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WORKING PAPER

ASSEMBLY — 37TH SESSION

TECHNICAL COMMISSION

Agenda Item 36: NextGen and SESAR as part of the Global ATM system

THE SATELLITE NAVIGATION APPLICATIONS IN CHINA'S CIVIL AVIATION AND ITS CONSIDERATIONS OF FUTURE DEVELOPMENT

(Presented by China)

EXECUTIVE SUMMARY

In accordance with ICAO planning and SARPs, and also in light of the specific conditions in China, and the Civil Aviation Administration of China (CAAC) has taken a number of activities in relation to R&D and implementation of GNSS. Recently, it carried out its GNSS implementation work in parallel with the Asia-Pacific Regional Implementation Plan and conducted a detailed review of its long-term GNSS strategy. Last October, CAAC published a "CAAC Implementation Roadmap of Performance-Based Navigation System". In March 2010, the CAAC Flight Standards Department promulgated an advisory notice on "Guidelines of Operational Approval for Implementation of RNP in Terminal Area and Approach", which clearly stated to use China's BeiDou (COMPASS) satellite navigation system in the future. It also confirmed that the development of application systems will take into consideration integration issues with COMPASS. In light of rapid deployment of the COMPASS global system, with five satellites having already been launched, and based on the discussions of a CAAC information paper by ICAO Navigation System Panel, we believe there is an urgent need to include the future application of the COMPASS constellation into the ICAO work plan with a view to its early approval and inclusion into specifications. In this context, a proposal is made to the Assembly.

Action: The Assembly is invited to:

a) note the rapid growth of China's civil aviation and its successful experience in satellite navigation applications;
b) identify the future strategy and planning requirements; and
c) initiate relevant activities in the ICAO work plan during the next triennium in order to incorporate COMPASS materials into the SARPs of Annex 10 in accordance with ICAO requirements and planning, as appropriate.

Strategic Objectives:	This working paper relates to Strategic Objectives A, D and E on safety, efficiency and continuity.
Financial implications:	Not applicable.
References:	Annex 10 – *Aeronautical Telecommunications*

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* The original of this working paper was submitted in Chinese.

1. INTRODUCTION

1.1 Overview of GNSS activities in China's civil aviation

1.1.1 In accordance with ICAO planning and Standards and Recommended Practices (SARPs), and also in light of the specific conditions in China, the Civil Aviation Administration of China (CAAC) has taken a number of activities in relation to research and development (R&D) and implementation of global navigation satellite system (GNSS), which include receiver autonomous integrity monitoring (RAIM) prediction system, ground-based augmentation system (GBAS) test, satellite navigation regional integrity monitoring system (GRIMS), etc. At present, the implementation and operation of performance-based navigation (PBN) is moving ahead steadily. The CAAC carried out its GNSS implementation in parallel with the Asia-Pacific Regional Implementation Plan and conducted a detailed review of its long-term GNSS strategy. This process involves the future multi-constellation and multi-augmentation system, improvement of accuracy, continuity, integrity, availability and other functions of GNSS, in order to meet the civil aviation demands for satellite navigation systems.

1.2 The progress status of relevant systems and approval of documentation

1.2.1 *RAIM prediction system, GBAS test and GRIMS integrity monitoring system*

1.2.1.1 The RAIM prediction system, developed by CAAC, is an important auxiliary means for the implementation of PBN. RAIM provides global positioning system (GPS) satellite signal information to aircraft dispatch and air traffic control (ATC), and meets the operational requirements of GPS signals as the main means en-route and in terminal areas. At the end of last year, CAAC officially approved RAIM trial operations, and it is expected that RAIM will be certified and gradually improved in the PBN approval process. CAAC developed a test prototype system for satellite navigation GBAS, which has already undergone a series of tests at Linzhi Airport in Southwest China. Flight tests were conducted with the application of GRIMS, and real-time integrity information was disseminated in areas where automatic dependent surveillance — broadcast (ADS-B) was under test. At present, a trial operation project of GBAS is being launched.

1.2.2 *China's PBN Roadmap*

1.2.2.1 In a resolution adopted by the Assembly at its 36th Session, ICAO requests: "States complete a PBN implementation plan by 2009, and to ensure transition to PBN by 2016 in a global harmonized and coordinated manner". In accordance with the Asia-Pacific Regional Implementation Plan, CAAC has accelerated the application of PBN technology, full-scale implementation work is under way. In October 2009, CAAC published a "CAAC Implementation Roadmap of Performance-Based Navigation System". The roadmap, which is based on the actual situation in China, identifies PBN implementation policies and overall plans in China through 2025. It is intended to provide guidelines for all stakeholders and promote the global harmonization of standards and international cooperation.

1.2.3 *The latest advisory notice*

1.2.3.1 On 1 March 2010, CAAC promulgated an advisory notice on "Guidelines of Operational Approval for RNP Implementation in Terminal Area and Approach". The notice provided operators with guidelines pertaining to approval of required navigation performance (RNP) arrival and departure procedure in terminal area (RNP-1 STAR, RNP-1DP), approach (RNP APCH) and pressure vertical navigation (Baro-VNAV) operations.

2. DISCUSSIONS

2.1 CAAC's GNSS activities and its future plan

2.1.1 The GNSS-related projects in China have fully taken into account the future evolution of GNSS constellations as well as its augmentation system. The current test system and the application issues of other systems were also taken into consideration. It is certain that the development of future application system will consider integration issues relating to COMPASS, and there is a need to carry out assessment and verification work as soon as possible. China has requested to discuss these issues through information papers WGW/IP4 and WGW/IP9 respectively presented to ICAO NSP Meetings of Nov 2009 and May 2010. Based on the discussions, we realized that ICAO needs to take the first step to approve the inclusion of the project in its future work program before it formally initiates the relevant work.

2.2 PBN Roadmap

2.2.1 The PBN Roadmap has made it clear that China's COMPASS system will be used in future application. The details are provided in the following sections. PBN Roadmap Section 3.3, the "Future Development: according to the National Aeronautics and Space Development Strategy", China's "Larger Civil Aircraft" project and the new generation of "COMPASS" satellite navigation system have already started. Section 5.2, "Medium Term (2013-2016)" promotes implementation of RNP APCH approach procedures with Baro-VNAV, also consider to use, on the trial basis, "COMPASS" navigation system for the provision of navigation services; Section 5.3, "Long-Term (2017-2025)" all flight stages, such as en-route, terminal area and approach will mainly use PBN, and will gradually transit from a mixed type of operation environment to full PBN compatible operation. GNSS will constitute as the main navigation means of PBN operation. CAAC will use GNSS on the basis of multilateral cooperation and will also consider use of "COMPASS" satellite navigation system. In combination with other advanced supporting systems, such as ADS-B surveillance technology and satellite-based data link communications system, PBN will be able to offer increased operational capacity to achieve the synergic development with CNS/ATM. Section 6.2 "Development Strategy for General Aviation" it is planned to equip general aviation aircraft with GNSS navigation system for the purpose of conducting RNP-4, RNP-2, RNAV-2, RNAV-1, RNP-1 and RNP APCH and other operations. GNSS compatible multi-satellite navigation system, which include "COMPASS", are the premier choice for general aviation in the future. Detailed description of the "COMPASS" satellite navigation system is provided in paragraph 8.2.4 .

2.3 The latest Advisory AC-91-FS-2010-01R1

2.3.1 In Advisory AC-91-FS-2010-01R1, 4. Definition G describes: Global navigation satellite system (GNSS) is a generic term of the satellite navigation system that provides positioning, velocity and timing services. The system consists of one or more satellite constellations, airborne receiver and system integrity monitoring system, including the US's GPS, Europe's Galileo, Russia's GLONASS, China's

COMPASS, as well as the satellite-based augmentation system (SBAS) and ground-based augmentation system (GBAS), etc.

2.4 The international activities of COMPASS System and status of its development and deployment

2.4.1 China has already joined the International Committee on Global Navigation Satellite Systems (ICG) under the auspices of the United Nations Committee on the Peaceful Uses of Outer Space (UNOOSA). China has actively participated in all ICG's previous meetings and had extensive discussions and exchanges of views with other States on the issues such as compatibility and interoperability, improvement of GNSS's performance, information dissemination and capacity building. It also interacted with relevant authorities at both national and regional levels and with appropriate international organizations on the issues of mutual interest. China is now working with ICG to explore the feasibility of hosting its seventh meeting in 2012.

2.4.2 China has indicated through ICG and at appropriate international forums that the COMPASS system will provide its end users with open and high-quality of services free of charge, users around the world are encouraged to make use of it. China will exchange its experiences with other States in a full range of issues concerning satellite navigation system with a view to promoting the development of GNSS technology and its associated industry. As an important component of global GNSS, COMPASS is eagerly seeking to cooperate with other systems in order to achieve a win-win situation for all parties. Compatibility and interoperability is the prevailing development trend for GNSS system, and the COMPASS system will follow the same suit to provide the world users with better services. The COMPASS system looks forward to increasing the exchange of cooperation with other systems on the issues of compatibility and interoperability.

2.4.3 The COMPASS system has accelerated its deployment pace, with five satellites having been launched to date. The first satellite was launched on 14 April 2007, and the second on 15 April 2009. The others were launched on 17 January, 2 June and 1 August 2010, respectively. Currently, COMPASS system has five satellites in operation.

2.5 COMPASS's progressive harmonization with other global systems (COMPASS GALILEO GPS GLONASS)

2.5.1 Galileo cooperation programme is the largest scientific and technological cooperation project to date between China and the European Union (EU), which will help provide better satellite navigation signals to their respective users. China and EU held six technical coordination meetings with respect to COMPASS. China also had necessary coordination with other satellite navigation systems, including four technical coordination meetings with GPS and a technical coordination meeting with GLONASS.

3. ACTION BY THE ASSEMBLY

3.1 The Assembly is invited to:

a) note the planning information of relevant tests and research activities taken by the People's Republic of China with respect to GNSS applications;

b) note the planning consideration of the People's Republic of China with respect to COMPASS programme as contained in its PBN roadmap;

c) note that some preparatory works are required to incorporate COMPASS system's application into ICAO GNSS framework and Annex 10, in order to ensure a harmonized, safe, cost-effective and smooth transition in the future; and

d) request the appropriate bureaux/office in the Organization to develop relevant standards and guidelines.

— END —