International Civil Aviation Organization

THE SIXTH MEETING OF THE ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (GBAS/SBAS ITF/6)

(Bangkok, 7- 9 May 2024)

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

KOREAN SBAS (KASS) AIP (Aeronautical Information Publication) and Operation

(Presented by Republic of Korea)

SUMMARY

The Republic of Korea completed the Development and Implementation of Korean SBAS (KASS, Korea Augmentation Satellite System) led by the government (MOLIT, the Ministry Of Land, Infrastructure and Transport). This paper presents the current status of KASS Operations in the Republic of Korea.

1. INTRODUCTION

1.1 The Korean SBAS (Satellite Based Augmentation System) program was initiated in October, 2014. Korea Augmentation Satellite System (KASS) will be a national navaid system to be owned and operated by the Ministry Of Land, Infrastructure and Transport (MOLIT) in the Republic of Korea.

1.2 The KASS Program Office (KPO) in the Korea Aerospace Research Institute (KARI) selected a prime contractor in October, 2016 for the joint development of KASS and full-fledged development had been ongoing.

1.3 For the KASS project, R&D was carried out by KPO for a period of 9 years and 4 months from 30th October, 2014 to 29th February, 2024, and as of 1st March, 2024. Currently, KANSC (Korea Air Navigation Satellite Center) of ATMO (Air Traffic Management Office), which is affiliated with MOLIT, is responsible for KASS operation. And KARI is playing the role of a professional consignment agency for KASS operation and maintenance under the mandate of KANSC.

2. DISCUSSION

2.1 Overview

2.1.1 The Republic of Korea had completed the development of Korean SBAS, named KASS, which provides navigation services to various users in Korea - including aviation, transportation (road, rail, maritime), and others. KASS was developed by applying the SBAS Performance requirements from the International Civil Aviation Organization (ICAO) Annex 10 Volume I (Amendment 89). And the KASS signal-in-space is in compliance with the corresponding requirements in the SBAS Minimum Operational Performance Standards (MOPS) published by RTCA (Radio Technical Commission for Aeronautics) DO-178B and DO-229D. It is augmenting the GPS L1 signal and providing the APV-I approach services at first in the Incheon FIR. The KASS service will benefit not only the aircraft navigation but also the evolution of the industries related to the LBS (Location Based Service) and Self-driving car and UAM (Urban Air Mobility), etc.

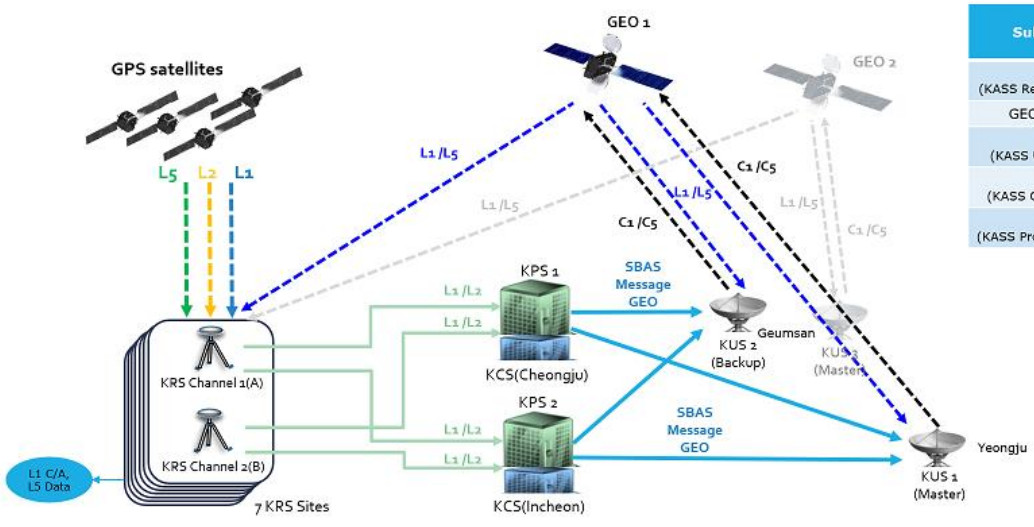
2.1.2 KASS is certified by the MOLIT with supports from experts in certification, safety and software domain. The European Aviation Safety Agency (EASA) provides them with general technical advice in the certification process.

2.2 **KASS Configuration**

2.2.1 The KASS system comprises of seven KASS Reference Stations (KRSs), two KASS Processing Stations (KPSs), two KASS Control Stations (KCSs) and three KASS Uplink Stations (KUSs at 2 sites). The subsystems communicate each other over the Wide Area Network (WAN) with low latency and high availability, continuity and integrity performance.

2.2.2 The KRS collects measurement data and broadcast messages from all GPS and GEO satellites and delivers the data and the message to the KPS. The KPS performs correction processing, safety process, and SBAS message processing. The KUS generates “GPS-like” signals combined with the SBAS messages from the KPS and transmits them to the GEO satellites. The GEO satellites receive the signals from the KUS and transmit GPS compatible signals. The KCS controls and monitors the entire KASS ground subsystems.

2.2.3 The first KASS GEO satellite is the Measat-3D (located at 91.5° E), which was launched on 23rd June 2022 (KST).



Sub System	Qty. (site) (Baseline)
KRS (KASS Reference Station)	7
GEO Satellites	2(1)
KUS (KASS Uplink Station)	2
KCS (KASS Control Station)	2
KPS (KASS Processing Station)	2

Figure 1. KASS system architecture

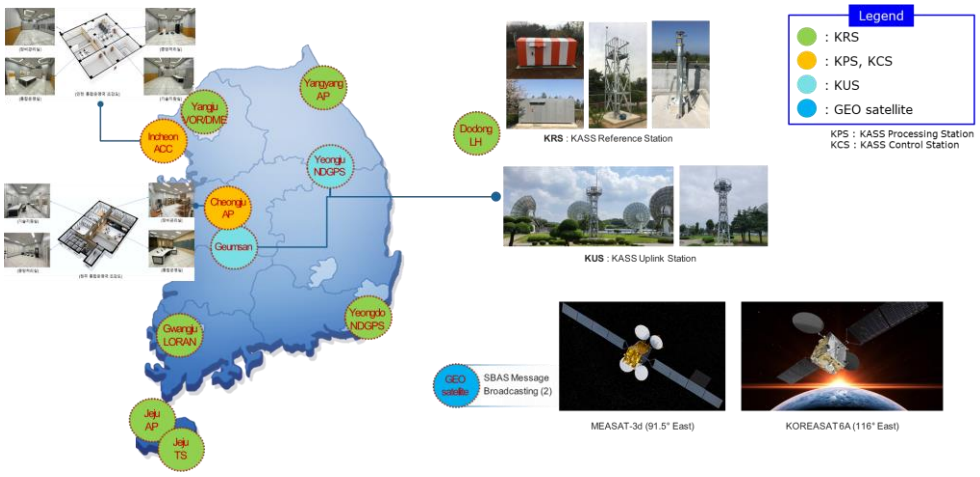


Figure 2. KASS system configuration.

2.3 KASS Implementation and Initial Operational Status

2.3.1 In April 2017, the Korean Government announced the KASS service provision plan and requested to register the SBAS Service Provider ID.

2.3.2 In September 2017, the Contribution Documents for the ground system and space system (GEO satellite) of the KASS system had been submitted to the ITU (International Telecommunication Union).

2.3.3 In June 2018, KASS had been granted SBAS Service Provider ID number 6, seventh worldwide and the Korean Government applied for a temporary PRN code for the KASS 1st GEO satellite.

2.3.4 On 6th January 2021, KASS 1st GEO satellite was assigned a temporary PRN code (134, 3yrs).

2.3.5 On 22nd June 2023, PRN 134 was allocated to the permanent PRN code (134, 10yrs).

2.3.6 On 11th November 2023, the Korean Government applied for a temporary PRN code for the KASS 2nd GEO satellite and was assigned a temporary PRN code (142, 3yrs) from SSC (Space Systems Command) on 12th March, 2024.

2.4 KASS Service Commencement and Operations

2.4.1 In developing and implementing KASS system, the KASS signal provided from 1st to 3rd.

2.4.2 With ongoing KASS R&D program, MOLIT have cooperated with Airline companies and LBS industry, telecommunications and automobile-related companies and sharing the timelines of KASS service. KANSC monitors the rate of the readiness for the registered aircraft in Korea Office Civil Aviation (KOCA). The rate is still low as 25% of national registered aircraft but it is increasing. On the other hand, some drone company adopted KASS and open the drone in the market.

2.4.3 MOLIT have a new flight check aircraft with SBAS APP capability and upgraded other flight check aircraft from the open service signal (MT0/2).

Figure 3. Aircraft (Cessna Citation CJ1) for Flight Check

2.4.4 KANSC has been analyzing the KASS signal performance of SIS (Signal In Space) since the APV-I class SoL service was first broadcast on 28th December 2023. Long-term data accumulation is required, however for the accuracy of the KASS system, the horizontal is within 1.2~1.7m and the vertical is within 2.2~2.7m (March 2024).

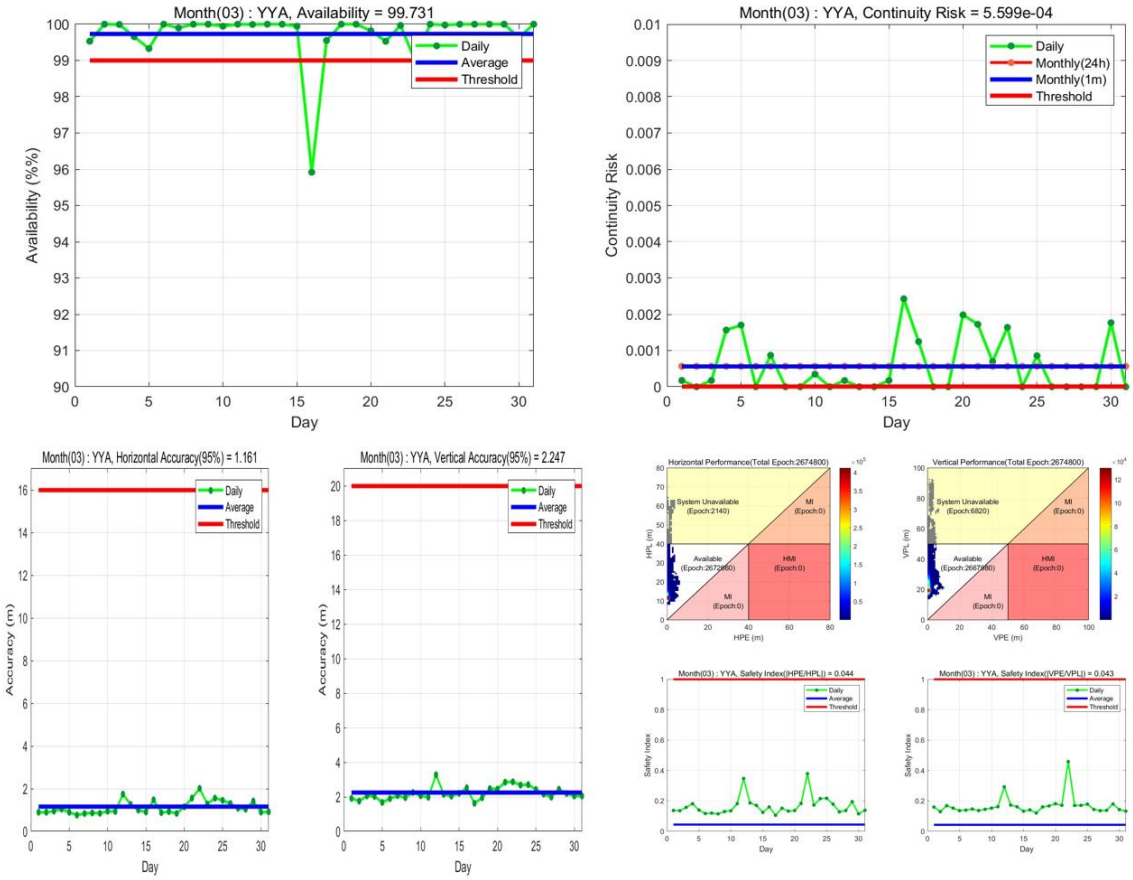


Figure 4. Example of KASS SIS performance at the Yangyang airport (March 2024)

2.4.5 The first round of KASS signals was a test broadcast (MT0/0) on 15th December, 2022, and the second round of signals broadcast as an open service (MT0/2) on 26th July, 2023. And the MOLIT published the AIP on 14th December, 2023 to prepare the provision of SoL service.

2.4.6 The third round of KASS signals launched an APV-I class SoL service on 28th December, 2023. And the AIP became effective on 24th January, 2024. The flight approach procedure using the KASS (APV-I class) signal was created for Muan airport and Ulsan airport.

2.4.7 KASS APV-I is backup for ILS CAT-I. In Ulsan airport, there is an ILS CAT-I APP for RWY 36. Currently, due to terrain, ILS installation is not possible at 18RWY. Instead, RNP AR approach procedures are being provided, and with SBAS APV-I APP service, the Decision Height (DH) for landing will decrease from RNP 900m to a maximum of 380m.

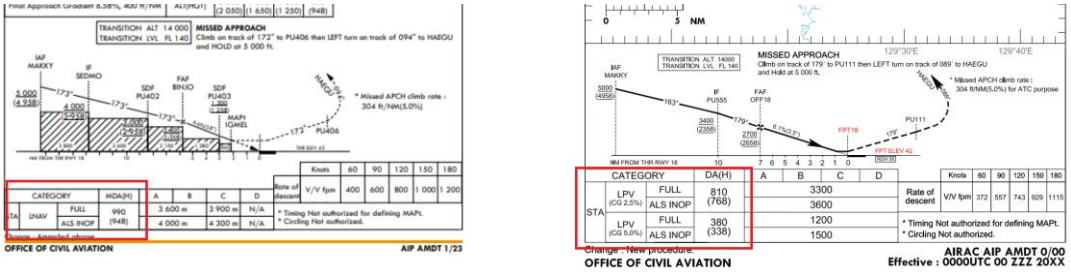


Figure 5. Example of Flight approach procedure at the Ulsan airport

2.4.8 KANSC has been operating and maintaining the KASS system with KARI since March 2023 to prepare for the initial operation of KASS. And KANSC is currently providing more stable SoL service.

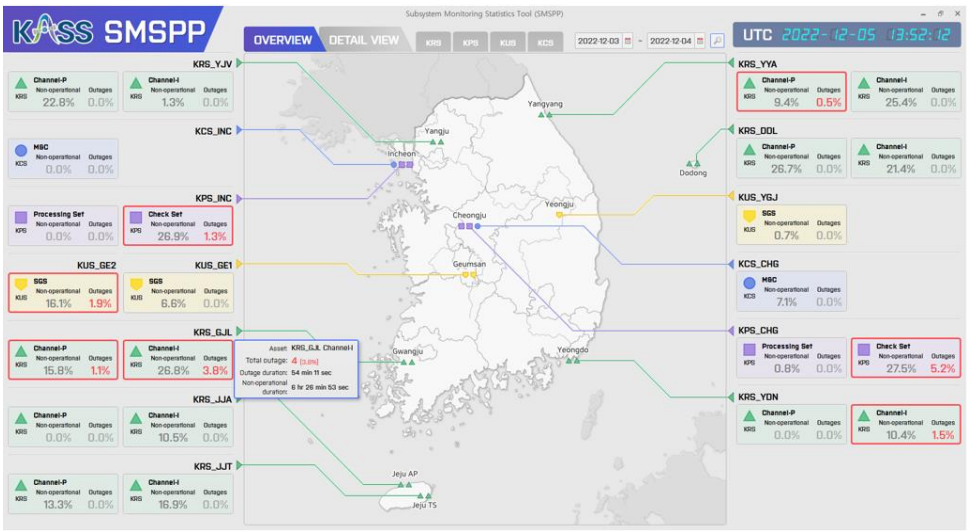


Figure 6. KASS Subsystem Monitoring Statistics Tool.

3. FUTURE PLANS OF KASS PROGRAM

3.1 The MOLIT will gradually expand the number of airports using KASS service.

3.2 Some of the KASS operational tools are expected to be developed by the second half of 2024, allowing KASS operators to monitor various KASS-related conditions more diversely.

3.3 In the second half of 2024, the second KASS GEO satellite (KOREASAT 6A) will be launched. ROK will go through the development for LPV-200 Service which will be given in 2028.

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