BULETIN Geospatial SEKTOR AWAM

Edisi 2/2009
ISSN 1823 7762

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Test Results on Marine Positioning Using Differential GNSS Radio Beacon Service in Malaysia

Malaysian 3D Property Legislation - A Preliminary Approach

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Assalamualaikum dan Salam Sejahtera,

MaCGDI merupakan sebuah agensi kerajaan yang berperanan membangunkan Infrastruktur Data Spatial Kebangsaan (NSDI) bagi memacu pembangunan industri geospatial di Malaysia ke arah merealisasikan faedah-faedah penggunaan maklumat geospatial. Oleh itu, MaCGDI terlibat dalam segala urusan berkaitan dengan maklumat geospatial termasuk memperkenalkan dan membangun kepiawaian, polisi, rangka kerja dan infrastruktur kepada semua agensi kerajaan di negara ini. Pada masa kini, terdapat beberapa negara besar yang telah pun mempunyai infrastruktur seumpama ini seperti Amerika Syarikat, Kanada, United Kingdom, Australia, Korea dan juga Jepun.

Dalam usaha kita menumpukan pembangunan Sistem Maklumat Geografi (GIS) di peringkat nasional (atasan), kita kadang kala alpa untuk membina satu asas yang kukuh ketika di peringkat sekolah (bawahan) lagi. Pepatah Melayu mengatakan 'melentur buluh biarlah daripada rebungnya'. Oleh yang demikian, MaCGDI mengambil pendekatan turun ke peringkat sekolah dengan mengadakan program kesedaran GIS melalui sambutan 'GIS Day 2009'. Fokus utamanya adalah memberi pendedahan tentang geografi dan GIS kepada pelajar-pelajar sekolah rendah dan menengah. Program ini diadakan pada 19 November 2009 di Putrajaya bertepatan dengan sambutan 'GIS Day' di seluruh dunia. Pengisian 'GIS Day 2009' penuh dengan program-program yang mempromosikan geografi dan teknologi GIS dalam kehidupan seharian kita.

Sementara itu, pada tahun 2010, program besar dwi tahunan MaCGDI adalah Persidangan dan Pameran GIS Kebangsaan kali keempat (4th NGIS) dijangka akan dianjurkan pada pertengahan tahun 2010. Melalui persidangan ini, dapat digunakan sebagai platform bagi komuniti GIS di Malaysia untuk mendapatkan pengetahuan dan maklumat terkini berkaitan penggunaan, pengendalian dan penyelenggaraan maklumat geospatial di samping sebagai tempat perkongsian pengalaman dan kepakaran dengan pakar-pakar dalam bidang GIS bagi menyemarakkan lagi perkembangan GIS di Malaysia ini.

Melalui dua (2) program besar GIS ini, ia bertindak sebagai 'serampang dua mata' kepada MaCGDI dalam menjalankan aktiviti berkaitan *outreach* dan pembangunan modal insan dalam bidang GIS di Malaysia. Justeru itu, sewajarnya penglibatan daripada semua pihak amat penting dalam menjayakan sambutan GIS dan NGIS ini untuk memartabatkan lagi aktiviti komuniti GIS di Malaysia.

Selamat membaca.

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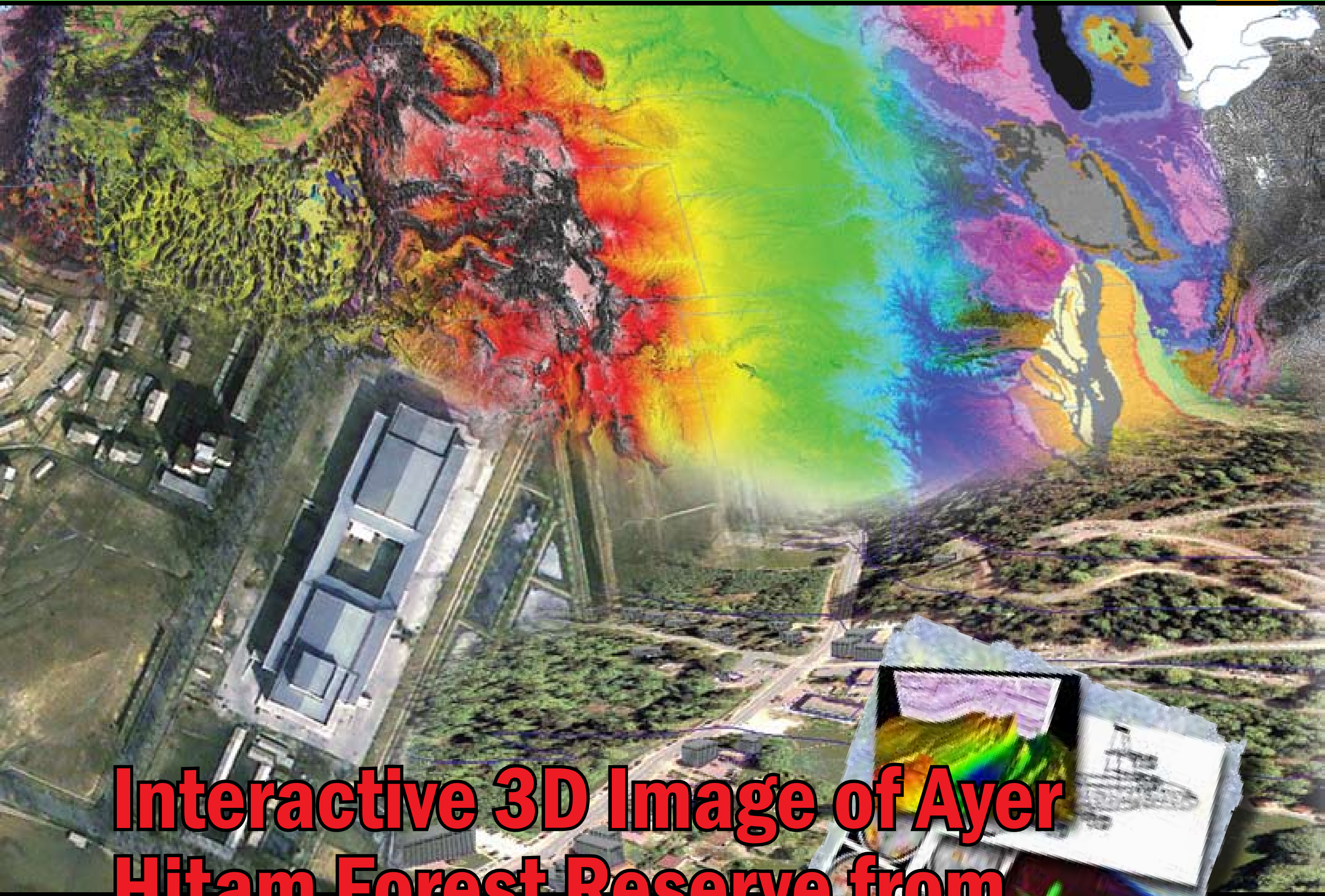

Interactive 3D Image of Ayer Hitam Forest Reserve from Triangular Irregular Network (TIN) layers by Draping Technique

Mohd. Hasmadi Ismail, Khairul Amirin Mohamed

Abstract

Currently, the virtual reality of world features or image can be achieved easily from the various sources such as Google map, NASA online, ESRI, etc. For the user such as cartographer, surveyor, geospatial analyst, and also student, the available geography images mean a lot of benefit and advantages. With the aid of the geography images, i.e. satellite image, not only the view of real world can be visualized but any changes or any possible planning can be planned more effective. However, the geography surface in Geospatial Information System (GIS) environment easier to understand when it is viewed in 3D view with satellite images as a backdrop. This process can be done through software such as Erdas Imagine and the functionality of GIS environment such as Arc GIS module. The integration of satellite image and data collected for GIS application will perform a good result of geography surface. The objective of this work was to develop and present a procedure for generating more interactive 3D map using satellite image of Ayer Hitam Forest Reserve (AHFR) in Puchong, Selangor. The 3D model of AHFR looks more interactive with the draped image via capabilities of GIS and 3D analyst system. The surface of AHFR showed more clear and understandable to visualize. Finally, this study concluded that the GIS with extension module were capable and very useful tool to anyone who needs to generate quantitative variation in developing 3D model.

INTRODUCTION

GIS or in other simple understanding phrase is the database of the geographical. It consist the geographical information such as coordinate, size of an area, distance, height, residency and any other data related to the geography. The GIS has been practiced since 15 500 years ago when the data of the track lines have been recorded manually. Years by years, the intelligence of human brain has invented the tools and techniques to become more matured and modern towards the era of civilization. The achievement of the endeavours is called the technology. The modern GIS technologies use the computer for data storage and run the selected software such as ArcGIS for mapping and analysis. According to Environmental Science Research Institute (ESRI, 1995), GIS is a tool for capturing, analyzing, managing and displaying all forms of geographically referenced information data according to their location. Nowadays, GIS can help to answer questions and solve problems by looking at the data in a way that is quickly understood and easily shared. A GIS is most often associated with a map. The end product of GIS can be view in Database view, Map View and Model View.

The definition of 3D GIS is very much the same as for 2D system. In GIS, 2D system are common, widely used and able to handle most of the GIS tasks efficiently. The same kind of system, however, may not be able to handle 3D data if more advanced 3D applications are demanded such as representing the full length, width and nature of a borehole. 3D GIS very much needs to generate information from such 3D data. Such a system is not just a simple extension by another dimension (i.e. the third dimension) on to 2D GIS. Adding this third dimension into existing 2D GIS needs a thorough investigation of many aspects of GIS including a different concept of modeling, representations and aspects of data structuring (Raper and Kelk, 1991). 3D Model represents an object using a collection of points. The use of 3D model approve the concept of communicate to a diverse of audience, without sacrificing tried-and-true modes of communication with suppliers and partners (Autodesk, 2005). The Triangular Irregular Network (TIN) is the surface and shape of the topography including the height which is collected from the remote sensing technique or land survey. The data from the DEM than present a digital data surface called TIN. TIN represent a physical surface of 3D coordinate derived from the data of DEM. The 3D GIS aim at providing the same functionality as 2D GIS. The ArcGIS 9.1 from ESRI is the software available on the market contains the 3D Analyst (3DA) modules. 3DA can manipulate data such as surface generations, volume computation, draping raster image and terrain inter visibility from one point to another. Raster files can be incorporated into 3DA, but only for improving the display of vector data. With ArcGIS 8.1, the extension ArcScene also available similar to 3DA with enhanced of 3D visualization, flyby, texture mapping on building facades, 3D symbols, animation and surface analysis for both raster and vector data (Zlatanova et al., 2002).

The 3D model created from the 3D Analyst is a model of 3D environment including the information and analysis of the data. To get the clear image of the area, the satellite image is needed. The image from satellite imagery will share the information of real time data and the spectral band of different features. The satellite image will overlay on the 3D model so the 3D Model visualization are better. Thus, the objective of this work was to develop and present a procedure for generating more interactive 3D map using satellite image of Ayer Hitam Forest Reserve (AHFR) in Puchong, Selangor.

THE DIFFERENCES BETWEEN 2D AND 3D TECHNOLOGIES

3D design technology is the must-have design tool and it's not just for the biggest aerospace and automotive manufacturers who require their suppliers to provide 3D models. Research shows 3D design and engineering is increasingly prevalent among mainstream manufacturers as well. In fact, estimates put spending roughly at RM21 billion worldwide on 2D and 3D design technology and data management solutions. Design engineers most often are focused on two major tasks: design and/or documentation. The primary difference between 2D and 3D technology is apparent in the amount of time designers spend on these tasks when they use the respective tools. Unlike 2D drafting tools, 3D modelling technology provides lifelike representation of a design, from structural composition and the way parts fit and move together, to the performance impact of characteristics such as size, thickness, and weight. When engineers can see the sum of the parts in 3D, they can see issues and opportunities without ever having to spend time creating documentation. Rather than starting a new product concept with meticulous 2D technical drawings of elements that might not function as planned, 3D design technology quickly shows whether a design idea is viable. This difference amounts to business advantage for companies that otherwise might have to retrace all manufacturing processes in search of an answer – or build physical prototypes of products that don't function as desired (Autodesk, 2005).

The 3DA is one of the modules available in ArcView GIS. In ArcView these modules are known as extensions. ArcView is designed to provide stand alone and corporate wide (using client-server network connectivity) integration of spatial data. The 3DA can be used to manipulate 3D data such as 3D surface generation, volume computation, draping for other raster images (such Landsat TM, SPOT, GeoSPOTV images, aerial photos or scanned maps), and other 3D surface analysis functions such as terrain intervisibility from one point to another (ESRI, 1997). The 3DA can be used to manipulate 3D data especially for visualization purposes. Thus, ArcView is very much a 2D GIS system, but 3DA supplies 3D visualization and display (e.g. of data with x, y, z coordinates). 3D GIS analysis is not achieved. It is worth noting, however, that 3DA supports TIN data structure.

MATERIALS AND METHODS

Description of study area

The Ayer Hitam Forest Reserve (AHFR) is located in the state of Selangor, Peninsular Malaysia (Figure 1) at Latitude of 2°56'N - 3°16'N and Longitude of 101°30'E - 101°46'E. Located 20 kilometres from Universiti Putra Malaysia (UPM), 45 kilometres from the city of Kuala Lumpur and it is close proximity to the residential areas of Puchong, Putra Jaya and Kuala Lumpur. AHFR is a logged over forest and has yet to reach fully rehabilitated state. The forest being allocated as an education forest by the Selangor State during 22nd June 1994 convention at the Selangor State Meeting Council (Kamaruzaman and Mohd Hasmadi, 1999). The surrounding area is a home town and urban areas. The AHFR area in 1906 is 4270.7 hectare and after some areas is harvested and developed, the remaining area is about 1248 hectare. It is divided into 6 compartments namely compartments 1, 2, 12, 13, 14 and 15. The average temperature is 26.6º C and the relative moisture is 83%. The two main rivers here are Sungai Rasau and Sungai Bohol. The geology in this forest contains the igneous rock and the main component of granite.

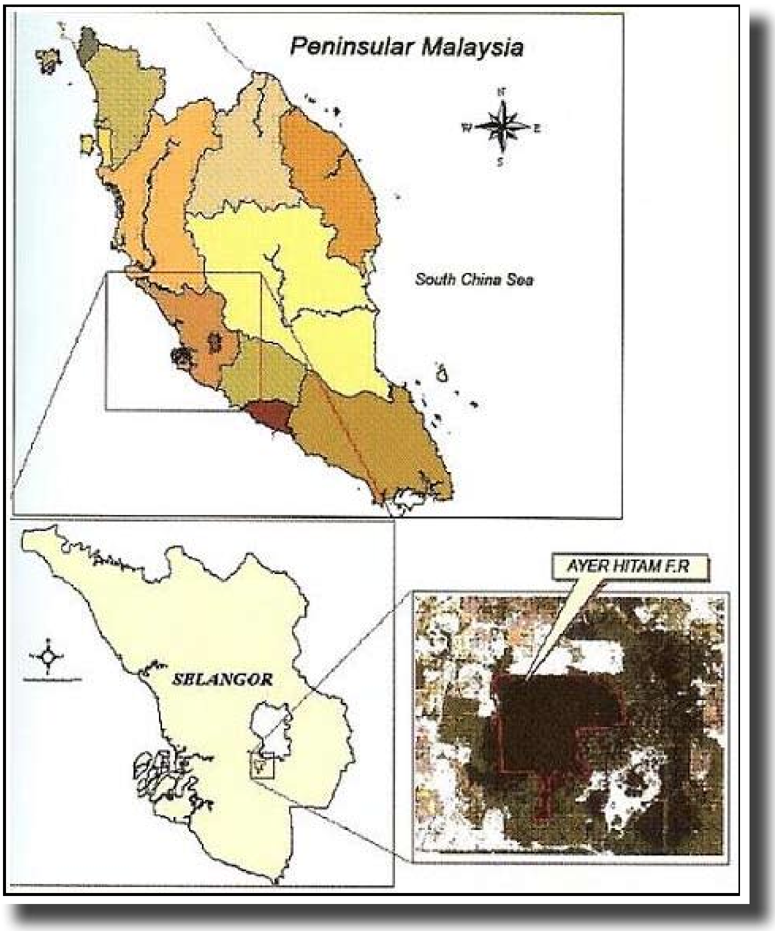

Figure 1 : A map of Peninsular Malaysia showing the location of AHFR in Puchong, Selangor

Methods

The main data used is the digital map of AHFR obtained from the Library of Sultan Abdul Samad, Universiti Putra Malaysia. Then, the digital map was converted into the Arc GIS format (*.shp). To support the digital data, the topographic map scale 1:10 000 from the Department of Survey and Mapping Malaysia was used as reference map to determine features on image. SPOT 5 pan sharpened image with 2,5 spatial resolution was used as a backdrop layer. The major data used were contour, river and boundary. The contour data was selected to develop the 3D surface base on the height. In the process of generating DEM, a total of 48 height point were added and were checked on ground. Draping is often performed solely for purposes of visualization. ArcGIS 9.1 and Erdas Imagine 9.1 was used to manipulate and generate outputs. The ArcScene module was used to vary the view of the model. For all features layers, the coordinate's system Universal Transverse Mercator (UTM) projection was set to ensure they are easily georeferenced. Prior to this, ArcMap can set the coordinate system for a data frame. Layers added to the map will automatically transform to projection. After that, shapes and attributes of a layer regardless of the coordinate system it was stored in can be editing. A DEM feature was generated from a 3D with elevation values (z-values) stored within the feature's geometry. Besides geometry, the feature may have attributes stored in a feature table. The ArcScene was used for generating DEM from TIN. The cell size was 20 m X 20 m. The summary of the steps taken to generate the model are illustrated in Figure 2.

This information derived is useful in decision making process and further research to be conduct. The 3D visualization is more attractive and understandable.Based on the result it can be drawn that the 3D generation for AHFR is relatively good and showing a convincing accuracy of the DEM analysis. The differences are slightly exist in slope than elevation but seem to less or similar in the flat surface. The technique of creating 3D model presented can be used as a basic procedure for creating other information in 3D model.

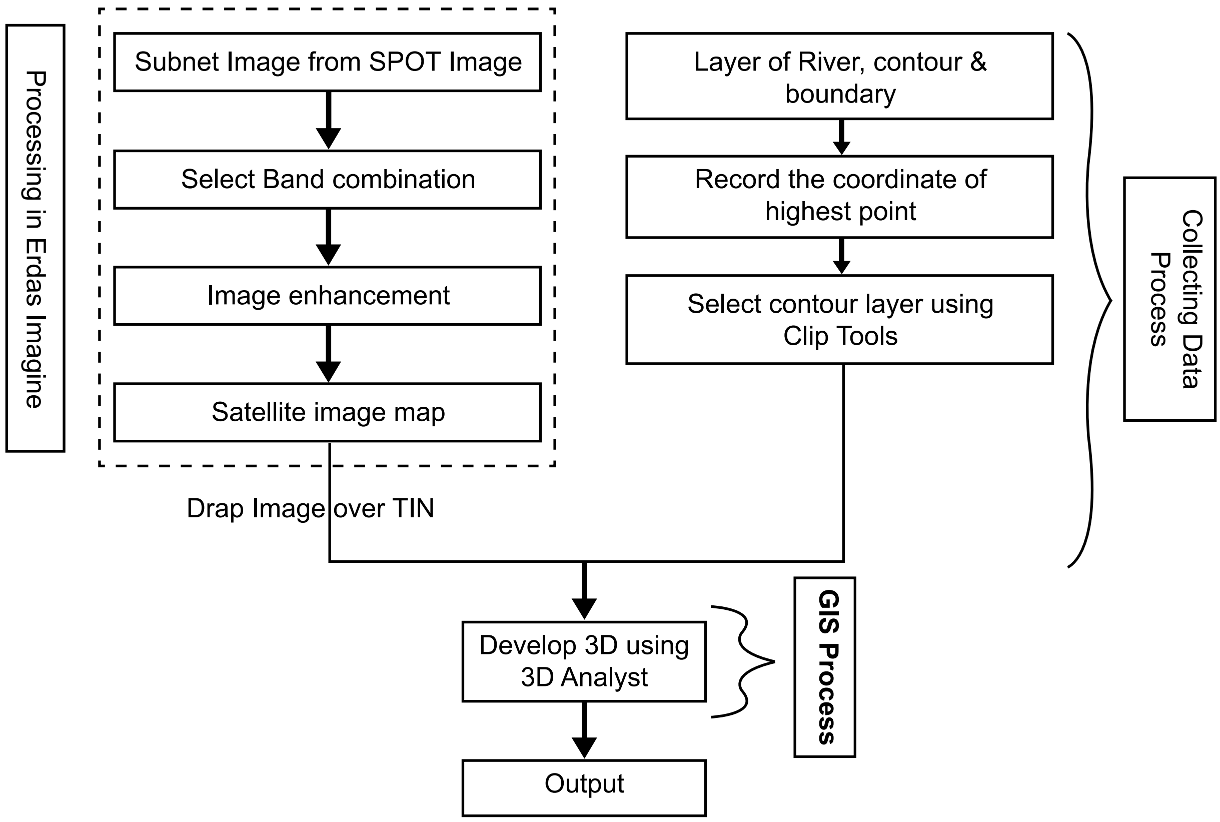

Figure 2 : A flowchart diagram of the method used in this study

RESULTS AND DISCUSSION

Figure 3 shows the development of contour layer from TIN. The height of every contour line was used to develop the 3D visualization and satellite image derived from image processing in Erdas Imagine. Figure 4 shows the result from the adopted methodology for the AHFR. The result from this paper showed that the creation of the 3D is possible within the limitation of the quality of a contour data. However, this model was improved by draping the SPOT image, rivers and forest compartments layers as features classes onto the DEM. In the 3D visualization, the highest point of the forest area was determined at 202.5 meters which is located in compartment 15. Another advantage of the 3D visualization is we can simply determine the flow of the river and in this case may be the catchments boundary can be delineated.

The advantages of the perspective view of 3D model are information such as river network, road, slope and elevation can be viewed from any angles. However, The 3D model developed is not concentrated on the spatial modelling aspect including the topological aspect.

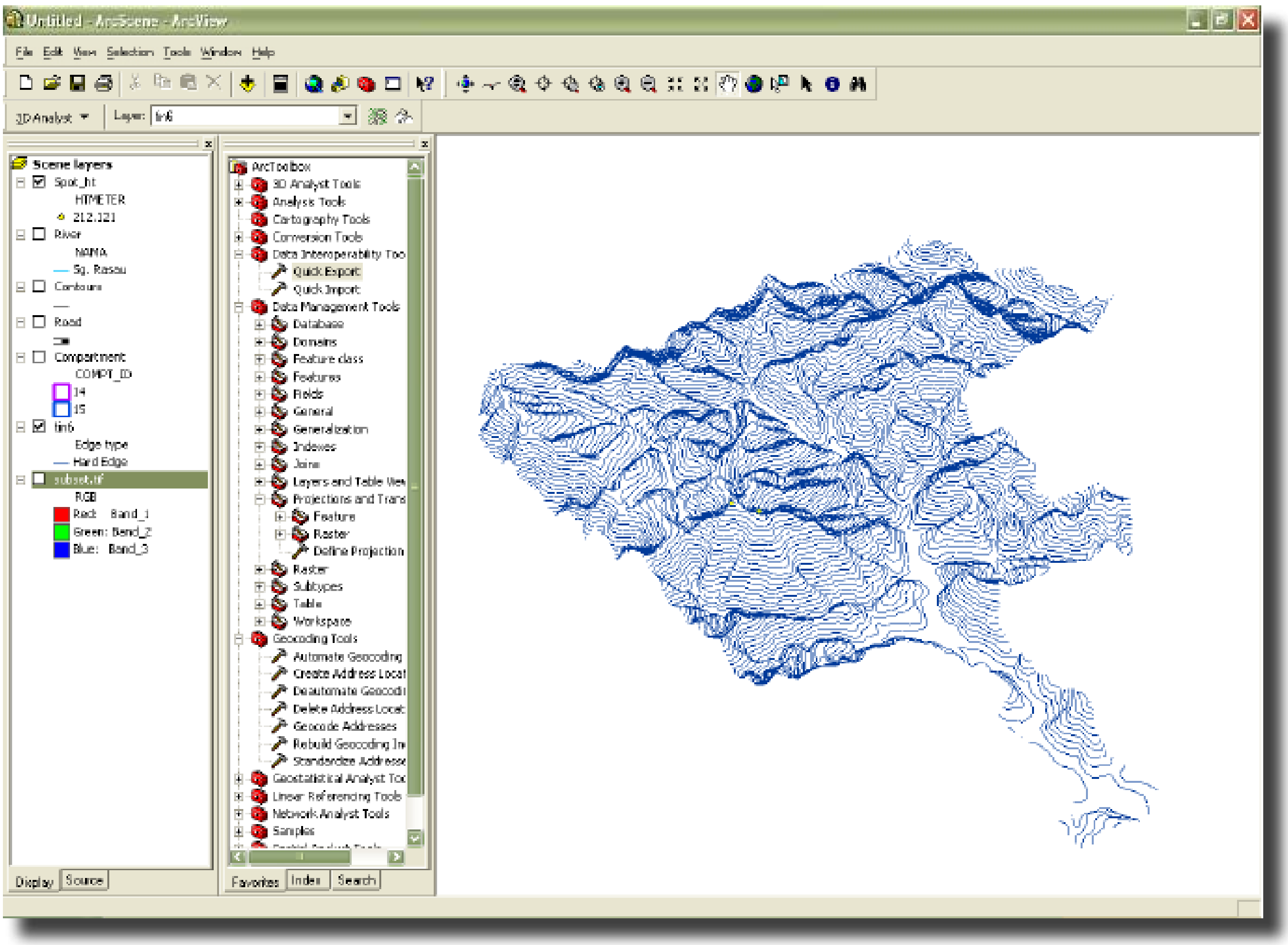

Figure 3 : 3D visualization from TIN for AHFR from contour line

The image drape result was shown in Figure 4. From the result, the 3D Model created is simple but enough to understand the surrounding features and angle of AHFR. Such example is useful for planning and management purposes where features such as compartment boundary, river and etc are lying along the terrain on surface. Moreover, the visualization of 3D model with the draping satellite image is more attractive and simple to understand especially in decision making process. Meanwhile, Figure 5 show the AHFR with designated compartment and also water body within the area.

The result obtained from this work show that the capability of Arc GIS software to handle and create of 3D map. The satellite image use in this research was derived from Spot 5 Panchromatic Image with the 2.5 meters resolution which is represents the 2.5 meter pixel size on the ground. The use of 2.5 meters of satellite image is acceptable since most of the AHFR area in the satellite image is still covers with the vegetation. Spot 5 image is the high resolution image which is suitable for the mapping on vegetation type (Stephen et, al. 2006). The 3 Bands from Spot 5 image can reflect the features on the ground. Although only several areas in AHFR can identify the water body's area, it is also help to overcome the problem of time consuming.

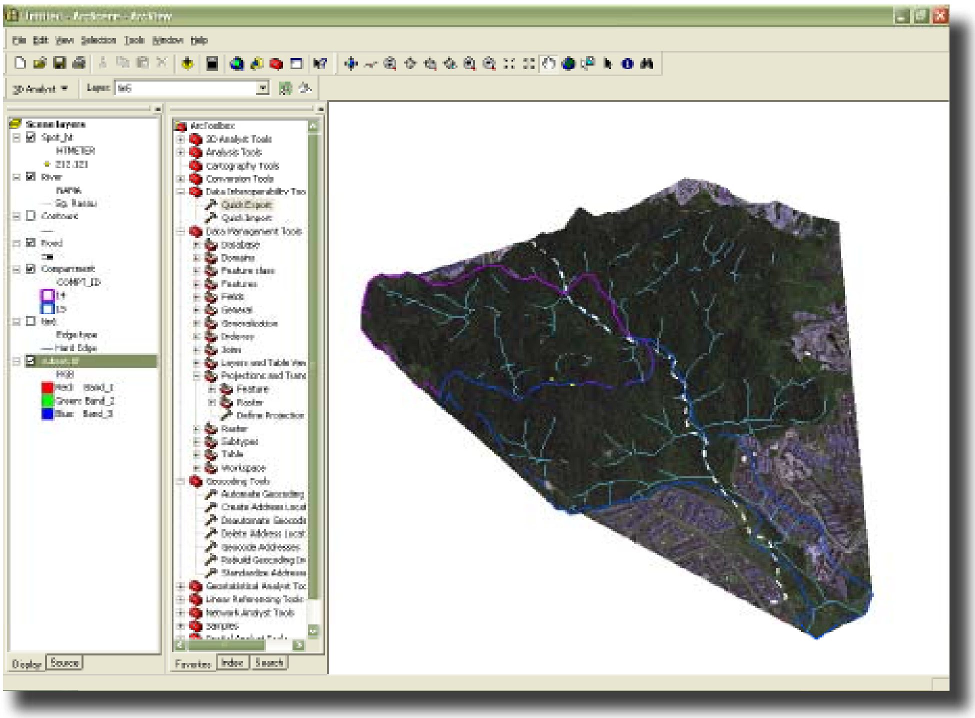

Figure 4 : 3D visualization with the overlay of satellite image

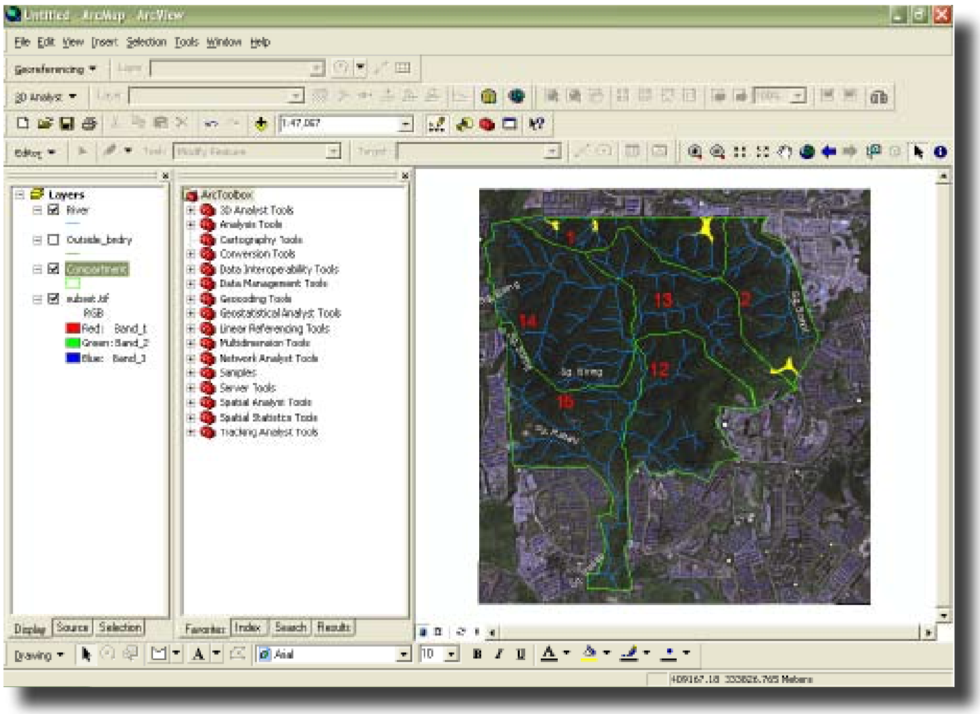

Figure 5 : AHFR with designated compartment and also water body within the area (yellow)

CONCLUSION

The 3D model of AHFR was look more interactive with the draped satellite image with the capabilities of GIS and 3D analyst system. The surface of AHFR will be more clear and understandable to visualize. The interaction between the 3D model and water bodies area explain roughly how the flow of the water to the catchments area. This information derived is useful in decision making process and further research to be conduct. The 3D visualization is more attractive and understandable. Based on the result it can be drawn that the 3D generation for AHFR is relatively good and showing a convincing accuracy of the DEM analysis. The differences are slightly exist in slope than elevation but seem to less or similar in the flat surface. The technique of creating 3D model presented can be used as a basic procedure for creating other information in 3D model. The advantages of the perspective view of 3D model are information such as river network, road, slope and elevation can be viewed from any angles. However, The 3D model developed is not concentrated on the spatial modelling aspect including the topological aspect. It just the construction of solid model to view in the 3D and the problem is it needs very large computer space and memory. There is further study need to be conducted on the aspect of developing land feature on 3D perspective.

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Test Results on Marine Positioning Using Differential GNSS Radio Beacon Service in Malaysia

Rozaimi Che Hasan

Abstract

Differential Global Positioning System (DGPS) has been used widely in many types of application including for marine navigation and hydrographic surveying. Recently, most of the DGPS receiver development applies the code and carrier phase on single frequency L1 C/A code receiver for submetre accuracy. Differential Global Navigation Satellite System (DGNSS) radio beacon is a system that use concept of DGPS based on pseudorange. This system provides free DGPS corrections using the commercial reference station. The availability of reference station that operates 24 hours a day means that the users are no longer required to set up their own reference station. This study is intended to evaluate the performance of DGNSS radio beacon, not only for positioning but also for data availability and reliability at the remote receiver. For this purpose, static and dynamic test have been carried out on the DGPS corrections received from DGNSS radio beacon. Both of the tests make use of the National Marine Electronic Associations 0183 (NMEA 0183) data format generate by remote receiver to examine the DGPS broadcast signal. The results show how the distance separation (static test) effects the age of DGPS correction, Horizontal Dilution of Precision (HDOP), numbers of satellite use and also the signal strength recorded at remote receiver. Meanwhile, the tracking method (dynamic test) differentiates the automatic and manual tracking results. This is to estimate the most suitable method to be used for marine navigation and hydrographic surveys.

INTRODUCTION

DGNSS radio beacon is a system designed as an aid to safety for marine navigation. In comparison to a terrestrial navigation or any other direction-finding system, DGNSS radio beacon systems used Global Positioning System (GPS) satellite (some used Global Navigation Satellite System (GLONASS)) to position a vessel at sea. By using real time DGPS method, users available get better result rather than a single receiver. Receive corrections from a DGNSS radio beacon, users are required to encompass a GPS receiver that capable to track the signal transmits by the system.

DGNSS RADIO BEACON SYSTEM

DGNSS radio beacon has been recognized in most country as an aid to safety for marine navigation. The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) has listed all DGNSS stations that are officially operated around the world. The authorized frequency for DGNSS radio beacon is between 283.5 kHz to 325 kHz. In this way, users are able to receive DGPS correction through Radio Technical Commission for Maritime Services Special Committee 104 (RTCM SC-104) format (IALA, 2001). Figure 1 shows a DGNSS radio beacon system. A typical DGNSS station consists of the following components:

a) Reference Station
   Generate the DGPS correction.
b) Control Station
   Used for fault detection and correction.
c) Integrity Monitor
   Verify the correctness of the corrections generated by the Reference Station.
d) Transmitter
   Broadcast the DGPS corrections generated by the Reference Station to users.
e) Control Monitor
   Monitor the status of the DGNSS system.

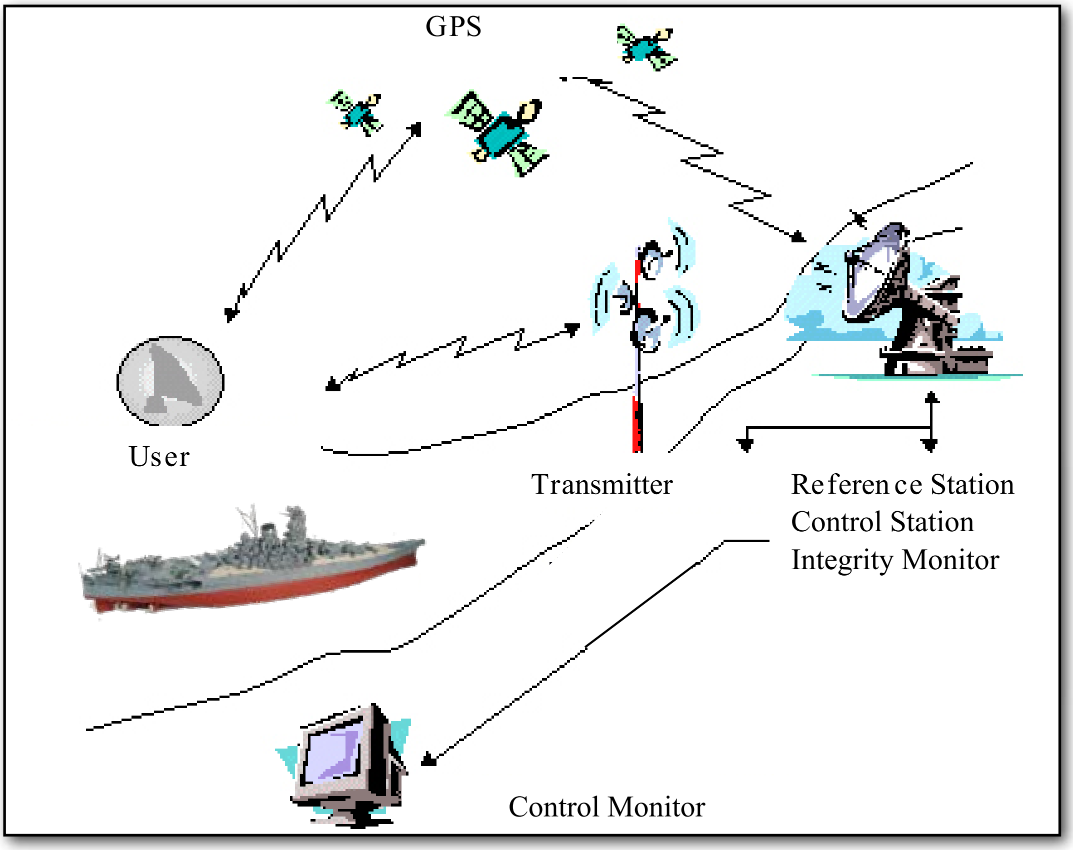

Figure 1 : DGNSS radio beacon system

Each DGNSS radio beacon system has its frequency and also an identification (ID) station number. This is to make sure that users know exactly which signal is been recording. To receive a signal from DGNSS radio beacon, user needs to have a Minimum Shift Keying (MSK) radio beacon receiver with antenna and a minimum of L1 C/A code GPS receiver with its antenna. Nowadays, most of the receiver manufacturers have developed a combined MSK radio beacon and GPS receiver with a combined MSK and GPS antenna. MSK receiver will demodulate the signal from DGNSS radio beacon to receive the differential correction. The differential correction will be applied to GPS position in order to get position in DGPS mode.

STATIC TEST FOR DGNSS RADIO BEACON

Essentially, an appropriate technique to determine the accuracy of real time DGPS system is to test the position solution compare to a known station. Two tests have been carried out using two separate ranges from DGNSS radio beacon. Both of the tests were conducted using Trimble DSM212H receiver on a known point inside Universiti Teknologi Malaysia (UTM) main campus, which is BC10. Note that BC10 has been set up using a post-processing static GPS survey through the global International GPS Service (IGS) station and also the Malaysian Active GPS System (MASS) station run by the Department of Survey and Mapping Malaysia (DSMM). The observations were recorded from Pulau Satumu, Singapore DGNSS station (46 kilometres) and from Kuantan DGNSS station (250 kilometres) for about 24 hours for each station (Figure 2). Note that both of the observations were recorded independently on two different days using BC10 as a known station. The observations are in National Marine Electronics Association 0183 (NMEA 0183) format.

Besides using difference distance, the tests will also evaluate some other factors such as the effect of the age of DGPS correction and the percentage of the DGPS fix recorded. The reason for the observations being recorded for 24 hours is to determine the best time for the DGNSS radio beacon for the transmission of the differential corrections. This is because the use of medium frequency (MF) radio signal by the station is easy to be affected by skywave and groundwave propagation. However, the study of the skywave and groundwave propagation is not intended to be enlightened here since it is beyond the span of this research.

DYNAMIC TEST FOR DGNSS RADIO BEACON

The focus of this test is to investigate the tracking methods of DGNSS radio beacon mostly used by DGPS receivers. Two types of tracking methods were tested, namely automatic and manual. The first is automatic method. Using this technique, DGPS receiver will automatically receive the strongest DGNSS radio beacon signal. Meanwhile, the latter technique will only select a signal from a specified DGNSS radio beacon

Figure 2 : Map showing DGNSS radio beacon station at Kuantan and Pulau Satumu from BC10

station. Both of the position solution techniques were compared to a Wide Area DGPS (WADGPS) services to study the position differences. During this research, three receivers were used, whereby two receivers received DGNSS radio beacon signal and one more receiver received WADGPS signal. Analysis will only take into consideration if the three receivers have equal time fixing. In this case, the Universal Time Coordinated (UTC) from the NMEA 0183 messages was used.

RESULTS FOR STATIC TEST

DGNSS NMEA Analysis Program (DNAP), a computer program developed at UTM, was used to analyze both the static and dynamic test since huge amount of data are involved in this test and there is still no specified software to study the NMEA 0183 messages.

To evaluate a positioning system, it is important to draw attention on availability and the reliability of the system. In this research, the availability can be described as the available data, which can be recorded in a certain time. It is refers to the numbers of fix, which are recorded via differential mode (DGPS). Besides the DGPS fix, there are two other types of fix, which is the stand-alone fix and fix which are not valid. Stand-alone fix is a position solution without differential correction from reference station. Meanwhile, fix that are not valid occurs when there is no position solution from the receiver. The receiver also has been configured to reject the fix which contain the age of differential correction more than 30 seconds and also if the satellite elevation reached more that 15 degrees (the value set is according to the best value recommended by the receiver manufacturer).

To detect outliers and any gross errors, a 3 sigma (3σ) statistical test has been used before all data are analyzed. The purpose for this test is to remove outliers from the data. To carry out this test, standard deviation (σ) for the observation has to be computed using the following equation:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

where,

$\bar{x}$ = mean of observation
x_i = observation
n = numbers of observation

Besides the standard deviation, an average value for the observation was also calculated. If the discrepancy between the average value and an observation recorded exceeds 3σ, then the specific observation will be rejected. The tests are carried out for every observation before proceed with the availability and reliability issues.

Table 1 shows the availability for the static test using 46 kilometres and 250 kilometres reference station in 24 hours time period. For a 24 hours observation with one-second interval, there should be 86,400 fixes. Therefore, availability in Table 1 can be expressed by:

$$\textit{Availability}\text{ (24 hours)} = \frac{\text{Fix with DGPS}}{86{,}400} \times 100$$

From Table 1, it shows that for a maximum coverage of 250 kilometres (most of the DGNSS radio beacon coverage is between 200 to 250 kilometres), the available DGPS fix for one day is 93.59 percent. At medium distance (46 kilometres), at least 99 percent of recorded data were carried out by DGPS mode.

Types of fix / Distance	No. of fix recorded	Fix with DGPS	Stand-alone fix	Not valid fix	Availability
46km	85,947	85,917	14	16	99.40%
250 km	85,877	80,866	4,797	214	93.59%

Table 1 : Percentage of data availability at different distance

The reliability for this test can best be described as how reliable the data was or can be expressed as: "can we believe the DGPS fix". The reliability can be calculated by:

$$\textit{Reliability}\text{ (24 hours)} = \frac{\text{DGPS fix (pass } 3\sigma \text{ test)}}{86{,}400} \times 100$$

Table 2 shows the number of fix, which passed 3σ tests. It shows that the reliability for the 46 kilometres distance is 99.42 percent and 92.75 percent for 250 kilometres distance. The result shows that the about value compared to the availability outcome. Both of the availability and reliability results agreed that at least 99 percent from all the data for 46 kilometres are recorded using DGPS mode and can be truly trusted.

kilometres) and 4.58 metres (250 kilometres). Figure 5 and 6 show the age of DGPS correction for both of the observation. The 250 kilometres observation produces more high age of DGPS correction rather than the 46 kilometres distance. Besides the age of DGPS correction, numbers of satellite used by 250 kilometres distance observation also degrade because of high distance separation (Figures 7 and 8). The increase of horizontal dilution of precision (HDOP) value explains that a longer distance observation has poor horizontal satellite geometry.

Signal strength recorded during both of the observations also describes the effect of longer distance separation. Figure 9 and 10 shows that the signal strength during the observations and Table 3 summarizes that the

Types of fix / Distance	No. DGPS fix	Passed	Failed	Reliability
46km	85,917	85,903	14	99.42 %
250 km	80,866	80,136	730	92.75 %

Table 2 : Percentage of data reliability at different distance

From the 46 kilometres and 250 kilometres distance observation, the coordinate differences, the age of DGPS correction and also the signal strength were analyzed. Figure 3 and 4 represent two-dimensional coordinate dispersion for 46 kilometres and 250 kilometres distance (24 hours observation). The 46 kilometres distance observation produce horizontal accuracy of 0.55 metres while the latter observation offer 1.86 horizontal accuracy. At 95 percent confidence level (multiplied by 2.45 for two dimensional accuracy, Hofmann, et al., 2001), the accuracy is 1.35 metres (46

value recorded in decibel microVolt per meter (dB µV/m). In Europe, the signal strength recorded must be at least 20 dB µV/m and above or as published by the local authority (Grant, 2002). This is to make sure that the signal is strong enough to prevent from any interfering. At 250 kilometres (Figure 10), the signal was unstable at the middle of observation (11:00 to 24:00 UTC), which is approximately from 6.00 pm to 8.00 am local time (late evening to early morning). At the meantime, the beginning and the last signals show a consistent variation around 20 dB µV/m.

Value (dB µV/m) / Observations	Minimum	Maximum	Average
At 46 km	1.0	70.5	48.4
At 250 km	0	56.0	27.0

Table 3 : Minimum, maximum and average value of signal strength recorded

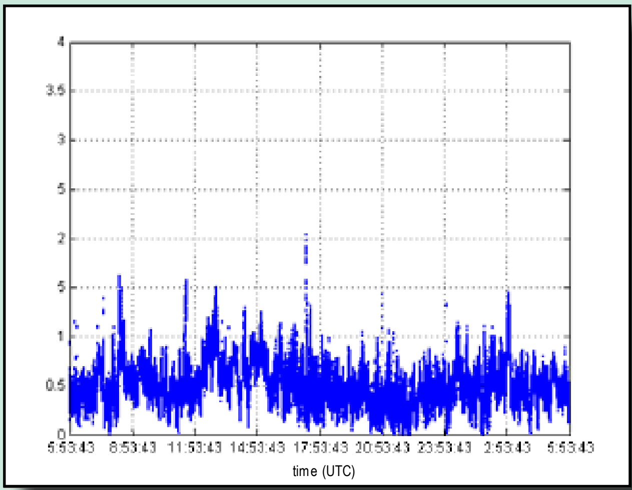

Figure 3 : Coordinate differences at 46 kilometres distance

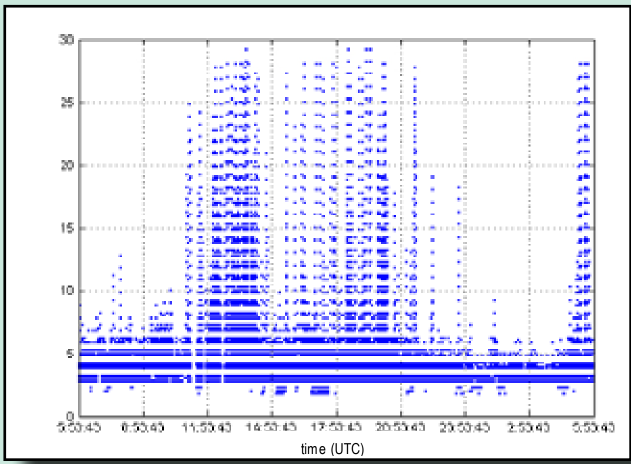

Figure 6 : Age of DGPS correction at 250 kilometres distance

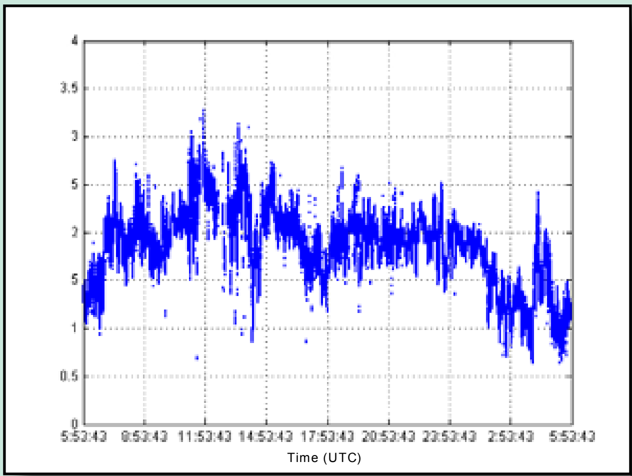

Figure 4 : Coordinate differences at 250 kilometres distance

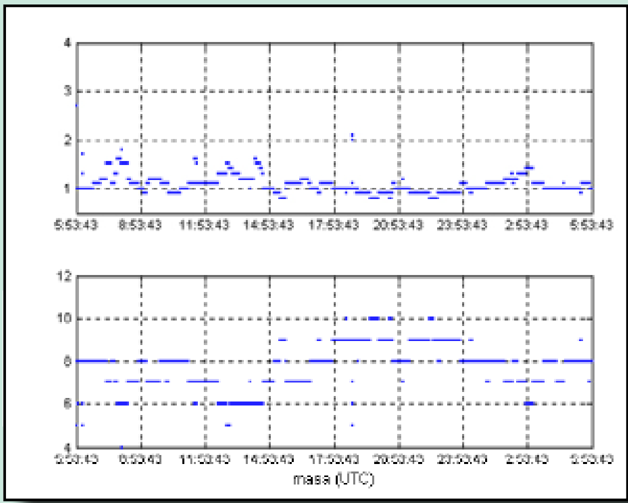

Figure 7 : HDOP value and numbers of satellite used at 46 kilometres

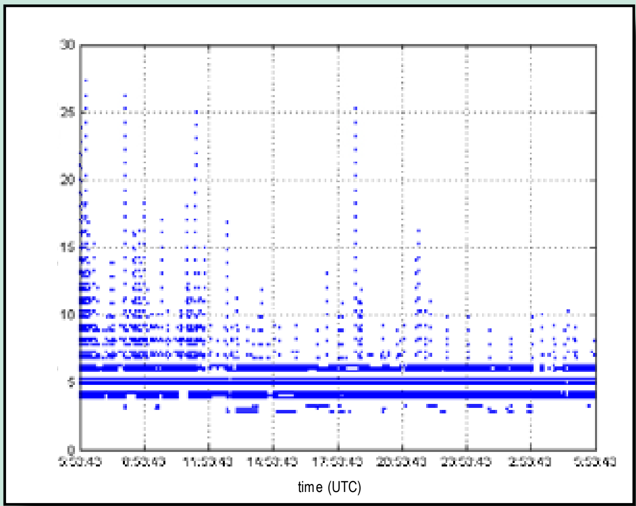

Figure 5 : Age of DGPS correction at 46 kilometres distance

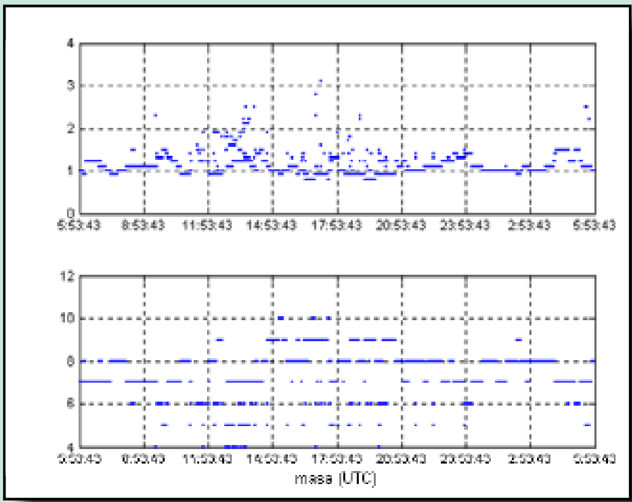

Figure 8 : HDOP value and numbers of satellite used at 250 kilometres

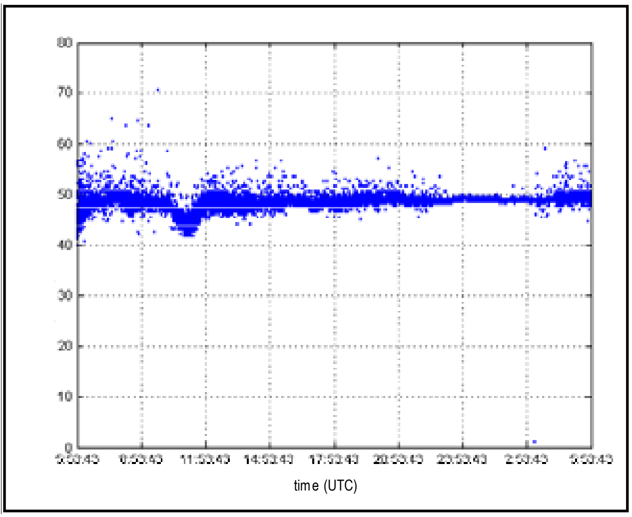

Figure 9 : Signal strength (in decibel microVolt per meter) at 46 kilometres distance

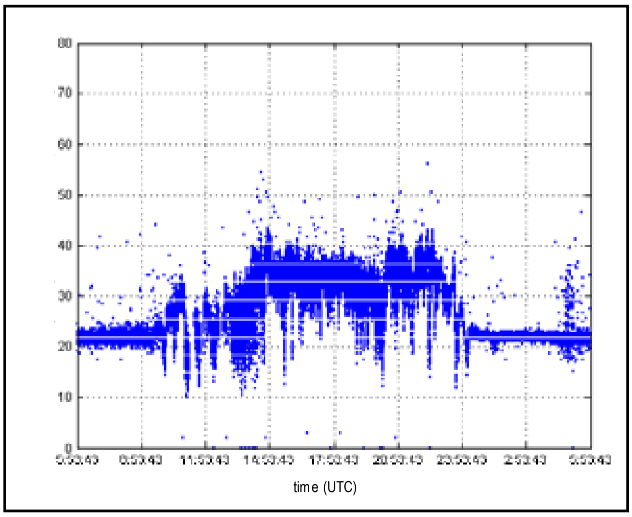

Figure 10 : Signal strength (in decibel microVolt per meter) at 250 kilometres distance

The primary users may be the marine navigators (marine navigation) and the hydrographic surveyors (positioning hydrographic works).

RESULTS FOR DYNAMIC TEST

Instead of coordinate differences, the term 'antenna separation' will be used in this dynamic analysis due to the antenna movement during the test. A better result is illustrated by a small value of antenna separation. Table 4 and 5 summarize that antenna separation value between the two methods. The mean and range value for antenna separation have been computed at every 50 kilometres until to more than 200 kilometres distance. It is proved that the value for Table 5 (manual tracking method) is better than the automatic method. However, the change of mean value at different distance is somehow insignificant for both of the method. For more information, Figure 11 and 12 graphically shows that antenna separation value, age of DGPS correction, signal strength and station identification during the test.

	Distance from station				
	0-50 km	**50-100 km**	**100-150 km**	**150-200 km**	**>200km**
Mean of antenna separation (m)	1.85	1.91	1.66	1.89	2.49
Range of antenna separation (m)	0.01 - 3.98	0.25 - 3.96	0.40 - 3.14	0.56 - 4.40	0.34 - 15.68

Table 4 : Mean and range value of antenna separation at different distance (automatic tracking methods)

	Distance from station				
	0-50 km	50-100 km	100-150 km	150-200 km	>200km
Mean of antenna separation (m)	0.63	0.91	0.96	0.96	0.83
Range of antenna separation (m)	0 - 1.77	0 - 1.81	0.01 - 1.81	0 - 2.18	0 - 4.17

Table 5 : Mean and range value of antenna separation at different distance (manual tracking methods)

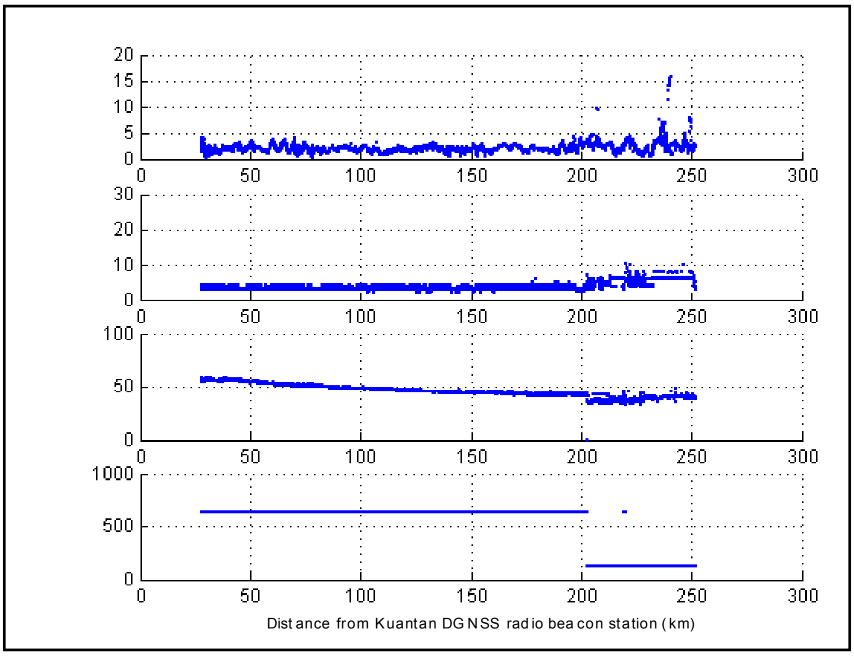

Figure 11 : Result for automatic tracking method (dynamic test)

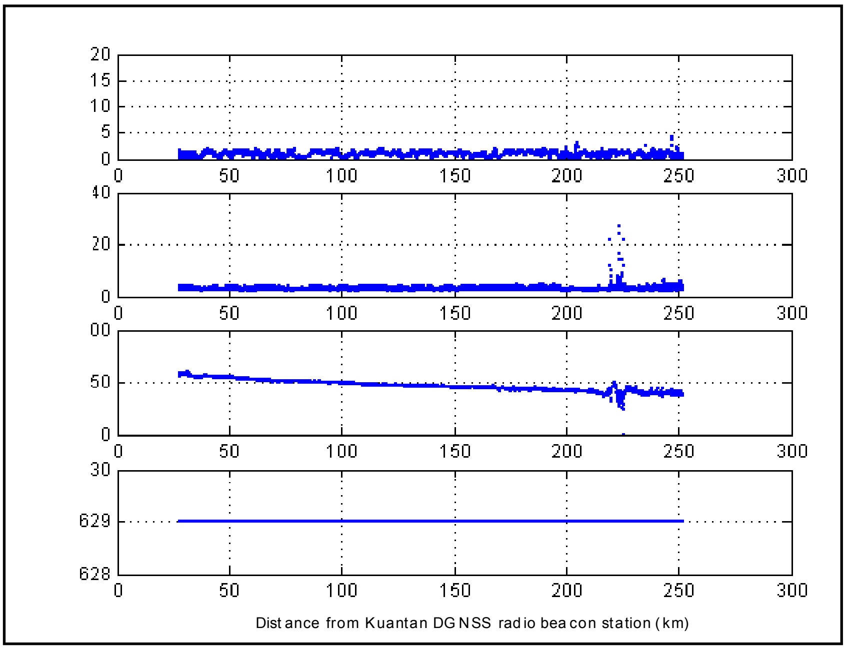

Figure 12 : Result for manual tracking method (dynamic test)

CONCLUSION

Distance separations between the reference station and user are main factors, which are degrades the accuracy. Due to the increase distance, the reference station and user will not experienced the same errors (ionosphere, ephemeris, satellite clock) anymore. This also will increase the age of the DGPS correction, which will lead to a latency issue. Meanwhile, the worst signal strength recorded has been identified at 6.00 pm to 8.00 am local time (late evening to early morning). However, the static test has been carried out on the ground and not at sea. For further study, the authors suggest that a proper static test at sea can be made to describe the true marine signal.

For the dynamic test, the result from the manual tracking method is much better than the automatic method. To use the manual tracking method, users should recognize some information about the DGNSS radio beacon station. This includes the frequency transmitted reference the station, station identification number and also status of the station (operate or not). This is to make sure that the right signal is been received from the right station.

Further investigation on the availability and the reliability for the system is needed due to the variety of individual, which currently used it. The primary users may be the marine navigators (marine navigation) and the hydrographic surveyors (positioning hydrographic works). The system will provide a lot of benefits for these users since the service is a 24 hours free broadcast signal.

ACKNOWLEDGEMENT

A special thanks to Mr. Abdul Rahman Abdul Jalil (Marine Department) and Assoc. Prof. Dr. Mustafa Din Subari (now with National Space Agency) for the opportunity to test the SISPELSAT system.

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Malaysian 3D Property Legislation-A Preliminary Approach

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Abstract

Malaysian land administration provides a variety of rights, depending on the traditions of the country but the legalistic cadastre system and land law are still using 2D geometry in legal and law expression (2D legislation) for land and property tenure and not prepared in 3D property legislation. These entire binding and legal document do not give enough 3D property legislation information for 3D property in Malaysia. This paper describes the overview of cadastre system for 3D purpose and the situation in Malaysia. Some cases on 3D property will be illustrated concerning the 3D property legislation in Malaysia. Research Questions and objectives have been identified in order to propose and realise the 3D property cadastre system. A study on the contents analysis of secondary data comprising of Registry Title, Land Office Title, Certified Plan, Strata Title Act 1985 (Act 318) and National Land Code 1965 (Act 56) can then be used to identify suitable contents in those legal documents that would change 2D legislation to 3D legislation. The instrument used in the data collection would be a questionnaire that is divided into five areas of study. The respondents comprises of the State Director/Registrar/Land Administrator from State Lands and Mines Office, State District Land Office, Chief Surveyor and Licensed Land Surveyors from Perlis, Kedah, Pulau Pinang, Perak, Federal Territory of Kuala Lumpur/Putrajaya, Selangor, Malacca, Negeri Sembilan, Johore, Pahang, Terengganu and Kelantan. Throughout the paper is become clear that quite a lot of study will be needed to realise the 3D property legislation for 3D property in Malaysia. Finally, conclusions on scope and contribution of the research are presented.

INTRODUCTION

A systematic record of lands matters involving registration of the details of transaction such as transfer of land and interest, lease, charge, releasing of easement and change of condition of land is very important in the land administration, planning and development of land. As stated in ECE/HBP/96 (1996), land administration consists of Cadastral Survey and Mapping Registration System, and Land Registration System. Both systems contain different sets of records about land. These two systems are very important for the formation of a good cadastre system. A cadastre system is an information system consisting of a series of maps or plans showing the size and location of all land parcels together with text records that describe the attributes of the land. This 2D cadastre system is adopted by many countries in the world including Malaysia because the system provides essential information about land and property such as ownership of the lot and land parcel for the country.

THE CADASTRE SYSTEM FOR 3D PURPOSE

There is a need for a refined description of land because land is the most valuable resource for humans and it is the fundamental or base for all forms human activities. Land is the key to human needs as it is the source of shelter, labour, economy, business, food, finance and other resources as well as the basis for meeting the different kinds of societal needs of the community (Nordin, 2001). Without land, there would not be any human activities carry on in the world. This is due to the fact that land is both a physical commodity and an abstract concept of rights of ownership. However, depending on the jurisdiction, the definition of land may or may not include everything which is attached to it, such as building on the surface or vegetation growing on the land or minerals below the ground surface. A definition by Kaufmann (1999) mentioned that:

> "As land is an important part of nature and the environment is the basis for nutrition, housing, energy production, resource exploitation, leisure activities, waste disposal, economic activities- in short for the maintenance and survival of humankind- cadastres are crucial aspect of sustainable development…."

One of the important issues with regards to land is the in adequacy of vacant land for development. There are many countries from all over the world including Malaysia who do have not enough vacant land on the ground surface to cater for the rapid development, particularly in big cities. In densely developed area and crowded cities, many of the real estate developments are either above or below the ground surface such as apartments and business complexes and engineering constructions which could be underground car parks, skywalks and buildings above road reserve. These new types of development not listed in the conventional developments are in need of a proper registration in land registry and cadastre system for 3D purpose. This is to make sure owners of those properties not subscribed by the conventional definition of ownership, could fully enjoy the ownership rights of their real estate properties. This is crucial to establish a more secure ownership and mapping facilities of real estate properties and objects in the cadastre system and land registry. Thus, more effort, attention and interest have to be put in to formalise the land registration meant for 3D purposes. Furthermore, the current cadastre system is not able to handle the registration of 3D property within the legislation and this problem in the system needs to be addressed and taken into consideration to avoid complications in the land registry system.

It is vital that everyone who is involved in land matter needs to have knowledge of the cadastre because it plays a very important role in Land Administration System where it should provide order and stability in society by creating security for everyone involved (Hassan, 2008) that includes landowners, investors, moneylenders, traders, dealers, and governments (ECE/HBP/96, 1996). Furthermore, a good cadastre system in a country can lead to the stability of social, economic and environment management and development. There is a need to make changes to the present cadastre system in order to meet the changes in the modes of development as Valstard (2006) highlighted the fact that traditionally, land has been described and registered into 2D and all cadastre systems of the world are in fact 2D nature.

3D cadastre & 3D property

At present, there is a lot of development taking place that is not covered in the 2D cadastre system as there is a lot of interest in utilising land and space above and below the ground surface. From an institutional perspective, land administration includes the formulation of land policy, the legislative framework, resource management, land administration arrangements, and land information management as well as entails organisational, i.e. both government and private initiatives.

Thus, there is a necessity to find a suitable cadastre solution for multilayer constructions. Therefore, the proposed 3D cadastre system should be able to represent the actual real world situation and not the surface parcel. The traditional cadastre system and land registry based on 2D have not been prepared to register these utilisation of land in a 3D situation. The implication of these new ways of land use due to a high demand for ground space means that, there must be changes made to the 2D paradigm in law and legal aspects.

Today's property situations often occur whereby the third dimension play a significant role in determining the legal status of such property, especially in areas with multilayer use of space.

Examples of such property unit can be found in the following situations:

a. Above surface constructions, such as apartments, constructions on top of each other, overhead infrastructure and utilities & use of air space.

b. Below surface constructions, such as underground constructions, infrastructure and utilities, region of polluted area & geological activities

THE SITUATION IN MALAYSIA

The cadastre system is adopted worldwide and Malaysia is one of the countries who adopted the system for its land management. Peninsular Malaysia (hereinafter called as "Malaysia") land administration is traditionally based on the Malaysian land law and this provides a variety of rights that are dependent on the traditions of the country. In Malaysia, land use rights are often based on occupation of land over a long period and this is defined in the written law or set by traditions. As the context of land use is no longer confined to the conventional definitions, the application of Malaysian legalistic land law of Malaysian Cadastre System for property which consists of Land Registration System and Cadastral Survey and Mapping System using 2D geometric in legal and law expression for land and property tenure is no longer adequate.

Furthermore, the utilisation of land for various purposes in Malaysia has not followed the process of the ideal Malaysian Cadastre System. It would be more practical if the Malaysian Cadastre System includes relevant information such as foundation of buildings, underground utilities, skywalks, using of air space, transportation services, and underground construction or whenever a situation arises for the need of exploiting a lot or land parcel for different activities.

Legal documents related to 3D property in Malaysia

The present scenario is that the rights, restrictions and responsibilities of the proprietor of the surface parcel shall also apply to the proprietor of properties above and below the ground surface, however, it have not been fully regulated and legalised by the Malaysian Cadastre System. In order to comprehend further these related matters, the legal documents which are related to lot, land parcel and land registry such as Registry Title, Land Office Title, Cadastral Map, so-called Certified Plan, National Land code 1965 (Act 56), Strata Title Act 1985 (Act 318), Survey Regulation 1976 (Peninsular Malaysia), Federal Constitution 1957, Survey and Mapping Director General Secular, Uniform Building By-Laws 1984, Street, Drainage and Building Act 1957, Building and Common Property (Maintenance and Management) Act 2007, Town and Country Planning Act 1976, Local Government Act 1976 AND States Land Code, Act and Rule should be used to make the legislation feasible for all proprietors on the surface, above and below the ground surface.

The importance of 3D property legislation in Malaysia

Since late 1990s, the population of Malaysia has increased from approximately 21.80 million to 27.73 million in 2008 (Statistics, 2008) and it is predicted to reach 31 million by 2020. Hence, an efficient 3D land use in real estate property especially for multilayer objects is directly linked to the socio-economic and environmental development in Malaysia. As highlighted by Forrai and Kirschner (2002) who stated that the availability of land use for future further construction is both expensive and limited. Traditionally, the Malaysian Cadastre System has different structures and authorisations whereby the jurisdiction for land registration is under the administration of the state government while cadastral survey and mapping is under the federal government. Both the systems deals with properties located on and above the surface level, as well as the ones below the surface level. Ahmad-Nasruddin and Abdul-Rahman (2006) has highlighted that each country has its own authority that is responsible for managing and monitoring the cadastre system and the cadastral objects can be either lot, or land parcel, or parcel which is held under separate Land Registry, i.e. strata title. However, the system practised in Malaysia is the parcel bounded system with a 2D nature only provides essential land and property information about the lots and land parcels (Hassan, 2008). This, however, does not include the 3D object registration and 3D rights as this current system only apply to the ordinary Land Administration System. For example, the digital cadastral map, registry title, content survey and mapping as well as textual record information about lots or land parcels are still using 2D natural for registration of 3D object rights is not comprehensive enough for 3D objects.

Cadastre registration system in Malaysia

There are two systems in the Malaysian Cadastre System namely Cadastral Database Management System (CDMS) and Computerised Land Registration System (CLRS) operated by the Department of Survey and Mapping Malaysia (DSMM), State Land and Mines Office (PTG) as well as District Land Office (PTD). The CDMS database store information about land attributes, spatial objects etc. while the CLRS database store land ownerships, land tenures etc., but these two systems work separately in each organisation having different legal aspects which are still in 2D nature. This means, there are no 3D object property rights as well as 3D cadastre rights within the CDMS and CLRS. Furthermore, it would be appropriate if these two systems could be incorporated for the registration form combining the present as well as advance and modern technologies such as GIS, internet, web based and e-commerce applications for a better cadastre system.

Meanwhile, one of the three main organisations responsible for managing and maintaining the cadastre system in Malaysia such as the Department of Survey and Mapping Malaysia (DSMM) that deals with the cadastral survey and mapping is under the Federal Government. Their responsibilities include registration of cadastral objects, such as lots and land parcel boundaries, identification of location, size and dimension of the properties. These details are determined through a very accurate cadastral survey. Besides that, the organisation is also responsible for preparing, producing and managing the spatial data. On the other hand, the non spatial data, i.e. the land title registration is the responsibility of the PTG and PTD which are both under the State Government. Their duties also include ownership registration which is managed by the Registry Title and Land Office Title. Within this Malaysian Cadastre System, there are also many direct and indirect codes and acts as well as legal documents that relate to cadastral survey and mapping , and land registration for property ownership currently governing the land administration. All these issues need to be addressed and are important towards the implementation of a 3D cadastre for 3D property in Malaysia.

It is anticipated that for future urban developments, the alternatives to the land surface would be the space above and below the ground surface and the shallow underwater areas along the seashore which involves marine cadastral. Both, the above and below ground surface developments as well as marine development have increased in recent years. However, expensive and high costs of construction and the lack of legal and organisational aspects of right to property have always intimidated and made potential investors cautious.

3D property cases in Malaysia

In Malaysia, public road i.e. state roads and municipal roads belong to state government while federal roads belong to federal government. When a private property is constructed above the public road, the cadastre system should recognise two or more different owners at the same time. There are a few cases for 3D property above the ground surface of public road in Malaysia.

Building over a public road

The most characteristic cases of private properties construct above public properties are the roads, as shown in Figure 1a, 1b & 1c.

(a)

(b)

(c)

Figure 1 : (a) Multilayer shop parcels above road reserve, (b) Skywalk above road reserve & (c) Balcony, bay window or structure above road reserve

Transportation network over a public road

The most characteristic cases of public properties construct above public properties are the monorail, light rail train rail line and their station, as shown in Figure 2a, 2b & 2c.

(a)

(b)

(c)

Figure 2 : (a) Monorail, (b) Light Rail Train & (c) Station above public road

Overlapping private properties

The most characteristic cases of private properties construct above private properties are the townhouse type houses and shop houses that probably do not apply for strata title under Strata Title Act, 1985, as shown in Figure 3a, 3b & 3c.

(a)

(b)

(c)

Figure 3 : (a) & (b) Type of townhouse and (c) Mix shop houses at below and residential houses at above

ISSUES REGARDING 3D PROPERTY

The basic land code in land administration adopted by many countries includes special legislation governing the operation of the cadastre system and land registration system and the definition with regards to the nature of land and real property. Every country's land administration is aimed at ensuring an undisturbed performance of the ownership rights. Thus, the ability to fulfil this task demonstrates the extent of society's ability to organise the legal base for land ownership. In this regard, legal relations must be precisely defined in land law, and also in other laws which are related to a lot, parcel and land parcel as well as property that is above ground surface. As pointed out by Ossko (2005), multilayer objects property has its own Unique Parcel Identifier (UPI) and physical description which make it possible for the property to be registered within the land registry and cadastre system.

The legal context

In the present land registry system, there are difficulties to register the ownership and other rights of real estate objects above or below the ground surface. The implication is that public facilities such as roads, streets etc. as well as objects that have been constructed above or below the ground surface of public domains have not been included as a part of the land registry. Some examples of the developments are public utilities, underground tunnels, garages, metro stations, shopping complexes, business centres, skywalks, using of air space as well as the mining and marine rights. Furthermore, the delineation of surface parcels, spatial sub parcels and spatial parcels that are vertically layered require a spatial description that should include data defining the vertical and horizontal boundaries between these units.

The complexity of land management is intertwined within the legal system. The law and legal system comprised of a complex set of rules that have been developed gradually and naturally within each society. This is to ensure order and maintain peaceful behaviour of its members and this is stated in ECE/HBP/96 (1996) that there are statutory law, customary law and common law. Furthermore, this is supported by Ossko (2005) who highlighted that due to certain legal constraints, especially legal ones will result in creating difficulties to register objects such as properties constructed above and below the ground surface within the traditional 2D cadastre system and land registry. This is due to the fact that the legal system was meant for 2D space.

In a real world situation, issues of legal and organisational meant for 2D cadastre are insufficient and would not be able to cope with the advanced development of the country especially information concerning 3D constructions and developments. This is in addition to the fact, that land use is becoming so intricate whereby different types of land use and properties are being placed in complicated 3D situations. Therefore, there is an urgency to develop and implement a 3D cadastre system that would fulfil the legal, organisational and technical aspects. This would ultimately be used as a means to solve problems associated with 3D complex situations. Based on the scenario discussed earlier, it shows that there are many issues associated with the legal and organisational aspects of problems associated with the 3D cadastre which need to be investigated further. This proposed new system must also take into account that 3D situations need a good system that must clearly reveal the drawbacks of real work situations (Abdul-Rahman, 2006; Abdul-Rahman, et al, 2005).

Malaysia adopts a title registration system where the register contain info about the proprietor, encumbrances, express conditions, implied conditions, restrictions in interest, caveats and prohibited orders if any. However, not all imposed conditions and restrictions are stated clearly in the register as there are some that are provided by law and have to be complied by the proprietor. Meanwhile, the land register can be considered as the pillar of the record machinery in the Malaysian Registration System.

Problems and constraints in current Malaysian Cadastre System for 3D property

The current 2D Malaysian Cadastre System is insufficient to meet the changes brought about by the booming yet complex high density developments in urban areas. Furthermore, there is a growing interest and need for using space above or below the ground surface for construction real estate property objects especially in metropolitan areas. In such developments, some of the buildings have been built on top of each other or crossing boundary edge (Hassan, 2008; Hassan, et al, 2006), but the legal changes in the land registry has not been changed in accordance with the complexity of the developments that are taking place. The growing request for changes mentioned earlier is bogged by constraints and difficulties to register the ownership of real estate properties created above or below ground surface. These problems need to be addressed and there is a need for a legal registration status of such property, so that one would be able to define and manage the juridical situation satisfactorily. Thus, information based on 3D is becoming absolutely necessary for land administration in Malaysia.

The traditional paper based method of CP and Registry Title conversion to digital based method of registration includes all maps and titles comprising the legal status of parcel boundaries, land parcels and other objects registered for 2D space situation. As a result, problems will occur during the implementation of 3D cadastre because there would be difficulties with reference to legislation for registration of such objects into 3D situation although Strata Title Act 1985 (Act 318) (Strata Title Act, 1985) allows the registration of 3D property in 2D space situation. Furthermore, the 3D information is presented on paper or as a scanned image drawing in CP and Registry Title which is actually a 2D visualisation. Thus the information presented cannot be interactively viewed. This indicates that there is a flaw in such a presentation because the ability to present information and interpret the situation correctly in 3D may be very helpful in cases of complex volume parcels.

The aims of cadastre is to survey, record and follow by register rights and interests to land because the law recognises these rights and interests as a legitimate relation between a rightful claimant and a certain lot of land. Therefore, without law and legally defined, the mechanisms for acquisition, transfer, protection, restriction, creation as well as recording or registration of these rights and interests is meaningless in the cadastre.

The Malaysia legal cadastre system and land law are still using 2D geometric in the legal and law expression for land and property tenure. As there is a growing need for ground space, the 2D paradigm in law and legal should be changed. But, the question is how does one determine and define the current legal practices meant for complex development situations. There is also the issue that the traditional cadastre maps, survey regulation and land registry which are still in 2D are no longer technically, legally and organisationally adequate to cater for these 3D situations.

Finally, it seems that the problems associated with 3D property could be solved by proposing suitable legal and organisational methods. In Malaysia, there is a pressing need for a comprehensive legal, organisational and technical solutions required for the development of a 3D cadastre for 3D property. This would entail changes in certain land laws and legal documents such as Survey Regulation 1976 (Peninsular Malaysia) (Survey Regulation, 1976), National Land Code (Act 56) (National Land Code, 1965), Strata Title Act 1985 (Act 318) (Strata Title Act, 1985) and Survey and Mapping Director General Secular are fairly essential.

Purpose of 3D property legislation

The main obstacle in adopting 3D cadastre is that the legal and organisational systems are slow to change. Some countries have made progress in this respect and recent laws, especially from Northern European, have made it possible to register properties in 3D situation. However, none of these laws defines 3D cadastre clearly because the law only accepts that volume parcel can be established both below and above the main surface parcel (Valstad, 2006). Because of these, we have to find elements and contexts which are common in different systems by creating new guidelines even through changing the law for those countries facing the problem of 3D registration in cadastres and land registries.

Different countries have different solutions to solve the registration of 3D ownership of volumetric parcels, but in most cases the actual parcel is not registered as a separate entity, but is linked to the surface parcel in a descriptive way (Valstard, 2006). Thus, this solution to the registration is not sufficient to satisfy the 3D structures owners because volumetric parcels might not be the same as the surface parcel. Furthermore, the owners of the 3D structures want their ownership registered in a proper way as constructions above or below the ground surface. The need for a change in the law is of course due to the demand for 3D property use, coupled with the impossibility of forming property units which are 3D defined (Julstad and Ericsson, 2001). Hence, the first attempt should start from the legal registration of 3D property units in the cadastre system and land registry meanwhile underground tunnel, using of air space and others will follow suit.

Malaysia adopts a title registration system where the register contain info about the proprietor, encumbrances, express conditions, implied conditions, restrictions in interest, caveats and prohibited orders if any. However, not all imposed conditions and restrictions are stated clearly in the register as there are some that are provided by law and have to be complied by the proprietor. Meanwhile, the land register can be considered as the pillar of the record machinery in the Malaysian Registration System. The hardcopy land registry is now replaced by computerised land registry which enables the proprietor to transfer, lease and change the land or grant rights of easement.

The rights associated with this registration would be clear in the registry titles issued as well as that provided for under legislation. For example, Strata Title Act 1985 (Act 318) (Strata Title Act, 1985) allows land to be subdivided into parcels or land parcels based on the area occupied. Besides that in National Land Code 1965 (Act 56) (National Land Code, 1965), air space is permitted up to a maximum of 21 years only, and there are still a lot of arguments about the surface under different categories of land use, subdivision, partition, amalgamation as well, because all these are still in 2D nature. However, these arguments would clearly be different if they are used in the case of 3D property alienation, although the mode of registration being quite similar. It is important to note the fact that there is provision of volumetric parcel alienation, in particular for underground land alienation under the said legislation.

In addition, heights reference is very important in defining the Z-coordinate and the absolute heights related to a datum or relative heights that related to the surface level should be used. Absolute heights are more stable and enable unambiguous definitions of 3D property nationally whereas relative heights between properties may be different. Height information only exists in CP for stratum objects (PKPUP/2, 2006, PKPTG/1, 2008)) and there is no height information in CP for strata objects (PKPUP/3, 2006).

In Malaysia, the main thing that hinders the progress has been the national legal system, because there are no provisions and there is a lack of proper Malaysia cadastre law to cater for the registration of legal and organisational aspects for 3D property in full 3D cadastre as described by Stoter (2004). Therefore, the legal profession is always very conservative because they are attached to the old and traditional land registry law and legal changes generally take quite a long time to change.

QUESTIONS NEED TO BE ADDRESSED

The changes in the legal and organisational aspects enabling 3D cadastral survey and mapping as well as registration by DSMM, PTG and PTD are essential. In order to propose a comprehensive 3D property cadastre system in relation to the specific problems discussed earlier, this study seeks to answer the following major research questions and their sub-questions from legal and organisational aspects which is part of a 3D cadastre system:

a) What are the problems from legal and organisational aspects in order to implement Malaysian Cadastre System for 3D property and how to address them?
   i) What are the new 3D property regulations and practices information needed in Registry Title, Land Office Title, STA 1985 and NLC 1965?

b) What are the changes needed in the current cadastral and land practices in order to achieve the succession implementation of Malaysian Cadastre System for 3D property in Malaysia?
   i) How could information about the new 3D property regulations and practices information be collected, structured and presented that would propose a 3D property cadastral survey and mapping which includes registration?

c) What are the contents in the relevant legal documents that have to be amended in order to translate the legal and organisational expression from 2D to 3D for implementation of Malaysian Cadastre System for 3D property in Malaysia?
   i) What kind of framework or criteria is needed to establish and implement these new legislations and how would it affect the cadastral survey and mapping practices of the 3D property?

OBJECTIVES, METHODOLOGY OF STUDY AND ANALYSING METHODS

Objectives

In view of the Malaysian Cadastre System that is based on the 2D cadastre system, this research proposes that changes be made in the legislation of cadastral survey and mapping as well as registration of a 3D property. To realise this, the objectives of the research are:

a) To review literature associated with the execution and application for 3D property legislation in the Malaysian Cadastre System.
b) To develop a congruent framework that were matched the needs of DSMM, PTG, PTD and Licensed Land Surveyor (LLS) onto Registry Title, Land Office Title, Certified Plan, Strata Title Act 1985 (Act 318) and National Land Code 1965 (Act 56) for use in 3D property legislation.
c) To make recommendations to DSMM, PTG, PTD and LLS for the amendments and performance of the 3D property legislation that are the fundamental principles for the Malaysian Cadastre System and propose changes that would facilitate the cadastral survey and mapping practices.

Methodology of study and analysing methods

In order to answer the research questions and achieve the research objectives, this study took a quantitative and qualitative approach that attempted to make recommendations to change the 2D legislation to 3D legislation for property above ground surface. A pilot testing will be conducted onto 20 respondents from identified DSMM, PTG, PTD and LLS for improvement of the survey instrument. The following research methodologies will be used and the research design took the following format (See Table 1):

The research will focus on five types of legal documents. The legal documents are Registry Title, Land office Title, Certified Plan, National Land Code 1965, (Act 56) and Strata Title Act 1985 (Act 318). These legal documents are chose because they require the inclusive of 3D into the current 2D cadastre system for 3D property above ground surface and they are directly involved in the registration and cadastral survey of the multilayer property above ground surface.

Stage	Process	Related Information
1	Data collection from secondary data	Registry Title, Land office Title, Certified Plan, National Land Code 1965 (Act 56) and Strata Title Act 1985 (Act 318).
	Content analysis	
Pilot Testing		
2	Design an instrument	Open-ended and close-ended Questionnaires. (Quantitative approach)
	Pilot the instrument	- Field survey. - Respondents from State Lands and Mines Office, State District Land Office, Department of Survey and Mapping Malaysia, Department of Director General of Lands and Mines Office and Licensed Land Surveyors from Peninsular Malaysia.
	Data Analysis	- First stage secondary data content analysis and questionnaire from field study will be evaluated and compared with Survey Regulation 1976 (Peninsula Malaysia), Survey and Mapping Director General Secular and Land Code, Act and Regulations from Sweden, Norway, Denmark and the Netherlands. - Electronic Strata Survey Module from the Department of Survey and Mapping Malaysia will be used as a technical reference.
Pilot Testing		
3	Further refine the instrument	The results and analysis from the pilot study process will be used to improve the initial recommendations through an open-ended unstructured interview sessions. (Qualitative approach)
	Analysis	The final recommendations made in the content of legal documents mentioned will be tested and checked though in-person interviewing method

Table 1 : Research Design

CONCLUSIONS

The research will focus on five types of legal documents. The legal documents are Registry Title, Land office Title, Certified Plan, National Land Code 1965, (Act 56) and Strata Title Act 1985 (Act 318). These legal documents are chose because they require the inclusive of 3D into the current 2D cadastre system for 3D property above ground surface and they are directly involved in the registration and cadastral survey of the multilayer property above ground surface. Besides, the eSSM is chose because it gives the 3D technical registration, cadastral survey and processing methods. This research would focus on 3D property legislation for multilayer objects above the ground surface but not below the ground surface in Malaysia because the existing law and guideline for stratum which under Part Five (A), Disposal of Underground Land, Section 92A to 92I (National Land Code, 1965) and Federal Lands and Mines Director General Secular (PKPTG/1, 2008) are already in existence.

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Appendix A

	Secondary Data	Content Analysis
1	Registry Title	Annual rent, Area, Category of land use, Express conditions, Restrictions in interest, Plan of the land, Record of dealings and Other matters affecting title
2	Land Office Title	Annual rent, Area, Category of land use, Express conditions, Restrictions in interest, Plan of the land, Record of dealings and Other matters affecting title
3	Certified Plan	Area, Coordinates, Bearing/distance, Height/depth and Plan of the land
4	National Land Code 1965 (Act 56)	Division I-Introductory, Part One-Preliminary-Section 5-Interpretation, Part Three-Rights and powers of the state authority, Chapter 1-Property in land and powers of disposal, Chapter 2-Classification and use of land –Classification, Chapter 3-Rights of access to, and use of alienation land.
		Division II-Disposal of land, Part Four-Disposal otherwise than by alienation, Chapter 1-Reservation of land, Chapter 4-Permit to use air space above state land and reserved land, Part Five-Disposal by alienation, Chapter 1-Introductory, Chapter 2-Approval of land for alienation, Chapter 3-Alienation under final title.
		Division III-Alienation lands: Incidents and registration of title, Part Six-Rent, Chapter 1-General, Chapter 2-Collection of arrears of rent, Chapter 3-Revision of rent, Part Seven-Conditions and restrictions in interest, Chapter 1-General, Chapter 2-Summary of conditions and restrictions in interest affecting alienated lands, Chapter 4-Express conditions and restrictions in interest, Chapter 5-Enforcement of conditions, Part Nine-Subdivision, partition and amalgamation, Chapter 1-Sub-division of lands, Chapter 2-Partition of lands, Chapter 3-Amalgamation of lands, Part Ten-Preparation and maintenance of registers of final title, Chapter 1-The registers.
		Division VI-General and miscellaneous, Part Twenty Nine-Survey, Chapter 1-General, Chapter 2-Deposited plans.
5	Strata Title Act 1985 (Act 318)	Part I-Preliminary-Section 4-Interpretation, Part II-Application for subdivision of building or land, Part III-Registration of Strata Title, Part IV-Provisional block : Issue of strata titles upon completion of building, Part V-Subdivided buildings : Division and amalgamation of parcels, Part VI-Rights and obligations attaching to individual parcels and provisional blocks

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The 8th International Symposium and Exhibition on Geoinformation (ISG 2009)

Wan Faizal bin Wan Mohamed

KUALA LUMPUR : The 8th ISG 2009 was officiated by Y.B. Dato Sri Douglas Uggah Embas, Minister of Natural Resources and Environment, Ministry of Natural Resources and Environment (NRE).

This year event was jointly organised by University Putra Malaysia (UPM) and Malaysian Centre for Geospatial Data Infrastructure (MaCGDI) which been held at Crowne Plaza Mutiara Hotel, Kuala Lumpur on 10 - 11 August 2009.

This annual symposium involves the Malaysian Geoinformation Community such as, government agencies, private sector and academia. The main objectives of this symposium is to gather all of the professional participants from all geoinformation industry experts with vast experience and to disseminate the Geoinformation globally. This is also the perfect venue for updating the steady flow of the latest technology in geoinformation.

The theme of the conference, “Geoinformation for All” can be interpreted as geoinformation for the benefit of all; available to all; accessible to all; useful for all; producible by all and understandable for all. This theme is appropriate as it identifies the remarkable achievements of Malaysian Community in the utilization of geoinformation technology for a better quality of life for all and productive environment for present and future generations.

There are more than 100 technical papers related to geoinformation technology has been presented at this symposium which cover the topics such as; the uses of geoinformation technology in environmental conservation, disaster management and monitoring, infrastructure geospatial data development and urban management.

With this system implemented locally in all areas, it will give a positive impact especially to the Government agencies which involve in geospatial information management. More benefits could be adapted from the using of Geoinformation Technology. As such, it will enhance government delivery system to ensure more efficient, effective and timely services to the public as well as to stimulate private sector activities.

The effort of organizing this symposium will be continued in future as the important platform at national level which will involve the public sectors, private sectors and even academia for gathering the latest and new knowledge rapidly with advance technology, hardware and software which related in geoinformation technology.

From the exhibition itself, the latest multi-technology in geoinformation has been presented. The exhibition that involve of various agencies such as from local government and private sector which are the lead in geoinformation technology nowadays.

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Minggu Pembangunan dan Kesedaran Sains dan Inovasi Peringkat Negeri Kedah 2009

Norazmel bin Abd. Karim

Pada 24 Julai 2009, telah berlangsung Minggu Pembangunan dan Kesedaran Sains dan Inovasi Peringkat Negeri Kedah di Stadium Sultan Abdul Halim, Suka Menanti, Alor Setar. Program tahunan ini merupakan gabungan program jelajah sains yang dianjurkan oleh Pusat Sains Negara yang merupakan sebuah agensi di bawah Kementerian Sains, Teknologi dan Inovasi (MOSTI) dengan kerjasama Kerajaan Negeri Kedah Darul Aman. Pada tahun ini Kerajaan Negeri Kedah dipilih oleh MOSTI bagi mewakili zon utara iaitu Kedah, Perlis, Pulau Pinang dan Perak.

Objektif program ini adalah bagi memberi pendedahan dan kesedaran berkaitan sains dan inovasi kepada golongan luar bandar terutama pelajar yang tidak berkesempatan mengunjungi Pusat Sains Negara sebelum ini. Dengan adanya program seumpama ini di Negeri Kedah, diharap dapat menarik minat generasi muda untuk menyelami dunia sains angkasawan selain meningkatkan kefahaman dan pengetahuan mengenai sains dan teknologi kepada umum.

Majlis perasmian Minggu Pembangunan dan Kesedaran Sains dan Inovasi Peringkat Negeri Kedah telah disempurnakan oleh Yang Teramat Mulia (YTM) Tunku Bendahara Kedah, Dato' Seri Tunku Annuar Al-Haj ibni Almarhum Sultan Badlishah. Berangkat sama ialah YTM Dato' Seri DiRaja Tunku Soraya Sultan Haji Abdul Halim Mu'adzam Shah dan YTM Tunku Panglima Besar Dato' Seri Tunku Puteri Intan Safinaz binti Kebawah Duli Yang Maha Mulia Tuanku Sultan Haji Abdul Halim Mu'adzam Shah.

Pelbagai aktiviti menarik dan menghiburkan yang berorientasikan pendidikan seperti cerapan langit malam, demonstrasi sains, menaiki basikal bermuzik, penyelesaian matematik dan lain-lain lagi disediakan kepada pengunjung untuk turut serta mencubanya secara percuma. Program yang berlangsung selama lima hari ini juga telah membuka peluang kepada peniaga-peniaga tempatan untuk turut serta memperkenalkan produk-produk mereka kepada pengunjung termasuklah gerai-gerai makanan dan minuman, jualan kain dan tudung sehinggalah kepada gerai Celcom.

bahan-bahan radioaktif. Maklumat-maklumat ini amat berguna kepada pengunjung dalam meningkatkan kesedaran, kefahaman dan pengetahuan mengenai sains dan teknologi kepada umum.

Bagi memeriahkan lagi program tersebut, pihak penganjur turut mengadakan sesi kuiz dan cabutan bertuah kepada pengunjung-pengunjung yang hadir. Pengunjung-pengunjung yang bertuah akan mendapat hadiah *hamper* berupa barangan makanan untuk dibawa pulang.

Di sebelah malam pula, para pengunjung berpeluang mencerap bulan, bintang dan planet-planet yang lain yang berhampiran dengan bumi yang hanya boleh dilihat dengan jelas dengan menggunakan teleskop yang berkuasa tinggi. Peluang seperti ini tidak akan dilepaskan oleh pengunjung bagi melihat sendiri keajaiban dan keindahan ciptaan Allah.

Di samping itu, program ini juga turut mendapat penyertaan pameran daripada pelbagai agensi seperti Jabatan Meteorologi, Petrosains, Oseanografi Kebangsaan, Malaysia Super Coridor (MSC), Jabatan Tenaga Atom, Majlis Reka Bentuk Malaysia, Akademi Binaan Malaysia Wilayah Utara, Sky and Teoh Observatory, Agensi Remote Sensing Malaysia, Jabatan Ukur dan Pemetaan Malaysia (JUPEM) dan juga Pusat Infrastruktur Data Geospatial Negara (MaCGDI). Booth-booth pameran ini menyediakan maklumat yang berinfomatif kepada para pengunjung daripada aspek pengukuran, Sistem Maklumat Geografi (GIS), foto-foto planet di cakerawala hinggalah kepada aspek keselamatan mengendalikan

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TAKLIMAT/BENGKEL

MyGDI METADATA

Tujuan taklimat dan bengkel ini diadakan adalah untuk memberi tunjuk ajar dan pendedahan kepada pihak negeri di dalam penyediaan MyGDI Metadata. Aktiviti ini akan memberi penerangan kaedah penerbitan data *(Map Services)* dan penyediaan Metadata secara *hands-on*, seterusnya mengemas kini MyGDI Metadata secara *on-line* melalui MyGeoportal. Metadata ini akan diguna pakai bagi memudahkan pembekal data merekodkan maklumat mengenai data mereka dan juga bagi memudahkan pengguna memperolehi data geospatial yang dikehendaki.

Taklimat MyGDI Metadata Terengganu diadakan pada 19 Ogos 2009 di Cherating Beach Resort, Pahang

Taklimat MyGDI Metadata Johor diadakan pada 1 Oktober 2009 di Hotel Puteri Pan Pacific, Johor Bahru

Taklimat MyGDI Metadata Negeri Sembilan diadakan pada 24-26 Februari 2009
di Corus Paradise, Port Dickson

LAWATAN

LAWATAN SAMBIL BELAJAR PESERTA ARKIB NEGARA MALAYSIA (ANM)

Arkib Negara Malaysia (ANM) telah melawat ke MaCGDI pada 22 Julai 2009 yang melibatkan seramai 10 orang delegasi mewakili negara-negara seperti Sri Lanka, Korea Utara, Yaman, Kepulauan Fiji , Kyrgzstan, Ethiopia dan Malawi serta termasuk juga 3 orang pegawai dari ANM sebagai urus setia. Kedatangan delegasi jabatan arkib negara ini adalah bertujuan untuk melihat bagaimana rekod-rekod elektronik disimpan dan diuruskan oleh MaCGDI.

LAWATAN SAMBIL BELAJAR DARI UTM, SKUDAI, JOHOR

20 Julai 2009 – MaCGDI sekali lagi terpilih untuk menerima kunjungan pelajar-pelajar tahun dua (2) Sarjana Muda Sains (Geoinformatik) UTM Skudai, Johor. Peserta lawatan adalah seramai 60 orang yang terdiri daripada 56 orang pelajar dan 4 orang pegawai pengiring. Lawatan ini bertujuan untuk mendedahkan para pelajar dengan aspek penyediaan dan pengendalian data geospatial serta guna pakai GIS yang terdapat di MaCGDI selain melihat perkembangan teknologi GIS dan peluang kerjaya di bidang sains geoinformatik.

LAWATAN SAMBIL BELAJAR UiTM PERLIS

27 Mac 2009 - Satu lawatan sambil belajar oleh seramai 100 orang pelajar jurusan Diploma Sains Ukur dan Geomatik, Diploma Sains Geomatik Sistem Maklumat Geografi dan Diploma Sains Geomatik Sumber Alam dari Fakulti Senibina, Perancangan dan Ukur, termasuk 4 orang pensyarah UiTM Perlis telah melawat MaCGDI untuk mendapat pendedahan mengenai GIS.

LAWATAN TEKNIKAL SYARIKAT AIR JOHOR HOLDINGS SDN. BHD. (SAJ HOLDINGS SDN. BHD)

26 Mac 2009 – MaCGDI telah menerima kunjungan daripada SAJ Holdings Sdn. Bhd. yang merupakan syarikat terbabit di dalam aktiviti merawat air mentah kepada bekalan air bersih di sekitar Negeri Johor. Lawatan ini bertujuan untuk mengetahui dengan lebih lanjut berkenaan dengan fungsi dan peranan MaCGDI dalam pembangunan GIS dan seterusnya mendapatkan maklumat spatial untuk aktiviti pengemaskinian data spatial sumber hutan bagi Negeri Johor.

LATIHAN

LATIHAN APLIKASI MyGDI DAN PENERBITAN DATA

23 Julai 2009 – MaCGDI telah mengadakan sesi Latihan Aplikasi MyGDI dan Penerbitan Data kepada agensi di Negeri Melaka yang melibatkan Jabatan Perancangan Bandar dan Desa, Jabatan Ukur dan Pemetaan Melaka, Pejabat Daerah dan Tanah Alor Gajah, Jabatan Kerja Raya Melaka, Majlis Bandaraya Melaka Bersejarah dan Perbadanan Hang Tuah Jaya. Latihan penerbitan data ini bertujuan untuk memberi pendedahan dengan lebih terperinci cara menerbitkan data menggunakan *Map Services* versi ArcIMS.

LATIHAN APLIKASI MyGDI

25 Mei 2009 – Seramai 11 peserta daripada Jabatan Perancang Bandar dan Desa Semenanjung Malaysia (JPBDSM) telah diadakan Sesi Latihan Aplikasi MyGDI oleh MaCGDI yang bertujuan memberi pendedahan barkaitan dengan fungsi-fungsi aplikasi MyGDI dari segi penggunaannya dan kebaikan kepada agensi terbabit. Latihan ini juga dapat merapatkan lagi hubungan antara MaCGDI dengan JPBDSM.

BULETIN GEOSPATIAL SEKTOR AWAM

FORMAT DAN GARIS PANDUAN SUMBANGAN ARTIKEL

****

Buletin Geospatial Sektor Awam diterbitkan oleh Pusat Infrastruktur Data Geospatial Negara (MaCGDI). Sidang Pengarang amat mengalu-alukan sumbangan sama ada berbentuk artikel atau laporan bergambar mengenai perkembangan Sistem Maklumat Geografi di Agensi Kerajaan, Badan Berkanun dan Institusi Pengajian Tinggi.

Garis Panduan Untuk Penulis

Manuskrip boleh ditulis dalam Bahasa Melayu atau Bahasa Inggeris.
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Segala pertanyaan dan sumbangan hendaklah dikemukakan kepada :

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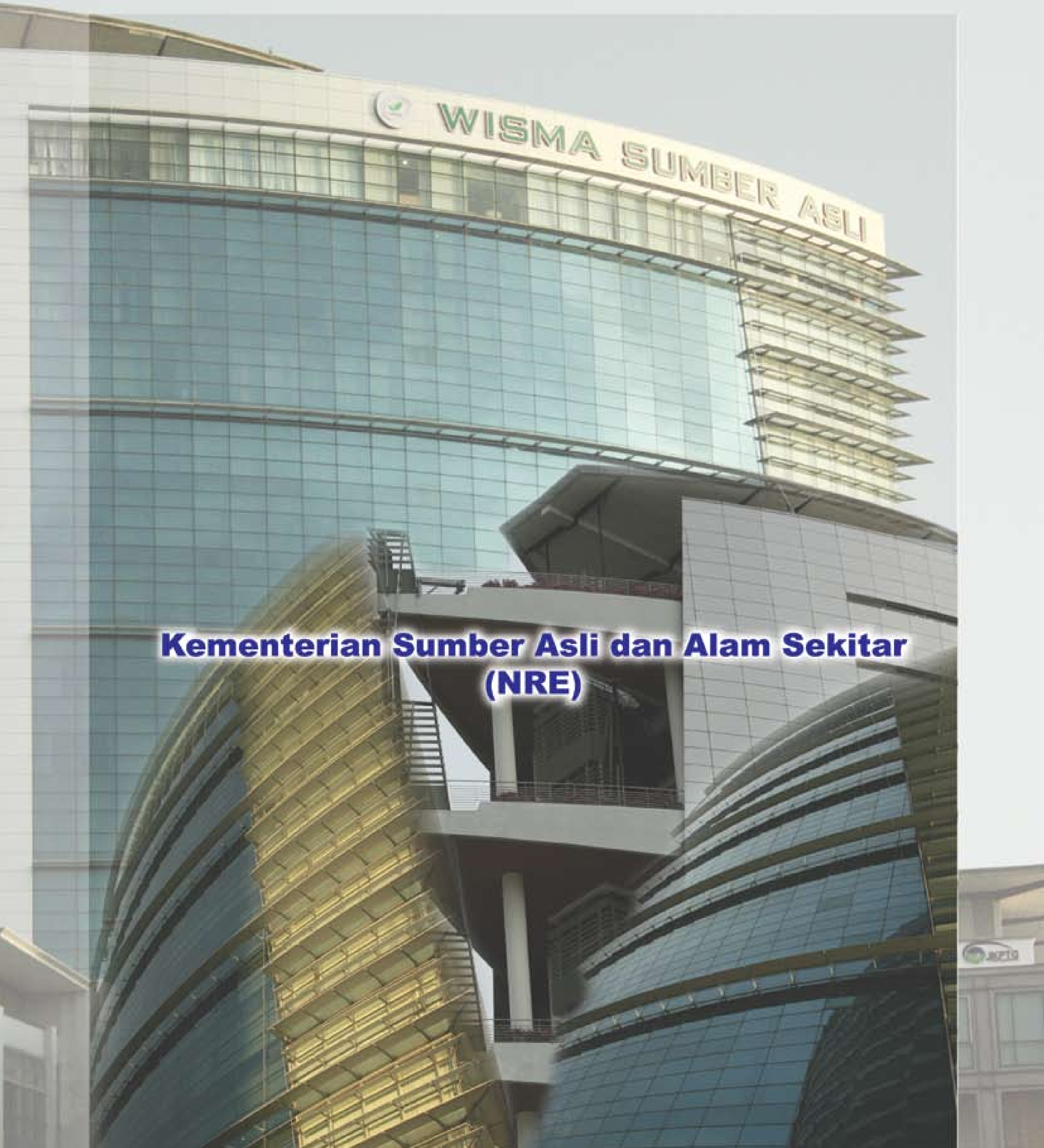

Kementerian Sumber Asli dan Alam Sekitar (NRE)

MaCGDI

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