No.

Japan International Cooperation Agency (JICA)
Nicaraguan Institute of Territorial Studies (INETER)

The Study for Establishment of Base Maps and Hazard Maps for GIS in the Republic of Nicaragua

Final Report (English Edition)

Main Report

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OYO International Corporation

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Preface

In response to the request from the Government of Nicaragua, the Government of Japan decided to conduct the Study for Establishment of Base Maps and hazard Maps for GIS in the Republic of Nicaragua and entrusted the study to Japan International Cooperation Agency (JICA).

JICA organized and dispatched a study team headed by Mr. Fujio Ito of Pasco Corporation and composed of Pasco Corporation and OYO International Co., to Nicaragua six times from January 2004 to October 2006.

The study was completed as scheduled with submission of the base maps, hazard maps and associated products. The study also included technology transfer to the counterpart agency.

We strongly believe that all the outputs of this project are important to protect lives and properties of people in Nicaragua from various types of natural hazards. We hope that the digital topographic maps and hazard maps are shared by all the people in the Republic of Nicaragua and utilized as the foundations of national development. It is clear that continued endeavors for establishing sound and effective policies and projects on disaster management and for implementing them at national, local and community levels are inevitable to achieve sustainable development in the Republic of Nicaragua. For this purpose, we have no doubt that all stakeholders will benefit from the study results. We also hope that this study will contribute to promote future projects and enhance friendly relationship between two countries.

Finally, we wish to express our sincere appreciation to the officials concerned in the Government of Nicaragua for their close cooperation extended to the Study.

Kazuhisa MATSUOKA

Vice President

Japan International Cooperation Agency

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1 INTRODUCTION

The government of the Republic of Nicaragua included the prevention and mitigation of disasters in the strategy to relieve poverty. After Hurricane Mitch in 1998, the National System for the Prevention, Mitigation and Attention of Disasters (hereinafter referred to as SINAPRED) was established in 2000 to strengthen measures against disasters at the national level. The Nicaraguan Institute of Territorial Studies (hereinafter referred to as INETER) is in charge of the preparation of hazard maps and national base maps for prevention and mitigation of disasters.

In the strategy, preparation of basic maps of the Pacific region and hazard maps are considered the first priority. However, the existing maps were not updated and they had accuracy problems to represent the actual situations of the territory. Therefore, the existing topographic maps at a scale of 1/50,000 were not adequate as a basic geographic information source for hazard map preparation. Taking those circumstances into consideration, the government of Nicaragua requested the "Study for Establishment of Base Maps and Hazard Maps for GIS in the Republic of Nicaragua" (hereinafter referred to as “the Study”) to the government of Japan in June of 2002.

In response to the request, the Japan International Cooperation Agency (hereinafter referred to as JICA), the official agency responsible for the implementation of the technical international cooperation programs of Japan, dispatched a preparatory Study Team to investigate the situation of basic maps and hazard maps in Nicaragua. After a thorough investigation by the preparatory Study Team, the Scope of Work was signed on August 27th, 2003. The Nicaraguan Institute of Territorial Studies (hereinafter referred to as INETER) was assigned as the counterpart agency for the implementation of the Study.

The JICA Study Team (hereinafter referred to as “the Study Team”) consisting of joint venture entities of PASCO Corporation and OYO International Corporation carried out the Study from January, 2004. At the beginning of the Study, the Study Team had a series of meetings and discussions based on the Inception Report of the Study with the officials of INETER. As a result of the discussion, the Inception Report was accepted.

Based on the Inception Report, the field operation such as setting of aerial photo-signals, aerial photography, ground control survey, field identification for topographic mapping and hazard simulation modeling were carried out in Nicaragua; and aerial triangulation, stereo plotting and Digital Terrain Model (DTM) were prepared in Japan in the first year. Also necessary hardware and software for on-the-job training (OJT) were installed in INETER in July, 2004 as scheduled. These activities were reported as Progress Report (1).

In response to the request of the INETER as written in the minutes of September 10th, 2004, several study items were added to the original scope. They were: 1) Bathymetry survey in the shallow coastal area in front of Masachapa and its vicinity for Tsunami hazard analysis; 2) Profiling of the Maravilla River for flood hazard simulation; 3) Preparation of topographic map at a scale of 1/5,000 of Managua City area for the Study on Improvement of Water Supply System project by the technical cooperation of JICA; 4) Basic facility information map for the natural disaster prevention for GIS application.

The progress and results of the original study activities and additional study items were reported and documented as the Progress Report (2) including the original study activity.

This Final Report is compiled to summarize all the Study contents from January, 2004 till October, 2006.

1-1 Objectives of the Study

The objectives of the Study are the followings:

(1) Establishment of the national digital base maps (1/50,000) and GIS database in about 20,000 km^2 of the Pacific-ocean region;

(2) Establishment of hazard maps;

(3) Technology transfer regarding the digital national base maps, the GIS database, and the hazard maps.

1-2 Scope of the Study

1-2-1 Scope of the Study

Scope of work is shown in Table 1-1 and the areas by each theme are shown in Figure 1-1

Table 1-1 Study Areas by Type and Zone

Work Type	Region	Area	Scale
Aerial Photography	Pacific Ocean Region in B/W	12,000 km^2	1/40,000
Aerial Photography	Volcanic area in Color	1,350 km^2	1/20,000
Topographic mapping and GIS database	Pacific Ocean Region	20,000 km^2	1/50,000
Basic facility information map for natural disaster prevention	Pacific Ocean Region	20,000 km^2	1/250,000
Topographic mapping	Managua City	300 km^2	1/5,000
Volcanic Hazard Map	Telica-El Hoyo Volcanic Zone	1,300 km^2	1/50,000
Seismic Hazard Map	Managua Metropolitan Area	700 km^2	1/50,000
Flood Hazard Map	Maravilla River （Masachapa）	100 km^2	1/50,000
Tsunami Hazard Map	The four selected areas along the Pacific coast (Corinto, Puerto Sandino, Masachapa, and San Juan del Sur)	120 km	1/50,000

1-2-2 Additional Study Items

(1) Work Items

INETER requested four additional work items during the meeting held in September in the first year. JICA and the Study Team had discussed the matter and recognized the significance of the work items. The work items were decided to be conducted during the second year of the Study. Followings were the items added to the scope of the Study:

(a) Topographic-map preparation at a scale of 1/5,000 in the City of Managua
(b) Preparation of information maps on disaster prevention related-facilities in the Study area
(c) Bathymetry survey in the shallow coastal area in front of Masachapa and its vicinity for the Tsunami analysis
(d) Profile and cross sectional leveling of a river for flood simulation

(2) 1/5,000 Topographic-Map Preparation in the City of Managua Districts

The necessity for the topographic-map information at a scale of 1/5,000 was recognized for the "Mid-term Water Facility Improvement Plan Study in The City of Managua" which was conducted by JICA since July, 2004. Although the Study Team provided existing topographic maps with a scale of 1/10,000 acquired from INETER to the Water Facility Improvement Plan Study Team, they and their counterpart, Nicaraguan Company of Aqueduct and Sewage (ENACAL), indicated problems associated with the out-dated information and

missing building information. They strongly requested to prepare 1/5,000 topographic maps in Managua to INETER. INETER reported to the Study Team that the City of Managua owned the aerial photographs that had been taken in 2000, and offered necessary arrangement to acquire the aerial photographs for preparation of the topographic map at a scale of 1/5000. The request of INETER was confirmed in the Minuets of Metting in September, 2004. The Study Team, with the request, reported its significance to the JICA headquarters.

The request from INETER was reviewed; its importance was recognized. And it was concluded that the preparation of topographic maps (1/5,000) not only benefit the waterworks facility improvement plan but in other areas such as infrastructure planning, urban development, small dam development to prevent flooding and reservoir development. The topographic data (1/5,000) were to be provided from INETER to ENACL, the City of Managua, the Environmental Agency and other end users.

(3) Preparation of Information Maps for Disaster Prevention Related Facilities

The hazard maps in preparation helped prepare the simulation models based on analyses and evaluation of natural hazards' degrees of effects in relation to volcano, earthquakes, floods, and Tsunami by district. In order for the Republic of Nicaragua to improve simulation models, to decide upon disaster damage assumptions and to improve disaster prevention planning, detailed data, such as a population distribution and building configuration and distribution and other data, are needed. Much time and costs were required. The national topographic maps, on the other hand, were designed for general purposes such as development planning and construction. It was true that disaster prevention policies were not treated as the main theme of topographic mapping.

Providing information on disaster prevention facilities was very important as an emergency measure of public administrators soon after disasters hit certain areas. However, information on disaster-prevention-related facilities had not been established at a national level and at a local level in the Republic of Nicaragua. INETER, with the reasons mentioned, requested its preparation to the Study Team. The Study Team proposed the benefits of the additional portion of the Study to the JICA headquarters.

(4) Bathymetry survey in the shallow coastal area in front of Masachapa and its vicinity for the Tsunami analysis

Among the Tsunami hazard analysis areas Corinto, Puerto Sandino, Masachapa, and San Juan del Sur, three areas other than Masachapa had existing bathymetry data and the Study Team had acquired them in the first year of the Study. However, in Masachapa, where the flood in 1992 seriously affected, existing bathymetry data were found to be unavailable, even though the data were indispensable for Tsunami analysis. Therefore, INETER requested the acquisition of the necessary data to the Study Team in September 2004. In response to the request, the Study Team reported the necessity to the JICA headquarters, and as a part of the Study it was materialized and set be commenced from the second year of the Study.

The bathymetry survey at the Masachapa was planned to acquire the data up to a targeted depth range of 100m by using a depth sounder with built-in GPS receivers of INETER. The width of the frontal coast area for the survey was set to be 7.5 km along the shore and the survey lines in 100-meter interval. The acquired data became the first product, for the Republic of Nicaragua, of a precious bathymetry data necessary for Tsunami simulation analysis under the cooperated work by a supervisor of the Study Team and INETER staff.

(5) Profile and Cross- Sectional Leveling for Flood Simulation

After the field identification in areas of the Maravilla river, which was the target river of flood simulation, and of nearby rivers, it was found that profile and cross-sectional leveling was needed. As in other three additional study items, its necessity was recognized. The actual work was planned to be conducted under the supervision of INETER.

1-3 Study Area

The study area of topographic maps at a scale of 1/50,000 covers about 20,000 km^2 of the Pacific-ocean region.

The study area of topographic maps at a scale of 1/5,000 covers about 300 km^2 in the Managua City area. Basic facility information map for natural disaster prevention covers about 20,000 km^2 of the Pacific-ocean region. The hazard mapping areas within the topographic mapping area are shown in Figure 1-1..

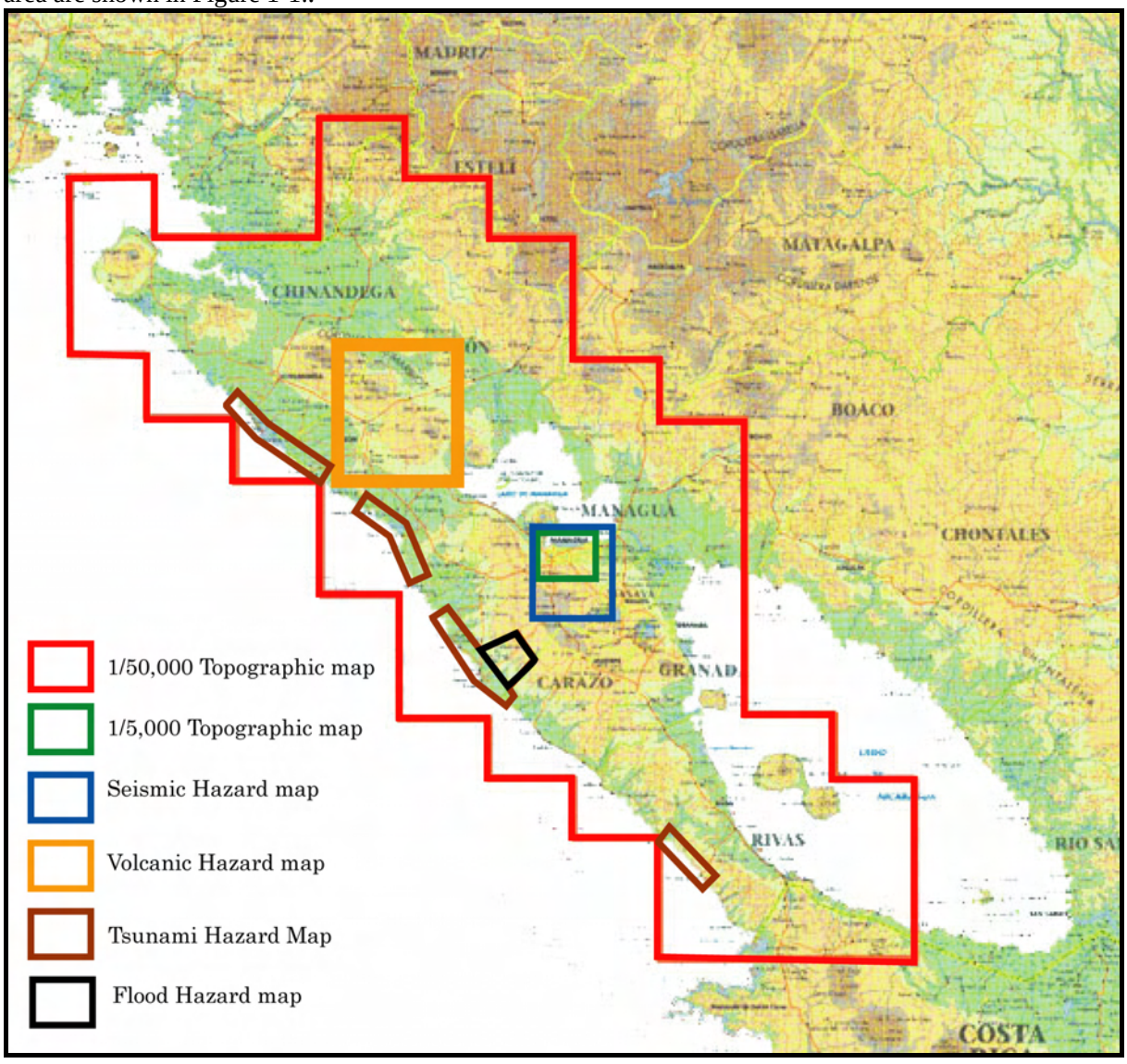

Figure 1-1 Study Area

1-4 Implementing Organizations

The Study was carried out through the joint efforts of the JICA Study Team and Nicaraguan counterpart personnel, who formed the Study implementing body. The JICA Study Team was comprised of members from Pasco Corporation and OYO International Corporation. The Nicaraguan counterparts were delegated from INETER.

In Nicaragua, INETER is the exclusive authorized agency to prepare a national base map and hazard map for research and disaster management activities. Considering the necessity of involving relevant organization concerned in the Study, the Nicaraguan side established the Steering Committee consist of INETER, Ministry Foreign Affairs, and SINAPRED. The responsibility of the Steering Committee was to advise to proper directions to INETER and the Study Team on appropriate technologies to be applied in the Study, and to provide relevant information.

Figure 1-2 shows the relationship of study organizations. The members of the Steering Committee are shown in Table 1-6.

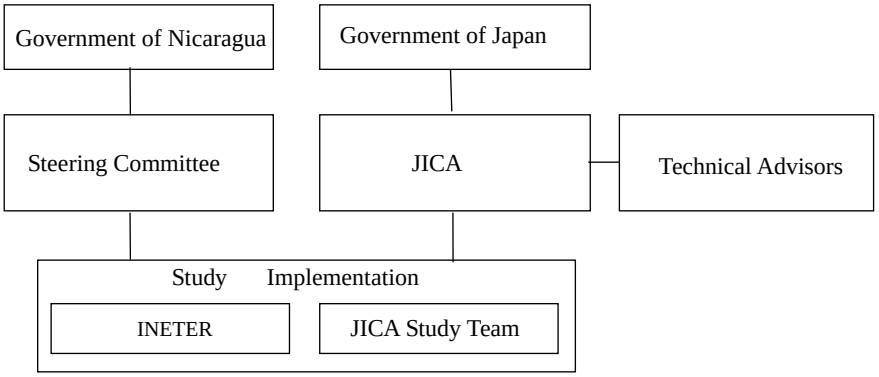

Figure 1-2 Study Organization

1-5 Study Team

The Japan International Cooperation Agency (JICA) organized the Study Team and technical advisors for implementation of the Study. The members assigned are listed in Table 1-2 and 1-3.

Table 1-2 JICA Technical Advisors

Name	Affiliation
Kenji CHUJO	Infrastructure Development Institute
Kouisei OTOI	Infrastructure Development Institute
Tuneo TANAKA	Infrastructure Development Institute

Table 1-3 JICA Study Team

Name	Title	Remarks
Fujio ITO	Leader	Pasco Corporation
Yoshiaki OTOKU	Deputy Leader for Topographic mapping	Pasco Corporation
Osamu NISHII	Deputy Leader for Hazard Mapping	OYO International
Daikichi Nakajima	Supervisor of Field Work	Pasco Corporation
Kiyofumi TAMARI	Supervisor of Field Work	DMS
Minori ONAKA	Supervisor of Digital Plotting	DMS
Takeo MUTOH	Supervisor of Digital Plotting	Pasco Corporation
Awadh Kishor SAH	Supervisor of GIS database	Pasco Corporation
Hidetoshi KAKIUCHI	Supervisor of GIS analysis	Pasco Corporation
Choi Jaeyoung	Supervisor of GIS analysis	Pasco Corporation
Yoshinori TAKAHASHI	Supervisor of GIS analysis	Pasco Corporation
Kozo YAMAYA	Supervisor of map symbolization	Pasco Corporation
Yoshitaka YAMAZAKI	Supervisor of Volcanic Hazard	OYO International
Toshihiro ASAHINA	Supervisor of Tsunami Hazard	Pasco Corporation
Toshiaki UDONO	Supervisor of Flood/Geomorphology	Pasco Corporation
Carlos VILLACIS	Simulation Technology Transfer	OYO International
Ikuo KATAYAMA	Special Technical Adviser for Hazard Mapping	Pasco Corporation
Hisashi MORI	Coordinator	Pasco Corporation

1-6 Host Agencies

1-6-1 INETER

According to the Scope of Work Mission, INETER acted since the beginning as the principal counterpart body.

In 1981, the National Geographic Institute of the Ministry of Defense, the National Meteorological Service back then Ministry of Transport and the Seismic Investigations Institute back then Ministry of Construction united and it INETER was established. Those days, INETER functioned as a very important technical and scientific organization of the country. It supplied fundamental information for the society in general (maps, land registry, meteorology, hydrology, geology, etc.) carrying out investigations and studies about the physical environment, which promotes the social-economical development, and at the same time it reduces vulnerability caused by natural disasters. It also carried out continuous security measures toward natural disasters.

The main activities that INETER performs are:

1) Renovation, expansion and the modernization of the land registry system at a national level;
2) Operation on meteorology, hydrology, tide, geodesy, seismic, acceleration and volcanic stations and the use of the data bank;
3) Carrying out investigations and studies about the physical environment, which sets up socio-economic development and at the same time, reduces the vulnerability.
4) Development of the official maps of the country, including thematic maps about the physical characteristics of the territory;
5) Carrying out investigations in the field about territorial regulations which support the development of the country;
6) Establishing the physical boundaries, the presentation of proposals about departmental and municipal limits and administrative division of the country.

The Department of Geodesy and Cartography, the Department of Hydrology and the Department of Geophysics were assigned as the counterparts of the project. Major activities of the departments are as follows:

(1) Department of Geodesy and Cartography

The Department of Geodesy and Cartography consists of Geodesy Section, Photogrammetry Section, and Cartography Section. It is in charge of administration, coordination, preparation of maps, operation and maintenance of the basic maps system of the territory, creation of thematic maps, operation and maintenance of the geodesic network of the national system of coordinates and coordination and implementation of the aerial photographs of the country. It is the body responsible for the creation of geo-space data using as a foundation the aerial photographs and the satellite images and it supplies information for the GIS. It also publishes its products as maps.

(2) Department of Hydrology

It participates in the observation network of the USGS through the meteorological satellite GEOS of the U.S.A. In the five stations of the country the water level of the river and its precipitation are noticeable. It is measured every 15 minutes and the information is sent every three hours. When the water level surpasses the alert level, the data is automatically sent every 15 minutes. There is a continuous observation of the water level in 23 stations nationally.

(3) Department of Geophysics

Department of Geophysics has been on duty for 24 hours monitoring of earthquake and strong motion, Tsunami, and volcanic activities by operating its observation network consisting from 57 stations with using Telemetric, Radio, and Internet, and is working as an important base within National Disaster Prevention and Mitigation Information System. When an earthquake the magnitude of which is larger than 7.0 should occur, Tsunami Alert System is activated and releases timely information to responsible National organizations. The eruptions and release of hazardous gases of active volcanoes San Cristobal, Telica, and Cerro Negro in the northern area and Conception in the southern area are continuously monitored by web cameras installed respectively in Leon and Isle of Ometepe. These hazard related information will be transmitted to hazard mitigation related Governmental and Public Institutions through wire lines directly connected with the National Agency for Civil Defense (Defensa Civil). For this obligation, the department is operated by the personnel in charge of research, observation, and maintenance.

(4) Mapping capacities in INETER

The Study Team reviewed all equipment of the INETER for the OJT equipment installation. The results of investigation are as follows:

1) Map production

INETER has taken the initiative prior to the neighbor countries like Honduras, Costa Rica and El Salvador in the development of the exchange data program for the creation of GIS data based on DIGEST. The prototype of the GIS system based on DIGEST has bee completed. Currently a program is being developed that could very useful for the government in the future. The goal is to establish the Web Mapping Service before 2007. This would permit the database to be shared between the countries in Central America.

New digital topographic maps for a generally-purpose were prepared under the specifications of VMAP-2 series in accordance with the FACC (Feature Attribute Coding Catalog) of DIGEST. As for VMAP2 Geosym symbols have been adopted.

The primary-data captures including the attributes are prepared in MicroStation in accordance with the specification of FFD (Feature Foundation Data). At the same time, the attributes of the geographic features are assigned with the macros of MicroStation. This information is converted to the binary format VPF using the Geofacc program which has been developed by INETER.

On the other hand, databases were prepared on aeronautical maps (1/250,000) under

VMAP1 series and UMAP (1/25,000) series is going on for the urban area.

MicroStation software is employed for the editing and map symbol. In some cases, Windows Draw is also used.

The number of employees of INETER is limited, excluding the administrative personnel, about 45 employees in the Department of Geodesy and Cartography and about 30 in the Department of Geophysics. Although the technical level is high, there are not enough human resources to produce final products, beginning from the data capture to the processing and editing of the data.

2) Printing

INETER does own facilities for printing maps; the task is out-sourced to private companies. There are about four companies with the capacity and the experience of printing maps such as administrative maps and Central American maps at small scales.

Even though INETER affirms that it is not a technical problem in what refers to the printing of maps, currently none of the companies has worked with high precision multicolor maps.

3) Preparation of negative and positive films

For the preparation of the original positive and negative films for multicolor maps, INETER possesses the Mapsetter 5,000 from Optronics, a division of Intergraph. Since an employee of INETER received a training course on the operation of the Mapsetter, and there was also an operation manual, there seems to be no problem in what refers to the operation of the equipment. There was also an engineer who seemed to know a lot about PCs and programs. This means that INETER have the capacity to plot the map image onto the base of the film with a high precision laser.

Recently, there have been some problems with the Mapsetter. The instability of the voltage damaged the battery. Therefore, it was replaced with a UPS battery with a voltage stabilizer. Nonetheless, the operating system of the Mapsetter is not upgraded and a computer is not assigned exclusively to the Mapsetter.

4) Equipment and Materials of INETER

The Photogrammetry Section of Department of Geodesy and Cartography in INETER has four (4) analog plotting machines just like the PLANICOMP C120 and the C130. These plotters are in need of repair. The plotting machines that were actually functioning at the moment are the following:

Table 1-4 Plotting Machines

Analog system	Digital system	Software for digital system
PLANICART A3	ImageStation Z	Photogrammetric manager Digital Mensuration Feature collection Match T Auto DTM collection Base rectifier Stereo display

An encoder was installed to PLANICART A3 for the digitalization of the captured data. In addition to the mentioned equipment, there is one Intergraph Photoscan (Movie scanner), and one HP Designjet 750C (AO color plotter).

The photo-laboratory has the following equipment:

- Contact revealer
- SAG-V amplifier
- Photograph copier

- Automatic movie revealer
- Register movie machine

It's noticeable to mention that the MILIGAN ELECTRONICS contact copier has the bright rod in malfunction and in the moment it's out of service.

In the Cartography Section, the mapping data are edited with MicroStation software.

The kinds of software being used are the following:

- MicroStation
- ArcEditor 8.2 (1 license)
- Window Draw
- Picture Publisher

A PLTS (Pro. Line Tool Set) menu was equipped in ArcEditor that is based on the NIMA standards for the VMAP-1 (aeronautical Map 1/250,000) series data acquisition.

The Geodesy Management possesses 12 GPS receptors of double frequency, 6 GPS receptors of 1 frequency and 1 station.

The Department of Geophysics has various desktop computers and one large size plotter. They carry out their work using the following software:

- ArcInfo 8.3 (2 floatable licenses)
- 3D Analist Modules
- Spatial Analyst Modules
- Geostatistics Module
- Arcview 8.3 (1 license)
- Spacial Analyst Module
- ArcIMS 4.01 (1 license)

The Department of Hydology has the following software:

- ArcGIS 3.3 (two licenses)

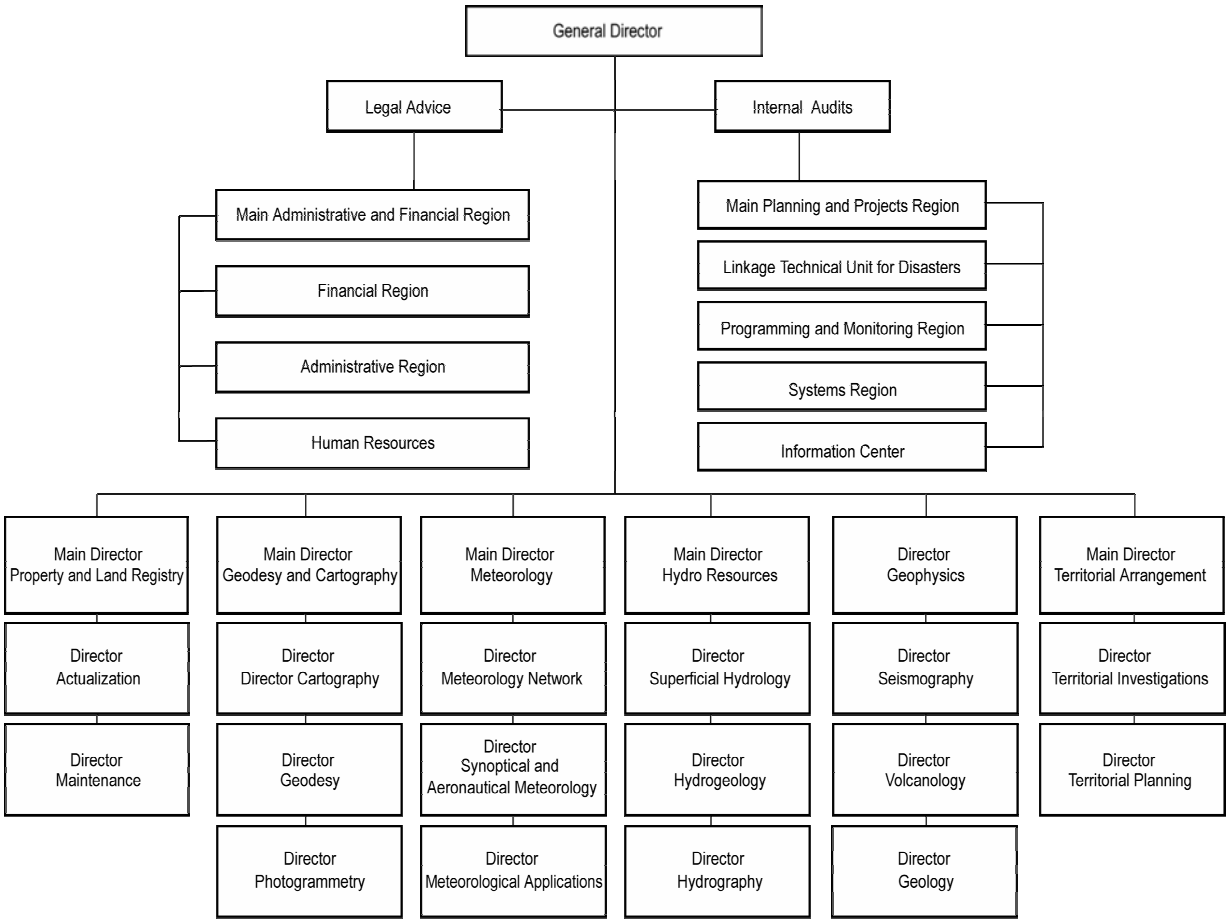

Figure 1-3 Organization Chart

Table 1-5 Member List of Main Counterpart Agency

Name	Title
Claudio Gutiérrez Huete	Executive Director of INETER
Pedro Miguel Vargas Carvajal	General Director of Geodesy and Cartography
Gonzalo Medina Pérez	Technical Director of Geodesy and Cartography
Isidro Jarquín Vélez	Director of Cartography
Ramón Avilés	Director of Geodesy
Josué Donado Figueroa	Director of Photogrammetry
Wilfried Strauch	General Director of Geophysics
Manuel Traña	Director of Volcanology
Martha Navarro	Vulcanologist
Carlos Guzmán	Superficial Seismologist
Guillermo Chávez	GIS Specialist
Luis Palacios Ruíz	General Director of Hydric Resources
Isaías Montoya	Technical Director of Superficial Hydrology
Jamil Robleto	Forecaster Hydrologist
Sergio Cordonero	Director of Hydrology

1-6-2 Organizing Steering Committee

In response to request from the Study Team, INETER side agreed to set up the Steering Committee consisting of the Executive Directors of INETER, SINAPRED (Systema Na-

cional de Mitigación y Prevención de Desastres) and a representative of the Ministry of Foreign Affairs for the Study. The first meeting was held in the beginning of February 2004, the second meeting was held on 18th August, 2004. In the first meeting, the Study Team and the counterpart reported results of investigation in the field to the committee. The Study Team reported the progress of the Study during the second meeting also. Representative of Managua City and ENACAL participated in the third meeting held on February 22, 2005. The fourth meeting was held on November 21,2006. During the final meeting, which was held on August 21, 2006, the final report was presented, and the report was accepted.

Photo 1-1 First Steering Committee

Photo 1-2 Second Steering Committee

Table 1-6 Steering Committee Members

Name	Title
Claudio Gutiérrez Huete	Executive Director of INETER
Jerénimo Giuston Robelo/ Geronimo Giusto	Executive Secretary of SINAPRED
Isolda Frixione Miranda/ Miriam Fonseca	General Director of Bilateral Management of Ministry of Foreign A ffairs

1-7 Work Flow of the Study

Work Plan of the Four-Year Study is shown in Figure 1-4.

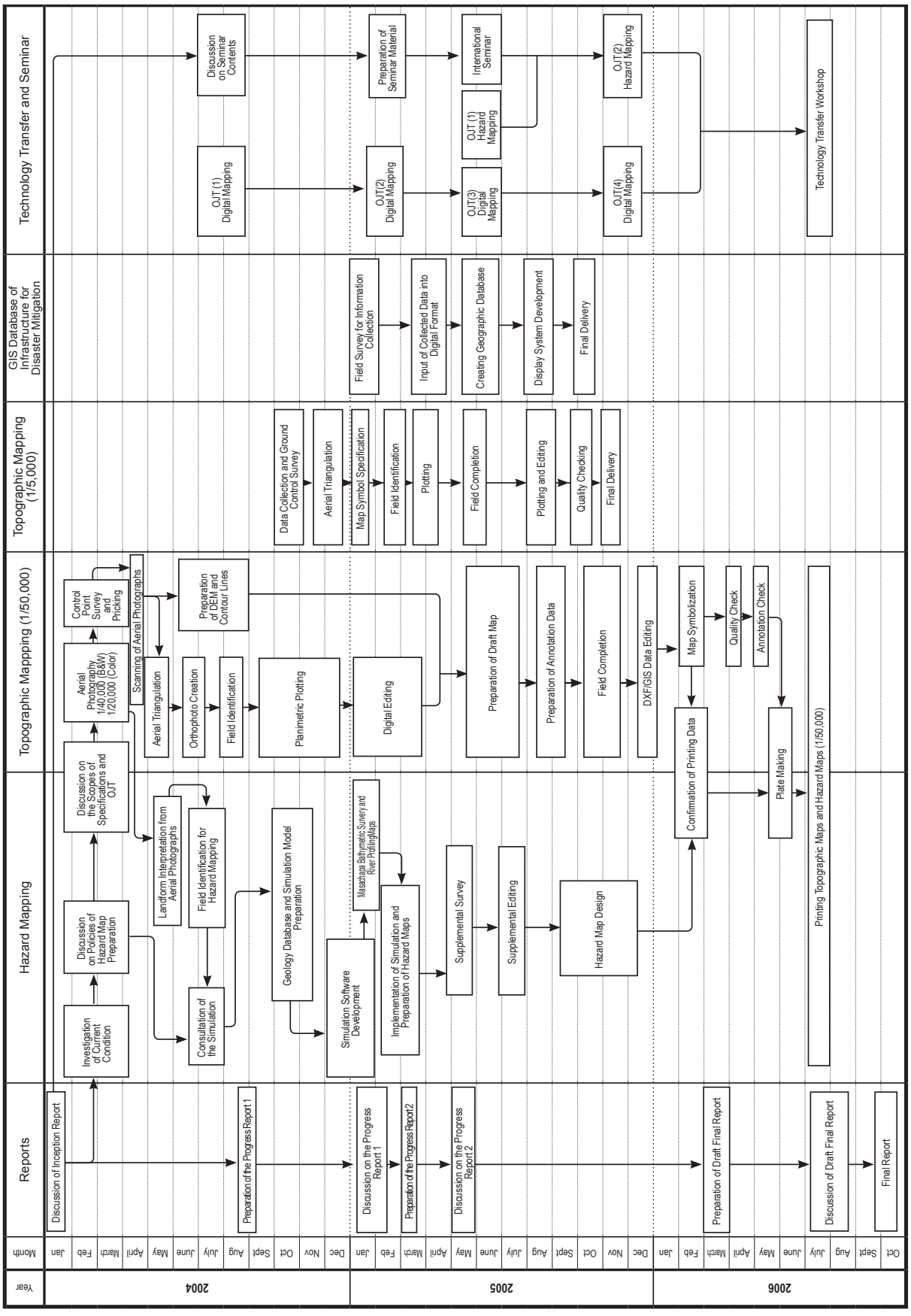

Figure 1-4 Study Flow Chart

1-8 Final Products

The following is a list of output.

Table 1-7 Outputs

	Item	Quantity	Note
(1)	Study Report		
1)	Inception Report (English)	20 copies	
	Inception Report (Spanish)	20 copies	
2)	Progress Report 1 (English)	20 copies	
	Progress Report 1 (Spanish)	20 copies	
3)	Progress Report 2 (English)	20 copies	
	Progress Report 2 (Spanish)	20 copies	
4)	Draft Final Report		
	Main Report (English)	20 copies	
	Summary (English)	20 copies	
	Main Report (Spanish)	20 copies	
	Summary (Spanish)	20 copies	
5)	Final Report		
	Main Report (English)	20 copies	
	Summary (English)	20 copies	
	Main Report (Spanish)	20 copies	
	Summary (Spanish)	20 copies	
	CD-ROM	2 Sets	
	Manuals	2 Sets	CD-ROM (.pdf)
(2)	Study Results		
1)	Aerial photography		
	Negative film	1 set	1/40,000 B&W; 1/20,000 color
	Digital Data File	1 set	1/40,000 B&W
	Contact print photographs	1 set	1/40,000; 1/20,000 color
	Index map	1 set	1/40,000; 1/20,000 color
2)	Results of Field Survey	1 set	
3)	Results of aerial triangulation	1 set	
4)	Plate film for Printing		
	Film for Topographic Maps	1 set	1/50,000
	Film for Hazard Maps	1 set	1/50,000
5)	Digital Data File		
	Topographic Map Data for GIS Database in Managua	2 set	1/5,000
	Topographic Maps and GIS Database	2 set	1/50,000
	GIS database of infrastructures for Disaster Mitigation	2 set	1/250,000
	Hazard Maps	2 set	1/50,000
6)	Printing Maps		
	Topographic Maps	500 copy each for 60 sheet	1/50,000
	Earthquake Hazard Maps	500 copy each for 5 scenario	1/125,000
	Volcano Hazard Maps	200 copy for Lava flow	1/100,000
		200 copy for Pyroclastic flow and lahar, Volcanic bomb	1/100,000
		200 copy for Tephra fall	1/200,000
	Flood Hazard Maps	100 sets	1/3,500-1/7,000
	Tsunami Hazard Maps	a) 125 copy for Corint b) 55 copy for Puerto Sandino c) 45 copy for Masachapa d) 75 copy for San Juan del Sur	1/50,000