Seventh ATS Coordination Meeting of Bay of Bengal, Arabian Sea and Indian Ocean Region (BOBASIO/7)
New Delhi, India, 18 - 19 September 2017

Agenda Item 7: SBAS implementation in the region and possibilities of entering into MoU with the concerned states of BOBASIO region

GAGAN APPLICATIONS FOR BOBASIO REGION

(Presented by Airports Authority of India)

SUMMARY

This paper presents the current status of Indian SBAS – GAGAN and its expansion plan in the BOBASIO region. Recognizing the benefits accruable through Satellite-based Augmentation System (SBAS) implementation and India's efforts towards implementation of SBAS based PBN operations, the Conference encouraged States to consider examining feasibility for use of GAGAN (GPS Aided GEO Augmented Navigation).

This paper presents the further actions initiated by India for implementation of GAGAN based services through establishment of mandates by Government of India for new aircraft being registered in India from 1st January 2019. India plans to introduce GAGAN message service for disaster management and India Meteorological department to provide last mile reach to stakeholders within its footprint.

1. INTRODUCTION

1.1 The Indian SBAS- GAGAN (GPS Aided GEO Augmented Navigation), first in equatorial region, and 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 ICAO SARPS.

1.2 Presently GAGAN system consists of 15 Indian Reference Stations (INRES), 3 Indian Master Control Centers (2 primary and 1 backup), 3 Uplink stations, and 3 geostationary satellites (2 operational and 1 is under integration process). Additionally, 25 dual- frequency GPS receivers are deployed for monitoring of the Ionospheric Total Electron Content and Scintillation.

1.3 Airports Authority of India in coordination with all stakeholders has worked on a cost benefit analysis of GAGAN for its utilization in the Indian aviation sector. Based on the same, Ministry of Civil Aviation has considered mandates for new aircraft registered after 1st January 2019 and retrofits mandates from 2024-25.

1.4 Envisaging the benefits of GAGAN in Non-aviation applications, India has planned to utilize GAGAN signals for broadcasting short Message Service (SMS) with suitable changes in message structure using GAGAN satellites, this service is called as GAGAN Message Service (GAMES).

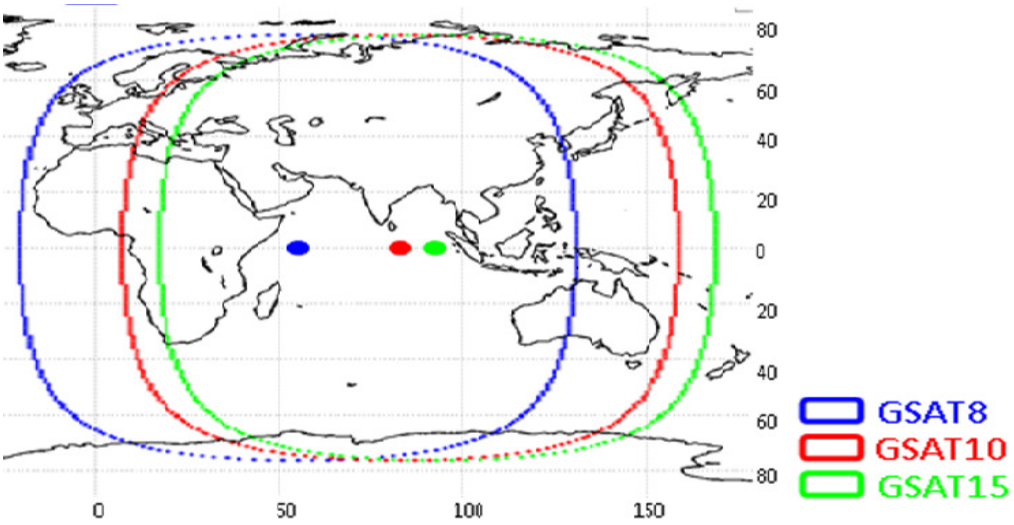
2. DISCUSSION

2.1 GAGAN reference stations are strategically located 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.

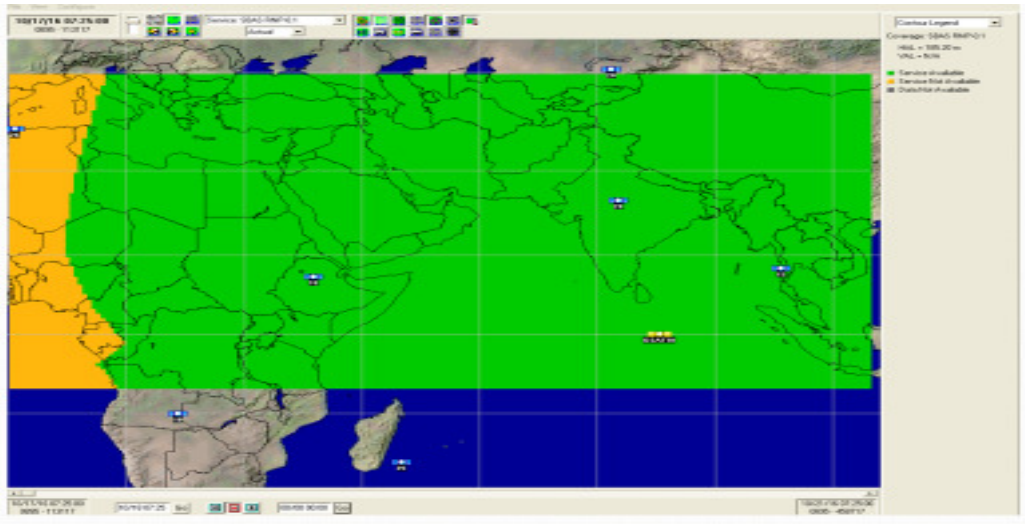
2.2 In order to provide geographical redundancy, an additional INMCC at Delhi has been established. The stability test for the same has been completed in May 2017. 3rd Geostationary satellite (GSAT-15 with PRN 132) is already available in space with GAGAN payload and is planned to be integrated with GAGAN system by March 2018. It will provide in-orbit space redundancy to GAGAN system.

2.3 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 neighboring nations.

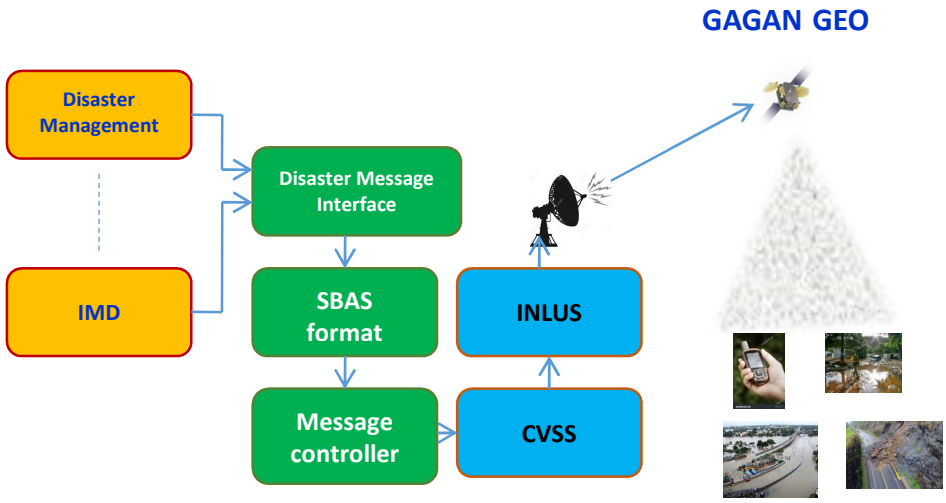
2.4 Footprint of GAGAN GEO satellites are shown as below. The real time GAGAN performance is available on http://gagan.aai.aero/gagan/.



2.5 Following figure shows the coverage of GAGAN RNP 0.1 over BOBASIO states. All member states may utilized GAGAN for seamless navigation over BOBASIO region. India (AAI) is also a member of BOBASIO group. AAI being the GAGAN service provider ensures the availability of GAGAN signal-in-space as per ICAO standards to meet the defined requirement of availability, accuracy, integrity and continuity over the BOBASIO region.



2.6 India has planned to utilize GAGAN signals for broadcasting short service messages with suitable changes in the message structure via GEO satellites. This service is named as GAGAN Message Service (GAMES) and will be used to broadcast early warning messages on the occurrence of natural disaster, calamity, danger, search & rescue, relief & humanitarian related message for the safety of life within GAGAN coverage area. The architecture for GAGAN Alert Message Service is shown below.



2.7 Recognizing the benefits accruable through SBAS implementation, National Civil Aviation Policy (NCAP) 2016 envisages to mandate SBAS equipage on new aircraft being procured after 1st January 2019. NCAP also encourages the retrofitting of the existing fleet by incentivizing airline operators. On successful completion of the development of the business case and stakeholder consultation, India will strive for mandating the use of GAGAN in all eligible aircraft from 1st January 2025.

2.8 Presently India has approx.100 operational airports catering schedule airlines, general aviation and cargo flights. Indian aviation market is projected to be among the one of the leading aviation market in the world by 2020. By analyzing the potential of GAGAN, Ministry of Civil Aviation in coordination with AAI in coordination with KPMG has worked out a cost benefit analysis of GAGAN utilization in Indian aviation

sector. The analysis is based on data, information, assumptions and prevailing market and aviation sector conditions as of 1st January 2017.

2.9 Two-step approach has been adopted while carrying out economic and financial analysis of GAGAN implementation in the Indian commercial aviation sector. In the first step, AAI has developed a high-level assessment of the key costs involved in retrofitting existing aircraft operated by scheduled commercial operators; and second step has been worked out based on source materials, industry outreach, and industry research, and evaluated corresponding potential benefits from deploying GAGAN across the domestic commercial aviation fleet in the Indian FIR.

2.10 The key benefits for the scheduled commercial operators will be realized from an increase in the utilization of airspace, fuel savings from a reduction in delays, diversions and shorter approach path to the runway and other savings (crew costs, aircraft maintenance cost, aircraft ownership costs and miscellaneous cost) from reduction in delays, diversions and cancellations. The net benefit (undiscounted) for scheduled commercial operators will be approximately USD 1,364.64 million over a span of 20 years between FY 2018 and FY 2037.

2.11 India proposes to assist in study the impact analysis for GAGAN implementation for the member States of BOBASIO. The states may consider providing data as per templates as per appendix A. The States are also invited for collaborative development of applications based on Indian SBAS-GAGAN.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the current status of GAGAN implementation in Indian airspace;

b) Consider GAGAN applications / usages for RNP 0.1 and APV 1 service by BOBASIO States taking note of the India's efforts towards cost benefit analysis of GAGAN implementation for Indian aviation sector and proposed GAGAN mandate by Government of India for new aircraft being registered in India after 1st January 2019 and retrofits (eligible aircraftsby 1st January 2024.

c) consider the India's proposal to assist in study the impact analysis for GAGAN implementation for BOBASIO member states and accept the proposal to provide data as per the template

d) Discuss any relevant matters as appropriate.

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APPENDIX A

Questions for Cost-Benefit Analysis	
Data Point	**Sub Data Points**
General data	% IFR and % VFR flights in the country
	% of aircraft capable for IFR in each category (for both Commercial Aviation and General Aviation)
	Number of aircraft landings/ ATMs over last 10 years airport wise and aircraft wise (Schedules/ Non-scheduled classification)
	Average density and capacity of air traffic movements across the Flight Information Regions (FIRs) across the airspace.
	Air Traffic Movements (ATM) projections for next 15-20 years for Commercial Aviation
	Details of airports with PBN/ RNAV/ RNP procedures
	Number and type of approach procedure at each airport
	Number of operational airport runways
	% penetration of Route Navigation Performance (RNP)
	% of penetration of APV
	Total number of RNP/ RNAV Routes being followed by the aircrafts
Fleet Classification	Current classification of fleet (for scheduled commercial operators, General Aviation, Rotary wing operators – Helicopter) along with following information:- 1. Leased or Owned 2. In case the fleet is leased, remaining lease of the aircraft 3. Fleet Age 4. Avionics Model (also whether it supports GNSS and GAGAN, if yes, then make of the system) 5. Make of GPS supported 6. Navigational Aid Supported 7. Procedures Supported
	Fleet expansion plan for each of the airlines for next 5 years (along with delivery dates of the aircraft)
	Average density and capacity of air traffic movements
	Average vertical separation and horizontal separation maintained in the different FIRs across the airspace of the country
DDCs (Delays, Diversions and Cancellations)	Number of (with respect to total ATMs) – Delays – Diversions – Cancellations
	Average time lost in:

Questions for Cost-Benefit Analysis	
Data Point	**Sub Data Points**
	– Delays – Diversions – Cancellations
	Total number of missed approaches along with reasons
	Compensation paid by airlines to passengers due to delays, diversions and cancellations over last 5 years
	Average number of passengers in a flight
	% or number of delays, diversions and cancellations attributed to: 1. Weather at destination airport. IATA Code - WT 2. Navigational equipment un-operational at the airport 3. Aircraft doesn't support the navigational aid (for e.g. ILS) 4. Pilot doesn't have requisite training for ILS 5. Air traffic management system 6. Other relevant delays which might be impacted by GAGAN (Suggestive IATA Codes - WT, AW, AF, AD etc.)
	Analysis of weather data to ascertain how GAGAN can facilitate operations at airports where operations are difficult as per visual flight rules.
	Breakup of delays in arrivals and departures
	Cost of for airlines: – Delays – Diversions – Cancellations Cost breakup could be fuel, crew, maintenance, aircraft ownership and average passenger time value per minute. (Could be in total for the airline or per flight or per unit time)
Airport procedure costs	Who is responsible for procedure development?
	Costs for developing new procedures and conducting aeronautical surveying
	Is procedure development a manual process or you use software for the same?
	Who is the prime approval authority for granting approvals on the new procedures?
Navigation Aids	Data on types of navigation aids at all the airports and runways by airport name and runway end.
	Frequency of conducting O&M of the current navigation aids