

Introducing GIS to TransNav and its Extensive Maritime Application: An Innovative Tool for Intelligent Decision Making?

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ABSTRACT: This paper aims to introduce GIS, its definition, principle, application in any discipline particularly maritime, its process, data sets and features and its benefits to maritime and universities. Specifically, the paper intends to provide an overview of its wide applications in maritime including but not limited to marine transportation, marine environment, port management and operation, maritime education and training (MET) and maritime research. GIS simplest task is in mapping and visualization. But its most important function is in spatial analysis. Spatial analysis takes into account the location, geometry, topology, and relationships of geographic data, which lend itself to intelligent decision making. GIS is not just for researchers and students. GIS is especially useful for decision makers such as: managers, administrators, and directors of large and small projects. Scenarios are “seen” and analyzed even before events happen. To planners and decision makers, this is very important because they can assess the impact of events or scenario and may save a lot of time, effort, and money before implementing the actual project. An additional skill on GIS when learned or thought would certainly result to a technically competent maritime global workforce. The paper would provide ideas on possible areas for collaborations among TransNav member institutions for data sharing which may be processed and analyzed by a GIS specialist.

1 INTRODUCTION

The 10th Jubilee International Conference TransNav 2013 on Marine Navigation and Safety of Sea Transportation is indeed a challenge to MAAP and its co-TransNav members to keep up with fast-developing changes and advances in the maritime and shipping industry, both domestic and global for safety of life at sea in the Asia Pacific region and beyond.

Maritime Education and Training Institutions (METIs) have to continually evolve into more relevant institutions to better address the dynamic global challenges in the maritime industry. METIs need to strengthen itself to meet the present and future

demands and expectations of its students and the workplace they are going to serve, and at the same time be always on top with other maritime institutions pursuing similar goals. In this day and age of globalization, the use and development of information technology, specifically marine information technologies, is increasing exponentially. The maritime industry is fast adapting to these changes. This is also in consonance with the implementation of the STCW 2010 known as 2010 Manila Amendment that requires the use of technology like ECDIS, as one of the emergent developments, needed to enhance the seafarers' skills on board for safety of life at sea.

Needless to say, TransNav member institutions as a major manpower provider and player in the maritime and shipping industry have to keep up with these advances to produce graduates who are knowledgeable and updated with the use of latest marine information technologies. Having such qualifications, graduates are more suited and highly attractive to the maritime and shipping labor market globally. These skills encompass the so-called geospatial technology (GST) which is especially valuable to marine officers, having substantial responsibility of manning people and maintaining smooth maritime operations such as: deck and engine officers, port planners, administrators, marine transportation systems managers, ship managers, and maritime company personnel. This paper aims to introduce GIS and its wide applications in maritime to provide some ideas on possible areas of collaborations among TransNav member institutions.

Now where GIS does comes in? How can GIS help in fulfilling the MISSION of TransNav? What is GIS? How can TransNav benefit from it? This paper answers these questions. Based on degree of applicability, this is a basic (fundamental or pure) type of research which is driven by the researcher's curiosity or interest in scientific questions. The main motivation is to expand man's knowledge, not to create or invent something. Based on approach or strategy, this is a grounded theory qualitative research that investigates the quality of relationships, activities, situations or materials wherein the researcher attempts to generate a theory that is grounded in data systematically gathered and analyzed. Hence this study utilized a basic grounded theory qualitative research using the following methods of data collection: internet search, literature search, documentary and content analysis (74 research references)) with almost one year of intellectual email query (weekends or evenings) to a GIS specialist (Dr. Alejandro Tongco from Oklahoma State University This is also based on the understanding of the researcher (GIS aspirant) having trained on GIS for the month of March 2012 with GIS expert Dr Alejandro Tongco as mentor during his visit in the Philippines as an invited trainer by MAAP.

As part of MAAP extension services program, GIS software were shared and trainings conducted to different interested groups as co-sponsors namely : Philippine Navy in their conference room on March 6-9 (N8 Head Capt Sean Anthony Villa), the Province of Bataan on March 12-16 in one of the rooms at the Capitol (Governor and Mayor Enrique Garcia/ PMO Engr Ric Yuzon), the Bataan Peninsula State University on March 20-23 (President Dr. Delfin Magpantay) and the Maritime Academy of Asia and the Pacific on March 26-29 (President VAdm Eduardo Ma R Santos, AFP (Ret)). The researcher (DRES Director) also facilitated the GIS training of MAAP interested students (MRESC and PAEPI members) on three Saturdays (March 12, 17 and 24) at MAAP computer room. To date, the 2013 TransNav Conference on Marine Navigation and Safety of Sea Transportation is indeed a challenge to all.

2 DISCUSSIONS

2.1 GIS Definition

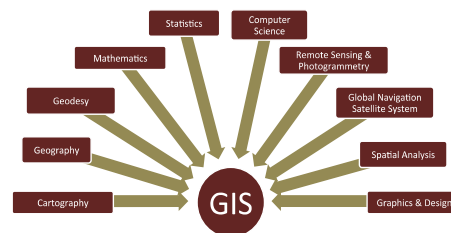
Geographic Information Systems (GIS) (4) is a computerized analytical tool that processes geographic data and produces information that helps in making intelligent decisions. These are valuable to planners, administrators, educators, researchers, environmentalists, social scientists, institutional researchers, students, analysts, strategists, and policy makers.



2.2 GIS, a Convergence of Several Disciplines

GIS is a new paradigm, a new way of thinking. Since its inception about 40 years ago, the field of GIS has distinctly evolved from a blend of several disciplines, mainly: *Geography, Cartography, Geodesy, Mathematics, Statistics, Computer Science, Remote Sensing, Global Navigation Satellite System (GNSS), Spatial Analysis, and Graphics & Design, that are used in varying degrees to solve specific problems. GIS analysts must be generalists and must have high level of familiarity of several of these disciplines including his/her own professional background*

GIS is a Convergence of Several Disciplines:
For Spatial Data Management & Intelligent Decision Making



2.3 GIS Applications by Discipline

Whatever field of specialization or disciplines, GIS can be applied to it. Some of the headings and sub-headings below (particularly those underlined>) in relation to AMFUF Conference may be applicable to Maritime.

Agriculture (Agricultural Economics, Agricultural Engineering, Agronomy, Farm and Ranch Management, Pest Management and Veterinary Science); Architecture (City, Community, and Regional Planning, Landscape Architecture, Urban and Environmental Design); Business (Banking and Financial Service Business Administration, Decision Support Systems, Economic and Management Research, Asset and Facilities Management, Marketing ,Media and Press, Operations Research,

Real Estate Management and Retail); Defense, Security, and Intelligence (Defense and Force Health Protection, Enterprise GIS, Geospatial Intelligence (GEOINT), Installations and Environment, Military Operations); Education (Campus / Multi-campus Management, Continuing and Distance Education, Educational Management and Administration, Elementary and High School, Institutional Research, Extension Planning, Vocational and Technical Education, Alumni Management, GIS Science & Technology Curriculum Development, Research, Theses, & Dissertations); Engineering (Aerospace Engineering, Chemical Engineering, Civil and Sanitary Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Geomatic / Geodetic Engineering / Surveying, Industrial Engineering, Mechanical Engineering, Mining Engineering); Government (National, Regional, Provincial, Local, Economic Development, Elections, Land Administration, Public Works, Urban and Regional Planning); Law (Real Estate, Jurisdictional Law); Libraries & Museums (Government Documents, Map and Imagery Collections); Mapping and Charting (Aeronautical, Cartographic Publishing, Nautical, Spatial Data Infrastructure); Natural Resource Management (Conservation. Environmental Management, Fisheries, Forestry, Parks and Recreation, Petroleum, Range Management. Wildlife Management and Water Resources Management); Natural Sciences (Biostatistics, Botany, Conservation Biology, Entomology, Marine Biology, Zoology, Ecology, Environmental Science, Oceanography and Coastal Studies and Soil Science); Physical Sciences (Applied Physics, Climate Change, Computer Science, Geology, Geosciences, Earth Science, Geographic Information Sciences, Geochemistry, Hydrology, Paleontology, Quaternary Research, Seismology Research, Meteorology and Climatology); Public Health and Medicine (Environmental Health, Epidemiology, Hospitals and Health Systems, Managed Care, Public Health); Public Safety (Computer-Aided Dispatch, Criminal Justice, Criminology, Emergency/Disaster Management, Homeland Security, Law Enforcement, Fire and Rescue, Emergency Medical Services); Social Sciences (Area and Ethnic Studies, Anthropology and Archaeology, Communications and Journalism, Economics, Geography, Historic Preservation, International Studies, Political Science, Public Administration, Psychology, Sociology, Demography ; Travel and Tourism); Transportation (Aviation, Highways, Logistics, Railways, Ports and Maritime and Public Transit); Utilities and Communications (Electric, Gas, Location-Based Services, Pipeline, Telecommunications, Water/Wastewater)(5)

These are only partial list. Almost all disciplines can benefit from GIS. GIS has almost unlimited applications in many disciplines. As Roger Dangermond (founder of the ESRI, the maker of ArcGIS) has said, "The applicability of GIS is limited only by the imagination of those who use it."

2.4 GIS Applications in Maritime

As GIS is applicable to any disciplines. Geospatial Technology (GST or GIS) has become pervasive nowadays in a wide variety of applications and

industries, ranging from agriculture to local governance to utilities (Cimons, 2011). The maritime industry has increasingly applied geospatial technologies such as GNSS, remote sensing (RS), hydrographic surveying and coastal mapping, ports planning and management, and charting, as well as development of a marine spatial data infrastructure (MSDI).

The GIS in marine transportation are certainly useful in varied areas namely: routing of vessels and the type of vessel; knowing the positions of vessels in real time; mapping and analyzing incidence; selecting new sites and analyzing marine aids such as buoys, signal lights, and other man-made coastal and offshore structures; hydrographic and bathymetric mapping of harbors, approaches, and channels; delineating shipping channels, maritime zones, and marine protected areas; producing, managing and upgrading IMO-compliant navigation charts; designing and analyzing transportation networks; and monitoring and analyzing climate patterns and ocean currents. Maritime mapping can also best be accomplished by GIS software. To address the challenges in maritime mapping and charting, the United Kingdom Hydrographic Office (UKHO) has proposed competencies in several spatial related skills such as cartography, geodesy, GPS, International Maritime Organization (IMO)-compliant electronic navigational chart (ENC) and digital nautical chart (DNC) production based on new International Hydrographic Office (IHO) S-100 and S-101 standards, spatial database management system (SDBMS), GIS software such as ArcGIS and SevenCs, and electronic chart display and information system (ECDIS) (UK Hydrographic Office, 2007).

GIS in management and operations of ports namely: design of ports infrastructure; future expansions; environmentally compliant storm water systems; port asset and facility management; security planning and operations; berthing assignments and vessel tracking and routing; cargo multimodal operations; disaster response planning; and delineating restricted areas and danger zones. A sample application of GST in ports management and cargo handling is a revolutionary, cost-saving technology that uses robotic balloon cranes, currently being developed by Jeremy Wiley of Tethered Air (Hsu, 2012; Katdare, 2012). Harvard University has manifested interest in this cabled robotics industry as a whole for their vision to build a center of excellence for the industry. At present, said type of robot is currently being built in cooperation with students from Georgia Institute of Technology. With balloon cranes, any seaport or coastal area can be used to load and unload ship containers and heavy cargo, in lieu of conventional cranes that are seen in seaports.

GIS techniques can be used to help design and implement a sustainable marine environment through the following: mitigating oil spills; restoration of wetlands; coastal zone management that includes coral reefs and mangroves restoration and estuary maintenance; and assessing environmental impacts of man-made coastal structures and coastal activities such as dredging. Some examples of software tools used in maritime GIS are ESRI suite of software, CARIS, and SevenCs.

GIS techniques can be integrated in the MET curriculum. For example, the enclosure of GIS topics can enrich the curricular content of several courses. Existing courses may include: information and communication technology (ICT); ships and ship routines; meteorology and oceanography; world geography; maritime pollution and prevention; and merchant ships search and rescue. In establishing curriculum guidelines on GIS, the following URLs from the internal pages of the company IPTC or Integrated Power Technology Corporation founded by Engr. Andrew Gizara, would be good references: 1. Geographical Information System Development (<http://www.intpowertechcorp.com/gis.html>); 2. Supervisory Control & Data Acquisition Development (<http://www.intpowertechcorp.com/scada.html>); 3. Velocity Performance Prediction Development (<http://www.intpowertechcorp.com/vpp.html>); and 4. Unmanned Marine Vehicles Development (<http://www.intpowertechcorp.com/umv.html>). The integration of GIS in maritime curricular programs has already started. For example, a maritime graduate program called Master of Science in International Maritime Studies - Marine Spatial Planning is offered by Southampton Solent University (www.shippingedu.com). The Faculty of Navigation of the Gdynia Maritime University and the Nautical Institute recognizes the importance of Geomatics and GIS in maritime applications, as shown in the list of the 87 Transnav conference main research topics or subjects (<http://transnav2013.am.gdynia.pl/Symposium/conference-main-topics.html>) for 10th International Navigational Conference on Maritime Navigation and Safety of Sea Transportation they organized on 19-21 June 2013. The conference gathers global scientists and professionals to meet and share their respective expertise, knowledge, experience and research results, concerning all aspects of navigation and sea transportation. GIS techniques can be integrated in the MET curriculum. For example, the enclosure of GIS topics can enrich the curricular content of several courses. Existing courses may include: information and communication technology (ICT); ships and ship routines; meteorology and oceanography; world geography; maritime pollution and prevention; and merchant ships search and rescue.

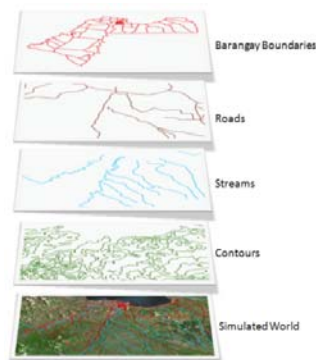
Areas for maritime research, the GIS are vast. This is where any MET schools can empower and prepare itself and its students for new emerging GIS developments for the maritime industry. This requires an innovative interested GIS-skilled faculty and a supportive MET management. On the other hand, MET graduates students can enhance the research environment of their schools through discipline-based thesis as part of their study program. There is dire need for maritime research in the Philippines that is focused on technical disciplines, i.e., science, technology, engineering, mathematics, and design (STEMD). GIS-based maritime researches can contribute to these disciplines. Having the most number of maritime schools (95) and graduates in the country, it is expected that the Philippines would be able to produce a proportionate number of maritime technical research outputs in international forums. An equally important GIS initiative that a maritime school can create for a better impact in maritime

research for the maritime industry is the establishment of a maritime spatial data infrastructure (MSDI) or similarly an integrated shipping spatial information system (ISSIS). An MSDI or ISSIS is a framework of geospatial data, software tools, and metadata for users to use the information efficiently. It is GIS in itself, which involves the collection, processing, management, storage, distribution, and display of geospatial information for the maritime industry, maritime researchers, and MET schools. An MSDI of ISSIS can assist for the planning, implementation, and assessment of spatially related content of maritime studies. The comprehensive database may include spatial information about port facilities, maritime security, marine hazards and incidents, MET students and alumni, greenhouse gas emissions, and environmental and meteorological data. Examples of web-based MSDI or ISSIS are the Narragansett Bay data portal, US National Oceanic and Atmospheric Administration (NOAA) marine web GIS, and MarineCadastr.gov. GIS-skilled maritime graduates are offered wider employment opportunities, not just sea-based, but in land-based jobs as well. They may venture into jobs such as development and production of ENC's based on IHO S-100 and S-101 standards (MarineCadastr.gov; International Hydrographic Office (IHO) and Hydrographic and Oceanographic Service of the Chilean Navy (SHOA), 2009); design, development, installation, operation, and training of ECDIS hardware and software; development of marine spatial data; establishment and maintenance of MSDI and ISIS; marine research, e.g. marine surveying, bathymetry, marine geology, and coastal projects; employment in shipping and maritime companies and agencies; and teaching and research in MET schools.

GST issues related to the maritime industry are being shared through conferences, such as the one organized by Geo Maritime (Geo Maritime, 2012) and by Transnav (<http://transnav.eu>) with published refereed papers on International Journal on Marine Navigation and Safety of Sea Transportation. Some of these GIS-based papers demonstrate the benefits of integrated use of satellite & GIS technologies on ships to various options of using other electronic navigation systems (Boykov 2012); the GNSS for an Aviation Analysis based on EUPOS and GNSS/EGNOS Collocated Stations in PWSZ CHELM (Fellner, et. al., 2008); the digital chart application in the field of maritime traffic with the purpose of resolving "Information Isolation" thru development of Web chart systems using raster data instead of vector chart based, which is accessed with higher speed than most vector chart based web rendering system in wide bandwidth network with least errors for many kinds of application (Hu et al, 2007). On the other hand, the paper of Prof. Weintrit comprehensively explains the problems connected with the utilization of GIS technology and more sensitively speaking, its waterborne implementation, i.e. ECDIS (Electronic Chart Display and Information System) technology and the electronic navigational charts (ENC) in the widely comprehended maritime (open sea, coastal and harbor), inland navigation and sea-river navigation areas. (Weintrit 2010). In reference to the 2007-2012 TransNav scientific papers specifically the 54 refereed papers, it can be surmised that the

maritime industry employs GIS technologies in areas such as: 1.) GPS and GPS-enabled communication systems (Januszewski 2007; Vejrazka, et al, 2007; Bosy, et al, 2007; Lemanczyk & Demkowicz, 2007; Aguila, et. al., 2008; Bober, et. al., 2008; Grzegorzewski, et. al., 2008; Fellner et al, 2008; Dziewicki, 2009; Yoo et al, 2009; Kujawa, et. al., 2009; Im & Seo, 2010; Vejrazka, et. al., 2010; Janota & Koncelik, 2010; Bober, et. al., 2010; Fukuda & Hayashi, 2010; Fellner, et. al., 2010; Ilcev.2011; Januszewski, 2011; Arai, et. al., 2011; and Ambroziak, et. al., 2011); 2.) ECDIS (Rudolph, 2007; Hu, et. al., 2007); 3.) Automatic Identification System (AIS) (Aarsather & Moan, 2007; Yousefi, 2007; Weizhang, et. al., 2007; Naus et. al., 2007; Harati-Mokhtari, et. al., 2007; Drozd et. al., 2007; Banachowicz & Wolejsza 2008; Plata & Wawruch 2009; Hu et al 2010; Wolejsza, 2010; Aarsather & Moan, 2010; Bukaty & Morozova, 2010; Park & Kim, 2011; Miyusov et al 2011; Stupak & Zurkiewicz, 2011; Ni Ni HlaingYin, et. al., 2011; Krol, et. al. 2011; Yang et. al., 2012 Xiang et. al., 2012; Kwiatkowski et al, 2012; Mazaheri et. al., 2012; Gucma & Marcjan, 2012; Goerlandt, et. al., 2012; and Krata, et. al., 2012) and 4.) Remote sensing imagery (Stateczny & Kazimierski 2009). It is first time that maritime schools like MAAP that has thought and initiated the probable use of GIS as an innovative tool for MET, research and campus management enhancement (Baylon and Santos, 2013)

When using the GIS software, several datasets can be overlaid on a computer screen to simulate and view a scenario. If all data layers have uniform geographic reference they will lay on top of each other like a deck of cards. On a computer screen they may appear like a rendition of the real world. A layer can be turned on and off, zoomed in or out, clipped to desired size, further attributed, labeled, and applied with desired symbology, among many other processes.



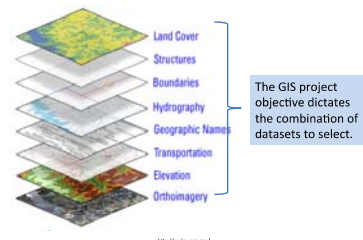
Terms that describe GIS have been repeatedly cited for emphasis and not for redundancy. This is done purposely to embed the concept of GIS in people's consciousness. GIS is a new paradigm – a new way of thinking.

2.5 The GIS Process

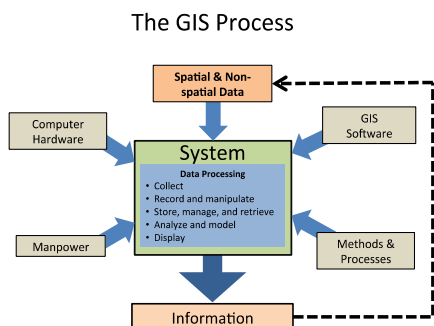
Geographic data are data about people, places, things, and events on earth that have geographic coordinates or are geographically referenced. Because of the data's unique feature, spatial relationships and patterns can be visualized and analyzed to produce information that are useful to researchers and managers. The GIS process is made up of several components called inputs (*spatial and non-spatial data, GIS software, Computer hardware, manpower and methods and processes*). These data are processed (*collected, recorded and manipulated, stored, managed and retrieved, analyzed and modeled, displayed*). The System produces useful information (which may be recycled) to produce specifically desired information.

GIS is a stack of several commonly referenced geographic datasets to

- Simulate a scenario
- Stimulate spatial analysis
- Induce intelligent decision-making

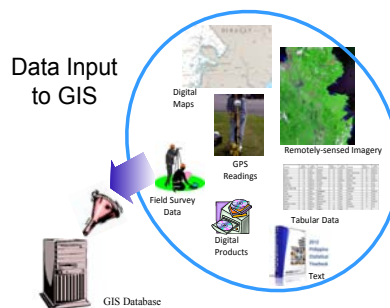


To some, if not too many of views, GIS may have a steep learning curve as illustrated by various data layers (land cover, structure, boundaries, hydrography, geographic names, transportation, elevation and orthoimagery). The GIS project objective dictates the combination of datasets to collect



2.6 Data Input to GIS

The GIS system needs data to be processed into useful information. Examples of input data are the following: digital maps, GPS readings, remotely-sensed imagery, tabular data, field survey data, digital products, texts etc

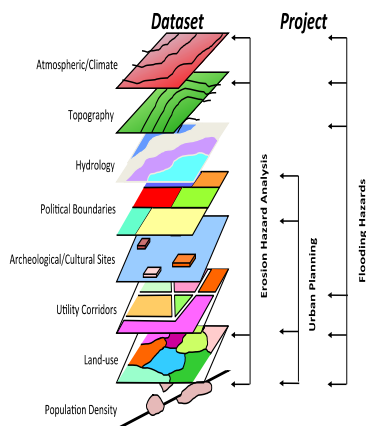


2.7 GIS Datasets

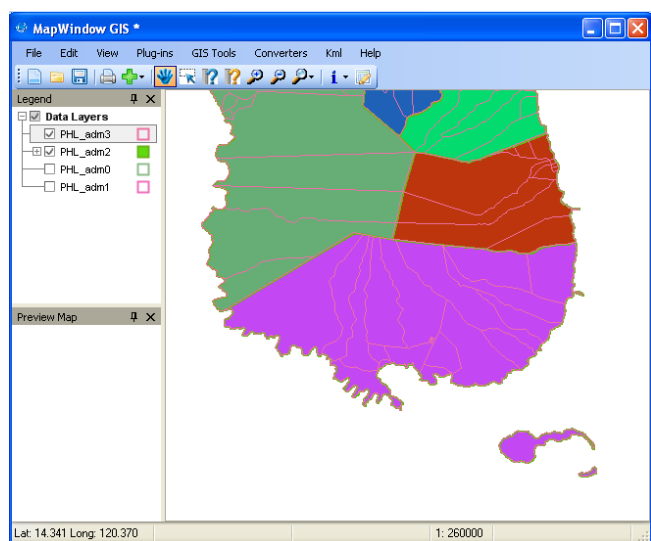
GIS datasets to be chosen are dependent on the project to be accomplished. Shown are typical GIS

datasets to be used. There could many others, depending on the project goals. For example, if the project is about Erosion Hazard Analysis, datasets may include, but not limited to: precipitation data (e.g., in the form of contours), land topography, land use, population concentration, etc. If the project is about Urban Planning, data sets needed maybe political boundaries, cultural sites (e.g. cemeteries, church, etc), land use, and population concentration.

Which GIS Datasets to Choose?



GIS is a powerful spatial analytical tool that recognizes and leverages the unique location of people, things, places on Earth – what they are and what are in them, where they are, and how they relate with their neighbors – within a defined geographical entity. These factors require building a database with similarly referenced data layers. Overlaying of data layers enables users to visualize relationships, interactions, connections, patterns, and trends. The datasets are the foundation to scientific spatial analysis that gives informed interpretation of research or project results and thus minimizing guesses in decision making. Location is the key word in GIS. Without “Location” component, GIS is of no use.



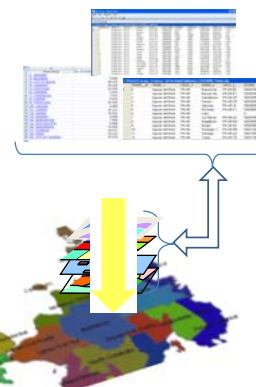
2.8 GIS Features

Basically, GIS consists of one or more layers of data. Each layer of data is in the form of lines, points or polygons called VECTOR or imagery called RASTER.

Each layer is accounted with an attribute data table. A layer has uniform geographic coordinate system (example: latitude and longitude). An overlay of layers can reveal patterns of trends useful for spatial analysis.

Features of a GIS: A Brief Summary

- Consists of one or more layers of data
- Each layer is in the form of lines, points, or polygons (called VECTOR), or imagery (called RASTER)
- Each layer is associated with an attribute data table
- Layers have a uniform geographic coordinate system (i.e., latitude and longitude)
- An overlay of layers can reveal patterns and trends useful for spatial analysis
- Other Names of GIS:
 - Geographic Data Visualization Tool
 - Data Mapping
 - Visual Communication Tool
 - Computer Mapping and Spatial Analysis Tool

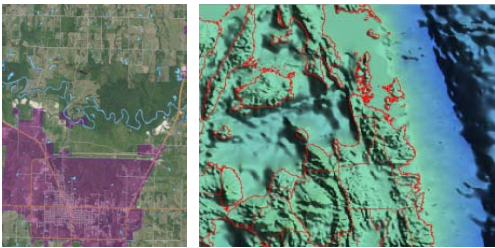


Depending on the specific information a user needs, the GIS specialist can mix and manipulate different data layers to produce the combination to produce the desired analysis, information, and display. Each data layer is linked to a corresponding table of attributes that quantitatively and qualitatively describes the nature of that data layer. GIS other names are: Data Mapping, Geographic Data Visualization Tool, Visual Communication Tool and Computer Mapping/Spatial Analysis.

Having common characteristics, almost all problems have a location component. Problems involve people, location of people, things in those locations, events and phenomena in that location, and relationships of these components. These components and their relationships lend well to scientific GIS analysis and thus intelligent decisions. Hence, a challenge for TransNav

Its simplest task is in mapping and visualization. But its most important function is in spatial analysis. Spatial analysis takes into account the location, geometry, topology, and relationships of geographic data, which lend itself to intelligent decision making. GIS is not just for researchers and students. GIS is especially useful for decision makers such as managers, administrators, and directors of large and small projects. Scenarios are “seen” and analyzed even before events happen. To planners and decision makers, this is very important because they can assess the impact of events or scenario and may save a lot of time, effort, and money before implementing the actual project.

The accompanying illustration shows an overlay of various datasets, i.e. river and water bodies, highways, city streets, and city boundary, all on top of true-color satellite imagery. All data layers are projected to the same coordinate system. Other figures show simple map samples



A map created using free GIS software (Map Windows) and free data : bathymetric data (www.gebco.net) and administrative boundary data (www.philgis.org).



Map created using free Map Window GIS software and elevation and administrative boundary data (www.philgis.org).



This a close-up views of the campus of the Maritime Academy of Asia and the Pacific displayed by Google Earth. One can see the building roofs and thus the footprints. Fortunately for GIS people, GIS datasets can be derived by digitizing (i.e., tracing a point, line, or polygon) the building footprints. To do this, the Google Earth KML file can be converted into a GIS shape file, which can be done by most GIS software. Building footprints can also be scanned or digitized from building plans and then georeferenced (i.e. tagged to real-world coordinates). Most GIS software can do this conversion and georeferencing. Furthermore, room division lines may be traced for each building footprint. The resulting attribute table - which initially is empty - can then be populated with data such as number and specs of computers and other equipment, office furniture and fixtures, number of personnel, etc.

2.9 Benefits in using GIS for Maritime and Universities

Certainly, the use of GIS in Maritime and Universities would result to: Better Decision Making (Better decisions about location whether in research or

development work and common examples include evacuation planning, conservation, natural resource extraction, school facilities management, etc.) Making the right decisions about a location is critical to the success of an organization or project, e.g. in local governance, management of academic institutions, etc; Improved Communication (GIS-based maps and visualizations greatly assist in understanding situations and in chronicling). GIS results are a type of medium that improve communication between different project teams, departments, offices, professional fields, and the public.; Better Record Management (Maintains authoritative records about the status and change of geographic events and also Easy query and retrieval of spatial data that are centrally managed) Geographic records gives comprehensive transaction support and reporting. They are a valuable aid for fulfilling government and accreditation requirements; Managing Geographically (Essential to understanding: what is happening—and what will happen—in a particular geographic location . Problem in understanding is necessary to make the correct prescription for action Managing geographically is a new approach to management—taking into account the inherent geographic or spatial nature of things. The Overall Result: is increased efficiency and cost savings.(6)

2.10 Available Base GIS Data

To download free data, visit the website www.philgis.org (7) which is made available especially to GIS users of the Philippines. The following data may be used for GIS-based research and development activities: Administrative boundaries: Province, Towns, and Barangays for use in population and demographic studies, student distribution studies, etc; Elevation data: DEM (digital elevation model, 30-m resolution) for use in delineation of protected areas, road construction planning, watershed delineation, river volume forecasting, etc ; Landsat ETM+ with 3 multi-spectral bands (30-m resolution) and panchromatic band (1-m resolution) for use in land-use and land-cover studies, calculation of vegetative coverage, coastal resource management, etc. Bathymetry: 1-km resolution for use in marine studies, e.g. delineation of marine sanctuaries and protected areas and Rainfall for use in studies on climate change, erosion, flood disaster mitigation, etc.

The other available sites are: <http://en.wikipedia.org/wiki/GIS> or websites : www.gis.com, www.gislounge.com, and www.philgis.org may be useful . Google Search is also helpful in locating a site or for more specific GIS task. Short seminars and intensive hands-on training in GIS are available by arrangement. Seminar and training focus may be tailored to participants' background, professional interests, or requesting party's needs, e.g. GIS applications in specific disciplines such as maritime , institutional research, extension services , environment and natural resources. Seminars and trainings may also be done onsite if requested.



Article Discussion

Geographic information system

From Wikipedia, the free encyclopedia
(Redirected from GIS)

2.11 Is GIS costly ?

It may be yes and no . GIS may not be costly to learn. There are several online schools that offer GIS degrees and short courses that charge for a fee. But there are also online lessons and tutorials that are free. Commercial GIS software licenses can be quite expensive to acquire and maintain. There also several free and capable GIS software releases containing sophisticated functionalities that are present in commercial models (www.freegis.org and http://en.wikipedia.org/wiki/List_of_geographic_information_systems_software) for numerous selections of free GIS software tools.



3 CONCLUDING REMARKS

It can be surmised that GIS is a powerful innovative tool for analyzing the data. It provides answers to the following questions or point of interest like: What's happening inside a certain location? How to prepare for something that will occur within a certain radius or distance? What to expect from nearby after finding out what's occurring within a certain radius or distance? GIS can be a very useful research and decision-making tool. GIS helps users to make scientific and informed decisions in research and project planning and implementation, thus avoiding guesses and perhaps costly mistakes. GIS certainly enhances the analytical and critical-thinking skills of individuals (e.g. students or researchers). Through GIS, learning becomes a journey of discovery, motivating individuals to explore uncharted simulated worlds.

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