

## **SOME PRE-REQUISITES FOR DEFINING GEOSPATIAL VISION ABSTRACT**

We are all aware that more than 90% decisions at various levels of management are based on Geographies which in turn is dependent on Geospatial data. The author who has been involved for over 50 years in generating, utilization and quality assessment of Geospatial data feels a lot has to be done before defining our Geospatial vision which shall and can meet our 21<sup>st</sup> century requirements.

The author has therefore tried to put before this August gathering, some of the realities in existing Geospatial data to be encountered in the present Geospatial scenario and discuss how to bring its easy availability after enhancing its usefulness by bringing in uniform standards through NSDI framework.

In addition to the above there is a dire need to bring in uniformity and quality in Geospatial data being generated throughout the Country by various agencies to remove inconsistencies, create a national data warehouse as part of NSDI and to avoid duplicacy of national effort and enforce standards at state / national level and build a repository of Geospatial data at District, State & National level in a uniform manner, whether part of existing set up or otherwise.

Last but not the least, generation of Geospatial data is a very time consuming and costly process and a mechanism has to be put in place so that Geospatial data norms are not only enforced but also that all data generation follows uniform standards and which can be construed as major usefulness of the NSDI.

### **INTRODUCTION**

The topographical maps on different scales are not meeting the requirement of planning and infrastructure development in rural and urban areas. Therefore, now there is a need of digital spatial data on scales commensurate to the requirements of planning for urban and rural areas. Latest methods of data capture and processing using digital techniques is the requirement of present day. In this context, all maps on scale 1:250k, 1:50k and 1:25k scale available with Survey of India (SOI) are mostly on paper form which are cumbersome to use. These maps are being converted into digital form by SOI to provide framework spatial data to customers in NSDI platform. Topographical maps need to be updated using inputs like high resolution imaging data or rapid ground truth checking with digital techniques on a fast track mode.

### **PRESENT SCENARIO OF SOI TOPOGRAPHICAL AND OTHER MAPS**

1:250,000 with contours at 100 m/200 m, 394 Map Sheets

1:50,000 with contours at 10 m/20 m, 5,104 Map Sheets

1:25,000 with contours at 5 m/10 m, 19,540 Map Sheets

In addition some guide maps & specifically prepared project maps are also available.

Digital maps on 1:250k are available with SOI for the country. Maps on scale 1:50k have also been digitized and 1:25K maps cover only about 30% of the country. More over these maps are on Everest Spheroid Datum, are restricted and not available to the general public for use.

However, SOI has brought out a new series maps which are on WGS-84 Datum. These new series maps are on Universal Traverse Mercator (UTM) projection, which is a projection, used for topographical maps adopted by most of the countries in the world.

The contours and spot heights on the existing topo maps are based on Mean Sea Level heights. In the present scenario, GPS provides plan coordinates in WGS84 datum and heights are on WGS 84 spheroid. The relationship between Geoid (MSL) and spheroid is not known very precisely in India. Therefore, height obtained through GPS technique cannot be converted very accurately in terms of MSL height. In fact, Geoid model for India has many shortcomings like it is not based on the Gravity model. There is a need to have dense gravity control points in the country for determining best fitted gravity model and then to define best fitted spheroid. Once the separation between these two surfaces are well defined the GPS technology can effectively be used for collecting geospatial data including heights.

Establishing gravity model is a Herculean task. The Government of India through Survey of India should take up this task on priority basis as a first step. The separation between Geoid & Spheroid (Geoidal Undulate) should be available to every GPS users so that they could use the GPS technique and provide geospatial data for developmental activities.

The maps, which are available with SOI, are also quite old. These maps require updating as well as conversion to WGS 84 datum for which decision has already been taken that maps shall be made available on this datum as open series maps.

Topographical maps are on small scale i.e. maximum up to 1:25 K. There is a need to have large-scale maps for developmental activities. It is another very big task, which requires to be completed as early as possible.

## **GEOSPATIAL DATA IMPORTANCE**

Geospatial data is becoming more and more critical for effective planning and decision-making. With the availability of modern technology, it is possible to exploit technology to good advantage, obtaining new products and services faster and cheaper as compared to conventional techniques.

There is a need to have large-scale land base for the country for development and planning.

In fact, we should cater for the following scales for entire country.

- a) Very Congested Area - 1:500 Scale
- b) Urban Area - 1:1,000 Scale
- c) Semi Urban Area - 1:2,500 Scale
- d) Country Side - 1:10,000 Scale

To achieve this the author proposes Public and Private partnership.

## **TECHNOLOGIES**

Introduction of the technology of Pictometry, 3D Mapping, LIDAR, Global Positioning System (GPS), Electronic Distance Measuring (EDM) Instruments as well as Total Stations, Precision Level, sophisticated measuring techniques have made it possible to prepare large scale maps.

The Air-borne Laser Terrain Mapping (ALTM) or (Light Detection and Ranging) LiDAR technology is now being accepted as a state-of-the-art technology and is being used by many countries in the field of surveying and mapping. Over the past few decades, the developments in computer technology has made the availability of Spatial information in real time for the manifold activities in different spheres of human endeavor and at an affordable cost enabling fast critical decisions on all aspects of our lives.

Geographical Information Systems (GIS) allow users to create, analyze and manage information about locations in ways, which were never before possible.

In the present scenario, we may identify various technologies and modern techniques where its products and services are directly representing their applications in sustainable development.

These are:

### **Technologies:**

- Navigation and positioning
- High resolution images
- GIS
- Data visualization
- Database management
- Geospatial data and its infrastructure
- User application

### **Modern Techniques:**

I would also like to list some of modern techniques being used in Geospatial domain:

- Field Work: GPS, Total Station, Satellite Imagery, Pictometry and ALTM/LiDAR
- Data Editing: Digital technology
- Cartography: Color separates digital technology
- Reproduction: Advance technology

Some of the modern technologies which are revolutionary in use for rapid collection of geospatial data, data manipulation and visualization are being briefly described below:-

## **Pictometry and LiDAR**

The power of oblique images had not been fully harnessed until pictometry came into existence. This exciting new system integrates multiple viewpoints in a user-friendly viewing package.

Pictometry's software allows users to access oblique (3D-like) aerial photos of every building, Highway and all other features.

Light Detection and Ranging (LiDAR) uses the same principle as RADAR except that it uses a laser instead of radio waves. One of the principle uses for LiDAR is for the measurement of elevation.

In its raw form, LiDAR is a series of points stored as x, y, z where x and y can be longitude and latitude; z is the elevation . Another representation for LiDAR data is as contours lines. The lines can be stored in a number of different CAD and GIS file formats.

## **Navigation and Positioning**

The principal navigation and positioning technologies in use today are the GPS, inertial navigation systems (INS), radio-navigation systems such as differential GPS, beacons, satellite wide-area systems and local radio links.

Recent developments in GPS technologies include the incorporation of the Russian GLONASS system

## **High Resolution Images**

Characterized extremely flexible and broad range of high-resolution data enabling mapping at scales of better than 1:1000; black-and-white and color photography, mono and stereo; high-resolution multi-spectral and radar digital imagery.

## **Geographic Information Systems**

Geographic information systems (GIS) deal with the storage, management, retrieval, conversion, analysis, modeling and display of spatially related data in a systematic way.

GIS software is potentially applicable in nearly any situation that calls for decisions involving a spatial component. In other words, GIS can be a useful tool in situations as diverse as area to determining the environmental impact

## **Data Visualization**

Geospatial-related data visualization technologies are tools that facilitate the understanding of complex data sets, models and issues that have a spatial component. They include everything from their simplest form -- paper maps -- to a wide range of computer hardware and software.

While these represent a broad spectrum of complexity, these media are linked by their purpose of presenting geospatial data from different perspectives

## **Database Management**

Database management systems (DBMS) are specialized pieces of software that provide functionality for :

- Storing
- Updating
- and retrieving information

It generally provides mechanisms for maintaining the integrity of stored information, managing security and user access, recovering information after the system fails, and accessing database functionality from within an application written in a third-generation language such as C or JAVA.

## **APPROACH TO MEET THE USERS REQUIREMENT**

The guiding principles in this area can be, to account for requirement and continuously improve performance and remained customer focused. In order to achieve this, it requires to speedup data collection and meet demands in a timely manner. Private parties may be involved in collection of data. The partnership may be on a contractual mode.

The characteristics of the geospatial data set are changing. First and foremost is to meet users demands effectively, the capacity for the real-time collection, synthesis and access must exist; data currency is essential.

Presently Real time applications of geospatial data are gaining momentum. These applications need a dense coverage of geospatial data in advance for the entire country. The data needed should have currency and accuracy. In India, we lack this information as data with SOI was collected keeping in view the topographical maps and its accuracy is 6.25m to 12.5m at Sigma Level and also the data is quite old, may not speak ground truth in the present form due to fast developments and other natural calamities. There is therefore, a need to have ground truthing for data in present form.

Government of India/ Ministry of Science and Technology/ SOI should think on these line and formulate guidelines for collecting geospatial data for entire country in short time so that the real time application not only for navigation but also for developmental activities could be undertaken by all users of geospatial data.

## **Conclusions**

Core technologies such as GIS and GPS have matured during the 1990s and increasing attention is now being focused on the development of user applications and solutions. This technology segment can be defined as software/hardware solution bundles developed specifically to solve geospatial information user's problems. Pictometry and LiDAR technology could be used for rapid data collection

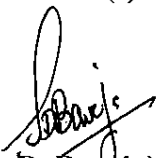
Geospatial data is becoming more and more critical for effective planning and decision-making. With the availability of modern technology, it is possible to exploit technology to good advantage, obtaining new products and services faster and cheaper as compared to conventional techniques.

Survey of India as a National Mapping Agencies (NMA) in the country, should provide geospatial data to the whole user community timely and in cost effective manner. At the same time recognize that there is no monopoly in good ideas and practices. The NMA of India should benchmark itself with other national mapping organizations in the world and ensure that the geospatial data is available to all enabling critical decisions on all aspects of our lives.

Process and a mechanism has to be put in place as part of Geospatial Vision so that Geospatial data norms are not only enforced but also that all data generation follows uniform standards and which can be construed as major usefulness of the National Spatial Data Infrastructure (NSDI) also.

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**With Warm Regards,  
For RCE-(I) Pvt. Ltd.**

  
**(S. D. Baveja)**  
**Managing Director**