

Survey of India's plan to meet the country's need for digital geographical data

R. N. Srivastava

Surveyor General's Office, Post Box No. 37, Dehra Dun 248 001, India

Preparation of an accurate topographical map is a painstaking and hazardous task and the technology adopted is quite different to tracing the artefacts from space imageries. Despite space imageries having the advantage of large and repetitive coverage, topographical maps still continue to be used for preparation of base maps for thematic representations, research and spatial planning on account of their accuracies, precision and contents. In fact, keeping such requirements in mind the Survey of India has started bringing out a number of public series maps to promote tourism, explorations, environmental and heritage awareness, etc. Topographical maps on all scales of about two thirds of our land mass and smaller scale maps of the remaining area are in public domain, and maps of all categories and associated digital data are being released to the Government organizations on 'need to know' basis. The policies on this issue are generally commensurate with practices in the neighbouring countries. The Survey of India cannot, of course, be blamed for objecting to copyright violations and digitization of maps without consent.

The Survey of India, being the producer of topographical maps, has been in the eye of the storm over various restriction policies of the Government for some time past. However, the intensity of criticism has increased after the publication of policies regarding dissemination of digital map data to the public in November–December 1998 issue of *GIS@development*. With the issue being equally important to academics and scientists, a panel on 'Scientific Data of Public Interest' was formed at the Indian Academy of Sciences, Bangalore and a discussion was organized on 'Public Access to Indian Geographical Data' on 14 and 15 July 1999. This paper is a compilation of various issues discussed by the representative of Survey of India regarding the future plans of the Department to meet the country's needs for digital geographical data and the existing scenario on map data dissemination. The paper also includes some issues related to creation of a digital spatial database in public domain and various policies which will require attention of the GIS community for implementation of the plan.

Introduction

The Survey of India, presently placed under the Department of Science & Technology, has the responsibility of preparing Topographical Maps for India on various scales and has been generating the topographical data for the last 230 years. Maps on various scales covering the entire territory of India are available for sale to public on one million or smaller scale. Topographical maps on larger scales, are also being released to public except of areas near the international boundary and coastline, which being sensitive for the external and internal security of the country, are being released on need to know basis. Generalized District maps of these areas on 1:250,000 are available to public. Even after generalization of details, the contents and accuracies of the Survey of India topographical maps can be compared with any equivalent maps of other countries. These maps have all along formed the base for the preparation of thematic maps and research. Besides topographical map series, the department brings out many public series maps, such as guide maps, tourist maps, trekking maps, etc. to increase the awareness of general public towards the environment.

Introduction of digital technology in cartography and use of digital cartographic data base (DCDB) for bringing out updated maps was initiated in the Department in early eighties for in-house activities. Complementary developments associated with the use of DCDB within the Department, such as formulation of map data structure, development of data exchange formats, translators, etc. were undertaken using the limited resources in Survey of India. The Digital Vector Data Exchange Format (DVD) was released to the nation by P. V. Narasimha Rao, the then Prime Minister of India on 30 June 1992. The Survey of India thus, became the first government organization in India to adopt digital cartographic technologies for enhancing their map making capabilities in fulfilment of their role. We take pride in stating, that as a leader in this field, expertise of the department was extended to many government scientific departments and today the standards developed by the Survey of India have been adopted in most of these organizations. DCDB produced by the Survey of India is also in use in many government departments and its undertakings after clearance by the Government. An approved procedure for the Government Departments and its undertak-

ings for obtaining the digital map data is in vogue and except for setting up an efficient system for the clearance and supply of the data, the Survey of India has very minimal requirements to augment its existing system. This procedure is also applicable to Universities and other research organizations. Some of the NGOs have also been supplied digital data on behalf of their concerned Ministries. The euphoria, that the Survey of India is coming in way of development, is therefore baseless except for those segments of society who either do not know the procedures or have no respect for the law of the land. The statements regarding map data of Indian hinterland being openly available in other countries, often being published in media, are also a suspect as the contents, the accuracy of the spatial details as well as the semiotics of such maps is conveniently left unexamined, with respect to the situation on the ground.

While considering the Survey of India's plans for dissemination of Geographical Data, it is logical that the issues related to the dissemination of high resolution. Geographical Data in other fields such as hydrology, climatology, geology, seismology, etc. being generated by other Government of India scientific organizations is also considered for the purpose of maintaining the consistency at the time of integration of data as just the cartographic base, on its own, is insufficient for any development work and research.

The initiative taken by the Indian Academy of Sciences, Bangalore for evaluating the country's need for Geographical Data and the mechanisms for its dissemination is very appropriate at a time when a lot of pressure is being built by the media against various restriction policies of the Government of India. This paper is, however limited to the role of the Survey of India with respect to dissemination of topographical information only. It is anticipated that the Academy will extend such efforts to other disciplines of Geographical Data and provide a suitable platform for their standardization, integration and dissemination in the form of a consistent and homogeneous Geographical spatial data base to serve a meaningful purpose in public domain.

Role

Preparation of up-to-date topographical coverage in map form is the primary role of the Survey of India. The dissemination of these maps, prior to the Independence of the country, was limited for official use only. However, realizing the importance of topographic database for development, planning and other scientific research, the map dissemination policies underwent reviews from time to time and as a result, open circulation of maps covering about 2/3rd land area of the country on large scales was permitted to the public. The secondary roles of the Survey of India, primarily on the basis of specific

requirements, were enlarged to include development surveys, precision surveys of geodetic accuracies and other research programmes in the field of earth sciences. Its expertise and products, even in this space era, form the backbone of all thematic representations and research. Some of the secondary role/activities are briefly enumerated below:

- (a) Topographical surveys
 - (i) Establishment of geodetic control framework through precise planimetric, height, gravity, geomagnetic and tidal observations and topographical control network.
 - (ii) Photogrammetric and ground surveys.
 - (iii) Maps in soft copy forms on various scales to expedite map revision process.
- (b) Developmental surveys
 - (i) Paid for surveys for development projects in hand and soft copy forms.
 - (ii) Provision of data for precise alignments of tunnels, dams, power house complex, barrages and railways, etc.
- (c) Public series mapping

Guide maps, town maps, road maps, tourist and trekking maps, etc. on various scales. Geographical maps on 1:1 M and smaller scales in hard and soft copy forms.
- (d) Publication of charts and tables
 - (i) World aeronautical charts.
 - (ii) Indian tide table.
 - (iii) Monthly mean sea-levels of Indian tidal stations.
- (e) Mapping for defence forces
 - (i) IAF charges and maps.
 - (ii) Cantonment maps.
 - (iii) Topographical maps with special information.
 - (iv) Special maps/digital data.
- (f) Assistance to scientific programmes
 - (i) Irrigation and multipurpose hydro-electric schemes.
 - (ii) Glaciological studies.
 - (iii) Crystal movement/dam deformation studies.
 - (iv) Tidal studies.
 - (v) Gravity and geomagnetic observations.
 - (vi) Digital cartographic database. Elevation models, etc.

Except for the geodetic data (generated for map making), special maps prepared for specific indentors and those large-scale maps declared sensitive by the Government, all other data is being already disseminated to the public. Further, the Department regularly undertakes surveys for development projects which are projected by the concerned development agencies. NGOs engaged in development work are also utilizing the Survey of India maps in unrestricted areas and, with permission, even in restricted areas. To some extent many Government of India Ministries and State Governments are known to have utilized even the remotely sensed image-ries for the tasks involving large-scale maps such as in rural development, etc. and, if these experiments have proved successful, then the Survey of India perhaps has no necessity to spread its limited resources even more thinly in the country. It will also be appropriate to point out that government departments and scientific undertakings are normally mandated to disseminate the base products and not the data generated for arriving at those products. The Survey of India cannot be made an exception to these practices and expected to disseminate the geodetic or digital data being used as tool for map generation. There are many outstanding scientific organizations specially funded to develop such technologies, and perhaps more qualified to make such data available to the public and business community. However given the resources and mandate, the Survey of India will not hesitate to take up this challenge.

Classification of geographical data

To qualify the above views it is necessary that a broad classification of the data being generated by the Survey of India is understood in relation to its mandate for dissemination of data. Perhaps a data classification into the data published on the map and data used as a platform for preparation of a map, with contents of each as under, would suffice:

(a) Published data

- (i) Terrain information (topology) such as relief, drainage, land forms and a few heights/relative heights to indicate lay of the land.
- (ii) Physical artefacts such as built up areas, roadways, railways, canals, bridges, tele-phones, power lines, wells, tube wells, administrative boundaries up to village level, reserve forest boundaries, geographical names, vegetation under broad classification, road classification and kilometre stones, etc. Many such information are value-added on the basis of ground survey to make the map more useful.

(b) Unpublished data

- (i) High precision planimetric control data (coordinates) and heights.
- (ii) Gravimetric and geomagnetic data.
- (iii) Topographical plan and height control data.
- (iv) Network of spot heights for contouring purposes.
- (v) Civil and military VAs and VPs.
- (vi) Classified information.
- (vii) Sub-soil data.
- (viii) Digital Cartographic Data base (DCDB).
- (ix) Administrative Boundary Records.
- (x) Records of Geographical Names.

The Survey of India, in fulfilment of its primary role, has set up a number of map sales offices throughout the country. The unpublished data is also being supplied on need to know basis after receiving approval of the appropriate authority and till such time it is mandated to disseminate such data (including the DCDB) on mass scale and appropriate infrastructure is provided. The Survey of India has no choice but to travel in the existing grooves.

Restrictions on data dissemination

Restriction policy on map data has been changing from time to time according to the assessment of internal and external threat perceptions arrived at by the Ministry of External Affairs, Ministry of Home Affairs and Ministry of Defence. This practice against all belief, is not unique in this country. However, in recognition of the need for geographical data in scientific and educational programmes, all classified data is being permitted for bonafide use after going through certain laid down procedures. Recently, in view of the introduction of digital technology in the planning process, the requirement of digital data for use in GIS environment, and limitations in the digitization potential of the Survey of India, the Ministry of Defence has decided to allow nine government organizations to digitize the bulk of topographical data from unrestricted Survey of India maps on 1:50,000 scale. This de-restriction is aimed at making digital geographical data available to scientists, planners, educationalists and other general users.

Present scenario

Before listing the plans of the Survey of India for strengthening its existing data dissemination infrastructure, it will be worthwhile to list present practices on use of topographical data and scenario on this issue in brief.

The national policy on geodetic, geophysical and map data dissemination has been reviewed from time to time keeping in view the user's requirement for such data

and the security implications. The salient features now in force with regard to availability of data are given as under:

- (a) All geographical data and maps, including those in restricted zone, are available to Scientific and Educational Institutions and planners for bonafide use after obtaining clearance from the appropriate authorities.
- (b) Surveying activity in unrestricted zone is open to all Government and non-Governmental agencies. State Governments are allowed to undertake mapping on cadastral and engineering scales (large scales) in restricted zone as well. Such maps are being published after MOD's clearance. Unrestricted large scale maps and charts of coastal areas (restricted zone) published by NHO are available for sale.
- (c) A number of Scientific Institutions and Departments such as FSI, GSI, NGRI, NIO, IIG, ONGC, NIC, etc. are independently charged with the responsibility of collecting a variety of geographical/geophysical data for scientific and developmental purposes and their value-added maps, after clearance, are available to public.
- (d) High resolution satellite imageries of Indian and foreign origin are already being used by the government and non-government agencies for spatial planning, research and public usage. Large-scale imageries have been used for rural and urban development planning and related GIS activities, and as claimed, meet the user requirements.
- (e) There being no monitoring agency, maps of unrestricted and restricted zones are being digitized by various government and non-government organizations in violation of the copyright (Amendment) Act 1994. Value additions are being carried out in an unsystematic manner, generating a lot of incompatible data of different accuracies.
- (f) The Survey of India maps in restricted and unrestricted zones undergo security vetting before publication. Cultural information content in SOI maps is more often less than the maps published by various agencies. Notwithstanding, SOI maps are being regularly used as base maps for publication of thematic data and research papers as no organization has the capabilities to produce accurate topographical maps based on geodetic control.
- (g) Many scientific government and private organizations have adopted GPS for control and mapping activity, resulting in generation of geographical data in geodetic framework other than Everest Spheroid. Such maps, if limited in extent, sufficiently serve their purpose.

From the above, it can be seen that a variety of cartographic, geodetic, and geophysical data is already

accessible to the central/state governments, their undertakings and other non-governmental organizations under stipulated guidelines formulated by the Ministry of Defence. Alternative technologies for development surveys through satellite imageries and GPS, besides the nine government organizations now empowered to release digital spatial data from unrestricted SOI topographical maps, are already in use. Development projects, requiring higher precessions in database, are already being undertaken by SOI, of course, data generation being a cost-intensive process, will have to be selective and will require financial commitment from the users.

Future plans

Notwithstanding the above, SOI has already upgraded one of its survey units to Geomatics Party in 1997-98 to meet the increasing requirement of geomatics data. It is now proposed to upgrade the unit to a Geomatics centre aimed at:

- (i) Generation of user geographical data base on larger scales for public use.
- (ii) Generation of cartographic digital database of unrestricted public series maps use in GIS environment.
- (iii) Coordinate digitization of data and vetting of value added digital data products as outlined in MOD, OM No. 2(5)/95/D(98 III) dt. 13 July 1998.
- (iv) Meeting data requirement of multi-disciplinary agencies from a single window.
- (v) Undertake specialized survey projects at national level, viz. Micro Watershed Development, Coastal Zone Management, Cadastral Surveys, Irrigation and multipurpose schemes, etc.
- (vi) Constancy in geodetic and allied geophysical surveys, topographical surveys, digital cartography, etc.

Besides the above, the following programmes are being formalized in order to keep pace with the state-of-the-art technologies within the department:

- (i) Redefinition of Indian geodetic height and plan datums.
- (ii) Creation of Digital Cartographic Databases (DCDBs), GPS database, Gravimetric database, Tidal database, including sea-level information for departmental use and research.
- (iii) Strengthening of infrastructure for developmental surveys and modernization of printing and digital technologies.
- (iv) Increased availability of resources to assist government sponsored research programmes.

Policy issues

It is apparent that the Survey of India, being a national mapping agency, will have to play an important role for providing spatial information to the government and private sectors for accelerating the pace of sustainable development. However, important issues, which ingress the roles of other departments, will have to be solved with the help of government intervention. Some of such issues are listed below:

- (a) Classification of scientific data on topographical maps.
- (b) Generation of geographical data on an uniform meta data standards by various data generating agencies.
- (c) Individual responsibilities of data generating agencies for dissemination of concerned geographical data.
- (d) Resource generation and participation of government and non-government organizations in the user data generating efforts of SOI.
- (e) Financial and legal arrangements for data sharing.
- (f) Need to review the geographical data generation and mapping policies.
- (g) Legal backing to safeguard the copyright and royalty issues related to map data.
- (h) Security aspects of classified spatial data.

Conclusion

As a data generator, SOI is interested in dissemination of the cartographic data subject to the clearance of the

government and the requirements of data for various commercial and development purposes being identified. Of course, generation of data being cost intensive, its dissemination will, undoubtedly be at a cost proportionate to the accuracy and contents of data. Scientists, planners and industry, will therefore, have to play an important role in identifying the data specifications for specific activities to avoid undue financial commitments and over-loading the softwares/GIS.

In conclusion, it will suffice to postulate that many misgivings and presumptions being circulated in the media and which have become a cause for immense pain to the committed surveying community in Survey of India, will stand clarified and public at large will be more reasonable in their approach besides being sensitive to the nation's security environment. While there is no doubt that the business and scientific community has to play a very important role in guiding the national policies but their perceptions, must be arrived at after closer interactions with the policy makers and clear understanding of national priorities. This community would do a great service to the nation, and in particular Survey of India, in directing their endeavour, towards setting up consortiums for standardization for spatial data, its dissemination and its use, not only with reference to the requirement of commonly available softwares, but developing GIS tools relevant to the development needs in the country.