





NavIC and GAGAN System Updates





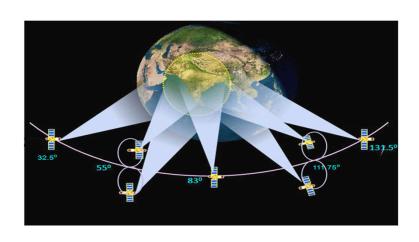
Hemanth Kumar Reddy
Group Director - Space Navigation Group
Indian Space Research Organization (ISRO), India

ICG-16 October 2022



Satellite Navigation Programme - India







NavIC: Indian Regional Navigation Satellite System

- Provides SPS (civilian) and RS (Restricted) services in L5 and S band
- Service area: India and 1500km beyond its geo-political boundary.

GAGAN: GPS Aided GEO Augmented Navigation

- Provides Air Navigation services (Safety of Life) over Indian Flight Information Region (FIR)
- GAGAN certified for RNP 0.1 and APV 1.0



NavIC Architecture



Space Segment	
Nominal Constellation	7 satellites (3 GSO, 4 IGSO)
Ground Segment	
Navigation Centres	2
One way ranging stations	17
Two way ranging stations	5
Network Timing Centre	2 (upgraded with in-house timescale)
Spacecraft Control Centre	2
Frequency band	L5, S and L1*
Service	SPS and RS



^{*}Civil signals in L1 band planned from NVS-01 satellite onwards



Current status Update



- NavIC constellation is operational and Follow-on satellites are under realization with indigenous atomic clocks. Next launch scheduled for Q4-2022.
- SPS service (civilian service) in L1 frequency band in the upcoming satellites (NVS-01 onwards) with SBOC modulation and IZ4 PRN codes.
- New SPS signal in the L1 is compatible and interoperable with other GNSS signals in L1 band.
- NavIC adopted for assisted-GNSS by Global standards body 3GPP. NavIC is included in the Release-16 LTE specification.
- NavIC is incorporated into the AIS 140 (Automotive Industry Standard) of India.
- NavIC has been incorporated in the NMEA 0183 standard.
- NavIC has been incorporated in the RTCM (Radio Technical Commission for Maritime services) 10403.3 standard.
- NavIC has been accepted as a component of the World Wide Radio Navigation System (WWRNS) for operation in the Indian Ocean Region by the International Maritime Organization (IMO).

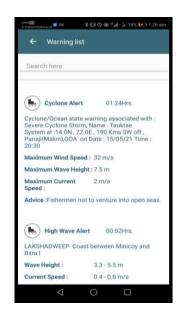


Current status Update – Contd..



- NavIC is offering short messaging service for users in Indian region through IRNSS-1A and 1E satellites. Web based interface for message submission through internet.
- Messaging service is presently used by INCOIS for broadcasting Potential Fishing Zone messages, Cyclone & High wave alerts etc. to fishermen across the country
- NavIC Service Advisory portal is planned to be launched by end 2022.
- Indigenous Time Scale system has been developed and made operational.
- Major smartphone chipset manufacturers (Qualcomm and Mediatek) have included NavIC in their SoC and NavIC services are available across different mobile handsets.





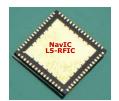


NavIC and Industry



ISRO Designs: NavIC-Only





Pioneer- Sktraq NavIC-Only

























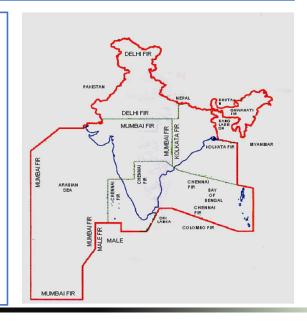


GAGAN SBAS System



Joint development by ISRO and Airports Authority of India

- To deploy and certify an operational SBAS for India
- > To achieve an RNP0.1 capability over Indian FIR and
- > To Provide APV-1 service over Indian land mass on nominal days
- ❖ GAGAN Technology Demonstration System (TDS) Minimum set of ground and space elements implemented to demonstrate the proof of concept
- ❖ GAGAN Final Operational Phase (FOP) Certifiable SBAS built over the TDS elements with additional ground and space elements





GAGAN Status Update



GAGAN Certified by DGCA

- RNP 0.1 Operations over Indian FIR, 30th Dec 2013
- APV 1 Operations over Indian Landmass, 21st April 2015
- GAGAN is fully operation since the month of May 2015

Three GEO S/C carry GAGAN payload

GSAT-8 at 55° : GAGAN signal with PRN127

GSAT-10 at 83° : GAGAN signal with PRN128

GSAT-15 at 93.5° : GAGAN signal with PRN132

Compatible and Interoperable with other SBAS, providing Seamless navigation



GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
DGCA COMPLEX, OPP. SAFDARJUNG AIRPORT, NEW DELHI-110 003

CERTIFICATE

No. ANS 2015/001

In exercise of the powers delegated under SO-727 E and part XII-A of the Aircraft Rules, 1937 notified on 14th January, 2015, this certificate is hereby issued to Airports Authority of India by The Director General of Civil Aciation

Certifying the

GPS Aided GEO Augmented Navigation (GAGAN) System

Com

lavigation Performance level of Approach with Vertical Guidance (APV-1) over India

Required Navigation Performance (RNP 0.1) within Indian Flight Information Region

for a period not exceeding 60 months from the date of issue. This authorizes the certificate holder to provide the facility to operate as navigational aids to support air traffic services to all users on equal terms and conditions.

The certificate is liable to be suppended modified withdrawn or subject to any limitations or conditions. It in visibilities of the provisions of the Aircraft Act 1934 & the Aircraft Fluies 1937, or any order direction equivaments issued under the suid Act Fluids is observed.

This certificate is non-transferable

Place : New Delh

Date of Insue: 21.04.2015



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GAGAN Status Update - Contd..



- AAI has developed 65 localizer performance with vertical guidance (LPV) procedures. GAGAN based LPV approach Procedure validation completed. Passenger aircrafts have started utilizing GAGAN based procedures for approach and landing.
- DGCA Mandated that all aircrafts being registered in India after July 1, 2021 shall be suitably equipped with GAGAN equipment.
- Demonstrated Automated Take-Off and Landing (ATOL) of Unmanned Aerial Vehicles (UAV) using GAGAN.







