



NavIC and GAGAN System Update

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IRNSS-NavIC – A Self Reliant Navigation

**Indian Regional Navigation Satellite System-
Navigation with Indian Constellation**

- Provides Standard Positioning Service (SPS) and Restricted Service (RS) in L5 and S band
- Service area is Indian region bounded by Latitude 5°S to 50°N and Longitude 55°E to 110°E



GAGAN-Indian SBAS

GPS Aided GEO Augmented Navigation

- Provides air navigation service (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	4
Network Timing Centre	2
Spacecraft Control Centre	2
Frequency band	L5, S and L1*
Service	SPS and RS



*Civil signal in L1 band planned from upcoming NVS-01 satellite onwards

Current Status and Update

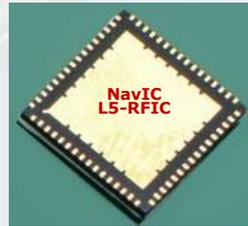
- NavIC constellation is operational. Follow-on satellite is under realization with indigenous atomic clocks and satellite launch is expected by the first quarter 2022.
- SPS service (civilian service) in L1 frequency band in the upcoming satellites (NVS-01 onwards).
- NavIC L1 civilian signal, with SBOC modulation and IZ4 PRN codes, has been designed as an interoperable signal with other GNSS MBOC signals.

- NavIC is offering short messaging service for users in Indian region. Web based interface for message submission through internet.
- Messaging service is being used presently used by INCOIS for broadcasting Potential Fishing Zone (PFZ) messages, Cyclone & High wave alerts, etc to fishermen across the country
- NavIC Service Advisory system is planned to be launched in 2021.
- Major smartphone chipset manufacturers (Qualcomm, Mediatek etc.) have included NavIC L5 SPS signal in the SoC.

- NavIC has been adopted for assisted-GNSS by Global standards body 3rd Generation Partnership Project (3GPP). NavIC SPS signals in L5 and S are included in the Release-16 LTE specification.
- NavIC is incorporated into the Automotive Industry Standard (AIS 140) of India.
- NavIC has been incorporated in the National Marine Electronics Association (NMEA) 0183 standard.
- NavIC has been incorporated in the Radio Technical Commission for Maritime services (RTCM) 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).

NavIC and Industry

ISRO Designs: NavIC-Only



Pioneer- Sketraq NavIC-Only



NavIC+GAGAN/GPS : 2 Types

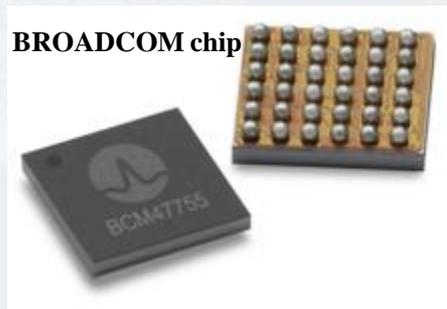
NavIC-Only



NavIC+GAGAN/GPS : 2 Types



BROADCOM chip



Joint development by ISRO and AAI

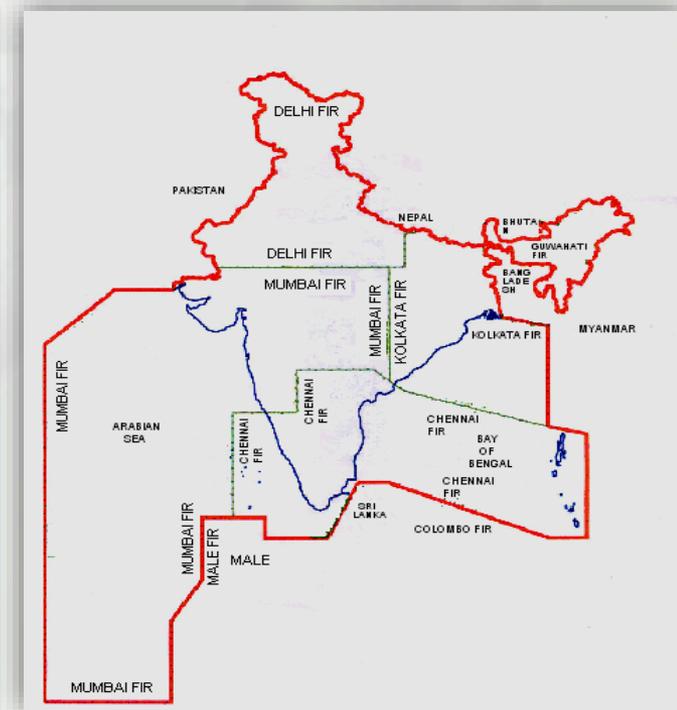
- To deploy and certify an operational SBAS for India
- To achieve an RNP0.1 capability over Indian FIR and
- To Provide APV-1 service over Indian land mass on nominal days

❖ 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 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 operational since the month of May 2015

Three GEO satellites carry GAGAN payload

GSAT-8 at 55° : GAGAN signal with PRN127

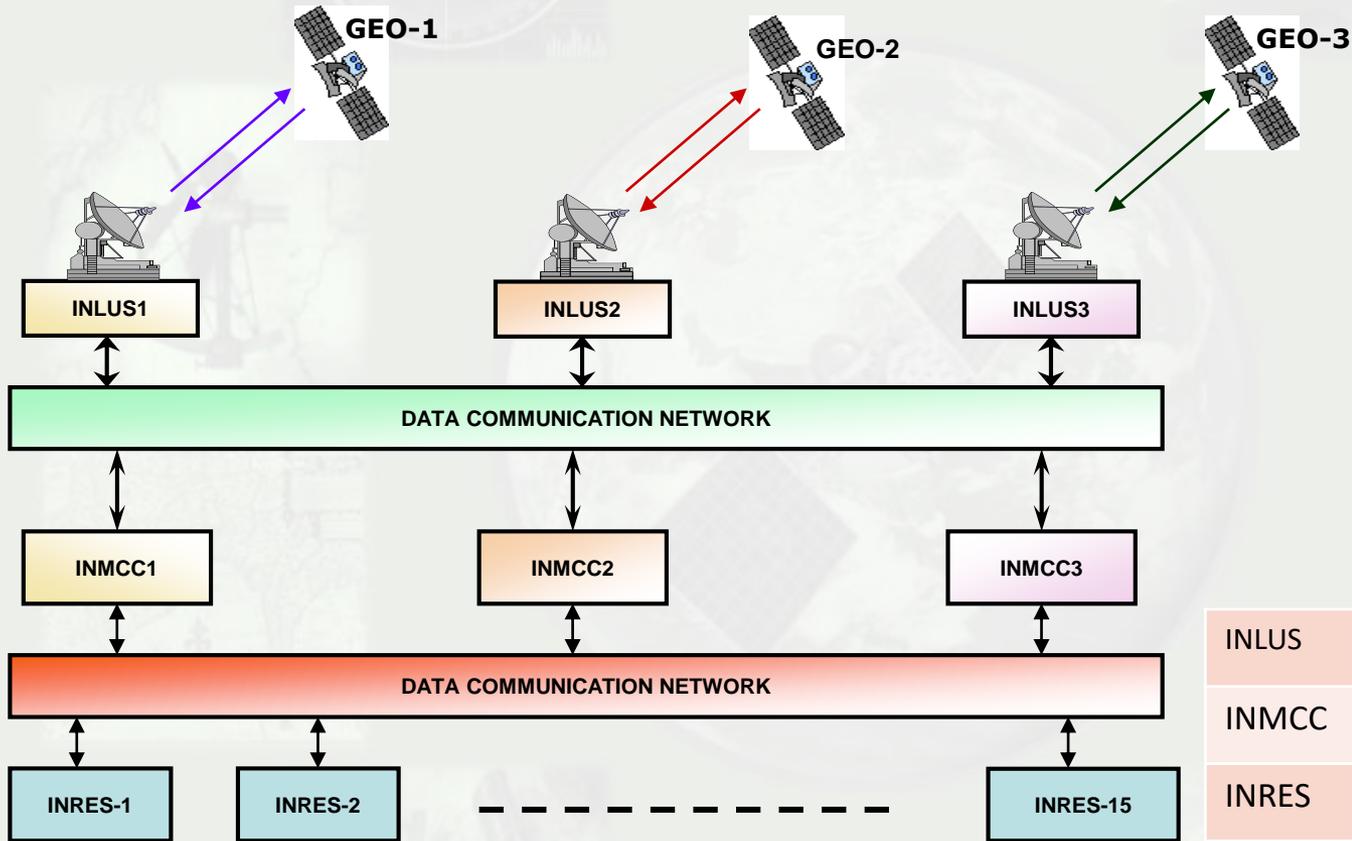
GSAT-10 at 83° : GAGAN signal with PRN128

GSAT-15 at 93.5° : GAGAN signal with PRN132

Compatible and Interoperable with other SBAS to provide seamless navigation

First SBAS system to serve the equatorial anomaly region

GAGAN Architecture



INLUS	Indian Uplink Station
INMCC	Indian Master Control Centre
INRES	Indian Reference Station

GAGAN system Infrastructure

- Establishment of Delhi INMCC (Third Control Centre).
- AAI has developed 65 localizer performance with vertical guidance (LPV) procedures and flight validation in progress.

Mandate by Civil Aviation

- All Aircrafts being registered in India after July 1, 2021 shall be suitably equipped with GAGAN equipment.

