



WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 2: Enabling the global air navigation system

2.3: Future provision of aeronautical meteorological service

FUTURE PROVISION OF AERONAUTICAL METEOROLOGICAL SERVICE

(Presented by the Secretariat)

EXECUTIVE SUMMARY

This paper presents an overview of the development of the global requirements for aeronautical meteorology, in progress since the Meteorology (MET) Divisional Meeting (2014), and highlights those aspects that need specific emphasis and resources in order to maximize the benefits for the aviation community as a whole.

Action: The Conference is invited to agree to Recommendation 2.3/x – Future provision of aeronautical meteorological service in paragraph 3.3.

<i>Strategic Objectives:</i>	This working paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives.
<i>Financial implications:</i>	<i>Impact for the aviation community:</i> Significant benefits can be obtained with relatively low levels of investment in aeronautical meteorology. Variable investment levels will be required to see a full implementation of SWIM-enabled provisions depending upon the size of State aviation systems and the current level of maturity in the provision of air navigation systems. Significant costs are expected for those States involved in the establishment of space weather centres and their operation until such time that an appropriate cost recovery mechanism can be put in place. <i>Impact for ICAO (relative to the current Regular Programme Budget resource levels):</i> Since ICAO's Standards and Recommended Practices (SARPs) development and roll-out will continue over the next triennia, additional resources are required, both financial and human, to support ICAO's efforts in the highly specialized areas associated with aeronautical meteorology.
<i>References:</i>	Annex 3 — <i>Meteorological Service for International Air Navigation</i> Doc 10003, <i>Manual on the Digital Exchange of Aeronautical Meteorological Information</i> Doc 10045, <i>Meteorology (MET) Divisional Meeting (2014) Report</i> Doc 10100, <i>Manual on Space Weather Information in Support of International Air Navigation</i> Doc 9750, <i>Global Air Navigation Plan</i> Doc 7475, <i>Working Arrangements between the International Civil Aviation Organization and the World Meteorological Organization</i>

1. INTRODUCTION

1.1 A comprehensive assessment of the development of requirements for aeronautical meteorology for international civil aviation was carried out during the Meteorology (MET) Divisional Meeting (7 to 18 July 2014). The meeting provided confirmation of and some adjustments to the meteorological component of the *Global Air Navigation Plan* (Doc 9750) through the aviation system block upgrade (ASBU) modules relating to aeronautical meteorology (AMET).

1.2 Further support for the ICAO work programme relating to aeronautical meteorology was voiced at the Global Air Navigation Industry Symposium (GANIS, 11 to 13 December 2017). This symposium included a session dedicated to aeronautical meteorology showcasing a number of presentations by members of the Meteorology Panel (METP) which is the expert group providing assistance to ICAO in this respect. It was noted at the World Meteorological Organization (WMO) Aeronautical Meteorological Conference 2017, held in Toulouse, France, that the direct benefit of aeronautical meteorological information is of the order of USD 20 to 30 billion per year and that the use of meteorological information will remain critical to international civil aviation and to State economies.

2. DISCUSSION

2.1 Aeronautical meteorology as an enabling function

2.1.1 Aeronautical meteorology is described as an enabling function of international air navigation in the *Global Air Navigation Plan* (GANP).

2.1.2 The scope of meteorological products to support international air navigation has not markedly changed for several decades. There continues to be a focus on flight planning information but little to support the increasingly complex domain of air traffic management or the notion of collaborative decision-making. The focus of the work programme relating to aeronautical meteorology is to identify the needs of the various operational improvements described in Doc 9750. A number of these initiatives are highly complex, such as trajectory-based operations, remotely piloted aircraft and network operations. It is essential that the supporting meteorological requirements are developed in parallel with the development of these initiatives.

2.1.3 To put into place a timely set of requirements, a collaborative approach is needed involving all stakeholders engaged in air traffic management as well as meteorological information service providers and their supporting research community. This approach ensures that appropriate meteorological information requirements are identified with due regard to the operational needs and the current or future capabilities to meet those needs. The continuing support of the WMO can be expected in this regard as spelled out in the *Working Arrangements between the International Civil Aviation Organization and the World Meteorological Organization* (Doc 7475).

2.2 New aeronautical meteorology initiatives

2.2.1 A number of initiatives have already been identified as requirements which are actively being developed with the assistance of the METP.

2.2.2 Initial Standards and Recommended Practices (SARPs) for the provision of space weather advisory information services have been introduced in Amendment 78 to Annex 3 — *Meteorological Service for International Air Navigation* for applicability on 8 November 2018. The SARPs, developed as a follow-up to Recommendation 2/7 of the Meteorology (MET) Divisional Meeting (Montréal, 7 to 18 July 2014), are in response to user needs expressed by International Air Transport Association (IATA) as no information is currently available to assist operators in assessing the risks associated with space weather events. The space weather SARPs are supported by a process for the

assessment of prospective providers of space weather information, the designation of providers and the further development of higher resolution information over time.

2.2.3 The provision of information relating to en-route hazardous meteorological conditions (SIGMET) has been a challenge in many regions. Work is currently progressing on the development of a global system for the dissemination of information concerning en-route hazardous meteorological conditions. Focus is on meteorological phenomena rather than the current practice of information constrained to individual flight information regions (FIR) which interrupts meteorological information at geographical boundaries. A number of meteorological centres will be required to combine to provide such an integrated service in the future; these centres may be local, regional or global depending on the phenomenon in question. In the short term, guidance material is being developed to enable a greater level of cooperation between States to assist in the provision of SIGMET information.

2.2.4 It is increasingly apparent that the dissemination of meteorological information is expected to involve multi-State service provision with both regional and global centres providing services on behalf of other States. This is already the case for the world area forecast system (WAFS), the international airways volcano watch (IAVW) and the tropical cyclone advisory system, and can be expected in the near future for space weather service provision and the provision of en-route hazardous weather information. This by necessity involves service provision by a single State entity that covers potentially many States and is expected to increasingly create an imbalance in cost-recovery practices. ICAO needs to consider how to address such imbalances which can be expected to increase in scope and complexity.

2.2.5 It is recognized that significant impacts can be expected on the aviation community as a whole from climate change and associated extreme weather events. Recent widespread disruption of aviation operations due to extreme weather events around the world highlighted the importance of rapid, decisive and concerted action by all partners to better understand and react to these events. Studies by WMO have been ongoing into these impacts and ICAO needs to be ready to provide appropriate guidance to States in areas such as aerodrome design, route planning, aircraft design and maintenance. Such guidance is needed in collaboration with the WMO to identify the most appropriate mitigation strategies.

2.3 System-wide information management

2.3.1 The global exchange of meteorological information via system-wide information management (SWIM) is an essential capability of the future air navigation system. To this end, a number of existing legacy products have been integrated into potential SWIM information services based on the ICAO Meteorological Information Exchange Model (IWXXM). The next step is to move towards a network-centric, service-oriented approach while progressively removing the legacy products. The objective is to provide interoperable SWIM information services that can be suitably tailored to meet the unique needs of the operational users.

2.3.2 The rapid advance of meteorological science will provide benefits to the aviation community through the integration of and improvements in existing meteorological systems which are prompted by the changing needs of aviation and the demand for increased capacity and efficiency. Improvements in systems like the WAFS, concerning data resolution, data format, decrease in forecast time steps, improved science and integration of aircraft derived data, will result in improved route planning during significant weather events, improved fuel efficiency and passenger comfort, improved arrival time predictions and meteorological information that can be readily exchanged among all stakeholders via SWIM.

2.3.3 SWIM initiatives to date have concentrated on the ground-ground infrastructure. The next phase of SWIM will include the aircraft as an active node in the system. This will enable further

consideration of the requirements for meteorological information in the cockpit but also of the wider need for meteorological information provided either directly or indirectly from the aircraft or between aircraft. It is known that the use of airborne information contributes significantly to the improvement of numerical forecast models and the extended use of more widely available data, together with appropriate governance and usage of the information, would be of great benefit to the aviation community.

2.4 Implementation concerns

2.4.1 The implementation of a space weather information service will be supported by the *Manual on Space Weather Information in Support of International Air Navigation* (Doc 10100). No significant implementation issues are expected, except for the issues concerning the cost, related to the establishment and subsequent provision of space weather services that the Provider States will have to cover for the first three years. On the positive side improved information about space weather events that may affect communications, navigation and surveillance systems will lead to improved decision-making, particularly in the planning phase, to mitigate the potential impacts of space weather events on aircraft operations.

2.4.2 The implementation of the IWXXM as the meteorological exchange model of SWIM is expected to be a challenge for all States and users alike. To this end a concerted effort is required to provide adequate implementation guidance and support, both in terms of the technical aspects as well as the institutional issues that accompany the adoption of SWIM. Activities in support of this effort need to be coordinated with the SWIM community and also with the WMO who are responsible for the development of the IWXXM and for the associated technical guidance.

3. CONCLUSION

3.1 The ICAO work programme for aeronautical meteorology has been recently modified and expanded by the Meteorology (MET) Divisional Meeting (2014) and subsequently highlighted at the GANIS. The aspects related to aeronautical meteorology as described above and detailed in Doc 9750 are a vital component to enable the future development of the global air navigation system.

3.2 In order to develop the requirements for meteorological information in support of international air navigation there is a need for strong ongoing support from ICAO in coordination with WMO as well as from States and the industry itself, including the SWIM community.

3.3 In light of the above, the Conference is invited to agree to the following recommendation:

Recommendation 2.3/x – Future provision of aeronautical meteorological service

That the Conference:

- a) request ICAO to progress the work on the development of provisions related to aeronautical meteorology as described in the draft sixth edition of the *Global Air Navigation Plan* (Doc 9750) under development; and
- b) request ICAO to place emphasis on the development of implementation assistance for space weather information service, the meteorological component of system-wide information management (SWIM), cost-recovery solutions for regional and global systems, and potential new initiatives such as the impact of climate change on aviation.

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