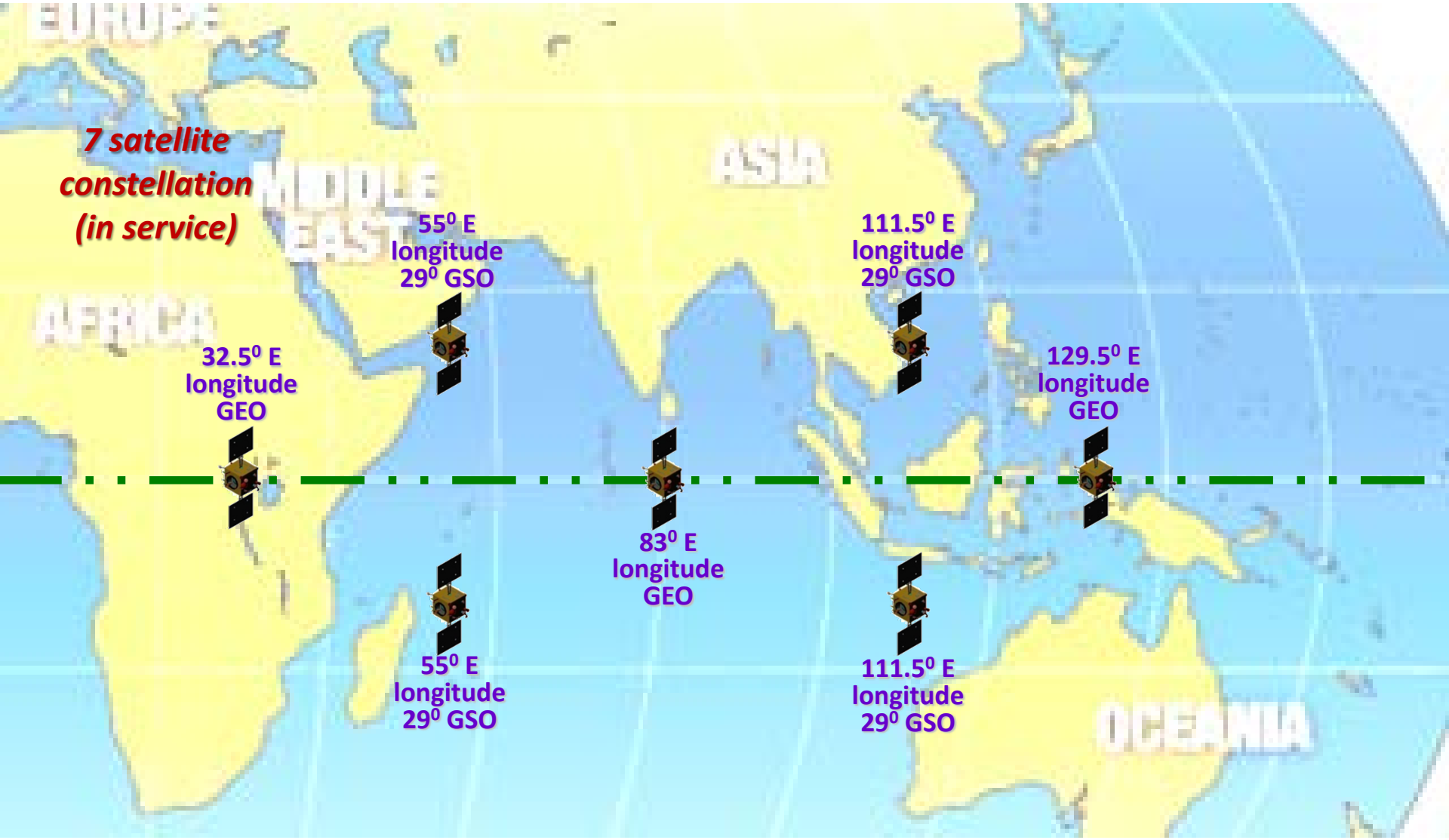
NavIC – An overview

Presentation to
IALA Council meet
3-4 June 2020

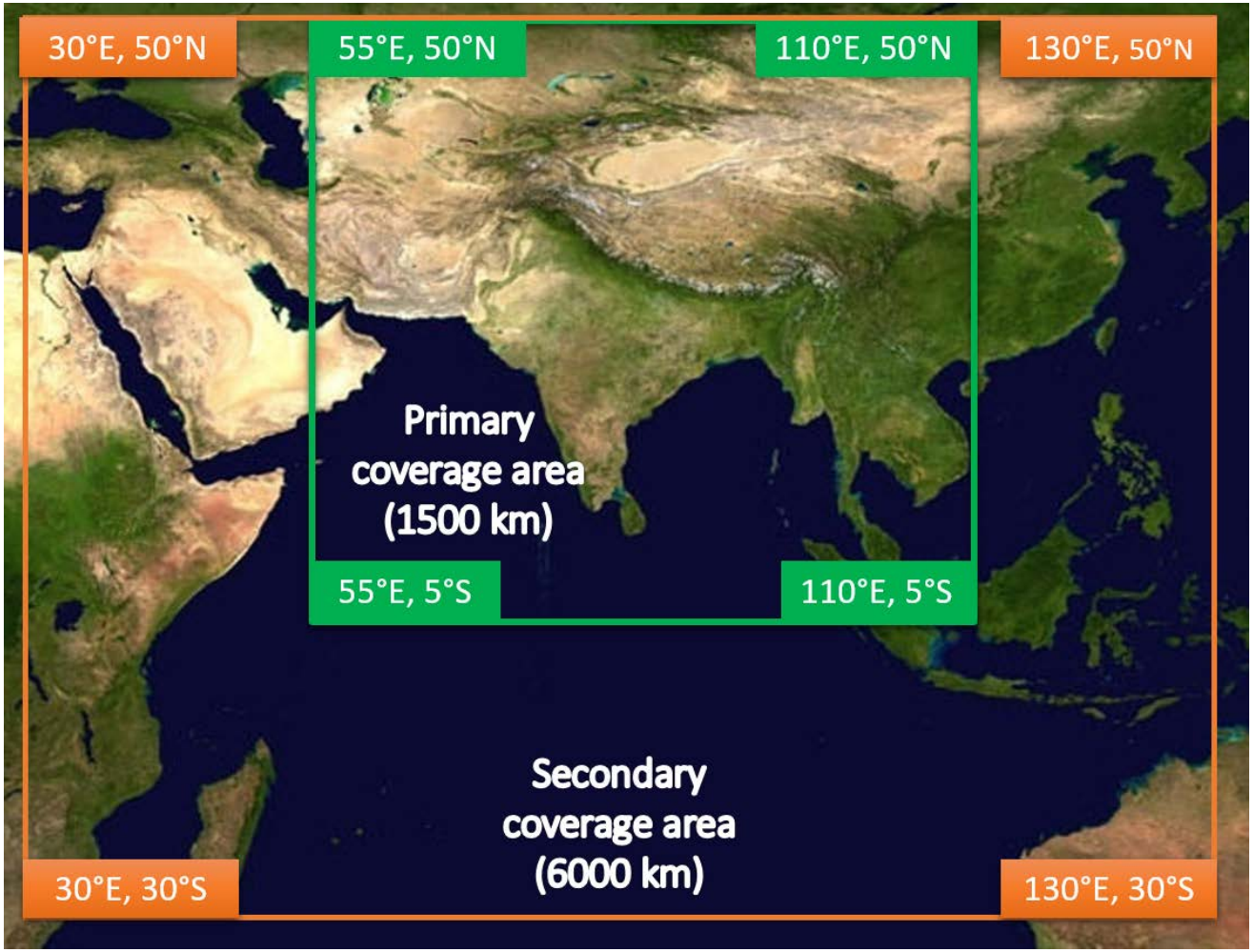
Introduction

- ✓ An independent Regional Navigation Satellite System providing navigation services in India and its Islands and neighbouring regions.
- ✓ IRNSS/NavIC system provides the user with a targeted position accuracy of better than 20m(2σ) over India and the region extended to about 1500km around India.
- ✓ Signal transmission in L5 (1176.45 MHz with 24 MHz bandwidth and S-Band (2492.028 MHz with 16.5 MHz bandwidth) frequencies
- ✓ Standard Positioning Service (SPS) and Restricted Service(RS)
- ✓ Modulation scheme for SPS service is BPSK
- ✓ Interoperable with GPS,GLONASS, GALILEO and BEIDOU
- ✓ IRNSS/NavIC –A self reliant Navigation System

Constellation



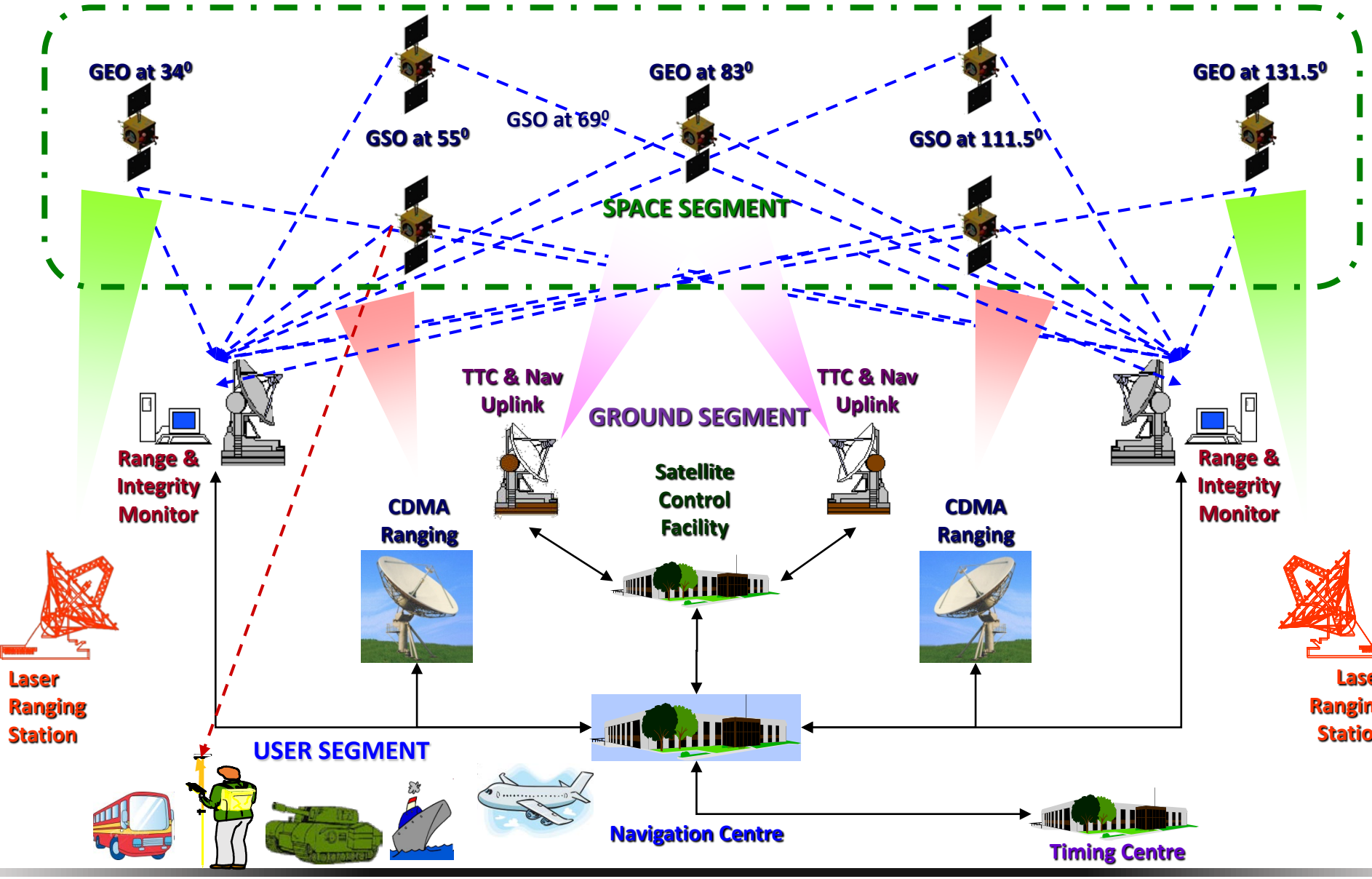
Coverage



Primary coverage area

Guaranteed position accuracy as per system specification.

System Architecture



NavIC in Standards

Incorporated

- ✓ AIS-140 based Vehicle Tracking Devices
- ✓ Data Format – NMEA / RINEX
- ✓ Differential GNSS – RTCM
- ✓ Telecom Standards – 3GPP

On-going

- ✓ International Maritime Organisation (IMO)
- ✓ International Civil Aviation Organisation (ICAO)
- ✓ CORS / PPP – International GNSS Services
- ✓ Unmanned Aerial Vehicles (UAV)

AIS-140 Based Vehicle Tracking Devices

Govt Mandate

- ✓ **MoRTH:** All commercial vehicles (regd after 01/01/19) to be fitted with VLT and panic button in accordance with AIS-140
  - ❑ **AIS-140:** All new vehicles manufactured after 1st April 2019 need to have NavIC based VLT devices. Vehicles that are manufactured earlier shall be fitted with NavIC enabled devices at a later date

NavIC Enabled Chips

Telit

SkyTraQ

Quectel

UTraq

Allystar

Current Status

- ✓ >100 NavIC enabled vehicle tracking devices are certified by ARAI/ICAT
- ✓ >100,000 commercial vehicles are fitted NavIC enabled Tracking Devices

Data Formats – NMEA/RINEX

- National Marine Electronics Association (NMEA): combined electrical and data specification for communication between marine electronics
  - ✓ V2.03 onwards supports NavIC
- Receiver Independent Exchange Format (RINEX): data interchange format for raw satellite navigation system data
- RINEX 3.04 supports NavIC

Differential GNSS

- ✓ Radio Technical Commission for Maritime Services (RTCM): international organisation for international maritime radio navigation and communication policies and standards
- ✓ RTCM SC-104 standard defines data structure for differential corrections
- ✓ RTCM SC-104 formed IRNSS/NavIC working group (WG) in May 2018
- ✓ WG conducted NavIC L5 interoperability testing
- ✓ Interoperability tests results approved in SC-104 Plenary, Trondheim, Norway Sep 23-24, 2019
- ✓ NavIC L5 CDV document was formally approved after voting in SC-104 meeting, San Diego, Jan 16-17, 2020.

RTCM (Radio Technical Commission for Maritime Services) Standards for NavIC in DGNSS application, officially released on RTCM website on April 28, 2020 .

- ❑ Enables NavIC into the applications like Maritime fields, Surveying, Construction, Asset Monitoring and Control, Deformation monitoring, Plate tectonic monitoring & Geodesy

Telecom

- ✓ 3rd Generation Partnership Project (3GPP): international standards body for cellular telecommunications technologies
- ✓ Work-item for NavIC in assisted-GNSS in Rel-16 LTE introduced in 3GPP meeting at California in Sept. 2019
- ✓ Specifications document submitted in Feb. 2020
- ✓ **NavIC specifications are published in Rel-16 of 3GPP standards in April 2020**
- ✓ As follow-on, assisted-GNSS is to be taken up as part of Rel-17 5G
- ✓ Work item in progress under TSDSI also
- ✓ ISRO is a member of 3GPP and TSDSI

3GPP A GLOBAL INITIATIVE

tsdsi India's Telecom SDO

Maritime

- ✓ International Maritime Organisation (IMO) - Global standard-setting authority for safety, security and environmental performance of international shipping.
- ✓ Maritime Safety Committee (MSC): highest technical body of IMO
- ✓ Sub-committee on Navigation, Communications and Search and Rescue (NCSR) has recommended NavIC/IRNSS as component of WWRNS during the 7th meeting of NCSR on 15 & 16 Jan 2020 at IMO, London
- ✓ MSC is expected to recognise IRNSS/NavIC as component of WWRNS in the 102nd meeting of MSC in June 2020

IMO
INTERNATIONAL
MARITIME
ORGANIZATION

Maritime

- ✓ Testing standards for NavIC/IRNSS ship-borne receiver equipment being formulated in accordance with International Electro-technical Commission (IEC-TC80)
- ✓ India is represented through TED-19 of BIS
- ✓ ISRO is a member of TED-19
- ✓ Specification preparation in progress
- ✓ Specification formulation timeline: Mid-2022

Recognition of IRNSS/NavIC as a component of World Wide Radio Navigation Systems(WWRNS), a Certification from International Maritime Organisation (IMO) by 2020.

- ❑ **Enables NavIC into the Shipborne Navigation equipment in the international market**

Civil Aviation

- ✓ International Civil Aviation Organisation (ICAO): specialized agency of UN with headquarters at Montreal
- ✓ Global authority for international civil aviation standards, recommended practices and policies
- ✓ ICAO council consists of 36 members including India
- ✓ Air Navigation Commission (ANC) under ICAO considers and recommends Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS)
- ✓ **G**eo **A**ided **G**PS **A**ugmentation **N**avigation (GAGAN) is certified for RNP 0.1 in Dec. 2013 and APV 1.0 in Apr. 2015 by ICAO.
- ✓ Similar procedures are being initiated for NavIC

ICAO

Continuously Operating Reference Stations (CORS)

- ✓ International GNSS Service (IGS): voluntary organisation for providing high-accuracy GNSS satellite orbits
- ✓ IGS Central Bureau has conveyed IGS station operators within the foot-print of NavIC to track NavIC satellites, vide communication in May 2019
- ✓ High-accuracy geodetic grade multi-GNSS receivers with NavIC L5 & S capability are needed to service this requirement

IGS INTERNATIONAL GNSS SERVICE

UAVs

- ✓ ISRO is a member of TED-14 of Bureau of Indian Standards (BIS)
- ✓ Sub-committee on specification formulation for UAVs formed under TED-14 of BIS; ISRO is a member of the sub-committee
- ✓ Discussions initiated for incorporating NavIC in the standards for the UAVs.

मानकः पथप्रदर्शकः
भारतीय मानक ब्यूरो
Bureau of Indian Standards
The National Standards Body of India

Thank You