

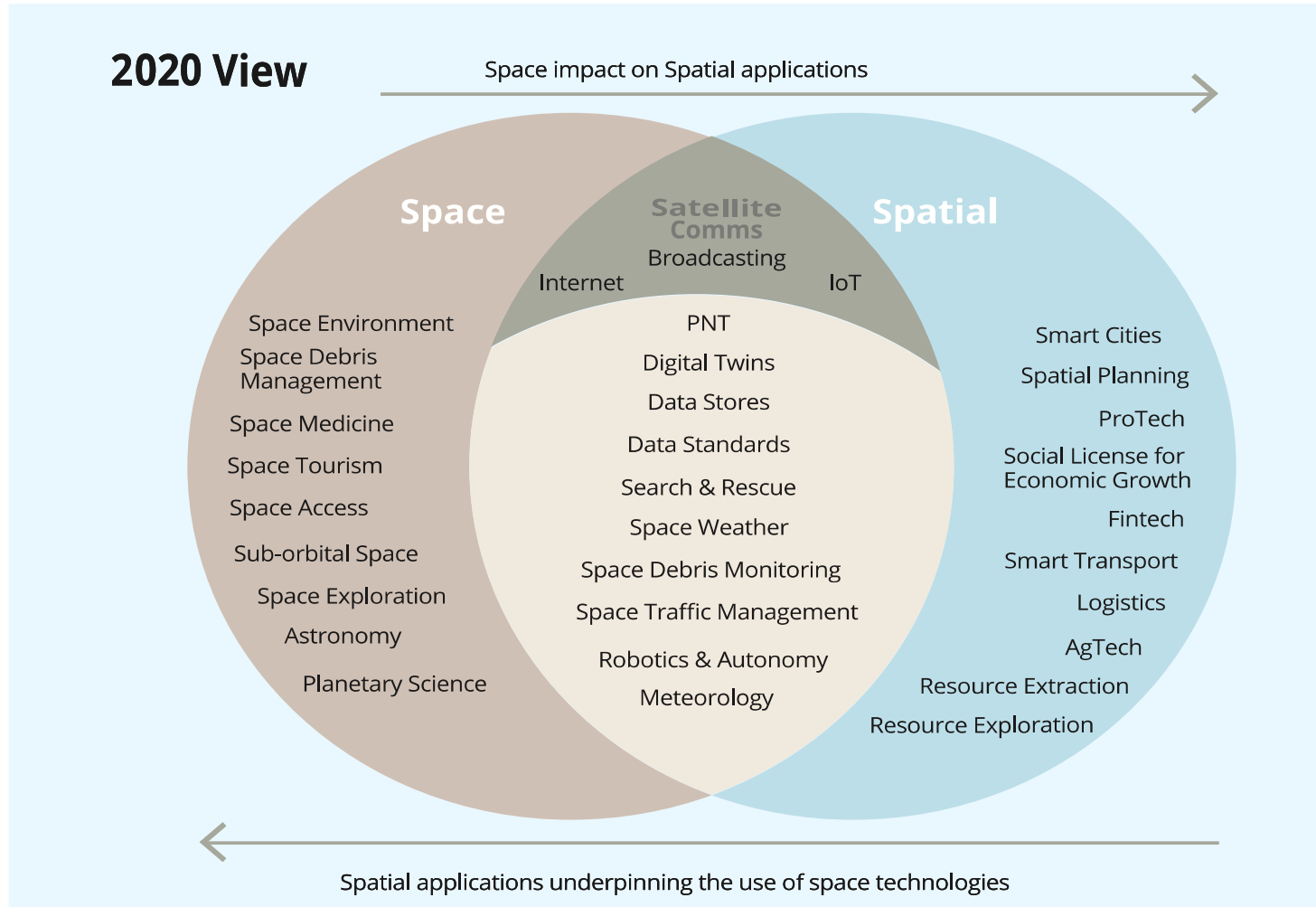
Collaborative Space & Positioning Infrastructure and Geospatial Value Chain

Lt Gen Girish Kumar, VSM (Retd)
Mission Director, Govt of Haryana
(Former Surveyor General of India)

Introduction

- In today's Digital world Space Services & Geospatial data impact our daily lives.
“The power of where, enabled through space and spatial, is the record of what we do, when and where we do it, and in what environment—because everything happens somewhere”.
- Space Services, Positional Infrastructure and Geospatial Complement each other, create value individually however, collaboration can lead to significant benefits.
- These are making a critical contribution to digital transformation and are important for the Future Growth & Prosperity of countries.
- Position can be used by Govt., Industry & Individuals to connect data and work to make decisions that have positive impact on economies, environment and society in general
- Integration of space and spatial sectors will:
 - increase productivity in key sectors including agriculture, mining, transportation, construction and energy etc.
 - Support national defense & security, disaster mitigation & management, environmental monitoring & management, smart city planning and management to name a few.

Space + Geospatial Synergy & inter-dependence

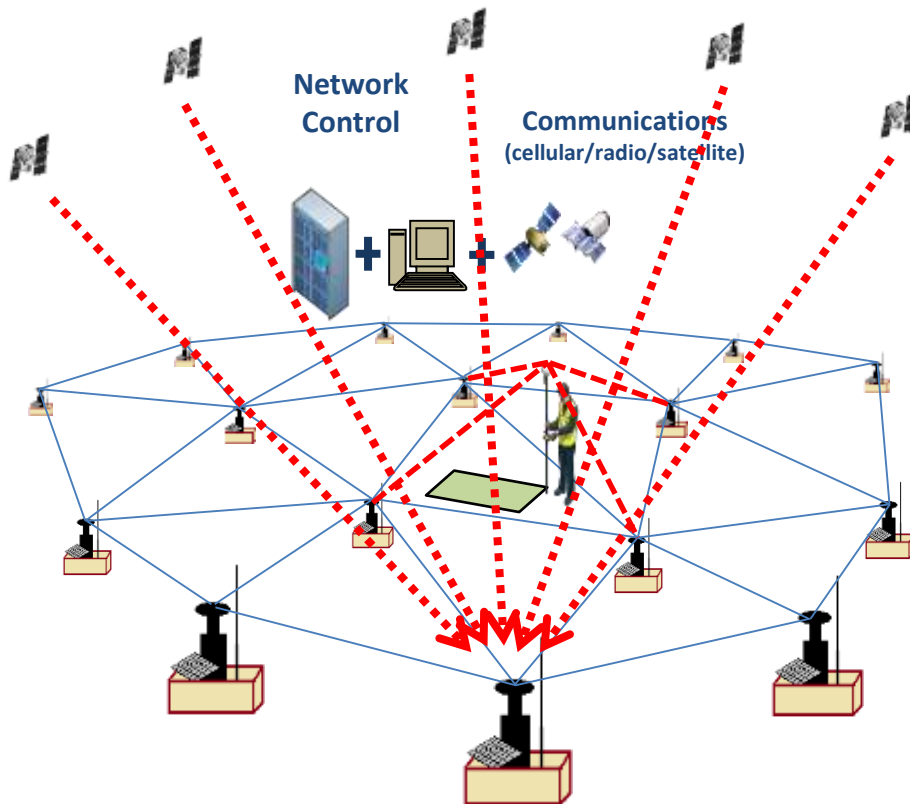


Space provides a vantage point to collect and deliver “ubiquitous data”. Space underpins the availability of spatial applications “everywhere”. Spatial applications demonstrate the value of space capabilities.

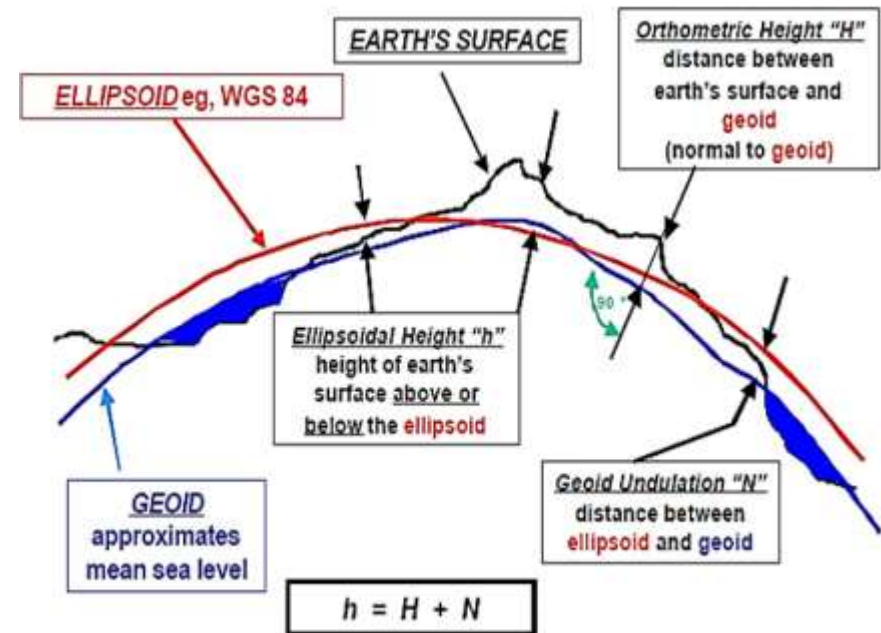
Positioning Infrastructure

GNSS (Space technology) - GPS, GALILIO , GLONASS, BEIDOU AND NAVIC

Horizontal / Terrestrial Reference Frame



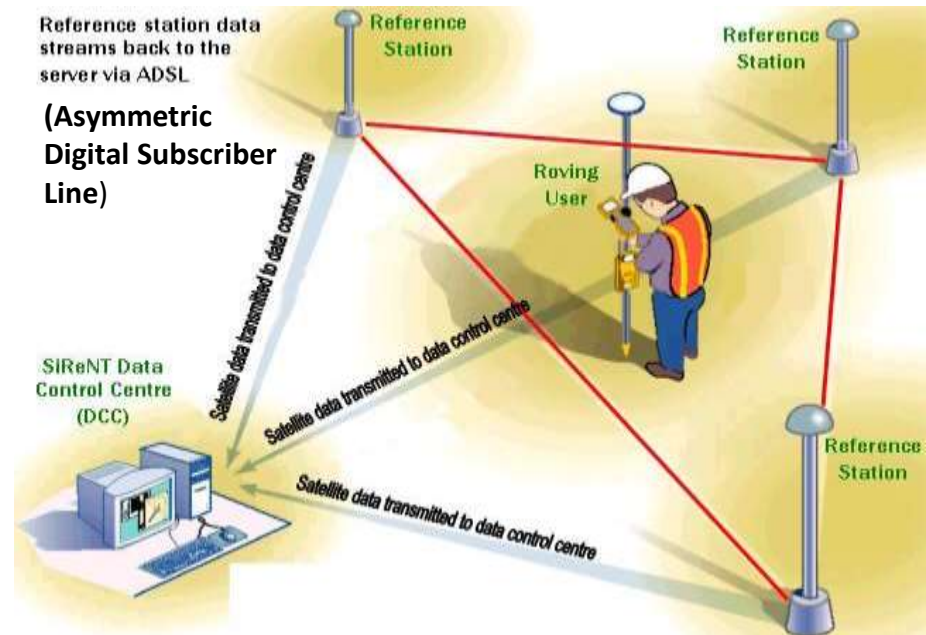
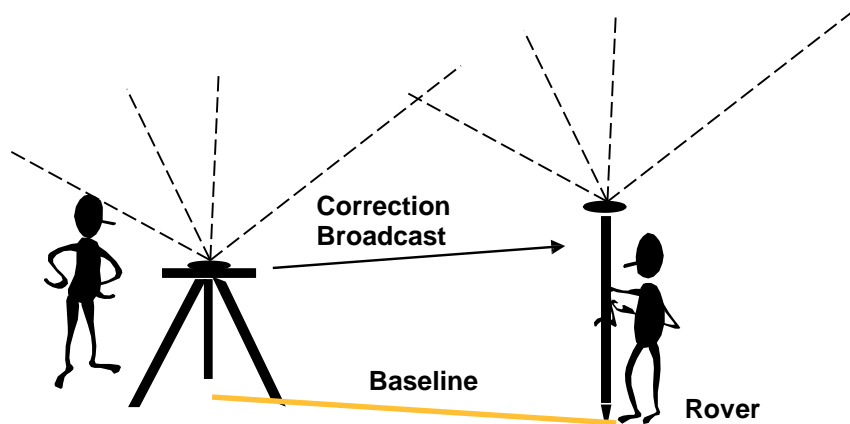
Vertical Reference Frame Conversion of Ellipsoidal to Orthometric Height



GNSS Accuracies

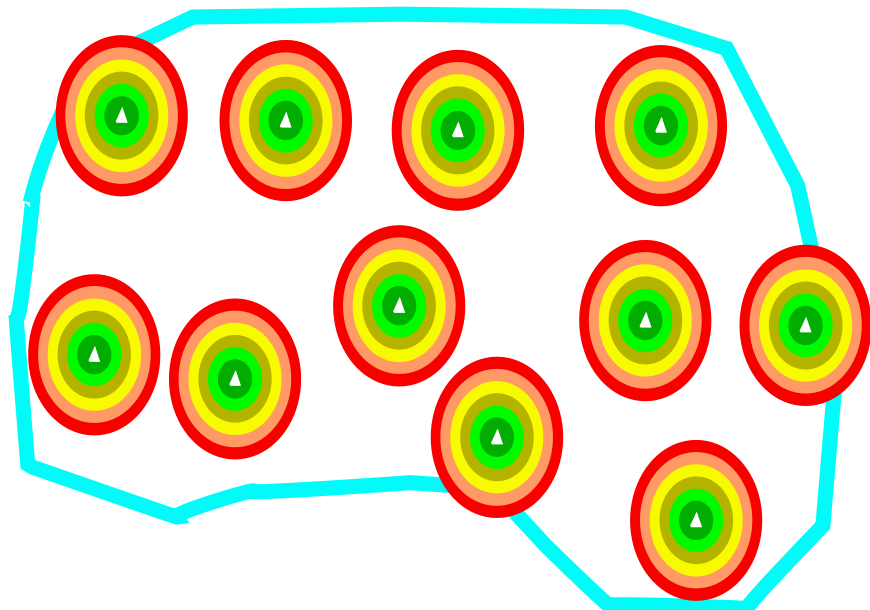
- Stand Alone Positional Accuracy is around 7 meters
- Post Processing accuracy about centimeter is achieved by collecting data for minimum 24 hours and further processing time is required
- Real Time accuracy can be achieved upto 5 cms using Differential GPS station using RTK technique with a limitation of maximum 10 kms
- To achieve Higher accuracy Reference stations are established at a distance of around 50 kms for network RTK

Conventional RTK: procedure



Network of Single Reference Stations and Their Coverage

- Baseline length Limitation 15Kms
- Communication Links (Line of sight or Radio)
- Expensive Resource (Atleast 2 Receivers,two person and known RS required)

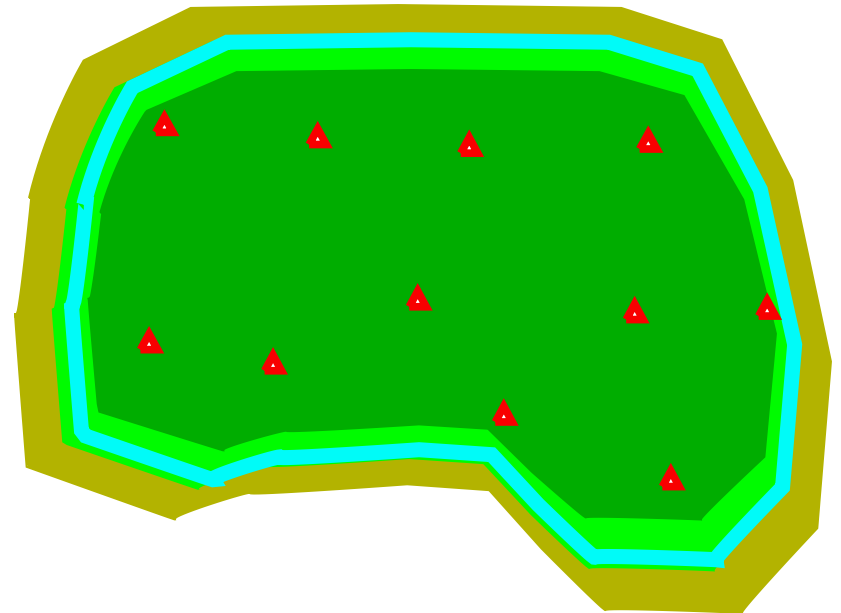


Accuracy, Reliability, Availability

Good  Bad

Network RTK and Their Coverage

- Improve accuracy, reliability and availability (precisely model distance dependent errors in a region)
- Reduces the number of RS needed (inter-station distances upto 100 Kms)
- Modelling GPS errors over the entire network area.
- Provide data & corrections in a consistent datum
- Capable of supporting multiple users and applications



Time to Solution

Combination of GNSS and CORS enables Real-time, Accurate Positioning and Surveying.

Accuracy

Higher ↑

1cm

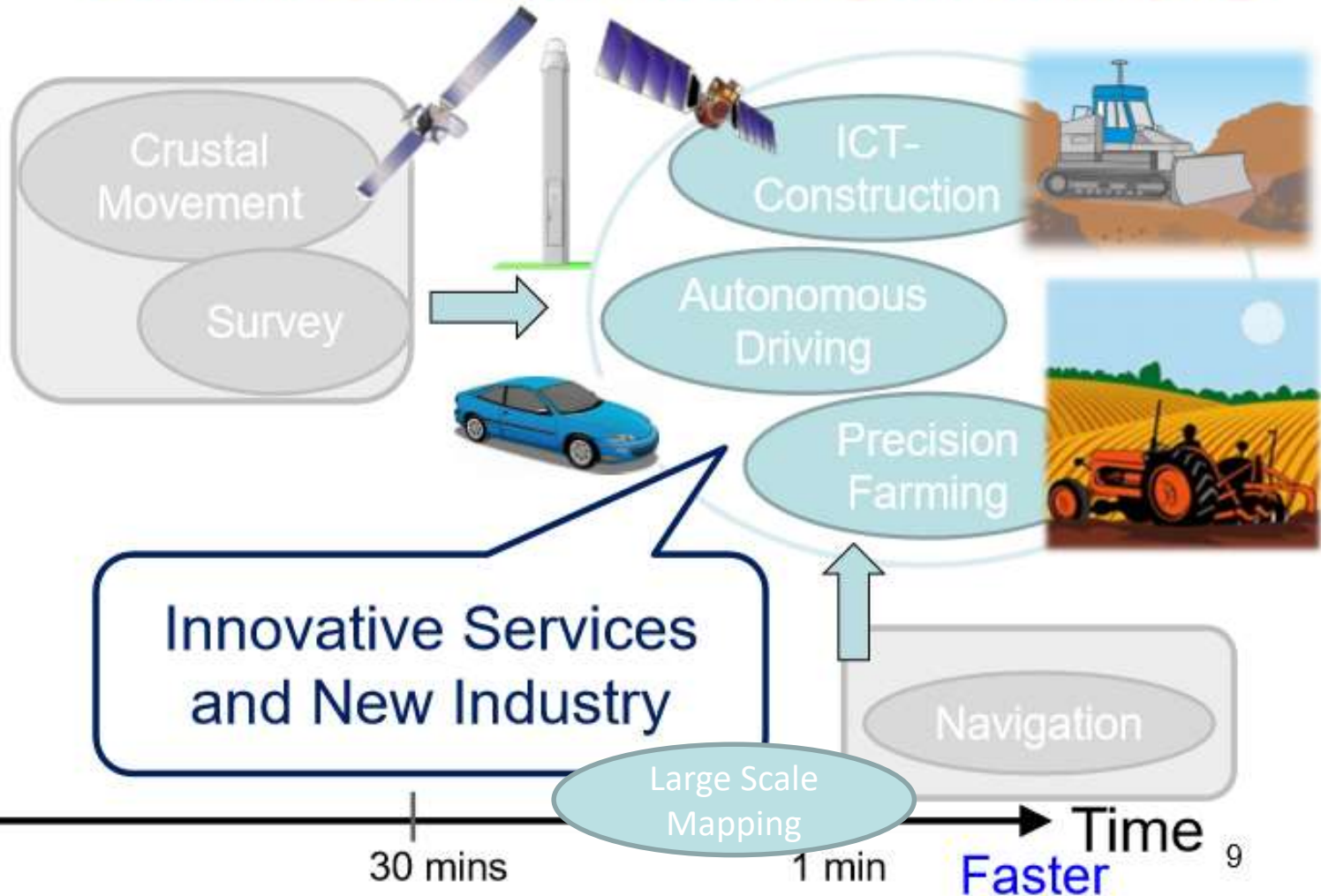
10 cm

meters

30 mins

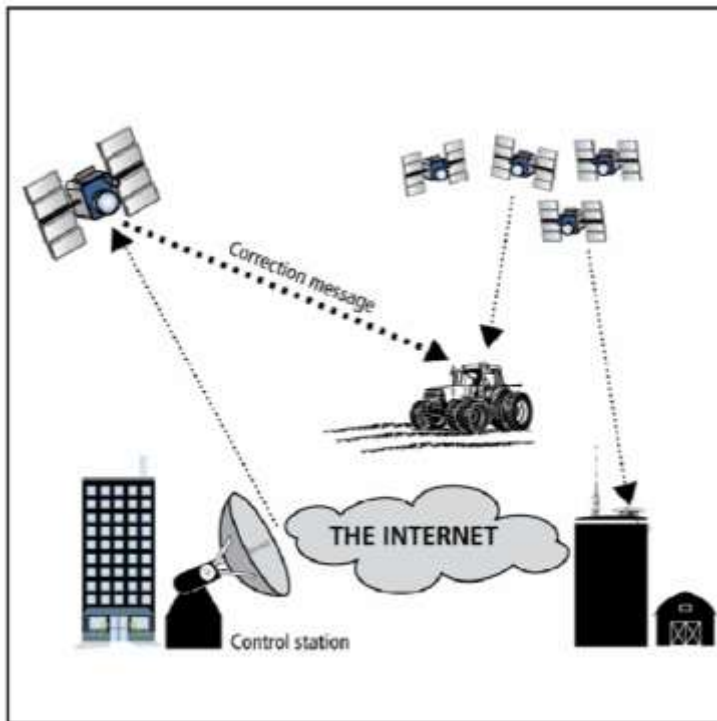
1 min

Time
Faster →



PPP (Precise Point Positioning)- The Next Step & the Future of Correction Services

This technology leverages real-time data from a global tracking station network along with innovative positioning and compression algorithms to compute and relay satellite orbit, satellite clock, and other system adjustments to the receiver, resulting in the high accuracies.



These adjustments are transmitted to the receiver via satellite (where coverage is available) and via IP (Internet Protocol)

Achievable Accuracy:

dm to cm level, depending on service subscription

RTK CORS Applications



Government

- Land and Revenue
- Town & Country Planning
- Public Works Dept.
- Municipal Corporations
- Transportation
- Forestry
- Defense and Internal Security
- Utilities
- Natural Resources
- Mining
- Fleet Management and Vehicle Tracking
- Assets Inventory
- Agriculture



Construction

- Roads / Highways
- Power Grids
- Oil and Gas
- Dams/ Harbour/ Ports
- Metro Rail
- Railways
- Airports
- Bridges
- Industry
- Utilities
- Telecom
- Tunnels
- Water Supply and Sewage



Hazard Monitoring

- Earthquake Prediction
- Tsunami Warning System
- Landslide
- Subsidence
- Volcano
- Oil fields
- Micro seismic Zonation
- Flood Zonation
- Global Warming
- Monitoring
 - ✓ Dams
 - ✓ Subsidence
 - ✓ Tunneling
 - ✓ Bridge Deformation
 - ✓ Landslide Monitoring



Environment

- Rainfall Estimation
- Watershed Management
- Inland Waterways
- Green House Gas
- Forestry
 - ✓ Canopy Cover
 - ✓ Wildlife Conservation
 - ✓ Forest Fire
- Agriculture
- Atmospheric Studies
 - ✓ Ozone Study
 - ✓ Glacial Study
 - ✓ Coastal Mapping

Enables you to reduce costs for capital improvement projects

Cost Saving in various Application

Estimated size for Precise Positioning in India per year Economic Benefits

- Mining – Estimates of **30%** Productivity Improvements. In Surveying, Grading, Dozing, Drilling and Fleet Management
- Agriculture – Reduced Input costs for Fuel, Seed, Fertiliser, Herbicide and time by **15-20%..**
- Civil Engineering – Machine Control reduces time by **30%** creating **10%** reduction in overall project costs.
- Photogrammetric Surveys – Reduced by over **30%**. No need to setup own GNSS Reference Stations
- Rail Track Surveys – Introducing GNSS Based track surveying reduces field surveys by **80%**
- Individual citizens who want precise positioning for their own use – like accurate house boundaries, Navigation, etc..
- Emergency Services – Police, Fire, Ambulance, and Disaster Management services – e.g. - Mapping of Fire Fronts reduced from 6-7 hours to 1-2 hours
- General Surveying – Reports of **30-40%** savings through Productivity Improvements

THANK YOU FOR YOUR PATIENCE!!