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

SBAS Status Update in Japan

(Presented by Japan)

SUMMARY

This paper provides information on the update of MSAS status and future plan.

1. INTRODUCTION

1.1 As a part of SBAS implementation in Japan, MSAS started its operation with MTSAT GEO for Japan's FIR on September 27th 2007. Then, MSAS (Michibiki Satellites Augmentation Service) using QZSS (Quasi-Zenith Satellite System) GEO has taken over the operation since April 2020. Currently, the Quasi-Zenith Satellite System is operated by four satellites, QZS-1R/2/3/4, with QZS-3 as a GEO and the others as IGSOs. QZS-5/6/7 are scheduled to be launched in the future, making a total of seven satellites in operation. QZS-6 and 7 will be GEOs. JCAB has decided to work on improving the performance of MSAS and aims to realize MSAS-LPV capable using the three GEOs (QZS-3, 6, and 7).

2. DISCUSSION

2.1 MSAS has been providing GPS Augmentation Information for RNAV/RNP, from En-route through NPA (RNP 0.3), and the trial operation of LPV/LP began on Dec 2 2021 based on the agreement with stakeholders. JCAB eventually aims to start the official operation of LPV-200 after 2023.

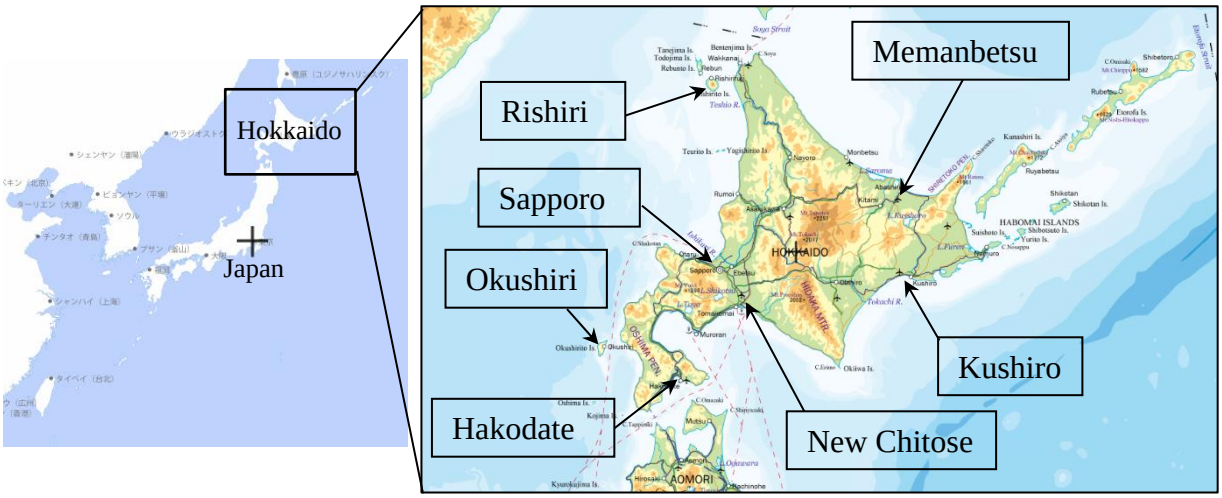
2.2 In the past, two PRN codes (129 and 137) were assigned to MSAS, but we have recently added one more PRN code (139). This will allow us to use three PRNs for three GEO configurations to move forward to MSAS LPV service after 2023.

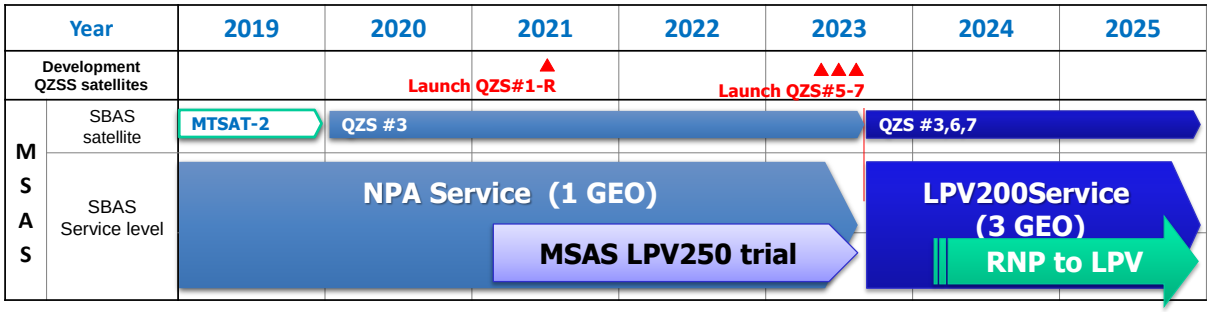
	▲April2020		▲After2023
	MTSAT MSAS	QZSS MSAS	
PRN 129	MTSAT-2	QZS3	QZS6
PRN 137	MTSAT-2	QZS3	QZS3
PRN 139	-	-	QZS7

2.3 JCAB is planning the following schedule for LPV.

＜MSAS LPV250 trial operation＞ 2021～

Using current MSAS V2 which has been provided by only QZS-3, MSAS LPV250 approach will be introduced step by step from 2021 as MSAS LPV250 trial operation in advance of MSAS LPV full-scale operation. This trial operation will be expected to boost the proficiency of Airline pilots maneuver and the motivation for introducing SBAS LPV receiver in Airline. The LPV250s planned for 2022 are the following airports.





＜MSAS LPV full-scale operation＞ 2023～

For MSAS LPV after 2023, we plan to introduce LPV at many airports currently using the IFR approach in order to maximize the policy effectiveness of the MSAS LPV.

2.4 MSAS configuration for each operational step is explained in the following table.

MSAS Version	**Topics**
MSAS V1: Initial Performance Phase (2007 ～ 2020)	- Operation with a MTSAT, 2 Master Control Station (MCS) and 6 Ground Monitor Stations (GMS) until 2020
MSAS V2:	- Operational takeover to new GEO (QZS-3)

System Update Phase (2020 ～ 2023)	- Full replacement of the SBAS ground system - 2 MCS, 13 GMS and 3 Uplink Station in domestic - Expected performance better than the MSAS V1
MSAS V3: LPV Performance Phase (after 2023 ～)	- Vertical guidance: LPV operation by three QZSS GEOs - Need development of high performance IONO software for low latitude magnetic equatorial region based on the research outcome from ENRI
MSAS V4: DFMC Validation Phase (2017 ～ Experimental)	- In support of ICAO SARPs validation activity, the initial target performance is LPV 200 - ENRI has started DFMC SBAS experiment in 2017 with QZS2 -QZS3 and QZS4 are available for DFMC SBAS validation -Support to GPS, Galileo, QZSS

2.5 Seven satellites configuration of QZSS will provide the constellation with additional two GEOs (i.e. QZS-6 and QZS-7). Therefore, a total of three GEOs will be capable of transmitting L1 SBAS signal in 2023. The longitude of the QZS-6 is 90.5degE, and the center longitude of the QZS-7 is 190degE while its longitude will drift by some degrees due to a longer East West station-keeping maneuver cycle. The reduction of orbital maneuver frequency aims at an improvement of the service availability.

2.6 All QZSS satellites have the capability of broadcasting DFMC SBAS messages through the L5S signal. Therefore, L5 augmentation signal with PRN196 (QZS2: IGSO) for DFMC SBAS validation became available on September 23 2017. Subsequently, PRN197 (QZS3: GEO) and PRN200 (QZS4: IGSO) have also become available. The new seven satellites (QZS-5, 6 and 7) will improve L5S signals, including Manchester encoding and Q-channel messages. Based on these improvements, JCAB will begin the process of converting the current L5 PRNs (PRN197, PRN196, and PRN200) to SBAS PRNs at an appropriate time.

2.7 The L1 SBAS ranging is not be provided at the start of the QZSS GEO's service. Evaluating the accuracy of the ranging signal in terms of GEO trajectory and clock accuracy would allow for the provision of a ranging function in the future. We will also evaluate the ranging signal on DFMC SBAS L5 signal not only for GEOs but also for IGSOs.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matter as appropriate.