary of discussions was prepared and circulated amongst the MG subsequent to each teleconference.

2.3 The MG agreed that it would be essential to continue to convene teleconferences during the intersession period, typically on a quarterly basis and at other times as necessary, and requested the Secretariat to prepare and coordinate a schedule for 2017 accordingly. **Action A01-2016**

2.4 The MG agreed that the Action List (table) provided in **Annex 4** should be used as a tracking tool for the status of follow-up of actions agreed by the MG. The MG agreed that it would be beneficial to maintain the Action List on the WMO extranet AeMP website, which was under development, including a unique identifier and follow-up status scheme that more clearly denotes the origin and status of the actions agreed. **Action A02-2016**

2.5 The MG emphasized that all actions identified and agreed by the MG should be SMART (specific, measurable, assigned, realistic and time-bound).

3. REPORT OF THE PRESIDENT OF CAeM (Doc. 3 and Presentation)

3.1 P/CAeM, Mr Chi Ming Shun, presented his report covering the period since the last full meeting of the CAeM-MG. In his presentation, Mr Shun highlighted the following developments:

- Cg-17 reconfirmed Aeronautical Meteorology as one of the WMO strategic priorities and agreed with the proposed CAeM action plan;
- Joint meeting of ET-ETC and ET-GOV (having joint activities with ICAO METP AG-MCRGG) was held in Wellington, New Zealand in December 2015 and ET-CCP meeting was held in St Petersburg, Russian Federation in May 2016 with tangible results;
- Good progress has been made by Members in the implementation of QMS and AMP competency assessment. Further updates are expected from the Global Survey;
- Letters were sent by WMO SG to remind Members on the entry into force of the WMO standard on required qualifications of AMF on 1 December 2016 and the training and educational opportunities offered by RTC for Members in need;
- A series of events were organized or being planned to increase the awareness of Members to the changes in aeronautical MET services arising from ICAO GANP and ASBU methodology, in particular the WMO RA VI European Conference on MET for Aviation (ECMA) held in October 2015 and the WMO RA I African Conference on MET for Aviation (ACMA) being organized for 2017;
- New aeronautical MET services are being developed/offered by private sectors as well as NMHSs meeting evolving aviation user needs, with focus on trajectory-based operations, high-impact weather, and integration of MET information with ATM;
- Useful inputs on climate change impact on aviation were provided by ET-ASC to the ICAO Committee for Aviation Environmental Protection (CAEP) as well as a recent article in WMO Bulletin 65;

- A WMO stakeholders survey conducted in May 2016 identified threats related to aeronautical MET services, namely, proliferation of private weather services, competition from global and regional weather providers, and pressure on NMHS's role due to external developments;

- Aviation highlighted as priority by majority of RAs.

3.2 In addition, Mr Shun emphasized the importance of the ET-GOV Global Survey results, which are expected to be available in early 2017, providing a global landscape for better baseline supporting strategic planning and guidance. The ET-GOV report on regional service provision models expected in December 2016 and the ET-GOV information paper on global cost recovery models for aeronautical meteorological service provision expected in early 2017 will provide very useful inputs to the work of impact assessment.

3.3 As regards the progress of the work to improve guidance provision, Mr Shun highlighted that development of IWXXM has reached the milestone of version 2.0, and guidance and training had started to be made available. Further regional training was expected to be organized in 2017. The work by ET-GOV for updating WMO-No. 732 to replace WMO-No. 731 and 732, and for updating WMO-No. 904 has been in progress at different stages.

3.4 As regards the development of regulatory provisions with ICAO, the president, vice-president, WMO Secretariat as well as core experts of the ETs have contributed actively to the work of ICAO Meteorology Panel (METP) and its working groups. Particular contributions include:

- ET-ISA supported publication of ICAO MET Information Integration for TBO Concept, now renamed as Concept for the Integration of Meteorological Information for ATM;

- IUGG/WMO VASAG and WMO VAAC Best Practices supported ICAO METP MISD-VA & MOG-VA; and

- CBS/CAeM ICTSW supported ICAO METP MISD-SW (with IPT-SWISS to be established at CBS-16 with co-chairs from CBS and CAeM).

3.5 Mr Shun however pointed out that the heavy workload, limited resources and ambitious work plans could hinder work progress on both ICAO and WMO sides. He also highlighted issues arising from the recent METP/2 meeting held in October 2016 with recommendations deviating from the inter-governmental agreements reached at the Conjoint Meteorology Divisional Meeting in 2014. He requested the MG to ponder over the notion of "No Country Left Behind" and how this could be ensured in developing the future aeronautical MET services for GANP and ASBU.

3.6 Mr Shun also invited the MG to consider the future role of WMO and in particular CAeM amidst the international trend of ever-increasing user demands for enhanced aeronautical meteorological services with global support and severe competition from the private sector. He suggested that a holistic approach would be needed as such trends are also affecting other WMO programmes, e.g. public weather services, at the same time.

3.7 Finally, Mr Shun also draws the MG's attention to the following forward-looking tasks which will have important bearings on the future of the CAeM:

- Preparation of the Long-term Plan for AeMP as requested by Cg-17;

- CAeM position on ICAO METP MCRGG White Paper on Future Aeronautical Meteorology Information Delivery;

- WMO Scientific Event 2017;

- Update of the WMO/ICAO Working Arrangements;
- Future structure of Technical Commissions;
- Inputs to WMO's organization-wide discussions on Public Private Partnerships and Big Data; and
- Preparation of CAeM-16 which will be a milestone where WMO could provide strong position on various issues.

3.8 During its consideration of the report of P/CAeM, the MG noted that aircraft-based observations were currently under the remit of the Commission for Basic Systems (CBS). The MG questioned whether there was a need to reinstate aircraft-based observations in the work programme of the CAeM given, not least, the recognition in ICAO's GANP that aircraft based meteorological observations are an enabler to enhanced operational decisions through integrated meteorological information, and the increasing importance of their availability to the wider MET community in view of their benefits in improving forecasting for TMA and airports. In this regard, the MG agreed to determine the need and feasibility of reinstating aircraft-based observations in the work programme of the CAeM. **Action A03-2016**

4. REVIEW OF THE WORK PROGRAMME IMPLEMENTATION

4.1 Experts Teams Reports

4.1.1 Expert Team on Governance (ET-GOV) (Doc. 4.1(1))

4.1.1.1 Jan Sondij and Kent Johnson presented a report on the key tasks and activities of ET-GOV, specifically:

- Monitor global landscape of aeronautical meteorological service provision (Activity 1);
- Guidance on the oversight of aeronautical meteorological service provision (Activity 2);
- Governance issues (Activity 3);
- Guidance on roles and responsibilities of meteorological authorities and meteorological service providers (Activity 4);
- Review of WMO-No. 732, Guide to practices of meteorological offices serving aviation (Activity 5);
- Address WMO and ICAO data management and governance policies (Activity 6);
- Coordination of evolution of WMO regulatory and guidance material on aeronautical meteorology (Activity 7); and
- Report on progress of WMO CAeM ET-GOV (Activity 8).

4.1.1.2 The MG noted that ET-GOV and ET-ETC had held a joint meeting in Wellington, New Zealand in November/December 2015, and that ET-GOV had been represented at the ET-CCP meeting in St. Petersburg, Russian Federation in May 2016. The MG further noted that ET-GOV was represented in an ICAO METP ad hoc group on meteorological cost recovery and governance guidance (MCRGG).

4.1.1.3 In respect of monitoring the global landscape of aeronautical meteorological service provision (Activity 1), the MG welcomed news that an online global survey of WMO Members

had commenced in October 2016. The MG was informed that the findings of the global survey were to be expected in early 2017 and made available via the AeMP website.

4.1.1.4 In respect of guidance on the roles and responsibilities of meteorological authorities and meteorological service providers (Activity 4), the MG considered Annex 2 to Doc. 4.1(1) which presented a skeleton (straw man) of a potential new publication, subject to the outcome of the global survey and further coordination with the AG-MCRGG.

4.1.1.5 In respect of the review of WMO-No. 732 (Activity 5), the MG considered Annex 3 to Doc. 4.1(1) which presented a proposed skeleton (straw man) for the new/consolidated publication. The MG agreed to provide ET-GOV with feedback on the proposed straw man accordingly. **Action A04-2016**

4.1.1.6 Concerning the composition of ET-GOV, the MG noted that Juana Ravines Ruiz (Peru) had been unable to continue as a core member due to changes in her home organization. Consequently, ET-GOV was pleased to welcome Miriam Andrioli (Argentina) as new core member of the team.

4.1.2 Expert Team on Communication, Coordination and Partnership (ET-CCP) (Doc. 4.1(2))

4.1.2.1 Olga Petrova (on behalf of Marina Petrova) and Gaborekwe Khambule presented a detailed report on the key tasks and activities of ET-CCP. The report encompassed:

- Interactions within ET-CCP;
- ET-CCP teleconferences;
- ET-CCP/1 meeting;
- ET-CCP coordination with the MG;
- Cooperation with other CAeM Expert Teams, in respect of the ET-GOV global survey, implementation of Amendment 77 to ICAO Annex 3, liaison with aviation task teams/subgroups, and the ICAO METP;
- Coordination and cooperation with Regional Associations, including aviation meteorology conferences; and
- Communication and outreach, including network of aviation experts, CAeM newsletters, and social enterprise networking.
- The successful publishing of the first issue of a CAeM newsletter and the second issue which was envisaged for publication in January 2017.

4.1.2.2 During the intersessional period, ET-CCP had been tasked to coordinate an encouraging response from CAeM to the requests for advice and guidance, enabling the Regional Associations to align their Operating Plans with the recommendations made at the conjoint Meteorology Divisional Meeting in 2014, including the ICAO GANP and ASBU implementation. Monitoring and evaluation (M&E) tools throughout the WMO Regions/sub-regions had been used by ET-CCP to identify gaps/challenges, as well as weaknesses and successes, in the WMO Members in meeting the requirements for enhanced meteorological service delivery arising from the ICAO GANP and ASBU strategies.

4.1.2.3 The MG noted that, in 2016, the composition of ET-CCP had changed slightly when a core member (Collins Osague) from the Nigerian Meteorological Agency (NMA) was replaced by his colleague (Ishiyaku Ibrahim, General Manager in Aeronautical Meteorology) from the same agency. Additionally, a new core member from the Meteorological Service of Singapore (Ms Kar Lin Yap, Executive Meteorologist, Aviation Weather Services) had entered the team for better

liaison with RA V (South West Pacific). The MG was pleased to note that, at present, the six core members of ET-CCP represent the six WMO Regions.

4.1.2.4 The MG recalled that the terms of reference of ET-CCP had been reviewed and revised following the last MG meeting (May 2015).

4.1.2.5 The MG was apprised that the ET-CCP members had been communicating effectively through teleconferences and email, putting together the updates on regional/sub-regional implementation process. Overall, four teleconferences had been held so far with detailed reports thereon having been forwarded to the P/CAeM on a timely basis.

4.1.2.6 The MG noted that ET-CCP had convened its first face-to-face meeting in St. Petersburg, Russian Federation in May 2016 to address a range of communication and outreach issues and to update its work plan. The participation of a co-chair of ET-GOV, as alluded to above, had helped take forward coordination efforts between the two expert teams. A major effort was undertaken after the meeting to finalize a list of Members' focal points on aeronautical meteorology as a precondition for the success of the ET-GOV-led global survey and for the outreach of the CAeM Newsletter. This effort was assisted by the ET-GOV and the Secretariat.

4.1.3 Expert Team on Education, Training and Competency (ET-ETC) (Doc. 4.1(3))

4.1.3.1 Chris Webster and Robert Rutledge presented a report outlining the key tasks and activities of ET-ETC. The report encompassed:

- Guidance on second-level competencies;
- Process for dealing with requests;
- Maintenance of ET-ETC moodle website;
- Achieving the 1 December 2016 qualification deadline;
- Advice on competency requirements;
- Workshops;
- Translation;
- Educational aspects of GANP and ASBU;
- Advice to other bodies;
- WMO competency guide; and
- Face-to-face meetings

4.1.3.2 The MG was informed that the leadership of ET-ETC had changed in January 2016 when Robert Rutledge (United States) had replaced Michael Pat Murphy (United States) as an ET-ETC co-chair. The MG was apprised that there was a strong possibility that Robert Rutledge may soon be tasked by his administration to pursue space weather matters only for WMO and therefore that there may be a need to identify a new co-chair for ET-ETC. In this regard, the MG agreed to monitor developments and to identify and establish a new co-chair for ET-ASC if necessary. **Action A05-2016**

4.1.3.3 The MG noted that the focus of ET-ETC was continuing to slowly shift from competency-related matters to education and training and that this had been particularly apparent in the task related to the 1 December 2016 qualification deadline for aeronautical meteorological forecasters (AMF), a deadline which was now imminent.

4.1.3.4 Notwithstanding 4.1.3.3, the MG was apprised that many aeronautical meteorological service providers still required assistance with implementing competency standards, even though the deadline for implementation passed in December 2013. The MG noted therefore that the ET-ETC continued to provide guidance on competency standards and assessment.

4.1.3.5 The MG was apprised that a WMO Competency Guide was in preparation and expected to be published in early 2017. The MG appreciated that ET-ETC had been actively involved in this work in collaboration with the WMO Education and Training (ETR) Office.

4.1.3.6 The MG was informed that ET-ETC contained enthusiastic experts with a variety of experiences and specializations, and that the combination of backgrounds had enriched the quality of the team and greatly enhanced its outputs.

4.1.4 Expert Team on Aviation, Science and Climate (ET-ASC) (Doc. 4.1(4))

4.1.4.1 Herbert Puempel presented a report outlining the key tasks and activities of ET-ASC. The report encompassed:

- Nowcasting and very-short-range forecasting;
- Cooperation with ICAO CAEP and other bodies on the impact of aviation on climate change;
- Studies on climate change impact on aviation; and
- Regulatory aspects.

4.1.4.2 The MG was informed that ET-ASC had been instrumental in the publication and outreach of issues concerning aviation and climate, and in co-operation with other bodies such as the Commission for Atmospheric Sciences (CAS) in supporting the joint Aviation Research Demonstration Project (AvRDP), the Global Framework for Climate Services (GFCS), the ICAO CAEP, and external stakeholders such as Eurocontrol/Single European Sky (SES), original equipment manufacturers (OEM) such as Airbus, and other international groups.

4.1.4.3 The MG appreciated that ET-ASC has been strongly engaged in: the preparation and running of the European Conference on Meteorology for Aviation (ECMA) held in Vienna, Austria, in October 2015; the aviation-centric Workshop during WSN-16 on Nowcasting and Very Short Range Forecasting for Aviation held in Hong Kong, China, in July 2016; and preparing a first set of scientific answers to the questions posed by Airbus on the challenges of future climates for airframe and engine manufacturers. In addition, the MG noted that ET-ASC would be central to the preparation of the joint CAeM-CAS-CBS Scientific Event in 2017 in cooperation with ICAO on the underpinning research and development to the future MET services to aviation. In this connection and noting that, unlike other ETs, ET-ASC was currently served by just one chair rather than by two co-chairs, the MG agreed to the urgent need to identify and establish a co-chair for ET-ASC.
Action A06-2016

4.1.4.4 The MG was informed that the most significant achievement of ET-ASC probably lays in the remarkable increase of awareness of aviation stakeholders of the importance and challenges of providing fit-for-purpose, consistent and scalable MET services in an increasingly hostile and changing climate reflected by new risk scenarios.

4.1.4.5 In this connection, the MG discussed in particular the impact that a changing (warming) climate may have on aerodrome design and operations. The MG appreciated that, at present, the planning of the design aspects of a new aerodrome, say, may be predicated upon climatological tables and aerodrome reference temperatures that are unrepresentative given the current pace of climate change and the sensitivity of such datum to the averaging period applied. Accordingly, the MG agreed to add a work programme item to ET-ASC on

climatological tables and aerodrome reference temperatures with a view to preparing a study note (or similar) for consideration by ICAO. **Action A07-2016**

4.1.5 Expert Team on Information and Services for Aviation (ET-ISA) (Doc. 4.1(5))

4.1.5.1 Stephanie Desbios and Jun Ryuzaki presented a report on the key tasks and activities of ET-ISA. The report encompassed:

- Development of relevant background material, methodology and implementation of guidance on the meteorological (MET) components of the ASBU;
- Current and future MET capabilities to support requirements of GANP and ASBU;
- Performance metrics and validation methodologies for new or enhances MET information and services; and
- System-wide information management (SWIM) MET data standards and policies, implementation of MET information exchange under SWIM by WMO Members

4.1.5.2 The MG was apprised that since the last MG meeting (May 2015), ET-ISA had mainly focussed on its contribution to the ICAO METP working groups (WGs), especially those for the development of concept of operations, roadmaps and implementation guidance on the MET components of the ASBU and on the transition to system-wide information management (SWIM) and implementation of the ICAO Meteorological Information Exchange Model (IWXXM). The MG noted that some ET-ISA experts, as advisors in the METP WGs and work streams, contributed to the improvement of the description of the B1-AMET ASBU module for terminal area aspects and will continue to provide input for the ICAO ASBU framework update in preparation of the next major GANP update (2019 edition).

4.1.5.3 The MG was informed that ET-ISA tasks for gathering requirement information from large-scale programmes such as Single European Sky ATM Research (SESAR) or NextGen, or from other projects for new services in support of ATM, especially in the terminal area, had made little progress up to now. Nevertheless, this activity would be reinforced especially on the performance requirement aspect, with the objective to contribute to the functional and performance requirements definition task for ASBU MET modules, a task which was being led by the ICAO METP WG-MRI (Working Group on Meteorological Requirements and Integration).

4.1.5.4 The MG noted that ET-ISA team experts have also been involved in several WMO or ICAO groups on MET information exchange under SWIM (definition of the IWXXM, guidance for the implementation of exchange of OPMET data) and on SWIM (including standards and policies development). In this regard the MG was informed of the availability of first versions of guidance material for the implementation of IWXXM and exchange of OPMET data, and about the coordination with WMO CBS groups about possible connection between SWIM and the WMO Information System (WIS). In this connection, the MG agreed to the need to clarify the role and responsibility of CAeM/ET-ISA in respect of IWXXM developments given the activities of other related bodies/groups such as CBS (TT-AvXML) and those in ICAO. **Action A08-2016**

4.2 Coordination of outstanding tasks

4.2.1 The MG noted that all ETs had prepared their draft work programmes that contained a number of cross-cutting tasks, which needed to be closely coordinated across the concerned ETs. The approach of conducting joint ET meetings, as alluded to above, was considered a good practice that should be encouraged to continue as appropriate.

4.2.2 Moreover, the MG appreciated that coordinated outreach and communication, such as via the periodical CAeM Newsletter, was essential to ensure connectivity across the aeronautical meteorological community. The MG also emphasized that the AeMP website should continue to be enhanced with additional awareness materials, links to publicly accessible information, etc.

4.3 Volcanic Ash Activities (Doc 4.3)

4.3.1 Ian Lisk, Vice-President of the CAeM (VP/CAeM), provided an overview of volcanic ash activities being undertaken by the CAeM. The report addressed the following:

4.3.1.1 *IUGG/WMO Volcanic Ash Scientific Advisory Group (VASAG)*

The sixth meeting of the IUGG/WMO VASAG, chaired by Andrew Tupper (Australia) and Larry Mastin (United States Geological Survey), was held for two days in Anchorage, Alaska, United States of America in October 2015 (VASAG/6 report here). The VP/CAeM represented the CAeM and also provided Secretariat support on behalf of WMO C/AEM. The next full meeting of the VASAG is due to take place in mid-2017 – exact date and location to be determined.

4.3.1.2 *WMO Volcanic Ash Advisory Centre Best Practice (VAAC BP)*

A VAAC BP workshop, chaired by VP/CAeM with Secretariat support provided by C/AEM took place over 3-days in Buenos Aires, Argentina in April 2016 (VAAC BP 2016 report here. The next VAAC BP workshop is confirmed to take place back-to-back with the next ICAO METP VA-MOG and VA-MISD meetings in Tokyo in June 2017.

4.3.1.3 *ICAO MET Panel (METP) Volcanic Ash MET Operations Group (VA-MOG) and MET Information and Services Development (VA-MISD)*

A VA-MOG meeting chaired by Nigel Gait (UK) and a VA-MISD meeting chaired by Steve Albersheim (USA) met for two days in Buenos Aires, Argentina in April 2016. WMO C/AEM, advised by VP/CAeM, represented the CAeM. Discussions focussed on the development and delivery of services in support of volcanic ash, including a significant item on achieving improved harmonisation Volcano Notice to Airmen (VONA) alert states, and Sulphur Dioxide (SO2) related requirements of the ICAO Global Air Navigation Plan (GANP). These issues were further discussed at the ICAO METP in Montreal in October 2016. The next meetings of the VA-MOG and VA-MISD are confirmed to take place back-to-back with the next VAAC BP Workshop in Tokyo in June 2017 (referenced above).

4.3.1.4 *WMO International Volcanic Ash Workshop (IVAW)*

The Seventh WMO IVAW took place over five days in Anchorage, Alaska, USA in October 2015 (IVAW/7 report here). The workshop was attended by over 100 delegates from across the aviation industry, MET service providers and the geophysical and MET science community. The next workshop is tentatively planned for 2018 or 2019 – exact date and location to be determined.

4.3.1.5 *ICAO EUR/NAT Volcanic Ash Contingency Plan (VA CP)*

An updated version of the ICAO EUR/NAT VA CP was agreed and published by the European Air Navigation Planning Group (EANPG) Coordination Group in July 2016. It should be well noted by the CAeM MG that the VA CP Annexes do (continue to) include references to the use of ash concentration thresholds in support of volcanic ash safety risk assessment procedures. Work led by the United Kingdom and France is ongoing to develop a more scientifically robust and harmonised suite of supplementary ash 'contamination' charts based on an improved understanding of aircraft engine susceptibility to volcanic ash and the use of quantitative ash mass column loading based assessments of volcanic ash contamination.

5. ICAO ACTIVITIES AND COORDINATION NEEDS (Doc. 5 and Presentation)

5.1 The MG considered a detailed report by ICAO on the main outcomes of the Second Meeting of the ICAO Meteorology Panel (METP/2) held from 17 to 21 October 2016 in Montreal, Canada, together with an overview of recent and ongoing activities of the METP working

groups and other ICAO developments of direct relevance to CAeM and other Technical Commissions. The report was summarized as follows:

5.1.1 *Second Meeting of the ICAO Meteorology Panel (METP/2)*

5.1.1.1 The second meeting of the Meteorology Panel (METP) was held in the ICAO Headquarters, Montreal, Canada, from 17 to 21 October 2016. The meeting was attended by some 60 members, advisers and observers nominated by eighteen Contracting States and six international organizations.

5.1.1.2 The main outcomes of the meeting include Recommendations for proposed amendments to Annex 3 — *Meteorological Service for International Air Navigation*, for inclusion in Amendment 78 aiming at 2018 applicability, and for modifications to various job cards of the METP to reflect the evolving needs and more realistic timeframes.

5.1.1.3 Among the amendment proposals are those concerning the use of a circle (cylinder) in SIGMET messages, including RDOACT CLD; SARPs for the establishment of the space weather service and a template for an advisory message, and consequential amendments to Annex 15 — *Aeronautical Information Services*, PANS-ABC (Doc 8400) and PANS-ATM (Doc 4444); Note in Annex 3 referring to guidance material to improve the coordination between MWOs in the provision of SIGMET information; Amendment to Annex 3 regarding IWXXM standards for METAR/SPECI, TAF, SIGMET, AIRMET, volcanic ash advisories and tropical cyclone advisories; Amendment to Annex 3 regarding the Operational Status Indicators (TEST or EXERCISE) in VAA, TCA and SIGMET; and changes to Annex 3, Table A2-2 (TCA) and A6-1A (SIGMET/AIRMET), particularly to indicate improvements to tropical cyclones services.

5.1.1.4 Apart from the above, the METP/2 provided its four working groups and one ad hoc group with strategic directions by endorsing various roadmaps and work plans, which will facilitate the future work of these groups.

5.1.2 *METP working group activities*

5.1.2.1 The working groups of the METP had made much progress in a relatively short period of time since the METP/1 (20 to 24 April 2015), which contributed significantly to the successful convening of the METP/2.

5.1.2.2 Some detailed information regarding the outcomes of the METP/2, reflecting activities of different working groups as well as coordination needs between ICAO and WMO was provided in part 2 of Doc. 5.

5.1.3 Other relevant ICAO developments

5.1.3.1 In addition to coordination with WMO, the METP work requires coordination with some other ICAO panels, including, but not limited to the Air Traffic Management Requirements and Performance Panel (ATMRPP) and the Information Management Panel (IMP). The ATMRPP would hold its second meeting (ATMRPP/2) from 14 to 18 November in Montreal, where work on job card ATMRPP.006.02 (Aeronautical meteorological information to support ATM operations from gate to gate) would be coordinated. The Third Meeting of the IMP Working Group (IMP/WG/3) would also be convened on the same dates in Montreal, which will give an opportunity for the Secretariat to coordinate work in the field of SWIM.

5.1.3.2 The 39th Assembly of ICAO (27 September to 7 October 2016) endorsed the fifth edition of the GANP, including the ASBU framework, which was an integral part of the Plan, as the strategic direction for global air navigation. Aeronautical meteorology was an important part of the ASBU framework.

5.1.3.3 It is envisaged that the next edition of GANP will be published in 2019. In this regard and as alluded to at 4.1.5.2 above, the MG was reminded that some ET-ISA experts were currently providing inputs to an ICAO-led initiative to review the ASBU framework in

preparation for the next edition of the GANP. Furthermore, the MG was informed that ICAO was planning to convene a Global Air Navigation Industry Symposium (GANIS) in 2017 and the 13th Air Navigation Conference (AN-Conf/13) in 2018, where strategic issues on global air navigation would be discussed, forming the basis for the future work programme of ICAO in the field of air navigation.

5.2 The MG expressed its appreciation to ICAO for the foregoing report and for being in attendance at the meeting, citing that coordination and collaboration on all aeronautical meteorological matters between ICAO and WMO was fundamentally important to the evolving service provision based on the users' requirements. Some members of the MG however reiterated the concern of P/CAeM (see 3.5 above) that certain recommendations of METP/2 (namely, in the proposed establishment of global centres only for space weather service and in the drive to accelerate the globalization of the regional hazardous weather advisory system) deviated from the inter-governmental agreements reached at the Conjoint Meeting in 2014, and acknowledged that these could have significant ramifications down the road.

5.3 In connection with the foregoing, the MG was briefly informed on the status of the review and proposed revision to the working arrangements between ICAO and WMO which was an ongoing activity within the respective Secretariats (INF. 1). In particular, the MG considered that the close cooperation between CAeM and METP, including joint ET/WG meetings, will be essential to the global development of aeronautical meteorology. However, given the nature of the METP being a group of independent experts not representing the governments (i.e. Member States), serious consideration should be given to the continuation of the Conjoint ICAO Meteorology Divisional Meeting / CAeM Session which had served as a critical platform for reaching inter-governmental agreements on milestone changes to aeronautical meteorological services in support of international air navigation.

6. FUTURE WORK PROGRAMME

6.1 Long-term Plan for AeMP aligned with GANP and ASBU (Doc. 6.1)

6.1.1 As a follow-up of Resolution 3 (Cg-17), the MG was apprised that Decision 43 (EC-68) had, inter alia, requested the president of CAeM to prepare, in coordination with the Secretary-General, regional associations and technical commissions, a draft long-term plan for the Aeronautical Meteorology Programme (AeMP) aligned with the ICAO Global Air Navigation Plan (GANP) and aviation system block upgrades (ASBU), for consideration at EC-69 in 2017. The MG noted that Decision 43 was accompanied (annexed) by an Action Plan – Meteorological Services for Aviation (INF. 2).

6.1.2 The MG appreciated that ICAO's GANP and its ASBU methodology serves to guide complimentary and sector-wide air transport progress, including in the context of aeronautical meteorological service provision, over the next 15 years (rolling period, reviewed and updated every three years). Therefore that the long-term plan established for the AeMP should have a complimentary time horizon and review/update cycle to the extent practicable.

6.1.3 In this connection, the MG noted that the 39th Assembly of ICAO had recently endorsed the latest (2016) edition of ICAO's GANP. In this edition, a series of technology roadmaps were included in the GANP that portrayed new and legacy technologies needed to support the ASBU modules, the dates by which the technology is needed, and the availability of the technology. The MG noted that meteorology component of the ASBU methodology was, together with system-wide information management, flight and flow information, aeronautical information and time, a component of the Information Management roadmap (Roadmap 7) (INF. 5). The MG considered that Roadmap 7, together with the other relevant aspects of the latest GANP/ASBU methodology, could serve as valuable input to the development of the AeMP long-term plan. The MG further noted that concepts of operation (ConOps), roadmaps and other relevant documents within the ICAO METP would also assist in the realization of the AeMP long-term plan, in particular given such documents endeavoured to realize the vision set forth in the GANP/ASBU for a globally interoperable, harmonized air traffic management system over the next 15 years.

6.1.4 In discussing the mechanics of how to efficiently and effectively develop a draft long-term plan for AeMP, the MG considered that it should be built around time-bound blocks with modules, activities and deliverables (akin to ICAO's GANP and its ASBU methodology). The MG recommended that the long-term plan should take account of relevant concepts of operation and roadmaps (or equivalent) in the ICAO domain as well as those that similarly exist in the WMO domain, such as for WIGOS, WIS and seamless GDPFS. In this connection, the MG noted that the long-term plan covering 15 years would be expected to be fairly detailed in the near-term years and less detailed in the far-term years. The MG also considered that the long-term plan should be scalable, flexible to accommodate regional and sub-regional differences that may exist.

6.1.5 P/CAeM offered the following viewpoints in drafting the long-term plan:

a) WMO has the fundamental mandates to provide MET standards, guidance and expertise to support the development of aeronautical meteorology, in cooperation with ICAO. These should cover governance on service quality of AMSPs, personnel qualification and competency;

b) Given that regionalization and globalization, as well as stronger competition, will be the reality, WMO should facilitate capacity development for those NMHSs which will remain as AMSPs and provide assistance for those NHMSs in need (e.g. not remaining as AMSPs) to sustain their basic MET infrastructure, in line with the notion of "No Country Left Behind";

c) WMO should upkeep scientific expertise, through research and their applications to operations, to support service developments by AMSPs; and

d) SWOT analysis (strengths, weaknesses, opportunities, threats) should be considered to identify any other issues that need to be addressed.

6.1.6 In concluding, the MG agreed that, in the first instance, an introduction and template for the draft long-term plan for the AeMP should be developed by the Secretariat and circulated to P/CAeM and VP/CAeM for comment. **Action A09-2016**

6.2 CAeM Operating Plan (2016-2019): Priorities – Review and Update (Doc. 6.2)

6.2.1 The MG noted that the Seventeenth World Meteorological Congress (Cg-17, Geneva, 2015) approved the WMO Strategic Plan 2016-2019 which, as a result of a planning process driven by the needs and priorities identified by WMO Members, is guiding decision-making of the Organization and its constituent bodies during the period 2016-2019. In this context, the WMO Strategic Plan sets the directions and priorities to guide the activities of Members and all WMO constituent bodies to enable all Members to improve their core information, products and services, maintain necessary infrastructure, and to directly benefit from advancements in science and technology. The MG appreciated that the WMO Strategic Plan 2016-2019 maintained a strategic priority on aviation meteorology as one of seven priorities.

6.2.2 The MG noted that in order to achieve significant, targeted improvement of services to address the escalating needs, WMO would focus its endeavours on eight Expected Results (ER) contained within the WMO Strategic Plan. Insofar as the activities of the CAeM under the Aeronautical Meteorology Programme (AeMP) were concerned, these would contribute mainly but not exclusively to ER 1 – *Improved service quality and service delivery* and ER 2 – *Reduced Disaster Risk*.

6.2.3 The MG further noted that the seven strategic priorities as well as the eight expected results of the WMO Strategic Plan 2016-2019 were reflected in the integrated WMO results-based budget and were detailed in the WMO Operating Plan 2016-2019**,** which presents time-bound programme activities and projects and forms the basis for resource allocation – at the level of the WMO Secretariat, six regional associations and eight technical commissions – during the seventeenth financial period. In addition, the WMO Operating Plan defines the risks

and performance metrics against which to assess progress to achieve expected results through the WMO Monitoring and Evaluation System. The MG noted that the WMO Operating Plan was a 'living document' that would be updated regularly so as to include any required adjustments. The MG further noted that the CAeM Operating Plan 2016-2019 was yet to be submitted.

6.2.4 In connection with the foregoing, the MG recalled that at its meeting in 2015 it had formulated Action A07-2015 concerning the preparation of a CAeM Operating Plan 2016-2019, coordinated by ET-GOV, as a compilation of the work programmes of the expert teams with appropriate grouping of the tasks according to key outcomes as identified in the WMO Operating Plan. Furthermore, the last meeting had formulated a set of (five) high-level priorities for the CAeM Operating Plan 2016-2019 (Annex 5 to CAeM-MG-2015 report and Action A09-2015 refers).

6.2.5 The MG acknowledged that while the work plans of the ETs had continued to be maintained during the intersession period, no progress had been made to populate the priorities table with deliverables, activities, key performance targets (KPTs) and key performance indicators (KPIs). The MG also acknowledged that the development of a CAeM Operating Plan for 2016-2019 and future financial periods would need to be consistent with the long-term plan for the AeMP described above.

6.2.6 In view of the pressing need to establish (populate) a CAeM Operating Plan 2016-2019, the MG agreed that each CAeM Expert Team should, in the first instance and using their existing work plans as a guide, prepare their respective inputs to the priorities table as presented at **Annex 5** to this report. **Action A10-2016** To ensure continuity, the MG agreed that ET-GOV should remain in charge of overall coordination across the ETs.

6.2.7 In concluding the discussion, the MG agreed that the CAeM Operating Plan for the current as well as for future financial periods should be periodically reviewed and, as necessary, updated by the MG (preferably at each MG meeting held). **Action A11-2016**

6.3 CAeM-16 Session (2018) – Initial Planning (Doc. 6.3)

6.3.1 The MG acknowledged that there was a requirement to conduct the sixteenth session of the CAeM (CAeM-16) not later than 2018 owning to the fact that WMO Technical Commissions are required to convene at least once per four-year WMO financial period and the fact that the last session (CAeM-15) was convened in July 2014 in Montreal, Canada conjointly with the ICAO Meteorology Divisional Meeting.

6.3.2 The MG noted that the CAeM-16 had been included in the WMO plan for sessions of constituent bodies for 2018, tentatively in July, and that a formal letter of invitation had been received from the United Kingdom in February 2015 in respect of their willingness and ability to host CAeM-16 in 2018.

6.3.3 In considering the duration of CAeM-16 and respecting general principles of conducting efficient and effective sessions, the MG expressed concern if the session were to be made too short, e.g. if its duration were to be comparable with the two working days reserved for the last session (CAeM-15). The MG was of the opinion that limiting the CAeM-16 session to two working days, say, would inhibit sufficient delegate deliberations on critical matters of importance at what is already a substantial time of change within both the aviation and meteorological communities alike.

6.3.4 The MG briefly discussed a proposal to hold CAeM-16 back-to-back, parallel or conjoint with the ICAO METP/3 meeting (tentatively Q3 2018), however the MG expressed reservations owing to potential complications that could arise – not least the limited ability of ICAO to conduct its Panel meetings away from ICAO headquarters and the fact that many experts/members that reside on the WMO (CAeM) side also reside on the ICAO (METP) side which can create problems when conducting meetings in parallel. Despite these logistical issues, the MG would keep the above proposal open considering the benefits of the mini-Conjoint concept.

6.3.5 In respect of the agenda for the CAeM-16, the MG recommended that it should be developed in accordance with the WMO General Regulations and also cover the new tasks and challenges stemming from the prevailing ICAO GANP and its ASBU methodology.

6.3.6 The MG recommended that one half day immediately following the conclusion of the CAeM-16 should be dedicated to the convening of a CAeM-MG meeting.

6.3.7 Building on the successful model for a Technical Conference (TECO) used at each of the last two CAeM sessions (CAeM-14 in 2010 and CAeM-15 in 2014), and taking into account the above considerations as well as recognition that a WMO scientific event was planned for 2017 (see §7.3 below), the MG agreed that a one-day TECO should precede the CAeM-16 session. The MG recommended that the TECO should take the form of plenary keynote presentations and, where time permitted, break-out group discussions that would report back to plenary, and that a report stemming from the TECO plenary should be submitted to CAeM-16 in the form of an information paper.

6.3.8 In view of the referred WMO scientific event in 2017, the MG agreed that the TECO in 2018 should focus on aspects *not addressed* by the precursor scientific event. The TECO should focus its attention instead, say, on the current and evolving global landscape of aeronautical meteorological service provision and the accompanying institutional arrangements, partnerships, etc. that are considered essential to ensure that aeronautical meteorology can fulfil users' needs and expectations aligned with the ICAO GANP and its ASBU methodology going forwards.

6.3.9 In concluding its consideration of the CAeM-16 session, TECO and CAeM-MG meeting, the MG devised the following draft sequence of events (which may change as the planning for the events progresses):

DRAFT 1 (as at CAeM-MG-2016)							
	Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
Morning		TECO	CAeM-16	CAeM-16	CAeM-16	CAeM-16	
Afternoon		TECO	CAeM-16	CAeM-16	CAeM-16	CAeM-MG	

6.3.10 Acknowledging the extensive planning, preparation and coordination required to organize a TECO, CAeM-16 and CAeM-MG in 2018, the MG agreed to establish an informal organizing committee (OC-CAeM) – comprising the MG members, Secretariat and others as necessary – to oversee and assist with all the necessary arrangements, including logistics and outreach, up to and including the conducting of the events. The MG requested that the OC should conduct the bulk of its coordination through correspondence and tele-/video-conference, and that the OC should initiate its coordination not later than 31 March 2017.
Action A12-2016

6.4 Review of WMO Publications under CAeM Responsibility (Doc. 6.4)

6.4.1 The MG was informed that Decision 93 (EC-68) had, *inter alia*, requested technical commissions to prioritize in their work plans the review and update of relevant parts of the WMO Technical Regulations in accordance with their specific terms of reference. In this connection, Decision 93 contained a roadmap for enhanced WMO Technical Regulations framework and a list of all related regulatory publications that should be reviewed and updated accordingly by the time of Cg-18 (2019). (INF. 6)

6.4.2 The MG noted that ET-ETC, during its joint meeting with ET-GOV (30 November to 3 December 2015, Wellington, New Zealand), had reviewed a list of WMO AeM-related publications and, where appropriate, had made recommendations on actions to be taken as alluded to in the following.

6.4.3 The MG recalled that the CAeM had a lead responsibility in the development and/or maintenance of the following aeronautical meteorology-specific WMO guides/guidance material (most recent year of publication in [brackets]):

WMO-No.	Title	Most recent year of publication
731	*Guide to meteorological observing and information distribution systems for aviation weather services*	2014
732	*Guide to practices for meteorological offices serving aviation*	2003
770	*Methods of interpreting numerical weather prediction output for aeronautical meteorology*	1999
904	*Guide to aeronautical meteorological services cost recovery: principles and guidance*	2007
1001	*Guide to the quality management system for the provision of meteorological service for international air navigation*	2014

6.4.3.1 In respect of WMO-Nos. 731 and 732, the MG recalled that ET-GOV was tasked (Action A03-2015) to revive WMO-No. 732 and to fully update it so that it becomes a placeholder for new guidance material. In this connection, the MG was informed that ET-GOV intended to simultaneously transfer guidance from WMO-No. 731 (appropriately updated as necessary) into WMO-No. 732, resulting in a single, consolidated guide. The MG was pleased to note that recommendations and structure for the new, singular document had been developed by ET-GOV (Annex 3 to Doc. 4.1(1)). The MG further noted that ET-ETC (Wellington, 2015) had made an overall recommendation that WMO-No. 732 should become an overarching aviation services guide and to make a reference to competency guidance, which was consistent with the latest ET-GOV considerations.

6.4.3.2 In respect of WMO-No. 770, the MG was apprised that the first and second editions of the guide – more precisely, Technical Note No. 195 – had been published in 1992 and 1999 respectively stemming from extensive work of the (then) CAeM Working Group on Advanced Techniques Applied to Aeronautical Meteorology (ATEAM). In considering the continued need for and utility of such a guide for the provision of aeronautical meteorological service – in that it covers global models and mesoscale models, direct use of model output, validation and verification as well as future trends – and appreciating the significant advances in numerical weather prediction (NWP) capabilities and output over the past two decades, the MG was apprised that ET-ETC (Wellington, 2015) had recommended the withdrawal of WMO-No. 770 given the rapidly changing NWP field, that it was impossible to keep it up-to-date using the WMO publication process and that the cost of production were prohibitive. The MG agreed in general with the view held by ET-ETC but requested the Secretariat to consult with the DPFS Division, WWRP Division and others concerned to determine if other existing WMO publications could sufficiently accommodate the aeronautical meteorology components alluded to in WMO-No. 770. **Action A13-2016**

6.4.3.3 In respect of WMO-No. 904, the MG noted that ET-GOV would be in a position to determine whether an update to the guide was necessary once the ICAO METP AG-MCRGG had completed its related analyses.

6.4.3.4 In respect of WMO-No. 1001, the MG agreed that there was a need to reconsider the continuation of the guide in light of the 2013 publication of WMO-No. 1100. The MG acknowledged that WMO-No. 1100 reproduced, to a great extent, the QMS guidance contained in WMO-No. 1001, albeit intended for a broader audience, and that it was presently undergoing a review and revision within WMO (through the support of a consultant) in order to align the guidance with the ISO 9001:2015 standard for QMS. The MG agreed that, in order to avoid potential duplication or even divergence between the two QMS guides going forwards, there would be merit in discontinuing (or at least distilling) WMO-No. 1001 and transferring any essential supplementary material specific to QMS for aeronautical meteorology into WMO-No. 1100. In this connection, the MG appreciated that WMO-No. 1001 had been developed and

maintained jointly by WMO and ICAO[1] since its inception in 2007, and therefore that any discontinuation (or distillation) of WMO-No. 1001 would have ramifications for ICAO. In this respect, the MG recommended that ICAO should consider the impacts that a discontinuation (or distillation) of WMO-No. 1001 would have on ICAO Doc 9873. **Action A14-2016**

6.4.4 In addition to the foregoing, the MG noted that CAeM had a supporting responsibility in the development and/or maintenance of the following aeronautical meteorology-related WMO guides/guidance material:

WMO-No.	Title	Most recent year of publication
782	*Aerodrome reports and forecasts*	2014
842	*Guide to the provision of meteorological service for international helicopter operations*	1996
958	*AMDAR Reference Manual: Aircraft Meteorological Data Relay*	2003
1038	*Weather forecasting for soaring flight*	2009
1083	*Guide to the implementation of education and training standards in meteorology and hydrology, Volume I – Meteorology*	2015
1100	*Guide to the implementation of a quality management system for national meteorological and hydrological services*	2013
TD 1390	*Aviation Hazards*	2007
####	*WMO Guide on Competency* (working title)	—

6.4.4.1 In respect of WMO-No. 842, the MG was apprised that the publication (available in hard-copy only) had been developed and maintained jointly by WMO and ICAO[2], providing detailed guidance on what meteorological service should be provided for helicopter operations. In discussing the continued need for and utility of such a guide and appreciating the advances over the past two decades in both helicopter operations and the provision of aeronautical meteorological service, the MG requested ICAO to determine as to whether there was a specific aeronautical requirement for meteorological service for international helicopter operations that differs from that contained in ICAO Annex 3/WMO-No. 49, Technical Regulations, Volume II – *Meteorological Service for International Air Navigation*.
Action A15-2016

6.4.4.2 In respect of WMO-No. 1390, the MG noted that this was a WMO Technical Document, under the responsibility of the Education and Training (ETR) Programme, intended to guide forecasters working for the aviation community in the many and varied phenomena which can prove hazardous to aviation. The MG was apprised that ET-ETC (Wellington, 2015) had noted that some of the useful material in WMO-No. 1390 had been mapped to a Hong Kong Observatory website resource and thus, if WMO-No. 1390 was removed, this mapping would need to be updated. ET-ETC had also noted that some of the WMO-No. 1390 material needed to be updated. In this regard, the MG agreed that ET-ETC should undertake a review of the content of WMO-No. 1390 (with a view to developing a proposed update) and that the Secretariat should determine the feasibility to migrate ownership of WMO-No. 1390 from the ETR Programme to the AeMP. **Action A16-2016**

6.4.4.3 In respect of the WMO Guide on Competency (working title, as yet unpublished), the MG was pleased to be informed that, through the WMO Education and Training Office and with the generous support of Australia, work was well underway to develop the first edition of the Guide with a view to its publication in 2017. The MG noted that the Guide will be formal WMO guidance material as part of the WMO Technical Regulations framework (comprised of Technical Regulations Volumes, their Annexes (Manuals) and related Guides). It will cover competency assessment guidance for AMP as well as for other disciplines (e.g. marine, PWS,

[1] ICAO Doc 9873, Guide to the quality management system for the provision of meteorological service for international air navigation.
[2] ICAO Doc 9680, Manual on the provision of meteorological service for international helicopter operations.

etc.) and would make reference to existing online resources such as those maintained by the ET-ETC on behalf of the CAeM. In this regard, the MG agreed that ET-ETC should undertake a review and, as necessary, update of its existing online resources to ensure consistency with the (prospective new) WMO Guide on Competency. **Action A17-2016**

6.4.5 As a result of the foregoing, the current or expected future action of each of the referred WMO publications is presented at **Annex 6** hereunder.

6.4.6 In the context of new guides/guidance material in the field of aeronautical meteorology, the MG was apprised that the ICAO METP/2 meeting had considered the introduction of guidelines for the implementation of OPMET data exchange using the ICAO Meteorological Exchange Model (IWXXM). In this regard, the MG noted that the METP had endorsed a guidance document that was intended to be adopted by each of the ICAO Planning and Implementation Regional Groups (PIRGs) and their Member States. The MG further noted that this new (regional) guidance was intended to compliment pre-existing guidance contained in ICAO Doc 10003 (*Manual on the Digital Exchange of Aeronautical Meteorological Information*) which had been first published in 2014.

6.4.7 Lastly, in connection with WMO-No. 49, Technical Regulations, Volume I – *General Meteorological Standards and Recommended Practices*, the MG was apprised that the 2015 edition contained a restructure compared to previous editions, with the publication now structured around the WIGOS (Part I), the WIS (Part II), Data Processing and Forecasting (Part III), Meteorological, Hydrological and Climatological Services (Part IV), Qualifications and Competencies of Personnel involved in the Provision of Meteorological (Weather and Climate) and Hydrological Services (Part V), and Education and Training of Meteorological Personnel (Part VI). In the context of Part IV, specifically sub-section 3 concerning meteorological services for international air navigation, the MG noted that WMO-No. 49, Volume I now simply provided a direct cross-reference to WMO-No. 49, Volume II – *Meteorological Service for International Air Navigation*, so as to ensure the link and to avoid duplication. While giving consideration to WMO-No. 49, Volume II and appreciating its preponderance to duplicate ICAO Annex 3 provisions, the MG noted that the continued need for WMO-No. 49, Volume II may need to be addressed by WMO's constituent bodies at a future stage in light of the development, by ICAO, of a restructured Annex 3 and new PANS-MET in the 2020 (or later) timeframe, and that opportunities to remove duplication should be duly considered provided that they are in the interest of WMO Members.

7. COOPERATION WITH OTHER WMO BODIES AND INTERNATIONAL ORGANIZATIONS

7.1 Inputs to PTC-2017 and EC-WG-2017 and coordination with other Technical Commissions (Doc. 7.1)

7.1.1 PTC-2017

7.1.1.1 The MG noted that the 2017 meetings of the Presidents of the eight WMO Technical Commissions and Presidents of the six WMO Regional Associations would convene in parallel during week commencing 9 January 2017 at WMO headquarters.

7.1.1.2 The MG was informed about the on-going governance review of the WMO led by the EC Working Group on Strategic and Operational Planning (EC WG-SOP) which covered the structure of the WMO constituent bodies. Decision 84 (EC-68) endorsed the recommendations of the EC WG-SOP including, inter alia, governance advice to the technical commissions (INF. 3). In this connection, the MG affirmed that the working arrangements between WMO and ICAO was and should remain a fundamental tenet of any future handling of aeronautical meteorology within WMO and its governance structures.

7.1.1.3 Noting that the PTC-2017 would be an important step in consolidating the views of the presidents regarding the future of the technical commissions, the MG considered how the case of the CAeM should be presented at the meeting in order to ensure continuation of its activities

in an optimal way. In this regard, the MG agreed that a discussion paper (or equivalent) should be developed by P/CAeM and VP/CAeM, with the assistance of the Secretariat, on key topics and principles of the technical commissions "reform" from CAeM perspective for consideration at PTC-2017. **Action A18-2016**

7.1.2 EC-WG-2017

7.1.2.1 The MG recalled that Resolution 1 (EC-67) had re-established, with amended terms of reference, an Executive Council Working Group on WMO Strategic and Operational Planning (EG-WG-SOP) to conduct activities on strategic planning and budget, roles and operations of NMHSs, improvement of WMO processes and practices, governance and the quality management framework. The MG recalled that aviation meteorology was a WMO strategic priority for the current financial period (2016 to 2019) and that a position for the next WMO Strategic Plan (2020 to 2023) would have to be determined.

7.1.2.2 The MG further recalled that Resolution 5 (EC-67) had established an Executive Council Working Group on Disaster Risk Reduction (EC-WG-DRR) to provide guidance on the implementation of the DRR Programme, to provide advice, guidance and recommendations for more effective engagement of WMO Programmes involving DRR and service delivery activities with GFCS (Global Framework for Climate Services), and to monitor progress made in these respects and to report back to the Executive Council accordingly.

7.1.2.3 In this connection, the MG discussed the role of aviation meteorology in the DRR context. The MG acknowledged that aviation has clearly defined requirements to receive information on meteorological and other hazards in a timely, reliable and consistent manner (i.e. right time, right place, right format) in order to minimise or mitigate operational risk, and that the supply of standardized aeronautical meteorological products such as volcanic ash advisories, tropical cyclone advisories, SIGMET and aerodrome warnings were all driven by the explicit users' needs. The MG considered that, by making more efficient and effective use of focal point expertise across the Regional Associations and Technical Commissions, there would be opportunities to take a more coordinated approach on all DRR aspects across WMO, not simply in an aeronautical meteorology sense, for example, through the sharing of certain services addressing hazards, sharing of best practices, etc..

7.1.3 Technical Commissions

7.1.3.1 In respect of CBS, the MG appreciated the recent and ongoing efforts of the OPAG-ISS Task Team on Aviation XML (TT-AvXML) to, inter alia, identify the meteorological information that WMO must represent in XML in response to the ICAO requirements and the development of the supporting IWXXM schema. In this connection, the MG noted ICAO's intentions to:

a) upgrade existing provisions concerning the issuance of METAR and SPECI, TAF and SIGMET as well as for AIRMET, volcanic ash advisories (VAA) and tropical cyclone advisories (TCA)[3] in XML/GML from recommended practices to standards as part of Amendment 78 or 79[4];

b) introduce new provisions concerning the issuance by designated centres of information on space weather as part of Amendments 78 and/or 79[5]; and

c) introduce new provisions (standards and/or recommended practices) that would modify the current practice of the issuance of SIGMET information, potentially as early as Amendment 79.

[3] The issuance of AIRMET, VAA and TCA in XML/GML is a recommended practice with effect 10 November 2016.

[4] XML/GML data representation will, for the foreseeable future, be in addition to their representation in TAC code form (for METAR, SPECI and TAF), abbreviated plain language (for SIGMET, AIRMET, VAA and TCA) and graphical format (for SIGMET, volcanic ash and tropical cyclone information).

[5] The provisions for space weather information may entail XML/GML data representation, TAC code form and/or graphical format.

7.1.3.2 Of the foregoing proposals, the MG noted that a) would necessitate little, if any, change to the extant IWXXM (version 2.0) since this was purely a change in status (recommended practice to Standard), while b) and c) would lead to some, potentially significant, further development of IWXXM necessitating CBS support going forwards. The MG agreed that continued collaboration and coordination between ET-ISA and TT-AvXML in this context would remain essential.

7.1.3.3 Concerning space weather, the MG recalled that the Inter-Programme Coordination Team on Space Weather (ICTSW), established in May 2010, had greatly assisted the CBS, CAeM and ICAO in advancing the understanding of, inter alia, the methods of observing and forecasting space weather events with impacts on international air navigation, and the roles, responsibilities, capabilities and overall number of global and regional forecasting centres as well as their designation process, governance and cost recovery principles, competency standards and duration of mandate. Moreover, Resolution 38 (Cg-17) had agreed that WMO would facilitate international commitments and enable the establishment of operational space weather services, in particular in the context of support to ICAO, and that a four-year plan for WMO coordination of space weather activities had been established together with draft terms of reference of the Inter-Programme Team on Space Weather Information, Systems and Services (IPT-SWISS) as a successor to ICTSW. The MG noted that IPT-SWISS would be established jointly under CBS and CAeM, contributing to relevant expert teams of these commissions as well as other groups of technical commissions including those of CIMO and CAS. As a pursuit jointly led by CBS and CAeM, the MG acknowledged that co-chairs (one representing CBS, one representing CAeM) were required for IPT-SWISS. In this connection, the MG was informed that the upcoming CBS-16 session intended to elect its co-chair representative while CAeM was required to do likewise during the (CAeM) intersession period. For continuity, the MG was supportive should the current co-chair of ICTSW representing CAeM be nominated as the co-chair of the IPT-SWISS in the same capacity.

7.1.3.4 The MG accepted that WMO, through the IPT-SWISS, would have an important advisory role to play in the designation, by ICAO, of space weather information providers. More precisely, that experts from within IPT-SWISS would be involved in the conducting of impartial site assessments and audits of prospective space weather information providers for aviation in accordance with timelines and assessment/auditing criteria set by ICAO.

7.1.3.5 In the context of the WMO Information System (WIS), the MG was apprised that the CAeM had had representation, through an ET-ISA co-chair, at an inaugural Inter-Commission Task Team on the WMO Information System (ICTT-WIS) meeting (12-13 September 2016, Geneva), which had been established as a result of EC-68 (Decision 38). EC-68 had noted the need for CBS to ensure a continued user focus, working with other technical commissions, to resolve present governance issues impacting on the operation of the WIS and to establish how WIS should evolve over coming decades together with the approach to achieving this. The ICTT-WIS was tasked to develop a governance structure for the operation management of WIS and to facilitate stakeholder input into the WIS strategy and the development of Part C of WIS. EC-68 requested CBS to present a proposal for the governance structure and strategy for the evolution of WIS to EC-69 (2017).

7.1.3.6 In the context of the Global Data-Processing and Forecasting System (GDPFS), the MG was apprised that the CAeM had had representation, through the Vice-President of CAeM, at an inaugural Future Seamless-GDPFS meeting (1 to 4 November 2016, Geneva), which had been requested at EC-68 (Decision 55). The meeting was intended to provide guidance and to monitor the development of a process for the gradual establishment of a future enhanced integrated and seamless WMO DPFS, to manage the integration of new components in the GDPFS, including addressing synergies with and requirements of all WMO Programmes and Regions, to develop a description of the set of products the system should produce, and to complete an implementation plan for the process for consideration at EC-69 (2017).

7.1.3.7 In respect of CAS, and also in connection with the developments envisioned by ICAO's GANP/ASBU, the MG recalled that the WMO World Weather Research Programme (WWRP) was leading an Aviation Research Demonstration Project (AvRDP), as a joint venture between the

CAS, CAeM and CBS, in order to develop, demonstrate and quantify the benefits of end-to-end nowcasting (0 to 6 hour timeframe) of aeronautical meteorological services for the terminal area focused on high-impact weather. The MG was apprised that Resolution 44 (Cg-17) had requested, inter alia, the presidents of CAS, CAeM and CBS to:

a) establish effective coordination in implementing the AvRDP activities; and

b) to stimulate and coordinate research and development activities and studies of nowcasting methods, numerical predication tools and assimilation methods to increase the potential benefits of AvRDP implementation for Members

7.1.3.8 Furthermore, Resolution 44 (Cg-17) had requested the Secretary-General to, inter alia, support the implementation of AvRDP and to organize appropriate events for the dissemination of project results for the maximum benefit of Members, within available budgetary resources. In this regard, a special session on AvRDP was held in Hong Kong, China in July 2016 during the WMO/WWRP 4th International Symposium on Nowcasting and Very-short-range Forecast (WNS16). Moreover, EC-68 gave necessary consideration to AvRDP as an inter-commission aviation research project, where Decision 44 (EC-68) endorsed, inter alia, a proposal for organizing in 2017 a WMO scientific event (conference, symposium or workshop) with broad participation of research, operations and user communities, with the objective to identify needs and plan the research activities during ASBU Block 1 and Block 2 timeframes.

7.1.3.9 As part of a WMO Rolling Review of Requirements (RRR) – a process defined by the Manual on the Global Observing System (WMO-No. 544) whereby user requirements for observations are compared with the capabilities of present and planned observing systems – the MG was apprised that a Statement of Guidance (SOG) had been developed for the aeronautical meteorology application area and duly reviewed and approved by the CBS Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) in April and June 2016 respectively. The SOG provided an assessment of the adequacy of observations to fulfil requirements and suggested areas of progress towards improved use of space-based and surface-based observing systems. The MG agreed that there was a need to ensure that the RRR and SOG in the aeronautical meteorology domain respected the evolving strategic direction of aeronautical users' requirements as represented by ICAO's GANP and ASBU methodology.

7.1.3.10 In connection with the SOG for Aeronautical Meteorology, the MG undertook a review of issues raised by its author, Jitze van der Meulen (Netherlands), deemed to be of relevance to the MG (INF. 7). The issues raised concerned the SOG and RRR itself, the WMO Integrated Global Observing System (WIGOS), the Commission for Instruments and Methods of Observation (CIMO), and the standardization and quality assessment of ICAO aircraft-based observations exchanged over the global telecommunications system (GTS).

7.1.3.11 In respect of the SOG and RRR itself, the MG agreed to identify experts willing to review and suggest improvement to the prevailing Statement of Guidance for Aeronautical Meteorology. **Action A19-2016**

7.1.3.12 In respect of WIGOS, the MG agreed to undertake a review of ICAO Annex 3/WMO-No. 49, Technical Regulations, Volume II – *Meteorological Service for International Air Navigation* with a view to improving its consistency with WMO-No. 49, Technical Regulations, Volume I – *General Meteorological Standards and Recommended Practices* concerning WIGOS and the specific requirements thereof as defined in the RRR. **Action A20-2016**

7.1.3.13 In respect of CIMO, the MG agreed that there should be further consultation between CAeM and CIMO on methods of observation, in particular automation issues, at the aerodrome and (increasingly) in the terminal area. **Action A21-2016** In this connection, the MG expressed that aerodrome observations was an area garnering limited attention at present, particularly given the dissolution in 2015 of the ICAO Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG) arising from the establishment of the METP. The MG

acknowledged that consideration should be given to addressing such aerodrome observation issues as part of the CAeM's future priorities and associated structures.

7.1.3.14 In respect of the standardization and quality assessment of ICAO aircraft-based observations (air-reports) exchanged over the GTS, noting a non-standardized format that currently prevails, and accepting that aircraft-based observations are becoming more-and-more important from both a meteorological perspective and an aeronautical perspective, the MG requested ICAO to consider efforts to improve the standardization and quality of air-reports received at the ICAO world area forecast centres (WAFCs) and to further disseminate the air-reports as basic meteorological data to the wider MET community normally on the WMO GTS. **Action A22-2016**

7.2 Regional Activities (Doc. 7.2)

Note, the following provides information on activities coordinated mostly by the AEM Division of the WMO Secretariat to complement the regional activities information presented in the report of the ET-CCP (Doc. 4.1(2)).

7.2.1 *RA I (Africa)*

7.2.1.1 The MG was informed that, as part of a Weather and climate Information SERvices for Africa (WISER) Programme of the United Kingdom, WMO had recently submitted a bid to support the conducting of a project in RA I on quality management systems (QMS) and related activities in the aviation meteorology sector of East Africa. The aim of the project was to contribute to the safety and protection of the livelihoods and property of the people of East Africa, and to maintaining the standards, regularity and efficiency of international civil aviation, by providing capacity development support to beneficiary institutions[6], enabling compliance with international regulations for QMS, competency assessment and cost recovery. The MG noted that, if approved, the two-year project was expected to commence before the end of 2016 and that it would be supported by Tanzania Meteorological Agency and Kenya Meteorological Department (serving as resource institutions) as well as the WMO Secretariat.

7.2.1.2 As part of the efforts aimed at resolving deficiencies and building national capacity for requisite aeronautical meteorological services, the AEM Division supported missions to Democratic Republic of Congo (April 2016) and Guinea (November 2016). The DR Congo mission was in conjunction with a World Bank (WB) assessment that would serve as the basis for a WB funded project (approximately USD 4 million). It was proposed that the project should include an aviation MET component.

7.2.2 *RA II (Asia)*

7.2.2.1 The MG was apprised of the establishment of a WMO partnership with Météo-Suisse aimed at assisting Bhutan through the delivery of used equipment (ceilometers for Paro International Airport). The donor (Météo-Suisse) would guarantee that the equipment has been fully serviced and with sufficient resource to serve the new location. Arrangements for shipment and installation are being negotiated between WMO and Météo-Suisse.

7.2.2.2 Initial steps have been undertaken for an action targeting Southeast Asian countries lagging behind with the implementation of QMS, competency and qualification requirements. Inputs have been provided to the WB team working on a large-scale modernization project for Myanmar highlighting the need of an aviation component in this project.

7.2.2.3 The MG was further informed that Japan Meteorological Agency (JMA) had organized a WMO/JMA SIGMET Workshop, from 27 to 30 June 2016 in Tokyo, Japan. This workshop, also coordinated with ICAO, was a contribution to the international effort in RA II and in other WMO Regions to improve the provision of aeronautical meteorological service to international air navigation (a WMO priority for the current financial period). The aim of the workshop had been

[6] Institut Geographique Du Burundi (IGEBU), National Meteorological Agency of Ethiopia (NMA), Rwanda Meteorological Agency, Uganda National Meteorological Authority (UNMA) and South Sudan Meteorological Department (SSMD).

to assist aeronautical meteorological service providers in the Asia/Pacific Region, especially those within the coverage of JMA's meteorological satellite Himawari-8, in improving the competency of their aeronautical meteorological forecasters in meeting effectively the international requirements for issuance of SIGMET information.

7.2.3 *RA III (South America)*

The MG was pleased to hear about progress made since 2014 in developing stronger links within RA III. In close coordination with the RA III president a very successful South American aviation MET training seminar was excellently hosted in Buenos Aires by SMN Argentina followed by the 4th VAAC Best Practice Workshop in 2016, also hosted by SMN. Strong representation from RA III is also now for the first time evident on the ET-GOV and ET-CCP.

7.2.4 *RA IV (North America, Central America and the Caribbean)*

The MG noted that a WMO RA IV Workshop had been organized by the RA IV Task Force on SIGMET and Competency of Aeronautical Meteorological Personnel, with support from the WMO Office in Costa Rica and the AEM Division (25-27 August 2015). The objective of the Workshop had been to assist RA IV Members to improve their SIGMET practices and resolve related deficiencies, and to progress the competency assessment of the aeronautical meteorological forecasters.

7.2.5 *RA V (South-West Pacific)*

7.2.5.1 The MG noted that the operational phase of a Pilot Project on SIGMET Coordination (SIG-Coord) was currently underway in RA V, involving Indonesia (BMKG), Malaysia (MetMalaysia) and Singapore (MSS) with the assistance of Hong Kong, China (HKO), Japan (JMA) and the WMO Secretariat. The MG was informed that the Meteorological Watch Offices (MWO) of Indonesia, Malaysia and Singapore were conducting cross-border coordination via teleconference and web-based chatrooms whenever observed or forecast meteorological phenomenon for which SIGMET are warranted were expected to transition from one flight information region (FIR) to an adjacent FIR of a neighbouring country. The MG further noted that the operational phase of SIG-Coord was expected to last five months (until March 2017) after which a review and evaluation would be conducted in order to determine the feasibility and suitability to introduce SIGMET coordination permanently amongst the MWOs concerned. The MG expressed its appreciation to HKO and JMA for making online tools and guidance available to assist the MWOs in their preparation of SIGMET. The MG considered that, subject to the outcomes of SIG-Coord, the pilot project could serve as a model to be applied elsewhere in RA V as well as in other WMO Regions.

7.2.5.2 The MG was informed that an annual WMO/United Kingdom Met Office Aviation Seminar was hosted this year by the Meteorological Climatological and Geophysical Agency (BMKG) in Jakarta, Indonesia, from 26 to 30 September 2016. The seminar provided training, guidance and practical examples of several key aspects of meteorology and forecasting for aviation, to support forecasters in this specialized area. The 2016 seminar programme focused on the topics of Aviation Hazards and SIGMETs.

7.2.6 *RA VI (Europe)*

In addition to ECMA-2015 (as covered in the report of ET-CCP, Doc.4.1(2)), the MG noted that the first ICAO Workshop on Implementing the ICAO Meteorological Information Exchange Model (IWXXM) for the exchange of OPMET data was held in Paris, France, 31 May to 2 June 2016. The event was targeted at the experts from Regional OPMET Data Banks (RODB) in order to initiate the planning for a transition period from TAC to XML.

7.2.7 *Multi-region*

The MG noted that an Aviation Research Demonstration Project (AvRDP) – established to develop, demonstrate and quantify, through international collaboration, the benefits of end-to-end nowcasting services for the terminal area focussed on high-impact weather – was continuing in RA I, RA II, RA IV and RA VI as a joint venture between CAeM, CAS and CBS. The MG was pleased to note that a capacity building workshop in this regard had been held in Hong Kong, China in July 2016 coinciding with a special session on AvRDP held during the WMO/World Weather Research Programme (WWRP) 4th International Symposium on Nowcasting and Very-short-range Forecast (WSN-16).

7.2.8 *Proposed topics for future coordination with the Regional Associations*

7.2.8.1 The MG noted that the next cycle of RA Sessions starts in the first quarter of 2017 with the 16th session of RA II (Asia) to be held at Abu Dhabi, United Arab Emirates, 12 to 16 February 2017, preceded by the seventh session of Regional Conference (RECO-7) on 10 and 11 February 2017. The 17th Session of RA IV (North America, Central America and the Caribbean) will be held in Costa Rica from 27 to 31 March 2017. The 17th Session of RA VI (Europe) is scheduled for September 2017 in Croatia (dates to be advised in due course).

7.2.8.2 The MG agreed that the following topics should be included in general in the relevant RA's decisions with the reflection of specific regional needs and priorities:

- Improvement of SIGMET provision – promotion of the cross-FIR SIGMET coordination;
- Implementation of QMS – for State that already implemented QMS - migration to the ISO 2001:2015; for those States that have not completed the implementation – focused support (e.g., through projects, such as the WISER as described above);
- Competency and qualification of AMP – continued monitoring and identification of needs for capacity development;
- Migration to IWXXM – coordinated implementation support actions together with CBS and ICAO regional groups; and
- ICAO GANP and ASBU awareness and national planning – further awareness events to be proposed for the regions, as appropriate; support of information sharing on national implementation programmes and achievements to build collective capacity in support of the regional ATM enhancement.

7.2.8.3 In connection with the foregoing, the MG emphasized the importance of not only conveying to the RAs the reflection of CAeM-identified specific regional needs and priorities, as described, but the equal importance of obtaining from the RAs a reflection of their RA-identified specific needs and priorities from CAeM.

7.3 Scientific Event 2017 (Doc. 7.3)

7.3.1 The MG recalled Resolution 44 (Cg-17) established an Aviation Research Demonstration Project (AvRDP) and Resolution 66 (Cg-17) endorsed the engagement of WMO, in close collaboration with ICAO, in supporting the meteorological components of the Global Air Navigation Plan (GANP) and aviation system block upgrades (ASBU). The MG was aware that a special session on AvRDP was held in Hong Kong, China, in July 2016 during the WMO/WWRP 4th International Symposium on Nowcasting and Very-short-range Forecast (WNS-16), also in response to Resolution 44 (Cg-17).

7.3.2 In addition, the MG was apprised that Decision 44 (EC-68) inter alia agreed with proposed general principles for extended research activities coordinated by WMO, building on the progress of the current AvRDP and taking into consideration the envisaged performance

improvements in the ASBU blocks with focus on transfer of the results into operational practice, and also that the presidents of CAS, CAeM and CBS were requested to prepare a coordinated roadmap for an extended aviation meteorology research and development project, in support of future operational solutions for air traffic management (ATM) for consideration by the PTC-2017. Moreover, Decision 44 (EC-68) endorsed the proposed organizing in 2017 of a WMO scientific event (conference or symposium or workshop) with broad participation of research, operation and user communities, with the objective to identify needs and plan the research activities during the ASBU Block 1 and Block 2 (2018-2028)[7]. (INF. 4)

7.3.3 The MG reviewed a draft Concept Note for the WMO scientific event in 2017 that presented the background and rationale, objective and theme, expected outcome and outputs, stakeholders and partners, format and responsibility for the event. Having completed its review of the draft Concept Note (**Annex 7** to this report), supporting in principle its intent, the MG agreed that the draft Concept Note should be finalized by 16 December 2016 and used during the subsequent planning and preparations for the event by the organizing committee (see below). **Action A23-2016**

7.3.4 In respect of the timing, duration and location of the event, the MG considered that Q3 or Q4 of 2017 would provide optimal timing, that 3 or up to 5 days duration would be sufficient, and that the event should be held at a location with connectivity to the meteorological and aeronautical research and development communities. In this latter respect, the MG was apprised that Météo-France in Toulouse may be in a position to host the event subject to confirmation.

7.3.5 Acknowledging the extensive planning, preparation and coordination required to organize the WMO scientific event in 2017, the MG agreed to establish an informal organizing committee (OC-SCI) – comprising MG members, Secretariat and others as necessary – to oversee and assist with all the necessary arrangements, including logistics and outreach, up to and including the conducting of the event. The MG requested that the OC should conduct the bulk of its coordination for WMO scientific event through correspondence and tele-/video-conference as appropriate, and that the OC should initiate its coordination not later than 31 January 2017. **Action A24-2016**

8. ANY OTHER BUSINESS

8.1 White Paper on Future Aeronautical Meteorological Information Delivery

The MG was apprised that the ICAO METP/2 meeting (17 to 21 October 2016) had considered a White Paper on Future Aeronautical Meteorology Information Delivery, as developed by the METP AG-MCRGG. With the White Paper still in its development phase (and thus restricted to a limited audience), the MG was informed that the AG-MCRGG was willing to receive feedback from the MG to assist with its further maturation. Noting a need to digest the content of the White Paper, to consider its ramifications, to formulate opinions and for consolidated feedback to be arranged, the MG requested the Secretariat to seek an extension (from AG-MCRGG) to the review period established by METP/2. **Action A25-2016** Subject to the foregoing, the MG agreed to provide specific comments as well as general remarks on the White Paper to the Secretariat for consolidation and forwarding to AG-MCRGG.
Action A26-2016

8.2 Next meeting(s)

8.2.1 The MG recommended that, in the interest of ensuring continued efficient and effective follow-up and coordination of activities during the intersession period and noting CAeM-16 is scheduled for mid-2018, its next MG meeting should be arranged in Q4 2017 or at the latest Q1 2018. In this connection, the MG noted a potential offer from the United Kingdom (Met Office) to host the meeting, which would be confirmed (or otherwise) in due course.

[7] Note, the ASBU Blocks described in the GANP have been revised as part of the fifth edition (2016) of the GANP. ASBU Block 1 now covers 2019 to 2024, while ASBU Block 2 covers 2025 to 2030. Collectively therefore, ASBU Block 1 and Block 2 now covers the 2019-2030 timeframe.

8.2.2 In respect of the next meetings of the ETs, the MG recalled that it was desirable to hold up to two meetings of each ET during each four-year financial period – i.e. an ET would typically convene one face-to-face meeting every two years. In this connection, the MG noted that over the past two years several of the ETs had held meetings conjointly in order to minimise costs and maximise efficiency and effectiveness on matters of mutual interest across the ETs. The ETs were encouraged to continue this practice where it was deemed necessary and appropriate. For 2017, the MG recommended that an ET (or conjoint ETs) should be convened in Q1/Q2 2017, and a further ET (or conjoint ETs) should be convened in Q3/Q4 of 2017. At this stage and to allow flexibility, the MG did not decide which ETs specifically should convene in 2017.

9. CLOSURE OF THE MEETING

After the customary exchange of courtesies, the meeting closed at 15:30 hours on Thursday 10 November 2016.

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

CAeM MANAGEMENT GROUP 2016

HALL (INNSBRUCK), AUSTRIA

8-10 November 2016

AGENDA

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session
1.2 Adoption of the Agenda
1.3 Working arrangements

2. REVIEW OF ACTION LIST

3. REPORT OF THE PRESIDENT OF CAeM

4. REVIEW OF THE WORK PROGRAMME IMPLEMENTATION

4.1 Expert Teams' reports
4.2 Coordination of outstanding tasks
4.3 Volcanic Ash Activities

5. ICAO ACTIVITIES AND COORDINATION NEEDS

6. FUTURE WORK PROGRAMME

6.1 Long-term Plan for AEMP aligned with GANP and ASBU
6.2 CAeM Operating Plan (2016-2019): Priorities – Review and Update
6.3 CAeM-16 Session (2018) – Initial Planning
6.4 Review of WMO Publications under CAeM Responsibility

7. COOPERATION WITH OTHER WMO BODIES AND INTERNATIONAL ORGANIZATIONS

7.1 Inputs to PTC-2017 and EC-WG-2017 and coordination with other Technical Commissions
7.2 Regional Activities
7.3 Scientific Event 2017

8. ANY OTHER BUSINESS

9. CLOSURE OF THE SESSION

CAeM MANAGEMENT GROUP 2016

HALL (INNSBRUCK), AUSTRIA

8-10 November 2016

LIST OF PARTICIPANTS

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Action List

Status of follow-up key:

Not started	On hold	On-going	Completed	Deferred	Cancelled
Work on the task has not begun and is not underway.	*Work on the task has begun but is not finished and is not being actively worked on.*	*Work on the task has begun and is actively underway.*	*Work on the task has been completed.*	*Work on starting or completing the task has been deferred to a later date.*	*Work on the task has stopped without being started or completed and is no longer required.*

Action identifier key:

A[nn]-[yyyy]	For actions arising from CAeM Management Group meetings, where A[nn] denotes the action number and [yyyy] denotes the year
Example: A01-2016	*Action 01 arising from the CAeM Management Group meeting in 2016*

Actions agreed by the CAeM Management Group meeting in May 2015
(As updated by CAeM-MG-2016)

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A01-2015	3	Action List table should be used as a tracking tool of the status of implementation of the actions agreed by the MG and ETs meetings. All actions should be clearly formulated and addressed to a responsible body/person with specific target date and deliverable.	P/CAeM Secretariat	Action List	Permanent	On-going	Recurrent activity
A02-2015	4.1.1	Conduct global survey on institutional arrangements for the provision of MET Service for aviation, including business models and cost-recovery aspects.	ET-GOV	Survey	End of 2016	Complete	
A03-2015	4.1.1	Revive WMO-No. 732, Guide to Practices for Meteorological Offices Serving Aviation. WMO-No. 732 should be fully updated and become a placeholder for the new guidance material; the starting point should be developing a new outline of the document.	ET-GOV Secretariat	Outline of updated WMO-No.732	ET-GOV meeting, Nov 2015	Complete	
A04-2015	4.1.5	Transforming the WMO-Doc.1083, Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology, Volume I, into a Guide which on compliance with both qualification and competency requirements. Coordinate with Secretariat how this work would be organized and should contribute the chapters related to the AMP.	ET-ETC Secretariat	Proposed outline of the Guide; Inputs on C&Q for AMP	ET-ETC meeting, Nov 2015	Complete	

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A05-2015	4.1.1 – 4.1.5	The updated TORs of all ETs to be published on the WMO AEMP website	Secretariat	Updated web site	Jul 2015	Complete	
A06-2015	4.2	All ETs should review and update their work programmes and submit to Secretariat for posting on the website	ET Chairs, Co-Chairs	Updated final work programmes	Sep 2015	On-going	Connected with A09-2015 and A09-2016
A07-2015	6	Prepare CAeM Operating Plan 2016-2019 as a compilation of the work programmes of the Expert Teams with appropriate grouping of the tasks according to the KOs.	ET-GOV to coordinate	Draft CAeM OP 2016-2019	ET-GOV meeting, Nov 2015	Cancelled	Superseded by A09-2016
A08-2015	6	Request EC WG-SOP to provide appropriate templates and guidance on the WMO organization-wide integrated strategic/operating planning process	P/CAeM Secretariat	Working paper for EC WG-SOP meeting in 2016	Jan/Feb 2016	On-going	To be restated in 2017 through P/CAeM
A09-2015	7	All ET Co-Chairs to consider the new CAeM priorities in the formulation of their work programmes and tasks. The priorities to be posted on the WMO/AEMP website	ET Chairs, Co-Chairs Secretariat	Updated work programmes and website	Sep 2015	On-going	Connected with A06-2015 and A09-2016
A10-2015	8	Submit proposals to the 2016 PTC and PTC/PRA meetings aimed at improved top-level coordination and prioritization of tasks	P/CAeM	Working paper for PTC and PTC/PRA 2016	Jan 2016	Complete	With inputs from MG members

Actions agreed by the CAeM Management Group meeting in November 2016

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A01-2016	2	To prepare and coordinate a schedule for 2017 CAeM-MG teleconferences	Secretariat	Teleconference schedule	16 Dec 2016		
A02-2016	2	To maintain the CAeM-MG Action List on the WMO extranet AeMP website	Secretariat	Action List on WMO extranet	16 Dec 2016		
A03-2016	3	To determine the need and feasibility of reinstating aircraft-based observations in the work programme of the CAeM	Secretariat	Report/feedback to MG	31 Mar 2017 (or Telecon #1 of 2017)		
A04-2016	4.1.1	To provide ET-GOV with feedback on the proposed straw man of revised WMO-No. 732	All ET chair/co-chairs	Feedback on proposed WMO-732 revision	16 Dec 2016		
A05-2016	4.1.3	To monitor developments insofar as current ET-ETC co-chair (United States) is concerned and to identify and establish a new ET-ETC co-chair if necessary	P/CAeM in coordination with MG	New ET-ASC co-chair if necessary	31 Jan 2017		
A06-2016	4.1.4	To identify and establish a co-chair for ET-ASC	P/CAeM in coordination with MG	New ET-ASC co-chair	16 Dec 2016		
A07-2016	4.1.4	To add work programme item to ET-ASC on climatological tables and aerodrome reference temperatures with a view to preparing a study note for consideration by ICAO	ET-ASC chair	Study note (or similar) to ICAO	30 Sep 2017		

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A08-2016	4.1.5	To clarify the role and responsibility of CAeM/ET-ISA in respect of IWXXM developments given the activities of other related bodies/groups such as CBS (TT-AvXML) and ICAO	ET-ISA co-chairs	Update to TORs and/or work programme, as necessary	31 Mar 2017 (or Telecon #1 of 2017)		
A09-2016	6.1	To: a) develop a draft introduction and template for an AeMP long-term plan; and b) circulate to P/CAeM and VP/CAeM for comments	Secretariat	Draft AeMP long-term plan introduction and template	16 Dec 2016		
A10-2016	6.2	To: a) undertake a review and, as necessary, revision of the CAeM Operating Plan priorities; and b) to populate with high-level deliverables, activities, KPTs and KPIs	Coordinated by ET-GOV with inputs from all ET chair/co-chairs	Draft CAeM Operating Plan (2016-2019)	a) 30 Nov 2016 b) 16 Dec 2016		See Annex 5 of CAeM-MG-2016 report. Supersedes A07-2015 and connected with A06-2015 and A09-2015
A11-2016	6.2	To periodically review and, as necessary, update the CAeM Operating Plan	MG	Up-to-date CAeM Operating Plan	Each CAeM-MG meeting		Recurrent activity
A12-2016	6.3	To: a) activate an Organizing Committee (OC) for the planning and preparation of the CAeM-16 Session and TECO in 2018; and b) initiate OC coordination not later than 31 March 2017	Secretariat in coordination with MG and others concerned	OC-CAeM for CAeM-16 and TECO	a) 16 Dec 2016 b) 31 Mar 2017		
A13-2016	6.4	To consult with the DPFS Division, WWR Division and others concerned to determine if other existing WMO publications could sufficiently accommodate the aeronautical meteorology components alluded to in WMO-No. 770	Secretariat	Report/feedback to MG	31 Mar 2017 (or Telecon #1 of 2017)		

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A14-2016	6.4	To consider the impact that a discontinuation (or distillation) of WMO-No. 1001 would have on ICAO Doc 9873	ICAO	Report/feedback to MG	31 Dec 2017 (or CAeM-MG-2017)		
A15-2016	6.4	To determine whether, in the context of WMO-No. 842, there is a (continuing) requirement to provide specific guidance on meteorological service for international helicopter operations	ICAO	Report/feedback to MG	31 Dec 2017 (or CAeM-MG-2017)		
A16-2016	6.4	To: a) undertake a review of the content of WMO-No. 1390 to ensure continued relevance; and b) determine the feasibility to transfer ownership of WMO-No. 1390 from ETR to AeMP	a) ET-ETC b) Secretariat	Review of WMO-No. 1390 and (potential) transfer of ownership	a) 30 Jun 2017 b) 31 Mar 2017		
A17-2016	6.4	To undertake a review and, as necessary, update of existing online ETC resources to ensure alignment with the (prospective new) WMO competency guide	ET-ETC	Review and, as necessary, update of online ETC resources	30 Sep 2017		
A18-2016	7.1	To develop a discussion paper (or equivalent) on key topics and principles of the technical commissions “reform” from CAeM perspective for consideration at PTC-2017	P/CAeM and VP/CAeM with Secretariat assistance	Discussion paper (or equivalent)	16 Dec 2016		
A19-2016	7.1	To identify experts willing to review and suggest improvement to the prevailing Statement of Guidance for Aeronautical Meteorology	Secretariat based on inputs from MG	Grouping of experts to serve as reviewers of the SOG	16 Dec 2016		

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A20-2016	7.1	To review ICAO Annex 3/WMO-No. 49, Volume II with a view to improving its consistency with WMO-No. 49, Volume I concerning WIGOS and the specific requirements thereof as defined in the Rolling Review of Requirements	Secretariat based on inputs from MG	Evaluation of consistency between WMO-No. 49, Volumes I and II	30 Sep 2017		
A21-2016	7.1	To further consultation between CAeM and CIMO on methods of observation, in particular automation issues, at the aerodrome and (increasingly) in the terminal area	P/CAeM and VP/CAeM	Consultation with CIMO	31 Mar 2017		
A22-2016	7.1	To consider efforts to improve the standardization and quality of air-reports received at the ICAO world area forecast centres (WAFCs) and to further disseminate the air-reports as basic meteorological data to the wider meteorological community normally on the WMO GTS	ICAO	Report/feedback to MG	31 Dec 2017 (or CAeM-MG-2017)		
A23-2016	7.3	To: a) finalize the draft Concept Note for the WMO Scientific Event 2017; and b) use the Concept Note during the subsequent planning and preparations	a) Secretariat based on input from MG b) Organizing Committee	Finalized Concept Note	a) 16 Dec 2016 b) 31 Jan 2017		Connected with A24-2016
A24-2016	7.3	To: a) activate an Organizing Committee (OC) for WMO Scientific Event 2017; and b) initiate OC coordination not later than 31 January 2017	Secretariat in coordination with MG and others concerned	OC-SCI for WMO Scientific Event 2017	a) 16 Dec 2016 b) 31 Jan 2017		Connected with A23-2016

ID No.	Ag. Item	Action	Responsibility	Deliverables	Deadline	Status	Note
A25-2016	8.1	To seek an extension to the review period established by the ICAO METP/2 for the AG-MCRGG White Paper on Future Aviation Meteorology Information Delivery	Secretariat	Extension to the White Paper review period and report/feedback to MG	30 Nov 2016		Connected with A26-2016
A26-2016	8.1	To provide specific comments as well as general remarks on the ICAO METP AG-MCRGG White Paper on Future Aviation Meteorology Information Delivery	MG	Feedback to Secretariat for consolidation and forwarding to METP AG-MCRGG	To be determined		Connected with A25-2016

CAeM Operating Plan 2016-19 Priorities

WMO Strategic Priority: Aviation meteorological services

Improve the ability of Members to provide sustainable high quality services in support of safety, efficiency and regularity of the air transport worldwide, with due account to environmental factors by:

(a) Accelerating the implementation of ICAO / WMO competency and qualification standards and Quality Management Systems (QMS);

(b) Addressing the emerging institutional and technological challenges associated with the ICAO Global Air Navigation Plan;

(c) Strengthening the sustainability and competitiveness of aeronautical meteorological service provision through improved cost recovery mechanisms and suitable business models for service delivery frameworks.

CAeM OP 2016-19 Priorities

Priority	Key Outcome	Deliverables	Activities	KPT	KPI
1. Support integration of MET information in SWIM	Contribute to the development of SWIM MET data standards and policies; and to promote implementation of MET information exchange under SWIM by Members				
2. MET information and service enhancements to support GANP and ASBU and related performance metrics	Inform the development of GANP and ASBU MET requirements, based on best practice, science and methodologies Assist Members in delivering services to meet the GANP and ASBU requirements				
3. QMS and AMP competency requirements, guidance and advice	Update guidance material addressing Members' needs				

Priority	Key Outcome	Deliverables	Activities	KPT	KPI
4.Communication to Members of GANP implementation challenges and opportunities	Promote Members' awareness of GANP requirements, challenges and opportunities				
5. Address institutional issues for Aeronautical MET	Contribute to development of policies, guidance material on governance, business models and regional cost recovery				

Review of WMO Publications
(See 6.4)

Note, the following listings exclude reference to WMO Technical Regulations.

WMO publications under CAeM **lead** responsibility:

WMO-No.	Title	Most recent year of publication	Current or expected future action by CAeM
731	*Guide to meteorological observing and information distribution systems for aviation weather services*	2014	Revive and update 732 and simultaneously transfer (updated) guidance from 731. [Action A03-2015]
732	*Guide to practices for meteorological offices serving aviation*	2003	
770	*Methods of interpreting numerical weather prediction output for aeronautical meteorology*	1999	Recommend withdrawal subject to determining if other existing WMO publications could sufficiently cover the AeM components alluded to in 770. [Action A13-2016]
904	*Guide to aeronautical meteorological services cost recovery: principles and guidance*	2007	Determine need for update following completion, by ICAO METP AG-MCRGG, of related cost recovery guidance analysis.
1001	*Guide to the quality management system for the provision of meteorological service for international air navigation*	2014	Consider discontinuing (or distilling) 1001 in light of the emergence and updating of 1100. Consider impacts on ICAO Doc 9873. [Action A14-2016]

WMO publications under CAeM **supporting** responsibility:

WMO-No.	Title	Most recent year of publication	Current or expected future action by CAeM
782	*Aerodrome reports and forecasts*	2014	Nil.
842	*Guide to the provision of meteorological service for international helicopter operations*	1996	Consider need for continuation following determination, by ICAO, of need for specific guidance supporting helicopter operations. [Action A15-2016]
958	*AMDAR Reference Manual: Aircraft Meteorological Data Relay*	2003	Nil.
1038	*Weather forecasting for soaring flight*	2009	Nil.
1083	*Guide to the implementation of education and training standards in meteorology and hydrology, Volume I – Meteorology*	2015	Nil.

1100	*Guide to the implementation of a quality management system for national meteorological and hydrological services*	2013	Nil but see comment concerning 1001 above.
TD 1390	*Aviation Hazards*	2007	Review and, as necessary, propose update to 1390. Consider transference from ETR Programme to AeMP. [Action 16-2016]
####	*WMO Guide on Competency* (working title)	—	Nil however review and, as necessary, update of ET-ETC online resources to be undertaken to ensure consistency. [Action A17-2016]

WMO SCIENTIFIC EVENT 2017

Draft Concept Note

1. Background and rationale

1.1 Cg-17 (2015) established an Aviation Research Demonstration project (AvRDP) and endorsed the engagement of WMO, in close collaboration with ICAO, in supporting the meteorological components of ICAO's GANP and ASBU methodology. EC-68 (2016) agreed with general principles (refer to **Attachment**) for extended research activities coordinated by WMO, building on the progress of the current AvRDP and taking into consideration the envisaged performance improvements in the ASBU blocks with focus on transfer of the results into operational practice. EC-68 also endorsed the organizing of a WMO scientific event (conference or symposium or workshop) in 2017 with broad participation of research, operation and user communities, with the objective to identify needs and plan the research activities during the ASBU Block 1 and Block 2 timeframe.

1.2 In the context of the foregoing, there is an identified need for WMO to lead a consolidated scientific evaluation of the (present and expected future) meteorological capabilities required to support the (present and expected future) aeronautical requirements aligned with the evolving GANP and ASBU methodology, in particular to support ICAO's vision of a globally interoperable, harmonized air traffic management (ATM) system. In addition, there is an awareness of the need for WMO to assist ICAO in determining the potential impacts of climate change and variability on aviation.

1.3 From a WMO perspective, the event will be a cross-cutting collaborative endeavour involving, as a minimum, CAS, CAeM and CBS in areas including observations and data processing, nowcasting, very-short-range forecasting and verification.

2. Objective and theme

2.1 With broad participation from research, operations and user communities, the objective of the event is to identify common aeronautical user needs and expectations over the next 15 years and to plan scientific research activities consistent with these.

2.2 The event will embrace and strengthen community partnerships that already exist at a national and sub-regional level and will establish new partnerships fostering regional and global collaboration.

2.3 The theme (working title) of the event will be:

"Aviation, science and climate: Turning research into operations in a changing world."

3. Expected outcome and outputs

3.1 The expected outcome of the event will be a common vision for scientific research and development activities over the next 15 years aligned with the evolving needs and expectations of international civil aviation together with an increased awareness of the potential impacts of climate change and variability on aviation operations now and into the future.

3.2 Outputs of the event will include the production of a WMO Publication (comprising full scientific articles/presentations) and other relevant, related materials to be used to report the outcomes of the event to ICAO and other interested parties.

4. Stakeholders and partners

4.1 A broad suite of scientific research partners, aviation stakeholders and other parties is expected to express interest in and support to the conducting of the event as follows:

a) WMO Member States and Territories (NMHSs), Technical Commissions and Regional Associations;

b) Scientific research institutes, universities and other academia;

c) Aviation community such as: standardization bodies (ICAO, Eurocae, RTCA, SAE); regulators (national civil aviation authorities/administrations); airlines (IATA); air navigation service providers (CANSO); air traffic control (IFATCA); pilots (IFALPA); airports (ACI); aerospace industries (ICCAIA); national or regional ATM modernization programmes (e.g. SESAR, NextGen, Carats); flight dispatch (IFALDA); business aviation (IBAC); and general aviation (IAOPA);

d) Meteorological instrumentation systems, data processing and display providers; and

e) Commercial meteorological service providers and other private enterprise.

5. Format and responsibilities

5.1 The event will be conducted in the form of a global <conference>. The <conference> will comprise Plenary keynote presentations, national and regional case studies/best practices and breakout group discussions (reporting back to Plenary) as well as the formulation of recommendations and a statement.

5.2 The basic programme structure for the event will focus on:

a) Scientific challenges in observing, nowcasting and very-short-range forecasting for time scales of 0-20 minutes, 20-120 minutes and 3-30 hours;

b) Tools to support strategic planning with time scales of 1 to 7 days;

c) Scientific and technological capabilities to support enhanced provision of information on hazardous weather phenomenon to meet evolving aeronautical users' requirements; and

d) Potential impacts of climate change and variability on aviation operations in the context of long-term (years/months), medium-term (weeks/days) and short-term (hours/minutes/seconds) needs.

5.3 An organizing committee (OC) will be responsible for overseeing and assisting WMO with all of the necessary arrangements up to and including the conducting of the event. The OC will, in particular, assist and oversee logistics and outreach for the event including dates/duration, location and host, funding, sponsorship and exhibiting, hospitality, agenda and programme schedule, keynote and other supporting presentations, invitations, communications and other related publicity.

Attachment to Concept Note

Annex to Decision 44 (EC-68)

RESEARCH AND DEVELOPMENT FOR FUTURE AVIATION METEOROLOGICAL SERVICES ENVISAGES IN THE ICAO GANP AND ASBU

(General principles)

1. Alignment with ASBU time blocks and planned performance improvements

   (a) AvMET research should be planned in accordance with the ASBU time blocks, as follows:
   - Block 0 - 2013-2018
   - Block 1 - 2018-2023
   - Block 2 - 2023-2028
   - Block 3 - 2028+

   (b) Research should be focused on the four performance improvement areas defined by the ASBU:
   - Airport Operations
   - Globally Interoperable Systems and Data
   - Optimum Capacity and Flexible Flights
   - Efficient Flight Path

2. Areas of research. The planning of future projects should consider the already established ASBU MET modules and contribute to achieving the planned outcomes. The following areas of research activities should be considered:

   (a) Improved observations, forecasting and warnings:
   - Enhanced global MET data – further development of the WAFS
   - Enhanced 4-dimensional information for meteorological hazards of any type – further development and integration of warning and advisory systems
   - Enhanced high resolution 4-dimensional MET information for airports and terminal areas

   (b) Integration, use cases, fitness for purpose, delivery:
   - Integration of MET information in the digital information management through the ICAO System-Wide Information Management (SWIM)
   - MET information to support collaborative decision making (CDM)
   - MET information to support trajectory-based operations (TBO)
   - MET information representation and delivery for enhanced situational awareness and decision making support to different ATM decision horizons – from “immediate” (0-20 minutes) to several days ahead

   (c) Climate change impacts on aviation industry.

3. Coordination between technical commissions and WMO Programmes

   (a) Research activities should be planned in close coordination between CAeM, CAS and CBS. Other Commissions like CCl should be involved in some specific activities;

   (b) Technical commissions should participate through their relevant expert subsidiary bodies whose work programmes should be aligned with the agreed inter-commission tasks and projects;

   (c) The overall coordination of the aviation-oriented research and development projects should be done by the AeMP. Support to such projects should be provided by relevant Programmes, such as WWRP, GAW, WIGOS, WIS, GDPFS, WCRP.

4. External coordination and partnership

(a) Research and development activities on enhanced meteorological information and services in support of the future ATM are being conducted by many research institutions, consortia and private companies. Large scale ATM projects (NextGen (USA), SESAR (Europe), CARATS (Japan), etc.) include comprehensive research programmes with substantial funding. A number of Members' NMHSs are engaged in such projects. The current WMO AvRDP and future projects on MET support to GANP and ASBU performance improvement areas should be well coordinated with existing research efforts and partnerships with ICAO, other relevant organizations and stakeholders should be fostered;
(b) Engagement of service providers and stakeholders should be sought in order to ensure the "fitness for purpose" and accelerate the transfer from research to operations;
(c) Research and development of systems to improve nowcasting for aviation purposes should be of such a nature that developing countries can also benefit from this initiative to enhance aviation safety in areas where highly sophisticated instruments and computer resources are not always available.

5. Format of project activities and funding

(a) WMO research projects should be based mostly on voluntary cooperation between WMO Members and their NMHSs or other aeronautical meteorological service providers (AMSP), and relevant research institutions. Jointly planed research activities and information sharing are among the main drivers that would bring collective benefits;
(b) WMO Secretariat should facilitate the research activities through secretarial support, in particular organization of project events, editing and publishing project outcomes, communication and outreach;
(c) WMO should also play an important role in organizing dedicated scientific events that would demonstrate the importance of the coordinated research and development for the enhancement of the MET information and services to aviation that would bring the desired benefits to the aviation safety, efficiency and regulatory, and address the related environmental issues;
(d) In view of (c) above, a dedicated scientific WMO event should be organized in coordination with relevant partners, preferably in 2017, to ensure the appropriate WMO positioning in the global research activities related to aeronautical meteorology during the time period of ASBU Block 1 and Block 2 (2018-2028);
(e) Funding of research activities through the WMO regular budget would not be sufficient, therefore, appropriate resource mobilization actions should be envisaged.

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