



ICAO

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**Twenty Sixth Meeting of the Communications/
 Navigation and Surveillance Sub-group (CNS SG/26)
 of APANPIRG**

Web-conference, 5 September – 9 September 2022

Agenda Item 6: Navigation

6.4 Other navigation related issues

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. The Space Policy Committee of Japan officially decided the development of QZS5 (QZO), QZS6 (GEO) and QZS7 (GEO) in January 2019. In response to this decision, JCAB has decided to work on improving the performance of MSAS and aims to realize MSAS-LPV capable using the three GEOs (QZSS 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 will start 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.

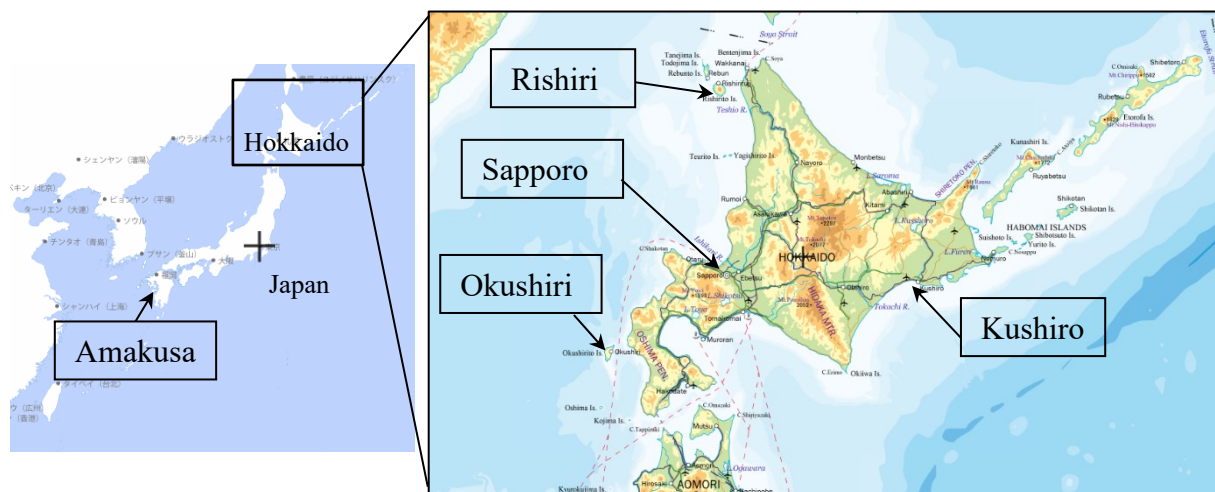
Agenda Item 6.4

5-9/9/22

Year	2019	2020	2021	2022	2023	2024	2025	
Development QZSS satellites			▲ Launch QZS#1-R		▲▲▲ Launch QZS#5-7			
M S A S	SBAS satellite	MTSAT-2	QZS #3			QZS #3,6,7		
	SBAS Service level	NPA Service (1 GEO)				LPV200Service (3 GEO)		
			MSAS LPV250 trial		RNP to LPV			

MSAS LPV250 trial operation 2021

In advance of LPV full-scale operation, JCAB has been introducing step by step MSAS LPV250 approach as trial operation using MSAS V2 since 2021. This trial operation will be expected to boost the proficiency of Airline pilots maneuver and the motivation for introducing SBAS LPV receiver in Airline. Currently, the MSAS LPV250 trial operation has been demonstrated at five airports and will be expanded to many airports across the country.



MSAS LPV full-scale operation After 2023

As to MSAS LPV after 2023, to maximize the policy effect of MSAS LPV, JCAB will implement LPV operations at many of the airports currently implementing the IFR approach.

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: System Update Phase (2020 ~ 2023)	- Operational takeover to new GEO (QZS-3) - 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 ~)	<ul style="list-style-type: none"> - 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)	<ul style="list-style-type: none"> - 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: QZO) for DFMC SBAS validation became available on September 23 2017. Subsequently, PRN197 (QZS3: GEO) and PRN200 (QZS4: QZO) 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 (PRN129, PRN137 and PRN139) 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 QZOs.

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.
