

Indian IRNSS and GAGAN

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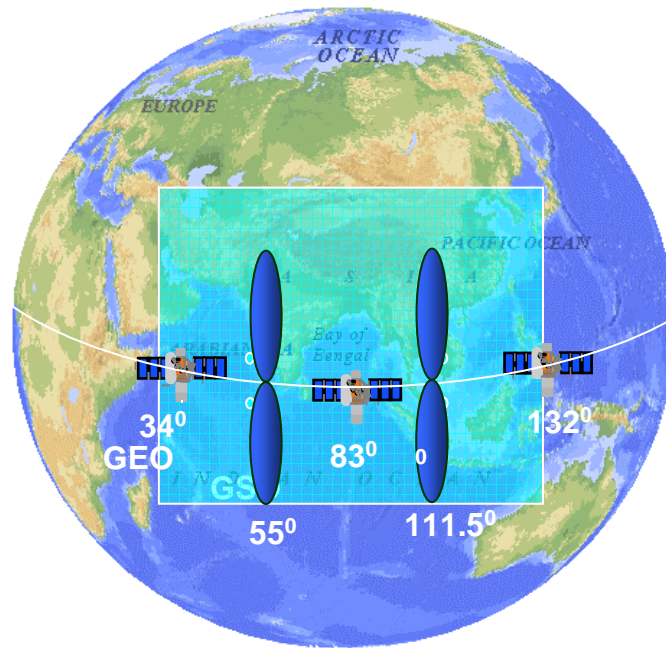
Indian Regional Navigation Satellite System

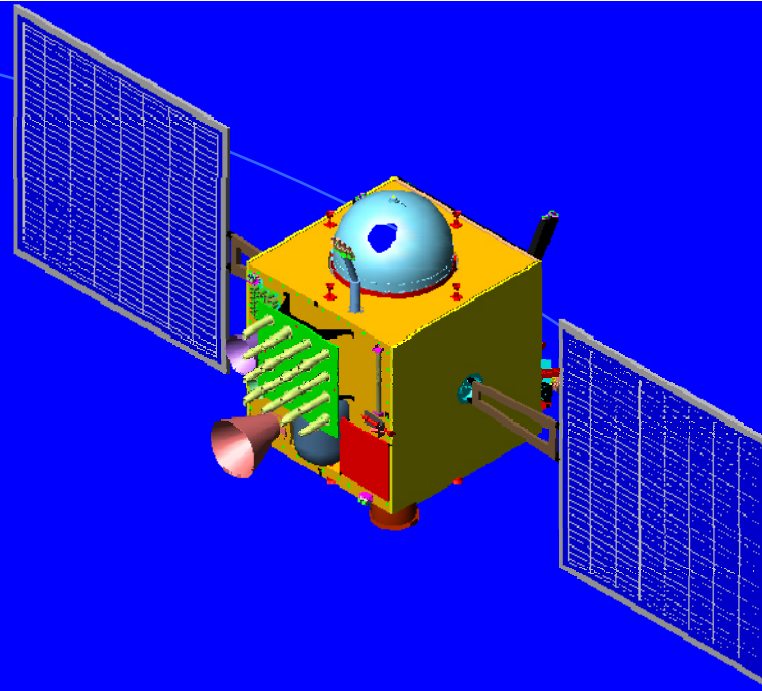


- IRNSS is planned to be an independent regional navigation system covering an area of about 500kms around India.

IRNSS is planned with 7 satellites and a commensurate ground segment. 3 Satellites shall be in GSO and 4 in N-GSO.

It will provide 20 m accuracy over the Indian Ocean Region and 10 m accuracy over India and adjacent countries.



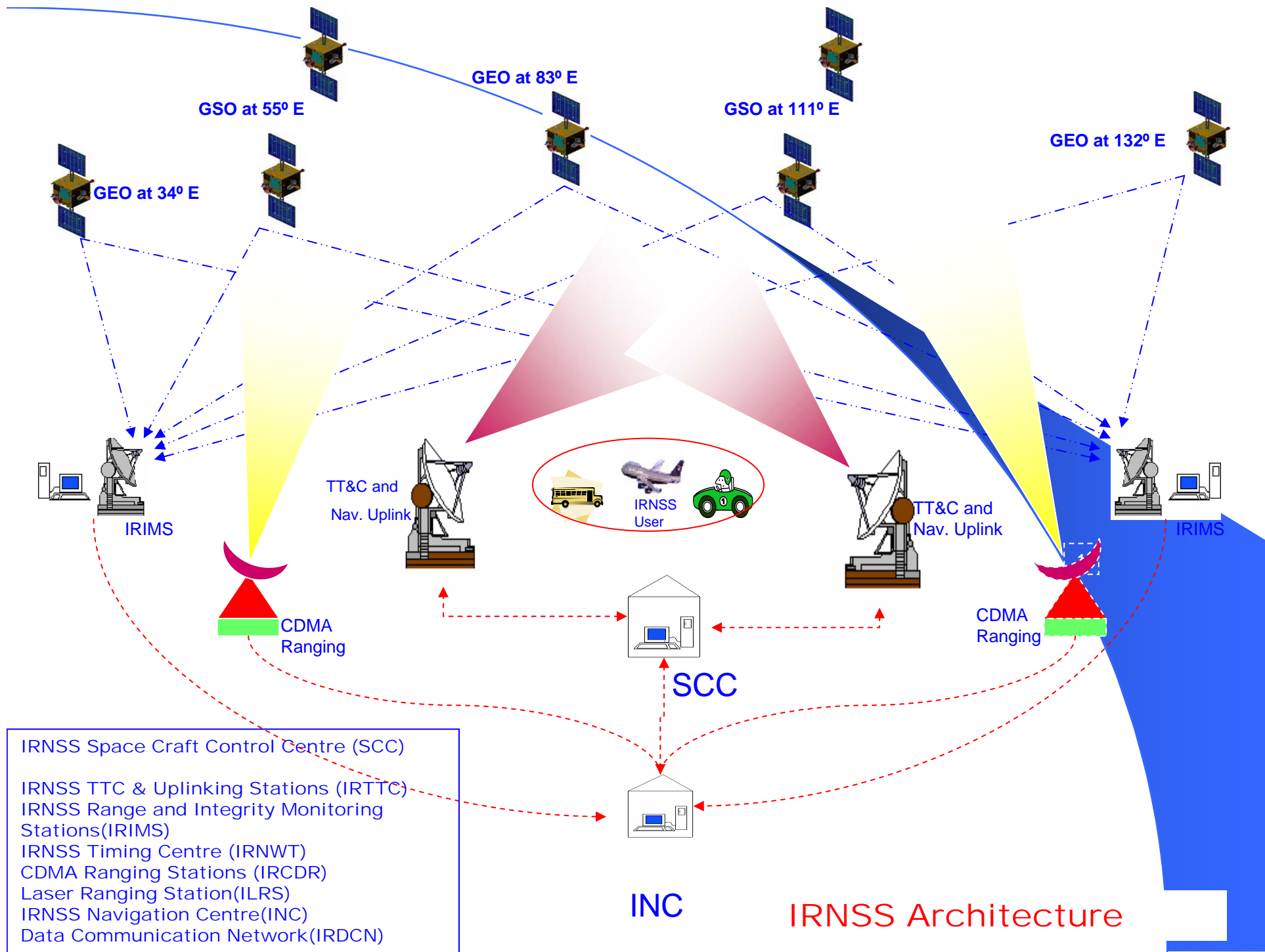


IRNSS Satellite

***PSLV Injects IRNSS
in 250 km x 24000 km orbit***

***Dry mass: 575 kgs
Lift off mass: 1370 kgs
Life of GEO: 9.4 years
Life of GSO: 11 years***

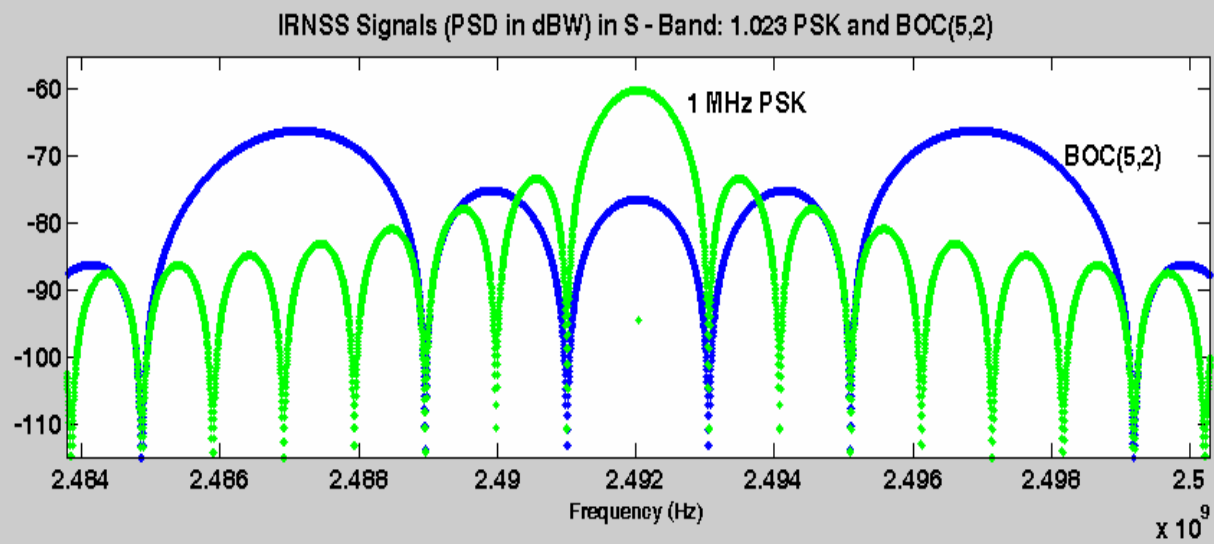
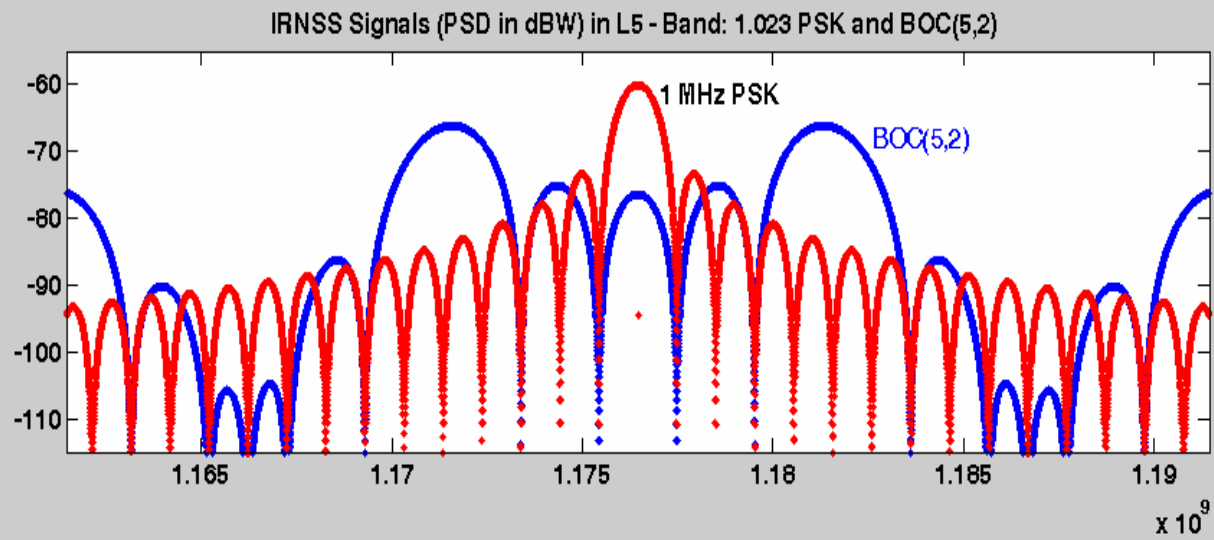




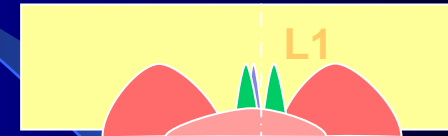
- IRNSS Space Craft Control Centre (SCC)
- IRNSS TTC & Uplinking Stations (IRTTC)
- IRNSS Range and Integrity Monitoring Stations (IRIMS)
- IRNSS Timing Centre (IRNWT)
- CDMA Ranging Stations (IRCDR)
- Laser Ranging Station (ILRS)
- IRNSS Navigation Centre (INC)
- Data Communication Network (IRDCN)

IRNSS SERVICES & CENTRE FREQUENCIES

Service Type	Signals	Frequency Band
Standard Positioning Service	1 MHz BPSK	L5 (1176.45 MHz) S (2492.08 MHz)
Precision Service	BOC(5,2)	L5 (1176.45 MHz) S (2492.08 MHz)



Compatibility & interoperability with other GNSS



IRNSS & COMPASS USE S-band (2483.5 – 2500 MHz) downlinks

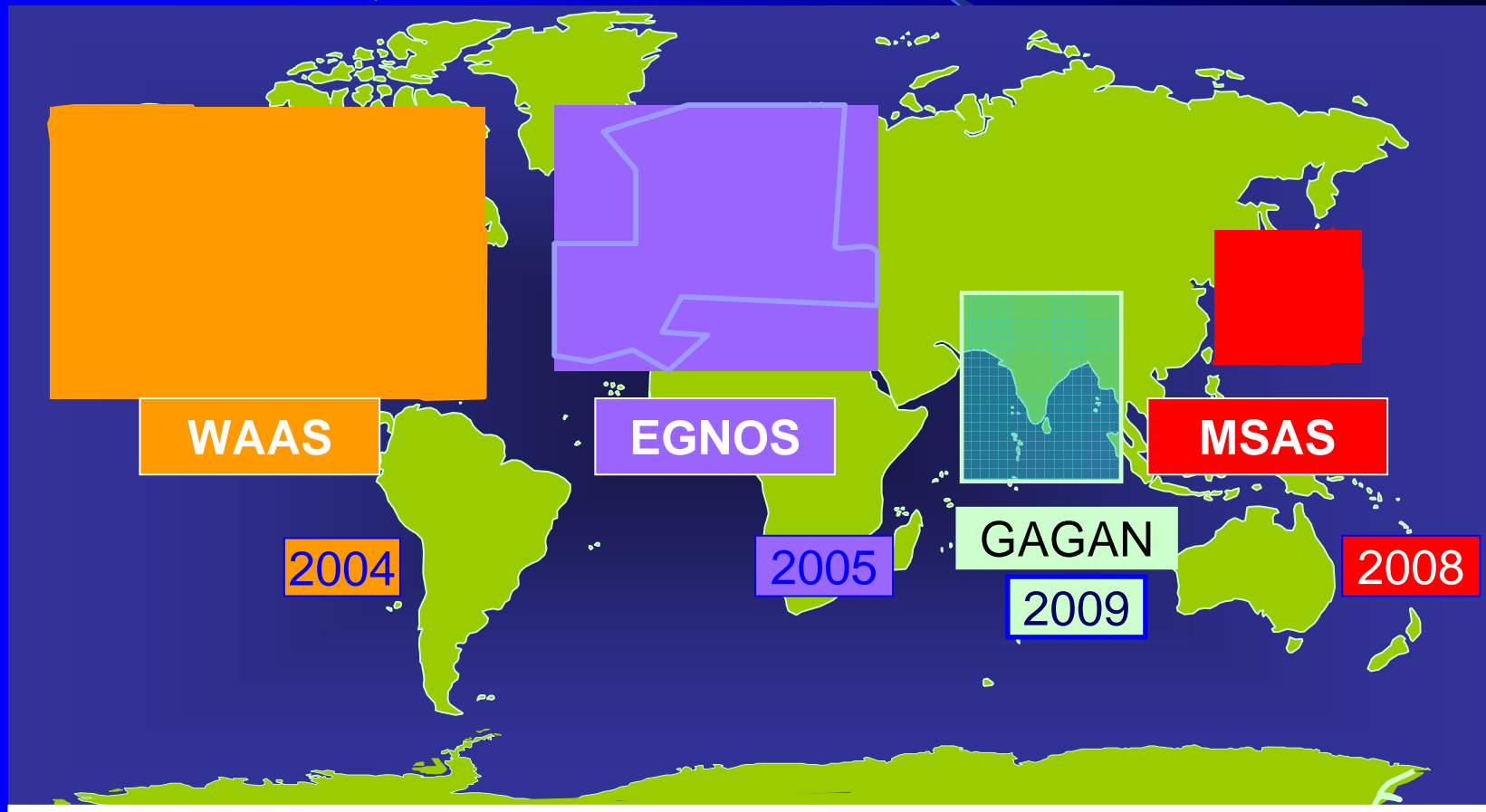
IRNSS Schedule

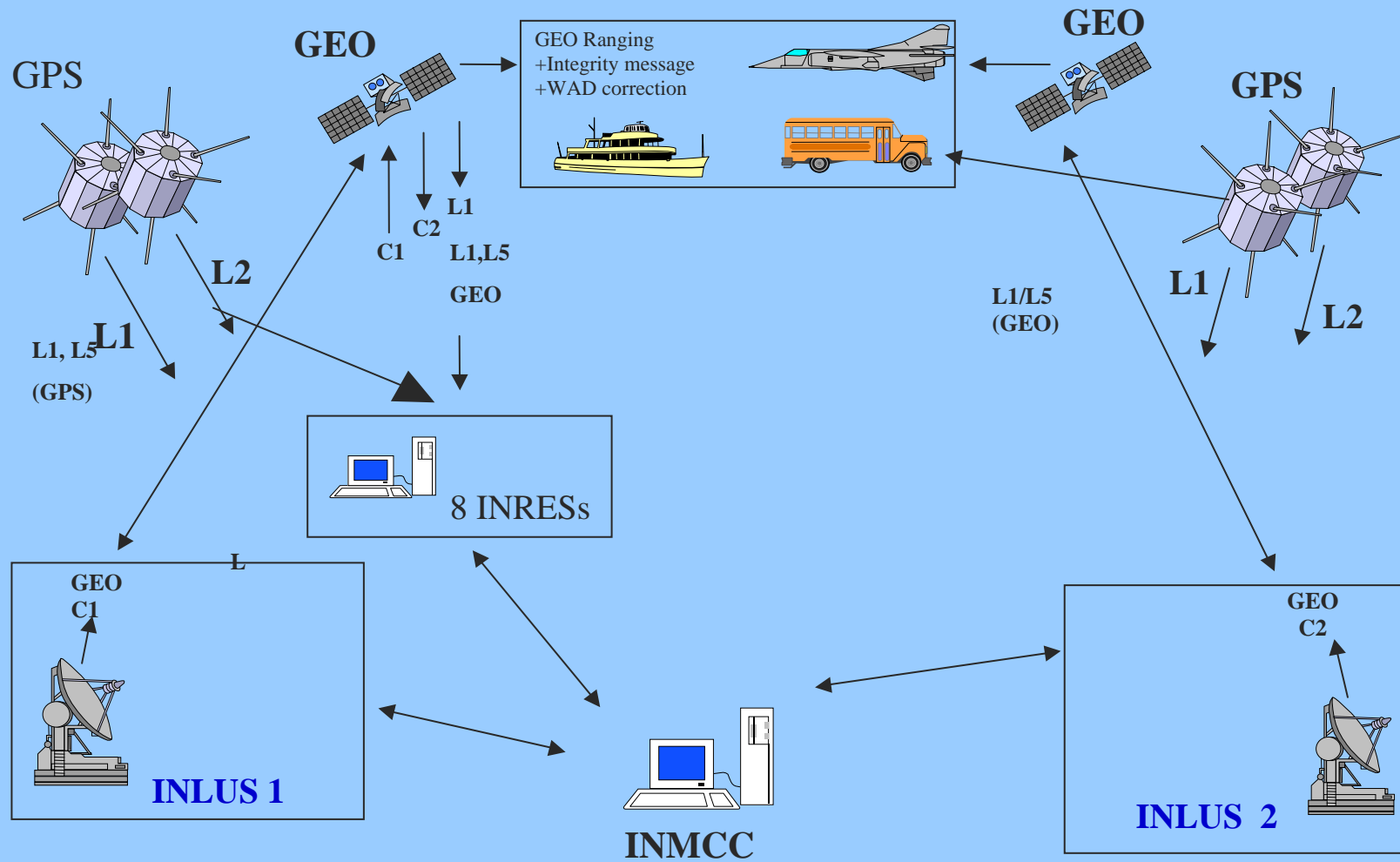
- The first Satellite will be launched by end 2009.
- The next three satellites will be launched by end of 2010-11.
- The entire constellation will be in place by 2011-12.

GPS Aided GEO Augmented Navigation(GAGAN) System

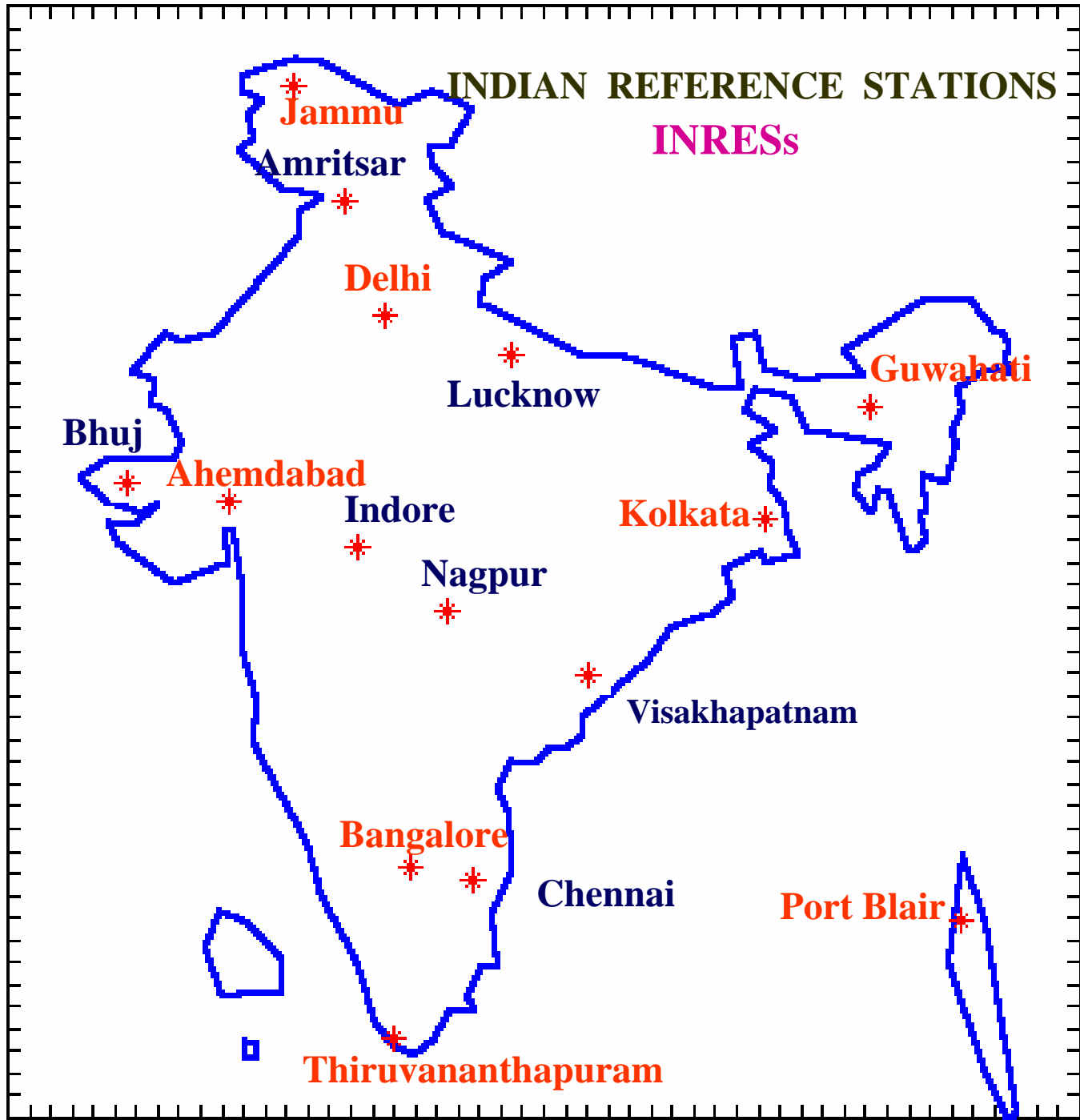
- GAGAN is a Satellite Based Augmentation System (SBAS) over the Indian Air-space being jointly implemented by the Indian Space Research Organisation (ISRO) and the Airports Authority of India (AAI). GAGAN will have 2 downlinks: L1 and L5. **GAGAN in Sanskrit means 'Sky'**
- It is being implemented in three phases:
 1. Technology Demonstration System (TDS)
 2. Initial Experimental Phase (IEP)
 3. Final Operational phase (FOP)
- TDS has been completed in August 2007 using the INMARSAT 4F1 Navigation payload. The first Indian GAGAN payload is to fly on the indigenously built GSAT-4 satellite later this year.
- IEP and FOP is under implementation.
- GAGAN is primarily meant for civil aviation.

GPS Aided GEO Augmented Navigation (GAGAN) System & GPS Augmentation systems in the World



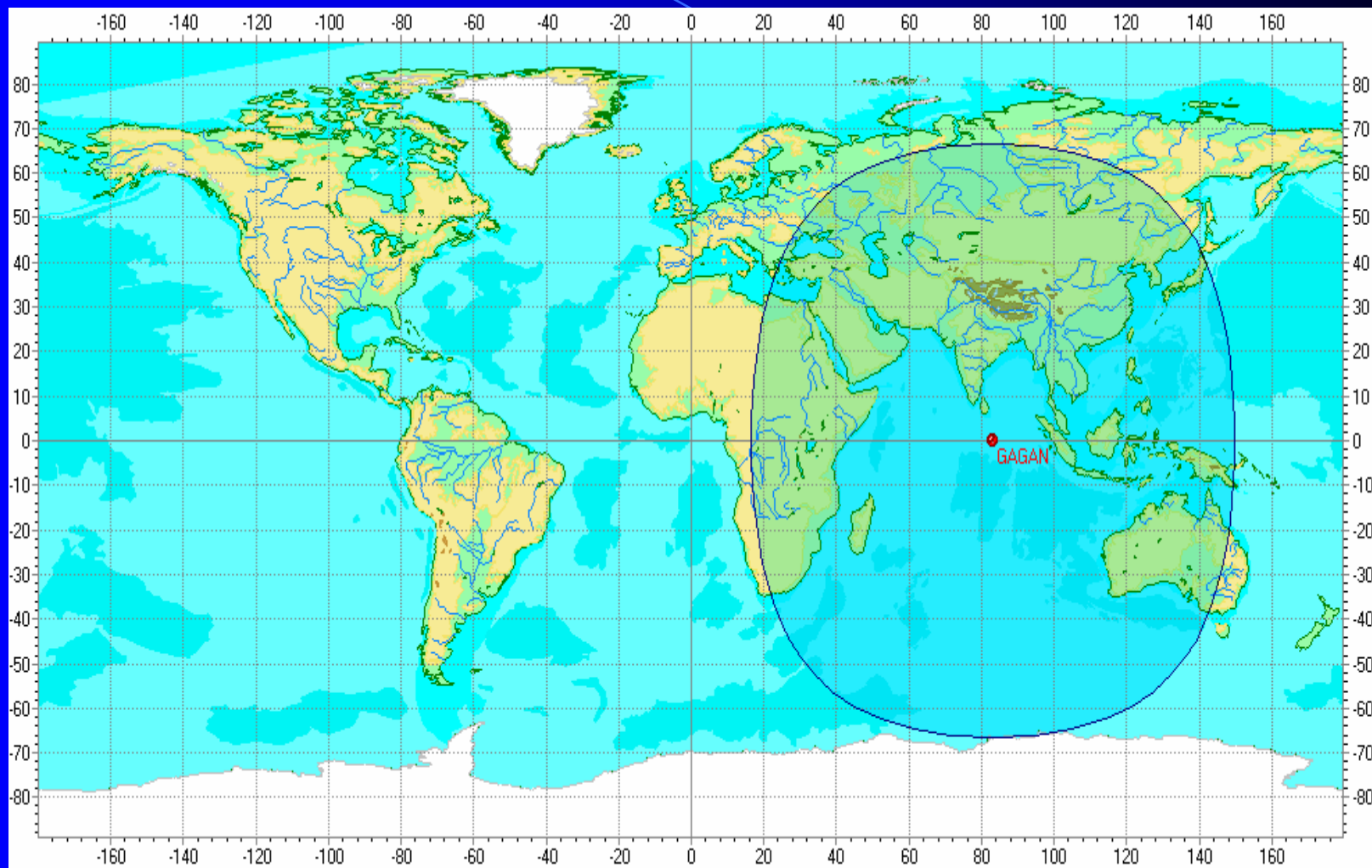


GAGAN Ground Segment Concept



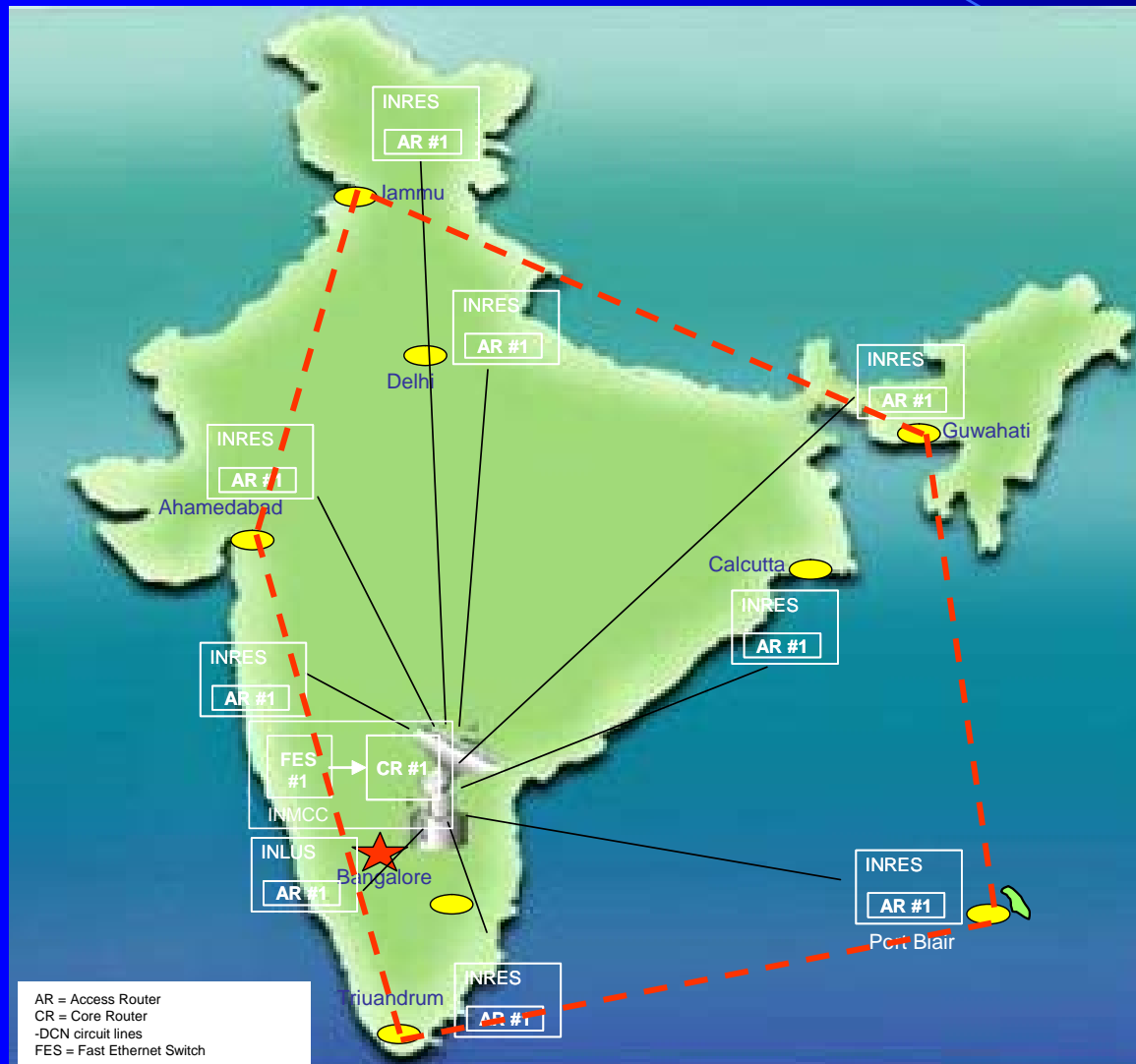
- INRESs**
- Delhi
 - Ahmedabad
 - Bangalore
 - Thiruvananthapuram
 - Kolkata
 - Guwahati
 - Port Blair
 - Jammu
- Future INRESs**
- Indore
 - Bhubaneswar
 - Amritsar
 - Chennai
 - Nagpur
 - Lucknow
 - Visakhapatnam

GAGAN COVERAGE FROM 82 Deg.E



Final System Acceptance Test (FSAT) configuration

Target Position accuracy: 7.6m



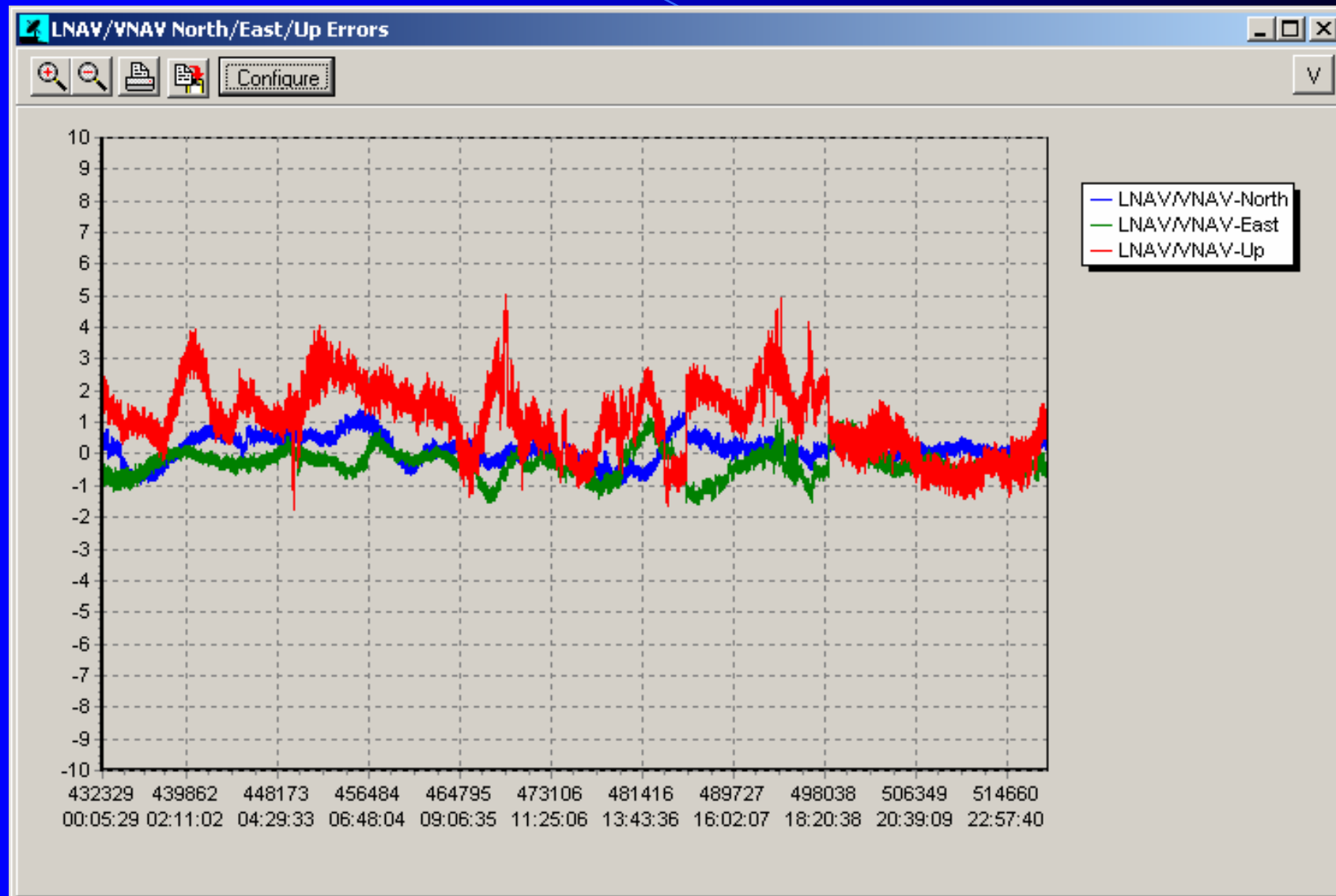
Ground Segment

- 8 INRES: 2 INREEs
- 1 INMCC
- 1 INLUS
- 1 ring of OFC (7 INRES)
- 1 VSAT link (GPB)

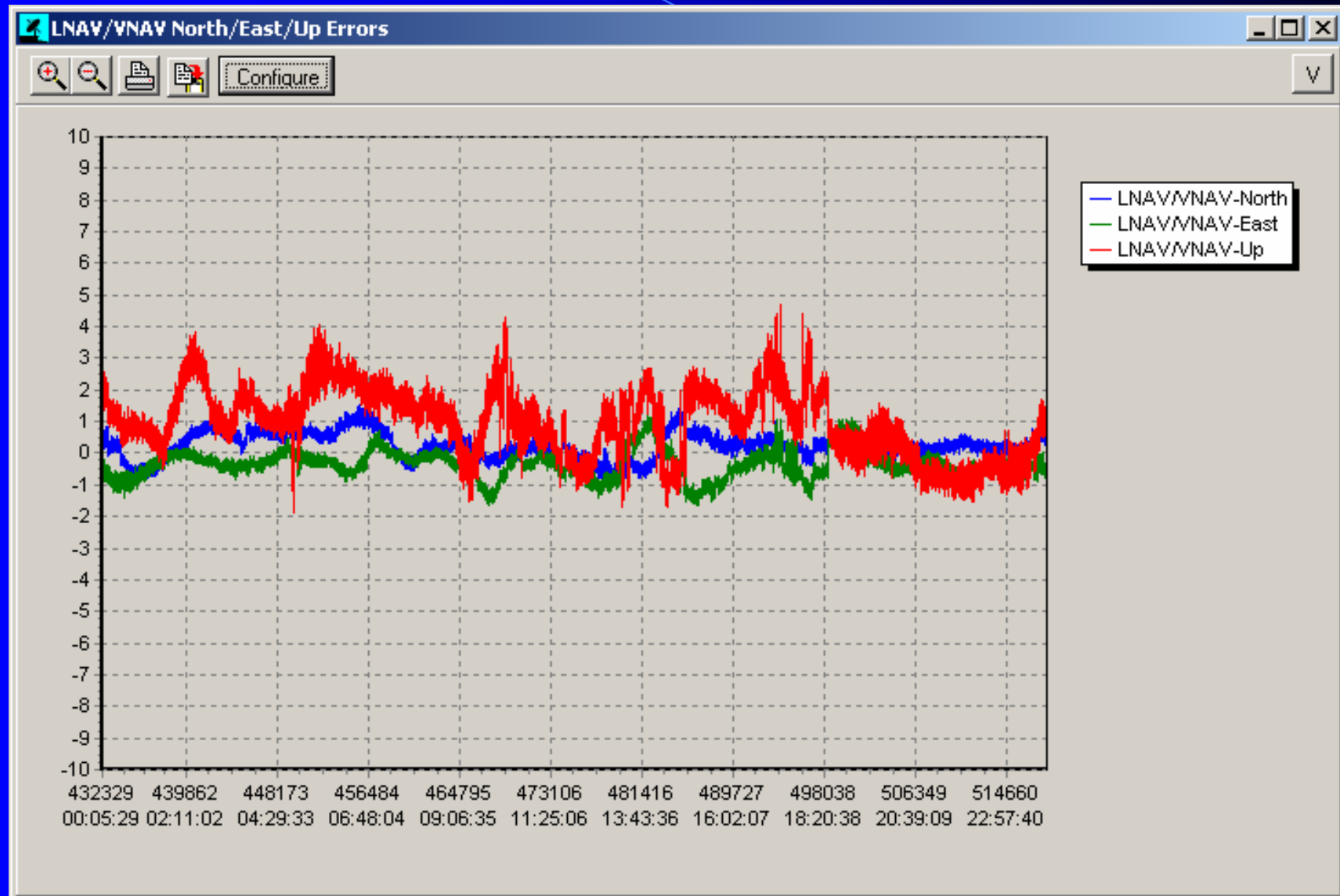
Space Segment

- INMARSAT-4F1
- Accuracy was evaluated within the perimeter of the GAGAN-TDS INRES at Bangalore, Delhi etc.

Measured Position accuracy at Bangalore A



Measured Position accuracy at Bangalore B





THANK YOU
For Your Attention