International Civil Aviation Organization

THE SEVENTH MEETING OF THE ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (GBAS/SBAS ITF/7)

(Bangkok, Thailand, 14- 16 May 2025)

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

GAGAN (SBAS) BASED LPV PROCEDURE IMPLEMENTATION UPDATE IN INDIA

(Presented by India)

SUMMARY

This paper provides an update on India's GAGAN (GPS Aided GEO Augmented Navigation) implementation, operational experience and challenges. This paper also highlights the progress on development of GAGAN based LPV procedures at various Indian airports.

Additionally, it highlights the information regarding upcoming SBAS/GBAS Workshop for Airspace Users scheduled to be held at Bengaluru, India during 14th – 16th October 2025.

1. INTRODUCTION

1.1 GAGAN (GPS Aided GEO Augmented Navigation) is an Indian Satellite Based Augmentation System (SBAS) certified by DGCA, India. It was declared operational for RNP 0.1 services in the year 2013 for Indian FIRs and for APV I services in the year 2015 for Indian Landmass.

1.2 GAGAN architecture comprises of fifteen ground reference stations (INRES) located at precisely known locations within India, two Master Control Centres (INMCC) located at Bengaluru (GBC) & Delhi (GBM) and three uplink stations (INLUS), two located at Bengaluru & one at Delhi integrated with three Indian GEOs satellites (GSAT-8, GSAT-10 & GSAT-15) with PRN codes 127, 128 &132 respectively.

1.3 Till date, twenty-three (23) LPV procedures for fifteen airports in India have been published.

1.4 Currently, LPV procedures are preferably being designed for those airports where ILS is not installed.

2. UPDATE ON GAGAN SYSTEM UPGRADATION

2.1 Frequency standard and Phase Noise Enhancer (PNE) are replaced with *Microsemi 5071A* High Precision Frequency Standard (HPFS) in all three GAGAN uplink stations (INLUS) in the year 2020.

2.2 All three GAGAN uplink stations (INLUS) are upgraded with *NovAtel GUS Type-I* Signal generator in the year 2022.

2.3 All the fifteen GAGAN reference stations (INRES) are upgraded with *Novatel G-III* receiver and *IBM S914* server. This has enabled the GAGAN reference stations to be DFO/DFMC ready. The upgradation has been executed in three phases.

2.3.1. Phase I: Ahmedabad INRES(Year-2020).

2.3.2. Phase II: Bengaluru, Trivandrum, Port Blair, Guwahati, Delhi (Year-2023).

2.3.3. Phase III: Porbandar, Dibrugarh, Jaisalmer, Bhubaneshwar, Kolkata, Gaya, Nagpur, Jammu, Goa (Year-2023-24).

2.4 Indian Ionosphere monitoring network is upgraded with *Septentrio PolaRx5S* receiver which supports Multi -Frequency, Multi-constellation.

3. UPDATE ON GAGAN BASED LPV PROCEDURES

3.1 A total of 53 ICAO SBAS channel numbers for LPV procedures have been assigned to India as on date.

3.1.1 AAI has published Twenty-three (23) LPV procedures for fifteen airports in India as on date.

3.1.2 AAI has developed Twelve (12) more LPV procedures for various airports in India. Simulator validation and flight trials of these procedures are in progress.

3.1.3 Eighteen (18) LPV Procedures are under design & development phase.

3.1.4 The published LPV procedures are available on the following link (Please select the applicable Aerodrome from AD_2 under section PART 3 - AERODROMES):
https://aim-india.aai.aero/eaip-v2-02-2025/index-en-GB.html

3.1.5 Additionally, list of published and planned LPV in India can also be seen on the following ICAO APAC web-link:
https://www.icao.int/APAC/Pages/GBAS-SBAS-MAP.aspx

3.2 AAI has also upgraded its Flight Inspection Unit aircraft for GAGAN LPV procedures validation and same has been certified by DGCA, India.

4. HOSTING OF SBAS/GBAS WORKSHOP FOR AIRSPACE USERS IN INDIA

4.1 India will host the SBAS/GBAS Workshop for Airspace Users in Bengaluru during 14th –16th October 2025, bringing together global aviation stakeholders to advance the implementation of satellite and ground-based augmentation systems. All ICAO Member States are warmly invited to participate in this collaborative platform aimed at promoting PBN adoption and enhancing airspace efficiency.

4.2 The city of Bengaluru, also referred as India's "Silicon Valley," offers a unique blend of innovation, heritage, and culture. With its pleasant climate, green spaces, and vibrant arts and cuisine, the city provides an engaging and welcoming environment for delegates attending the workshop.

4.3 The city becomes vibrant during the festive season, with major celebrations such as Dussehra and Diwali. Diwali, the Festival of Lights, will be celebrated on 20th October 2025, featuring colorful decorations, cultural performances, and fireworks. Delegates are encouraged to plan their travel accordingly to experience the rich cultural heritage and tourism opportunities that India has to offer.

3. DISCUSSION

The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.
