UNITED NATIONS **E/CONF.97/6/IP. 30**

ECONOMIC AND SOCIAL COUNCIL

Seventeenth United Nations Regional Cartographic Conference for Asia and the Pacific
Bangkok, 18-22 September 2006
Item 7 of the provisional agenda*

INVITED PAPERS

ON THE ESTABLISHMENT AND APPLICATIONS OF NATURAL DISASTER SPATIAL INFORMATION SYSTEM FOR GOVERNMENT AGENCIES

Submitted by Chinese Academy of Surveying & Mapping**

* **E/CONF.97/1**

** **Prepared by Mr. Wang Liang, Chinese Academy of Surveying and Mapping.**

On the Establishment and Applications of Natural Disaster Spatial Information System for Government Agencies

Wang Liang
Chinese Academy of Surveying & Mapping, Beijing, China
Wangl@casm.ac.cn

1.Introduction

China is one of the few countries with serious natural disasters in the world. Flood, typhoon, drought, geological disasters and earthquake occur frequently. The government agencies have responsibility for administering the affairs of preventing and reducing the natural disasters. Today, with the rapid development of information technology, to improve our ability and efficiency of disposing the natural disasters, advanced information technology and effective management pattern are greatly needed to enforce the construction of disasters management disposing technology system. Chinese government has been making great effort to developing science and technology concerning reducing and preventing disasters, actively constructing information management system about the natural disaster. With the efforts, Chinese government has established the natural disaster spatial information system for government agencies. The work establishes stable foundation for the government agencies in getting the disaster information in time and making decisions more scientific.

The national natural disaster spatial information system serves for central government agencies. It is leaded and harmonized by the central government, executed and constructed by the state bureau of surveying and mapping and other correlative ministries and bureaus. The system follows rules of integrating and using fully of the information resources of the involved disaster departments and rules of unifying spatial information foundation and software platform. The object of the system is instant, accurate and intact in reporting disaster information. The system serves for the central government in macro and daily management, assists leaders to make decision by service of providing comprehensive natural disaster information.

Construction of this system began 1996. By the ten years continuous work, the system has progressed obviously in these aspects: (1) function of the system is improved and perfected gradually. (2) Types of the disaster information have gradually increased from flood to earthquake, geological disaster. Dust storm, red-tide and forest fire disaster information. (3) Interface of operation is becoming reasonable. (4) The information service has changed from only flood season to whole year service. (5) The stability, security and credibility of the system improved continuously.

2. System Construction Pattern and Running Mechanism

2.1 Uniform Planning and Deploying

The construction of this system is a complicated systematic project involving many specific departments and application domains. The construction of this system adopts strategy from top to

bottom, i.e. starting from the application of the state and provincial government, through typical demonstration and then extending to region and county government agencies.

2.2 Uniform Software Platform

The comprehensive function of the government agencies requires the information from multi specific departments to be processed and integrated which result in the software platform becomes one of the nuclear content of this system construction. Based on the China practical situation, the software platform adopts self-developing and supporting intranet and internet application of the government affairs.

2.3 To Make Uniform Criterions and Standards

Due to demands of data share in many departments, each item of the system should be canonical and standardization, that basically includes: application technique standardization, foundation information, disaster information and public information standardization, database criterion and standards, name of network region standardization, interface standardization etc.

2.4 Mechanism of Cooperating Service

Coordinated service is basic mechanism of the system, i.e. With the support of uniform network platform, uniform criterion and standards, uniform geographical spatial infrastructure and uniform security guaranteeing system, information resource are shared and used among all kinds of departments in charge of nature disaster and central government, among government agencies and correlative government agencies, among government agencies and corporations (enterprises). The system gives preferential assure to provide information service to government head agencies.

3 Contents of the system construction

Based on practical needs of management work of Chinese governments, the primary assignments of the system is to establish foundational spatial database which is applicable to nature disaster macro analysis, to actualize uniform management and scheduler. Through data exchange center, different disaster information of flood, earthquake, geological disaster and other disaster thematic information are integrated in time and effectively on uniform geo-spatial infrastructure to ensure different information matching in spatial position. The assistant making decision system is developed on the same GIS platform. Under the leadership of the national superintendent departments, the State Bureau of Surveying and Mapping unions professional disaster management departments and directive center, the State Meteorological Bureau, the Ministry of Water Conservancy and National Headquarters of Preventing Flood Disaster to supply disaster information about disaster distribution, disaster situation and disaster analysis for the national agencies.

3.1 Logic framework of the system

The system is constructed on foundation of spatial database and society economy database. By

data exchange center, data dynamic exchanging are realized among different departments including such as water resources, flood, remote sensing investigation, weather and geographical spatial data etc. Exchanged data, which has entered into the system database and has been integrated with foundational spatial data and social-economic data, provide different levels information service for different rank administrative agencies, by uniform software platform. The logic connection of each part is showed in figure 1.

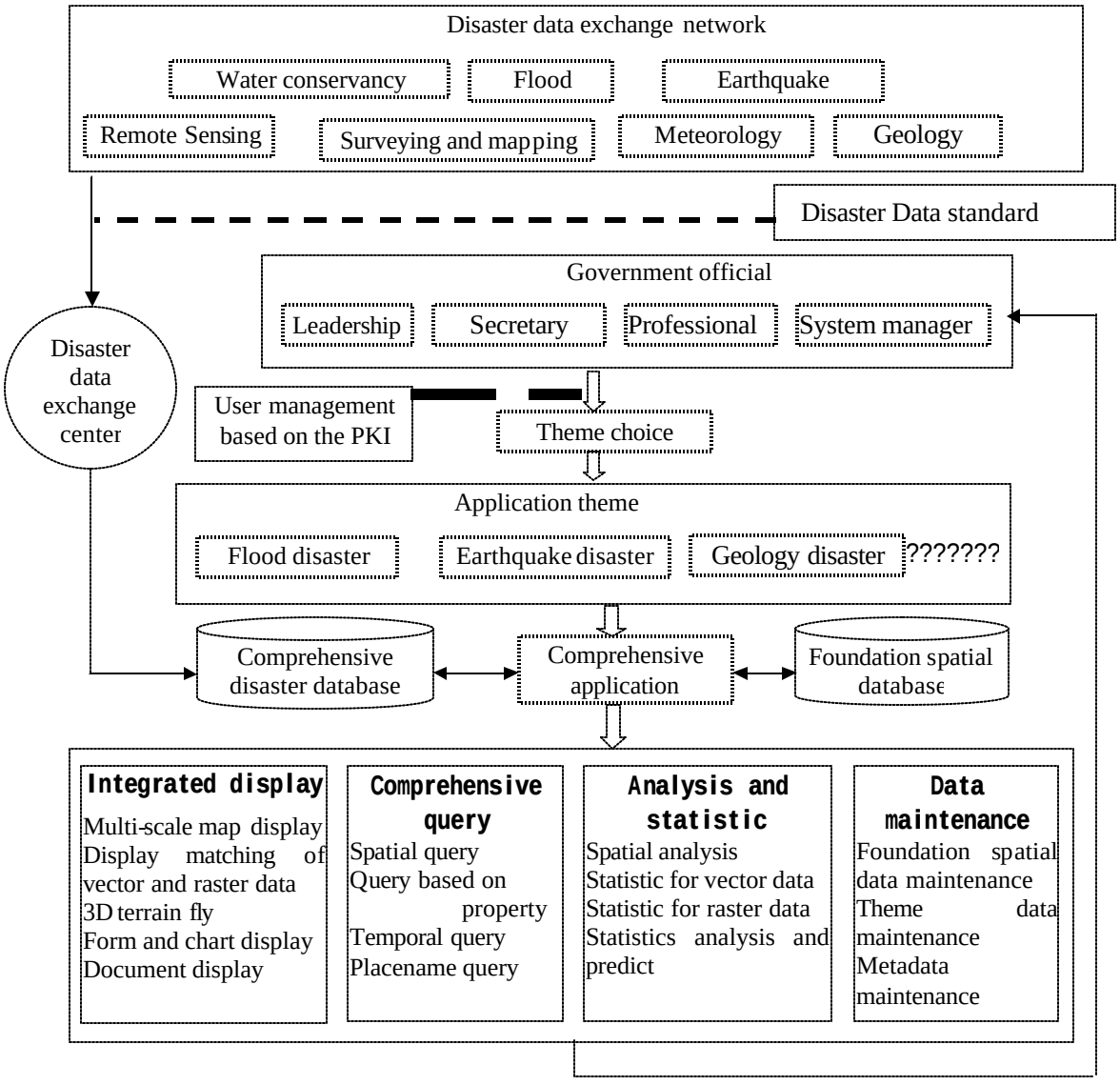

Figure 1. Logic structure of Natural disaster information system

3.2 Content of Database Construction

3.2.1 Construction of base database

Foundational spatial database is the spatial base of accurately matching, integrating and conforming theme information. The contents including:

(1) Topographical database: including three grades scale of 1/4,000,000, 1/1,000,000, 1/250,000. The content includes features of administrative district, water system, transport system and residential area.

(2) DEM database: including three grades DEM of 1/1,000,000, 1/250,000, 1:50,000.

(3) Toponym database: including three grades placenames of 1/1,000,000, 1/250,000, 1:50,000.

(4) Image database: TM color images with 30 meters resolution in 2000 year.

(5) Map products database: digital raster map of partial important regions at scale of 1/50,000.

3.2.2 Integration of thematic disaster data

Thematic disaster data include static information and dynamic data, belong to different departments and different classifying standard system. To enable information system could be integrated to serve, each department translates their own thematic data to unified formatted exchange data to support system integrating and importing database. For the department of their thematic data used by many other departments, the departments supply especial data interface, and develop especial transform platform to solve. For the character of thematic data change frequently, data integrating is performed in server side and client side respectively to solve exchange and integrated of static data and dynamic data. Mainly thematic database for integrating are flood information, weather information, earthquake information, geological disaster information and remote sensing information about disasters.

3.2.3 Information integration

Facing to so huge quantity and structure complicated spatial data, it needs deeply integration and conformation to make the data useable. Main methods include: directly getting various thematic information by integrative management of various data; managing information according to themes of user concerning, to solve user's difference in requirement, content, display way, management and operation.

3.3 Content of software platform construction

Software platform is based on foundational geographic spatial information system, integrating disaster thematic spatial information, statistic information of national economic, government affair document and multimedia information. The system has integrated geographic information system with disaster macro analysis technique and supplied uniform spatial assistant decision making platform for natural disaster management. The software platform supports information management in multi-themes, multi-levels, standardization, individuation and distribution.

3.3.1 Framework of the platform

Application service of the platform adopts B/S architecture. System maintenance adopts C/S architecture, as showing in figure 2. By uniform designing for system architecture, database structure, module function and interface, the system is developed by component method. Now, the system implements tightly integration and flexible call each other between geographic information and assistant decision-making system.

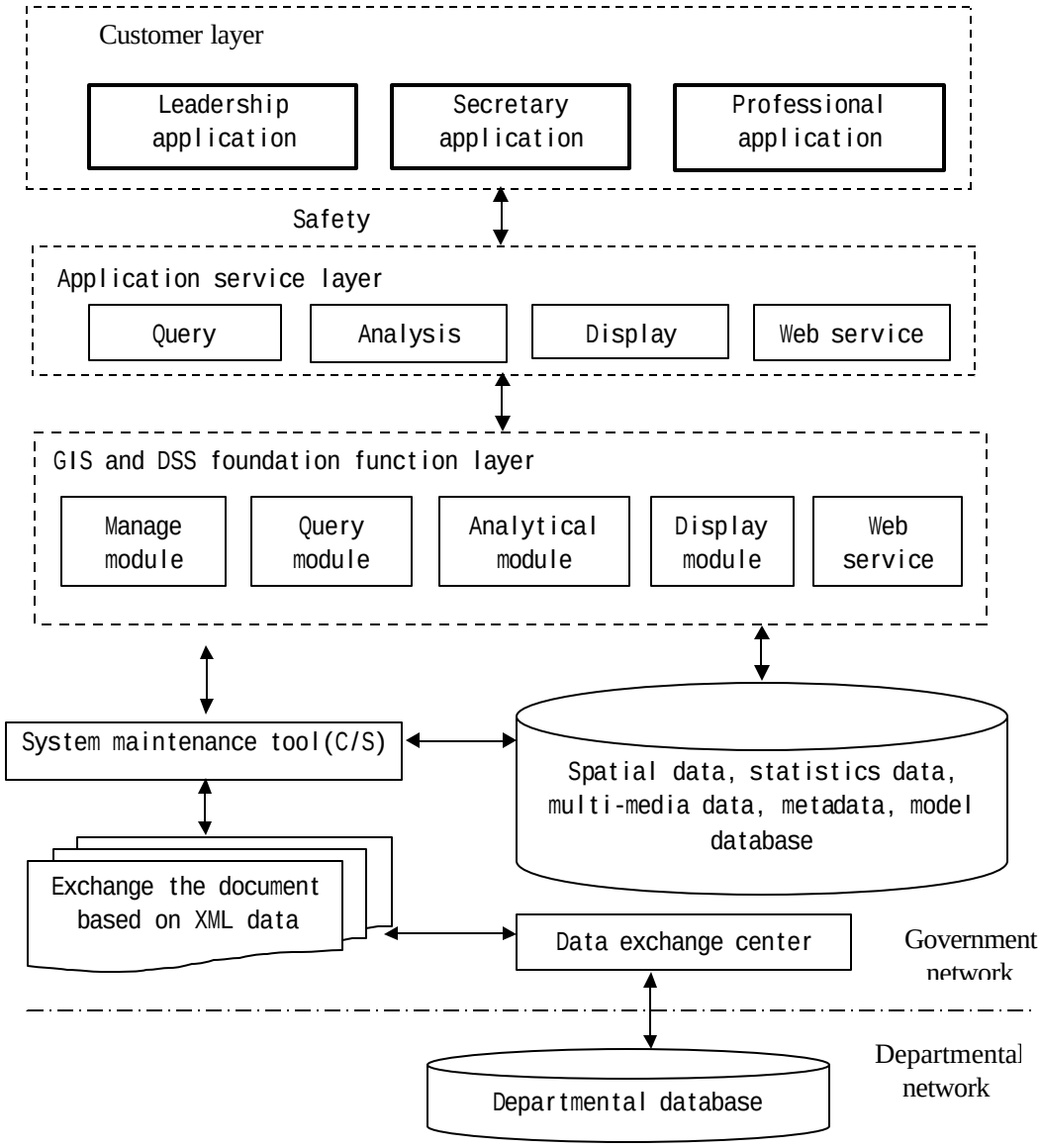

Figure 2. Software platform architecture

3.3.2 Software and hardware environment of platform running

(1) Hardware environment: including high efficiency PC server, microcomputer client and wire network whose speed is above 2M.
(2) Software environment: including the Windows operation system in server and client side, data management by Oracle 9i.

3.3.3 Main functions of the system

(1) Data maintenance function. The system adopts C/S architecture. Professional administrators manage and maintain spatial database, general information database, operation flow as well as user interface. The system supplies various maintenance tools for spatial database, non-spatial database, metadata database and application themes.

(2) Data application and service function. The system supplies various basic application functions as the management tools, such as: data accessing tools, data inquiring tools and data analysis tools. By custom-built developing, the system also supplies various thematic information server tools, such as various client information server tools based on Web environment.

(3) Dada exchanged function. Each data source establishes institutional and automatic updating mechanism according to uniform technique specification, such as data criterion, data dictionary and data coding. In this way, the data can be exchanged automatically by the data exchange center.

4. Application system establishment

On the base of software platform and database, several application systems oriented to government disaster control have been established. In these application systems, basic spatial data, disaster thematic spatial data and various attribute data are integrated in uniform platform. The information expressional way and user interface can be easy modified by system administrator or users. Now, these application systems are running in intranet of the government, serving for various users of the government agencies.

4.1 Flood Theme

(1) Water information, including reservoir engineering information from the national irrigation ministry, real-time flood information from the national headquarters of protected flood and drought, showing in figure 3.

(2) Weather information, including weather bulletin, nephogram, rainfall actual situation, rainfall forecast, and typhoon information.

(3) Remote sensing information, remote sensing ravages of water, remote sensing ravages of a drought, remote sensing ravages of fire.

(4) Statistical analysis and the historical disaster : stricken situation statistic according years and zones; statistic of situation of countries around disaster, residential area, traffic line, GDP and population.

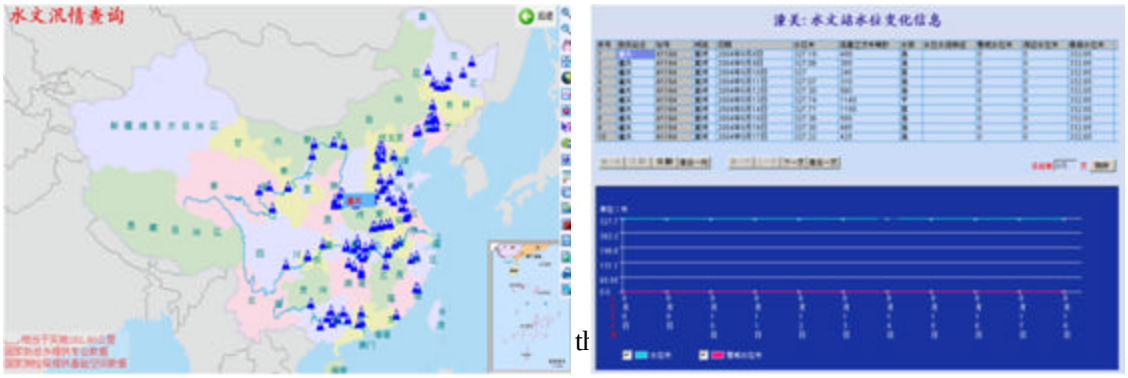

Figure 3. Hydrological stations distribution and information from the hydrological station.

4.2 Earthquake Theme

(1) Earthquake disaster: statistic information above grade 5 earthquake, surrounding 3D spectacle and geographic environment information of the earthquake happening.
(2) Historical earthquake circumstance, BC and the recent years earthquake records.
(3) Earthquake disaster statistic, earthquake disaster statistic of the appointed district; county about residents, traffic, GDP and population statistics of the disaster 's surrounding.

Figure 4. The earthquake information from earthquake department.

4.3 Geological Disaster Theme

(1) Geological disaster information, land slide, mudslides, landslip, surface subsiding, earth crack, surrounding 3D spectacle of the geological disaster happening and geographic environment information.
(2) Statistic analysis of the earthquake disaster, statistic of the geological disaster situation about the appointed district or other any areas; County situation, residential area, traffic line, GDP and population statistics around the disaster's happening place.

Figure 5. Geological disaster distribution and stricken situation information

5. Profit of the System Application

This system achieves the aim of providing disaster information services for the national government and relevant leaders. It has run for ten years in the state government agencies' office network and becomes a formal operation running system. As one of the indispensable information platform, it serves for the government's disaster analysis and decision-making. It's concrete functions are as following:

(1) Disaster information from many departments have been integrated and served for the leader decision-making. On the basis of geographic information, this system integrates the information from many departments. As a result, it provides service for leaders with uniform data, platform and application patterns. Thus, it exerts the advantages of integration and synthesis of diversified subject information.

(2) Applications of the spatial information technology have been promoted. The spatial information technology becomes perfect and practical gradually during its serving for the management of the government agencies. It also accelerates the profound integration of the geographic information technology and the government affairs management information technology.

(3) Sharing and standardization of information have been promoted. By establishment and maintenance of the system: 1) data exchange standards have been established and executed, 2) technique of automatic exchange have been developed, 3) sharing information in departments of government has become mechanism, 4) channel of the disaster information reporting has been standardized.

(4) Domains and level of spatial data application have been widen and lifted. Construction and application of this system put forward a higher requirement for multiformity, multi-temporal and instantaneous update of spatial information. For spatial information science itself, by this work, 1) application scope has been extended, 2) application level has been lifted and 3) technology system has been perfected.

(5) The pattern of the system construction and application has expanded in local government. Besides central government, some provincial governments, such as Hubei, Jilin, Henan and Guangxi, also have adopted the same technology platform and construction patterns to construct their disaster information system, including flood and drought disaster, and have gained effective progress.

6.References

(1) Study and Application of Comprehensive Data management for Spatial Decision-Making for E-government [J]. Liu Jiping etc. Science of Surveying and Mapping, 2005(30):9.

(2) Design and Development of Software Platform of Spatial Aided Decision-Making Based on GIS and DSS [J]. Wang Liang etc. Science of Surveying and Mapping, 2005(30):18.

(3) The Government Geographical Information System [B], Zhang QingPu etc. Science Publisher, 2003.

(4) Technical document of "The Demonstration Project of Spatial Decision-making for E-government of China", 2004.