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Agenda Item 2: Improving the safety and efficiency of international air navigation through enhanced meteorological service provision

2.2: Enhanced integrated meteorological information to support strategic, pre-tactical and tactical operational decision-making from 2018 (including ASBU Module B1-AMET)

INCLUSION OF METEOROLOGICAL SERVICE FOR THE TERMINAL AREA IN AVIATION SYSTEM BLOCK UPGRADE METHODOLOGY

(Presented by China)

SUMMARY

This paper proposes the inclusion of meteorological service for terminal area in Block 1 of the aviation system block upgrade (ASBU) methodology that forms a part of the fourth edition of ICAO's *Global Air Navigation Plan* (Doc 9750) and raises a couple of issues to be considered in the context of the meteorological component in the ASBU. Action by the meeting is in paragraph 3.

1. INTRODUCTION

1.1 The existing aviation meteorological services and products are crucial in maintaining safety and regularity in air navigation. With growing air traffic and further development of the aviation industry, the impact of adverse weather in the terminal area on its operation is becoming more serious. In line with Block 1 of the Aviation System Block Upgrade (ASBU), in recent years, to meet the needs of air navigation, the meteorological service for the terminal area, which include various new aviation meteorological products for terminal area, have been developed and operated by a number of States to support the air navigation service providers (ANSP) and users. This paper proposes that the meteorological service for the terminal area be included in Block 1 of the ASBU methodology that forms a part of the fourth edition of ICAO's *Global Air Navigation Plan* (Doc 9750).

2. DISCUSSION

2.1 The necessity for meteorological service for the terminal area

2.1.1 There is currently a gap between the aerodrome forecast (TAF) and the en-route forecast in the existing aviation meteorological services for international air navigation due to the lack of meteorological services tailored for the terminal area. Noting that weather forecast products for the terminal area would be highly effective in meeting the pressing need from ANSP, pilots and other air traffic management (ATM) users, some States have promoted the concept of "Meteorological Service for

Terminal Area", conducted relevant research, and developed some experimental/operational products with a view to filling the gap between TAF and en-route forecast and providing better meteorological services to support air navigation.

2.1.2 The existing technology and equipment, including inter alia, Doppler weather radar, lightning location system, aircraft meteorological data relay (AMDAR), regional numerical weather prediction (NWP) and associated algorithms have matured enough to make the provision of meteorological forecast for the terminal area possible.

2.2 Development in China and Hong Kong, China

2.2.1 China has developed meteorological service, i.e. experimental/operational products on wind field/wind gust, convective weather, turbulence and icing, for the terminal area (see MET/14-IP/10| CAeM-15/INF. 10). The meteorological service for the terminal area is tailored and provided in graphical, tabular, text or coded format to users including ATC, pilots and dispatchers. The period of validity of the meteorological services for the terminal area is very-short-term or nowcast (i.e. less than 6 hours) for convective weather and short-term (i.e. less than 24 hours) for the other elements, and accuracy specifications of the services is determined by agreement between the meteorological authority and user community based on capability of the provider and requirements of the users. The trial convective weather nowcast products, valid for 1 hour and with 6-minute updates, have been provided to the area control centre, terminal control centre, flight service centre and operations control centre for several terminal areas in China. The users' feedback has been positive.

2.2.2 Hong Kong, China has developed a suite of products, ranging from nowcast (0-1 hour), very short-term forecast (next 6 hours) and short-term forecast (next 12 hours), for predicting the impact of convective weather on air traffic along the flight paths and holding areas (see MET/14-IP/11| CAeM-15/INF. 11). The impact to air traffic is categorized into three tiers, namely "low", "medium" and "high". In respect of nowcasting, Hong Kong, China has developed a system known as the "Aviation Thunderstorm Nowcasting System" which forecasts the locations of thunderstorms in the next hour and is automatically updated every six minutes. On the very short-term and short-term forecast, Hong Kong, China has made available to Hong Kong ATM personnel a product known as "Significant Convection Monitoring and Forecast". The Significant Convection Monitoring and Forecast is based on automatic forecast plus forecasters inputs through the use of combined man-machine forecast. It effectively fills the gap between the conventional weather forecasts provided and the meteorological information required for ATM. It facilitates the air traffic controllers to issue capacity forecast to neighbouring control areas and airlines. The capacity forecast is updated whenever necessary according to the latest situation to better manage the flow control.

2.2.3 The benefit of Meteorological Service for Terminal Area has been showcased in many other occasions. The pilot project on Meteorological Service for Terminal Area by the WMO Commission for Aeronautical Meteorology (CAeM) Expert Team on Meteorological Services to ATM (MSTA) and Meteorological Information Exchange (ET-M&M) provides more examples in other parts of the world, such as the new terminal area forecast products operated or to be operated by Japan Meteorological Agency, Météo-France, National Oceanic and Atmospheric Administration of the United States, Meteorological Service of Canada, Bureau of Meteorology of Australia.

2.2.4 Other than the above pilot project, to demonstrate the application of nowcasting and mesoscale modelling technique research as further proof of concept and to evaluate the potential benefits of the future capability for ASBU AMET-B3, the WMO CAeM and Commission for Atmospheric Science (CAS) have planned to jointly take forward an Aviation Demonstration Project (AvRDP). To cater for different high impact weather at different locale, projects would be conducted at a number of

airports over different parts of the world with different climatological conditions. The project would address a number of issues including:

a) What is the performance of the current state-of-art of the nowcasting and mesoscale modelling techniques, how to verify the products, and are they sufficient to support the trajectory based operations concept?

b) What would be the suitable aviation nowcasting and modelling methodologies for meeting the ASBU requirements, deterministic and/or probabilistic?

c) How to translate the MET nowcast/forecast products and uncertainty information into ATM impact?

2.2.5 China supports the effort by WMO and has offered two airports, Shanghai Hongqiao Airport and Hong Kong International Airport, to join the AvRDP. Other airports have indicated interest in joining to work on other intense weather conditions such as winter weather, low ceiling/visibility, etc.

2.2.6 Considering the experience that would precipitate from AvRDP, and to avoid further costly parallel development of similar products, the meeting is invited to formulate the following recommendation:

Recommendation 2/x — Development of Meteorological Service for Terminal Area

That ICAO, in close coordination with WMO, be tasked to:

a) include Meteorological Service for Terminal Area in Block 1 of the aviation system block upgrade methodology and reflect them in the relevant standards in Annex 3 /Technical Regulations [C.3.1] and the PANS-MET;

b) provide support to the AvRDP as appropriate;

c) use the experience gained from AvRDP as blueprint for developing further Meteorological Service for Terminal Area in Block 3 of the aviation system block upgrade methodology and reflect them in the relevant standards in Annex 3/Technical Regulations [C.3.1] and the PANS-MET; and

d) integrate the information of Meteorological Service for Terminal Area into the future system-wide information management environment underpinning the future globally interoperable air traffic management system.

2.3 Key issues on the transition of ASBU MET component

Importance of local information, knowledge and expertise

2.3.1 Currently, to comply with Annex 3/Technical Regulations [C.3.1], each Contracting State has installed various monitoring and observing systems to provide continuous updated observations and support the issuance of warnings and forecasts. Despite the potential improvement in the accuracy, resolution and update frequency of global numerical weather prediction model in the future, they cannot replace the actual observations at the airport, forecasts from nowcasting systems and expert assessment of

forecasters. Furthermore, presently a number of States also operate higher resolution regional numerical model to better utilize their own observations so as to enhance their warning and forecasting capability. The global models are unlikely to rival the level of details and accuracies of such local observations and regional numerical model data. Thus it is considered that the need for such local information, knowledge and expertise should continue to be emphasized in the future global air navigation plan.

Information for pilots

2.3.2 While common situational awareness is a key concept behind ASBU, the specific needs of pilots are rarely elaborated as the various documents on ASBU focus very much on ATM needs. We should however never lose sight that both airlines and pilots are major user communities of the aeronautical meteorological information. The complex weather information should be presented to pilots in a highly consistent and concise way so that they could comprehend the weather situation readily, at a glance, in the system-wide information management (SWIM) environment, in particular given the limited ground-air data exchange capability in the foreseeable future.

Enabling technologies for implementation

2.3.3 Although the time schedules for ASBU are intended only to depict the initial readiness of the components needed for deployment, it should be recognized that certain technologies required for performing the upgrade are still lacking or immature. For instance, in respect of numerical weather prediction modelling, the forecasting capability of certain weather elements, such as turbulence intensity and significant convection are far from meeting the users' needs. There remain great challenges ahead. Meanwhile, some pertinent meteorological equipment, such as equipment for measuring flight or slant visibility, has yet been developed.

2.3.4 In the future, the realization of globally interoperable, exchangeable meteorological information between the air traffic controllers on the ground and the pilots in the air shall impose a great demand on the ground-air data exchange. At the same time, the "big data" concept behind the SWIM operation concept will also depend on the availability of abundant aircraft weather data, e.g. wind, turbulence, icing, etc. from flights for both improvement of forecast accuracy and validation of forecast performance. At present, the communications equipment and technology capable of meeting such functional requirement are still lacking, particularly over the oceans. Even if such equipment and technology are to be developed, it would still need a lengthy testing and implementation before they can be put in operational use. The planned schedules are hence too optimistic.

2.3.5 Considering the above discussion, the meeting is invited to formulate the following recommendation:

Recommendation 2/x — Transition of ASBU MET component

That the ICAO expert group tasked with further development of the MET component of ASBU to take into consideration the following issues in the transition:

a) need for local information, knowledge and expertise to be emphasized in the future global air navigation plan;

b) specific needs of pilots in respect of aeronautical meteorological information; and

c) readiness of other components, e.g. air-ground datalink availability, for transition to the fully net-centric environment.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) consider the adoption of the draft recommendations proposed for the meeting's consideration.

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