GAGAN & IRNSS - Signal In Space Utilization Plan

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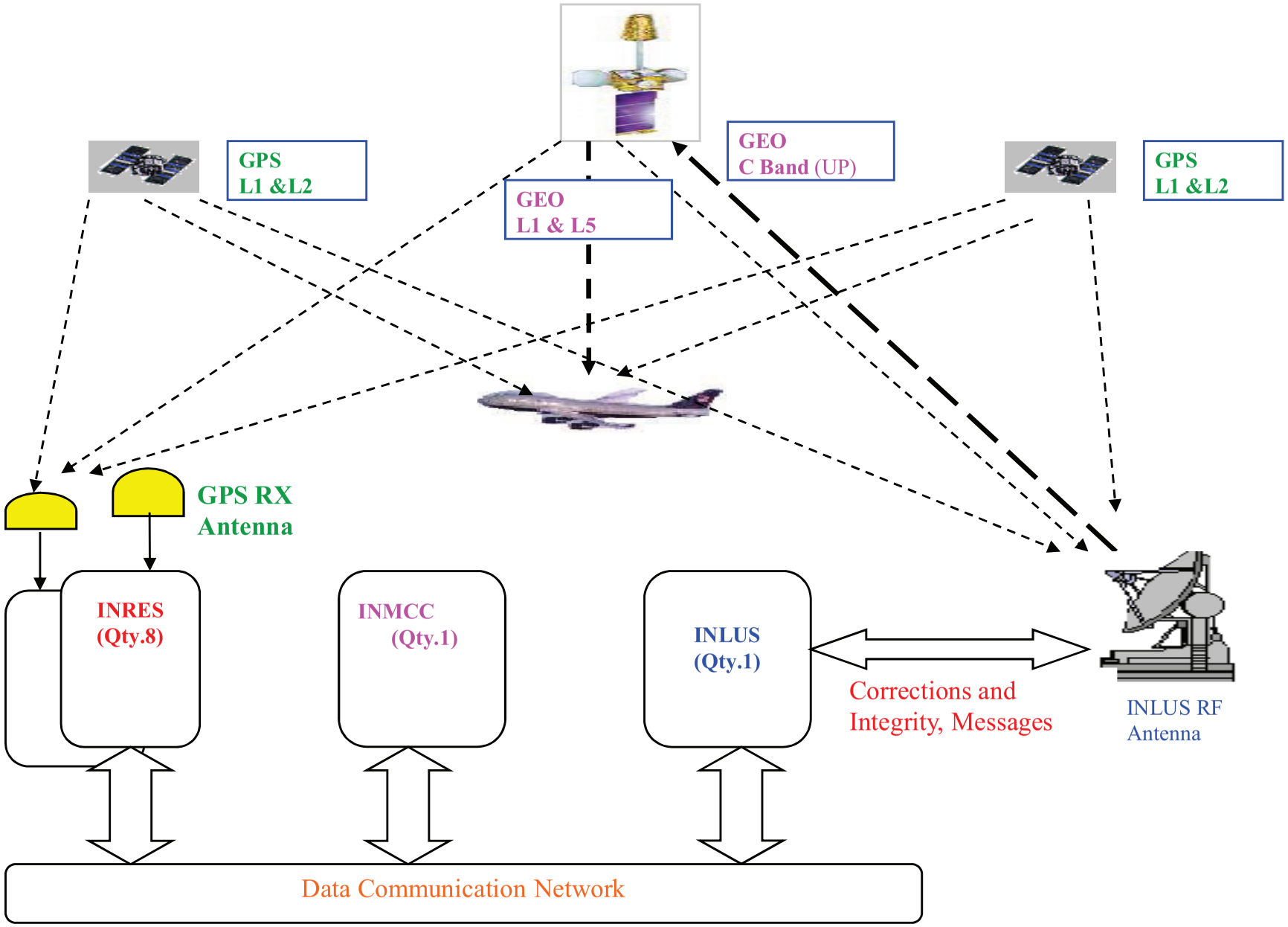
6th ICG, Tokyo, Japan

September 4-9, 2011

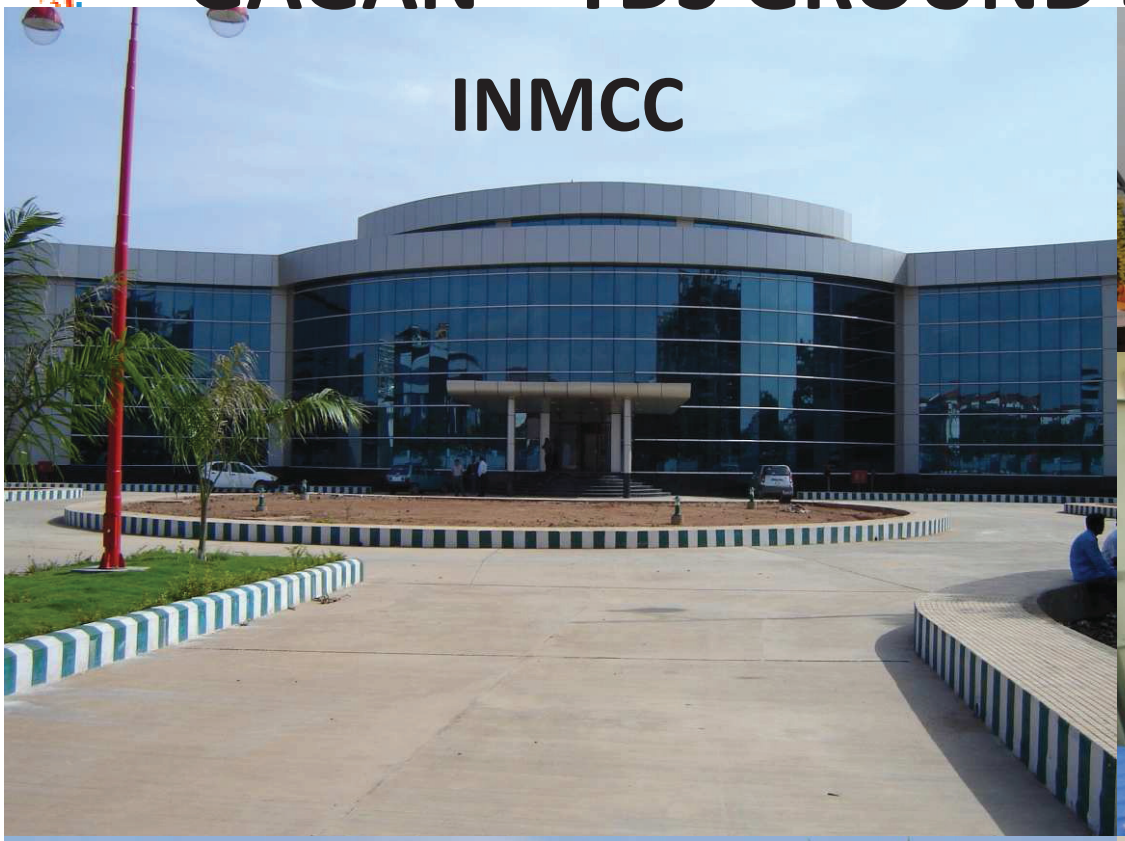
Things to Follow….

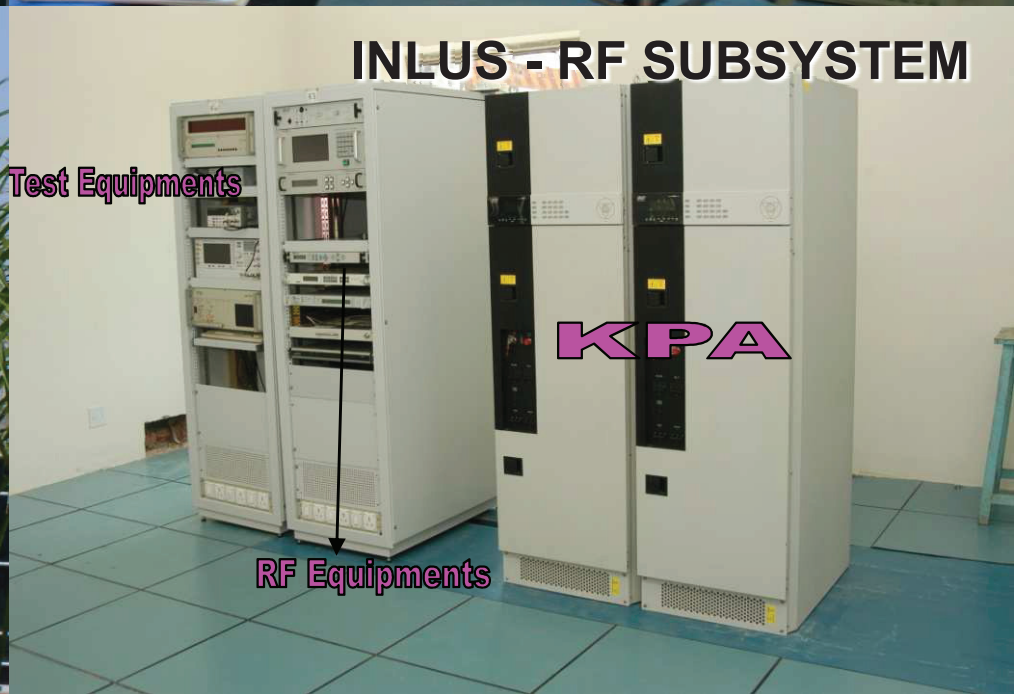
- GAGAN-TDS
  - Architecture
  - Flight tests using GAGAN SIS
- Next Steps in SIS utilisation
- GAGAN/IRNSS Applications

GAGAN-TDS Architecture

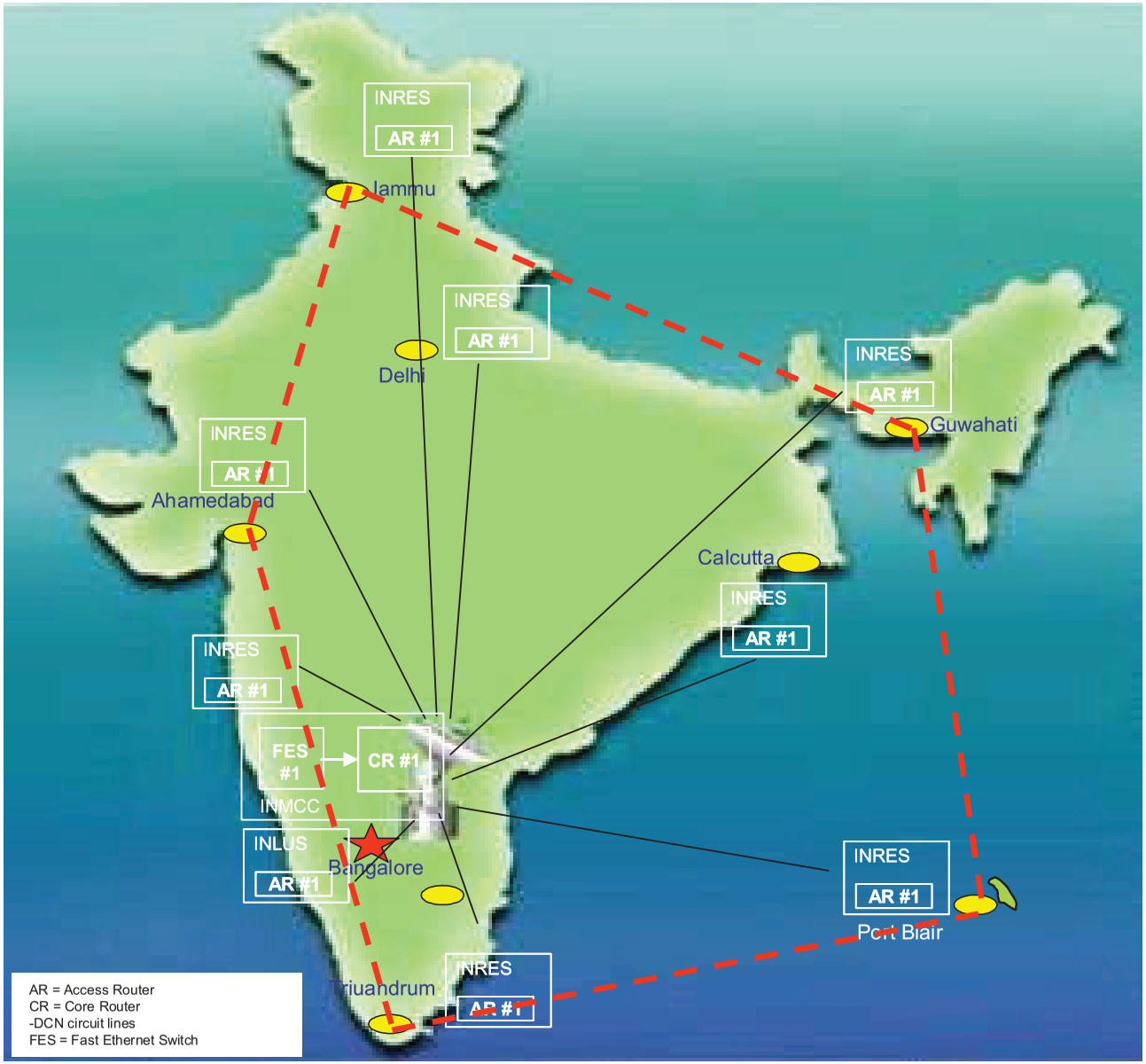


GAGAN – TDS GROUND SEGMENT ELEMENTS





TDS Configuration for FSAT (13-14th August, 2007)



Ground Segment

- 8 INRES: 2 INREEs
- 1 INMCC
- 1 INLUS
- 1 ring of OFC (7 INRES)
- 1 VSAT link (Port Blair)

Space Segment

- INMARSAT-4F1 (L1 downlink to user)

- Accuracy evaluated (7.6m) within the perimeter of the GAGAN-TDS INRES (Bangalore, Delhi, Kolkata)

Tests with GAGAN SIS

- Static tests at INRES locations (Bangalore and Delhi)
- SIS verification at fringe area (Dibrugarh & Agatti)
- Low dynamic test
- Dynamic tests using NRSA a/c and DGPS (Differential GPS) stations (Bangalore to Hyderabad)
- Dynamic tests with FIU (Flight Inspect Unit) aircraft of AAI (Calicut & Bangalore)
- Dynamic tests using certified airborne receivers (Accord S/w) on NRSA a/c
- Data analysis using DGPS & SBAS on FIU a/c
- Establishment of GAGAN ARP (Airport Reference Points)
- Non-civil aviation users (Port trust)

SBAS Receiver on FIU Aircraft, NEW DELHI

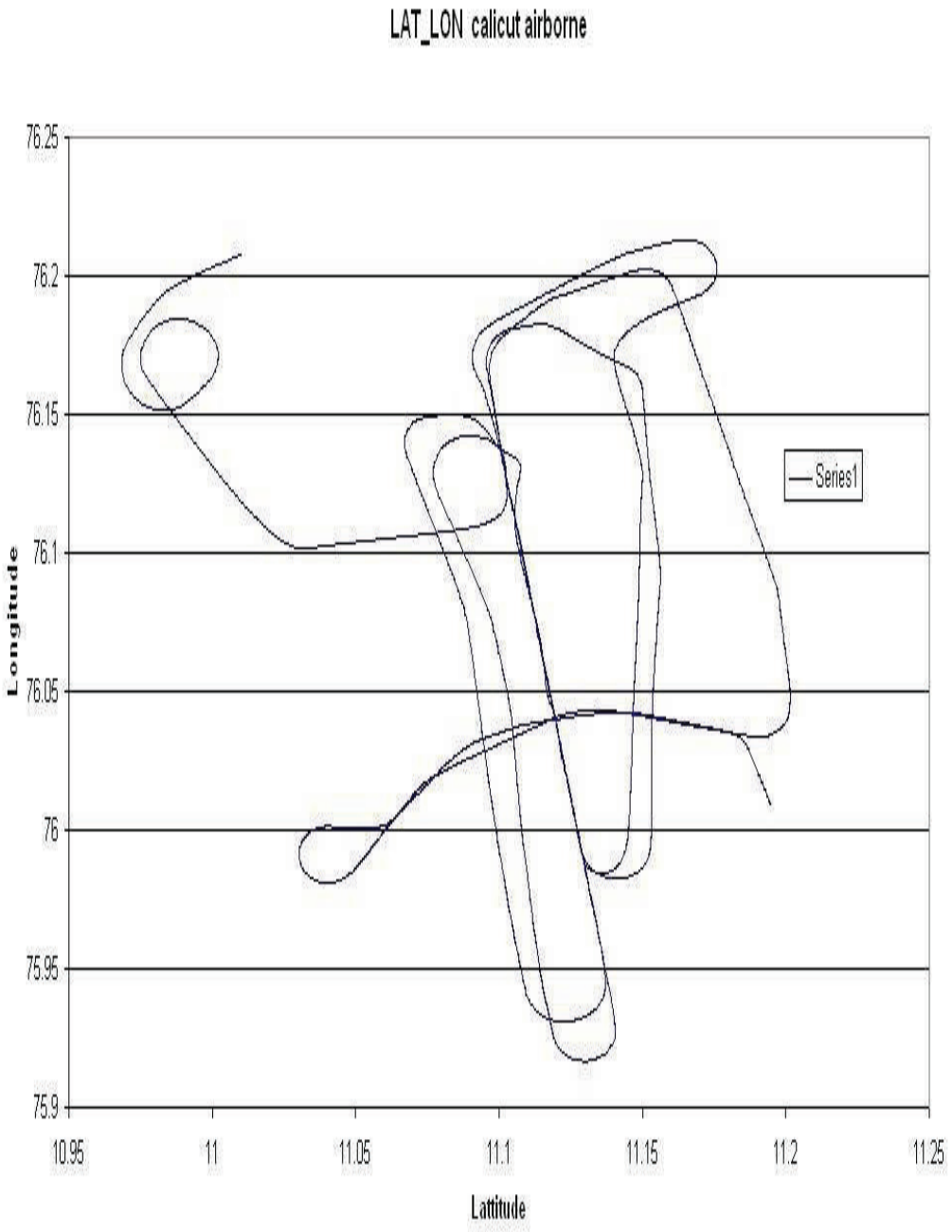
GPS Antenna

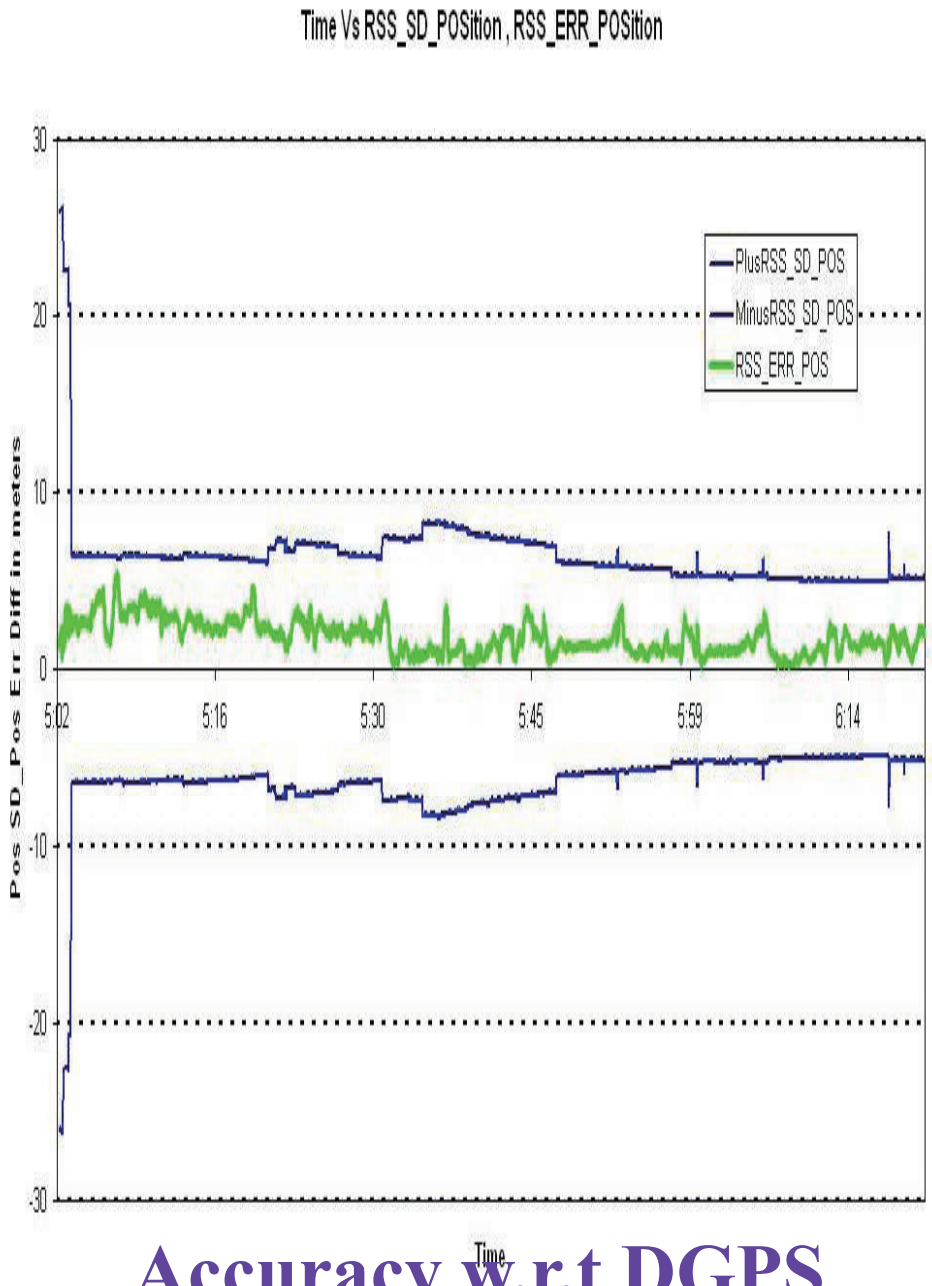
SBAS Antenna

DL-4 SBAS Receiver

ProPack GII DGPS Receiver

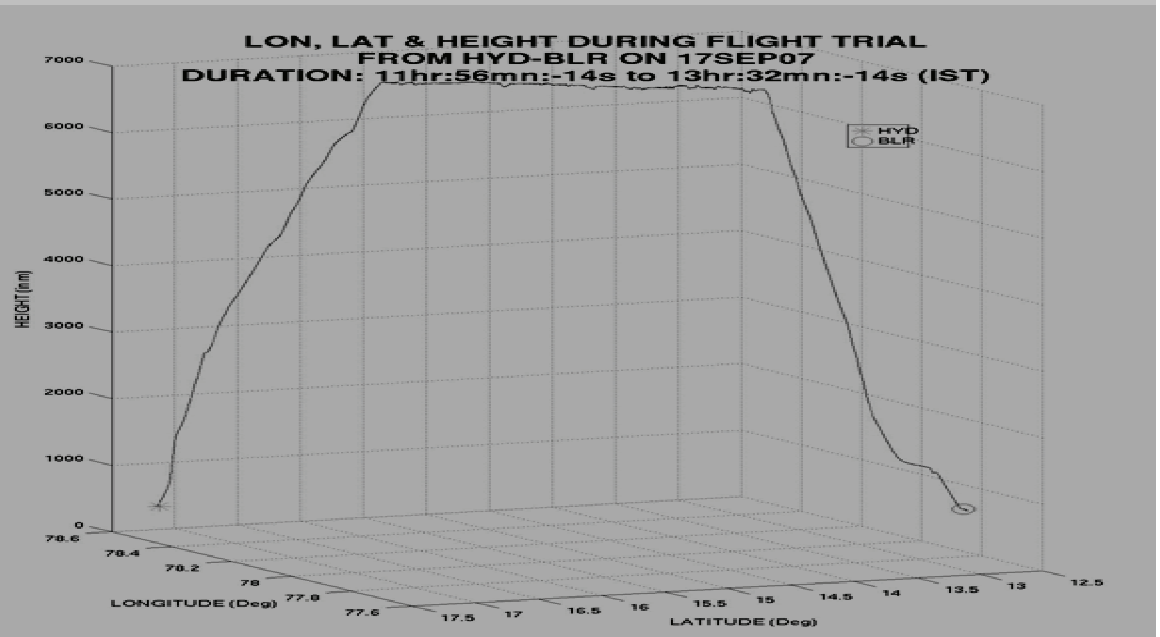
Flight Path around Calicut



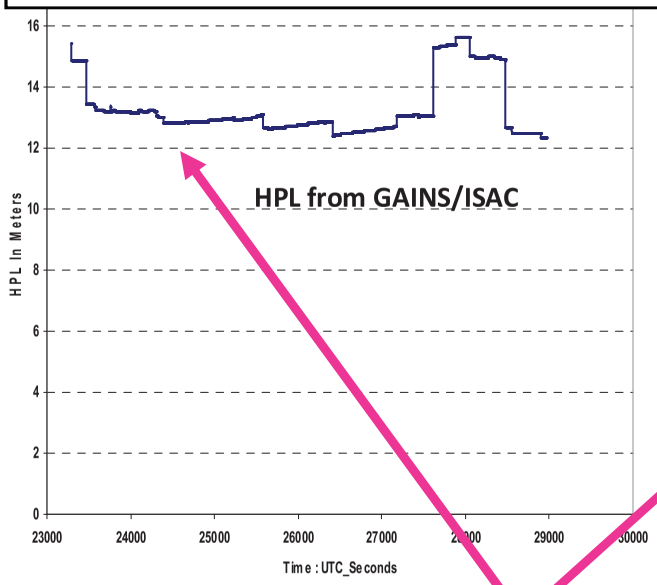


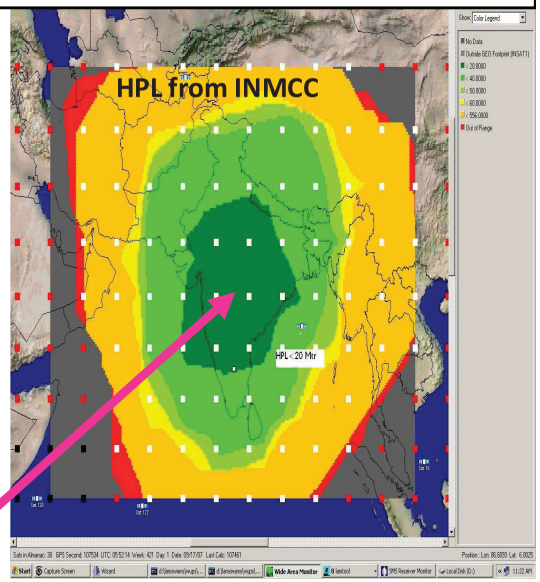
Accuracy w.r.t DGPS

Flight Path from Hyderabad to Bangalore on 17th Sep 07



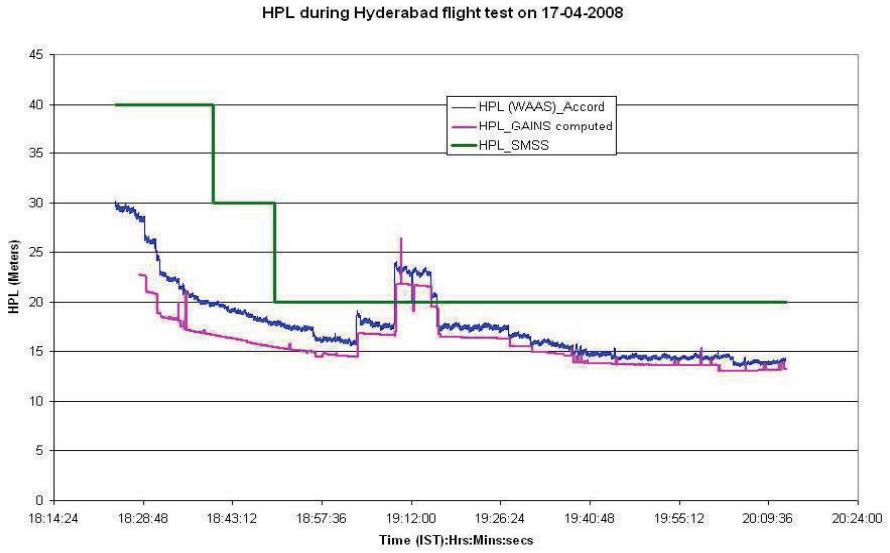
HPL computed for the flight path and HPL contour for the same duration from INMCC on17th Sep.

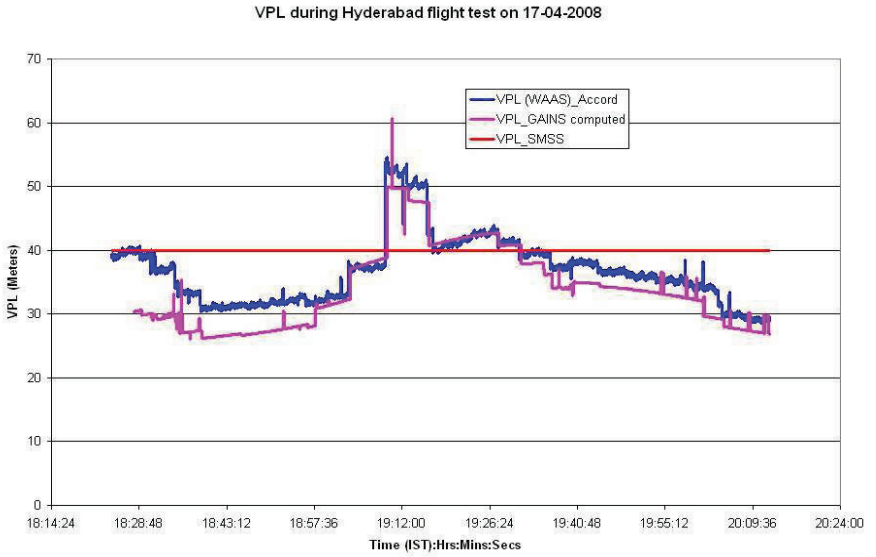




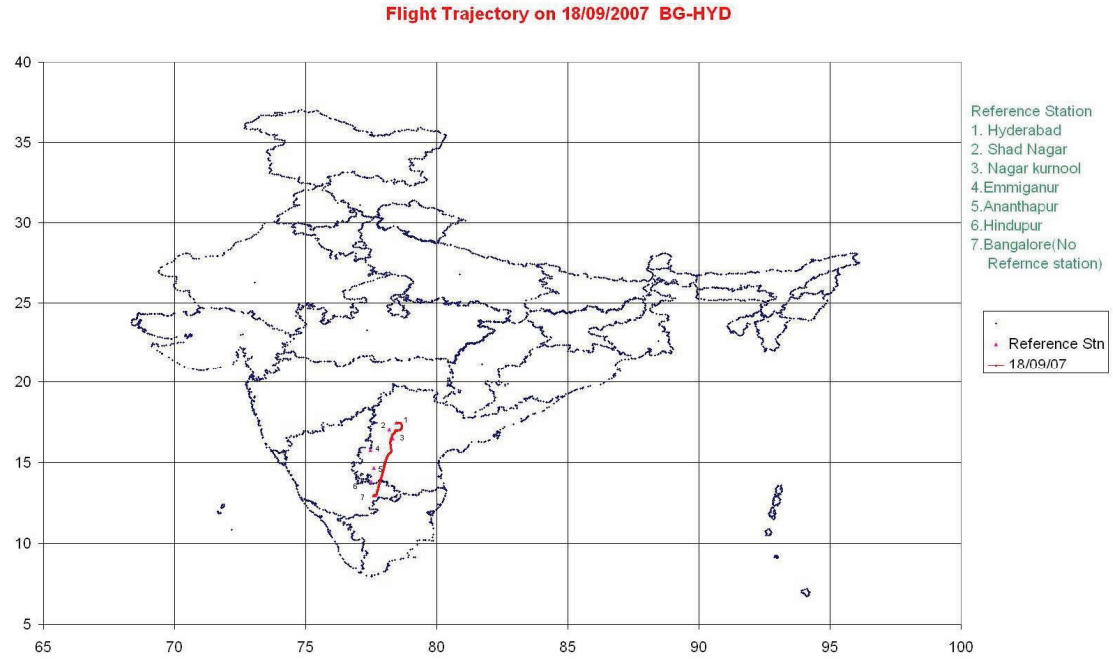
HPL< 20 m (SL:LNAV/VNAV)

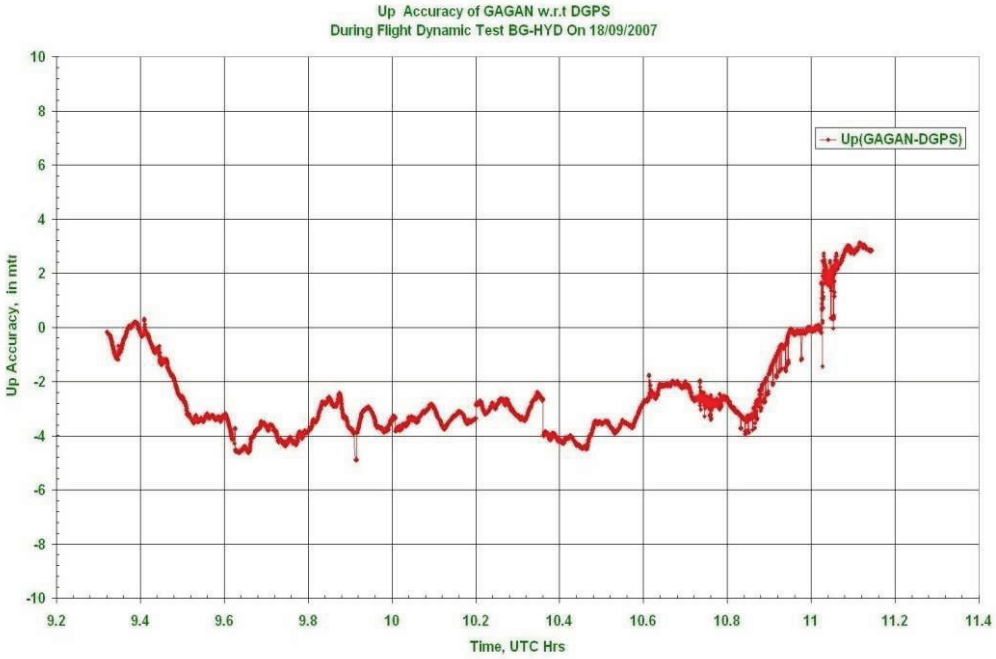
Certified Indian SBAS Receiver flight tested



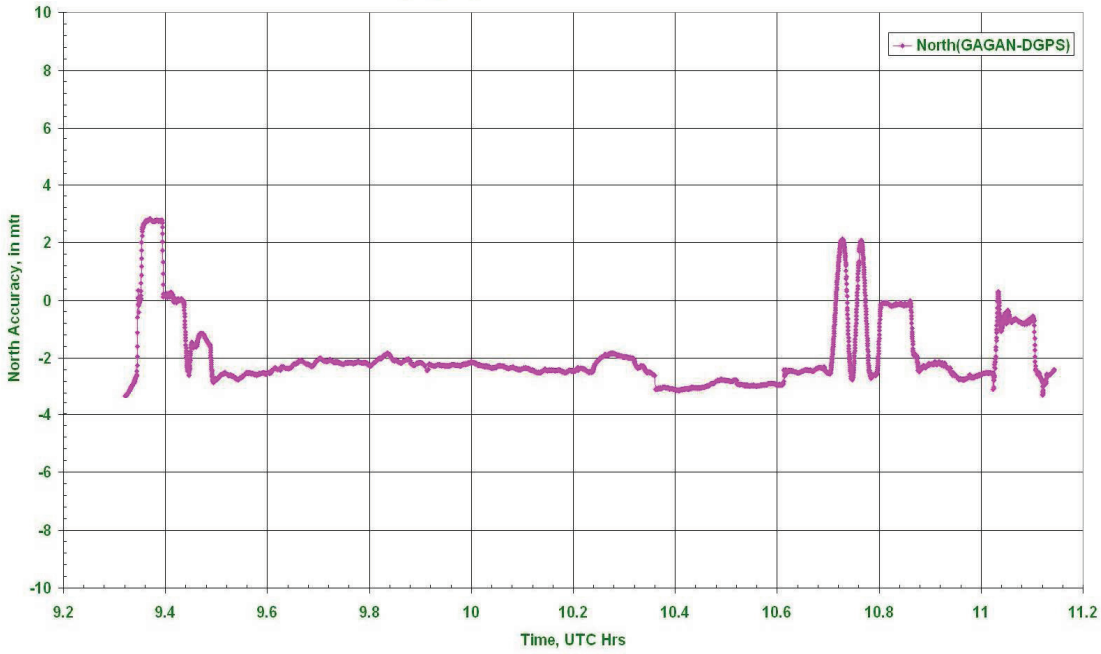


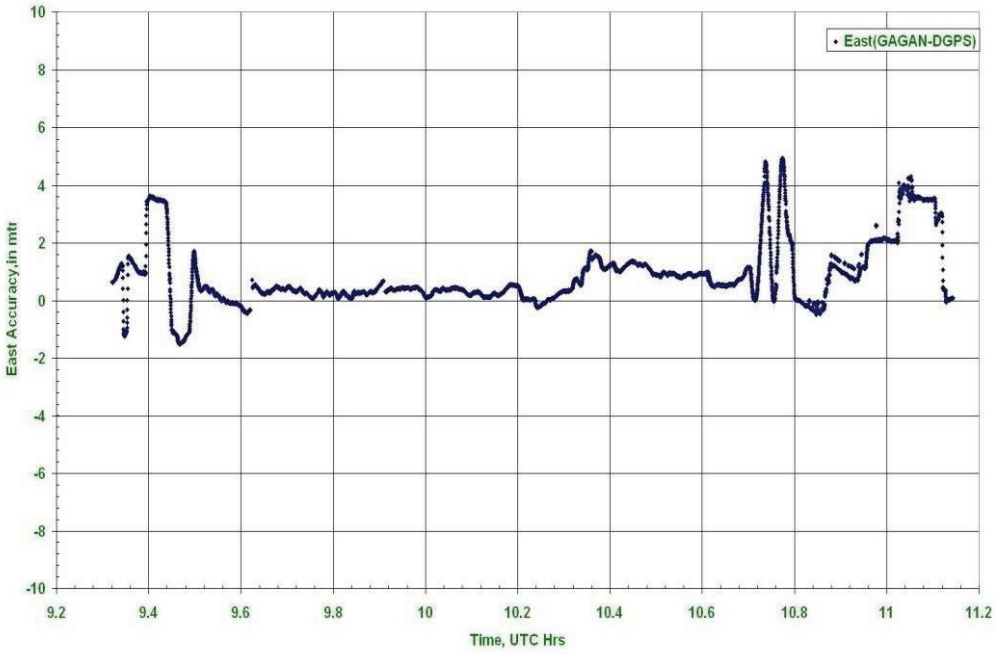
Position Accuracy of GAGAN, BG- HYD Sortie on 18/09/2007



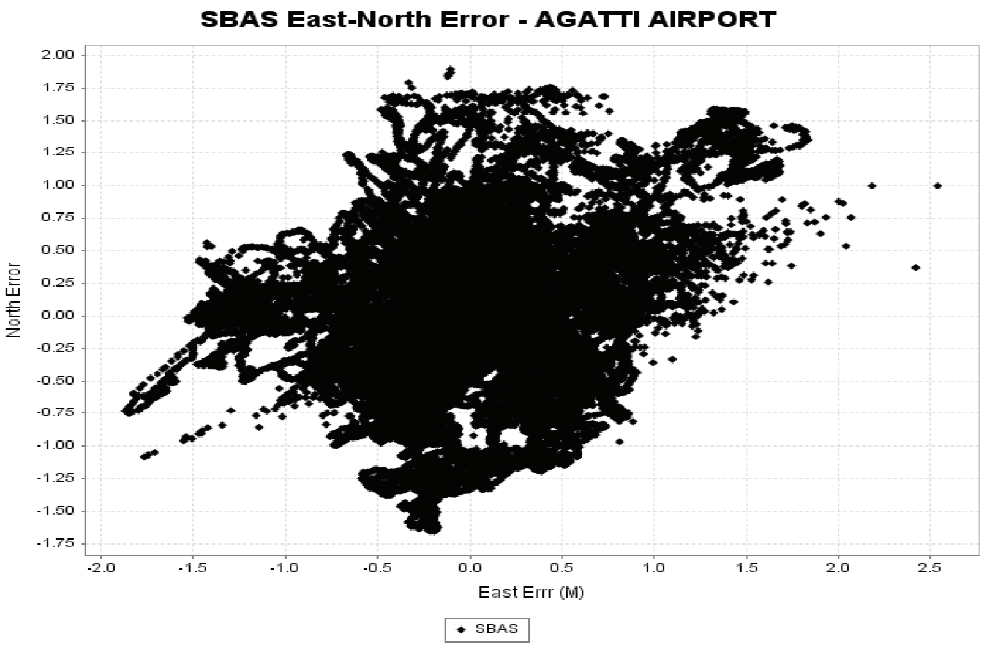


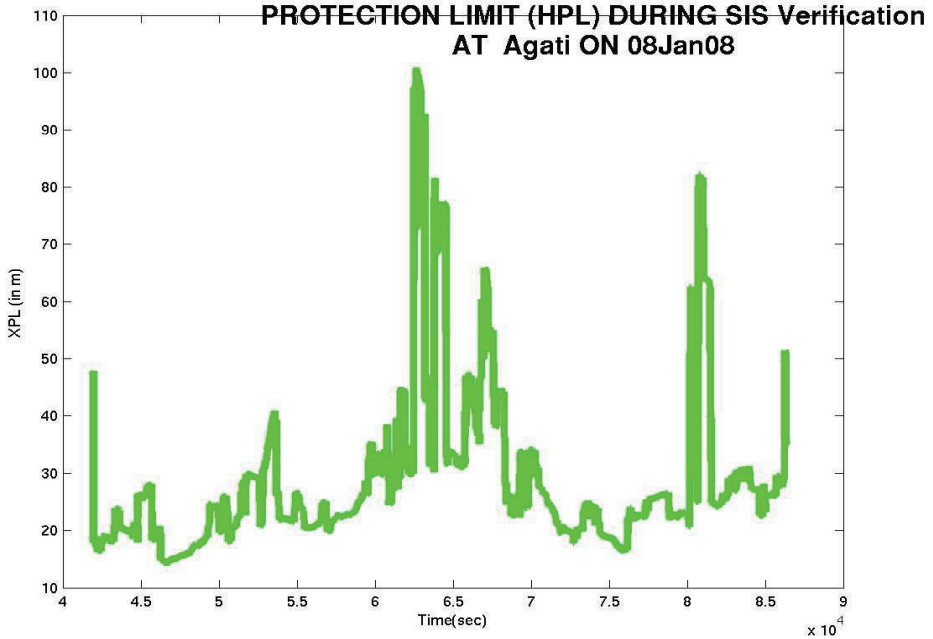
100% less than 7.6m threshold value

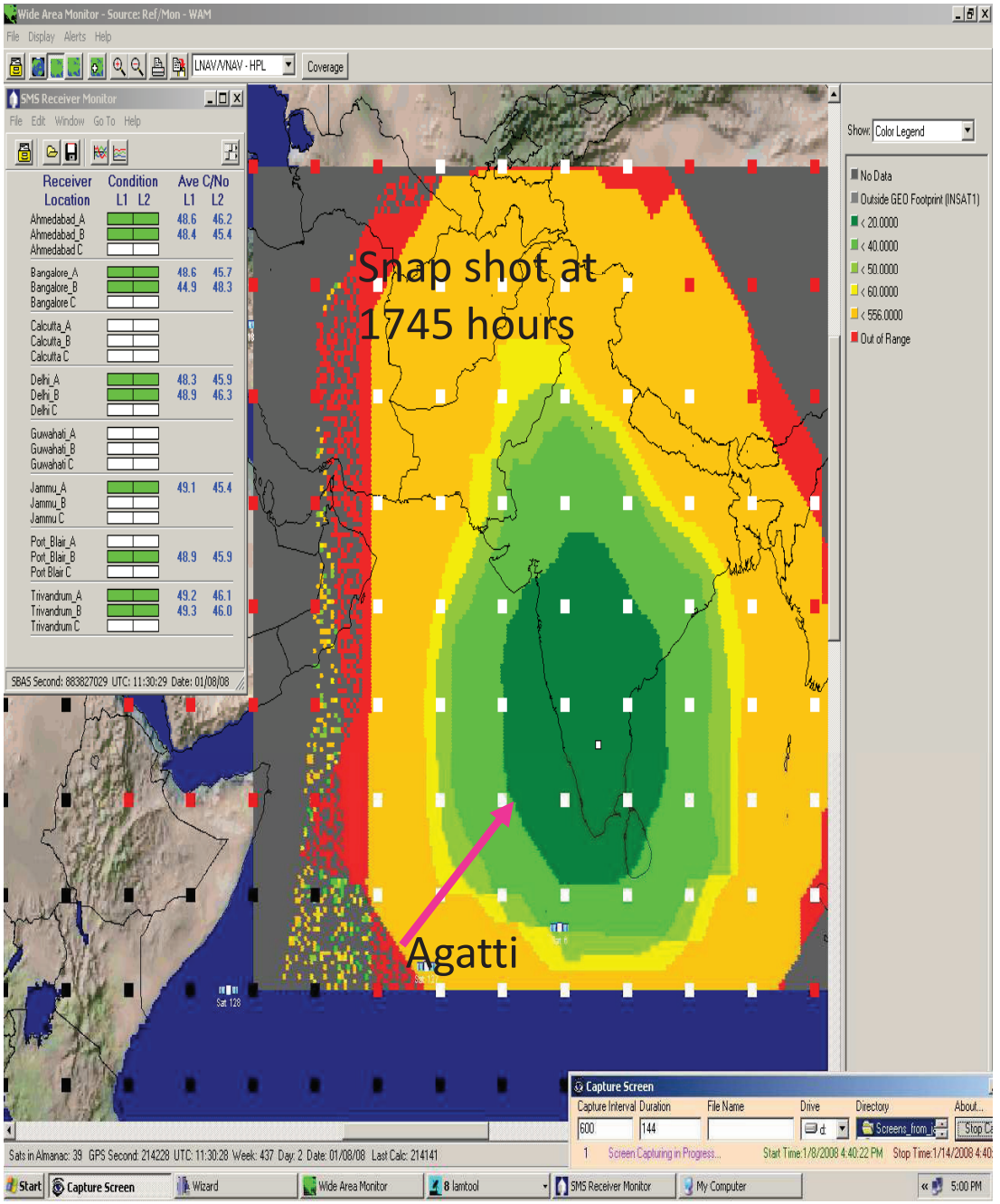




SIS Verification at Agatti (HPE & HPL on 08-01-2008)







Next steps in SIS utilisation

- Verification of system performance for various operations
  - Aviation user performance requirements
    - Flight test
      - Approaches, at 8 identified geographically distributed locations
      - En route flight testing
    - Monitoring at fixed locations
      - INRES locations
      - Identified GARP locations (SIS Verification)

SIS utilisation plans

1) Build user support, especially to encourage the introduction and use of receivers by non-aviation applications. Particularly,
   - Maritime navigation
   - Establish the use of SBAS for land mobile

2) Encourage receiver development -by maintaining the SIS

3) Allow the flight inspection aircraft, airline operators and crews to familiarize themselves with the signal and system performance

4) Ministry of Shipping (Requirement of 5 m accuracy across Brahmaputra river and Ganga, Bhagirathi-Hooghly river system – to be demonstrated)

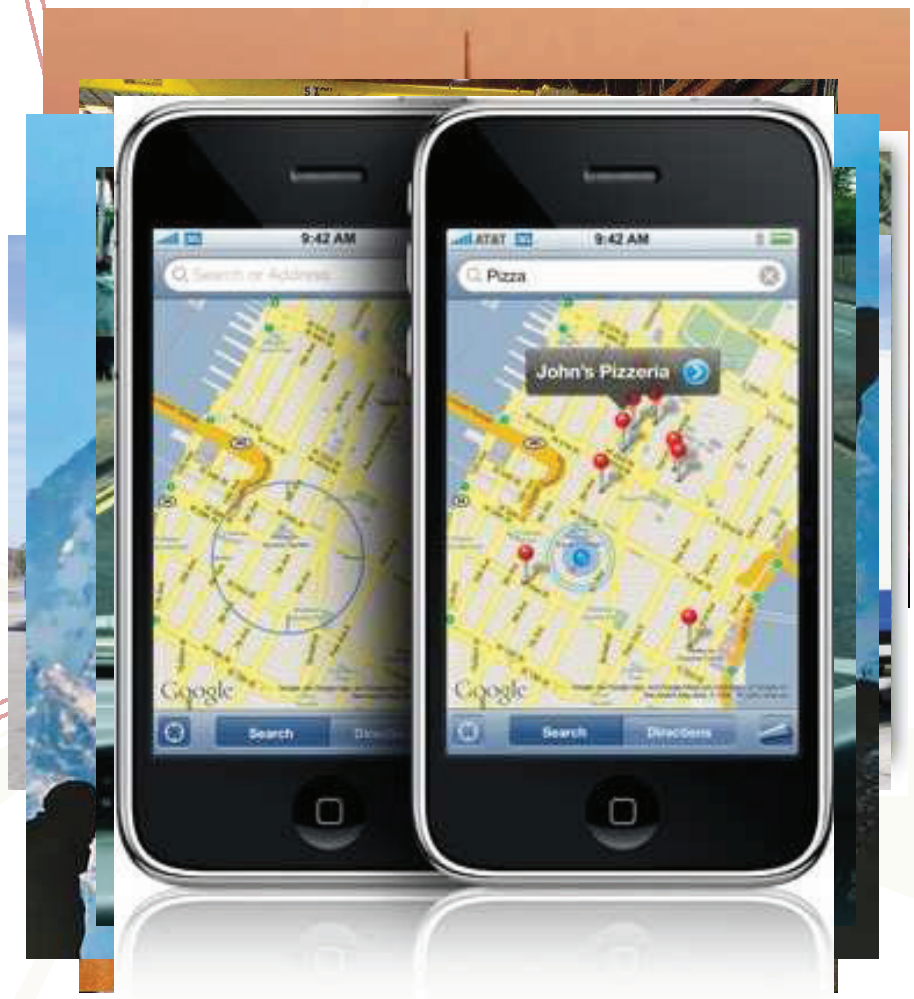
Inland Waterways – GAGAN Application

Potential GAGAN/IRNSS Applications

- Agriculture
- Maritime
- Remote Sensing, Surveying, Railroad
- Precision Timing
- Mining/Geology
- Banking
- Power, Construction
- Telecommunications
- Emergency, Law Enforcement
- Weather, Disaster Response
- Recreation
- Environmental Studies

GAGAN/IRNSS: Applications

- Avionic navigation and precise landing system (GAGAN)
- 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