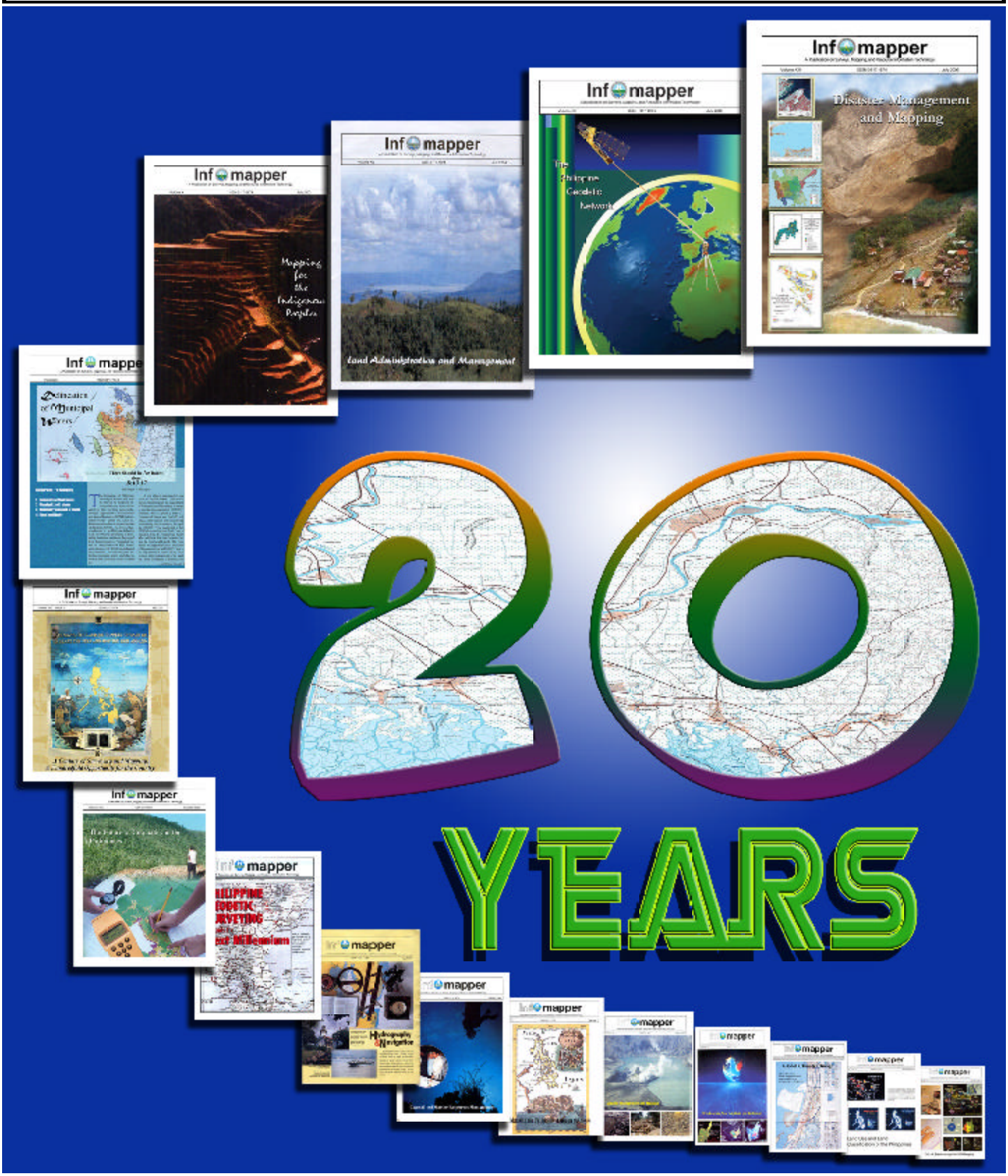
# Infomapper

A Publication on Surveys, Mapping, and Resource Information Technology

Volume XIV | ISSN-0117-1674 | July 2007

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*Cover and spread design: Sheilah Mae G. Lopez*
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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

# Two Decades of NAMRIA

The creation of NAMRIA arose from the need for only one agency to undertake surveying and mapping functions of a national scope. Twenty years ago, by virtue of Executive Order (EO) number 192, four government agencies performing related works were merged because the thinktanks at that time believed that the consolidation will result in considerable cost-efficiency and effectiveness for the government. Now, 20 years later, has it all been worth it for NAMRIA? Have the architects of EO 192, in the case of NAMRIA, realized the envisioned goals relative to national development?

The fledgling NAMRIA in its early stages, under the helm of a visionary leader, coped with the available resources on hand. Material resources included a limited budget and the pieces of equipment inherited from the National Cartography Authority, the Bureau of Coast and Geodetic Survey, the Natural Resources Management Center, and the Land Classification Teams of the Bureau of Forest Development. "Organizational problems," "financial and technical difficulties"—these were the stumbling blocks to a steady and fruitful course for the agency, as identified in the earliest annual report available. Rather than be defeated by such conditions, the agency had to overcome them, for there was a lot of work to do. By 1988—there was a national cartography center to set up, hydrographic and oceanographic surveys to undertake, topographic maps to revise and update, resource and environmental assessment studies to make, natural resource information systems to develop, and thousands of hectares of unclassified lands to deal with.

Forward into the future—the agency has soared high. Despite the ever-present financial constraints and other uncertainties, the agency manages to provide the public with maps and related services. NAMRIA remains the central mapping agency, depository, and distribution facility for geographic and natural resource data. Our customers, our programs and projects, our local and foreign partners and donors—these affirm NAMRIA's ability to serve the nation. Administrator Diony A. Ventura, as what his predecessors did before him, has been keeping well at bay the detrimental factors.

This issue of *Infomapper*, an official publication of NAMRIA, highlights the agency's progress through the years. Featured is the Philippine Reference System of 1992 (PRS92), a project that is of great importance to Philippine surveying and mapping. It can also be described as a truly cumulative or defining undertaking of the agency for the most part of its 20-year existence.

NAMRIA certainly has had to deal with its fair share of challenges through the years. It has managed to survive and to thrive mainly because of its dedicated manpower. And so NAMRIA has prevailed, notwithstanding the realization of rationalization or reorganization. Only good wishes should be in store for NAMRIA and for its future. May its capabilities in surveying, mapping, and resource information management be further enhanced. May it have many more opportunities to be of service to the nation.

Cheers!

***Infomapper***

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Published by the Media Production Division, Information Management Department
National Mapping and Resource Information Authority (NAMRIA)
Office: Lawton Avenue, Fort Andres Bonifacio, Taguig City • Tel. Nos.: (02) 8102890; 810-4831 to 36, local 430 Telefax: (02) 810-5466 or 810-5468 • E-mail Address: mpd@namria.gov.ph

# From Analog to Digital: Vignetting the Evolution of NAMRIA Technologies for Surveying and Mapping

*by Xenia R. Andres*

New technologies have revolutionized the way individuals accomplish their tasks. Information and communications technology (ICT), for example, has facilitated data exchange and sharing. ICT is now merging with the technologies for collecting and dealing with geographic and spatial information.

The surveying and mapping community is not spared from the fast and relentless shifts in the technological arena, such as the development of surveying equipment. Forerunners of modern surveying equipment were crude and unpolished but each technological development improved not only the quality of the surveying instrument but also the accuracy of surveying. The electronic distance measuring devices were commonly used early on and were later combined with angle measuring devices to form total stations. Recent developments include automatic data collectors for total stations, the global positioning system (GPS), and robotic total stations.

This article describes the evolution of NAMRIA technologies from analog to digital to produce its products and perform its mandates in surveying, mapping, remote sensing, and information management. Analog relates to or is a mechanism in which data are represented in plain text or continuously such as a photograph. Once the same data, for instance, are recorded, stored, processed, or displayed in electronic form, usually by computers, they become digital.


*Left picture–Balanacan (Marinduque Province, O. W. Ferguson, 1906; 1907). On the highest hill at the northwest point of Marinduque Island. Salvaria Island in the entrance to Looc Bay bears N. 9º E., distant 3 kilometers, and the highest point of the western one of the two San Andres Islands bears 80º E., distant 3 kilometers. It is on the northwest end of the hill, 10 meters northwest of the highest point, and is in a commanding situation, seeing a hundred miles of the south coast of Luzon, much of the north and west coasts of Marinduque, the coast of Mindoro and other islands. Station mark is the center of a hole 1.5 centimeters in diameter and 6 centimeters deep, drilled at the center of a triangle 16 centimeters on a side, cut in a hard rock. Reference mark is on a hard, white boulder of about one cubic meter in volume, standing 80 centimeters above the ground and 90 centimeters higher than the station. The mark is a hole 1.5 centimeters in diameter and 8 centimeters deep, at the center of a cross cut on top of this stone. From the station, the reference mark is in azimuth 326º 34' and is distant 18.85 meters. (Maynard and Bond, The Triangulation of the Philippine Islands, 1927). Right picture–standard monument for new stations established using GPS.*

### Water, Coastal, and Land Surveys

From 1981 to 1997, NAMRIA used for its hydrographic and physical oceanographic survey fleet, the survey vessels presented to the Philippines by the Australian government as a component of the economic assistance program of the Southeast Asian Treaty Organization from 1962 to 1970. With the passage of time, the requirement for digital data that support the Electronic Chart Display and Information System and other electronic chart systems escalated and was pressing hydrographic communities worldwide.

In 1996, NAMRIA acquired an initial batch of hardware and the Computer-Aided Resource Information System software to be utilized in the conversion from analog to digital format of the paper charts maintained by the agency. The Electronic Navigational Chart (ENC) Development Unit was created during the year to digitize the existing charts, automate the chart-making processes, and eventually produce ENCs.

Two brand-new oceanographic research and survey vessels were acquired in 1998 through a state-to-state soft-loan facility from the Government of Spain. The multidisciplinary twin vessels, BRP HYDROGRAPHER PRESBITERO and BRPH VENTURA, are capable of hydrographic charting and geophysical and oceanographic surveys. Onboard the vessels are advanced instruments like the wide-swath, multibeam echo sounding equipment for a more thorough sea bottom coverage; the Acoustic Doppler Current Profiler for tidal current metering; the satellite positioning (Differential GPS); and the navigational equipment. The vessels' integrated survey and data operation systems comprising dry and wet sample laboratories, multibeam echo sounder, sonar, and automated cartographic systems facilitate the gathering and processing of results and information base.

In 2000, a memorandum of agreement was signed between NAMRIA and the Japan International Cooperation Agency (JICA) for the research and development of an RP-wide ENC. The five-year ENC development and technology transfer project involved the conversion of nautical or paper chart data to digital format which facilitated the updating and revision of charts. In 2006, another JICA-funded project called Enhancement of Hydrographic Capabilities for Navigational Safety project was commenced. This collaboration aimed to improve NAMRIA's capability in hydrographic data acquisition and processing techniques; nautical chart compilation in paper and electronic formats and databasing techniques; and tidal observation and data analysis. The project is expected to be completed in 2008.

NAMRIA continuously undertakes the digitization, standardization/updating, and compilation of charts covering the whole country in accordance with the International Hydrographic Organization Special Publication 57 and Publication M-4. The S-57 contains the IHO transfer standards for digital hydrographic data while the M-4 contains the IHO regulations for International Charts and Chart Specifications. At present, NAMRIA has in its holdings an array of hardware, software such as SevenCs (ENC Designer, ENC Manager, ENC Analyzer, ENC Optimizer, ENC Cartographer), dKart Inspector, and Adobe Illustrator CS2, and GPS survey systems. These new technologies provide an end-to-end production of paper and digital charts.

The primary tide stations established and maintained in the different coastal areas in the country are equipped with analog- and digital-type tide gauges. The analog-type tide gauges include the Leupold & Stevens model and the A.O.T.T. float-type model. The use of digital tide gauges was made possible through the Association of Southeast Asian Nations (ASEAN)-Australia Tides and Tidal Phenomena-Regional Ocean Dynamics Project from 1986 to 1992. These digital models include the cartridge-type EMS 16 and the pressure-type ENDECO which indirectly measures water levels through sensors registering hydraulic pressure. The tide stations in Davao City and in Subic Bay Metropolitan Authority have a telemetric capability, which monitors tidal measurement in real-time mode.

The growing need for a suitable spatial framework to support integrated surveying and mapping activities was addressed through the RP-Australia Natural Resources Management and Development Project of the Department of Environment and Natural Resources (DENR). NAMRIA became the pioneer in using GPS on its

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## From Analog to Digital...

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large-scale geodetic survey from 1989 to 1992. GPS revolutionized the conventional ways of establishing ground control points through triangulation, traverse, and trilateration.

In 1991, the Philippines through NAMRIA became the host of the 39th Determination Orbitography for Radio Integrated System (DORIS) beacon. The DORIS project was an international network of transmitter beacons that carries geodetic and geophysical data of a satellite station receiving feeds from other stations worldwide. The beacon transmits to the SPOT2 satellite information allowing very precise orbit determination and accurate determination of reference points. The powerful beacon is very essential to the conduct of geodetic and geophysical surveys.

Operations of the 38-year old Magnetic Observatory in Muntinlupa were stopped in 1988 after a fire razed the Variation Building. The building, which was the Observatory's sensor house, was reconstructed in 1993 and a new set of magnetic instruments was acquired through JICA. These instruments were the three-axis magnetometer; fluxgate magnetometer; Overhauser magnetometer; portable proton magnetometer; and proton magnetometer. The Observatory provides a reference station for all magnetic surveys in the country. Magnetic surveys are conducted to gather information for the preparation of an isogonic chart which is updated every five years. Magnetic data gathered are important in determining the local variations which are reflected in NAMRIA's nautical charts and topographic maps. They are also used to correct compass bearings during navigation, surveying, and finding directions on land.

With the Asia-Pacific Space Geodynamics Project for the establishment of the Absolute Gravity Standard Station Network in East Asia and Southeast Asia with FG-5 absolute gravimeters, absolute gravity measurements for the Philippines though NAMRIA were conducted using FG-5#203 gravimeter. The gravity base mark made of a metal plate was installed in the main office of NAMRIA in 2005. A magnetic station for the Magnetic Data Acquisition System (MAGDAS) Project was also set up at the Observatory in 2005 in collaboration with the Space Environment Research Center, Kyushu University, Japan. MAGDAS is a very sensitive, state-of-the-art, real-time magnetometer which can detect small changes in the earth's magnetic field. The equipment installed through these projects has helped NAMRIA in carrying out its functions.

### Mapping and Remote Sensing

With the extension from 1987 to 1992 of the National Cartography Center Project through the German Assistance for Technical Cooperation, various surveying and mapping equipment were acquired, including technical assistance and training. Among the equipment were microcomputers and a reprographic process camera. The installation of the KLIMSCH REPROGRAFIKA P in 1991 augmented NAMRIA's mapmaking facilities in establishing self-reliance in the continuous production of updated maps.

The reprographic camera was a computer-assisted, high-precision instrument capable of performing various reprographic processes such as halftone, line, and screen work. It was a special darkroom camera in horizontal construction used for industrial reproduction and repro-drafting. It was equipped with electronic digital control for automatic sizing, focusing, and exposure.

In support of the rapid advancement of GIS technology and other geographically referenced databases, digital mapping efforts in NAMRIA started in 1991 with the acquisition of the ZEISS program PLANIMAP as part of its software updating for the C100 Planicomp Analytical System. The program enabled digital plotting through graphical elements measurement, coding, and storage in a computer file. Unlike other forms of digital map acquisition, data were captured online; thereby, the loss of accuracy due to secondary tracing in cartography and to random errors introduced during printing was reduced. With the flexibility of data in digital form, more users were supported aside from the traditional users of printed maps.

Also in the early 1990s, NAMRIA used a number of photogrammetric instruments such as four B8S WILD Heerbrugg, 1 WILD Autograph A10, 3 ZEISS Planicart E3, ZEISS Planimat D3, 1 ZEISS Orthocomp, one ZEISS Orthocomp, 1 ZEISS C100-Planicomp Analytical Plotter, and 1 ZEISS SEG 6 Rectifier/Enlarger. Additional acquisitions in 1992 were the ZEISS Planicomp P2, a universal analytical stereoplotting system, and five multi-terminals NEC/Multi-Sync 5D for AutoCAD users. P2 Planicomp was a cost-effective analytical plotter which combined the capability of C100 Planicomp viewer and the new PHOCUS features and contained P-Series Control Unit and integrated P-processor. Compared to analog instruments, the analytical plotter has a higher level of accuracy, versatile application, and faster operation.

Capability building to meet the rapidly increasing demand for digital maps continued in 1992 with the total upgrading of three ZEISS Planicart E3, one ZEISS Planimat D3, and one ZEISS Planicomp P2. The equipment can now access or make use of AutoCAD, a program for computer-aided design, which introduced a whole new approach to digital mapping. During this period, NAMRIA's analog stereoplotters (four WILD B8S and Aviograph stereoplotters and one WILD A10 Aviograph) were still being used for mapping operations.

The use of AutoCAD for mapping facilitated activities, increased accuracy, and reduced errors. The use of pencils, erasers, and similar instruments was reduced by this drawing tool. Editing operations were performed with ease and flexibility. Traditionally, aerial triangulation measurement was performed using the analytical plotter and automatic plotting table for map sheet preparations. With AutoCAD, editing was directly done at the terminal without the use of the automatic plotting table. Moreover, legend and label placement no longer required painstaking manual lettering. Mapping operations were also faster with this software. What would have normally taken three days to convert an aerial photo model's planimetric features (non-urbanized area) and contours into a manuscript took only two days or less.

From 1987 to 1995, cartographic enhancements were done through manual scribing, stick-up of names, and stripping of color and symbols. Digital cartographic enhancements using Freehand software started in 1996. The digital data are outputted directly to film through image setting.

In 2000, the Integraph Digital Photogrammetric Workstation (DPW) was acquired to enhance mapping capabilities. The DPW offered the multiple benefits of flexible scanning, superb stereo viewing, and fast image processing and display. With this system, NAMRIA can now produce digital maps direct from the scanned aerial photographs at a much faster rate than using the conventional plotters. The workstation has state-of-the-art systems such as the ImageStation Digital Mensuration which provides a multi-image, multi-sensor stereo point transfer and measurement environment for a photogrammetric triangulation workflow; ImageStation Feature Collection which minimizes the interaction required to collect or edit feature data; and the ImageStation Base Rectifier which allows the user to establish a wide variety of rectification parameters on an image-by-image basis to provide the ultimate in flexibility for large projects.

NAMRIA provided services for geodetic control survey and digital orthophoto mapping for the implementation of the DENR Land Administration Management Project in 2001. Two prototype areas were also developed that sought to improve the efficiency of administrative processes and to accelerate the registration and issuance of titles to people. The photo control points were established using GPS and a fully digital method in the orthophoto production was employed.

In 1988, NAMRIA implemented the land classification component of the Comprehensive Agrarian Reform Program. Used in the reconnaissance surveys were basic tools such as the Japanese compass transit which gets bearings or directions, along with steel tapes or calibrated chains and the stadia for measuring distances. Equipment used in LC surveys has since evolved from that time. ***(See related article on LC milestones in NAMRIA.)***

The remote sensing (RS) capability of NAMRIA was upgraded from 1990 to 1993 through bilateral assistance from Australia. The Philippines-Australia RS Project aimed to provide a national archive of RS data and the capability to process these data for use in government and private development programs. The archiving, processing, and applications center component was lodged at the National RS Center (NRSC) in NAMRIA.

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Jose G. Solis

Liberato A. Manuel

Isidro S. Fajardo

Diony A. Ventura

# The NAMRIA Administrators

*by Maria Romina dR. Pe Benito*

Upon every creation is bestowed a distinctive mark by its maker. The leader likewise leaves something of himself in the hearts and minds of his followers. It is an indelible, significant imprint that sets him apart from both his predecessor and his successor. *JGS*, *LAM*, *ISF*, *DAV* —these are the initials of NAMRIA's four administrators, past and present. For the men and women who have been part of NAMRIA's storied history for the last 20 years, these initials by themselves speak volumes. The term of each administrator is made unique and truly memorable by all of the varying events it encompasses. Then of course it is also the administrator, the foremost agency representative and the one at the forefront of all of these events, who defines the period with his character and wisdom.

### The Time of *JGS*

And so it came to pass that NAMRIA was to be created. ***Jose Guyala Solis*** shares deeply in NAMRIA's history as its first leader and also as one of its founders. Former Administrator Solis was schooled in civil engineering and attended training courses and seminars on mapping, surveying, and remote sensing. From 1972 to 1976 he was the commanding officer of the 516th Engineer Base Topo Company of the Armed Forces of the Philippines (AFP). He had a hand in reorganizing the Company into the AFP Mapping Center. He was the commanding officer of the Center for nearly ten years. Former Administrator Solis was involved in the creation of the National Cartography, Photogrammetry and Remote Sensing Center, in turn the forerunner of the National Cartography Authority (NCA). He served as executive director of NCA from 02 July 1986 until it was merged with three other offices and became NAMRIA on 01 July 1987, with him as Administrator. He had more than 25 years of military service when he retired as a colonel of the Philippine Army in 1987.

Former Administrator Solis saw NAMRIA in its period of adjustment while the powers and functions of the four distinct and separate entities were still being integrated. Capabilities were united with his guidance and inspiration to jumpstart NAMRIA's accomplishment of its regular program of activities, including the pending tasks carried over from the former offices. A noteworthy accomplishment for his first year in NAMRIA was the historic compilation of the first topographic map at scale 1:50,000 produced entirely in the Philippines and by Filipinos. Its launching on 22 December 1988 marked the beginning of regular map production at NAMRIA. Equipment and technical expertise leading to this accomplishment were acquired through the National Cartography Center Project (1981-1992) of NCA. The project was a bilateral technical and financial cooperation undertaking of the governments of the Federal Republic of Germany and the Republic of the Philippines.

By 1989, NAMRIA had established membership in organizations such as the Asian Wetland Bureau and the Economic and Social Commission for Asia and the Pacific/Regional Remote Sensing Program (ESCAP/RRSP). According to the 1989 report, NAMRIA "hosted 53 conferences, seminars, and meetings," such as a regular meeting of the ESCAP/RRSP Intergovernmental Consultative Committee and a workshop on Geographic Information Systems (GIS) technology. Former Administrator Solis was also the Chairman of the National Statistical Coordination Board. In the succeeding years of his term, he grew in prowess and prominence as NAMRIA Administrator. In 1995, he was elected as one of the seven vice-presidents of the International Cartographic Association and headed the Commissions on Education and Training, and Mapping and Satellite Imagery.

In his third year of stewardship, former Administrator Solis managed to set NAMRIA on a steady course in fulfilling its mandates. Early in his term and for the duration of it, he wanted NAMRIA to be firmly established and kept in the public eye. This was accomplished through the extensive use of various tools to market and promote the agency's products and services. Among these were publications, information campaigns, radio and television feature interviews and guest appearances of NAMRIA officials, technical fora, and video documentaries. During his term, NAMRIA was able to develop its official homepage under the Integrated Environmental Management for Sustainable Development Program of the DENR and the National Economic and Development Authority. Through the homepage, which was launched in 1996, NAMRIA's products and services became more accessible to Internet users.

Former Administrator Solis endorsed well NAMRIA's participation in special projects with both local and foreign institutions. These projects during NAMRIA's formative years with his leadership enabled the agency to accomplish noteworthy endeavors, improve and upgrade its surveying and mapping capabilities, and establish important linkages. The respect and confidence especially of other government agencies, private institutions, as well as foreign counterparts in mapping and related fields were gained for NAMRIA.

One such project enabled NAMRIA to establish the Philippine Reference System of 1992. This was under the Geodetic Survey component of the Natural Resources Management and Development Project or NRMDP (1989-1993), an Australia-assisted project of DENR ***(see related articles in this issue)***. Another Australia-funded project (1990-1994) established the country's archiving, processing, and applications center of remotely sensed data in the country. The NRSC was the object of the visit of Thai Princess Maha Chakri Sirindhorn on August 28, 1991.

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## The NAMRIA Administrators

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During his term, former Administrator Solis also gave NAMRIA's full support to the major programs and activities of the Philippine Government spearheaded or supported by the DENR. Among these were the Comprehensive Agrarian Reform Program (CARP) which used NAMRIA's land classification maps; government efforts to rehabilitate the Pasig River for which the agency conducted hydrographic survey in 1988 and produced an updated land use map in 1994; and the Coastal Environment Program (CEP) for which the agency, starting in 1994, conducted mangrove inventory, assessment, and mapping of CEP areas. Likewise, he rallied the agency to assist in the rehabilitation efforts following the grievous destruction to life and property caused by such natural disasters as the 1990 earthquake and the eruption of Mount Pinatubo in 1991. Disaster management maps of Mayon and Taal volcanoes were also produced by NAMRIA in 1993.

As a leader, he fully endorsed a comprehensive manpower development thrust for NAMRIA though the attendance of the agency's staff in local and foreign trainings, conferences, conventions, and seminar-workshops. He encouraged the creation of the Organization of NAMRIA Employees (ONE) which was formally established in 1993 and he was generally supportive particularly of its projects and activities promoting the welfare of employees.

Former Administrator Solis likewise strongly supported the creation in 1993 of the Information Technology Strategic Plan (ITSP) and the Inter-Agency Task Force on Geographic Information (IATFGI). The ITSP is a framework for efficient and cost-effective integrated information systems to support NAMRIA's functions. The IATFGI aimed to promote and coordinate the efficient development, management, and utilization of geographic information at all levels and in all sectors in the country. He was also a staunch advocate of the importance of modern mapping technologies like GIS. Near the end of his term in 1998 he wanted NAMRIA to take an active role in teaching the usefulness of these technologies especially among the local government through the holding of seminars and workshops. Also by the end of his term, the NAMRIA Modernization Bill was still being discussed in the appropriate committees at the Lower and Upper Houses of Congress. Its approval, which he vigorously pursued, and implementation would have meant the further development of the agency's capabilities particularly in mapping and surveying. It could also have been a most fitting culmination of all of his hopes and dreams for the agency he had helped to build.

Former Administrator Solis served as NAMRIA Administrator for more than 10 years and under two Philippine presidents. Incidentally, then President Fidel V. Ramos attended NAMRIA's seventh-year anniversary celebration on 05 July 1994. Former Administrator Solis left NAMRIA in March 1998 to run for the position of Congressman of Sorsogon province in the national elections of May 1998. In the interim, Deputy Administrator Evangeline C. Cruzado served as Officer-in-Charge of the agency.

### The Time of *LAM*

The new administrator of NAMRIA who was able to serve for two years was no less than a retired brigadier general of the AFP — ***Liberato Arrieta Manuel***. He was designated as the new head of the agency on 02 July 1998. A graduate of the Philippine Military Academy (PMA), former Administrator Manuel is also a holder of master's degrees in business administration and national security administration, from the Ateneo de Manila University and the National Defense College of the Philippines respectively. He also completed a strategic business economics program leading to a master's degree in business economics from the University of Asia and the Pacific.

Buckling down to work after assuming leadership of NAMRIA, former Administrator Manuel's first agendum as administrator was the re-orientation of officials and employees on love of country, especially through their serious and faithful attendance at the flag ceremonies. The regular recitation of the *Panunumpa sa Watawat* and the *Panunumpa ng Kawani ng Gobyerno* became a part of the flag-raising ceremony. He also instituted value-formation through the giving by employees themselves of a series of relevant talks during the Monday formation. The new administrator instituted a gradual restructuring of the organization which he believed was necessary in order to improve the agency's performance of its mandated functions.

It was through his encouragement that NAMRIA's present day Multi-Purpose Cooperative (NMPC) was established. The NMPC grocery opened in 1999 and in the same year he also approved the establishment of the NAMRIA day care center as the agency's contribution to the Gender and Development Program (GAD) of the government. The setting up of the center had been the brainchild of ONE since the time of former Administrator Solis. Through the holding of a consultative assembly in December 1998 which was facilitated by ONE and was part of NAMRIA's observance of National Government Employee's Week, he afforded employees with the opportunity to directly communicate with management the issues and concerns they considered important and were for the immediate attention of his administration. Similar sessions followed in an Administrator's Hour held in April 1999 and two sessions of the Administrator's Day held on 24 and 26 November 1999.

The projects and activities undertaken during his term of office were pursued in line with the programs of the administration of former President Joseph E. Estrada. Foremost of these was the production of maps to serve as vital reference materials for policy makers, development planners, and land use developers in the formulation of regional and provincial plans and the judicious use of the country's natural resources, among others. As NAMRIA's commitment to the first 100 days of the Estrada Administration, the agency produced and printed 108 sheets of updated land use and forest type maps of Luzon and Visayas at 1:100,000 scale; a summary map at 1:2,000,000 scale indicating the land cover of the country; and 30 digital maps covering CALABAR areas at 1:10,000 scale.

Former Administrator Manuel also encouraged the agency's drafting of the guidelines for delineating Philippine municipal waters and gave his support to the agency's pilot project for the Philippines in the overall "Technology in Updating Topographic Maps Using Remote Sensing." It was a regional cooperative project done in 1999 and was spearheaded by the ASEAN Experts Group on Remote Sensing, with funding from the Australian Surveying and Land Information Group. Gainful experiences were derived by NAMRIA from efforts to test the use of automated remote sensing and cartographic modeling techniques for a more practical but cost-effective method of updating base maps.

The new leadership of NAMRIA also made as a priority concern of the agency, the pursuit of the country's claim over portions of the disputed *Kalayaan* Island Group. The foremost mission target of the agency was the completion of the survey and mapping of the country's maritime territory, including the Exclusive Economic Zone. Fortuitously enough for the accomplishment of this mission target, the agency's two modern oceanographic research and survey vessels arrived in 1998 and 1999.

In giving support to DENR thrusts and priorities during the period, NAMRIA continued with the mapping and inventory of mangrove areas within CEP sites for the DENR flagship program on coastal environment. The agency also pursued the creation of a GIS database on the country's identified critical watershed areas for the ENR preventive and rehabilitation program for sustainable development. During the period the preparatory training for the development of geographic information systems for local government units also culminated. NAMRIA coordinated this activity under its Municipal Base Mapping Program with technical assistance and financial support from the Swedish International Cooperation Development Agency. The NRSC in NAMRIA also took part in an undertaking involving Philippine government agencies and the National Aeronautics and Space Administration to investigate the potentials of AIRSAR and TOPSAR datasets.

The *NAMRIA Newsletter* (1988-1989) was revived during his term of office. Former Administrator Manuel endorsed a heightened promotions and marketing strategy for NAMRIA through print and broadcast media, printing of information materials, and the conduct of information campaigns. He likewise vigorously pursued the expansion program for the agency's map sales offices (MSOs). A total of 11 regional MSOs were established in 1998 and 1999 in addition to the already existing MSOs which

included those in the main office in Fort Bonifacio and in the branch office in Binondo. The NAMRIA One Stop-Shop was established and had its initial operation in 1998. To date it houses all available information on the agency's map products, digital and remote sensing data and services.

NAMRIA successfully hosted several significant events during the term of office of former Administrator Manuel. One of these was the 19th Asian Conference on Remote Sensing. The seminar, "National Information Infrastructure for Management of Marine Resources and Traffic at Sea," held in October 1998 was sponsored by the trade council of the Royal Norwegian Embassy in cooperation with NAMRIA. In commemoration of the Philippine centennial celebration, the agency produced a centennial map calendar which featured the famous 17th century map made by Father Pedro Murillo Velarde and a 200-year perpetual calendar. Copies of the maps were disseminated to various clients, visitors, and other government agencies.

**The Time of *ISF***

NAMRIA's third administrator, who was also able to serve the agency for two years, shared with his predecessors a transition from a military career to civilian service. ***Isidro Sarmiento Fajardo*** took over the reins of leadership of NAMRIA on 03 January 2000. Among the positions he previously held were the following: Chief of Engineers, AFP, 1996-1999; Commanding Officer, AFP Mapping Center, 1990-1994; and Deputy Administrator, Local Waterworks Utilities Administration, 1986-1988. He is a licensed civil engineer and sanitary engineer with master's degrees in business administration, management, and national security administration. His civilian and military schooling included training courses in applied geodesy and photogrammetry. He was conferred the Career Executive Service eligibility in August 2000 by the Career Executive Service Board.

Early in his administration, former Administrator Fajardo strove to gain the trust and confidence of NAMRIA officials and employees alike and to reinforce the spirit of camaraderie among them, so as to ensure smoother flow of work. Team building was a core component of the management planning workshop in January 2000 and the management conference in June 2000 which he both spearheaded. The two occasions afforded him with the opportunity to foster a harmonious working relationship with the agency's officials. He later instituted the reforms he considered urgently necessary. A major policy decision he made was the delegation to the deputy administrators and department directors the authority to approve financial and personnel matters. This was a setup which allowed direct participation of officials in running the affairs of the agency. He also made as part of his programs and projects the construction of quarters to house stay-in employees and of the day care center. The agency's staff house opened in March 2001 while its day care center opened in July 2001. He likewise gave his support to the Collective Negotiation Agreement (CNA) between management and ONE. The CNA was initially signed in March 2002.

Former Administrator Fajardo strongly supported NAMRIA's accomplishment of its continuing activities in accordance with its mandated tasks. These included efforts to help accomplish the delineation of the municipal water boundaries of the Philippine archipelago. The draft guidelines which NAMRIA prepared in 2000 for delineating municipal waters were later incorporated in DENR Administrative Order (DAO) number 2001-17, which was signed into law in June 2001 by former DENR Secretary Heherson T. Alvarez. The guidelines introduced the Enrique A. Macaspac Concentric Circles Method of Determining an Equidistance Line in Maritime Boundary Delimitation. In 2001 and for and beyond the duration of his term of leadership in 2002, NAMRIA was involved in conducting information campaigns and briefings for the order's full implementation. The agency was also pursuing actual delineation of municipal waters in all of the country's coastal provinces.

In 2000, his first year in NAMRIA, the agency began its participation in several noteworthy undertakings. These included NAMRIA's project in support of the DENR flagship program on the delineation and establishment of permanent forestland boundaries. NAMRIA did surveys and mapping in an effort to clearly mark on maps and on the ground the specific limits of forestlands and national parks as expressly provided for in the 1987 Philippine Constitution. For the project of the Department of Health, NAMRIA designed and developed a Maternal GIS and health facility maps as part of overall efforts to improve technical services for women's health and safe motherhood. The joint project of NAMRIA with JICA would help the the agency acquire the technology to develop ENCs covering the whole Philippine sea area.

Projects which officially began during his term of office, in February 2002 included the conduct of survey and mapping of ancestral domains of indigenous cultural communities/ indigenous peoples. Projects officially completed during his term of office, in 2001 included the second phase of the Land Cover and Land Use Change (LCLUC) Project which analyzed the inter-annual changes in deforestation and re-growth, through remote sensing images and GIS, and developed a model for land use change. NAMRIA also finished implementing, with Japan Forest Technology Association, the Information System Development Project for the management of the country's tropical forests. Project outputs turned over to the LGU beneficiaries included updated land use and forest-type maps and corresponding statistics.

It was during the term of office of former Administrator Fajardo that NAMRIA marked the centenary of surveying and mapping in the Philippines with the holding of a conference, product presentations, and a trade exhibit in July 2001. NAMRIA likewise spearheaded the national celebration of GIS Awareness Week in November 2000 in collaboration with both government and private entities. A conference was held for imparting knowledge about GIS technology and its importance. A significant event successfully hosted by NAMRIA was a national training in RS and GIS with JICA in March 2001.

The NAMRIA homepage won the Best Web Award for the government and law category of the 3rd Philippine Web Awards held in November 2000. The agency placed as a semifinalist in 2001. Three MSOs were launched during the term of former Administrator Fajardo, one of which was the branch office at the DENR central office in Diliman, Quezon City.

**The Time of *DAV***

The first former police official to assume the reins of leadership of NAMRIA is Retired Police Major General ***Diony Alvaro Ventura***, the present NAMRIA Administrator. He started his military career as second lieutenant of the former Philippine Constabulary right after his graduation from the Philippine Military Academy in 1967. He rose from the ranks in the military hierarchy and later became the police director of the Philippine National Police in December 1998 until his retirement in February 2001. He is a holder of master's degrees in public administration and national security administration from the University of the Philippines and the National Defense College of the Philippines, respectively. He also studied for a doctorate degree in peace and security administration from Bicol University Graduate School, under the extension program of Camp Crame in Quezon City. He was in the military and police service for close to 40 years.

Among the key policy directions for NAMRIA set by Administrator Ventura early in his administration were the continuing development and enhancement of the agency's existing capabilities, priority equipment acquisition, and maintenance of discipline in the organization. He strongly emphasizes in his leadership the need for the unity and hard work of the agency's officials and employees, especially to fulfill the agency's commitment to the priority programs of the national government and the DENR.

There are several top priority concerns under his leadership at present, as identified in the agency's General Program of Action and the12-point agenda of DENR. One is the completion of the Philippine Geodetic Network by calendar year 2010 that will establish common reference points to all vital surveys and mapping activities of DENR. These include cadastral (CARP-related) surveys, land classification activities, delineation of forestlands and alienable and disposable lands, demarcation of protected areas, mineral land surveys, and other similar surveying activities. Another is the continuous production of large- and medium-scale base maps to be used for geohazard mapping, covering areas that are highly vulnerable to natural hazards and calamities. NAMRIA is also pursuing the continuous survey of unclassified public lands to be able to fulfill the government's commitment of providing areas for development,

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## The NAMRIA Administrators

*from page 7*

whether for agricultural, industrial, housing, tourism and for other purposes. Finally, another pressing concern for the agency is the redefinition of the archipelagic baselines of the country in compliance with UNCLOS and to enable the submission of maritime claims by May 2009, including the survey and charting of the country's EEZ.

Key accomplishments of NAMRIA during the recent years of the leadership of Administrator Ventura include the agency's production of the geohazard map for rainfall-triggered landslides; the construction of the 1:10,000 relief model of the Pasig River system to assist the geohazard mapping activities of the Pasig River Rehabilitation Commission; the agency's support to the different committees of the Green Philippine Highways Project of DENR; the successful location by NAMRIA's survey vessels of the exact position of M/T SOLAR 1 whose sinking caused the massive oil spill in the seas of the Guimaras Strait which threatened the coastlines in Central Visayas; and production of the 1:1,500,000-scale base maps for each of the country's five "super" regions and the Philippine Super Region Map at 1:2,000,000 scale. President Gloria Macapagal-Arroyo grouped the various provinces and regions into super regions to boost development and productivity especially in the countryside.

Administrator Ventura strongly rallies the agency to participate well in noteworthy undertakings that will further strengthen its technical capabilities. His support and encouragement helped ensure the success of the technical cooperation project with JICA for ENC development and technology transfer in the country. NAMRIA is now producing, updating, and publishing the country's ENCs in large- and small-scales covering the entire Philippine waters, major ports, and harbors. The Norwegian Agency for Development Corporation, through Blom Maritime, a technical consultant on matters pertinent to the UNCLOS, is helping the Philippine Government through DENR in preparing the necessary documents to support the country's claims to maritime boundaries in accordance with the UNCLOS. NAMRIA is the implementing arm of DENR in this effort.

With his leadership, NAMRIA comes even closer to its vision of becoming a highly-professionalized, technologically-advanced, globally-competitive, and ENR-caring agency. The facilities operated and maintained by the agency to date are manned by well-trained and dedicated personnel working with some of the most modern equipment. The NAMRIA Geomatics Training Center (GTC) located in the NAMRIA main building in Taguig City started its operations in 2003. Accredited by the Civil Service Commission, the GTC is a training institution on GIS, mapping, and allied technologies.

Administrator Ventura strongly endorses a heightened information, education, and communications strategy for NAMRIA through the preparation/packaging and dissemination of the agency's major information materials like the *NAMRIA Annual Report*, *Infomapper*, *and GIS Link*; press and photo releases in major newspapers; primers and posters; audio-visual productions; and map and technology exhibits. NAMRIA's 19th MSO in Koronadal City was launched in June 2006. It is the fifth NAMRIA sales outlet in Mindanao.

*Meeting of NAMRIA Board of Governors chaired by DENR Secretary Angelo T. Reyes with Administrator Diony A. Ventura as Board Secretary*

NAMRIA likewise hosted the 9th executive board meeting of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) in October 2002, the first time for the meeting to be held in the Philippines. The PCGIAP is a 55-nation council that aims to maximize the economic, social, and environmental benefits of geographic information in accordance with the provisions of Agenda 21 of the Rio de Janeiro Summit. Two siginificant events for November 2002 were NAMRIA's spearheading the national celebration of GIS Day, in collaboration with private and government agencies; and the agency's again winning for best website in the government and law category of the 5th Philippine Web Awards.

As NAMRIA's new leader in 2002, Administrator Ventura's establishment of kinship with the agency's staff component was auspiciously sealed by way of an affirmation-signing ceremony in May 2002 for the CNA between ONE and the NAMRIA management. To date he has been giving his full support for the successful implementation of the provisions of the CNA during his term of office. He again concluded for management the second CNA with ONE in the signing ceremony held in March 2005. He is likewise strongly supporting the housing project in Fort Bonifacio to benefit the agency's employees. He greatly encourages everyone's participation in physical fitness activities.

Administrator Ventura ably supports the projects and activities of the GAD committee of NAMRIA to celebrate "National Women's Month" and mainstream GAD concerns in the agency's operations. During his term of leadership, there is the continuing operation and maintenance of the day care center in Fort Bonifacio. Key notable agency contributions also include the production in 2002-2003 of the DENR-GAD audio-visual presentation "*Magkasama Tayo"* and the distribution of its copies in 2004 to the regional offices and attached bureaus and agencies; and in 2005, the production of a documentary on DENR GAD initiatives and the admission of female cadets in the NAMRIA-CGSD Corps of Commissioned Officers.

### Towards Greatness

Section 5 of DAO 31 which contains the guidelines implementing EO 192, dated 10 June 1987, with respect to the creation of NAMRIA, lists as the foremost qualifications of the NAMRIA Administrator his/her being an appointee of the Philippine President; a Filipino citizen; at least 35 years of age at the time of the appointment; of good moral character; and with recognized managerial competence in surveys, mapping, and/or resource information. With these qualifications, only a chosen few will indeed be able to have the title of "Administrator." NAMRIA administrators only aspire for the agency's greatness. Their backgrounds may differ but what truly matters is that they are able to lead the agency, and lead it well. True leaders, however, are also good servants. They can better teach their followers to work hard, to be honest, and to stay strong and united. Thus the agency will win the respect not only of the national leadership but most importantly of the people it serves.

# Milestones in 20 Years of Land Classification by NAMRIA

*by Olivia R. Molina**

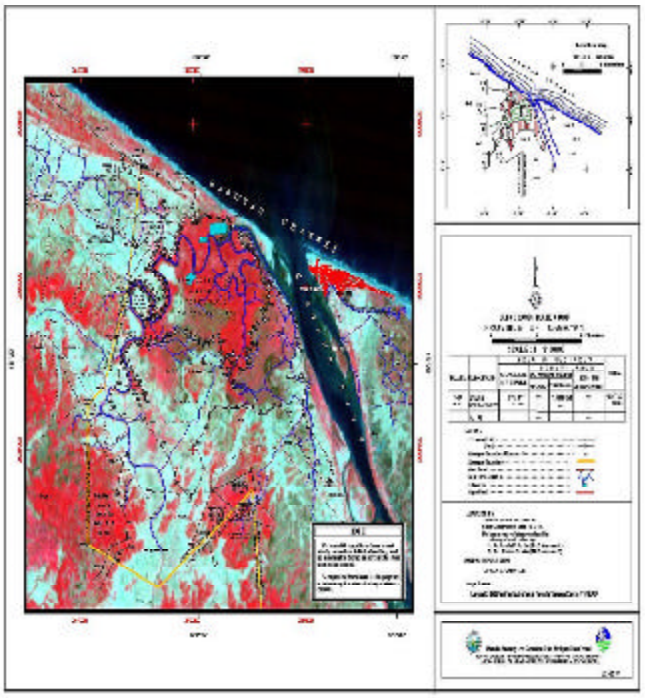
Land classification (LC) is the process of demarcating, segregating, delimiting, and establishing the best category, kind, and use for a public land. Its objective is to determine through inter-bureau action which portion of the public domain is suitable as a forestland (FL) and which could be released as an alienable and disposable (A & D) land.

Before the creation of NAMRIA, land classification was a function of the former Bureau of Forest Development (BFD) under the former Department of Natural Resources. On 10 June 1987, pursuant to EO 192 known as the Reorganization Act of DENR, the LC teams of this bureau were integrated into NAMRIA and constituted the LC Division of the Remote Sensing and Resource Data Analysis Department (RSRDAD). Hence, from then on, land classification has been a continuing function of the LC Division.

From its office at Perlas Building in Quezon City to its location now within the NAMRIA compound in Taguig City, the LC Division is continuing the LC activities started by the BFD. Land classification, however, was conducted only in the remaining areas of unclassified public forests. The reclassification of forest or mineral lands was also stopped as this activity was prohibited under Section 4(a) of the Comprehensive Agrarian Reform Law of 1988. Tie points used in the survey were the Bureau of Lands Location Monuments (BLLMs) and *Barangay* Boundary Monuments (BBMs) established by the former Bureau of Lands and the triangulation stations established by the former Bureau of Coast and Geodetic Survey (BCGS).

During this period, there were 14 LC teams in NAMRIA. Each team was composed of one team leader and one or two members. There were, however, only three total stations (one unit Shokisha, one unit Pentax, and one unit Wilde) being used by the field men. Hence, the remaining teams used surveying compass and engineer's transit. The use of the compass entailed longer time spent during fieldwork since the maximum distance that could be sighted/ measured in one shot/reading was 100-200 meters only. With the total station, a maximum of more than one kilometer distance could be measured in one sighting/reading. The RSRDAD office was able to acquire additional six Geodimeter total stations during the implementation of new projects such as the Old Growth Forest Boundary Project and the Establishment of 12.5-Meter Reglementary Elevation of Laguna de Bay in a memorandum of agreement with the Laguna Lake Development Authority. The new instruments replaced the outdated instruments. To date, there are five units of operational Geodimeter Total Stations survey equipment (four units 600 series and one unit 500 series) being used by the LC teams. Surveying was made easier with the use of high technology theodolite with Electronic Distance Meter (Total Station), combined with the team's use of other surveying accessories like radios and cell phones which facilitate their communication while doing boundary delineation between A & D lands and forestlands.

Integrating the LC staff of the former BFD into NAMRIA in 1987 resulted in the carryover of LC statistics on the remaining unclassified lands of the public domain/forest totaling 1.1 million hectares. During the implementation of the LC program in NAMRIA, more and more unclassified lands such as small islands and gaps were discovered while the LC projects were in the stages of compilation and final mapping. Another regular project, "Updating of LC Status," which was started in 1995, entailed the projection of individual LC maps into the provincial administrative maps to provide a quick look of the indicative legal status of provinces in the country. With this project, more unclassified lands were discovered and also included in the work programs of the LC survey teams. Hence in 1997, the latest statistics showed that field accomplishment on classification/assessment of lands of the public domain totaled over one million hectares. From 1989 to 2000, there were 38 approved LC projects covering a total of 226,955.31 hectares.



*Proposed land classification boundaries of an area in Aparri, Cagayan overlaid in high-resolution satellite imagery*

The worn-out/dilapidated LC maps were retraced in mylar print medium to preserve the information contained in them. A certification in each retraced map was of its being the true and correct retracing of the old LC map and was duly signed by RSRDAD Director Virgilio F. Basa. As the division also gained knowledge in using GIS software particularly ArcView, the provincial indicative maps were eventually digitized in 2003.

The methodology of land classification has developed since the time of the integration of the LC staff of the former BFD into NAMRIA. The preparation of thematic maps (i.e., drainage map, hazard map, land cover map, regulatory status map, road map, slope map, and the soil map prepared by the Bureau of Soils and Water Management) is a requirement before the actual fieldwork is conducted. Overlaying the proposed map on available high-resolution satellite imageries is also done to determine the preliminary line/corners of the proposed land classification and the present land cover of the subject area. Starting in 2002, all LC surveys were tied up to PRS92. LC surveys were conducted in the provinces of Benguet, Cagayan, Culion, Nueva Ecija, Pampanga, and other areas using total station and high-grade GPS. The results of the surveys were mapped digitally indicating the boundary between the A & D land and the forestland.

Other thematic maps were also prepared. The proposed LC maps that were surveyed a couple of years ago were also digitized and overlaid on high-resolution imageries primarily to determine the present status of the area (i.e., present land use and accessibility). There were a total of 14 proposed LC maps presented to and deliberated/approved by the LC-TWG and eventually endorsed to the DENR Secretary by the National Technical Evaluation Committee (NTEC) chaired by the Undersecretary for Planning and Policy. These maps were approved on 31 August 2004 by then DENR Secretary Elisea G. Gozun, who approved on 14 October 2003 one LC map covering a portion of the Municipality of Subic, Zambales. A total of 45 proposed LC projects have already been submitted to the Office of the DENR Undersecretary for Planning and Policy for the eventual approval of the DENR Secretary.

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**Forester Molina is the Chief, Land Classification Division, RSRDAD and holds a Master's degree in Management from the Technological University of the Philippines.*


# NAMRIA then and


now . . .

# NAMRIA in the Next Decade

*by Ruel M. Belen**

The world is rapidly changing: technological innovation, restructuring of organizations, economic growth, and growing use of Internet vis-à-vis increasing population. The advancements on the one hand and demographic growth on the other,brought about competing demands on the use of the earth's finite natural resources to further sustain economic development and prosperity. Hence, nowadays, environmental issues shape planning for tomorrow's needs, and more recently, the issue on climate change due to global warming. In this regard, managers, planners, and customers are demanding more accurate and updated information about their natural environment, delivered on a timely basis, in order to help them make rational decisions.

NAMRIA, as central mapping agency of government, continuously strives to contribute in addressing the above issues in undertaking its mandates. Through the years, it has been building on its traditional strengths while becoming more flexible and responsive to the changing times. It is working to integrate its expertise in the fields of mapping, surveying, and information management and build up its technical excellence; streamline operations to become as efficient as possible; acquire and utilize the rapid advances in information technology to better deliver information to support the needs of decision-makers; and do a better job of understanding the needs and increasing demands of our varied customers and stakeholders for different types of geographic information.

How do we see NAMRIA in the next 10 years? As we move towards the next decade, NAMRIA envisions to create a responsive spatial data infrastructure, open up new opportunities to improve its present technology, produce more products and services brought about by evolving requirements in planning, face new challenges in surveying and mapping, and continue to evolve and adopt to the rapid changes in the economic, political, and natural environment.

By the next decade, the rationalization plan of NAMRIA would have been completely instituted, resulting in a lean and mean agency. As organizations continue to evolve over time, we foresee NAMRIA undergoing another series of organizational restructuring due to new technology, varying customer requirements and the changing role of government. In ten years time, mapping and surveying technology would have improved several folds over, with software and hardware becoming more affordable and as a result, there will be more private sector participation in the field of mapmaking and surveying activities.

By that time, NAMRIA would be embarking on the updating cycle of its medium- and large-scale maps and would start moving towards the production of even larger scale maps down to the barangay level. With volumes of maps needed for updating and production by then, the agency would exercise mainly the role of regulator and less of an implementor, while concentrating on the production of specialized maps and embarking on research and development activities. The streamlined agency would be able to focus on undertaking its core functions, channeling resources where they are most needed, and acquiring state-of-the-art mapping and surveying technology, thereby resulting in a more efficient and effective mapping agency. Most of the mapping equipment at present would be rendered obsolete, discarded, and replaced by more compact ones that operate in a fully digital environment. It is not far-fetched that with the advancement in remote sensing technology, the resolution of satellite images would vastly improve, perhaps up to less than half a meter. This would enable NAMRIA to acquire very high-resolution images and facilitate large-scale mapping of the entire country; and the use of these accurate geographic data would result in the fast-tracking of infrastructure projects and the delivery of basic services to the rural communities.

PRS92 would have long been established in the next 10 years as a homogenous national network of geodetic controls, and adopted as the reference system in all surveying and mapping activities in the country. NAMRIA would be concentrating on the maintenance of the network, especially the operations of the permanent GPS stations or the Active Geodetic Network (AGN). By then, the impact of this NAMRIA flagship project would have immensely contributed to national development. With land as one of the country's primary resources that spur economic activity, the project would have established the integrity of land management, administration, and the tenurial system, by transforming into PRS92 all cadastral data, and by that time continuously enhance the integrity of the country's land titling system. The PRS92 would likewise contribute to the international scientific community in the field of geodesy with the migration of the system into the international geodetic reference system. In the same respect, the present land classification activities would have been accomplished. With the ever-changing use of land due to population pressure and economic activity, however, we may see the start of the cycle on land reclassification.

By the next decade, NAMRIA hopefully will be in the final stage of its survey of its EEZ but negotiations with our neighboring countries on overlapping maritime claims would still be ongoing. On the resolved boundary areas, joint undertaking would have started on scientific research and exploration for energy and marine resources. Such negotiations should be taken into the context of the expected improved trade and diplomatic relations with our neighbors by that time. Likewise, our claim for an Extended Continental Shelf would have long been submitted to the United Nations and ruled on in favor of the country. It would translate to expanded jurisdiction over our maritime zones where potentials for possible energy resources could be explored.

The emergence of powerhouse economies in the Asia-Pacific region in the coming years shall make the Philippines a strategic site for maritime trade, hence ports and harbors would be improved and expanded to accommodate the large volume of seagoing vessels. By then, NAMRIA would be in the forefront in the installation of electronic navigational charts on designated major harbors, as well as in the hydrographic survey of navigational routes using more advanced technology.

By the next decade, growth centers would have expanded to the countryside with more municipalities being converted into cities due to growing population and the increasing income of local governments. Hence, the demand for updated and reliable geographic information for development planning and monitoring changes in the country's landscape. To serve this end, a web-based National Spatial Data Infrastructure (NSDI) would have been set in place so that users could readily access accurate map-based data and information. NAMRIA would be the central hub of the NSDI that links other national government offices, their regional offices, as well as the local government units.

As for the workforce of NAMRIA, most of its old guards would have retired, replaced by new generations who would be at the helm of the agency. Others would have sought brighter futures outside. Hopefully, with a competitive salary scale, the agency would be able to attract and retain the best and brightest technical personnel.

The scenarios painted above put into context the challenges that face NAMRIA in the years ahead, in the light of a constantly changing global and local environment. Despite our present uncertainties, apprehensions, and anxieties, there should be always room for optimism. As the famous US President John F. Kennedy said, "Change is the law of life. And those who look only to the past or the present are certain to miss the future."

**Engineer Belen is the Officer-in-Charge, Plans and Operations Division and holds a Master's degree in National Security Administration from the National Defense College of the Philippines.*

# PRS92 at 15 and Beating the Odds

*by Concepcion A. Bringas*

PRS92 this year turns 15 years old. At the forefront of the NAMRIA work plan is the fast-tracking of the activities for its full adoption by 2010.

**Beginnings**

The idea of establishing a new Philippine reference system was conceived in 1987 as a priority component of the Natural Resources Management and Development Project (NRMDP) of DENR. The NRMDP was an Australian bilateral assistance to the Philippine government to uplift the economic growth of the land and environment sectors through improved management of natural resources and land utilization. The project study found the sectors to be poorly contributing to the gross domestic products of the country. The primary reason attributed to the low economic performance of these sectors is the absence of consistent and standardized land and resource use data which are tools in revenue collections, land property development, and management natural and land land resources.

The NRMDP identified the areas for improvement, namely: Geodetic Network, Institutional Strengthening, and Land Laws and Administration. These were envisioned to increase the economic yield of the concerned sectors. NAMRIA, through the Coast and Geodetic Survey Department (CGSD), was tasked as the project leader of the Geodetic Component. Its objective was to establish using GPS a consistent and homogeneous national geodetic network. The execution of a full geodetic survey of the Philippines as a support framework for the NRMDP is economically feasible only with the present state-of-the-art satellite technology. The then existing geodetic network of the Philippines established in 1903-1946 and made up of narrow chains of coastal triangulation was not capable of supporting the integrated surveying and mapping programs required for the definition of land ownership and for the assessment and management of the country's natural resources.

It took almost three years, from November 1988 to mid-1991, of field surveying in Northern and Southern Luzon, Central Visayas, Mindanao, Palawan, and Sulu Islands to complete the establishment of the new Philippine reference system. It consisted of 330 first-order stations, 101 second-order stations, and 36 third-order stations. In the ensuing year, the new system, now known as PRS92, was endorsed and subsequently approved for adoption as the standard reference for all surveying and mapping activities in the country through EO 45, as amended by EO 280, and further amended by EO 321.

*GPS observation over a signalized ground control point*

**Growth and Adoption**

The underlying reason for the adoption of PRS92 is its being an accurate homogenous national network, capable of supporting the surveying and mapping of the nation, and the sustainable management and development of its environemnt and natural resources. This spatial framework provides the basis for the integration of the different elements of a successful Land Information System.

The government supported the advocacy with the issuance of EO 45 in 1993, which mandated the use of PRS92 in all surveying and mapping activities in the country. It set Calendar Year 2000 as the deadline for the integration of all surveys and maps into the new system. EO 280, however, was later issued to extend the deadline of the integration to CY 2005. In the two presidential issuances, no agency was designated to oversee its implementation, and so monitoring compliance was never done.

There was a confirmation of low compliance with the EO in the 2003 gathering of PRS92 stakeholders in 2003 which included other government agencies engaged in surveying and mapping, private surveying companies like CERTEZA and F. F. Cruz and non-government organizations like the Geodetic Engineers of the Philippines (GEP). Upon their recommendation, EO 321 was issued in 2004 which further extended the deadline to 2010. The EO also directed DENR to allocate funds and designate which office will oversee the implementation of the order.

The DENR initiatives that followed included the issuance of DAO 2005-13 prescribing the revised guidelines for the implementation of PRS92; creation of a program steering committee chaired by the DENR Undersecretary for Lands with the heads of NAMRIA and of the DENR bureaus as members; setting up of regional operations committees headed by the respective regional executive directors; and creation of technical working groups and the PRS92 National Secretariat. NAMRIA was designated as the National Secretariat.

Given the remaining four years to comply with the deadline in 2010, the program management is faced with the challenge of fast-tracking the activities. NAMRIA is collaborating with the Land Management Bureau (LMB) and the DENR Regional Land Management Sectors (LMS) for the implementation of the various components in the regions. Other institutions like the GEP and the University of the Philippines were tapped to help accomplish the enormous task.

**Caretaker of the Program**

As the PRS92 National Secretariat, NAMRIA is taking its role seriously in the implementation of the EO. To expedite the task, it created TWGs on the project components, namely, Geodetic Network Development (GND); Transformation and Integration (TI); Geodetic Network Information System and Information and Communications Technology Support (GNIS and ICT); Information, Education, and Communication (IEC); and Project Management (PM).

Information campaigns on PRS92 are being done in both formal and informal gatherings to generate further support and cooperation for the endeavor. The present NAMRIA administration, under Administrator Diony A. Ventura, is unwavering in its efforts to accomplish its mission for PRS92.

# Geodetic Network Development

*by Dennis B. Bringas**

**Background**

The upgrading of the old geodetic reference system of the country through PRS92 was envisioned to address the inconsistencies of various surveys, maps and other geographic information in the Philippines. The adoption of PRS92 as a common geodetic reference system should have been instrumental in resolving these gaps, overlaps, and other inconsistencies had it been fully implemented. The full implementation of PRS92 was severely hampered by various reasons, namely: limited resources for densification of geodetic controls; lack of standard methods for local transformation and integration of old surveys and maps into the new geodetic network; presence of errors in some areas of the country when transforming old data into the new PRS92 datum; and legal implications of PRS92 on the existing land titling and registration projects.

As the central mapping agency, NAMRIA is determined to fast-track the full implementation of PRS92. Geodetic Network Development (GND) is one of the project components for its full implementation.

The results of the previous users' and stakeholders' consultations and meetings conducted by NAMRIA served as a catalyst for the project implementation. It became imperative that PRS92 should be upgraded in terms of horizontal and vertical reference systems and ensure its reliability, completeness, and accuracy as a geodetic reference network. This article presents the main tasks of the GND component being implemented by NAMRIA's CGSD.

**The GND Project Sub-Components**

**Horizontal Reference Network**

*Densification of Horizontal Controls*

Since the establishment of PRS92, NAMRIA continuously seeks to densify the number of horizontal geodetic control points available to users. The primary horizontal reference network of the PRS datum consists of 330 first-order, 101 second-order, and 36 third-order stations. These numbers are insufficient as determined during the stakeholders meeting. Destroyed or missing concrete monuments undoubtedly contributed to this issue.

Densification of the PRS92 network has been a continuing activity of NAMRIA since 1993. As of 2006, the following GCPs have been established by NAMRIA: first order, 347; second order, 723; and third order, 2,218.

The NAMRIA-established control points were mainly of the third-order accuracy. It was however unclear what the primary basis was in determining the areas that need to be densified. Apparently, the densification of the control network was done independently of the spacing between geodetic controls points. Hence, several areas were left out. This contributed to the need to consider the spacing of the geodetic control points to be able to consistently cover a wider area and determine gaps that need to be saturated with geodetic control points.

Aside from NAMRIA, DENR-LMS and LMB were also tasked to contribute to the densification of the PRS92 network. The total number of targeted control points for 2007 is 11,459. It is broken down as follows: second order, 1,453; third order, 1,424; and third- and fourth-order project controls, 8,582.

It was determined that out of the total number of targeted control points, only 735 points could be done by NAMRIA and the remaining 2,142 points would be contracted out.

*Active Geodetic Network*

Anchored on the whole PRS92 Program objectives, a viable track to hasten the full implementation of PRS92 is the establishment of several continuously operating reference stations (CORS) that would make up the Active Geodetic Network (AGN) of the Philippines. An AGN encompasses several first-order control points that serve as a permanent reference station. Each station is equipped with continuously operating survey-grade GPS receivers, a computer system, and communications and networking equipment. With an AGN, users doing a new GPS survey will no longer have to set up a reference GPS receiver at a control point because the CORS will serve that purpose.

The AGN will endeavor to solve the issue on the availability of geodetic control points to surveyors densifying the PRS92 primary network. With the projected full nationwide coverage, the AGN will significantly hasten the adoption and implementation of the PRS92 datum in all surveys, including an intensification of the GPS technology applications in the country.

The concept of AGN or CORS as another GPS application is new to the Philippines. For this year, six active geodetic stations located in Metro Manila and vicinity will be established to serve as pilot areas for NAMRIA to gain experience and test its reliability in the Philippine setting. A full AGN coverage will then be designed and developed for the whole country.

The infrastructure, instrumentation, and operationalization requirements of the AGN will go through the bidding process.

**Vertical Reference Network**

Generally, a geodetic reference system does not only refer to the horizontal component but also to its vertical component. Indeed, the World Geodetic System of 1984 (WGS84), where all GPS surveys are referred to, has the ellipsoidal heights as its vertical component, but this has not been exploited in our local surveying GPS applications.

Geodetic surveying using GPS continues to evolve in the country. Its applications as well as benefits have been proven and the need to optimize its capability will be a great help to the surveying sector in the country. One of its proven capabilities is the use of the so-called "GPS heighting." The geodetic surveying sector utilizing the GPS technology has yet to capitalize on this feature. To be responsive to this issue, PRS92 has to be upgraded to incorporate a vertical component. To do this, a local geiod model should be developed wherein geiodal heights could be determined. The geiodal heights are essentially the elevation of control points above mean sea level (MSL), or the so-called orthometric height. The orthometric heights are required in geodetic leveling surveys.

*Leveling Network*

The existing level network of the country is composed of around 7,000 line-kilometers marked by benchmarks (BMs) at least one kilometer apart. With its vast area, the leveling network of the Philippines should be expanded. The heights of the BMs are related to the local MSL and were established by the continuous tidal observations from the existing tide stations.

A wider coverage of the leveling network will determine more accurately the geoidal model for the whole country. The vertical component is likewise essential. A local geiod model can be developed in conjunction with MSL heights and gravity information on the BMs and/or control points.

For this year, a total of 8,139 kilometers of level lines are targeted to expand the leveling network. The leveling survey will be conducted partly by NAMRIA due to equipment and personnel constraints. From this year's total target, only 2,139 line-kilometers will be done by NAMRIA and the remaining 6,000 line-kilometers by private contractors.

*Gravity Network*

A critical parameter to establish a geiod model is the gravity survey of various control points and/or BMs. The data on gravity stations established during the period 1950-1960 by the United States Coast and Geodetic Survey Department are in the archives of the NAMRIA CGSD numbering 425 throughout the country. These stations need to be re-surveyed and/or re-established in order to update/check their current values and other information.

***...continued on page 19***

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# Transformation and Integration of Cadastral Datasets into PRS92

*by Jowill E. Rodriguez**

In response to the growing demand for a standard national reference system in the Philippines, NAMRIA, in partnership with the different stakeholders is spearheading the implementation of the PRS92 project. The Mapping Department of NAMRIA in collaboration with Lands Management Bureau is tasked to oversee the transformation and integration of all cadastral survey and map data into the new system.

In order to facilitate the proper execution of activities under data integration, a framework for the transformation and integration of cadastral data, surveys, and maps into PRS92 has been prepared as shown in the figure. This framework will serve as basis for the continuous implementation of the project.

The approach shall include the following activities, namely: conversion of coordinates, bearings and distances, and maps in preparation for the digital cadastral database; recovery and observation of existing cadastral survey controls and reference monuments and densification; determination of local transformation parameters, verification and approval of the derived parameters, derivation of PRS92 coordinates for project controls and lot corners, and assessment of results on derivation; and the integration and projection of cadastral data, surveys and maps into PRS92 control map.

The conversion of analog cadastral records into digital format is guided by an instructional manual provided during the recently concluded on-the-job training for the LMS staff of the respective DENR-regional offices conducted by the data integration task group in February-April 2007.

## Conversion of Cadastral Data, Surveys, and Maps into PRS92

The transformation and integration of approved cadastral maps and coordinates shall start with the conversion of lot corners, survey project controls, and other reference points. The data conversion of coordinates and maps is an initial step in the creation of the digital cadastral database. Hence, the following data or records shall be used in the conversion: lot data computation sheets, lot description sheets, traverse computation sheets; political boundary computation sheets; boundary index maps such as provincial, municipal, barangay, and cadastral maps, monument description books,monument recovery reports, project control schemes, and other relevant records that are necessary. In cases where no data is available, extra efforts shall be taken to retrieve, validate, assimilate, and re-establish the data based on existing guidelines.

Before the conversion of cadastral data, the inventory of all cadastral survey records must be conducted in the respective DENR regional offices to ensure the completeness of the records. Priority for the conversion shall be given to the municipalities with approved and complete cadastral survey records. DENR regional offices must take note of the errors observed in any of the aforementioned data and report these to higher authorities involved in this project for immediate rectification.

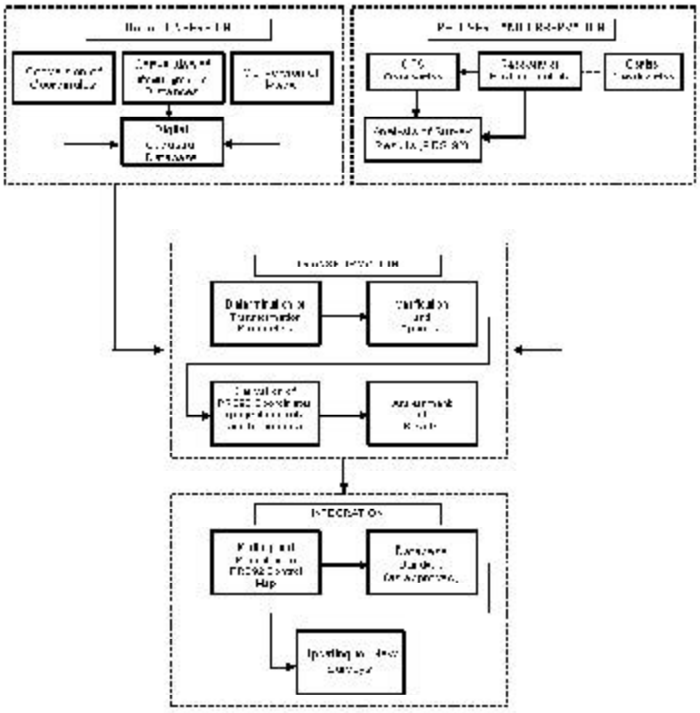
The training on cadastral database buildup and data integration was held at selected training sites for the DENR-Regional Offices in May-June 2007. The featured topics were GNIS, GIS, and Data Conversion, Derivation of local transformation parameters and Transformation of ENR data into PRS92.

Under the topic on the derivation of local transformation parameters using MS Excel, the participants from the different regional offices of DENR composed of geodetic engineers.

During the training, participants were provided a transformation template in MS Excel format. This will be used for deriving the local transformation parameters and eventually the new lot data coordinates. The operation simply involves encoding the rectangular coordinates of the existing survey control points and the newly observed coordinates of these survey control points. The template will automatically generate the four-transformation parameters which will be used to transform old lot data coordinates into the new system.

The provided template computes for the transformation parameters based on the four-parameter transformation procedures.

**Strategic Framework for the Integration of Cadastral Datasets into PRS92**



## Guidelines on Determining Local Transformation Parameters

Prior to the determination of local transformation parameters, initial activities are a recovery survey and re-observation of all existing survey controls using GPS technique in the priority target locality

There will be two sets of cadastral data that need to be transformed and integrated to PRS92. The four-parameter transformation—scale constants, rotation constants, and shift constants—will be derived from the cadastral data on the existing survey controls such as project controls, political boundary, and reference monuments of the target priority municipality. After generating the four-parameter transformation from the existing survey controls of a particular municipality, the second set of cadastral data pertaining to the lot data records of the same municipality is now ready to be transformed and integrated to PRS92.

Once the integration of cadastral datasets has been completed, the far-reaching concept of having a unified system of cadastral projection will now become achievable.

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# PRS92 Implementation in Manifold: A Simple Spatial Accuracy Assessment

*by Benjamin P. Balais**

The PRS92 seven-parameter tranasformation values were already defined and estimated as early as 14 years ago. Coordinate values for PRS92, WGS84, and Philippine Transverse Mercator (PTM) for all geodetic controls were generated and compared using only their tabular values. The PRS92 parameters were not applied and tested using any GIS software. This article presents and compares, using the GIS Manifold System, the spatial accuracy of GEOCALC, the transformation tool used by the NAMRIA CGSD and the Manifold Software using the PRS92 transformation parameters.

## PRS92

The derivation of the seven parameters for PRS92 is based on the 3D Helmert transformation method which defines a new reference system based on three translations (shift of origin), three rotations, and one parameter modeling a possible scale difference. The seven-transformation parameters are the following:

Translation parameters:

| | |
|---|---|
| Delta X | 127.62195 meters |
| Delta Y | 67.24478 meters |
| Delta Z | 47.04305 meters |

Rotation parameters:

| | |
|---|---|
| Rot X | -3.06762 seconds |
| Rot Y | 4.90291 seconds |
| Rot Z | 1.57790 seconds |

Scale parameter: 1.06002

These parameters are applied to WGS84 geocentric Cartesian coordinates to give Cartesian coordinates on the Luzon Datum which will then be transformed to geographical PRS92 coordinates.

The generation of a standard reference system for the country serves as the fundamental component of the country's spatial data infrastructure. PRS92 shall ensure a unified, consistent, and reliable geographic information database to be used in many planning and decision-making activities of both the government and the private sectors.

## The Manifold System

Manifold is an advanced GIS software developed by the group called **manifold.net** team. Its features include the capability to customize coordinate systems (projections) by specifying customized projection presets. These presets refer to the derived parameters used in generating a specific coordinate/reference system. Manifold uses high accuracy coordinate transformation mathematics when re-projecting data from one coordinate system to another.

Manifold includes numerous standard types of projections that, with optional parameters, may be used to specify hundreds of standard projections. Within most projection types, optional parameters may be used to create an effectively infinite number of different projections. Even standard projection types can exist in thousands of different variations when optional parameters such as **datum** are changed.

All projection formulas used within Manifold have been programmed by the **manifold.net** team using the full ellipsoidal formulae that define the projection, wherever applicable. The main source of projection formulae is J.P. Snyder's definitive work, "Map Projections-A Working Manual" (USGS Professional Paper 1395).

## Data Used in Assessment

A total of 18 first-order control stations being maintained by the CGSD are used in the visual analysis of its positional accuracy. These control points are scattered throughout the country. **Three** are situated in **Aklan**; **two** are in **Ilocos Sur**; **six** in **Davao del Sur**; **three** are in **Laguna**; **three** are positioned in **Cebu**; and the **Metro Manila 1** (MM1) control station in the NAMRIA compound. The geographic coordinates based on the WGS84 datum and the PRS92 coordinates computed by the CGSD using GEOCALC transformation software were utilized. The WGS84 geographic coordinates were then transformed to PRS92 coordinates using the customized projection utilities of Manifold. The three values are then plotted and compared in Manifold.

## Results

Coordinate values (WGS84, PRS92/CGSD and PRS92/Manifold) of the 18 controls were compared. The 18 point features in three different projections were displayed on a map component within Manifold. A map as a component in Manifold shows drawings, images and text labels as **layers** in a map window. An important function of maps is to show the data they contain in **projected** form, where the native coordinates of drawings are transformed (on the fly) into a desired geographic or another projection.

For **MMA1**, the result shows that the GEOCALC-derived coordinates are about **8.68 mm** (Eucledian distance) away from the WGS84 geographic coordinates. The Manifold-derived, PRS92 coordinates are only about **1.5 mm** away **from the same WGS84 coordinates** ***(See Figures 1 and 2.)***

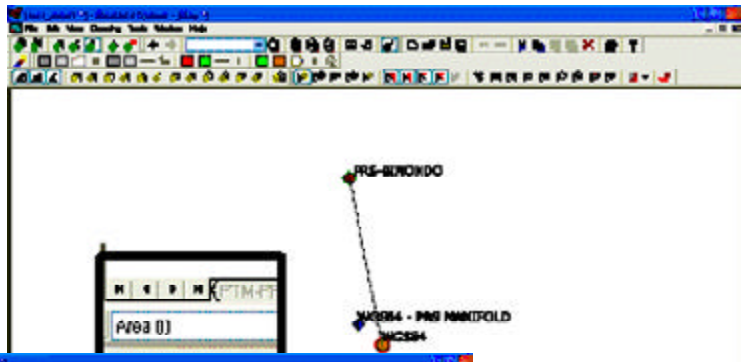


***Figure 1.*** *The distance between GEOCALC-derived MMA1 point and the WGS84-projected MMA1*


***Figure 2.*** *The distance between Manifold-PRS92-derived MMA1 point and the WGS84-projected MMA1*

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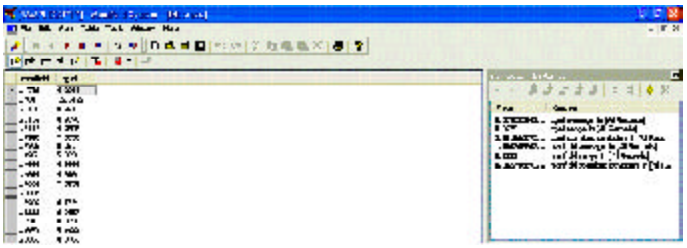


***Figure 3.*** *Manifold-generated table and its summary statistics*

To further evaluate the accuracy of the Manifold transformation procedure, 17 sample controls scattered throughout the country were used. For the **17** controls, a distance of GEOCALC-derived points from the WGS84 coordinates **averaged** about **8.029 mm** with a standard deviation of about 2.3819. **Manifold-derived PRS92** coordinates only averaged about **1.458 mm** with a standard deviation of 0.0527 from the WGS84 projected points. Figure 3 illustrates the comparative distances between the WGS84 and GEOCALC-derived points, and between WGS84 and Manifold points. Also shown in the figure are the summary statistics for the Manifold and GEOCALC values. Figure 4 shows the zoom-in view of one control point in Cebu as depicted in a Manifold map window.

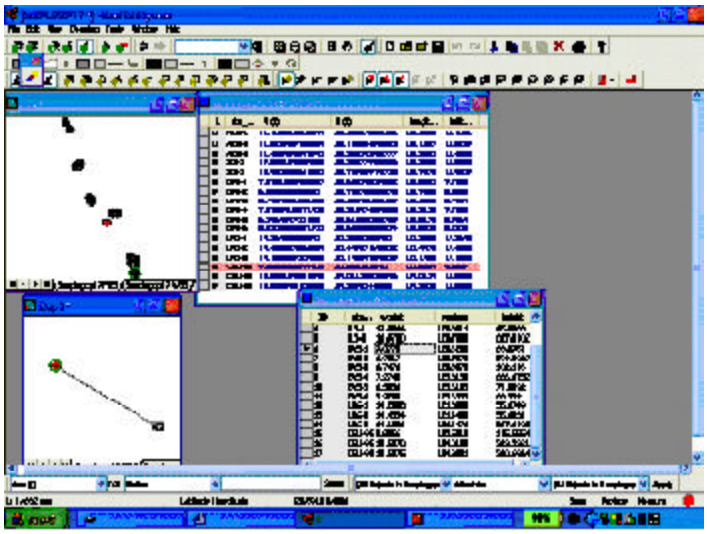


*Figure 4. Display of the position of the 17 first-order control points along with their coordinate values; a zoom-in view of a sample control point from Cebu, illustrating the difference between the Manifold-transformed coordinates and the GEOCALC-calculated PRS92 coordinates*

**Concluding Remarks**

The Manifold software offers an accurate customized projection utility based on the display of the position of the sampled and computed coordinates. This is important since the software will be provided as part of the implementation of PRS92 in the regional offices. The accuracy of the Manifold-computed PRS92 coordinates can be attributed to the precise mathematical method being utilized by the software. The software also uses the floating point double precision type of number, which other softwares may not be using in transforming coordinates from one projection to another.

## From Analog to Digital...

***from page 4***

In 1991, NAMRIA acquired and installed in the NRSC two MicroBRIAN (Barrier Reef Image Analysis) Systems, four Stanford University Network (SUN) Workstations, a SUN Sealable Processor Architecture Fileserver, an upgraded Versatec Plotter, a 2.3 Gigabyte tape drive (Exabyte), an AGFA Forte Film Recorder (utilizing image system slide production software), a Sharp Color Scanner, and a Kennedy tape drive (open reel). Previously, NAMRIA only had two MicroBRIANs with dual monitor systems and a half-inch magnetic tape drive (9 track). In 1992, acquired was a Macintosh Quadra700 which is capable of converting recorded video images into computer-compatible format.

Through the RS project, the capability of the former NAMRIA photolaboratory installed in 1988 was also upgraded. The lab catered to the needs of RS people by printing and enlarging images from transparencies and duplicating slides, LANDSAT imageries, and SPOT data. The photolaboratory equipment included the Colenta Roller Transport Processor which eliminated the tedious manual processing of prints and the accessories for the Durst Laborator Color Enlarger.

In 1999, NAMRIA contributed to the regional cooperative project on the technology in updating topographic maps using RS spearheaded by the ASEAN Experts Group on RS. The ASEAN-Australian Surveying and Land Information Group aimed to enhance the implementation of new ideas and technologies in updating topographic maps. The RS component used MicroBRIAN version 3.0 and ERMapper 5.5 software in processing, classification, registration, and integration.

In 2002, a joint NAMRIA-Clark Development Corporation land use mapping project was implemented. The project was the first detailed topographic/land use mapping of an area to be conducted in the country, utilizing high-resolution earth imagery produced by the IKONOS imaging satellite. A three-dimensional model of the Clark Special Economic Zone image was developed using RS software packages. To date, the NRSC continues to provide RS data and operational image processing requirements of various government and private sector clients.

**Information Management and Statistical Services**

The rapid advancement in computer technology as well as in surveying, photogrammetry, and remote sensing paved the way for the linking of spatial information obtained from these different fields into a multipurpose system—GIS. With GIS, large amounts of data are easily stored and updated; spatial features can be sorted and stored; and new maps can be created by modeling or reinterpreting existing data.

NAMRIA is mandated "to integrate geographic and related information to facilitate access to and analysis of data and its transformation into useful information for resource policy formulation, planning, and management." NAMRIA remains committed to this mandate through its leadership in the development of GIS application models and in the promotion of the use of GIS through technology transfer.

GIS initiatives in NAMRIA cover various applications such as land-based statistics, determination of suitable upland agricultural areas, natural resources management, land information, and soil erosion susceptibility mapping. NAMRIA undertakes thematic mapping utilizing GIS technology. Among the software used in the past and in the present were the Comprehensive Resource Inventory and Evaluation System, ArcINFO, ArcVIEW, TYDAC-SPANS (Spatial Analysis System), and Manifold. Currently being developed is a Manual of Procedures and Standards for the Development of a Standard Seamless National Digital Topographic Database. From heads-up digitization, the process is now done onscreen. Conversion of analog maps into digital format involves scanning, georeferencing, and accuracy assessment which produce digital raster data.

**Looking Forward**

Surveying and mapping technologies have indeed come a long way. From freehand drawings based on ground surveys, maps are now produced with the aid of computers and satellites. Modernity indeed shaped surveying and mapping activities. The terms "surveying" and "mapping" have also evolved into "geomatics."

As one writer has said, after every great development in technology in the past, there has been a greater one down the road. NAMRIA must be able to keep attuned with the incessant shifts and advances in technology to be able to provide timely and reliable geographic information, which is vital to national planning, development, and security.

## Milestones in 20 Years ...

*from page 9*

At present, there are more than 4,000 map sheets of LC maps which are stored in the RSRDAD Map Room. These maps are traced in different types of print media such as tracing paper, tracing cloth, and mylar. Due to wear and tear after long usage, some of the old LC maps are no longer readable especially when printed. There are also missing or lost maps due to several transfers of office location. Hence, it is the long-term vision of the LC Division to convert into digital format all these LC maps for easier management, retrieval, access and preservation of records for present and future use.

With the PRS92 project, the LC Division is tasked to transform and integrate all LC maps, old and new, into PRS92. The six phases of integration are as follows:

(1) Map database creation – This is an inventory of all approved LC maps with detailed information such as LC map number, province, area of A & D, FL, number of sheets, size/s, price/sheet, Forestry/DENR Administrative Order No., date approved, map rack number, and availability.

(2) Manual and digital map compilation – This is the scanning, geo-referencing, digitization of map features, replotting, and adjustment of the LC lines and corners to come up with a digitally compiled topo based map. ***(See Figure A)***

(3) Reconstruction of missing LC maps – The process is based on available references such as existing/adjoining LC maps, LC maps gathered from the DENR regional offices, and cadastral maps from the Land Management Bureau. It involves the compilation of the adjoining LC maps to identify the coverage of the missing LC map. Once the missing coverage is identified, the area shall be subjected to ground survey. The resulting map will be presented to the LC-TWG and subsequently to the NTEC for issuance of a DAO by the DENR Secretary. The diagram of LC map reconstruction is in ***Figure B***.

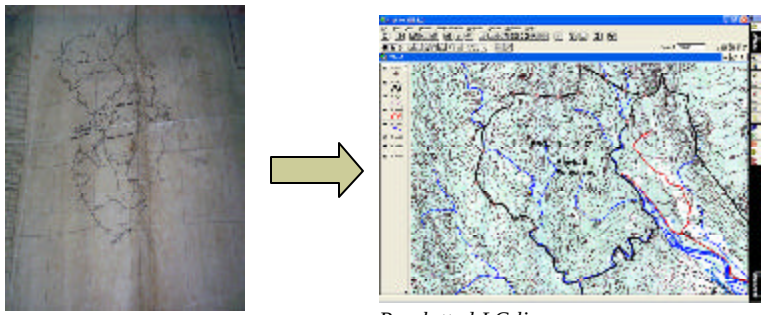
(4) Field observation/field survey – This is the actual ground validation of selected LC corners which are distributed evenly within a certain block in the LC map to approximate the position of the said LC block with respect to the adjacent blocks.

(5) LC map integration into PRS92 – The points identified during field survey shall be plotted together with the compiled LC maps. The points identified on the ground will be considered as common/fixed points to obtain the best fit position for a certain project block. Points that do not meet the criteria for accuracy, however, will be deleted to minimize the error of the whole block. Thus, LC corners will have PRS92 coordinates. (Note: The standard for computation of acceptable error is still under study and development as the pilot study areas for LC map transformation are subjected to ground survey.) ***(See Figure C)***

(6) Map integration of other ENR data sets – The integration of ENR data sets such as Community-Based Forest Management, Integrated-Social Forestry, Social-Integrated Forest Management Application, Integrated Forest Management Application, Timber License Agreements, watersheds, protected areas/ National Integrated Protected Areas System, mining claims and other tenural instruments, will follow after the integration of LC maps into PRS92.

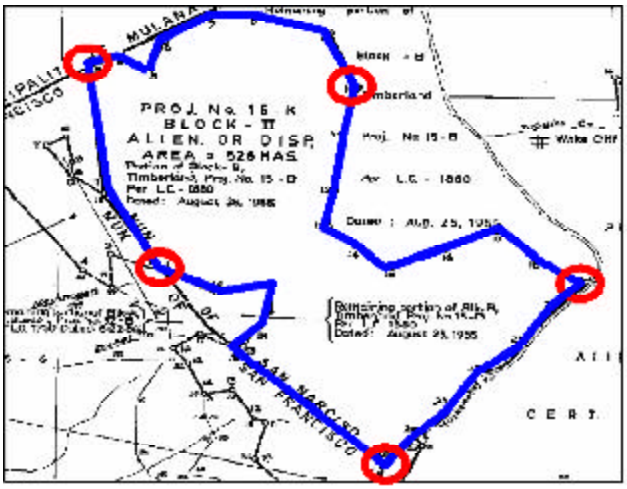
With the PRS92 project, 2,724 LC maps consisting of about 4,000 map sheets will be scanned and stored in digital format. These LC maps will be eventually compiled and digitized for their eventual integration into PRS92.

There are 22 personal computers in the division to facilitate the implementation of this project. NAMRIA has hired contractual employees to help in the compilation and digitization of the LC maps. On the other hand, a total of 824 missing/lost LC maps will hopefully be retrieved or reconstructed subject to ground survey and approval by the TWG and NTEC.



*Original LC lines* *Re-plotted LC lines*

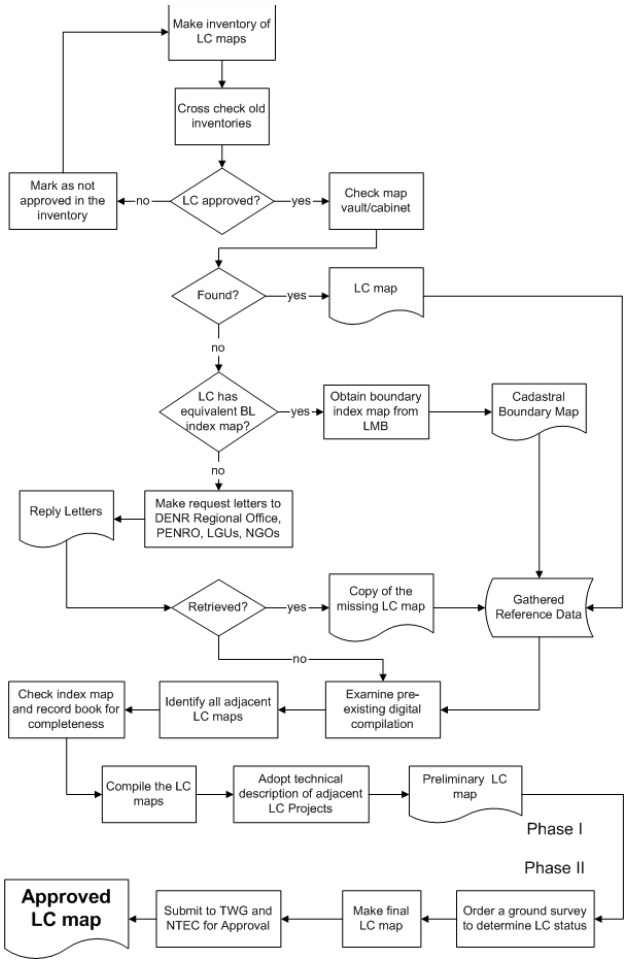
**Figure A**




*Selected LC corners to be validated on the ground which serve as common/fixed points to obtain the best fit position for the certain project block*

**Figure C**

**Figure B**



## Geodetic Network ...

*from page 14*

NAMRIA has targeted to re-survey and/or re-establish 80 gravity base stations for the year 2007. Due to the lack of technical capability and instruments, however, the gravity surveys will be contracted out to private companies.

*Tide Station Network*

Another parameter in establishing a geoid model is the elevation of control points. The elevation of a control point should be determined above the MSL, hence the establishment of various tide stations throughout the country. This is in preparation to refer the benchmarks and/or control points to the local MSL.

For this year, 10 new tide stations will be established and seven existing tide stations will be upgraded in terms of equipment.

### Project Component Status

#### Horizontal Reference Network

*Densification of Horizontal Controls*

From January to June 2007, the GPS densification conducted by NAMRIA has established a total of 209 second-order control points and 89 third-order control points.

The budget allocation was already released to the DENR-LMS to start their own surveys for the PRS92 Program.

*Active Geodetic Network*

At least 10 potential AGN sites near Metro Manila have been inspected while the final six sites will be decided on, based on practical considerations such as the distance between permanent reference stations and accessibility. Being pilot sites, it is essential that these AGN stations are near Metro Manila for easy management and operation. The bidding terms of reference (TOR) are being prepared.

#### Vertical Reference Network

*Leveling Network*

The leveling survey done by NAMRIA has completed at least 395 line-kilometers mainly in the Luzon areas, while the rest of the targeted level lines are in the final stages of the bidding process.

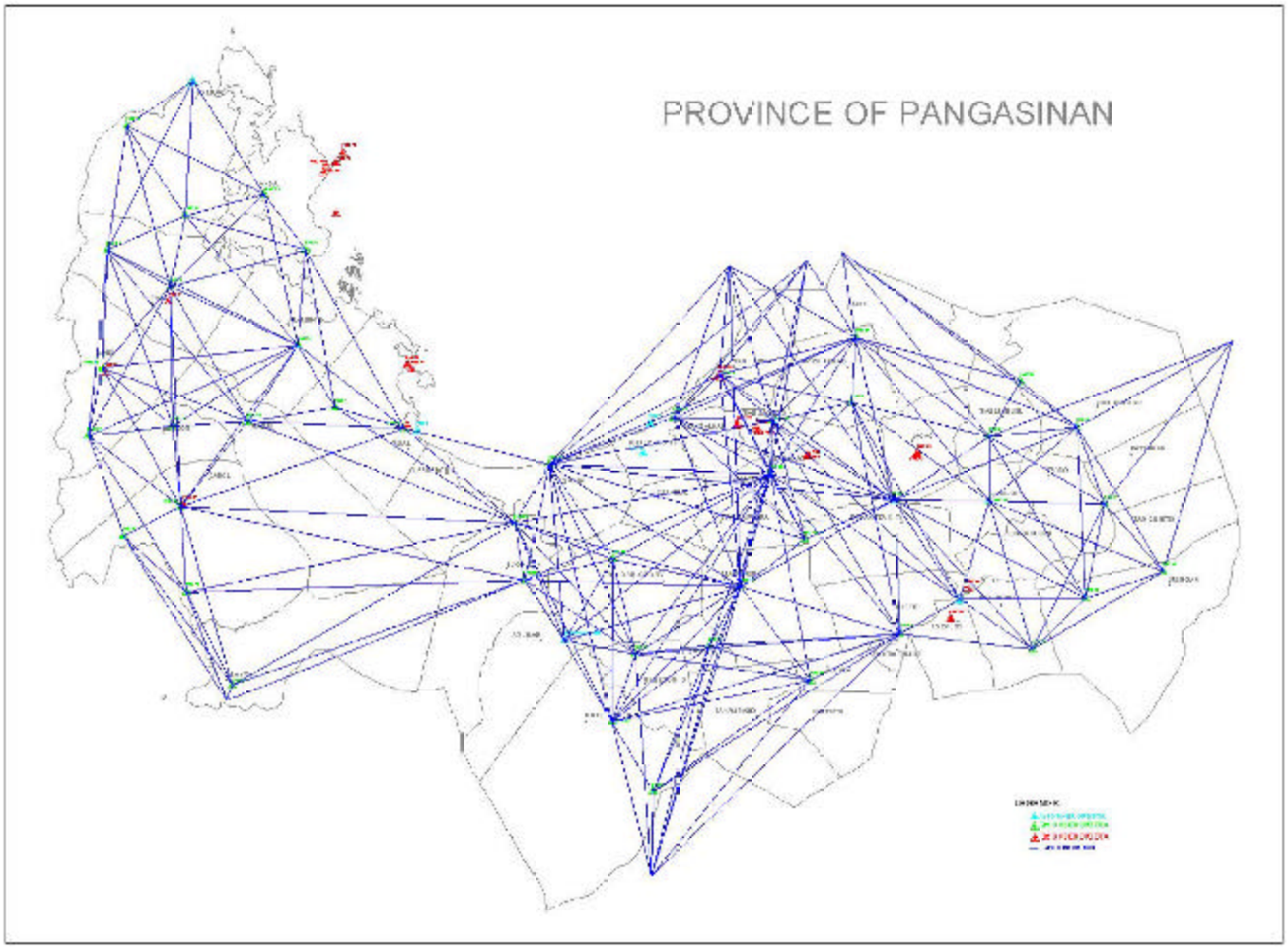
*Gravity Network*

The locations of the 80 gravity base stations have been identified and the preparation of bidding documents and terms of reference (TOR) is ongoing.

*Tide Station Network*

The following is the status of the accomplishment of the project sub-component: inspected sites for the 20 new tide stations; upgraded tide stations in Legaspi, Subic, and Davao; completed construction of the tide station in Claveria; ongoing construction of tide stations in San Fernando, La Union and Currimao, Ilocos Norte; reconnaissance being conducted of Dipolog, Cagayan De Oro, and General Santos City, Puerto Princesa, Balanacan, San Vicente (Cagayan), Zamboanga and the Kalayaan Islands Group (KIG) stations; and approval being awaited of the request for space for Guiuan, E. Samar and Tandag, Surigao del Sur.

The benefits of PRS92 will redound to the improvement not only of the country's land management and administration but also, among others, to disaster and risk mitigation, infrastructure and energy development, local governance, public order and safety, and health and education.



# The Geodetic Network Information System

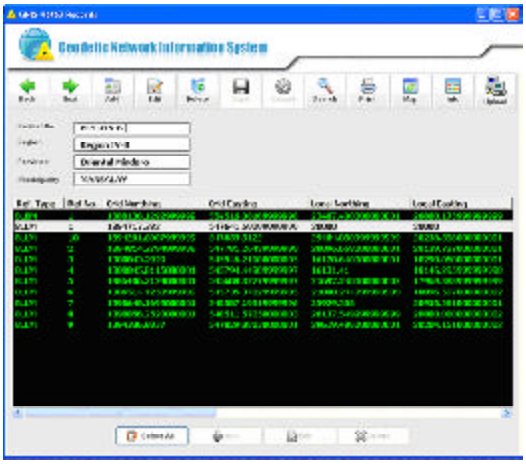
*by the Systems Development and Programming Division*
*NAMRIA Information Management Department.*

GNIS, a component of the PRS92 project, is a system developed to provide NAMRIA, LMB, and the LMS of the DENR regional offices with effective and efficient management of geodetic network data. It is a windows- and web-based system that provides online access to users, recording and updating of geodetic network data, and a facility to generate reports and listings. The GNIS also utilizes GIS technology to provide graphical representation of the geodetic network data. In addition, the technical capability of NAMRIA, LMB, and LMS will be strengthened through training, ICT support, and the full use of local area network.

**Features of GNIS**

The GNIS is composed of two sub-systems to manage the geodetic network. These are the regional GNIS and the national GNIS. The regional GNIS sub-system was developed specifically for the use of LMB and LMS in the population and maintenance of third- and lower-order geodetic control points/project control points. The sub-system works by allowing entry of geodetic network data on a "per cadastral project" basis. It also allows entry of multiple formats for given geodetic network data such as local coordinates, PTM, and PRS92. The regional GNIS is also capable of recording station markings, sketches, and inscriptions to provide information on the characteristics and location of specific geodetic network data. Another feature of the syb-system is a search module that facilitates direct access to any geodetic network data. Searching of data is possible either textually or spatially. The sub-system can easily generate reports and maps such as survey certificates with sketch, geodetic network data per cadastral project, and geodetic network per administrative unit.

The regional GNIS was designed to be implemented on a local area network and access is restricted to authorized personnel from LMS. The screen below shows a snapshot of the regional GNIS main screen.




*Regional GNIS main screen*

The national GNIS sub-system was also developed to manage the national geodetic network database consisting of approved geodetic network data from NAMRIA and LMB to LMS. This database will be housed at NAMRIA with backup and mirror copies at LMB and DENR-Management Information Systems Division, respectively. The database and the sub-system will be incorporated into the NAMRIA and PRS92 website. Access to the national geodetic network database is possible through the Internet.

**Regional GNIS Prototype**

From 30 April to 01 June 2007, training was conducted by the NAMRIA GNIS Development Team for LMB and the regional LMS on the use of the prototype regional GNIS. The cluster training was held at the Geomatics Training Center in NAMRIA, Baguio City, Cebu City, Davao City, and Cagayan de Oro City. The objective of the activity was to train the participants on how to use and operate the system. The training also served as an avenue to evaluate the capabilities of the system and to recommend necessary features to satisfy the requirements of the participants. As part of the training, the participants from LMB and LMS were required to bring cadastral projects, project controls and reference points as sample data. At the end of the training, suggestions and enhancements were provided by the participants for integration in the final version.

**Ongoing and Future GNIS Activities**

The ongoing and future activities of the NAMRIA development team for the GNIS project are: compilation and review of suggestions and comments provided by the participants during the recently concluded cluster training; designing and programming of an additional module to monitor the submission and verification of newly surveyed controls from the regions to NAMRIA; revision of the database design and re-programming of the prototype GNIS; modification of the user's manual; user's training; and monitoring the progress of the project implementation.

**PRS92 Website**

The PRS92 website is designed to provide basic information on PRS92. It features a GIS-based networkof geodetic control points and a forum wherein surveyors, foresters,geodetic engineers, and students can discuss relevant topics. The website also provides updates of activities that are being done at the regional level to monitor the progress of the project.


PRINTED MATTER

The *Infomapper*
A Publication on Surveys, Mapping, and Resource Information Technology
National Mapping and Resource Information Authority, Fort Andres Bonifacio, Taguig City