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ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

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

APPLICATION OF BEIDOU GNSS IN GLOBAL FLIGHT TRACKING OF CHINA

(Presented by China)

EXECUTIVE SUMMARY

This paper presents the progress in the application of BeiDou GNSS in global flight tracking (GFT) in air transport. BeiDou Navigation Satellite System (BDS) is one of the GNSS that is developed and operated independently by China. It can effectively accommodate the tracking demands of the commercial aviation. The progress in China's civil aviation includes: the commencement of the third phase of "implementing global flight tracking and monitoring based on independent intellectual property rights" according to the roadmap of China's global flight tracking and monitoring; completing the retrofit of airborne BeiDou avionics on a total of 20 aircraft covering B737NG and A320 by the year 2020; and establishing a ground data processing system and demonstrate global flight tracking capability of these 20 aircraft by using BeiDou.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objectives of Safety, and Air Navigation Capacity and Efficiency.
<i>Financial implications:</i>	
<i>References:</i>	

¹ English and Chinese versions provided by China.

1. INTRODUCTION

1.1 BeiDou system, which is a global navigation satellite system independently developed and operated by China, is currently under the deploying. This system is unique because it has two kinds of functions: radio navigation satellite service (RNSS) passive positioning, and radio determination satellite service (RDSS) using two-way short-message communication. China plans to complete BeiDou system's deployment around the year 2020 to provide global navigation services.

1.2 The RDSS short-message communication function of BeiDou system provides global service with an uplink communication frequency of 1610-1626.5MHz, a downlink communication frequency of 1207.14 MHz, a single short-message communication length of 560 bytes. Through BeiDou satellite, a user terminal requesting for communication can establish a link with other user terminals, and the short-message sending terminal will first encrypt the communication request signal consisting of the receiver's ID and communication contents and then send it to the station via Beidou satellites; upon receiving the communication request signal, the ground centre station will decrypt and re-encrypt that signal and then add it into a continuously outbound broadcasting message, which will be received by users via satellite broadcast. The receiver's user set will receive the outbound signal, and decode and decrypt the outbound message, thus completing a communication. Without any support from other communication networks, an all-weather communication and navigation service can be realized by the Beidou system itself.

1.3 At present, BeiDou has been successfully and widely applied in areas such as China's road transport (more than 4.6 million key operating vehicles are installed with BeiDou compatible vehicle terminals), and water search and rescue (with more than 400 000 sets of BeiDou search and rescue portable terminal devices), and positive demonstrational application effect has been achieved. These results have fully shown that BeiDou system is technically ready to be applied in the civil sector. BeiDou system was officially acknowledged by the International Maritime Organization as a global navigation satellite system in 2017, marking that BeiDou system has made significant progress in international maritime applications.

1.4 In 2017, Civil Aviation Administration of China (CAAC) issued the Roadmap for Implementation of China Civil Aviation Global Flight Tracking and Monitoring System, which put forward the "three-step" implementation route: in the first phase (2015-2016), the aim is to realize 4D/15 tracking of overseas operating flights based on existing technologies (ACARS, etc.); in the second phase (2017-2020), the aim is to realize seamless global flight tracking based on new technologies such as automatic dependent surveillance — broadcast (ADS-B) (including satellite-based ADS-B) and broadband satellites, and launch BeiDou experimental validation of commercial aircraft; in the third phase (2020-2025), the aim is to deploy a global flight tracking and monitoring system based on independent intellectual property.

1.5 In May 2018, the CAAC decided to launch demonstration of tracking commercial aircraft using Beidou System, which is one of the important tasks in the second phase of the "three-step" roadmap.

2. DISCUSSION

2.1 The CAAC has actively promoted demonstration tracking commercial aircraft using Beidou System, which has now entered a substantive development stage. The program invites manufacturers and air operators with design assurance system (DAS), airworthiness management

experience and continuous airworthiness support capabilities to participate in the demonstration to ensure the smooth implementation of the work.

2.2 This work focuses on the application of BeiDou function of RDSS short-message communication in aircraft positioning and tracking. The demonstration validation of 20 dominant aircraft (10 B737NG and 10 A320 respectively) will be completed by 2020. According to previously gained experience, the overall deployment will be implemented gradually. And it is initially planned that commercial aircraft of the Chinese civil aviation will all be capable of BeiDou-based positioning and tracking by the year 2023.

2.3 The demonstration mainly includes two parts: the airborne system and BeiDou ground data processing system. The airborne system mainly includes BeiDou-compatible avionics, an aircraft platform retrofit solution, and related technical standards. BeiDou ground data system mainly serves operational supervision and control center of CAAC and airlines.

2.4 BeiDou-compatible avionics mainly includes transceivers and antennae, providing functions of positioning, automatic position report and short-message communication. BeiDou-compatible avionics will be installed on 20 aircraft. The transceivers will be in the avionics chamber powered from the aircraft directly, whereas the antennae will be installed outside the cabin. The following information shall be provided in the automatic position reports: the flight number, aircraft registration number, 4D position, ground speed. The following information shall be provided optionally: aircraft posture, heading, fuel consumption, signal status of BeiDou satellite, and working status of the avionics. For BeiDou airborne transceivers and antennae, and the supplemental retrofit package, the first batch of aircraft retrofit equipment will be approved together with the approval of the type design. And in the following mass production, the parts will be applied for CAAC approval.

2.5 BeiDou ground data processing system coordinates with BeiDou-compatible avionics to validate and test various functions and performances. The main functions include receiving the flight data transmitted downward by BeiDou-compatible avionics, data fusion and processing, and visual display to form an integrated flight situation within the global airspace; realizing auxiliary emergency rescue based on BeiDou positioning service; supporting statistics and analysis of operational data such as flight data; and supporting airlines and other users to check flight data within the authorized range via the Internet.

3. CONCLUSION

3.1 The CAAC is actively promoting demonstration of application of BeiDou system in the commercial aircraft. It is hoped that by means of the demonstration, explorations of standards and specifications, operational procedure, and mode of management will be carried out:

- a) promoting the research and development and application of BeiDou-compatible avionics in the commercial aircraft, and accumulating technical data and actual operational experience based on demonstration, so as to build the foundation for formulating the minimum operational performance standards (MOPS) and China Civil Aviation Technical Standard Order (CTSO) of Beidou avionics for aircraft tracking; and
- b) promoting the research and development and application of the ground system that is capable of processing tracking information from the BeiDou-compatible avionics; researching and developing and validating the structure of the ground system in the

demonstration, so as to provide technical support for the construction of global flight tracking and monitoring system with independent intellectual property.

3.2 The Assembly is invited to take note of:

- a) the recent efforts and progress of China concerning the application of BeiDou system in commercial global flight tracking; and
- b) the unique functions of BeiDou system in positioning and short-message communication, which have provided a new means achieving global flight tracking.

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