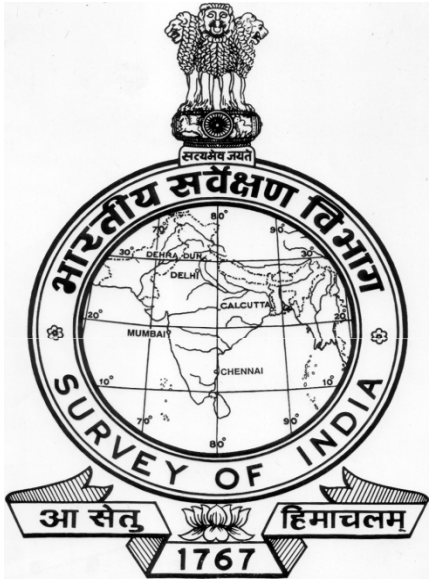
National GIS Initiatives & Challenges



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Additional Surveyor General

MAPPING LAND MARKS

- Mapping started in India during regime of Lord Clive.
- Topographical maps, aerial photographs and satellite imageries crucial for military intelligence and operations.
- Maps being sensitive were classified till 1950 and available only for official use. Topographical maps for civil and defence use have same info and accuracy.
- Developmental needs forced liberalization of map restriction policy.
- New two series map policy approved by CCS in May 2005. Separate series namely OSMs and DSMs. SOI started 1:10 K mapping in 2012.
- New initiatives in mapping from images from space borne and aerial platforms.

NATIONAL MAP POLICY (NMP)

- **CCS approved NMP of DST on 27.04.05.**
- **SOI mandated to take leadership role in liberalizing access of spatial data to user groups without jeopardizing national security.**
- **Two series maps namely DSMs and OSMs approved.**
- **OSMs on WGS-84 have been made unrestricted after one time security clearance of MOD. Contents include contour and heights, in unrestricted zones and without same in restricted areas.**
- **DSMs with VAs and VPs, Lambert grids with on Everest/WGS-84 datum**
- **User agencies free to use/publish OSMs on hard copy and web with or without GIS data base. All transactions registered in the Map Transaction Registry (MTR) with the details of the receiving agency, end user.**
- **Accuracy of OSMs and DSMs same and derived from National Topographical Data Base (NTDB).**

National GIS Background

- Planning Commission constituted an Interim Core Group for National GIS with SGI as Member in April 2011.
- NGIS Mission is an inter-ministerial Initiative of M/o Science and technology, M/o Earth Sciences, Department of Information Technology – NIC and Department of space.
- Duration - 5 years. To be operational in 3 years.

National GIS Objectives

- A seamless nation-wide GIS ready database.
- **To serve as a platform for G-Gov**
- State of art Data/Apps hosting environment
- **Enabling service provision for different user groups**.
- To capture and assimilate data owned by public owned agencies, create a data platform and develop demand driven GIS products to promote G-Gov.

Role of Survey of India

- SOI to establish National GIS Ver 1.0 with input from 1:50K OSM DTDB and component of NSRF(National Spatial Reference Frame)
- Generation of Foundation Geo-data for NGIS.
- DST and SOI are central organisation in NGIS.

NGIS- Data Asset Building Plan

- To start immediately, NGIS Data Asset will be built based on 1:50k Geospatial data of SoI.
- secondly, this will be replaced/ upscale with 1:10k data
- Advantages:
  - Meets some immediate requirements and also makes all agencies of Govt aware of NGIS and it's importance
  - Many technical procedures get established
  - Can be achieved in 1 year time.
  - Scope for incorporating better methods and ideas for developing full scale data asset on 1:10k

NEED FOR 1:10K MAPPING

- 1:50,000 scale, it is not possible to depict utility buildings like hospitals, schools, police stations, post offices etc
- On 1:10,000 scale, all such buildings can be comfortably depicted.
- Microzonation for Disaster Management requires 3D base maps on scale 1:10,000.
- In assessing natural resource endowments, agricultural practices, grazing lands, village forests, which are essential for rural development can be shown on scale 1:10K.
- Security forces expressed need for maps on 1:10K / 5K scale for the whole country.
- Increase of population the cost of land/property is increasing exorbitantly creating Demand for large scale maps and the requirement of the accurate control ,

Quantum of Topographical Maps

SCALE	CONTOUR INTERVAL	NO. OF SHEETS
SURVEY OF INDIA		
1:250,000	100m/200 m in hills	394
1:50,000	10 m/20 m in hills	5,104
1:25,000	5 m/10 m in hills	19,540
1:10,000	1m/2 m in hills	1,27,600

COVERAGE IN TERMS OF TERRAIN TYPE

TERRAIN TYPE	AREA IN Sq. Km.	No. of Sheets
HILLY AREA (33%)	10.8 Lakh	43,400
FOREST AREA (20%)	6.7 Lakh	24,400
PLAIN AREA (47%)	15.38 Lakh	64,200
TOTAL AREA	32.88 Lakh	132,000

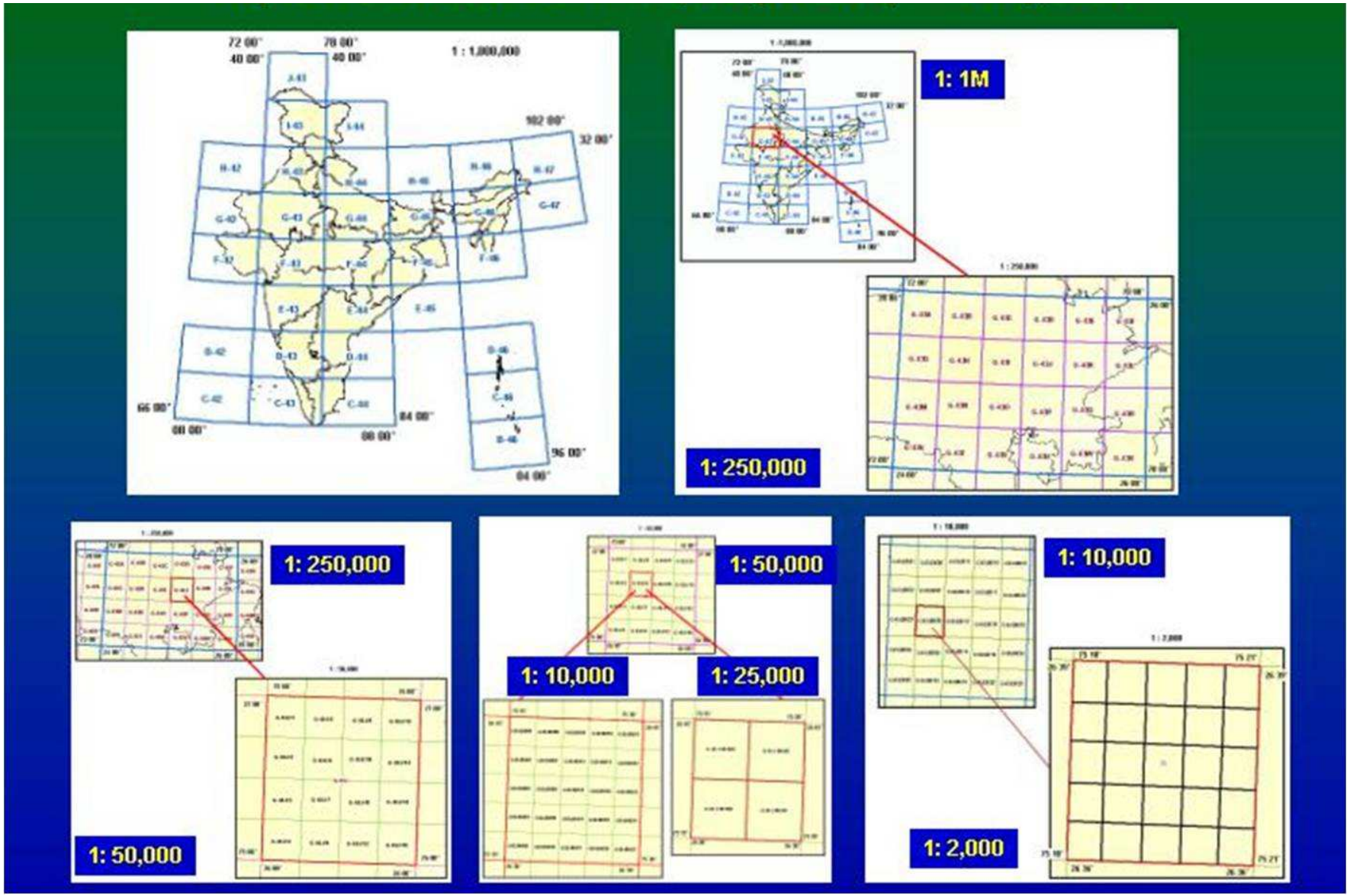
- **INPUTS**
  - High Resolution Satellite Imagery (0.5m)

    AND/OR

    Aerial Photography (Scale 1:30,000/ 30 cm gsd)

    Ground Svy data
- **DELIVERABLES**
  - **High Resolution Geo-Spatial Data on 1:10,000 scale for the entire country**
  - **National Topographical Data Base**
  - **Monumented Ground Control Points Library (X, Y and Z)**
  - **Digital Terrain Model**
  - **Ortho rectified images**
  - **GIS compatible Data**

LAY OUT OF SHEETS
(as per national map policy)



Re-engineering of 1:50K Data

- Generation of GIS enabled 1:50k foundation data from OSM DTDB database.
- To meet the immediate spatial data requirement of NGIS Version-1.0 to operationalize the NGIS Asset.
- Enable integration of data owned by multiple agencies.

Re-engg of 1: 50k Data cont……

- Existing 1:50K data will be reorganized in a database whose whose schema have been structured as per the GIS compliant 1:10K Data Model of SoI.
- The entire 1:50K DTDB data is to be made seamless
- Topological checks and corrections is required to be made to generate GIS-ready data.

Re-engg of 1: 50k cont……

- The re-engineered data will be transferred to a robust, secure, enterprise level RDBMS like Oracle.
- further processed for delivery as interoperable Web Feature Service (WMS/WFS) in OGC's Geography Mark up Language (GML) version 3.2.1 (ISO 19136:2007) format.
- The metadata information implicit in the annotation layers and auxiliary files associated with the data also will be extracted and structured as per NSDI standards .
- Web Catalog Service is also to be created.

Need for Establishing Data Centres

- The production system in SoI is PC based.
- Data moves back and forth several times from every SOI state centers to centers like NGDC and GIS & RS for QA/QC, Cartographic symbolization etc.
- Shipment of data occurs in offline mode – generally in CDs and HDs generating multiple copies of the same data .
- Virtually there are lots of duplication in processes to meet every demand resulting in huge wastage of time, effort and resources.
- Security of data being a manual exercise gets compromised.

Establishing Data Centres

- Establishment of state of the art enterprise production system.
- Data centre comprising of Central Storage Systems at each production centre, networked with other production centres using data net centric approach.

Establishing Data Centres

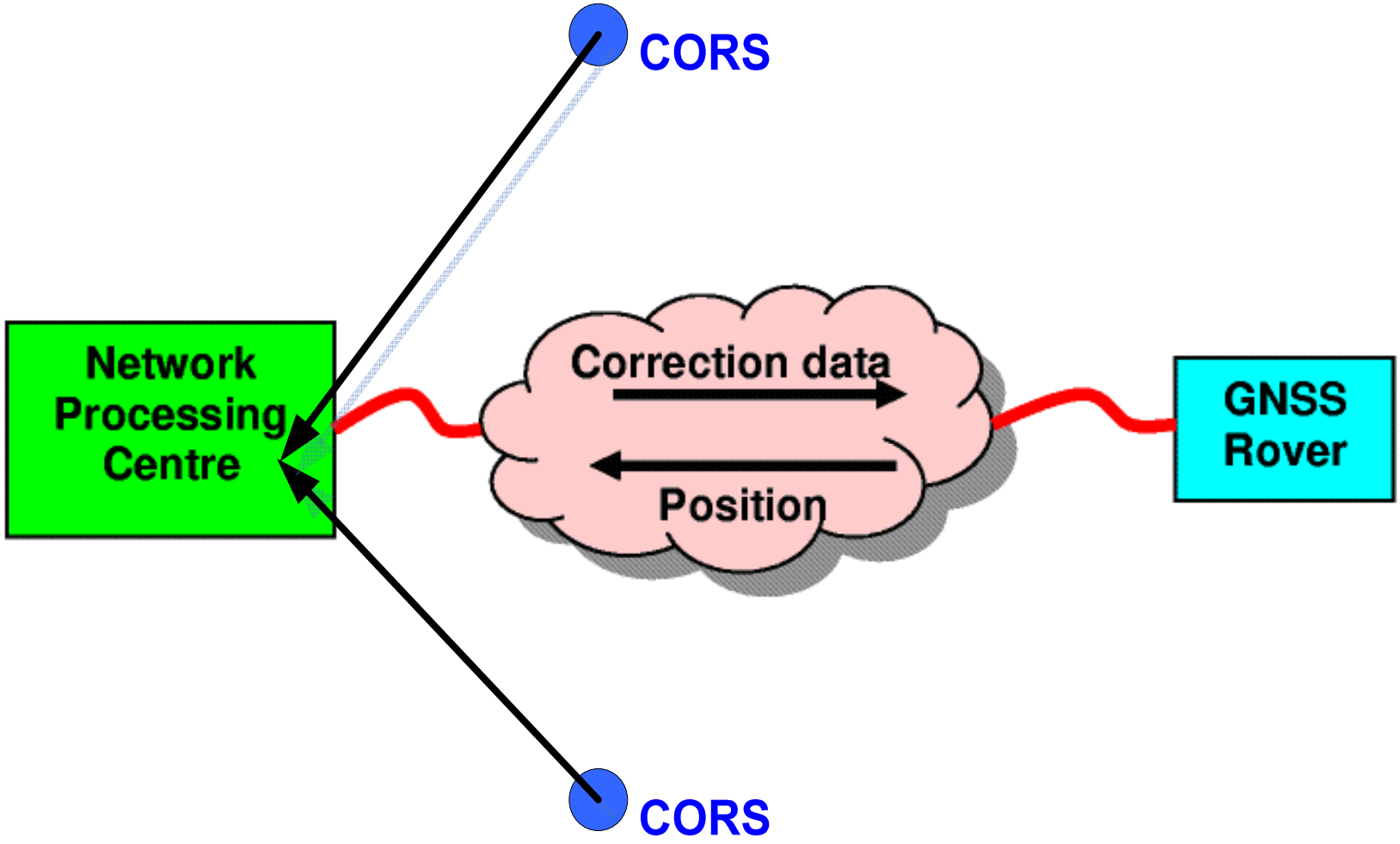
- Automating the job-management.
- Storing data in central database.
- Evolving managed workflows and operations that permit long transactions by relying on the technologies of database versioning and database replication.
- Leveraging the security features present in DBMS for data security.
- Creating web-services for dissemination of data from the authoritative database.

Need for Virtual Reference System

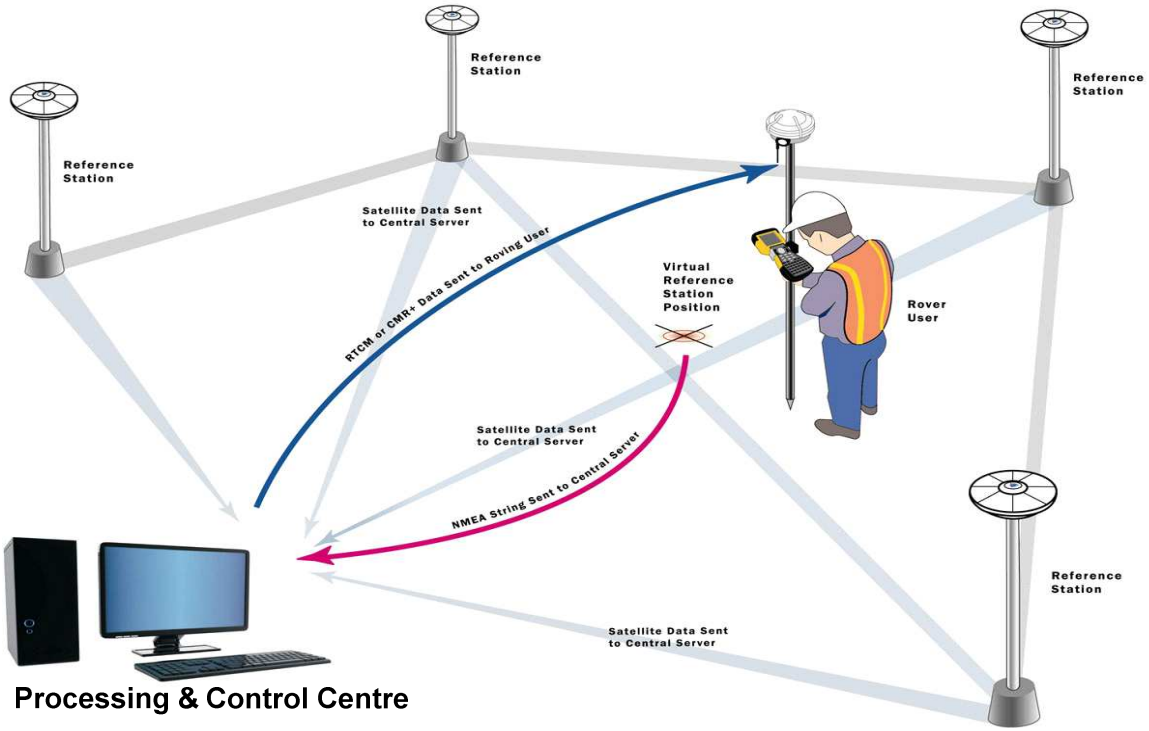
- The use of GNSS/GPS technology in survey applications is limited because of inherent errors of 10-20 meters in stand-alone mode.
- Use of GNSS/GPS data in differential mode by post-processing the data offline addresses the requirement of positional accuracy but introduces complexity in work-flow making it an exclusive domain of a small sub-set of surveyor community .
- Using Real-Time Kinematic(RTK) Positioning is one of the widely used techniques to overcome the rqmt of positional accuracy and real-time requirements, but it is an ad-hoc approach.
- Local Reference Station (equipped with GNSS/GPS and radio) is requirement of every Survey mission.

Virtual Reference System (VRS)

- VRS offers highly accurate, alternate DGPS service as a solution to positional accuracy problems.
- VRS involves Continuously Operating GPS Reference Stations (CORS), at spacing up to 50 to 60km. CORS feed their GPS data to a central processing computer via a computer network.
- The user makes a mobile phone call into the central processing facility, supplying its approximate position (based on a GPS navigation position) and request for corrections.
- The central processing computer generates corrections as though there is a reference station at the approximate coordinates of the rover's position and the rover is positioned relative to this VRS.


CORS
Network Processing Centre
Correction data
Position
GNSS Rover
CORS

- The **Virtual Reference Station** (VRS) concept is an extension of the so-called real time kinematic (RTK) technique developed for GPS surveying and other forms of high precision positioning.
- With RTK, one can establish a base (or reference) station at a known point and broadcast the data from the reference station to one or more roving receivers.
- The computer processor at the roving receivers (usually in the hand held data recorder or survey controller) combines the reference station data with the rover data.
- With modern equipment, only a few epochs of data are typically required to fix the ambiguities associated with the GPS phase data observable and compute a GPS baseline; the difference in latitude, longitude and height between the reference and rover positions



STRUCTURE OF VIRTUAL REFERENCE STATIONS

STRUCTURE OF CONTROL STATION

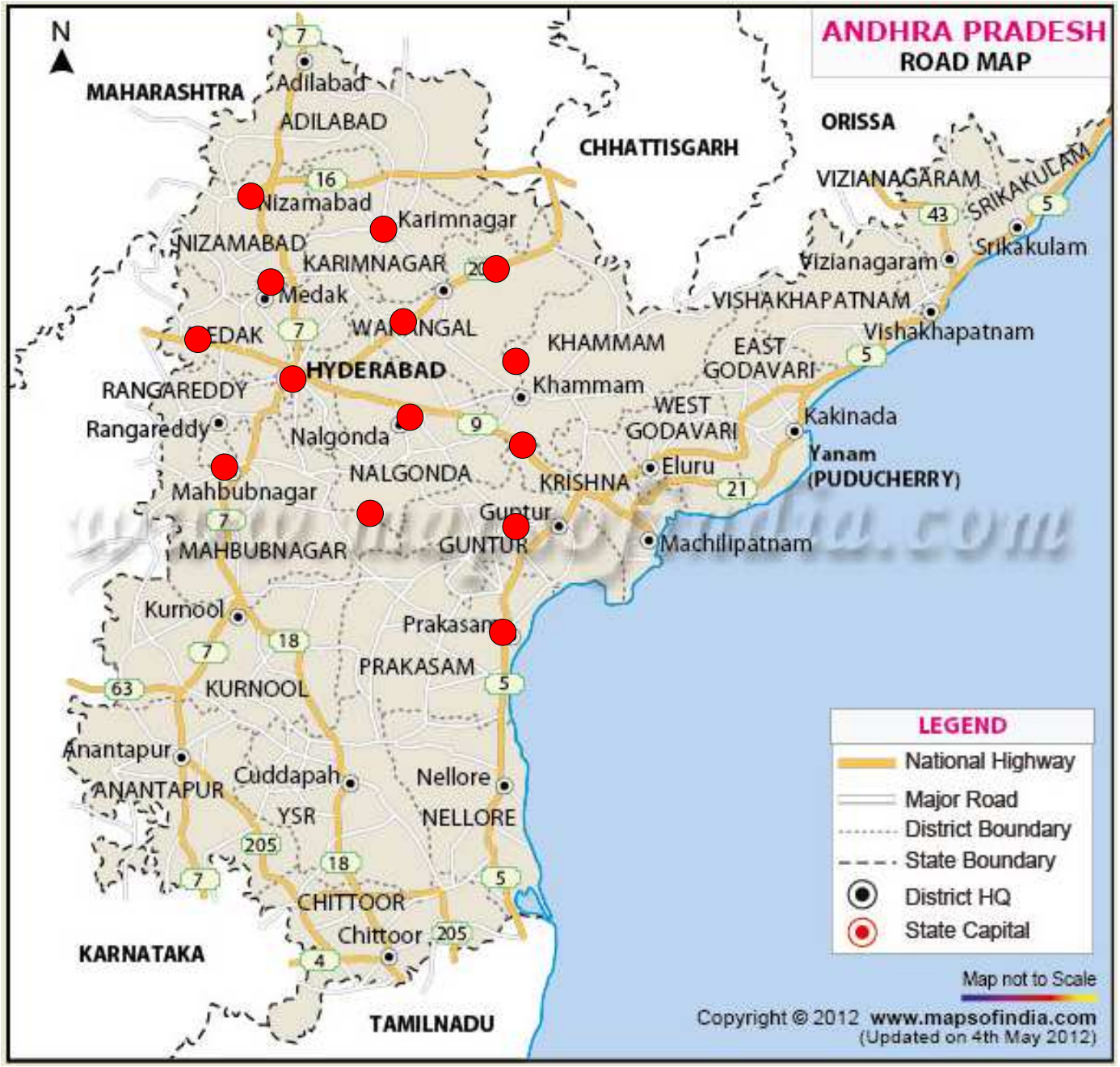
- Control Station consists of Servers for incoming data and outgoing data, one server for processing the data at Control Station and one backup server for each of the above.
- The adjoining picture shows the rack mounted servers in a Control Station.


08/12/2011

Pilot project for VRS

- The location of reference stations has been selected in such a way that they fall in the most developed areas of the above three states.
- The radial distance between two adjacent stations has been kept within 50 to 60km.
- Total 32 reference stations will be established in the first phase of the project in the three states Odisha, Andhra Pradesh and Gujarat. For establishment of reference station available GCP Phase-I or GCP Phase-II locations will be selected whose coordinates have been computed and standardised with reference to a particular ITRF at a particular epoch.
- The Control station will be located at Geodetic & Research Branch, Survey of India, Dehra Dun.

Location of Reference Stations in Andhra Pradesh:



Location of Reference Stations in Orissa:

Location of Reference Stations in Gujarat:

WAY AHEAD

Sl. No	Target	Timelines	Deliverables from SOI	Status
1.	National GIS Version 1.0	18 months	▪ A basic level of National GIS Infrastructure on which the Asset and applications would be hosted would be operational	National Spatial Reference Frame: ▪ 300 1st order precision GCPs at a spacing of 250 to 300 km. in phase-I completed. ▪ 2200 additional precision GCPs at spacing of 30 to 40 km. apart completed. ▪ 44,800 lin. Km. H.P. leveling line with establishment of BM at regular interval completed. ▪ Network of 36 Tide Gauge Stations already established along the Indian coast. OSM DTDB on 1:50k completed A portal (www.survekshan.gov.in) for providing WMS is under process, necessary infrastructure is already in place.

WAY AHEAD

Sl. No	Target	Timelines	Deliverables from SOI	Status
2.	National GIS Version 2.0 Mission and INGO	2012-2016	Enhancement & Scaling up of National GIS Version 1.0 with 1:10 K data and 24x7 services and operations	National Spatial Reference Frame: ▪ Densification and establishment of bench mark at 25-30 km. apart by running precision leveling line of 1,00,000 lin. km. connecting already existing GCPs with geo-potential numbers, orthometric height and gravity values to create India Geoid. ▪ Establishing Virtual Reference Station Infrastructure in India by establishing around 500 stations to cover entire country spacing 50-60 km apart. ▪ Maintenance of already established NSRF.

WAY AHEAD

Sl. No	Target	Timelines	Deliverables from SOI	Status
1.	National GIS Version 1.0	18 months	A nation-wide GIS Asset of ~30 features would be available based on 1:50K OSM DTDB-	
			▪ Administrative boundaries up to village level.	Compilation in desired format completed
			▪ Transportation Layer	Compilation of Major Portion in desired format completed
			▪ Digital Elevation Model based on orthometric height	Compilation in desired format completed
			▪ Hydrography	Compilation in desired format is Under Process
			▪ Forest Cover	Compilation in desired format is Under Process

WAY AHEAD

Sl. No	Target	Timelines	Deliverables from SOI	Status
2.	National GIS Version 2.0 Mission and INGO	2012-2016	National GIS Asset with 41+ features and 15+ geo-tagged attribute data from census, demographic & planning i.e GIS Ready DTDB on 1:10k	▪Specific Training Module of SOI personnel for this activity completed ▪Sample GIS ready map on 1:10k already released. ▪Team of Officers from SOI & DoS working on comprehensive project document. ▪Standards & SOPs for various component activities are being finalized. ▪PoC is being done for firming of methodology of different component tasks.

Questions?

THANK YOU