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THIRTEENTH AIR NAVIGATION CONFERENCE

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COMMITTEE A

Agenda Item 2: Enabling the global air navigation system
2.2: Integrated CNS and spectrum strategy

GBAS IMPLEMENTATION STATUS IN JAPAN

(Presented by Japan)

EXECUTIVE SUMMARY

This paper provides information on the current status of the ground-based augmentation system (GBAS) implementation and related activities in Japan.

1. INTRODUCTION

1.1 ICAO Aviation System Block Upgrades (ASBUs) Navigation Roadmap Block-0 defines the ground-based augmentation system (GBAS) to be implemented worldwide. Indeed, GBAS has been used for Category-I operations in the world. However, all the operational GBAS facilities are currently at the mid-magnetic latitude region. Operational GBAS implementation in the low magnetic latitude region has not been started yet.

1.2 For Category-II/III support of GBAS, Amendment 91 to Annex 10 — *Aeronautical Telecommunications* Standards and Recommended Practices (SARPs) including the updates to support GBAS approach service type-D (GAST-D) will be in effect in November 2018. ICAO Navigation Systems Panel (NSP) is still working on improving availability of GAST-D in the low magnetic latitude region through the Ionosphere Gradient Mitigation (IGM) ad hoc group.

1.3 In accordance with ASBUs, the Japan Civil Aviation Bureau (JCAB) developed a long-term vison of future air traffic management (ATM) and communication, navigation, and surveillance (CNS) structure in Japan, which is called Collaborative Actions for Renovation of Air Traffic Systems (CARATS). GBAS is defined in CARATS as an enabler of advanced precision approaches and landings. Category-I GBAS is defined in the CARATS near-term plan which will finish by 2020 and expected to continue implementation in the mid-term plan from 2021 to 2024. Category-II/III GBAS is defined in the CARATS long-term plan starting from 2025.

1.4 The JCAB decided to implement GBAS at Tokyo International Airport (Haneda) in Japan. Tokyo-Haneda Airport is located at the boundary between the lower to mid- to low magnetic latitude regions. JCAB plans 24-hours-a-day operation of a Category-I GBAS at Tokyo-Haneda Airport.

1.5 This paper shares information on the current status of GBAS implementation and related activities in Japan.

2. DISCUSSION

2.1 In 2016, JCAB awarded NEC Corporation a contract to implement a Category-I GBAS at Tokyo-Haneda Airport. As of August 2018, the system design has been almost completed. Site installation will be completed by the end of March 2019. Operational evaluation will start following the completion of site installation. Operational commissioning is expected by the end of March 2021.

2.2 Whole processes of system design, development, and installation are carefully evaluated by technical review meetings. The JCAB designated the Electronic Navigation Research Institute (ENRI) as a technical advisor to the JCAB to support these evaluation processes.

2.3 There are two major challenges in implementing GBAS at Tokyo-Haneda Airport. One is siting of reference stations and VHF data broadcast (VDB) transmitter antennas, and the other is mitigation of ionospheric threats.

2.4 Because Tokyo-Haneda Airport is a big complex airport with four runways and three terminal buildings, there are only a few sites where GBAS reference stations can be installed. Even those candidate locations have different constraints. Therefore, it was not an easy task to choose a site for reference stations, and some compromise had to be made. Due to the complexity of the airport, it was turned out to be impossible to serve all the runway ends by a single VDB transmitter antenna. Therefore, two-VDB antenna configuration had to be adopted, though it was not easy to find sites of VDB transmitter antennas. It was also a technical challenge, because there has been no operational GBAS system with two-VDB antenna configuration.

2.5 The ionospheric threat model used is based on the GBAS ionospheric threat model for the Asia and Pacific (APAC) Region developed by the Ionospheric Studies Task Force established under the Communications, Navigation, and Surveillance (CNS) subgroup of Asia-Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG). It has been modified based on analysis by the ENRI by considering the ionospheric environment around Tokyo-Haneda Airport and is relaxed in some extent as compared to the original APAC GBAS ionospheric threat model.

2.6 Even with the relaxation, the threat space of the model is still wider than those of the mid-magnetic latitude region. Especially, the ionosphere in the low magnetic latitude region is more disturbed in the night. To realize 24-hour operations of GBAS at Tokyo-Haneda Airport, additional GNSS receiving stations that are located several kilometres away from the GBAS reference stations to monitor the ionospheric variations are adopted, which is called the ionospheric field monitor (IFM) technique. The IFM technique has been developed by the ENRI and was tested at the Osaka-Kansai Airport from 2011 to 2015. During the operational validation at Tokyo-Haneda Airport, performance the GBAS with the IFM will be evaluated.

2.7 Japan, in collaboration with other States, contributed to the development of the APAC GBAS ionospheric threat model. Japan has also contributed to the validation of the GAST-D SARPs especially from the viewpoint of suitability for the low magnetic latitude region and is still actively involved in the ICAO NSP activities to improve availability of GAST-D in the low magnetic latitude region.

2.8 Japan is also working on development of next generation GBAS with multi-frequency and multi-constellation GNSS (GAST-E/F). ENRI has started a five-year project of GAST-E/F concept development and validation from 2015. The project includes developments both ground and airborne experimental subsystems for comparative studies of different augmentation methodologies and designing integrity monitors suitable for GAST-E/F. The research outcome will be shared for GAST-E/F SARPs development by ICAO.

3. CONCLUSION

3.1 Japan is willing to share the experiences and lessons learned in the Category-I GBAS implementation at Tokyo-Haneda Airport as well as from other GBAS related research and development activities.

3.2 In light of the above, the Conference is invited to note the information provided in this information paper.

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