First, the draft maps were reviewed and checked referring to the existing maps. The field team put markers on the draft maps such as ground objects, road classification and toponymy. All draft maps were marked with indication for doubtful parts and uncertain point before the field work. Reviewing of the draft maps took three weeks for 60 map sheets by five (5) people. They are very organized and well managed.

In the field, there was no problem to verify about the point data using Handy GPS because of experience of the previous field identification. As for point data such as school, hospital, church, and others, it was necessary to make some omission or generalization since, it was impossible to express all point data on a topographic map. Although it was shown quite many point data in the draft maps, the Study Team instructed to omit some of the data to the field team. After finishing the field work, they were instructed to arrange the field data with the indication key code using the printed draft maps.

The instructor gave the field team the simple key codes for the data arrangement. During the control process in the office work, several key codes were annotated on the draft maps. The key codes for the arrangement were as follows:

CB: Change

S: Delete the indicated object (point, line etc.) c

A: Adding

Spending two weeks in office, the Study Team completed the arrangement of the work. OJT for the field completion including the annotation toponymy was successfully implemented.

3-2-2 Hazard Mapping

(1) Earthquake

1) Contents and schedule

Items on which the technology transfer was conducted are followings:

1. Improvement of earthquake catalogue
2. Selection of suitable attenuation formula for explaining historical earthquake damage
3. Evaluation of proximity of Managua against existing type of past earthquakes
4. Establishment of scenario earthquake and determination of most probable earthquakes
5. Ground modeling for site amplification
6. Generation of grid system
7. Calculation of distance from scenario earthquake to the grid
8. Expression of simulation result on map

Technology transfer for Item 1, 2, 3, and most part of Item 4 were completed in the period of March 2004 to January 2005. Other items from 5 to 8 for the technology transfer and the transfer of computation technique of the probabilistic earthquake in Item 4 were completed in the period of May 2005 to November 2005.

Basically the technology transfer was preceded in two types; one is independent teaching and discussion performed timely in between Study Team member and INETER staff in charge of each Item above cited and the other in the style of seminar where most staff within INETER including those people in charge of relevant Item attended.

All the seminars were given by members of the Study Team and made open to the staff of all relevant sections of INETER. Two seminars were held in total and each one was held with 30-40 attendees in average. Each seminar lasted about two hours.

In the seminars, first the simulation models and preliminary results were presented and explained to INETER staff followed by the discussion on the contents of presentation

with attendees. Before finalizing the seminar, an inquiry sheet was delivered to attendees for collecting their questions and recommendations on the subject, thus to feedback them into the Study results.

Photo 3-14 Photo of Technical Discussion with people in charge of Earthquake Hazard Analysis

Additionally, a one-day seminar was opened under the title: Introduction to Risk Management, for the promotion of future utilization of Hazard Maps by providing examples of applications of hazard maps in actual risk reduction initiatives that have been implemented in various regions of the world.

To assess the level of understanding achieved by the local counterpart of the simulation models and the preliminary results, they were asked to present and explain the Study's progress at the international seminar organized with the participation of all related Nicaraguan institutions. The INETER staff had also the opportunity to discuss the uses and applications of the hazard maps directly with the potential users of those maps.

In November 2005, a three-days-short course on seismic motion calculation was conducted. The participants to the course are as follows:

Table 3-14 List of Participants (Earthquake)

Name	Affiliation
Wilfried Strauch	Department of Geophysics
Carlos Guzmán	Department of Geophysics
Guillermo Chávez	Department of Geophysics
Manuel Traña	Department of Geophysics

2) Results

Mr. Carlos Guzmán is the engineer in charge to establish the seismic microzoning map in INETER. He properly understood the procedure of calculation of surface earthquake motion. Then, he developed a new man-machine interface for easy operation of the calculation process. This program covers: 1) grid system generation; 2) calculation of the shortest distance from fault line to the center of each grid; 3) calculation of attenuation and obtain base rock motion of each grid; 4) calculation of surface amplification and obtain PGA at the center of each grid; and 5) generate GIS database file to present on GIS base map. Figure 3-20 shows the covered task by the developed program in the total flow of earthquake hazard simulation. Figure 3-21 show an example of in-

put sheet of the program.

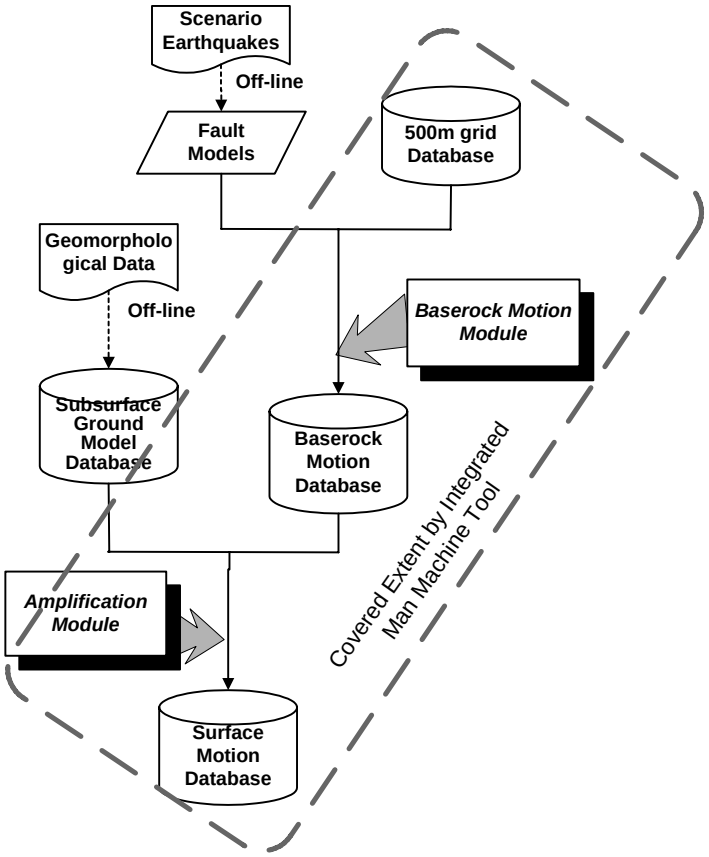

Figure 3-20 Covered Extent by Integrated Man Machine Tool

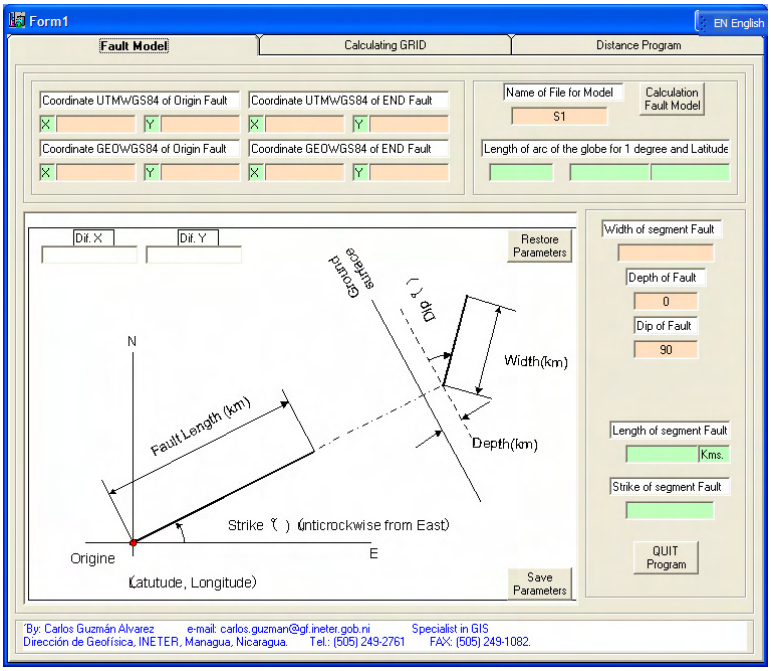

Figure 3-21 Example of Input Screen of Man Machine Tool

Through the technology transfer programs, as discussed in Section 3-2-2, Mr. Carlos Guzman developed the man machine tools for the simulation software. It shows that he understood the calculation procedure well. In the other word, each component of simulation, i.e. setting of fault line, calculation of attenuation, setting of ground model, calculation of amplification and presentation on GIS base map is not including Black Box which can not be theoretically and mathematically understood. Therefore, this simulation software can be applied in other cities in Nicaragua by INETER staff. However, the most obvious problem is the lack of basic and reliable database for determining relevant parameters for simulation. These are:

- Earthquake catalogue with improved location
- Strong motion database compiling the recorded and corrected motions.
- Relational data on the characteristics of past disastrous earthquakes and the characteristics of consequences in terms of damage and loss observed in a particular type of such existing objects as flat lands and slopes, houses, buildings, and industrial facilities.
- Database of quantitative geophysical and geotechnical data of surface soil layers and underlying engineering bed rock.
- Geologic and geotechnical field survey data of active faults

The quality and quantity of currently available data required for the simulation of 500 m grid system are very poor even in Managua area. It is essential and inevitable to acquire and make available those important technical data through extensive and detailed observation and investigation in order to perform a more reliable earthquake hazard simulation.

With the situation above described, it might be presumed that there exists more adverse environment on the necessary information in other areas of concern than Managua area. Therefore, the earthquake hazard simulation method applied to Managua in this project should be carefully extended to other area considering the quality and quantity of existing data.

Education, knowledge and ability of the staff of Seismology Section in the Department of Geophysics of INETER are fairly better than other section and department. Many foreign assistances and contributions have been and being supplied to the Department because they are treating the most of natural hazard affecting to Nicaragua such as earthquake, landslide and volcanic eruption. From these supports and contributions, many new methodology, equipment and software have been carried in the Department. This is one of the reasons of their knowledge and ability.

However, these technologies are limited to individuals in charge of these foreign projects. In order to continue and improve their capability, internal educational scheme in the Department is indispensable.

(2) Volcano

1) Structure and Schedule

The goals of technology transfer for the trainees are to be able to: confirm volcanic areas by aerial photography interpretation; simulate volcanic activities; and produce hazard maps. The Study Team conducted OJT sessions to seven trainees in geography and hydrology departments. The trainees attended the training are listed in Table 3-15.

Table 3-15 List of Participants (Volcano)

Name	Affiliation
Martha Navarro	Department of Geophysics
Antonio Alvarez	Department of Geophysics
Guillermo Chávez	Department of Geophysics
Mayra Guerrero	Department of Geophysics
Marisol Echaverry López	Department of Geophysics
Rosario Avilés Alemán	Department of Geophysics
Armando Saballos	Department of Geophysics

The six of seven trainees did not have previous experience in aerial photo interpretation other than through college courses. One of the trainees has practical experience from the tasks assigned. A six-full-day course was conducted; all the trainees learned as much as they could.

The OJT session on geology and field identification were held twice from July to August in 2003 and May to June in 2004. Six trainees attended.

Table 3-16 List of Participants (Field Identification for Volcanic Hazard)

Name	Affiliation
J. Armando Saballos	Department of Geophysics, Volcanology Section
Guillermo Chavez	Department of Geophysics, Geology-GIS Section
Rosario Avilés A.	Department of Geophysics, Volcanology
Antonio Alvarez	Department of Geophysics, Applied Geology Section
Marisol Echaverry L.	Department of Geophysics, Applied Geology Section
Mayra Guerrero	Department of Hydrology, Hydro-Geology Section

All the trainees did not have experiences in field identification in the volcanic areas.

Photo 3-15 Aerial Photograph Interpretation

2) Results

Interpretation skills come with experiences and they need to be practiced many times to acquire them. The trainees have mastered the basics of all the processes of photo interpretation.

OJTs on methods and theory on simulation and hazard mapping were conducted through discussions on volcanology. Theories and methods on mapping were not studied or discussed in the Geography Department; some parts of the training were hard to be absorbed. Hazard mapping has special theoretical foundations on possible eruption areas

or probability of eruption. This is different from simulation whose results can be derived from mathematical calculations. The special concept or philosophy on hazard mapping was somehow difficult for the trainees; however, through discussion and explanation, the trainees began to grasp what hazard mapping was to be. For the field identification, the trainees learned the basics in a two day training course. For volcano geologic survey, the training was conducted in a selective manner to the trainees participated.

All the trainees had little experience in aerial photograph interpretation; the technology was not widely known. When its use is widely recognized and more aerial photographs are taken, the interpretation skills will be raised. One of the concerns is the number of stereoscopes available in INETER. It was reported that only six pairs of stereoscope were available. There should be more to train and to conduct the work on aerial photograph interpretation.

The staffs in the Department of Geography have not discussed concepts and methods on hazard mapping adequately. There seemed to be an illusion among the staffs that computer software itself satisfied the conditions of hazard mapping. The Study Team recommends that discussions on methods and concepts continue among the staffs to respond to various conditions.

As for the volcano geologic survey, researchers had basic knowledge through education; however, more training and education would be necessary to practice volcanic researches. As an organization, there should be systematic human resource development programs by experts would be necessary for it seemed there was only one researcher capable of conducting geologic survey.

Fundamental data are lacking or low in quality. Even when data exist, they are not disclosed. Training on a systematic method on data acquisition and on organization and integration of the data would be necessary. For this purpose, planners and volcanic researchers or academics need to guide the staffs in the Department of Geography. Further, textbooks and academic journals should be available to establish an environment to foster leaderships in volcanic researches and hazard mitigation planning.

In sum, supports on continuous training on introductory subjects on volcanology, field work, methods on applied mapping using results of calculation, seismic observation being conducted by the Department of Geography will improve capability of the section of volcanology. Most of the trainees, who had taken part in the training sessions, would like continuous technological support strongly.

Photo 3-16 Volcanic Geology Survey

Photo 3-17 Discussion with the Counterpart

(3) Flood

1) Structure and Schedule

The goal of OJT for flood hazard is for the trainees to carry out two dimensional flood simulations. Preparation of data, displaying of the results, creation of hazard maps, and uses of hazard maps were covered in the OJT program.

The types of software used are: mesh-data creation tool for geographical feature model creation; two-dimensional-calculation program; FORTRAN compiler; and a tool for importing into GIS. Sources of material used are: the manuals of a series of procedures; data used for training; CD which stored all information; and hazard map data. Preconditions of OJT are: 1) the source codes for the simulation are written in Japan and provided without a fee and compiler is added to the program; 2) a computer required for calculation is to be the one provided through the Study or by the counterpart.

From the Water Resource Bureau and Hydrology Section, seven trainees were selected.

Table 3-17 List of Participants (Flood)

Name	Affiliation
Luis Palacios Ruíz	Department of Hydrology
Isaías Montoya	Department of Hydrology
Luz Marina Rodríguez	Department of Hydrology
Erwin Rueda	Department of Hydrology
Carlos Collado	Department of Hydrology
Jamil Robleto	Department of Hydrology
Ena Gámez Balmaceda	Department of Hydrology

In OJT carried out during the fourth work in Nicaragua, the major focus was the simulation technique. The training was conducted using an operation manual and sample data. The operation manual and sample data were prepared during the fifth work in Japan. The operation manuals and data were store in CD and provided to the trainees. The operations manual is included in the separate volume--Manuals of Hazard Mapping.

Luis Palacios, Luz Marina Rodriguez, Erwin Rueda, Carlos Collado, Jamil Robleto, and Ena Gamez were the participants to the training sessions. The schedule is listed below.

Table 3-18 Training Schedule (Flood)

Date	Hour	Content
6/2 (Thurs.)	10:00-12:00	Introduction and demonstration
6/3 (Fri.)	10:00 - 12:00	GIS and the geographical feature model creation approach using DM data
6/6 (Mon.)	10:00-12:00	Hydrological-data preparation
6/7 (Tue.)	10:00-12:00	Contents of the program and compilation methods
6/8 (Wed.)	10:00-12:00	Methods of importing the results to GIS and of expressing in a thematic map form.

Photo 3-18 Workshop 1

Photo 3-19 Workshop 2

In OJT sessions carried out during the 5th work in Nicaragua, hazard map preparation and utilization of the maps were focused as the study items.

Luis Palacios, Isaias Montoya Blanco, Luz Marina Rodriguez, Erwin Rueda, Carlos collado, and Jamil Robleto participated to the OJT sessions. The schedule and contents are shown below.

Table 3-19 Schedule of Technology Transfer (Flood)

Date	Hour	Content
10/07 (Fri)	10:00-12:00	Introduction and schedule
10/14 (Fri)	10:00-12:00	Discussion on draft hazard map
10/21 (Fri)	10:00-12:00	Discussion on draft hazard map
10/28 (Fri)	10:00-12:00	OJT on hydrological - statistics analysis (hydrological statistics analysis)
11/04 (Fri)	10:00-12:00	Discussion on draft hazard map

Photo 3-20 Workshop 3

Since there was a request on the hydrological-statistics analysis during the fourth work, the training was conducted on 10/28. Isaias Montoya, Jamil Robleto, Carlos, and Luz took part in the session. The session title was the practice the statistics probability calculation (computation method of plan rainfall) using rainfall data from sample data. Source materials provided were: probability calculation program; plot program; explanation on procedures and program (English), and probability paper

The program is the gratis software which can be obtained on the Internet, and is created on the macro of Microsoft Excel. The Study Team translated the probability calculation program into English.

2) Results

Simulation Technique

During the fourth work in Nicaragua, training on flood simulation was conducted. For the same members, a two-hour training session was conducted for five consecutive days. Teaching materials were prepared in Japan in advance; a young assistant engineer was dispatched. Since two persons covered the sessions, explanation and training during the training went very smoothly.

Since time, resources and equipment were limited; unfortunately, all the technology to be transferred to be self sufficient was not fully achieved. The contents covered were mapping data, GIS, computer programming, language, hydraulic and etc. To understand all the aspects of the flood simulation, broad knowledge and experiences were required. It seemed that those who understood and performed all the procedures alone were not found among the trainees since the trainees' basic knowledge and background were not the same. However each person's capability of understanding and specialties are sufficient to comprehend each procedure of the simulation. Therefore, when tasks were divided and the problems were tackled as an organization, the technology transferred would be utilized fully. A systematic approach to organize the problems would

be necessary based on the situations in Nicaragua using the materials provided. At the same time, the technologies need to be practiced in their daily work to enhance skills of their own.

Hazard Map Preparation and Uses

Through the discussions and explanation on the draft hazard maps, technology was transferred. The fundamentals of mapping, contents to be included, and considerations to users were the types of technologies accumulated in Japan to be introduced in Nicaragua. One of the participants went to Japan for training. The experience and information acquired in Japan were helpful in linking to the discussions in Nicaragua. The absorptive capacity was already high because of the training in Japan. It was reported that in INETER, there was not enough discussion on the subjects. It was to be valued that the trainees took part in the discussions with interests and wills of utilizing the hazard maps, and the new type of hazard maps that integrates Japan and Nicaragua came to reality.

Hydrological-statistics Analysis

Using the actual data for the hazard map preparation as sample data, the trainees conducted the rainfall probability calculation by manual operation. After the operation, the calculation was conducted using a computer program. The procedure seemed to be comparatively simple and it was easily understood. However, since some fundamentals in hydrology was lacking, it was necessary for the trainees to study theories of statistical analysis based on the actual data in INETER and to grasp characteristics of Nicaraguan hydrology.

(4) Tsunami

1) Structure and Schedule

On the job training was made in INETER, for counterpart in geophysical and hydrology department, to understand the detail of model development and methodology of hazard map development. The contents of the course are as shown in Table 3-20.

Table 3-20 Topics and Items of OJT Course

Day	Topic	Date
1	Modeling	October 20, 2005
2	Calculation	October 21, 2005
3	Calibration	October 25, 2005
4	Plotting	October 27, 2005
5	Implementation	November 1, 2005
6	Evaluation	November 3, 2005

2) Trainees

Two staffs from geophysics department and three staffs from hydrological resources department participated in the OJT as listed in Table 3-20.

Table 3-21 List of Participants

Name	Title
Wilfrield Strauch	Department of Geophysics
Luis Palacios Ruíz	Department of Hydrology
Manuel Traña	Department of Geophysics
Luz Marina Rodríguez	Department of Hydrology
Carlos Armando Collado	Department of Hydrology
Carlos Ramos	Department of Hydrology

3) Problems and solutions

Members in geophysical department are very busy with routine monitoring works and other projects in INETER, though they have good knowledge of Tsunami, good experience of programming and GIS operation. As basic methodology was explained in last time, calculation process and evaluation is explained in depth this time to geophysical department staffs. Data files for topography model, program source code, and plotting data in GIS format are given for the exercise.

On the other hand, staffs in hydrological departments had limited knowledge on Tsunami and programming, though they have experience in GIS. A series of sessions of lectures, one hour for each session as shown in Table 1, are given with exercises. They are expected to explain the methodology as well as limitations when they are asked from users outside INETER, and run and modify other cases.

Due to the limitation of time, training to the counterpart was limited. However, they become familiar with Tsunami topics, and are expected to explain the methodology and limitations when questions arise, and to study other cases with their understandings if necessary. The recommendations to future development are as follows.

- Topography model improvement

In this study, best available topography data to date is used to develop topography model. However, it is found that density of data is still limited, especially in near coast where data with sufficient distribution density is required to develop a 100 m sized grid. It is strongly recommended to conduct bathymetry survey in the near future, at least in areas where population is concentrated along the coast. For this, good collaboration between geophysical department and hydrological resource department is required.

- Field survey

For a reliable simulation basic data gained from disaster survey is very important. Though the field survey for the 1992 Tsunami was done by mainly foreign researchers, such studies should be done by Nicaraguan by themselves in the next event. For this, training of field survey should be done. Additionally, hearing from residents is recommended to document disaster memory among local residents for educational purpose, as well as to record scientific data.

- Hazard map development

As INETER is a scientific research institution, its interest in hazard map is rather limited to do simulations. The purpose of developing hazard map should be discussed within INETER and with related institutions.

- Trainings to other staffs

There is no staff currently assigned uniquely to Tsunami study, and the number of trainees was rather limited this time. It is expected that contents provided in training should

be transferred to other staffs within INETER to promote basic understandings.

- Application to disaster prevention

The use of hazard map for disaster prevention, territorial planning department in INETER and SINAPRED can be important elements for land use planning. Besides, cooperation with related institutions such as INTUR, EPN, MTI, MARENA, and MIFIC etc are important. It is recommended to form a working group including these institutions and to incorporate preventive measures in main activities in each sector.

- Learning from international experiences

As major Tsunami is rare phenomenon, experiences in other countries and access to the advance in Tsunami study in international level provide good opportunities to its better understandings. For this, joining International Tsunami society (www.sthjournal.org), or studying experiences in other countries, such as Japan, US, Hawaii, Chile, Indonesia etc is recommended.

(5) Additional Bathymetry Survey at Masachapa Coast

For Tsunami Hazard Analysis, the field survey for rigorous sounding of the sea bottom pro-file was performed for one month from February 8th through March 7th, 2005 in response to the request of the INETER as written in the minutes of September 10th, 2004.

1) Structure and Schedule

The basic survey planning started in early February in 2004. Technical items were included such as:

- How to decide the covering area of the bathymetry survey necessary for connecting the available NGDA data which lacks the resolution near coastal zone
- How to determine the interval, orientation, maximum length of sounding lines
- Choice of portable computer used on board and on land, and connected to the available sounding apparatus in INETER for maintaining necessary
- How to put staff on duty from the view point of safe operation during the survey and selection of communication system between the launch and on land base

List of participants and work period are tabulated in Table 3-21.

Table 3-22 List of Participants (Bathymetry Survey)

Name	Affiliation
Luis Palacios Ruíz	Department of Hydrography
Sergio Antonio Cordonero Gonzáles	Department of Hydrography
Francisco Javier González	Department of Hydrography
José Tomas Valle Paz	Department of Hydrography
Juan José Martínez Aguirre	Department of Hydrography

2) Results

Lessons learned and countermeasures taken were as follow:

- To hire the launch which has been frequently used and well designed for various marine survey including bathymetry survey of shallow water and a captain who has good experience for various marine survey from a Marine Construction Company EPN.
- Trial and show up how to build-up an ideal PC system to be used on board. It is expected to work well with ideally less battery power consumption and reducing the expenses of power back up devices and maintenance work.

- The settlement of extension length of sounding survey lines was tried to determine on the first day of preliminary sounding by judging the limit of echo reflection from sea bottom to the sensor of sounder.
- Settlement of the temporal tide scale at Montelimar pier and continuous measurement of tide level at every 20 minutes were tried. The observed record was compared with the predicted astronomical tide data of Puerto Sandino based on the Lower Low Water Level at Puntarenas in Costa Rica. It was found that observed tide indications were very consistent with these tidal data. Based on this fact, the tidal change of the working days was measured with every 30-minutes interval throughout the survey period and the data were used to correct the sounding data.

Photo 3-21 Cabin of the launch to install PC and device with the Leader and Supervisor

The Bathymetry Survey Team could finish the field-survey just on March 7th as scheduled and also submitted corrected field data to the Study Team.

The survey team had the meeting to reconcile the lessons learned from this time of survey for their future extension to their work on the day of completion.

Because of the survey of this time was the first achievement of bathymetry survey to acquire practically engineering data completed under cooperation of INETER and EPN with the financial support of JICA, the both institution concluded an agreement of cooperation in the technical area in the future.

3-2-3 Training in Japan

A total of eight INETER staff was invited to Japan, in two groups, to receive training. The training courses were designed to provide the trainees a general review of what they had learned about topographic map and hazard map elaboration in the OJT sessions in Nicaragua. Below are the names of the participants and the period of their stay in Japan.

Table 3-23 Training in Japan

Session Name	Trainee	From	To	Location
Hazard Mapping 1	José Manuel Traña Pérez	2005/1/10	2005/2/08	Tokyo
Hazard Mapping 1	Guillermo Chávez	2005/1/10	2005/2/08	Tokyo
Digital Photogrammetry 1	Fernando Osorio	2004/11/22	2004/12/22	Tokyo
Digital Photogrammetry 1	Josué Donado	2004/11/22	2004/12/22	Tokyo
Hazard Mapping 2	Carlos Guzmán	2005/9/1	2005/9/30	Tokyo
Hazard Mapping 2	Jamil Robleto	2005/9/1	2005/9/30	Tokyo
Digital Photogrammetry 2	Mayra Silva Díaz	2005/9/1	2005/9/30	Tokyo
Digital Photogrammetry 2	Isidro Jarquín Vélez	2005/9/1	2005/9/30	Tokyo

3-3 Seminars

(1) The Final Seminar

As the final event of the project and to present the study results to the Nicaraguan authorities and institutions, a seminar was implemented at Hotel Crowne Plaza – Centro de Convenciones on August 17, 2006 from 9:00 AM to 4:15 PM. National, and local organizations were invited. The seminar aimed at not only presenting the results of the study but also at helping the participants to get familiar with the maps' contents and possible applications.

The seminar was organized by INETER and the JICA Study Team. From INETER, the Departments of Geodesics and Cartography, Geophysics, and Hydraulic Resources participated in the organization of the seminar. Several meetings were held previously to the seminar to coordinate and prepare the event.

1) Participants

A total of 106 participants attended the seminar representing relevant Nicaraguan institutions including national, local, and the Nicaraguan chapters of international organizations.

Photo 3-22 Seminar Participants

2) Objectives and Program

The seminar had the following three specific objectives:

- To present the project results
- To present and discuss possible applications of those results
- To provide the participants with the opportunity to use and get familiar with the maps elaborated by the project

To achieve these objectives, a program was prepared that included the presentation of the maps and results produced for each of the five components of the project: Basic Maps (including the 1:50,000 map for the Pacific Coast and the 1:5,000 for Managua Metropolitan Area), Earthquake Hazard, Tsunami Hazard, Volcanic Hazard, and Flood Hazard. In each presentation, four aspects were taking into consideration:

- Short background on the technical process utilized for the map preparation
- Presentation and explanation of the prepared maps
- Description of possible applications of the presented results
- Listing of some of the potential users of the presented results

Additionally, a session was included to present the recommendations produced by the JICA-INETER study group on what should be done next to continue the work started by the project, promote the utilization of the produced results, and improve disaster risk reduction in Nicaragua. The session included an open forum in which the participants commented on the proposed recommendations and added their own suggestions.

Finally, and in order to help the participants to get more familiar with the project results and interact with the JICA-INETER study group, the seminar program included a poster session in which all the produced maps were exhibited. The seminar participants could try computer demonstrations and simulations especially prepared for this seminar and get in depth insights on the preparation and applications of the project results.

Photo 3-23 Preparation of the Basic Maps Explained by INETER Staff

Photo 3-24 The Produced Maps and Simulation Programs Presented at the Poster Session

Photo 3-25 The Maps Explained by INETER Staff to the Seminar Participants

3) Suggestions and comments from particiants

The seminar participants had the opportunity of asking questions and giving comments and suggestions in questions-and-answers sessions after the presentations and at the open forum in which the recommendations on what should come next were presented. Examples of suggestions and comments given by several institutions are presented below:

Fire Department:

- Since communications are crucial in times of disaster, a method should be developed to integrate the communications system into the interactive map of disaster emergency facilities prepared by the project. This information could be used for the delineation of Early Warning Programs.
- The contribution of private sector facilities and participation should also be included in the database of disaster emergency infrastructure.

INETER

- The project products and information should be used to design and implement new development programs for the country.
- In order to coordinate the work at national level, INETER should receive, revise, and approve the cartographic information produced by other institutions.

León Municipality

- To ensure proper utilization of the project results, local authorities and other potential users should receive the necessary training and coaching. This will allow the users to add new information, tailor the maps to their specific needs and/or edit the produced maps.

Ministry of Public Health

- Process and methodologies should be established to facilitate the feed back, updating and information exchange of the GIS database prepared by the project.
- An institutional framework should be designed and implemented that facilitates the distribution and utilization of the project results.

Ministry of Defense

- The users should be able to interact directly with the GIS database from the web provided that the necessary security measures are put in place.

- Unrestricted access of the data by the public could result in the wrong use of the information, which could compromise even the national security.

4) Final Remarks

It was recognized that the information provided by the project results is basic information that is crucial in the process of development planning, investment decisions, disaster risk reduction and general decision making at both public and private levels.

There was a good reception of the presented results as well as general approval of their quality, accuracy, and usefulness. The opportunity provided by the poster session to get more specific information on the maps and their preparation processes was especially appreciated by the seminar participants. This interest demonstrates the existing demand for this information.

While there was a general consensus on the importance and value of the project results, the participants agreed on the fact that this is just a starting point and there is still a great deal of work to be done before Nicaragua has the necessary information for a proper planning of its development, investment, and social programs. The transfer of knowledge and technology that was implemented by the project will be crucial for the continuation of the studies initiated by this study.

To achieve full benefit of the products of the project, it is crucial to ensure their effective dissemination among all the potential users in the public, private, and civil society sectors. Communication and dissemination mechanisms should be developed for both the digital and hard copy versions of the results.

(2) International seminar

As part of the activities included in the Study, an international seminar was held on June 9, 2005 that comprehensively covered the contents and progress of the Study. National, local, and international organizations were invited. The seminar aimed at not only presenting the results of the study but also at promoting sustainable production of hazard maps and effective uses of both digital and hard copy maps.

The seminar was organized by INETER and the JICA Study Team. From INETER, the Sections of Geodesics and Cartography, Geophysics, and Hydraulic Resources participated in organizing the seminar. Several meetings were held previously to the seminar to coordinate and prepare the event.

1) Participants

A total of 90 participants attended the seminar representing the related Nicaraguan institutions including national, local, and the Nicaraguan chapters of international organizations. The participants included international guests from related organizations in Honduras, Guatemala, and Costa Rica.

2) Objectives and Program

The seminar had the following three specific objectives:

- To present the progress made by the Study and its partial products;
- To present and discuss the work to be carried out in the Study's second part; and
- To get suggestions and comments from the audience.

To achieve these objectives, a program was prepared that included the presentation of the progress made and the results obtained for each of the five components of the Study: Basic Maps, Earthquake Hazard, Tsunami Hazard, Volcanic Hazard, and Flood Hazard. Additionally, and in order to collect views and recommendations of the potential users, a discussion session was implemented with representatives of the various sectors that would utilize the maps produced by the Study. The invited sectors for the discussion

were: mitigation and risk reduction, emergency response, research and investigation, lifelines, local authorities, and infrastructure and development.

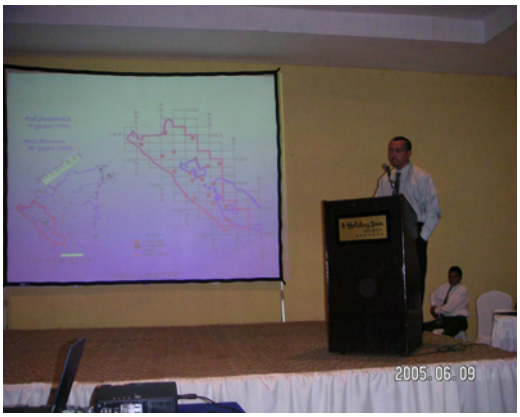

Photo 3-26 Presentation of Cartography Section

Photo 3-27 Presentation of Volcanic Hazard

Photo 3-28 Presentation of Tsunami Hazard

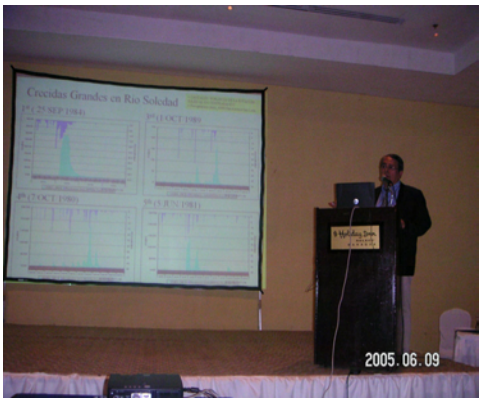

Photo 3-29 Presentation of Flood Hazard

Photo 3-30 Presentation Earthquake Hazard

Photo 3-31 Partial view of the seminar participants

3) Participant survey

Taking advantage of the fact that most of the related Nicaraguan institutions as well as several Central American and international organizations were represented at the seminar, a questionnaire was developed to collect the participants' opinions and recommendations on: a) the preliminary project results presented at the seminar; and b) possible applications of those products for disaster reduction. The institutions that should be in charge of implementing those applications and the characteristics the maps should have to be utilized for those applications.

The completed questionnaires were collected at the end of the seminar and would be utilized to produce the Study's final recommendations on the possible applications of the maps and information produced by the study.

4) Main conclusion and recommendation

1 It was recognized that the information provided by the Study results is basic information that is crucial in the process of decision making at both public and private levels.

2 While these maps provide basic information, the participants indicated that it is necessary to go from the studies and the maps to actual actions. The maps have to be utilized to prepare concrete action plans that must be accompanied with the necessary strategies for implementation to ensure the actual application of these studies.

3 These studies cover just about 15% of Nicaragua's territory. There is almost no work done for the central region and the Atlantic Coast of the country. It is necessary to use the experience of this project to develop similar works for other areas of Nicaragua. Therefore, the transfer of knowledge and technology is crucial for the continuation of the studies initiated by this project.

4 For these studies to be used effectively, the institutional system for disaster reduction needs to be strengthened. It is necessary to improve the coordination and communication among the various institutions. Mechanisms should be developed to facilitate the exchange and sharing of information among the institutions.

5 To improve the cooperation among institutions, other related institutions could be incorporated in the continuation of this project. The universities and research centers are among the institutions suggested as logical collaborators to be considered for inclusion.

6 The local authorities are the logical end users of the results expected from this project. However, for them to be able to utilize these products, it is necessary to implement capacity building programs that would provide them with the knowledge required to apply the Study results to urban planning, risk reduction, and public investment decision making.

7 It was also recognized that for any application of the Study results to succeed, it is necessary to have the active participation of the entire community. All the produced products should respond to the community's needs so that their application and utilization can have the necessary support to be successfully implemented.

8 In order to allow the utilization of the Study products by the largest possible number of users in the community, the produced maps and information should be presented in a language that is easily understood by non-technical people. The preparation was suggested of an accompanying glossary explaining the technical terms included in the produced maps and information.

9 Given the importance of the expected products of the Study, it is crucial to ensure their effective dissemination among all the potential users in both the public and private sectors. Communication and dissemination mechanisms should be developed for both the digital and hard copy versions of the results.

10 To ensure a wide utilization of the results by all the related institutions, special care should be taken in the compatibility of the digital results with the systems

utilized b other institutions. Formats and conventions should be standardized at the national level to facilitate exchange and combination of information among institutions.

11 The new information produced by projects like this should be incorporated in formal education to ensure that the community has an accurate view and knowledge of their country's realities. The Geography textbooks that are utilized by the school system, for example, should be revised to incorporate the new information produced by this and similar projects.

(3) INETER-National University of Engineering-JICA Study Team Seminars

On February 10th, 2005, two seminars were held at the National University of Engineering (UNI), organized by INETER, UNI and the JICA Study Team.

The first seminar was on the impact of the Indonesia Tsunami of December 2004 and its consequences on the Central American region and was presided by the Mayor of Managua City and by Mr. Cristóbal Sequeira, Executive Secretary of SINAPRED. Dr. Carlos Villacís, the members of the Study Team were invited to present a report on the main findings and recommendations of the Kobe's World Conference on Disaster Reduction and their implications for Nicaragua. The event was well covered by several representatives of the mass media.

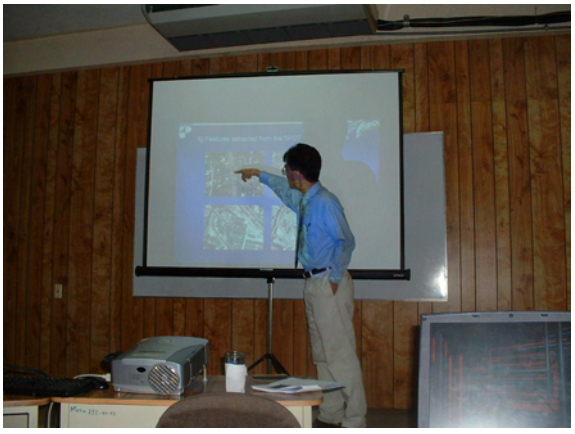

Photo 3-32 Presentation by Expert

Photo 3-33 Question by Participant

In the evening, another seminar was held at the National University of Engineering (UNI) that was supposed to last from 5 pm until 8 pm. The seminar continued until later than 9 PM and many participants stayed until the end. The presentation of Mr. Kakiuchi on the use of satellite imagery for mapping and GIS application for disaster reduction in El Salvador was useful. To test the results of our technology transfer activities, members of the local teams made also presentations. Mr. Alvaro Amador, from INETER-Geophysics, made a presentation on the estimation of structural vulnerability using cadastral data, and Ms. Ena Gamez made a presentation on simplified tools that use GIS principles to estimate urban risks.

(4) Seminar at Managua City

In collaboration with the Municipality of Managua and the National University of Engineering, a seminar was held at Managua's City Hall to present a progress report of the JICA-INETER project, learn about the City's program for disaster reduction, and propose activities for a closer relation and collaboration between INETER, Managua City and the National University of Engineering. The seminar was held at the City Hall's

auditorium on February 17th from 10 AM to 12 noon.

The seminar participants included representatives of the Mayors of Managua, Tipitapa, Ticuantepe, Ciudad Sandino and El Crucero as well as the Director of SINAPRED, the JICA representative and representatives of other institutions such as, the Ministry of Environment and Natural Resources, Civil Defense, Ministry of Health, etc.

The opening ceremony included speeches by the General Secretary of Managua City, the JICA Representative, and the President of the National University of Engineering.

Photo 3-34 Opening Ceremony

To put the seminar under the national context of Nicaragua, Mr. Tito and Sequeira, Director of SINAPRED, presented the main results and recommendations produced by the recent World Conference on Disaster Reduction held in Kobe Japan. Mr. Sequeira emphasized the problems that Nicaragua would face if its coasts were affected.

Mr. Fujio Ito, the Leader of the Study Team, presented a progress of the Study and pointed out the need to expand the study area in Managua City to include the Southern Area where most of the flood problems are initiated during the rainy season.

Photo 3-35 Mr. Ito's Progress Reporting

A representative of Managua City presented several risk reduction activities being implemented by the local government. Those activities are the result of a study that determined the city's 64 most vulnerable sites. The Municipality is working on 19 of those 64

sites with the financial assistance of, especially, MARENA.

Dr. Carlos Villacís, of the JICA Study Team, explained the increasing risk caused by the fast growth of cities around the world, especially in developing countries, and pointed out the need to incorporate risk management as an integral part of urban planning and development programs. He then presented a simplified risk assessment tool whose application is proposed to train local authorities in Nicaraguan cities and give them the necessary knowledge to better utilize the maps that are going to be produced by the Study.

After these presentations, the floor was opened for discussions with the participation of the participants and the presenters. The audience had a very active participation that produced the following main recommendations:

(a) The extension of the mapping area must be implemented to have the necessary information for the design and construction of flood control works.

(b) The Municipality indicated that it is ready to provide the necessary funds for this implementation

(c) There should be a closer interaction between the Municipality and all the other organizations working on risk reduction initiatives, including SINAPRED and INETER

(d) Regular programs of seminars to exchange information and promote collaboration should be implemented

(5) Workshop on Preparation of Hazard Maps and Application for Risk Reduction in León, Nicaragua.

The workshop was held on August 23, 2004 at House of Protocol UNAN - León. The organizations participated were: León City, INETER and the Study Team.

The workshop had three specific objectives:

- To present the JICA-INETER Study, its expected products and their possible applications to the authorities and the community of León City;
- To present the current local capacity and the advance achieved in disaster vulnerability reduction in the City of León; and
- To discuss and produce recommendations to ensure that the Study results respond to the necessities of the City of León and increase the local disaster reduction capacity.

The approximately 110 workshop participants were divided into four working groups to produce recommendations on specific aspects that would increase the Study's benefits for disaster risk reduction in León Municipality. The four groups formed in the workshop were the following ones:

GROUP 1: Application of the Study results and their potential users.
GROUP 2: Moving from hazard evaluation to risk management
GROUP 3: Participation of the various community sectors (public, private and civil society) in the Study implementation
GROUP 4: Accessibility and dissemination of results; Use of the products and the implementation of the Study for community education and awareness

Photo 3-36 Open Remark by Mr. Akihito Yamada

Photo 3-37 Workshop Participants

1) GROUP 1: Application of the Study results and their potential users

Table 3-24 Identified Potential Users

1. MINSA	8. MIFAMILIA	15. RADIOS (UREN)
2. MAGFOR	9. MTI	16. LEÓN MUNICIPALITY
3. MARENA	10. RED CROSS	17. UNAN – León
4. NATIONAL POLICE	11. NGO'S	18. CIVIL DEFENSE
5. FIRE DEPARTMENT	12. ENITEL	19. COMMUNITY LEADERS
6. VOLUNTARY FIREMEN	13. DISNORTE	20. INTA
7. MECD	14. ENACAL	

Possible applications of the Study results for the specific needs of León Municipality

Table 3-25 Possible Applications

Before disaster	During disaster	After disaster
Risk Evaluation (to identify the risk)	Application of Mitigation actions	Evaluation of Damages and needs
Training of local and municipal authorities	Security	Recovery monitoring and evaluation
Equipment	Good communication flow	Rehabilitation actions
Mitigation Actions	Monitor the situation	Bring up to date maps and emergency plans
Preparedness evaluation and monitoring		

(a) The Municipal Commission for Disaster Prevention, COMUPRED, will provide the JICA Study with the necessary materials for the elaboration of the maps.

(b) The information on the maps must be presented in simple language to facilitate its understanding by the community.

(c) The maps have to be prepared in sizes that facilitate their use (pamphlet-size/not so big)

(d) A glossary of technical terms should accompany the maps.

(e) Smooth communication among the related institutions should be promoted during

the preparation of the maps.

(f) Reference points should be added to the maps (towns, geographic landmarks, historical buildings, etc.) to facilitate their utilization.

(g) COMUPRED will facilitate communication and coordination, in collaboration with mass media, utilizing internet, phone, and any other means of communication.

2) GROUP 2: Moving from hazard evaluation to risk management

This group produced the following recommendations:

(a) Implementation of long-term processes for effective risk reduction; Going from projects to long-term processes

- Preparation of a database of the available technical resources, natural disasters-related information, and the risk management activities that have been implemented so far.
- Evaluation of the physical and social vulnerability of the municipality.
- Definition of responsibilities and of ways to incorporate the relate institutions in the process.
- Facilitation of coordination and communication among the organizations involved in risk reduction activities.
- Creation of a commission that coordinates and leads risk reduction activities.
- Systematization of the information on natural disaster experiences.

(b) Use of this project to complete (rather than repeat) existing information

According to law 337, the Municipal Government of León is responsible of reducing the vulnerability and it presides over the disaster prevention committee and all related institutions, such as ONGs, INETER etc.

All the existing information should be systematically compiled and integrated into a database with the participation of all related organizations. Training should be provided and sustainability ensured.

(c) Incorporation of the risk management in development plans and municipal programs

COSUDE, INIFOM, and SINAPRED are revising the guidelines for risk management programs to be adopted by the municipalities to ensure sustainable development. The community should be informed about this process.

(d) Sustainability of risk reduction activities; required legal, financial and political frameworks

The necessary legal and institutional studies should be performed to define the specific responsibilities of all the related institutions within the risk reduction process.

Creation of the legal and regulatory frameworks that would allow the implementation of the results and recommendations produced by the scientific studies and would help control the development of new residential, tourist, and industrial areas.

Photo 3-38 Presentation from the Study Team

Photo 3-39 Group Discussion

3) GROUP 3: Participation of the various community sectors (public, private and civil society) in the Study implementation

This group produced the following recommendations: Active and continuous participation of the different social sectors in this project; Provision of information; validation of results, establishment of necessities and priorities.

- Utilization of law 337, art. 20-21 to promote the participation of the community sectors
- Strengthening of COMUPRED
- Facilitation of information exchange including validation processes.
- Development and negotiation of financial alternatives
- Community awareness raising through the optimal utilization of existing communication resources (example bulletins)
- Implementation of a regular program of meetings, discussions, and simulation exercises.

4) GROUP 4: Accessibility and dissemination of results; Use of the products and the implementation of the Study for community education and awareness

This group produced the following recommendations: Identification of effective means for the dissemination of the results and the new knowledge generated by the Study; Evaluation of existing dissemination means and their effectiveness; Identification of alternatives.

Preparation of an inventory of existing dissemination means and evaluation of their effectiveness.

These could include:

- Ham radio associations
- UNAN-León Radio system
- Civil Defense Radio system
- COMUPRED Radio system
- National Police Radio system
- MINSA Radio system
- Local radio stations of departmental coverage
- Available Web pages
- Journalists and their professional associations.
- Voluntary Personnel of MOVITERRA

Alternatives:

- Identification of mechanisms to assure that potential users of the Study products know about their existence and have access to those products.
- Improvement of frequencies' regulations
- Revision of the physical conditions of existing communication media
- Inventory of existing refuges
- Promotion and regulation of multi-institutional and multi-sector coordination
- Preparation of simplified versions of scientific maps for the community
- Implementation of an early warning system in the León municipality

Mechanisms to facilitate access to expected results:

- Strengthening of educational programs presented by radio stations
- Implementation of educational and awareness raising campaigns for local authorities and public institutions (MINSA, MECD, MARENA, National Police, National Army).
- Implementation of a training programs on early warning systems for fire and seismic hazards.
- Revision of the existing and on-going disaster mitigation programs and projects.

Dissemination means and formats

- Implementation of a regular program of community workshops
- Implementation of grass-root level programs (final beneficiaries)
- Preparation of simple, informative, and accessible maps
- Establishment and training of properly equipped brigades for dissemination of results
- Establishment of a regular program (twice a year) of simulation drills
- Facilitation of the preparation of community-prepared hazard maps and disaster prevention and mitigation plans
- Incorporation of risk management into urban development planning
- Community education
- Incorporation of disaster prevention and mitigation into the official school programs
- Training of the members of the education sector including the parents' committees, school councils, and student leaders.
- Establishment of a regular program of simulation drills at educational institutions (twice a year)
- Implementation of training programs for members of the civil society.
- Possible incorporation of the CONDELEÓN's GIS information into the municipality's risk reduction activities

Vulnerability Reduction Needs In the City of León

Additionally, the workshop participants identified and discussed the many limitations – several of them being basic ones – that hamper León Municipality's efforts to reduce disaster risk to acceptable levels. A list of some of the most important identified needs is presented below.

- Lack of necessary equipment and materials to provide appropriate disaster emergency response
- Lack of information sharing and coordination among institutions
- Lack of transportation equipment for emergency response
- Lack of proper training and access to updated information for personnel of the COMUPRED

- All the current activities are limited to preparation for the emergency. There is no work on disaster prevention and mitigation
- Proper access to Internet and LAN connectivity would increase COMUPRED's work productivity and efficiency.