RNI: DELENG/2005/15153
ISSN 0973-2136
Vol I, Issue 3 Aug 2005
Rs.100

Coordinates

POSITIONING, NAVIGATION AND BEYOND

TRAPPED

A cGIT publication

Confederation of Indian Industry

Department of Science & Technology
Govt. of India

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Articles

Columns

This issue has been made possible by the support and good wishes of the following individuals and companies Alok Upadhyaya, Amitabha Pande, Amit Kishore Prasad, Anshu Sharma, Dhruv Sodani, I V Murali Krishna, Janaki Turaga, J K Ghosh, Kislay Kishore, Madhav N Kulkarni, Madhur Juhuri, Muneendra Kumar, P Misra, S D Baveja, Shveta Mathur and; AAM Hatch, CII, Contex, Leica, Trimble; and many others.

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Printed and published by Sanjay Malaviya on behalf of Centre for Geoinformation Technologies (cGIT) at A221 Mangal Apartments, Vasundhara Enclave, Delhi 110096, India. **Editor** Bal Krishna | **Owner** Centre for Geoinformation Technologies | **Designer** Sahil Fernandes | **Printer** Sonu Printer, A110 DDA Sheds, Okhla, New Delhi, India.

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SCANNING TECHNOLOGY

Moved and moved on

I was terrified.

Terrified at what we saw through the electronic media; the agony and trauma that Mumbai underwent after the unprecedented rainfall (944 mm in a span of 24 hours on July 26, 2005).

Terrified by this sudden rain burst. And more terrified by the total collapse of the system.

Many died. Many left to live with the trauma.

This cannot and should not be treated as an isolated event.

It is a reflection of a phenomenon. The human 'indulgence' to the so-called concept of 'development'.

It is a reflection of the fact that there is no regard to mother earth and developmental decision making is more governed by short term business economics rather than long term eco-logics.

It is a reflection of the fact that constructing buildings is more important than conserving forests.

Great cities, great planners, great technologies and great decision makers.

Yet such disasters. Any accountability? Anyone care?

True, many of us were moved. And, also true, most of us just moved on.

Probably, something is seriously wrong in our approach and attitude.

Till that changes, let's keep watching.

The wrath of disasters, hopelessly.

And helplessly too.

Bal Krishna, Editor
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Physical information inputs for planning agencies

Proposed Design of technology-mix based on GPS and Photogrammetry

Prof P Misra

The environment of a Municipal Information system has undergone a sea change over last few years. Couple of years back the requirements of information system was designed and projected primarily from the planners community. They were satisfied if the physical information was supplied on a scale of 1:5000/ 1:10,000.

Presently the demands are coming from urban engineers involved in detailed design of water supply and sewerage systems, traffic and transportation (including fire and police), electricity and power and revenue authorities that are concerned with the land/ property related matters. Comparatively new entrants are the professionals from the telecommunications (diggers for fibre cables!) and other utility – infrastructure personnel, who have started looking at the third dimension of the town (heights of buildings) for mobile cell communications. There are hosts of other users who need accurate urban information.

The upshot of all the above information is that the Municipal Information System (MIS) which is being designed today must cater to all the future requirements which should be presented in the most friendly manner. What is mentioned above is the perspective of the proposed design incorporating the optimal use of various technologies in the realm of modern geomatics. The digital database of physical information will, in fact depend on the judicious combination of technologies of photogrammetry and Global Positioning System (GPS) which will form the ultimate Geographic Information System (GIS) of the Metro town.

Requirements and Scale Matrix of Different users

The table 1 indicates the needs/ functions in terms of scale of maps and information on elevations. For digital maps the scale depicts the density of information and inherent accuracy linked with that scale.

Determination of Scale, Elevation and Contents of Database

A glance at the table 1 clearly indicates the design of the database which should cater to the present and future needs of the various stakeholders (users) of the database. The database should also take care of the various 'attributes' as defined in GIS. For example in housing function, apart from the spatial location of the house, the ownership, tax status, number of inhabitants, usage (residential/ commercial) etc should also be stored in the Database for the benefit of end user of GIS.

It is very evident that all the required information need not be built as one project. The urban database can be designed on the 'evolved' basis. The priority information needed by most of the users can be collected first. The remaining information and attributes can be acquired in the phased manner. The direction of thinking has led us to first create the essential information through proper aerial photography, field surveys for ground controls and Photogrammetry which will act as foundation to link any other spatial information to be collected in subsequent phases. As a word of caution, the control technology in the field should be very reliable and accurate right from the beginning.

Objectives of the Design

To establish computer based (digital) database for an urban area or a metro area utilizing the modern technologies of: Aerial photography, Control

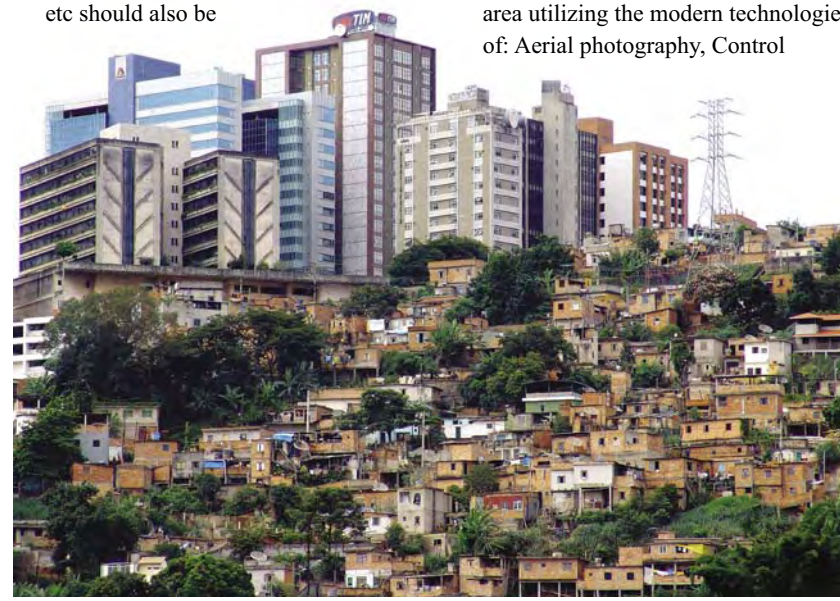


Table 1

Need/ Function	Scale	Height/ Contour Interval (m)	Remarks
Planning: Master Plan/ Structure Plan, Zoning Plan	1:4000 to 1: 5000	2 to 5 m	Legal document
Engineering Plans	1:2000 to 1:4000	0.5 m/ 2 M, Bench Marks`	Frequent revision
Housing Plans	1:1000 to 1:4000	do	
Water Supply, Sewerage	1:1000 to1:2000	Spot heights + Bench Marks	
Traffic Junction Plans	1:1000 to1:2000		
Transportation Routes	1:5000 to 1:10000	2 m	
Road & Highways	1:2000 to 1:10000	1 m	
Regulatory Functions			
Revenue Authorities	1:1000 to 1:4000		Checking encroachments, property matters
Unauthorised construction, encroachment, squatter settlement, monitoring	1:2000 to 1:4000		
Other Departments			
Ground Water	1:10000 to 1:25000		
Drainage	1:10000 to 1:25000		
Inventory of trees, parks, environmental themes	1:4000 to 1:10000		
Heritage Monuments	1:1000		
Police/ Fire	1:2000		

technology of GPS Photogrammetry; Orthophoto and stereo restitution GIS and satellite imagery

To design the information retrieval system which is friendly to the functioning departments who will utilize the databases

To keep this database updated to the time cycle of 4 – 6 months.

Design Concepts

Methodology

In particular, we recommend the use of aerial photography, a well proven technology of Photogrammtry, which is productively and commercially being utilized for many urban projects. The modern technology of GPS will go to support the preparation of Digital Database and the processing of Photogrammetry. The basic steps involved in the methodology are described further.

a. Aerial Photography

It is proposed that the whole urban area should be covered with aerial photography on scale of 1:8000. The above scale has been selected in order to produce accurate base-maps up to1:2000 scale. These base maps can also be utilized for urban cadastral purposes (authentic map of property) and for determining the encroachments.

b. Urban vector maps

Urban agencies will be interested in true location of almost all the physical features. Keeping this in view a scale of 1:8000 for aerial photography is proposed as optimum which will be used for producing 1:2000 scale vector maps. The vector maps based on accurate technologies of GPS and photogrammetry only can resist the legal onslaught in any dispute.

c. Vital Role of GPS

Photogrammetry stipulates a minimum number of ground controls points at proper location with respect to the incidence of aerial photographs (model) on the ground. These groundcontrol points are marked very accurately on the aerial photographs and form the first and most important input to the process of photogrammetry. By resorting to the differential GPS for provision of ground control an accuracy of ± 5 cm can be achieved.

As mentioned earlier, the ground control points form the first input to Photogrammetry. In that, these control points are used to orient the aerial photographic model (stereoscopic model) for scale, elevation and accuracy. We wish to identify some ground points in the town which are small in size, peculiar and symmetrical so that these are easily identifiable on aerial photographs. We would like to provide x, y, z control points for photogrammetry. The special requirements, if any, by user agencies for identifying certain fixed points can also be taken care of.

d. Monumentation of Ground Control Points

It is the normal practice to provide some permanent pillars (x, y, and z coordinates) at suitable places in the city which will be most valuable for any future references. These references have a tendency

to crop up in land oriented legal disputes. The permanent pillars also are ideally useful for location of engineering projects on the ground. A suitable design on the survey pillar appropriate to the city and the location of the pillar can be evolved in consultation with the authorities.

e. Photogrammetric processing

This is photogrammetric operation in which initial field control (as mentioned earlier) is augmented by a set of procedures on photogrammetric instruments. The result is that the photographs (stereo models) will have control points at optimum places. These control points obtained after aerial triangulations are used for automatic orientation of models in analytical/ digital photogrammetric instruments before carrying out photogrammetric plotting/mapping. The digitization of all the physical details of the map and elevation is done mechanically while plotting. Thus in present day photogrammetric machines the map output can be obtained as hard copy as well as in digital form.

Digital Database – Contents and Format

The database will have the following information, the list is just indicative and can be modified as per the requirements of Urban Agencies.

a. Physical Information

All topographical features subject to the scale of 1:1000, contours at 1 m contour interval, spot height at 100 m grid, ground control and GPS stations.

b. Buildings

Building roof; Building, heights of buildings, especially high rise buildings; Industry/ Commercial area/ Business sheds; Retaining wall; Chimney; Brick Kiln

c. Road

Metalled/ consolidated road; Unmettaled/ unconsolidated road; Parking; Traffic Island/ Boulevard; Traffic fence; Internal road; Road center line; Road various/ path; Road Bridge

d. Drainage

Rivers (>3 m wide – 2 lines); Streams (<3 m single line); Edge of drain/ ditch; Canal bed; Canal Bank; Culvert; Well; Lake/ Pond/ Tank; Marshy land/ Bogs

e. Physical Boundaries

Landuse boundaries; Fence; Hedge; Slope top; Slope bottom; Plantation line; Garden; Forest Area; Rocking/ quarry Area; Mining areas; Wasteland

f. Others

Powerline; Poles; Electric/ telephone poles; Transformers; High Tension Line; High Tension Pylon; Pylon base; Railway track

g. Land Use Information

Type of soils; Ground water table; Water logged areas; Sport/ golf course; Trees and vegetation; Pylon Base; Mast

h. Slums and Squatter Areas

The roof area of slum cluster with open spaces, lane etc.

i. Water Supply and sewerages (based on local records)

Major water supply lines
Manholes
Sewerage Junction etc

Note: The above list provides an idea about items which can be picked up by aerial photography. Similar objects can also be suggested by the users.

Basic information attribute to be supplied by the urban agencies

a. Socio-economic data

Plot ownership and other attributes; Property ownership and other attributes; Agricultural/ villages inhabited area socio economic data will be collected/ collated by local authorities for information

b. Boundaries (with pillars, if any)

Municipal ward; Defence land; Government land; Names of localities and important landmarks

c. Any other information (attribute) as desired

Revision and updating of urban digital data

Preparation of Municipal Information System will entail major efforts in generation of physical database. This is a common scenario in all developing countries, as all the information required for GIS is not readily available.

After the data base is prepared through the photogrammetric process, it will be incumbent on the authorities to update the database. Major physical changes take place

Smallest size of ground object on aerial photography

Taking 20 microns (1 micron = 1 mm/ 1000) as the resultant resolution of aerial negative; the minimum size of object on the ground, which will be visible, is 20 microns X 8000 (scale) = 160 mm or 16 cms on orthophoto. It means that most of the distinct manholes or equivalent sized objects will be visible on the aerial photograph.

The aerial photography in India is generally carried out by the National Remote Sensing Agency (NRSA), Hyderabad. The modern camera, which NRSA uses, is fitted with GPS and Image Motion Compensation (IMC) device. This entails significant reduction of field control and improves the quality of aerial photography. The quality of aerial photography adheres to world contemporary level.

on the periphery of the town. Fast growing town, will have a lot of changes in building, roads, parks, drainage, landuse and infrastructure and a host of underground utilities. It is therefore suggested that digital database should be kept updated with the help of field visits, aerial photographs/ high resolution satellite imagery and verification by ground surveying techniques, especially GPS.

GIS

GIS is basically a comprehensive spatial decision support system based on geo-referenced digital database, computer hardware/ software and non-spatial attribute data. The spatial data is obtained from satellite imagery, aerial photography/ photogrammetry, GPS and ground visits. Preparation of the digital database is 70 – 80% of total efforts for the establishment of the GIS. The digital database, once complete, will be a big fillip towards establishment of GIS.

Municipal Information Functions

It is our objective to design an operational and dynamic Municipal Information System, which will be greatly facilitated not only by the generation of a detailed Digital database but also which can be easily accessed, updated and analysed for different purpose.

It is proposed that the GIS will cater to the data requirements of all the departments. The provision of a common database and access to it by the various departments of planning, property, finance, engineering, industry, personnel and that of marketing and rural development will not only increase efficiency and productivity but also go a long way for future decision support system.

The section below indicates the possibilities that exist each of the departments. The Engineering Department would not only be able to have a complete grasp of the existing situation, but also plan for the design of new roads and facilities. Detailed utility mapping showing the exact spatial location of the water supply lines, the sewerage network, the telephone and electricity supply lines would go a long way in providing optimal services and increasing revenues. The detailed spatial database would also provide the ideal basis for the monitoring operations and maintenance of existing assets.

The Planning Department would require detailed landuse maps, which would not only help in the preparation of the new Master Plan but also help in the process of monitoring. The contents of same database can be used to develop an approval system wherein the process of building/ plan sanctions can be approved on-line or with minimal paper work.

With respect to Revenue and Cadastral Management system the detailed base map can be used as a base to develop a monitoring mechanism with the details of the properties, their current value and the rate of taxation, etc. This will give a clearer understanding of current status of properties related to their various aspects and thereby help in initiating processes for revenue collection.

Once a detailed digital database is created, the contents of this would be used to develop web-based application. The web based applications can not only be used to inform and interact with the public, but also reduce paper work, increase efficiency and if necessary limit direct contact with the public to a minimum.

Map Updation and Maintenance System

A modern coordinated cadastral system requires regular Maintenance. To keep the records up-to-date and without losing the reliability of data, the cadastral maps have to be updated from time to time. A programme of renovation would be required to be incorporated into the regular surveys replacing the coordinated points which are lost, disturbed and become invalid.

Land Information Technologies - Regulating the City

Regular Monitoring for Encroachments

Encroachment of government land and unauthorized construction are very much a common feature of any urban centre. By comparing the base maps of different epochs of time one can get the handle on the extent of encroachments and its location. The technology of producing the base maps will be suitably designed to get authentic extent of the encroachment.

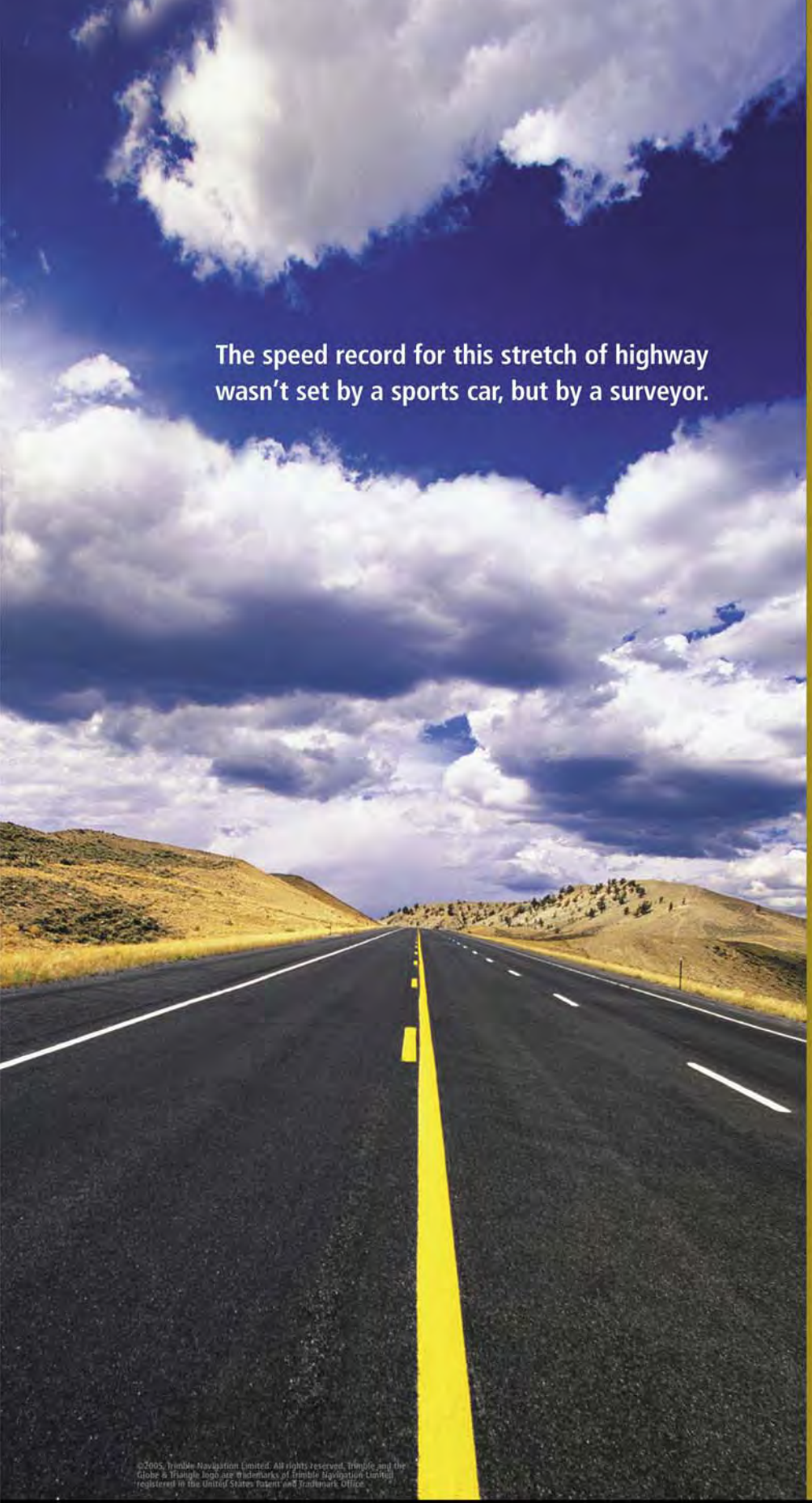
Environment Monitoring

This function in managing a city has recently gained a major dimension. The fact is that public perception of a city administration is judged mainly by the way environment is officially monitored. The proposed design will be able to provide working information on:

Inventory of all trees and vegetation (type, location) as Bench Mark study. Any subsequent change will be measured with respect to this Bench Mark Surveys.

Urban Digital Orthophoto

Orthophoto by definition is an aerial photograph, which has been scaled and does not have geometric distortion (tilt and relief distortions). Photogrammetric process is carried to the stage of Aerial Triangulation which then helps in generating the digital terrain model of the overlapping photographs (model). The DTM generation will be carried out in two phases, in phase I, the automatic terrain extraction will be processed which will be followed by manual editing to incorporate the break lines and rectifying the inconsistency of contours to fit the terrain. The resultant DTM is made as an input to generate dimensionally accurate Orthophoto.



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Establishment of urban village boundary (Lal Dora) – Village boundary determines the land use of urban village. This should be clearly established on the map in an unequivocal manner.

Financial Aspects

The cost of the Design Proposal will depend on the following:

- Technical Activities
- The Managerial decisions about the phases for the production and its strategy.

Strategy of Production Phases / Scheduling of Investment

Decision about these phases becomes important to reduce the budget allocation per year. For example, aerial photography (which is not costly) should be ordered for the whole area of town. Similarly, field control (GPS operations and leveling) is also essential for the whole area. Once these two items are done, the process of aerial triangulation can proceed at convenience. This is a low cost item and can be taken up for the whole urban area. After incurring this cost, the decision of the Agency (or several agencies) can be taken to spread the cost of mapping to a longer period of more than one financial year by asking for photogrammetric mapping of only a small portion of the town. This is being suggested as the major cost of mapping lies in the photogrammetric plotting. A suggestive cost pertaining to the various processes/ activities is given in table 2.

Table 2

Creating Digital Database through GPS control

List of Activities

Assumption: A representative area of 20,000 ha is being considered for costing. Prorata costing can be done for the actual area of the town.

1.	Commissioning of Project Collection of Maps, records, Literature & Reports Recruitment of Manpower Purchase of Statellite imagery from NRSA	@ Rs 15/ha = Rs 3.0 lakhs
2.	Aerial Photography Aerial Photography by NRSA on scale 1: 8000 Assumed area 20,000 @ Rs 40/ha	20,000 X 40 = 800000 = Rs 8.0 lakhs
3.	Field Work, GPS based Leveling Total Station Settings and Survey Operation through GPS @ Rs 80/ ha A field control point generated through Differential GPS method may cost between Rs 2500 to Rs 3500 per point	20,000 X 80 = 1600,000 = Rs 16.0 lakhs
4.	Miscellaneous items Construction of pillars/ monuments No of pillars 50 @ Rs 6000 (all controlled by GPS)	Rs 3.0 lakhs
	Pre-pointing of pillars and control points On aerial photographs including signalization of Ground points	Rs 2.0 lakhs
4.1	Aerial Control Extension @ Rs 20/ha	Rs 4.0 lakhs
	Total	**Rs 36.0 lakhs**

Note: The above expenditure should be extended for the whole area of the town.

5.	Mapping of the First Phase Area (10,000 ha) Photogrammetric plotting @ Per ha Rs 350 X 10000 ha (350,0000)	@ Rs 350/ha = Rs 35.0 lakhs

Note: Cost of urban orthophoto is likely to be 60 to 70% of the abovecost

6.	Field Verification Rs 20 X 10,000/ ha	@ Rs 20/ha = Rs 2.00 lakhs
	Total (5+6)	**Rs 37 lakhs**
7.	Documents Hard copies/ soft copies/ cartography/ autocad drawings and report writing	Rs 20/ha = Rs 2.0 lakhs
	Total of 1 to7	**Rs 75.0 lakhs**

GIS Price not given in this document

Conclusion

The proposed design of a mix of the various available technologies in India will provide a robust, reliable, comparatively low cost and easily operable Information Base in digital and paper mode. The various agencies can pool their part budget(s) towards the cost. The ideas suggested in this paper could easily be converted to a project/ tender and can be easily accomplished through Public Private participation in the matter of one to one and half years. The most difficult part is to make a beginning.

Yet another feature of the design is that the data base will provide the utmost accuracy which is primarily required for engineering projects and establishing encroachments in the 'final' sense. There will be permanent landmark on the city for further accurate work or the re-establishing 'rights'/ right location in legal sense.

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Geodesy

In continuation of the discussion about the ellipsoid and geoid in the earlier interaction through the Classroom feature, let us define the reference coordinate systems. Consider a vertical axis oriented towards the north pole as Z axis. The X axis is oriented towards the First point of Aries γ. The Y axis completes a right handed system. Let 'r' be the unit radius of the sphere as defined in spherical astronomy. The transformation of spherical coordinates α, β, r into Cartesian coordinates X, Y, Z then can be defined as follows:

$X = r \cos\beta \cos\alpha$, $Y = r \cos\beta \sin\alpha$ and $Z = r \sin\beta$

The inverse formulae are

$r = \sqrt{[X^2 + Y^2 + Z^2]}$

$\alpha = \arctan(Y/X)$ and

$\beta = \arctan\{ Z/(\sqrt{[X^2 + Y^2]}) \}$

The coordinate systems for describing the satellite motion and for the position of the observation station are indeed different. One is a inertial reference system and the other is a terrestrial reference system.. Detailed description of these systems is beyond the scope of this article and the explanation of these can be found in any book on geodetic astronomy. For most practical applications ellipsoidal coordinate systems are preferred especially for horizontal coordinates in geodetic networks, because they closely approximate the earth surface.

Geodetic datum

The concept of geoid and ellipsoid can better be understood through the figure 1. For most practical applications ellipsoidal coordinate systems are preferred especially for horizontal coordinates in geodetic networks, because they closely approximate the earth surface. The angle θ between the directions of the ellipsoidal normal and of the plumb line at point P is called the deflection of the vertical. A global ellipsoidal system is related to reference ellipsoid system that fits the earth surface as a whole. The origin of the ellipsoid is supposed to coincide with the geocentre. The set of parameters that describe the relationship between a particular local ellipsoid and a global geodetic reference system is called geodetic datum. A geodetic datum is defined by a set of parameters depending upon the extent of consideration of the parameters of the ellipsoid. The most significant parameters to be considered are ε, f, Δ X, Δ Y and Δ Z. Here 'ε ' is semi-major axis of the ellipsoid, f is flattening parameter, and ΔX, ΔY and ΔZ are the coordinates of the ellipsoid origin (translation parameters or datum shift parameters) with respect to the geocentre. They represent a mean position of the particular local system with respect to the geocentric system. For Δ X, Δ Y and Δ Z equal to zero, the geodetic datum is called an absolute datum. Here the three rotation parameters are ignored. The number of the datum definition parameters increases when the datum information is derived from satellite orbits. In such a case the coefficients

of earth gravity field, constants of earth rotation, geocentric gravitational constant form part of datum definition. WGS 84 is an example of such geodetic datum. For Δ X, Δ Y and Δ Z equal to zero, the geodetic datum is called an absolute datum. The parameters of WGS 84 based on continuous evaluation are as follows:

Semi major axis ε = 6,378,137 meters

Flattening parameter f = 1 / 298.257223563

Angular velocity ω = 7.292115 x 10^{-5} radians per second

Geocentric gravitational constant Ω = 398600.5 km^3 sec^{-2}

The period from 1980s onwards has brought useful developments in satellite geodesy. This has resulted in operational use of satellite techniques in geodesy, geodynamics and surveying. This process started with NAVSTAR GPS.

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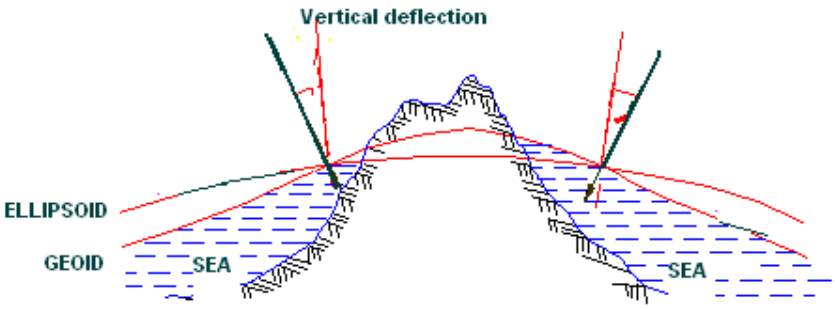

Fig 1 RELATIONSHIP BETWEEN GEOID AND ELLIPSOID

The Coordinates Class room espouse readers to graticules of Mathematics and Physics that epitomize the Geospatial Information Technology. A chain of structured presentations related to interdisciplinary principles that define Geodesy, GPS, GIS, Geospatial data management and Image processing are to be en suite in this section in each issue of the Coordinates. Initially the chain trembles with Geodesy which is the mother of technologies to position the Coordinates.

Fly around the world for free!

Google redefines the earth. A review from a common man's perspective

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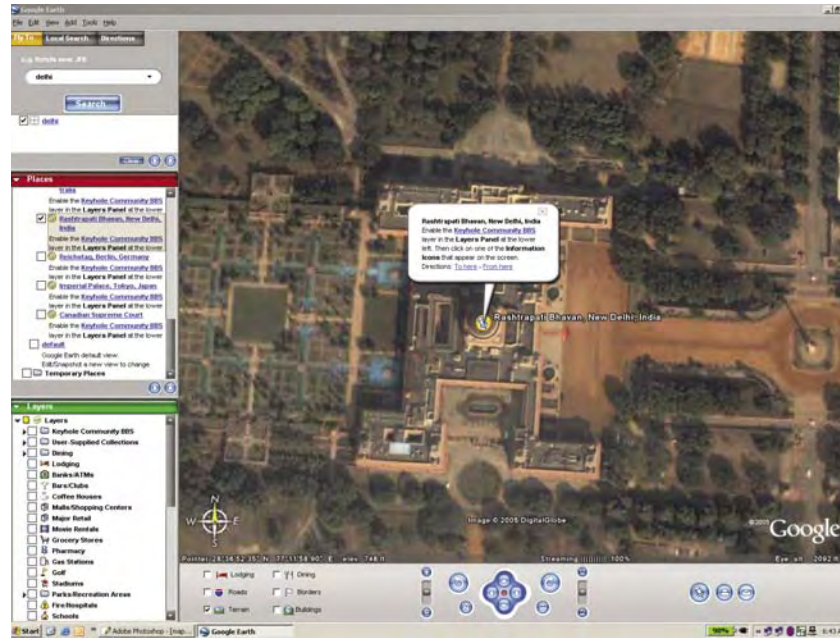


The recent internet mapping interventions by Google and MSN have significantly changed the mapping world by bringing high and medium resolution aerial and satellite maps into the reach of the common map at the click of the mouse. All you need is a personal computer and a cable/broadband connection.

Though internet maps were provided earlier by different players, the interventions of major players such as Google (http://earth.google.com/)and MSN (http://virtualearth.msn.com) have consolidated the internet map industry.

Medium and high resolution aerial and satellite maps are available for non-commercial use freely.

Both Google and MSN provide satellite imagery maps, of places with street names, locating places. The range of area for which data is provided by Google is the world, while for MSN, it is only USA, though it plans to extend this service to the rest of the world. Of the two, Google has a wider range of services and facilities, and products, such as GPS enabled Earth Plus, and for commercial products. Both the service providers are in the beta phase and plan to provide varied services and products to diverse users. With the entry of these two players, the internet map service industry(map data providers, technical support and technology base and the service providers) is in the process of being overhauled, and consolidated. Google's Earth Plus can read in GPS data, and thereby create customized maps.

A significant quantum of data is open for free (as yet) for diverse everyday uses such as finding directions, locating exotic places, planning for holidays, sites, etc.

Besides having opened up the world to everybody at the click of the mouse, internet map providers have melded multiple technologies to give high quality maps which were prohibited and prohibitively expensive in order to provide near real time maps for every day use for either free or at a fraction of the cost of the original maps. These maps are live and technology driven with maps being generated by GPS for individual users, and which are customized.

Future trends are demand based- providing real time maps, adaptable to new technologies for generating customized maps.

Therefore information is packaged broadly into non-commercial and commercial. The non-commercial segment is primarily free and provides data which is basic-such as finding directions, information about a place, locate your building, locate a site, etc. which enable a vast number of users in their daily lives. Such an exercise is based upon the necessity that only that data which is wired/ mapped is on the screen. Which means that if you are not wired or mapped you don't exist on the map. Secondly, the challenge that this has for third world countries, especially India, where urban entities have grown organically finding your building or your site or the best eatery on the map is going to be a difficult task, especially in the absence of street numbers and even house numbers. Finding your home/ a home based business enterprise in Dharavi slum in Mumbai or Munirka Village in New Delhi is going to be a challenging task, which google and msn would need to address in the near future. The changing urban landscapes- both organic and the planned have for long foxed the urban planners/ municipalities themselves.

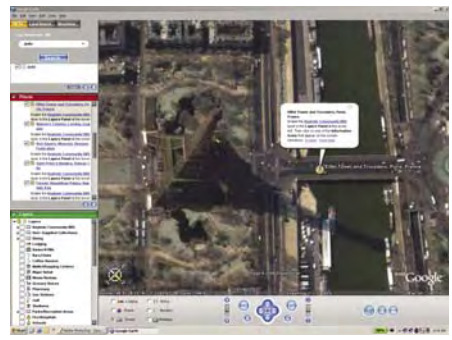
But then, with the increasing demand for real time imagery, GIS and GPS enabled map service providers

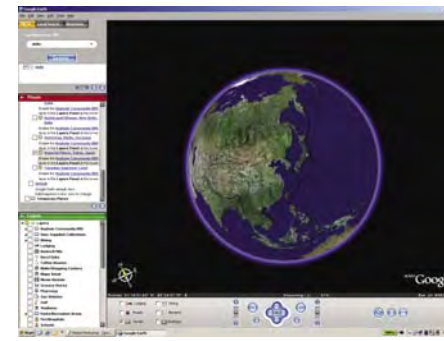
can provide real time pictures of situations such as the recent floods in Mumbai/Ahmedabad in India and also of other disasters, which enable better provision of disaster relief with better disaster management.

medium resolution imagery and terrain data which show major geographic features and towns etc., 3 dimensional maps, seamless 'viewing experience', resolution of more than 1 meter. But then, one requires to be on broadband/cable connection. Dial

others. And soon the most elusive eatery would be a thing of the past.

All this points to the making of a wired world, and are we driving towards that?





Readily available basic satellite imagery and aerial photos data is already being used. TV news channels are using satellite imagery in their bulletins. CNN used Google earth imagery in its Breaking News on August 16th, 2005 at 6 pm (IST) to show the site of the West Caribbean Airways airline's crash site in Venezuela. They showed the imagery of the crash site, and gave basic geographic information of the area based upon the available visual imagery.

With the availability of satellite and aerial photographs, a huge market has been opened up, with diverse users using the data now in the public domain. The commercial potential of this data is huge and earth google has multiple products for different users. While basic data is freely available, multiple layered data is available for commercial use for a fee. As of now the products are packaged with multiple users-basic data users. The hardware requirements are that of the configurations that are normally integral to a personal computer.

Google's Earth Plus, available for a nominal fee, has crossed the boundaries for customized maps as it is GPS compatible which leads to generation of real time customized maps.

The key features of Google Earth are: The entire earth is mapped in

up modem users are out. In India as most of the internet users are on dial up modem, this facility is out of reach. At the click of a mouse the world is at your use. Restricted data is now available. New trend-provide hitherto inaccessible satellite imagery and geographic systems information to anybody who has a broadband/cable connection. Opened up restricted data and made it unrestricted. Now in the reach of the common man.

The mobile food *carts/pav bhaji/ chaat/gol gappe wala* which sustain most of urban India's office lunch and snack time needs, would go out for a toss, primarily because they are mobile, and their physical space is undetermined in conventional mapping methodology. Salivating food aficionados have gone on expeditions in trying to locate the best *pav bhaji* eatery which has often been elusive. And those who have been there and eaten, find it hard to give 'directions' or to fix the physical space of a joint which has firmly located itself in their mental and gastronomic map. Finally it just boils down to 'I will take you there'. But this is where the GPS enabled map comes in handy. Foodies now can map the most elusive eatery in urban India thereby making driving directions simple. The one who has gone there and eaten has to use the GPS to map the route and share the map with

By making available free of charge basic GIS/Satellite imagery, India's national policy of restrictive map disclosure is now challenged. At medium resolution, basic data is available to anyone with a personal computer and a cable/internet connection. And also generate personal map for varied uses. Literally, the map is in your hands. And you make your own map. The world is in your hands, make your own world and your map.

From restriction to unrestricted information. Countries with policies of restriction of map information and maps, would now have to address this open access map information. Despite the decided information advantage that a toposheet has over a satellite map, the satellite map scores over the Survey Of India's toposheet in providing basic information, which is restricted to the Indian public for the restricted zone. India is now opened up to Indians, with the availability of satellite maps as well as the generation of GPS enabled customized maps. There is literally no frontier to breach. The trend of making the latest map information available has begun and will continue. With the availability of high resolution imagery, finally the satellites would finally justify their cost, by making the data available to the common man of the world.

Products

MapInfo Delivers OGC Compliance

MapInfo Corporation the announced that its MapXtreme® family of products has been certified as fully compliant with the Open Geospatial Consortium's (OGC) OpenGIS® WMS Specifications.

Applanix Releases POSPac LAND 5.0

Applanix announced the release of its latest data post-processing software specifically developed for the challenges of land-based mobile survey operations—POSPac LAND 5.0. Configured for use with its industry-leading POS LV (Position and Orientation System – Land Vehicles), the new software is designed to take advantage of the powerful, tightly-coupled inertial/GPS engine to provide new levels of performance while operating in a land environment.

It also annmounced that Wuhan University, one of the largest universities in China, has purchased its POS AV 510 . The university's School of Remote Sensing Information Engineering will be using the system on its RC30 aerial camera to expand its geodetic surveying, remote sensing and GIS data acquisition capabilities for geospatial research. *www.applanix.com*

Topcon announces GPT-7000i Imaging Total Station

Topcon's GPT-7000i Imaging Total Station is a full-featured total station that houses the innovation of a built-in camera mounted coaxially with the instrument telescope. This instrument offers new possibilities for surveyors that are not feasible with any other instrument, including direct visualization of stakeout points, visual blunder detection and a "telescope view" record of the survey work that has been done. *www.topcon.com*

Portable GPS With XM WX Satellite Weather

Garmin International, Inc. has announced the GPSMAP 376C — a portable GPS navigator that can display graphical XM WX Satellite Weather data directly on the unit's display like NEXRAD radar, storm cells, wind speeds, surface temperatures, forecasts, and more than a dozen other weather attributes. The weather data is the same leading site-specific, analytical weather technology and data provided to professional meteorologists across the USA *http://www.telematicsjournal.com*

Atmel and u-blox release indoor-capable GPS signal tracking

Atmel and u-blox AG have announced a new GPS weak signal tracking technology, called SuperSense. With this new GPS software, accurate GPS navigation becomes possible in building interiors, deep urban canyons, covered roads and other locations where GPS reception has previously been impossible. Previously such areas prevented effective GPS navigation due to systems' inability to effectively receive faint GPS tracking signals. *http://www.geekzone.co.nz*

ESRI launches ArcGIS 9.1

ESRI has announced that ArcGIS 9.1 is now available. ArcGIS 9.1 is a full release of ArcGIS Desktop (ArcReader, ArcView, ArcEditor, and ArcInfo), ArcGIS Engine, ArcGIS Server, ArcIMS, and ArcSDE. In addition, it is the main vehicle for the release of Network Analyst on the ArcGIS platform. *www.esri.com*

LPS V8.7 Service Pack 2 – ADS40 update

Leica Geosystems GIS & Mapping, has announced the release of LPS V8.7 Service Pack 2 (SP2) – ADS40 Update. The update provides users the ability to process images captured with the Leica ADS40 Airborne Digital Sensor. Concurrently released are updates for Leica GPro and ORIMA Orientation Management Software. These releases work together to facilitate a complete digital workflow in LPS using ADS40 data. *http://www.leica-geosystems.com*

Latest version of Geomatica 9 released

PCI Geomatics has announced the newest release of Geomatica 9, Version 9.1.7. This update offers significant enhancements to its renowned orthorectification and mosaicking capabilities. New features include an improved accuracy of PCI Geomatics' Rational Functions (RPC) modeling for multiple-image blocks.

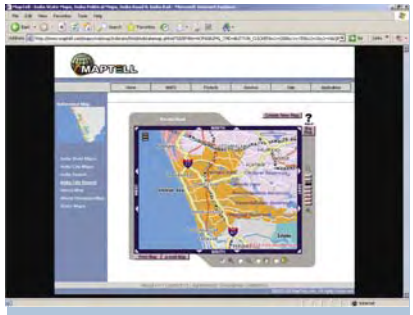
It also announced an extended partnership with GeoTango by becoming a global distributor of SilverEye, a software solution designed to extract 3D information from a single image, which uniquely builds 3D models and can obtain 2D and 3D measurements using only a single satellite or aerial image. Building textures can be applied using information from the imagery, employing a texture library or from ground photographs. *http://www.pcigeomatics.com*

Asian developer maps software to location services

An Asian software company has developed a new application for accessing location-based services on Symbian-based cellphones. Called NavFone, the software was developed by Agis, a Singapore-based company. Users can download it from the company's Web site and install it on cellphones like the Nokia 6600 and 6630. The software includes a directory map of the island-state, together with addresses of places such as restaurants, banks, roads, malls and churches. *http://www.zdnetindia.com*

Navman iCN 520 satellite navigation system

New Zealand-based Navman entered the satellite navigation market with



Maptell, an Indian Web GIS company has opened a new portal for mobile mapping. Mobile/ PDA devices enabled with GPRS connectivity can now access real-time location information. The current version contains Indian maps. http://www.maptell.com/mobile.

the launch of its iCN 520 model. Designed mainly for in-car use, the new model is based on a touch screen system. Featuring a black finish and comes pre-installed with the latest TeleAtlas maps, it run on the SmartST 2005 Navigation software that is indispensable when it comes to finding points of interest, streets, and postcodes. http://www.ubergizmo.com

Trimble introduces new features for RealWorks Survey Software

Trimble has introduced a new version of RealWorks Survey software for surveyors and engineers that leverages the rich point-cloud data set provided by today's advanced 3D laser scanners. The new software version incorporates a series of new precision tools and features for civil survey, building, heritage, forensic and other applications, allowing surveyors to produce 2D and 3D information for direct output or export to AutoCAD or MicroStation software design packages. *www.trimble.com*

Alliances

Antrix Corporation signs MoU with ERDAS India

Antrix Corporation Limited has recently signed a memorandum of understanding with ERDAS India Private Limited, Hyderabad for development of an interface software which will enable integration of CARTOSAT-1 Satellite Data products with Leica Photogrammetry Suite (LPS) and ERDAS Imagine Software Package. The CARTOSAT-1 satellite, which was launched by Indian Space Research Organisation on 5th May 2005 provides stereo data suitable for advanced and large scale mapping applications with its two panchromatic cameras having spatial resolution of 2.5 meter. The data is also a source for generation of Digital Terrain Models (DTM)/Digital Elevation Models (DEM). *www.erdasindia.com*

BAE SYSTEMS signs international distributor agreement with ICS

BAE Systems has signed an International Distributor Agreement with International Computer Systems (London) Ltd. (ICS), to distribute its Geospatial Exploitation Products (GXP) in Jordan and UAE through sister companies in Amman and Dubai. The distributor agreement with ICS extends BAE Systems' commitment to involve international partners to distribute its photogrammetry and image analysis software, which includes SOCET SET(R) and SOCET GXP(TM). *http://home.businesswire.com*

Business

Intermap announces new contracts

Intermap Technologies, has announced new contracts for its digital topographic mapping data totaling more than US$2.6 million. Intermap, in conjunction with Aero-Metric reported that the two companies have received a follow-on contract to map additional areas in the state of Alaska. AERO-METRIC is an U.S. based aerial photography, surveying and geo-spatial services firms. Following from the previous successes with the Department of the Interior, the Intermap/Aero-Metric team has once again been selected to collect and process data for the National Petroleum Reserve Alaska (NPRA). *http://www.ccnmatthews.com*

NAVTEQ acquires South Korean map provider

NAVTEQ, a leading global provider of digital map data for vehicle navigation and location-based solutions, has acquired PMI, a South Korean digital map company, for $28.5 million. With the purchase, NAVTEQ now has a local presence in South Korea and a digital map product available to service the dynamic Korean market. *http://www.tmcnet.com*

GIS for Philipines National Transmission Corporation

ESRI announced that Geodata Systems Technologies, Inc. (GSTI), its distributor in the Republic of the Philippines, has won a contract worth more than $600,000 to implement a GIS-based assets management system for Districts 1 and 2 of the National Transmission Corporation (TRANSCO). TRANSCO is responsible for electrical transmission for the country's National Power Corporation.

China Plans Woman In Space By 2010

China will put its first woman in space within five years and has selected around 30 omen pilots to be trained as astronauts, according to the state media. Hu Shixiang, deputy chief commander of China's manned space program, said some of the women will embark on a space mission no later than 2010, working as flight commanders or on-board engineers, according to the China Daily.

Have a news release?
Send it to us.

talktous@mycoordinates.org

USS Cape St. George is first ship using digital mapping system

Sailors on the USS Cape St. George is the first in the U.S. Navy fleet to switch from paper maps to a new digital charting system, linked to GPS and instant updates on ocean obstructions. The Navy, which has been working on the new technology since 1998, plans to install and use the new digital maps on the entire fleet by 2009. *http://www.estripes.com*

Satellite data, GPS aids study on Antarctic iceberg detachment

A multifaceted research effort by scientists at Scripps Institution of Oceanography at the University of California, San Diego, and their international colleagues from the University of Tasmania and the Australian Antarctic Division, have been investigating the mechanisms by which Antarctic icebergs detach from the main continental ice sheet because of the importance of determining the future stability of the entire Antarctic ice mass. Little is known about the processes and forces that lead to iceberg detachments, or "calving." *http://www.innovations-report.de*

School buses to be equipped with GPS

All 600 school buses in Metro Nashville in U.S.A. will have a GPS monitoring device onboard. The GPS will use software for tracking these buses from a computer at the school system's transportation headquarters, which shall include their location, speed etc.. The devices are so accurate that during a test run last year, officials caught several bus drivers speeding. *http://www.newschannel5.com*

China to introduce electronic GPS maps

China will use electronic GPS maps in 142 cities in order to weave a network across the country within 10 years. China's Planet Map Publishing House and Shenzhen Maxwell Technology Corp. Ltd., the developers, have invested more than 100million yuan (some 12.2 million US dollars) in the project, hoping to make the system cover major Chinese cities, counties and towns. The maps can help car drivers to choose the best travel route and people can easily find the exact positions of restaurants, supermarkets, hospitals and other facilities on the map. *http://news.xinhuanet.com*

Boy scouts of US embrace GPS

More than 42,000 Boy Scouts and leaders from across the USA used more than maps and compasses to learn the ropes of outdoor navigation during Boy Scouts of America's 2005 National Scout Jamboree. For the first time in its 68-year history, the Jamboree is teaching advanced navigation skills through the use of Magellan(R) GPS receivers donated by Thales and offer scouts a fun and exciting learning experience through geocaching, an increasingly popular outdoor GPS challenge likened to a high-tech treasure hunt. *http://www.tmcnet.com*

Microsoft tracks WiFi for new mapping system

Microsoft has dispatched cars to trawl many city and suburban streets across the U.S. to locate the signals sent out by millions of short-range home and office wireless (or WiFi) networks. The unusual move, is part of a plan to create a ground-based location system as an alternative to the GPS satellite system. This echoes an effort by A9, a search engine owned by Amazon.com, the online retailer, to use trucks with cameras mounted on the roof to photograph millions of storefronts in the U.S.

Microsoft says it has a database containing the whereabouts of "millions" of WiFi networks, while A9's Web site gives access to 26m pictures from 20 US cities. Microsoft has also used low-flying aircraft to catch big urban centers on film, while the software company and Google, the search company, are racing to make widely available the most detailed satellite images of every corner of the earth's surface. These and other initiatives are now being extended internationally, as the Internet companies vie to attract users.

Microsoft said it had collected only the unique identifier, known as a MAC address which each WiFi network broadcasts. This could not be traced to an address or an individual user. Microsoft said that, by recording the position of every MAC address on a giant map, it had created a positioning system that would make it possible for anyone with a WiFi-enabled laptop computer to identify their location to within 30.5 meters. *http://msnbc.msn.com*

UK Union calls for European ban on staff tracking

A UK trade union is calling for a European-wide ban on supermarkets and other employers using Radio Frequency Identification (RFID) and GPS technology to tag and track staff in the workplace. The general workers' union GMB has submitted a report to the European Commission warning that tagging technologies are an invasion of workers' privacy and calling for legislation to restrict its use. The GMB warned supermarkets last month that they face strike action if they continue doing the same. *http://hardware.silicon.com*

Lawmakers introduce GPS tracking bill in Wisconsin

Two state lawmakers have joined forces to protect Wisconsin's children

from repeat sexual predators. State Representative Scott Suder (R-Abbotsford) and Joel Kleefisch (R-Oconomowoc) unveiled their groundbreaking legislation recently called Project KidSafe, which will require the state's most-dangerous sex offenders to wear satellite tracking devices to aid law enforcement officials in monitoring their exact whereabouts 24 hours a day. *http://www.zwire.com*

GPS bracelets to safeguard mentally disordered offenders

The TBS system of secure hospitalisation for offenders with psychiatric difficulties in the Netherlands is to be reformed making them wear GPS-tracking ankle bracelets when on supervised visits outside the hospital to cut down on escapes. This will help to track the person with great accuracy by GPS positional satellites. *http://www.expatica.com*

Locating Iraq's missing artefacts

Archaeological sites in southern Iraq have been systematically looted for over two years, but experts say the dig will have to go much deeper to find out where thousands of lost artefacts have ended up. Experts say it may be years before the riddle is solved. What is known is the breadth of looting, with satellite images showing ancient sites turned into chessboards of square-shaped holes. The focus has also concentrated on the smugglers of such artifacts. Archaeologist Abdal Amir Hamdani, in charge of antiquities for Dhi Qar province, home to some of Iraq's most famous archaeological sites uses what he calls a "hunting dog", a former looter turned paid informant, who follows up rumours and goes out with a digital camera and GPS equipment to locate and mark smugglers' houses. These expeditions often result in fruitful raids. *http://abc.net.au*

Maps and GPS help historians retrace a historic route

Guided by a 1914 article by Harvard University professor John Kennedy Lacock, and using old maps, journals and GPS technology,

Bantz, a historian has painstakingly plotted most of the 58 kilometres of Braddock's Road in western Maryland in the U.S.A. He said there are 29 kilometres of undisturbed road in Maryland, almost all on private land, while just traces exist in Pennsylvania. 250 years ago, British and colonial American troops hacked through almost 200 kilometres of Maryland and Pennsylvania wilderness en route to a resounding defeat by the French near what is now Pittsburgh. Today, their route known as Braddock's road is barely recognizable. *http://www.canada.com*

When ellipsoidal heights will do the job, then why not use them!

The paper explains and provides important details "where and how" the ellipsoidal height will work. It also includes algorithm(s) or procedural steps to get the best results in using ellipsoidal heights or depths.

Muneendra Kumar, Ph.D.

In Today's world, with GPS, we can survey ellipsoidal heights (h) with 5-10 cm accuracy for geodetic control points on land and differential heights (Δh) between well defined topographic features with relative accuracy of 1: 1Million or better. In few specific cases, this type of accuracy may require specially designed GPS surveys. In navigational mode, an instantaneous positional accuracy of about ± 5 m is easily possible. As these heights are the direct product of the GPS survey(s) and thus defined with respect to the ellipsoid, which is a time-invariant zero reference surface, they can be used without any reference to the geoid or Mean Sea Level (MSL). If we recall, in the classical surveys, e.g., triangulations and/or traverses, the vertical angles used to provide the "Δh" and thus there will not be any need to convert them to orthometric heights.

Direct use of ellipsoidal heights will eliminate the need for leveling control to support topographical mapping and other non-engineering projects. This would be a major saving of time and resources.

This paper explains how ellipsoidal heights and/or depths can be used in many applications e.g., for contouring Earth's topographic relief on maps over the entire Earth, navigating safely in open ocean, shallow waters, and in harbors avoiding grounding and overhead structures. Furthermore, the use of these heights will help to fly clear of mountains tops and vertical obstructions with full confidence and land on runways without bumps. Algorithm(s) or procedural steps to get the best results using "h or Δh" are also included.

Ellipsoidal Heights

Many misconceptions and confusing definitions about heights are still floating around with many users. Some of them are even taught in schools. To clarify a few important examples, the following factual statements about them are:

a. Orthometric heights, "true" and "Normal", are not the same. Thus, treating them under "elevations" can mix up the different data sets.
b. Geoidal heights are neither elevations nor orthometric heights.
c. Mean Sea Level (MSL) is a non-equipotential surface and not equivalent or identical to the gravimetric geoid.
d. Ellipsoid is NOT the zero reference surface for either elevations or orthometric heights.
e. All the associated ellipsoids with the local and regional geodetic datums, except for the North American Datum (NAD 83) are not geocentric.

Here, it is also felt necessary to include the definition of the ellipsoidal heights (Figure 1).

Topographic Maps

A. Geodetic Control and Spot Heights -

Using the high accuracy global, continental, regional, and national 3-D geodetic systems, viz., WGS 84, SIRGAS 00, KGS 95, and other 3-D geocentric datums, viz., NAD 83, differential GPS surveys can easily provide the required heights at 1-2 m accuracy for topographical mapping.

B. Contouring -

Figure 2 shows a topographic scenario, which includes a hilltop "H", building "B", a shore point on an inland sea "I", e.g., Caspian, a lake "L", road crossing "R", and stream junction "S" on a map, which is directly drawn on Earth's ellipsoidal surface without projection. There will be no seam and discontinuity of geodetic coordinates between any two maps, adjoining or far apart. In addition, these maps will retain the true North orientation and have no practical distortion in scale and/or shape (Kumar, 2004) [1].

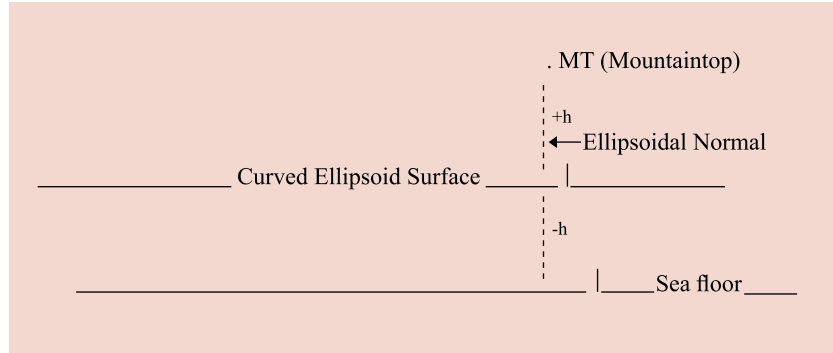


Figure 1. Definition of ellipsoidal heights or depths

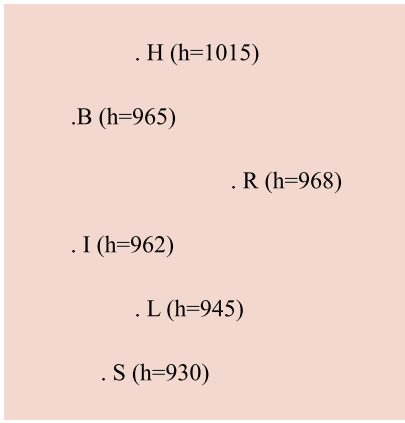


Figure 2. A Typical Topographic Scenario with Ellipsoidal Heights

On the real Earth surface, a GPS survey will directly provide the ellipsoidal heights (h) of the topographic features and the differential heights (Δh) between them (Figure 2). Thus, we can contour Earth's real topographic relief with these ellipsoidal heights. There is no need to establish MSL and/or model the geoid as zero reference and compute orthometric heights. This approach will eliminate gravity survey requirement(s) towards production of topographic maps.

It is to be noted that we will not have a height anomaly for the Caspian or Dead Sea to show that they are below the sea level (?). Also, there will be no need to have a separate lake datum, e.g., the Great Lake Datum, to over come the "reality" of having different heights for any two-shore points.

Monitoring vertical movement

Just like the horizontal case, we can monitor vertical crustal movement. For land areas, ellipsoidal height changes at Benchmarks (BMs) and for the sea level at Tidal Benchmarks (TBMs), can be measured with specially designed GPS surveys. Here, a geodetic "caution" is that there should be no definition change in the World Geodetic System (WGS) 1984, the coordinate system used in GPS surveys. In addition, there should be no change in the position processing software during the project.

Nautical charts

A nautical chart "KChart", like a topographical KMap, compiled and drawn with the KMap system will provide seamless coverage. Computerized digital charts can also be combined into a mosaic, which will be unfolding the real ocean underneath, to guide the ship's captain for safe navigation along any route.

On a KChart, using the time-invariant ellipsoidal depths of the sea floor (Refer Section on Marine Navigation below), depth contours can also be depicted. Here, the time-variant ellipsoidal heights of the sea surface, like an instant sea floor "state", will enable the captain to monitor the clearance of the keel especially inside harbors.

Use of ellipsoidal depths for ocean areas will also ensure continuity with the land areas.

Marine Navigation

For safe marine navigation, a very important requirement is to know the exact "location" of the sea floor or its depth with respect to a zero reference surface. Time-invariant ellipsoidal depths or heights (h) of the sea floor surveyed with GPS provide such locations and when stored in a bathymetric database, they will be available for future use. Figure 3 is a schematic scenario showing the locations of overhead structure, highest mast, pilothouse, sea surface, keel, seafloor, and the ellipsoid.

In Figure 3, the different measurements are:

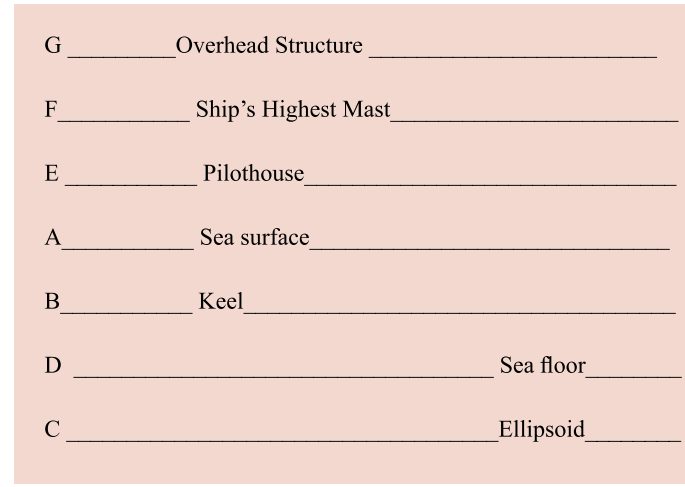


Figure 3. Ellipsoidal Heights with ellipsoid as Zero Reference.

DC = Ellipsoidal Height of sea floor (+h)

AC = Ellipsoidal Height of sea surface (+h)

BC = Ellipsoid Height of ship's Keel (+h)

CE = Ellipsoidal Height of the Pilothouse (+h)

CF = Ellipsoid Height of Ship's Mainmast (+h)

CG = Ellipsoid Height of the Overhead Structure (+h)

BD = Depth of Sea Floor from keel as measured by acoustic sounding.

During the GPS surveying, the distance BD between the ship's keel and sea floor will be measured with presently used acoustic sounding techniques. Then, the ellipsoid height of the sea floor DC will be

DC = BC - BD = [CF - BF] - BD

In this configuration, the distances CF, BF, and BD are measured during GPS surveys without any reference to the stage of the tide or any tidal surface. This is the decided advantage over the time-variant bathymetric depths, determined with respect to "fluctuating"

[1] The new name for "USNM" is Kumar Mapping (KMap) System and each map or chart will be called a "Kmap or KChart".

tidal surfaces. While underway, using a mainmast-mounted GPS antenna and the ship's general arrangement drawings, the captain of any ship can determine at any time the ellipsoid depth or height of the ship's keel and mainmast. Combining this information with the ellipsoid depth of the sea floor, the shipboard computer can calculate the keel clearance for safe navigation independent of the tides. Similarly, knowing the ellipsoid height of overhead obstructions, vertical clearance of the mainmast can also be easily determined (Kumar and Maul, 2004).

Air navigation

A. Aeronautical Charts

Aeronautical charts, like topographic maps, can also be compiled and drawn using the no-projection mapping system (Kumar, 2004). All height information for aerodromes and vertical obstruction will be surveyed using GPS as ellipsoid height (h) in WGS 84.

B. Vertical Clearance while Navigating

Obtaining the plane's ellipsoid height (hA) from the onboard GPS receiver and combining it with vertical obstruction height data, the pilot will be able to compute the vertical clearance "Δh". Figure 4 shows a scenario for an aircraft flying over a mountaintop. While flying over buildings and towers in cities and near aerodromes, the accuracy of "Δh" can be improved with DGPS surveys. Recalling that the vertical angle surveys of the past provide "Δh", the ellipsoidal height "h" for the mountain peaks can be easily computed from the existing survey data.

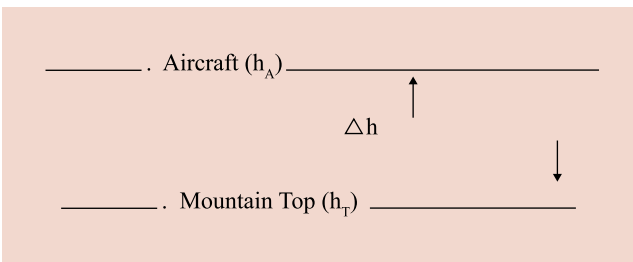


Figure 4. Schematic location of an Aircraft and Mountaintop.

C. While Landing

When descending near the aerodrome and approaching for landing, the pilot can routinely obtain with DGPS surveys the separation "Δh" with accuracy of ± 5-10 cm between the plane's rear wheels and runway for smooth landing (Figure 5).

D. Computing Shortest Distance between Aerodromes

Aerodromes are not located on the ellipsoid and thus, the geodesic will never provide the shortest distance between them. In an actual flying, a plane starts from an aerodrome "A" at height "h_A", climbs to an altitude "h", which may vary during the flight for various reasons, then descends towards the aerodrome "B" at height "h_B" and lands there. No pilot will ever be able to adhere to any mathematically computed route.

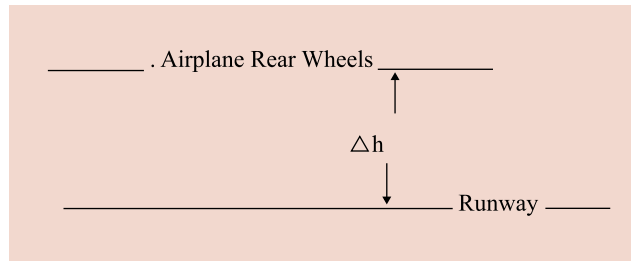


Figure 5. Schematic Location of Airplane Wheels and Runway.

Thus, what is needed a good approximation of the shortest separation (or distance) between the starting and landing aerodromes to plan a route for saving fuel and flying time. A practical estimate for distance between two aerodromes will be the great elliptic line "GLE" (Bowring, 1984), which can be computed using the semi-major axis (a') as under (van Gelder, 1998):

$$a' = 6378137 + (h_A + h_B)/2$$

where "6378137 m" is the semi-major axis (a) of the WGS 84 Ellipsoid.

Summary

In topographic mapping, charting, navigation, vertical crustal movement monitoring, and other non-engineering applications, direct use of GPS surveyed accurate ellipsoidal heights will provide a practical, cost effective, and time saving approach. In case of vertical movement monitoring, any change in definition or the software can contaminate the data integrity.

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Measurement of deflection of a bridge

An experimental observation followed by preliminary study has been carried out for a suspension bridge at Roorkee

Engineering structures undergo deformation due to various kinds of static and dynamic loads. Thus, monitoring of structure, specifically large structures such as high-rise building, bridges, dams etc., is essential to ensure its safe deformation behavior. With multifold rise of traffic, to provide safety and to prevent disaster, it has become necessary to detect uncharacteristic deflections and vibrations of bridges. The instruments which are often used for measurement of deflection such as strain gauge, accelerometer, tiltmeter, vision system, optometer, laser gauge meter etc are often cumbersome as well as costly in implementation. Moreover, they suffer from one deficiency or the other. Hence, there is a need for a method which is simple, economic yet provides accurate and reliable measurement.

Global Positioning system (GPS) provides the position of a point easily, quickly and very precisely in a predetermined co-ordinate system (WGS84). Observation in relative GPS positioning has been found to be a viable tool for monitoring the deflections of structure with real time capabilities.

A detail investigation towards the viability of GPS system for measurement of deflection in a bridge is going on. An experimental observation followed by preliminary study has been carried out for a suspension bridge, as a part of detail investigation and the same has been reported.

Cable-Stayed Bridge at Roorkee

The Cable-Stayed Bridge at Roorkee is situated over upper Ganga Canal near Irrigation Research Institute Roorkee (Figure 1). It provides a convenient way for pedestrians and bicycle riders to cross the canal. It is trussed structure having span of about 30 meters. It has two pylons, one at either bank of the canal. The experiment was carried out to determine the deflection of a point near the mid-span of bridge where deflection is most perceptible.

Figure 1 Observation Station on the Cable-Stayed Bridge [on Ganga Canal near Irrigation Research Institute (IRI) Roorkee].

GPS observation and Results

Figure 1 shows the location of the GPS station near the mid-span of the IRI bridge. Two GPS receivers have been used in this experiment. One of them, served as reference, was placed on the roof of Geomatics Engineering section of Civil Engineering Department of IIT Roorkee. The other one (rover receiver) was placed over the point of observation i.e. near the mid-span of bridge, which is about 1.3 kilometer away from the reference station. The observations were recorded at 1 Hz sampling rate on both L1 and L2 frequencies in a single session of about 25 minutes. While reference receiver collected data in static mode, rover receiver collected data in kinematic mode.

The carrier phase raw data from both L1 and L2 frequencies were processed using Leica SKI 2.3 software. Ambiguities were resolved at each epoch by applying stringent constraints on the approximate coordinate of the unknown point. The epoch-by-epoch ambiguity fixed solutions in Cartesian WGS84 X, Y and Z components of deflection of the observed point are as shown in Figure 2. It can be noted that deflection in X direction is much less severe than that of Y and Z- direction.

The spikes in all the three components can be attributed to the displacement of the observation station due to passing pedestrian or cycle riders. It can be noted the amount of component of deflections were increasing gradually and then decreasing once they reached maximum. These were due to the dynamic action of load which gradually approached towards and then gradually moved away from, the observation station. The amount of absolute values of deflection components along the Cartesian WGS84 X, Y and Z directions and their maximum deviation from mean position are shown in Table 1. It can be found that deflection components having precision in sub-millimeter range were measured from GPS observation.

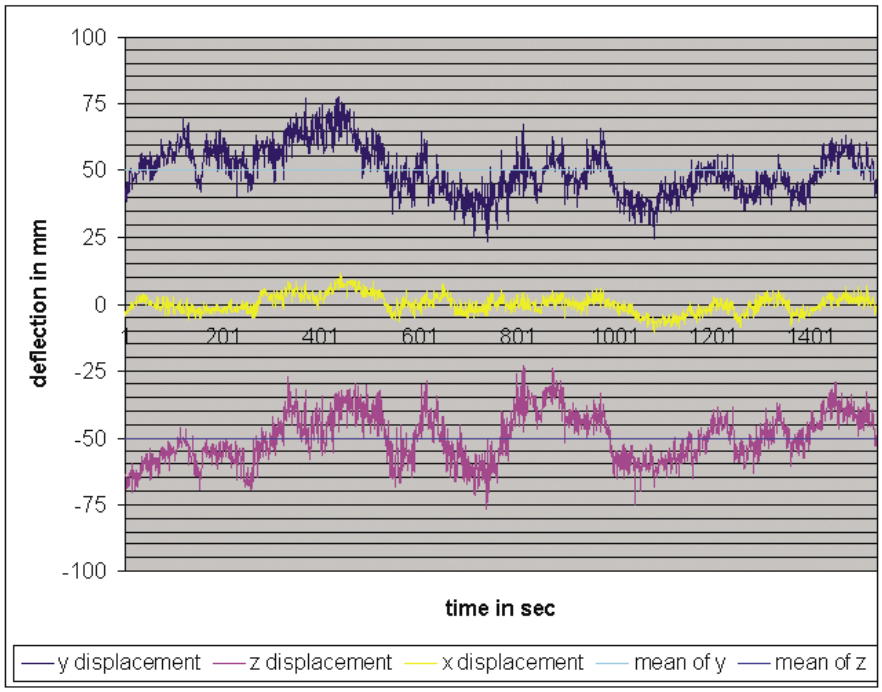

Figure 2 X, Y and Z components (WGS84 system) of deflection of the observed station

Conclusion

The results from preliminary investigation show encouraging outcome for carrying out the detail investigation of the work. As GPS observations are associated with some inherent errors, the raw data will be preprocessed first before utilizing the data during further investigation. In order to improve the precision of positioning, processing will be carried out using scientific software in detailed investigation. As most structure has their inherent natural response, to find the absolute value of deflection of bridge under dynamic load the natural frequency component will be detected and removed in further investigation. Moreover, to find the deflection components in field condition the WGS84 coordinates will be transformed to bridge co-ordinate system. Further, to ensure the reliability of the measurements using GPS, deflections will also be measured and then compared with those conventional methodology. Thus, efforts are on to ensure that GPS is a reliable instrument for maintenance and real time monitoring of bridges.

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Table 1 Maximum of Component Deflection Values

Component direction	Absolute Deflection (mm)	Deflection from the mean position (mm)	
X	23.1	12.1	-11
Y	54.1	27.5	-26.6
Z	53.8	27.2	-26.6

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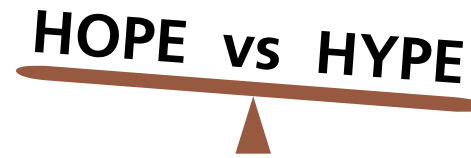
The debate continues

India's National Map Policy



In our last issue we initiated a debate on India's Map Policy. In continuation we are presenting a few more observations

Digital Mock-up of International Boundaries should be made available

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I congratulate the Department of Science & Technology (DST) for their historic achievement and evolving a New National Mapping Policy and for making diverse Spatial Data Bases available for use in an Integrated manner but the mandate still rests with Survey of India, one of the oldest scientific departments of Government of India with a lot of old legacies which are very hard to die, as I have first hand experience while working as co-ordinator Survey of India (SOI) Computerization program when digital mapping /digital technology was adopted, and implementation shall require a real push from DST.

The need of the hour is therefore immediate action for implementation to fulfil the objectives of New Mapping Policy on dissemination of maps & spatial data on one side & formulation of mechanisms of partnerships, be it for promotion of geo-spatial knowledge or value addition of available products, on the other.

While issue of two map series is a welcome move, unless OSMs (Open Series Maps) are made available quickly the very purpose shall get defeated. Since the Onus of bringing OSM also lies exclusively with SOI which involves redesigning the numbering system, specifying the deletion of Civil & Military Vulnerable areas and points etc., the DST may kindly ensure their quick availability for the whole upto international boundary.

The user community is eagerly awaiting issue of detailed guidelines regarding all aspects of OSMs, procedure for accessing them and value adding them. I feel digital Mock-up of International boundaries on various scales should be made available to mapping agencies who want to print a map with containing International boundaries, to avoid verification from SOI as these boundaries are fixed, and a note to this affect shall suffice.

I presume that contents of City maps to be decided by SOI in consultation with Ministry of Defense (MOD) shall be one time actively and approved contents shall be circulated and made available as free for use and updating.

Maintenance and updating NTDB is going to be Herculian Task and here public/private partnership with companies having ISO Certification in ground Survey & Digital Mapping should be invited and after registration they could be assigned the task for better service to the public. National Digital Elevation Model could however be treated differently from Digital line graphics for obvious reasons of security.

The procedure for registration of user agencies, their selection, for specific tasks and agreement contents require to be laid down for value addition on SOI maps or for preparing value added maps on their own.

The guidelines for sharing of information through map Transaction registry are also required to be laid down as it may involve issue of IPR for data generated or value added by various agencies other than Survey of India.

It shall not be out of place to mention that a compiled pamphlet of MOD detail guidelines is made available to general public on various aspects of map access and use as they still continue to hold good.

I feel the following should also be included in ANNEXURE – IA

- Lakes, falls etc. as part of water features.
- Places of tourist interest
- Historical Places
- Heritage Sites
- Petrol Pumps
- Picnic Spots

The purpose of above observations is not to undermine the above historic achievement but to request for fast implementation and to give impetus to Government of India's desire for fast Infrastructure development.
In case it is found appropriate a working group with public-private participation could be constituted for Implementation of New Mapping Policy in a pre-determined time frame to ensure execution of the new policy.

The present map policy is a pale shadow of the original proposal

Amitabha Pande

Principal Resident Commissioner, Government of Punjab

The present policy as originally drafted by Department of Science and Technology/ Survey of India and approved by committee of secretaries has been far more comprehensive and detailed and very different from the final form as it appeared. It stands today as a pale shadow of the original proposal and will not change things very much. However, as the policy is silent on many issues eg the map data held by private sector and its publication and dissemination, this silence can be hopefully constructively interpreted and used for value addition. Similarly other places where policy does not explicitly prohibit anything, it can be assumed that doing anything does not require any permission. In any case hopefully in view of the developments like Google Earth, the very concept of map policy will lose any value what so ever.

There is an urgent requirement of large-scale maps

Alok Upadhyaya

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There are few directional changes that the proposed map policy must undertake in its initial take off/ramp-up period. Some of the lessons learnt in other countries are in front of us. As Kampsax India is associated with the Positional Accuracy Improvement (PAI) Program of Great Britain I would like to touch upon some of the available highlights in public domain as a back drop to the directional changes referred above. The PAI program is aimed to improve absolute accuracy of existing maps (including rural areas) to the level of about 1 meter (RMSE). Most of the existing maps were based on overhaul mapping from 1950s and subsequent 1996 update. It was also aimed to sell web enabled digital map to all users across the nation via Internet. Ordnance Survey that had continued making losses for 35 years, were converted into Trading Fund in 1999 with target of 9% return on Capital employed in 5 years. The target was achieved in 2004 as the PAI program started with 7 consultations (1997-2000).

The major directional change at that point was recognition of the fact that greater use of GPS was essential to survey assets. The PAI Program started in April 2001 and is due for completion in early 2006. The sale of maps was started by Ordnance Survey via their website and through identified stockists in all major cities. In FY 02-03 a turnover of Rs 851 crores was achieved with a loss of Rs 3 crores which turned into profit in FY 03-04 to the level of Rs 72 crores against a turnover of Rs 913 crores; the surplus contributing to meeting target of 9% 5-year Return on Capital Employed , set by treasury when Ordnance Survey became a Trading Fund in 1999.

In the Indian context and at this historical moment, Survey of India need to take the leadership role as a national agency who shall be the custodian of one single map (mosaic) of the entire country that shall provide uniform accuracy of atleast 1 meter for the entire nation. That such a map shall be updated periodically atleast every 5 years. For urban areas, local civic agencies or even Survey of India may undertake large scale mapping which shall provide accuracy levels in the range of 5-10 cm. Such a step would lead to 5-year mapping program covering 6 lakh Sq-km of mapping every year that shall require doubling of existing strength of Survey of India from present 4000 to 8000 level (mainly to undertake quality control activities), involvement of industry to undertake matching production deploying 40,000 production staff for a period of 5 years and investment of about Rs. 2000 crores. Needless to say required funds would be available from International lending agencies such as DANIDA, ADB, World Bank etc. or alternatively from Central Government. In case Government does not have the funds for such an important activity, the private sector would be more than willing to undertake this financing once request is made public.

Coming to some of the specific issues relating to the proposed map policy it may be pointed out that

(1) For value addition to the SOI digital maps, the essential inputs are Aerial Photographs. This has not been dealt with in the proposed policy. Without the availability of aerial photographs to the private mapping companies and users, the new map policy will not achieve the desired target.
(2) Map policy should make it mandatory for all civic authorities, planning bodies, custodian of cadastral maps and other users of public money to use this one single map as a means of reducing

conflicts while digging the roads or by judiciary while deciding the Title of Land to the Poor.

(3) From the List of Map Features given in the Annexure to the New map Policy, it appears that the new policy basically deals with small-scale maps like 1:25,000 / 1:50,000 / 1:250,000. These small scales will not serve the purpose of most of the users of geo-spatial data both in Government, Industry and public.

(4) There is an urgent requirement of making the maps of the entire country available at scale as large as 1:2,500 providing uniform 1-meter accuracy across the nation. For mapping on this scale, the list of features should include atleast 1000 features of interest, 78 of which are listed in Annexure – 1 to this note as a starting point.

(5) From the New Map Policy, it appears that the Open Series Maps produced by SOI will remain tile-based as before. The World is moving toward 'Seamless Data' or one single mosaic of the entire nation. This concept should be incorporated in the new policy as a starting point.

Recommendation of features for inclusion in open series public domain (large scale) maps

S.N.	Major Details
1	Academy (School, College)
2	Adventure playground
3	Aerating Tower
4	Aerial Ropeway
5	Aerodrome
6	Aerodrome (disused)
7	Afforested Area
8	Agricultural Land
9	Airport
10	Airport (disused)
11	Allotment gardens
12	Amusement Park
13	Archway
14	Barn
15	Barrage or Barrier (water)
16	Barrier (road)
17	Beach Hut
18	Bird Sanctuary
19	Boating Lake/Pond
20	Bridge
21	Bungalow
22	Bus Depot/Garage
23	Business Park
24	Buildings
25	Bus Stop
26	Bypass
27	Canal (irrigation)
28	Car Park
29	Cemetery
30	Coastal Slope
31	University
32	Communication Mast
33	Community Centre
34	Complex Multilevel Structure
35	Culvert
36	Electricity Pole/Tower
37	Electricity Pylon
38	Electricity Sub-station
39	Electricity Transmission Line Network
40	Farm
41	Fence
42	Fire Station
43	Flyover
44	Gas Distribution Station
45	Zoological Gardens
46	Guidepost
47	Hall
48	Harbour
49	Helipad
50	Issues
51	Jetty
52	Lay-by
53	Level Crossing
54	Library (public)
55	Park (public)
56	Pavement
57	Pump House
58	Quarry
59	Racecourse
60	Radar Station
61	Radio Station
62	Recycling Centre/Depot
63	Reservoir
64	Roundabout
65	Sea Wall
66	Sewage Farm/Works
67	Sewage Pumping Station
68	Slipway
69	Slopes (artificial)
70	Slopes (natural)
71	Sluice/Sluice-gate
72	Sports Centre
73	Stadium
74	Subway
75	Tank
76	Telephone Exchange
77	Television Mast
78	Toll Gate

Let's give spatial applications a new life

Amit Kishore Prasad

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The map policy is truly a positive step as it corrects a long time anomaly in the existing laws. With this forward looking document, the spatially enabled services in our country will get a big boost benefiting the common man and also enhancing efficiency across industry segments through various high-end applications.

I feel that there is still scope for improvement; by restricting the availability of the data through specific channels and seeking that each copy be tracked and recorded we are increasing bureaucracy and burdening the industry. While it is understood that the restrictions appear beneficial as per national interests, it should be kept in mind that people who buy data with ill intentions are not likely to purchase it from the Indian market. The global market has many other sources which they will utilise and then misuse the data.

Even the Google Earth images show entire Delhi and specifically Rashtrapati Bhavan etc with great precision. The city of Mumbai, which is completely "restricted" as per SOI guidelines, is also clearly visible. We need to ask ourselves what we are achieving by a restrictive policy?

Let's give GIS and Spatial applications a new life by further improving the policy, make map making and mapping a non-cumbersome effort so that good quality databases come into the market and those can be used for even life saving applications like flood mapping simulation etc to avoid the kind of calamities that recently happened in Mumbai."

China's first digital long distance pipeline

Ji-Ning line is China's first pipeline featuring digital technologies. World advanced technologies are applied in it, including remote sensing technology, GIS, large database, virtual reality technology, web application technology, project management, enterprise resource planning, exploring a new idea and method of in the design and operation management of long-distance pipeline. Welding has been completed for over 700 kilometers along the Ji-Ning line (from Hengshui in north China's Hebei Province to Nanjing in east China's Jiangsu province) for West-East Gas Transmission project. The line extends across north and east China and connects the area around Bohai Sea with Yangtze River Delta. It is expected the main pipeline will be put into operation at year-end. The pipeline will put an end to the coal-dominated energy structure in the areas alongside. *http://english.people.com.cn*

Missing child program utilizes satellite imagery

Local law enforcement now has another tool to help protect children, the disabled and the elderly in Cheboygan County in U.S.A. The County Sheriff Dale Clarmont said that the "A Child Is Missing" program utilizes satellite imagery, geographical mapping and telephone technology to alert local residents when a child is reported missing. Clarmont explained how the program works: When a deputy responds to a report of a child missing, they first conduct a preliminary investigation to ensure that the child is not hiding or has wandered nearby. If the child cannot be located, the officer will develop a description with information such as what the child was wearing, a physical description and the location where the child was last seen. The deputy then calls a specific number and gives the information to a dispatcher who then determines the calling area. The dispatch will then implement a unique calling system, putting out 1,000 calls within 60 seconds to all homes and businesses in the area. If the child is reported in another location, another 1,000 calls can go out. *http://www.cheboygannews.com*

Tracking stolen cars via satellite in India

Imagine your car has been stolen and all that you need to do is to sit in front of a PC and make it 'immovable' wherever it may be. Sounds improbable but a new device being developed by Bangalore-based MobiApps in India can make this happen. The MobiApps device, which will sit inside the vehicle, will essentially stops the car engine from functioning by taking instructions from a satellite-based communications network. In addition, it will also be able to monitor fuel-level, oil and gas level in the vehicle, tyre pressure, brake fluids and other essential resources in real-time.

The device is based on the company's telematics platform. Telematics enables remote access to vehicle data over a wireless network. MobiApps offers hybrid communication products using converged wireless communications technologies such as 802.11, GPRS, CDMA, and ORBCOMM's Low-Earth Orbit (LEO) satellite system to provide global communications capabilities to a number of industrial applications such as containers, heavy equipment, marine vehicles, light motor vehicles or any movable asset. *http://financialexpress.com*

UK directory service features detailed aerial imagery

UK directory service 192.com has added a number of new features to its local search engine including property prices and detailed aerial imagery. A virtual high street feature lets one find online pictures of both high-street shop fronts and high-resolution aerial photos when one searches for a business or people. The shop front photos give detailed information such as nearest transport links, web addresses, the average price of a meal in a restaurant and disabled access. *http://www.webuser.co.uk*

Ordnance Survey responds to customer feedback

Ordnance Survey publishes the outcome of a consultation on proposed changes to its most highly detailed geographic information. Customers were asked to comment on plans affecting bench marks and triangulation points, both traditional sources of height data for surveyors across Great Britain. Feedback showed a continuing need to provide symbols for these features, so they will be retained in the Topography Layer of OS MasterMap and in the Land-Line and Superplan products. However, the actual height values, including supporting information, will in time be provided free of charge on the Ordnance Survey website instead of the mapping itself. The move widens access to height data for those surveyors still requiring physical control information to check GPS measurements. It also reflects the growing trend towards more web based geographic information. At the same time, customers agreed with plans to remove specific textual details from the margins of standard map sheets generated from the Land-Line and Superplan products. These include the names of areas, roads and administrative and electoral boundaries. The changes are required due to growing customer demand for seamless mapping as opposed to fixed tiles. *http://www.ordnancesurvey.co.uk//aboutus/reports/D03701.pdf*

City in Lebanon launches GIS project

The Chamber of Industry and Commerce in Sidon a city in Lebanon launched a GIS project for the South with the participation of the Delegation of the European Commission in Lebanon. Recently a ceremony was held to mark the occasion at the chamber's headquarters in the presence of

South Governor Malek Abdel-Khaleq, chamber President Mohammad Zaatari, European Ambassador Patrick Renauld and several southern mayors. The chamber's director general, Radwan Sabaa, said the two year project will provide data related to some 28,000 commercial establishments in Sidon, Tyre, and Nabatieh, without tackling geographic information. *http://www.dailystar.com.lb*

Mobile phones show useful maps in Bahrain

People are now able to get maps on their mobile phones to find their way around Bahrain. The service was launched recently , as part of Bahrain's e-government programme, at a ceremony held at the Central Informatics Organisation (CIO), Isa Town. It has been developed by the CIO which is represented by the GIS and the Addresses Directorate. Anyone having a mobile phone can now locate addresses or places like hospitals, restaurants or commercial banks, said CIO president Shaikh Ahmed bin Ateyatalla Al Khalifa. *http://www.gulf-daily-news.com*

Court rules public has right to GIS information

In a case watched closely by Westport and other towns upgrading technology, the Connecticut Supreme Court in the U.S.A. has ruled that the public has a right to see aerial photos and other records of Greenwich despite concerns about privacy, crime and terrorism. The high court ruled unanimously that Greenwich must release its computer database of aerial photographs and maps known as a GIS. The court said the town failed to show the records are exempt from disclosure under the Freedom of Information Act because of security concerns. Greenwich officials have said that the uncontrolled release of detailed information on infrastructure, public safety facilities, schools and celebrities' homes in electronic form could lead to breaches in security and privacy. *http://www.westportnow.com*

CE Info Systems launches eLocation

CE Info System Pvt Ltd announced the launch of eLocation, a unique and innovative location based service through its internet portal www.mapmyindia.com. eLocation is a smart and techno savvy way of letting others know where you are located and how to reach your location. It solves the problem of reaching thelast mile of any destination in any part of India. This innovation is first of its kind in the world.

The intellectual property rights of eLocation vests with CE Info Systems Pvt Ltd. The revolutionary eLocation service of CE Info Systems provides a single ID for each location that is just enough for anyone to know where exactly that location is, how to reach there and the driving directions to that location. While creating the eLocation ID, one is able to give customized direction for the last mile from a known land mark the way normally one gives direction to people over the phone or other wise. While drawing a parallel between eLocation and email services, Rakesh Verma, Manageing Director CE Info Systems said, "While email is a faster and smoother way to communicate with someone, eLocation is an instant solution to our location problems absolutely in tune with our fast paced day-to-day lives."

In a related development, CE Info and Novasys SA, a European Location based Services company announced their joint venture agreement. Under this agreement, a new company will be formed to provide location-based services and content for the mobile subscribers of India for easy navigation and driving directions. Novasys will be providing the technology platform for these services while CE Info systems will provide first class mapping and Points of Interest content from CE Info. CE Info and Novasys will work closely with mobile telecom operators in order to provide innovative location based services to the subscribers' mobile device.

'Privacy' a bar to disclosure of electronic GIS maps by FEMA

Electronic maps maintained by the Federal Emergency Management Agency do not have to be given to a non-profit environmental group under the personal privacy exemption of the Freedom of Information Act, the U.S. Court of Appeals in Denver (10th Cir.) ruled recently.

FEMA argued and the court agreed that releasing electronic versions of GIS maps could allow the group, Forest Guardians, to match mapping data with other data to deduce the names and addresses of policyholders under the National Flood Insurance Program. Policyholders' identities are protected by Exemption 6 of the FOI Act, the court said. Forest Guardians first requested the data in January 2001 to geographically trace how federally subsidized flood insurance affects endangered species in New Mexico floodplains.

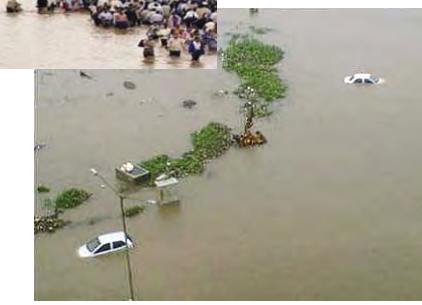
FEMA released paper copies of GIS maps that plotted the location of buildings on the San Juan, Animas, and Rio Grande floodplains and detailed whether they had been built after the surrounding community had bought into the flood insurance program. FEMA redacted the policyholders' names and addresses from the paper maps, citing Exemption 6. *http://www.rcfp.org*

Mumbai floods

How GPS-GIS can help

The Mumbai floods have again highlighted the importance of disaster management using modern technology

Prof Madhav N Kulkarni

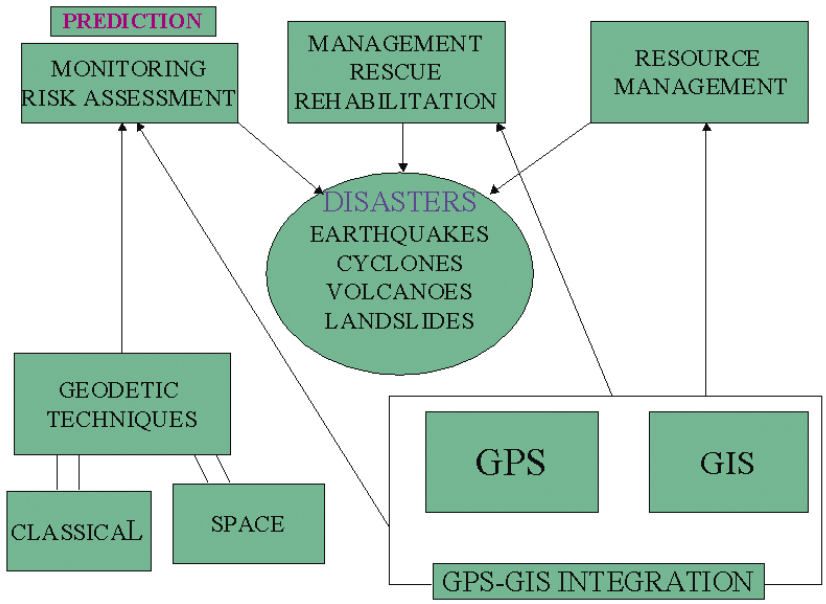


The 26th July 2005 floods in Mumbai, which caused widespread destruction, deaths and damage to property and infrastructure, have once again highlighted the importance of disaster mitigation and management using modern technology. Monitoring natural disasters like floods, earthquakes, volcanic eruptions, landslides, avalanches, cyclones, etc., with the ultimate aim of predicting them, and managing the rescue and rehabilitation operations during and after such calamities, have been discussed in various forums in the past. The devastating Latur earthquake of 1993, the Bhuj earthquake of 2001, the Orissa cyclone, and the recent tsunami after the Sumatra earthquake, which caused extensive damage in terms of human lives and property, have drawn the attention of the Indian scientific community to the immediate need of monitoring and managing such disasters in our country in the most effective, efficient and economic manner. Traditionally, maps are being used for this purpose, as an effective tool, since ancient times. However, with the introduction of computer-aided techniques in map-making, and the space technology in surveying and mapping, the utility of geodetic and map data for this important activity has increased many-fold. However, a well-coordinated programme for optimum utilization of these important technological tools, resulting in efficient management of the disasters, still remains an elusive dream of administrators, scientists and technologists.

The Geographical Information System (GIS), and the Global Positioning System (GPS), have evolved over the last decade, to become the two most important developmental and planning tools of modern times. Today, there is no field of human development, natural resource management, disaster monitoring, science, engineering, and technology, where these revolutionary systems do not play a significant role. GIS provides the most effective, economic and efficient tool for storing, manipulating, and presenting spatial and non-spatial information in an integrated manner. GPS, is being used all over the world for numerous navigational and positioning applications, including navigation on land, in air and on sea, determining the precise coordinates of important geographical features as an essential input to mapping and GIS, precise cadastral surveys, vehicle guidance, earthquake and landslide monitoring, etc. In India also, GIS and GPS are being used widely for numerous applications in diverse fields by various Governmental and non-governmental organizations, and the field of their applications is ever-widening. However, the important question facing us today is: did these technologies in any way help us in managing these recent disasters, and what are the ways in which we can use them effectively in future, for minimising the losses due to such disasters.

Both GPS and GIS have a vital role to play in the three aspects of disaster management: the rescue work, the relief work, and the rehabilitation work, including all types of rehabilitation: human, economic, dwellings, education, business, etc. Even though floods is a natural calamity, and no system can cope with a once-in-hundred years rainfall event, the importance of proper design and construction of the urban drainage system in managing floods in cities, is beyond question. Most recent and accurate maps/ GIS of the area, is a prerequisite for this. The Mumbai metropolitan region, with a total area of 4355 sq. km, consists of 1273 sq. km urban area, which has a population of 17.7 million, out of the total population of 18.9 million. Thus, this urban area has a very high population density of 139 persons per hector, as compared to overall density of only 43 persons per hector. Such high population density, in a gently undulating region, with several low elevation patches, requires a very elaborate drainage system. Such a system is certainly non-existent at present, which is the main cause of the severe flooding problems the city faces every year. Accurate large scale GIS of the entire region is a must for the planning, design and installation of such an elaborate drainage system.

Considering the aspect of hazard assessment, an extensive GPS-based national programme for earthquake hazard assessment has been launched by the Department of Science & Technology (DST), since 1993. The extensive geodetic data being generated through the GPS networks established under this programme, can also contribute significantly in monitoring the other natural disasters, like floods. These GPS stations can be utilized as base stations for precise positioning of rescue teams and vehicles during the disasters. Another important application is the use of GPS-GIS integrated systems to disaster mitigation and management. GPS, integrated with GIS, has the potential to become an effective tool for monitoring the natural disasters, and during the rescue and relief operations, for instantaneous accurate positioning, and as an input to the Digital maps and GIS. The integration of location-based spatial mapping system: GIS, with GPS can directly give the map of the area being covered. The Video Mapping System, a digital video camera directly linked to a GPS receiver can give us the complete picture of the region. This will allow improved image interpretation, which is very useful for hazard mitigation and management. The GPS-GIS automobile navigation technique can be used in an emergency management system. It is already being used by the ambulances in Centralised Accident and Trauma Service (CATS) in New Delhi, and has potential for wider applications in disaster management.



The effective monitoring and management of natural calamities requires the most recent terrain information, and quick updating of the digital maps / GIS of the affected area on real – time basis. For this purpose, aerial photographs and satellite imagery of the area, when integrated with the digital maps / GIS, can yield the best results. For controlling the scale and other errors in the imagery, ground survey control is absolutely essential. The GPS technique can be used for this purpose, to yield very accurate results in an efficient and economic way. The GPS receivers on-board the camera can provide the accurate co-ordinates in real-time basis, and GPS surveys on the ground can establish an accurate GPS ground control network.

In conclusion, an integrated approach to include input from several diverse techniques is a must for understanding, monitoring and managing the various natural and man-made disasters. It is essential that coordination at all levels must be ensured to facilitate smooth functioning of the entire system, easy data exchange, and scientific cooperation. Frequent meetings of the agencies involved in the work, and close monitoring are essential for this purpose. It is important that latest digital map data on largest possible scale, and GPS-GIS integrated positioning systems are made available to the disaster management teams, for effective rescue and rehabilitation operations.

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Mumbai Floods

Another wake-up call

SHVETA MATHUR AND ANSHU SHARMA

Maharashtra was the first state in the country to have a disaster management plan. It all started with the Latur Earthquake of 1993. As a part of response programme, the Maharashtra Emergency Earthquake Rehabilitation Project (MEERP) was launched the same year. This later led to the exercise of preparing a State Disaster Management Plan. The World Bank, United Nations Development Program (UNDP) as well as several bilateral donor agencies supported the initiative.

The framework for disaster management was multi-dimensional. The strategies were mainly based on three intervention areas: communication network, state disaster management plan, and district and local disaster management plans. A network of telecommunication and information systems was set up, consisting of an Emergency Operations Centre (Central Control Room) at the Secretariat at Mumbai, a standby Control Room at the Centre for Disaster Management at YASHDA, Pune, Control Rooms at each of the six divisional headquarters, and District Control Rooms at each district collectorate. This network is connected with VSAT telecommunication facilities for data, voice and information exchange and video-conferencing. In a second level of communication network all local nodes are linked together through a VHF wireless network. State-of-the-art facilities like wireless base stations, mobile sets and radio communication units are provided to the sub-divisional officers to ensure contact with Control Room at all times.

As a part of the multi-hazard response plans, the Maharashtra Remote Sensing Applications Centre (MRSAC), Nagpur, prepared maps with details for developing a comprehensive Disaster Management Information System (DMIS). A Geographic Information System (GIS) interface operates as a front-end to a disaster management database, providing it flexibility to respond to user queries regarding location specific details. The thematic data on natural systems includes disaster geomorphology, geophysical data such as slopes, soils, geology, land use, land cover, drainage network, surface reservoirs, and data on climate like rainfall pattern, temperature, wind, humidity etc. The support data consists of administrative setup, socio-economic and demographic profile of the population, resources, irrigation, health facilities, educational infrastructure, animal husbandry, agriculture, power, infrastructure, industry, fisheries, public distribution system, tourism, etc. All the locations in the state have been assessed for the availability of various facilities listed above and their infrastructure capabilities have been mapped and included in the database to permit querying.

Maharashtra thus became the first state to prepare a comprehensive State Disaster Management Plan and also undertake risk assessment and vulnerability analysis of the state. A separate volume on Standard Operating Procedures details the manuals for various departments to be activated during an emergency. This integrated facility of multi-hazard response plans, communication network and GIS is believed to have enhanced the level of preparedness of the administration and also improved the capability of the government machinery to respond to disasters more effectively.

As part of the initiative, an exhaustive disaster management plan was also prepared specifically for Mumbai. This was the first urban disaster management plan in the country. Mumbai, being the commercial capital of India, has a strategic importance for the country. Located on the western coast across an island formation, it is a multi-hazard prone city. Mumbai is also the capital of the state of Maharashtra, and got the benefit of the disaster management planning exercise going on in the state. That is how it overtook even the national capital, Delhi, in getting a disaster management plan for itself.

The Mumbai Disaster Management Plan is an exhaustive document, giving a profile of the city, identifying hazards, laying down procedures for disaster response down to ward levels, and also covering aspects of disaster preparedness and mitigation.

It covers floods, earthquakes, landslides, road accidents, industrial and chemical accidents and cyclones. It specifies the setting up of committees and control rooms. The plan is available for viewing on the website of the Government of Maharashtra. There have also been international seminars on the Mumbai Disaster Management Plan, applauding its comprehensiveness.

Yet, it all came to a naught on 26 July 2005. The rain gods got a little over-liberal to Mumbai and showered an unprecedented 944 mm of rain within a span of twenty-four hours. The bustling city of thirteen million population simply drowned. The rain continued for the next few days, leading to continued flooding and hampered rescue and relief efforts. Over 1,000 died in the region, a majority of them in and around Mumbai. Many died from secondary impacts such as mudslides, electrocution, wall collapses, and car submergence. Politicians blamed the disaster on the unusually heavy rain, but there is no denying the fact that this is the kind of situations a disaster management plan is supposed to take care of, which it couldn't. All the hype about the Mumbai Disaster Management Plan would have got washed down the drain, but for the fact that all drains in Mumbai were choked that day! The blame game was still going on when Mumbai was hit by an outbreak of water borne diseases resulting from the floods. Within two and a half weeks, over fifty had died of such diseases while 8,000 were reported ill in Mumbai and 100,000 in the state.

What really went wrong?

Perhaps the answer is not easy to arrive at. Surely a number of things went wrong; they have been going wrong for years, and are going wrong all over the country. Let us look at two of the major follies: top heavy disaster management plans, and a missing link between development planning and disaster management.

The Disaster Management Plan: Sitting in an ivory tower

Effective plans are those that get built from the people up, not from the government down. Our disaster management plans talk of who the decision makers are, and what technologies are at their disposal. They do not mention where the people are, what makes them vulnerable, and how they can play a part in reducing their levels of risk.

Urban Development and Civic Management: Ancient Greek for disaster managers

Today's disaster manager wants to talk about emergency response, search and rescue, sniffer dogs, medical response teams, satellite phones and red jackets. Who wants to discuss drains and taps? That is boring stuff that municipalities mess with. The lessons of linking disasters with development have been around for years in textbooks, but they haven't gone home. Unless population distributions are planned in accordance with carrying capacities of settlements, civic systems planned in accordance with worst scenario demands, and services maintained diligently, the simple process of urban management will turn into a nightmarish disaster whenever any out-of-the-ordinary event dislodges its precarious balance.

Hasn't it happened before?

Prafulla Marpakwar in his article `Mumbai's Disaster of a Management Plan', which was published in the Indian Express dated 13 July 2000, gives a graphic account of how the city came to a standstill on the previous day due to heavy rains. He blasted the disaster management plan, saying "A quick look at the manner in which the Congress-led Democratic Front dealt with the crisis following heavy rains in the metropolis as well as several parts of the state leads one to the conclusion that the disaster management plan has remained on paper and there was lack of coordination between government agencies". A million people had stayed stranded in their offices, railway stations, bus stands and other places for over twenty-four hours. It is evident that the lesson was not learnt. Five years later it has happened again, with greater ferocity, and our paper tiger plan has again proved useless.

Mainstream Disaster Management

The answer to Mumbai's woes, and those of many cities like it, lies in mainstreaming disaster management in development planning. The environment needs to be given some space in our cities. Politicians need to be stopped from converting green buffers into paved real estate that reduces ground percolation and increases surface runoff. Landuse plans, network and service plans, transport plans and civic infrastructure management plans, all need to take into account the critical factors of environmental carrying capacities of cities, and incorporate risk reduction measures as well as emergency response mechanisms. Unless this is done, we will continue writing and rewriting obituaries of our disaster management plans.

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Microsoft releases a beta of Virtual Earth

Microsoft released a beta of Virtual Earth, its web-based mapping service that combines local search with maps and aerial photography according to a recent report. The move comes some three weeks after Google released a beta of its Google Earth, and nearly a month after MSN unveiled a service combining satellite imagery with maps with its local search results. However, MSN's Virtual Earth, like Google Earth, is focused primarily around maps and aerial views, allowing users to zoom in and out of maps or images and drag them around within the display area. MSN Virtual Earth for now covers only the U.S. and major Canadian cities, and offers fewer local-search options. *http://www.marketingvox.com*

New Joint Venture between Spot Image and CRISP

CRISP (Centre for Remote Imaging, Sensing and Processing) has signed a joint venture (JV) agreement with Spot Image, S.A., to become a partner in Spot Asia, the regional Spot Image subsidiary located in Singapore. The Centre for Remote Imaging, Sensing and Processing is a research centre established in the National University of Singapore with funding from the Agency for Science, Technology and Research. SPOT Image headquartered in Toulouse, France is the worldwide commercial operator of the SPOT satellite system, a constellation of 3 satellites that can acquire medium to high-resolution imagery of almost any point on the globe every day. *http://www.spotimage.fr*

Satellite imagery receiving system in Vietnam

A French-funded project to build an environment and natural resources monitoring system that can receive and process satellite images in Vietnam is to commence next month. Europe's Defense and Communications Systems signed a 20 million euro trade deal with the Ministry of Natural Resources and Environment to supply Vietnam with a station which receives images from France's SPOT and the European Space Agency's ENVISAT satellites. Vietnam will have the first satellite imagery receiving system in Southeast Asia once the project is completed after three years. Using the system, Vietnam will be able to monitor sea, water, mineral resources and the risks of forest fires. *http://thanhniennews.com*

Forest department in India to detect fires

A pilot project initiated by the Karnataka Forest Department in India to monitor and detect the presence of forest fires with the help of satellites detected as many as 180 cases, of various intensities, across the State from January to June this year. It has been reported that the fires, however, ranged from high to moderate and low intensities, and did not cause any serious harm. The Rs 5 lakh pilot project initiated in collaboration with the Karnataka State Remote Sensing Applications Centre made use of the remote sensing data available on the MODIS satellite platform, which has transponders dedicated to sense fire incidences on the earth's surface. The study has helped identify the most vulnerable areas in terms of the occurrence of forest fires. *http://www.deccanherald.com*

Remote Sensing reveals the increase of forest cover in India

According to the State of Forest Report 2003 the total forest and tree cover of India has increased to 778,229 sq. km constituting 23.68% of its geographic area, against 757,010 sq. km constituting 23.03% of geographic area in 2001 assessment. Thus, there is an increase of forest and tree cover by 21,219 sq. km, which is 0.65% of geographical area as compared to 2001 assessment. The State of Forest Report – 2003 (SFR-2003), was released by the Minister of Environment and Forests, Thiru A. Raja. This report is the ninth assessment of the forest cover of the country carried out by the Forest Survey of India (FSI), Dehradun – an organization under the Ministry of Environment & Forests, which assesses forest and tree cover of the country on a two-year cycle. The assessment of forest and tree cover is based on interpretation of data from Indian Remote Sensing Satellites for the year 2002. *http://pib.nic.in*

Satellite maps of Pune every six months

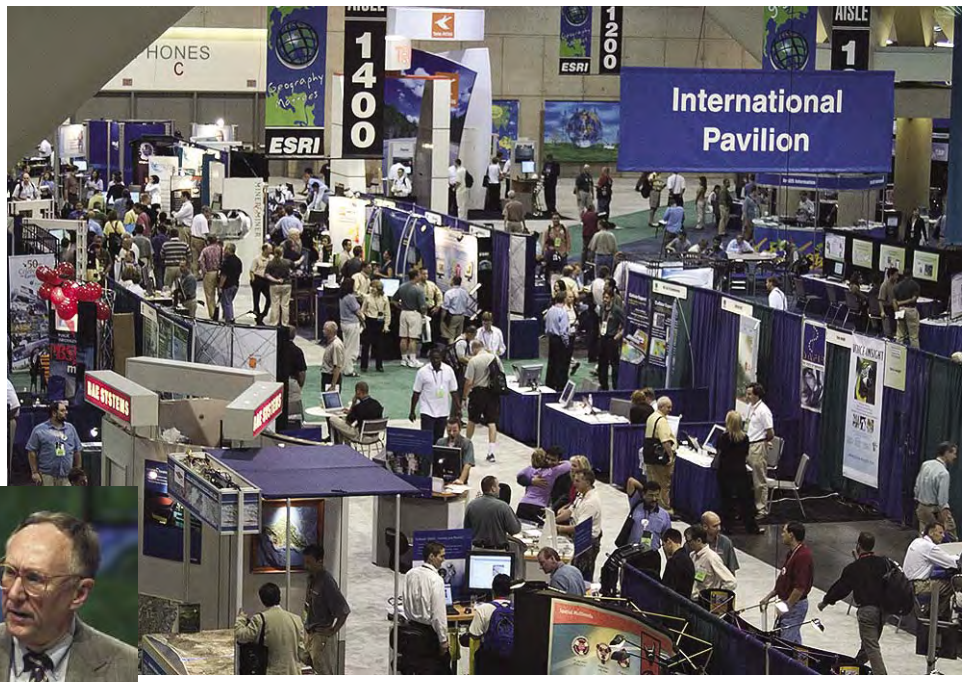
The Pune Municipal Corporation will obtain satellite maps of the city twice a year to monitor use of urban land and also to control unauthorised constructions. Municipal Commissioner Nitin Kareer has sent a proposal to the standing committee, asking for a provision of Rs 12 lakh for the purpose. Satellite pictures of the city will be taken every six months with help from the Nagpur-based National Remote Sensing Agency. Quick Bird satellite has been selected for the work. *http://cities.expressindia.com*

GIS – Helping manage our world

13,000 users attend ESRI's 25th Annual User Conference

Jim Baumann, ESRI

With nearly 13,000 users attending from more than 135 countries, ESRI's 25th annual International User Conference again demonstrated the company's strength in the industry. By the numbers, there were about 1,150 paper sessions and panel discussions, more than 400 technical workshops, 112 special interest group meetings, and 23 special displays. In addition, ESRI staged four concurrent conferences including the Senior Executive Seminar, Telecom, Survey Summit, and EdUC that had a combined attendance of about 1,300, as well as 38 pre-conference seminars that attracted more than 1,400 attendees.



Elaborating on this year's conference theme, GIS - Helping Manage our World, ESRI president, Jack Dangermond said, "GIS provides a particularly valuable framework for managing both human and natural activities because it facilitates the integration and analysis of complex data, making it readily accessible to scientists, planners, and the general public. GIS is now evolving on the Internet, creating a kind of distributed global GIS. We are using it for publishing our maps and our data, and now with Web Services, we're beginning to link together applications that are modeled to data remotely accessible across the Web. I think that this will evolve into something I like to call the GeoWeb; a large, widespread, distributed collaboration of knowledge and discovery that promotes and sustains worldwide sharing and interoperability. I see a fabric of applications that work together synergistically for a whole range of purposes."

At a press conference, Dangermond and others discussed the next generation of MapMachine, the online atlas hosted by the National Geographic Society. Plans include a link to the data and metadata of the Geospatial One-Stop (GOS) portal, as well as the addition of 3D globe services, which will allow users to drape their own data onto an interactive globe.

The big product announcements at the conference concerned the powerful new features in ArcGIS 9.2, which will be available early next year. Commented Clint Brown, ESRI's Director of Software Products, "At 9.2, we'll see the addition of COGO construction tools, better attribute editing, and better raster to vector conversion. In Survey Analyst, we'll be implementing a complete workflow for cadastral data measurements to be integrated inside of a GIS, and also improvements in the CAD area with better annotation support, better native rendering, and better support for georeferencing. We will also continue to support heavily interoperability in two ways: Continued support for some of the new standards coming forth in OGC, on both the server and on the client, and also the addition of new data sources in the data interoperability extension. This interoperability procedure is very important, particularly when we talk about the GeoWeb. It's a kind of key for bringing the maps, the schema maps and the semantic maps of distributed organizations together.

"At 9.2, we're also going to be introducing something called a design or sketching tool for geographic information. The idea is that with symbolic representation, I could design a scheme, plan, or a land-use plan, and then have that graphic design represented in geographic features in the geodatabase that I can analyze and evaluate and get feedback on instantly."

Peter Becker discussed ESRI's new

Image Server, which will store images as raw scans and process them on the fly; including radiometric balancing, pan-sharpening, and the creation of mosaics. Because Image Server stores the raw image, compression, color, and viewpoint can be easily changed.

Eminent primate researcher and conservationist Jane Goodall delivered the keynote address. Describing more than 40 years of studying chimpanzee communities and behavior, she detailed her first sighting of what was the one of the most important discoveries in the history of biology. "He pulled out the twig and expertly picked a few termites off of it with his lips. A mere non-human had just fabricated a clever and effective tool right before my very eyes."

Recognition for outstanding achievement in GIS is a time-honored tradition at ESRI's International User Conference. This year, the Presidential Award went to NESA, the Danish energy company and longtime user of ESRI software, while the Lifetime Achievement Award was presented to Dr. David Cowen of the University of South Carolina. Chuck Johnson, Chief of the Land Resources Branch of the U.S. Bureau of Reclamation won the Distinguished Service in GIS Award. In addition, nearly 150 Special Achievement in GIS (SAG) awards were presented by ESRI President Jack Dangermond with winners coming from throughout the world.

The concurrent Education User Conference attracted more than 500 educators. Map collector and GIS innovator David Rumsey presented the keynote address and discussed historical and contemporary methods of teaching geography. "I'm particularly focused on the gaming technology (now)," Rumsey said. "Flying through maps, zooming in---it's what kids know."

Mike Weir, ESRI's Survey Industry manager opened the 2005 Survey Summit by stating that, "GIS is the framework for integrating surveying, engineering, and GIS processes. Surveyors locate and create the data; engineers build on top of it; and GIS professionals create maps for analysis."

Concluded Dangermond, "I experienced and observed so much and realized once again the significance of all of our cumulative efforts as reflected in our user's applications and systems. The conference clearly showed we are helping many people and our willingness to listen and strive to do better in making user's successful, is an important part of our success."

ITS AP2005

The 7th Asia Pacific ITS Conference & Exhibition was held in New Delhi, India, during August 09-11, 2005.

This was the first International Forum and Exhibition of its kind to be held in the South Asian region. Here is the summary of the conference: AWARENESS among key Ministries about the importance of SAFETY, ITS and what it can do to make safer healthier societies was the main aim of AP2005.

The Ministers of Science & Technology, Heavy Industries and Urban Development visited the exhibition and interacted with the participants. Their response was very encouraging. They have assured support towards a structured ITS development in India. All the Ministers have expressed keen interest to take on research, position papers, programme and projects on ITS with AITS.

MoU's were also signed between AITS, India and Ertico, Taiwan and Korea. These are aimed at promoting greater cooperation on ITS between India and these countries. AITS India looks forward to presenting some concrete programmes and proposals undertaken as a follow–up to these MoU's soon.

There were 17 stalls taken up at the exhibition: Taco MobiApps, ST Engg, Singapore; Itramas, Malaysia; Efkon; 'Best of ITS', USA; TIFAC (Technology Information & Forecasting assessment Council), India; ITS Japan; Kapsch; ESRI, India; IBI Srishti; IIT, Mumbai; Delhi Transport and BSNL, India.

Media partners were Telematics Ltd, and Coordinates.

Eighteen sessions were conducted of which there were four Executive Sessions, eleven Technical Sessions and three Special Sessions. The provisional number of delegates from various countries included:

1.	Japanese	24
2.	Korean	21
3.	Malaysian	35
4.	Taiwan	20
5.	China	04
6.	Singapore	09
7.	Europe	07
8.	UK	01
9.	USA	05
10.	Australia	03
11.	New Zealand	01
12.	Indian	150

Galileo update

Galileo – the European Programme for Global Navigation Services for civil purposes is an initiative led by European Union. We provide regular updates to our readers on the Galileo programme.

China gets three Galileo application projects

A Chinese general contractor for the European Galileo Project recently obtained three application projects. The Galileo Joint Undertaking (GJU) endorsed China Galileo Industries (CGI) to develop the fishery application system, the location-based services and special ionospheric studies for the Galileo regional augmentation services.

The EU and the European Space Agency had kicked off the 3.5 billion-euro Galileo Project in March 2002 to develop a satellite-navigation system independent of the U.S. The first Galileo navigation satellite is expected to be launched later this year. China was the first country outside Europe to join the Galileo Project, agreeing to invest a total of 200 million euros into the global consortium. About 70 million euros of the Chinese investment have been put into technologies development and the remaining 130 million euros into deployment of space and ground infrastructure. The EU estimated that by 2020, the Galileo Project will bring Europe tens of billions of euros in revenues and tens of thousands of job opportunities. Chinese experts expected revenues worth 260 billion yuan (23.6 billion euros) in Galileo systems applications by 2020. http://news.xinhuanet.com

Galileo satellite arrives at ESA-ESTEC for testing

Two satellites are being developed for the Galileo System Test Bed – Version 2, which will make up the first phase of in the 'in-orbit validation' of the Galileo system. The primary mission of the first Galileo satellites is to secure the Galileo frequency filings, validate new technologies for operational use, characterise the radiation environment of the medium earth orbits that the operational satellites will occupy and enable experimentation with live Galileo signals. www.esa.int

U.K Quarrel Threatens Further Galileo Delay

British industry officials have expressed concern that the U.K portion of a 420-million-euro ($512-million) additional financing package necessary to fund the in-orbit-validation (IOV) phase may not be forthcoming because of squabbling about who should pay for it. Based on its current 17% stake, Britain would have to fork over about 35 million euros to cover the extra costs, which are related to signal security and management requirements not originally foreseen as well past program delays. According to an industry source, British Transport Minister Stephen Ladyman recently wrote to industry and Research Minister David Sainsbury to say his ministry would not contribute additional funds.

Source: Aviation Week and Space Technology

August 2005

IAG/IAPSO/IABO 2005
22 – 26 August, Cairns, Australia
http://www.dynamicplanet2005.com

GITA Annual Conference 2005;
15-17 August, Melbourne, Australia
imsevent@bigpond.net.au
www.gita.org.au

Map Asia 2005
22 - 25 August, Jakarta Indonesia
info@mapasia.org
http://www.mapasia.org

11th GIS AnnualConference in Vietnam (GISnet'11)
August 8th, 2005, Vietnam
phuoc.gis@bdvn.vnd.net

September 2005

12th International Symposium on Deformation Measurement
12 - 15 September 2005, China
isdm12@sdust.edu.cn
http://www.fig.net/isdm12

International Workshop Series in GeoInformation Science
27 Sep - 15 Oct 2005 Hong Kong SAR
jlgis@cuhk.edu.hk
http://www.jlgis.cuhk.edu.hk/events

The 6th Arab Map conference
12 - 13 September, Cairo Egypt
arabmap2@iti-idsc.net.eg
http://www.ngisc.gov.eg

Surpac Minex Users Conference and Training
13-16 September, Bhubneshwar, India
krudra@surpac.com
www.surpac.com

National Workshop on GPS Technology and Applications
14-15 September, Hyderabad, India
IVM@ieee.org

Technology Summit 2005
21-22 September, New Delhi, India
vineet.goyal@ciionlone.all
www.technologysummit.org

International Symposium on Landslide Hazard in Orogenic Zone
25 - 26 September, Kathmandu Nepal
symposium@nels.org.np
http://www.nels.org.np

Navtech Seminars
12 - 13 September, Long Beach, United States
http://www.gpsetc.com

50th Photogrammetric Week
5 - 9 September 2005, Stuttgart, Germany
info@ifp.uni-stuttgart.de
http://www.ifp.uni-stuttgart.de

ION GNSS 2005
13 - 16 September, Long Beach, USA
http://www.ion.org

GeoSolutions 2005
28 - 29 September, Birmingham, UK
sthomas@cmpinformation.com
http://www.geosolutions-expo.com

Kuwait First Remote Sensing Conference & Exhibition
26-28 September, Kuwait
info@promedia-international.com
http://www.kuwaitremotesensing.com/

50th Photogrammetric Week
05- 09 September 2005,
Germany, Stuttgart
martina.kroma@ifp.uni-stuttgart.de
http://www.ifp.uni-stuttgart.de/phowo

5th International PHOTOMOD User Conference
13 - 16 September 2005, Latvia, Jurmala
http://www.racurs.ru

October 2005

GeoBusiness Conference 2005
13 October 2005 London United Kingdom
conferences@geobusiness.co.uk
http://www.geobusiness.co.uk/events

Asia and Pacific Region Socet Set Users Conference;
24-26 Oct Cairns; Australia
rob.coorey@baesystems.com

Trimble Dimensions 2005 User Conference
23 - 26 October, Las Vegas, USA
rhonda_heninger@trimble.com
http://www.trimbleevents.com

URISA's 43rd Annual Conference
9 - 12 October, Kansas City, USA
info@urisa.org
http://www.urisa.org/annual.htm

Asia and Pacific Region Socet Set Users Conference; BaE Systems
24-26 October, Cairns; Australia
rob.coorey@baesystems.com.

Intergeo 2005
4 - 6 October, Dusseldorf, Germany
ofreier@hinte-messe.de
http://www.intergeo2005.de

November 2005

The 12th world congress of the Intelligent Transportation Society (ITS).
6- Nov 10, 2005 San Francisco, CA, United States
http://www.itsworldcongress.org

25th International Cartographic Congress
28 Nov – 1st Dec 2005Sagar, M.P. India
rkt_sagar@hotmail.com, inca25_sagar@yahoo.com
www.incaindia.com

AfricaGIS 2005
30 Oct - 4 Nov, Pretoria, South Africa
fduplessis@openspatial.co.za
http://www.africagis2005.org.za

GEOINT 2005
30 Oct - Nov 2, San Antonio, USA
http://www.geoint2004.com

12th world congress of the Intelligent Transportation Society - 2005
6 - 10 Nov, San Francisco, USA
http://www.itsworldcongress.org

South East Asian Survey Congress
21 - 25 Nov , Brunei
secretarygeneral@seasc2005.org.bn
http://www.seasc2005.org.bn/congven.html

ACRS 2005
7- 11 Nov, Vietnam, Hanoi
eisa.ig@fpt.vn
http://www.acrs2005.ac.vn

Qatar GIS Conference & Exhibition 2005
14 -16 Nov, Qatar, Doha
info@gisqatar.com
http://www.gisqatar.com

AGI 2005
1- 3 Nov, Chelsea Village, London
angela.mcmahon@agi.org.uk
http://www.agi2005.org.uk

2nd International Conference 'Earth from Space'
30 Nov - 2 Dec, Moscow, Russia
http://www.transparentworld.ru/conference/

December 2005

Middle East and Africa Conference for ESRI Users 2005
6th – 8th Dec 2005
meauc2005@qs4it.com
www.qs4it.com/meauc2005

Gulf Traffic - GIS Zone
12 - 14 December, Dubai UAE
davyd.farrell@iirme.com
http://www.gulftraffic.com

First International Symposium on Health GIS
1 - 2 Dec, Bangkok, Thailand
healthgis@gmail.com

GNSS 2005
8 – 10 Dec, Hong Kong, China
lswuchen@polyu.edu.hk
http://www.lsgi.polyu.edu.hk/GNSS2005

ITC 55 years Lustrum Conference
14 - 16 Dec 2005
The Netherlands, Enschede
verburg@itc.nl
http://www.itc.nl/news_events

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Dr. Scott Pace, Associate Administrator for Program Analysis and Evaluation, NASA HQ, Washington, DC. May 11, 2005

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