





## Editorial

Advances in cartography have revolutionized map making in the world. From the most unsophisticated maps of antiquity, including those drawn from the imagination of the world's early cartographers, those we know today are made with the use of modern methods and instruments.

A study of the history of cartography will reveal that surveying and mapping were already being done in highly developed societies long before Christ, particularly in Mesopotamia and Egypt.

There were also mostly political and commercial motives for the production of maps. The drive to discover new worlds and explore the vast area of land and sea led to the need for maps. In the outer world, with the invention of book printing techniques and the increasing amount of geographic information, thousands of maps were produced for profit.

Drawing, lettering, and copying were first done by hand. Coloring also had to be done this way even with the introduction of copperplate printing. The use of lithography or "printing from stone" facilitated the production of colored maps. Map production, especially when bigger quantities were required, was further improved with the invention of photography and the offset-press.

Today, the various possibilities provided by space exploration, including satellite remote sensing technology, have greatly revolutionized map making. Electronic methods have made map making faster, efficient, and cost-effective. Now, the map is no longer viewed as solely a reproduction on a sheet of paper but is also on video, where changes can be made with the touch of a finger.

The importance of map making can never be disregarded, considering the

rapidly increasing geographic information. In these current times, there is also the urgent need to conserve our natural resources and monitor changes in the environment.

As the country's present central mapping agency, NAMRIA has, for the past seven years, acquired advanced remote sensing, photogrammetric, GIS, and GPS equipment through foreign grants or aids. These are periodically upgraded for the fast and efficient production of quality maps and other geographic information. The agency's personnel capability is also enhanced through linkages with foreign institutions for technology sharing and transfer; participation in trainings, conferences, and seminars; and cooperation in special projects.

It is our hope that this sixth issue of the Infomapper will not only serve as an important reference material on Philippine mapping for readers but will also deepen their appreciation and interest for mapping in general.

## NEW PRODUCTS

The following maps were revised:

- Three 1:50,000 scale topographic map sheets of Cavite/Laguna;
- Five 1:50,000 scale topographic map sheets of Nueva Ecija;
- Two 1:250,000 scale administrative map sheets of Autonomous Region of Muslim Mindanao (ARMM); and
- One hundred twenty 1:200,000 scale map sheets of Map #201.

The following maps were reprinted:

- One 1:200,000 scale administrative map sheet of the Province of Pangasinan;
- One 1:250,000 scale administrative map sheet of the Province of Surigao del Sur;
- One 1:250,000 scale administrative map sheet of Region VI; and
- One 1:50,000 scale map sheet of the Province of Batangas

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# A Profile on Notable Filipino Cartographers

by: Maria Romina B. dR.-Pe Benito

**C**artography, mostly for practical reasons, is not very popular in the Philippines, particularly as a career. There is the prevailing and generally undisputed notion that it is not profitable, salary-wise. Many also think of cartographic work as simply involving drafting and some Filipinos even associate it more with the making of sketches of police suspects than of maps!



**Ponciano C. Ciceron**

In fairness to the country's professional cartographer, he is involved in a myriad of activities which vary in degrees of complexity. The likes of "map sheets layout," "editing," "scribing," "names placement," "masking," and "color separation" should also be associated with Philippine professional cartography.

Considering the lack of published materials on Philippine cartography and cartographers, particularly on notable Filipino cartographers, the next best sources of information for this writer were persons connected or familiar with the Cartography Divisions of the NAMRIA, the country's present central mapping agency, and the old BCGS, one of NAMRIA's forerunning agencies which had been involved in map making since 1901.

**P**onciano Castillo Ciceron, Rogelio Pascual de la Rosa, Felisa Melad Nepomuceno, Reynaldo Pineda Bajar, and Basilia Andres Norada are only some of the Filipinos recognized as authorities in the field of cartography. This early it should be stressed that even from a cursory examination of their biographical profiles, one already realizes that what sets the five cartographers apart from other cartographers is not really any distinctive, tangible contribution they may have made to their field. The basis for their recognition by their peers or those who have known them in their work as cartographers is clearly more on their having managed to survive and even thrive in cartography despite its uncertain promise of either fame or fortune for its practitioner. It is no coincidence that all the cartographers featured in this article rose from the ranks to positions of leadership in the government service.



**Rogelio P. de la Rosa**

Engineer (Engr.) Ciceron retired in 1992 as Assistant Director of the Mapping and Reprography Department of the NAMRIA;

Engr. de la Rosa presently holds the position of Division Manager A in the Project Investigation Division of the National Irrigation Authority, under its Project Development Department;

Engrs. Nepomuceno and Bajar are both the present Chiefs of the Cartography Divisions of their respective offices: Engr. Nepomuceno of the NAMRIA and Engr. Bajar of the Bureau of Soils and Water Management;

And finally, since 1988, Engr. Norada has been the Chief, Agrarian Reform Program Officer at the Department of Agrarian Reform.

## What it Takes to be a Good Cartographer

It would all depend on the cartographer if he wishes to excel in his chosen field. He himself has to do all that is possible to deepen his interest and involvement in cartography. Certainly, there are difficulties so would-be cartographers should "work, work, work, and work," as summed up by Engr. Ciceron.



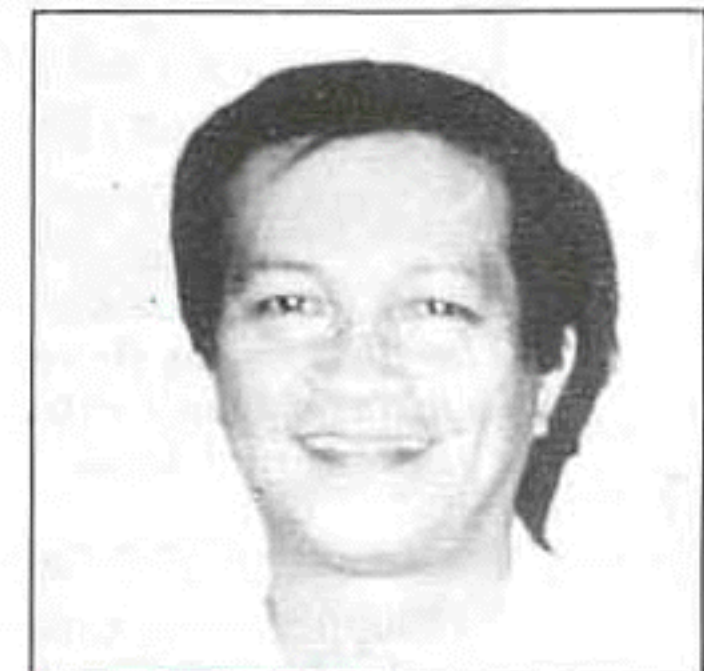
**Felisa M. Nepomuceno**

In the Philippines, good cartographers should have an adequate knowledge not only of cartography in all its aspects but also of related fields like surveying and geodesy through formal education and training, work experience and even self study.

Cartographic Engineering was offered by the National University from the '60s to the '70s. Among its first graduates were Geodetic Engrs. de la Rosa, Bajar, and Norada. The offering of the course was unfortunately stopped due to the lack of interested students.

The absence of formal education in cartography can be made up for by learning experiences from cartographic work. Both Engrs. Ciceron and Nepomuceno held mostly cartographic positions in the old Bureau of Coast and Geodetic Surveys (BCGS) and the NAMRIA. Civil Engr. Ciceron spent some 40 years in the government service while Civil and Geodetic Engr. Nepomuceno who also has an associate degree in Surveying has been in the government service for about 31 years.

Engr. Ciceron also took the examination for Senior Cartographers given by the Civil Service Commission (CSC) in 1962 and was the only one who passed it among 438 examinees. He was the Co-Chairman of the committee for the



**Reynaldo P. Bajar**

examinations for Cartographers and Head Cartographers given by the Commission in 1978. The 1978 CSC examination for Head Cartographers was taken and passed by Engr. Nepomuceno when she was still a Supervising Cartographic Engr. at the BCGS.

**O**f course, learning experiences from formal trainings are also invaluable in honing one's cartographic skills. Both Engrs. de la Rosa and Bajar stressed the need for education in cartography to be continuing. All the cartographers were fortunate to avail of many good training opportunities in cartography offered locally and abroad where they learned the latest in cartographic technology. Apprenticeship training programs, like those offered in the BCGS in the '70s and '80s, would be of great help as invaluable opportunities for career growth, especially to those without formal education and work experiences in cartography.

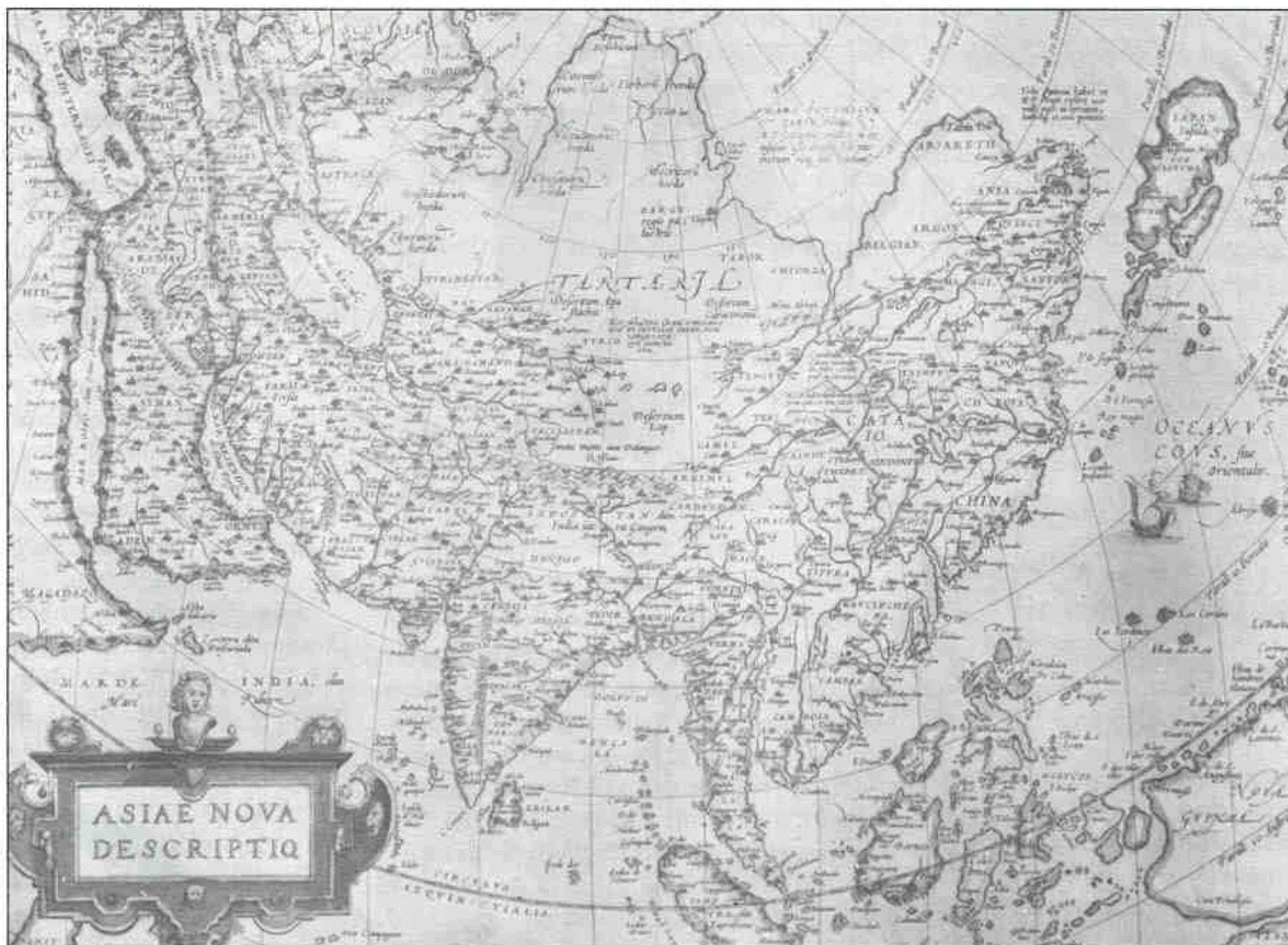
A good cartographer should not also disregard the importance of augmenting his own

*(Continued on page 11)*



# Philippine Mapping - A Historical Perspective

by: Charmaine Rowena C. Aviquivil



The Philippines (lower right) appears in Abraham Ortelius' map "Asiae Nova Descriptio" which is contained in his world atlas entitled "Theatrum Orbis Terrarum" published in Antwerp in 1570. Note that only Mindanao, Palawan, and some Visayan Islands are shown.

**D**id you know that in long-forgotten times, the Philippines was called *Ma-yi* by the Chinese, and was named the Islands of St. Lazarus by Ferdinand Magellan? Or that prior to 1590, European-made Philippine maps did not contain any reference to Luzon? These bits of information and more could be gleaned from the study of ancient Philippine maps and of Philippine cartographical history.

Maps play a significant role in today's information society, providing graphic information on the world around us. Very few of us, however, realize that these "pieces of paper showing different places" can actually be works of art, showcasing the rich heritage and colorful history of a nation, or even of the world. A brief look at the origins of mapping will tell us why this is true.

## Early Mapping Origins

It is not known when mapping first started. It is, however, fairly certain that mapping is an ancient art, and early civilizations produced maps of some sort (crude representations of locations and their relative positions and distances) on the earth, on stones, and on animal skins.

The world's oldest surviving map is a clay tablet dating from about 3800 BC found in Nuzi, Iraq showing mountains, water bodies, and other features in Mesopotamia.

In China, three 1:90,000 topographic and military maps on silk dating from the Han Dynasty (168 BC) have been found. These were quite sophisticated, using *scale\** and well-developed symbolisms. China was also considered more cartographically advanced than Western countries because of its earlier use of the compass, paper, and printing press in mapping.

The dominant figure in mapping during the first century AD was Claudius Ptolemy (90-160 AD) of Alexandria. He introduced the concepts of *longitude\** and *latitude\** and produced a book entitled *Geographia* which was a cartographic treatise. The book also listed all the places in the world known at that time.

Centuries later, Arabian mapping contributions which included Idrisi's *atlas\** and world map (1154 and 1161 AD) were made. In the Mediterranean and adjacent areas, quite accurate sailing charts called *portolan charts\** (13th century) were produced. Map making and publishing reached new heights during the late 15th and early 16th centuries with the travels and con-

quests of Columbus, Magellan, and other explorers.

In later years, accuracy and scientific principles in map making were emphasized. Many national surveys were conducted and universal units of measurement were adopted in most countries. From manual reproduction, cartographers progressed to the use of lithography\*, photography, color printing, and computer-aided mapping for easier and faster map reproduction.

## History of Philippine Cartography

Greek mariners were said to have reached the Malay Peninsula and Southeast Asia long before explorers like Marco Polo traveled to the Orient. Ptolemy mapped several islands of the Malay Peninsula including Barussae and Maniolae, which early scholars mistakenly thought referred to our archipelago.

**T**he first recorded reference to the Philippine islands was in 982 AD when an Arab ship arrived at Canton with a boatload of Mindoro goods. A geography book written by Chau Ju-Kua in the 13th century identified the islands as *Ma-yi*, with one of the islands called *Lin-hsin* (thought by some as Luzon) and the Visayan islands called *San-hsu*.

\* Terms in bold type and marked with asterisks are defined in the Glossary of Terms on page 14.



Noted Muslim traveller Ibn Battuta was also said to have reached in 1345 the kingdom of Princess Urduja, considered by many as Pangasinan.

### Early Maps

Probably the first map which included the islands was the *Yu-t'u* or terrestrial map of China and its neighbors made by eminent Chinese cartographer Chu Ssu-pen from 1311-1320 AD. In the *Hun-i* map of 1402 made by Korean Koon Kun, the Philippines appears as Ma-yi and several islands were incorrectly lumped into one big island. This map is preserved at the Ryukoku Daigaku in Kyoto, Japan. A 117-sheet atlas prepared by Chinese scholar Lo Hung-hsien in the 1550s also included the Philippines.

### Mapping in the Age of Discovery

The Portuguese were the first Europeans to reach our country. In 1513, some eight years before Magellan set foot on the islands, a Portuguese pilot named Francisco Rodriguez drew and identified the Philippines in his rutter\*. Aided by Javanese-made maps and rutters, he was the first westerner to sketch some of the islands of the Philippines, referring to these as *Ilhas Allagadas* or Surfy Islands. The rutter is now at the French National Assembly in Paris.

Who in this country has not heard of Ferdinand Magellan, the acknowledged discoverer of the Philippines in 1521? When he first landed here, he named the archipelago as the *Islands of St. Lazarus*. Antonio Pigafetta, the noted chronicler who accompanied Magellan, was the second westerner to make sketches of the islands, including Zamal (Samar), Humunu (Homonhon), Bai-bai (Leyte) and Zsubu (Cebu). Being a writer and not a cartographer, and because he was unaided by actual surveys, Pigafetta's crude sketches were a far cry from reality.

Several more Spanish fleets were sent to the islands to consolidate the gains from previous travels. One of these was commanded by Ruy

Lopez de Villalobos who renamed the islands *Felipina* (now known as the *Philippines*) in honor of then Crown Prince Philip in 1543. Legazpi led succeeding expeditions and sailed for Luzon in 1571. Years after, the present name of the archipelago as well as Luzon were already incorporated by European cartographers in Philippine maps.

### Other European Influences

The Magellan expeditions generated a lot of interest back in Europe. The Philippines was identified in maps produced by mappers not only in Spain but in other parts of Europe. European cartographers of the time including the Spanish cosmographers of the *Casa de Contratacion* in Seville drew new maps incorporating fresh information and corrections from the survivors of Magellan's travels. They include Nuño Garcia de Torenio, Sebastian del Cano, and Pedro Reinel.

German map maker Johannes Schoner made an engraved globe in 1523 which was the first to include the islands in printed form. In Basle, Switzerland, German cosmographer Sebastian Munster included Puloan (Palawan) in his 1554 *Cosmographiae Universalis*. Abraham Ortelius of Antwerp also included the Philippines minus Luzon in his 1570 *Theatrum Orbis Terrarum* or Atlas of the Whole World, the first modern atlas of uniform size.

The first map made in the islands was one of Negros done by Diego Lopez Povedano in 1572. A Dutchman, Petrus Kaerius Caelavit, better known as Pieter van den Keere, drew the first map devoted exclusively to the Philippines in 1598. Sir Robert Dudley's atlas printed in 1646 which contained 131 sea charts included four charts covering the Philippine islands.

The best-known ancient Philippine map is Father Pedro Murillo Velarde's, *Carta Hydrographica y Chorographica de las Islas Filipinas* which was published in Manila in 1734. Measuring 27 in. (width) by 42 in. (height), it was the largest, most complete, and most accurate map

of the archipelago at that time. It also influenced the works of other cartographers in the 18th century.

### Hydrographic Surveys of the Islands

Soon after the British occupied Manila in 1762, Captain William Nicholson drew nautical charts of the city unsurpassed in accuracy for over a hundred years after. Towards the end of the 18th century, Spain through its *Comision Hydrographica Española* entrusted the charting of the archipelago to Alejandro Malaspina. He completed a preliminary hydrographic map of the country, and in 1808, published a general chart of the Philippines.

When the British left Manila, it still continued to map the waters around the country. They conducted hydrographic surveys of the country and by the latter half of the 19th century, the west coast of Palawan had already been surveyed, supplementing those made by their Spanish counterparts.

### American Contributions

The Americans have shown interest in mapping the country since 1842 when Captain Charles Wilkes, head of a United States exploring expedition visited Manila and Sulu. He featured the Philippines in several of the charts contained in his book *Hydrography* which was published in 1861.

After the victory of the Americans over Spain for the possession of Manila in 1898, American interest in the Philippines heightened. More maps and charts on the Philippines were published by public and private bodies.

### Mapping the Philippines in the 20th Century

The British-made charts were widely used until the United States Coast and Geodetic Surveys (USCGS) took over the task of map making on January 1, 1901. It was able to establish an interlocking series of triangulation points which covered the whole country and which served as the basis for mapping activities for

(Continued on page 7)



Sebastian Munster, a German cosmographer, included Puloan (Palawan) in his 1552 wood-cut map called "India Extrema."



Petrus Kaerius Caelavit, a Dutchman, drew the first map devoted exclusively to the Philippines called "Philippinae Insulae" in 1598.



# AutoCAD as a Tool for Digital Mapping

by Cezar J. Rebolledo

There are evident changes in today's world of science and technology. New developments particularly in the technical fields of geodesy, cartography, surveying, and in related mapping activities have been seen through the years. The increased application of computers has heightened effectiveness and accuracy in the field.

One good example is in photogrammetry. Around 1960, there was a transition from analog to analytical photogrammetry which to a certain extent was due to the availability and greatly increased performance of digital computers. Photogrammetric mapping has undergone great developments by making use of computer technology and graphical data processing. As a result, graphical plotting of map manuscripts has evolved into digital mapping.

Modern analytical stereoplotters\* represent a much higher level of accuracy, convenient handling, speed of operation, and adaptable application than their analog ancestors. Significant differences in the mode of operation and level of performance which can be achieved today as compared to ten years ago are evidenced by today's accurate and speedy digital output.

## AutoCAD Use at NAMRIA

A recent development in the Photogrammetry Division of NAMRIA is the total upgrading of the following equipment: three ZEISS Planicart E3, one ZEISS Planimat D3, and one ZEISS Planicomp P2. These equipment can now access

or make use of AutoCAD, a program for computer-aided design (CAD). NAMRIA's stereo-operators or photogrammetrists have already received instructions on the application of this new prescribed drawing tool. AutoCAD Release 11 edition is now being used by stereo operators on the workstations of the Photogrammetry Division.

Together with the updated equipment, the agency's analog stereoplotters (four WILD B8S Aviograph stereoplotters and one WILD A10 Aviograph) are still being used for mapping operations.

## AutoCAD Capabilities

The AutoCAD is probably the most popular CAD program worldwide. A powerful drawing tool, it allows greater accuracy and flexibility compared to traditional hand-drafting methods.

Based on the Reference Manual of AutoCAD Release 11, there is virtually no limit to the kinds of line drawings which can be made using this software. Here are some of the applications for which it is being used today:

- Architectural drawings of all kinds
- Drawings for electronics, chemical, civil, mechanical, automotive, and aerospace engineering applications
- Topographic maps and nautical charts
- Proposals and presentations
- Interior designs and facility planning
- Company logos
- Theater set-lighting designs
- Technical illustrations and assembly diagrams

AutoCAD drawings are contained in a mathematical database with the position of an object stored as a coordinate and then translated into an image on the screen. Objects using AutoCAD can be drawn according to their actual size. This software provides a new way of looking at the geometry and characteristics of objects in a way that would be difficult or even impossible using conventional drafting tools. This is

achieved largely by the use of a rectangular coordinate system which places the object in the database. A rectangular coordinate system called the World Coordinate System (WCS) is used to locate objects. The WCS contains X and Y axes perpendicular to one another, with the X coordinate specifying a horizontal distance and the Y coordinate specifying a vertical distance. Therefore, an X and Y coordinate pair of the form (X,Y) can indicate the position of any two-dimensional point.

A more sophisticated method of describing objects using AutoCAD is to model them in three-dimensional space. The simplest form of 3-D CAD modeling is called wireframe modeling, which is a skeletal description of a three-dimensional object. A wireframe model can be used in a wide variety of applications to provide a superior method of describing and examining objects as they really exist.

AutoCAD uses the DAT/EM system for interfacing with mapping and surveying instruments. With a DAT/EM interface, all data sampling and editing take place in real time directly into the CAD System. The DAT/EM system is made up of hardware and software combined into a comprehensive stand alone interactive graphics digital mapping workstation. This includes two widely used software systems - the Microsoft Disk Operating System or MS-DOS (version 3.2 and up) and Autodesk's AutoCAD graphic package version 11. The user should be reasonably familiar with both softwares.

## AutoCAD for Mapping

NAMRIA has enough resources to produce quality maps through the use of AutoCAD and its newly upgraded equipment. With this development, the agency's stereo-operators will be expected to spend most of their time with computers rather than using the traditional method of photogrammetric operations. Basically, the use of pencils, erasers, and similar instruments on the manuscripts will be reduced by this drawing tool with which one can perform editing operations with ease and flexibility.

The use of AutoCAD has greatly facilitated many photogrammetric operations. In the traditional way, aerial triangulation measurement was performed using the analytical plotter and automatic plotting table for map sheet preparations. With AutoCAD, editing can directly be done at the terminal without using the automatic plotting table.

Accuracy is increased and errors are reduced with AutoCAD. Operators could avoid many judgment errors they are susceptible to. For instance, operators may fail to change the plotters' pencil even when the lead point has already become too thick for plotting.

Placing of legends and labels, such as those of geographic names and elevations, no longer require painstaking manual lettering as these can be done using AutoCAD. Mapping operations



Stereoplotted map using analog method (map sheet 3130-IV-4 covering Minalin, Pampanga).



are also faster with this software. Before, it would normally take about three days to convert an aerial photo model's planimetric features (non-urbanized area) and contours into a manuscript. With AutoCAD, the process takes only two days or less.

The use of AutoCAD at NAMRIA is expected to enhance the agency's digital mapping capability. The idea in digital mapping is to facilitate the production of edited plots which will directly save the draftsmen or cartographers from the tedious efforts associated with the usual operations. As graphical functions became more complex and as editing demands increasingly grew, mappers welcomed the advent of computers with interactive workstations. It is now possible to produce a digital map which contains all editing instructions and cartographic symbolizations.

Indeed, AutoCAD has introduced a whole new approach to digital mapping.

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### From page 5.... Philippine Mapping

several decades.

The Army Corps of Engineers in 1911-1914 produced maps of parts of populated Luzon at scale 1:63,360. About twenty years later, the Corps produced 1:31,680 scale maps of Bataan and Lingayen Gulf, areas which were to figure prominently in World War II.

In 1941, the USCGS (which had become part of the Philippine Commonwealth government Department of National Defense) issued 17 topographic maps of the major islands on a 1:200,000 scale except for Mindanao, which was covered on a 1:600,000 sheet. Combined with 1939 Census data, these maps were published in the form of an atlas, the *Census Atlas of the Philippines*. Among the maps contained in the atlas were a map of the entire country; 24 provincial maps at scale 1:500,000; population distribution, climate, and economic maps; and ancient maps and charts. The atlas is valued for its list of the country's 7,100 islands, lakes, provinces, and municipalities. The maps were published by the Bureau of Coast and Geodetic Surveys (BCGS), the Philippine counterpart of the USCGS.

The need for local maps was greatly felt during the war. Although the maps existed, these were not reproduced en masse, and were not as accurate as the military had hoped. On April 25, 1944, the Joint Chiefs of Staff issued a directive calling for the complete coverage of the Philippines using aerial photography. Monsoon, fog and clouds, however, obstructed aerial survey

efforts and the American liberators had to make do with the existing 1:200,000 scale maps.

At the end of the war, the Army Engineers commented that the lack of accurate maps and geographical information contributed to the difficulty and cost of defeating Japan. Mapping and surveying activities began to escalate since then. When the Philippine Republic was established on July 4, 1946, the BCGS assumed the work begun by the USCGS.

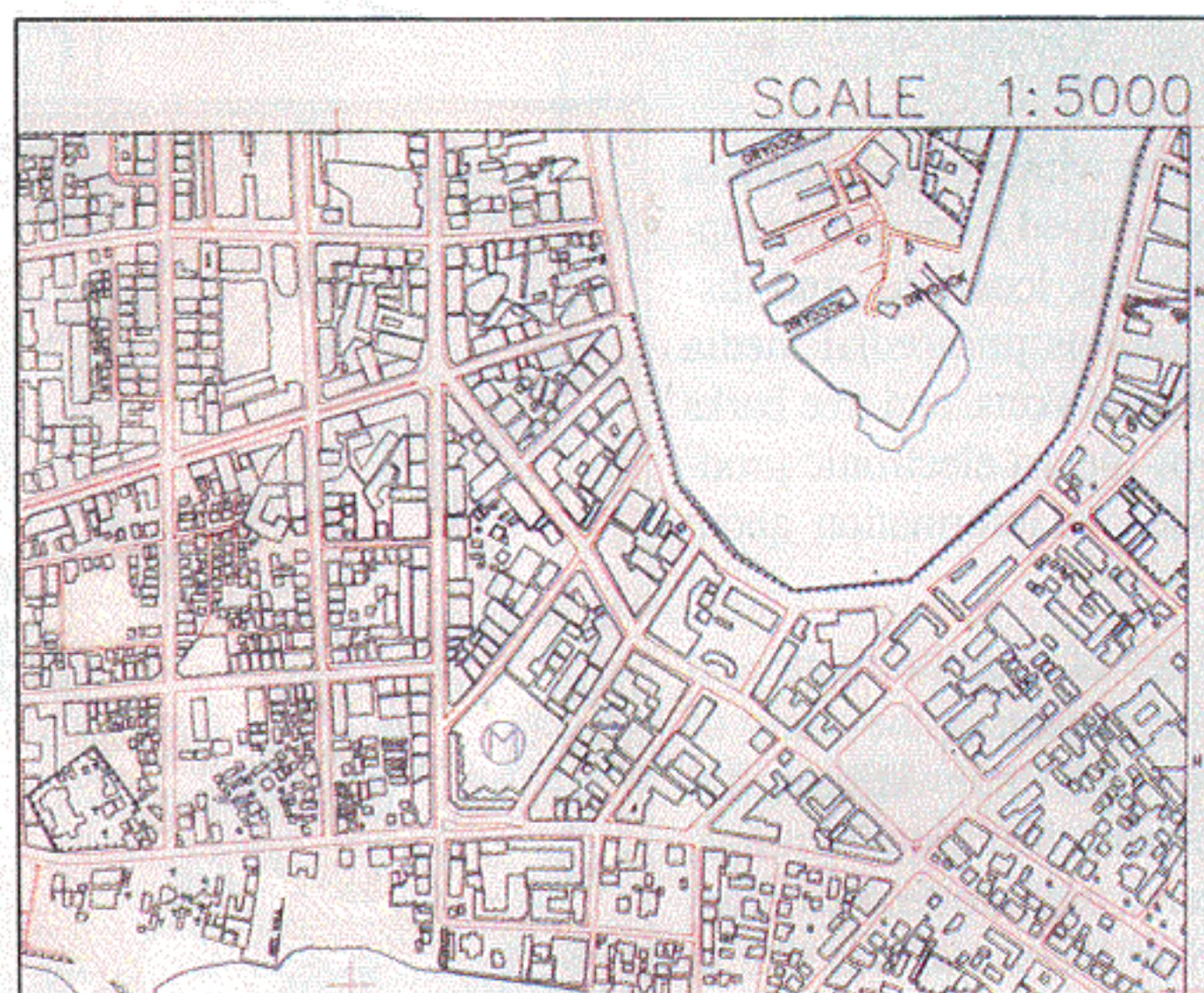
**B**y 1965, the entire Philippines had been mapped and about 970 1:50,000 scale map sheets were made. By then, there were as many as 31 government agencies performing mapping activities, thus necessitating the creation of a Board of Technical Surveys and Maps (through Republic Act 2912) to coordinate these agencies' surveying and mapping activities. The Board was chaired by then Defense Secretary Ferdinand E. Marcos.

In 1987, the government recognized the need for a central mapping agency. Four agencies performing major mapping and surveying operations were integrated to form the National Mapping and Resource Information Authority or NAMRIA, which now takes responsibility for mapping the Philippines.

Mapping has indeed come a long way. In the past, maps were just freehand drawings based on ground surveys. Today, maps are being done with the aid of computers and satellites. But whether they be merely simple sketches as they were before or the sophisticated electronic products we are familiar with today, maps remain to be vital sources of information about our planet.

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Stereoplotted map using digital method (map sheet 3522-III-7D covering a portion of Iloilo City).

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### From page 13...Trainings/Conferences

Thailand.

7. Rolando dela Cruz, Spvg. RS Tech/RSRDAD - Training Course on Application of GIS in Managing Tropical Forests and Conserving Natural Resources in SEA, 8 November - 4 December 1993 in Malaysia.

8. Denicia Rivera, Engineer III/CGSD - Group Training Course on Nautical Charting, 11 November 1993 - 25 March 1994 in Japan sponsored by JICA.

9. Jesus de Tagle Perez, Lt. Jr. Grade/CGSD - Training Course on Systems Analysis and Design, 28 November 1993 to 8 February 1994 in Singapore, sponsored by JICA.

10. Feliciano Opeña, Spvg. RS Tech/RSRDAD - Advanced Training and Conference on ERS - 1, Landsat, Spot Application: A Complementary Approach, 15 - 25 November 1993 in Indonesia, sponsored by European Space Agency (ESA).

11. Virgilio Fabian, Spvg. RS Tech/RSRDAD - Information Systems Development Project for the Management of Tropical Forests, 8 - 22 December 1993 in Japan, sponsored by JAFTA.



## Photo Essay

# Evolution of Philippine Maps

Maps have been with us since ancient times. They have evolved from simple representations of places, locations, and distances done on various primordial media such as stones, animal skins, and tree barks to today's state-of-the-art electronic products which provide vital information about the earth.

Even in this age of satellite maps and digital geographic products, the study of old maps remains to be a rewarding endeavor. Together with historical writings, ancient maps can assist modern scholars in visualizing what the world was like in olden times, thus helping them piece together historical events which can shed light on the world as we know it today.

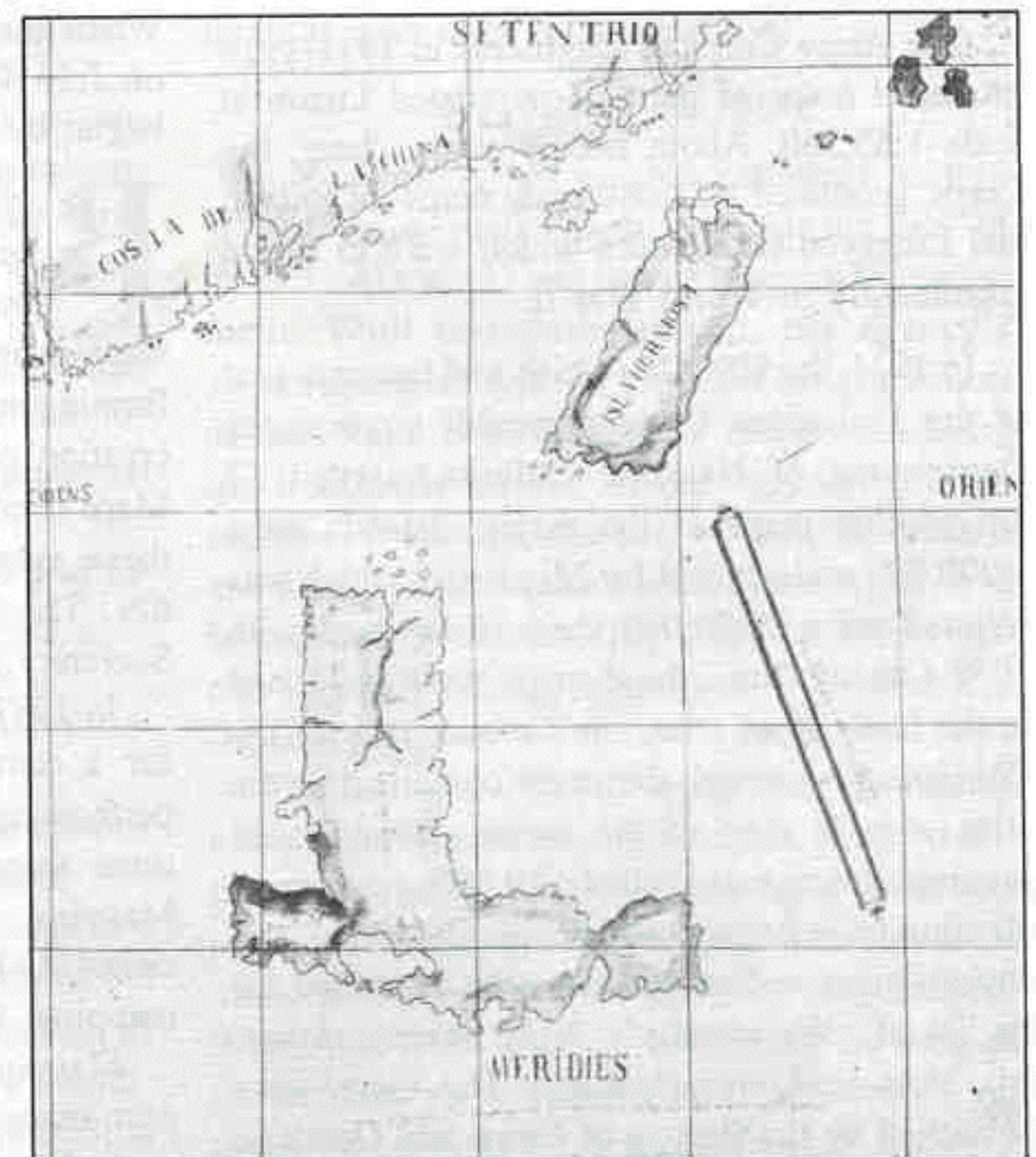
This spread features various ancient and modern maps of the archipelago, tracing cartographic evolution in the Philippines from historical times to the present.



Gerard Mercator from Amsterdam made the map "Insulae Indine" in 1595. The Philippines, with some of its islands bearing their ancient names, is shown at the top center.

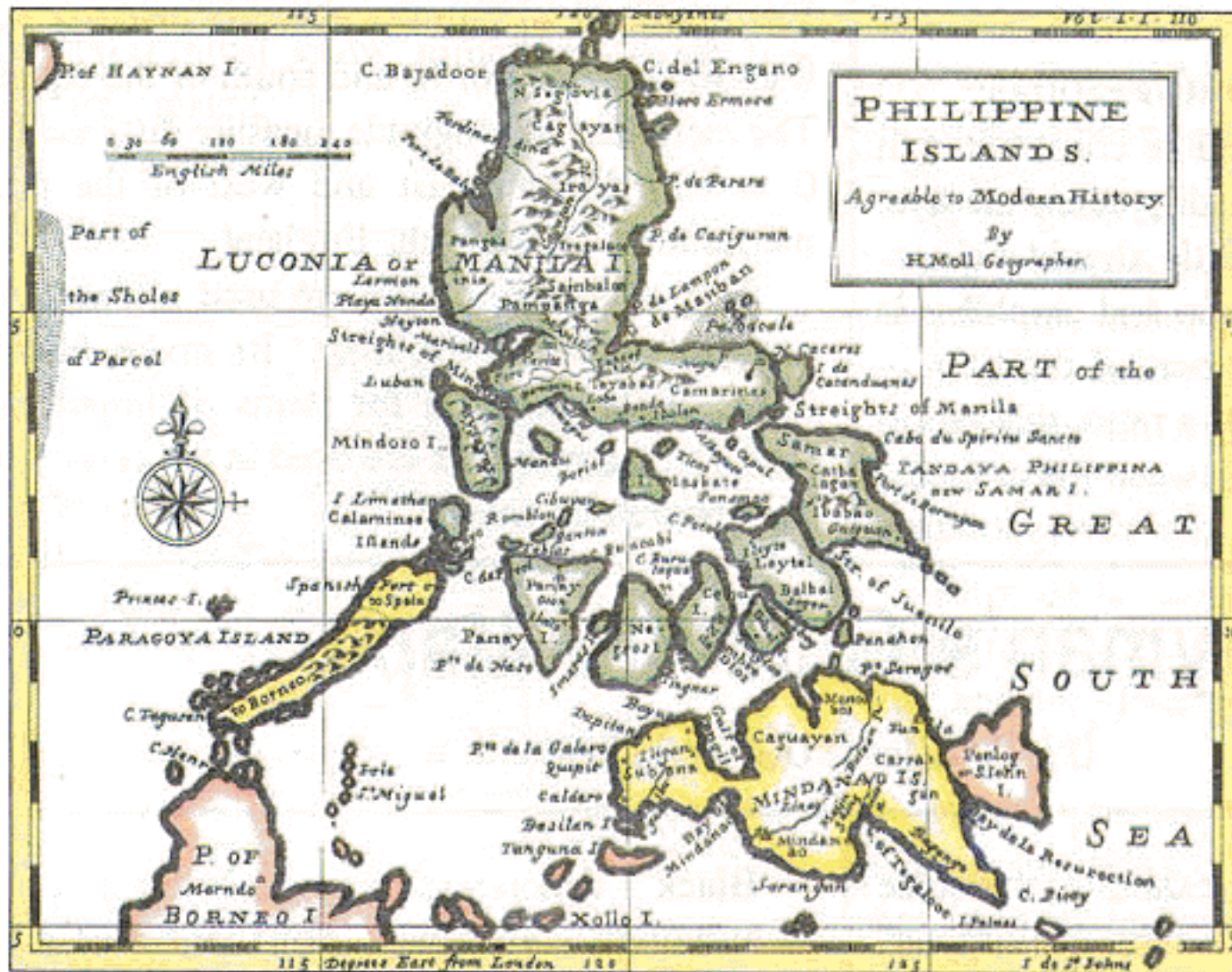


A Chinese map circa 1551 sent by Gov. Lavezares to King Philip II presumably shows the Philippines at the right hand side, bottom.

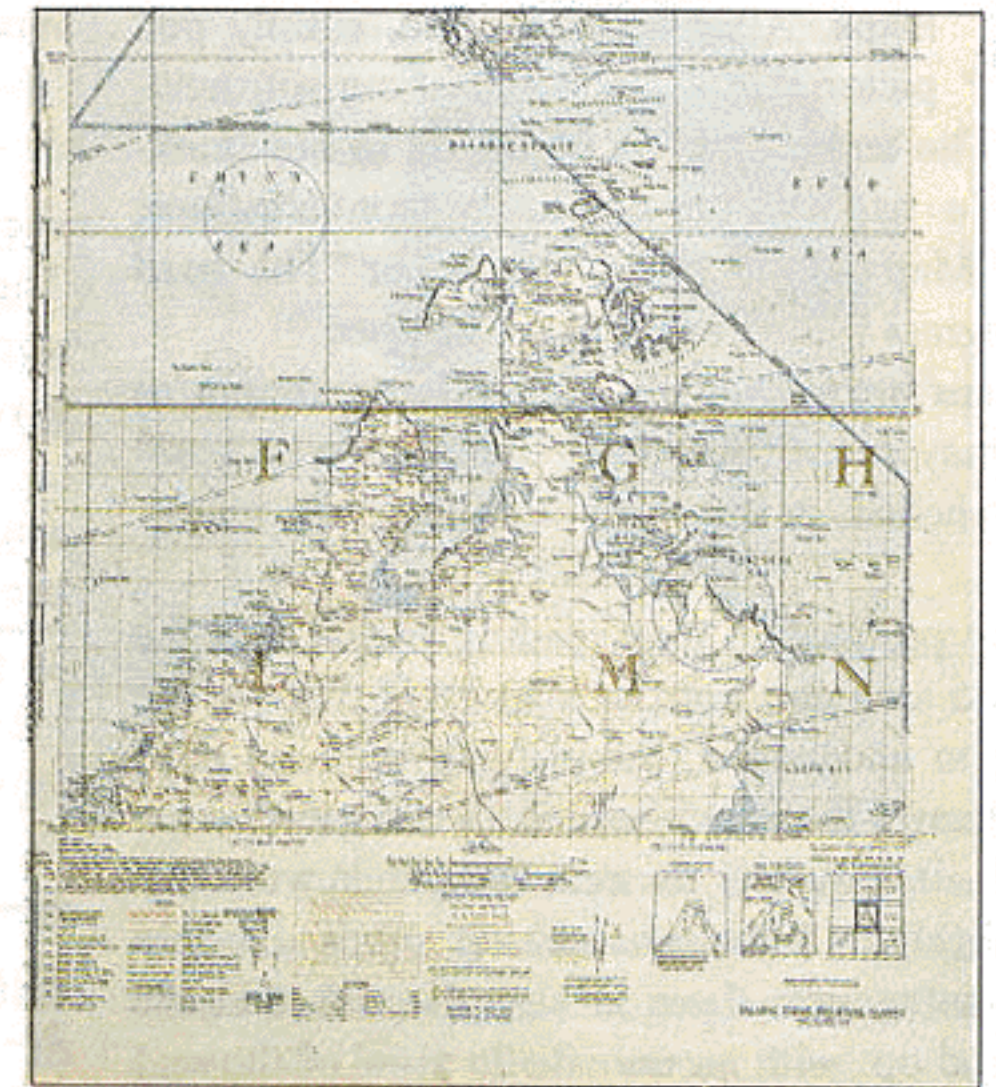


Johannes Vingboons' "The Philippine Islands" circa 1660 extends only up to the Visayan Islands. Luzon was referred to as "Limbonas."

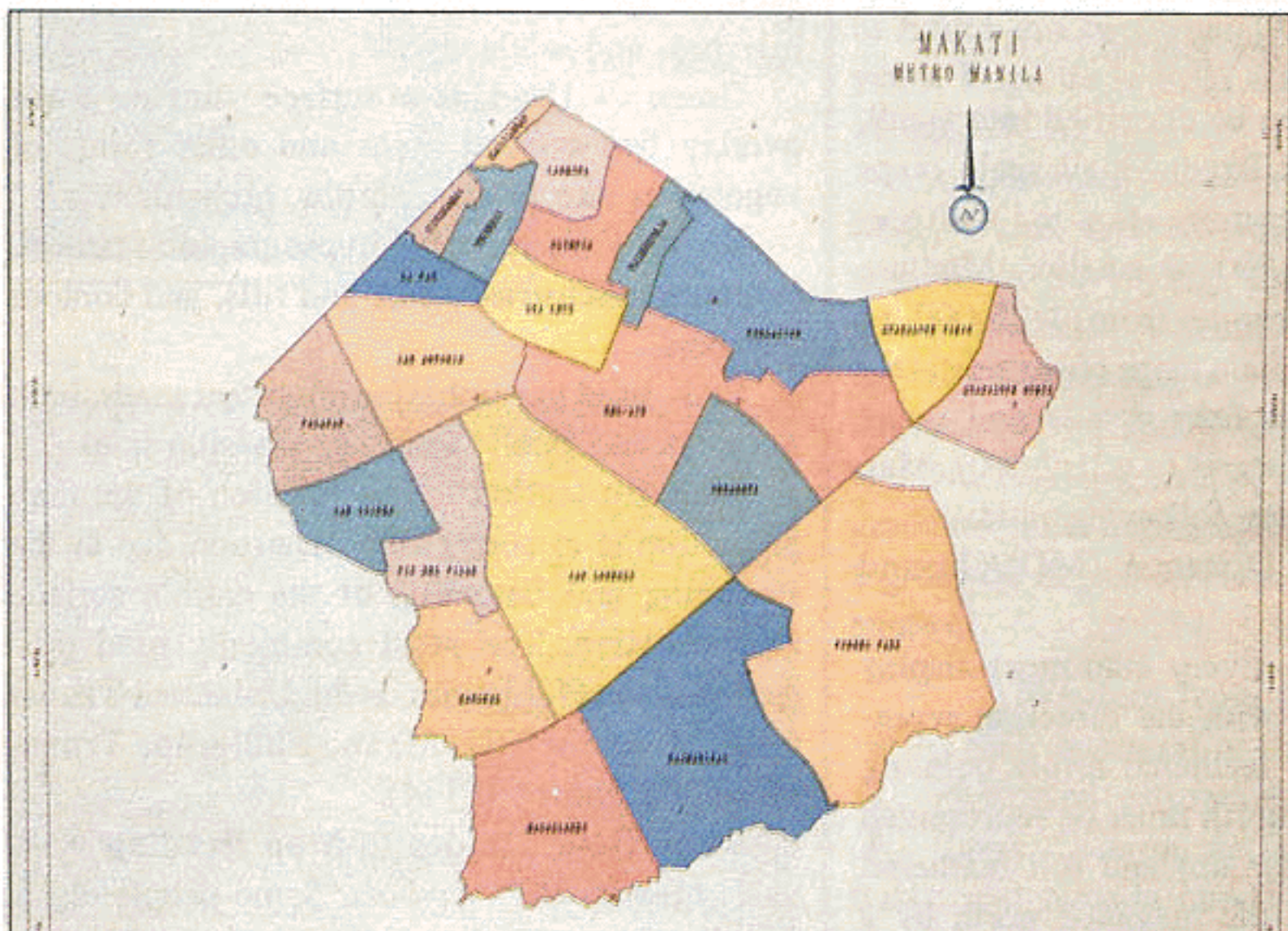




Philippine map by Herman Moll of London circa 1710.



Topographic map of Balabac Strait at scale 1:500,000 prepared under the direction of the Chief of Engineers, U.S. Army, Washington D.C., 1944.



Barangay boundary map of Makati, Metro Manila at scale 1:15,000 prepared using GIS.

### PHOTO CREDITS

- Records Management and Archives Office (National Archives)
- Ayala Museum Library
- NAMRIA Binondo and Fort Bonifacio
- Media Production Division, IMD



Thematic map, produced by the NAMRIA, of Laiya, Batangas at scale 1:50,000 based on satellite remote sensing data.



Topographic map of Mt. Pinatubo & vicinity



**A**t first glance, it would seem easy to read maps. After all, maps are, simply put, pictorial representations of our surroundings. The term "map" is ingrained in our thinking. We use it in our day-to-day conversations, as in "Map out our plan of work," or "The road to progress has already been mapped."

Maps are, however, not really as simple as they may seem. They may sometimes be complex, unclear, or incomprehensible to the majority.

The problem in map reading is that it is the mapped area and not the map itself that we are trying to understand. Simplifying the map does not change the condition of the mapped area. Rather, it only lets us treat it as if it were uncomplicated. Although making maps simple is advantageous, there is also the risk that we may end up with an unrealistic view of the real world. It is therefore important not only to recognize a map when we see one, but to gain a rudimentary understanding of what it contains and what it means.

#### Definition

A map is a reduced and simplified graphical representation of a part or parts of the earth's surface drawn on a plane by means of signs, symbols, and photographic imagery of some given scale or projection to which lettering is added for identification. A map may emphasize, generalize, or omit certain features or themes, depending on specific requirements. It also shows natural or man-made features of a particular place such as mountains, hills, rivers, forests, swamps, roads, bridges, towns, administrative boundaries, and many others.

#### Why People Don't Appreciate Maps

1. They never had to. Some people don't use maps, they just follow the road signs;
2. They were never taught how. There should be courses in map use and appreciation in the elementary grades but there hardly are. Many of us think that knowing one's way around is some kind of intuitive knowledge that one either has or hasn't. People often say "I have no sense of direction" but actually, no one is born with a sense of direction — it is learned just like reading and writing;
3. We turn to maps only in emergency situations. Typically, we look at maps when we are lost, late, or near panic. This is obviously not the best time to cultivate a fondness for maps. The best time is when one is relaxed and has the leisure to study these maps.

#### Map Uses and Importance

Maps are graphical inventories of the physical state of a place and are indicators of its progress. The basic purpose of the map is to show the relationships among the natural features of the earth, its products, and inhabitants, giving us an idea of the generalized course of the past, present, and future events. Maps serve as indispensable tools for planning, decision

making and other aspects of national development.

#### Basic Map Components/Features

**Map Titles** - These should be constructed in such a way that they will readily catch the eye. The space occupied by the title should be proportional to the size of the map and emphasis is given to the most important part of the title.

**Map Scale** - Expressed as a ratio, this represents the fixed relationship between linear measurements on the map and the corresponding

distance on the ground. For example, the scale of 1:50,000 means that one unit (millimeter, centimeter, inch, etc.) of the map represents 50,000 units on the earth's surface or one (1) cm. of the map represents 50,000 cm. or 500 meters or 0.5 km. on the ground.

**M**ap scales can be classified into small, medium, or large. Small scale maps tend to cover more areas but with less details such as 1:250,000 or smaller. Medium scale maps have a range from 1:25,000 to 1:250,000 while large scale maps cover relatively smaller areas but with finer details and range from 1:25,000 to the largest (e.g. 1:2,000). Map scale is expressed as the following ratio:

Map Scale = Map Distance (MD) / Ground Distance (GD)

**Meridian Arrow** - Every map must display the meridian\* arrow with the direction represented by a needle or feathered arrow pointing to the north. The true north must be represented by a full headed (upper tip) and full feathered (lower tip) arrow and the magnetic north by a half headed and half feathered arrow.

**Annotations** - A large proportion of the information presented on a map is conveyed through map lettering. Map lettering of names of places, elevations, names of water bodies, and others must be uniform and legible. The size of the letters is governed by the map itself and by the character of the title, name, or statement to be shown.

**Map Notes and Legend** - The legend, which explains the meaning of the map symbols used, is required because many map users are not familiar with standard symbols. Explanatory notes also appear on the maps to assist in their interpretation. These contain sufficient information so as not to leave any doubt in the minds of the user. Notes also cover special features pertaining to the specific map (e.g. reference datum, spheroids\*, contour interval\*).

**Graticules** - These are the geographic values of latitude and longitude at equal intervals around the edges or borders of the map sheet. Lines of latitude and longitude allow every place to be

exactly located in terms of coordinate system. The parallels of latitude measure distance from 0 to 90 degrees north and south of the equator. The meridians of longitude measure distance from 0 to 180 degrees east and west of the prime meridian at Greenwich, England.

**Map Colors** - Colors are used to emphasize certain features of the map. Its major function is to attract attention for items of importance. Generally, five colors are used in the preparation of topographic maps:

**Black** - denotes all man-made features such as buildings, cemeteries, boundaries, railroads, and other roads, placenames, etc.

**Blue** - for water or hydrographic features such as rivers, lakes, seas, reservoirs, ponds, marshes, and wetlands.

**Green** - Used as a surface tint or cover overlay for wooded areas and other forms of vegetation like forests, shrubs, orchards, etc.

**Brown** - for relief or hypsographic features, contours, hachures\*, cuts and fills, and contour numbers.

**Red** - used to emphasize important roads, built up areas and public land subdivision lines.

**Map Projection** - The function of the map projection is to control the distortion due to the stretching and flattening of the earth's surface representation. The most commonly used projection in the Philippines is the Universal Transverse Mercator\* (UTM) and Philippine Transverse Mercator\* (PTM).

#### Some Basic Guides to Map Reading

1. **Identify map symbols.** Some people claim that they know how to read maps but only, they don't understand the lines, the colors, the squares, and the other symbols. So, does he really read and interpret the map correctly? The reader should be able to translate the world of the map into an image of the environment, the real world. It requires the reader to look first at the map legend to confirm the intent of familiar symbols and to make sure of the unfamiliar or poorly designed ones. It is imperative not to look at the symbols only after being confused as it is both inefficient and potentially dangerous.

Much of what actually exist in the world around us have been omitted from maps, while many things in maps are not found in reality. Thus, maps and reality are not identical. Many map reading errors happen because the user forgets the above facts and expects one-to-one correspondence between maps and reality, which is impossible.

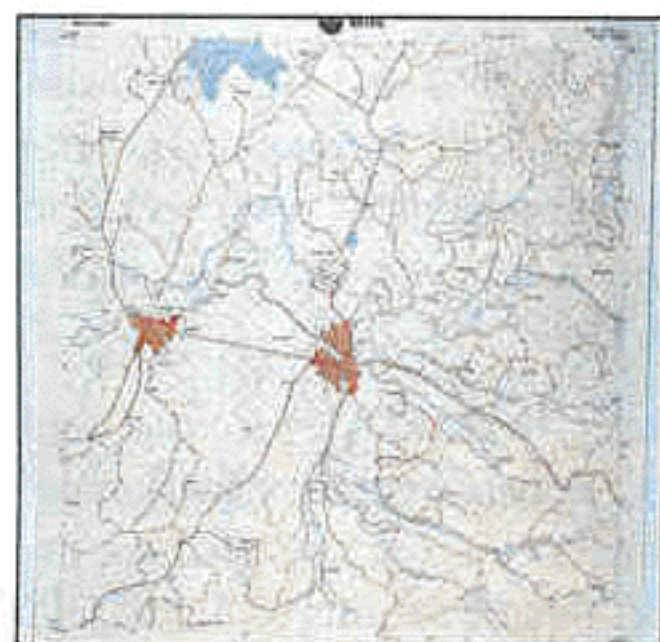
2. **Never use a map without asking how it has been biased by the method used to make it.** The cartographer translates reality into the clearest picture he can and the map reader converts this

## Layman's Guide to Maps

by Mac A. del Rosario



picture back to reality. For such a communication to take place, the map reader as well as the map maker must know something about how maps are created.



A large scale map (1:25,000) of Batac



A medium scale map (1:50,000) of San Antonio.



A small scale map (1:250,000) of Puerto Princesa.

3. *Relate the map to the landscape.* Assume a bird's eye position high above the region covered in the map. We must imagine what features may look like when viewed from above or from a distance. If we are to look at maps from the bird's point of view, they may show things that are foreign to our everyday experience.

4. *Finally, the best way to read maps is to be familiar with the basic map making process.* Read materials on map making. These will greatly help one to better understand maps.

## References

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## From page 3... A Profile on Notable

learning. Engr. Ciceron advised aspiring cartographers to read books, journals, and other publications on cartography and its related subjects.

A good cartographer's strong sense of discipline in his field enables him to have the time and energy for his work and such activities as teaching, giving lectures on cartography for trainings, membership in associations, and even taking up other fields of learning.

Engr. de la Rosa was a part-time professor of cartography for 16 years at the FEATI University and for four years at the National University.

As a member of the Philippine National Cartographic Association (PNCA), Engr. Ciceron has been its present official Secretary since the late '80s. For its joint publication, the *Journal of Cartography, Geodesy, and Photogrammetry*, he occasionally contributed articles and served as Editor-in-Chief from 1980 to 1984. For a few years, Engr. de la Rosa also served as Secretary of the PNCA.

As additional scholarly pursuits, Engrs. de la Rosa, Bajar, and Norada also have associate degrees in Surveying. Engr. de la Rosa even earned Bachelor of Science degrees in Civil and Sanitary Engineering, a graduate degree in Public Administration, and graduate units in Statistics and Nuclear Engineering; Engr. Nepomuceno, graduate units in Management; and Engr. Bajar, a graduate degree in National Security Administration.

## Wisdom from Experience

In their appraisal of the current situation of Philippine cartography and cartographers, Engrs. Ciceron, de la Rosa, Nepomuceno, Bajar, and Norada cited several crucial needs. One of these is for Philippine cartography to be professionalized mainly through the revival of an updated Cartographic Engineering course in schools and the giving of the corresponding Cartographic Engineering board examination in order for graduates to be properly licensed and registered. Engr. Norada is in fact exerting efforts for the upgrading of the cartographic profession in the country and the consequent upgrading of the salary grade of workers. Their being poorly compensated is what generally causes their feelings of neglect and dissatisfaction. Cartographers also give great importance to favorable working conditions and the strict implementation of policies on recruitment and promotion.

Filipinos should not underestimate the importance of cartography. As Engr. Nepomuceno said, it is a "vital tool in planning and management." What can partly account for the people's generally low opinion of cartography and cartographers is their weak "map consciousness." Engr. Bajar cited the "need to enhance map conscious-



Basilia A. Norada

ness among the Filipinos in order to broaden the number of map end users." A possible solution to this is Engr. Norada's proposal of giving emphasis to subjects in Geography in, at least, the secondary level of education.

The five cartographers also pointed out the need for Philippine cartography to be upgraded, especially through the use of modern technology, for it to be at par with the cartography of other countries. If all the necessary improvements have been made in Philippine cartography, it can be what Engr. Bajar described as a "viable, honest to goodness" business venture. Engr. Bajar is himself proficient in computer-assisted cartography.

## Due Credit

Not every Filipino knows that it was Engr. Ciceron who designed and supervised the construction in 1968 of the relief map\* model of the Philippines at the Rizal Park. In truth, not every Filipino will know of the accomplishments of the five cartographers and of others like them. Nevertheless, they still deserve the gratitude of their countrymen for their services in development projects and programs; the wisdom they impart, especially to those who are fortunate to be under their tutelage and guidance; and their collective concern and efforts for Philippine cartography and cartographers.

## Sources

- \* Interviews  
Engrs. Reynaldo P. Bajar, Ponciano C. Ciceron, Rogelio P. de La Rosa, Felisa M. Nepomuceno, and Basilia A. Norada; November-December 1993.
- Mrs. Carla P. Falconit, College of Engineering, National University, 14 December 1993.
- \* Information Material  
Quirino, Carlos. *Philippine Cartography (1320-1899)*. 2nd revised ed. N. Israel Amsterdam, 1963.



## NEWS NEWS NEWS NEWS NEWS NEWS NEWS

## NAMRIA, NSC undertake carrying capacity project

**N**AMRIA and the National Security Council (NSC) are jointly undertaking a project called Carrying Capacity for RP Urban Centers. This is in response to the lack of determined effort of the local government units to develop a plan that uses the carrying capacity concept as a primary consideration.

The carrying capacity of an urban center is the maximum number of people in the center that can be adequately sustained with basic necessities for continued humane existence.

Among the project's objectives are: to develop a procedure that will determine the carrying capacity of Metro Manila, Metro Cebu, Metro Davao, and Olongapo as prototype areas with water as the object commodity; estimate the carrying capacity of selected urban centers; and design and recommend responsive government procedures or measures that are consistent with the carrying capacity of the urban center to deal with problems associated with urbanization.

A technical working group composed of representatives from the NAMRIA and NSC was organized to work on the project.

The project covers only water and food commodities and NAMRIA's role is to handle the water aspect of the project using the GIS approach or the use of digital data to present information. This will involve the overlaying of water demand and water supply maps to identify areas which are adequately serviced, potential areas whose groundwater resources can be tapped and critical areas which do not have good groundwater resources and which at present are not covered by existing water utility companies.

NAMRIA has already conducted a study of the existing and projected water supply and demand of Metro Manila and Olongapo. Digitization of thematic maps of Metro Manila and Olongapo has also been undertaken to present

water related statistics in map form. A report is being prepared on the water carrying capacity of the two pilot areas to be presented by January 1994.

The project is expected to come out with the following: various maps in digital format, decision maps, a report on the findings of the study, and recommended policies.

## TSS in Verde Island Passage implemented

**A** Traffic Separation Scheme (TSS) in the busy Verde Island Passage is being implemented to promote safety in sea travel in the area. In Memorandum Circular No. 06-93 issued by the Philippine Coast Guard (PCG), ships traversing the busy passage will now have to observe the TSS.

The TSS consists of two-way sealanes which will be depicted in nautical charts and special navigational rules. It will also be explained in the Notices to Mariners. Nautical charts and Notices to Mariners are published regularly for the information and guidance of the maritime public.

Verde Island Passage lies between Batangas Province in southern Luzon and Mindoro Island. Commercial vessels as well as passenger ships coming from Manila to the Visayas and Northern Mindanao regularly ply this route.

The project is the first Traffic Separation Scheme implemented in the country. Other TSS proposed to be established are along Tablas Strait, Romblon Pass, Surigao Strait, and Balabac Strait, among others.

The project is being undertaken by the NAMRIA in cooperation with PCG.

## NAMRIA holds 6th technical forum

**T**he sixth of a series of technical fora with the theme "RS and GIS for Disaster Mapping/Risk Management and Coastal Resources Management" was conducted by the NAMRIA on 21 October 1993, at the agency's Lecture Hall.

Lecturers from NAMRIA presented and discussed projects for disaster mapping/risk management and coastal resources management using applications of remote sensing (RS) and GIS while Cipriano C. Ferraris, Deputy Director of Operations and Services of the PAGASA, gave a lecture on the "Applications of RS in Meteorology."

NAMRIA resource speakers were Deputy Administrator Ricardo T. Biña, Dexter Grageda of the Mapping Department, and Rolando dela Cruz and Daisy Leonor of the Remote Sensing and Resource Data Analysis Department.

Following the presentations of the different speakers, there was a brief Open Forum moderated by Virginia M. Sicat-Alegre, Chief of the Information Services Division, IMD.

The conduct of the technical forum is one of the regular activities of NAMRIA for the promotion and marketing of the agency's products and services.

In his opening remarks, USec. Jose G. Solis, NAMRIA Administrator, pointed out that the country has the technology to properly cope with natural calamities although it lacked the necessary equipment. He especially cited the effectiveness of RS technology and lamented the country's lack of a monitoring station for tsunamis or tidal waves. USec. Solis also said that hazard maps, such as those produced by NAMRIA, often lose their usefulness especially during natural disasters owing to the general public's inability to understand their contents. In connection with this, he mentioned the need for the inclusion of the study of maps in the school curriculum.

In her brief closing remarks, IMD Director Linda SD. Papa expressed NAMRIA's expectation of there being many more users in the public and private sectors of RS and GIS technologies in the future, especially for disaster mapping/risk management and coastal resources management, as a result of the technical forum. Dir. Papa called on the participants to make use of RS and GIS technologies and to coordinate and integrate with users like NAMRIA all their efforts to help the country.



*TSS in Verde Island Passage.*



## NAMRIA demarcates remaining old growth dipterocarp forest

**I**dentification and demarcation of the remaining 800,000 hectares of the **old growth dipterocarp forest\*** in the country is currently being undertaken by the NAMRIA for forest protection and management purposes.

The project has been started in Region 10 (specifically in Bukidnon province) with a target area of approximately 40,000 hectares. Ten NAMRIA technical staff who will establish geodetic survey reference points near the peripheries of the old growth forest and five NAMRIA forest survey teams were dispatched to the province.

Other target areas of the project are Regions II, IV and VIII. Twenty-one land evaluation teams from the Cordillera Autonomous Region and Regions 1-12 were formed for the project.

The project is being funded under the Asian Development Bank (ADB) Forestry Loan 2 with a total appropriation of Two Hundred Nineteen million pesos (P219,000,000). The project will end in 1995.

DENR Special Order No. 35 Series of 1992 which provided the basis for the implementation of this project also created a National Secretariat that oversees the schedule of activities of the project. The National Secretariat is headed by Director Virgilio Basa of NAMRIA's Remote Sensing and Resource Data Analysis Department.

*Topographic map sheet of Mt. Mayon at scale 1:33,000 produced by NAMRIA shows the delineated six-kilometer permanent danger zone around the volcano.*

## Permanent danger zone around Mayon delineated

**N**AMRIA is currently undertaking the delineation of a six-kilometer permanent danger zone around Mayon Volcano in cooperation with the Office of Civil Defense, National Disaster Coordinating Council, and PHIVOLCS.

The project will establish 40 physical monuments at one-kilometer intervals around the perimeter of the danger zone using the Global Positioning System.

A total of six municipalities and 16 barangays are affected by the said project. The delineation will guide government agencies in enforcing the restrictions within the danger zone. It will serve as a warning among residents around Mayon Volcano of the risks in staying inside the danger zone.

### CONTRIBUTIONS

The National Surveys, Mapping, and Resource Information Technology Quarterly (Infomapper) is accepting contributions for its forthcoming issues. Manuscripts should be typed, doubled-spaced, and must indicate the author's name, position, and office/home addresses. Photographs and illustrations with captions are also welcome.

The Editors reserve the right to edit materials submitted. •

## TRAININGS/CONFERENCES/SEMINARS

**A**s part of the NAMRIA's goal to promote manpower development and personnel skills, the agency sent its staff to various trainings, conferences, seminars, and workshops as well as scholarship grants conducted abroad.

NAMRIA officials who attended trainings/workshops include the following:

1. **Admtr. Jose G. Solis** - 1st Asian-German Conference 1993 in Batam, Indonesia, 21-24 November 1993. This conference was held at Turi Beach Resort Hotel and was participated in by representatives from Thailand, Philippines, China, Indonesia and Singapore. Admtr. Solis was requested to talk about the development of NAMRIA with the topic "Experience of NAMRIA in the Provision of Geographical Information for Economic Utilization in the Philippines."

2. **DA Ricardo T. Biña** - UNEP/FAO Expert Meeting on Land Cover and Land Use Classification Harmonization in Geneva, Switzerland, 23-25 November 1993. DA Biña was invited by UNEP to act as a resource person in said conference. His participation will enable NAMRIA to input significant contributions with respect to the UNEP/FAO efforts on global environmental monitoring.

3. **Dir. Linda SD. Papa, ADir. Wilhelmina P. Capistrano, and Engr. Dexter James Grageda** - Observation Tour of Facilities in Vancouver, Canada, 31 October - 13 November 1993. The NAMRIA representatives were invited for an observation tour to complete the development of the Information Technology

Strategic Plan (ITSP) project and to attend a series of working meetings with the various departments of the British Columbia Government who are engaged in work and managing systems similar to those of NAMRIA.

Other NAMRIA staff who have undergone foreign travel engagements for 1993 were the following:

1. **Audie L. Soriano and Nicandro P. Parayno**, Engrs. IV and III/MRD - Training Course On the Use of Photogrammetric Methods and Information into GIS, 29 August to 26 September 1993 in Madras, India, sponsored by DSE.

2. **Rufino Sevilla**, Photographer III CGSD-Nautical Charting, 2 September - 13 November 1993 in Japan, sponsored by the Government of Japan.

3. **Antonio dela Cruz**, Petty Offr. III and **Sunday Lingad**, Computer Programmer III/IMD - CGSD Equipment Maintenance and Short Course on Int'l. GIS, 26 September to 18 December 1993 in Australia.

4. **Marvilyn Palaganas**, Sr. RSTech/RSRDAD - Remote Sensing Collaborative Investigation with the NIAES, 4 - 28 October 1993 in Japan, sponsored by NIAES.

5. **Oscar Braganza**, Sr. RSTech/RSRDAD - Seminar on Remote Sensing for Coastal Zone and Coral Reef Applications, 25 October to 1 November 1993, sponsored by MOTIC/SOM.

6. **Violeta Quiliza and Nancy Vasquez**, both Sr. RS Tech/RSRDAD - Forest Cover Monitoring with the Use of RADAR data in Tropical Countries, 28 October - 4 December 1993 in

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## NAMRIA joins nat'l environmental workshop

**N**AMRIA participated in a national workshop on Global Environmental Issues: Philippine Country Study on Climate Change on 3 August 1993 at the Holiday Inn Manila. The workshop was conducted by the Environmental Prime Movers of Asia, Inc. and the Climate Institute in cooperation with the Inter-Agency Committee on Climate Change (IACCC).

Scientists and specialists from government and private institutions involved in climate change studies gathered to assess the present state of research and to exchange views and experiences on current issues and developments.

Sen. Heherson Alvarez, Chairman of the Senate Committee on the Environment and Natural Resources was the special guest of honor. He emphasized the need for the Philippine government to promote environmental concern among the citizenry. He further urged everyone to take an active part in preventing global warming because its effects are detrimental to the planet.

During the workshop, the Philippine Country Study on Climate Change was presented for comments, discussions, and validation of its findings and recommendations. This study is an Asian Development Bank (ADB) - funded project focusing on the country's specific vulnerabilities to climate change and on the socio-economic impacts on the country's sustainable development.

With the growing global concern, the Intergovernmental Panel on Climate Change (IPCC)

sought to address the climate change issue and formulate strategies for a concerted global response to climate change, taking into consideration the development needs of individual countries and regions.

Workshop outputs were: an assessment of the current state and progress of research in the country with regard to climate change and its impact; scientific activities to be integrated into the government's overall science and technology program addressing environmental problems, and courses of action to be pursued in relation to climate change.

The IACCC is chaired by DENR Undersecretary Ben S. Malayang, with DOST Secretary Ricardo T. Gloria as co-chairman. Its member agencies are: NAMRIA, PAGASA, Environmental Management Bureau, and Department of Foreign Affairs (DFA).

NAMRIA representatives to the workshop were Director Renato B. Feir and Mr. Paquito Miralles, both from the CGSD.

## International planning seminar held

**M**ore than 50 development planners and policy makers from different countries gathered at the Montebello Villa Hotel in Cebu City from 25 - 27 October 1993 to participate in the International Seminar on Planning Support System (PSS) for Local/Regional Development. The NAMRIA co-sponsored this event together with the United Nations Center for Regional Development (UNCRD) as the lead organization, the National Economic and Development Authority (NEDA) Region VII, and the Central Visayas Regional Development Council (CVRDC).

The aim of the seminar was to promote the effective use of PSS as a tool for improving the value and usefulness of information as well as for enhancing the quality and effectiveness of local and regional planning in developing countries.

NAMRIA, which provides important inputs to planning and decision making through its maps, charts, and other products and services, was represented by Deputy Administrator Evangeline C. Cruzado who presented a paper on the role of NAMRIA in physical planning.

NAMRIA's computerized planning systems which include Tax Mapping and Zoning Information System and Ecological Profiling were demonstrated during the seminar. NAMRIA's maps, satellite remote sensing and GIS products, nautical charts, publications, and other products were exhibited at the seminar site.

## GLOSSARY

**Atlas** - a book of maps

**Contour intervals** - the vertical distance between contours.

**Contours** - traces which result from passing parallel, equally spaced, horizontal surfaces through the three-dimensional land surface and projecting these traces orthogonally to the map surface.

**Hachures** - short linear symbols positioned in the direction of greatest slope. Systematized in 1799 by Austrian Johann George Lehmann, these used to represent terrain and provide an illusion of viewing an illustrated three-dimensional surface.

**Latitude** - the distance north or south from the equator measured in degrees.

**Lithography** - the process of printing from a plane surface on which the image to be printed is ink-receptive while the blank area is ink-repellent.

**Longitude** - the distance east or west of the prime meridian expressed in degrees.

**Map scale** - the proportion or ratio between map dimensions and those of reality.

**Meridian** - a circle on the earth's surface passing through the geographical poles and any given point.

**Old growth dipterocarp forest** - tropical rain forest dominated by Dipterocarpaceae without traces of commercial logging.

**Philippine Transverse Mercator (PTM)** - also called the Philippine Plane Coordinate System, it has been adopted as the official coordinate system for surveying and mapping in the Philippines since 1961. With its X-axis on the equator and Y-axis on a full degree of longitude, it is similar to the UTM grid system.

**Portolan charts** - sets of sailing instructions created on parchment at around 1250 by a community of Italian draftsmen.

**Relief map** - map containing lines which show the differences in height of various land forms.

**Rutter** - a nautical manual.

**Spheroid** - a body almost but not quite a sphere.

**Stereopair** - two overlapping vertical photos which are viewed stereoscopically or with an eye simultaneously focused on each photo.

**Stereoplotter** - an instrument for plotting a map or obtaining spatial solutions by observation of stereoscopic models formed by stereopairs of photographs.

**Universal Transverse Mercator (UTM)** - the best known grid or plane coordinate system of international scope based on the Transverse Mercator projection. It extends around the world from 80° North to 80° South, with 60 north-south zones used.

## Information Campaigns

**T**he NAMRIA has successfully conducted its information campaign this year in the cities of Naga, Iriga, Trece Martirez, Olongapo, and Dumaguete with focus on GIS and remote sensing applications and technology.

The information drives emphasized the importance of geographic information which may be in the form of maps, charts, aerial photos, statistics, and satellite imageries; and also promoted the use and applications of modern mapping and information processing and integration.

Mini-information campaigns were also held in Zamboanga City and in the provincial capital of Bohol.

These campaigns were attended by local officials and representatives from the different government agencies; and people from the private sector, the academe, and NGOs. The participants expressed their hope and looked forward to the establishment by NAMRIA of at least one regional map sales office in their area which would respond to their mapping and geographic information needs.



## TECHNICAL REPORT

### I. BACKGROUND

There is today an increased awareness of the importance of integrating remote sensing, geographic information systems (GIS), and conventional mapping techniques.

The situation in NAMRIA is that these fields have been developed separately, retaining their own identity both within the structure of the organization and production flow. The technologies are there but are not integrated.

The Philippine government has come up with the National Topographic Base-Mapping Program (NTBMP) that will produce a new topographic base map series at 1:50,000 scale for the whole country with the NAMRIA as the main proponent. At present, the production of these maps are being done in an entirely conventional manner—aerial photography, survey, photogrammetry, cartography, and printing. The NTBMP, however, provides an opportunity to implement the integration of digital mapping, remote sensing, and GIS.

This attempt in the form of a thesis recognizes and discusses the existence of these technologies within the set up of NAMRIA and provides alternative procedures to better attain the goal of the NTBMP and the other benefits that come with digital technology.

### II. RESEARCH OBJECTIVES

#### A. General Objective

To provide a framework or guideline to optimize and improve the NTBMP through proper integration of new and existing technologies in the field of geoinformation production.

#### B. Specific Objectives

1. Identify and compare alternative procedures to optimize the creation of a Digital Topographic Database System within NAMRIA, digital map revision using satellite data, and production of image maps.
2. Provide the basis for the creation of standards for the classification of topographic information and identification of user needs.
3. Develop procedures for implementation of digital technology.

4. Analyse the effect of the proposed NTBMP improvements through a cost-benefit analysis.

### III. OVERVIEW OF METHODOLOGIES

A. Fieldwork - Analysis of the NTBMP and NAMRIA.

B. Consideration of budget, personnel, time, and equipment constraints.

C. Provision of guidelines for the design of a Digital Topographic Database and creation of a Prototype Database at 1:50,000 scale.

D. Provision of alternatives in support of the NTBMP.

E. Analysis of improvements.

### IV. ELEMENTS FOR OPTIMIZATION

#### A. Map Revision

Two of the several alternative procedures for map revision include the following:

1. Digitization of Photographs and Maps
2. Use of Remote Sensing Techniques

1 This technical report is a condensed version of the thesis submitted by the author to the International Institute for Aerospace Survey and Earth Sciences (I.T.C.), Enschede, The Netherlands in partial fulfillment of the requirements for the degree of Master of Science in Integrated Map and Geoinformation Production.

## Optimization of the National Topographic Base-Mapping Program

by Engr. James Dexter A. Grageda

(condensed for publication by Charmaine C. Aviquivil)

### B. Image Mapping

Production of image maps offers the possibility of providing topographic data within a relatively shorter period than conventional line maps. It is possible to process data using entirely digital techniques.

### C. Topographic Data Management

Capturing topographic data and converting it into digital form provides us with an opportunity to support a variety of applications to maximize the use of the data. The availability of maps in digital form enables the fast and dynamic updating of data; the identification and analysis of spatial relationships between map features and their graphic and non-graphic attributes; and the versatile integration of various data from different disciplines and flexibility of output in scale, area, display, and storage.

### V. EXPERIMENTAL TESTS

These were conducted to test the elements tackled in part IV.

#### A. Materials

These included the following: NTBMP draft proposal, NAMRIA manual, printed maps and map reproducibles, satellite data, aerial photographs, and software programs to handle digital data and the database such as PC ARC/INFO, DMS (Desktop Mapping System), Photo Styler, ILWIS, Turbo PASCAL, and DBASE IV.

B. Scanning of Map Separates and Photographs using PhotoStyler

Since there was no existing digital data on the test area, this had to be generated by scanning the color separates using the Photo Styler software package.

#### C. Vectorization of Scanned Maps using ILWIS

The output of the scanner which was in TIFF format was converted into the ILWIS format. It was ensured that all scanned data were in a consistent coordinate system. Since the scanned data were not free of noise (dirt, scratch marks, unevenness), cleaning was necessary by filtering. Using the ILWIS RasterToVector conversion program, the data was vectorized. Final checking of the vectorized data was done using ARC/INFO by overlaying it with the raster image.

D. Digital Image Processing Using the Desktop Mapping System

The scanned raster image was georeferenced before digitization. A similar procedure in georeferencing using ILWIS was performed. All features were digitized and coded. The digitized data were converted into an ARC/INFO file and a PASCAL program (Snapnode) was developed to eliminate redundant points.

#### E. Digital Topographic Database in ARC/INFO

In implementing the Topographic Database System in ARC/INFO, a series of logical steps were undertaken. These were:

1. Building the database - It involved database design, data input, and database management.
2. Analyzing the data - It involved the following:
  - a) Updating analysis, wherein more recent data from the 1:10,000 map was used to update the 1:50,000 map; and b) Map sheet analysis.
3. Presenting the results of analysis - This was done through maps, which are best used to display

geographic relationships, and through reports, which are appropriate for summarizing the tabular data and documenting any calculated values.

### VI. PRESENTATION AND EVALUATION OF ALTERNATIVES

#### A. Presentation of Alternatives

Alternative A: Digital Topographic Database and Manual Digitization.

All data digitized in the Photogrammetry Division after implementation of the topographic database will be entered in the database. All maps produced prior to the implementation of the database will be manually digitized. Digitization procedure for this has to be established. Only the photogrammetric manuscripts have to be digitized in any case. Large scale paper maps (1:10,000 or larger), which can be used to update the 1:50,000 digital data, should be digitized only in case they are within specification (e.g. no large shrinkage or distortions). If, however, the color separates are available, they will be used instead (film medium is more stable).

All digital data collected will be entered into the digital topographic database.

Alternative B: Digital Topographic Database, Manual and Semi-Automatic Digitization

Similar to procedures described in Alternative A, data can be generated by scanning the color separates, photogrammetric manuscripts or maps and on-screen digitization. Software such as DMS may be needed here, but ARC/INFO also has an on-screen digitization option.

Alternative C: Digital Topographic Database, Manual and Semi-Automatic Digitization, Map Revision Using Satellite Data and Image Mapping

In addition to the procedures described in Alternative B, image mapping and map revision using satellite imagery are introduced in the map production. A completely digital approach to image mapping can not be attained with the available equipment, but it is possible to make orthophotographs using the orthoprojector. Satellite imagery is available on film and if DTM is available too, it can be processed to produce image maps. Image mapping is introduced here since it is faster than production of conventional maps. For areas with little detail (e.g. forests and mountains), orthophotographs are sufficient.

#### B. Cost, Time, and Benefit Analysis

##### 1. Cost and Time Analysis

Assumption 1: Only 491 Map Sheets Should Be Produced

A) Yearly output map requirement (for survey, photogrammetry, and cartography): 491 map sheets/8.5 years = 57.7 or 58 map sheets/yr.

##### B) Capability of NAMRIA

NAMRIA will use eight photogrammetric instruments for the NTBMP (four are purely analogue and the rest are capable of digital mapping).

For analogue photogrammetric instruments, the estimated duration in days for one photogrammetric manuscript to be compiled is computed at about 22 days. For computer supported photogrammetric instru-

(Continued on page 16)



ments, the estimate is about 28 days. This is because a photogrammetric operator will spend more time in digitization owing to additional features as compared to the usual routine, as well as conversion of the digital data to the required format and coding.

Assuming 252 days per year for compilation, the following computations were made:

i. For analogue photogrammetric instruments:

Output/year = 1 sheet/22 days x 252 days/yr.

= 11.45 sheets/yr. x 4 instruments

= 45.8 or 45 sheets/yr.

Total Output = 45 sheets/yr. x 8.5 yrs. = 382 map sheets

ii. For computer supported photogrammetric instruments:

Output/Year = 1 sheet/28 days x 252 days/yr

= 9 sheets/yr. x 4 instruments

= 36 sheets/yr.

Total Output = 36 sheets/yr. x 8.5 yrs. = 306 map sheets

Both analogue and computer supported instruments shall produce a total of 688 sheets per year (382 + 306).

iii. For digitizing (two digitizers and one scanner)

Yearly map requirement = 58 sheets

Assuming only one digitizer or scanner will be used: 58 map sheets/12 months = 4.8 or 5 map sheets/instrument/month

Assuming two digitizers will be used: 58 map sheets/2 digitizers /12 months = 2.41 or 3 map sheets/digitizer/month

Assuming two digitizers and the scanner, dividing the load equally: 58 map sheets/3 digitizers/12 months = 1.61 or 2 map sheets/instrument/month

The computations show that it is realistic to assume that NAMRIA can complete the topographic database within the planned duration of the NTBMP. One workstation with 3 terminals for the ARC/INFO is sufficient.

Assumption 2: All Map Sheets Should Be Produced

If all 642 map sheets will be produced, it is estimated that an additional 43 million pesos will be required to include the 151 map sheets originally not considered.

The computations did not include the cost of acquiring satellite imagery, supplies, and materials; and maintenance of equipment to be used in the map revision using satellite imagery, as well as in the database implementation. A total of 6.840 million pesos will be spent on satellite imagery acquisition alone. Total cost for materials can be assumed to equal 13.033 million pesos at 20,300 pesos/map sheet.

Thus, roughly 63 million pesos for the incorporation of the alternative procedures is required. That is about 32% more than the original NTBMP financial budget (199.500 million pesos). This is fairly a small percentage considering the benefits expected from digital techniques (see next section). Moreover, this estimate includes all 642 map sheets which the NTBMP original did not consider.

## 2. Benefit Analysis

Benefits may be categorized into five types:

Type 1 - Quantifiable efficiencies in current practices, or benefits that reflect improvements to existing practices.

These are usually associated with enhanced productivity, cost savings, etc. In NAMRIA, the duplication of work in digitization will be eliminated. Data

from the mapping department can be digitally transferred to the remote sensing department.

Type 2 - Quantifiable expanded capabilities or benefits that offer added capabilities.

These are equivalent to hiring additional staff. In the alternatives presented above, the digital topographic database system can be viewed as an added personnel complement. Tasks formerly left undone due to lack of staff and support services can be accomplished with the help of the system. Tasks which required significant labor input, such as drafting and map inventory, would be reduced; thus requiring less additional personnel.

Type 3 - Quantifiable unpredictable events, or benefits that result from unpredictable events.

These are usually discovered after the system has been implemented. For example, it could expedite NAMRIA's response to natural disasters or assist a major development proposal.

Type 4 - Intangible benefits, or benefits that produce intangible advantages.

These may include improved workshop morale and higher self-esteem for personnel given the opportunity to work with "high-tech" tools. Benefits associated with reduction in staff turnover and absenteeism may exceed those that can be quantified. In some cases, the sharing of data and analytical tools may trigger better working relationships within and between organizational units.

Type 5 - Quantifiable sale of information, or benefits that result from the sale of information services.

NAMRIA's main income-generating activity is the sale of maps. With the data in digital form, more users can be supported aside from the traditional users of printed maps. These benefits can occur because of the flexible nature of digital data. Latent interest in both basic data and its manipulation into standard and custom products can be discovered.

## VII. CONCLUSIONS AND RECOMMENDATIONS

### A. Conclusions

1. Enormous costs are incurred in the collection, processing, storing, and retrieval of geographic information. If a computer system equipped to handle such tasks is acquired and if it can effectively and efficiently provide support and service to a variety of geoinformation users other than the traditional map users, its cost becomes of secondary importance.

2. The substantially reduced cost of computers and faster development of new systems offer an enhanced use of geoinformation for the management and use of resources, planning, and decision making; as well as a number of options and a variety of tools in handling our problems.

3. The general public must be made aware of the potential benefits of GIS. Lack of awareness may result in failure of these systems for the purposes they wish to serve.

4. Satellite or remotely sensed data can not be assumed as the sole source of information, especially in topographic map production. These should be used in conjunction with other sources such as aerial photography, topographic maps, and ground survey data.

5. The creation of the Digital Topographic Database shows the following benefits: quick and easy access to large volumes of data; ability to select detail by area, theme or layer; ability to link or merge data sets; ability to analyze spatial characteristics of data; ability to search for particular characteristics; ability to update data quickly and cheaply; ability to model data and assess alternatives; and ability to produce new and flexible forms of output such as maps, graphs, address lists, and summary statistics which are tailored to meet particular needs.

6. With digital technology, problems of lack of trained and skilled personnel for conventional map production are overcome, if not avoided.

7. NAMRIA as the central mapping agency and depository and distribution facility for natural resources data is in a position to spearhead endeavors in creating a digital topographic database and establishing the standards that go with it.

### B. Immediate Recommendations

1. Consultation with geoinformation users to establish the final general data model is needed.

2. A research team should be formed to test and investigate new mapping software in the market to keep the agency up-to-date and competent on new methodologies, ideas, and processes.

3. Since the implementation of the new technology may take some time before it becomes fully effective, it is appropriate to organize a separate team to take care of new map production so as to provide better monitoring of activities.

4. A pilot project for new map production must be undertaken to determine the feasibility and practicality of the suggested alternatives in a production environment.

5. Time is of importance in the implementation of the proposed improvements of the NTBMP. The time and labor intensive tasks of digitizing maps require it to be commenced as soon as possible.

6. Immediate location of funding sources for the suggested improvements is necessary.

7. The full potential of the database shall be secured only by coordinating the interests of the widely dispersed community of users.

8. Establishment of a quality control model for the system is important.

9. A clear product strategy for NAMRIA based on user requirements must be defined.

*Editors' note: Due to space constraints we cannot publish the list of references consulted for this thesis. Those interested in consulting the references can avail of a list from the author or from the editors of this publication.*

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