

NATIONAL REPORT OF THE REPUBLIC OF CHINA

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ABSTRACT

In the Republic of China on Taiwan, photogrammetry is widely applied to topographic mapping, land use classification, water and soil conservation, and civil engineering projects; while remote sensing techniques are used for weather forecasting, damage investigation, natural resources monitoring, and agriculture and forest inventories. The equipment and techniques of digital mapping are increased and improved to provide data for the geographic information system (GIS) which consists of nine data bases, namely: natural environment, natural resources and ecology, environmental quality, social and economic, traffic network, land, regional and urban planning, public pipe line and topographic map data bases. The islandwide digital elevation model has been scanned with 40x40 m intervals. Photogrammetry and remote sensing courses are taught in the departments of survey engineering at the Chungcheng Institute of Technology and the Chengkung University, and also taught in departments of geography, geology, forestry and civil engineering at other universities and colleges.

1. INTRODUCTION

In recent years, the surveying and mapping organizations, both official and commercial, have made great efforts to procure new photogrammetric and remote sensing equipment and improve mapping and sensing techniques in order to meet the requirements of national economic development. As a result, great achievements have been made in the design and construction of highways and railways, urban development, land use, water conservancy, agriculture and forest inventory, and geology investigation. In the future, the application of photogrammetry and remote sensing for cadastral survey, pollution measurement and monitoring, and the establishment of GIS data bases can be expected to make even greater contributions to the national economic development.

2. DEVELOPMENT OF PHOTOGRAMMETRY

2.1 Topographic Mapping at All Scales

2.1.1 Revision of the Existing Photo Base Maps
Orthophoto base maps of Taiwan were produced at the scale of 1:5000 for low land regions and 1:10000 for mountainous regions, numbering 3773 map sheets in total, including 3209 sheets on 1:5000 scale and 564 sheets on 1:10000 scale. Due to rapid changes in ground features, the maps must be revised from time to time. During 1988-91, 1200 sheets were revised with the aid of new photographs.

2.1.2 Production of 1:1000 Photo Maps of the Coastal Zones of Taiwan
An orthophoto map production project for the coastal zones of Taiwan was initiated in 1986. The scale of the maps is 1:1000. Contour intervals are one meter for the maps covering flat areas, while two meters for those of hilly areas. Among the total 3225 map sheets, 2025 sheets were produced during the years 1988-90.

2.1.3 Revision of the Existing Medium Scale Topographic Maps
The existing medium scale topographic maps (line maps) were revised from the published photo base maps. The progress of the revision is as follows:

- + 1:25,000 topographic map, 261 sheets, of the total, 148 sheets were revised in 1985-87, 113 sheets in 1988 and 89.
- + 1:50,000 Topographic map, 79 sheets, all were revised in 1990 and 91.

2.1.4 Cadastral Mapping
In the past, cadastral

mapping project was carried out by ground surveying method. Now a field test is being performed over an area of 1.56 Km², 5730 parcels in southern Taiwan by using a mixed photogrammetric-ground survey method. If the result of the test indicates that the cadastral map accuracy standards can be met by this method, then the combination of modern photogrammetric and ground survey method can be adopted to speed up the rural cadastral mapping in Taiwan.

2.1.5 Mapping Projects in the Six-Year National Development Plan
In the 6-year national development plan started in 1991, maps in different scales used in planning and designing the Second North-South Freeway, New Cross Island Highway, High Speed Railway and Nankang-Ilan Freeway are all produced by aerial photogrammetry.

2.2 Non-Topographic Applications

Close-range photogrammetry was used to measure the deformation of dams and bridges. This method has proven to be practical and successful.

3. DEVELOPMENT OF REMOTE SENSING

3.1 Weather Forecasting

Remote sensing of the atmosphere from satellites is practical and effective. In Taiwan, image data from U.S. polar-orbiting satellite-TIROS-N and Japan's geostationary satellite-GMS are collected and processed by a Digital Color Image Processing System. All the information about the position, size and intensity of typhoon or storm can be obtained, and early forecasting can be made possible.

3.2 Damage Investigation

Whenever a natural disaster occurred, the affected area was imaged with an airborne multispectral scanner to estimate the extent and degree of damage. Indemnity was paid and remedial measures taken accordingly.

3.3 Forest Land Cover Classification

The DS-1260 11-Channel Airborne Multispectral Scanner was used to collect data. Processing of the MSS data was performed through the use of the Interactive Digital Image Manipulation System (IDIMS). Forest cover types were interpreted with a hybrid supervised and unsupervised approach.

3.4 Satellite Receiving Station

A satellite ground receiving station is being installed in the Center for Space and Remote Sensing Research, National Central University. After completion of the station in 1993, data from SPOT, Landsat 6 and ERS 1 will be received automatically.

4. DEVELOPMENT OF GIS AND DIGITAL MAPPING

4.1 Development of GIS

Almost the same as GIS, a National Land Information System (NLIS) was developed jointly by the Council for Economic Planning and Development and many other organizations. A working section was organized to carry out the project. NLIS consists of nine data bases.

4.1.1 Natural Environmental Data Base Information on soil, geology, topography, weather, and hydrology was collected and processed by the Ministry of Economic Affairs.

4.1.2 Natural Resources and Ecology Data Base Information on the resources of water, agriculture, forest, fishery and mineral and the ecology of animals and plants was collected and processed by the Council of Agriculture.

4.1.3 Environmental Quality Data Base information on the quality of air and water, soil pollution, and natural disaster was collected and processed by the Environmental Protection Agency.

4.1.4 Social and Economic Data Base Information on population, culture, social welfare, production, industry, commerce and finance was collected and processed by the Directorate General of Budget, Accounting and Statistics.

4.1.5 Traffic Network Data Base Information on highway, railway, transportation quantity and urban transit systems was collected and processed by the Ministry of Communications.

4.1.6 Land Data Base Information on land survey, registration, price, ownership and usage was collected and processed by the Department of Land Administration, Ministry of Interior.

4.1.7 Regional and Urban Planning Data Base Information on the management of building and public housing, land inventory and urban modernization was collected and processed by the Construction and Planning Administration, Ministry of Interior.

4.1.8 Public Pipeline Data Base Information on the pipelines of telecommunication, electricity, water, sewage, gas and gasoline was collected and processed by the Construction and Planning Administration, Ministry of Interior.

4.1.9 Topographic Map Data Base Information on the maps of 1:50,000, 1:25,000, 1:5,000 and 1:1,000 scales was collected and processed by the Information Center, Ministry of Interior.

4.2 Development of Digital Mapping

4.2.1 1:1,000 Digital Map The Taipei City Map and The Second Freeway Planning Map at the scale of 1:1,000 were prepared by digital mapping process. Among the total 673 sheets of the Taipei City Map, 115 sheets were produced in 1991 and 92. All the 1500 sheets of the Second Freeway Map were made du-

ring the years 1990-92.

4.2.2 Digital Terrain Model The digital elevation model of the whole island has been scanned and recorded along with the production and revision of 1:5,000 orthophoto maps. The recording interval in both X and Y directions is 40 meters.

5. EDUCATION AND RESEARCH

5.1 Education

The departments of survey engineering at both the Chungcheng Institute of Technology and the Chengkung University offer the subjects of photogrammetry and remote sensing. Besides, the departments of geography, geology, forestry and civil engineering at the Taiwan University, Central University, Chungshing University and the University of Chinese Culture provide courses in remote sensing and photograph interpretation.

5.2 Research

During the past four years, research has been carried out on the following subjects by various agencies in Taiwan:

- +The corrections of SPOT satellite data over mountainous terrain and their application.
- +Automation of GMS/WEFAX data reception.
- +Accuracy of recognition of ground controls in SPOT images.
- +Satellite remote sensing of water quality around Taiwan coastline area.
- +Automated DTM generation using digitized aerial photography.
- +A remote sensing and GIS integrated study on resources development and environmental conservation.
- +Forest resource modeling with Geographic Information System.
- +Research on the integration of Geographic Information System technologies.
- +An environmental information system for water pollution control region.
- +A study on application of remote sensing techniques and GIS on forest resources inventory.
- +Application of remote sensing to the geological environment in high mountain areas of Taiwan.
- +Application of remote sensing for the land restoration in eastern Taiwan.
- +Road design and route selection at mountainside area utilizing a 3-D GIS.
- +Software development for change detection and management of mountain agricultural resources in Pa-chang River watershed.

6. SCIENTIFIC AND PROFESSIONAL ASSOCIATION

6.1 Education and Research Organizations:

- +Institute of Photogrammetry, National Chengkung University, Tainan, Taiwan, 70109, ROC.
- +Center for Space and Remote Sensing Research, National Central University, Chungli, Taiwan, 32054, ROC.
- +Photogrammetric Branch, Institute of Forestry, National Taiwan University, Taipei, Taiwan, 10764, ROC.
- +Department of Survey Engineering, Chungcheng Institute of Technology, Taoyuan, Taiwan, 33509, ROC.
- +Remote Sensing Section, Energy And Mining Research / Service Organization, Industrial Technical Research Institute, Hsinchu, Taiwan, 31015, ROC.

6.2 Organizations Other Than Education and Research

- +Agricultural And Forestry Aerial Survey Institute, 100-1, Hoping West Road, Section 2, Taipei, Taiwan, 10721 ROC.
- +Topographic Service, P.O. Box 90496, Taipei, Taiwan, ROC.
- +Taiwan Provincial Cadastral Survey, 37-10, Leeming Road, Taichung, Taiwan, ROC.
- +Chinese Society of Survey Engineering, 4th Fl., No.2, Alley 1, Lane 116, Hsinglung Road, Section 3, Taipei, Taiwan, 11711, ROC.
- +Chinese Society of Cadastral survey, No. 4, Lane 469, Sungchiang Road, Taipei, Taiwan, ROC.
- +Chinese Society of Photogrammetry and Remote Sensing. P.O.Box 93-158, Taipei, Taiwan, ROC.

7. PUBLICATIONS

7.1 Periodicals (in Chinese, with contents in both Chinese and English):

- +Photogrammetry and Remote Sensing, published by Chinese Society of Photogrammetry and Remote Sensing, Taipei, Republic of China. Issue No. 1, June 1979 through No. 21, December 1991.
- +Remote Sensing, published by the Remote Sensing Technology Development Group, Council of Agriculture, Taipei, Republic of China. Issue No. 1, February 1983 through No. 15, December 1991.
- +Survey Engineering Quarterly, published by Chinese Society of Survey Engineering, Taipei, Republic of China. 1958-1992.
- +The Cadastral Survey, published by Chinese Society of Cadastral Survey, Taipei, Republic of China. Issue No. 1, 1982 through No. 11, 1992.

7.2 Textbook (in Chinese):

Photo Interpretation and Remote Sensing, 299 pages, by Jen-hsing Hsieh, 3rd edition, September 1990.

7.3 Important Reports (in Chinese):

- +Chiao, Kuo-mo. A Study on the Establishment of Forestry Resources Data Base of Chitou District Experimental Forest, National Taiwan University, 1988.
- +Sun, Chih-hung. Study on the Establishment of Geographic Information System: Evaluation and Testing of GIS Softwares, 1988.
- +Liao, Yang-cheng. Digitization and Process of Gra-

- phical Data in Geographic Information System, 1988.
- +Chu, Tzu-hao. The Application of Remote Sensing and Expert System Techniques on Geographic Information System, 1989.
- +Fu, An-ming. The Establishment of GIS Data Base in Taiwan Area, 1989.
- +Ho, Wei-hsin. The Procedures and Data Format for Digital Mapping, 1989.
- +Liu, Jin-King. Mining Environment Information System, 1989.
- +Liao, Ta-neu and Wu, Mu-lin. Applications of a Generic Geographic Information System for Mountain Agricultural Resource Management, 1989.
- +Wang, Shin. Environmental Assessment of the Second N-S Freeway from Taoyuan To Miaoli County, 1989.
- +Chen, Che-chun. Study on the Possibility of Rice Paddy Estimation From SPOT Imagery-Sample Site: Chung-Li, 1990.
- +Lu, Chin-ming. Remote Sensing Technique and the Litoral Drift Sand of Taichung Harbor, 1990.
- +Tseng, Ching-liang. A Digital Data Base Application System for Taipei Mass Rapid Transit System, 1990.
- +Liu, Tso-teng. Long Range Planning of Remote Sensing in Oceanography and Meteorology, 1990.
- +Chiao, Kuo-mo. A study on Application of Airborne MSS Data on Forest Stand Volume Estimation, 1991.
- +Cheng, Chi-chien. A Study on He Multi-level Sampling for Forest Inventory, 1991.
- +Chen, Yung-Kuan. Digital Forest-land Information System-A Case Study, 1991.
- +Liao, Yang-cheng. Potential Analysis for Object-Oriented Paradigm in Geographic Information System, 1991.
- +Lo, Ching-chang. DEM Generation from SPOT Stereo Imagery, 1991.
- +Tseng, Ching-liang. Quality Control for the Digital Graphic Data in GIS Database, 1991.
- +Wang, Shue-chia. Using Moment Invariants for Initial Matching, 1991.
- +Wu, Mu-lin. A 3-D GIS Which Can Be Implemented Right Away, 1991.
- +Wu, Ming-ji. Digital Topographic Map Production by Photogrammetric Method, 1991.
- +Wu, Hsin-cheng. The Application of Map Information System, 1991.
- +Wu, Chi-nan. Change Analysis of Waisandingzou, 1991.
- +Yang, An-Kang. The Development of Modern Photogrammetric Workstation, 1991.