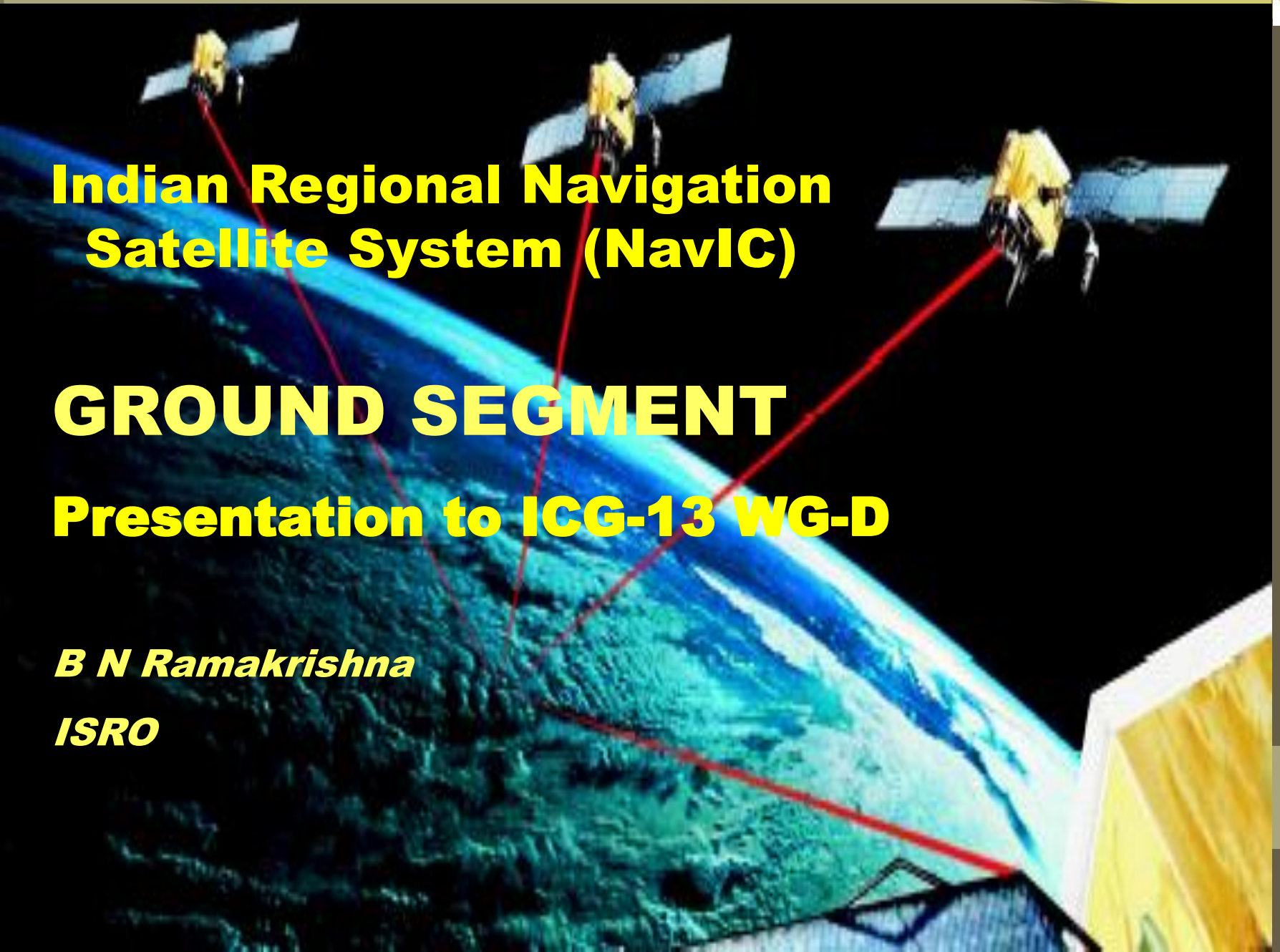


Indian Regional Navigation Satellite System (NavIC)

GROUND SEGMENT

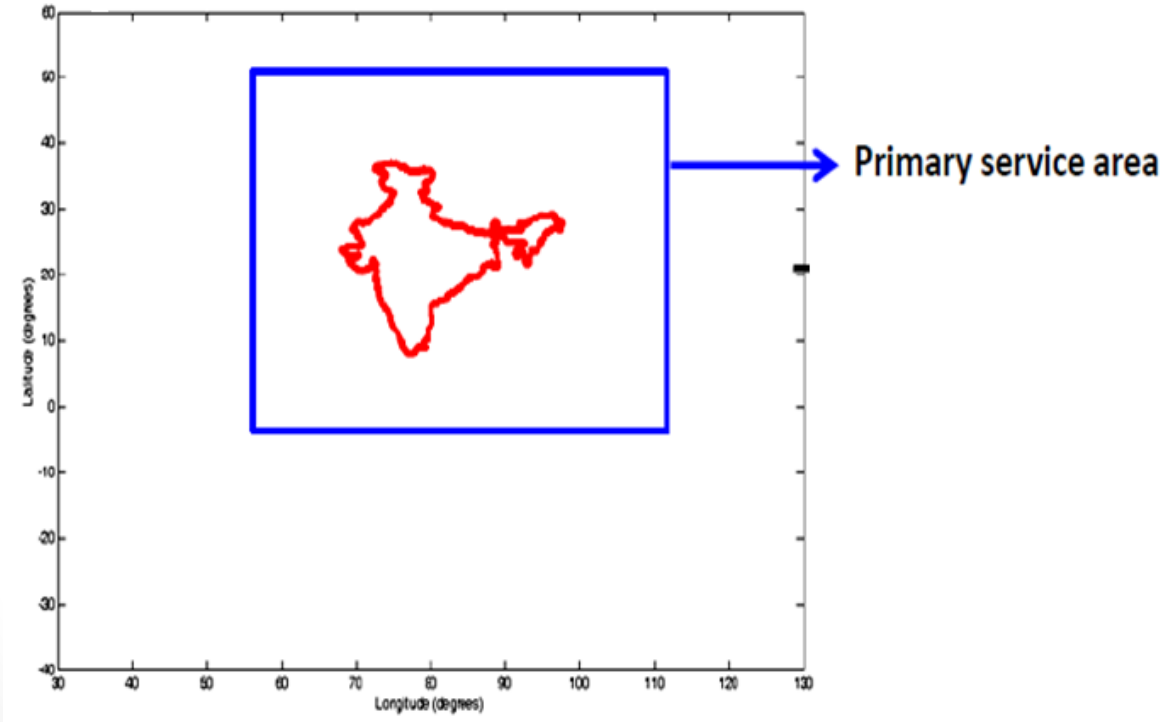
Presentation to ICG-13 WG-D

B N Ramakrishna

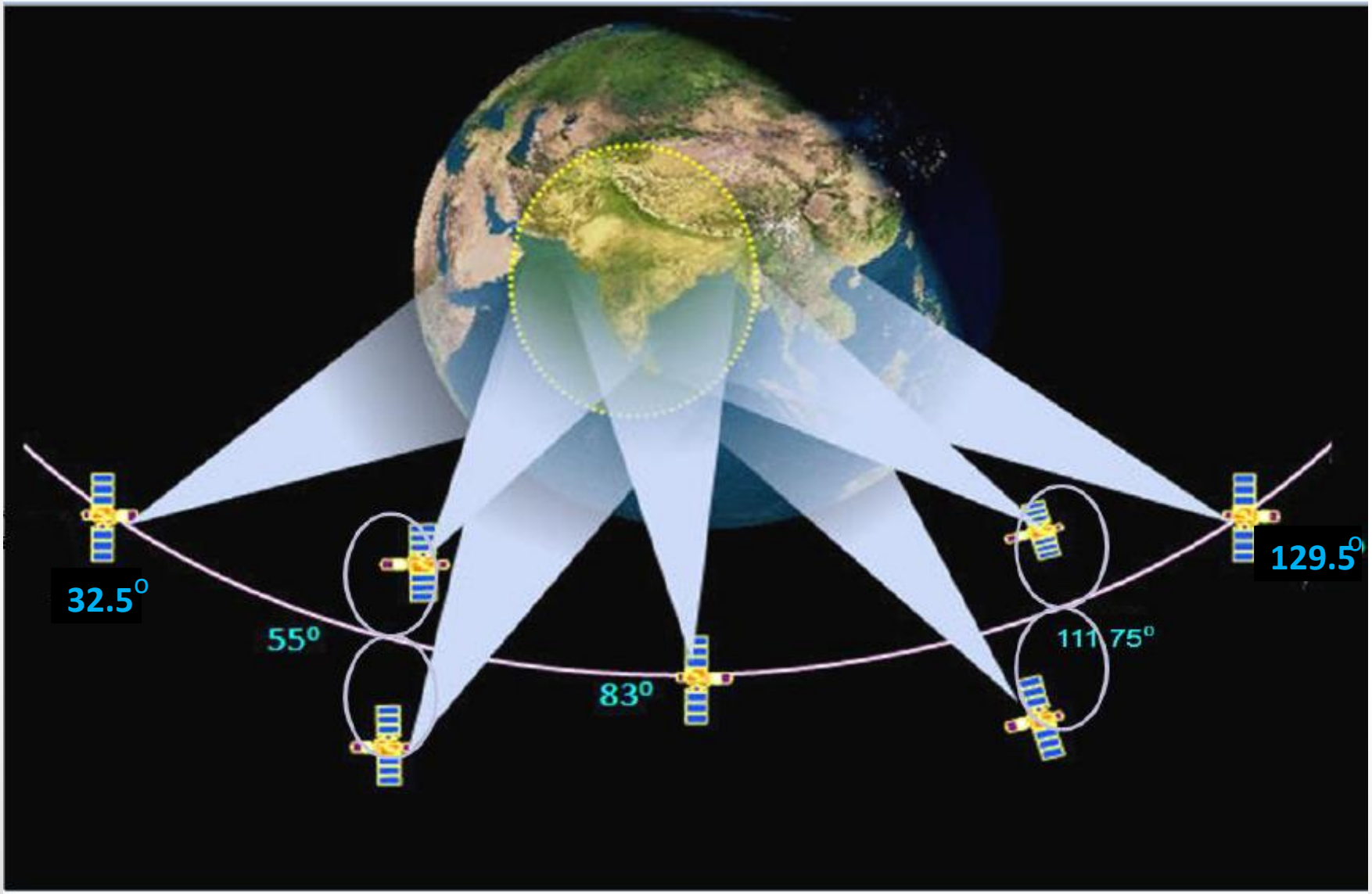
ISRO

IRNSS (NAVIC)

- Independent Navigation Satellite System providing navigation services in the Indian region
- Provides the user with a targeted position accuracy over India extending to about 1500 km around India



IRNSS: Indian Regional Navigation Satellite System

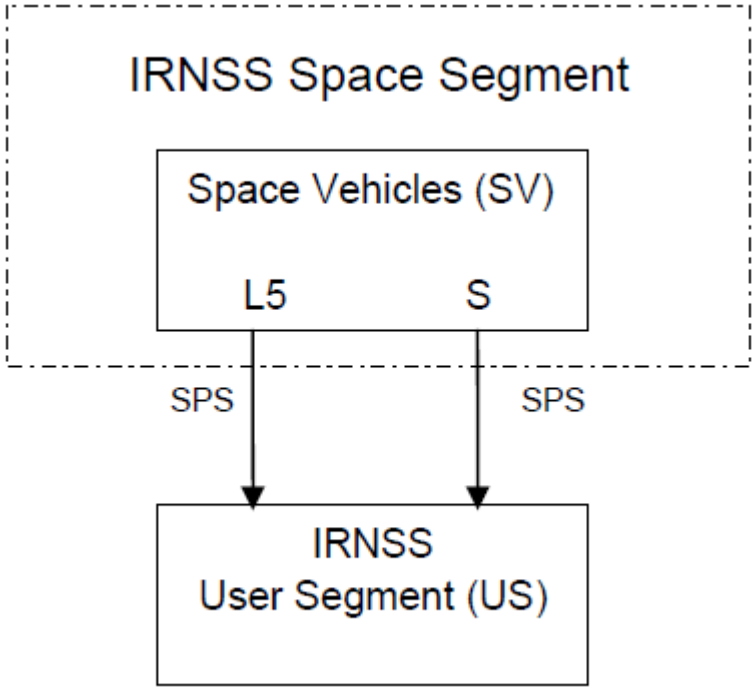


Civilian Services in IRNSS

- Standard Positioning Services (SPS)

Frequency

1. L5: 1176.45 MHz
2. S: 2492.028 MHz



Navigation message broadcast by IRNSS satellites

- The IRNSS Master frame comprises of four Sub-frames. Each Sub frame is 600 symbols transmitted at 50 sps.

600 symbols	
Sync code	Subframe
16 bits	584 symbols

- Data rate is 25 bps (50 sps)
- The IRNSS System Time is given as 27-bit binary number composed of two parameters: Week Number and Time of week Count.
- The transmission timing of the navigation message provided through the TOWC is synchronized to IRNSS System Time.

Navigation Data

Primary navigation parameters:

- Satellite Ephemeris
- Satellite clock correction model parameters
- Satellite & signal health status
- Total group delay

Secondary Navigation parameters:

- Satellite almanac
- Atmospheric (Ionospheric) correction model
- IRNSS Time Offsets w.r.t to UTC & GNSS
- Constellation status
- Ionospheric grid delays
- Differential corrections
- Earth orientation parameters

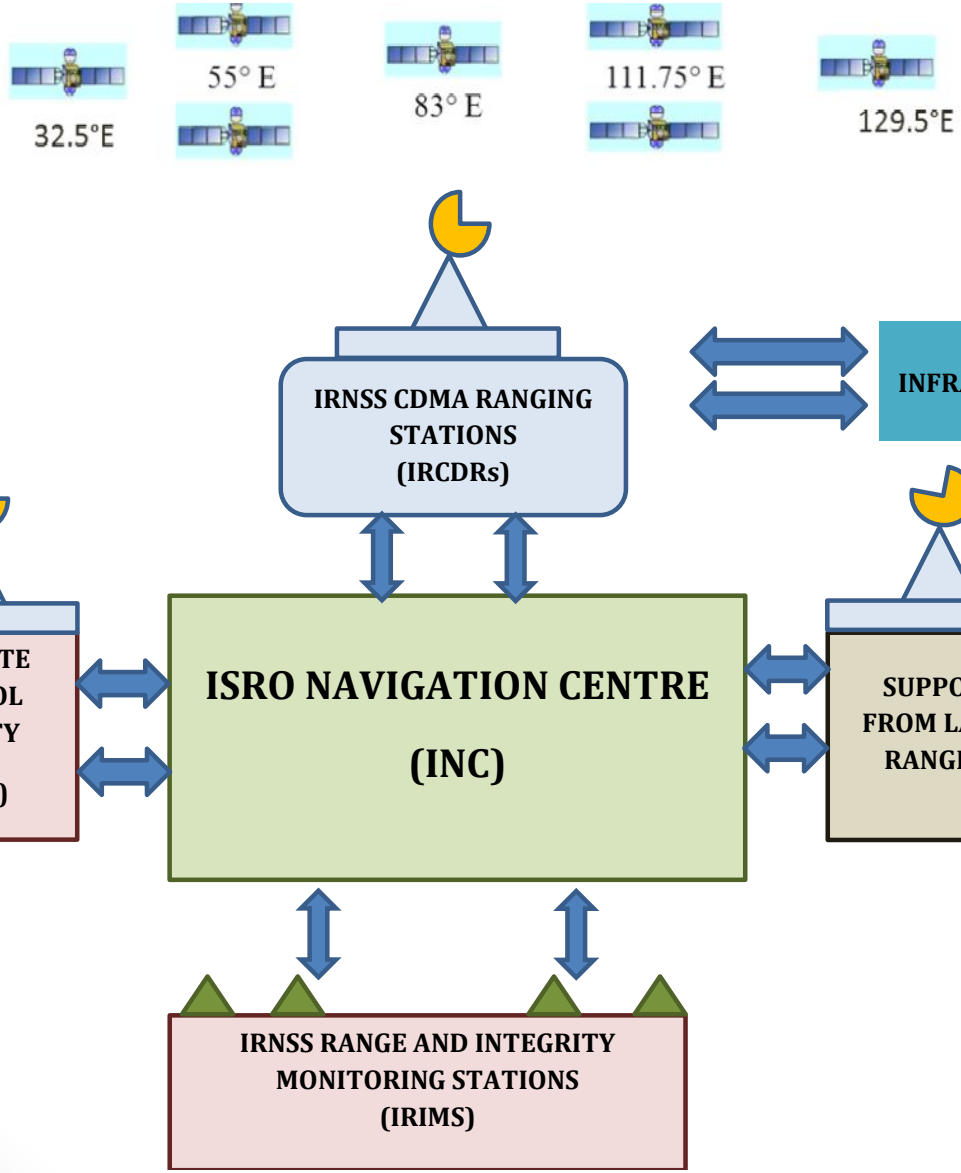
All these parameters are generated using the Ground segment network.

- Available in Published ICD

IRNSS Ground Segment

- House-keeping of IRNSS satellites
- Carry out precise orbit determination of all IRNSS Satellites
  - one-way and two way CDMA ranging
  - Laser ranging (Limited Measurements)
- Generate maintain and disseminate IRNSS network time using an ensemble of highly stable atomic clocks
- Estimate
  - onboard satellite clock bias and drift rate
  - Ionospheric delay
- Have dedicated uplink facility for each satellite for housekeeping and navigation uplinks
- Enable 24X7 automated operation of the IRNSS Ground Segment

Overview of IRNSS Ground Segment Architecture



ISRO NAVIGATION CENTER

- Orbit Determination
- Navigation Parameter Generation
- Timing Synchronisation

IRNSS Network Timing (IRNWT)

- IRNWT serves as the reference timescale for the IRNSS system.
- IRNWT is responsible for the generation, dissemination and maintenance of a precise and stable system time of IRNSS.
- Ensemble of Active Hydrogen Masers, Passive Hydrogen Masers and Cesium atomic clocks
- Timescale output is steered to a desired reference

IRNSS two-way CDMA Ranging stations

- A network of IRCDR Stations have been established across India.
- Two-way CDMA ranging carried out to IRNSS satellites in C-band

IRCDR Stations

IRNSS Range & Integrity Monitoring Stations

- A network of IRIM Stations have been established across India.
- Carry out one-way CDMA ranging to IRNSS satellites continuously.
- New Reference Stations are Planned Outside India.

IRIMS Antenna

IRIMS Equipment

Conclusion

All the elements of the ground segment is realized and fully functional,

supporting NAVIC constellation

Thank You!