

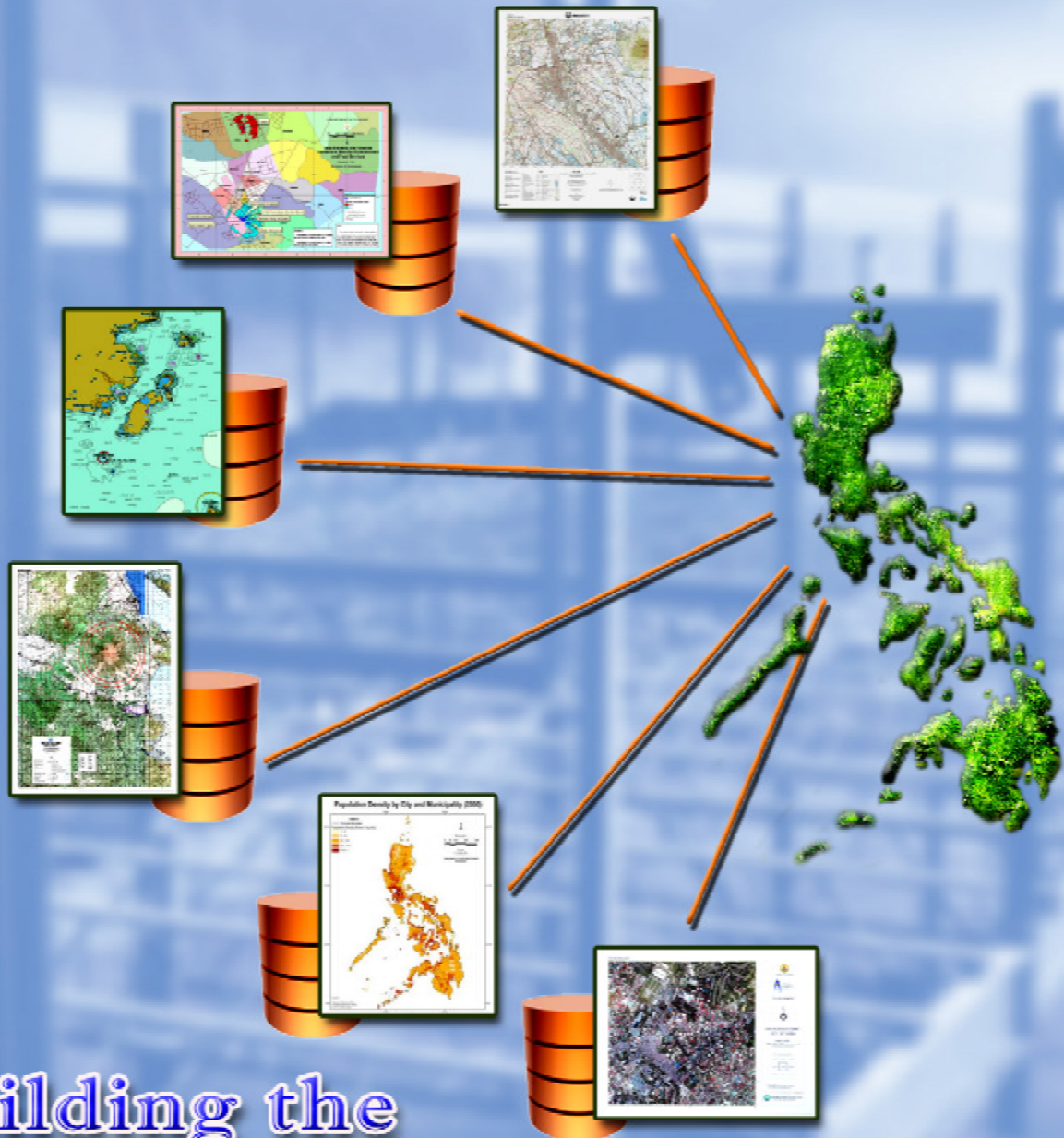
# Inf mapper

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Building the

# NSDI

NATIONAL SPATIAL DATA INFRASTRUCTURE

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Editors' note: Due to space constraints, we cannot publish the references consulted for the articles for this issue. Interested individuals may avail themselves of the lists from the authors or the editors of this publication.

## Editorial

### NSDI: Impact on National Development and Security

The National Spatial Data Infrastructure (NSDI), in its simplest terms, seeks to establish an Internet-based geographic information system in the Philippines whereby interested users in the government, private sector, and even the general public can have ready access to various types of geographic data such as topographic base maps, thematic maps, geodetic control point coordinates, and other kinds of maps. In other countries, the NSDI comes in different variants like a national geographic information system, spatial data information system or the like, but the basic concept remains the same. The success of the NSDI thus mainly rests on the availability of a comprehensive and updated database that can be readily accessed by users. Where will the data come from? NAMRIA, as lead agency, will produce the base maps to be used by other agencies, which will in turn upload the value-added maps to the system.

Such a system will have a significant impact for national development. For instance, municipal governments use base maps and other thematic data (e.g., forest cover maps, socio-economic maps, geohazard maps, and soil maps) in the formulation of their comprehensive land use plans with the aid of GIS. Concerned sectors in the same municipality could also use them in recommending further inputs to refine the plans. In short, with the availability of geographic data to all stakeholders, rational planning and enlightened decisions can be made. This will also lead to the standardization of planning tools to be used from the local level up to the national level.

The NSDI will be very essential for disaster management as maps become readily available during times of calamities for formulation of quick-response mechanisms and conduct of rehabilitation activities. Multihazard maps of the different high-risk localities in the country can also be uploaded to the system. The same is true for agricultural production where an accurate inventory of areas planted to crops can be undertaken and arable lands may be tapped for additional cropping. In not so short a time, as the awareness level of the user community rises and with more detailed map data, there will be a more complex application of the system.

These are just some examples of the enormous potentials to be derived from the NSDI. It really depends on the users on how to take

advantage of these datasets to serve their purpose. With such distributed information at one's fingertips, think of the convenience, savings, and timeliness in utilizing the data holdings that will be realized. The impact can be measured in terms of the government physical infrastructures built, the vital services rendered, and how well the environment was protected. The downstream effect will be on the livelihood generated in the countryside and the improvement of the income of the people.

How about the security aspect of NSDI? Would it, in any way, compromise or enhance national security? Traditionally, national security was equated with military security and did not take into account its other dimensions. Hence, much restriction was imposed on the distribution of maps, aerial photographs, and other geographic data. The advent of the information age changed the entire picture. The GPS, for example, once the exclusive domain of the military is now in wide commercial use. The same is true with space imaging systems with high-resolution satellite imageries. These are readily available in the market today and can even be viewed online. With rapid globalization and growth which fuel the need for more complex mapping systems, the benefits of this type of technology already outweigh the risks, with military establishments still maintaining the most sophisticated and sensitive systems. The most imminent threat to national security at this time lies in the economic front with current spiralling energy and food prices, which hopefully can be solved in part through the employment of accurate and consistent geographic data for sound decision making.

Of course, establishing the NSDI comes with a price as in any other infrastructure investment. A data clearinghouse network connecting data custodians all over the country will have to be established, along with the physical linkages among these sub-systems. Technical standards, policies, and protocols will have to be formulated. Building up the geographic database is a major cost component, and in this respect, massive information and education campaigns need to be undertaken, as well as capacity building of data producers and custodians.

What is the next step? The project is being proposed as part of next year's budget. Let's hope for the best so we can buckle down to work. ♦

## Infomapper

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## Tapping the UNCLOS Limits for Philippine ECS

by Usec. Diony A. Ventura, MNSA  
NAMRIA Administrator\*

Popular interest was stirred during the early part of this year over the Philippines' maritime claims under the United Nations Convention on the Law of the Sea (UNCLOS), for an Extended Continental Shelf (ECS). What is the role of the National Mapping and Resource Information Authority (NAMRIA) in this matter and what has it done so far? We deal with these questions in this article.

### UNCLOS and the ECS

The UNCLOS we know today refers to either the international conference or the resulting international agreement of the third UNCLOS. The series of sessions making up the third UNCLOS was held in various places in the world from 1973 to 1982. It was the third UNCLOS conference which succeeded in establishing through a treaty a comprehensive set of rights and obligations of the international community in the use of the world's oceans and their resources. Commonly referred to as the "Constitution of the Oceans," that treaty or agreement bears the name *United Nations Convention on the Law of the Sea* or *UNCLOS*, which came into force in 1994.

Continental shelf jurisdiction is one of the significant issues covered by the UNCLOS. In Article 76 of the UNCLOS, the continental shelf of a coastal state is said to comprise: *the sea-bed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the*



Administrator Ventura (second from left) presides over a meeting of the ECS TWG in the NAMRIA board room.

*breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.*

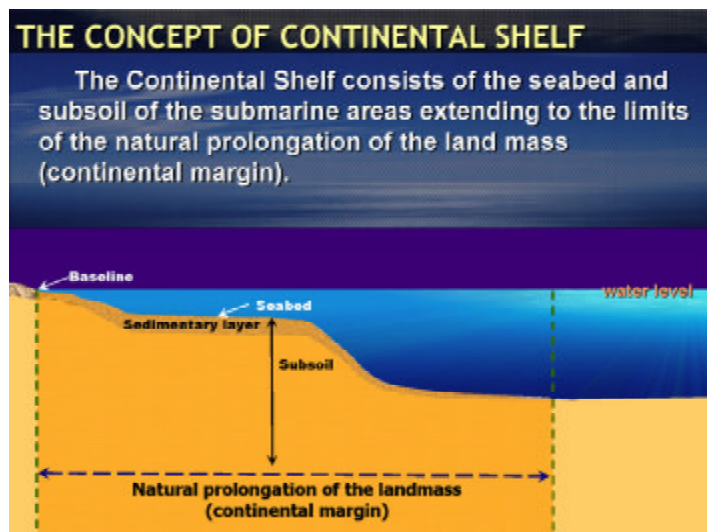
Pursuant to the provisions of the guidelines of the UNCLOS, the coastal state is entitled to a juridical and mandatory 200 nautical mile continental shelf from the baselines from which the breadth of the territorial sea is measured. It does not need to delineate or delimit its mandatory continental shelf except where it overlaps with a neighbor state. The coastal state is allowed to claim or submit a claim for an ECS up to the maximum limit of 350 nautical miles from its baselines, or 100 nautical miles from the 2,500-meter isobath.

Article 77 of the UNCLOS affirms the rights of coastal states to explore and exploit the natural resources of the continental shelf; that these rights are exclusive in the sense that no one may explore or exploit the continental shelf without explicit consent of the coastal state; and that these rights are inherent and do not depend on occupation. Thus states have the right to manage, conserve, and harvest the natural resources within the continental shelf which consist of the mineral and other non-living resources of the seabed and subsoil together with living organisms belonging to sedentary species. The wealth of the continental shelf may include offshore oil resources and minerals like coal, cobalt, copper, diamond, gold, nickel, platinum, and silver; along with living sedentary resources such as crustaceans and deep-sea vegetation.

### The Philippines and UNCLOS

The Philippines signed the UNCLOS in 1982 and in 1984 ratified it or assented to it with Congressional approval. The Philippines is

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ECS TWG slide

\*Administrator Ventura is an active member of the Commission on Maritime and Ocean Affairs and is a prime mover in the preparation of the Philippine ECS submission.

## Tapping ...

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one coastal state in Asia that is presently establishing its ECS entitlements under the UNCLOS. With a legitimized claim over its ECS, under the UNCLOS, the Philippines can boost its development by making use of the natural resources therein to be able to meet the rapidly increasing demands especially of its industries.

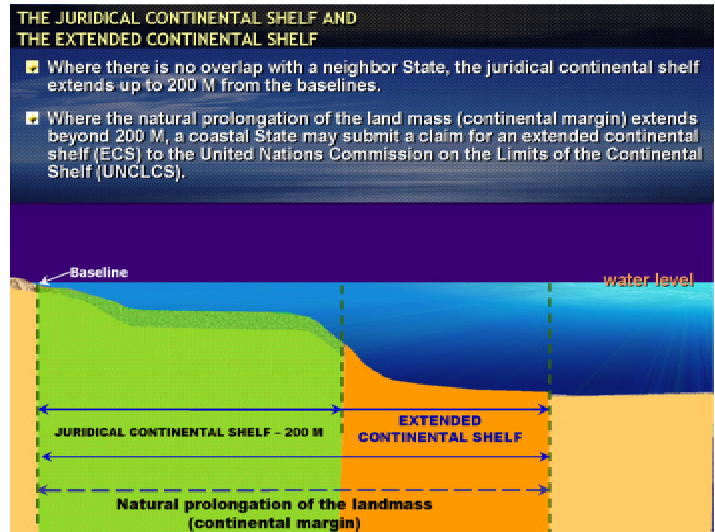
To delineate its ECS, the Philippines must acquire pieces of scientific evidence consisting of bathymetric, geological, and geophysical data that satisfy the technical criteria prescribed by the UNCLOS. The Philippines has to submit the data to the Commission on the Limits of the Continental Shelf (CLCS) for entitlement. The CLCS is the UN body charged with the scrutiny of all ECS submissions. Early ratifiers of UNCLOS, such as the Philippines, have to make their ECS submissions on or before 13 May 2009. A coastal state's failure to submit a claim on or before the deadline may mean loss of its ECS to a neighbor coastal state with an overlapping claim or to the International Seabed Authority, the UN agency charged with the management of all marine seabeds that do not belong to any state.

### NAMRIA and the Philippine ECS

In the wake of the coming into force of the UNCLOS and in accordance with its provisions, NAMRIA has been working to complete the hydrographic/oceanographic surveys and charting particularly of the country's Exclusive Economic Zone (EEZ). The agency in fact acquired in 1998 and 1999 two new multidisciplinary survey vessels to facilitate work in this regard.

All maritime zones are measured from the baselines. The Philippine baselines, however, as officially defined under the existing baselines law, Republic Act (RA) Number 3046 as amended by RA 5446, have been found not to be fully in accordance with the provisions of the UNCLOS. NAMRIA has through the years been providing the required technical inputs for the drafting of a new baselines law. NAMRIA was particularly involved from 1992 onwards in the survey of basepoints which serve as bases for delineating the new baselines of the country. NAMRIA was a member-agency of the Technical Committee of the Cabinet Committee on Maritime and Ocean Affairs (CABCOM-MOA, 1994-2001), whose concerns included the delineation of the baselines and maritime boundary delimitation. The CABCOM-MOA was previously the CABCOM on the Treaty on the Law of the Sea (1981-1994). The CABCOM-MOA Secretariat became in 1999 the Maritime and Ocean Affairs Center (MOAC). This in turn became in 2001 the Department of Foreign Affairs (DFA)-MOAC, and then by virtue of Presidential Executive Order (EO) Number 612, Series of 2007, the present Commission on Maritime and Ocean Affairs (CMOA) under the Office of the President. NAMRIA is a CMOA member by virtue of the said EO.

With regard to the ECS, from 2002 to 2003, NAMRIA was part of a group which conducted a desktop study to determine the Philippines' potential for ECS entitlement. The Norwegian Agency for Development Cooperation provided financial assistance and



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technical support through the consultancy firm Blom ASA. Later efforts of NAMRIA led to the development of the project to fast-track the delineation of the country's ECS. NAMRIA's technical staff is working with geophysicists, geologists, and other scientists from the Department of Energy, the Mines and Geosciences Bureau-Department of Environment and Natural Resources (MGB-DENR), the National Institute of Geological Sciences-University of the Philippines, the Philippine National Oil Company, and other government agencies in this regard. NAMRIA is the implementing arm of DENR which chairs the technical working group (TWG) concerned with the project that officially started in 2006 and is under the supervision of CMOA. The gathering and integration of scientific and technical evidence for submission to the CLCS are ongoing. The preparation of the ECS submission has legal policy and diplomatic components which are the responsibilities of the Department of Justice and the DFA.

### Hopes for the Future

The significance of the outputs of the ECS Project more than makes up for the costs in preparing the submission. The data gathered are primarily useful in supporting the ECS submission but they likewise have other benefits for the country. Such benefits are for hydrographic survey data to update nautical charts for safety of navigation; for geophysical and geological data to provide scientific bases for the exploration and exploitation of oil, natural gas, and hard mineral resources; and for hydrographic, geophysical, and geological data to serve as valuable inputs in the protection and conservation of the marine environment.

With steely determination, technical capability, and political will, the Philippines, through the ECS project, will assert its rights under the UNCLOS to put to greater use and better management the ocean resources under its jurisdiction. The Philippines will then be able to take its rightful place in the community of nations that have only the best intentions for the welfare of nature's resources and that of their citizens of the present and the future. ♦

# Reviewing the NSDI

by Xenia R. Andres

Imagine that you are the owner of a hauling company and a client in a construction company calls to tell you that your service is needed fast. You plan your route using a web-based mapping service network and dispatch your trucks to their destination at the least possible time. The client is impressed and you become industry partners.

Imagine that a tsunami occurs with plenty of casualties in the area. You are watching a live broadcast and maps of the victims' location and the extent of damage are shown. Moved by the sight and armed with map information, you help the local disaster action group in rescuing and evacuating survivors and distributing relief goods. You are able to save lives.

The immediate responses in the scenarios above are made possible through information on the location or geography of things, people, places, and events. Geographic information, also known as geospatial data, identifies the geographic location and characteristics of natural or man-made features and boundaries on the earth. It makes up a large percentage of the information needed in government, business, and individual activities.

Many government and private agencies collect, process, and use geographic information. Thus, a framework is vital to coordinate the acquisition, production, integration, and dissemination of consistent, accurate, and updated geographic information that can be analyzed and utilized according to user requirements. Such a framework is a spatial data infrastructure or SDI, which is composed of the technology, policies, standards, human resources, and related activities necessary to use and share spatial data in an efficient and flexible way. In order to support data sharing in a comprehensive context, a national spatial data infrastructure (NSDI) is developed.

The NSDI for the Philippines or the PNSDI was conceived through the efforts of the NAMRIA-spearheaded Interagency Task Force on Geographic Information (IATFGI) created in 1993. The IATFGI was primarily tasked to promote and coordinate the efficient development, management, and utilization of geographic information in the country. The formulation of the NSDI framework plan was made possible through a project entitled "The Establishment of a Technical, Operational, and Legal Framework for the Management of Geographic Information in the Philippines." This project was implemented from 1999 to 2001 through the assistance of the World Bank Information for Development Program.

## The Philippine NSDI and its Components

The NSDI is a national initiative for the provision of geographic information that are fundamental, better accessed, reasonably-priced, and produced and maintained by different agencies. It is a network of digital databases located throughout the country, which collectively will provide the fundamental data needed for socioeconomic, human resource, and environmental development objectives. The NSDI ensures that geographic information users will be able to acquire the complete and consistent datasets they require even though several agencies happen to collect and maintain the data.

The development of the NSDI addresses worldwide efforts to build global, regional, and national SDIs. Examples of these are the European Geographic Information Infrastructure, and the respective NSDIs of the United States of America, India, and Singapore. The Permanent Committee for Geographic Information System Infrastructure for Asia and the Pacific, of which NAMRIA is a member, has also taken similar steps to address regional SDI needs.

The components of the PNSDI include (1) the institutional framework, (2) the technical standards, (3) the fundamental datasets, and (4) the clearinghouse network. The **institutional framework component** defines the policy and administrative arrangements for building, maintaining, accessing, and applying standards and datasets through a especially created council or committee. This group shall provide the leadership necessary for the adoption of the NSDI and shall serve as the vehicle for the determination of national priorities, the development of geographic information applications, and the education and training of human resources.

The **fundamental datasets component** involves the identification and development of primary data from various sources (e.g., base maps, geodetic control network, land parcels/cadastre, populated places, and climatology) from which other information are derived and integrated to create value-added products. The technical characteristics of these fundamental datasets are defined and are compliant with the **technical standards component** which requires protocols in geographic reference system or geodetic datum, data models, data dictionaries, data quality, data transfer, and metadata. While the geodetic datum enables geographic information integration, data dictionaries provide standard definitions for the spatial and attribute components of the fundamental datasets. These data dictionaries include topography, cadastre, utilities, street addresses, and geosciences.

Data models are leveled into conceptual, logical, and physical. The conceptual data model is a schema to represent the spatial and attribute components of the fundamental datasets and their relationships. The logical data model, on the other hand, specifies the manner in which the relationships of the various datasets are to be defined. The physical data model is implemented in the data transfer protocol which comprises a set of data encoding rules for effective data and metadata communication. Standards in metadata or data about data specify how data are described, such as dataset name, content, structure, and access procedure and restriction. Data quality information, meanwhile, enables users to make an informed judgment about the data's "fitness for purpose."

The **clearinghouse network component**, on the other hand, is the means by which the fundamental datasets are made accessible to the community in accordance with the policies determined and the technical standards agreed upon within the institutional framework. The key element of the network is the data directory system which contains the metadata of the fundamental datasets. This system should be freely accessible to the user community through this component's technological framework.

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Reviewing ...

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The Benefits of the NSDI

The indiscriminate collection of geographic information by any agency leads to resource waste and data inconsistency because the data are duplicated and cannot be integrated with other data in order to produce value-added information. The NSDI reduces the duplication of efforts and the inconsistency of data because the user community has reached an agreement on the priority national fundamental datasets to be collected, the standards by which they shall be acquired and maintained, and the custodianship of the data. Figure A shows the data acquisition of two agencies during the Mt. Pinatubo eruption in 1991.

Moreover, the utilization of geographic data systematically collected for a specific purpose is cost-efficient for use in other applications. Geological information, for example, not only supports the mining and petroleum exploration industries but also helps the government in the identification of suitable underground water for towns and barangays. The multipurpose nature of the NSDI provides repeatable data and avoids resource waste on data collection, storage, and integration. The economic returns of government geographic information investments and the savings

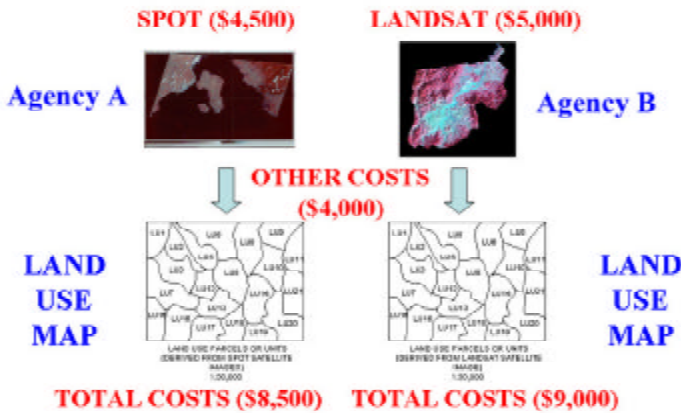
in cost of geographic information users are thereby maximized and improved, including government and business planning and decision making which are impacted by geography. Emerging applications include population census, defense and public safety, land title registration, land reform, voter registration and precinct mapping, vehicle navigation, integrated area development, and emergency management.

The NSDI also promotes the growth of private industries and facilitates their active participation in the development, acquisition, and provision of geographic information to local and global markets. An information infrastructure is needed by each country to compete in the new global economy or information age and the geographic information infrastructure is just as much an infrastructure as roads, communications, schools, health facilities, and so on. The NSDI takes advantage of new opportunities brought about by developments in information and communication technologies. Figure B\* below shows the status of activities in building the NSDI.

The Fundamental Datasets and NAMRIA

The fundamental datasets are the required datasets of government agencies and industry groups in order to achieve their social and corporate objectives. They are the building blocks of the NSDI, the information to share and manage. These datasets include the primary references, the natural and built environments, and the

...uncoordinated Efforts & Resources



...and with "Coordination"



Status	Major Activities/Outputs Leading to the Establishment of PNSDI by Core Components			
	Institutional Framework	Technical Standards	Fundamental Datasets	Access (Clearinghouse) Network
Completed (from 1993)	<ul style="list-style-type: none"> <li>NSDI Framework Plan</li> <li>Draft executive order on the creation of a National Geographic Information Council</li> </ul>	<ul style="list-style-type: none"> <li>Manual on Data Definitions and Manual on Data Classification and Coding</li> <li>DENR Administrative Order No. 2006-12 entitled "Development and Management of a Standard Seamless National Digital Topographic Database and Providing for the Guidelines for its Operationalization"</li> <li>Policies and resolutions on data sharing</li> <li>Technical standards on map scales, map projections, and data classification scheme</li> <li>GIS Cookbook for Comprehensive Land Use Planning</li> </ul>	<ul style="list-style-type: none"> <li>Identified fundamental datasets are specified in the NSDI Framework Plan</li> </ul>	
Ongoing/Continuous	<ul style="list-style-type: none"> <li>Inventory of GIS projects and data holdings</li> <li>LGU GIS capability assessment reports</li> <li>Trained government staff on GIS</li> </ul>	<ul style="list-style-type: none"> <li>Metadata standards (ISO 19115)</li> <li>Philippine Reference System of 1992 (PRS92) policies and guidelines on cadastral and ENR data transformation and integration</li> </ul>	<ul style="list-style-type: none"> <li>Data generated for PRS92 Project</li> <li>Data generated for multihazard mapping (READY, JICA, GOP)</li> </ul>	<ul style="list-style-type: none"> <li>Geodetic Network Information System</li> <li>Land Survey Database Management System</li> </ul>
Future Plans of Action	<ul style="list-style-type: none"> <li>Permanent body for NSDI</li> <li>Policies and administrative arrangements on custodianship, data access, and leadership not yet in place</li> </ul>	<ul style="list-style-type: none"> <li>Standardization activity at the network infrastructure level</li> </ul>	<ul style="list-style-type: none"> <li>New data (i.e., satellite images, aerial photographs) for most parts of the country</li> <li>Updating of maps for most parts of the country</li> </ul>	<ul style="list-style-type: none"> <li>Operational network infrastructure</li> <li>Making data accessible through the Internet</li> <li>Making dynamic cataloguing or metadata system accessible to the public</li> </ul>

Figure B

Figure A

administrative and socioeconomic subsets (Figure C). The fundamental datasets component of the PNSDI is undertaken to (1) provide updated, consistent, and digital fundamental datasets with national coverage to meet requirements of users; (2) fill the gaps in available fundamental datasets; (3) serve as a basis for adjusting or correcting existing fundamental datasets to facilitate the building of a complete national coverage for fundamental framework datasets; and (4) facilitate search and access to the datasets.

Through the NSDI Development Program, NAMRIA is in the process of developing data acquisition and access mechanisms for the core datasets it is mandated to produce, manage, and distribute. It is currently implementing projects which encompass all the fundamental datasets mentioned above. These projects aim to (1) enhance the Philippine Reference System of 1992 (PRS92); (2) establish a national common spatial database comprising an updated and digitized set of base data or topographic maps at 1:50,000 scale; (3) provide the topographic database of the country's maritime zones and extended continental shelf through bathymetric survey and mapping; (4) update nautical charts and navigational aids; and (5) develop a web-based standard seamless digital topographic database system and clearinghouse for environment and natural resources (ENR) management and sustainable development. Also proposed are the following projects: Topographic Mapping of Population Centers at 1:10,000 Scale; Remote Sensing Data Transmission and Processing; Geographic Names Inventory and Updating; and Land Use and Vegetation Cover Mapping.

**Virtual Philippines**

The NSDI seeks to make Philippine society fully use geographic information resources for socioeconomic and physical development through improvements in the availability, usability, consistency, compatibility, and affordability of

geographic datasets produced by various sources. The optimal use of geographic information **moreover** supports the information system plan to bring the Philippine government online. The NSDI is the enabling technology to realize a virtual Philippines. It aims to improve service and access to a wider scope of data, with a size and a complexity that are beyond the capacity of a single agency, through partnership of all spatial information organizations, public or private.

NAMRIA and the Advanced Science and Technology Institute (ASTI) are now in the process of undertaking a collaborative project with the Philippine Atmospheric, Geophysical, and Astronomical Services Administration and the Philippine Institute of Volcanology and Seismology. The Federated Geospatial Information System (FedGIS) will be developed to pilot the physical network and dissemination infrastructure of the Philippine NSDI. Inputs for the FedGIS are the existing base data of NAMRIA and the outputs of the Hazard Mapping and Assessment Effective Community-Based Disaster Risk Management or READY Project. Web-based interfaces to the FedGIS, including browsers, make its database accessible to collaborating agencies as well as to other stakeholders and provide the base

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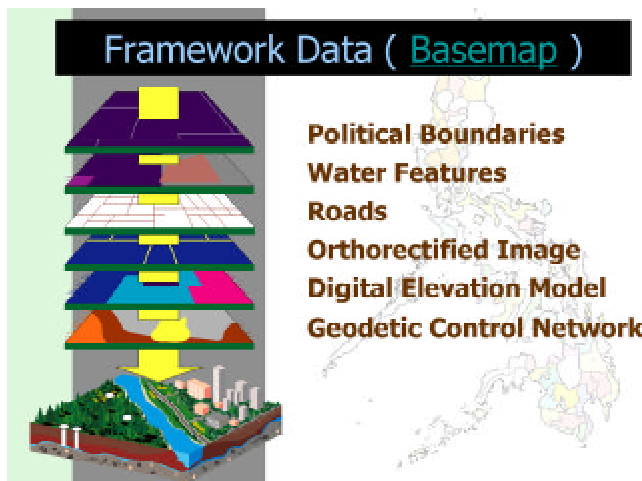


Figure C

\*Figures B and D used for this article were adapted from the unpublished paper of Mr. Bobby A. Crisostomo, former Chief of the Database Management Division (DMD), NAMRIA Information Management Department (IMD).

# The GCPs and the NSDI

by Engr. Enrique A. Macaspac\*

A vital backbone to any geoinformation is an accurate, consistent, and homogeneous geodetic control network. PRS92, which is the official common reference system for all surveying and mapping in the country, serves that purpose. It is a network of geodetic control points (GCPs) strategically located throughout the country. Furthermore, PRS92 will be used as the geographic reference system of the Philippine NSDI. GCPs are important components of NAMRIA fundamental datasets together with the base maps. Without migrating to PRS92, all the geographical data holdings of different institutions in the country cannot be integrated consistently and geographically. Thus, there is difficulty in achieving the benefits of having a common spatial data infrastructure in development and governance. To support the contribution of government and non-government institutions in the establishment of the NSDI in the country, GCPs in PRS92 are made readily available to them.

## Densification of the Network

NAMRIA, in coordination with the regional offices of DENR, particularly the Lands Management Service (LMS), is spearheading the densification of GCPs throughout the country. Members of the Geodetic Engineers of the Philippines (GEP) who establish GCPs for their land surveying projects now get free evaluation of their survey results, which were obtained using the Global Positioning System (GPS). The GCPs that they establish form part of the network in recognition of the GEP members' contribution to the densification.

GCPs are classified according to order of accuracy. PRS92 was established with a network of 330 first-order GCPs, which is the basis by which all other controls of lower orders are derived. NAMRIA has been densifying PRS92 after the completion of the Geodetic Component of the Natural Resources Management and Development Project, an Australian-funded project of

DENR. Densification of the network was intensified when NAMRIA got funding from the Department of Budget and Management for its PRS92 Project, with an implementing period from 2007 to 2010 in preparation for the full implementation of EO 45, Series of 1993, as amended by EO 280, Series of 2000 and EO 321, Series of 2004. EO 45 mandated the adoption of PRS92 as the common reference system for all surveying and mapping activities in the country by year 2000. The last EO amended the mandatory year of full implementation to 2010.

Last year, some 12,099 GCPs were targeted – 1,453 second-order; 1,424 third-order; and 9,222 fourth-order. NAMRIA and the LMS conducted the surveys, part of which was contracted out. The accomplishment was about 85% at the end of 2007 with the remaining 15% almost completed to date. This year, 12,052 fourth-order control points will be established: 11,524 by the LMS and 528 by NAMRIA.

## Active Geodetic Network

A network of continuously operating receiver stations (CORS) or active geodetic stations (AGS) is also being established with

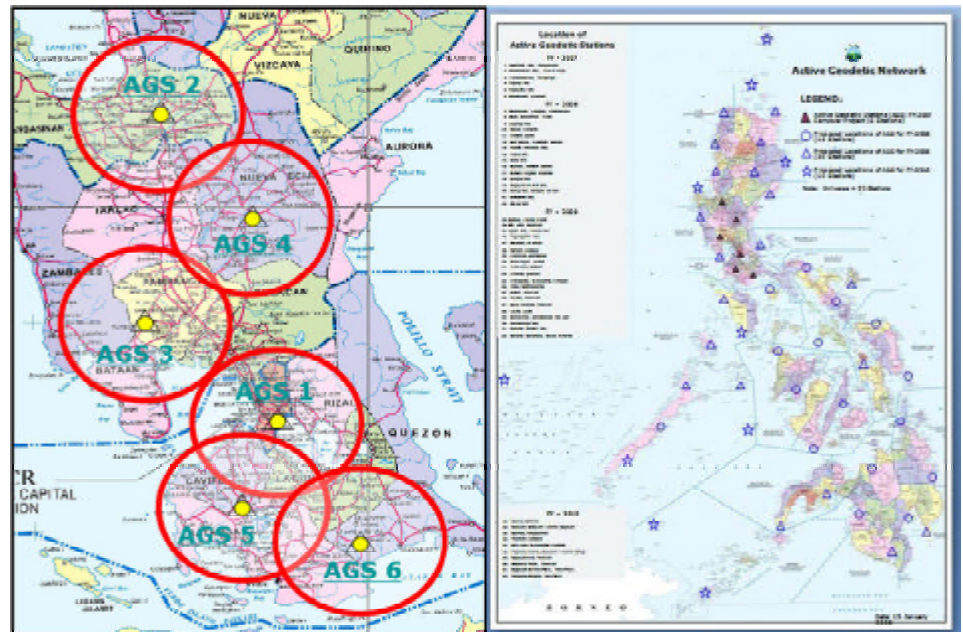
the control operating center at the NAMRIA main office in Fort Bonifacio, Taguig City. Six CORS were established in 2007, 16 more in 2008. The Active Geodetic Network (AGN) will complement the GCPs already in place. When operational, the AGN will enable the conduct of surveys, with more receivers being used for the details. Since there will be no more need for receivers to be set up on reference GCPs, the CORS will substitute as reference GCPs.

## Orders of Accuracy

NAMRIA adopted the Australian standards and specifications for the PRS92 and GPS surveying. These standards are comparable with those set by international geodetic authorities. The following geometric relative positioning accuracy standards apply at the one sigma confidence level:

First-order	10 parts per million
Second-order	20 parts per million
Third-order	50 parts per million
Fourth-order	100 parts per million

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Establishment of AGS

\*Assistant Director, Coast and Geodetic Survey Department (CGSD)

\*\*With inputs from Geophysicist IV Dennis B. Bringas, MMM and Ensign Reyna C. Henson of the Geodetic and Geophysics Survey Division, CGSD



## On NSDI and NCSD

by Engr. Mary Jane R. Montemor\*

The need for stronger, coordinated planning among national and local units in all sectors of society is real in the light of the country's social, economic, and environmental development objectives. With the increasing demand and use of the geographic information system, a national framework plan was drafted to recommend an infrastructure of essential and consistent geographic information produced and maintained by government entities.

This framework plan became the NSDI. While each agency has its own role in the NSDI, the Mapping Department of NAMRIA is currently addressing one of its components which is focused on structuring the fundamental datasets produced within the institutional framework and are fully compliant with technical standards. Through this, the establishment of the National Common Spatial Database (NCSD) was undertaken. Its objectives include the establishment of the NCSD to digitize and update NAMRIA's base data such as topographic maps, aerial photographs, satellite imageries, and other land information data; produce a forestland boundary delineation digital database; and create image mapping of selected small islands. It likewise aims to establish a GIS

Data Center and to upgrade NAMRIA's capacity to house the NCSD. It is a project to transform all base maps of NAMRIA into an updated and GIS-ready database.

To address the needs brought about by new developments in information technology and the concurrent effort of all government offices to construct an effective data management system, the production of digital topographic maps is in progress to be one of the fundamental datasets for the project. The topographic maps at standard scales of 1:50,000 and 1:10,000 are now being digitized and updated to meet the technical standards required in the fundamental dataset by the NSDI.

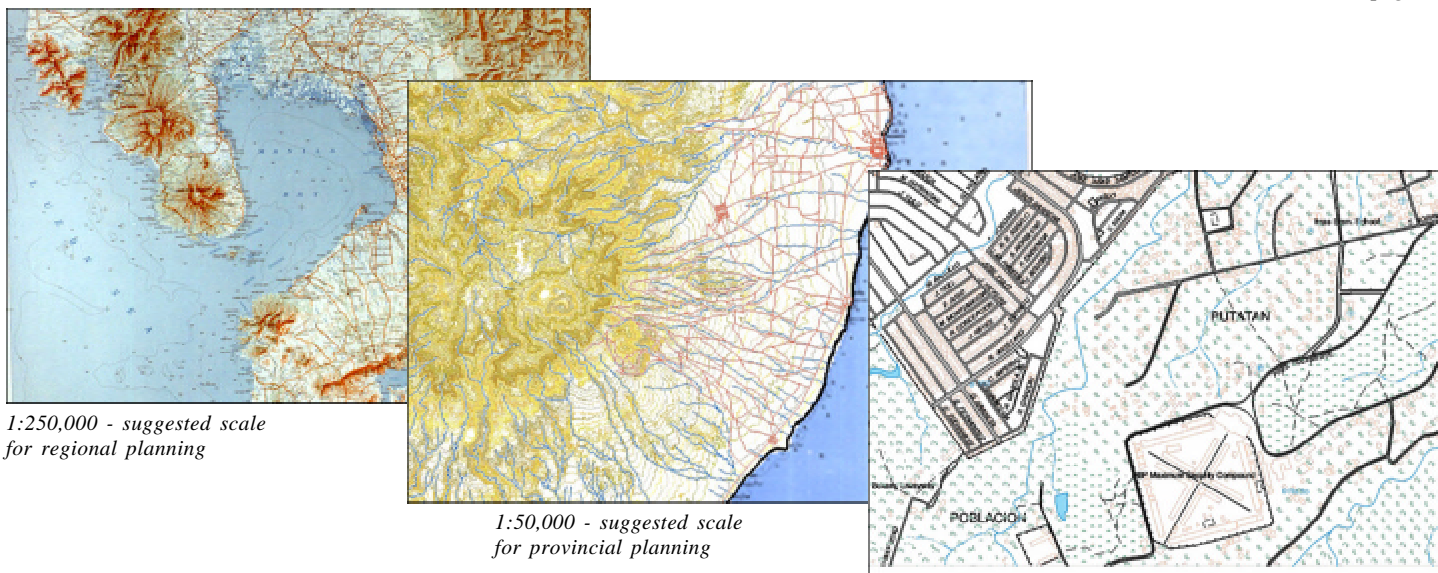
Medium-scale mapping at 1:50,000 accuracy level covers the whole country which is about 300,000 square kilometers. This phase consists of the following major activities: (1) acquisition of satellite imageries to update planimetry of old topographic maps; (2) production of digital terrain model at a 50-meter grid which is currently under research and development for a standard processing procedure; (3) production of a digital orthoimage at 1:50,000 scale; (4) digitization and editing of maps; (5) integration and data structuring for GIS; and (6) cartographic enhancement. The

topographic base map will consist of fundamental geoinformation such as contours, roads and railways, hydrology (rivers, lakes, and coastal lines), public buildings and structures, vegetation, administrative boundaries and geographic names.

Large-scale mapping at the 1:10,000 accuracy level covers only urban and priority areas in the country. The recommended geospatial databasing at this scale is ongoing, to cover populated centers of about 10% of the entire land area of the Philippines from new aerial photographs and high resolution satellite imageries. The geodatabase will primarily consist of roads and railways, rivers, coastal lines and lakes, contours, buildings, vegetation cover, annotation and administrative boundaries. This phase consists of: (1) GPS and aerial photography; (2) aerial triangulation; (3) digital terrain modeling at a 20-meter grid; (4) digital orthophoto production; (5) photogrammetric compilation; (6) field completion and data validation; and (7) data integration, structuring, and design.

The Mapping Department, with its ongoing projects such as Geohazard Mapping and PRS92, is presently structuring a system integration of all its

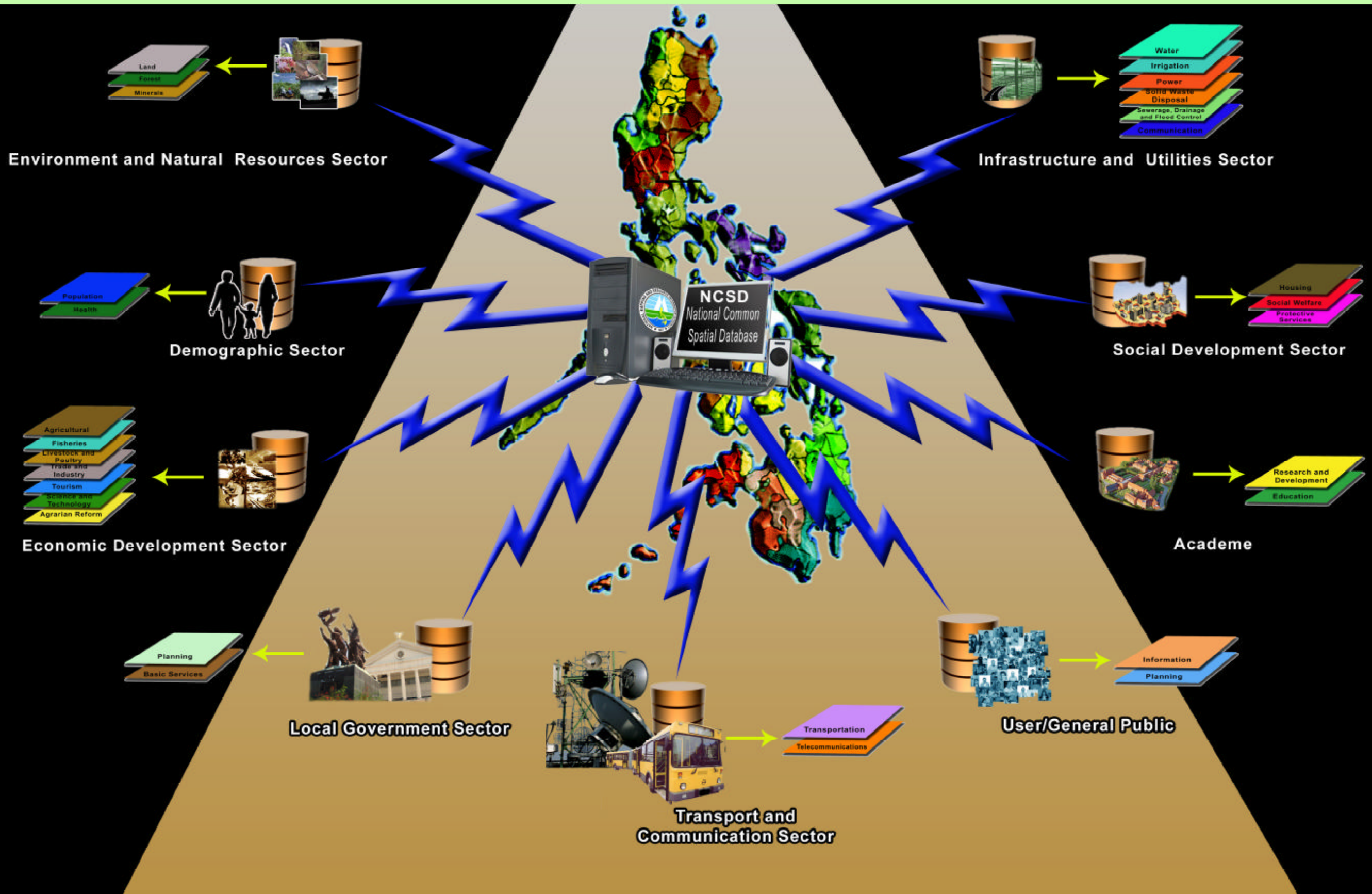
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1:250,000 - suggested scale  
for regional planning

1:50,000 - suggested scale  
for provincial planning

1:10,000 - suggested scale  
for city/town planning



**The Philippine National Spatial Data Infrastructure**  
 - a seamless interconnectivity of geographic information

## The READY Project and the NSDI

by Jaime P. Mallare\*

The “*Hazard Mapping and Assessment for Effective Community-based Disaster Risk Management*” or *READY* Project is being sponsored by the United Nations Development Programme and the Government of Australia. The project has three significant aims: at the local level, to address the problem of disaster risk management (DRM); at the national level, to institutionalize and standardize DRM measures and processes; and at the community level, to empower the most vulnerable municipalities and cities in the country and enable them to prepare DRM plans.

The project is spearheaded by the Office of Civil Defense-National Disaster Coordinating Council (OCD-NDCC). Also involved in the project are two agencies of the Department of Science and Technology (DOST)—the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA); and two agencies of the Department of Environment and Natural Resources (DENR)—the Mines and Geosciences Bureau (MGB) and NAMRIA.

In NAMRIA, the Mapping Department is tasked to provide the raster-rectified and the vector file of topographic maps, while the Information Management Department (IMD) and the Remote Sensing and Resource Data Analysis Department (RSRDAD) are tasked for the project with the data integration, preparation of map layouts, and conduct of information, education, and communication (IEC) activities. To date, the RSRDAD has submitted the final integrated provincial and municipal maps for Surigao Del Norte and Surigao Del Sur. On the other hand, the IMD prepared and submitted the integrated provincial maps for the provinces of Bohol, Leyte, and Southern Leyte. Both the IMD and the RSRDAD also participated in IEC activities for the project such as conducting lectures on map appreciation and preparing flyers and posters for distribution to the local government units.

### From READY Integrated Mapping to NSDI

The Philippines’ NSDI is a national initiative to provide all Filipinos with better access to essential geographic information. The NSDI’s main objective is to provide users of geographic information with complete and consistent datasets and to meet their requirements at the national level, even though the data is collected and maintained by different agencies. The NSDI will help achieve better outcomes for the country through better economic, social, and environmental decision making.

The NSDI is backed by standards, guidelines, and policies on community access to that data, to support the country’s economic growth and its social and environmental concerns. It is not planned to be a central dataset, but rather a distributed network of databases, managed by individual custodians with the expertise and incentive to maintain them and who are committed to the principles of custodianship.



With all this in mind, the READY Project adheres to the basic principle of distributed data and standards. The agencies involved in the project are preparing and managing specific thematic maps with integrated provincial and municipal thematic hazards maps as the final outputs. Each agency prepares the specific thematic layers and submits these to NAMRIA for integration. The map themes are as follows: for PHIVOLCS—ground rupture, ground shaking, liquefaction, earthquake-induced landslides, and volcanic; for PAGASA-DOST—tsunami, rainfall-induced landslides, and storm surge; and for MGB-DENR—floods and flashfloods. The base maps at 1:50,000 as well as 1:10,000 scales, on which the specific thematic maps prepared by the agencies are overlaid, are prepared and distributed by NAMRIA.

Eventually, all member agencies of the READY project will become integral parts of the sectoral nodes of the NSDI. Each agency is expected to develop its own fundamental dataset that will form part of the distributed databases of the entire infrastructure and will service the needs of the general public. Particularly, the sectoral node to which the READY agencies belong will address the needs of the community in terms of disaster management and emergency response information. Like any other thematic information, the hazard maps will be reckoned from the base information of NAMRIA which in turn will be a vital content of the NSDI. ♦

\*Officer-in-Charge, Database Management Division, IMD

# Conversion, Transformation, and Integration into PRS92: The Continuing Challenge

by Olivia R. Molina\*

The Philippines has no standard national reference system for all its surveys and mapping activities, thus the creation of the Philippine Reference System of 1992 (PRS92). Pursuant to Executive Order (EO) number 45 as amended by EOs 280 and 321, PRS92 became the flagship project of NAMRIA. A sub-component of this project deals with the development and formulation of effective procedural guidelines in the treatment and processing of land classification (LC) maps and other environment and natural resources (ENR) datasets for the PRS92 system. These shall be adopted by DENR Regional Offices and are also for the effective implementation of LC matters and management of the country's remaining natural resources. The LC Division under the NAMRIA Remote Sensing and Resource Data Analysis Department (RSRDAD) is the lead group in the implementation of the

conversion, transformation, and integration of LC maps and ENR datasets into PRS92.

The LC maps and other ENR datasets can be part of the fundamental datasets of NAMRIA, together with the base maps which the agency is mandated to generate. NAMRIA serves as the clearinghouse for all of the digital databases or geographic information for the sectoral nodes of the projected NSDI for the Philippines.

### The Process...

The three pilot sites for the activities were chosen to represent the country's major island groups: Benguet in Luzon, Biliran in the Visayas, and Davao del Sur in Mindanao (Figure 1). Benguet is a landlocked and mountainous province, Biliran is an island province, and Davao del Sur is a coastal province. These three provinces will serve as test areas to

determine the best procedure to transform the LC lines into PRS92. Office work, field observation, and verification were conducted in these pilot areas. The LC Division also formulated draft guidelines on the transformation and integration of LC maps into PRS92. A process flowchart (Figure 2) to serve as a reference was also developed. It involves the following phases: map database creation, LC map replotting and compilation, recovery and reconstruction of lost/missing LC maps, recovery of existing monuments, and map transformation and integration of LC and other ENR datasets into PRS92.

### ...The Results...

Based on the draft guidelines and the process flowchart, the following have so far

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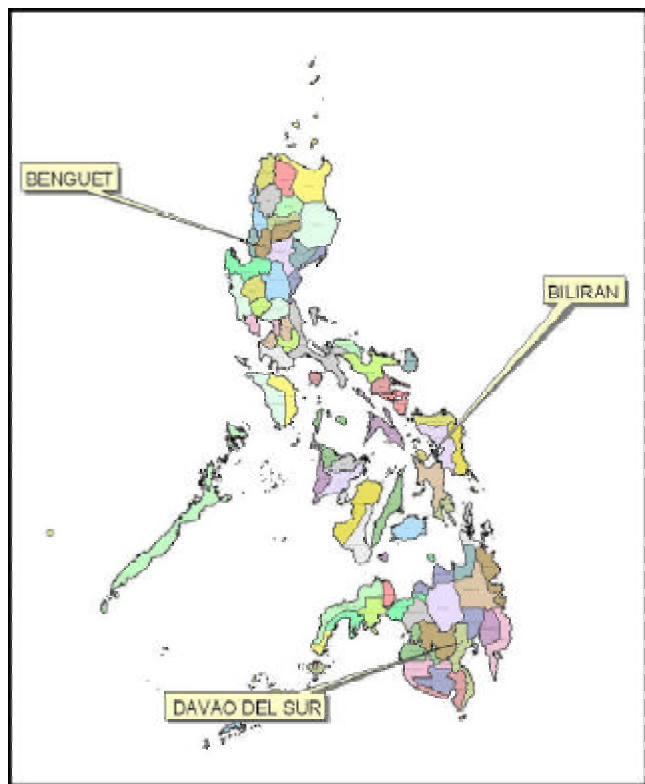


Figure 1: Location of pilot sites

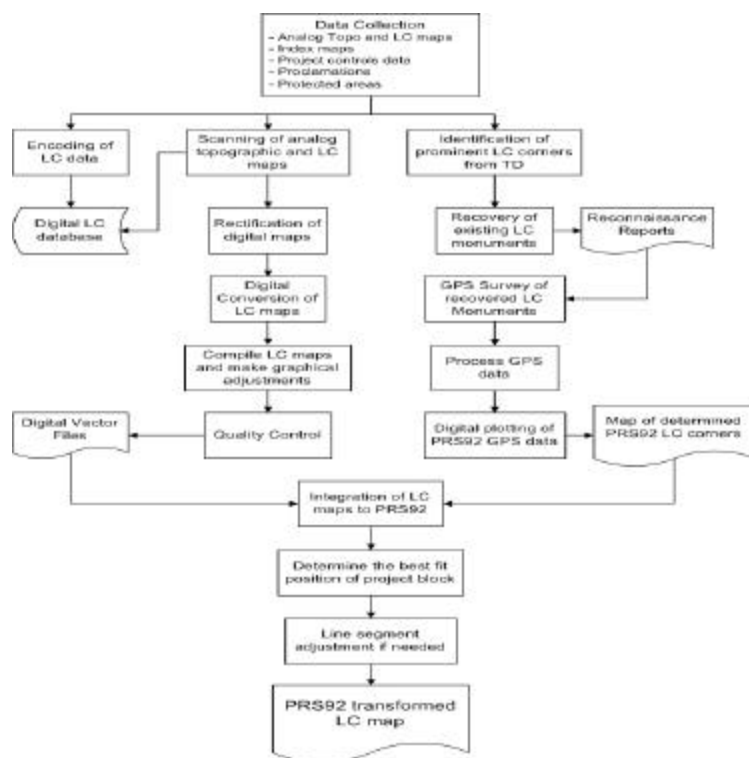


Figure 2: Process flowchart of integration and transformation to PRS92

\*Chief, LC Division, RSRDAD

## News

## New tools for better charts

by Ensign Ali M. Chavez and Ensign Cherrylene A. Nuñez\*

To complement NAMRIA's support of the network of digital databases known as the NSDI, there are programs now available to the agency that can clearly project the features seen in paper charts and electronic navigational charts (ENCs). These are the HYPACK and the TNTmips. The HYPACK is a tool in displaying and analyzing the multibeam survey files and tide and correction files while the TNTmips is a GIS software for overlaying coastline topographic survey with new soundings from the multibeam survey. With these in hand, images needed for the NSDI can be accurately and easily produced.



(Top) In BRPH PRESBITERO's post-processing room, commissioned officers learn from JICA expert Mr. Heiji Sakamoto (seated with his back to the camera) about the processing procedures of bathymetric data gathered by the ship using Hypack MAXX version 6.2.

(Left) CGSD Commissioned Officers, with an outboard motor operator and a boat crew, launch in Manila Bay the Expendable

Bathy Thermograph (XBT) under the supervision of JICA expert Mr. Heiji Sakamoto (seated facing front) to determine the general characteristics of the survey area before or during a hydrographic survey.

The HYPACK Survey System was introduced in 2006 to the NAMRIA Coast and Geodetic Survey Department (CGSD) through a project to enhance the agency's hydrographic capabilities for navigational safety. The project, which was funded and supported by the Japan International Cooperation Agency (JICA), aimed to have new multibeam surveys done of major ports and harbors in the Philippines. Projected outputs of the new surveys included new paper charts and updated ENCs.

The project commenced in March 2006 with the installation of a new survey system in the motor launch (ML-JP1) of BRP HYDROGRAPHER PRESBITERO. The system included HYPACK Survey computers for data acquisition, GPS receivers for positioning, the TSS-DMS (but replaced by POSMV a year after) for the motion sensor, and the RESON SeaBat 8101 for the multibeam echosounding. This HYPACK software, which is integrated to GPS receivers, motion sensor, and echosounder, is a suite of programs that assist in collecting and processing data pertinent to surveying and dredging projects. It contains powerful tools for quick display and design of planned survey lines, tide correction



Motor Launch Jaime Presbitero 1 (ML-JP1), equipped with the newly installed RESON SeaBat 8101 transducer, is lifted using the winch in preparation for another day of surveying.

and sound velocity correction databases, and other files to assure complete and accurate results.

The HYPACK Survey System is helping enhance the hydrographic capability of CGSD. Before this project was launched, only a singlebeam echosounder was being used to survey shallow water areas. This kind of echosounder has limited capability and low accuracy compared to the multibeam echosounder. Having a multibeam echosounder like the RESON SeaBat 8101 increases the accuracy of gathered data since it has the capability of 100% bottom coverage survey. With this, the entire seafloor can be examined for obstructions, shoals, and wrecks.

The Manila North and South Harbor, Cebu Harbor and approaches, and Batangas Bay and vicinity were the pilot areas of the project. The project instructions for Manila Harbor included the verification of existing wrecks, shoals, and obstructions, and the hydrographic survey of entrance channels to piers. The survey was conducted on 28 July 2006-20 September 2006. The survey for the Cebu Harbor project, with the same instructions as the Manila Harbor project, was done on 18 October 2006-08 November 2006. The survey for Batangas Bay and vicinity was done in October 2007.

Japanese experts including long-term expert Mr. Heiji Sakamoto provided technical assistance to the project. They conducted trainings to familiarize the CGSD-NAMRIA technical staff with the system. They also conducted frequent inspections of the status of the project and monitored the capability of personnel in handling the new survey system.

In addition to the HYPACK Survey System, the TNTmips GIS software was also introduced. TNTmips is a professional system

## READY Project prepares provinces for disasters

by John SF. Fabric\*

The multiagency READY Project has to date conducted IEC campaigns in seven of the 27 target provinces since its inception in 2006. The seven provinces are Surigao Del Norte (November 2006), Surigao del Sur (November 2006), Leyte (August-September 2007), Southern Leyte (December 2007), Bohol (February 2008), Aurora (May 2008), and Cavite (June-July 2008).

The READY IECs mainly focus on seminars and workshops on the results of the multihazard mapping, a collaborative activity of NAMRIA, PHIVOLCS, PAGASA, MGB-DENR, and OCD. The participants in the IECs are municipal and city mayors, disaster action officers, local planners and engineers, *barangay* captains, teachers, and other local government officials. The IECs cover topics on *Map Appreciation; Results of the Hazards Mapping on Storm Surge, Rain-Induced Landslide, Ground Rupture, Ground Shaking, Earthquake-Induced Landslide, Liquefaction, and Tsunami; Early Warning System for Flood and Tsunami; and Philippine Disaster Management System and Contingency Planning.*

During the workshops, participants are provided with hazard maps, which will help them evaluate the hazards present in their respective areas. By knowing the dangers they are susceptible to, the municipal and *barangay* officials become further and better

equipped in making plans and actions to mitigate the adverse impacts of the hazards in their localities. An identical one-day workshop for selected elementary and high school teachers includes basic instructions on reading maps, tracking typhoons, utilizing rain gauges, and the conduct of earthquake drills in school. It is expected that after the workshops, all participants will conduct echo workshops to their constituents and fellow teachers.

The remaining provinces that are scheduled for IEC campaigns until 2011 are: Pampanga, Zamboanga del Sur, Northern Samar, Eastern Samar, Zambales, Laguna, Antique, Ilocos Sur, Catanduanes, Abra, Quirino, Agusan del Sur, Nueva Vizcaya, Cagayan, Isabela, Zamboanga Sibugay, Rizal, Iloilo, Ilocos Norte and Benguet. The member agencies involved take turns in organizing the IECs. The READY Project is supported by the UNDP, the Australian Agency for International Development, and the NDCC. ♦

*Provincial IEC activities:*

### New tools...

from page 14

for fully integrated GIS, image analysis, CAD, TIN, desktop cartography, and geospatial database management. To start with, three CGSD-NAMRIA technical personnel were sent to Japan for two months to undergo comprehensive training in the use of this software. Their work assignment is the integration of new sounding information to old charts and/or creation of new charts. CARIS GIS software is, however, still considered in generating the final outputs of paper charts, new ENC's, and updated ENC's.

All in all, the equipment given by JICA for the duration of the project were the portable pressure-type tide gauges, desktop computers and laptops for data acquisition and processing, plotter and printers, scanner, latest versions of HYPACK and TNTmips software and their respective software keys, and the HYPACK Survey System.

A month before it ended, a Japan Evaluation Mission Team was dispatched to assess the status of the project. With the conduct of the set site inspections, a project presentation, and discussions, the project was finished in March 2008.

In addition to the three pilot areas, the Pakiputan Strait in Davao and part of Sarangani Bay in General Santos were also surveyed using the HYPACK Survey System in 2007. Then in February 2008, a new multibeam survey was conducted in Manila Bay covering portions of the Manila North and South Harbor and Manila International Port Terminal. Matnog Bay in Sorsogon was also surveyed in May 2008. The next areas scheduled to be surveyed this year are Dumaguete, Iloilo Strait, and Cagayan de Oro. ♦



One of the seminar-workshops held in Bohol in February 2008



A READY resource person explains the hazard map to barangay captains.

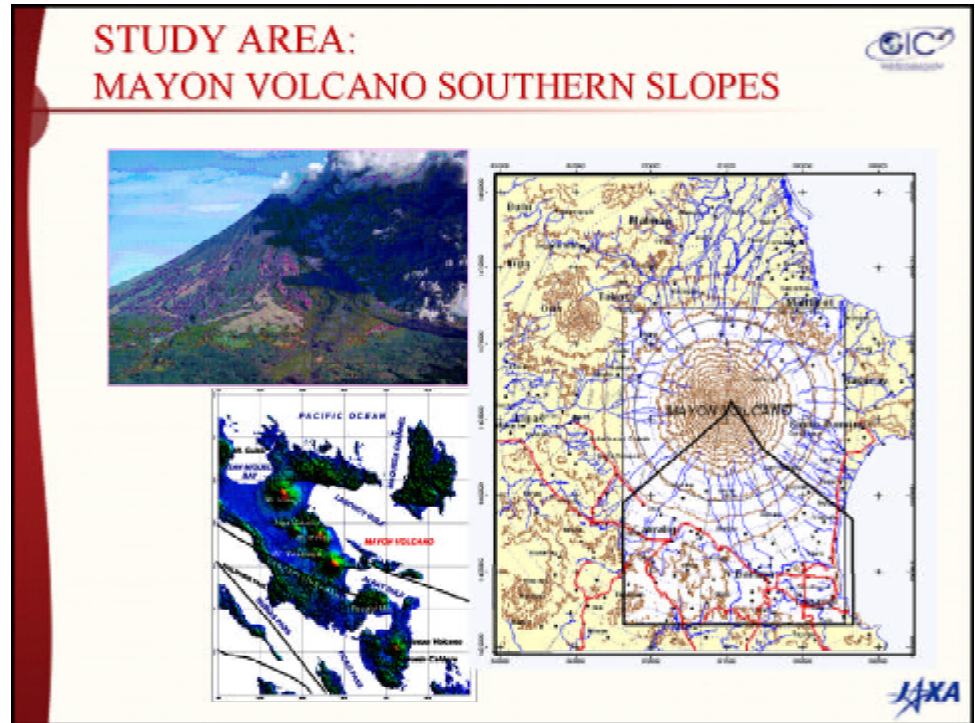
## News

## Agencies complete lahar hazards study of Mayon Volcano

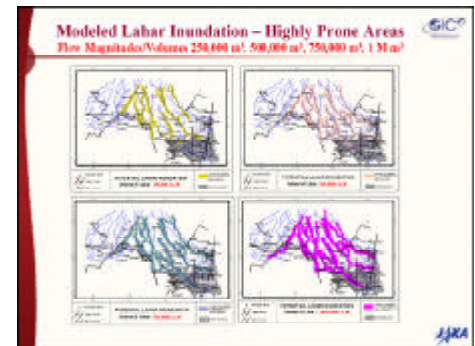
by Estela C. Gumabon\* and Mariton V. Bornas\*\*

**M**ayon Volcano which is situated in the Province of Albay, Southern Luzon is the most active volcano in the Philippines. Approximately a million people in seven towns inhabit the volcanic slopes which are constantly threatened by various volcanic hazards, among which are rain-lahar inundation hazards. The most devastating recorded instance of these hazards in recent years occurred in November 2006 due to Super Typhoon *Reming*. The lahars caused significant changes in the topography and hydrography of the southern slopes and in the existing danger characterization.

In April 2007-February 2008, a mini-project sponsored by the Japan Aerospace Exploration Agency (JAXA) was undertaken by PHIVOLCS-DOST, NAMRIA-DENR, and the Geoinformatics Center-Asian Institute of Technology (AIT). Their objective was to delineate current rain-lahar inundation hazards through the modeling of constrained lahar volumes on a digital surface of the southern volcanic slopes of Mayon. The widely adopted RS/GIS-based semi-empirical, probabilistic inundation model LAHARZ was utilized for the purpose. The main input was a post-event digital elevation model (DEM) produced by data of December 2006 from the Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer, the earth-looking scanner onboard the Terra satellite. Height to length ratios in the range of 0.20-0.35, characterizing the proximal limits of lahar inundation, were selected by a careful visual examination of the ASTER-derived DEM. Flow volumes ranging in cubic meter from 0.25 to 5.0 were simulated within the limited data resources. Simulations were also performed using a DEM created from the contour data of 1977 for comparison and interpretation of results.



Through successful model runs, the resulting lahar inundation maps corresponding to 0.25, 0.5, 1.0, 2.0, 3.0, and 5.0 in cubic meter of flow volumes were prepared characterizing the associated danger. These maps show differences in the lateral extents, geometries, and sites of inundation between the ASTER-derived and the contour-derived DEM, as expected. The former resemble that of small-volume, channel-confined lahar deposits while the latter replicate that of actual fan-shaped lahar aprons or debris deposits. However, some of these differences are considered to be pronounced due to the limited accuracy of satellite-based topographic data failing to capture the actual shallow channel topography with the range of channel widths of 20-60 meters and depths of 3-20 meters. Had there been high-resolution DEMs such as those derived from the Advanced Land



Observing Satellite/Panchromatic Remote Sensing Instrument for Stereo Mapping, the error involved in modeling features of the terrain could have been greatly minimized.

The map outputs are presently featured in the respective websites of JAXA and AIT. Possibly for this year will be conducted, as the continuation of the project, volcanic risk assessment and loss estimation covering the same study area. ♦

\*Senior Remote Sensing Technologist, LC Division, RSRDAD

\*\*Senior Science and Research Specialist, PHIVOLCS-DOST

**Reviewing ...**

from page 15

information and the basic GIS tools for the integration of this base information with the users' or stakeholders' data. *Figure D\** below

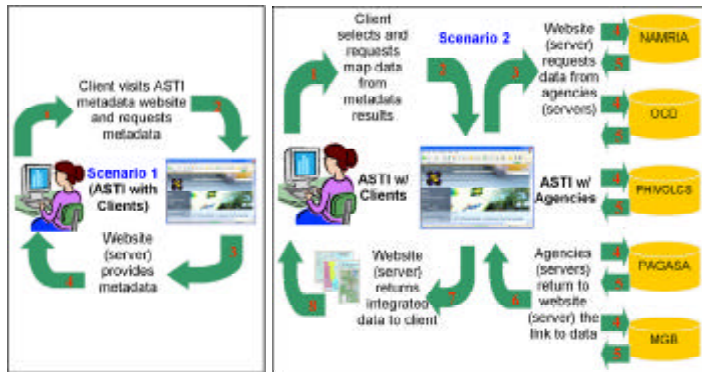


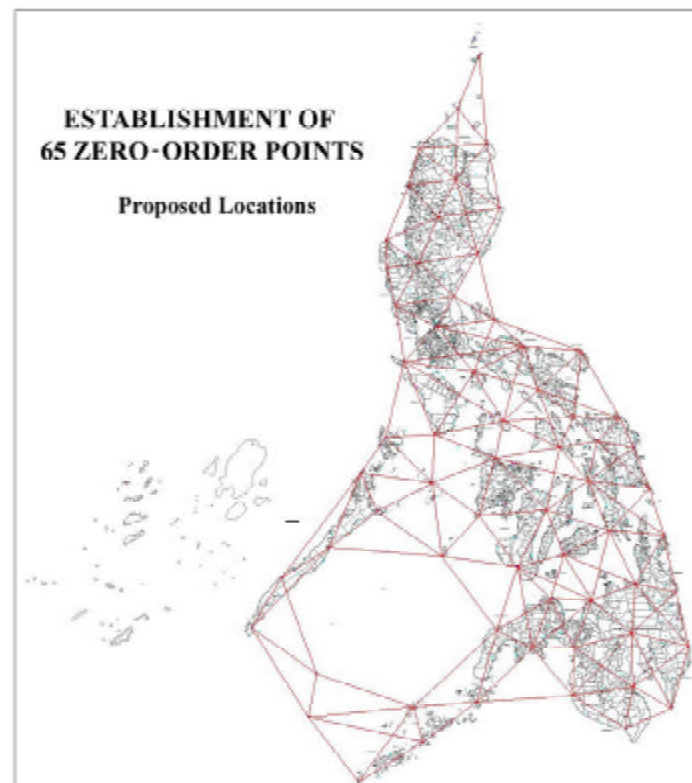
Figure D

is the illustration of the data flow between ASTI and the client and between ASTI and data-providing agencies.

With the full implementation of NSDI, a call center operator of a food company is able to view the location of a caller and is able to transmit the delivery order to the store nearest to the caller's location just by knowing the caller's address or phone number. A utility service provider is able to determine the location of and possible causes for a service complaint and to quickly dispatch a service crew since the information is web-accessible. An elementary pupil is likewise able to learn about Philippine geography by obtaining information about maps. These will no longer be just scenarios but realities. The Philippines will surely reap benefits from its NSDI. ♦

**The GCPs ...**

from page 8



**On NSDI and NCSD...**

from page 9

data holdings. NAMRIA and partner agencies such as the Office of Civil Defense-Department of National Defense (OCD-DND); MGB-DENR; the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA); and the Philippine Institute of Volcanology and Seismology (PHIVOLCS) are implementing the Geohazard Mapping Project under the assistance of the United Nations Development Programme. In this project, conversion of topographic maps into digital database is ongoing in response to disaster risk mitigation nationwide. In the PRS92 Project, the data integration component is actively implemented by the Mapping Department. The data will be consequently part of the fundamental datasets needed for NSDI. Transformation of all topographic base maps into PRS92, the new standard reference for all surveying and mapping activities in the country as stated in EO 45, as amended, is in progress in the national and local levels.

The transformation and standardization of these base maps into a geospatial database, together with attribute data that will be accessible through a network system, will provide easy access to various users. The NCSD will stage the transformation of the current topographic maps into a new, sophisticated, and GIS-ready database that will be used by all government agencies as well as the public as **a common reference to all their thematic maps and applications.** ♦

Depending on the requirement of an application, the appropriate level of accuracy is adopted. Any method of surveying that meets the requirement for accuracy may be employed. Appropriate instruments shall be used. Nominal spacing of GCPs is as follows: first-order – 50 kilometers, second-order – 25 kilometers, third-order – 10 kilometers, and fourth-order – 5 kilometers.

**Zero-Order Control Points**

NAMRIA is establishing this year 65 zero-order control points with an accuracy higher than first-order. Nominal spacing for these points will be 100 kilometers. The design was to recover and re-occupy first-order GCPs. To date, eight zero-order points have been surveyed.

**GNIS**

At NAMRIA, a Geodetic Network Information System (GNIS) is being maintained. It contains, among others, a description of each GCP which includes its geographic location (specifying access to it and its exact physical position relative to reference marks in its immediate vicinity), and geographic coordinates (latitude, longitude, and/or elevation). For a minimal fee per GCP, a certification for each GCP is issued to a surveyor or mapper who needs to geographically reference his survey. The LMS will also soon maintain their own regional GNIS to facilitate issuance of certification to users in the region. ♦



**Conversion...**

from page 13

been achieved (Figures 3-5): (1) Recovery of missing LC maps, (2) Creation of a map database, (3) Replotting and compilation of LC maps and ENR data, (4) Identification of prominent LC corners, (5) Field observation and surveys, and eventual (6) Transformation of compiled LC and ENR maps into PRS92.

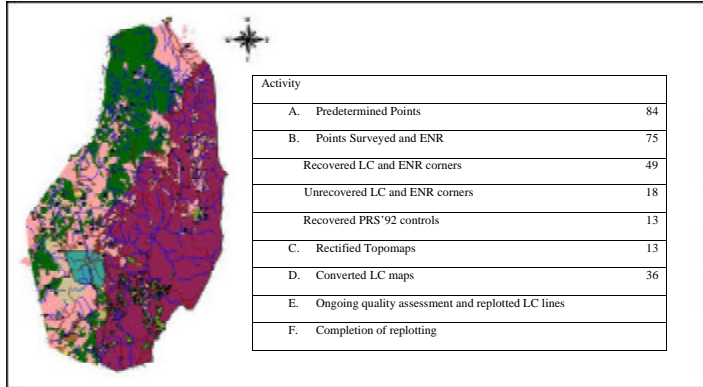


Figure 3: Partially integrated map and status of accomplishment for Benguet Province

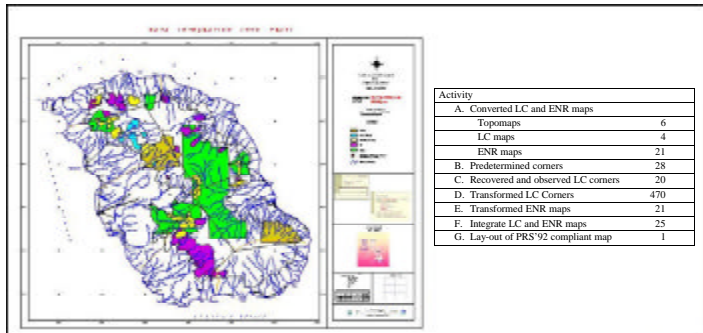


Figure 4: PRS92 transformed map and status of accomplishment for Biliran Province

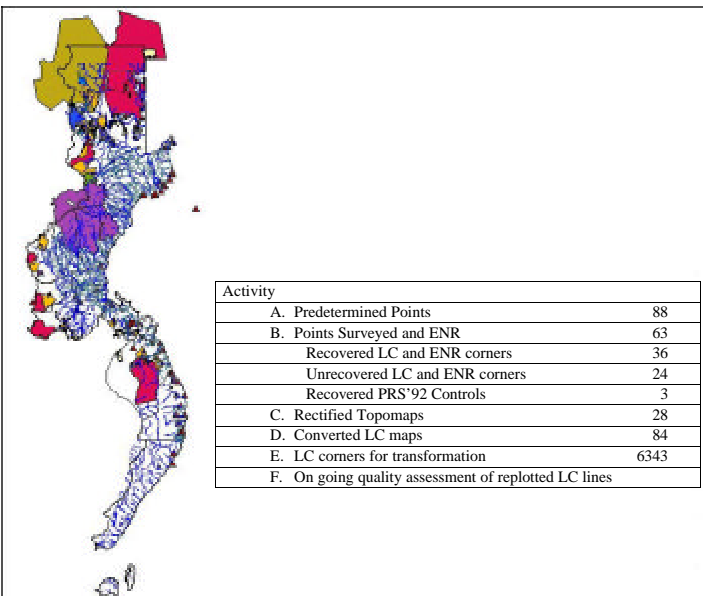


Figure 5: Partially integrated map and status of accomplishment for Davao del Sur

Missing LC maps were recovered from the regional offices during fieldwork and the monitoring of PRS92 outputs was conducted per region. The numbers of recovered LC maps are as follows: 3 from Benguet, 1 from Biliran, and 18 from Davao del Sur. Additional data and maps were also gathered during the briefing/seminars held in the three pilot sites. A digital database was designed to accommodate queries and to facilitate LC data storage and retrieval of data and important details provided by the LC maps.

LC and ENR maps were manually replotted in analogue format using topographic maps as base maps, which were georeferenced at 1:20,000 scale. These topographic base maps will be used in the projection and rectification of LC lines and corners which in turn were based on the technical descriptions of the reference locations of LC corners. The rates of accomplishment for the compilation and completion of LC maps and ENR data for Biliran, Davao del Sur, and Benguet were 100%, 80%, and 70% respectively.

The projected and replotted LC and ENR boundary corners were likewise identified through careful examination of the technical descriptions indicated in each LC map. The corners fall on natural or man-made features which are easily identifiable on the ground, such as the mouth of rivers and streams, the junction of rivers or creeks, boulders, mountain peaks, the junction of roads and trails, Bureau of Lands (BL) monuments (i.e., BL location monuments, barangay boundary monuments, municipal boundary monuments, and provincial boundary monuments), and other topographic features. The corners were tabulated for easy reference. The coordinates of the identified corners were extracted/determined and stored in the database.

Field verification (Figure 6) was conducted in each of the three pilot areas to recover the predetermined LC corners. The recovered LC and ENR corners were surveyed in accordance with standard procedures specified in the *Manual of Land Surveying*, following at least the fourth-order of accuracy. A survey-grade Global Positioning System (GPS) and Conventional (Total Station) survey was applied for corners that were found to be undisturbed and/or corners identical to the BL boundary monuments. In Biliran, 20 GPS readings were recorded. They include location monuments, PRS92 controls, field network survey party monuments, the junction of rivers and creeks, and the mouth of rivers. In Davao del Sur, 39 LC corners had GPS readings while 24 LC corners were tracked.



Figure 6: Field survey and observation of existing monuments

Monuments, however, were not recovered and the remaining LC corners were not tracked due to the peace and order situation in the southern portion of the province. For Benguet, 49 GPS readings for LC corners were recorded while 18 LC corners were not recovered. Eight PRS92 controls were also recovered while the remaining

LC corners were not investigated due to the harsh terrain, inadequate time, and the peace and order situation in the area.

Finally, the transformation phase required a second adjustment to conform to the ground-surveyed fixed point. The coordinates derived from GPS surveys for the predetermined corners were plotted and overlaid in the digitally compiled map. Coordinates of the compiled LC corners were likewise extracted from the digitally compiled PRS92 map. The datum shift transformation parameters stated in section 50 of the revised *Manual of Surveying Regulations* were used in transforming the LC corners into PRS92. Other transformation methods were also explored, such as the four-parameter transformation method.

### ... And the Challenges

New technologies such as large-format scanners and powerful desktop computers helped in the preliminary stages of integration particularly in the database creation and digital conversion of LC and ENR maps. However, problems and difficulties were encountered. During their replotting, the old and dilapidated LC maps were compared with the topographic base maps being used today and overlaid. The contributing factors for the discrepancies were the type and the accuracy of the equipment that were used in the survey. In the replotting of LC maps, the high incidence of errors was observed in the boundary closures and graphical adjustments of lines and corners, due to the individual's subjective reasoning, decision making, interpreting, and plotting of LC map features on topographic base maps.

Fieldwork and survey activities proved to be challenging for the pilot study which is at the stage of developing the draft guidelines in transforming and integrating ENR data into PRS92. Sophisticated equipment like the survey-grade GPS, the high-accuracy handheld GPS, and the Total Station Theodolites proved to be indispensable instruments in collecting field survey data. The handheld GPS unit is very effective in searching for the predetermined corners.

Among other problems encountered by the team in the field were the inaccessibility of the sites owing to the rough roads, rugged terrain, and the peace and order situation in the area which prevented the recovery and location of some predetermined corners.

The accuracy of the handheld GPS was also assessed using a high-precision handheld GPS unit and the survey-grade GPS. The handheld GPS unit was found to have an average positional accuracy of  $\pm 10$  meters when it receives a minimum of five to six satellite signals, as compared to the survey-grade GPS.

In the transformation phase, a study was also made to determine the magnitude of changes when the lines are adjusted for distribution of error. At the same time, the four-parameter transformation adjustment was also tested. The perpendicular distances were measured in four random sites from the unadjusted line to the graphically adjusted and four-parameter adjusted lines. In both instances, the perpendicular distances between the unadjusted and the adjusted lines were observed. Initial findings indicated that there is no conclusive evidence to show that one is better than the other. As long as the variances are within the tolerable limit, both methods can be employed. The adjustments were found to be dependent on the location of the ground-surveyed LC points and how they are evenly spaced out (*Figure 7*).

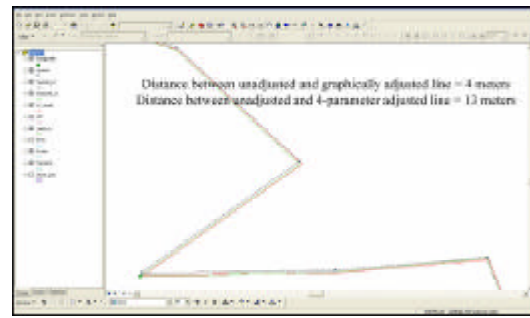


Figure 7

### Findings and Recommendations

Guidelines should be developed to acquire a homogenous spatial data. Based on the draft guidelines for PRS92 integration, standards were set for each of the major activities such as digital data conversion, replotting and compiling, and transforming and integrating maps.

Currently, the guidelines in transforming and integrating ENR data into PRS92 are in the final stages of editing. They are also scheduled for the PRS92 technical committee's final review, deliberation, and recommendation to the Secretary of DENR for approval. The following activities are furthermore recommended, based on the results and data gathered in the three pilot areas:

In the replotting and compilation of old and dilapidated LC maps, a 50-meter allowable limit of adjustment or buffer should be applied for all LC lines, since a one millimeter in a 1:50,000-scale topographic map is equivalent to 50 meters on the ground. This may also address the issue of overlapping boundary lines between forestlands and cadastral maps.

A survey-grade GPS unit must be used for recovered concrete monuments or markings for a more precise point-position reading. A fourth-order accuracy for GPS position is required to ensure a more correct and accurate re-adjustment and compilation of LC and ENR maps for transformation into PRS92.

To complement the use of survey-grade GPS units, a handheld GPS unit would suffice in recording WGS84 coordinates of the recovered predetermined corners. The coordinates of corners found to be disturbed or not monumented and subsequently fall on natural features, such as the junction of rivers or creeks and the junction of roads or trails, can be recorded using handheld GPS instead of survey-grade GPS. Certain factors, however, must be considered to obtain the required degree of accuracy.

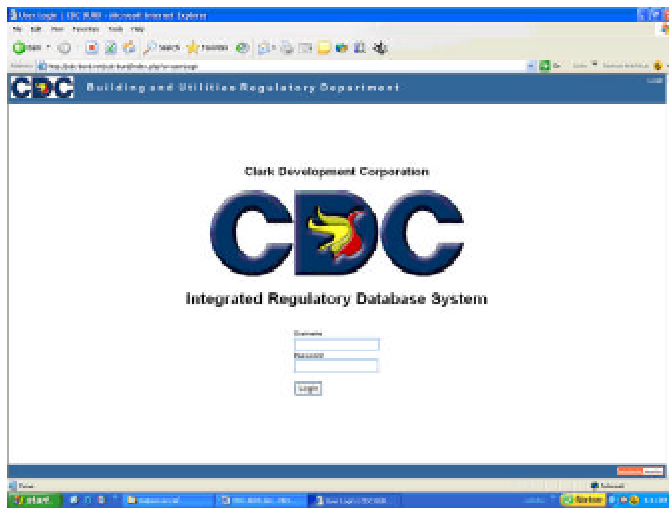
The handheld GPS unit should receive at least six satellite signals during the observation. The location of the LC corner to be observed by the handheld GPS unit must be free from obstructions coming from canopies. The elevation mask simulated by the mountains should be less than an angle of 45 degrees. The accuracy rating displayed by the handheld GPS unit should be less than 15 meters.

Finally, the transformation phase requires a second adjustment to conform to the ground-surveyed fixed points. The graphical method and the four-parameter solution were tested in the transformation process. The discrepancies between the two methods depend on the distribution and frequency of the ground-surveyed points in the adjustment of the project block. The four-parameter solution can be employed if the variances are within a tolerable range. Otherwise, the graphical method may suffice. ♦

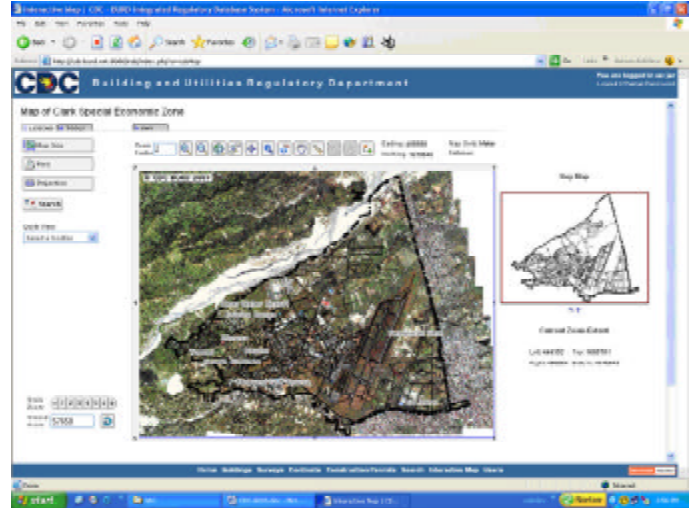
## News

## CDC CSEZ Sub-Zone Project (Phase II)

by Rosalyn D. Sontillanos\*



Log-in page



Map page

NAMRIA, through the RSRDAD, carried out the Delineation of Boundary of Clark Freeport Zone (CFZ) as part of the second phase of the CSEZ Sub-Zone Project for the Clark Development Corporation (CDC) under a Memorandum of Agreement.

The completed activities in 2006 during the first phase of the project include: (1) Development of the Integrated Regulatory Database System (IRDS) for CDC–Building and Utilities Regulatory Department (BURD); (2) Establishment of GPS survey and control points; and (3) Densification of boundary monuments for the Sub-Zone Eastern Boundary.

For the second phase of the project, activities include (1) the survey/delineation of the CFZ boundary, physically defining its 4,400 hectare-area which is composed of the CDC Main Zone and the properties leased to BB International Resort Corporation and former True North Golf course, which are situated in the western portion; and (2) the establishment/installation of third-order GPS survey control points within the CFZ. All surveys were tied to PRS92 GPS reference points and certified by the CGSD.

Aside from the delineation, another major activity is the continuing upgrading and development of the IRDS. The IRDS serves as the central repository of alphanumeric and graphical data of the

BURD for efficient data management. It is a web-deployed, integrated, and structured database created using an open source web GIS application like Apache Web Server, PHP, PostgreSQL with PostGIS extension, and UMN Mapserver. Through this system, the various sections of the department can now access a single multiuser database server, update data from it, steering clear of concurrency and integrity conflicts, and extract up-to-date data efficiently. The IRDS can be described as a combination of three components: portal, database, and map.

The *portal component* is composed of *html* pages delivered via the Apache Web Server as user interface to the system. This is where user validation and requests are interpreted and stored to be passed on later to either the database or the map component of the system for processing. The *database component*, on the other hand, is the structured storage mechanism for the alphanumeric data of the system. It is a behind-the-scenes, back-end component. It was developed using the open-source relational database management system (RDBMS) software PostgreSQL, whose robustness and stability rival the expensive closed-source RDBMS software like DB2 and Oracle. Lastly, the *map component* is also back-end like the database component. The behind-the-scenes component is run by UMN Mapserver using PHP-Mapscript as the scripting interface. ♦



A sample pre-installed monument

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