INETER is the Nicaraguan mapping agency. One of the primary responsibilities of INETER is to maintain and update the geodetic network of the country. The country's network of geodetic control points consist of 50 first order control points, 12 of which are located in Managua. The locations of the current network of geodetic control points are given according to the North American Datum of 1927, which is based on the Clarke spheroid of 1866. One of the first order control points located in Managua has also been tied into the worldwide network of geodetic control points, which are related to the World Geodetic System of 1984 (WGS 84). Nicaragua also has a fairly dense network of secondary and tertiary geodetic control points throughout the country. INETER standards dictate that first order control points have an accuracy of +/- 5cm, second order control points have an accuracy of +/- 10 cm, and third order control points have an accuracy of +/- 20cm.

What is a datum?

Horizontal and vertical datums are networks of control monuments and bench marks whose horizontal positions and/or elevations have been determined by precise geodetic control surveys. These monuments serve as reference points for originating subordinate surveys of all types. In the past, datums have been based upon a locally best fitting ellipsoid (an ellipsoid that is a mathematical approximation of the earth's surface). With the advent of GPS, a world wide reference system (WGS 84), an earth-centered, earth-fixed, three dimensional coordinate system, with an ellipsoid that best approximates the surface of the earth as a whole, has been developed.

Since GPS data relate to WGS 84, all processing of data should be done in this system and then transformed into the local reference system. In order to do this, the relationship between WGS 84 and the local reference system must be computed. This can be done if the position of the monuments in the network of geodetic control points is known in both systems. In Nicaragua, the U.S. Defense Mapping Agency has determined the WGS 84 location of one first order control point in Managua. The rest of the first order control points' WGS 84 coordinates were to have been determined by April of 1995, but this has been delayed until 1996.

Unfortunately, INETER does not have current data on many untitled parcels. And even on properties which do have titles, boundaries have changed, lots have been parcelized into small houses, and public lands and rights of way have been invaded.

What are orthophotographs?

Orthophotos are orthographic photographs, or, in other words, they are planimetrically correct photographs. They do not contain the scale, tilt, and relief distortions that characterize normal aerial photographs. In short, they are "photomaps." Like maps they have one scale, even in varying terrain, but unlike maps, the terrain appears in "true," photographic, detail, not as representative lines and symbols.

Orthophoto production has traditionally been a time consuming process, and it is not unusual for a lag time of one and half to two years between the taking of aerial photographs and the delivery of the finished orthophotographs. Complicating this, countries in the developing world often have last second conflicts over secrecy rules with military authorities that sometimes delay orthophoto production.

On the positive side aerial photographs allow residents to point out their properties to surveyors, giving a sense of participation, and orthophotos are currently being used with great success to title small, fractured agricultural parcels in Paraguay at 1:5000 scale. Orthophotos are especially useful when property boundaries are clearly identifiable on air photos. However, the air photos usually have to be taken during the dry season.

INETER is also the implementing agency for the municipal cadastres. The U.N. HABITAT Program has purchased equipment for the Municipality of Managua, which is currently being used at INETER. As part of the project, INETER is taking all the maps of Managua and digitizing them. INETER already has a digitizing table, an Integraph pentium personal computer with one gigabyte of hard-drive and twenty megabytes of RAM, a Hewlett Packard plotter, and a bubble jet printer. The software being used is Integraphs Micro Station (a CAD system) and SysCAD, a relational database.

INETER's professional staff appear highly qualified and have generally done impressive work on cadastral components of the World Bank project underway.

A review of INETER's work in urban areas shows that dispute resolution has not been a problem. The vast majority of property boundaries are clearly visible. Further, INETER has always notified local community representatives of the institute's work prior to commencing with the surveys. As a result, virtually no boundary disputes are found and surveying proceeds unhindered.

1. Summary of INETER's main constraints.

The major constraint facing INETER is financial: they simply lack the manpower and modern tools to carry out their tasks. They continue to use traditional technology of theadolites and tapes to survey in parcels.

In terms of the Vice Minister for Property's directive of surveying and titling 100,000 parcels in 18 months, INETER is not prepared. Just Managua is 312 square kilometers. At 1:5000 scale, 600 photos would be needed. Using tradtional photgrametry techniques with no automation, the survey process for the 75,000 Managua lots would take about three years.

What is a CADD?

Computer aided drafting and design (CADD) software provide the capacity to design and draw maps and diagrams in real-time using a computer.

What is a GIS?

A geographic information system (GIS) is a system of hardware, software, data, people, organizations, and institutional arrangements for collecting, storing, analyzing, and disseminating information about areas of the earth; also a data base management system used to store, retrieve, manipulate, analyze and display spatial information. (Software used in a GIS often consist of relational data base software tied to CADD software.)

What is an LIS?

A land information system (LIS) is a geographical information system having as its main focus, data concerning land records.

What is an MPLIS?

A multi-purpose land information system (MPLIS) is a system in which the fundamental means of organizing data is the cadastral or proprietary land unit, whose main objective is the provision of institutional data concerning land ownership, value and use.

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2. INETER's Proposal.

As part of the World Bank project, INETER is carrying out orthophoto mapping. This is not what is being proposed for urban areas. Orthophotos take about two years to produce. In Managua, INETER wants to use aerial photography to survey the *barrios marginales*. INETER would fly over the city (about 5 hours to photograph the entire city at 1:5000) and use traditional photogrametric techniques to digitize from the photographs the boundaries of

the neighborhoods and the boundaries of individual parcels. INETER would like to do aerial photography because it believes it would be more cost effective than to physically go on the ground and actually survey out each of the individual parcels.

By using this type of aerial surveying INETER believes it can survey the neighborhoods twice as fast (in 18 months) as it would take to survey them using traditional methods (estimated at 3 years). However, in order to do this, one would have to start the project today, and this would cover only Managua, and would address only INETER's constraints, not those of the registry or OTU. In order to carry out this project INETER's proposal includes requests for the requisite aerial photos, three GPS receivers, one digitizing table, one pentium PC, one 486 PC, one Hewlett Packard plotter, one printer, Integraph Micro Station software, and Oracle MGE software (a relational database software).

What is GPS?

Formally called the Navigation Satellite Timing and Ranging Global Positioning System (NAVSTAR GPS), GPS was designed by the U.S. Defense Department. It uses 24 satellites orbiting the earth in very high, stable, orbits. GPS allows one to carryout geodetic surveys with a high degree of accuracy. Positions are calculated using triangulation--measuring the distance a point on the earth is to three or more satellites simultaneously.[6]

For convience sake, some people have classified GPS as providing low, medium and high accuracy position fixes. "Low accuracy" GPS provides a positional fix to +/- 100 meters. In order to obtain this level of accuracy, one receiver is used and four satellites are read only long enough to collect a positional fix. Position locations collected using this method are often good enough to roughly demarcate forest reserves or large territories. Single unit GPS is also often used for navigational purposes, since GPS receivers can cost as little as $500. "High accuracy" GPS refers to using GPS receivers to obtain positional accuracies to the centimeter or sub-centimeter unit. This method requires that two GPS receivers be used. One, which is very accurate and has the capability to download large amounts of positional information obtained from the satellites that are in view, is located as a "base station" over a first order control point, the second acts as a rover and is used to collect positional information in the field. On a daily basis, after field work is completed, the position locations collected by the rover are differentially corrected using information collected by the base station. The precision with which accurate positions are collected depend upon the amount of time the rover rests at the point in the field. To obtain centimeter accuracies, the rover should rest at the point for around 30 minutes. "Medium accuracy" GPS uses the same method as high accuracy GPS except that the rover only rests at the point for around 30 seconds. This amount of time is long enough to get accuracies, once differentially corrected using information from the base station, to +/- 50 centimeters.

The main advantages of medium accuracy GPS are: (1) it can be accurate enough for survey purposes, if +/- 50 centimeters is within the order of accuracy desired; (2) occupation time at a point is minimal; (3) training staff for use of a rover can be done in about an hour.

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[6]While three satellites are theoretically all that are needed in order to determine a single point on the earth's surface, in reality, four satellites should be used in order to correct for offsets.

The field work of INETER would be facilitated by the use of the three GPS receivers. One receiver would function as a base station. It would be located over the control point in Managua that is already tied into the worldwide network of geodetic control points. The other two receivers would be used as rovers. They will be used to establish first order control points in the neighborhoods where surveying will take place. INETER could also use the rovers to establish second order control points in the neighborhoods.

GPS Hardware Costs:

Rovers cost around $10,000. Specifically, the Trimble 8 channel Pro XL with 1 megabyte of memory costs $10,450 and the 8 channel Pro XL with 640 kilobytes of memory costs $8,950.

Base stations cost between $10,950 and $16,950. Specifically, the Trimble 12 channel Pro XL with 4 megabytes of memory costs $10,950, the Trimble Pathfinder community base station (with 12 channels) costs $9,950 plus a personal computer (which can cost from $1500 on up), and the Trimble 4000 SE (12 channel) costs $13,500 plus a single frequence antenna which costs $3400. All of these configurations are specified to provide sub-meter accuracy. The advantage of the Pro XL base station is that it is more mobile. The Pathfinder provides automatic logging of files (as it is continuously attached to a personal computer). The 4000 SE is a base station that is often used by professional surveyors. However, all three base stations have the same basic GPS receiver as its kernel.

Once the first order control points are established and aerial photography is in hand, INETER will digitize the boundaries to the barrios and the individual parcels from the photos.[7] INETER will register these boundaries to a map base of the first order control points and use photogrammetrical methods to create an accurate cadastral map of the barrios and parcel boundaries.

After the cadastral maps are made from the aerial photographs, INETER will send teams out to the *barrios marginales* to locate the parcel corners from the cadastral maps and drive metal stakes in as corner monuments. It is believed that the parcel corners will have an accuracy of +/- 20 cm (third order accuracy) by following this method. INETER is proposing the use of aerial surveying because they believe that this method will reduce the cost of carrying out the physical survey and be more economical. However, aerial surveying may not be more economical if INETER has to wait eight months, provided that there are no

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[7]The 23 cm aerial photos will have to be enlarged so that the boundary lines can be accurately traced on a digitizing table.

complications, just to get a contract through the bidding process.[8] This means waiting until February 1996 to contract the firm for the aerial photography. After this, the photos have to be delivered, boundaries digitized, photogrammetrical corrections made, cadastral maps produced, and corners monumented. Also, during this period the GPS surveying of the first order control points must be done. Ideally, this surveying would take place in conjunction with the flyover so that monuments could be erected that would appear in the aerial photographs (thus facilitating the photogrammetrical correction process), however, due to the uncertainty of when the flyover will take place, this may not be done.

It should be noted that there is another reason INETER has requested the aerial photography. Other governmental units and institutions, National Defense, Civil Defense and the Mayorality, would also like access to current aerial photography. Aerial photography could help them update defense and evacuation plans, and also facilitate urban planning efforts.

When the titling effort in Managua is complete, INETER plans to take the GPS receivers to the other cities where titling efforts are underway. Depending on funding, INETER may decide to purchase additional units and leave the base station erected in Managua.

Qualified surveyors will also be needed to carry out this proposal. In Nicaragua there are currently around 300 licensed surveyors. These surveyors either have the appropriate university degree or have passed an exam administered by INETER. The World Bank has already prepared a list of pre-qualified surveyors, and according to the local World Bank representative, has contracts with most if not all of the best qualified surveyors in the country. The IDB and UNDP may want to consider using this list in order to identify and contract out the urban surveying work required for this project.

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[8]This time frame could be cut to six months if IDB and UNDP agree to accept the list of firms pre-qualified for taking aerial photographs that has already been compiled by the World Bank project for the rural titling project.

SECTION IV
DISCUSSION AND ANALYSIS OF THE PROPERTY REGISTRY

1. Introduction to the Registry

The *Registro de la Propiedad Inmuelble y Mercantil* (Real Estate and Commercial Registry, hereinafer referred to as the property registry) presents another constraint in the titling process for urban properties. The registry fuctions both as a real estate registry and as a corporate registry. The institution falls under the direction of the Supreme Court, and is run in accordance with provisions in the Civil Code and a *Reglamento del Registro Público* (an administrative order) which provides operational guidance. In all, there are 16 autonomous, decentralized property registries in the country, one in each department. Of these, six have been microfilmed.

The condition of the registry in Managua is typical if not better than average in Central America. The office has no photocopiers. Central air conditioning does not work, although the Registrar does have an individual unit which functions. The office is relatively clean. The public is attended at a large counter, providing adequate protection for documents, although no security guard was observed. No electric generator is available, and electricity often fails at some point during the day, hindering productivity.

Within the registry, 59 percent of personnel are women. 63 percent have only a high school education, with less than 5 percent having a university degree. 60 percent receive about US$1200 per year in salary. 60 percent of employees have less than six years experience, with this being divided equally between 0-2 years experience (20 percent), 2-4 years experience (20 percent) and 4-6 years (20 percent). Low salaries create incentives for employees to seek supplements in the forms of bribes just to pay living expenses.

As part of the World Bank's rural titling initiative, Miguel Gómez (the World Bank's Nicaragua Representative) reports that a Costa Rican attorney has been hired to provide a diagnostic on the property registry. This report is due out shortly. Margarita Argüello of INRA advises that a commission is to be set up shortly in Nicaragua to examine the registry.

2. The Folio Real System

The *folio real* system is found in many Latin American countries. In Costa Rica, this same basic system has been largely automated. In the traditional registry in El Salvador, and other places, like Nicaragua and Guatemala, the registry system is entirely manual, using no automation, photocopy, or microfilm technology. Instead, the system uses a series of books

(Receipt books, *folio real* books and Copy books (tomes)). The specific steps involved in a transaction, under either the *folio personal* or *folio real* systems, is outlined in Table 1.

Table 1: Inscription of a Transfer of Property

Property Registration Process at a Generic Traditional Registry in Central America: Sample Property Transfer		
Steps	Usual time	Comments
1. Presentation	Less than half an hour	Presentation of a registration request is carried out at the public counter. The request is called a *diario*. The *diarios* are usually presented by lawyers or notaries, to one of two windows where the receipt of the document is recorded. The receipt book contains columns for owner name, a document number (assigned serially by month), and the volume and page where copy of document is actually filed (in the tomes). The time and date are also stamped on the back of the last page of the document. Two copies must be presented for recording, with a copy kept for filing and the original returned to the owner.
2. Micro-filming	Microfilming of documents is relatively up-to-date, without any backlog.	Microfilm copies are made and stored on site.
3. Marginalization	A delay of about three months	Marginalization is a process of making marginal notes, indications of a transaction pending. The delay of about three months creates opportunities for fraud via multiple sales of a single parcel prior to completion of marginalization.
4. Distribution	Little delay	Distribution of the transaction is made to a working group which will inscribe the transaction. Working groups are referred to as "cells," or "células" in Spanish.
5. Confrontation	Usually several days. However, if someone else is using the book(s) needed to carry out the confrontation, the examination is put on hold until the book(s) is/are available. In practice, this means months in some cases.	Confrontation consists of examination of the document against the existing records in the Registry.

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6. Qualification	Assuming there is no problem, the document will pass the qualification in about a week. If a problem arises, however, the process bogs down and can carry on for as much as <u>ten years</u>.	Qualification involves a scribe who drafts up the document, which is then approved by a Registrar.
7. Typing	In El Salvador, for example, as of July 1994, there was a several month backlog in this office.	This involves preparation of a summary in the *folio real* or a note in the *folio personal*, according to the case. The same persons responsible for preparing the textual notes also receive public inquiries. Consequently, they spend most of their time answering questions rather than processing new documents.
8. Photocopying	This now takes about three days.	This activity is done on site.
9. Completion	Little delay.	a) If a *folio real* transaction: the documents are microfilmed. This process is up-to-date. The documents are then forwarded to the registry's internal cadastre office.
	Little delay	b) If a *folio personal* transaction: the documents are sent straight to the registry's internal cadastre office.

The traditional registry structure has several significant drawbacks. Large rooms are needed to contain all the volumes of the *folio real*, as the number of books and paper required to maintain the system is staggering. In theory, all information about a parcel is on one page, with a new page begun for each parcel. In practice, the information on many parcels is carried over to one or more additional pages. In extreme cases, it is necessary to examine dozens of pages in dozens of books to fully examine all the information about a particular parcel. Therefore, although the registry has the form of a parcel-based title registry, it is in fact much like the US deed recording system, using, instead of owner name, parcels as the primary indexing key.

Table 2: Technical Description of a generic *Folio Real* System

> The *folio real* is usually a large book (about 15 by 18 inches) containing
> about 250 pages per volume. The pages are two-page sets, facing each
> other. The left page has three major and several minor columns containing
> information about rights to the property. For example, the inscription
> (parcel description) is placed in the second of the three major columns.
> Only one inscription is written for each parcel. The left column contains
> any annotations such as judgments. The right hand column contains
> information on cancellations, such as cancellation of a use right. The right
> hand page also contains three major columns and several minor columns,
> all related to encumbrances on the parcel. For example, mortgages and
> liens are noted in the center column. Columns for annotations and
> cancellations, similar to the left page, are also available for the
> encumbrances page. All entries are handwritten or typewritten.

Related to the problem of access to books and records is the extreme delay, sometimes as long as ten years, in the qualification stage of the process. Delays occur in this area when a title has some defect, either in form or substance. Entire rooms of documents now sit unattended, awaiting final adjudication. This presents at least the appearance of an opportunity for corruption, as persons wishing to get their documents pushed out of this category may seek to entice registry employees with bribes.

Another defect in practice with the *folio real* system is its use of supplementary titles, called *títulos suplementarios*.[9] Supplementary titles are used in some cases, to avoid the cost and time of registering title. If an owner can claim the land by adverse possession, demonstrating occupation of the land and other formalities for a certain period of time, the Registrar can issue this "supplementary title." This avoids the need (and cost) of doing a complete title search. The result is that sometimes parcels are titled two, three, or four times, without ever actually registering an existing deed. Often, due to poor management, the Registry employees do not cancel out prior titles. Thus, multiple titles can exist for the same property.

Another major problem with the traditional registry system in Nicaragua, like El Salvador, is employee dissatisfaction. Salaries are low and labor problems are common. This is not necessarily a registry-specific problem, rather one that affects civil service employees rather than the private sector.

A final problem with the *folio real* is its lack, in practice, of any cross-reference to any cadastral number or parcel identifier code for properties in the registry system. In El Salvador, until recently, this was perhaps due to the civil war, which prevented

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[9] For a comparison with El Salvador, see Art. 699 et seq. of the El Salvador Civil Code.

implementation of this cross-reference, although the forms for cross-referencing were always available.

> What is a "title" or "land registration" system?
>
> Most people use the terms "titles (or land registration)" and "deeds" interchangibly. But registration of a deed only makes public note of a document. It does not necessarily prove who the owner is, unless it is noted in the transaction. The information found in a deed, may or may not coincide with previous deeds. Therefore, errors may be consistently duplicated from deed to deed.[10] This is in contrast with "title" registration systems.

3. Current Financial Picture

The *Ley de Arancel*[11] establishes what fees can be charged for services at the registry. Fees collected for service are, for example: 5 córdobas per 1000 of value for the sale of a property; 2 per 1000 for cancelation of mortgage. All money collected is paid to the central treasury without any retention to offset costs of collection. The registry is financed within the Supreme Court budget.

The present financial structure of the registry represents a public finance deficiency. Registry activities and improvements could be largely self-financing. However, because it does not retain any revenue, it is unable to carry out its functions in an efficient or legally-sound fashion.

4. Major Constraints

Perhaps the most serious constraint at the registry is the reception book (*diario*). As in most jurisdictions, Nicaragua follows the legal precept that "first in time is first in right." In other words, to determine priority of claims, it is important that the registry system capture information as to who presented what documents when to establish true ownership. In the *diario*, the receptionist receiving the document should note the time, date, document number, page and volume (*tomo*) for each transaction.

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[10] Peter F. Dale y John D. McLaughlin, *Land Information Management* (1990) page 22.

[11] Ley de Arancel, 21 April 1993, Gaceta Oficial No. 73.

There is already on the table a proposal to modernize the *diario*. That proposal, made to UNDP about a year ago, requests just under US$10,000 to computerize this one piece of the registry.

Manual procedures slow processing of titles. Inscribers copy by longhand not just fields of data, such as owner's name, parcel number and new owner, but also duplicative information such as physical boundaries (already in the INETER database) and value (captured by the Fiscal Cadastre). Further, this data is captured in narrative form, rather than as raw data.

The Vice Minister for Property estimates a backlog of between 12 and 15 years for granting some titles already in the system. A single reception book (*diario*) means that documents can only be processed once passing that stage in the inscription process.

Presently, there are 50-70 transactions per day at the Registry. This work is done by 18 inscribers. Unfortunately, only 2 persons supervise this effort. Consequently, only about 25 titles per day actually emerge from the process signed by the Registrar. At this rate, 100,000 parcels would require about six years to complete.