



ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other issues to be considered by the Technical Commission

ACTIVITIES WITHIN AND RESOURCING OF THE AERONAUTICAL METEOROLOGY  
DOMAIN TO BETTER ENABLE THE MODERNIZATION OF THE  
AIR TRANSPORT SYSTEM

(Presented by the World Meteorological Organization (WMO))

EXECUTIVE SUMMARY

This working paper is intended to summarize particular areas of intensive ongoing work activities within the aeronautical meteorology domains of the International Civil Aviation Organization (ICAO) and the World Meteorological Organization (WMO) in support of the Global Air Navigation Plan (GANP) and its aviation system block upgrades (ASBU) methodology.

The paper endeavours to draw attention to the threats posed to flight safety by adverse weather/meteorological conditions and a changing climate scenario, and to highlight concerns with regards to diminishing availability of expert/technical resources in the aeronautical meteorology domain which, unless resolved, could detrimentally impact the pace of progress of air transport modernization and/or quality of output of the aeronautical meteorology community over the coming years.

**Action:** The Assembly is invited to:

- a) note the information contained in this paper;
- b) note the importance of appropriate and necessary technical resources in aeronautical meteorology to sustain and enhance the standards-making and implementation support activities as well as the working arrangements between ICAO and the World Meteorological Organization (WMO); and
- c) urge States to ensure appropriate and necessary expert resources in aeronautical meteorology are available to ICAO to better enable the modernization of the air transport system as conveyed in the GANP and its ASBU methodology.

<i>Strategic Objectives:</i>	This working paper relates to the Safety, Air Navigation Capacity and Efficiency and Environmental Protection Strategic Objectives.
<i>Financial implications:</i>	Low.
<i>References:</i>	ICAO Doc 7475, <i>Working Arrangements between the International Civil Aviation Organization and the World Meteorological Organization</i> (reproduced within

<sup>1</sup> Arabic, Chinese, English, French, Russian and Spanish versions provided by WMO.

<p><a href="#">WMO Basic Documents No. 3 (WMO-No. 60), Chapter II</a> ICAO Annex 3, Meteorological Service for International Air Navigation (reproduced within <a href="#">WMO Technical Regulations (WMO-No. 49), Volume II</a>) <a href="#">ICAO Doc 9750, Global Air Navigation Plan (GANP)</a> <a href="#">ICAO Doc 10045, Report of the ICAO Meteorology (MET) Divisional Meeting (2014)</a> <a href="#">ICAO Doc 10115, Report of the Thirteenth Air Navigation Conference (AN-Conf/13) WMO-No. 1139, Report of the Fifteenth Session of the WMO Commission for Aeronautical Meteorology (CAeM-15)</a> <a href="#">WMO AeM SERIES No. 5, Long-term plan for aeronautical meteorology</a> <a href="#">IATA Safety Report 2018</a></p>
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## 1. INTRODUCTION

1.1 The International Civil Aviation Organization (ICAO) and the World Meteorological Organization (WMO) have had a long and mutually productive history of formal coordination, collaboration and cooperation dating from the formative years of the organizations in the 1940s and 1950s. While ICAO is the entity responsible for establishing the aeronautical requirements for meteorological service for international air navigation, WMO is the entity responsible for establishing the standardized meteorological technical methods and practices necessary to fulfil the aeronautical requirements<sup>2</sup>.

1.2 The two organizations, and their respective States/Members, dedicate resources on ensuring that the established aeronautical requirements are based upon high-quality, authoritative scientific and technical advice and the latest ‘state-of-the-art’ meteorological capabilities. This relationship between ICAO and WMO is a highly symbiotic one, for example: the two organizations periodically convene joint sessions of their respective technical bodies; Annex 3 — *Meteorological Service for International Air Navigation* is reproduced by WMO as Technical Regulations (WMO-No. 49), Volume II; and the two organizations have complementary technical guidance material and undertake complementary capacity development activities to promote implementation.

1.3 In July 2014, ICAO held a Meteorology Divisional Meeting (MET/14) conjointly with the Fifteenth Session of the WMO Commission for Aeronautical Meteorology (CAeM-15). In the spirit of the ongoing coordination, collaboration and cooperation between the two organization through their long-standing working arrangements (ICAO Doc 7475 and WMO-No. 60 refer), the conjoint meeting set the tone for the modernization of meteorological service for international air navigation over the coming years, fully aligned with the rolling 15-year plan for the modernization of the air transport system as conveyed in the ICAO Global Air Navigation Plan and its aviation system block upgrades (ASBU) methodology.

1.4 This working paper is intended to summarize particular areas of intensive ongoing work activities within the aeronautical meteorology domains of ICAO and WMO in support of GANP/ASBU. The paper endeavours to draw attention to the threats posed to flight safety by adverse weather/meteorological conditions and a changing climate scenario, and to highlight concerns with regards to diminishing expert/technical resources in the aeronautical meteorology domain which, unless resolved, could detrimentally impact the pace of progress of air transport modernization and/or quality of output of the aeronautical meteorology community over the coming years.

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<sup>2</sup> WMO is a specialized agency of the United Nations with headquarters in Geneva, Switzerland, dedicated to international cooperation and coordination on the state and behaviour of the Earth’s atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources. WMO has 193 Members (187 Member States and 6 Territories). More information on WMO is [available here](#).

## 2. DISCUSSION

2.1 Since MET/14 in July 2014, the aeronautical meteorological community has strived to proactively respond to the evolving needs of the international civil aviation community as portrayed in GANP/ASBU. While the activities of ICAO at a global level and at a regional level – most notably those within the Meteorology Panel (METP) and its working groups [global] and the Meteorology Subgroups or their equivalent [regional] – are being complemented by activities within WMO through its constituent bodies including CAeM, the scope of work and pace progress is being somewhat constrained by an evident diminishing availability of expert/technical resources. While a significant body of work and a concerted effort is currently underway within the aeronautical meteorology community to respond to the current and foreseen needs of the broader international civil aviation community (as illustrated at 2.2. below), there is immense pressure placed upon those experts currently involved in responding to the requirements. Unless appropriate and necessary additional resources are secured, the pace of progress of air transport modernization and/or the quality of output of the aeronautical meteorology community could be detrimentally impacted over the coming years.

2.2 While noting the foregoing remarks, ICAO and WMO strive to make progress in the following technical and non-technical areas:

- a) enhancement of the world area forecast system (WAFS), including the introduction of higher temporal and spatial resolution upper-air forecasts and significant weather (SIGWX) forecasts;
- b) enhancement of the international airways volcano watch (IAVW), including advances in volcanic eruption detection, volcanic ash cloud and gas (SO<sub>2</sub> etc.) observation and prediction as well as a concept for the introduction of quantitative volcanic ash forecast information;
- c) enhancement of the tropical cyclone watch, including the introduction of higher temporal resolution tropical cyclone advisory information;
- d) implementation of the global space weather information service, including operational coordination amongst designated space weather information providers and the augmentation of these global operations through the future integration of regional space weather information providers;
- e) implementation and enhancement of the ICAO meteorological information exchange model (IWXXM) as a key enabler to the system-wide information management (SWIM) environment of global air traffic management;
- f) concept for a regional hazardous weather advisory information service as a successor to the provision of SIGMET information;
- g) evolution of technical regulatory material and technical guidance material, including the restructuring of ICAO Annex 3/WMO-No. 49, Volume II, *Meteorological Service for International Air Navigation* and the (re)introduction of a *Procedures for Air Navigation Services – Meteorology* (PANS-MET);
- h) evolution of requirements for the education and training, competency and qualification of personnel engaged in the provision of meteorological service for international air navigation;
- i) refinement and/or establishment of information and data exchange policies and practices, including access management, as well as quality management system standards and cost recovery principles;

- j) advances in science and technology to enable faster transition from meteorological research into aviation operations, including through the enhancement of probabilistic and impact-based forecasting methodologies;
- k) assessments of the impacts of climate change and variability on aviation operations – at airports and in airspaces – and support to climate adaptation scenarios and extreme weather event mitigation; and
- l) initiatives to further improve the availability of in-situ aircraft-based observations of meteorological parameters, including water vapour.

2.3 WMO submitted information papers to ICAO's Thirteenth Air Navigation Conference (AN-Conf/13) in October 2018 and, here, the Fortieth Assembly (A40) in September/October 2019 illustrating why, where and how the Organization and its Members are working with aviation partners, including ICAO, on a daily basis to improve and, where needed, transform the meteorological service provided to aviation users worldwide consistent with and as an enabler to the modernization of the air transport system conveyed in GANP/ASBU. The information papers give examples of the relevance of meteorological information and services to aviation operations and allude to the potential impacts of climate change and variability on aviation operations. It is worthwhile to highlight here too that WMO has recently published a long-term plan for aeronautical meteorology which provides a framework upon which aeronautical meteorological service providers of Members/States in particular, and the broader meteorology and aviation communities in general, can plan a progressive transformation from a conventional "product-centric" approach to a modern "information-centric" approach to service provision for aviation through to 2030 and beyond.

2.4 The aviation industry is rightly demanding improvements in aeronautical meteorological service provision – both the eradication of existing (in some areas, long-standing) deficiencies and the introduction of new and more consistent information and services in line with aviation users' requirements and the latest meteorological capabilities – that will ensure that, by the 2030s, the aviation system (a system of systems) is safer, more efficient, more secure, more economic and more environmentally responsible than it is today.

2.5 As clearly set out in the 2018 Safety Report of the International Air Transport Association (IATA) published in April 2019, weather/meteorological conditions continue to pose a major threat and in some instances the highest threat to today's flight safety. Despite continual advances in observing and forecasting practices, weather/meteorological conditions – or rather, the intended or unintended penetration by aircraft into adverse conditions such as thunderstorms and strong gusty winds or wind shear – continue to be a contributory factor in aviation incidents and accidents such as loss-of-control in-flight (LOC-I), controlled flight into terrain (CFIT) and runway/taxiway excursions. Indeed, it could be concluded from the 2018 Safety Report of IATA that this threat has increased over recent years, perhaps partly due to changing weather patterns (e.g. more intense, more frequent convective activity in some regions) and perhaps partly due to operational pressures. This is a situation that deserves increased attention by ICAO, its States and its partners if the threats posed by adverse weather/meteorological conditions and a changing climate scenario are to be mitigated or otherwise reduced.

2.6 As aviation continues to grow – projected doubling in air traffic volume every 15 years – and as the impacts of climate change and variability on aviation operations become more evident (for example through the increased frequency and/or intensity of extreme weather events such as tropical cyclones, heat waves and droughts or other aviation-relevant changes in the operating environment such as the intensity and location of the jetstream at cruise levels or the incidence of severe flooding at aerodromes) the importance that needs to be placed by the entire community on the establishment and maintenance of high-quality, fit-for-purpose and cost-effective meteorological *and* climatological information and services for aviation operations cannot be emphasized enough. It demands a

collaborative, community response. These sentiments appear consistent with the vision put forward by ICAO in the proposed sixth edition (2019) of the GANP (ICAO Doc 9750).

2.7 Improved aviation system efficiency through enhanced strategic planning and tactical/pre-tactical decision-making that is enabled by improved meteorological and climatological information, in particular but not only in the terminal area, will contribute to a reduction of aviation's impact on the environment, through optimal flight trajectories resulting in reduced fuel burn and consequently reduced CO<sub>2</sub> emissions.

2.8 In addition, an increased ability of aircraft to perform in-situ observations of a range of meteorological parameters, especially in traditionally data-sparse areas such as large oceanic basins, is improving our ability to monitor the state of the atmosphere and our prediction capabilities. For example, measurements of water vapour in the atmosphere are critical to advancing our understanding of how the world's climate is changing and to our ability to predict climate change. It is essential that such in-situ aircraft-based observations are relayed to the meteorological community. In this connection, WMO and IATA are collaborating on the expansion of the Aircraft Meteorological Data Relay (AMDAR) programme.

2.9 As demonstrated at 2.1 above, it is worthwhile to observe that modernization within the aeronautical meteorology domain is not purely of a technical nature. There are a number of non-technical issues, especially governance, which are currently undergoing review or are in need of review to ensure that high-quality, authoritative aeronautical meteorological services can be supplied to users into the future. Such issues include cost recovery arrangements and policies for data/information management.

### 3. CONCLUSION

3.1 A collaborative, community response to the issues highlighted by this working paper demands the availability of appropriate and necessary technical/expert resources if the goals and aspirations of international civil aviation are to be realized within the timeframes envisaged by the GANP.

3.2 It is worthwhile to recall that, through Recommendation 2.3/1 of AN-Conf/13, States and international user organizations were requested to ensure that adequate expert capacity is applied in the collaborative management and development of aeronautical meteorological services for international air navigation. In addition, ICAO was requested to ensure it has sufficient capacity and expertise to progress the work on the development of provisions related to aeronautical meteorology.

3.3 While a significant body of work and a concerted effort is currently underway within the aeronautical meteorology community to respond to the current and foreseen needs of the broader international civil aviation community, a prevailing lack of expert/technical resources in aeronautical meteorology is placing immense pressure on those experts currently involved in responding to the requirements. Unless appropriate and necessary additional resources are secured, the pace of progress of air transport modernization and/or the quality of output of the aeronautical meteorology community could be detrimentally impacted over the coming years.