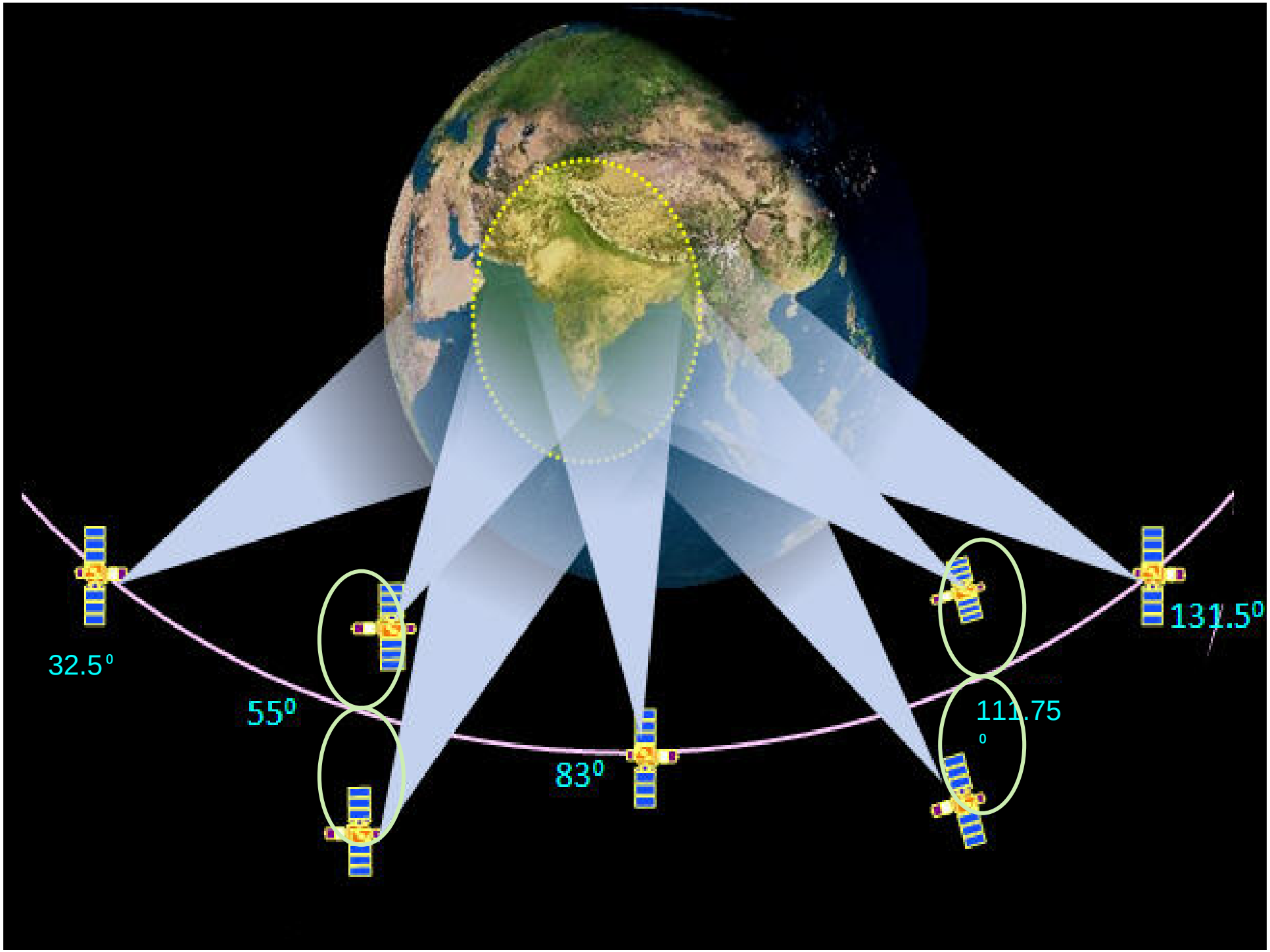
Indian Regional Navigation Satellite System – An Overview

Presentation at UN International Meeting on the Applications of GNSS

Anand Dwivedi

Scientist/Engineer
ISRO Satellite Centre
Bangalore, India

Satellite Navigation Program


32.5⁰
55⁰
83⁰
111.75⁰
131.5⁰

Contents

- IRNSS – Objective
- Signals and Services
- Architecture
- Space Segment
- Ground Segment
- User Segment

IRNSS Objective

- IRNSS Refers to Indian Regional Navigation Satellite System implemented by the Indian Space Research Organisation.
- IRNSS is an independent Navigation Satellite System providing Navigation services in the Indian Region.
- IRNSS system provides the user with a targeted position accuracy of better than 20m over India and the region extending to about 1500 km around India.

IRNSS Signals

L5 Band

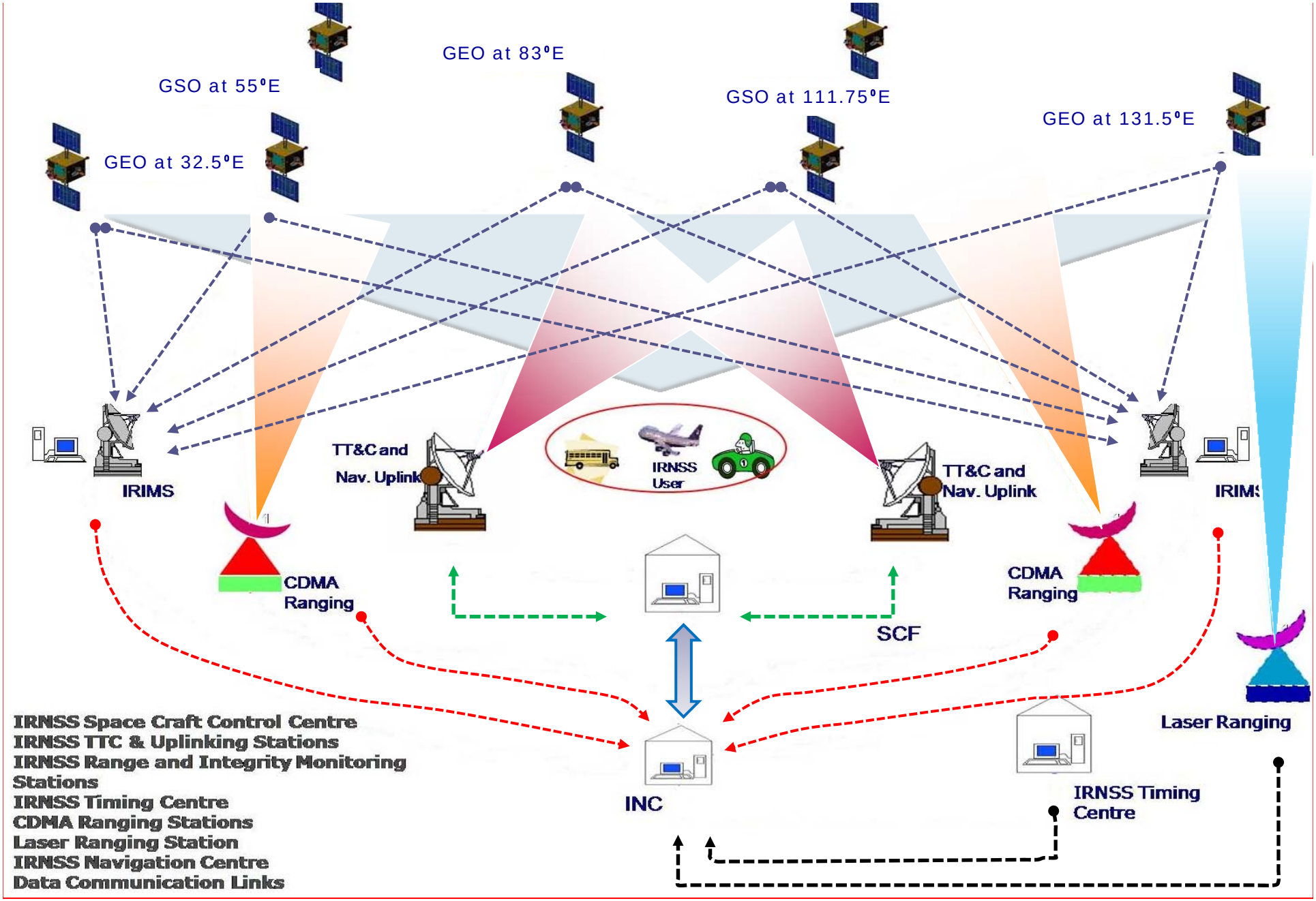
Service	Frequency Band	Centre Frequency (MHz)	Allocated Bandwidth (MHz)	Polarization	Modulation	Code rate (Mcps)
SPS	**L5-band**	1176.45	24 MHz (1164.45 - 1188.45 MHz)	RHCP	BPSK(1)	1.023
RS data	**L5-band**	1176.45	24 MHz (1164.45 - 1188.45 MHz)	RHCP	BOC(5,2)	2.046
RS pilot	**L5-band**	1176.45	24 MHz (1164.45 - 1188.45 MHz)	RHCP	BOC(5,2)	2.046

S Band

Service	Frequency Band	Centre Frequency (MHz)	Allocated Bandwidth (MHz)	Polarization	Modulation	Code rate (Mcps)
SPS	S-band	2492.028	16.5 MHz (2483.778 – 2500.278 MHz)	RHCP	BPSK(1)	1.023
RS data	S-band	2492.028	16.5 MHz (2483.778 – 2500.278 MHz)	RHCP	BOC(5,2)	2.046
RS pilot	S-band	2492.028	16.5 MHz (2483.778 – 2500.278 MHz)	RHCP	BOC(5,2)	2.046

IRNSS Architecture

- **Space Segment**
  - **Spacecraft Bus Elements & Navigation Payload**
- **Ground Segment**
  - **Range & Integrity Monitoring Stations, Navigation Centre, CDMA & Laser Ranging Stations, Satellite Control Centre & Uplink Stations, Data Communication Links, Network Timing Facility.**
- **User Segment**
  - **Single & Dual Frequency Receivers for SPS and RS**

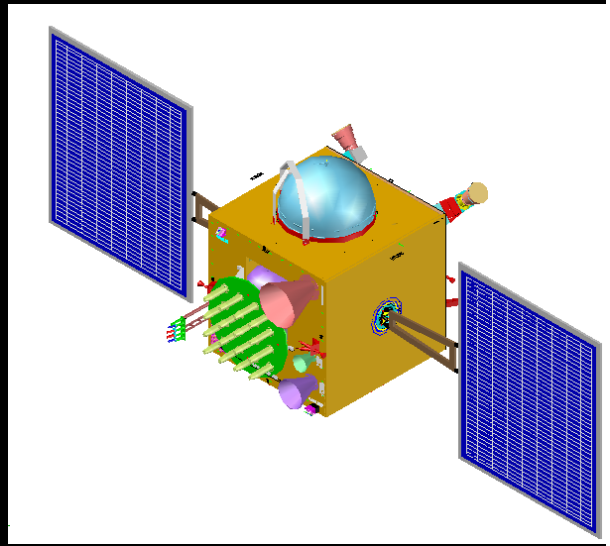


IRNSS Architecture

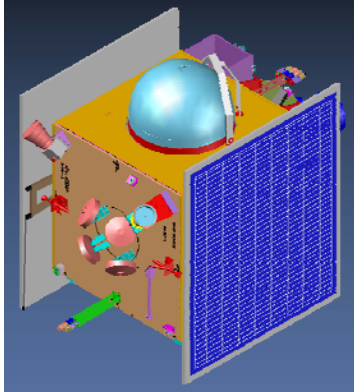
Space Segment

- Space Segment consists of Seven satellites
- 3 Satellites in Geo-Stationary orbit at 32.5°, 83° and 131.5° East.
- 4 Satellites in GEO Synchronous orbit placed at inclination of 29° with Longitude crossing at 55° and 111.75° East.
- Two spare satellite are also planned.
- The Satellites are specially configured for the Navigation. Same configuration for GEO and GSO which is desirable for the production of the satellites. Production plan & schedule are worked out.
- IRNSS Satellites are to be launched by the Indian launcher PSLV.
- The first Satellite will be launched by Second Quarter of 2012.The subsequent launches are planned once in Six months. The full constellation will be operational by 2015.

IRNSS Satellite



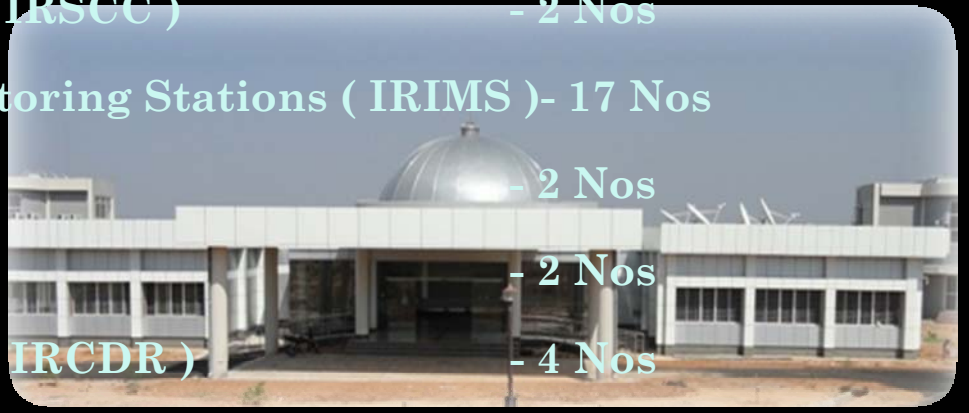
- IRNSS Satellites are designed around I-1K bus.
- Dry mass of around 600 kgs and lift off mass of 1425 kgs
- Power generation capability of 1600 W
- Navigation Payload Transmits SPS and RS signals in L5 and S Bands.



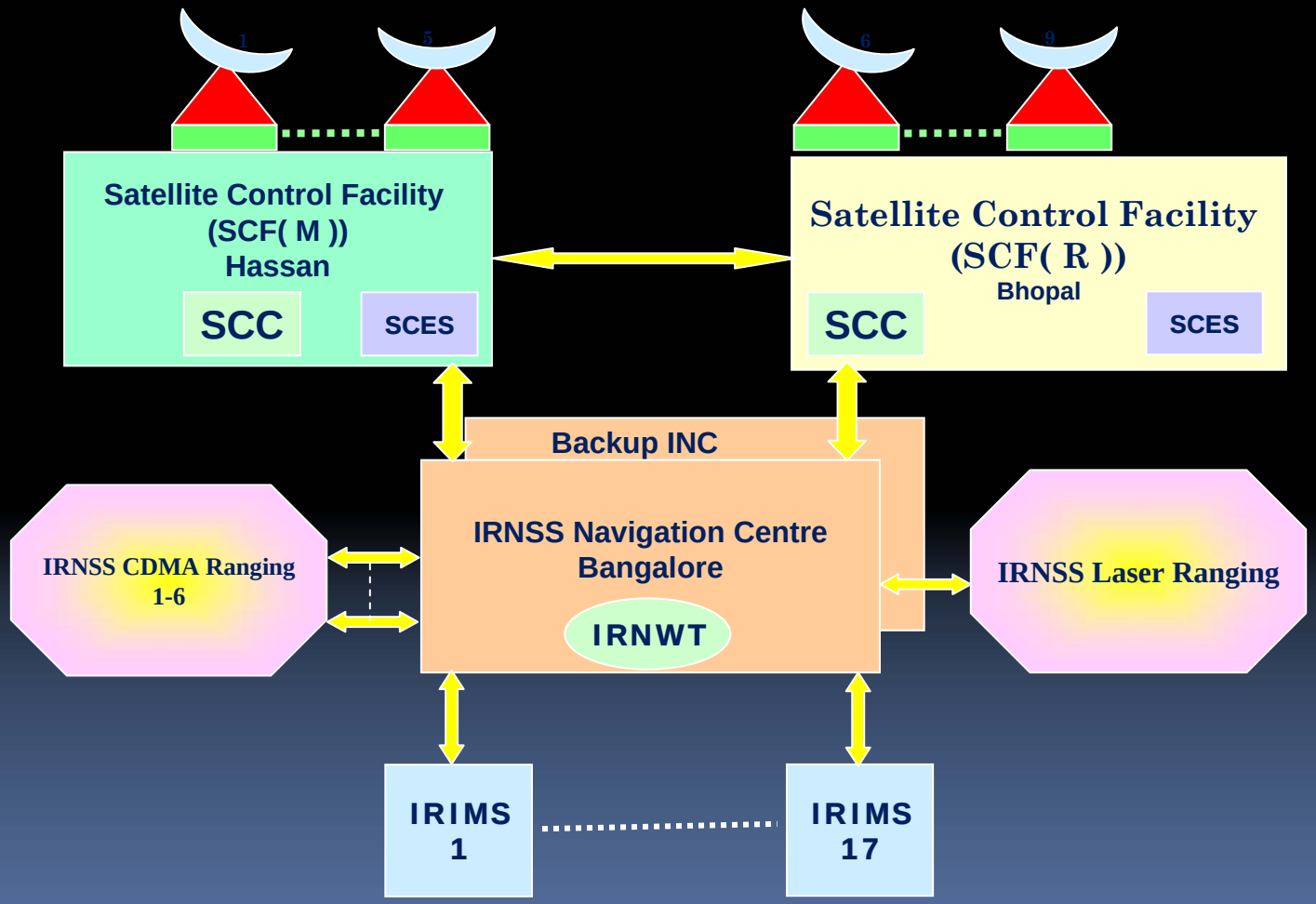
- Payload utilizes highly stable Atomic Frequency Standards for generation of Navigation Signals.

Ground Segment Subsystems

- IRNSS Satellite Control Earth Stations - 9 Nos
- IRNSS Satellite Control Centre (IRSCC) - 2 Nos
- IRNSS Range and Integrity Monitoring Stations (IRIMS)- 17 Nos
- IRNSS Navigation Centre (INC) - 2 Nos
- IRNSS Network Time (IRNWT) - 2 Nos
- IRNSS CDMA Ranging Stations (IRCDR) - 4 Nos
- IRNSS Data Communication Network (IRDCN) - 2 Nos



Ground Segment Architecture



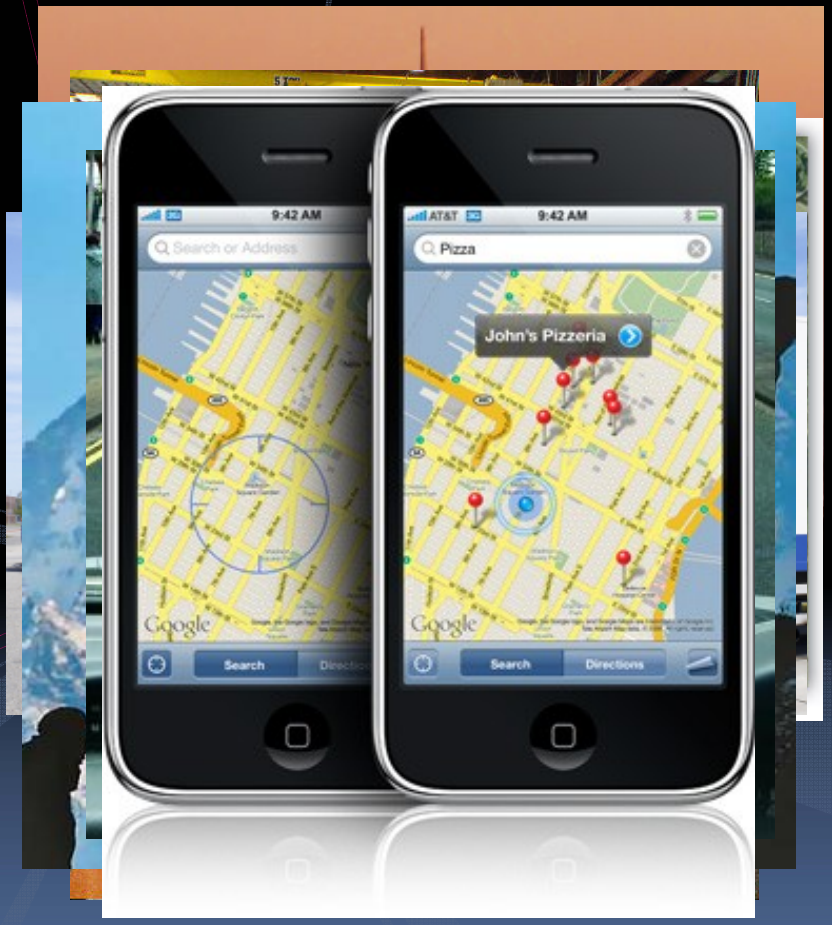
User Segment

- The user segment consists of IRNSS receivers operating in
  - **Single Frequency (L5 or S band)**
  - **Dual Frequency (L5 and S band)**

- Single frequency and dual frequency receivers shall receive both SPS and RS signals. SPS is for civilian users. RS signal is an encrypted service for authorized users.

Satellite Navigation Applications

- Avionic navigation and precise landing system
- Mapping and GIS data capture
- Automated logistics in factories, construction sites and mines
- Vehicle tracking and fleet management.
- Terrestrial navigation aid for hikers and travelers
- Visual and voice navigation for drivers
- Integration with mobile phones.




THANK YOU