



INTERNATIONAL CIVIL AVIATION ORGANIZATION

**TWENTY FIFTH MEETING OF THE
ASIA/PACIFIC AIR NAVIGATION PLANNING AND
IMPLEMENTATION REGIONAL GROUP (APANPIRG/25)**

Kuala Lumpur, Malaysia, 8 – 11 September 2014

Agenda Item 3: Performance Framework for Regional Air Navigation Planning and Implementation
3.4 CNS
UPDATE ON GAGAN AND PLANS FOR SEAMLESS NAVIGATION

(Presented by India)

SUMMARY

GPS Aided Geo Augmentation Navigation (GAGAN) – the Indian Satellite Based Navigation System (SBAS) programme is certified for RNP0.1 service over Indian Airspace is well on its way to provide APV approaches for select runways within India.

India proposes to adopt GAGAN implementation strategy merged with PBN plans within its service volume to ensure approaches with vertical guidance as envisaged by ICAO assembly resolutions.

India has been encouraging States in the Asia Pacific region to through BOBASIO forums to consider the use of GAGAN signal-in-space to ensure seamless global airspace harmonization within APAC Region.

1. INTRODUCTION

1.1 GPS Aided Geo Augmentation Navigation (GAGAN) – the Indian Satellite Based Augmentation System (SBAS) Programme is unique because of the implementation of **IGM-MLDF (ISRO GIVE MODEL MULTI LAYER DATA FUSION IONOSPHERIC ALGORITHM)** to meet the ionospheric challenges posed in Indian sub-continent and other Equatorial Ionospheric Anomaly regions.

1.2 APANPIRG 24 acknowledged the need for cooperation for implementation of GNSS among states that had implemented SBAS services and others who could use the technology. India supports active collaboration with Asia/Pacific States to utilise GAGAN services, noting that many proximate States could achieve operational benefits for seamless airspace harmonization through minimal infrastructure deployment. GAGAN system has the capability of integrating number of reference stations to its Master Control centres for processing and transmission of GAGAN signals through its multiple Uplink Stations.

1.3 India, through BOBASIO 1-3 and SAIOACG04 meetings provided updates to other states regarding GAGAN system developments and performance results within the notified service volume.

1.4 APANPIRG-20 recognized the need for characterization of ionosphere throughout Asia and Pacific Region and agreed to develop a cooperative effort in developing a standard Ionospheric model for the region to facilitate implementation of GNSS. An ionospheric study task force (ISTF) was formed with the main objective of characterizing the ionosphere over Asia-Pacific region and, if needed, develop the regional ionospheric models for GBAS and SBAS.

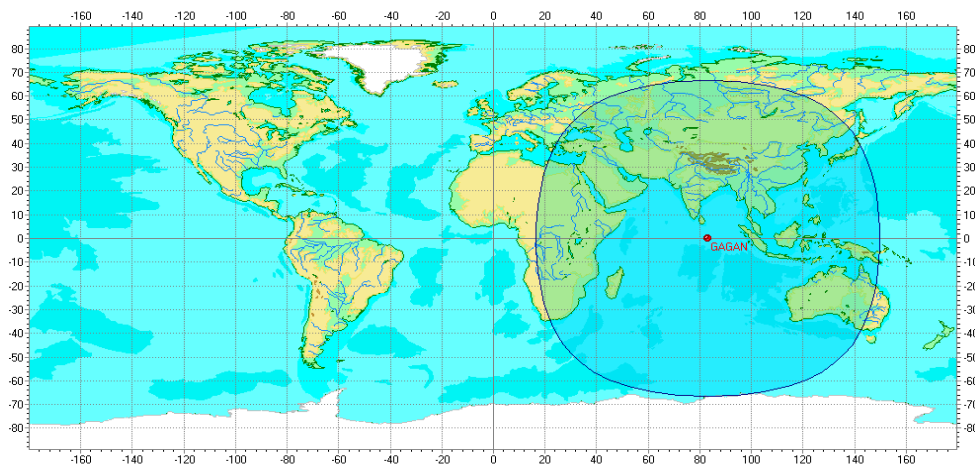
1.5 India has been actively participating and contributed to the ISTF since May 2011 and has provided critical data that has helped to analyze the regional specific algorithm that ICAO Asia Pacific region has envisioned for development of GNSS in the region. India is active participant of this task force team along with Japan, Australia and Republic of Korea.

1.6 The 4th Meeting of Ionospheric Studies Task Force (ISTF) was hosted by India at New Delhi from 4-7 February 2014 in conjunction with SBAS-Interoperability Working Group (SBAS-IWG). Total 8 action items were listed during the 4th meeting of ISTF to achieve its objectives. India has provided significant data related to iono behaviour over the past decade for analysis.

1.7 GAGAN system has successfully passed through phase I certification for RNP0.1 en-route services on 30th December 2013 and is working towards achieving Approach with Vertical Guidance (APV1.0) terminal capability by February 2015.

2. DISCUSSION

2.1 GAGAN is progressing as per the milestones set out to ensure APV1.0 terminal services and is well on its way to provide a cost effective regional SBAS solution to all states within the footprint of its GAGAN GEOs which extends over large portion of the Asia-Pacific region i.e., the whole of Indian region and neighboring countries such as Srilanka, Pakistan, Afghanistan, Bhutan, Nepal, Bangladesh, and states in the South Asia Region, including parts of Australia and Africa can derive benefit of the Indian experience to provide SBAS services by States appropriately augmenting ground segments.



2.2 The neighboring states can draw benefit of GAGAN services by a minimal augmentation of reference stations for LNAV/VNAV or APV (approach with vertical guidance) level performance. GAGAN is capable of taking data from as many as 30 more reference stations.

2.3 SBAS provision is cost intensive and ANS providers need to optimize the use of such services. It provides a way for the ANS service providers to monitor, correct, and ensure compliance to Annex 10 requirements of the primary criteria of accuracy, integrity, availability and continuity. It also ensures the capability of GNSS data recording. All the above factors are essential for assuring flight safety while promulgating GNSS based operations.

2.4 ICAO GNSS working group of NSP and the SBAS Interoperability working Group, RTCA have all identified the above fact and are working together to implement the use of harmonized systems capable of handling signals from any GNSS constellation or augmentation systems to provide seamless GNSS service.

2.5 India has adopted GAGAN implementation strategy to provide GAGAN approaches at all runway ends in a phased manner merged with PBN plans within its service volume to ensure approaches with vertical guidance as envisaged by ICAO assembly resolutions. India encourages the regional airlines to equip with appropriate GNSS receivers to derive the best benefits.

2.6 GNSS mandates that are promulgated in certain states such as Australia are in the right direction to ensure standardization of GNSS and ADS B receivers for the aircraft that will occupy the skies for the next ten to fifteen years. ATM airspace harmonization can be achieved by wide area navigation systems such as GAGAN. The levels of navigation performance over oceanic and land could be uniform allowing greater flexibility in route design and capacity enhancement.

2.7 ANS providers must optimize the services through the implementation of available technology and derive the benefits for user community that GNSS has to offer to ward off threats of spiralling aviation costs and the long gestation period of developing and implementing newer technologies.

2.8 In the short run, SBAS will provide great value to all regional airlines and general aviation including helicopter operations. It will also provide boost to the concept of creation of low cost airports and assist APAC region for implementation of Global harmonized ATM services.

2.9 India is willing to extend support to **APAC states in taking advantage of the capability of GAGAN signal-in-space** for achieving regional airspace harmonization for seamless navigation services in South East Asia.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- Take note of the GAGAN deployment as a viable SBAS solution within APAC Region capable of providing up to RNP0.1 en-route service and APV 1.0 terminal approach services
- States may consider deriving benefits from GAGAN services and promoting seamless navigation across the states in the Asia Pacific Region.