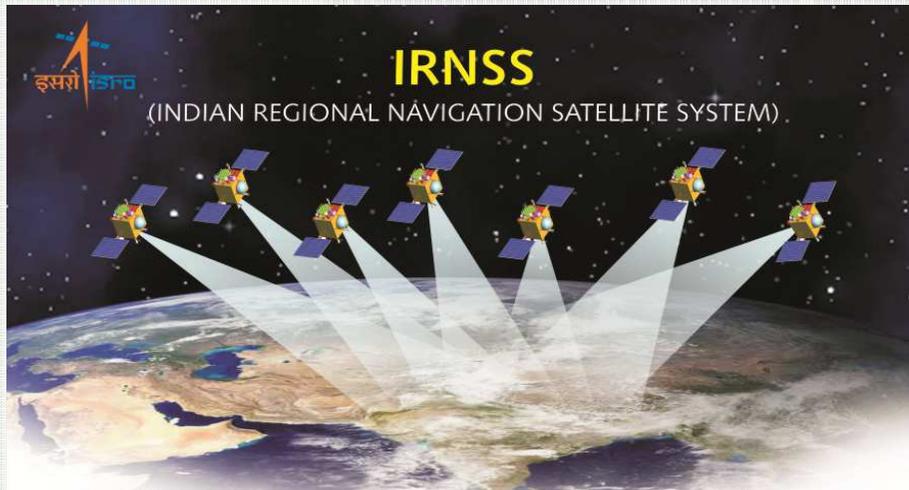




Introduction to ISRO's Navigation Programmes - NavIC and GAGAN

19-01-2021

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NavIC – A Self Reliant Navigation

Navigation with Indian constellation (NavIC)/ Indian Regional Navigation Satellite System (IRNSS)

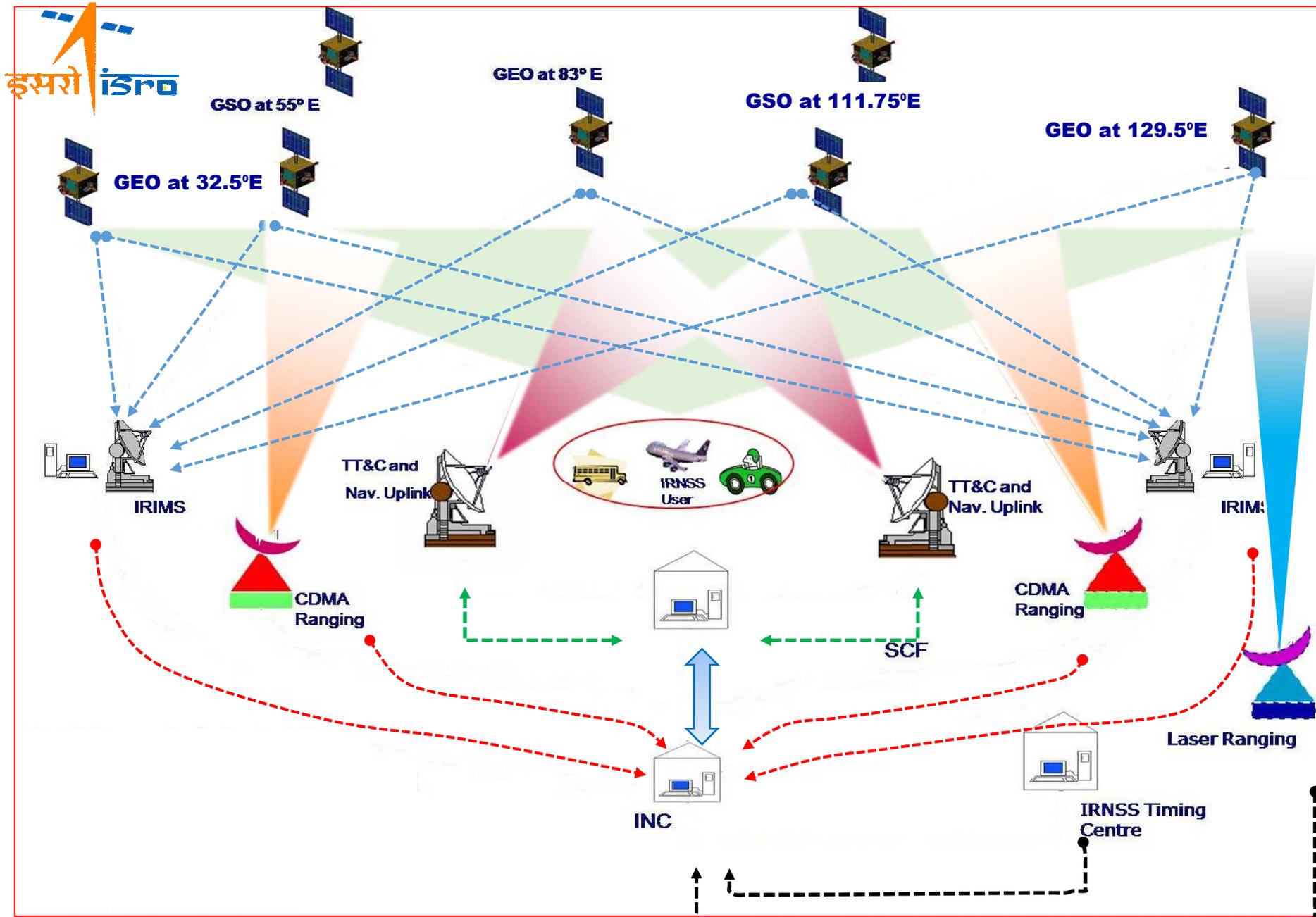
- Provides SPS (civilian) and RS (Restricted) services in L5 and S bands.
- Introduction of L1 civilian signal from NVS-01 onwards.
- The NavIC service area is bounded by Latitude 5°S to 50°N and Longitude 55°E to 110°E.



GAGAN-Redefining Navigation

GAGAN (GPS Aided GEO Augmented Navigation)

- Provides Air Navigation service (Safety of Life) over Indian FIR
- Certified for RNP 0.1 and APV 1.0
- First SBAS system to serve the equatorial anomaly region



NAVIC ARCHITECTURE

NavIC Architecture

| Space Segment | |
|-----------------------------|---------------|
| Satellites in Constellation | 7 |
| Ground Segment | |
| ISRO Navigation Centre | 2 |
| Reference Stations | 17 |
| CDMA Ranging Stations | 4 |
| Network Timing Centre | 2 |
| Spacecraft Control Centre | 2 |
| Frequency band | L1*, L5 and S |
| User Segment | |
| Service | SPS and RS |



* NVS-01 onwards

Current status and update



- Constellation operational. Follow on satellite is under realization with indigenous Atomic clock and is expected by fourth quarter of 2021.
- NVS-01 onwards introduction of new civilian signal in L1 frequency band.
- The new navigation signal in L1 frequency band will be Compatible and Interoperable with L1 Civil signal of GNSS providers.
- The NavIC service area is bounded by Latitude 5°S to 50°N and Longitude 55°E to 110°E.
- NavIC is offering short messaging service for users in Indian region through IRNSS-1A and IRNSS-1G spacecraft.

NavIC and Standards

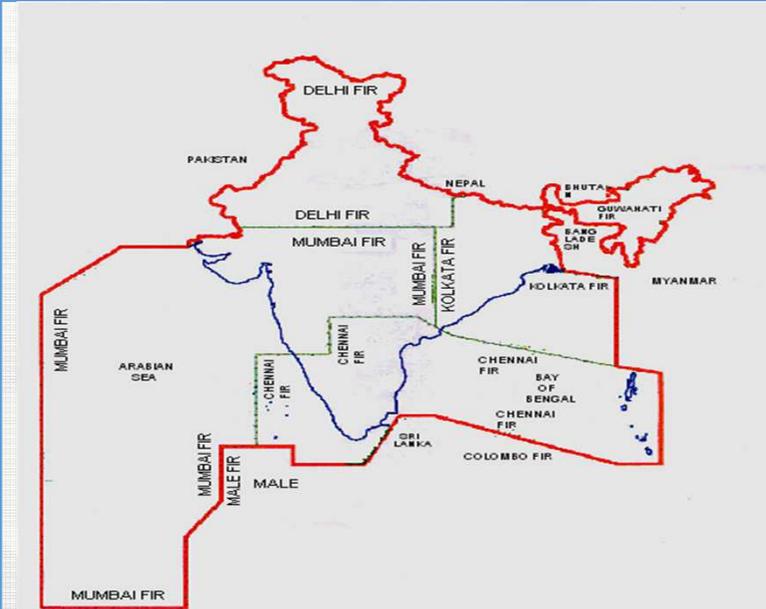


- NavIC has been adopted for assisted GNSS by Global standards body 3GPP (3rd Generation Partnership Project). NavIC will be included in the Release-16 LTE (Long Time Evolution) specification.
- NavIC is incorporated into the AIS 140 (Automotive Industry Standard).
- NavIC has been incorporated in the NMEA (National Marine Electronics Association) 0183 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).

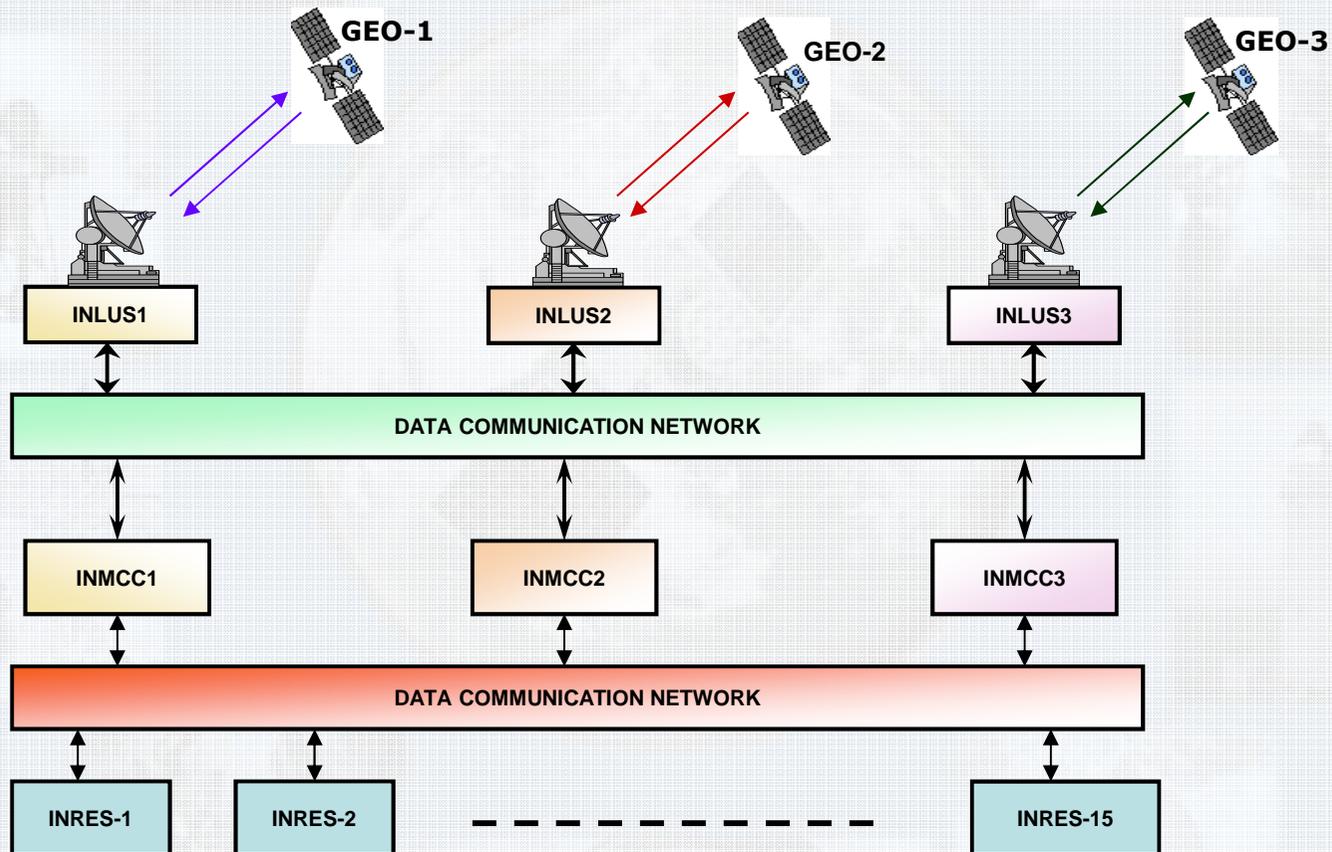
Joint development by ISRO and AAI

To deploy and certify an operational SBAS for India to achieve an RNP 0.1 capability over Indian FIR (Flight Information Region) and APV-1 service over Indian land mass on nominal days.

- ❖ GAGAN – TDS
Minimum set of ground and space elements implemented to demonstrate the proof of concept
- ❖ GAGAN – FOP
Certifiable SBAS built over the TDS elements with additional ground and space elements



GAGAN Architecture (Current)



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 spacecraft carry GAGAN payload
 - GSAT-8 at 55°E : GAGAN signal with PRN127
 - GSAT-10 at 83°E : GAGAN signal with PRN128
 - GSAT-15 at 93.5°E : GAGAN signal with PRN132
-
- Compatible and Interoperable with other SBAS to provide seamless navigation.
 - All Aircrafts being registered in India after June, 2020 shall be suitably equipped with GAGAN equipment.
 - GAGAN certificate No. ANS 2015/001 (APV1 & RNP certification), validity of GAGAN system extended by DGCA up to 18/07/2022

Applications (GAGAN and NavIC)



- Navigational guidance for Marine services
- Fisheries
- Mining
- Management of Fleet movement
- Collision avoidance for railways
- Town planning and road alignments
- Geographical Information Systems
- Power Grid Synchronization
- Automatic Banking
- Precise farming, dispensing of fertilizers and irrigation
- En-route and precision approach for aircrafts

