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PROMOTING THE APPLICATION OF AMDB TECHNOLOGY IN THE DIGITAL GROUND OPERATION AT AERODROMES

(Presented by China)

EXECUTIVE SUMMARY

At present, the ground operation of aircraft at aerodromes mainly depends on the visual environment and voice instructions. The traditional non-digital manual mode cannot improve the situational awareness or meet the operational efficiency and security needs of aerodromes. The aerodrome mapping database (AMDB) is expected to change this situation. AMDB supports transfer of traditional way of humans' reading information of aerodromes to a new way of systems' reading AMDB, and can provide real-time information data of aerodromes for the advanced surface movement guidance and control systems (A-SMGCS), and give graphical air traffic control (ATC) instructions and voice warnings with electronic flight bag (EFB). With the strong data-supporting capabilities of AMDB, and in combination with digital operation programs concerning A-SMGCS, 5G and EFB at aerodromes, we can achieve functions of taxi routes allocation, monitoring of ATC instructions, taxiing guidance, and prevention of runway incursions. The application of AMDB brings revolutionary changes to the ground operation at aerodromes, which can better meet the needs of digital ground operation at aerodromes.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objectives - Safety and Air Navigation Capacity and Efficiency.
<i>Financial implications:</i>	N/A
<i>References:</i>	Annex 15 - <i>Aeronautical Information Services</i> Doc 10066, <i>Procedures for Air Navigation Services — Aeronautical Information Management (PANS-AIM)</i> Doc 9881, <i>Guidelines for Electronic Terrain, Obstacle, and Aerodrome Mapping Information</i>

¹ English and Chinese versions provided by China.

1. INTRODUCTION

1.1 Releasing AMDB is a must-do task in the second phase of the planned transition from the aeronautical information services (AIS) developed by ICAO to the aeronautical information management (AIM). AMDB is an important part of system-wide information management (SWIM) and aviation system block upgrade (ASBU). It is clearly included in the category of releasing aeronautical information in Annex 15 to the Convention on International Civil Aviation and PANS AIM (Doc 10066). In the future, AMDB will support the exchange of airport aeronautical information data among countries.

1.2 AMDB can realize the digital storage of high-precision geographic information and data on elements of runways, taxiways, stands, lights, obstacles and-taxi routes at aerodromes, and can be applied to the ground operation systems at aerodromes by means of data sharing and fusion. Therefore, it is basis of realizing the digital ground operation at aerodromes. AMDB can realize graphic display of the digital NOTAM on aerodrome surface, raise the situational awareness of pilots and ATC controllers and prevent runway incursions by supporting A-SMGCS. The digital ground operation at the aerodromes based on AMDB is also the extension of the application of trajectory-based operation (TBO) concept in surface operation at the aerodromes, thereby truly achieving the digital air traffic management (ATM) covering the whole processes.

2. DISCUSSION

2.1 Refined standards for design and releasing of AMDB are of great importance. China civil aviation has been studying documents of RTCA DO-272D and DO-291C since 2017 and drafted the *Specifications on Development and Releasing of Aerodrome Mapping Database* in accordance with the situation of China's aerodrome construction and the operation needs of tower and apron control systems, which add seven elements such as protected areas for take-off and landing, protected areas for navigation facilities signals and standard taxi routes, storage of data on take-off runway entrance and shortened runway take-off, and optimize the setting rules of ASRN Edge and ASRN Node to better support the full digital surface operation at aerodromes. We suggest that ICAO improve or draft the relevant ICAO documents on the basis of the standards for design and releasing of AMDB of China civil aviation.

2.2 It is recommended that ICAO should revise and improve *the Guidelines for Electronic Terrain, Obstacle, and Aerodrome Mapping Information* (Doc 9881) in a timely manner since this document fails to adapt to design, releasing and promotion of AMDB at present.

2.3 It is suggested that the standards for releasing digital AMDB-based aerodrome surface NOTAM be established so as to achieve the dynamic and static integration of digital NOTAM and AMDB, for the existing digital NOTAM is designed on the basis of the standards of AIXM 5.1.

2.4 At present, there have been no AMDB products officially released by any countries. The AMDB products used on aircraft are mainly from commercial enterprises such as Jeppesen, and AMDB products have not yet been utilized for tower control and apron control systems. Only when AMDB is released and exchanged at the national level can aircraft equipment and ATC system use a common AMDB to achieve data sharing and to have common situational awareness.

2.5 The level-four A-SMGCS can be achieved through light guidance at present, but this mode needs high costs of construction, operation and maintenance and a long construction cycle, and is one-way information transmission which is not conducive to information exchange. The best way to achieve level-five A-SMGCS is to install the same AMDB in A-SMGCS and EFB so that the digital ATC

instructions generated by A-SMGCS can be transmitted to EFB through air- ground data communication legally provided to flight deck, and light guidance can be replaced by graphical and voice guidance. To realize this mode, it requires setting the standards for developing A-SMGCS based on AMDB, establishment of the air -ground data communication environment legally provided to flight deck at aerodromes, gaining airworthiness certification for the EFB navigation function and developing and releasing AMDB products. China civil aviation developed an automation system including the developing and releasing systems for A-SMGCS and AMDB and the EFB application program in 2020. This system was tested in Guangzhou Baiyun International Airport with B737-800 in November 2020, and the test subjects included ground taxiing guidance, route deviation warning, rational monitoring of ATC instructions, superposition of NOTAM, resolution of aircraft taxiing conflict, and runway incursion prevention. The test results showed that with the support of AMDB, light guidance could be replaced and level-5 A-SMGCS can be realized at the lowest cost.

2.6 The obstacle to the application of AMDB lies in the construction of the air -ground data communication legally provided to flight deck. Due to the high cost and long period of AeroMACS building based on 5G, it is suggested that ICAO promote the use of 4G communication to transmit digital ATC instructions to flight deck at the same time.

3. CONCLUSION

3.1 It is effective and feasible to facilitate the digital ground operation at aerodromes by applying AMDB technology. ICAO, however, still needs to improve relevant standards, work on developing and releasing AMDB products, design application scenarios and develop systems, and exchanges and cooperation among countries should also be strengthened. For example, concerning the question of how foreign aircraft effectively being adapted to the digital operation of airports in other countries, it is recommended that the application of AMDB technology can be piloted in some countries.

3.2 China civil aviation has strongly advocated digital and smart operation in recent years, and has done a lot of work in the preparation of AMDB standards, the development, releasing and quality management of AMDB products and the research and development of operation systems. Therefore, it is capable of carrying out the pilot application of AMDB technology in digital ground operation at aerodromes. It is suggested that the pilot application of AMDB technology be implemented at China's airports with multiple runways between 2022 and 2023, with the major pilot operation of voice instructions and the complementary pilot operation of EFB graphical navigation at the early stage. This technology should be gradually promoted and applied at 5 to 10 airports in China between 2023 and 2025.