International Civil Aviation Organization

THE EIGHTH MEETING OF THE ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (GBAS/SBAS ITF/8)

(Melbourne, Australia, 12-14 May 2026)

Agenda Item 4: Updates on GBAS/SBAS system and States' implementation status

KOREAN SBAS (KASS) Operations using 2nd GEO satellite
(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(Change 1). 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.

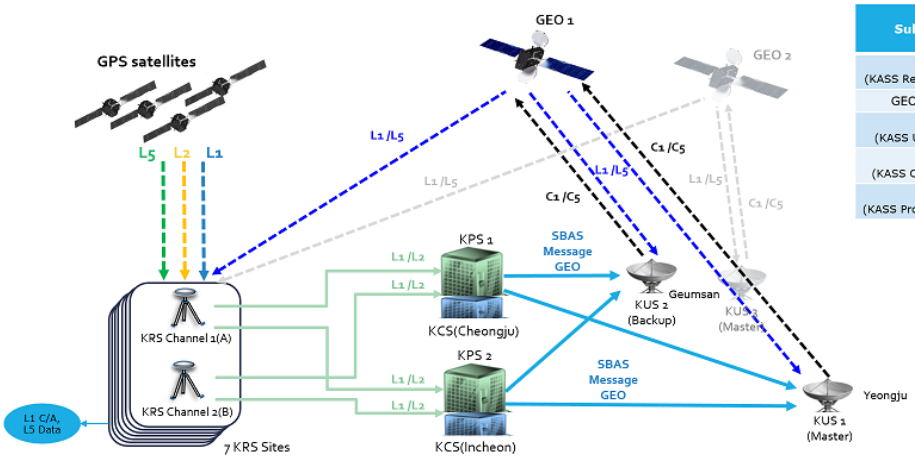
2.1.2 KASS was certified by the MOLIT with supports from experts in certification, safety and software domain. The European Aviation Safety Agency (EASA) provides them with general technical advice in the certification process.

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). And the second KASS GEO satellite is the KOREASAT 6A (located at 116° E) on 12th November, 2024 (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

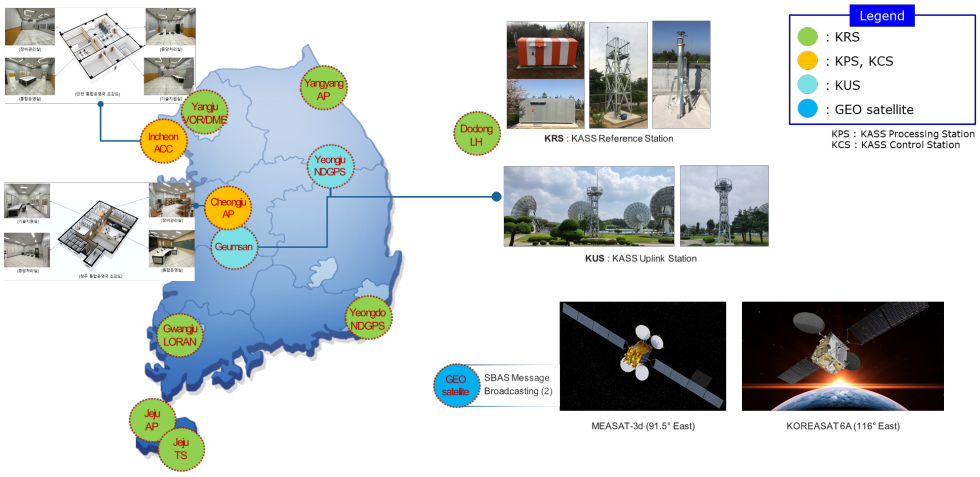


Figure 2. KASS system configuration.

2.3 KASS 2nd GEO Implementation

2.3.1 KASS 2nd GEO satellite was temporarily assigned PRN 142. After the completion of internal testing and performance compliance inspection of air navigation facilities, the satellite was officially assigned to be used until December 2027

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L1 C/A PRN CODE ASSIGNMENTS

PRN Code Number	**G2 Delay** (Chips)	**Initial G2 Setting** (Octal)	**First 10 Chips** (Octal)	**PRN Allocations** System (Satellite)	**Orbital Slot**	**Effective Through** (Month Year)
142	883	1644	0133	**KASS (KOREASAT-116N)**	**116 E**	**Dec 2027**
143	307	1312	0465	BDSBAS (G3)	110.5 E	Aug 2030
144	127	1060	0717	BDSBAS (G2)	80 E	Aug 2030
145	211	1560	0217	**Pak-SBAS (PakSat-MM1)**	**38.2E**	**May 2027**
146	121	0035	1742	Unallocated	---	---
147	118	0355	1422	ASECNA (ANGA)	20W – 55E	**Jun 2028**
148	163	0335	1442	A-SBAS (Alcomsat-1)	24.8 W	**Jan 2027**
149	628	1254	0523	Unallocated	---	---
150	853	1041	0736	EGNOS **(HOTBIRD 13G)**	**13 E**	May 2031
151	484	0142	1635	Unallocated	---	---
152	289	1641	0136	Unallocated	---	---

Figure 3. Allocated KASS GEO#2 of L1 C/A PRN code as PRN 142

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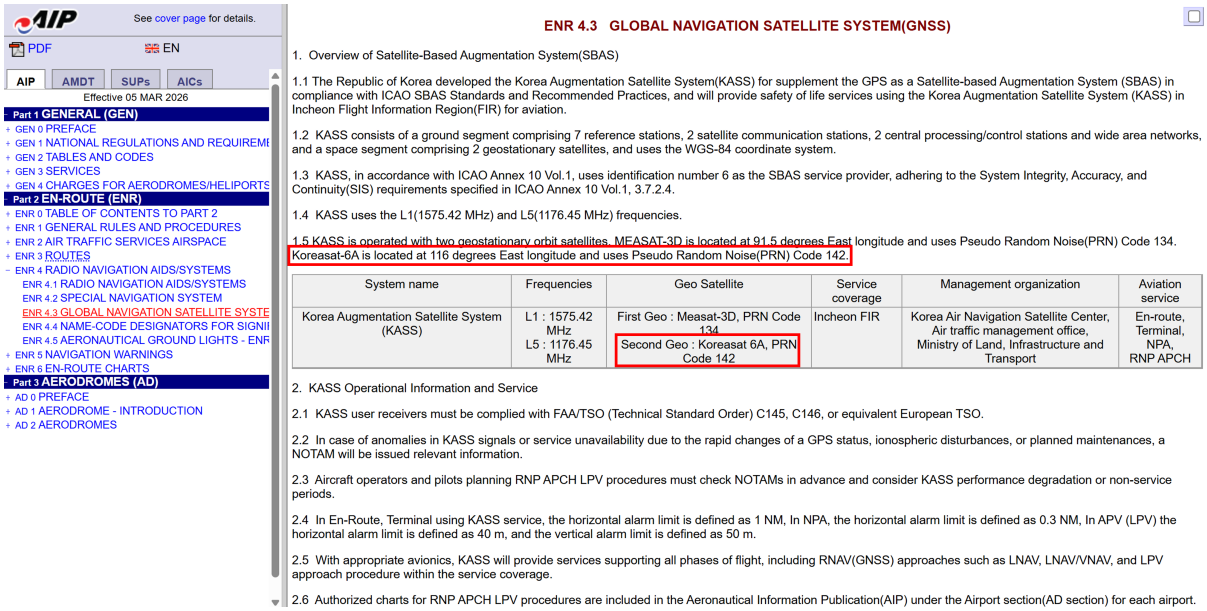
L5 PRN CODE ASSIGNMENTS

PRN Code Number	**XB Code Advance** (Chips)		**Initial XB Code State** (Octal)		**PRN Allocations** System (Satellite)	**Orbital Slot**	**Effective Through** (Month Year)
	I5	**Q5**	**I5**	**Q5**			
138	1197	7897	16360	03414	WAAS **(GEO 8)**	**117 W**	**Dec 2029**
139	7208	4054	07437	04313	**Reserved**	---	---
140	8000	3498	03560	12517	**Reserve**	---	---
141	152	6571	17110	04105	**Reserve**	---	---
142	6762	2858	01562	00174	**KASS (KOREASAT-116N)**	**116 E**	**Dec 2027**
143	3745	8126	05474	15167	BDSBAS (G3)	110.5 E	Aug 2030
144	4723	7017	02275	16761	BDSBAS (G2)	80 E	Aug 2030
145	5502	1901	15663	16721	**Pak-SBAS (PakSat-MM1)**	**38.2E**	**May 2027**
146	4796	181	03637	01263	Unallocated	---	---
147	123	1114	11257	07705	ASECNA (ANGA)	20W – 55E	**Jun 2028**
148	8142	5195	07757	04234	A-SBAS (Alcomsat-1)	24.8 W	**Jan 2027**

Figure 4. Allocated KASS GEO#2 of L5 PRN code as PRN 142

2.3.2 A performance compliance inspection was conducted by the Korea Institute of Aviation Safety Technology (KIAST) designated by the MOLIT from June to December 2025. As of December 30, 2025, KASS V1.4.0 was approved to comply with MOILT's standards for the installation and technical standards of radio navigation aids, ICAO SARPs Annex 10, and RTCA DO-178B.



AIP See cover page for details.
PDF EN
AIP AMDT SUPs AICs
Effective 05 MAR 2026

- Part 1 GENERAL (GEN)
  - GEN 0 PREFACE
  - GEN 1 NATIONAL REGULATIONS AND REQUIREMI
  - GEN 2 TABLES AND CODES
  - GEN 3 SERVICES
  - GEN 4 CHARGES FOR AERODROMES/HELIPORTS
- Part 2 EN-ROUTE (ENR)
  - ENR 0 TABLE OF CONTENTS TO PART 2
  - ENR 1 GENERAL RULES AND PROCEDURES
  - ENR 2 AIR TRAFFIC SERVICES AIRSPACE
  - ENR 3 ROUTES
  - ENR 4 RADIO NAVIGATION AIDS/SYSTEMS
    - ENR 4.1 RADIO NAVIGATION AIDS/SYSTEMS
    - ENR 4.2 SPECIAL NAVIGATION SYSTEM
    - ENR 4.3 GLOBAL NAVIGATION SATELLITE SYSTE
    - ENR 4.4 NAME-CODE DESIGNATORS FOR SIGNII
    - ENR 4.5 AERONAUTICAL GROUND LIGHTS - ENR
  - ENR 5 NAVIGATION WARNINGS
  - ENR 6 EN-ROUTE CHARTS
- Part 3 AERODROMES (AD)
  - AD 0 PREFACE
  - AD 1 AERODROME - INTRODUCTION
  - AD 2 AERODROMES

ENR 4.3 GLOBAL NAVIGATION SATELLITE SYSTEM(GNSS)

1. Overview of Satellite-Based Augmentation System(SBAS)

1.1 The Republic of Korea developed the Korea Augmentation Satellite System(KASS) for supplement the GPS as a Satellite-based Augmentation System (SBAS) in compliance with ICAO SBAS Standards and Recommended Practices, and will provide safety of life services using the Korea Augmentation Satellite System (KASS) in Incheon Flight Information Region(FIR) for aviation.

1.2 KASS consists of a ground segment comprising 7 reference stations, 2 satellite communication stations, 2 central processing/control stations and wide area networks, and a space segment comprising 2 geostationary satellites, and uses the WGS-84 coordinate system.

1.3 KASS, in accordance with ICAO Annex 10 Vol.1, uses identification number 6 as the SBAS service provider, adhering to the System Integrity, Accuracy, and Continuity(SIS) requirements specified in ICAO Annex 10 Vol.1, 3.7.2.4.

1.4 KASS uses the L1(1575.42 MHz) and L5(1176.45 MHz) frequencies.

1.5 KASS is operated with two geostationary orbit satellites. MEASAT-3D is located at 91.5 degrees East longitude and uses Pseudo Random Noise(PRN) Code 134. Koreasat-6A is located at 116 degrees East longitude and uses Pseudo Random Noise(PRN) Code 142.

System name	Frequencies	Geo Satellite	Service coverage	Management organization	Aviation service
Korea Augmentation Satellite System (KASS)	L1 : 1575.42 MHz L5 : 1176.45 MHz	First Geo : Measat-3D, PRN Code 134 Second Geo : Koreasat 6A, PRN Code 142	Incheon FIR	Korea Air Navigation Satellite Center, Air traffic management office, Ministry of Land, Infrastructure and Transport	En-route, Terminal, NPA, RNP APCH

2. KASS Operational Information and Service

2.1 KASS user receivers must be complied with FAA/TSO (Technical Standard Order) C145, C146, or equivalent European TSO.

2.2 In case of anomalies in KASS signals or service unavailability due to the rapid changes of a GPS status, ionospheric disturbances, or planned maintenances, a NOTAM will be issued relevant information.

2.3 Aircraft operators and pilots planning RNP APCH LPV procedures must check NOTAMs in advance and consider KASS performance degradation or non-service periods.

2.4 In En-Route, Terminal using KASS service, the horizontal alarm limit is defined as 1 NM, In NPA, the horizontal alarm limit is defined as 0.3 NM, In APV (LPV) the horizontal alarm limit is defined as 40 m, and the vertical alarm limit is defined as 50 m.

2.5 With appropriate avionics, KASS will provide services supporting all phases of flight, including RNAV(GNSS) approaches such as LNAV, LNAV/VNAV, and LPV approach procedure within the service coverage.

2.6 Authorized charts for RNP APCH LPV procedures are included in the Aeronautical Information Publication(AIP) under the Airport section(AD section) for each airport.

Figure 5. AIP Issue of KASS GEO#2 PRN code (142)

2.3.3 KASS 2nd GEO has begun operation on 18th February 2026 16:00 (UTC). Publication date was on 08th January 2026. It can be found in the ENR4.3 GLOBAL NAVIGATION SATELLITE SYSTEM(GNSS) of Aeronautical Information Publication (AIP).

2.4 KASS Operations and SoL Service Status

2.4.1 KASS Operational Status

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

2.4.3 Now, The MOLIT plans to gradually increase the publication of approach procedures to use KASS service. As of April 2026, flight procedures for APV-I approach have been published at three airports.

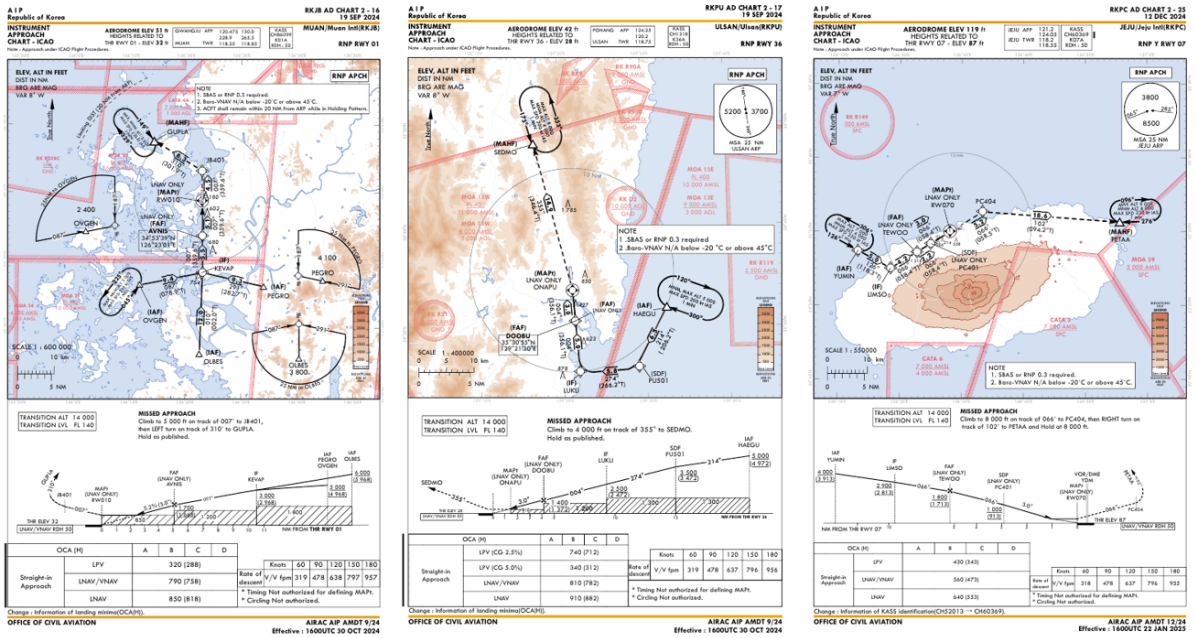
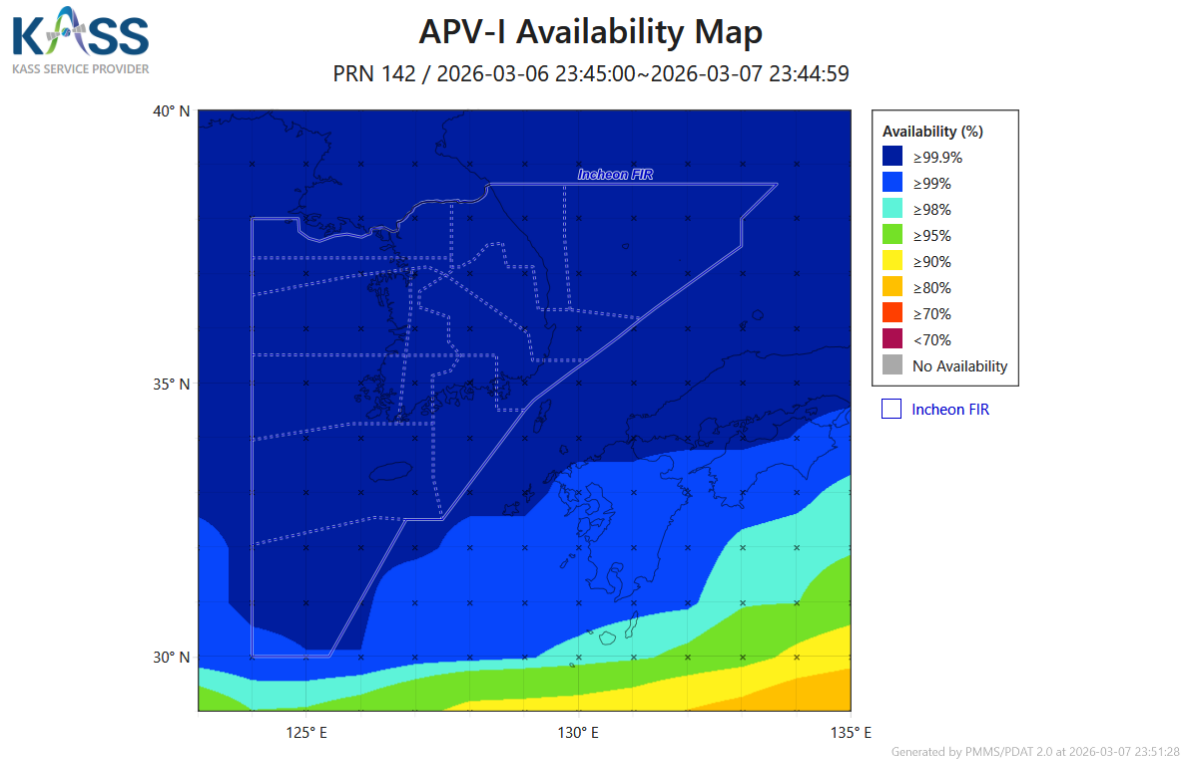


Figure 6. SBAS (KASS) Flight Procedures at three airports (Muan, Ulsan and Jeju) (as of April, 2026)

2.4.4 Since the broadcasting of the APV-I SoL service, KANSC has been strengthening monitoring and maintenance to maintain a stable KASS service.

2.4.5 KANSC has been analysing 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 average accuracy is about 1.28m (95% confidential interval) and the vertical average is about 2.15m (95% confidential interval) in March 2026.



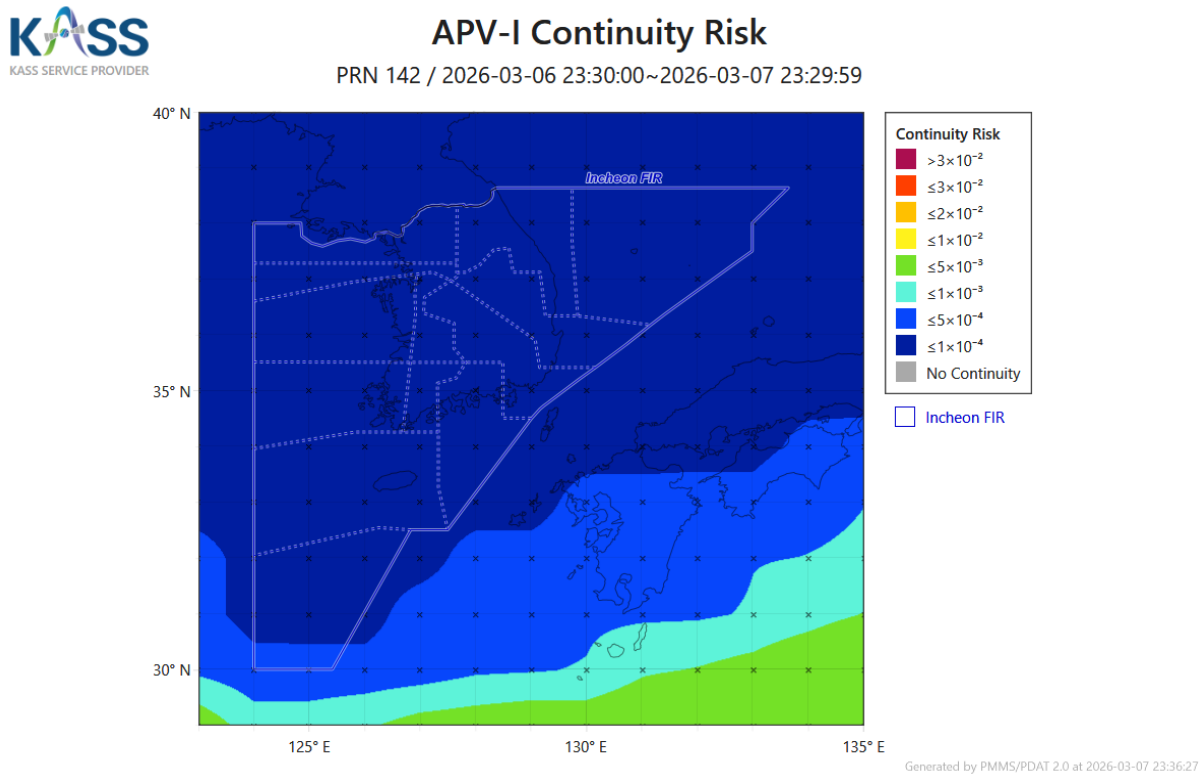


Figure 7. APV-I Availability and Continuity Performance at the 7 KASS Reference Stations (24-hours data, 6st March 2026)

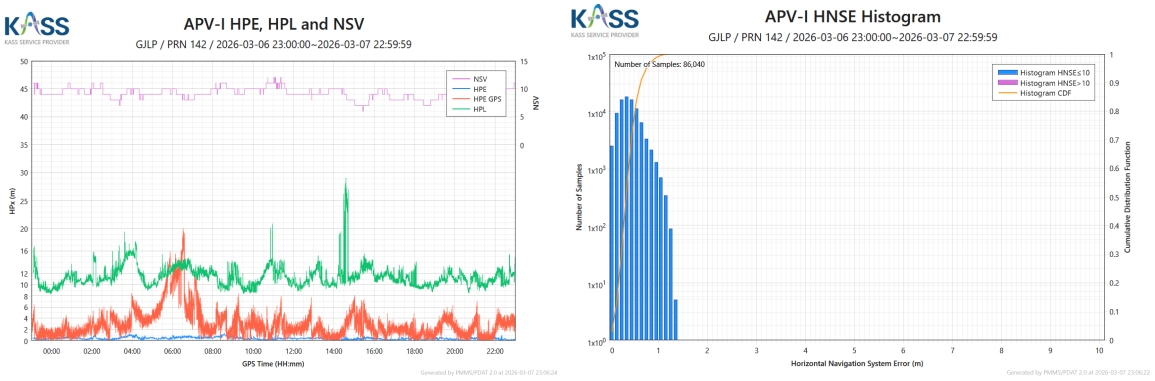


Figure 8. APV-I HPE, HPL and HNSE at the 1 KASS Reference Stations
(24-hours data, 6th March 2026)

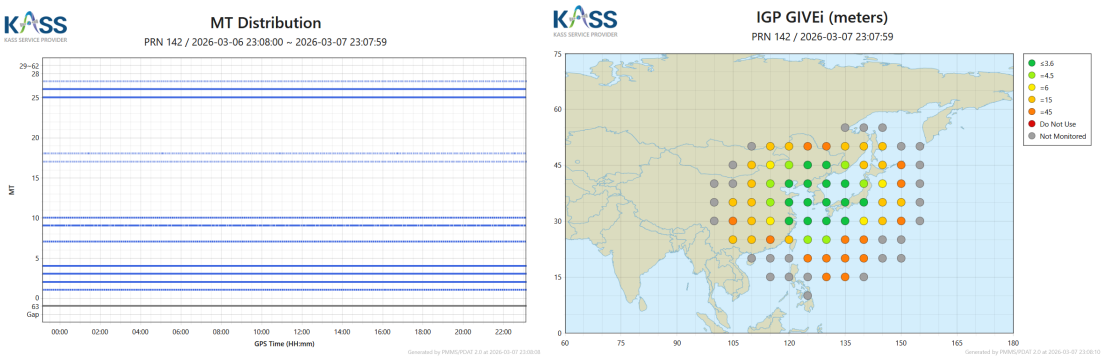


Figure 9. PRN 142 MT Distribution and IGP GIVEi
(24-hours data, 6th March 2026)

3. FUTURE PLANS OF KASS PROGRAM

3.1 KASS SoL service has begun after acquiring aviation certification. Using the performance monitoring and analysis tool, performance degradation due to solar activity from January to April was confirmed. If similar performance degradation continues in the future, we will take an action such as NOTAM and AIP considering the safety of using SoL service.

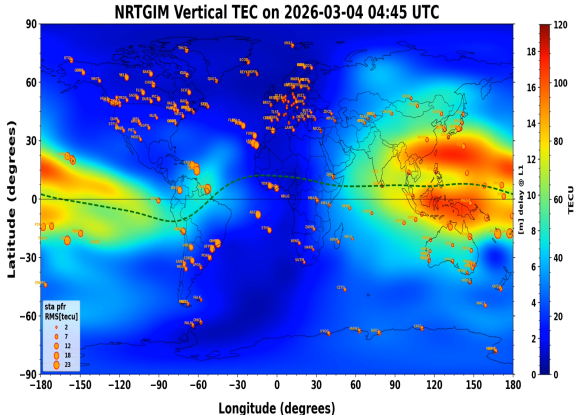


Figure 10. A map of the VTEC near the Korean Peninsula

3.2 KDAS (KASS Data Access System) is an innovative system that provides real-time precision position correction information from KASS via internet. Since the existing KASS

transmitted correction signals solely via satellite, its use was limited in shaded area. KDAS supports the safe and accurate performance of future mobility technologies, such as autonomous vehicles, UAM (Urban Air Mobility), and UAVs, etc.

4. ACTION REQUIRED BY THE MEETING

4.1 The meeting is invited to:

a) note the information contained in this paper; and
b) discuss any relevant matters as appropriate.

— END —