



International Civil Aviation Organization

**THE FIFTH MEETING OF THE ASIA/PACIFIC GBAS/SBAS
IMPLEMENTATION TASK FORCE (APAC GBAS/SBAS ITF/5)**

(Tokyo, Japan, 21- 23 June 2023)

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

GNSS RFI monitoring service by JCAB in Japan

(Presented by NPAC)

SUMMARY

Since 2020, Japan has been providing centralized information on GNSS navigation in the Fukuoka FIR through JCAB. The purpose of this is to quickly understand the current state of GNSS within the country and provide users with accurate and comprehensive information on the impact of GNSS navigation based on SARPs and GNSS manuals. This IP introduces the challenges related to GNSS prediction, monitoring, and performance evaluation tasks in the navigation field of JCAB.

1. INTRODUCTION

1.1 Japan Civil Aviation Bureau (JCAB) established the Network Performance Assessment Center (NPAC) in 2020 for the mission of centrally monitoring, analyzing and assessing service levels of CNS as the core of CNS performance management, which is an important key to realizing PBO. This paper introduces the performance monitoring of GNSS conducted by NPAC.

1.2 NPAC collects GNSS signals by GPM system and provides the following three services to users (Figure 1).

- a) GNSS Performance Prediction Service providing availability forecasts for ABAS and SBAS
- b) GNSS Performance Monitoring Service providing information on the impact on operations utilizing GNSS.
- c) GNSS Performance Analysis and Evaluation Service conducting analysis and evaluation of GNSS performance for safe and continuous utilization of GNSS.

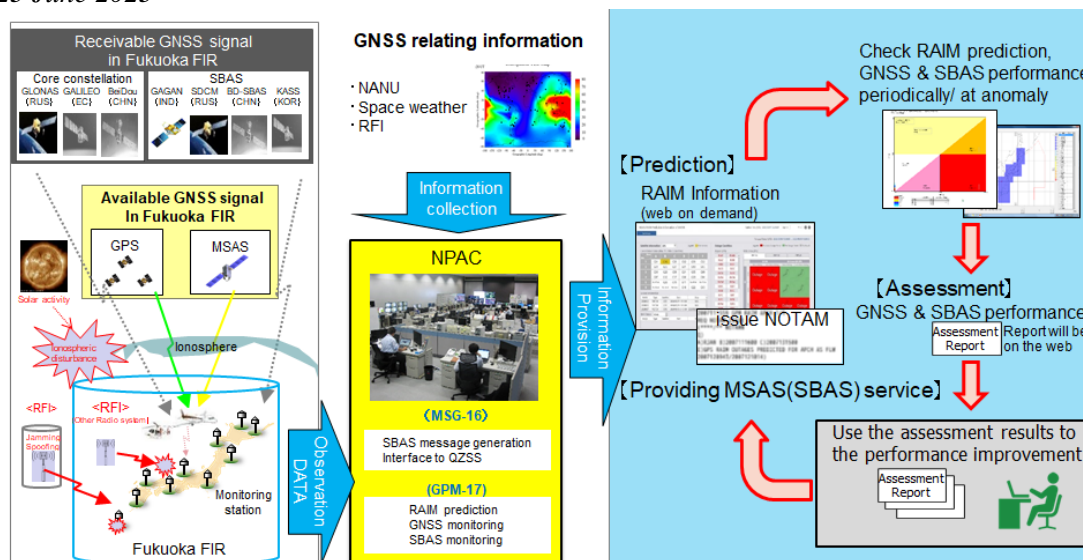


Figure 1. Services provided by NPAC

2. DISCUSSION

2.1 GNSS performance prediction service and challenges

2.1.1 GNSS performance prediction service predicts the navigation system's outage at any point for aircraft using PBN by using GPS satellite orbit information and MSAS augmentation information, etc. (Figure 2). If the aircraft is equipped with an ABAS (GPS-RAIM) receiver, it is a simple configuration as GNSS. On-board availability calculations are based solely on GPS placement and do not depend on radio wave propagation behavior or GPS positioning accuracy. For this reason, it is relatively easy to match calculations made by airborne equipment with predictions made by ground equipment.

2.1.2 However, if the aircraft is equipped with an SBAS receiver, it's more complicated than ABAS. On-board availability calculations must consider augmentation information that depends on radio wave propagation behavior of the day and GPS positioning accuracy. For this reason, it is very difficult to match calculations made by airborne equipment with predictions made by ground equipment. The SBAS prediction information output by the current GPM causes discrepancies with the real-time SBAS availability status in spring and autumn, which are the seasons when the influence of the ionosphere increases (i.e., prediction errors). Especially this spring, the deterioration of prediction accuracy can be seen, and this discrepancy was particularly pronounced in the southern regions with poor ionospheric conditions.

2.1.3 As mentioned above, our country's performance prediction service faces challenges related to the behavior of the ionosphere. Japan is improving the performance of MSAS, but it is necessary to ensure smooth LP/LPV operation after the performance improvement. For this reason, we are working to clarify the situation by analyzing the prediction relevance rate and operation rate in advance.

2.1.4 We are going to continue implementing similar evaluations at each LP/LPV-compliant airport. If the availability approaches near 100%, such initiatives may no longer be necessary. However, as long as the performance of MSAS augmentation data is not sufficient, we believe it is necessary to continue these efforts. Regarding the scheme and operational

framework of GNSS prediction, we recognize that the procedures may vary depending on each country's situation. We are actively seeking to learn from other countries' perspectives and consider incorporating them into our own practices.

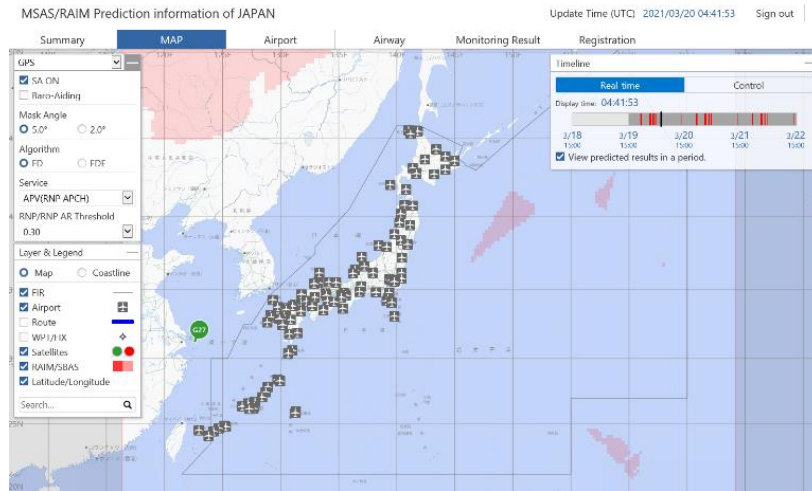


Figure 2. Example of MSAS/RAIM prediction service display

2.2 GNSS performance monitoring service and challenges

2.2.1 GNSS performance monitoring service collects data real timely such as GNSS monitoring data or ADS-B information from the aircrafts on enroute by 13 GPM(GNSS Prediction and Monitoring equipment) monitoring sites and 13 MSG(MSAS Signal Generation and operation equipment) monitoring sites installed all over Japan, and monitors the navigation performance degradation of the navigation system and the situation status of the L1 frequency. And it enables to confirm the effect to navigation system by monitoring interference or jamming from outsiders, which influences to GNSS performance (Figure 3).

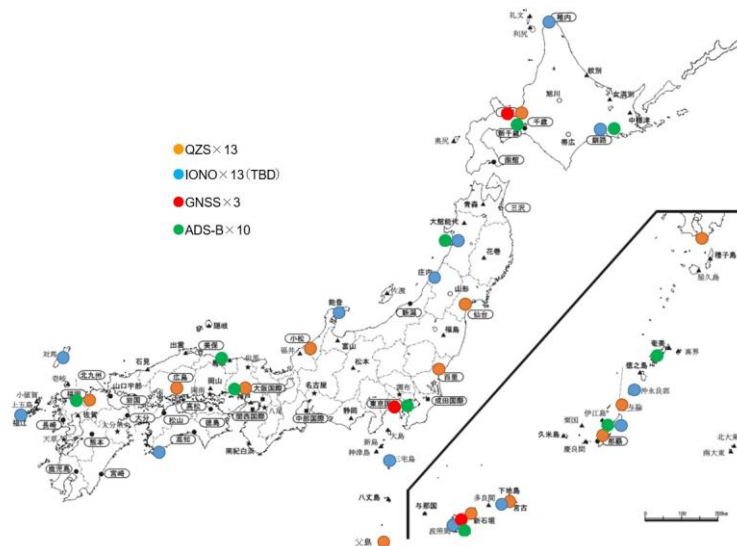


Figure 3. Antenna installation position

2.2.2 NPAC aims to establish a framework to detect the situation accurately and provide the information to users in the event of RFI to GNSS, to minimize confusion. Based on GNSS Manual (chapter 7.12.4), NPAC takes appropriate action in case of GNSS related failures.

2.2.3 As a response procedure when the impact of solar activity or man-made interference is suspected, NPAC organized the response method when RFI occurs and created the "GNSS Interference Response Flow" (Figure. 4). It considers cooperating organizations, interference monitoring procedures, trends in space weather information, detection procedures, NOTAM standards, responses to space weather advisories. (Note 1)

Note1. Space weather advisory: ICAO has started to provide space weather advisory since Nov.2019. JCAB declared notification of discrepancies and has not used the Space Weather Advisory. However, NPAC continues to monitor the situation to assess the effectiveness of the Space Weather Advisory.

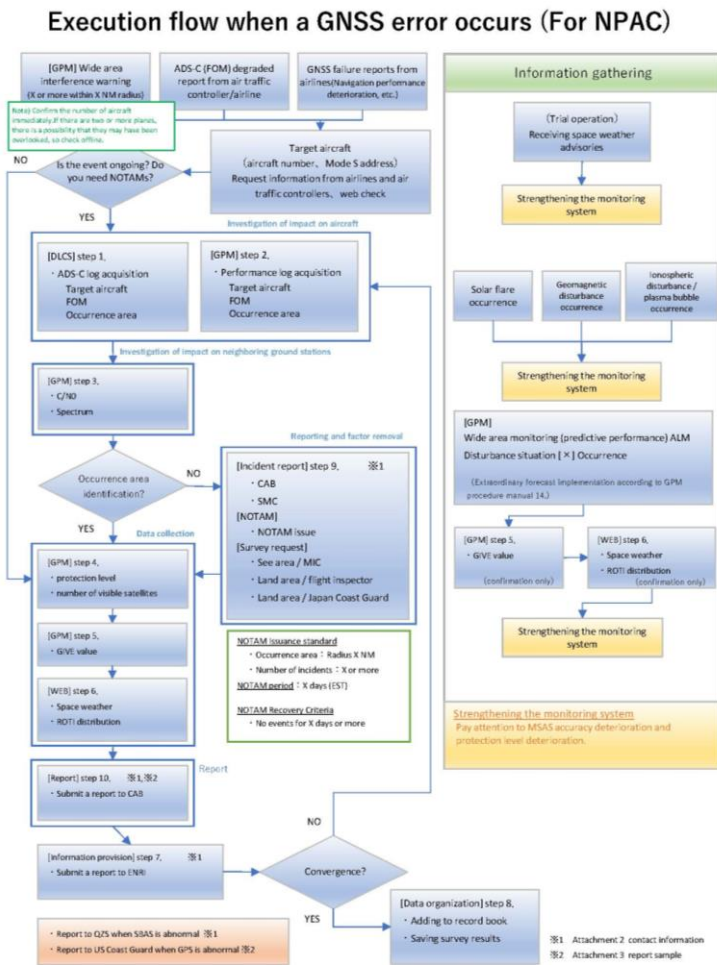


Figure 4. GNSS interference response flow

2.3 GNSS performance evaluation service and challenges

2.3.1 NPAC will monitor, record GNSS data and perform performance evaluation based on ICAO SARPs (V1 2.1.4.2, ATT-D-11, 12) and GNSS manual (7.8). The results of the analysis are summarized in performance evaluation reports on an annual basis. By checking this report, you can know the validity of MSAS performance.

2.3.2 NPAC is currently preparing to publish the MSAS performance evaluation report online. By widely disclosing the performance of MSAS, we believe that we can further contribute to the promotion of seamless SBAS use on a global scale. It will be uploaded in the near future.

— END —

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this papers.
