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Benefits of GAGAN to Non-Aviation users

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GAGAN (GPS Aided Geo Augmented Navigation)

Jointly Developed by ISRO and AAI



Deploy and certify an operational SBAS over the Indian Flight Information Region (FIR) with inter-operable capability with other SBAS services in the world



GAGAN

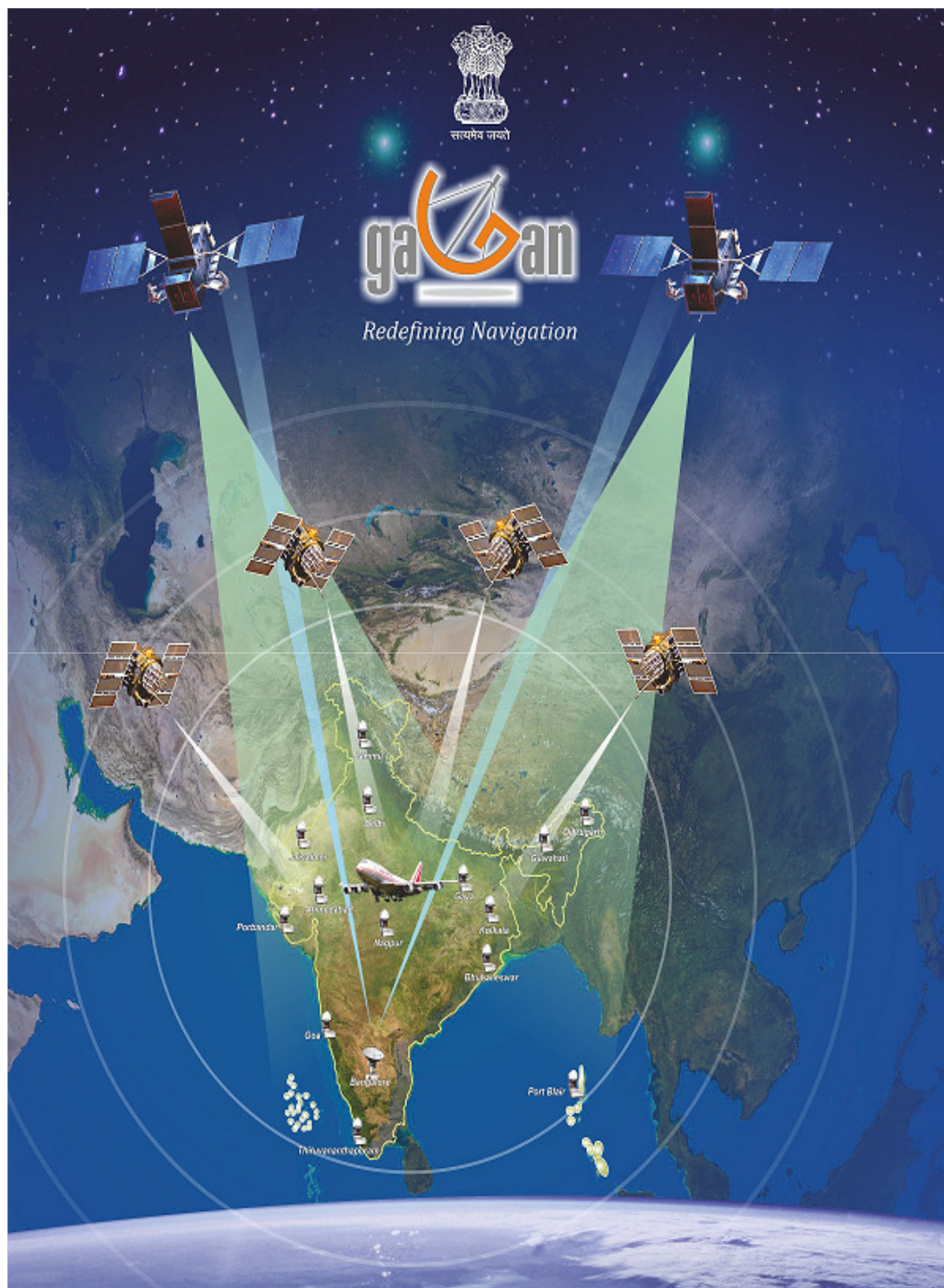
India's FIRST satellite navigation system & 4th SBAS in the World

**CERTIFIED
RNP0.1 OPERATIONS
ON 14-02-2014**

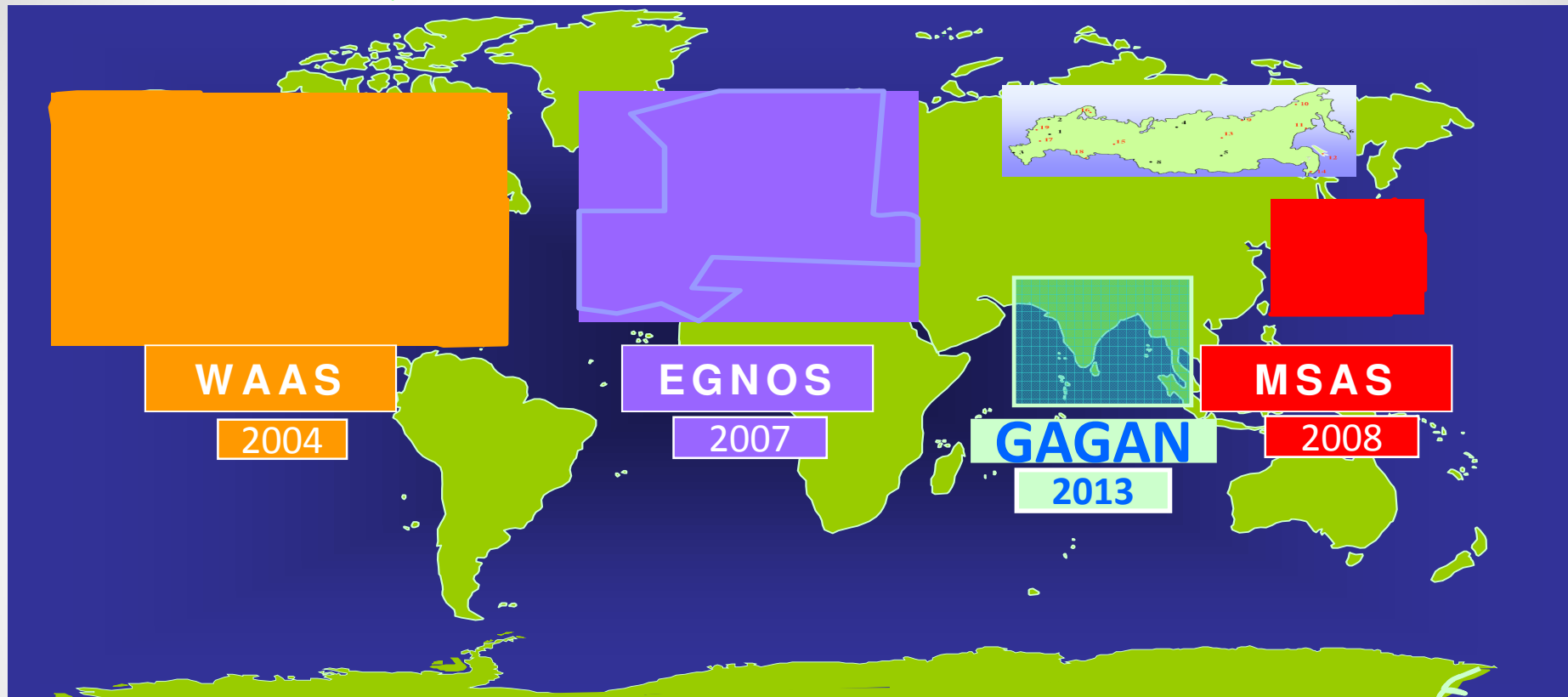
**JOINT PROJECT
OF
ISRO/AAI**

**TO PROVIDE
APPROACH WITH VERTICAL
GUIDANCE**

**EXPECTED BY FIRST QUARTER
2015**



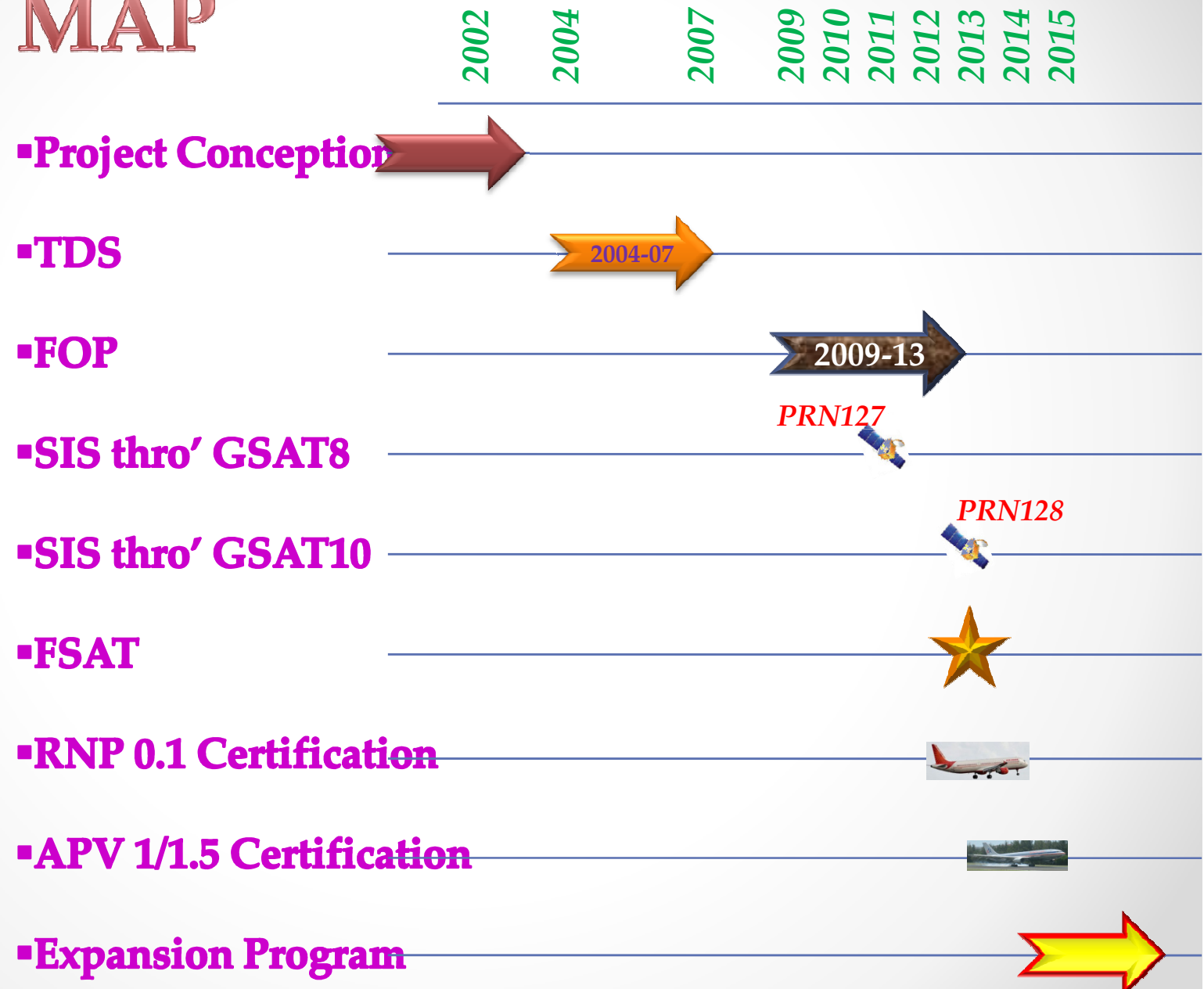
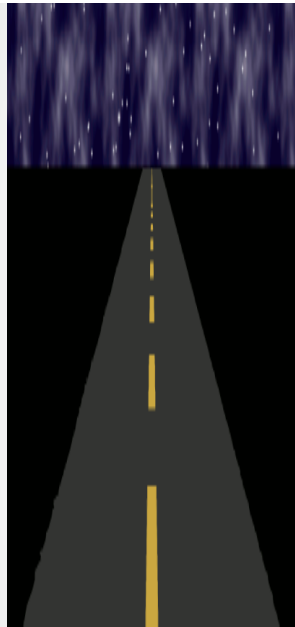
GAGAN Support for Seamless Navigation in the world



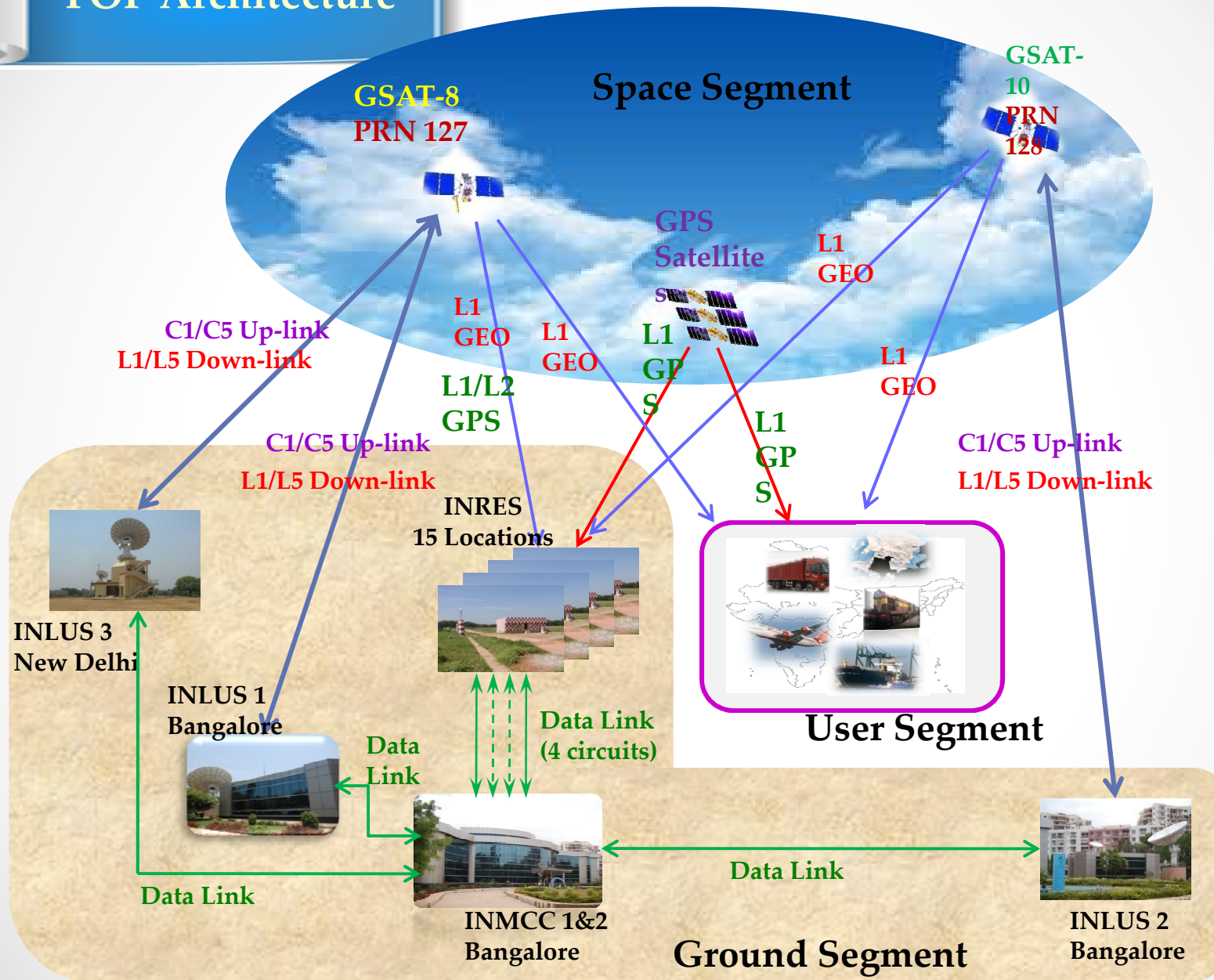
- US Wide Area Augmentation System (WAAS) is operational since July 2003 Certified for LPV-200 approaches by FAA
- European EGNOS is certified to APV 1.0 by the EUROCONTROL
- Japanese MSAS has been certified for RNP-0.3 performance level by JCAB

Indian GAGAN is certified for RNP 0.1 service

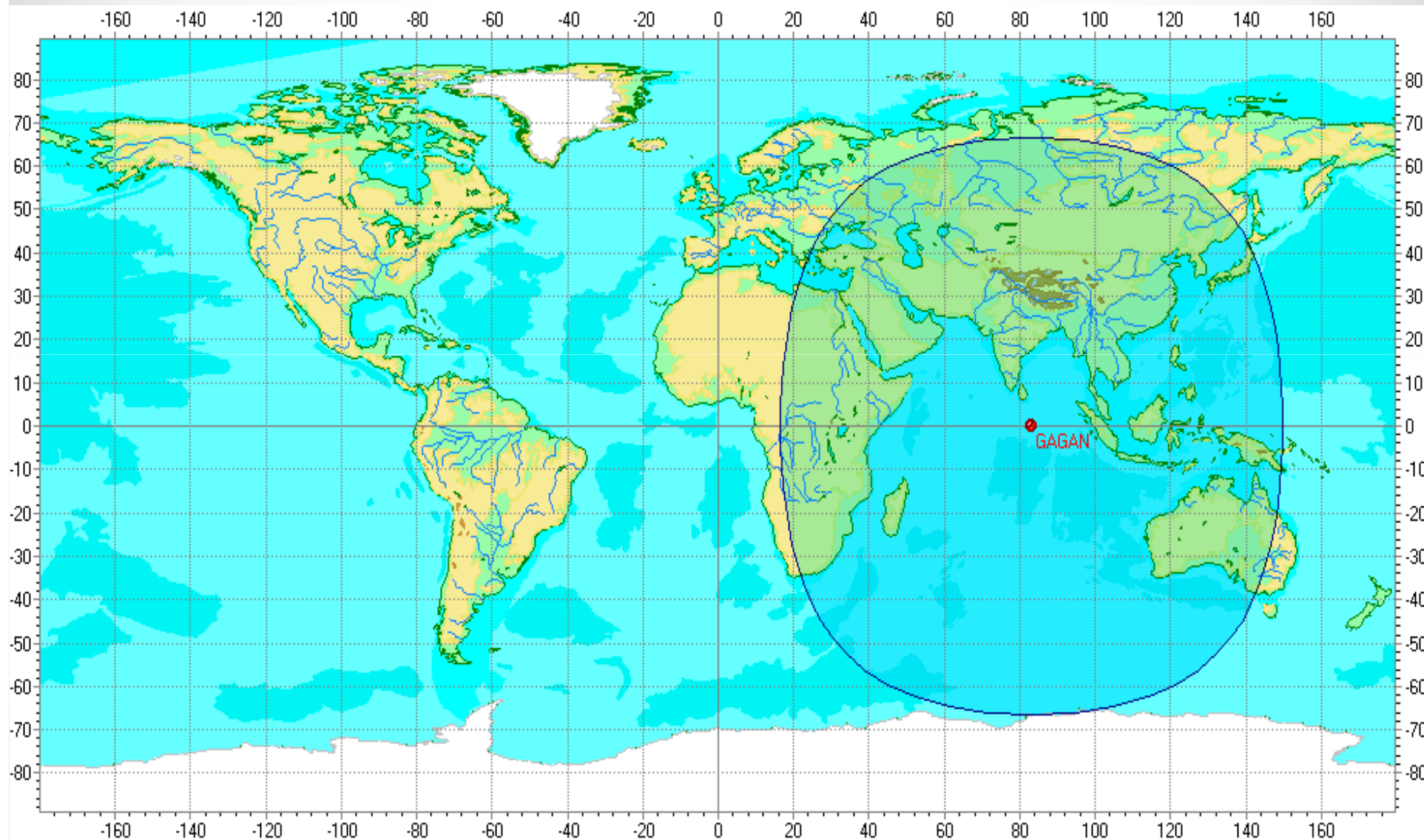
ROAD MAP



FOP Architecture

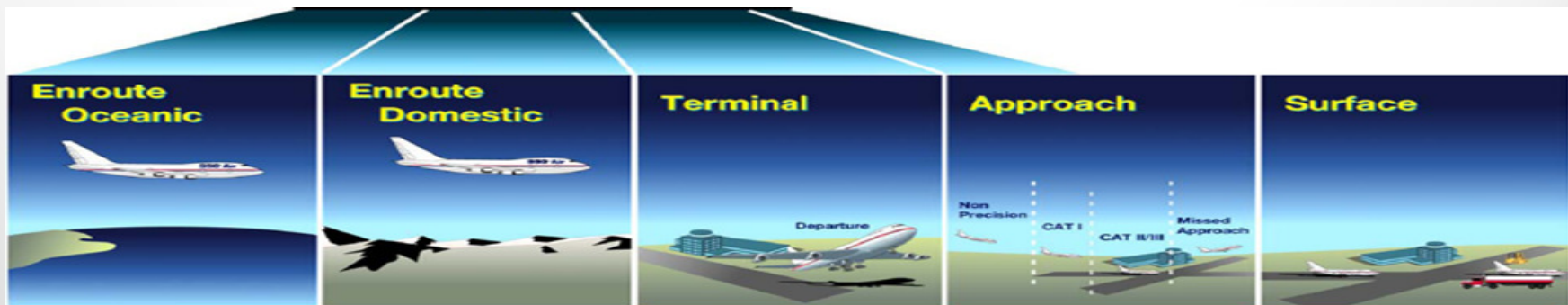


GAGAN Footprint



Impact of GAGAN for Aviation

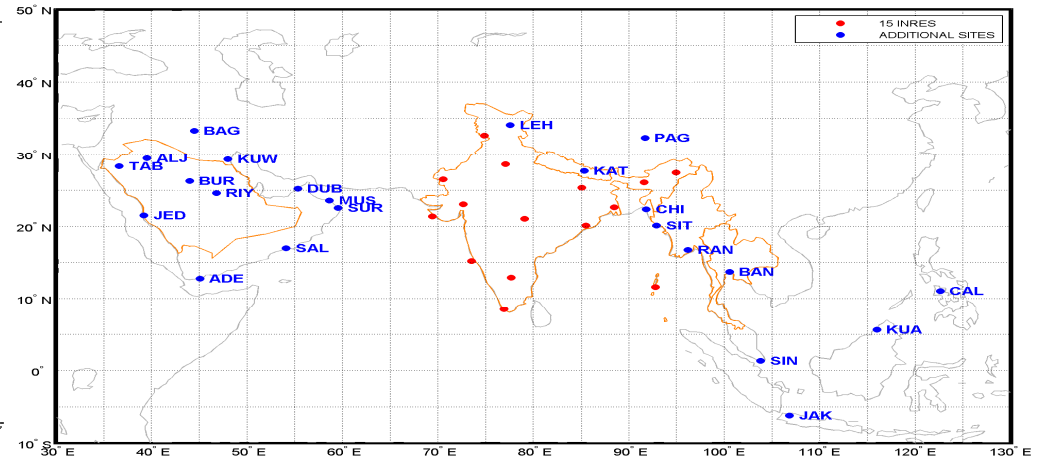
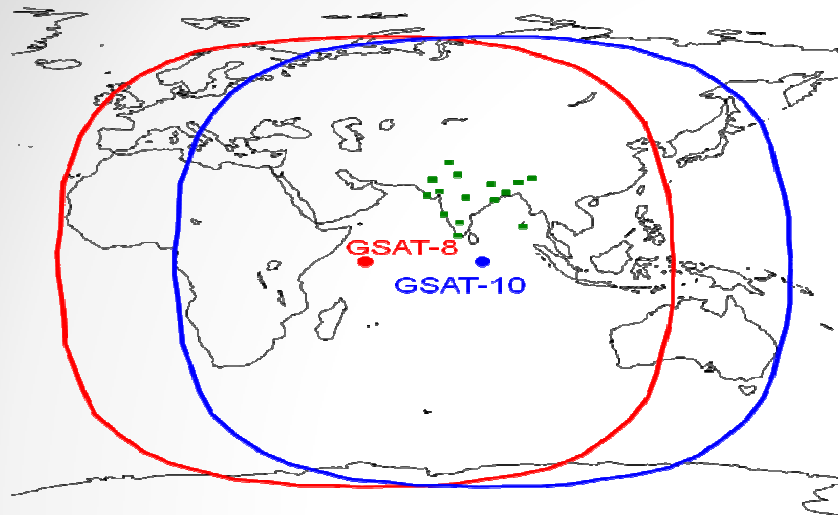
- Enabler for transition from Ground Based Navigation to Satellite Based technology
- Enabler for Performance Based Navigation
- Provides platform for harmonized Airspace for ATC across many Flight Information Regions
- One System for serving wide accurate area positioning and navigation for all phases of flight



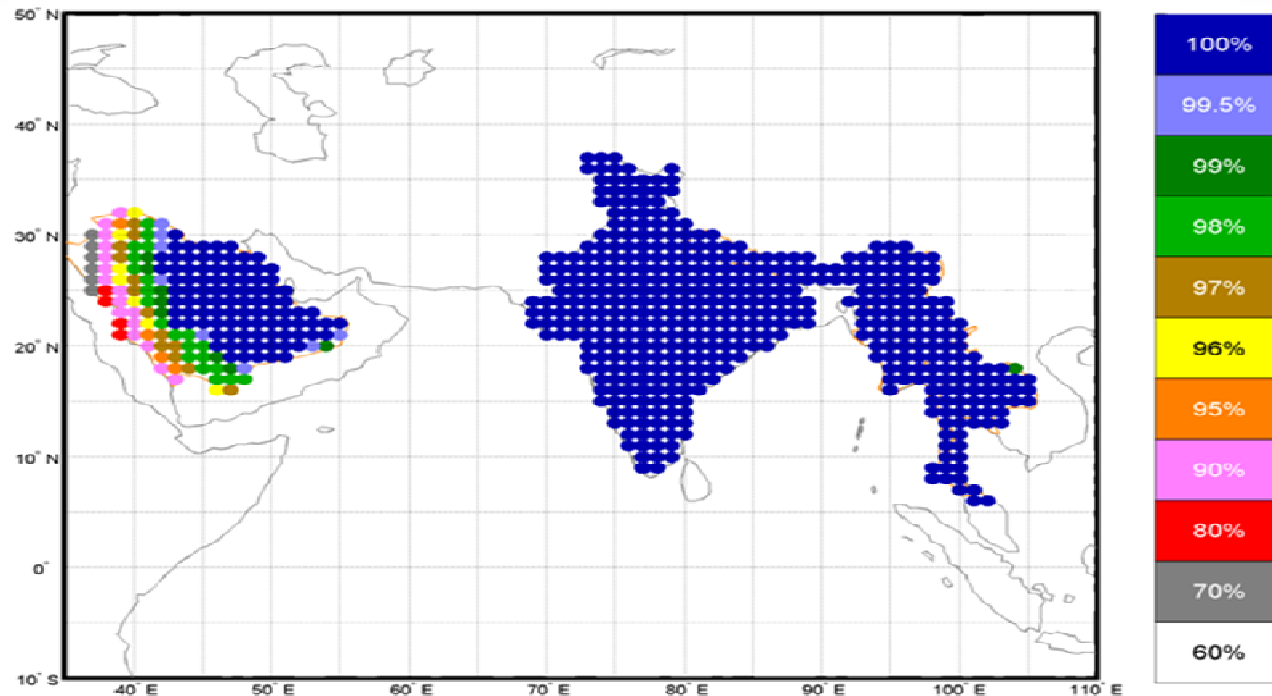
Promoting GAGAN in Aviation

- Encouraging regional airlines for retrofits of GAGAN enabled receivers coupled with cockpit avionics, and crew training.
- Joint coordination on business development with airlines to ensure demonstrative benefits.
- Encouraging neighbouring countries to participate in GAGAN expansion program
- Ensuring new aircraft registered in India are GAGAN capable through appropriate forward fit mandates.
- Developing Helicopter procedures for low level routing using GAGAN.

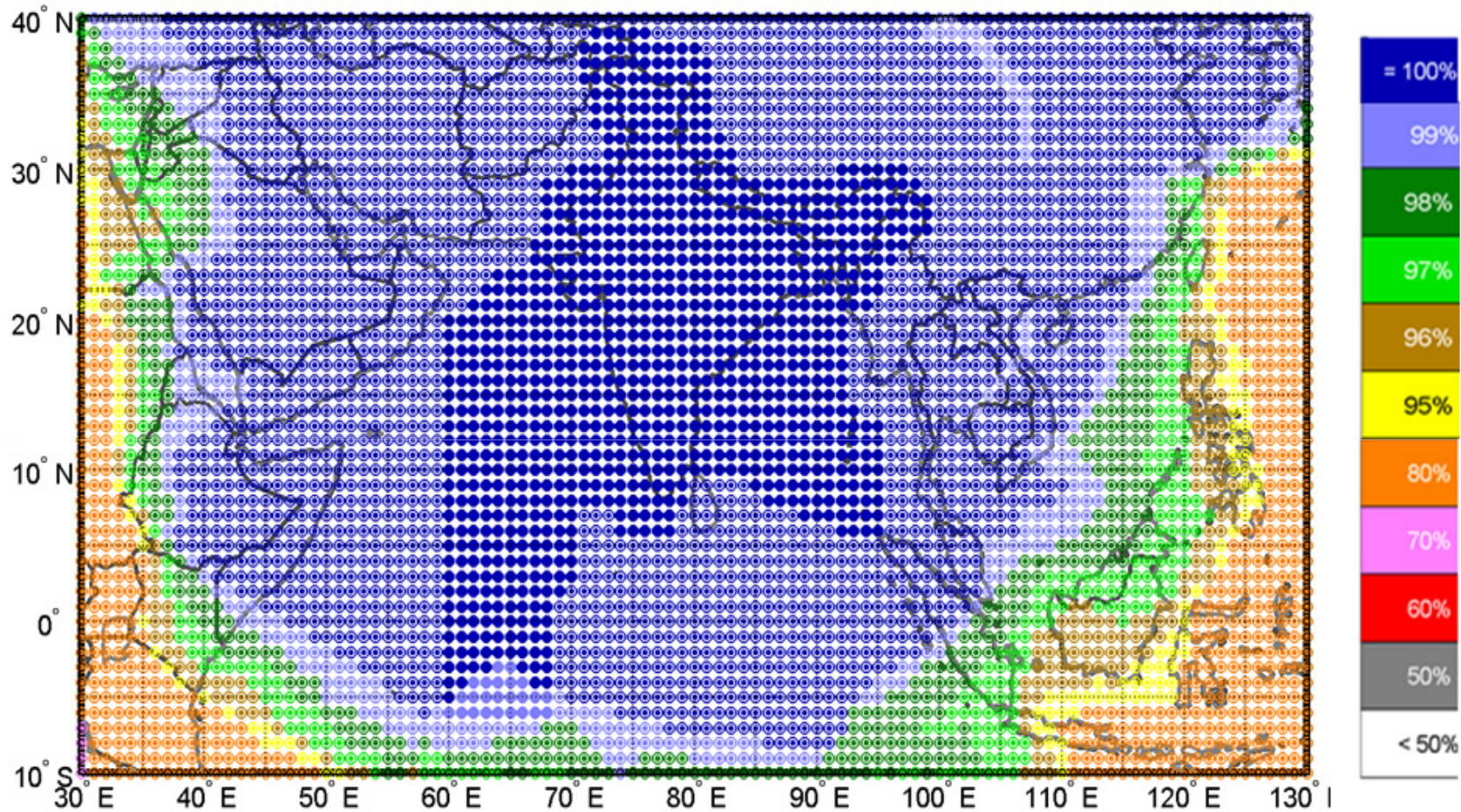
GAGAN Impact outside India



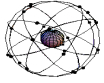
% of Time That APV-I Service Is Available



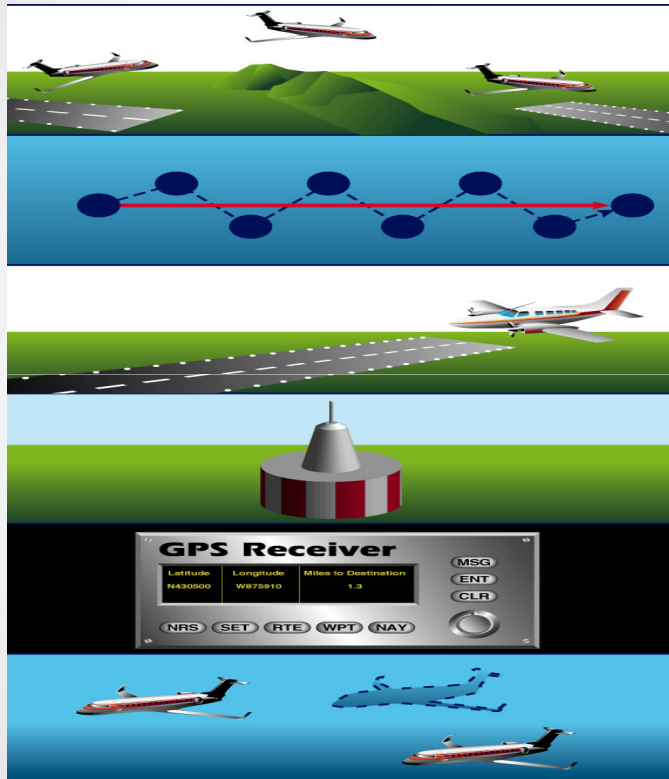
GAGAN – RNP 0.1 Coverage



Above availability is optimistic as it is based on user geometry based on the satellite constellation and the UDRE is modelled by the satellite geometry as opposed to the broadcast UDREs



GAGAN: Benefits in Civil Aviation



- **Primary Means of Navigation - Take-Off, En Route, Approach and Landing**
- **More Direct Routes - Not Restricted By Location of Ground-Based Equipment**
- **Precision Approach Capability - At Any Qualified Airport**
- **Decommission of Older, Expensive Ground-Based Navigation Equipment**
- **Reduced/Simplified Equipment On Board Aircraft**
- **Increased Capacity - Reduced Separation Due to Improved Accuracy**
- **Increase safety by using 3D approach operations**

GAGAN-Advantage

- GAGAN allows pilots, operators and air traffic control to make the best use of recent huge advances in navigation technology, and brings increased safety, efficiency and environmental benefits, including
 - Reduced separation standards for all phases of flight
 - Reduced track miles/fuel burn/carbon dioxide emissions during landing approaches
 - PBN and GNSS allow straight-in approaches to be designed for most runways. International Civil Aviation Organization (ICAO) data shows that straight-in approaches are 25 times safer than circling approaches
 - Approaches with vertical guidance, are a further eight times safer than approaches without vertical guidance, so are a significant safety enhancement
 - Reduced reliance on terrestrial radio navigation aid infrastructure
 - Global harmonization—ICAO's PBN navigation standards are being applied worldwide for use by any authorized operator from any ICAO state.



GAGAN Applications



- **En-route and precision approach for aircrafts**
- Navigational guidance for Marine services
- Help in Fisheries
- Mining
- Management of Fleet movement
- Town planning and road alignments
- Geographical Information Systems
- Power Grid Synchronization
- Automatic Banking
- Precise farming, dispensing of fertilizers and irrigation
- Collision avoidance for railways & real time traffic monitoring by IR

GPS vs GAGAN

(Accuracies, Integrity)

	Parameters	GPS	GAGAN
	Accuracy : (confirmation with respect to Established truth)	GPS accuracy is based on the geodetic location of user/Receiver position and also it varies with time. (Due to un accounted errors involved)	Provides Improved accuracy by applying corrections on any given user/Receiver position and consistent with time.
	Integrity: (Confirmation with respect to use or, not to use based on quality of data received)	Can't provide Integrity information on Real Time and also not guaranteed by the service provider.	Provides Real Time Integrity information to user and guaranteed by the service provider.

Non Aviation Applications of GAGAN

- **Ministry of Agriculture**
 - Farming
 - Auto Tractor
 - Resources analysis
 - Procurement
 - Planning
- **Road transport & Highways**
 - Fleet management
 - Asset management
 - Performance optimization
 - Accident rescue
 - Timing
 - Real-time information to Passengers
- **Science & Technology,**
- **Urban development**
 - Land Management
 - geographic information systems
- **Mines,**
 - Resource Analysis
 - Fleet management
 - Real time analysis
- **Shipping,**
 - Fleet management
 - Asset management
- **Railways,**
 - Real-time information to Passengers
 - Signalling
 - Optimization
- **Defence,**
 - Navigation
- **Power,**
 - Billing
 - Real time load analysis & optimization
- **deptt. of Space.**

Road



- Potential market for satellite navigation-based applications
- providing new services to people on the move.
 - electronic charging,
 - real-time traffic information,
 - Emergency calls,
 - route guidance,
 - fleet management
 - Advanced Driving Assistance Systems (ADAS).
- Drivers, car manufacturers, and law enforcement officials can benefit from the increased availability of GAGAN services in advanced car navigation systems.
- Can reap the rewards of
 - Reduced travel time
 - Demand management, and traffic monitoring and
 - Increased confidence in fleet
- Management and tracking of goods in all industry sectors.

Rail



- Traffic, wagon, and cargo control and monitoring
- Train signalling
- Track survey
- Passenger information services
- Reduced distances between trains
- Increased train frequency.
- Easy to locate the entire rail fleet.
- These applications will increase rail transport performance
- Reduce trackside equipment provide additional economic benefits for train control.
- Benefits of high positioning accuracy for efficient track surveying

Public transportation

- **The public transport sector can benefit from**
 - Optimisation of public transport
 - Reduced Traffic congestion, pollution & other negative aspects .
 - Improved services and lower costs,
 - Efficient fleet usage with better coverage of different urban zones
 - Increased driver security,
 - New solutions for car pooling
 - Improved car/vehicle navigation systems.



Maritime

- Innovation and progress will be brought to Navigation and activities such as
 - Fishing,
 - Oceanography
 - Oil and gas exploitation
- Increased efficiency, safety and optimisation of marine transportation.
- Reliable, safe, and accurate tool for maritime navigation for all marine applications, including
 - Recreational boats,
 - Commercial vessels, and
 - Unregulated and safety of life at sea (SOLAS)–regulated ships .
- Integrity information for Safety-of-Life
- Improved search and rescue (SAR) services.

Safety

- Risks for travellers and working crews will be reduced
- lives will be saved through
 - increased route guidance capabilities
 - Advanced driver assistance systems.
- Better air traffic management
- Reliable positioning information for trains and boats,
- Better fleet management
- En-route guidance of emergency services,
- Effective tracking of dangerous or valuable goods during their Transportation
- Effective monitoring of infrastructures.

Energy

- Improvement in control of energy infrastructures.
- Improved power flow
- Enhanced time-synchronisation of power-related instruments,
- Increased safety and efficiency in oil exploration,
- Improved control of drilling facilities,
- Faster positioning information, even in remote areas.

Telecommunications

- **Increase the level of communications and the efficiency of their networks.**
 - new services based on location, direction, or real-time traffic information.
 - Provide a precise and low cost tool for network synchronisation,
- **Ensure the stability of synchronisation,**
- **Increase communication traffic via Location Based Services(LBS),**
- **Customised services to clients**
- **Increased pricing and billing flexibility.**

Finance, banking, and insurance

- The digital lifestyle that so many of us lead requires the transmission of sensitive data every day. Therefore, security, data integrity, authenticity, and confidentiality have emerged as major issues in the electronic exchange of documents. The protection of such information is vital, and the latest encryption and authentication techniques are ever-evolving.
- The following will be offered:
 - Common, validated time reference at low cost;
 - Availability of advanced and simple security modules for low-cost encryption;
 - Simple and secure transactions with easily authenticated electronic documents and data;
 - Secure tool for e-commerce applications;
 - Satisfied insurance companies and users;
 - Fewer risks in highly sensitive operations.

Civil engineering

- This field, which relies on accuracy and reliability,
- Decreasing costs
- Increasing efficiency.
- Combined with digital mapping,
- Improving productivity
- spanning from planning of structures to the maintenance and surveillance of existing construction projects.
- Together with other technologies, GAGAN will make it possible to improve logistics and optimise human resources, which will lead to increased efficiency with no loss in quality and increased safety on the construction site.

Agriculture

- Food security issues will be managed in a more efficient way to overcome consumer concerns.
- The quality of agriculture will improve while respecting the environment.
- Together with other technologies, GAGAN will help
 - minimise the distribution and dilution of chemicals,
 - improve parcel yield from customised treatment
 - More efficient property management.



Fisheries

- Navigation and positioning of fishing vessels.
- Strict international rules governing intrusion into national waters demand that vessels are monitored to ensure that they fish only within designated areas.
- More effective exchange of information between vessels and stations,
- Improved fishing capabilities
- Enhanced navigational aids for fishermen.

People with disabilities

- Provide technological assistance for people with disabilities in a variety of situations, by increasing the availability of support services, especially in inner-city areas.
- Personal navigation assistance for people with impaired vision;
- Assistance for Alzheimer's patients with memory loss;
- Route planning for people with physical disabilities;
- Enhancement of telemedicine or emergency services through real-time localisation;
- Real-time public transport audio announcements regarding remaining travel time, stops, and connections.

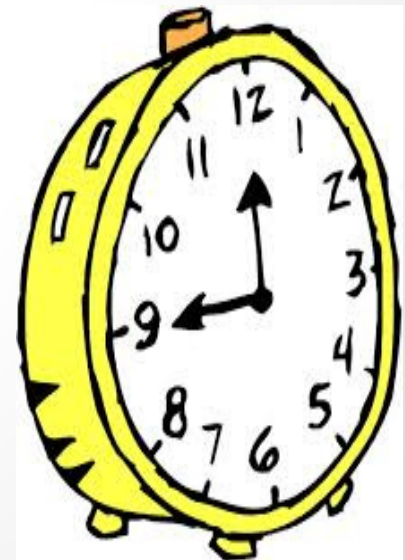
Civil protection

- **Disaster management - additional lives will be saved due to**
 - Space-based system with global coverage
 - Round-the-clock availability,
 - Reliable positioning,
- **Optimisation of rescue operations and resources.**
- **Available in difficult environments and even when local infrastructures and services may be temporarily unavailable.**



Time reference

- High accuracy time disseminated GAGAN
- Interoperability with applications that require a common time reference.
 - wireless telecommunication network management
 - Power plant
 - Network monitoring.
- Applications that require certified time stamps will benefit
 - electronic banking,
 - e-commerce,
 - the stock exchange,
 - quality assurance systems and services.
 - traffic light regulation,
 - certified documentation production, and so on.



Science

- **Improvement to data collection in the area of environment monitoring**
 - Analysis of polluted areas;
 - Study of tides, currents, and sea levels;
 - Tracking of Tsunami;
 - Study of tectonic movements.
- **Continuously tracking wild animals in the study of biology and animal behaviour.**
- **A miniaturised receiver can be attached with a collar to monitored or protected animals to follow the movement and migration of species that might be in danger.**
- **study of behaviour and for the monitoring and preservation of habitats.**

Leisure

- Recreational flying or boating,
- a navigator for amateur users will provide personal information
 - by means of handheld terminals combined with a map display and with secondary communication functions integrated with mobile communication technology.



Automobiles

- Emergency roadside assistance with just the push of a button, by transmitting the car's current position to a centre station.
- More advanced systems even show the car's position on a street map.
- Allow any driver to know his or her position
- Recommends the best route to reach the driver's destination.

Smart Cities

- Land Management
- Coordinate Location positioning
- Traffic management
- Power management
- Resource Management
- Time management
- Security Management
- Infrastructure planning
- Energy management
- Transportation management
- Environment

Questions?

