



INTERNATIONAL CIVIL AVIATION ORGANIZATION

TWENTY EIGHTH MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/28)

Bangkok, Thailand, 11 to 14 September 2017

Agenda Item 3 : Performance Framework for Regional Air Navigation Planning and Implementation

3.4 CNS

GAGAN STATUS AND EXPANSION

(Presented by India)

SUMMARY

This paper presents India's major accomplishment of GAGAN- SBAS certification for both enroute and landing operations in the equatorial anomaly region and thus becoming the third state to develop and certify APV 1 operations and first state to do so in the Asia Pacific Region. The paper also presents the current update on the performance of GAGAN systems and potential of Indian SBAS – GAGAN for providing services in aviation and non-aviation applications. This paper also presents the contributions made by India in achieving the objectives of Ionospheric Studies Task Force (ISTF).

Strategic Objectives:

- A: **Safety** – Enhance global civil aviation safety
- B: **Air Navigation Capacity and Efficiency**—Increase the capacity and improve the efficiency of the global aviation system
- E: **Environmental Protection** — minimize the adverse environment effects of civil aviation activities.

1. INTRODUCTION

1.1 The Indian SBAS- GAGAN (GPS Aided GEO Augmented Navigation) has been certified by DGCA for RNP0.1 and Precision Approach with Vertical guidance (APV1) services on 21st April 2015 and since then it is in continuous operations meeting the operational criteria specified in the SARPS.

1.2 At present GAGAN system consists of 15 Indian Reference Stations (INRES), 2 Indian Master Control Centers, 3 Uplink stations, and 2 geostationary satellites.

1.3 Recognizing the benefits accruable through SBAS implementation, Indian Government mandate SBAS equipage on new aircraft being procured after 1st January 2019 and also encourages the retrofitting of the existing fleet by incentivizing airline operators.

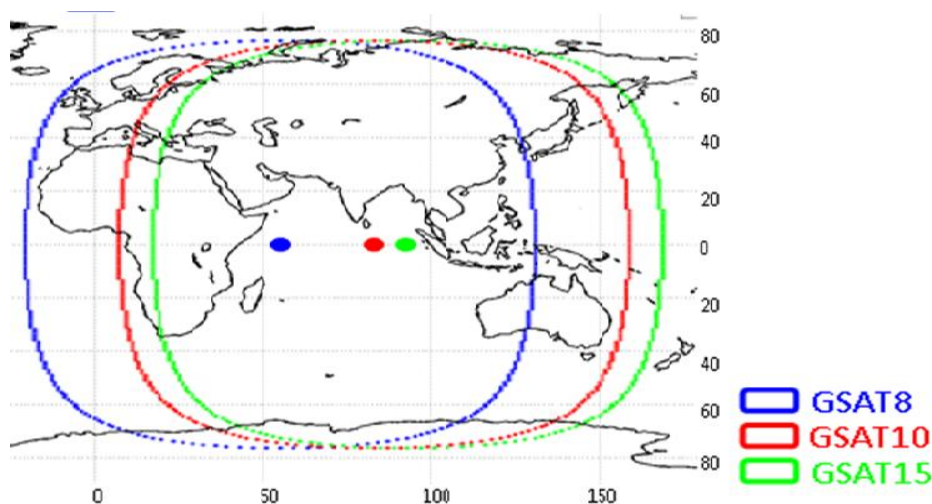
2. DISCUSSION

2.1 Most of the GAGAN reference stations are situated at the periphery of Indian boundary so as to cover large neighboring area in order to provide the RNP0.1 service over Indian Flight Information Region.

2.2 GAGAN system is capable of installation of total 45 INRES station at various places for GAGAN system. AAI working on installing INRES station out of Indian Territory and thus extending the RNP0.1 and APV1.0 services beyond present service area, to give advantage of SBAS to other nations.

2.3 Geostationary satellite (GSAT-15) is already available in space with GAGAN payload and AAI is in process of utilizing GAGAN payload by integrating it with 3rd INMCC at Delhi. Stability test also completed for 3rd INMCC in May 2017. This integration process is expected to be completed by December 2017.

2.4 Footprint of GAGAN GEO satellites are shown as below. The real time GAGAN performance is available on <http://gagan.aai.aero/gagan/>.



2.5 GAGAN procedure for few airports has been already made and soon after validation, these will be flight utilized by commercial Airlines.

2.6 Currently Indian commercial fleet is not equipped/certified for SBAS operations. Therefore Airports Authority of India (AAI) has retrofitted its flight calibration aircraft for SBAS operations. It is planned to utilize this capability for conducting flight validation of draft Instrument Approach Procedures.

2.7 India has played a key role in the ISTF activities owing to its experience in ionospheric studies over equatorial and low latitude region for implementation of SBAS, particularly GAGAN.

2.8 India has taken active participation in ISTF meetings for preparation of SBAS safety assessment guidance related to anomalous ionospheric conditions. The document is further adopted and published on ICAO APAC website:

(<http://www.icao.int/APAC/Documents/edocs/SBAS%20safety%20assessment%20guidance.pdf>). The document will assist States in their safety assessment of ionospheric threat and mitigation to SBAS signal.

2.9 The ripples in ionosphere created by Nepal Earthquake on 25 April 2015 were captured by Ionospheric monitoring stations over Indian region as shown in Fig. 4. This shows the potential application in tsunami warning systems based on GPS measurements.

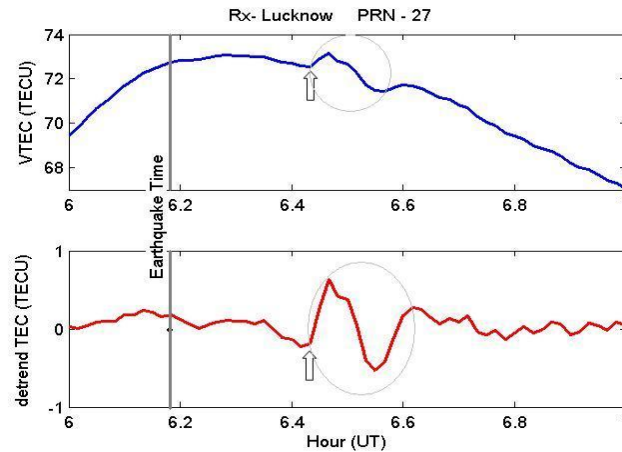
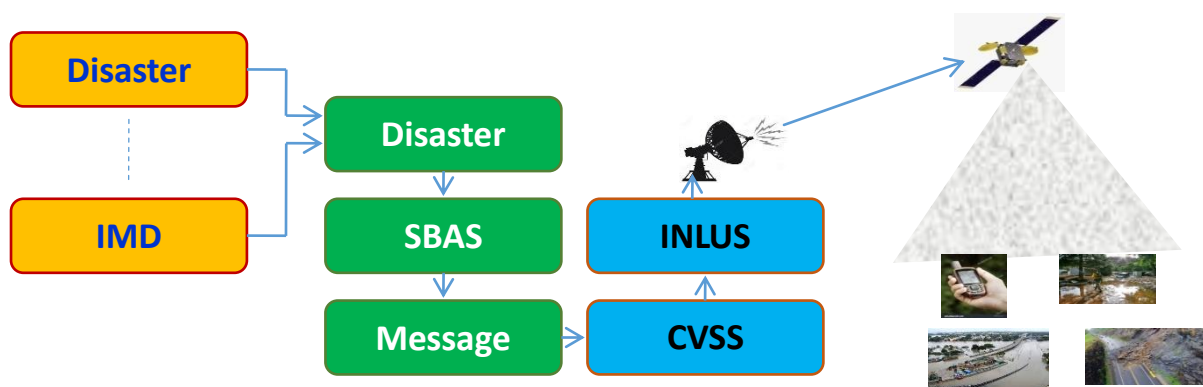


Fig. 4: Fluctuations in the Vertical TEC after 15 minutes from onset of Earthquake.

2.10 India has planned to utilize GAGAN signals for broadcasting short service messages with suitable changes in the message structure via GEO satellites.

2.11 GAGAN Alert Message Services (GAMES) is an idea conceived by AAI and putting this idea forward for life security of human being. The architecture for GAGAN Alert Message Service is shown below.



2.12 AAI is in process to sign MoU with INCOIS ([Indian National Centre for Ocean Information Services](#)) for GAMES implementation. INCOIS is responsible for message generation for GAMES. This will facilitate all government department to utilize GAMES services for safety of human life.

2.13 AAI is in process to utilized GAGAN for non-aviation industry and coordinated with Ministry of agriculture, Railways and shipping. These three ministry shows keen interest to utilized GAGAN according to their needs. AAI encouraging all others ministries in India to utilized GAGAN.

Agenda Item 3.4

2.14 India coordinated with Sri Lanka during the 9th session of the Sri Lanka-India Joint commission held on 5th February 2016 at Colombo for expanding cooperation in the aviation sector by building capacity for aircraft accident investigation, aeronautical SAR, use of Indian Satellite System GAGAN, sharing of training opportunities etc.

2.15 Mid-East ICAO Region invited India to understand the usability of GAGAN in the region during GNSS symposium in March 2016 and in the CNS-SG-7 meeting in Cairo during 31st May – 2nd June 2016. A team from ACAC visited GAGAN Complex Bangalore recently.

2.16 ACAC (Arab Civil Aviation Commission) delegates visited GAGAN facilities at Bangalore in Oct 2016. They had expressed interest in utilising the GAGAN services in ACAC Region. Preliminary studies have been done and it is found the availability of GAGAN signal with good signal strength at KSA, Djibouti stations. However, further studies needs to be carried out over ACAC Region by deploying stations (with dual frequency GPS receivers) across the region of interest.

2.17 India proposes to establish a MOU for examining the feasibility for use of GAGAN by states.

2.18 GAGAN can be used potentially in any GPS applications with better accuracy and reliability – location based services, transport/vehicle tracking systems, marine navigation etc.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

- a) Note the information contained in this paper;
- b) Recognize the India's continued support and contribution in ISTF activities; and
- c) Discuss any relevant matter as appropriate.

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