India's Satellite Navigation Programme- An update

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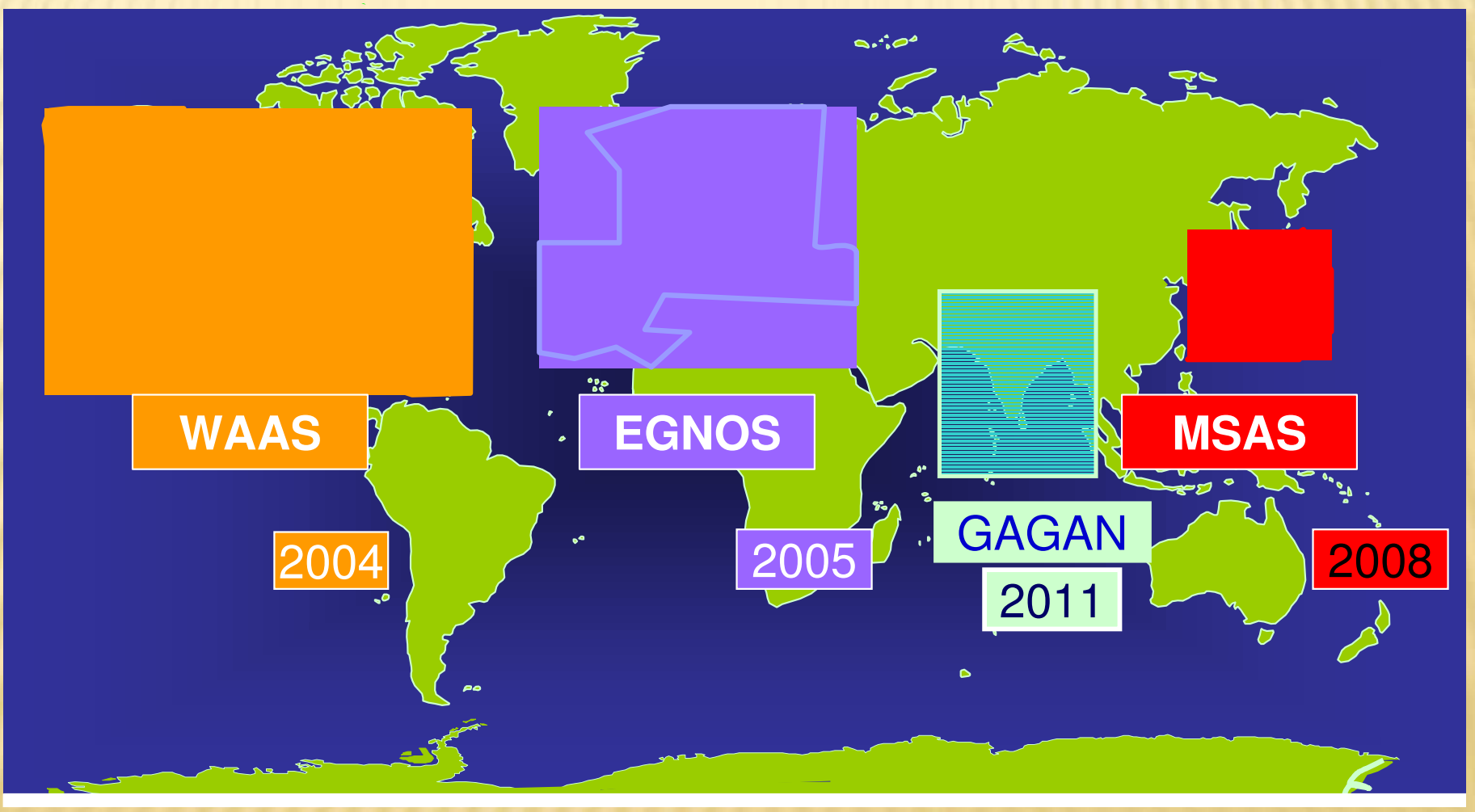
Forty sixth session of the Scientific and Technical sub committee of UNCOPUOS

12th February, 2009

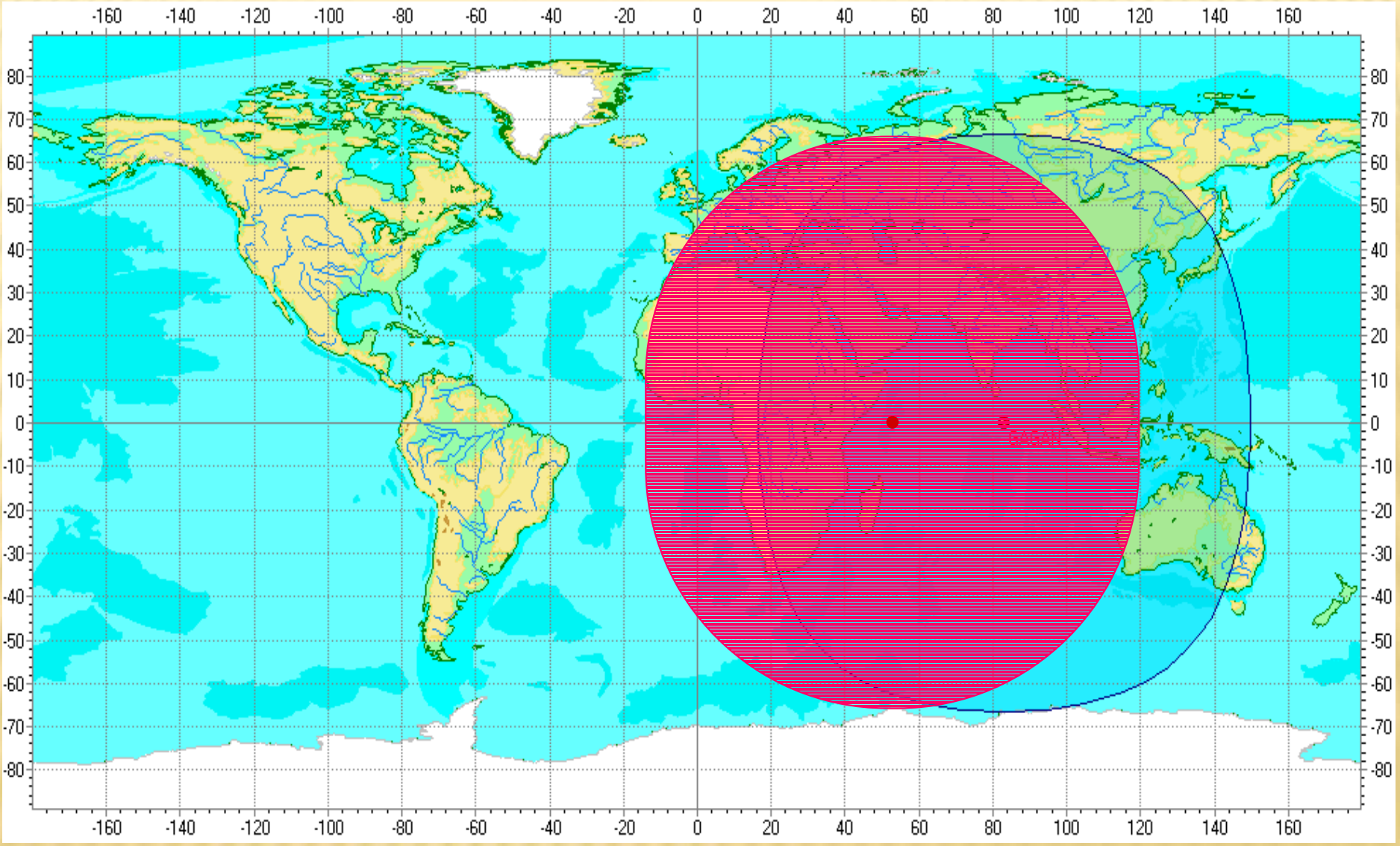
GPS Augmentation Systems in the World



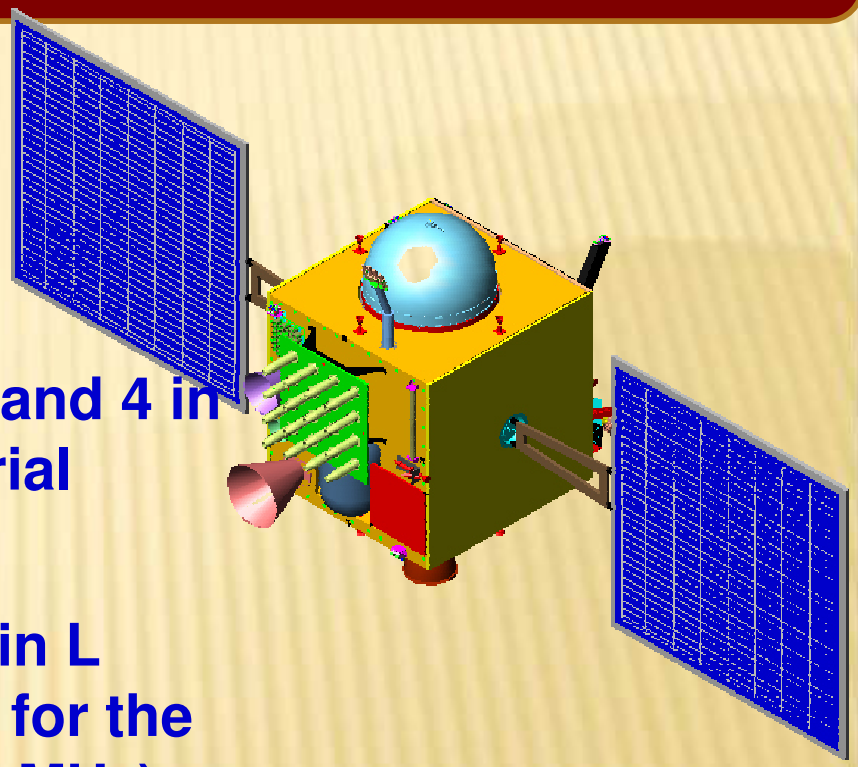
GAGAN – GPS aided GEO Augmented Navigation System

- GAGAN: not a stand-alone, but a regional augmentation to GPS
- To improves GPS accuracies (from 30m to 6m), availability and continuity for civil aviation
- The Ground system to include:
  - 8 Indian Reference Stations (IRNSS);
  - 1 Master Control Centre (MCC)
  - 1 Indian Navigation Land Uplink Station (INLUS)
- Correction signals generated & transmitted to user through Geo- satellite
- Position Accuracy achieved < 3 meters over Indian Region (Specs: 10 meters)
- GSAT-4 (Mid-2009 launch) , GSAT-8, GSAT-9 will carry navigation payload to support GAGAN Final operation payload Phase

GAGAN Coverage

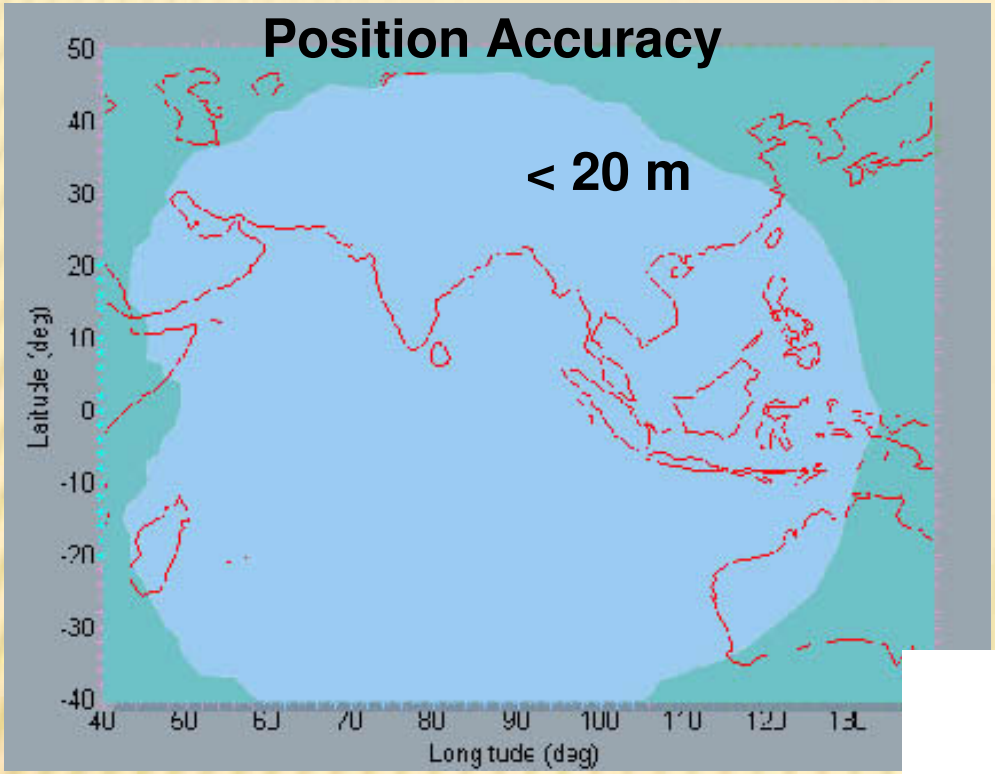


IRNSS



- Consists of Seven Satellites: 3 in GSO and 4 in Non-GSO (Inclined 29 deg with equatorial plane) Orbits
- India has filed for 24 MHz of Spectrum in L Band (1164 – 1215 MHz) for IRNSS and for the second signal in S band (2483.5 – 2500 MHz)
- Has been approved by the Government
- System implementation has been initiated

IRNSS Coverage & Accuracies



IRNSS CONSTELLATION

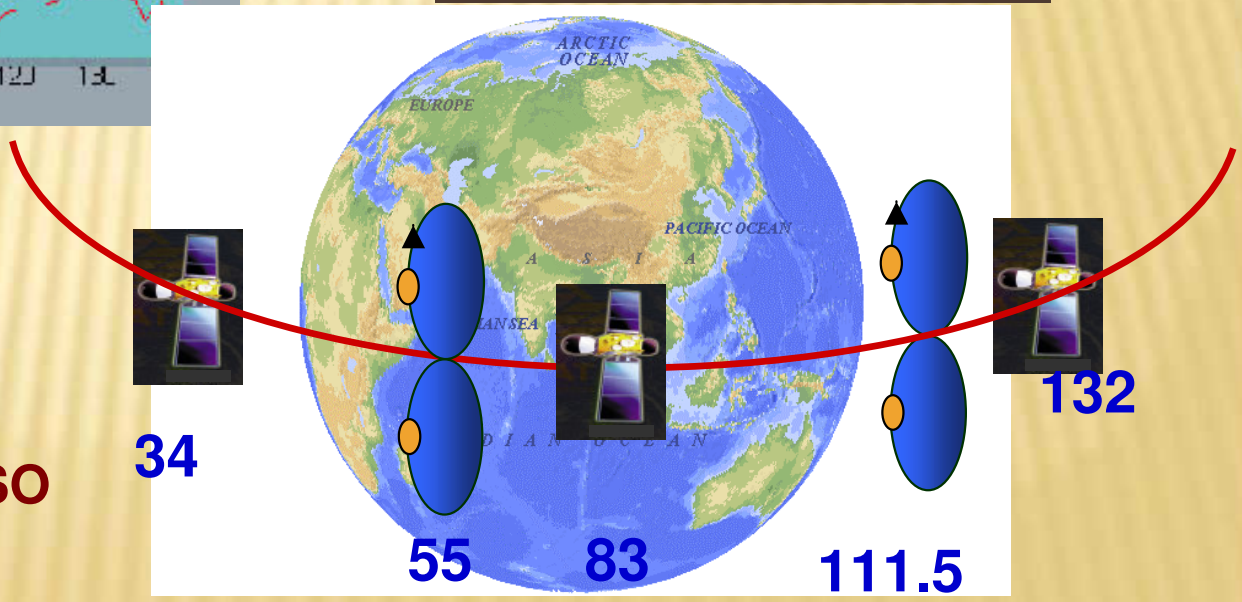
GEO(34,83,132)

4 GSO(55,111.5)

Coverage

Long(deg) 40 to 140

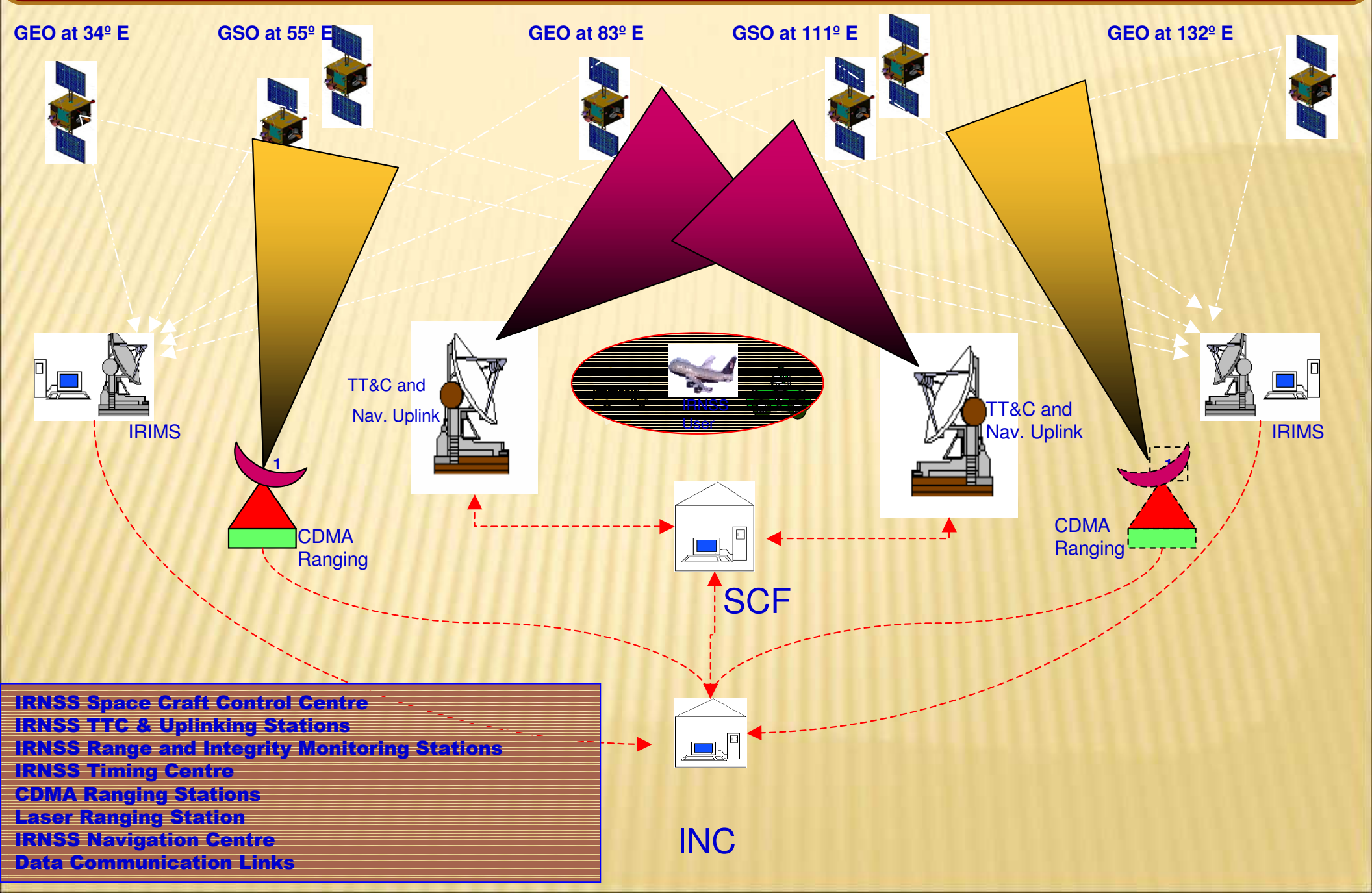
Lat(deg) –40 to 40



GEO

GSO

IRNSS Architecture



The Activities

- Implement IRNSS – an independent 7 satellite constellation built and operated by India with indigenous capability
- ISRO and AAI to implement GAGAN .
- Cooperate with other international systems such as, GPS, GLONASS and Galileo.
- Keep track of development of other regional systems such as, BEIDOU and COMPASS by China, Regional augmentations to GPS such as, WAAS, EGNOS, MSAS, Nigcomsat etc.
- Maintain interoperability between GAGAN and other regional augmentations to GPS for global navigation
- Maintain synergy between augmentation systems and IRNSS in terms of user receivers
- Develop indigenous capability in user receivers and terrestrial infrastructure , space science and atmospheric science research projects on radio occultation and local data assimilation in NWP models respectively.

International Committee on GNSS (ICG)

The responsibilities of ICG:

- **Benefit users of GNSS services through consultations among members of the committee;**
- **Encourage coordination among providers of GNSS core systems and augmentations in order to ensure greater compatability & inter-operability;**
- **Encourage and promote the introduction and utilization of satellite PNT services particularly in the developing countries through assistance with the integration of GNSS services into their infrastructures;**
- **Address future user needs in the GNSS development plans & applications**
- **Periodically report its activities to the UN COPOUS**

India as a member of ICG particpates in all its deliberations

Thank you..