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COUNTRY REPORT

Development of Surveying and Mapping in China during 1997 - 2000

( Paper Submitted by China)

# **Development of Surveying and Mapping in China during 1997-2000**

Country Report

Submitted by

State Bureau of Surveying and Mapping  
The People's Republic of China

From 1997 to 2000, great development has been made on surveying and mapping in China. Quite a few important projects have been completed, such as China GPS positioning network, 1:250,000 scale database, etc. In the coming years, the main tasks in China are: the establishment of 1:50,000 scale database, and the construction of Network for National Fundamental Geographic Information Systems.

## **I. ORGANIZATION STRUCTURE**

The State Bureau of Surveying and Mapping of China (SBSM) is an administrative agency of the Chinese Government for surveying and mapping, which was established in 1956. SBSM has two main functions: the organization and management of the national basic surveying and mapping work; and the overall administration of the surveying and mapping profession. In the restructuring of the Chinese Government in 1998, SBSM remains as one of the state bureaus, but moved from the Ministry of Construction to the Ministry of Land and Resources.

The main tasks for SBSM are as follows:

1. Drawing up administrative laws and regulations in surveying and mapping, making plans for the development of the surveying and mapping cause, management policies and technical standards for the surveying and mapping profession, and supervising their implementation according to law. Organizing and managing basic surveying and mapping, international and administrative boundary surveying and mapping, cadastral surveying and mapping and other national-level or significant surveying and mapping projects, scientific and technological projects in surveying and mapping.
2. Working out managing procedures for the verification of qualifications of surveying and mapping organizations, and according to law, examining and approving Grade A qualifications of surveying and mapping organizations,

managing the registration of surveying and mapping activities, examining and approving the supply of surveying and mapping results overseas, surveying and mapping activities in China conducted by foreign organizations or individuals, investigating and prosecuting national-level or serious illegal cases in surveying and mapping and being responsible for the reconsideration of relevant proceedings.

3. Managing national fundamental geographic information and data, organizing and guiding the social service of the fundamental geographic information; managing national surveying and mapping datum and surveying control systems; drafting standard sample maps defining the international boundaries of the People's Republic of China in cooperation with the Ministry of Foreign Affairs; examining and issuing important geographic information and data upon authorization; guiding and supervising the management of various surveying and mapping results and the protection of surveying markers nationwide.
4. Formulating plans and technical standards for cadastral surveying and mapping, administering the verification of cadastral surveying and mapping qualifications, and certifying cadastral surveying and mapping results.
5. According to law, administering the compilation of maps, examining maps to be published or presented to the public, administering the presentation of geographic names on maps.
6. Supervising and managing the national surveying and mapping budget and other earmarked funds.
7. Organizing international cooperation and exchanges.
8. Undertaking other missions assigned by the State Council and the Ministry of Land and Natural Resources.

In each of the provinces, autonomous regions and municipalities, there is a branch, either a provincial bureau or a regional office. In most of the cities and prefectures, surveying and mapping administrative offices have been established.

The surveying and mapping units in China are distributed in over 30 ministries and state bureaus with total 260,000 surveyors. They may be divided into three parts: the SBSM system; the military surveying and mapping system; and the professional surveying and mapping system. According to the statistics in 1998, there are over 5700 surveying and mapping units in China, which are legally qualified for mapping work, including 400 Grade-A units, 1000 Grade-B units,

2100 Grade-C units, and 2200 Grade-D units.

## **II. LEGISLATION AND REGULATIONS**

The Surveying and Mapping Law of the People's Republic of China was promulgated by the National People's Congress in December 1992. For meeting the requirement of the socialist market economy and the development of surveying and mapping technology, SBSM started in 1999 to make preparations for the amendments of the Surveying and Mapping Law. The emphasis of the amendments will be on the establishment of mechanism for basic surveying and mapping tasks, and the qualification of surveying and mapping units in the market, supplementary legal responsibilities. The amendment work has obtained support from the special committee of the National People's Congress.

In the past years, the State Council of China has promulgated a few regulations concerned with surveying and mapping such as the Regulations on Management of Surveying and Mapping Results, the Regulations on Map Compilation and Publication, the Regulations on the Protection of Surveying Markers. The Regulations on Management of Surveying and Mapping Market is now under appraisal in the State Council.

The State Bureau of Surveying and Mapping has worked out and published over 20 decisions and methods, such as the Provisional Methods on Surveying and Mapping Market Management, the Decisions on Surveying and Mapping Qualification.

In provinces and autonomous regions, over 30 regulations on Surveying and Mapping Management and more than 40 rules have been issued.

SBSM paid great attention to the issuing of the important geographic data, worked out the Decisions on Provisions and Applications of National Fundamental Geographic Information, and licensed system for application of national fundamental geographic data. In order to promote the applications of geographic data and establish data-sharing mechanism, SBSM offered free of charge a group of geographic data to 14 central government departments and over 10 provincial governments.

The National Committee on Geographic Information has been established in Chinese Government, with the chairman from the State Commission of Development Planning, and SBSM representative as one of the vice chairmen. SBSM has set up the National Technical Committee on Standardization of Geographic Information with many ministries and state bureaus involved.

Since 1997, the basic surveying and mapping became one of the important independent part in the National Economy and Social Development Annual Plan. Same in the provinces and autonomous regions, the mapping became an independent part of the annual development plan. SBSM and the Ministry of Finance have jointly worked out and published the Financial Rule for Mapping Units and the Financial Quotas for Mapping Production.

### **III. GEODETIC NETWORK**

The 1985 height system of China was established in the middle of 1980s. Since 1991, SBSM, jointly with other agencies in China, have made the remeasurement of the first-order leveling, with 241 leveling lines and 77 closing lops, and field results of 93,000 km. The data processing was completed in 1999. The vertical datum in China is in Qingdao City, Shandong Province.

Through 7 years efforts, a national GPS network of China was established in 1998, including A-order network and B-order network. The A-order network consists of 33 stations, and the B-order network consists of 818 points.

The first national gravity network of China was established in 1957. The 1985 National Gravity Network (NGN1985) has been in use for over a decade of years. Since 1999, SBSM together with other agencies, started to establish the 2000 National Gravity Network (NGN 2000), which consists of 18 original stations and 119 basic points. The field work will be completed by the end of 2000 and data processing will be done in 2001.

### **IV. FRAMEWORK CONSTRUCTION**

After the establishment of 1:1m national database in 1990's, SBSM completed the construction of 1:250,000 national database in 1998. The database consists of three sub-databases: the topographic sub-database, DEM database, and geographic name sub-database. The data for the databases are from 816 sheets of 1:250,000 maps. The topographic database includes 14 layers, such as hydrography, transportation, boundaries, settlement, topography, vegetation, etc. The DEM database includes two kinds: 100×100m and 3"×3". The geographic database has over 800,000 place names registered.

For the establishment of the National Spatial Data Infrastructure, SBSM launched in 1999 the construction of 1:50,000 national databases, including the Digital Raster Graphic (DRG) database, the Digital Elevation Model (DEM) database, the Digital Orthophoto Map (DOM) database, the Digital Line Graphic (DLG) database, the Geographic Names database, and the Land-cover database. The construction of the 1:50,000 national databases would be the main tasks for SBSM in the coming years.

1:10,000 database is one important part of the national fundamental geographic information. The establishment of 1:10,000 database is the main tasks for provincial and regional bureaus. SBSM has worked out Guidelines for 1:10,000 Fundamental Geographic Information Revision and Database Designing. SBSM also has published guidelines for standardization of urban geographic information system. The National Geodetic Database, as an important part of national fundamental geographic information systems, was established in the period of 1995-1999, including gravity sub-database, GPS network sub-database, leveling sub-database, and triangulation sub-database.

During the reported period, SBSM restructured the production units and established a group of production bases for digital products. A national digital surveying and mapping production systems has been formed under the support of "3S" technology (GPS, RS and GIS) and with "4D" products (DEM, DRG, DOM and DLG).

In 1999, as approved by the Chinese government, SBSM started a special large project called "National Fundamental Surveying and Mapping Infrastructure Project". The objective of the project is to establish the industrial infrastructure for geographic information acquiring, processing, storage, management, distribution and applications. The project is composed of four parts: the remote sensing data processing system, the fundamental geographic information management and service system, the fundamental geographic information production system, and the fundamental geographic information data communication network system.

## **V. MAP PUBLICATION**

During the reported period, the categories and quantities of maps have greatly increased and these maps have been used in more and more fields. Now in China, there are 9 specific cartographic publishing houses, and over 100 publishing houses which publish map-related products and are distributed all over China. The China Cartographic Publishing House is the largest map publishing house in China.

With the development of computer technology, map-making methods have completely changed. Computer-aided cartography, laser photographic technology and office networking have been used in map compilation and publication. Some electronic atlases have been in the market, such as the General Atlas of China, Beijing Electronic Maps, etc.

Since 1997, various kinds of physical, social and economic maps and atlases have been published, including some large cartographic products and plastic

stereo maps, e.g. a Collection of Ancient Maps in China (Chinese and English edition), and Atlas of Population and Sustainable Development of China (Chinese and English edition).

A large number of school maps and atlases were made jointly by map publishing houses and educational departments. Various specific maps and atlases have been published, such as transportation maps and atlases, regional and municipal tourist maps and atlases, urban maps and atlases, children maps and atlases, etc. Maps have been used in more and more fields, e.g. media, advertisement, and exhibitions.

The compilation of national atlas (second edition) was started in 1987, with the coordinating office located in SBSM as the leading agency. The national atlases consist of five volumes. By now, four volumes have been published: Atlas of Agriculture, Atlas of National Economy, Atlas of General Maps, and Atlas of National Nature. The Atlas of Chinese History will be published very soon.

## **VI. CADASTRE SURVEY**

The management of cadastral surveying and mapping is one of the SBSM administrative responsibilities. In 1985, SBSM started the re-establishment of cadastre in China, mainly in urban areas at the scale of 1:500, 1:1,000 and 1:2,000. SBSM has issued Regulations on Cadastral Surveying and Mapping, the Cadastre Map Format, and the Manual on Cadastral Surveying and Mapping. The development of cadastral survey differs in China from region to region. In Guangdong Province, multi-purpose cadastre and land information system have been established, and widely used in different fields such as land management, house management, taxation, urban planning, and household management.

At present, SBSM is working on national standards on cadastral surveying and mapping. SBSM is making efforts to set up administrative systems of cadastral survey for qualification of survey units, cadastral results checking and quality supervision.

## **VII. HYDROGRAPHY**

In China, the hydrographic charting mainly consists of the nautical charting and special purpose charting. The equipment used in hydrographic charting includes depth-sounder, side-scan sonar, marine gravimeter, magnetometer, depth-sounding automatic system, and one-thousand-ton comprehensive survey ships. The hydrographic charting is widely used in ocean transportation, fishery, ocean petroleum oil and gas exploration, and development of ocean resources.

In the past three years, GPS and D-GPS technology was used in hydrographic charting, and over 100 charts at various scales were made and over 1000 charts were compiled for coastlines, new-ports and islands. The construction of hydrographic charting database has started for data collection and processing. Some new-generation electronic charting has been provided to users. A few national standards have been published, e.g. the Regulations on Hydrographic Charting, the Formats for Hydrographic Charting, and Instructions on Electronic Charts.

## **VIII. RESEARCH AND DEVELOPMENT**

In China, a surveying and mapping research system and a scientific and technical service network have been gradually set up jointly by research institutions, universities and production units. The main objectives of the research and development are to provide technical support to national development of surveying and mapping, to set up example projects for national or regional development, to study and solve some key technological issues, and to speed up the transfer of scientific results into production.

In the research and applications of positioning technology, a large national project called "China Crustal Movement Monitoring Network" was carried out. The objective of the project is to establish a regional observation network for real time and dynamically monitoring the crustal movement and change in China. The observation network is composed of 25 continuously observing stations, 56 regularly observing stations and 1000 irregularly observing points. In China, there are now 8 ground GPS tracking stations distributed in Beijing, Shanghai, Wuhan, etc. The geoid of the areas of the China east coast lines was defined with two-year Geosat data and T/P data.

In the development of geographic information systems emphasis was put on data policy, data standards, framework database establishment, hardware and software development, data sharing, and data applications. With the completion of 1:1m and 1:250,000 database construction, the fundamental geographic information has been used in national economy and social development, such as natural resource investigation, natural hazard monitoring, environment monitoring and protection, regional development, land consolidation, urban planning and management, etc. SBSM, jointly with secretariat of the State Council, has developed an office automation tool for the Chinese government, called State Council Comprehensive Status Geographic Information System, which has become a special software platform used together with other specific information by the government leaders.

In GIS applications, quite a few example projects were implemented, e.g. a

county decision making GIS support system for sustainable development of agriculture in Huanghe and Huaihe areas, an ecological environment monitoring system in Shaanxi, Shanxi and Inner Mongolia areas, a national database of natural hazards, etc.

In scientific results transfer and industrialization, some home-made hardware and software are widely used in the production. The VirtuoZo Fully Digital Photogrammetric System and the JX-4A Digital Photogrammetric System, which were completely developed in China, have been equipped in most of the surveying units in China. Some Chinese designed GIS software such as Geostar and MapGIS have been used in 1:1m, 1:250,000 and 1:50,000 database management and digital mapping production. The high accuracy image scanners and laser-scanning plotters have been developed and used in production.

## **IX. EDUCATION AND TRAINING**

In China, there are 50 surveying and mapping faculties distributed in over 20 universities, with 20,000 students.

Wuhan Technical University of Surveying and Mapping (WTUSM) is the largest education base in China for the surveying and mapping. WTUSM, established in 1956, is one of the key institutions of higher learning. In the university, there are 7 colleges and 1 adult education college, with 20 bachelor graduate courses, 17 master-graduate courses, 8 doctor-graduate courses and 1 post doctor research station, and with 7200 students at present. The university has 4 academicians, over 300 professors and associate professors, 13 research institutes and 40 laboratories. SBSM has located its National GPS Engineering Center and NSDI Training Center in the university.

In China, over 20 technical schools have mapping courses. Zhengzhou Technical School of Surveying and Mapping is the largest one for training surveying and mapping technicians.

In China, on-the-job training and correspondence training attracts more and more people. Annually, SBSM organized over 20 various training courses for supervisors, engineers and technicians. SBSM implemented a "personnel project" and each year awarded dozens of persons who made great contributions.

## **X. INTERNATIONAL COOPERATION**

In the past years, the surveying and mapping department of China has further developed the bilateral cooperation relations with the counterparts of Asia and

Pacific, European and American countries, and reached beneficial results to both sides.

China has actively participated in international and regional organizations and their activities such as PCGIAP, GSDI, ISO/TC211 and ISCGM, and played important roles in these organizations. In September 1998, the 7<sup>th</sup> Plenary Meeting and Work Group Meetings of ISO/TC211 were successfully held in Beijing. In April 1999, the 5<sup>th</sup> PCGIAP Meeting and International Seminar on SDI was held in Beijing with participants from many countries of Asia and the Pacific Region.

China sent large delegations to attend the conferences, symposia, and meetings of IUGG, ICA, FIG and ISPRS. The 20<sup>th</sup> International Cartographic Conference (ICC2001) will be held in Beijing, China, August 6-10, 2001. Chinese Society of Geodesy, Photogrammetry and Cartography (CSGPC) with support from SBSM, is now actively applying for hosting the 20<sup>th</sup> ISPRS Congress in Beijing, China in 2004.

China continues the open-door and reform policy. The surveying and mapping department of China pays great attention to international cooperation and exchanges, and is willing to develop cooperation relations and carry out various exchange projects with the countries of the whole world, in particular, of Asia and the Pacific Region, so as to further promote the development of surveying and mapping in China and to make more contributions to the development of surveying and mapping in Asia and the Pacific Region and in the world.