**WMO AERONAUTICAL METEOROLOGY SCIENTIFIC CONFERENCE**

**(AeroMetSci-2017)**

**Toulouse, France**

**6 to 10 November 2017**

The Annexes to this information paper provide the latest (19 May 2017) draft:

1. concept note
2. long-list of topics
3. provisional programme

for AeroMetSci-2017.

**ANNEX 1**

**Concept Note**

**(DRAFT)**

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 current and foreseen aeronautical requirements stemming from 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 on aviation of climate change and of the consequent evolving atmospheric variability.

1.3 From a WMO perspective, the event will be a cross-cutting collaborative endeavour involving CAS, CAeM and CBS in areas including aviation meteorological observations and data processing, nowcasting, very-short-range to global forecasting and verification as well as turning enhanced meteorological services into operations. CCl may also be involved in respect of the climate change and variability issue.

1. **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.

* 1. The theme (working title) of the event will be:

*“Aviation, weather and climate: Scientific research and development for future aeronautical meteorological services in a changing atmospheric environment.”*

1. **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 recommendations and a statement to guide scientific/research strategies in support of future aeronautical meteorological service provision. In addition, outputs 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.

1. **Stakeholders and partners**

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

1. WMO Member States and Territories, Technical Commissions and Regional Associations;
2. Scientific research institutes, universities and other academia;
3. International aviation organizations/associations such as ICAO, IATA, IFALPA, IFATCA and CANSO and others from the international aviation industry;
4. National or regional ATM modernization programmes including SESAR, NextGen and CARATS;
5. Meteorological instrumentation systems, data processing and display providers; and
6. Public and private meteorological service providers serving aviation.
7. **Format and responsibilities**

5.1 The event will be conducted in the form of an international conference. The conference will comprise a blend of plenary keynote presentations, national and regional case studies and panel discussions, taking into account leading scientific/academic research and aviation/industry best practices and developments. A poster session will also take place.

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

1. Science underpinning meteorological observations, forecasts, advisories and warnings through:
2. enhanced global meteorological information for flight planning and en-route operations;
3. enhanced 4-dimensional information for meteorological hazards of any type, including the further development and integration of advisory and warning systems that serve aviation; and
4. enhanced high-resolution 4-dimensional meteorological information for airport and terminal area operations;
5. Integration, use cases, fitness for purpose and service delivery through:
6. integration of meteorological information into the future globally interoperable, harmonized air traffic management (ATM) system enabled by system-wide information management (SWIM);
7. availability of meteorological information to support collaborative decision making (CDM) and trajectory-based operations (TBO);
8. meteorological information/data representation and service delivery for enhanced situational awareness and decision-making support for strategic, pre-tactical and tactical ATM decision time horizons – from “immediate” (0-20 minutes) to hours and several days ahead;

and,

1. Impacts of climate change and variability on aviation operations, including through regionally-focussed changing frequency, intensity and duration of previously rare scenarios.

5.3 A scientific committee will assist WMO with the selection of oral presentations and poster displays for the event taking into consideration the abstracts received. In addition, an organizing committee will assist WMO to oversee logistics and outreach for the event including dates/duration, location and host, funding, sponsorship and exhibiting as appropriate, hospitality, agenda and programme schedule, invitations, communications and other related publicity.

**Attachment to Concept Note**

**Annex to Decision 44 (EC-68)**

**RESEARCH AND DEVELOPMENT FOR FUTURE AVIATION METEOROLOGICAL SERVICES ENVISAGED 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[[1]](#footnote-1):

* 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.

**ANNEX 2**

**Session Topics – Long List**

**(DRAFT)**

**Session 1: Science underpinning meteorological observations, forecasts, advisories and warnings to aviation**

* 1. Icing research
     + High-altitude ice crystal engine icing
     + Airframe icing potential
     + Environmental conditions and prediction
  2. Turbulence research
     + Clear air turbulence (CAT)
     + In-cloud turbulence
     + Atmospheric turbulence climatology
     + Low-level wind shear
     + Wake vortex/aircraft-induced turbulence
     + Mountain waves, orographic turbulence
     + Katabatic winds, valley effects
     + Turbulence near cumulonimbus (CB) cloud tops
  3. Significant convection research
     + Thunderstorms, hail, lightning (cloud-to-cloud, cloud-to-ground)
     + Funnel clouds (water spouts, tornadoes)
     + Squall lines, organized convection
     + Mesoscale convective systems (MCS), overshooting tops
     + Gust front and microburst monitoring and prediction
     + Role of helicity on storm development, tracking and predictability
  4. Tropical convection research
     + Tropical cyclone forecasting/track, intensity, rainfall prediction
  5. Winter conditions research
     + Snow, rain/snow mix
     + Freezing rain
     + Ground frost/ice forecast
     + Effects of coastal and orographic conditions on precipitation type/transition phase
  6. Atmospheric aerosol research
     + Volcanic gases, SO2, dust, sand, fire/smoke haze, etc.
     + Radioactive materials, other toxic chemicals
     + Detection and dispersion
     + Health effects, airframe/avionics impacts
  7. Space weather research
     + Geomagnetic storms and ionospheric disturbances observation
     + Solar radiation storms and solar flares, geomagnetic storms and ionospheric disturbances prediction
     + Health effects, airframe/avionics and communications impacts
  8. Advances in methods of observation
     + Ground-based observations, satellite-based observations, in-situ airborne (aircraft-based) observations, upper-air observations, uplink/downlink
     + Remote observation (e.g. webcam, LIDAR, radiometer, etc.)
  9. Seamless numerical weather prediction (NWP)
     + Global models, regional models, sub-regional/limited area models, very high resolution local area models
     + Nowcasting, ensemble prediction, probabilistic, blending
     + Data assimilation
  10. Verification and validation
  11. Persistent/Non-persistent contrail research
  12. Big Data technology

**Session 2: Integration, use cases, fitness-for-purpose and service delivery**

* 1. Electronic flight bags, in-cockpit MET capabilities demonstration
  2. Collaborative decision-making
  3. Impact-based forecasting (i.e. MET-ATM impact translation for, say, capacity, delay and runway conditions prediction)
  4. Air traffic flow management, network management
  5. MET in SWIM, data-/information-centric approach, IWXXM, web-feature services
  6. Trajectory-based operations (TBO), continuous climb operations (CCO), continuous descent operations (CDO), user-preferred routing
  7. Performance-based navigation, communication and surveillance (PBN, PBCS) and emergence of remote (ATC) towers
  8. On-time performance (gate-to-gate/enroute-to-enroute)
  9. Operators’ safety risk assessment, risk management

**Session 3: Climate change and variability**

* 1. Extreme weather events – frequency, intensity, duration, geographic location
  2. Jetstream – seasonal/mean position and strength
  3. Turbulence and icing – location, frequency and severity
  4. Aerosols/air quality – dust, fire/smoke haze, etc.
  5. Density altitude, ‘heat days’
  6. Heat waves, drought
  7. Winter conditions, snowfall distribution, incidence of low-visibility procedures (LVP)
  8. Storm surge, coastal inundation
  9. Flooding, mudslides
  10. Changing migratory patterns of birds/wildlife – incidence of hazard strike
  11. Changes to established climatic scenarios and conceptual models
  12. Need for re-evaluation of airframe/avionics standards and certification envelopes given a changing atmospheric environment

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**ANNEX 3**

**Provisional Programme**

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| --- | --- | --- | --- | --- | --- |
| **November 2017** | **Monday 6** | **Tuesday 7** | **Wednesday 8** | **Thursday 9** | **Friday 10** |
| **0900-0930** |  | *Opening of Day 2*  **Session 1** (continued) | *Opening of Day 3*  **Session 1** (continued) | *Opening of Day 4*  **Session 2** (continued) | *Opening of Day 5*  **Session 3** (continued) |
| **0930-1000** |  |  |  |  |  |
| **1000-1030** |  | Q&A | Q&A | Q&A | **Panel discussion on  Session 3** |
| *1030-1045* |  | *Break* | *Break* | *Break* | *Break* |
| **1045-1115** |  | **Session 1** (continued) | **Panel discussion on  Session 1** | **Panel discussion on  Session 2** | ***Closing addresses, recommendations, statement*** |
| **1115-1145** |  |  |  |  | 1. ICAO 2. PTCs |
| **1145-1215** |  | Q&A |  |  | 1. WMO 2. Host |
| *1215-1400* | *Conference registration* | *Break* | *Break* | *Break* | *Conference closing* |
| **1400-1430** | ***Opening addresses and keynote presentations***   1. Host | **Session 1** (continued) | **Session 2** – *Integration, use cases, fitness for purpose and* *service delivery* | **Session 3** – *Impacts of climate change and variability on aviation* |  |
| **1430-1500** | 1. WMO 2. PTCs |  | Keynotes 2.1 and 2.2 | *operations and associated science requirements* Keynotes 3.1 and 3.2 |  |
| **1500-1530** | 1. ICAO | Q&A | Q&A | Q&A |  |
| *1530-1545* | *Break* | *Break* | *Break* | *Break* |  |
| **1545-1615** | **Session 1** – *Science underpinning meteorological* | **Session 1** (continued) | **Session 2** (continued) | **Session 3** (continued) |  |
| **1615-1645** | *observations, forecasts, advisories and warnings* |  |  |  |  |
| **1645-1715** | Keynotes 1.1 and 1.2  Q&A | Q&A | Q&A | Q&A |  |
| *1715-1730* | *Summary of Day 1* | *Summary of Day 2* | *Summary of Day 3* | *Summary of Day 4* |  |
| **1730-1900** | **Poster session** |  |  |  |  |

1. Subsequent to Decision 44 (EC-68), the ICAO 39th General Assembly endorsed revised ASBU time blocks in the fifth edition (2016) of the ICAO Global Air Navigation Plan. Consequently, the ASBU time blocks are now: Block 0 (2013 to 2018), Block 1 (2019 to 2024), Block 2 (2025-2030) and Block 3 (2031 onwards). [↑](#footnote-ref-1)