



ASSEMBLY — 39TH SESSION

TECHNICAL COMMISSION

Agenda Item 35: Aviation safety and air navigation standardization

PROGRESS IN THE BEIDOU NAVIGATION SATELLITES SYSTEM AND APPLICATION OF MULTI-FREQUENCY AND MULTI-CONSTELLATION GNSS

(Presented by China)

EXECUTIVE SUMMARY

Since its offer to join force with ICAO's navigation satellites technology at the 37th Assembly, China has been developing its Beidou Navigation Satellites System rapidly both in terms of relevant components and applications. In 2012, regional services to the Asia-Pacific region were formally launched. In 2015, work began on building up its global systems. Initial services are now planned for certain parts of the globe by 2018 and full global services will be provided by 2020.

Action: The Assembly is invited to:

- a) note that China's Beidou Navigation Satellites System has been growing smoothly in components and applications, and is committed to providing international civil aviation users with continuous, open, safe and quality PNT services;
- b) note the challenges that single-frequency/single-constellation GNSS has faced in actual application, promote accelerated research on the production of ground and airborne equipment for multi-frequency and multi-constellation GNSS (MFMC GNSS) and on standards and guidance materials for systems and operations, and coordinate and facilitate global research, construction and monitoring of MFMC GNSS by civil aviation authorities, the aviation industry and scientific research institutions; and
- c) note the experience, future strategies and planning needs of member states in the use of satellite navigation by their civil aviation entities, and, with a view to ensuring proper future resources planning for harmonious development of all core GNSS constellations, including China's Beidou, as well as their related augmentation systems, consider an earlier start of research on constraints affecting ICAO-related MFMC GNSS framework and concurrent development, include relevant plans in the work of ICAO in the next three years and establish and set in motion related coordination work and long-term mechanisms to ensure that the ICAO GNSS framework will be implemented in a healthy manner consistent with the principles of safety, efficiency and sustainable use of resources for development.

<i>Strategic Objectives:</i>	This working paper relates to Safety Strategic Objective.
<i>Financial implications:</i>	N/A
<i>References:</i>	Doc 9849, <i>Global Navigation Satellite Systems (GNSS) Manual</i> Doc 9750, <i>Global Air Navigation Plan</i>

¹ Chinese version provided by China

1. INTRODUCTION

1.1 Since it began to offer regional services, China's Beidou System has been in continuous and stable operation. Preparatory work is now well under way for the provision of global services by 2020. The system's application and international cooperation around it have also seen rapid progress.

1.2 China has published a white paper on the Beidou System, outlining its history of development, China's philosophy on its development and the system's achievements by stage and broad prospects for future growth.

1.3 China will actively pursue the construction of its civil aviation navigation satellites system centered around Beidou, keep a close eye on and promote the development and application of MFMC GNSS in order to achieve a gradual transition towards a navigation systems framework in which GNSS serves as the primary source of navigation while land-based navigation facilities play only a backup role.

2. DISCUSSION

2.1 Development of the Beidou Navigation Satellites System

2.1.1 On 27 December 2012, the Beidou System formally announced that it would start providing regional services. On the whole, the system is now in stable operation, fulfilling the target of a positioning accuracy better than within 10 meters. Performance in certain areas has exceeded the pre-set target.

2.1.2 In 2015, China launched a new-generation Beidou navigation satellite to be employed in the provision of global services, the first of its kind. Up to date, six such satellites have been successfully launched and validation of their global networking is under way before a start of services in due course. It is expected that by 2020, China will have completed the Beidou network of navigation satellites systems composed of 5 geostationary orbit satellites and 30 off-orbit satellites, offering global coverage and providing users worldwide with more accurate positioning and timing services.

2.1.3 As a key supplier of global navigation satellites systems, the Beidou has been deeply involved in the activities of international counterparts, continuously participated in educational and training programs for the world in general and the developing countries in particular, obtained lawful status for international maritime applications and become a global navigation satellites system supported by international mobile communications standards. The Beidou System has also been engaged in cooperation in the field of compatibility, inter-operability and other satellite navigation activities with the Global Positioning System(GPS)of the United States, GLONASS of Russia and GALILEO of Europe.

2.1.4 China has also cooperated with countries such as Pakistan, Thailand and the United Arab Emirates, and regional organizations like ASEAN and the Arab League, in Beidou applications, signed a memorandum of understanding on GNSS cooperation with Saudi Arabia and the Arab League respectively and launched the "Beidou Roadshow" abroad to promote and demonstrate Beidou/GNSS applications to let more countries and people experience and feel the features and strengths of the Beidou Navigation Satellites System.

2.1.5 China attaches great importance to and actively promote the development of the satellite navigation industry and has promulgated in succession Guidelines on the Generation of Greater Domestic

Demand for Information Consumption and the National Mid-and-long-term Development Program for the Satellite Navigation Industry, thereby laying out an overall national roadmap for long-term industrial development. Up to date, a relatively comprehensive system has been formed under the Beidou, encompassing basic products, application terminals and operational services. As China's domestic chips integration capacity and related technologies further advance, the Beidou products will be used extensively not only in many industries such as transport and communications, marine fisheries, geo-surveying and mapping and emergency search and rescue, but will also start to be used in quantity in the field of mass applications like smart phones, tablets computers, smart bearing and wearing devices and vehicle-borne navigators. According to statistics, in 2015, the output value of China's satellite navigation industry reached 160 billion yuan, of which, Beidou products accounted for about 20%.

2.2 White Paper on China's Beidou Navigation Satellites System

2.2.1 On June 16 2016, China formally published a White Paper on China's Beidou Navigation Satellites System (the Beidou White Paper, for short).

2.2.2 The White Paper outlined the Beidou's history of development, China's philosophy on its development and the system's achievements by stage and broad prospects for future growth. The White Paper also responded to widespread concerns of the international community. As contained in the Paper, the Beidou's development goals and principles are to continue to build and grow the Beidou system, provide safe and reliable satellite navigation services, promote applications of the system and its industrial development and vigorously promote international cooperation and exchange.

2.2.3 The Beidou Navigation Satellites System has been self-reliantly built and independently run by China out of the need for national security and economic and social development. It is an important piece of national infrastructure in space designed to provide all-weather, all-time and high-accuracy positioning, navigation and timing services to global users. In order to continuously improve the system, China has always proceeded from its own conditions and capacities, adhered to self-reliance and innovation and built the system by stages. The Chinese government is committed to taking measures to ensure safe and stable operations of the Beidou, provide open and free services in information sharing, protect the spectrum of frequencies and make available uninterrupted, stable and reliable services openly and free of charge. In terms of application and industrial development, the Chinese government takes very seriously the development of Beidou applications and will actively cultivate the Beidou industrial chain consisting basic products, application terminals, application systems and operational services, and will continue to enhance its industrial assurances, promotion and innovation systems, improve its industrial environment, expand the scope of its application so as to achieve integrated development and enhanced economic and social benefits of the satellite navigation industry. In the field of international cooperation, China will continue to facilitate the Beidou system to go international, pursue active and practical international cooperation and exchange in a bid to make the global satellite navigation industry stronger and the Beidou System better serve the globe and benefit mankind.

2.3 Implementation of satellite navigation applications in Chinese civil aviation

2.3.1 On 30 December 2015, the CAAC issued Policies on the Application of Navigation Technologies in Civil Aviation (AC-115-TM-2015-03), which sets out the basic principles, overall objectives and implementing strategies for the application and development of navigation technologies to serve as guidance on the planning and application of various navigation technologies in order to promote their coordinated development and comprehensive application for the sake of continuous, safe and scientific development of civil aviation.

2.3.2 The CAAC will continue to improve the deployment of land-based navigation facilities and promote the application of GNSS navigation technologies in order to shift gradually towards a navigation systems framework in which GNSS serves as the primary source of navigation while land-based navigation facilities play only a backup role. Efforts will be vigorously pursued to build up a satellite navigation system centered around the Beidou and to promote its applications across the globe.

2.3.3 To meet the requirements of ICAO's global development strategy and its relevant standards, implementation plans and recommended practices, and in the light of the experience of major countries in Europe and North America in the field of satellite navigation applications, the CAAC has conducted a series of application and trial projects in this field, giving impetus to the application of new satellite navigation technologies in civil aviation. Up to date, GBAS systems made by Chinese domestic and international manufacturers have been installed in the Pu Dong International Airport in Shanghai and Bing Hai Airport in Tianjin. Validation and assessment of those projects are now under way.

2.3.4 The CAAC will actively follow and promote the development and application of MFMC GNSS and develop China's own means to monitor the GNSS performance. China is ready to assist and help CAAs of other countries as needed in their efforts to build up their monitoring means and will continuously monitor the construction and development of MFMC GNSS.

2.4 **Beidou's new generation of global signals regime**

2.4.1 At present, a new generation of the Beidou system's signals regime has been decided upon and is scheduled to be published in 2017. The new generation of Beidou Navigation Satellites System will go global and provide the world with compatible and interoperable navigation signals and satellite-based augmentation services. In keeping with the Chinese government's "One Belt, One Road" strategy, the new generation of Beidou is scheduled to provide initial services to countries and regions along the "Belt and Road" in 2018, and will be completed and providing full-fledged global services in 2020.

2.4.2 The MFMC GNSS is the direction that ICAO advocates for the development of a GNSS framework capable of ensuring safer and more efficient services to global air navigation. The application of the new generation of Beidou Navigation Satellites System will provide a stronger impetus to and support for the extensive use of MFMC GNSS in global civil aviation.