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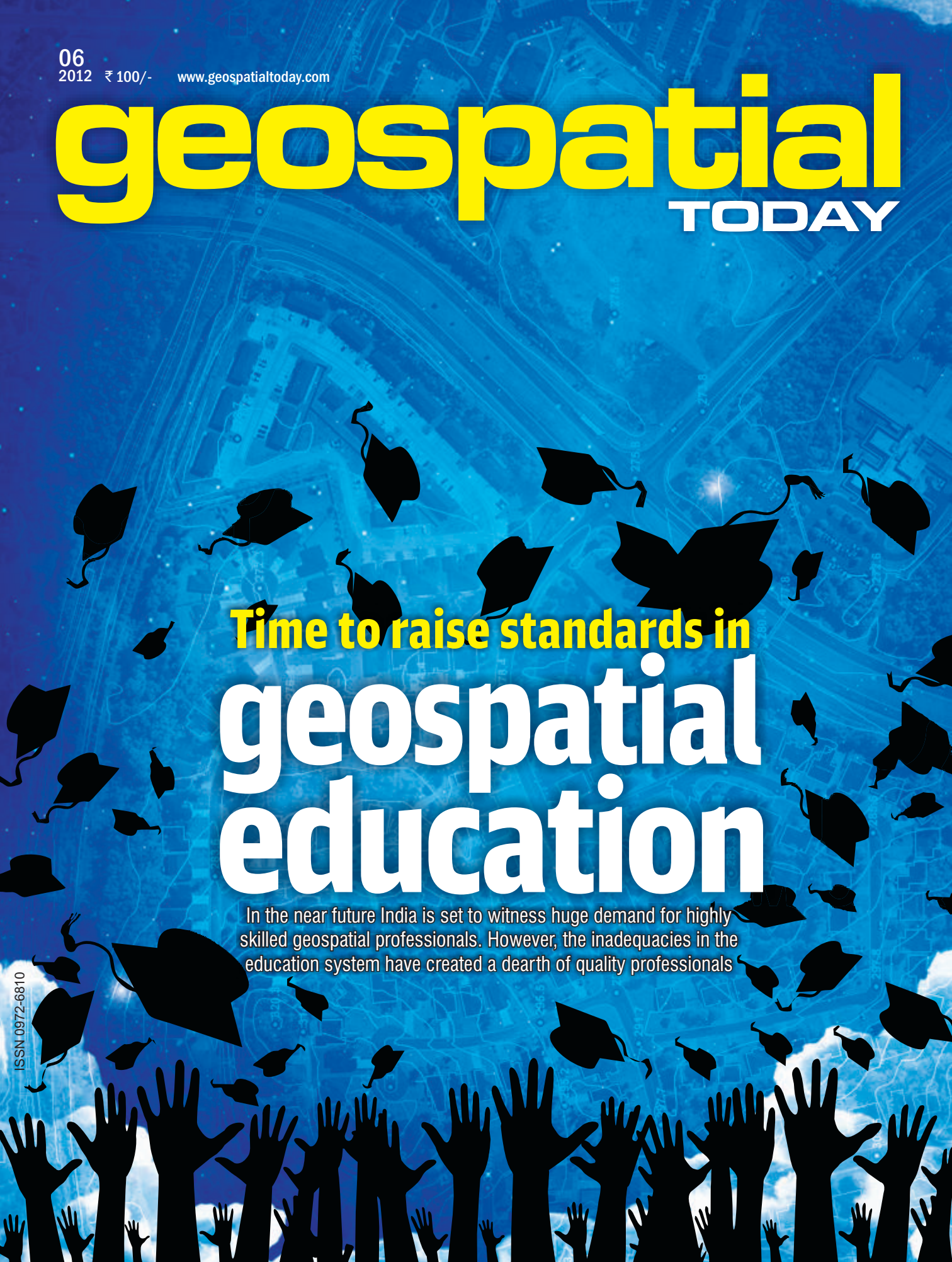

Time to raise standards in

geospatial education

In the near future India is set to witness huge demand for highly skilled geospatial professionals. However, the inadequacies in the education system have created a dearth of quality professionals

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Watersheds are hydrologic units that are considered to be efficient and appropriate for assessment of available resources and subsequent planning and implementation of various development programmes. Watershed is defined as "Natural hydrologic entity that covers a specific area expanse of land surface from which the rainfall as runoff flows to a defined drain, channel, stream or river at any point."

Of late, geospatial technologies are being extensively used for optimum development of land, water and plant resources within the natural boundaries of a drainage area for watershed management, to meet the basic needs of agriculture in a sustainable manner.

Another important aspect of water resource management is flood hazard mapping. Flood hazard mapping is of utmost importance in order to assess the impact of floods and plan mitigation measures, such as development of channels to drain off flood water. Flood hazard maps have been evolved over the years in response to user needs and are developed using improved technologies. However, production of new and revised maps has always taken place within the real-world fiscal constraints. Newer digital mapping techniques are often more cost-effective, in both short and long term than the old conventional methods.

Be it watershed management, irrigation, flood control or rain water harvesting, in any water resources project, right from planning to design and execution, preparation of base map with accurate contours is essential. Development of a Digital Terrain Model (DTM) is primary requirement for developing a base map. Conventional methods for development of a base map are very laborious, time-consuming and uneconomical. Many modern techniques using satellite imagery and geospatial technologies can be used very effectively to meet survey requirements for any mapping project.

Mapping watersheds

SECON Pvt Ltd has conducted a first of its kind study to map the 10 watersheds (sub basins) of Narmada River in the state of Madhya Pradesh. Narmada, the largest west flowing river of the Peninsula, rises near Amarkantak in the Shahdol district of Madhya Pradesh at an elevation of 900 m in the Maikla range. The total length of the river from the head to the outfall into the sea is 1,312 km.

The basic requirement for developing engineering design for projects of big magnitude such as watershed management, flood control studies and rain water harvesting is the generation of an accurate base map

Objectives of the study include:

- Mapping the area for an extent of 13,817 sq km
- Contour map preparation to obtain the contours of 0.50 m intervals so as to plan the medium and minor projects (micro water sheds) in the 10 sub basins/water sheds
- Geo referencing
- Establishing ground control points
- Digitising and editing data
- DEM generation

In a first of its kind initiative in India, watersheds in the Narmada basin have been mapped using high-resolution satellite imagery supplemented by ground surveys

Mapping watersheds in Narmada basin

- Ground truth validation
- Base map preparation
- Screening of the projects
- Identifying and locating the projects (location of dam sites)
- Water availability studies, water balance, basin plan
- Assess submergence and command area for 1,300 sq km of culturable command area
- Classification of land use/ land cover

Data used

The different types of data used for the project include:

- 0.50 m high-resolution, stereo satellite imagery
- Topographical maps
- Ground data obtained from field

Methodology

The basic requirement for developing engineering design for projects of big magnitude such as watershed management, flood control studies and rain water harvesting is the generation of an accurate base map with contours providing the details of 3D terrain configuration, catchment area, forest cover, land use, utilities, places of inhabitation etc. of sub basin area.

If the base map for this project was to be generated using conventional ground survey method, the volume of work to be executed was estimated to be about 100 land surveyors working for 8 to 10 years in undulating and forested terrain on each of the sub basin.

The process can be expedited using aerial surveys, but there

are restrictions and limitations on successfully and rapidly executing aerial surveys in India because of security clearance, customs delay, and weather conditions.

The High Resolution Stereo Satellite Image (HRSI) mapping method combined with ground control and validation was chosen as the fastest and cost-effective technique possible. 3D ground features were extracted from HRSI using a combination of suitable software along with photogrammetric software. The stability, speed and the user-friendly interface of software helped to extract the required information accurately from the large stereo pair images, each over 2 GB in size.

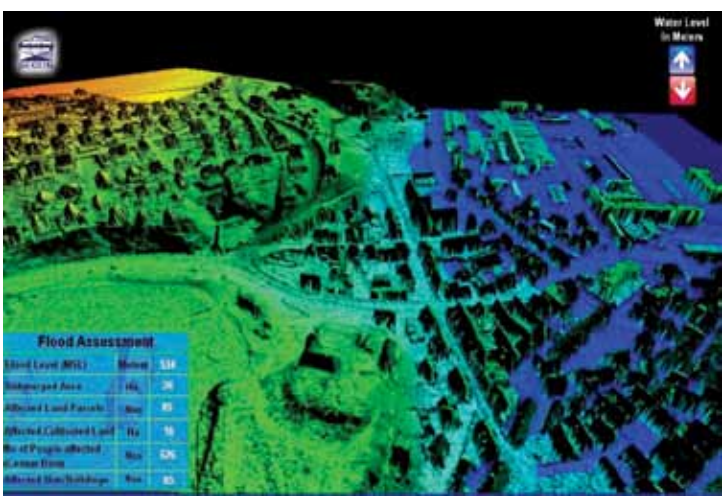
In order to compile data from stereo HRSI, Differential Global Positioning System (DGPS) control was established. It was post pointed and processed to achieve the desired accuracy.

Topographic compilation was performed and an automatic DTM was created. The DTM was edited to eliminate any spikes or error points. Ortho-rectified images were generated. Planimetric details were digitised from ortho-rectified imagery by on-screen digitisation. Contours were generated from the DTM after generation of Triangulated Irregular Network (TIN). All data was merged to create a map on desired scale with contours at 0.50 m interval. CAD editing was carried out to create map as per cartographic standards. Suitable software was used as drafting tool during photogrammetry compilation and CAD editing.

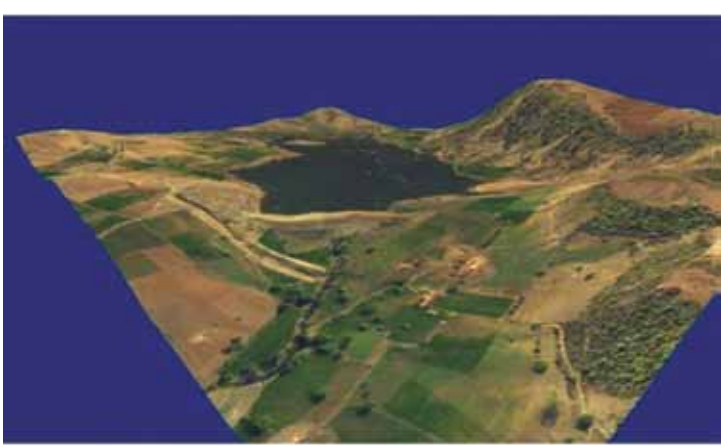
The High Resolution Stereo Satellite Image (HRSI) mapping method combined with ground control and validation was chosen as the fastest and cost-effective technique possible

Thus, combination of ground survey and planimetric topographic compilation in photogrammetry work station using HRSI has helped the project team to complete desired tasks in a short duration as compared to the time required by conventional ground surveys alone.

Macro-level mapping can be developed using Stereo HRSI, and this can be supplemented with LiDAR mapping to develop micro-level mapping with more details and higher accuracy. The maps thus produced by using modern methods was used for further planning, design of medium and minor projects in the 10 sub basins. These maps are used to support flood insurance and flood plain management activities. Maps can also be used for a variety of applications including disaster preparedness, response, recovery, risk assessment and diverse mitigation measures.



Flood mapping and modeling


3D map overlay of HRSI over Terrain Model

Conclusion

Conventional methods along with modern techniques can be sucessfully used for developing maps for all water resource projects without compromising on data quality. Remote Sensing and GIS proved to be very comprehensive in the study of large areas like watershed, flood plain studies and rain water harvesting where integrated and simultaneous activities have to be executed.