

Indian NSDI

A Passionate Saga



Edited by

Maj. Gen. (Dr.) R. Siva Kumar

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Acknowledgements

When we embarked on the journey to establish NSDI, we weren't really sure what we were to face. The day-long discussions, disagreements, never-ending meetings, seminars, study tours and the bonds that we formed along the way have all been a part of growing up as an organisation. This book relives the memories from the conceptualisation of NSDI to its maturity and realisation. I firstly thank the Department of Science and Technology (DST) for its support and Dr. T. Ramasami, Secretary, DST for his vision and belief in NSDI. His involvement in NSDI, soon after assuming charge, paid dividends in the form of cabinet approval. I sincerely appreciate the efforts of all the people who have contributed to the making of this book and thank all the writers, who took time off from their busy schedules to share their experiences and insights through written notes.

Perhaps the pages of this book will be seen as "thanks" to all those who have helped make NSDI what it is today.

- Editor

Empowering People Through Geospatial Data



Prithviraj Chavan

*Union Minister of State (IC) for Science & Technology
and Earth Sciences, Government of India*

The use of spatial data and tools/technologies like Geospatial Information System (GIS), Global Positioning System (GPS) and Remote Sensing at different levels of planning will improve the quality of resource management decisions/ strategies. Non-availability of spatial data of desired resolution, incompatible data sets, lack of user-friendliness of the processing tools and inadequate capacity amongst the end users have been the major bottlenecks. It therefore, has become imperative to improve spatial data management practices and appropriately align the tools/technologies with the workflow or business processes of local self-government (panchayats /municipalities) according to the spatial data infrastructure framework. In addition to technological issues, unwillingness on the part of the data generators to share and leverage the data assets and requisite policy framework, have hampered the use of spatial data in India.

NSDI has successfully brought out metadata and data exchange standards in tune with the international standards of ISO and OGC. Ultimately, let us look forward to see that NSDI works towards empowering citizens through geospatial data. ▲

Shaping the NSDI



Dr. K. Kasturirangan

Member (Science), Planning Commission

A new wave of technological innovation is allowing us to capture, store, process and display an unprecedented amount of geographical and spatial information about society and a wide variety of environmental and cultural phenomena. Much of this information is “spatial” – that is, it refers to a coordinate system and can be represented in map format. Current and accurate spatial data must be readily available to contribute to local, state and national development in addition to economic growth, environmental quality and stability, and social progress. It is in this context that the National Spatial Data Infrastructure (NSDI) was conceptualised.

I perceive that NSDI is a natural culmination of all that has happened in the area of surveying and mapping, remote sensing applications and GIS applications in this country over the past years. NSDI is not a sudden “out of the blue” development, but a logical roadmap of what has been done and also envisions what needs to be done ahead. With a core map information base, a spatial infrastructure is essential and this is where the NSDI becomes relevant.

Built on powerful GIS technology, NSDI can provide the framework by which maps and images are registered and brought

under an integrated view to “fuse spatial data” and derive meaningful information that addresses societal and national problems – irrespective of whether the information was from remote sensing, conventional surveys, census survey or from this department and that agency. The beauty of NSDI is that it allows each agency to provide its data but no single agency can say “I own all of it”. It is like a collective gain from individual ownership. That is where NSDI must become a central and, probably a logical culmination, ensuring the availability of converged and meaningful data for the benefit of this country. The important thing is to make data that is required for decision-making available to the right person who needs it, at the right time, and for addressing a rightful need. This exactly is NSDI’s goal.

As a decision-making and development process, basically three types of data are required. One is topographic information from ground surveying or available with the Survey of India – which serves as a base. The other is thematic information – mostly coming from images or thematic maps, prepared mainly by ground surveys. The third is crucial survey data and location-based data – a process of geo-tagging. On top of all these, there is also a need to integrate other enterprise-level non-GIS data and create an enterprise picture. But for a development or enterprise management activity, one needs to combine all these as integrated spatial modelling. But this facility is not available for everybody in a systematic manner – mainly because the information is “owned” by various agencies, formats are different, standards are different, heritage is different, update-cycles and business modules are different too. Only through common conventions and technical agreements, standards, metadata definitions, network and access protocols, will it be possible for the NSDI to come into existence. NSDI must close that gap and ensure

that processes and mechanisms to make this happen are available and positioned.

The question of institutionalising NSDI is not just the thing that one should be worried about. If the right programmes and projects are positioned and NSDI is seen as an over-arching framework that enables transparency, standardisation and accessibility and includes one and all, I think the institutional aspects will easily follow. We need to move on and create larger national GIS systems, reformat and standardise, build networks and develop GIS protocols and spatial search engines that truly make spatial data from different producers available and accessible through a common gateway.

To me another important aspect is how GIS and SDI can be useful in supporting governance and national development activities. NSDI must enable mechanisms by which it can bring in support for planning at the national level, support any disaster management needs; water resources management, climate change indices, land use planning, urban development and management, infrastructure development, watershed development planning, state/district plan generation, environmental impact analysis and other societal and governance requirements. Of course, SDI can also be extremely relevant and needed for corporate activities in enterprise solutions such as power, telecom and infrastructure. These are the applications that must enable the design and growth of NSDI and, in turn, NSDI must cater to these needs.

I see India becoming a vibrant nation in developing the SDI as a mode in which the right inputs are available to the users, who will use it in a way that has so far been unprecedented. I believe it will happen because all the elements are in place, the tools are there and

institutional framework is also evolving, so the next step I assume would be a transformation to NSDI as an operational system.

The world is going to have a large number of remote sensing satellites being launched soon, and increased activity is likely to be witnessed in areas of mapping, GPS and other sensory systems. I think the thrust will be on GIS databases and information availability – all of which are going to improve and increase. I feel there should be a concerted effort by the people who created this concept, to increase awareness among people who would be potential users of NSDI or support its activities. From that vantage point, one can envision NSDI as an effective mechanism for governance, societal benefit, commerce and business and good research. I trust that spatial data communities that include the generators and users of spatial data, will play a proactive role in making this happen.

I wish the NSDI Workshop in Pune all success. ▲



Dr. T. Ramasami

Secretary, Department of Science & Technology

National Spatial Data Infrastructure is an integrating platform to pool together valuable spatial data resource of the country. Geospatial data is emerging as an important asset and tool for planning the developmental processes of the civil society. National Remote Sensing capability, when combined with the efforts on ground by Survey of India, will help in achieving the desired goals. Several agencies and departments share the NSDI framework and platform. Therefore, it is important that interoperability of data is facilitated and this would require standardisation of both legacy and prospective datasets.

The potential of NSDI mechanism will be best realised through a professional coalition among all data source agencies and effective partnership among various stakeholders.

The beginning of NSDI has been passionate. The growth of NSDI needs to be purposeful. The value of NSDI will be realised only through societal profits. Let the passionate saga transform into an era of national profits. ▲



Dr. Shailesh Nayak

Secretary, Department of Earth Sciences

NSDI has been planning to develop the Spatial Data Infrastructure which could be used by Government and Research Institutes, NGOs, professionals as well as the industry. I am happy to note the steady progress in this field. We need to further enhance the participation of stakeholders. ▲

National Spatial Data Infrastructure (NSDI) Perspectives of ISRO on Data and Information Services



Dr. K. Radhakrishnan

Secretary, Department of Space and Chairman, ISRO

Geospatial databases have proved to be of immense use in the optimal management of natural resources in tune with the socio-economic development needs in the country. Indian Space Research Organisation (ISRO)/ Department of Space (DOS) had taken up major initiatives in this regard during the past decade, through specific national missions, viz., Integrated Mission for Sustainable Development (IMSD) and National Natural Resources Information System (NRIS). These initiatives provided unique opportunities to the scientists/ engineers of ISRO/ DOS in building expertise in areas of: multi-thematic mapping, integration of thematic/ spatial data layers, generation of criteria-based, location-specific development plans, standardisation of databases, development and customisation of solution-oriented software modules, design and development of web-based applications, building processes for automation, and strategies for data dissemination. Such efforts, in addition to helping capacity building within ISRO/ DOS, also enabled many states in the country to consolidate state-level geospatial databases for meeting their own / specific developmental needs. These initiatives, mobilised with the participation of many agencies and along with similar efforts of agencies, contributed to the sowing of the seed of National Spatial Data Infrastructure (NSDI) in the country, in the late 1990s.

ISRO/ DOS has been working further in this direction, to offer specific services to the user community, by way of disseminating data and information pertaining to the management of natural resources, through user-specific web portals, developed for the purpose. One of the early milestones in this process has been the establishment of a national level GIS Database at Prime Minister's Office (PMO), and a similar database for G2G applications at the Planning Commission. Simple map-server application tools were customised on a server engine to serve a variety of geospatial data to users in the intranet domains of the respective offices.

This was one of the initial attempts that paved way for providing multi-scale national GIS database through customised NNRMS portal. While realising such tools and services, ISRO/ DOS could also successfully establish a distributed computing architecture at national level through eight ISRO/ DOS centres, in addition to a centrally located server/ portal facility under the Natural Resources Data Base (NRDB) project.

The NRDB initiative has incorporated the lessons learnt from the previous projects, particularly with regard to content and metadata standards, search/ query engine design/ development, data dissemination mechanism, portal design, database update mechanism and web-based GIS applications. NRDB has since been operational within the network domains (VPN) of ISRO/ DOS, and large repository of multi-scale natural resources databases encompassing spatial and non-spatial components are deployed.

This database, through appropriate data dissemination policies, is made available to registered users in the country. On similar lines, ISRO/ DOS has also taken up a number of other initiatives to provide natural resources data through various other programmes,

such as Bhoo-Sampada, Web Portal of Disaster Management Support – Decision Support Centre (DMS-DSC), INFRAS – for online information and alert mechanism on forest fires, Biodiversity Information System (BIS), and Wasteland Information System (WALIS).

Yet another unique initiative taken up in the recent past by ISRO / DOS has been the designing, development and launching of the image and map data visualisation in 2D and 3D, through ‘Bhuvan’. *Bhuvan* in Sanskrit means Globe, and the entire geospatial raster and vector databases have been ported onto the globe with distinctive visualisation capabilities. This is an application which showcases Indian imaging capabilities by providing seamless viewing of coarse-resolution to high-resolution raster images, database cataloguing services, varieties of value-added services in 2D/3D, vector services, user-friendly interactive services etc.

The facility enables large number of users to utilise the services concurrently for such viewing and query, which is the unique feature of this portal. The beta version has quickly gained global popularity with over 300,000 users having registered in just two months with crores of hits recorded. Bhuvan has also got the distinction of being the 5th largest searched item in ‘Google Search’ during 2009. This initiative will further enable ISRO/ DOS to keep portraying current events as well as newer value-added services on a regular basis on a near-real-time basis for the benefit of the public.

NSDI is a unique concept of ‘consortium approach’ amongst government departments, enabling sharing of database repositories at national level. These databases are of great value for various national development projects – at different levels of administrative and ecological hierarchy. It is essential that efficient software tools and

data dissemination engines which are OGC-compliant, are put to effective use for public good. NSDI, through such a novel initiative, could provide varieties of WMS/ WFS services through well-designed user-friendly Geo-portals, for which ISRO/ DOS could significantly contribute with its expertise. ISRO/ DOS has made its own space in the geospatial domain, and would continue to actively participate in NSDI initiatives, by way of sharing access to databases, as well as the knowledge gained through various initiatives. The databases of BIS, WALIS, INFRAS, Bhoo-Sampada and Bhuvan portals could be linked to NSDI for the benefit of users. Such initiatives will go a long way in providing users with easy access to geospatial databases, meeting the information needs of a variety of national developmental endeavours. ▲

Vision to Mission - The Early Years of NSDI



Prof. V. S. Ramamurthy

Director, NIAS

The National Spatial Data Infrastructure (NSDI) was literally a concept a decade back. Arising out of several intense discussion meetings, involving spatial data generators and users, primarily drawn from the government sector, the concept developed into its present shape on the strong foundations laid by the Department of Science and Technology, Government of India. The fact that data sets from diverse sources with diverse formats need to be mixed and meaningful inferences are to be extracted to enable the stakeholders to connect to their decision support systems, clearly point out the need for the NSDI concept. Current issues like global climate change, disaster management, location-based services, energy production and distribution are some of the areas that will stand to benefit from NSDI.

Apart from the technical challenges like the evolution of standards and Web-based services, the concept itself requires a paradigm shift in the way we consider our data assets. Now the full-fledged NSDI portal is operational and some of the metadata sets are available online. It is contemplated that more data sets will be added and made available to the users in the coming days. I wish to commend the commitment and passion of the geospatial data community in developing the NSDI concept into a working model. ▲

NSDI: Retracing Steps

Maj. Gen. (Dr.) R. Siva Kumar

CEO, NSDI & Head, NRDMS, Department of Science and Technology

The creation of NSDI from concept to actualisation has been a very memorable journey for me, the seeds for which were sown at the International Society for Photogrammetry and Remote Sensing (ISPRS) Congress in Amsterdam in 2000, we had participated in. During one of the discussions, a lot was said about the value, need and benefits of having a National Spatial Data Infrastructure in every country. I had gone together with Lt. Gen. A.K.Ahuja, Surveyor General of India, former ISRO chairman Dr. K.Kasturirangan and Dr. Mukund Rao, then DDEOS, ISRO. We all agreed that there was an urgent need for something like NSDI in our country.

Immediately after the conference all the alumni of ITC, International Institute for Geo-Information Science and Earth Observation, were requested to attend the Golden Jubilee celebrations of ITC. A workshop had been arranged for all the participants. So all alumni of ITC headed to Enschede in The Netherlands. While we actively participated in many of the sessions, there was one particular talk by Dr. Richard Groot, a professor at ITC, which really impressed us. He talked about Spatial Data Infrastructure (SDI) and also showed us the draft of a book about SDI he was working on.

On returning to India, we still were occupied with what we had heard being discussed and we started discussing this amongst ourselves. We had a talk with Professor V.S.Ramamurthy of the Department of Science and Technology (DST) and Mr. Amitabha Pande, Joint Secretary, DST, who were equally intrigued by the idea. Finally it was decided that we start working on the concept of having an Indian NSDI and thought of calling it National Geospatial Data Infrastructure (NGDI).

After coming back from the ITC meet in July 2000, we had made a plan to take a study tour and learn more about what is happening with NSDI in other parts of the world. A team comprising me, Dr. P.Nag, Director NATMO and Amitabha Pande, visited ITC again and a meeting with Dr. Richard Groot was arranged. By which time his book was also ready. This was in the last week of September 2000. He gave us a copy of the book, which also explained why we need to leverage the data assets which are available with various national mapping organisations considering the wealth of data assets we had from the Survey of India (SOI) and other organisations like the Geological Survey of India (GSI), Forest Survey of India (FSI), Indian Meteorological Department (IMD), NRSA (now NRSC), NIC, Central Water Commission (CWC), Central Ground Water Board (CGWB) etc.

The idea got further refined during the ITC meeting which had Dr. Richard Groot, Rector Martien Molenaar and Dr. Yola Georgiadou, who is now professor of geoinformation for governance, participating. We then travelled to the UK and visited Durham University followed by the Ordnance Survey. At the Ordnance Survey (OS) we tried to understand the changes that were happening in geospatial community and how the structure of OS was being modified to suite the modern day requirements and the current level

of technology. Canada was our next stop, where we witnessed the working of a successfully implemented SDI called ‘Geoconnections’. We later had discussions with the Natural Resources Canada and managed to have a very deep understanding of the subject in addition to fruitful discussions. In the US, we visited the US Census and the USGS, ending our trip with a visit to the ESRI headquarters in Redlands.

The team came back in October 2000 and immediately after a few rounds of discussions, a Task Force was constituted by DST on 30th October 2000, with Lt. Gen. Ahuja as the chairman. I was made the member secretary. This was when I was serving in the Military Survey. The ball started rolling in December 2000 when we called the first meeting of the Task Force, which included members drawn from various organisations across the country. It was at this meeting that the concept was germinated and we started working on Indian NSDI.

However, before we could decide anything else, it was realised that there was an immediate need to understand the idea because it was just three of us who had met people around the world and discussed the concept. All the information gathered had to be shared and assessed carefully. We wanted to expose the members of the Task Force to a larger geospatial community and let them grasp what was essentially happening. To achieve this, we organised the first NSDI conference in February 2001 and called it ‘The National Geospatial Data Infrastructure: A Roadmap for India’. Prof. David Rhind, Vice Chancellor of the City University, London, and ex-director general of Ordnance Survey, was invited to the conference. A geographer and co-author of the first manual on GIS, he actively participated in the deliberations along with experts from ITC and other parts of the world. Discussions centered around evolving a

strategy for SDI including technical, institutional, financial and revenue models.” The Task Force met 25 times and the working groups constituted by The Task Force many more times in a period of over five years. Extremely heated discussions were witnessed during some of the meetings and I recall one Bangalore meeting in particular, where we discussed the whole day whether to use the word NGDI or NSDI. Our return trip to Delhi was equally exciting with turbulent weather creating panicky situation in the aircraft.

Since the beginning, we had stressed on the fact that NSDI will be a success only if there is consensus amongst all parties. Participation of the agencies will only happen when they find that NSDI will benefit them by leveraging their data assets. The natural tendency of being possessive will only yield to sharing when one is assured that their data is not misused. The other major issues are technical interoperability of data sets and the policies concerning spatial data acquisition and dissemination.

In March 2001, we attended a conference on Global Spatial Data Infrastructure (GSDI), GSDI-5 at Cartagena, Colombia and were received very well. The meeting was important because we thought we could take a leadership role in GSDI since we have inherent strength in IT and Geospatial Technologies and rich traditions of spatial data collection. Survey of India is the oldest surveying and mapping organisation in the world. Established in 1767, carrying out mapping of India, it has been responsible for commencing scientific mapping in many other countries including, Australia, parts of Africa, Hong Kong and a forerunner to Ordnance Survey UK. Subsequently we became the founding members of GSDI Association. Our participation was also sought in the International Steering Committee for Global Mapping (ISCGM). Hope and enthusiasm was flowing in the team when we returned. At GSDI we

also discussed the cookbook for NSDI. The draft copy was brought and we studied and discussed it after circulating copies amongst the members. We continued our thrust in the activities of GSDI and a number of us from various agencies ISRO, NIC, GSI and SOI attended GSDI-6 in Budapest, Hungary. It was during this trip that Dr. Mukund Rao was elected the Vice President of GSDI and subsequently the president. This added momentum to the issue. We have actively participated in the regional level SDI activities in the UN Permanent Committee for Geospatial Information in Asia Pacific (PCGIAP), and at the global level in the International Steering Committee for Global Mapping (ISCGM) and India became the Chairman of Working Group 4 in PCGIAP for Institutional Strengthening and Working Group 2 in ISCGM for Standards. The developments portrayed us as an internationally active group in the field of SDI. GSDI-7 and executive board meetings of PCGIAP were conducted in Bangalore in 2004 where we were asked to host the secretariat for GSDI. A PCGIAP workshop on Institutional Strengthening held in Mysore at the same time showcased our strengths in area of SDI. This led to PCGIAP requesting us to conduct courses for the member countries of PCGIAP. There was tremendous response for the course conducted at Survey Training Institute (now Indian Institute for Surveying and Mapping), Hyderabad. PCGIAP has been requesting us to conduct this course regularly.

We have been conducting annual meetings with NSDI stakeholders. The participating agencies organise them in rotation. Each event has been a memorable occasion (pictures from these events have been included in the book). Following is the chronological list:

- NGDI-1 by Department of Science and Technology (DST) February 05-06, 2001 New Delhi Theme: “National

Geospatial Data Infrastructure(NGDI) towards a roadmap for India”.

- NSDI-2 by Indian Space Research Organisation (ISRO), July 2002, Ooty.
- NSDI-3 by Survey of India(SOI), November 2003, Agra
Theme: ‘Empowering People Through Geospatial Data’.
- NSDI-4 by Geological Survey of India(GSI), November 2004, Lucknow. Theme : 'NSDI Strategy and Action Plan'.
- NSDI-5 by National Informatics Centre (NIC), December 2005, Hyderabad. Theme : 'Bharat Nirmaan'.
- NSDI-6 by Forest Survey of India(FSI), July 2006, Goa.
Theme: 'NSDI - Realities and Challenges'.
- NSDI-8 by NSDI, December 2008, New Delhi. Theme: 'Geospatial Technologies in India-Challenges and Opportunities'.
- NSDI-9 by Indian Meteorological Department, December 22-24, 2009, Theme: NSDI for ‘G-Governance’.

The evolution of NSDI has also seen us working hard on bringing out legislation for NSDI. A formal approval for NSDI was given by the government on 2nd June, 2006 through a cabinet legislation. Right from the beginning, we started working on the standards and working groups were established for different issues such as standards, network protocols and access. A strategy and action plan document was brought out in 2002 and the first version of Metadata Standards and Data Exchange Standards were brought out. Later, International Standards Organisation (ISO) Technical Committee 211 brought out the International Standard 19115 for Metadata, which was also endorsed by Open Geospatial Consortium (OGC). NSDI Metadata Standard Version 2.0 was released in 2009 which is in tune with ISO 19115.

Throughout our journey, new connections have been established and interlinked and this had helped strengthen our bond with the people who assisted us. During one of our meetings we found that the OGC was trying to bring an open facilitation which should be followed and DST became a principal member. Subsequently in 2006, I was elected as one of the directors to the OGC board, the only one outside USA and Europe. We have been participating in their Technical and Planning committees and Board meetings of OGC. OGC also wants us to create test beds and take active role in the standards processes.

Every step we have taken, has resulted in a smile and I feel that our biggest achievement is that we have managed to build a consensus amongst all the spatial data processing agencies and now they are willing to participate and share their data assets. They are prepared to come to one platform and NSDI has been acknowledged as that 'single' platform for spatial data issues. Even the open map policy of 2005 was the result of the sustained discussions that have happened during the evolution of NSDI. In this road we have travelled, we were fortunate to have been supported by other organisations. Foremost amongst these were the efforts of Natural Resources Data Management Systems (NRDMS) in creating district spatial data centres in over 60 districts across the country. This helped us in developing and conceptualising district level Spatial Data Infrastructure for governance. Now we have gone one step further and created village geospatial information systems, by setting up village kiosks in 20 villages in coastal Andhra Pradesh, in the local language offering scenarios for various events such as cyclones, tsunami, etc.

Today I feel that NSDI has been accepted as a platform or forum for the spatial data. It took us some time to make people distinguish between a website and a geoportal. The Karnataka geoportal

demonstrates the benefit of following NSDI/OGC Standards and makes the user platform independent. Our ultimate success will be when people start coming to a centralised data server, India Geo Portal, where we will have application routines, data, hardware and everything required, so that the common man can come with a problem and go back with a solution. I wish, hope and pray that this happens soon, not just through the Web but beyond the Web, a cell phone perhaps. It isn't impossible. That is our aim and we are getting ready for it.

Every project that is undertaken has to be sustained through the support of stakeholders. I am positive that more stakeholders will come once they realise the value of what we are doing. Till date the value is seen and realised only by the people who were involved in NSDI movement, but the number will grow once the data is available. Already because of the insistence on standards, most of the people working in this area are also ensuring that the software they buy is OGC-compliant to facilitate them in sharing their data assets with others. We have also had a lot of positive response. International agencies find that what we are doing is worthwhile. Also I feel that our kind of set up with different data sets, methodologies, languages and ways of data acquisition technologies has been a role model. We are also becoming a learning site for others. OGC Europe has expressed a desire to exchange ideas with us and learn from us. Many of the countries that tried to have NSDI, met with little success. We have learnt from their mistakes, we have modified the steps to suit us. We did it in a different fashion and it is a lesson for others. Our strength in IT and very good geospatial data acquisition management technology, in addition to diversity of languages and cultures is rare, and would definitely inspire others.

I feel that passion, perseverance and patience are key elements behind the present success of Indian NSDI. ▲

National Spatial Data Infrastructure in Retrospect

Dr. P. Nag

Director, National Atlas & Thematic Mapping Organisation

During the autumn of 2000, a scientific delegation was sent by the Union Department of Science & Technology to Europe and North America to exchange experience and expertise regarding geospatial initiatives. This team consisted of Joint Secretary DST, Director NATMO and Director, Military Survey. Executive Director of Technology Information, Forecasting and Assessment Council (TIFAC) of DST and the Surveyor General of India could not participate in the delegation due to some pressing engagement in the country.

Particularly, from the discussions with the specialists in the United Kingdom, Canada and the United States, it became apparent that India needs to organise its geospatial data assets because in the digital and Web world, there is no escape route. Hence a National Task Force was appointed initially named as National Geospatial Data Infrastructure (NGDI) with the Surveyor General of India as the chairman. But this name itself led to prolonged discussions. ‘Geospatial’ or ‘Spatial’ was the bone of contention. Similar initiatives in other countries were consulted. Nevertheless, Department of Science & Technology and Survey of India were proposing for ‘Geospatial’ while the Department of Space (DOS) and

the Indian Space Research Organisation preferred ‘Spatial’. There were obvious reasons, based on the nature of data produced by these organisations, to plead for these terms. Finally, ‘Spatial’ was agreed upon. Hence, the current nomenclature, i.e. National Spatial Data Infrastructure or NSDI, came into existence.

The development of NSDI should not be considered in isolation. It was a part of the major initiative taken up by the Department of Science & Technology and the Survey of India. The other initiatives were the National Map Policy, dual map series, and changes in field work methods, digitisation of topographical maps and re-organisation of Survey of India.

But, this was just the beginning of a long chain of problems that had to be solved. Though, the whole activity was to be a collaborative effort of all the stakeholders, the question was who will host this initiative. DOS was claiming their stake in this regard due to their contributions and experience. The arguments against Survey of India were its style of functioning, which was not always user-friendly. Data standards and proto-type Web portals were developed by both the sides. This led to a prolonged discussion, which still continues in some way or the other. Finally, based on the global experience, it was felt that the National Mapping Agencies should be made responsible for such initiatives. Further, by then, NSDI was included in the DST for the Allocation of Business. Hence, Survey of India, an organisation of DST, was made responsible for this activity.

But the problems continued. There was no space available in Survey of India Delhi, which was preferred as it is the central place for such collaborative activities. Further, its office has to be accessible to all the stakeholders. Strict security measures were considered counter-productive. Fortunately, the Survey of India Map Sales office

at Janpath was given a notice to vacate and in lieu of that an office space in R K Puram, New Delhi was provided by the CPWD. This space did not fall under security cover hence was considered suitable. Since then the present premises became functional.

Availability of space was solution to only a part of the problem. There were no funds and no head of budget available in the Survey of India, which was specifically to meet the expenses of NSDI. There was resistance within the Survey of India to provide funds as several other initiatives were then undertaken. These initiatives were depending on the same budget plan as well. Somehow funds were managed from the Survey of India budget for the initial years till the NSDI was approved by the Cabinet. Some funds of the DST through NRDMS support were made available too. On the other hand, office infrastructure was to be developed consisting of conference room, server and other usual amenities. Ultimately we were able to organise a conference room in this office. It was named after the former Surveyor General of India, Lt. Gen. K.L.Khosla. In addition to meetings, awareness among the stakeholders became necessary due to usual apprehensions. The data-producing organisations were requested to hold the annual seminar of the NSDI. Accordingly, several such seminars were sponsored by the Survey of India, Department of Space, NIC, GSI, FSI, DST and now IMD. These events were held in New Delhi, Ooty, Hyderabad, Agra, Goa and Lucknow. These annual gatherings did help in building up understanding and confidence among the data producers. As a result, two versions of data standards have already been produced. They are based on international standards and likely to be changed as the global scenario morphs.

NSDI Task Force tried very hard to involve the industry into their fold but the results were not commensurate with the efforts.

Representatives of the geospatial industry and industrial federation were always invited. But the industry had a different perception. They took this as an opportunity to promote their business interest. Earlier NSDI was considered for getting more projects from the government, and later to provide hardware and software or to get them approved for wider acceptability. Almost all the standard software now have facilities to exchange data from one format to another, or at least claim to be able to do so. The industry also looked towards NSDI for the certification of data quality, which was not acceptable because it would have led to bureaucracy and policing. This was against the principle of NSDI, and DST and Survey of India preferred to stay away from it. Instead, NSDI encouraged the industry to set their own standards and promote the same while taking up any geospatial projects. Further, NSDI's effort to organise a forum of geospatial industry did not go very far. Nevertheless, recently, a successful attempt has been made outside the fold of NSDI.

Though the developments in the country regarding NSDI were happening with all constraints, there was a lot of encouragement from the international community. The British University of Durham, with their experience of handling European spatial data, extended full co-operation. Professor Michael Blakemore of this university visited India several times, particularly during the NSDI seminars. ITC, The Netherlands provided training to some of the Indian scientists in this regard. The experience of the United State's FGDC based in USGS was extended to India. Dr. Julli Binder Maitra took special interest. The Natural Resources Canada not only helped India but also sent several delegations to India, even headed by their Ministers. Several Indian delegations also visited Canada. The role of professor D.R.F.Taylor is commendable. He also headed the International Steering Committee on Global Mapping of which India

is a participant. Surveyor General of India is the chairman of its committee on Data Standards. Another important international committee was the UN/PCGIAP, which was headed by Professor Peter Holland. Here again, the Surveyor General of India chaired its committee on Institutional Strengthening. Another Australian who helped India was Professor Ian Williamson of the University of Melbourne. OGC and its representatives still visit India in order to help in developing data standards and other facets of the NSDI. The major event in this regard was the GSDI conference held in Bangalore in 2004, in which David Schell, chairman OGC participated.

The status of NSDI in India today is not very different from other countries. There is success in some sectors while much more is yet to be done. Metadata standards have found more acceptability and the web portal of the data producing institutions is getting ready. The conversion of hard copy maps to digital form now follows the NSDI standards. Further, since NSDI has been approved by the Cabinet, there is a separate Division under the umbrella of DST. Perhaps persistent efforts and missionary zeal is required to promote cooperation in this high level application of technology. India took keen interest in our NSDI and also played a major role in OGC.

It is expected that the NSDI bill will be enacted by the Parliament very soon and a decade old small bubble will take the shape of a wave. Perhaps every stakeholder, including government, corporations, universities and industries, will find benefit in this activity. They would like to share their products at least by providing metadata and get themselves associated with this soft infrastructure. The business potential of NSDI still remains underexplored. The valuable resources of the nation should not be exhausted by duplication in data production. Hopefully, by 2020, every

participating agency will own NSDI and will find their future closely associated with it. Government's role is only of a facilitator – not to become a regulator or monitor. It has to expand its activities from north to south, and from Delhi to cover the whole of India. This will be the true essence of NSDI. ▲

Captain (IN) Sudhir K. Mittal

Defence Imagery Processing and Analysis Center (DIPAC)

Having participated in NSDI Task Force meetings and conferences since 2000 when it was no more than a discussion paper, it is heart warming to see NSDI today transform into a tangible entity. A cold hard reality with a name, form and a national habitation. And above all, with a firm momentum and a definite direction. Those who continued to believe in it wading through the thick undergrowth of procedure and dark clouds of skepticism, deserve our gratitude.

It inspires confidence to see that a catalogue service, the first step of any NSDI, is firmly in place through the OGC web-service CS-W (Catalogue Service – Web). Credentials of the NSDI metadata standard are established by the fact that the service sits on the metadata created using this standard.

The other major activity of standardising Data Models appears to be well on its way. A comprehensive data model for contents of a digital SOI topographical map on scale 50K has been posted on the NSDI website. I am sure this is being reviewed by different user ‘communities’ to facilitate incorporation of their slightly differing view of the features modelled. Eventually I believe different user

‘communities’ would develop different ‘Application Schemas’ based on GML, to model their different specialised features and products which could still be interoperable.

In a knowledge economy I think NSDI is no longer a ‘metaphor’ for infrastructure. It is a hard infrastructure itself on which all hardcore infrastrucutres rely for strength. Once upon a time it was said – “Map is not the territory”. Then came a time, when if you had the map you had the territory. Today, map is the ‘only’ territory. ▲

NSDI: Ensuring Usefulness and Usability

Dr. N. L. Sarda

IIT, Bombay

NSDI is destined to play a critical role as a nodal agency in facilitating spatial data dissemination and access, both to common public and to professionals, research institutes and agencies. The former are expected to be given free access, while the latter will get access on a paid basis. This goal mandates a clearing house role, offering a portal to people to come and find out what is available (metadata) and then get the data. As an aggregator, NSDI will allow various agencies to publish their metadata and data based on their own access policies in a standard establishment format. The effort is to have an established and a consistent framework for ontology (a standard object catalogue) and standards for data/metadata exchange.

NSDI has already initiated all these roles, but much more needs to be done. Metadata standards have been released, and they now need to be widely accepted and checked for completeness and practicality. A portal too is being set, but its content should be structured such that it attracts users. Clear definitions on what it aims to offer and also how it plans to achieve this will have to be given because, such portals present massive usability challenges. The usability requirements are different for common public (who will not understand what 'metadata' exactly is) and for professional users. The portal also needs to at least host some standard data that people can get directly. These may be data sets published by various agencies

along with their metadata. However, they will have to be used as keywords that are searchable or made available on the portal through suitable menus. It may be helpful to base the portal on a well-known model so that navigation and user-friendliness are looked into; the FGDC portal for instance.

NSDI will be able to meet its objectives only when the data collecting agencies share their metadata and data as per their own policies, and also keep them updated. Tools are required to ensure this. Once this framework is established, NSDI will have enough content to attract users. It will then enter the sustainable cycle of data sharing.

NSDI Gateway System for Data Providing Agencies

With the NSDI portal getting ready to host and publish metadata as well as data sets and providing access to users, it becomes very important that the various agencies owning geospatial data are supported in the extraction, uploading and updating of their metadata and also the data on the NSDI geo-portal. This is certainly not an easy task for the agencies. They require skilled manpower as well as tools (besides policies for data access) to engage in this responsibility.

The Executive Committee in its last meeting at Hyderabad took a very pragmatic decision to fund and provide this support to the agencies. In this context, I propose a methodology to provide this support.

The key element of the proposal is that NSDI develop and install at all agencies, an NSDI Gateway system which will interface with the agencies' internal GIS applications and data sources on one side

and the NSDI System on the other. It will extract and share both metadata and data sets for public use through the NSDI portal. The move will also ensure regular supply of incremental data/metadata to NSDI. Such a Gateway will smoothen the integration of all data providing sources within the NSDI goals, while ensuring data security and access control.

The main components of this Gateway will be as follows:

- Metadata and modelling tool (for building and extraction of metadata)
- Link modelling with Standard Object Catalogue to be defined by SoA/NSDI
- Tool for extracting data sets and creating their metadata
- Security policy filter
- Source System interface (these may be customisable for internal proprietary systems in these agencies)
- Maintaining the database of access logs, and GIS data to support WFS and WMS for NSDI as well as external world
- NSDI portal interface

This requires an extensive development and may be outsourced to a professional IT company in two steps:

- Defining the requirements for the Gateway (3-4 months)
- Implementation and pilot (say, at least 2 agencies) deployments (9-10 months)

I would expect this to require a dedicated team of 80 to 100 experienced developers.

Once the Gateway is developed, it can be hosted on Linux-based servers (with adequate redundancy for 24 x 7 operations) and can be managed by a small team of 2-3 IT/GIS persons who will carry out system administration and interfacing activities on a regular basis. ▲

Governance of NSDI – Way Ahead

Dr. Mukund Rao

President and COO, NIIT GIS Limited (ESRI India)

The concept of the National Spatial Data Infrastructure has been worked upon for the past 8-9 years. To some an infrastructure for spatial data may still be incomprehensible, but to many of us NSDI symbolises great relevance and importance for national development and optimising the efforts at making GIS work for society. Spatial data is the basis for economic growth and environmental integrity. Since the adoption of the NSDI Strategy and Action Plan in the early 2000s, slow-but-steady progress has been achieved. Standards have been defined and re-visited; NSDI Portal and Bhuvan have been launched, many states are taking up SDI portals, with the NSDI getting ready to penetrate the state and district level in the future. However, for me vertical proliferation is not so important for SDI to grow as is the lateral development of SDI.

One of the most important things that have happened in the past 7-8 years is that the awareness of GIS as a tool and mechanism for growth has been greatly recognised, and GIS usage has grown across the breadth of the country and the various sectors. To me that is the single most important contribution of the NSDI movement.

As we move into the second decade of 2000, I see six important issues that form the basic tenets of NSDI and need to be addressed for its success:

- Availability and easy accessibility to spatial data – A national GIS which is unhindered but regulated maybe, and requiring sound and adaptive policies for spatial data sharing should be aimed for. A society that has a good, reliable and detailed GIS database of its resources, assets, people and infrastructure is able to better manage, develop and protect itself and also generate successful business. We need a national effort for a database that provides a first-level snapshot of the world – and this may be “stitched” from many national perspectives. We need a national database that provides in-depth assessment of national disparities and opportunities and a complete city-level or property-level database of land/property assets. Mainly a GIS Database Enterprise – a national GIS System of Systems is what will drive NSDI (make data available and applications, demand, market will follow through). Today, many agencies (cities, municipalities, power agencies, real-estate agencies, government agencies, private agencies, academia, etc) in the nation have developed GIS databases for their own needs. Can these be “weaved” (after a standardisation sieving process) into the foundation of a multi-scale, multi-level GIS database that can form the foundation of NSDI? This, I think is possible and can be taken up easily and would take the NSDI movement to the next level.
- Good “GIS Process Standards” – A standardisation of the entire process of “spatial technology” – images, mapping, GIS database creation, spatial outputs, Spatial data Quality Assessment and Spatial Services (if all GIS data available is as

per common and agreed standards, applications, demand and market development will be easier) is essential. There are very good standards of NSDI, NNRMS. Adopt them and use them as “sieves” (guidelines) to standardise all GIS databases. This would require tools and automated mechanisms, which can be easily procured. The standards should be made relevant to the Indian context and not just emulated from the international ISO/OGC standards texts. Indian GIS (like everything else) has a very different nuance and these must make the standards “Indianised” – though there is no harm in referring and building upon the international standards (remember the Euro and Bharat standards for auto emission; that is the right way).

- Technical interoperability – Integration of services using the Services Oriented Architecture (SOA) and based on Web standards (spatial data and application services will be the order of the day for GIS in the future) is required. SOA is the foundation of NSDI because that is the only way interoperable services at data level, application level and user-need level can be achieved. Data in any format, application on any platform and user-need at any level – leading to common data, common applications that meet diverse user needs – will have to be managed. Technology for this is available and can be easily adopted.
- Spatial modelling and applications – These applications bring new perspectives and visualisation to spatial information and new insights into societal and economic processes such as – natural resources management, land planning, engineering and infrastructure, disaster management, education, health services and business (GIS services will broaden and touch almost all aspects of society and citizens). They will have to be arranged

for. Spatial data integration is intuitive and an imagination of the mind – from the simplest overlay of two maps to complex graph-theory models. Allow these to evolve and develop as the application layer of NSDI.

- Partnerships and enterprise for GIS – Replete with the infrastructure, mission critical capabilities, and robust architectures associated with other enterprises such partnerships will further the cause. The “forced” boundary between Spatial Technology and conventional Information Technology will disappear – and new kind of technologies would emerge (the more inclusive GIS is with other technologies/enterprises, the more success it will achieve). Involve one and all. According to me, it would be just impossible for a single entity (even government) to fully “establish” or “own” the NSDI on its own (and that is not the principle of SDI). Partnerships will have to be the core mechanism to make NSDI successful. There could be self-defined stake-boundaries – agencies providing data assets and developing applications; agencies providing services and maintaining the systems and many more. However, all of them knit on a value-based “royalty” model that will make a successful enterprise for each. In this individual successful enterprise, NSDI will emerge as the most successful enterprise of enterprise.
- I find that NSDI started with the goal of being “all inclusive” and over the years this has got eroded – some agencies found difficulty in cooperating and often take a ring-side position. Private sector finds no role in the present NSDI (like I find it really strange that in the NSDI Committee, NSDI Working groups or even the NSDI Workshops, private sector does not

find any position/role – but it is the private sector that has made it possible to build many a GIS databases and applications in the country). NSDI has become too government-inclusive (to some extent the government-appeasing is essential) and even department-inclusive to some extent– bring it out and make it “all inclusive”.

- Developing the GIS user communities – This can be achieved by educating and orienting all levels of society to become spatial-savvy and benefit from spatial technologies (if every citizen learns and benefits from GIS, it is he who will ultimately drive GIS technology and its future growth). Make the society aware and SDI will impact governance. To me reaching the lowest level of society with SDI knowledge is most important. Let us make massive efforts to bring SDI knowledge to every citizen. It is quite easy. Just bring out all the data and expose it, people will learn themselves (remember GoogleMaps!!!). Next, we can have active orientation through schools/colleges and institutional framework for an in-depth knowledge-sharing on SDI. On top of this we need an institutional mechanism for SDI training and skill development for professionals at all levels. These are steps that are easily implementable and will bring benefits. The mere fact that the NSDI flag has been “kept alive” is commendable and awareness has been maintained. But it still has “miles and miles to go.....”.

In short, position a National GIS on “Indianised” standards, open up SDI data and application services, steer an “all-inclusive” model for SDI governance – I think these are three important and relevant tasks for NSDI today.

In this tenth year of NSDI, I really wish that the NSDI Secretariat takes decisive steps that will make NSDI move “from a debating concept to a tool for governance”. I think the onus is on the Government to take corrective action (after having founded the Indian NSDI) by recognising the importance of NSDI across agencies/departments/societies. It is the responsibility of the Department of Science and Technology (the nodal department) to steer the NSDI in the right direction, so as to facilitate the making of the national SDI into a truly useful tool that supports governance, society and the nation. ▲

Rituals Keep Even God Alive

Bal Krishna

Editor, Coordinates

Many of us can recall the hype and euphoria associated with NSDI in the last decade. But in due course of time it subsided. It subsided for many reasons. One of the most important reasons was that the people, who initiated the concept, could not make it reach its logical conclusion in a reasonable timeframe. The reasons may be ‘genuine’ or ‘not so genuine’.

It also happened that “the people” who took the initiative moved on with different positions and with different responsibilities and priorities. It had been my considered view that NSDI should have been ‘policy driven’, not ‘people driven’ as that would have provided a sustained momentum to the initiative. But, in NSDI, later developments re-emphasised the importance of people. By the time NSDI was institutionalised in the year 2006, some of the key players had left. And those left with NSDI were virtually ‘left alone’. If the NSDI still exists as an entity, the credit goes to them, who still carried on with the process despite the growing indifference.

We should also understand that the scenario has changed. When the process of NSDI was initiated in 2001, it was a different environment. People took it as a possible relief from the then existing

‘data control regime’. Now the scenario has changed. Initiatives like Google Earth, Virtual Earth, Bhuvan have changed the way we looked at and dealt with spatial information. It is important for NSDI to reposition itself within this new scenario and emerging requirements that might be different from what was envisaged earlier. This will ensure the relevance of NSDI in present circumstances.

I would like to quote Prof. P.Misra here. He said in *Coordinates* July 2009 issue, “The Ministry looking after the NSDI should be the overall in-charge of ALL surveys. Applications of satellite imagery and remote sensing technology ought to be made more intensive and should form the basic inputs on laid out production norms of surveying and mapping. In addition, NSDI should have a special division offering exclusive assistance to states for the upgradation of their standards. It should evolve as a nodal organisation to advise other ministries, e.g. Defence on the impact of policies like map restriction.”

NSDI Pune conference is an opportunity to re-enthuse the zeal and vitality in the movement. At times, the NSDI annual event seems like just a ritual to be performed, but we must not commit the mistake of under-estimating the importance of rituals. Rituals are important. They keep even God alive in our psyche. That is the importance of the NSDI annual event – as a ritual that has kept NSDI ‘alive’.

And NSDI is still alive. We are talking about it and working on it. That gives us solace. However, it cannot be judged by what it has achieved so far despite the many hurdles and constraints. The parameters to measure its success will be the utility it offers to its users. It has to be better. It has to be the best. ▲

In February 2001, a workshop “**National Geospatial Data Infrastructure (NGDI): Towards a roadmap for India**” was organised by the Department of Science and Technology (DST) and the Department of Space. The workshop was attended by over 250 delegates from Government, academia, GIS industry from India as well as from abroad. The workshop was a landmark development on two accounts: one, it was the first public posser of Government of India on NSDI and second, was the release of a discussion document titled NSDI: Strategy and Action Plan - a comprehensive document that not only discusses the need, content and design elements of NSDI but also elaborates upon its organisational framework, funding mechanism and its implementation.



The 2nd Workshop on National Spatial Data Infrastructure (NSDI) was organised by ISRO at Ooty during July 29-31, 2002. Ooty Communiqué for NSDI was adopted in the presence of 155 delegates from 48 departments/agencies participating in the workshop and Secretaries to the Government of India, departments of Space, Science & Technology,



Rural Development, Information Technology and Minorities Commission. The Department of Space and Department of Science and Technology had taken the initiative to define the NSDI Strategy and Action Plan - which has been enthusiastically endorsed by all concerned government departments, the corporate sector, academia and NGOs.





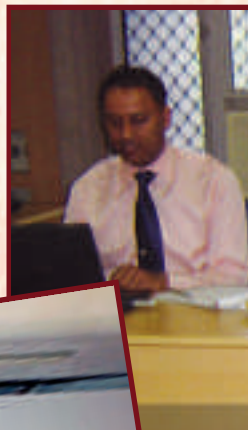
The Task Force completed its job and submitted its report in May 2006.

Subsequently, on 02 June 2006, the Cabinet approved creation of NSDI and constituted a National Spatial Data Committee and an Executive Committee with a lean secretariat to assist the two committees.





NSDI VI workshop was held in Goa during 28-29 June, 2007. The Goa communiqué for NSDI was adopted by 67 delegates from 12 departments and agencies.





The 8th National
Spatial Data
Infrastructure
(NSDI) conference
at FICCI

Auditorium on 22nd
December saw the
launch of NSDI
portal and India
Geoportal.

Inaugurating the
two-day conference,
former Union
Minister for Science
and Technology and
Earth Sciences,
Kapil Sibal informed
that the government
is formulating
legislation on
sharing geospatial
data among different
agencies – public and
private.



Evolution of NSDI

Chapter - III

Geospatial technology's initiation in India has had a rather elementary footing, with the technology being used only as a simple map making tool until the turn of the last decade. Notwithstanding its short history, spatial technology has witnessed phenomenal expansion in its applicability over the last few years.

India is speeding on the track to becoming an information and knowledge society, and GIS is perceived to be the leading lane on this path. Keeping in mind the potential GIS technology has to enhance our future growth, it is imperative that its development in the country be better organised and streamlined. With experts predicting that a major influx of investments will soon be witnessed by India in communication technology, and the growing emphasis on transparent e-governance leading to g-governance, it is only rational that steps to exploit the full potential of this burgeoning field are taken immediately. This is only possible if information sharing is facilitated between organisations that use, work with and depend on geospatial data, which unfortunately wasn't possible till recently.

Spatial data is vital to sound decision-making at the local, regional, state and central planning levels. It also plays a crucial role in the implementation of action plans, infrastructure development, disaster management support, and business development. Decision makers

also depend on its application in aspects such as natural resources management, flood mitigation, environmental restoration, land use assessment and disaster recovery. Yet it is deplorable that this increasing applicability and demand couldn't ensure easy accessibility and interoperability of information for users of geospatial technology in India. Because, only when organisations pool their varied data sets will the purpose take shape.

Means to an end

Governments the world over concede to the fact that the presence of a spatial data infrastructure is imperative to their digital growth. Not surprisingly, India sensed the urgent need for a National Spatial Data Infrastructure. Presently, the main challenge faced by the country is a politically driven map policy that is rallying between full democratisation of data and the probable issues and risks related to free and open availability of geospatial data. A solution that involves more open data policy blended with the available technology is sure to overcome any challenges related to spatial data. Thus, the need for a user-friendly platform based on scientific data that provides geospatial solutions to common man, for resolving their day-to-day issues, was perceived and on its path to being moulded.

Where withal

To address the problem, Government of India constituted a framework for developing a common set of methods, practices and standards that became the foundation for managing and disseminating digital geospatial data among its various users. Christened National Spatial Data Infrastructure (NSDI), the organisation was planned to be an autonomous body that offered easy access to information on spatial data developed by various government agencies throughout India.

NSDI India was to allow users to take the traditional approach to search for spatial data based on map sheets or choose to search for required information using more generic search criteria such as spatial extent keywords. The geoportal also aimed to provide quick access to information on spatial data via Web pages with metadata made available by participating agencies.

En route

Spirited planners of the organisation met for the first time to initiate the formation of NSDI at the Department of Science and Technology (DST), New Delhi in 2001. The primary agenda for the meeting was the designing of a framework to set up a single source information infrastructure. This would address the needs of users, planners, policy makers, industry and academia and also help them reap the benefits of high-end technologies such as GIS, GPS and high-resolution satellite sensors. Prof. V.S.Ramamurthy, the then Secretary of DST and Dr. K.Kasturirangan, a stalwart of the Indian Space Research Organisation, were the main torchbearers of NSDI, a gateway for the sharing of spatial data, with Mr. Amitabha Pande, then Joint Secretary of DST playing an important role in the conceptualisation of NSDI's structure.

Within two months of the first meeting, a blue-print elaborating NSDI's strategy and Action Plan was documented. A task force was also constituted by the Department of Science and Technology under the chairmanship of the Surveyor General of India. A vision for NSDI started evolving. This was followed by an international workshop jointly organised by the Department of Space and Department of Science and Technology, involving active participation from government departments, the academia, industry and international experts. Various aspects related to NSDI such as its

architecture, technologies, organisational structure and the sensitising of different agencies to the multifarious drivers for binding them to a common goal, were addressed by the task force. After thorough discussions, a vision, strategy and action plan was prepared and unanimously endorsed by all the participating members. The strategy of NSDI was finally adopted, marking the first step towards the realisation of the NSDI dream.

However, it was the decisive second conference at Ooty that gave NSDI the much needed visibility and focus. Six key secretaries of Government of India (GOI) and about 180 Indian NSDI stakeholders gathered together to churn out an upgraded action plan that brought the NSDI dream closer to reality. After far-reaching interactions, involving topics such as NSDI Exchange Standard, NSDI Applications protocol and NSDI Network Framework, a Metadata Standard document for NSDI was constituted.

While the institutionalisation of data through NSDI facilitated the smooth flow and sharing of spatial information, the journey of its establishment was far from being even. Within few months of the conference, a prototype of the NSDI portal was ready to be unveiled.

The Task Force decided to enhance the development of NSDI portal and present it at an opportune time during an important secretary-level meeting. What followed was an excellent online presentation and demonstration of NSDI to a group of secretaries. Consequent to a successful presentation, it was agreed that the country must have its much needed National Spatial Data Infrastructure. But what followed was nothing but a long wait or a trudge that lasted almost four years.

Slips and slides

November 2003 saw the unveiling of the NSDI portal prototype in Agra. This move was made possible through the support of DOS, DST and all stake holders.

The delay in receiving the approval had caused despondency to set in. But what the NSDI Task Force initiated then changed the scene completely. Following intense discussions, arguments and debates, the new map policy (2005), a much needed thrust to the formation of NSDI was established. This resulted in a consensus which addressed the fact that a more pragmatic policy was required. The development was further encouraged by various technological developments such as high-resolution images from Resourcesat and Cartosat and the Global Spatial Data Infrastructure Association Conference that took place in Bangalore, which propelled the creation of a wealth of GIS databases and activities.

Happy tidings

The Union Cabinet, through an executive order approved Indian NSDI in June 2006 and a great beginning was made to address the critical need for acquiring, processing, storing, distribution and improving utilisation of spatial data generated by various agencies of the Government of India. NSDI, the dream, was thus transformed into reality. ▲

NSDI: A Benefit Reaping Requirement

Chapter - IV

Moulded through the years, the primary aim of National Spatial Data Infrastructure (NSDI) in India is to provide a platform that can act as a consistent means to share geospatial data among all users, which not only produces significant savings for data collection and use but also enhances decision making. Presently, India is at a juncture wherein the need for an initiative like NSDI is more than at any time.

NSDI acts as a base or structure of practices and relationships among data producers and users, facilitating data sharing and usage. NSDI is a new way of accessing, sharing and using geospatial data that enables far more comprehensive analysis of information, to help decision-makers choose the best course of action. NSDI also helps in reducing duplication of effort among agencies, improving quality and lowering costs related to geospatial information, thus making geospatial data more accessible to the public and increasing the benefits of using available data for establishing key partnerships with states, counties, cities, tribal nations, academia and the private sector.

Twin-faced requirement

The present need for NSDI in India has been a result of two main factors – setting up of a national repository of a digital “warehouse”

of the national map data holdings and sharing and access to the digital spatial information. Use of spatial information for resource management and decision-making, is limited only by the imagination on how to combine the different data sets. Many a times, new ideas create the need for even more data so as to achieve the end goals. This has been matched by a significant increase in the information retrieval capabilities of GIS. It is because of this fact that GIS is now becoming widely popular and is being used for a wide range of applications – natural resources management, wasteland development, watershed development, urban management, coastal management, utilities management, infrastructure development, business development and their various departments.

Current and accurate spatial data must be readily available to contribute to local, state and national development so that it benefits economic growth, environmental quality and stability, in addition to promoting social progress. Establishment of NSDI will ensure accurate and timely spatial data to support sound decisions over a geographic area with minimum duplication of efforts and at reasonable cost. NSDI will also support efficient production and easy access and sharing of accurate, high quality spatial data to meet national needs in an urgent requirement, thus emerging not only as a major driver for providing impetus to development activities but also enabling formation of an information business sector that will promote economic and commerce activities.

Society in creation

Working on this model, NSDI would also facilitate the evolution of a spatial society, through the synergising of information, technology and accessibility. The coming years in India are likely to bring in unusual and continuous changes in technology. This will

have a profound effect on spatial information activities, which would help in the better understanding of the day-to-day processes, by representing them as maps. Thus, the emergence of spatial business from the highly volatile and dynamic synergy of information, technology and access will see the emergence of a truly spatial society.

This spatial society is bound to expand information interdependence among its various users. The increasing demand for spatial data would not only seek nationalisation of spatial information but would also define and drive the need and use of spatial data for individuals, society, nation and the world as a whole. The established structure would also increase emphasis on sustainability, which means that the scientific and economic development will lead to full integration of environmental and developmental information, facilitating decision-making on economic, social, fiscal, exploitation and regeneration of natural resources and other policies.

Towards effortless governance

Of critical importance to NSDI is the creation of community-based governance, wherein a greater involvement of people in developmental planning at local level would result in the emergence of participatory planning. Such a scenario will positively increase the demand for access to spatial information, thus making it a commonly used tool for developmental alternatives and societal choices for decision-making. Towards the end of the fishing line, it would be the individual, who will benefit the most from the information, both spatial and non-spatial. This in turn will facilitate the establishment of infrastructures, encompassing the individual's immediate circle of

family and society, the land he tills, the water he uses, the environment around him and to a larger extent the general awareness of the world.

Broad link

When there are several departments and agencies involved in a project, coordination, consensus and interlinking is of extreme importance. NSDI would serve as a link between the government, NGOs, academia, researchers, community and individuals, helping each one of them with easier, faster, and affordable spatial data. Government will find NSDI helpful in the preparation of spatial plans for the whole country – annual plans, five-year plans, perspective plans; inventory of natural resources and changes, for quick assessment of damages during natural calamities and disasters; and monitoring and evaluating the various governmental policies and programmes. NSDI would also provide information bases for infrastructure development in the country – specially the road, telecom, water distribution, sewerage management and would address issues related to land use, environment, land acquisition, visibility and line of sight and costs of projects. Private business owners and individuals will be facilitated by NSDI in the following ways:

1. Business GIS will work towards supporting the use of GIS databases to further business opportunities and enable spatial data commerce.
2. Universities involved in GIS research, education and training will utilise the NSDI for undertaking specific research of global and national issues; impart GIS education with appropriate case studies and practical hands-on training.

3. Info-savvy communities who would have spatial information access and bring in transparency in governance and insurance against discrimination and exploitation will be established.

Thus, in working towards a knowledge-based society, the NSDI has the potential of transforming the way in which decisions – particularly those that are contingent to location based information – are taken at all levels: individual, community, local government, district, state, regional and national. A factor that needs to be highlighted is that the establishment of infrastructure does not involve any major capital expenditure and only leverages the existing data assets of various organisations to add value and create massive entrepreneurial opportunities in the growing knowledge industry. NSDI would also facilitate an enormous saving of time and cost by avoiding duplication in the production of data, reducing the time spent in searching for data and reducing the cost of data exchange.

The essentials

In short, NSDI would:

- Provide data that once created can be used many times
- Avoid duplication of data and provide a platform to discover, access and publish geospatial data
- Act as a single source for all collated data
- Generate value addition, revenue and employment opportunities. ▲

NSDI Technology: Past and Present

Chapter - V

It is not uncommon to be presented with unfriendly territory when you set out to achieve something unusual. Just so, when the initiative to establish a national level spatial data infrastructure was first mooted by the Department of Science and Technology, problems related to the availability and accessibility of spatial data was the major issue.

Cymini sectoral role

Security concerns had been the major issue till the formulators were introduced to the map policy. Considerations of national security had prevented a large part of spatial data, especially the data in digital domain to be shared freely. To find a way to make data accessible without compromising security requirements, the Department of Science & Technology proposed, commissioning of dual series of maps, one for restricted use by the armed forces and another for unrestricted civilian use. The civilian series of maps would use a different geo-referencing system, a different projection system and a different sheet numbering system, which would be compatible with the international systems in use and which would make it difficult for such maps to be used for military purposes. The proposal was approved by the Ministry of Defence and the use and dissemination of civilian maps series was also agreed to be completely

unrestricted. This decision paved the way for DST to take the initiative towards the creation of a National Spatial Data Infrastructure (NSDI).

Though on one hand, issues related to security seemed to be getting rectified, the plan for streamlining the already existing spatial data with several agencies seemed like a daunting task. In a way, India already had a strong foundation of a spatial data infrastructure – though mainly analogue and paper-map based. The traditional central spatial information infrastructure has been managed as a set of discrete mapping responsibilities, within several central agencies. The data management role of central agencies has been that of data “stewards” for large homogenous data sets, which are generally in paper map form. Thus, all these central agencies have published data on maps, which they have been supplying whenever needed.

Now, though this set of traditional arrangements was undergoing change, the national agencies had yet to take on the process of conversion of their data holding in a digital format, which would make it amendable to better distribution and generation. Thus, it was quite obvious that the establishment of a platform like NSDI would definitely bring about a drastic change of traditional values and also provide a new direction to each of these agencies. However, to live up to this expectation, NSDI required an inspiration and it found the right one in the NNRMS and NRDMS programmes of the Department of Space and Department of Science and Technology.

Survey of India

Survey of India (SOI) is a principal mapping organisation under the Department of Science and Technology. Established in 1767, it is one of the oldest scientific departments of the Government of India, and

ensures that the country's domain is explored and mapped suitably to provide base maps for expeditious and integrated development. The organisation is entrusted with the responsibility to provide user-focussed, cost-effective, reliable and quality geospatial data, information and intelligence for meeting the needs of national security, sustainable national development and new information markets.

SOI also oversees whether all the available resources contribute their full measure to the progress, prosperity and security of India. It has geospatial data centres located in different parts of the country, to provide basic map coverage required for various developmental activities. The maps are used by defence forces, planners and scientists in the field of geo-sciences and in land and resource management. SOI assists various ministries and undertakings of the Government of India in many sensitive areas including settlement of international borders, state boundaries and in assisting planned development of hitherto under developed areas.

SOI has created three digital centres during the late eighties to generate digital topographical database for the entire country, for use in various planning processes and creation of geographic information system. Its specialised directorates such as Geodetic and Research Branch, GIS and Remote Sensing Directorate and Indian Institute of Surveying and Mapping, have been organised to meet the growing requirements of the user community. The department also assists many scientific programmes related to the field of geo-physics, remote sensing and digital data transfers.

National Topographic Data Base (NTDB)

NTDB consists of topographical data available in the National Standard Exchange Format. NTDB deals with the task of digitisation

of maps on a scale of 1:25,000, 1:50,000 and 1:2,50,000. Utilising NTDB, users would be able to obtain data pertaining to any part of the country without any restriction. Topographic information forms the base for other spatial information.

Natural Resources Data Management System (NRDMS)

NRDMS is a multi-disciplinary and multi-institutional programme launched by the Department of Science and Technology for developing a scientifically proven database approach for operationalising the concept of micro level planning. Major objectives of the programme include development of integrated district level resource databases on natural resources and allied sectors, research and software support for spatial data management technology, modelling and operational research, demonstration of the utility and use of databases in local level planning and development of rural development.

NRDMS has initiated various R&D seed projects to nurture spatial data, technology and applications. Its vast experience in identifying the niche and emerging areas of research and developing global collaborations and connecting the latest research activities, paved the way for development of GRAM+ +, a GIS tool for academic and research purposes. An in-house development by IIT Bombay, it was spearheaded and supported by NRDMS. It was the first of its kind in India and ignited the development of GIS both at the core and applications level.

As part of the programme, research activities are carried out for development of tools, methodologies and standards for use of geospatial information at various levels; from national to local/communities. The use of spatial data and tools/technologies

like Geospatial Information System (GIS) Global Positioning Systems (GPS) and Remote Sensing at different levels of planning will improve the quality of resource management decisions/strategies. Non-availability of spatial data of desired resolution, incompatible data sets, lack of user-friendliness of the processing tools and inadequate capacity amongst the end users have been the major bottlenecks. It therefore has become imperative to improve spatial data management practices and appropriately align the tools/technologies with the workflow or business processes of the local self-government structure (panchayats/municipalities), in the framework of spatial data infrastructure. In addition to the technological issues, unwillingness on the part of the data generators to share and leverage the data assets and requisite policy framework, have hampered the use of spatial data in India.

Over the past years, pilot scale district level Geographical Information System (GIS) databases on natural resources and other collateral parameters, have been set up in selected districts located in different geo-environmental settings. Databases have been put for the identification and investigation of area-specific problems, so as to draw up local level development strategies. A low-cost indigenous GIS software package GRAM ++ has been developed to equip databases with functionalities for spatial data analysis. Spatial Decision Support Systems in the sectors of water management, energy budgeting, land use planning, and location/allocation of facilities (roads, hospitals, fair price shops etc.) have been tested and demonstrated to user agencies .

Modelling/application studies have been launched in the sectors of hydrology, ecological biodiversity, sustainable agriculture; and landslides to better address the user's information needs. During

1996-2004, United Nations Development Programme (UNDP) supported NRDMS in upgrading its tools/technologies and providing a user bias to its activities in sectors of 'Rural Development' and 'Sustainable Agriculture'.

The success story of NRDMS data centres operating in over 60 districts in the country, has helped in evolving the National Spatial Data Infrastructure. The approach had been both top-down and bottom-up and the concept of spatial data infrastructure at different levels viz., state (province), district and village level, has also been successfully demonstrated. India Geoportal and Karnataka Geoportal of the province of Karnataka have come up after sustained efforts. A number of tools developed for data visualisation, have helped in taking the data to the people through web-based systems for health, water resources, management of elections, etc. Open Geospatial Consortium (OGC)-compliant, Web Map Services have led to the utilisation of geospatial data by ensuring interoperability. NSDI successfully brought out the metadata and data exchange standards which are now in tune with the international standards. By networking with a number of academic and research centres across the country, the programme has helped in generating the requisite human resources.

Capacity building of potential stakeholders and increasing NRDMS outreach, form an important component of the programme's strategy. Awareness and training workshops are organised to demonstrate the usefulness of tools/technologies and train potential users on their application in the task of planning. A network of government organisations, survey agencies, research and academic institutions and non-governmental organisations helps implement the programme's activities.

NRDMS also supports the Advanced Research Laboratory in Geospatial Sciences (ARL) at IIT Bombay. SDI as an operational activity requires continuous and dedicated R&D support, development of tools, spatial information processing models, multi-dimensional data analysis algorithms and on-line data acquisition technologies. It is the ARL which will provide the required R&D and HR development support in terms of masters, doctoral and postdoctoral research. This long-term investment is aimed at building capacity, training people and will also act as a think tank for NSDI.

Presently, 18 nodal agencies are affiliated to NSDI, and are major contributors to NSDI's development. Moreover, in an attempt to increase awareness on the importance of metadata, two courses have recently been concluded successfully.

NNRMS

National Natural Resources Management System (NNRMS), which supports the national requirements of natural resources management and developmental needs, by generating a proper and systematic inventory of natural resources, adopts various advanced technologies such as satellite and aerial remote sensing, Geographical Information Systems (GIS), precise Positioning Systems, database and networking infrastructure and advanced ground-based survey techniques. Over the years, NNRMS has provided impetus to the use of data from the Indian Remote Sensing Satellites (IRS) series and has generated spatial databases through national mapping missions of NNRMS – use of satellite images and GIS for creation of large databases.

In 1998, NNRMS took a major leap in defining GIS standards for the project Natural Resources Information System (NRIS) and

adopted the “NRIS Standards”, the first GIS standardisation in the country. Most of these standardisation efforts were “compartmentalised” and addressed separately for images, cartographic mapping, thematic mapping, GIS and outputs.

As a major effort towards establishment of a Spatial Data Infrastructure in India, NNRMS developed a Metadata Standard in 2002-2003. Metadata, which is the first element and interface of the user to a repository, enables a user to find, on-line, spatial data that is available with NNRMS. It was this NNRMS Metadata Standard that defined the schema and design for the NSDI Metadata. Thus, NNRMS ‘Metadata Standards’ became the foundation of NSDI, India.

It was then found that the main task of NSDI India would be to generate vast amount of map information through systematic topographic, geological, soil and cadastral surveys and using natural resources information generated through remote sensing data. Since then, various programmes have been taken up to facilitate the formation of GIS databases, which would mark the right step towards NSDI. The important ones are as follows:

NRIS

Natural Resources Information System (NRIS) of the National Natural Resources Management System (NNRMS), enables the availability of a national inventory of natural resources information in spatial formats and with proper linkages to other socio-economic data within the framework of a smart information system. It enables customised retrieval and analysis of data for specific needs. NRIS is visualised to be a network of GIS-based nodes covering data for districts, states and even the entire country. These nodes serve as repositories of natural resources information and assimilate other

tabular socio-economic data, providing vital inputs for decision-making at district/state/central levels. NRIS will later become a part of NSDI, enabling a national network of GIS-based information systems at local, state and national level on key parameters of natural resources management.

National Informatics Centre

National Informatics Centre (NIC) under the Department of Information Technology, Government of India, is a premier science and technology organisation, at the forefront of the active promotion and implementation of Information and Communication Technology (ICT) solutions in the government. NIC has spearheaded the e-Governance drive in the country for the last three decades, building a strong foundation for better and more transparent governance and assisting the government's endeavor to reach the unreached.

NIC has leveraged ICT to provide a robust communication backbone and effective support for e-Governance to the Central Government, State Governments, UT Administrations, districts and other government bodies. It offers a wide range of ICT services. This includes NICNET, a nationwide communication network with gateway nodes at about 53 departments of the Government of India, 35 State/UT Secretariats and 603 District collectorates to service ICT applications. One of the milestones of NIC, India Image Portal is a gateway to Indian government information, with a mission to extend comprehensive WWW services to government ministries and departments. Under this project, over 5,000 Government of India websites are being hosted.

NIC, a small programme started by the external stimulus of an UNDP project, in the 1970s, became fully functional in 1977, and since then has grown with tremendous momentum to become one of India's major S&T organisations promoting informatics-led development.

The beginning

India Geo-Portal was launched on 22 December 2008 by Shri Kapil Sibal, former Minister of State for Science and Technology and Earth Sciences, Government of India. With the launch of India Geo-Portal, NSDI has become the first government agency to host an Open Geospatial Consortium (OGC)-compliant metadata of spatial data, generated by government agencies on the Web, which helps in planning for the development activities of the nation. NSDI has helped in maintaining standard digital collection of spatial data by bringing in standardisation to the total process of format conversion, access and inter-operability.

Thus, NSDI acts as a national body that facilitates development of standards for metadata as well as spatial data by creating various committees for different elements. The work of preparing national standards for various elements of spatial data has been entrusted to different participating agencies in the country. ▲

Organisational Framework and Future Plans

Chapter - VI

As its base, geographic, geospatial or spatial data also constitutes the support-system for all planned human activity. Disaster management, management and conservation of natural resources, infrastructure planning and development, land use planning are just a few areas that demand quick decision-making based on the availability of accurate and high-quality spatial data. The burgeoning realm of digital technology, especially the incredible growth witnessed in the Geographic Information Systems and Global Positioning Systems have facilitated the correlation and use of map information at the click of a mouse. Large volumes of data sets have been converged on to one site, and in conjunction with one another through a networked environment, it has driven the need for data infrastructures. Spatial Data Infrastructures are now the order of the era.

The National Spatial Data Infrastructure or NSDI is a framework of spatial data, metadata, users and tools that are interactively connected in order to use spatial data in an efficient and flexible way. NSDI manages the distribution of these assets across several contributors for effective planning of natural resources in the country.

Structured cells

The organisational framework of NSDI comprises government agencies or the spatial information generators on one hand, and users of spatial information – government, private or public on the other. The formation and working of NSDI includes contribution from several participators such as:

- Government at local, state and national levels
- Non-governmental organisations (NGOs)
- Community groups
- Aid/Development organisations
- Educational organisations and academia
- Science and environmental community
- Private sector and end-users
- Public sector agencies
- Individual citizens

All these participators are divided into five different groups.

Government

Government, the main facilitator, plays the most important role in developing NSDI. The government aims at attaining full transparency while generating and disseminating data, and also implements strategies and policies at various levels. Thus, government is not only a major user of the NSDI, but also works consistently for its multifarious developmental activities and administration.

Private Sector

Private sector, the second major contributor, facilitates the design,

implementation and operations of NSDI. The private sector not only works towards NSDI aspects such as software development but also acquires resources to make NSDI a reality. Thus, the private sector serves as a major benefactor of NSDI, both by its own contribution to development and growth of business and by generating quality information commerce.

NGOs

NGOs, the outreach agencies, are primarily a user community for ensuring that NSDI reaches the different rungs of society and people access NSDI as an important information service. NGOs are also users of NSDI for their community development programmes and societal development at the grass-root levels.

Academia and Research Community

Academia and Research Community acts as the research and technology development backbone for NSDI. Academia is also a major user of NSDI for imparting their education and training programmes and undertaking scientific research programmes.

Individuals

Individuals are the largest group of users of NSDI – satiating their need for accurate spatial information and also for obtaining necessary services for their activities.

The regulator

The overseeing and coordination of the interagency aspects of

NSDI and also the regulation of its actions within different groups, is managed by the National Spatial Data Committee (NSDC). The NSDC addresses various NSDI policy issues and establishes the guidelines that position the NSDI as a reality.

NSDI is leaving no resource untapped to ensure that the efforts of Indian NSDI are routed in the direction of supporting national requirements of governance, sustainable development and economic growth. NSDI plans to establish procedures and mechanisms that make sure all organisations, agencies, institutions – from government, private or non-government sector, are encouraged to participate extensively in the NSDI programme. NSDI has also come up with a framework to encourage spatial information systems and applications to be assimilated into the infrastructure at village, district and state levels.

Partnering with private sector

The private sector, which provides IT solutions, services, human resources development and infrastructure, apart from committing its own data assets, is seen as an important partner in the NSDI initiatives. For this reason, NSDI plans to work proactively towards bringing an attitudinal change in the business environment governing spatial data in the country, and usher in an era of innovative public-private partnership for the growth of a knowledge-based economy and society.

Nurturing economy

As the success of Spatial Infrastructure is premised on the policies which nurture a proactive environment of information availability, access and a culture of information sharing and use, NSDI makes sure that the policies it adapts encourages and enables planned economic

development and good governance, along with technological advancements particularly in Earth observation, geographic information systems, global positioning system and information technology.

To constantly widen its scope and also to ensure support for better governance and socio-economic development, the NSDI makes an extra effort to continuously revise its policies with reference to spatial data, definition and evolution of standards, designing and implementation of servers, mechanism for spatial data quality, rules and guidelines for NSDI access and guidelines for agency participation.

Lessons learnt

Learning from successful SDI models of other countries, NSDI can not only avoid mistakes but also take the favourable course at an early stage. For this, NSDI continues to strengthen and further develop bilateral links with nations that have strong SDI programmes so as to enable mutual benefit and stimulate their perspectives of SDI, including third country partnership.

Thus, NSDI supports and advances the building of a National Spatial Data Infrastructure, consistent with national security, national defence, national intelligence, and international trade requirements. A virtual infrastructure that has the potential of transforming the way in which decisions are taken at all levels – individual, community, local self government, district, state, regional and national, NSDI facilitates the flow of spatial information from data producer to a vast and ever growing community of users in response to their needs. ▲

Annexures

Communiqués

New Delhi Communiqué

1st NSDI Workshop

“Encapsulating the maps and images into National Spatial Data Infrastructure (NSDI) is the need of the hour and the emphasis has to be on information transparency and sharing, with the recognition that the spatial information is a national resource and citizens, society, private enterprise and government have a right to access it, appropriately. Only through common conventions and technical agreements, standards, metadata definitions, network and access protocols will it be easily possible for the NSDI to come into existence.” Dr. K.Kasturirangan, Chairman, India Space Research Organisation (ISRO), writes in the foreword of Discussion Document on National Spatial Data Infrastructure (NSDI): Strategy and Action Plan. “During the valedictory session, two sub-groups were constituted. One standard sub-group that was to recommend data standards, metadata standards, exchange standards and the formats, while the other network subgroup was supposed to focus on technological issues connected with networking and accessibility.

The need was also felt to evaluate the requirements of Human Resource Development.”

The workshop can be considered as a landmark development on two counts: one, it was a first public posser of Government of India on NGDI and second, is the release of a discussion document NSDI Strategy and Action Plan. The discussion document was well-received and appreciated during the workshop and held long term prospects in making NGDI a reality. The document is very comprehensive as it discusses not only the need, content, design elements of NSDI but elaborates upon its organisational framework, funding mechanism and implementation. ▲

Ooty Communique

2nd NSDI Workshop (July 29-31, 2002)

Preamble

Spatial data and information (including maps and images and other attribute information) form the foundation of almost all planned human activities. Disaster preparedness and management, management of natural resources, monitoring the environment, management of bio-diversity, urban and rural planning, infrastructure development, business geographies and facilities management are some of the examples of the use of spatial information for better planning and informed decision making and governance at all levels — home and family, village or town, district, region, state and the nation. Ready availability and easy access to spatial information has to be viewed as a means for better governance and an improved quality of life.

It is noted that the concept of spatial data infrastructure has emerged globally to facilitate the flow of spatial information from data producers to a vast and ever-growing community of users in response to their needs. A National Spatial Data Infrastructure (NSDI) is defined as a collection of policies, policy instruments, technology, institutional and organisational arrangements to facilitate availability of, access to and utilisation of spatial data and information. In the Indian context, NSDI envisions the creation of a

structural framework of spatial information for sustainable development at all levels – individual, community, village/city, district, state and national – and to leverage economic growth.

The Department of Space and Department of Science and Technology have taken the initiative to define the NSDI Strategy and Action Plan – which has been enthusiastically endorsed by all concerned government departments, the corporate sector, academia and NGOs.

It is recognised that core competence has been created in the country – in terms of human expertise, GIS databases, software tools, operation and maintenance of spatial databases and utilisation. The NSDI datasets would include the holistic domain of varying types of data that are based on top-down and bottom-up collection strategies. Many of the major spatial data producing agencies are ready to provide their spatial datasets to the NSDI. Further, it is also clear that the definition, vision, perspective and implementation plan for NSDI now exists.

It is noted that the NSDI Task Force has made considerable progress in defining the technical design of NSDI and its attendant Standards on:

- NSDI Web-Server
- NSDI Content
- NSDI Metadata, Search and Access
- NSDI Network
- NSDI Exchange

It is also noted that work is in progress for defining NSDI Quality Standards; the NSDI Datum/Projection Standards; the NSDI Access Rules and a plan for human resources development for supporting the NSDI.

In view of the developments that have already taken place and the socio-economic transformational potentials of the NSDI, it is resolved that NSDI should become operational at the earliest so that India will become a part of the select few nations which have successfully implemented such an infrastructure,

Recommendations

1. The National Spatial Data Infrastructure is an integral part of the process to move towards a knowledge driven society. Its success is premised on policies which nurture a proactive environment of information availability, access and a culture of information sharing and use. The policies must encourage and enable planned economic development and good governance. Technological advancements, particularly in Earth Observation, Geographical Information Systems (GIS), Global Positioning System (GPS) and Information Technology provide excellent tools that can bring in a set of effective and powerful solutions to enable and strengthen NSDI. To this end, the workshop tasks the NSDI Task Force to urgently prepare a well-researched, comprehensive policy document which is consistent with the NSDI objectives. The workshop urges that such a policy document be collectively endorsed by the stakeholders of NSDI and placed before the highest levels of decision-making in the Government for consideration and adoption at the earliest.
2. The NSDI should emerge as an empowered apex authority for making and administering policies with reference to spatial data, definition and evolution of NSDI standards, designing and implementation of NSDI servers, define mechanisms for

- spatial data quality for NSDI, define rules and guidelines for NSDI access, define rules/guidelines for agency participation in NSDI, constantly widen the scope of NSDI and ensure support for better governance and socio-economic development.
3. All organisations, agencies, institutions and persons in the public or private sector, who have spatial data assets, which can conform to NSDI standards must be encouraged to participate in the NSDI.
 4. The NSDI Metadata Standard and the NSDI-Exchange Format as prepared by the NSDI Task Force should be taken up for a Standards Adoption Process by notifying them for public discussion (on the net) and then adopting them. The Workshop tasks the NSDI Task Force to initiate this process and formalise the Standards before adopting them as Version 1.0. The Workshop also charges the NSDI Task Force to formalize the NSDI Metadata Server, as designed, at the earliest so that it can be the first step towards NSDI operationalisation. The GIS industry should actively participate in the process of making available solutions for interoperability of spatial information from diverse sources.
 5. Make optimum use of the presently available NICNET, other high bandwidth public/private networks to support NSDI; continuously support the expansion and enhancement of such networks to eventually enable effective utilisation of the NSDI.
 6. User requirements must be yet another driver of NSDI and thus the target application potentials of NSDI must be

properly assessed and defined. The NSDI Task Force could take up a specific assessment on this.

7. NSDI Task Force is urged to make specific efforts to quickly complete important mapping programmes – availability of topographic maps in digital format for developmental applications (by March 31, 2003 as mentioned by SOI); availability of information on village location and boundaries and other applications (in about a year's time frame by involving Census, SOI and NRSA).
8. The private sector is seen as a partner in the NSDI initiative and its role is envisaged as providing IT solutions, services, human resources development and infrastructure, as also for committing its own data assets to such an infrastructure. The NSDI will proactively work towards bringing in an attitudinal change in the business environment governing spatial data in the country and usher in an era of innovative public-private partnerships towards the growth of a knowledge-based economy and society.

This Ooty Communique for NSDI is adopted at the 2nd NSDI Workshop at Udhagamandalam (Ooty), Tamil Nadu on the 31st day of July, 2002 in the presence of:

- 155 delegates from 48 departments/agencies (list attached) participating in the Workshop.
- Secretaries to the Government of India, Departments of Space, Science & Technology, Rural Development, Information Technology and Minorities Commission. ▲

Agra Communique

3rd NSDI Workshop (November 12-14, 2003)

Preamble

India has a vast amount of spatial (map) information generated through systematic topographic surveys, geological surveys, soil surveys, cadastral surveys, natural resources inventory programmes and the use of remote sensing images. Encapsulating these maps and images into a National Spatial Data Infrastructure (NSDI) has been a major inter-agency effort over the past three years. With the “NSDI Strategy and Action Plan” document of February, 2001 defining the direction for the Indian NSDI to become a reality, progress has been made in NSDI in various fronts.

It is recognised that the Indian efforts of NSDI are in the direction of supporting national requirements of governance, sustainable development and economic growth. At the same time, the NSDI efforts are in consonance with global efforts. In fact India has a lead position in the global arena of SDI activities. The NSDI is envisaged to create a structural framework for spatial information in support of sustainable development at all levels – individual, community, village/city, district, state and the Nation and to leverage economic growth.

The Department of Science and Technology; Department of Space and Department of Information Technology, along with partner agencies from the government, industry and academia, are collectively spearheading the NSDI initiative – which has been enthusiastically endorsed by all concerned government departments, the corporate sector, academia and NGOs.

The Ooty Communique, adopted in the 2nd NSDI Workshop, had translated the strategy into a set of actions, including:

- A coordinated effort at enabling a National Map Policy
- Formal Adoption of the NSDI Metadata Standard
- Establishment and operationalisation of the NSDI Metadata Server
- Formal Adoption of the NSDI Exchange Standard (NSDE)
- Use of NICNET to support NSDI
- An assessment of user needs and application profile for NSDI
- Enabling a public-private: partnership for NSDI

It is recognised that considerable achievements have been made and core competence has been created in the country in terms of human expertise, GIS databases, software tools, operation and maintenance of a spatial databases and utilisation. A national effort is enabling the emergence of a National Map Policy, which will usher in a new era of map data usage and applications. The NSDI Metadata Standard (Version 3.0) and the NSDE Standard (Version 1.0) were presented and documents released. A Proto-type NSDI, developed by ISRO/DOS and covering a full-fledged Metadata Server and demonstration-level NSDI Data and NSDI Applications servers, and the NSDI Portal, developed by DST, were unveiled and

demonstrated. The efforts made by various NSDI Agencies (NNRMS, NRDMS, NIC, SOI, GSI, FSI, NATMO, Census, etc.) to systematise their spatial data holding and generation of Metadata were reported upon and must continue for an early completion. Private industries in the SDI sector in India (ESRI, Rolta, Reliance, Speck Systems, Tata Infotech, etc.) reported on solutions and services developed by them and these were seen to be bringing many of the NSDI products and solutions into reality. Mapping the neighbourhood programme has shown the way of bringing the technology and applications of mapping and GIS to the grass-roots - especially the school children.

The NSDI Task Force, and the constituent sub-committees on Metadata/Search and Access; Exchange; Applications; Communications; Content and Network, need full commendation for the effort already put in. Many of the major spatial data producing agencies are ready to provide their spatial datasets to the NSDI. Further, it is also clear that the definition, vision, perspective and implementation plan for NSDI now is clear.

It is also noted that the NSDI programme has been presented to the Committee of Secretaries (COS) and has its endorsement for a higher-level clearance of the programme by the Cabinet. This should result in the formal institutionalisation of NSDI and its activities.

It is also noted that India will be a major player of the Global Spatial Data Infrastructure (GSDI) efforts and will host the 7th International Conference of GSDI in 2004 in India.

In view of the developments that have already taken place and the socio-economic transformational potential of the NSDI, it is resolved

that NSDI should become operational at the earliest so that India will become a part of the select few nations which have successfully implemented such an infrastructure.

Recommendations

1. The National Map Policy must be formalised at the earliest and its operational implementation taken up. An assessment of any consequential impact of the National Map Policy on NSDI and its activities must be made and solutions enabled by the NSDI Task Force.
2. The efforts to institutionalise NSDI must continue and all formal clearances and approvals obtained at the earliest – so that the NSDI, as an institution, can be positioned.
3. All organisations, agencies, institutions, be they from the government, private or non-government sector, and who have spatial data assets must be encouraged to participate in the NSDI. NSDI may establish procedures and mechanisms for this to happen.
4. The NSDI Metadata Standard (Version 3.0) is hereby adopted and all NSDI agencies are encouraged to generate their Metadata according to this Standard. However, a review mechanism of the Standard could be established to regularly update the Standard.
5. Similarly, the NSDE Standard (Version 1.0) is also adopted and all NSDI agencies are encouraged to conform to this exchange standard. NSDI, by involving GIS vendors and others, must enable the development of solutions and translators for the NSDE.

6. NSDI recognises the need for technical, institutional and organisational interoperability and recommends that NSDI commit itself to enable interoperability and be in line with international efforts, such as OGC, ISO.
7. The NSDI Metadata Server and the NSDI Portal efforts be integrated and the NSDI services made operational at the earliest. Agencies are urged to populate their Agency Metadata for the NSDI Metadata Server using the NSDI Metadata Utility at the earliest.
8. The demonstration efforts of the NSDI Data and Application Services be continued to evolve a sound design for the Data Servers and value-addition on NSDI. Appropriate standard documents for the Data Server and Applications Services need to be prepared.
9. There is an urgent need to take up standardisation efforts in the following areas:
 - Content and Design of NSDI
 - Applications and Value-Addition
 - Quality Standards
 - Network design
 - NSDI Policy/Guidelines for agency-participation and Access Rules
10. The scoping of NSDI must now address assimilating spatial data available at large scales – and especially those which are not based on spatial framework of SOI maps. Studies and assessments need to be made in this direction – especially on standards, linkages and applications of such datasets.

11. The NSDI must enable a framework under which spatial information systems and applications can be encouraged at village, district and state level and these need to be assimilated into the infrastructure. In this manner, NSDI could become a tool for empowering people.
12. The private sector has a major role to play in NSDI and leverage its capabilities in providing SDI technologies, SDI solutions, SDI services, SDI human resources development and infrastructure establishment, as also for committing its own data assets to such an infrastructure.
13. A separate assessment for Public-Private Partnership model for NSDI – with clear definition of roles and responsibilities of stakeholders and sharing of benefits from NSDI needs to be made.
14. The NSDI must proactively work towards bringing in an environmental change in the way spatial data transaction/business is to be carried out, and usher in an era of innovative public-private partnerships towards the growth of a knowledge-based economy and society.
15. The NSDI framework must position foundation partnerships with stakeholders based on financial equity principles and build for itself a viable financial model of growth and sustenance through public-private funding approaches.
16. A concerted campaign for generating awareness on NSDI amongst professionals, stakeholders, users and the public

needs to be made so that the benefits and advantages of NSDI in society is well-positioned.

17. NSDI must develop bi-lateral links with nations that have strong SDI programmes for establishing a mutually beneficial partnership. Similarly, NSDI must also actively participate in multi-lateral SDI programme and leverage Indian competitiveness in the global arena.
18. The NSDI Task Force is charged to initiate actions on the above and coordinate the progress, review and completion of the actions.

(This Agra Communique for NSDI is adopted by the 140 delegates from 40 departments/agencies, at the 3rd NSDI Workshop at Agra, Uttar Pradesh on the 14th day of November, 2003.) ▲

Lucknow Communiqué

4th NSDI Workshop (November 17-19, 2004)

Preamble

Spatial data, in the form of images and maps, along with developmental data in non-spatial format, forms the foundation for any national development activity. The vision for establishing a spatial data infrastructure for the country was unveiled in the “NSDI Strategy and Action Plan” document of February, 2001 defining the direction for the Indian NSDI to become a reality. The strategy and action plan outlined the NSDI efforts for supporting national requirements of governance, sustainable development and economic growth. The vision is to enable emergence of agency specific spatial data servers, all networked to bring the holistic view of a national infrastructure and positioning application services that contribute to development activity and economic growth.

Various agencies from the government, industry and academia are collectively spearheading the NSDI initiative – which has been enthusiastically endorsed by all concerned government departments, the corporate sector, academia and NGOs.

The Agra Communiqué, adopted in the 3rd NSDI Workshop, had identified a set of 18 actions, including:

- A coordinated effort at enabling a National Map Policy

- Adopted the NSDI Metadata and NSDI Exchange Standards
- A concerted effort at developing a comprehensive NSDI Standards document
- Encouraging Public-Private Partnerships for NSDI
- Develop applications of NSDI that focus on village, district and state-level development
- Develop bilateral links with other nations for mutual benefit

It is recognised that considerable progress has been made with focussed development of distributed spatial databases in different agencies and the emergence of a few Metadata Servers and innovative products and services by the industry.

The Lucknow Workshop addressed the key issues related to how NSDI can support and contribute to national development. Spatial data is seen to be an important tool in support of sustainable development at all levels – Individual, community, village/city, district, state and the nation, and also for leveraging economic growth.

Through a series of presentations, the Lucknow Workshop has seen considerable progress made by the:

- Government Sector through the efforts of National Natural Resources Management System, Survey of India, Geological Survey of India, Census of India, National Informatics Centre, India Meteorological Department, Central Ground Water Board, C-DAC and others

- Private Sector through innovative efforts of CE Info, ESRI, Speck System, Rolta, MLInfomap, Bentley, GIS Development, RMSI, Oracle and others
- Academic sector through research agenda definition by ITC, Kumaon University and University of Monster.

The following recommendations are made by the delegates of the Lucknow Workshop:

Recommendations

1. Work for establishing a mechanism for NSDI operationalisation through appropriate clearances and approvals.
2. Urge the early release of the National Map Policy which will enable the positioning of spatial data and application/ services on networks and enable the implementation of the NSDI vision and goals. The policy must be comprehensive and inclusive of all spatial data/information.
3. Agencies from the government, private and non-government sector, who have spatial data assets and solutions are urged to integrate their efforts and participate in NSDI. It is the collective efforts of all agencies that can bridge the gaps in supporting critical applications like disaster management, infrastructure development, natural resources management, etc.
4. Urge all agencies to populate their metadata and position metadata servers. An immediate effort to develop an

integrated national Metadata server/clearinghouse, encompassing links to agency servers is required. This would enable the first element of NSDI, Metadata Services to become operational.

5. Encourage generation of national level innovative content through the use of advanced technologies and positioning updated and accurate theme-oriented maps.
6. Developing national standards for NSDI – encompassing Content standards; CIS Design standards; Toponymy standards; Quality Standards; Application Metadata Standards; Network design and protocols and appropriate Policy/Guidelines for agency-participation and access rules is critical for the further progress of NSDI. Noting the efforts being made by different agencies (like the efforts of NRDMS to draft GIS Standards), it is essential to integrate standardisation efforts and position a National Spatial Data Standard for adoption by all.
7. NSDI must aim to establish interoperable spatial data and products/services across platforms and software products. To this end, NSDI needs to examine the level of compatibility and harmonisation of national NSDI standards with international efforts of standardisation through the works of OGC, ISO etc. In this, the involvement and commitment of the software product suppliers is important.
8. It is recognised that private sector would be the main source for SDI technology, solutions and services – which would be the backbone for NSDI. With a concerted effort towards Public-Private partnership for NSDI, there is a need to

articulate the mechanisms for active private sector participation in NSDI. Of specific interest would be the possibility of a partnership between data generating agencies and private sector to jointly position innovative products and application services. Concerted efforts to crystallise this partnership are essential.

9. There is a need to pursue a research agenda for NSDI – specifically encompassing topics like, standardisation, semantics, ontology, toponymy, GI market, pricing policy, GI Business Models, etc. The mechanics of involving academia and enabling research projects at universities and institutions needs to be looked into.
10. The demonstration efforts of NSDI for supporting national development must be continued to bring about a larger awareness of the benefits of NSDI. It may also be appropriate to expand the scope of case studies and develop newer applications in hitherto uncharted areas like rural development, cadastral LIS, utility services, health sector, business geographies, retailing, etc.
11. With the aim of leveraging the benefits and advantages of NSDI in society, a concerted campaign for generating larger awareness, on NSDI amongst professionals, stakeholders, users and the public needs to be continued. A plan of action encompassing technical training, workshops and hands-on orientation for users, technical experts and administrators/planners is called for. The programmatic details of this need to be worked out.

12. Noting the successful conduct of the GSDI-7 Conference and the acceptance of the offer made by India to the GSDI Association to host the GSDI International Secretariat in India, efforts to strengthen the linkages with GSDI, through development of institutional and programmatic linkages, and establishment of the International Secretariat must be pursued.
13. NSDI must continue to strengthen and further develop bilateral links with nations that have strong SDI programmes and enable mutual benefit. NSDI could also interact with nations that are emerging in this field and stimulate their perspectives of SDI, including third-country partnerships.
14. The NSDI Task Force is charged to initiate actions on the above and coordinate the progress, review and completion of the actions.

(This Lucknow Communique for NSDI is adopted by the 98 delegates from 35 departments/agencies, at the 4th NSDI Workshop at Lucknow, Uttar Pradesh on the 19th day of November, 2004.) ▲

Hyderabad Communique

5th NSDI Workshop (December 20th 2005)

The initiatives taken by Department of Science and Technology and Department of Space along with other data providing organisations in evolving the National Spatial Data Infrastructure (NSDI) for facilitating availability of data at various levels for sustainable and economic growth is indeed a welcome step. The NSDI-V workshop “National Spatial Data Infrastructure for Bharat Nirman” was organised by National Informatics Centre (NIC) from 18 to 20 December, 2005 at Ramoji Film City, Hyderabad. The workshop was inaugurated by Shri Rajeev Ratna Shah, Member Secretary, Planning Commission and the concluding session was chaired by Shri V Sampat, Additional Secretary, Ministry of Urban Development. The workshop mainly stressed upon the policy and technical issues related to spatial data, standards and quality control to ensure interoperability across various sectors of planning and addressing the needs of Bharat Nirman. A number of (heads of organisation including Surveyor General of India, Director Forest Survey of India, Director General of National Informatics Centre and Members of Central Water Commission attended the workshop.

The workshop discussed various issues connected with NSDI in the following technical sessions :

- i. Review of NSDI activities

- ii. NSDI for Urban Renewal Mission
- iii. NSDI for Bharat Nirman
- iv. NSDI contents and standards
- v. NSDI interoperability and OGC

The need for operationalising NSDI expeditiously has been voiced by all members. At the end of the workshop, on 20th December 2005, all the delegates deliberated and decided to adopt the Hyderabad Communiqué as given hereunder :

1. NSDI-V reiterates the Lucknow resolution of quickly operationalising the NSDI through government resolutions.
2. Urges the SOI for the quick release of implementation guidelines for the National Map Policy which has already been approved by the Cabinet.
3. Further, urges Survey of India, the nodal agency for the Map Policy, to bring out technical procedures and mechanisms for the Foundation dataset and National Spatial Framework.
4. Recommends a national endeavour to generate and position a new series of 1: 10,000 scale maps for the entire country which is critical for location specific planning and developmental activities and which will benefit all levels; from the village community to the national level.
5. Position policies and structures for NSDI to evolve a systematic public-private partnership. The possibility of NSDI as autonomous independent agency from the government

stakeholder agencies, which can independently evolve a business model for NSDI needs to be explored.

6. NSDI should demonstrate and showcase from conceptual level to all users and data providers by operationalising the electronic clearing house developed with Canadian collaboration. NSDI data agencies are urged to populate sample datasets for the clearinghouse.
7. Urges all agencies to quickly populate the metadata as per the established standard and operationalise it through NSDI clearing house within the next six months.
8. Develop fast track templates/procedures for outsourcing of tasks to private industry and to provide various solutions and services.
9. Endeavour to integrate and modify the existing policies for ground survey data, aerial survey data, satellite data, topographic/thematic/census/cadastral maps and GIS database into a comprehensive and holistic National Spatial Information Policy, which will provide a over-arching framework for generation, archiving, utilisation and dissemination of all forms of spatial data in the country.
10. Recognise that the datasets generated in the private sector have got potential for many applications and thus be made part of NSDI metadata. The private industry should quickly come forward to populate the metadata as per the standard of NSDI which will reduce duplication of efforts.

11. Urges the NSDI Task force to continue the standard definition process for NSDI and further define Standards for Content, Design, Spatial Framework, Quality, exchange and Services, etc., for NSDI. Noting the importance and critical need for land records maps, the Task Force could also undertake defining standards for cadastral map and LIS. Further, the Task Force is also urged to prepare documents related to terminologies and toponymy for the NSDI. All these efforts would bring about a common understanding and further the goals of NSDI.
12. Continue the leadership in various international organisations such as the GSDI and PCGIAP.
13. Initiate action for standardised capacity building endeavour so that the required number of professionals are available for furthering the NSDI goals.
14. Constitute a sub-group under the Task Force to study/assess the legal/policy issues of spatial data, in the context of NSDI, and come out with a comprehensive document dealing the legal, policy and IPR guidelines related to NSDI.
15. The NSDI Task Force is charged to initiate actions on the above and coordinate the progress, review and completion of the actions.

(Hyderabad Communique for NSDI is adopted by 120 delegates from 35 departments/agencies at the 5th NSDI workshop at Ramoji Film City, Hyderabad (Andhra Pradesh) on the 20th day of December 2015.) ▲

Goa Communique

6th NSDI Workshop (June, 28-29, 2007)

The Following recommendations have been made by the delegates during the NSDI-VI workshop held at Majorda Beach Resorts Goa during 28-29 June, 2007:

1. Noting the excellent steps that have been taken for the approval of NSDI and the technical actions that have been initiated by many agencies, NSDI-VI expresses deep concern over the delays in operationalising the NSDI – even as more than a year has passed since the notification.
2. Noting the Government resolution constituting NSDC has been issued in June 2006, the apex NSDC constituted under the resolution should be convened in the next 1-2 months, and must initiate an Action Plan.
3. As identified in the Government Resolution on NSDI, the anchor-role of the CEO is seen as crucial for furthering the objective and activities of NSDI. The delegates strongly urge the NSDC to immediately appoint and position a CEO and charge him with the Action Plan.
4. The operationalisation of the NSDI Portal and initiating the Metadata Services (and later Data Services and Applications Services) is yet another important step in bringing visibility

for NSDI. The delegates noted that all elements (technical and agency-level efforts) for the NSDI Portal are ready and available and the next steps of operationalising the NSDI portal be accomplished by December, 2007.

5. Excellent work on NSDI Metadata, Exchange, Content Standardisation has been done, but it is time to re-visit and update these and confirm them once again for the future of NSDI. This activity may be undertaken by setting up expert sub-committees of NSDI by NSDC/EC.
6. There is an urgent need to address standardisation in newer areas – NSDI Applications, Quality, NSDI database design issues IPR/Legal issues, etc.

This activity may also be undertaken by setting up expert sub-committees of NSDI by NSDC/EC.

7. Realising the importance of Cadastral maps and the usage of NSDI at the grass-root level and also noting the urgent importance of Cadastral LIS in various states, NSDI may initiate a mission of National E-Cadastre, which will bring standardisation and uniformity in bringing Cadastral GIS into NSDI. Efforts towards this must also involve defining E-Cadastre Standards and undertaking a Pilot for E-Cadastre leading to an operational programme.
8. The ultimate-success of NSDI will be when citizens and society will benefit from the usage of NSDI services, thus leading to the operational Enterprise-GIS solutions in the country. With this vision, NSDI may consider defining a plan for transitioning into a Service Oriented Enterprise GIS framework.

9. Noting the excellent progress made by SOI, FSI, GSI, NBSSL UP, NATMO, NRSA, CWC, Census and NIC at their agency-server level, it is time now to integrate and widen the scope of services available from NSDI portal and widen the scope of services available from NSDI.
10. The delegates discussed the provisions and implications of the National Map Policy-2005 and noted that there is a need for addressing various aspects that impacts NSDI and GIS activities in the country in a major way. Thus, there is a need for dove-tailing the Map Policy and harmonising it to further NSDI goals. In this connection, some of the important recommendations are as follows:
 - a. With the availability of OSM, a major effort at transforming the legacy Everest/Polyconice GIS databases of NIC, FSI, GSI, NBSSLUP, NRSA and many other agencies has to be undertaken. To achieve this, either the transformation parameters have to be shared by SOI or an institutional mechanism has to be in place for smooth transition of legacy-databases of various agencies to the OSM framework.
 - b. Clarity is needed in the various terminologies of the Map Policy as there were conflicting understandings of some of the terms. For example, there is a need for clear-cut Dos and Don'ts for mapping activities in the country by agencies/users; terminology definition in the policy has to be clear as there is conflict in understanding by various agencies like, value-addition to OSM means what (the agency thematic mapping which just uses OSM as base reference must not be governed by the New Map Policy), Licensing terms, Sharing of

data, Reuse of data etc., Media/Internet Licensing periods of OSM of 12 months is too short. It should rather be a perpetual license. Placing OSM and thematic maps prepared by various agencies on the net must be allowed as OSMs have been de-sensitised already.

- c. There is an urgent need to integrate and modify the existing policies for ground survey data. Aerial survey data, satellite data, topographic/thematic/census/cadastral maps and GIS database into a comprehensive and holistic National Spatial Information Policy, which will provide an over-arching framework for generation, archiving, utilisation and dissemination of all forms of spatial data in the country.
11. Recognise that the datasets generated in the private sector have got potential for many applications and thus be made part of NSDI metadata. The private industry should quickly come forward to populate the metadata as per the standard of NSDI which will reduce duplication of efforts.
12. NSDI, with the support of DST, should continue the actions for a standardised capacity building endeavour so that the required number of professionals are available for furthering the NSDI goals.
13. The NSDI Secretariat is charged to initiate actions on the above and coordinate the progress, review and completion of the action.

(This Goa Communique for NSDI is adopted by 67 delegates from 12 departments/agencies at the 6th NSDI Workshop at Goa on the 29th day of June 2007.) ▲

Task Force on Geospatial Data Infrastructure

Task force on Geospatial Data Infrastructure constituted by Department of Science and Technology vide letter No. SM/31/001/2000 dated 30th October 2000.

Chairman

Lt. Gen. A.K.Ahuja	30.10.2000	to	20.11.2001
Dr. P.Nag	03.12.2001	to	28.02.2005
Maj. Gen. M.Gopal Rao	02.03.2005	to	31.05.2006

Member Secretary

Brig. (Dr.) R.Siva Kumar	30.10.2000	to	31.05.2006
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Cabinet Resolution on NSDI

Introduction

Spatial data infrastructure is a collection of technologies, policies and institutional arrangements to facilitate availability of and access to spatial data, acquired and held by different agencies and organisations to a vast, diverse and ever growing community of users and promote the use of the spatial data infrastructure at community, local, state, regional and national levels for sustained economic growth. The Government of India proposes to establish a national infrastructure known as the National Spatial Data infrastructure (NSDI) for the purposes of acquiring, processing, storing, distributing and improving utilisation of spatial data, which would be a gateway of spatial data being generated by various agencies of the Government of India. The data producing agencies of the Government of India shall be initially the contributing agencies to the NSDI and the Government through the National Spatial Data Committee (NSDC) shall facilitate participation of other data producing agencies for such purpose. Therefore the Government of India has accordingly decided to establish NSDC with the composition, functions and powers as specified in this resolution:-

Constitution of the National Spatial Data Committee (NSDC)

The NSDC shall consist of the following permanent Members (ex-officio capacity):

- i. Hon'ble Minister of State (Independent Charge) for Science & Technology, GoI – Chairman
- ii. Secretary, Department of Science & Technology, GoI – Member
- iii. Secretary, Department of Space, GoI – Member
- iv. Secretary, Ministry of Home Affairs, GoI – Member
- v. Secretary, Ministry of Defense, GoI – Member
- vi. Secretary, Ministry of Water Resources, GoI – Member
- vii. Secretary, Department of Land Resources, GoI – Member
- viii. Member Secretary, Planning Commission – Member
- ix. Secretary, Ministry of Environment & Forest, GoI – Member
- x. Secretary, Ministry of Urban Development, GoI – Member
- xi. Secretary, Department of Ocean Development, GoI – Member
- xii. Secretary, Ministry of Mines, GoI – Member
- xiii. Secretary, Ministry of Information Technology, GoI – Member
- xiv. Registrar-General, Census of India – Member
- xv. Surveyor General, SOI/Director, NRSA– Member Secretary

On and from such date and term as may be decided by the NSDC, the NSDC can appoint the following additional Members:

- a. Maximum of five Secretary rank officials of the Government

of India or State Government departments whose activities are related to the NSDI.

- b. Maximum of five experts having experience and qualifications in the fields related to NSDI – Geographical Information System (GIS), Remote Sensing, Digital Mapping, Photogrammetry, Spatial and Non-spatial databases, Information Technology, Networking, Software, Business Management, Law and other related fields.
- c. Maximum of five representatives from industry, academia and NGO's.

Functions and Powers of the NSDC

NSDC shall be the apex national authority for formulation and implementing appropriate policies, strategies and programmes for the establishment, operation, management of the NSDI and utilisation and any other activities related to spatial data in the country. As part of this, the NSDC will:

- I. Determine the requirement of spatial data in the country and require the creation or collection of spatial data to fill such requirement.
- ii. Formulate and position policies on all aspects related to the NSDI, including its establishment, access, pricing etc.
- iii. Decide and arbitrate on issues relating to spatial data generation and its availability in the country.
- iv. Promote and enable investment in the spatial business sector and to create an environment that encourages competitive excellence.
- v. Promote the development of human resources in the spatial data sector by encouraging existing training institutes,

universities, institutions offering specialized courses, etc to undertake human resources development activities for NSDI.

- vi. Promote advanced research related to the NSDI activities and enable an ambience of R&D for NSDI in the country.
- vii. Require any Member, persons, entities or organisations to provide access to any data at such costs as may be reasonable.
- viii. Aid and advise the central Government on any matter related to or connected with the NSDI.
- ix. Enter into appropriate arrangement with any third party to undertake any specific activity connected with or related to any of the activities of the NSDI, including marketing, data generation, data assimilation, access, consulting, commercial exploitation of any data, etc.
- x. Do all such acts and deeds that may be necessary, beneficial or otherwise desirable to achieve the objectives of the NSDI.

Establishment of Executive Committee of NSDI

The NSDI Executive Committee shall have the following members (ex-officio capacity):

- I. Surveyor General of India – Chairman.
- ii. Director, National Remote Sensing Agency – Co-Chairman
- iii. Joint Secretary, Department of Science & Technology – Member
- iv. Joint Secretary, Department of Space – Member
- v. Director General, Geological Survey of India – Member

- vi. Director, Nat. Bur. of Soil Survey and land use Planning – Member
- vii. Director, Forest Survey of India – Member
- viii. Chairman, Central Ground Water Board – Member
- ix. Chairman, Central Water Commission – Member
- x. Director-General, India Meteorology Department – Member
- xi. Director-General, National Informatics Centre – Member
- xii. Representative of Registrar-General, Census of India – Member
- xiii. Director, National Atlas and Thematic Mapping, (NATMO) – Member
- xiv. Chief Executive Officer, NSDI – Member Secretary

In addition, the NSDC may appoint for a specified term, on recommendation of the Chairperson of NSDI Executive Committee, eight experts having experience and qualifications in the fields related to NSDI Geographical Information Systems (GIS), Remote Sensing, Digital Mapping, Photogrammetry, spatial and Non-spatial Database, Information Technology, Networking, Software, Business Management, Law and other related fields.

Functions and Powers of the Executive Committee

NSDI Executive Committee shall undertake any and all implementing and executive functions for and on behalf of the NSDC including functions as may be prescribed by regulations framed by the NSDC in this connection or otherwise as directed or delegated upon the NSDI Executive Committee by the NSDC. Such functions and powers would include:

- i. To define and ensure implementation of national standards for NSPI activities and to enable a smooth establishment and access to NSDI.
- ii. To constitute technical, financial or other sub-committees to establish the NSDI and any other objectives and functions under the Act.
- iii. To define and formulate rules and procedures for enabling NSDI databases servers, networks and access rules and filters.
- iv. To aid and advise the NSDC on any matter related to or connected with its functions and the NSDI.
- v. To advise the NSDC on expanding the scope of NSDI by including newer spatial and non-spatial data and enabling a larger participation in NSDI.
- vi. To undertake activities to attract new entrants, private sector participation and stimulate innovation related to NSDI.
- vii. To encourage and set into operations value-added-services related to the usage of NSDI for supporting developmental and economic activities.
- viii. To do all such acts and deeds that may be necessary, beneficial or otherwise desirable to achieve the objectives of the NSDI.

Rules & Procedures

NSDC shall have power to frame rules and procedures for the conduct of its business. The Committee shall meet at such time and places as fixed by the Chairman. ▲

NSDI Vision

- National Infrastructure for the availability and access to organised spatial data.
- Use of the infrastructure at Community, Local, State, Regional and National Levels for sustained economic growth.