

Construction of the National Spatial Data Infrastructure Under China's Digital Earth Development Strategy

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Abstract This paper describes the status of China National Spatial Data Infrastructure (CNSDI) under China's digital earth development strategy, introduces steps taken by the State Bureau of Surveying and Mapping for the construction of CNSDI, and raises a few important issues to be considered in the development of CNSDI. Today the world is entering the information age where the new technology revolution featured by information technology enables people to obtain enormous amount of information about the earth and human society. The information can then be integrated and analyzed organically for addressing such globally concerned issues as resources, environment, population and disasters to face the challenge of the changing world. In this process, the geographical spatial information which is a important part of the overall global information resources has been given great attention and widely used. At the same time, it has become an increasing concern how to realize the data sharing. A new industry which is geographical information industry and a new infrastructure which is spatial data (SDI) infrastructure have been vigorously developed accordingly.

1. Status of the Construction of National Spatial Data Infrastructure in China's Digital Earth Development Strategy

Digital earth is the natural extension of the programs of information high way and national spatial data infrastructure. From the multi-resolution and 3-dimension digital description on the earth we live in under the intelligent network systems and suppositional reality space by using geographical information data, we can see that digital earth can't be realized without the fully development of the spatial data infrastructure. SDI is the kernel and foundation of digital earth and can not be omitted in the development of digital earth.

The top priority of China's digital earth development strategy is to build China National Spatial Data Infrastructure (CNSDI). CNSDI, being constructed by the State Bureau of Surveying and Mapping (SBSM), is composed of the following parts: the first is the institutional framework including the authoritative organization leading and organizing the building of CNSDI, the digital surveying and mapping production bases which collect and process data, and organizations which are responsible for the maintenance, updating and distribution of spatial data. The second is fundamental datasets which are the framework and kernel of CNSDI, including data of space positioning control, land form, aerial and space remote sensing images, land cover, cadastral survey and other basic physical and human data related to spatial positions. The third is laws and standards, including regulations and policies of data sharing, and standards of geographical information technology. The fourth is data exchange network, including the fundamental geographical information

systems composed of software, hardware and spatial database systems which are served as network nodes, and the quadrangle digital spatial data transmission network composed of SBSM, provincial surveying and mapping bureaus, and other central and local government organizations.

2. Progress Made by Sbsm in the Development of Cnsdi

According to the duties designated by the State Council, SBSM is responsible for the production and management of fundamental geographical information and has been working on the construction of CNSDI. The following major progress has been made so far:

a. Established Hierarchical Management Structure and Budget Mechanism

In 1997, the central government listed fundamental surveying and mapping into the state economic and social development plan in order to meet the needs of the social market economy and the reform of the financial and taxation system. The government also determined that the fundamental surveying and mapping is administrated at different levels, set up special budget for fundamental surveying and mapping and largely increased the amount of the funds.

b. Set up Organization for the Management and Distribution of Fundamental Geographical Information Data

Approved by the central government, SBSM set up the National Geomatics Center of China to take charge of the construction and maintenance of the fundamental geographical information system, and

the updating and distribution of the data.

c. Established Digital Surveying and Mapping Production System and Built up the Capacities of Large Scaled Production of Digital Surveying and Mapping Products

After the innovation on the traditional analogue surveying and mapping technological systems in the period of the Eighth and Ninth Five-year Plans, SBSM has established 10 digital surveying and mapping production bases over the China. The digital production process and large-scale production mode, from the collection, processing, maintenance, updating of the fundamental geographical information to the production, have begun to take shape. New digital surveying and mapping products such as digital line graph (DLG), digital elevation model (DEM), digital orthophoto map (DOM), and digital raster graphics (DRG) are being used increasingly in all sectors in the economic development.

d. Established National High-Precision Spatial Positioning Framework and National Fundamental Geographical Information Database Systems

On the basis of the national astronomical geodetic network, precise leveling network, gravity standards network and satellite Doppler network, we have established, during the period of the Eighth and Ninth Five-year Plans, the national high precision GPS network and completed the construction of the topographic databases and geographic names databases, digital elevation models of 1:4 million, 1:1 million and 1:250,000, geodetic databases and gravity databases for the national fundamental geographical information systems. We have also started the digital production and database construction of 1:50,000 and 1:10,000 fundamental geographical information for the key areas of resources exploration and the key flood control areas of the 7 major river basins.

e. Conducted Research on the Standardization of Geographical Information

SBSM has developed over 20 national and professional standards concerning geographical information classification coding, data collection format, data record format, data exchange format and product mode in order to promote the standardization of geographical information. We took the lead in organizing the national committee of geographical information standardization and serve as the coordinator of ISO/TC211 in China. SBSM is also working as Vice Chairman of the Permanent Committee of GIS Infrastructure for Asian and the Pacific (PCGIAP), member of the

International Steering Committee of GSDI, and member of the International Steering Committee for Global Mapping (ISCGM).

f. Provided Services of Digital Fundamental Geographical Information Applications

To meet the requirements of management and decision making and promote geographical information sharing mechanism, SBSM has timely provided data of the national database of 1:250,000 to relative departments of the central government and governments at provincial level. We are working on building the geographical information systems for the national and provincial comprehensive GIS, have provided the 1:10,000 digital surveying and mapping products of the key flood control areas of the 7 major river basins to 14 provinces to meet their needs of flood control, disaster alleviation and post-disaster reconstruction. With new and high technology of surveying and mapping, we have conducted dynamic monitoring on land use of some key regions.

In addition, the 1:50,000 and 1:10,000 databases for CNSDI and the network of geographical information data transmission at national and provincial levels are under construction.

Although we have made remarkable progress in the construction of CNSDI, we still have distances to the NSDI in its real sense and are faced with arduous missions in the future.

3. Sbsm's Basic Thoughts on Cnsdi At Next Stage

In the framework of China's digital earth development strategy, NSDI should be built in the way of building the information highway to lay a solid foundation for the realization of the digital earth. Faced with the missions at next stage, SBSM has the following basic thoughts on the construction of CNSDI:

a. To Establish the Mechanism of Updating Fundamental Geographical Information

It is an essential step to establish the updating mechanism and budgeting mechanism for fundamental geographical information in order to ultimately change the situation in China that the fundamental surveying and mapping lags behind the national economic and social development, and to provide affluent geographical spatial data resources for CNSDI. In order to establish the updating mechanism and budgeting mechanism for fundamental geographical information, during the period of the Tenth Five-year Plan, we should first determine the updating cycle of the fundamental geographical information and establish a stable

government budgeting mechanism at the state and provincial levels according to China's physical geographical conditions and the level of economic development. Second, we should improve the methods of spatial data collection. For this purpose, we should strive for launching China's own high resolution satellite for land surveying if the state budget allows to do so. Third, we should further rationalize the distribution of and build the key national and provincial digital surveying and mapping production bases to increase the capacities of large-scale production of digital surveying and mapping products. Forth, we should carry out the program for updating fundamental geographical information to provide reliable fundamental geographical information for the economic construction and social development.

b. To Speed up the Construction of National Fundamental GIS Network System

The national fundamental GIS network system is the framework of NSDI, which is formed by connecting through data transmission network the fundamental GIS systems at state and provincial levels and databases of different sizes and different types. To prioritize the building of the fundamental GIS network system will stimulate the development of specialized information systems of other fields, promote information data sharing, and avoid redundant construction. During the period of the Tenth Five-year Plan, the government will increase the budget for the construction of the fundamental geographical information databases and network, complete the construction of the national 1:50,000 DEM database, DRG database, DOM database and land form frame features database to realize the network connection of the national and provincial fundamental geographical information systems and digital surveying and mapping production bases. Provinces, autonomous regions and municipalities directly under the State Council should complete

the construction of 1:10,000 DEM databases and DOM databases according to the requirements of the local economic development, if they have the conditions and abilities to do so.

c. To Formulate NSDI Standards and Data Sharing Policies

We should accelerate the formulation of the technical standards for NSDI including the national uniform standards for information classification coding system, fundamental data frame, data exchange format, quality control and metadata. We should develop the regulations and policies on spatial data sharing to identify the rights, responsibilities and obligations of different organizations for the maintenance, provision and demand of geographical information. We should also develop policies concerning the identification and protection of property right of data and information, and monetary compensation for data sharing.

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