International Civil Aviation Organization

THE FOURTH MEETING OF THE ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (APAC GBAS/SBAS ITF/4)

(Video conference, 11- 12 May 2022)

Agenda Item 3: Updates from States/Administrations about GBAS/SBAS Implementation

GBAS Status Update in Japan

(Presented by Japan)

SUMMARY

This paper presents an update to GBAS development in Japan.

Japan Civil Aviation Bureau (JCAB) installed the first GBAS at Tokyo international airport (HND), and is conducting CAT-I trial operation.

Electronic Navigation Research Institute (ENRI) has carried out research and development activities related to GBAS which includes DFMC GBAS concept development, GAST-D performance enhancement for the low latitude region and advanced operations by GBAS.

1. INTRODUCTION

1.1 Japan developed an ionospheric threat to define the anomalous ionospheric conditions in the low magnetic latitude region, and developed an integrity monitoring mechanism with an ionospheric field monitor (IFM) in order to address the ionospheric issues in the process of R&D and manufacturing/implementation of GBAS in Japan.

1.2 Japan Civil Aviation Bureau (JCAB) installed the first GBAS at Tokyo international airport (HND), and is conducting CAT-I trial operation.

1.3 Japan is conducting R&D on CAT-III GBAS with the GBAS prototype at Ishigaki airport (ISG).

1.4 Japan is also conducting R&D on Dual-Frequency and Multi-Constellation (DFMC) GBAS.

2. DISCUSSION

2.1 CAT-I GBAS(Activity Result)

2.1.1 Japan started R&D on GBAS, and installed the first prototype at Kansai international airport (KIX) in 2011.

2.1.2 Japan developed ionospheric threat model in order to meet the requirements for CAT-I operations in the low magnetic latitude region.

2.1.3 Japan developed IFM (ionospheric field monitor) to mitigate the navigation error due to the ionospheric abnormality.

2.1.4 JCAB awarded NEC Corporation a contract to manufacture and install GBAS at HND in 2016.

2.1.5 Operational trial of GBAS APCH started at HND in July 2020.

2.2 CAT-I GBAS(Trial operation)

2.2.1 CAT-I GBAS approach procedures may be used for runway 34R and 34L of HND.

2.2.2 Applicable time is from 14:00 to 21:00UTC.

2.2.3 Two Japanese airlines, ANA and JAL, conducted GLS approaches.

2.2.4 Pilot feedbacks indicated GLS provided a more stable approach compared to ILS.

2.3 CAT-III GBAS

2.3.1 Japan developed a CAT-III GBAS prototype for R&D in 2014.

2.3.2 Japan contributed to ICAO activities on CAT-III GBAS (see 2.5.2).

2.4 DFMC GBAS

2.4.1Japan started R&D on DFMC GBAS in 2015.

2.4.2 DFMC GBAS will improve availability based on multi-constellation, and will mitigate the threat of ionosphere based on dual frequencies as well.

2.4.3 The testbed of DFMC GBAS developed and deployed in ISG in 2019.

2.4.4 Japan will contribute to ICAO activities on DFMC GBAS (see 2.5.3).

2.5 GBAS R&D Status in Japan

2.5.1 Electronic Navigation Research Institute (ENRI) has been working on advanced operations by GBAS. Flight demonstration of RNP to GLS APCH were conducted at Hiroshima airport (HIJ) in April 2021 with a portable GBAS equipment. Flight demonstration of GLS steep glide slope and offset approach at Takamatsu airport (TAK) were conducted in November 2021 (Figure 1).

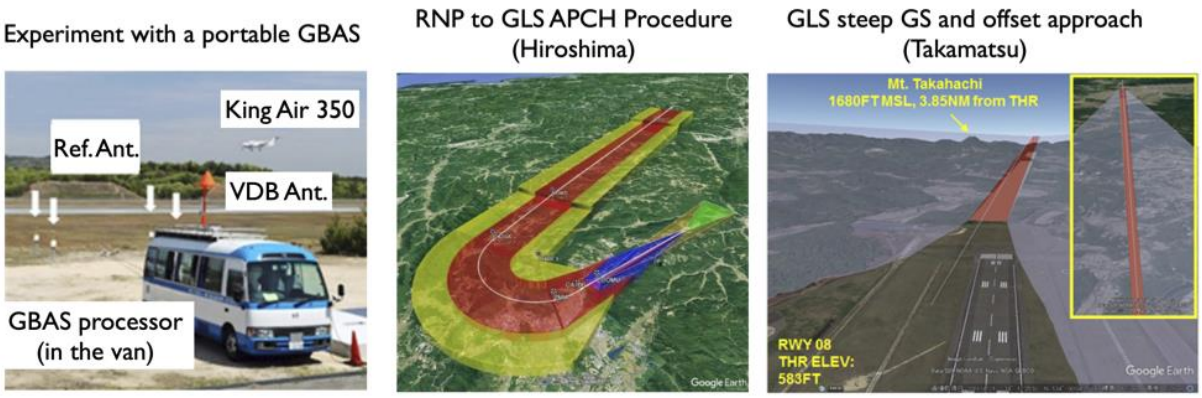

Figure 1. RNP to GLS APCH flight demonstration.

2.5.2 GAST-D performance enhancement in challenging ionospheric conditions such as the low latitude region is of great interest of Japan. ENRI has been contributing to the GWG IGM ad hoc activities. Main focuses are scintillation effects on the GAST-D integrity monitors and better ionospheric threat definition.

2.5.3 ENRI has been contributing to the concept development of the DFMC GBAS. ENRI operates a DFMC GBAS testbed installed at ISG which consists of five DFMC reference receivers installed in the airport field and a VDB transmitter. One of the receivers is located at the other end of the runway from the other four receivers and can act as a pseudo-user receiver. The antenna is the JAVAD G3T which is not a multipath-limiting antenna but with fairly good multipath rejection capability. The receiver is the Trimble NetR9 which can track most of the existing GNSS signals. The testbed has been operated since 2019. A flight campaign to collect data in ionospheric disturbances has been conducted in March 2022. Flights for data collection was made in the night when ionospheric disturbances, namely plasma bubbles, was found to exist by an all-sky airglow imager in ISG Ionospheric scintillation were also monitored at the same time (Figure 2).

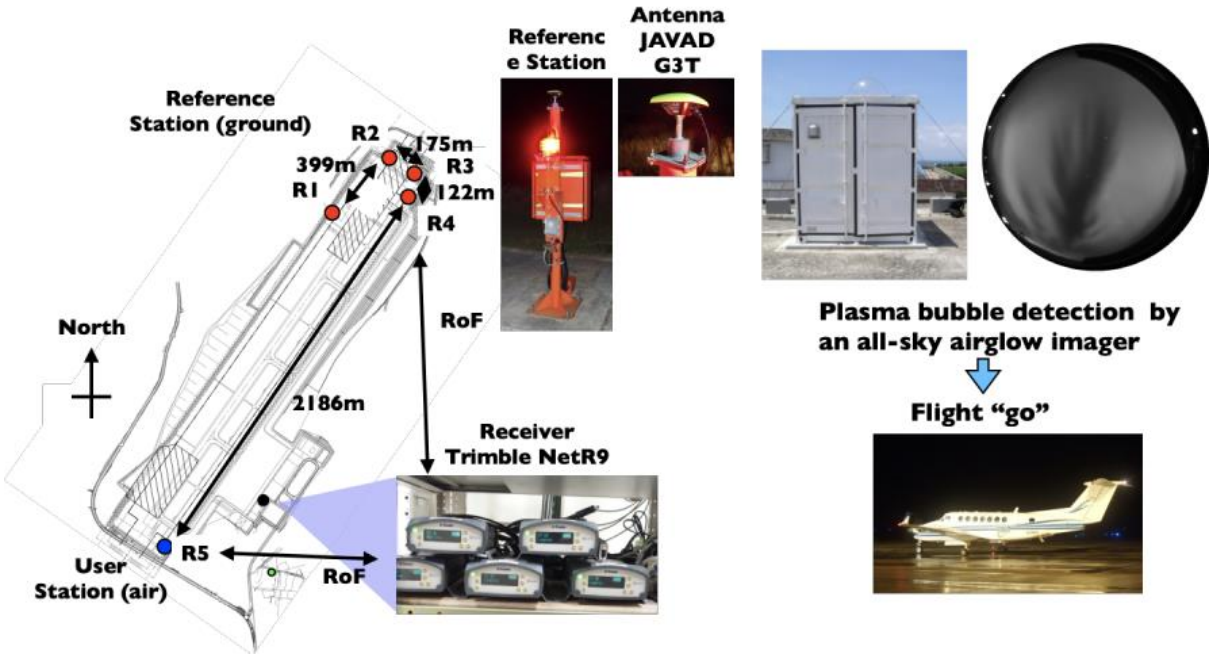

Figure 2. DFMC GBAS testbed at ISG and a plan for flight data collection under ionospheric disturbances.

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