NavIC and MSS based Messaging and Surveillance Applications

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NavIC Messaging Service

- NavIC Satellites have a message “Type 18” in secondary navigation data for broadcasting text message
- NavIC 1A satellite has been dedicated to messaging service
- NavIC 1A messaging services are provided in L5(1176.45 MHz) and S(2492.028 MHz) frequencies. User receiver can be operated in single and/or dual frequency operation mode.
- The signal is BPSK(1) modulated on L5 and S bands. The navigation data rate is 50 sps (1/2 rate FEC encoded) and PRN code chipping rate is 1.023M cps.
- NavIC 1A data is transmitted in sub-frame. Sub-frame is 600 symbols (16 bit Sync word followed by 584 bits of interleaved data) transmitted at 50 sps. The 584 symbols of interleaved data is obtained from FEC encoding 292 sub frame bits.
- Each sub-frame of 292 bits contains 220 bits of message data.
- Message data length can be ranging from 220 bits to 2220 bits. For messages exceeding the 220 bits, the longer message is fragmented and sent in the subsequent frames.
- **Different types of services can be given different priorities since messages are scheduled based on priority.**

NavIC Message Definition

1	9	26	27	28	30	31	37	257	263	287
TLM	TOWC	ALERT	RESERVED	RESERVED	RESERVED	MESSAGE ID	DATA	PRN ID	CRC	Tail
8 BITS	17BITS	1 BIT	1 BIT	2 BIT	1 BIT	6 BITS	220 BITS	6 BITS	24 BITS	6 BITS

Service ID	Seg.Count	Seg.ID	HWA1 Clear	HWA2 Clear	Spare	Port name 1	HWA message 1	Port name 2	HWA message 2
4 bits	4 bits	4 bits	1 bit	1 bit	34 bit	8 bits	78 bits	8 bits	78 bits

Example of a typical warning message with Message ID 21

NavIC Message Definition

- The sub frame is tailored to support messaging
- It contains 6 bit message ID, so 64 different types of messages can be transmitted
- Definition of 220 bits is left to user
- One such user is INCOIS (Indian National Centre for Ocean Information Services)
- Message Id 20 and 21 are allocated to INCOIS
  - Potential Fishing Zones (PFZ) – Msg 20
    - One sub frame can send 9 PFZs and will be repeated for more numbers
  - Emergency messages– Msg21 which further divided with service IDs
    - High Wave Alert Service ID 0111
    - Cyclone Alert Service ID 1111
    - Tsunami Alert Service ID 0011

IRNSS-1A messaging service overall flow

USER

- Users need to register in WIMS or via SFTP
- User will load Messages to WIMS Server or to SFTP

INC, ISTRAC

After successful registration message will be received by INC

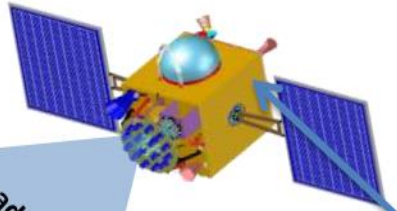
NAV S/W, INC

Navigation software at INC generates desired message and forward for uplink
INCOIS msg IDs are 20 and 21

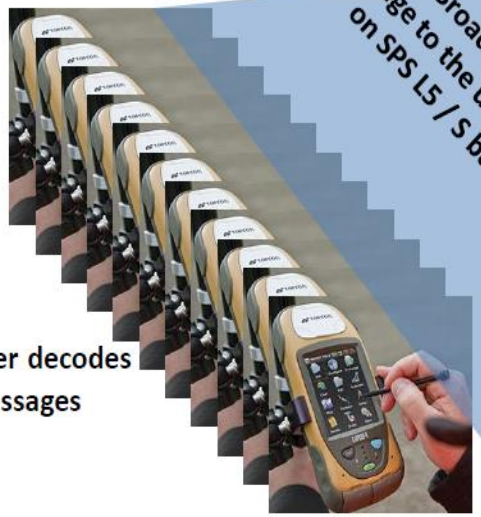
MCF , SCES

Message transmission to the IRNSS-1A satellite from MCF

IRNSS 1A

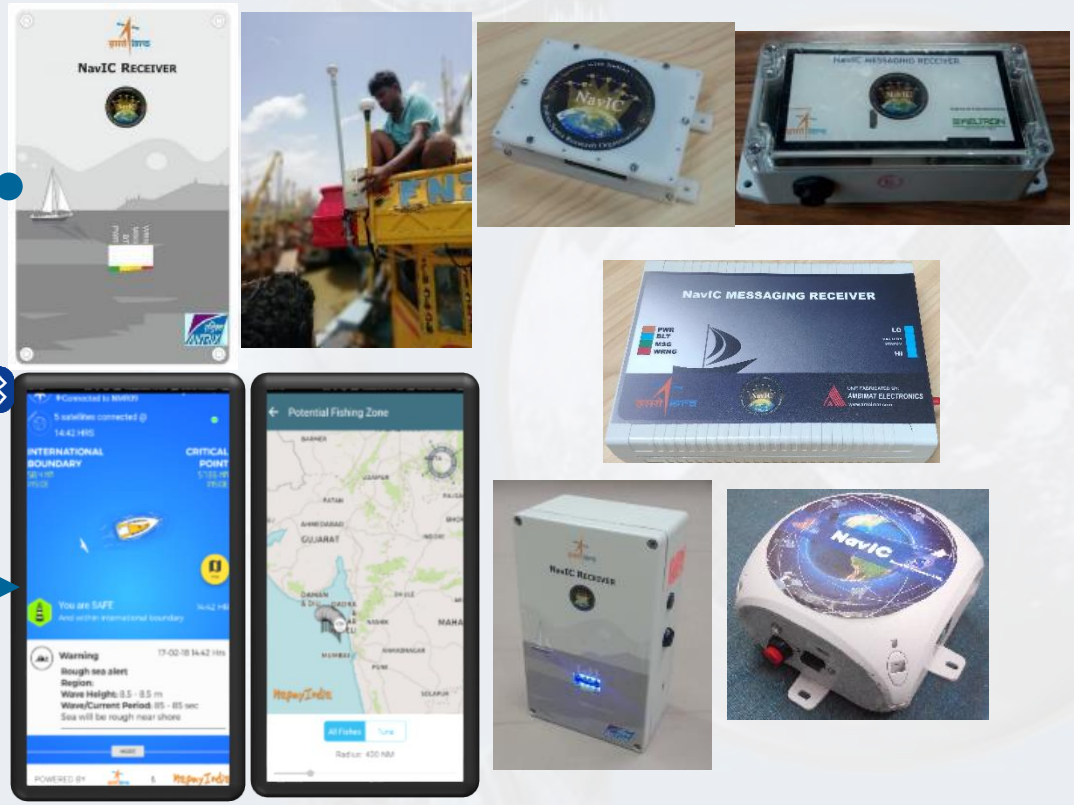


Broadcast of message to the user receiver on SPS L5 / S bands



User decodes messages

NavIC Messaging Receiver



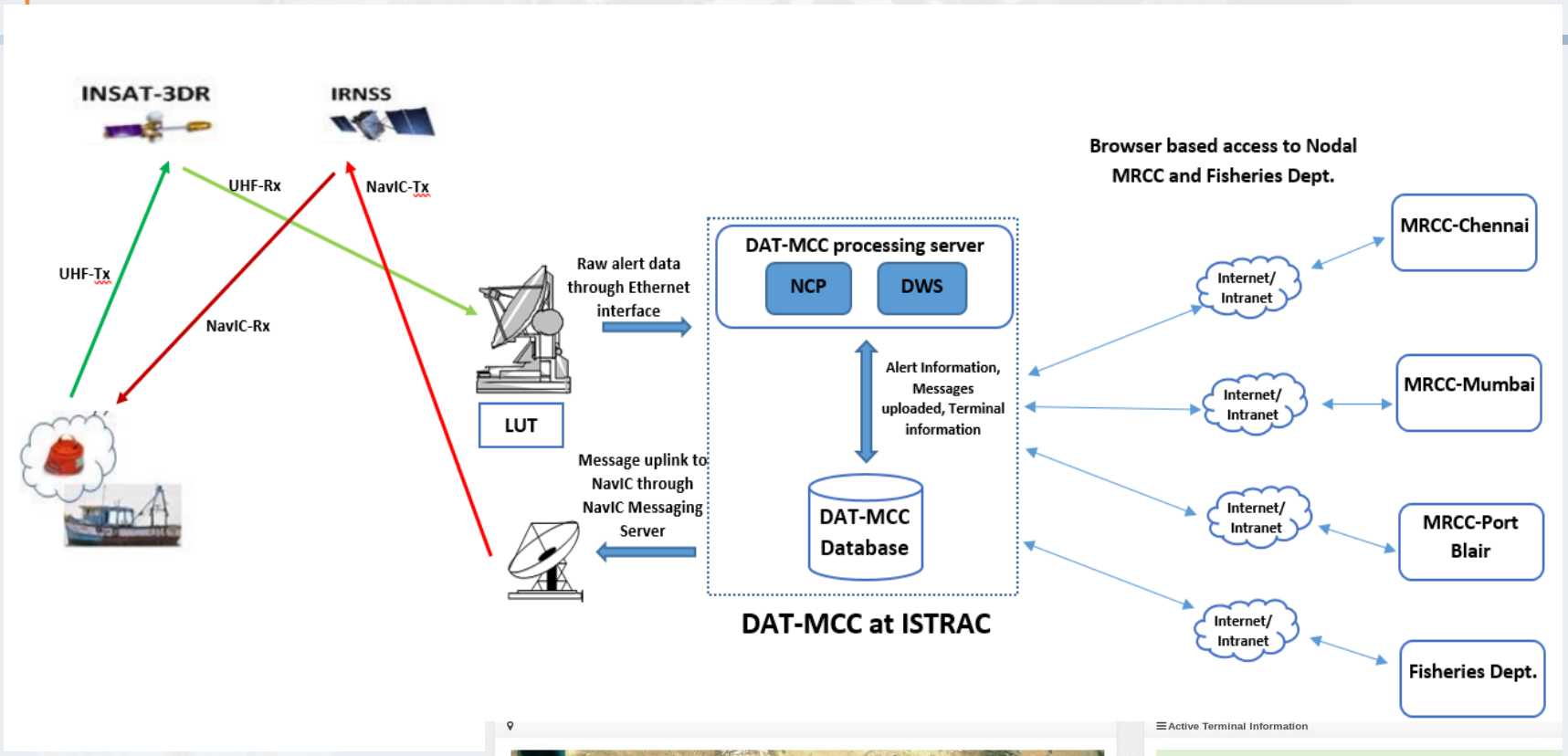
- NavIC based Messaging Receiver has been designed at ISRO
- It has Bluetooth connectivity with user Cell phone and audio alarm with 5 days battery capacity
- Technology of the design has been transferred to many Indian vendors for manufacturing of units
- Mobile app supporting audio/visuals alerts for Fisherman in 13 different regional languages

UHF Transmitter with NavIC Receiver

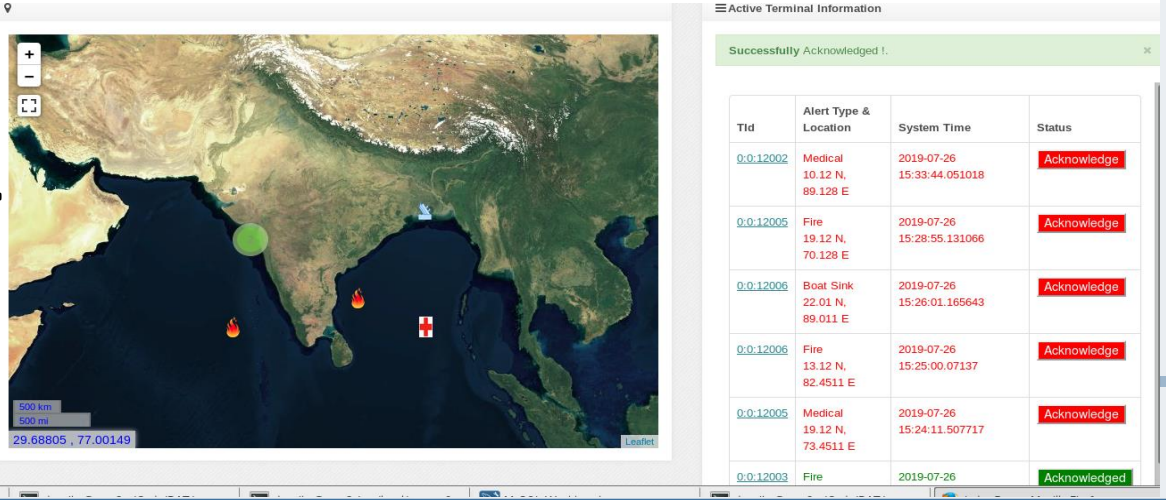
➢ **Distress Alert Transmitter**

- For Emergency Reporting by Fishermen using DRT transponder of INSAT (402.65-402.67 MHz)
- Six types of messages based on Manual Activation
- Sends its position along with distress type
- It is one way in nature
- DATs are in use since quite a long time
- Being upgraded by combining with NavIC Messaging service
- Message Acknowledgement using NavIC Messaging
- PFZ, Cyclone, Tsunami Warning using NavIC Messaging Channel
- Low Cost battery operated terminal
- Limited Short Messaging Possible from fisherman to HUB

DAT-2G Network Diagram



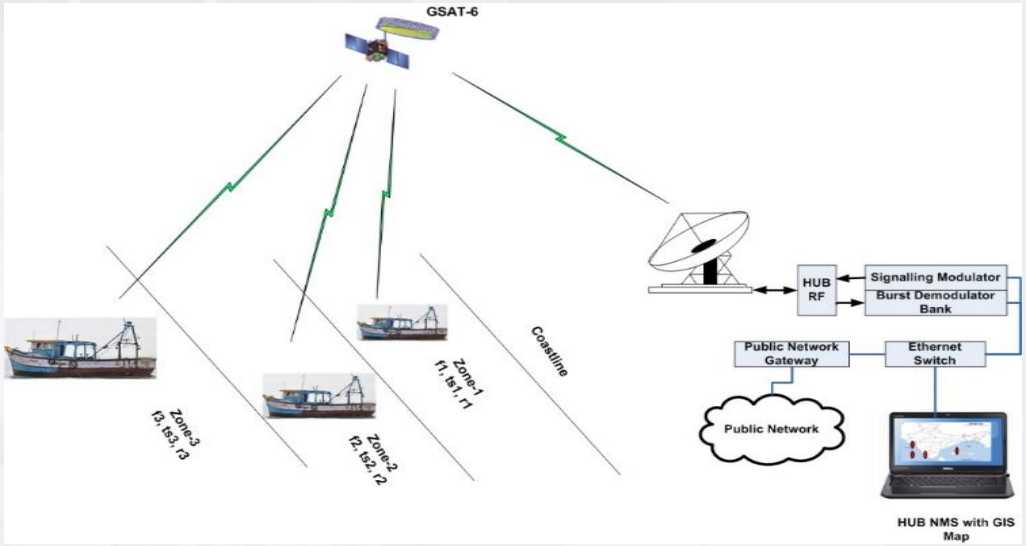
Display at Web Server

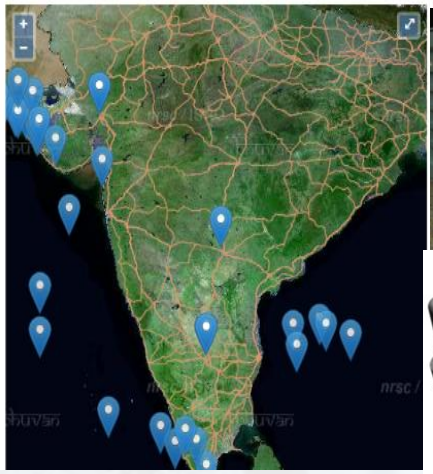


MSS NETWORK FOR TRACKING OF Sub-20m BOATS

MSS Network designed for

- Satellite based automatic periodic tracking of boats/ships
- Emergency Messaging (SoS) from Boat/Ship to Control Station
- Emergency Broadcast from Control Station to Boats/Ships
- Mobile App for Connectivity to MSS Terminal using Bluetooth/ Wi-Fi
- Technology developed and available through multiple vendors.
- **Salient Features of terminal**
  - Forward Link: 9.6kbps
  - Return Link: 2.4kbps
  - Channel Access: Dynamic TDMA
  - In built GAGAN/NavIC for position
  - Bluetooth/Wi-Fi Interface
  - IP 65 compatible package
  - Battery back up and light weight

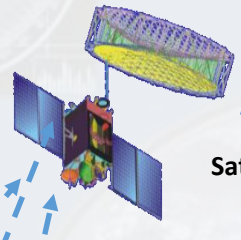




MSS Terminals

Position Reporting from Boats

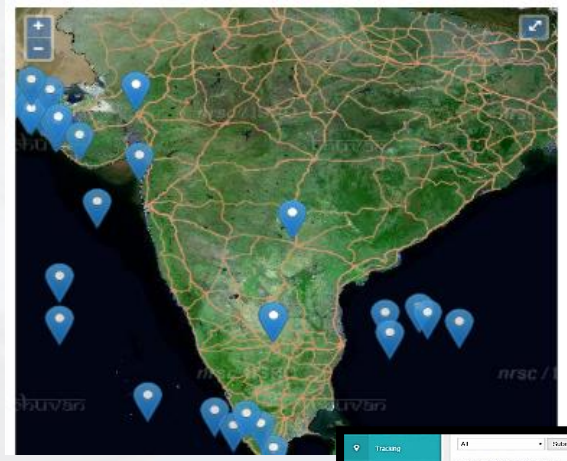
Each boat report its position once in every 15 minutes



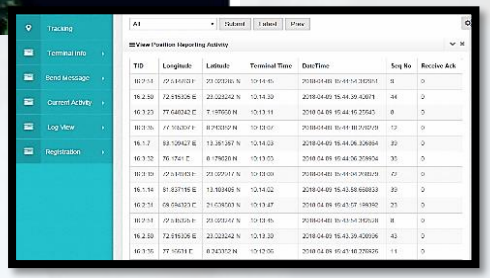
Satcom

Internet

Satcom

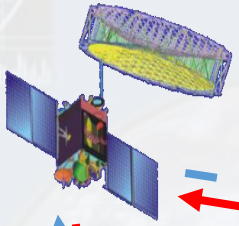


Position Reporting at allocated time

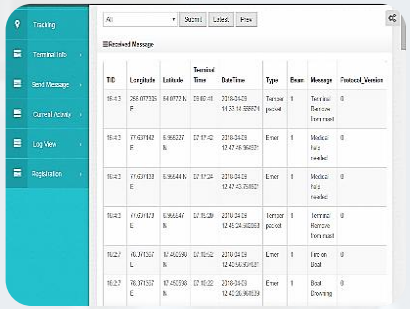


Coast Guard, Fisheries , Boat Owners will be able to view the boat location in real-time

Messaging Service between Boat Owners & Fishermen



Satcom



At Hub or Control Centre

Satcom

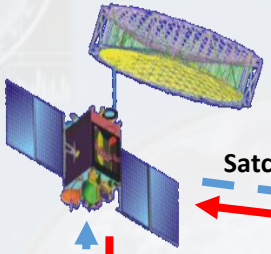
Messaging from Fisherman with acknowledgment

Internet

Boat Owner's Mobile & App

User Interface

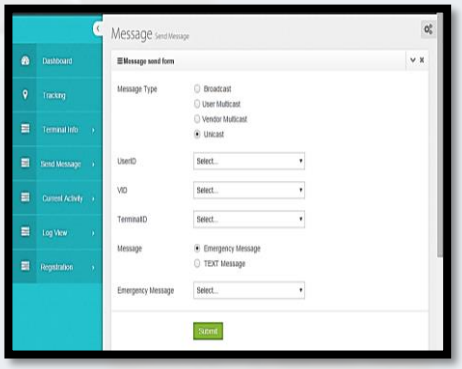
Emergency Warning Broadcast to Fishermen



Satcom

Satcom

Emergency Warning Broadcast



HUB/Control Centre

Cyclone

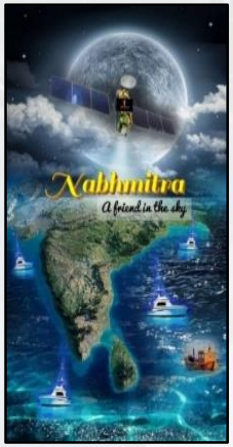
Bluetooth

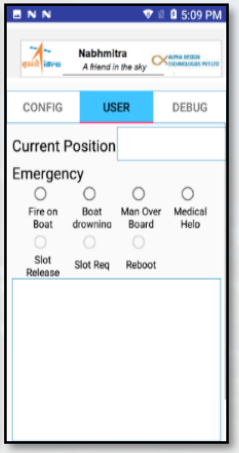
Internet/LAN

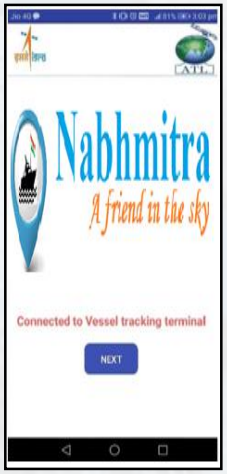
Warning Message

INCOIS/IMD/ISRO/
Identified state agencies

MSS TERMINAL & ANDROID APPLICATION SNAPSHOT



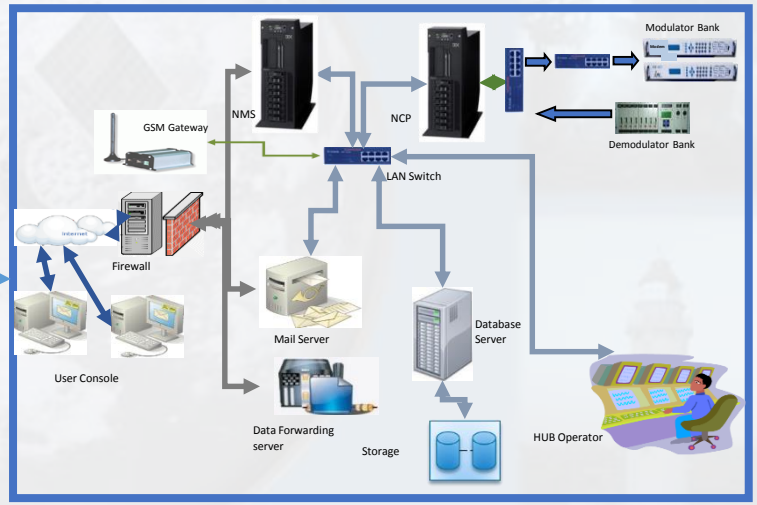




MSS HUB FOR TRACKING OF SMALL BOATS

Feature of MSS HUB for tracking of small boats:

- 11m C-band earth station at SAC, Ahmedabad used for pilot project
- 11m HUB at Delhi Earth Station to be used for operational phase
- Network Control Processor and Network Management System developed.

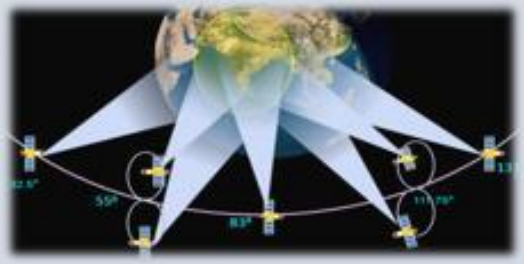


HUB Baseband System

Salient Features of NMS:

- Dynamic Slot Management ,
- User Agency Based Terminal Management
- Emergency Messaging (Unicast, Broadcast, Multicast / Vendor wise etc)
- Unique Numbering Scheme & terminal management

The HUB / Control centre is at ISRO, Ahmedabad & 960+ terminals are fitted in Tamilnadu, Gujarat states and Puducherry UT



Thank You