Satellite IoT
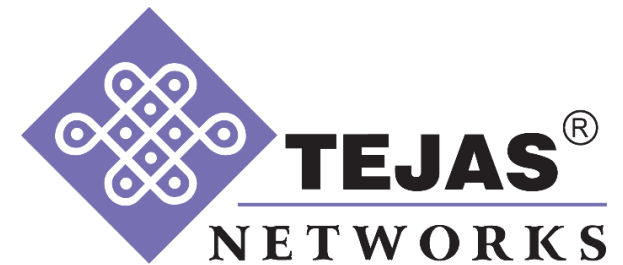
Presented by

Vinay K Prasad
Associate Vice President – Satcom

19th Dec 2024

Agenda

➢About Satellite IOT

➢Sat-IoT Key Components

➢Sat-IoT Communication Satellites

➢Sat-IoT Applications

➢Sat-IoT Real Life deployment, Case Study

➢Q&A

About Satellite IOT

- Integration of satellite networks and IoT devices to enable seamless connectivity and data exchange.

- "Smart" Devices to "IOT Devices" (NB-IoT and Broadband)

- Communication satellites

  - LEO <Lower latency, closer proximity, ideal for IoT>

  - MEO <Moderate latency>

  - GEO <Larger coverage area, but higher latency>

- Non-Standard to Standardization

  - Proprietary Waveforms

  - 4G/5G NTN with advancement of 3GPP Standards

Satellite IOT - Key Components

- IoT Devices: Terminals, Sensors and Trackers installed on machinery, vehicles or in the any other outer environment

- Satellites: Low Earth Orbit (LEO) or Medium earth Orbit (MEO) or Geostationary Orbit (GEO) satellites act as the communication link.

- Ground Stations: Facilities that receive and process the data sent by satellites.

- Cloud/Analytics Platforms: Data is stored, analyzed and visualized for actionable insights.

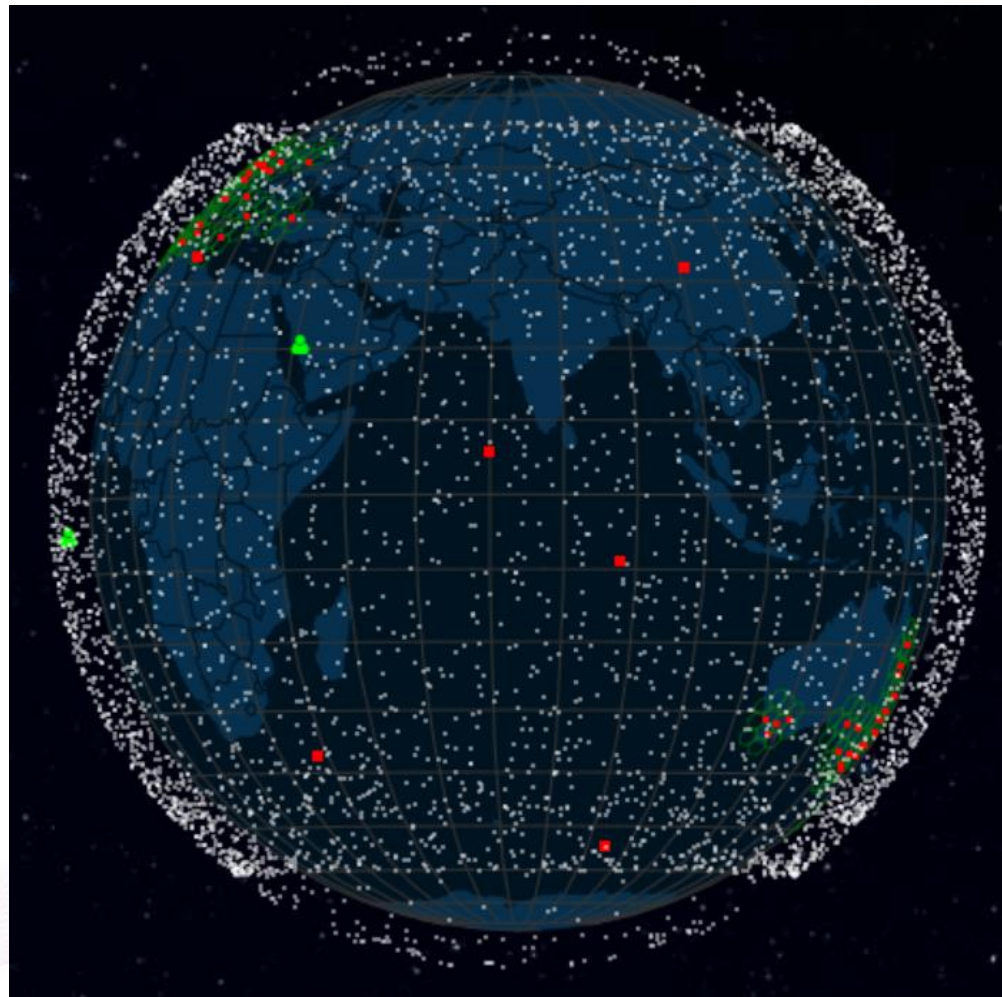# Satellite IOT - Communication Satellites
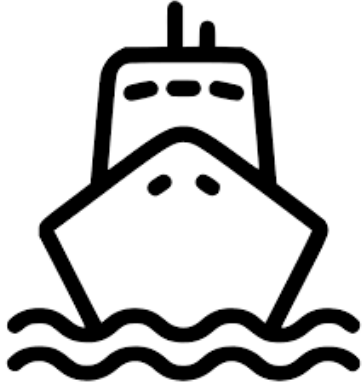
- Space Segment

- Ground Segment

Source : https://satellitemap.space/?constellation=starlink
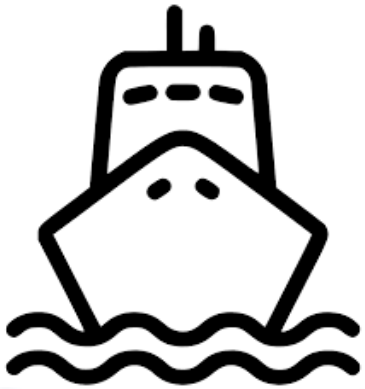
Satellite IOT - Communication Satellites

- Space Segment

- Ground Segment

Source : https://satellitemap.space/?constellation=starlink
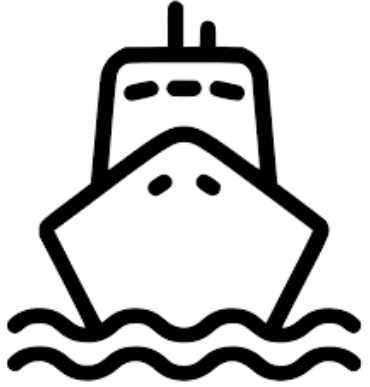
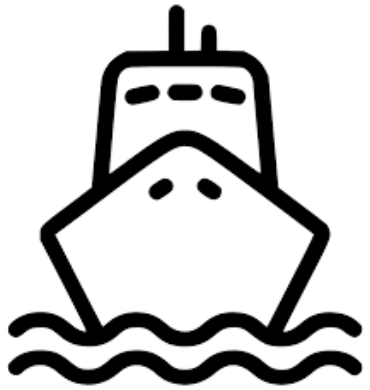# Satellite IOT - Applications

- Maritime Industry
  - Tracking ships, containers and fishing fleets using GPS + satellite uplink
  - Monitoring oceanic weather conditions
  - Provide safety and security
  - Technologies such as Bluetooth, WiFi, with a Satellite communication over S/L/Ku/Ka Bands

- Agriculture
  - Smart farming with sensors for soil moisture, crop health, livestock tracking
  - Technologies such as LoRA, ZigBee, etc with a Satellite Backhaul are popular to be used in such applications

- Oil & Gas
    - Monitoring pipelines, remote drilling sites and leak detection
    - Technologies such as LoRA, SOS and positioning requirements, with a Satellite communication are used in such applications
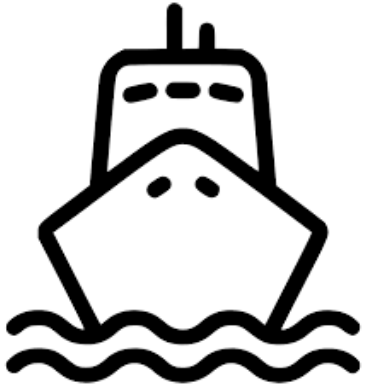
- Utilities
  - Managing power grids, remote solar farms, and water systems
  - Technologies such as LoRA, ZigBee, etc with a Satellite Backhaul are popular to be used in such applications
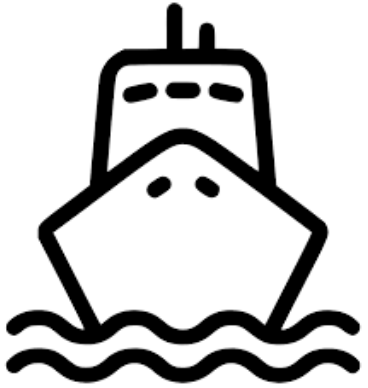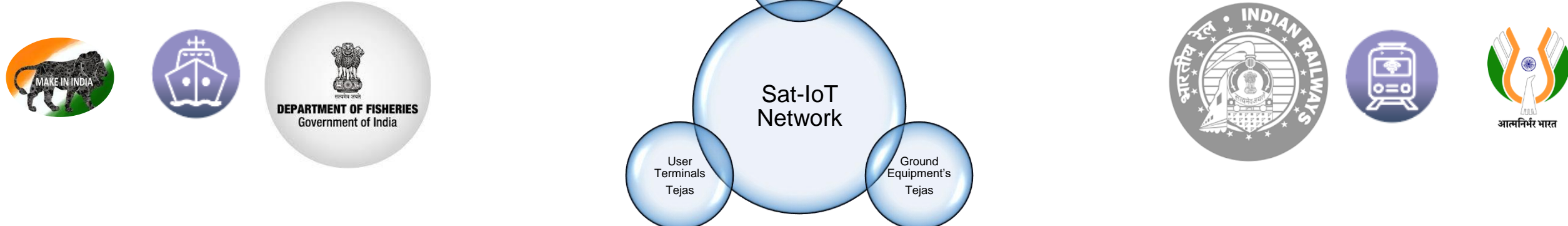
- Automotive
  - FOTA and SOTA
  - Connected car ecosystem
  - Technologies such as OTA over Broadcast networks with Satellite Backhaul are used in such applications

Satellite IOT - Real Life Deployment, Case Study

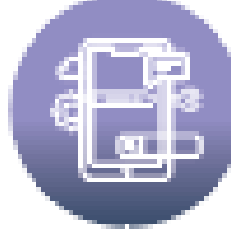**Deploying largest Sat-IoT Network**

End-to-End Satcom Solutions

Satellite ISRO

Sat-IoT Network

User Terminals Tejas

Ground Equipment's Tejas

Hub - Baseband

Network Management Software
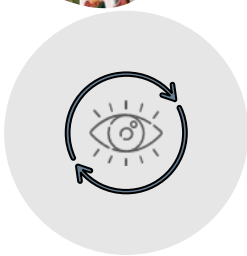
Indigenous SDR Chipsets

Remote User Terminals

End User Application

Sat-IoT Network for Dept of Fisheries, GoI

Why Vessel Tracking is Required ..

National Security

Hostile neighbors, history of terror attacks, better border vigilance & safeguarding of interests in Exclusive Economic Zone

Fishermen Safety

- Life safety, SOS, Aid in Search & rescue missions

- Weather info, International boundary alerts, Messaging

Maritime Vigilance

- Identification, Tracking, monitoring of fishing vessels.

- Better co-ordination amongst maritime security agencies
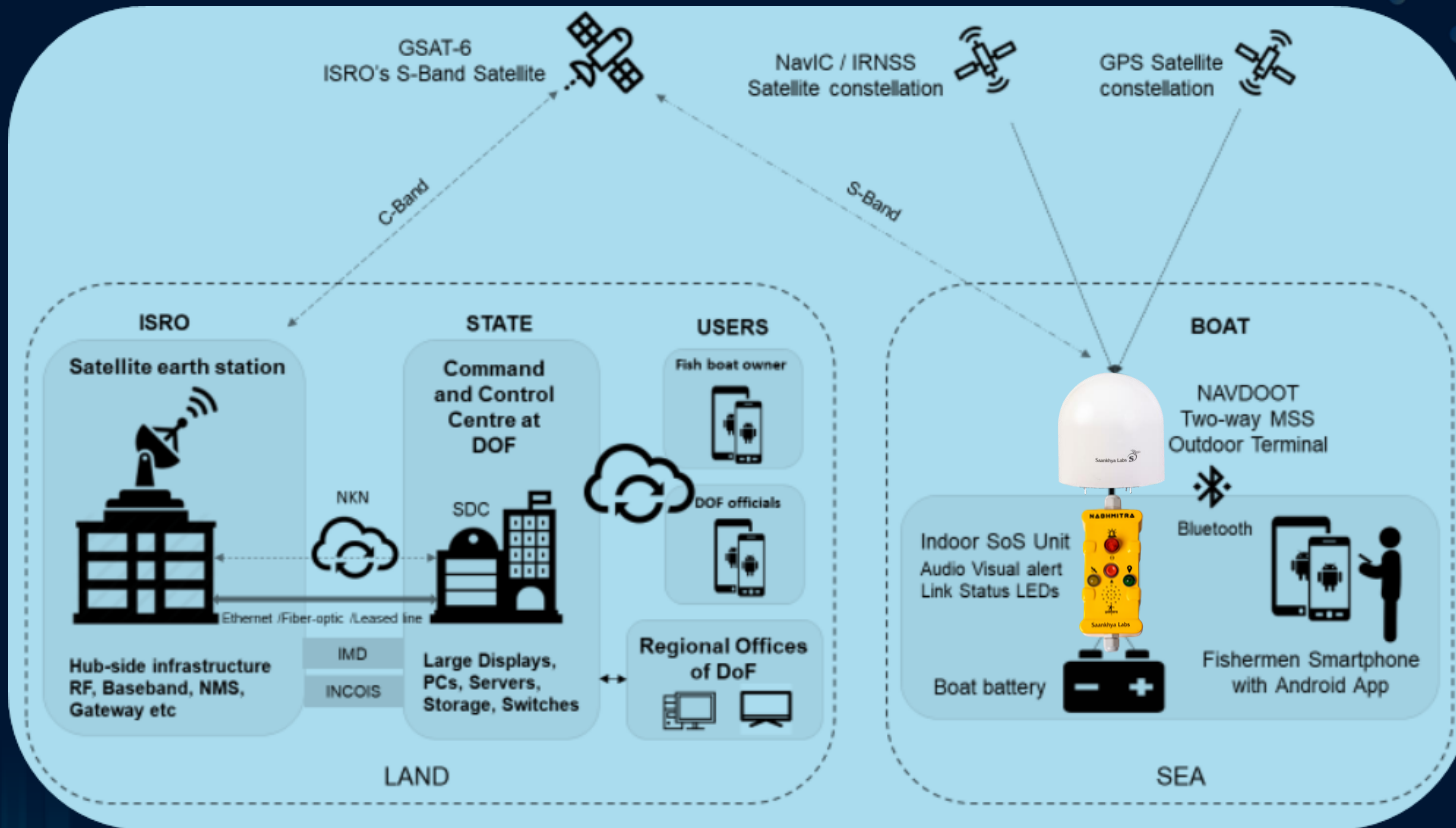
Enhance Productivity

- Access to modern technology, PFZ info,

- 2-way messaging, quicker monetization, reduce idle time, minimize losses

Fiscal Efficiency

- Better utilization of govt. subsidies & state resources.

- Digitization of boat, crew & trip records

The Satellite IOT Network

Command & Control room for DoF
Centralized command & control for monitoring, geofencing, SoS, weather alerts and administration

Navdoot – VTS terminals & SoS Unit
Two-way MSS terminals with integrated battery, Bluetooth and Indoor SoS Unit with audio-visual alert

Hardware (IT) - Hub UserNMS
Broadband connectivity, Servers, Storage, Switches etc at state data centre or DoF premises

Software - Hub UserNMS
Application software for Tracking, Monitoring & Administration of deep-sea fishing vessels

End-user Mobile App
Multi-lingual Android APP for fishermen, fish boat owners and DoF officials.

ISRO
Satellite, Bandwidth, Earth station / Hub-infrastructure support
Statutory & VTS unit approvals, Interfacing with State DoF, Technical assistance
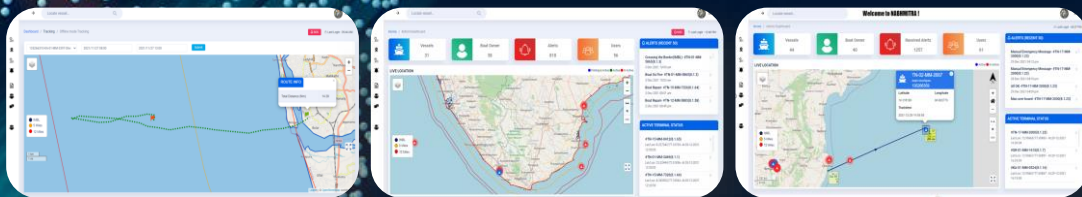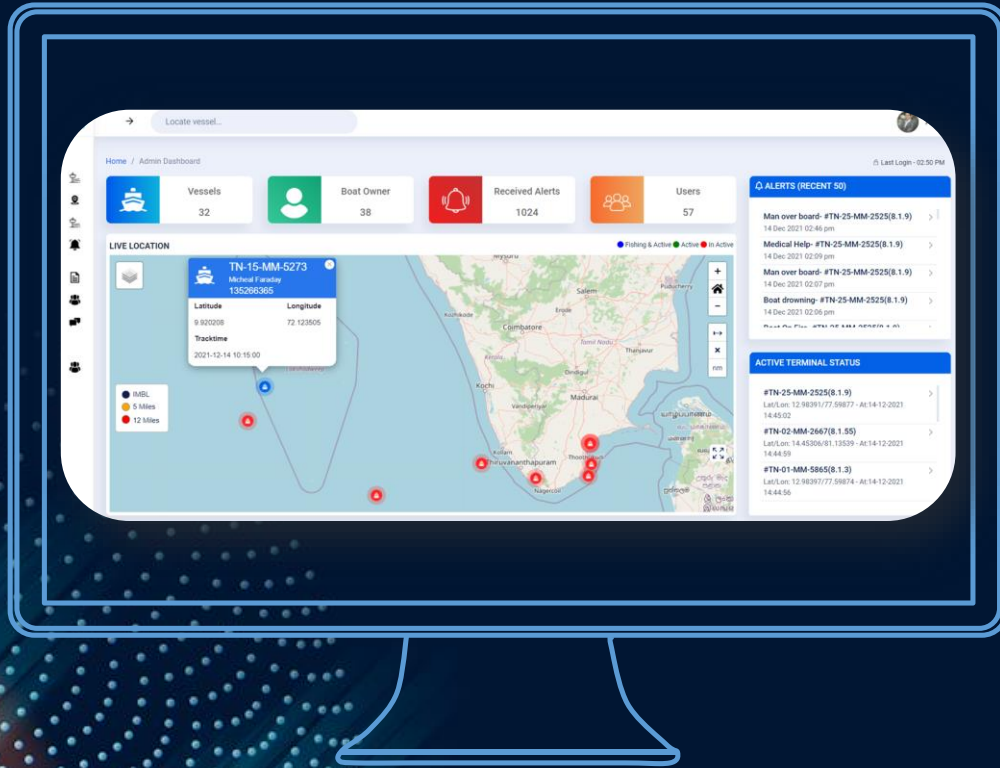Facilitate data from IMD, INCOIS

Two way MSS Network for Vessel Tracking & Fishermen Safety

Tracking & Monitoring | Two-way Messaging | SoS | Weather alerts & PFZ info | Productivity


ISRO's Satellite

Navigation Satellites (NavIC / GPS)

SOS

Multi-lingual
Fishermen App
for Android
Smartphone

ISRO's
Satellite Earth Station

RF, Baseband, NMS,
Gateway etc

DoF
Command & Control Centre at
HQ & Monitoring stations at
regional offices of DoF

Hub-User NMS hosted on
IT Infra at State Data Cantre

Boat Owner

Multi-lingual
Boat Owner App
for Android
Smartphone

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TEJAS
NETWORKS

Command and Control Center

- **Tracking** NavIC / GPS tracking & periodic location reporting

- **Monitoring** SoS, violation alerts, individual boat / cluster-based monitoring, overfishing

- **Control** Demarcation of international /state boundaries, Geo-fencing, environmental & permit enforcements

- **Surveillance** Assist coastal security agencies in identification, tracking, protection of eco-fragile zones & border surveillance

- **Fishermen Safety** Two-way messaging, SoS, Search & rescue, Weather alerts, Warnings & path to safety

- **Messaging** Broadcast message from control room One-to-one and One-to-many, PFZ data (INCOIS) and weather info (IMD)

- **Administration** Centralized digitization of boat, crew & trip records. Offline analysis of violations, distance calculation, subsidies and penalties for violation, daily, weekly, monthly reports,

User Applications
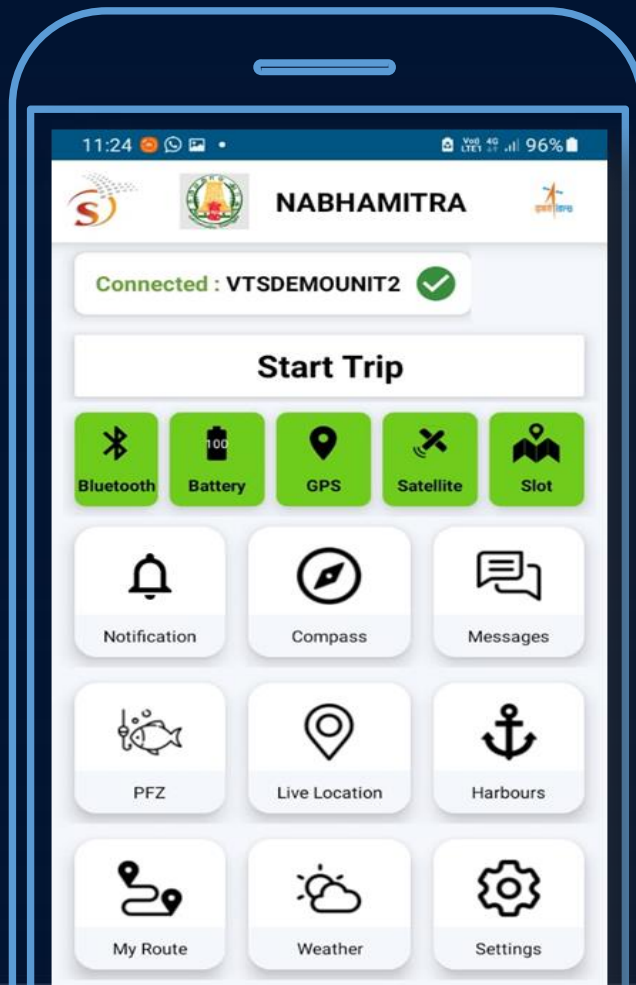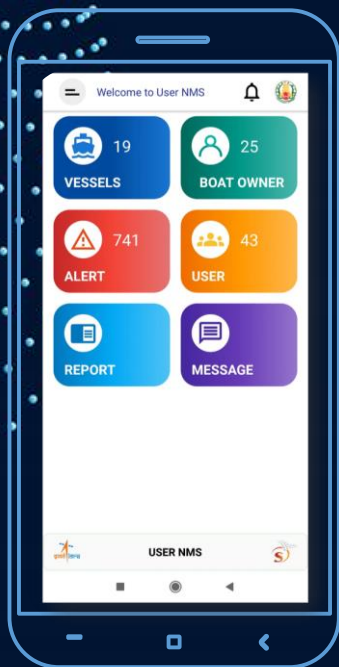
Dept official App

- Vessel tracking & monitoring
- Total / Active vessel list
- Alerts, Cluster tracking
- Geofence, Messaging
- Trip report
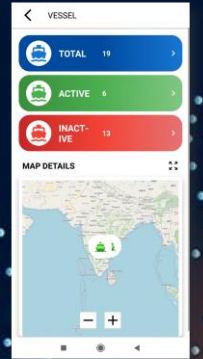
Fishermen App

- Multi-lingual app
- SoS, 2-Way Messaging
- Weather alert
- Path to safety, nearest shore
- Trip report

Fish boat owner App

- Tracking
- 2-Way Messaging
- Trip report
- Crew details entry
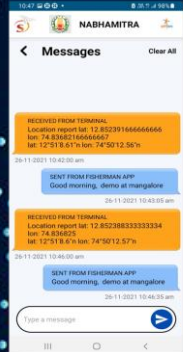
Sat-IoT Network for Indian Railways, GoI

- ❖ Deployed on 2600+ Indian Locomotives for for real time tracking and monitoring of trains – RTI project

- ❖ Supports two-way messaging, improves operational efficiencies, and helps in SoS situations

- ❖ Ability to receive and transmit data from multiple sensors

- ❖ Improved safety by superior diagnostics & remote management of assets

- ❖ Can be enhanced to support multiple interfaces

Heritage

Saankhya Labs supplied the hub-baseband equipment and

Satcom modems for a first of its kind MSS network whereby

over 2700 plus Indian Railways locomotives are reporting its

location live on near real time basis. The network is in operation

for about 2 years now.

Forward Channel	
Frequency Band	2560-2590 MHz
Data Rate	32 kbps scalable to 512 kbps
Return Channel	
Frequency Band	2670-2690 MHz
Channel Spacing	10 kHz
Data Rate	1.2/2.4/4.8/9.6 kbps in Burst Transmission
Transmit Power	+36dBm EIRP
Form Factor	
Dimensions	203 mm x 156 mm x 105 mm
Interface	Ethernet
Casing	IP 67 compliant

Network Architecture

Central Control Office

Railway Navigation Controller
Real time tracking of Trains
2-Way Communication
Emergency Communication with Loco Piot

Network Management System (NMS)
Multiple User Management
Resource Management
Customised Applications

L-Band TDM Modulator
Modulation of data transmitted to trains

Tarang Multichannel Demodulator
Demodulation of signals from trains

Navrail MSS Terminal

Indoor Unit with Indian Rail Navigator Application
Text Message
Location Tracking
SOS Signalling

Sat-IoT Hubside Equipment

❖ SDR based Multi-Channel Burst Demodulator and Modulator for MSS network

❖ Supports a variety of standard and custom waveforms by way of software change

❖ L-Band input with 10/100 ethernet interface for control and seamless data transfer to NMS

❖ Up to 48 Channels in a 3RU 19" rack mountable form factor with dual redundant power supply

❖ Easy to configure web-based application utility

Heritage

Saankhya Labs has supplied hub-baseband equipment for Indian Railways Real Time Train Information network. Over 2700 trains are currently operational on the network.
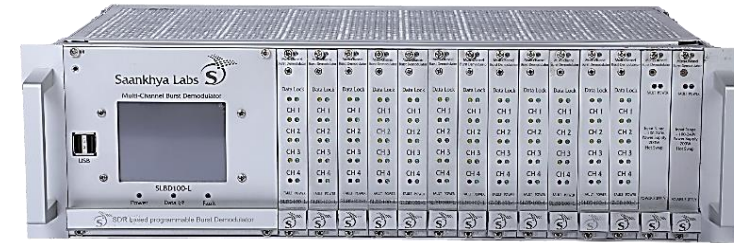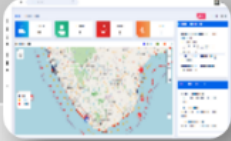
Input Frequency	
Frequency Range	950-2150 MHz
Frequency Tuning Step	1 kHz
Frequency Acquisition Range	± 5 kHz
Input Parameters	
I/P Level Range	-45 to -70 dBm
I/P Impedance	50 Ω
I/P Return Loss	>18 dB
I/P Spectrum Selection	Normal, Inverted
Coding	
Data rate	Selectable 1200bps, 2400bps, 2700bps & 4800bps
Modulation	BPSK, QPSK
FEC	Viterbi, Rate 1/2

Satcom Portfolio - A glance

Tejas Networks (acquired Saankhya Labs in Sept 2024) is the trusted technology partner of **ISRO** (Space Applications Centre (SAC)) and have delivered and deployed a host of indigenous solutions for strategic applications over the last decade

A summary of Tejas Networks Satcom offerings (non-exhaustive list)

Vessel Tacking	Satphone as Add-on device	MSS Modems for Railways	Hub-baseband equipment	Broadcast receiver	User NMS platform	Application software
VTS for Coastal security & fishermen safety	Companion device for Android Smartphone	MSS Modems for Real time tracking of Trains (RTIS – Phase I)	Hub-baseband equipment for RTIS Project	Portable, low-power Sat receiver for Smart devices	Developed & hosted the NMS platform for VTS	Android Application software for VTS, Satphone & receiver
Commissioned a VTS network in Tamil Nadu ~ **3K boats** ➤ **50K boats** in progress	Supplied to ISRO for strategic users ➤ *Can be customized to other L/S Band*	2700+ Trains in operation, BEL was SI partner ➤ *Phase –III opportunity under discussion*	Indian Railways RTIS is running on Saankhya's hub-equipment ➤ *Customizable for Sat-IoT applications*	Supplied to ISRO for strategic use ➤ *Can be customized to other L/S Band*	The VTS network is live in Tamil Nadu state ➤ *IT infra installed & commissioned by Saankhya at SDC*	➤ *Multi-lingual Android app enables the user to send & receive messages via the Smartphone connected to Satcom terminal over Bluetooth*

About Tejas Networks

Tejas Networks is a global broadband, optical and wireless networking company, with a focus on technology, innovation and R&D. Tejas' carrier-class products are used by telecom service providers, utilities, government, and defence networks in 75+ countries.

Tejas has an extensive portfolio of leading-edge telecom products for building end-to-end telecom networks based on the latest technologies and global standards with IPR ownership. Tejas Networks is a part of the Tata Group, with Panatone Finvest Ltd. (a subsidiary of Tata Sons Pvt. Ltd.) being the majority shareholder.

With a focus on deep technology and R&D, Tejas has a rich portfolio of patents and has shipped more than 900,000 systems across the globe. Tejas is ranked #1 in India's Optical Aggregation Market and stands among top ten players globally*.

Tejas Networks is currently the Sole supplier of 4G/5G RAN equipment for one of the largest mobile networks in the world!

>1,000,000	> 500	> 75	>30+	15
Network Elements	Networks	Countries	Prestigious Awards	Global Offices

Disclaimer

Thank you

Q&A

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