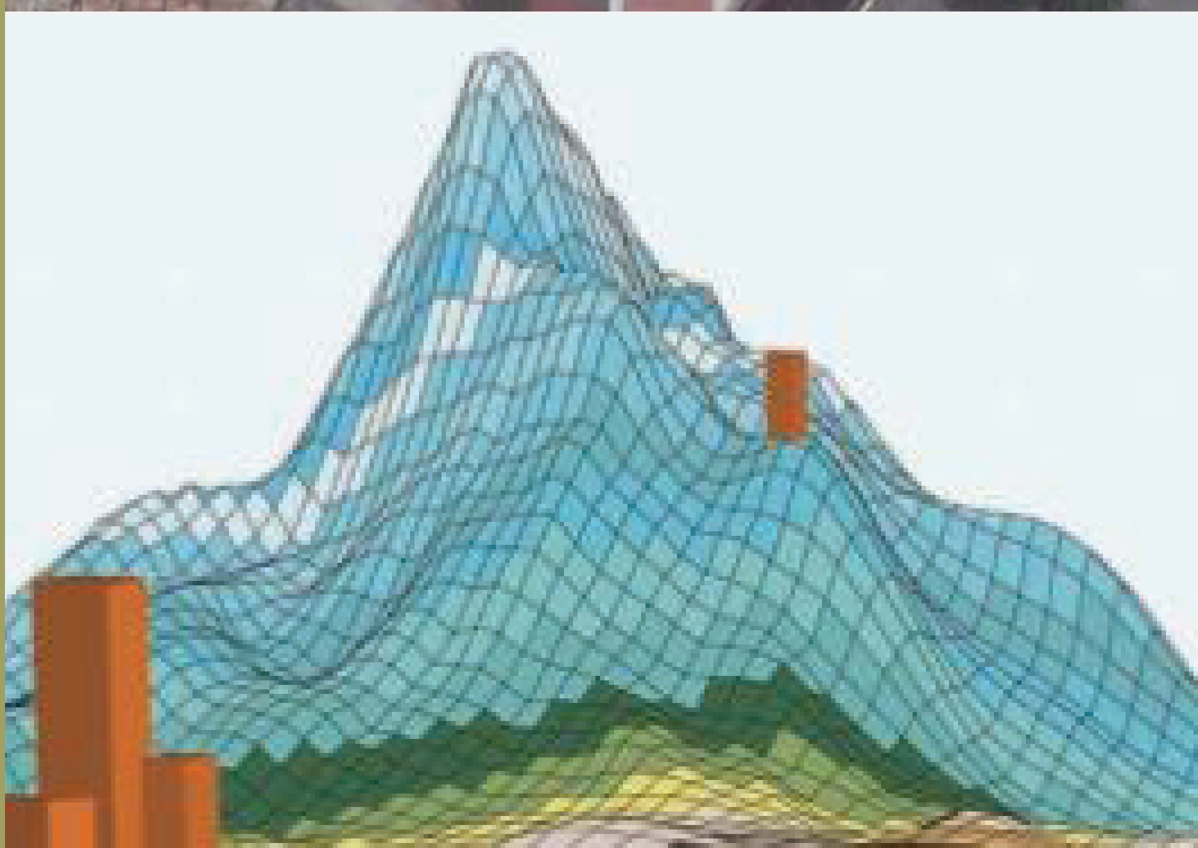
BULETIN GIS & GEOMATIK



JAWATANKUASA PEMETAAN DAN DATA SPATIAL NEGARA

BIL 2/2016

ISSN 1394 - 5505

PENDAHULUAN

Jemaah Menteri berasaskan Kertas Kabinet No.243/385/65 bertajuk *National Mapping Malaysia* telah meluluskan jawatan dan terma-terma rujukan *"Surveyor-General Malaya and Singapore"* sebagai Pengarah Pemetaan Negara Malaysia dan mengesahkan keanggotaan serta terma-terma rujukan Jawatankuasa Pemetaan Negara pada 31 Mac 1965.

Cabutan para-para 2(b), 2(c) dan 2(d) daripada kertas kabinet tersebut mengenai keanggotaan dan terma-terma rujukannya adalah seperti berikut:

"2(b) National Mapping Committee

That a National Mapping Committee be appointed to comprise the following:

i. Director of National Mapping
ii. Director of Lands & Surveys, Sabah;
iii. Director of Lands & Surveys Sarawak;
iv. Representative of the Ministry of Defence;
v. Representative of the Ministry of Rural Development (now substituted by the Ministry of Natura Resources and Environment);
vi. Assistant Director of Survey, FARELF

2(c) The terms of reference of the National Mapping Committee to be as follows:

i. to advise the Director of National Mapping on matters relating to mapping policy;
ii. to advise the Director of National Mapping on mapping priorities.

2(d) That the Committee be empowered to appoint a Secretary and to co-opt persons who would be required to assist the Committee,"

Seterusnya pada 22 Januari 1997, Jemaah Menteri telah meluluskan pindaan terhadap nama, keanggotaan dan bidang-bidang rujukan Jawatankuasa Pemetaan Negara kepada Jawatankuasa Pemetaan dan Data Spatial Negara (JPDSN), bagi mencerminkan peranannya yang diperluaskan ke bidang data pemetaan berdigit. Keanggotaan JPDSN pada masa kini adalah terdiri daripada agensi-agensi seperti berikut:

1. Jabatan Ukur dan Pemetaan Malaysia
2. Jabatan Tanah dan Ukur Sabah
3. Jabatan Tanah dan Survei Sarawak
4. Wakil Kementerian Pertahanan
5. Jabatan Mineral dan Geosains Malaysia
6. Jabatan Perhutanan Semenanjung Malaysia
7. Jabatan Pertanian Semenanjung Malaysia
8. Jabatan Perhutanan Sabah
9. Pusat Infrastruktur Data Geospatial Negara (MaCGDI) *(co-opted)*
10. Jabatan Pertanian Sabah
11. Jabatan Pertanian Sarawak
12. Agensi Remote Sensing Malaysia (ARSM)
13. Universiti Teknologi Malaysia
14. Universiti Teknologi MARA *(co-opted)*
15. Universiti Sains Malaysia *(co-opted)*
16. Jabatan Laut Sarawak *(co-opted)*
17. Jabatan Perhutanan Sarawak
18. Jabatan Perancangan Bandar dan DesaSemenanjung Malaysia *(co-opted)*

Buletin GIS ini yang diterbitkan dua kali setahun adalah merupakan salah satu aktiviti oleh Jawatankuasa Pemetaan dan Data Spatial Negara, sebagai salah satu media pendidikan dan penyebaran maklumat dalam mendidik masyarakat memanfaatkan maklumat spatial dalam pembangunan negara. Walau bagaimanapun, sebarang kandungan artikel-artikel adalah tanggungjawab penulis sepenuhnya dan bukan melambangkan pandangan penerbit.

Kandungan

Pencetak

Jabatan Ukur dan Pemetaan Malaysia,
Jalan Sultan Yahya Petra,
50578 Kuala Lumpur

Dari Meja Ketua Editor

Sidang Pengarang Buletin GIS dan Geomatik mengucapkan tahniah kepada YBhg. Dato’ Sr Hasan bin Jamil di atas perlantikan beliau sebagai Ketua Pengarah Ukur dan Pemetaan Malaysia (KPUP) yang ke-21 pada 4 November 2016 bagi menggantikan YBhg. Datuk Sr Ahmad Fauzi bin Nordin yang telah bersara wajib pada 3 November 2016. Atas perlantikan ini maka YBhg. Dato’ Sr Hasan bin Jamil adalah juga merupakan pengerusi kepada Jawatankuasa Pemetaan dan Data Spatial Negara (JPDSN). Terima kasih jua diucapkan kepada mantan KPUP, YBhg. Datuk Sr Ahmad Fauzi bin Nordin di atas sumbangan yang diberikan sepanjang perkhidmatannya bersama JUPEM dan juga sebagai Pengerusi JPDSN sebelum ini.

Dalam pada itu, JUPEM telah berjaya menganjurkan satu program antarabangsa iaitu ‘*International Forum on Policy and Legal Frameworks for Geospatial Information Management dan 5th United Nations Global Geospatial Information Management for Asia and The Pacific (UN-GGIM-AP) Plenary Meeting’* di Hotel Parkroyal Kuala Lumpur pada 16 – 20 Oktober 2016. Program ini telah dirasmikan oleh Yang Berhormat Dato Sri Dr. Hj. Wan Junaidi Bin Tuanku Jaafar, Menteri Sumber Asli dan Alam Sekitar pada 18 Oktober 2016 dengan dihadiri oleh 495 orang peserta dari 29 buah negara di mana 152 orang daripadanya merupakan peserta luar negara. Penganjuran program ini telah menghasilkan satu deklarasi berkaitan dengan kerangka polisi dan perundangan bagi pengurusan maklumat geospatial yang dinamakan *‘Kuala Lumpur Declaration on Policy and Legal Frameworks for Geospatial Information’.*

Selain daripada itu, sebagai menyahut saranan Perdana Menteri Malaysia, YAB Dato’ Sri Mohd Najib Tun Hj Abdul Razak agar Strategi Lautan Biru Kebangsaan (NBOS) diamalkan dalam sektor awam bagi mewujudkan kerjasama antara agensi kerajaan maka JUPEM juga telah menjalinkan kerjasama dengan beberapa agensi bagi tujuan perkongsian maklumat data geospatial. Dalam tahun 2016, JUPEM telah menandatangani Memorandum Persefahaman (MoU) bagi tujuan perkongsian maklumat data geospatial dengan Pihak Berkuasa Tempatan (PBT) iaitu Perbadanan Putrajaya dan Dewan Bandaraya Kota Kinabalu (DBKK). Atas kejayaan NBOS tersebut, JUPEM bercadang untuk memperluaskan pelaksanaannya dalam tahun 2017 dengan menandatangani MoU dengan Jabatan Perancangan Bandar dan Desa (JPBD), Majlis Perbandaran Seremban (MPS) dan Majlis Perbandaran Kota Bharu (MPKB). Bertepatan dengan keadaan ketidakstabilan ekonomi semasa sekarang, maka diharapkan dengan pelaksanaan NBOS ini akan dapat mengoptimumkan penggunaan sumber sedia ada dalam membangunkan produk geospatial oleh agensi kerajaan dan seterusnya dapat mengurangkan kos pembangunan dan pengurusannya.

SISTEM MAKLUMAT GUNATANAH PERANCANGAN BERSEPADU (I-PLAN): MEMACU SERTA MENGIMBANGI PEMBANGUNAN NEGARA YANG BERKESAN DAN MAMPAN

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ABSTRAK

Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (JPBDSM) selaku Pusat Maklumat Gunatanah Negara bertanggungjawab untuk membekalkan maklumat gunatanah perancangan Semenanjung Malaysia dan mengurus maklumat gunatanah yang sentiasa dikemaskini untuk merancang pembangunan yang lebih berkesan dan mampan. Gunatanah perlu diuruskan dengan baik untuk mencapai keseimbangan antara pembangunan fizikal dan pemeliharaan alam sekitar. Selaras dengan keperluan tersebut, JPBDSM telah membangunkan ***Sistem Maklumat Gunatanah Perancangan Bersepadu atau lebih dikenali sebagai I-Plan.*** *Tujuan utama sistem ini adalah bagi mengatasi masalah pengemaskinian maklumat perubahan gunatanah yang tidak dikemaskini selari dengan perubahan pembangunan yang berlaku. Sistem I-Plan mempunyai pangkalan data gunatanah geospatial yang bersepadu berasaskan Sistem Maklumat Geografi yang mengaplikasikan teknologi sumber terbuka (open source). Pangkalan data geospatial gunatanah yang dibangunkan akan membolehkan kerja-kerja pengumpulan, verifikasi, pemantauan, integrasi dan perkongsian data antara JPBD dan lain-lain agensi dilakukan secara dalam talian.*

PENGENALAN

Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (JPBDSM) merupakan custodian gunatanah perancangan yang bermatlamat untuk mewujudkan pangkalan data jabatan yang berkualiti, tepat, bersepadu, dan terkini. Ini kerana, maklumat gunatanah perancangan telah digunakan secara meluas sebagai asas maklumat dalam bidang pelaburan, kesihatan, statistik, kejuruteraan pengairan, rancangan pemajuan, penentuan projek pembangunan dan kawalan perancangan.

Bertepatan dengan itu, adalah amat kritikal bagi Jabatan untuk memastikan maklumat gunatanah perancangan berkualiti, tepat, bersepadu, lengkap dan terkini kerana data perancangan ini digunakan oleh pelbagai pihak.

INOVASI SISTEM MAKLUMAT GUNATANAH PERANCANGAN BERSEPADU *(I-PLAN)*

Sistem I-Plan ini dibangunkan menggunakan teknologi geospatial sumber terbuka iaitu selaras dengan Pelan Induk *Open Source System (OSS)* yang dilancarkan oleh MAMPU di mana sistem pengurusan pangkalan data atau *relational database management system (RDBMS)* menggunakan perisian *postGIS* dan *postgreSQL plus advanced* kerana ciri-ciri keterbukaan format pangkalan data yang boleh diakses serta dibaca menggunakan tiga perisian desktop GIS berbeza iaitu ArcGIS, Mapinfo dan Quantum GIS.

Kolaborasi yang padu antara semua pihak juga merupakan asas utama kejayaan pembangunan Sistem *I-Plan.* Pelbagai agensi kerajaan diperingkat tempatan, negeri dan persekutuan telah bersama menyumbangkan masa, tenaga dan idea dalam usaha mengemaskini data gunatanah perancangan sekaligus dapat memantapkan Sistem *I-Plan*. Pengurusan maklumat gunatanah perancangan secara mendatar dan menegak ini melibatkan 11 JPBD Negeri dan 99 Pihak Berkuasa Tempatan (PBT). Proses pengurusan maklumat gunatanah perancangan ini dirangka secara sistematik terutamanya bagi kerja-kerja pengemaskinian data agar data sentiasa terkini dan tepat.

Secara ringkasnya, sistem ini menyediakan satu platform pangkalan data yang komprehensif bagi membolehkan kerja-kerja pengumpulan, pemantauan, verifikasi, integrasi dan perkongsian data antara agensi dapat dilakukan secara atas talian. Melalui sistem ini, ia menjadi landasan untuk mencapai hasrat Jabatan sebagai Pusat Maklumat Gunatanah Negara yang bertanggungjawab untuk menyelaras data gunatanah seluruh negara bagi tujuan perancangan bandar khususnya dan pengurusan pembangunan negara amnya.

KEBERKESANAN *I-PLAN*

Sistem *I-Plan* yang dibangunkan ini, mengandungi pangkalan data dan aplikasi berasaskan web yang menunjukkan maklumat gunatanah perancangan bersepadu yang mengandungi ciri-ciri pembangunan aplikasi yang interaktif, responsif dan mesra pengguna.

Sistem *I-Plan* berkeupayaan memberi maklum balas berkaitan perancangan dengan cepat dan tepat terutamanya kepada pembuat dasar negara selaras dengan peranan JPBDSM iaitu bertanggungjawab dalam memberi khidmat nasihat kepada Kerajaan Persekutuan dalam segala hal perancangan yang berkaitan penggunaan dan pembangunan tanah. Selain itu, ia juga berperanan membantu kerajaan negeri, PBT dan agensi-agensi kerajaan dalam penentuan projek pembangunan di peringkat negeri dan tempatan yang secara tidak langsung, sistem ini merupakan medium saluran penyampaian maklumat yang berkesan kepada pihak berkepentingan.

Dengan adanya sistem *I-Plan* ini, kos bagi menjalankan kajian lapangan untuk penyediaan Rancangan Pemajuan dapat dikurangkan dengan menggunakan data yang disediakan sebagai panduan. Secara tidak langsung ia dapat mengurangkan beban kewangan kerajaan.

Penjimatan masa dapat ditingkatkan kepada pengguna dimana data dapat diakses dengan mudah dan pantas menerusi capaian sistem *I-Plan*. Pengguna juga boleh membuat semakan lot bagi lokasi yang dicari menerusi tablet atau telefon pintar dan ianya merupakan antara keberkesanan sistem yang dibangunkan ini.

SIGNIFIKAN *I-PLAN*

Pembangunan Sistem *I-Plan* berupaya memenuhi keperluan pihak berkepentingan di mana Pihak Berkuasa Negeri (PBN) dapat memantau dan memastikan PBT dan agensi teknikal negeri melaksanakan kerja-kerja pengemaskinian maklumat gunatanah secara berkala.

Sistem *I-Plan* turut menyediakan data gunatanah perancangan yang sentiasa dikemaskini untuk seluruh Semenanjung Malaysia dan dapat membantu pembuat keputusan menentukan hala tuju pembangunan di kawasan mereka dengan menggunakan tiga jenis data gunatanah perancangan yang disediakan iaitu data gunatanah semasa, komited dan *zoning*. Pemetaan gunatanah komited dapat membantu melihat tekanan pembangunan di lokasi tertentu manakala gunatanah zoning dapat melihat corak pembangunan pada masa hadapan. Pemantauan penguatkuasaan dan kawalan aktiviti gunatanah ini juga dapat dilakukan dengan berkesan kerana data disimpan mengikut tahun.

Menerusi sistem ini, pemantauan, penguatkuasaan dan kawalan ke atas aktiviti gunatanah dapat dilaksanakan dengan lebih berkesan di mana sistem ini menyediakan paparan maklumat statistik, peta, carta bagi memudahkan pemantauan perubahan gunatanah. Selain itu, penyediaan pangkalan data secara berpusat memudahkan integrasi data antara agensi di setiap peringkat persekutuan, negeri dan tempatan melalui perkongsian maklumat secara menegak dan mendatar.

Penyeragaman maklumat gunatanah perancangan dengan mengguna pakai format dan struktur data yang telah disediakan merupakan ciri utama dalam sistem ini. Kepelbagaian format sebelum ini seperti *.tab, shapefile* dan *CAD* dapat diatasi dan menjimatkan kos/sumber melalui pembangunan projek ini.

Pertindihan kerja antara agensi dapat dielakkan merupakan salah satu impak positif kepada kerajaan dan orang awam. Peranan PBN dan agensi teknikal negeri dapat digalas secara bersama melalui perkongsian maklumat yang dilaksanakan. Selain itu, sistem ini juga dapat meningkatkan integriti maklumat data gunatanah yang terkini, lebih tepat dan sahih melalui pembaharuan dan penambahbaikan ke atas pelaksanaan proses kerja pengemaskinian data. Proses kerja pengemaskinian dibahagi mengikut kategori gunatanah semasa, komited dan *zoning* serta peranan agensi yang bertanggungjawab adalah lebih jelas.

PELUASAN *I-PLAN*

Perancangan sistem ini dibahagikan kepada modul dan *outcome* yang dapat dirumuskan seperti berikut:

Modul Plan Making bagi sistem *I-Plan* berfungsi sebagai penyediaan pelan spatial bagi membantu PBT mengenalpasti keperluan dan kehendak semasa kawasan setempat dalam penyediaan rancangan pemajuan.

Dengan adanya modul ini, laporan untuk sesuatu kajian dokumen perancangan termasuklah kajian pengubahan dapat dijana dengan menggunakan data-data yang terdapat dalam pangkalan data *I-Plan*. Penambahan data-data berkaitan seperti data kecerunan, *building footprint*, kepadatan penduduk merupakan *output* kepada fungsi modul ini.

Modul Development Control dicadangkan sebagai fungsi bagi proses pengemaskinian maklumat yang diperlukan dalam proses kebenaran merancang. Selain itu, modul ini berperanan untuk membantu pihak PBT membuat keputusan dalam memberi kelulusan terhadap suatu cadangan pemajuan di dalam kawasan pentadbirannya. Dalam modul ini maklumat berkenaan nisbah plot, *plinth area* dan kepadatan akan dipaparkan bagi membantu pihak PBT membuat keputusan ke atas sesuatu permohonan.

Mobile updating merupakan cara pengemaskinian data paling cepat dan tepat yang boleh dilakukan. Sekiranya *mobile updating* dilaksanakan kelak, proses pengemaskinian data gunatanah akan menjadi lebih mudah kerana data yang dicerap boleh dikemaskini secara terus di dalam sistem *I-Plan* oleh pengguna samada di peringkat PBT mahupun untuk pihak JPBD Negeri.

Crowd sourcing merupakan satu cadangan untuk mendapatkan maklumat daripada orang awam untuk dimasukkan ke dalam sistem *I-Plan.* Maklumat yang diberikan melalui *crowd sourcing* perlu dikenalpasti dan diintegrasikan ke dalam maklumat perancangan atau maklumat berkenaan peta dalam sistem *I-Plan*. Sebagai contoh pengguna awam boleh mengemaskini nama tempat atau nama sesebuah institusi dalam pemetaan sistem *I-Plan.*

Sistem sokongan perancangan boleh dibangunkan dengan sistem perancangan lain dengan menggunakan maklumat tambahan untuk diambilkira dalam menambahbaik sistem *I-Plan* di mana *Planning Support System (PSS)* adalah *subset instrumen* geo-maklumat yang digunakan untuk meneroka dan menyokong proses perancangan gunatanah di mana maklumat yang ada digunakan untuk menjana penyelesaian. Sebagai contoh PSS yang digunakan oleh *Australian Urban Research Infrastructure Network (AURIN)* dalam gunatanah perancangan.

RUMUSAN

Sistem *I-Plan* ini adalah satu initiatif pembangunan sistem yang komprehensif melibatkan kolaborasi dan integrasi dalam penyampaian maklumat secara menegak antara JPBD Semenanjung Malaysia dan mendatar antara agensi di setiap peringkat persekutuan dan negeri.

Maklumat gunatanah perancangan bersepadu yang dikemaskini merupakan maklumat utama yang diperlukan untuk merancang dan memberi input kepada pembuat keputusan dalam membangunkan dan merancang sesuatu pembangunan di sesuatu kawasan.

Sistem *I-Plan* yang dibangunkan merupakan satu inisiatif untuk menggalakkan penggunaan teknologi maklumat dan komunikasi (ICT) ke arah perkongsian data dengan pelbagai agensi bagi mengatasi masalah pertindihan data dan kerja di antara jabatan dan agensi. Penglibatan pelbagai jabatan, agensi dan badan tertentu dalam menyedia, mengguna dan menambah nilai data gunatanah telah menjadikan *I-Plan* sebagai satu sistem pengurusan dan perkongsian maklumat gunatanah perancangan bersepadu yang sesuai digunakan di pelbagai peringkat.

FEASIBILITY STUDY TO DETERMINE HEIGHT INFORMATION INTO CADASTRE BOUNDARY MARK

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Keywords: Cadastre, Cadastre Boundary Mark, Height Information

1. INTRODUCTION

Department Survey and Mapping Malaysia (DSMM) has initiated the modernization program of the cadastre survey system in stages in line with the advancement of current technologies. eCadastre is the latest venture in empowering the digital cadastre database of DSMM in order to accelerate the delivery system for land title surveys. It is implemented with the new fully GIS-ready database, namely the NDCDB. At present, NDCDB contains 40 million CBMs based on Geocentric Datum of Malaysia 2000 (GDM 2000) for Peninsular Malaysia and Federal Territories of Malaysia (Taib, 2012). Recently, NDCDB has adopted a database of two-dimensional, where the information is stored in two-dimensional planimetric coordinate (North (N), East (E)) without vertical information (Height (H)).

However, in the future, 2D information may no longer capable of serving the community owing to the high demands for enriching information from the NDCDB, notably in more complex high-density developments in urban areas. Enhancement of existing NDCDB is required to suit the current circumstances. One way to deal with this situation is by having more 2D Cadastre database which include the 3D information about land information to NDCDB. This study is carried out to create height information to 2D land parcels and generate the terrain surface in 3D space.

2. AREA OF STUDY

For the implementation of this study, fieldwork observation is carried out for generating height information into Cadastre Boundary Marks (CBMs) at lot 48330, Bandar Johor Bahru, Johor. As seen in **Figure 1**, it shows the location of study area.

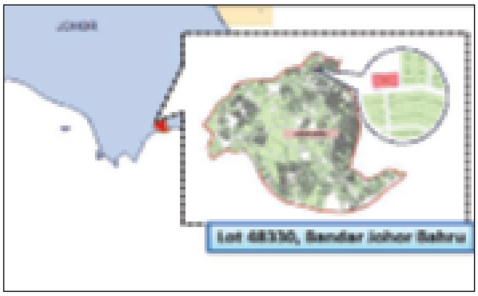

Figure 1: The Location of Study Area

3. TECHNICAL ASPECT OF 3D DATA ACQUISITION AND PROCESSING

In eCadastre environment, the adjustment only implicates 2D data. To create 3D NDCDB, an adjustment with 3D data should be done. For this study, the output coordinates (N, E) for horizontal and (H) for vertical derived in the formation of 3D NDCDB must be compatible with the existing coordinates.

The detailed studies should be conducted for field data acquisition using Digital Field Book (DFB); adjustment and calculation of observed data; changes of format and structure of the existing system; 3D NDCDB with height information of each boundary mark, Digital Terrain Model (DTM) and three-dimensional Certificated Plan (CP).

3.1 Field Aquisition Using Digital Field Book

In current practice, the acquisition of field data observation in cadastre survey is purposely to produce the horizontal information in 2D planimetric coordinate. Vertical information and height value were important as they were used to be added into new CBMs in order to create 3D NDCDB. Other than that, several field attributes were required such as the height of the instrument and height of the target which have to be added into Electronic Total Station (eTSM) software for implementation of 3D NDCDB.

eTSM was a part of the Virtual Survey System (VSS) and one of the components in eCadastre environment. By having this system, the measurements were carried out by field surveyors toward technology in ICT, GIS environment and GPS approach. In fulfilling this requirement, the trigonometric levelling method has been used. In field data acquisition stage, the observation was started with CRM. Nonetheless, a height value from CRM was referred to ellipsoid and derived from GPS observation. **Figure 2** shows the CRM point within the study area.

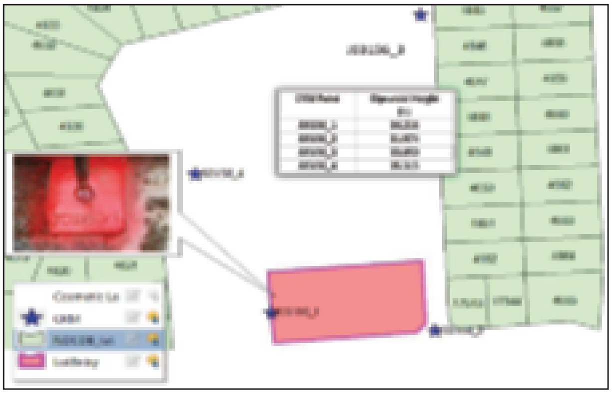

Figure 2: CRMs Point in Study Area

The ellipsoidal height (h) acquired from GPS was not used directly for practical surveying and should be transformed into orthometric height (H) using a local geoid model. This process uses the equation below;

$$H_{\text{Orthometric height}} = h_{\text{Ellipsoidal height}} - N_{\text{Geoid height}} \qquad (1)$$

In this study, the geoid height value (N) was acquired from MyGEOID. The next procedure was to set up the equipment of CRM station and the target height of the other instrument was taken. The height difference was calculated during traversing in order to acquire the height value of every station and the data was recorded. **Figure 3** shows the traversing in the study area.

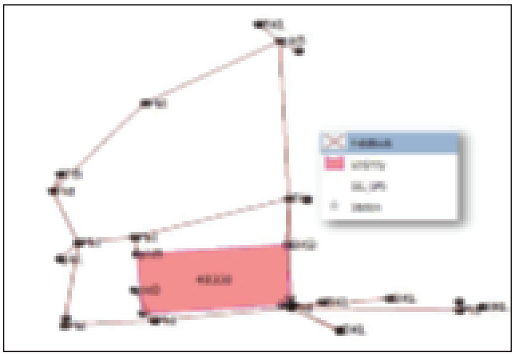

Figure 3: The Traversing in Study Area

3.2 Observation Record Format

The field data acquisition in eCadastre environment was fully digitized. In current practice, the field data observation is recorded using Digital Field Book (DFB). Based on the study, height value from boundary marks was an additional information that would create a 3D NDCDB and changes of format and structure for the existing DFB must be changed to suit those requirements. Therefore, several fields were added in the output of observation record format. **Figure 4** shows the new field attribute.

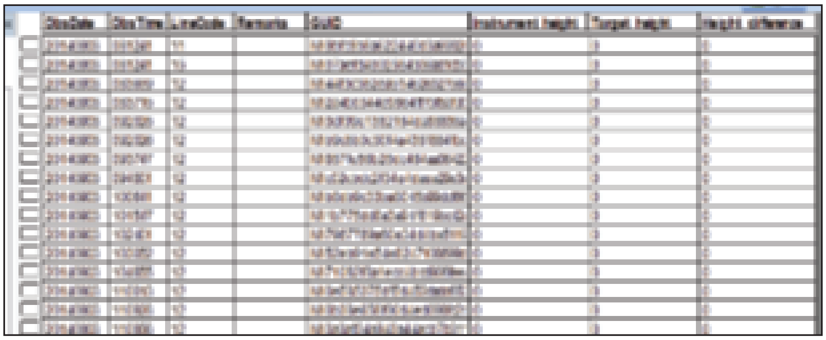

Figure 4: The New Fields Attribute

3.3 Adjustment and Calculation of Observed Data

In current situation, the LSA has been fully utilized in the cadastre survey in Malaysia to produce final bearing. For adjustment and calculation of vertical information height from CRM (h) ellipsoidal height must convert to orthometric height (H) using equation defined in (1). In this process the geoid (N) values were acquired from MyGEOID using GRAVSOFT (Geodetic Gravity Field Modelling Programs) software.

This software was purposely for regional and local gravity field modelling which contains a complete suite of programs for geoid modelling, conversion of satellite altimetry to gravity data, prediction of deflections of the vertical, etc. As can be seen in **Figure 5**, it shows the interface of the GRAVSOFT Software Interface and **Figure 6** shows the converted process using GRAVSOFT Software.

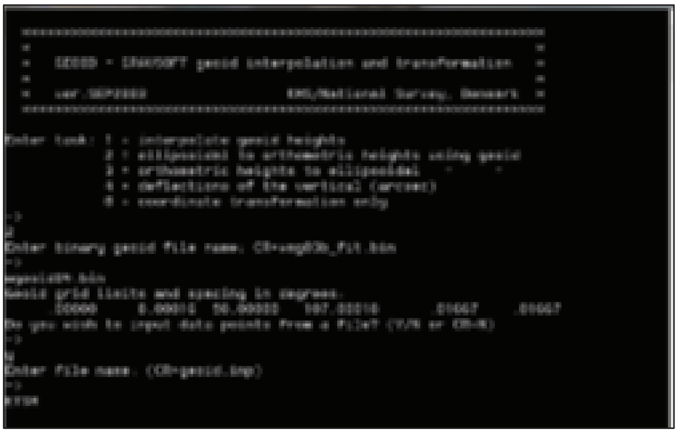

Figure 5: GRAVSOFT Software Interface

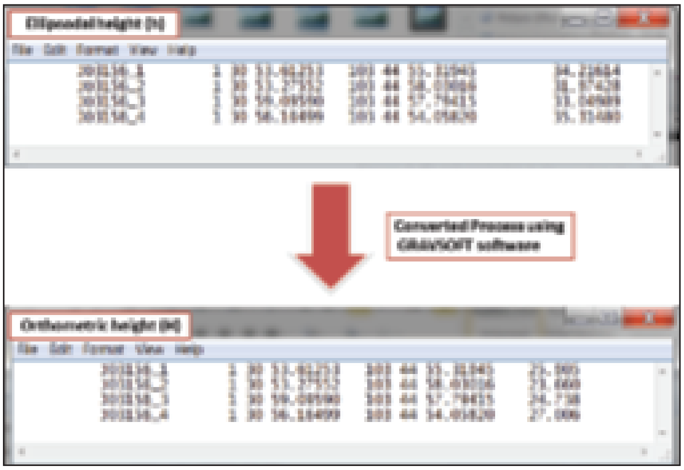

Figure 6: Converted Process using GRAVSOFT Software

After getting height information for CRM, the next process was to determine height information into new CBMs. To determine the elevation difference between A and B by the trigonometric levelling technique was illustrated in **Figure 7**. The vertical angles between the points were needed and then compute the distances using them.

The formula for getting difference height was:

$\Delta H = V_{AB} = L \sin \alpha = D \tan \alpha$ (2)

Where:

α	=	Vertical angle
z	=	Zenith angle
D	=	Horizontal distance
L	=	Slope distance

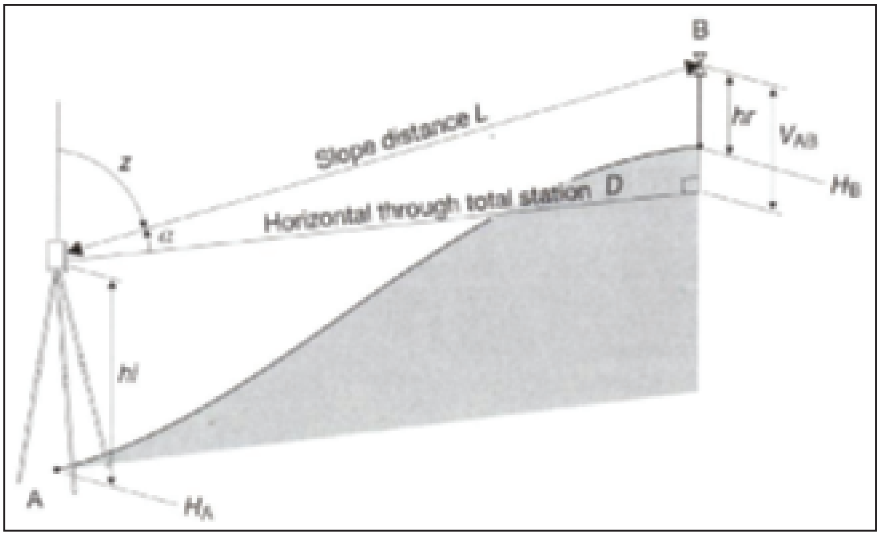

Figure 7:Trigonometric Levelling Technique to Determine Height Differences (Caulfield, 2014)

To obtain the height of station B, the equation was used

$H_B = H_A + V_{AB} + i - t$ (3)

Where:

H_B	=	Height Station B
H_A	=	Height Station A
V_{AB}	=	Difference Height between A and B
i	=	Height Instrument
t	=	Height Target

The value of elevation angle (α) was positive if the telescope was tilted about the horizontal through the total station.

4. RESULT AND ANALYSIS OF CADASTRE BOUNDARY MARKS WITH HEIGHT INFORMATION

In this study, several facets such as output structure, 3D Certificates Plan (CP), visualization and accuracy of height information derived for new CBMs. From the results, it indicates the appropriateness of the method that was used to obtain height information into new CBMs.

4.1 Output Structure

The output structure has been divided into three (3) stages. The first stage was the output of data collection, the output of the Digital Field Book (DFB) and following the output of NDCDB data structure.

4.1.1 Output of Data Collection

The output of data collection included eCRM and eTSM system. Based on this study, the amendment of the existing output files in this system would be suggested.

a) eCRM

After the collection data was completed, the output data were sent to CRM office section for quality data checking. In the current situation, the CRM office section is concentrated on the evaluation of planimetric data only. Actually, in this stage, a converted processed from ellipsoidal height (h) to orthometric height (H) could be executed if geoid data (N) were acquired from DSMM. When orthometric height (H) from CRM-derived allowing the determination of the orthometric height of the front station in cadastre survey data. For this study, an orthometric height was generated using GRAVSOFT Software (MyGEOID). **Table 1** shows the height information of CRMs in the study area.

Table 1: Height Information of CRMs in the Study Area.

CRM	North	East	Ellipsoidal Height (h) (m)	Orthometric Height (H)(m)
J03156_1	-58347.358	20876.988	34.216	25.905
J03156_2	-58357.691	20960.793	31.974	23.660
J03156_3	-58178.936	20953.492	33.050	24.738
J03156_4	-58268.959	20837.992	35.315	27.006

b) eTSM

In eTSM stage, orthometric height from CRMs was carried out using a trigonometric levelling technique. As can be seen in **Figure 8** and **Figure 9**, shows that height information of CRMs and height information for each point in cadastre survey respectively.

Figure 8: Height Information of CRMs

Figure 9: Height Information of each Point in Cadastre Survey

With the new requirement to produce height information for every boundary mark, the format and structure of the existing output for data collection by using Total Station shall be also enriched. As can be seen in **Table 2, Figure 10** and **Figure 11** below shows the suggestion to amend in the Field Book (*.fbk) and Coordinates Information (*.coo) respectively which must create the new column to putting height information. Also, for creating height information into new CBMs a few amendments must be done in eTSM programming to suit for the new requirement. Nevertheless, this study was not covered by the amendment of this matter.

Table 2: The Current File in eTSM and Suggestion of the Amendment of the Existing Output Files

NO.	FILE	FILE FORMAT
1	Field Book	*.fbk
2	Coordinates Information	*.coo
3	Traverses	*.tps
4	Solar Observation	*.sob
5	Corrections	*.cor
6	Bearing Close Statement	*.bcs
7	Area Comparison	*.acs
8	Deduced Field Data	*.ncp
9	Fahrasat	*.fah
10	EDM Test	*.edm
11	Topography	*.tpo
12	Job Details	*.job
13	Bearing, Distance & Coordinates	*.bdy
14	Old Value	*.po
15	Base Line	*.bln
16	Lot Details	*.lot

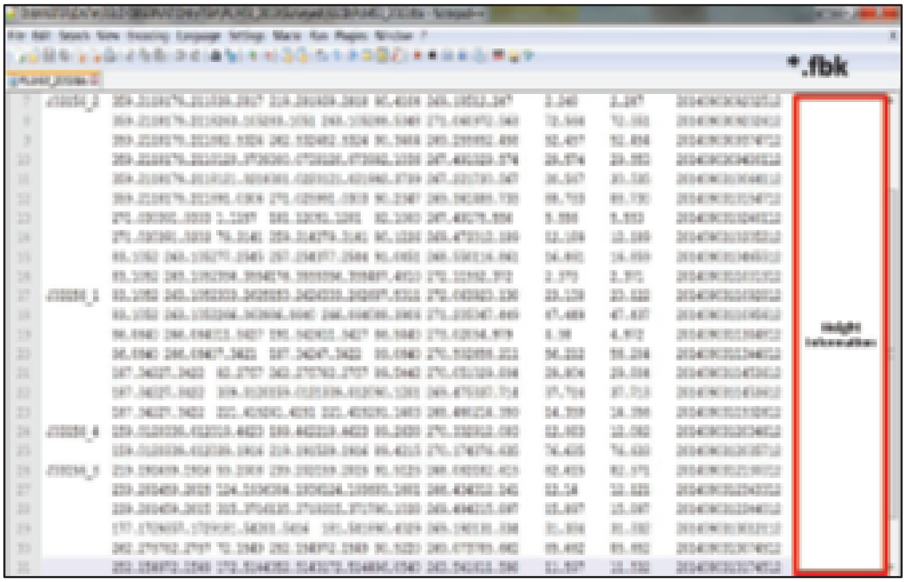

Figure 10: The *.fbk ascii File

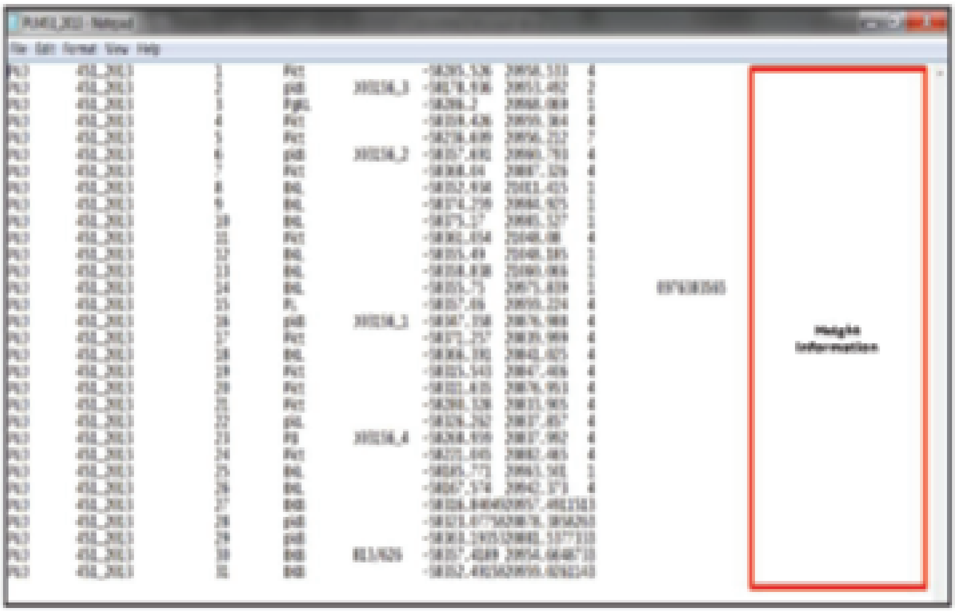

Figure 11: The *.coo File

4.1.2 Output of DFB

When height information was created into every point in the field cadastre survey, the output of DFB also must be changed. Several new information were generated into DFB. The detailed current and new DFB were given in Appendix C and Appendix D respectively. As can be seen in

Figure 12 it shows the current DFB and **Figure 13** shows the new DFB.

Figure 12: The Current Digital Field Book

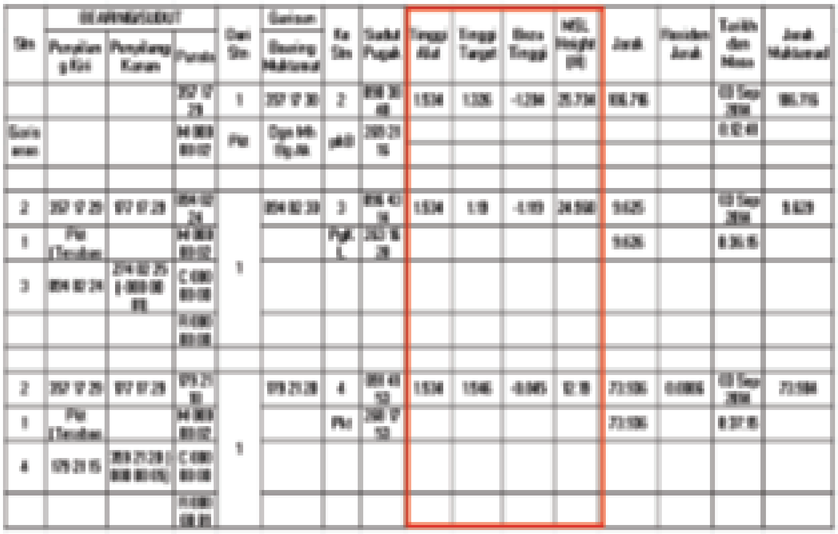

Figure 13: The New Digital Field Book

4.1.3 Output NDCDB Data Structure

To develop the 3D NDCDB, the existing NDCDB structure should revamp to accommodate the height information into new CBMs. Elevation information should be stored in the NDCDB stone layer. As can be seen in **Figure 14** it shows the current NDCDB stone layer and **Figure 15** shows the new NDCDB stone layer.

	ID BATU	UTARA	TIMUR	KOD PENJELA	STD ERR UTA	NOS
☐	2340293889	-59386.614	22342.760		0.012	
☐	2340393512	-59349.055	22342.955		0.013	
☐	2340601891	-60186.740	22343.153	0	0.006	
☐	2341301066	-60104.142	22343.914	0	0.003	
☐	2341496894	-59669.354	22344.577		0.011	
☐	2341699203	-59917.907	22344.199	0	0.006	
☐	2342000779	-60075.515	22344.572	0	0.008	
☐	2342199734	-59971.023	22344.715	0	0.006	
☐	2342293256	-59323.379	22344.816		0.013	
☐	2342399374	-59934.975	22344.863	0	0.007	

Figure 14: The Current NDCDB Stone Layer without Height Information

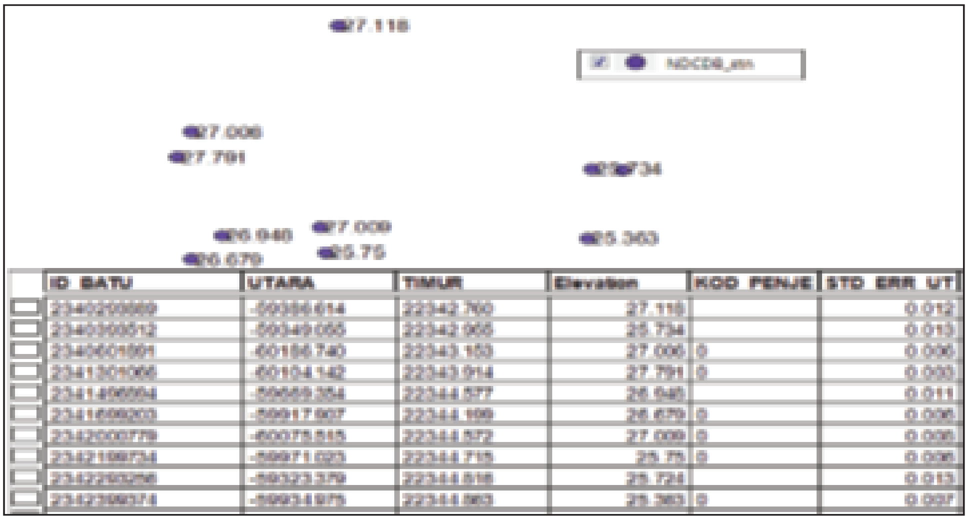

Figure 15: The New NDCDB Stone Layer with Height Information

4.2 3D Certificates Plan

After height information completed created in NDCDB, the 3D Certificates Plan could be also generated. As can be seen in **Figure 16** shows an example of 3D Certificates Plan of Lot 48830, Bandar Johor Bahru, Johor Darul Takzim.

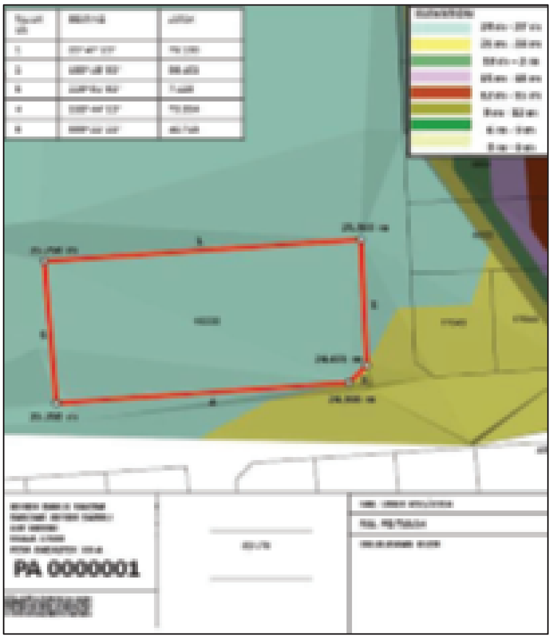

Figure 16: 3D Certificates Plan

4.3 Visualization

Similarly, with existing CBMs, the area of study could be visualized and as can be seen in **Figure 17** shows the 3D NDCDB of the study area.

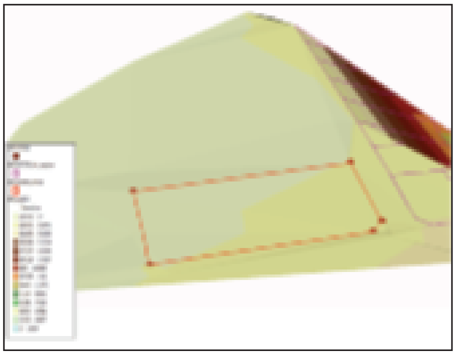

Figure 17: Visualization 3D NDCDB of the Study Area

4.4 Accuracy of Height Information Derived from New Cadastre Survey

The accuracy of new CBMs derived was based on the accumulated error from CRM to new CBMs and was illustrated in **Figure 18** as well as using the equation (4) below.

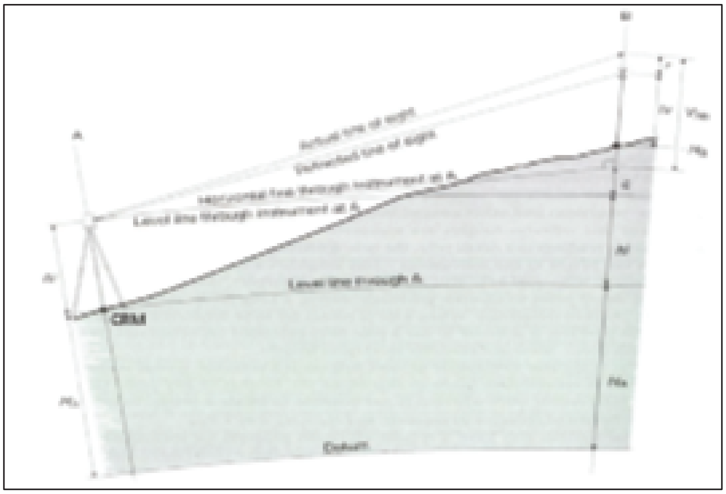

Figure 18: The Distance between A and B, with Accumulated Errors Introduced (Caulfield, 2014)

$$H_B = H_{A(CRM)} + h_i + V_{AB} - h_r + (c - r) \qquad (4)$$

Where:

H_B	=	height station B
$H_{A(CRM)}$	=	height station A (CRM)
h_i	=	height instrument
V_{AB}	=	Difference height between A and B
h_r	=	height target
c	=	curvature
r	=	refraction

According to the error propagation law, from (4) the following equation can be created.

$$\sigma^2_{HB} = \sigma^2_{HA(CRM)} + \sigma^2_{hi} + \sigma^2_{VAB} - \sigma^2_{hr} + (\sigma^2_{c} - \sigma^2_{r}) \qquad (5)$$

From (5), the detailed explanation was stated below.

The height from CRM (h) ellipsoidal height must convert to orthometric height (H) by using MyGEOID. As mentioned earlier, the accuracy of CRM (h) was ±6 cm for vertical components and accuracy of MyGEOID (N) is ±5 cm. The error in CRM was calculated according to equation (6) below.

$$\sigma^2_{HA(CRM)} = \sigma^2_h + \sigma^2_N + 2\sigma_{hN} \quad (6)$$

In equation (6), $2\sigma hN$ is 0, and thus the following equation could be created.

$$\sigma^2_{HA(CRM)} = \sigma^2_h + \sigma^2_N \quad (7)$$

$$\sigma = \pm 8 \text{ cm}$$

In acquiring the height difference between the two stations, other important elements were needed such as instrument height *(h_i)* and target height *(h_r)*. In this context, the total station was set up over a point whose height was identified. The height must then be transferred to the total station by measuring height instrument. The height instrument was the vertical distance from the reference height to the total station horizontal axis. Ordinarily, the total station will have a horizontal axis index mark standard. In this study, a tape was used to obtain the instrument height and target height. Nevertheless, measuring with a tape cause an error, but the error was very small and considered negligible.

Essentially, the errors were defined in electronic distance measurement. The accuracy of distance measurement specified using total station had a linear accuracy quoted in the form ± (a mm + b ppm). The constant was independent of the length being measured and comprises of internal sources within the instrument that were ordinarily beyond the control of the user. Moreover, it was an estimate of the individual errors caused by such parameter as undesired phase shifts in electronic components, errors in phase and transit time measurements. According to the linear accuracy, the systematic error (b) was proportional to the distance being surveyed, where 1 part per million (ppm) was equivalent to an additional error of 1mm for every kilometer surveyed. For this study, Leica TS06 total station varies from ± (1.5 mm + 2 ppm) to ± (3 mm + 2ppm) was used. The linear accuracy does not affect the short distance, but should be considered for long distances.

For example: ± (1.5 mm + 2 ppm), at 100 m the error in distance measurement will be ± 1.5 mm but at 1.5 km, the error will be ± (1.5 mm + [2 mm/km *1.5 km]) = ± 4.5 mm. Due to the error that exists only in the millimeters level, it also considered negligible.

To obtain the accuracy of height difference, referring a study executed by Zhou and Sun (2013), stated that the error in the observation height difference (V_{AB}) of the station were shown in T**able 3** (Zhou and Sun, 2013).

D	σ (mm)			
	0°	5°	10°	15°
60m	0.58	0.64	1.05	1.43
80m	0.48	0.82	1.17	1.52
100m	0.97	1.01	1.31	1.64
150m	1.45	1.48	1.71	1.99
200m	1.94	1.96	2.15	2.39
300m	2.91	2.92	3.08	3.28
400m	3.88	3.89	4.03	4.22
500m	4.85	4.86	5.00	5.18

Table 3: The Error in the Height Difference (Zhou and Sun, 2013)

In this study, all the distances were measured between 2 meters-110 meters. From the **Table 3** above, it could be used as a reference in the estimated error in the height difference derived which is ±1.7 mm. Based on the results, this error was also considered negligible.

Apart from that, the other source of error in determining the difference in height by trigonometric levelling techniques was the uncertainty in the curvature and refraction caused by variations in the atmospheric circumstances (Ave, 2000). But it occurs when trigonometrical height was carried out over long distances (more than 500 m), impact on the curvature of the earth and atmospheric refraction should be considered (Zhou and Sun, 2013).

A value for the combined correction for curvature and refraction *(c-r)* could be derived such as:

The curvature correction c is as follow by

$$c = \frac{D^2}{2R} \qquad (8)$$

Where:

D = horizontal distance between A and B
R = radius of the earth. Taking R to be 6370km
C (in meters) = $0.0785D^2$ (D in km)

According to Caulfield (2014), the influence of refraction in the atmosphere was often assumed to bend the line of sight of the total station towards the Earth, so that it decreases the influence of curvature by a ratio of about 1/7 and the combination of correction for curvature and refraction were often quoted as:

$$(c\text{-}r)(\text{in meters})) = \tfrac{6}{7}0.0785D^2 = 0.0673D^2 \text{ (D in km)(Caulfield, 2014)} \qquad (9)$$

Meanwhile, a study conducted by Nestorovič and Delčev (2015), stated that the changes of height differences influenced by changes of air refraction coefficients are shown in **Table 4** (Nestorovič and Delčev, 2015).

Distance (D) (m)	**100**	**150**	**200**	**250**	**300**
δh (m)	0.0000	0.0001	0.0002	0.0004	0.0005

Table 4: Influence of Air Refraction Coefficient Changes between Two Points on Height Difference (Nestorovič and Delčev, 2015)

Nevertheless, if the distance measurement between two stations was very short, the influence of curvature and refraction on height differences obtained by trigonometric levelling shall be insignificant and the accuracy of the distance obtained can be high (Zhou and Sun, 2013 and Nestorovič and Dečev, 2015).

In that sense, the results of height differences obtained by a trigonometric levelling method for this study was not affected by the influences of curvature and refraction because the all distances were measured between 2 meters-110 meters. The error due to curvature and refraction can be eliminated with proper field procedures.

5. CONCLUSION

As a conclusion, based on the initial study that has been carried out, the results indicate that the suggestion accuracy of height information for new CBMs was referring to accumulate error from CRM to new CBMs. According to equation (4.2), $H_{A(CRM)} = \pm 8$ cm, $h_i = 0$, $V_{AB} = 0$, $h_r = 0$ and $(c - r) = 0$. From all the factors above, it is suggested that estimation accuracy of height information for new CBMs was ± 8 cm.

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EFFECT OF SOIL MOISTURE ON GROUND PENETRATING RADAR (GPR) DETECTION AT THE DEPARTMENT OF SURVEY AND MAPPING MALAYSIA (DSMM) GPR TEST BASE

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KEY WORDS: GPR, Test base, Soil Moisture, Time zero adjustment, Amplitude Correction.

ABSTRACT:
Ground-penetrating radar (GPR) is a non-destructive geophysical method that produces detailed subsurface images without underground access. A study was undertaken to assess the suitability of using GPR in relation to sites or soil layer condition related to moisture content. The selected test site was located at the Headquarters of the Department of Survey and Mapping Malaysia (DSMM) in Kuala Lumpur. The site consists of utility pipes and cables, which are sewerage, electric, gas and water. Each utility pipe or cable installed is made from different type of material, and have different diameter and depth of installation. MALÅ Geosciences Ltd 'RAMAC/GPR' systems were used to survey and collect the data. The results showed that GPR has the potential to be an effective tool for identifying the buried pipes/cables in dry sand/soil and average sand/soil, but not in wet sand/soil. In Malaysia where soils in many areas are often high in clay content the absorption losses can be quite high. The effects on soil moisture at DSMM test base during the test is carried out after the rain and dry where situations appear that the penetration depth is only about sub-meter with a standard deviation of 0.05m. Compared to dry situations where the penetration depth is up to 2 meters with standard deviation is 0.02 to 0.05. However, the sewerage pipe was not well distinct because of pipe materials is made by clay and quite similar with the test base soil type. Based on the result, it is concluded that moisture at the test field site has a significantly influence in the analysis. It has high effect on the visibility of the GPR signal. Since the field test site was built at an open space, the moisture could not be controlled. The finding can also contribute to underground mapping at DSMM to develop National Underground Utility Database (NUUDB) in the future.

1. INTRODUCTION

In Malaysia, underground utility mapping was identified as a new priority. Taking into account the increasing instances of catastrophic damages of underground utilities and disruption of existing utility services from excavation works, the Cabinet, in its meeting on 24th August 1994, decided that the Department of Survey and Mapping Malaysia (DSMM) shall undertake the responsibility of maintaining a repository of all underground utility data in Malaysia, apart from those kept by the various utility agencies (PKPUP Bil. 1/2006).

Apart from that, DSMM also has been given a mandate to establish, develop and maintain the National Underground Utility Database (NUUDB).The main objective of the establishment and development of NUUDB is to store the related utility data to be available to utility owners and all other relevant parties whenever it's required. In Malaysia, there are five (5) types of underground utilities to be captured for the need of NUUDB, which are pipes containing gas, water, electrical cables, telecommunication cables and sewerage. One of the main function of DSMM is to produce a large-scale underground utility map.

Ground Penerating Radar (GPR) is one of the equipment that being used in carry out the underground utility survey. It is a state-of-the-art utility locator and a highly efficient way to perform Utility Mapping. GPR is a non-destructive geophysical method uses electromagnetic radiation in the microwave band of the radio spectrum that produces a continuous cross-sectional profile or record of subsurface features without drilling, probing or digging (Davis and Annan, 1989; Peters et al., 1994; Chen and Huang, 1998; Woodward et al., 2003; Booth et al., 2009; Khan et al., 2010; Murray and Booth, 2010; Porsani et al., 2012). It can help to map out the location of buried utilities down to significant depths and characterise both metallic and non-metallic subsurface features (Liu et al., 2007; Belli et al., 2008; Khan et al., 2010; Porsani et al., 2010; Santos et al., 2010; Simi et al., 2010; Porsani et al., 2012).

2. STUDY AREA

2.1 Study Area

The data collection has been done at GPR Test Site, Department of Survey and Mapping Malaysia (DSMM), Jalan Sultan Yahya Petra in Kuala Lumpur as shown in Figure 1.4-1. It is located within latitude N3.171089 and longitude E101.717511.

Figure 1- Study Area

2.2 Data Set

The test base has been chosen because it was designed and built based on the actual conditions of installed utility pipes and cables in Malaysia. Not only that, the material and diameter of installed pipes and cables were recorded and certified by the utility owners to provide the actual environment for surveying.

The dimensions of the test base are approximately 8 metres x 10 metres. It's consists of utility pipes and cables, which are sewerage, electric, gas and water. The material, diameter and depth of the utility pipes and cables installed are different. Since the installed utility pipes and cables are made from different type of material which are the water pipes were made from steel and iron whereas gas pipes, electric cables and sewerage pipes were made from polyethylene, PVC and clay, respectively.At the test base, both ends of the pipes and cables, there are vertical pipes that have been installed in order to measure the pipes and cables depth physically. The horizontal location of each pipe and cable were physically measured from the drain near to the water pipes location.RadExplorer, Ground Vision and Object Mapper were used to process and analyse in the study case.

Figure 2- DSMM Test Base.

3. METHODOLOGY

The methodology included the data collection using GPR to run through certain processes or filters in order to increase the hyperbolic visibility. In this study, a few processes were applied, namely, dewow, time zero adjustment, background removal, amplitude correction and Stolk F-K Migration. By doing this, users' interpretation of the surveyed data are rendered more reliable and useable.

Figure 3 – Methodology adopted from the study

3.1 Data Preparation

Before the survey was carried out, the grid or detection lines have to be identified in order to ensure that GPR is moving forward in straight line. In this study, three lines were drawn perpendicular to the pipe and cable alignment. The lines were drawn near to the both sides of the installed vertical pipes and at the middle of the pipes and cables. The detection lines were selected near to the installed vertical pipes, so that, the depths measured by GPR can be compared to the actual depths measured by measurement tape.

When doing the survey, the start point was close to the drain at the installed water pipes location for every detection line. Then each GPR system was pushed forward along the red detection line in one direction. When it reached to the end of the other side, GPR readings were stopped and the same procedures have been done to the rest of the detection lines.

3.2 Time Zero adjustment

Time-zero adjustment (Adjust Signal Position) – control of the vertical position of the surface reflection (the place in time where the radar pulse leaves the antenna, and enters the subsurface is considered as ”time zero”). Time-zero correction is necessary for adjusting all traces to common time-zero position before processing methods.

3.3 Background Removal

The reflected signal may contain noise and this noise will reduce the visibility of the signal. This makes it difficult for the GPR users to interpret and analyse the data. In RadExplorer, the issue can be resolved by selecting a background removal function (Woodward et al., 2003; Ercoli, 2012; Porsani et al., 2012; Slowik, 2012; Angelopoulos et al., 2013).

3.4 Amplitude correction

The correction was used in order to remove high amplitude, low frequency noise in the recorded signal (< 5MHz). Normally, this noise comes from electronics instrument (Barrett et al., 2008; Murray and Booth, 2010; Carpentier et al., 2012; Ercoli et al., 2012; Godio and Dall’Ara, 2012; Rejiba et al., 2012; Solla et al., 2012; Slowik, 2012; Zhao et al., 2012; Angelopoulos et al., 2013). It is essential to remove the noise from the data because it can dominate the signal recorded at the receiver antenna.

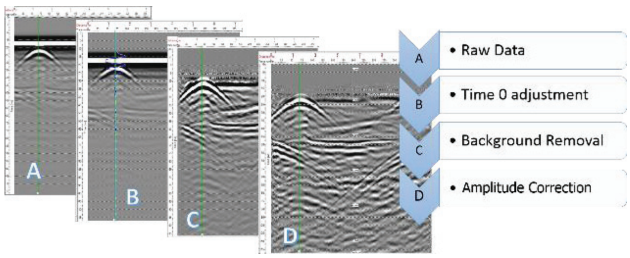

Figure 4a- Radargram processing for low soil moisture

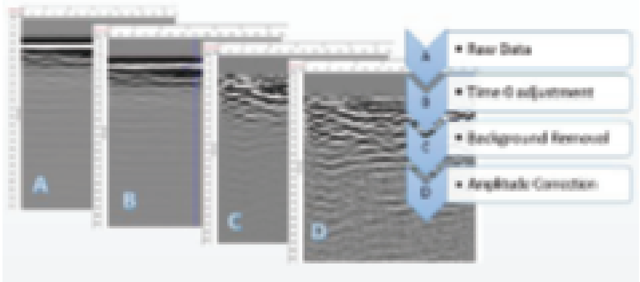

Figure 4b- Radargram processing for high soil moisture

4. RESULT AND DISCUSSION

Table 2 is depicted the differences in depth value obtained from the GPR test site. The observations have been done a day after heavy rain where the soil moisture is high and during the week or month without rain where soil moisture is low. Each conditions were observed for four (4) times, respectively.

Observation without rain			
Obs. 1	Obs. 2	Obs. 3	Obs. 4
17 Feb 2016	18 Feb 2016	19 Feb 2016	3 Mac 2016
Observation a day after rain			
Obs. 1	Obs. 2	Obs. 3	Obs. 4
2 April 2016	4 April 2016	5 April 2016	7 April 2016

Table 1- Date of Observation

The observation a day after heavy rain shows that the true depth reading is difficult and cannot be determined accurately and precisely. After four (4) sets of data were processed (figure 4), only hyperbolic for gas pipe with a depth of 0.5m can be identified. The results of peak hyperbolic measurement indicated that the standard deviation value is 0.05m as shown in Table 2. The result shows that, when the moisture content is high, the effective antenna 250MHz frequency is less than 1meter whereas in dry conditions, the hyperbolic reflection can be seen clearly even before filtering and curve fitting process is carried out. However, the sewerage pipe was failed to be detected at a depth of 2.4m (Figure 4.4 6). With that, it can be concluded that the material of pipe at GPR test site was composed using the same composition which is clay and soil. This factor influenced the hyperbolic reflection to the pipe. In this case, it has been proven that the hyperbolic reflection of ±2.4m depth from sources cannot be confirmed where the object which embedded in the test site might be debris.

Utility	True Depth (m)	Depth Measured (m)				Depth Mean (m)	SD (m)
		1	2	3	4		
Gas Pipe	0.5	0.51	0.49	0.45	0.48	0.45	0.02
Water Pipe	1.00	0.96	0.86	0.9	0.9	0.86	0.05
Sewer Pipe	2.47	ND	ND	ND	ND	2.47	
TMB	1.43	1.34	1.34	1.33	1.4	1.33	0.04

ND = Not Distinct

Table 2-. Depth measurement of utility pipe and cable at DSMM GPR Test Base during dry condition in four different days.

Utility	True Depth (m)	Depth Measured (m)				Depth Mean (m)	SD (m)
		1	2	3	4		
Gas Pipe	0.5	0.37	0.45	0.36	0.38	0.36	0.05
Water Pipe	1.00	ND	ND	ND	ND	ND	
Sewer Pipe	2.47	ND	ND	ND	ND	ND	
TMB	1.43	ND	ND	ND	ND	ND	

ND= Not Distinct

Table 3-. Depth measurement of utility pipe and cable at DSMM GPR Test Base a day after heavy rain in four different days. Base during dry condition in four different days.

5. CONCLUSION

The effects on soil moisture at DSMM test base during the test was carried out after the rain and dry condition significantly depth penetration is only about sub-meter with a standard deviation of 0.05m (after raining). Compared to dry condition, where the depth penetration is up to 2 meters with standard deviation is 0.02 to 0.05. However, sewerage pipe is not distinct because of the pipe materials is made by clay and quite similar with test base soil type.The results also showed that the reflection hyperbolic is indistinct for wet soil and sand with minimum soil-moisture content because the conductivity of the subsurface was rather high compared to average soil and dry sand.

As a result, wet sand attenuated the transmission of more signal compared to the other two soil types.This study also showed that the amplitude decreased because the attenuation or signal loss increased as the depth of the target increased. There was a drastic drop in the depth value between 0.5 metre to 1.0 metre depth. Then the depth value gradually decreased between 1.0 metre and 2.5 metres; and this indicated that the depth value became smaller as the soil moisture increased. As a result, the hyperbolic was less visible.It can be concluded that, GPR only effective to detect the depth and location depends on soil electrical conductivity. The soils with high electrical conductivity rapidly attenuate radar energy, which restricts penetration depths and severely limits the effectiveness of GPR (J.A Doolittle, 2007). The appropriate time to conduct the observation using GPR is suggested at least 48 hours after rain or until the soil is in dry condition. In terms of the limitations of this study, it was found that the soil moisture at the test site has significantly influence in the analysis and shows the effect on the visibility of the signal. Since the field test site was built in the open space, the soil moisture could not be controlled. Furthermore, the location of the field test site that nearby to the main road could cause the reflected signal contain noise and this noise will also reduce the signal visibility.

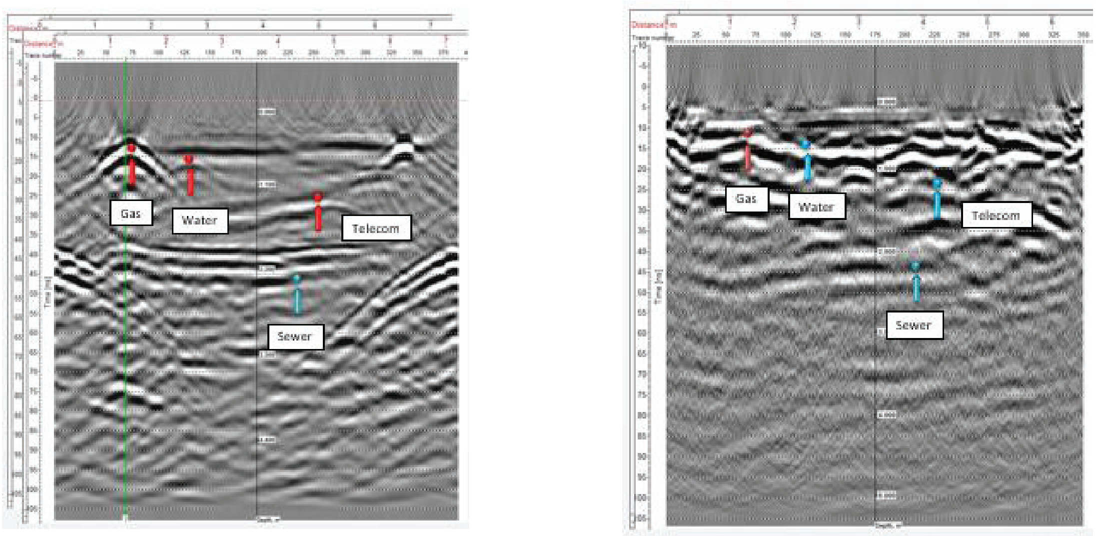

Figure 4- Location of pipes for MALÅ Geoscience System. Red arrow indicates distinct hyperbolic, while blue arrow is the indistinct hyperbolic.

6. SUGGESTION FOR FURTHER WORK

The use of GPR in this study has been successfully shown to aid the underground utility mapping activities. The following recommendations to further evaluate the application of GPR for underground utility mapping are suggested:

- An analysis of the hyperbolic from the buried pipes/cables where the moisture content of the test base and noise can be controlled. It is suggested to design and built a test base inside a building or under covered area. The need to ensure that the new test base is free from noise should be taken into account.
- An evaluation of a lower centre frequency of antenna, especially, for data collection at the field site for the identification of buried pipes/cables with a small diameter.
- A more complete study of the effects of external interference, for example, noise from surrounding areas, on the collected data.

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INTERNATIONAL CIVIL AVIATION ORGANIZATION AND IT'S IMPLEMENTATION OF ELECTRONIC TERRAIN AND OBSTACLE DATA (eTOD)

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1.0 Background

According to the Convention on International Civil Aviation and its Annexes, the International Civil Aviation Organization (ICAO) is entrusted, among others, with the role of establishing communication and information standards for all matters regarding on civil aviation with the aim to safeguard and regulate the civil aviation environment and its implementation.

Nowadays, the expected increase in aviation demands, economic pressure and attention to the environmental impact are relying ever more on accurate and timely information. Air Traffic volume of major airports around the world has increased considerably every year and many years to come. Travelling by air deems to be significance for every country in the world globally in order to empower their economic growth.

For example, Malaysian Airport Holding Berhad (MAHB), the main airport operator in Malaysia reported on their 2014 Annual Report, they have recorded a growth of 18.1%, which has surpassed the expected growth rate of 9.7% for 2014, with the total of 20.6 million passengers having passed through MAHB's 39 airports in Malaysia.

The Star dated 12 January 2015 reported that KLIA recorded 48.9 million passengers, 3.0% above 2013. Apart from the negative incidents, KLIA's growth was also affected by the shift in airlines' domestic operations for direct flights between the domestic airports, as compared to the previous, where connections to domestic airports were mainly through KLIA.

Prior to KLIA2's commencement in May, KLIA Main recorded an average of 17.2% year-on-year growth up to April but it declined to negative 11.2% for the next eight months. KLIA registered 339,680 aircraft movements for 2014. Cargo movements was 758,060 metric tonnes, the highest ever handled at KLIA. As at end of 2014 a total of 62 airlines operated from KLIA to 126 destinations.

Thus to provide for the efficiency of Air Traffic Management (ATM) services, Department of Civil Aviation Malaysia (DCA), the policy holder and the regulator of the civil aviation in the country and one of the signing states under the International Civil Aviation Organization (ICAO) Convention; DCA is giving full support for the ICAO's revised Global Air Navigation Plan (GANP) by following all the steps to formalizing clear and consensus-driven operational benefits under what has been termed the 'Block Upgrade' methodology.

2.0 Aeronautical System Block Upgrade (ASBU)

Today's air traffic management (ATM) system comprises a wide variety of applications developed over time for specific purposes. It is characterized by many communication protocols, each with their own self-contained information systems: on board the aircraft, in the air traffic service unit, etc. Each of these interfaces is custom designed, developed, managed, and maintained individually and locally at a significant cost. ATM information is defined/structured, as well as the way it is provided and used are specific to most of the ATM systems.

The ICAO has introduced various programs to enhance and improve the systems on global scales. System Wide Information Management (SWIM) is an integral part of the Global Air Navigation Plan (GANP) (Doc 9750), fourth edition and is covered in a number of the Aviation System Block Upgrades (ASBU) modules.

According to Michel Procoudine, Thales's SESAR Programme Technical Director, SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services as showing in **Figure 1** below;

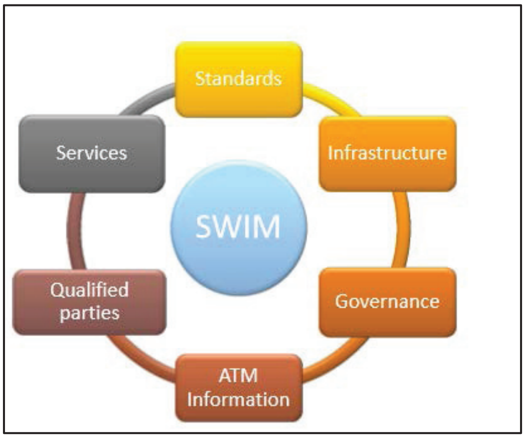


Figure 1: The Concept of SWIM

The Global Air Traffic Management (ATM) Operational Concept (Doc 9854) envisages the application of SWIM to promote information-based ATM integration, stated as follows:

“The ATM operational concept envisages the application of a system-wide information management concept, where information management solutions will be defined at the overall system level, rather than individually at each major subsystem (programme/ project/ process/ function) and interface level, as has happened in the past.”

The aircraft access to SWIM (AAtS) initiative is the effort that will define how and what is necessary to connect aircraft to SWIM infrastructure during all phases of the flight. It is important to realize that the AAtS initiative will not implement a specific infrastructure to create the actual link to the aircraft, but it will define a set of operational and technical requirements that will be used to drive that infrastructure. This infrastructure will create a full data information exchange (i.e. uplink/ downlink) capability. **Figure 2** shows the diagram on how the aircraft will benefits from the sharing of the data of all civil aviation authorities around the world.

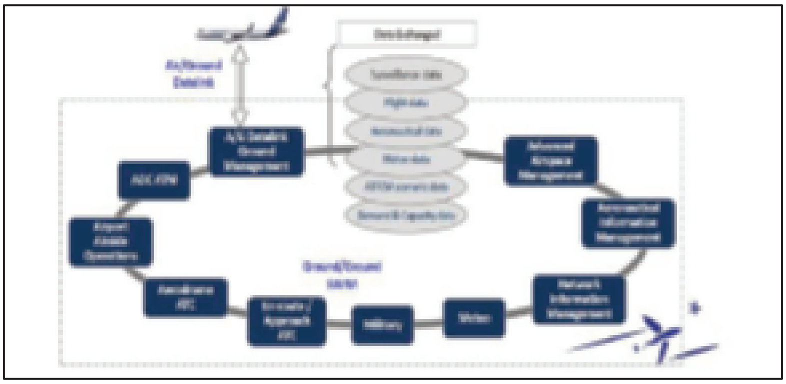


Figure 2: Diagram illustrating aircraft access to SWIM (AAts) (picture courtesy of SESAR Joint Undertaking)

ASBU is a programs set by ICAO and the Federal Aviation Authority (FAA), United States of America, within Single European Sky ATM Research (SESAR) and NextGen, each one to provide a significant regulatory framework for enhancement, optimization, and future technologies to be put in place.

This program is divided into four (4) phases as explained in **Figure 3;**

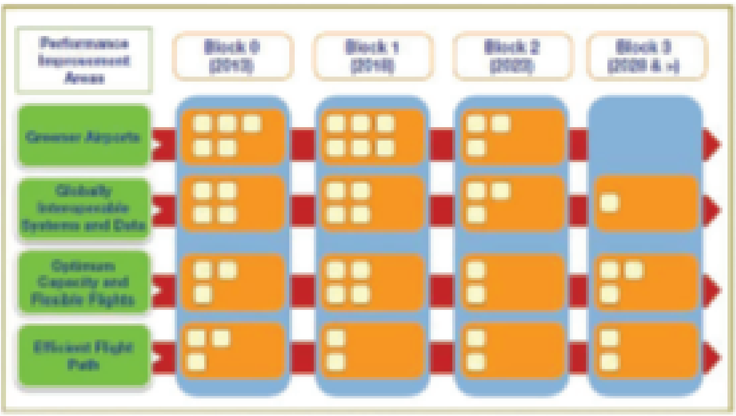


Figure 3: The schematic diagram of the Block Upgrades

There are four major components to the Block Upgrade are as follows;

i. Modules are a deployable package.

ii. A Thread is a series of dependent Modules.

iii. A Block is a group of combines Modules that enable improvements.

iv. Block is grouped into Performance Improvement Areas (PIA) as the executive overview.

So, what actually The Block Upgrades mean? A “Block” is a period of time, which defines when the system upgrades will be available. There are **four phases** of Block Upgrades starting from **Block 0** (started from **2013** onwards), **Block 1** (**2018**), **Block 2** (**2023**) and **Block 3** in **2028**. Each Block consists of modules (a ‘suite of capabilities’) defining solutions, with;

> *The intended performance improvement, including success metrics*
> *Necessary procedures (air and ground)*
> *Necessary technology (air and ground)*
> *A positive business case*
> *A regulatory approval plan; and*
> *A transition strategy*

Blocks are organised into **4 performance improvement areas** which support transition through time: areas:

> *Greener airports*
> *Globally interoperable systems and data (through Globally Interoperable System-Wide Information Management –SWIM)*

> *Optimum capacity and flexible flights (through Global Collaborative ATM)*)
> *Efficient flight paths (through Trajectory Based Operations)*

Three SWIM-related developments that may be of interest to member of ICAO signing States were introduced. The first refers to the Global Air Navigation Plan (GANP) ASBU modules related to SWIM. The second refers to activities exploring SWIM air-ground alternatives. The third refers to the interconnections of SWIM services across regional boundaries as showing on **Figure 4.**

Figure 4: ICAO GANP Roadmap on SWIM (http://www.icao.int/airnavigation/GANP2016Images/FINAL%20-%20Technology-Roadmap_SWIM-2016.jpg)

3.0 Electronic Terrain & Obstacle Data (eTOD)

International Civil Aviation Organization's (ICAO) has outlined a new requirement (Amendment 33) in Annex 15 which states that all ICAO participating states are to ensure the availability of terrain and obstacle data (eTOD) in electronic format between November 20, 2008, and November 18, 2010. The required eTOD data shall be defined by four coverage areas around any aerodrome or airport, which will be collected accordingly based on specific numerical requirements for each area, and stored in a geo-database with ICAO-defined attributes for the obstacle and terrain feature classes. Based on the ICAO Study Best GIS Practice by Gilbert Lasnier he states that *"Obstacle features can be represented as points, lines, or polygons and terrain data can be added as a raster dataset (all feature classes must be modelled according to the feature catalogue in ICAO Doc 9881), see* ***Figure 5****. Reliable and precise obstacle and terrain data for in-flight and ground-based applications can provide significant safety benefits for international civil aviation."*

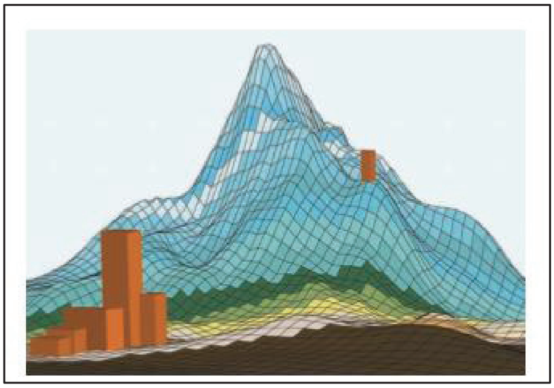


Figure 5: Obstacle data represents individual points, lines or polygons indicating the horizontal and vertical extent of a structure. (Michael Kupsch, COMSOFT)/Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier

According to Gilbert Lasnier (2015) the terrain data represents the surface of Earth including mountains, hills, ridges, valleys, lakes, seas and other bodies of water, as well as permanent ice and snow. It describes a closed surface of an area and is available either as grid data with a defined resolution, or as height contours in topographic maps. Obstacle data represents individual points, lines or contours indicating the horizontal and vertical extent of a structure. It supersedes the terrain data. In addition, a variety of mandatory and optional attributes for terrain and obstacle data, as well as numerical requirements for the data itself, are defined.

The accuracy of the terrain and obstacle information obtained are contributing to the importance for the safety of the flights. It will contribute particularly in the approach phase, where the aircraft will intentionally reduce their flight altitude and maintaining safety the flight safety procedure is very crucial. As the volumes of the air traffic will slowly increase and the capacity of airspace move closer to saturation, there are need for more sophisticated flight routes and procedures to maximize efficiency and in the same time will reduce fuel consumption and emissions. Thus, to maintain this safety margins, the terrain and obstacle data with accurate and in full details coverage of the topographic surface is very essential. The growth development around the airports and the growing numbers of aircraft which has been equipped with enhanced technology in ground proximity warning systems and synthetic vision demands for the availability of accurate and up-to-date terrain and obstacle data respectively. Rapid growth of the advanced technology in mapping allows the acquisition of digital terrain data with the best accuracy possible and these data will be fully utilized to enhance the safety and efficiency of the aircraft movements in the air traffic zonal area and within the aerodrome area where the accurate obstacle data will give a huge benefits in analysis of the aircraft route and air navigation procedure respectively.

ICAO's Annex 4, 14 & 15 as showing in **Figure 6** stated that all States to ensure terrain and obstacle data available in the required electronic format for air navigation applications. The reliability of the data is depending on its accuracy and is essential in current global navigation.

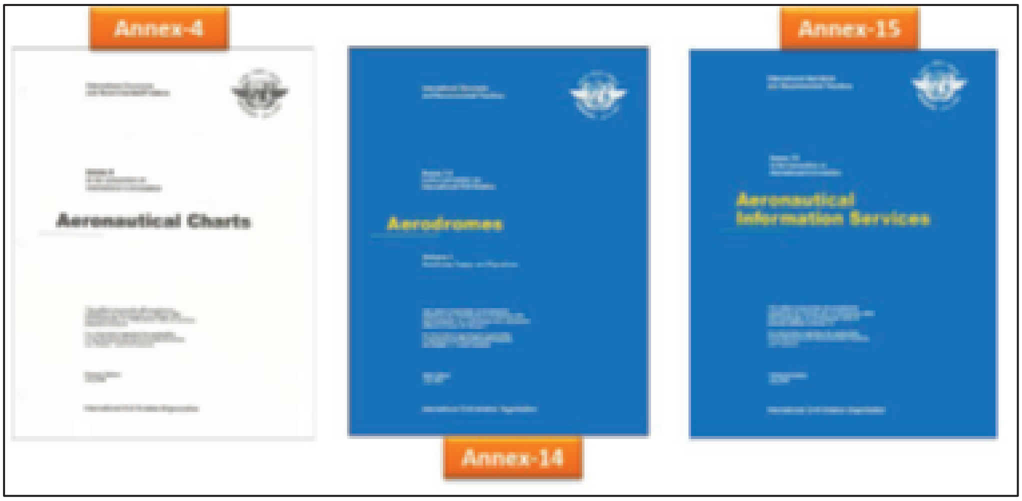


Figure 6: ICAO Annexes related on eTOD application

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Gilbert Lasnier explained that Annex 4 will provide on how to define the Take-Off Flight Path Area (TOFPA) which are used in Type A Obstacle Charts. However, Type A Charts is no longer needed if Annex 15 eTOD data is available. Annex 14 will define the traditional and Precision Surfaces used before Annex-15 was revised. It is widely used in Type B Obstacle Charts but it will no longer require if Annex 15 eTOD data is available. Annex -15 is the document which explained the new concept of Area-1, Area 2, Area-3 and Area 4 respectively. It encompasses much larger area around each Runway to better support PBN operations.

Four (4) specific areas of Terrain & Obstacle Data requirements as outlined in Annex 15 are collected as follows,

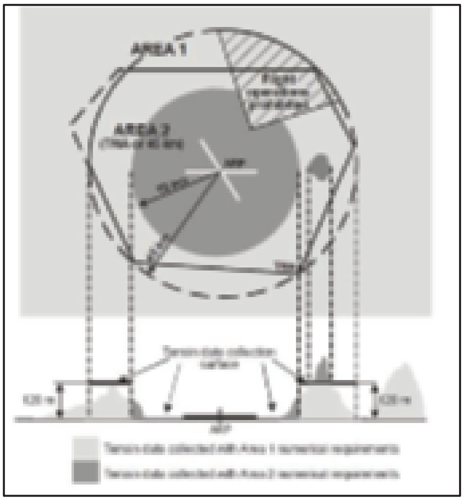
i. Area 1 : To collect and records sets of eTOD data which covers entire country and will be stored in the database which are defined in Annex 15 Chapter 10: Elevation Terrain Modelling.

ii. Area 2 :Covers the Terminal Control Area which is less than 45 kilometres and outside the runway.

iii. Area 3 :Covers the Aerodrome Area within 50 metres and 90 metres from the runway centreline from each parts of the aerodrome movement area.

iv. Area 4: Category II and Category III Operation Area which located at 900 metres prior to the runway threshold and 60 metres from each side of the extended runway centreline.

Diagram A1 below shows the eTOD Data Requirements explained on Annex 15, Appendix 8 for terrain data collection topographical surface for Area 1 and 2.



3.1 <u>Area 1 – Terrain And Obstacles, Coverage Areas and Precisions</u>

The State shall collect and up-dates their dataset electronically in compliance with ICAO publication standards for obstacles, notice to airmen (NOTAM) and terrain DTM publication (GIS platform).

Table 1 shows the data quality requirements for Area 1 Terrain and Obstacle Data.

Type of Precisions	Technology	
	DTM	IFSAR
Vertical	1 m	1 m
Horizontal	1 m	1 m
Obstacle		Terrestrial Survey
Vertical	1 m	1.0 cm

Table 1: The Precision of Area 1 eTOD Data

3.2 Area 2

a. **Terminal Control Area (TCA), Terminal Manoevering Area (TMA)**

- State shall collect the terrain data within:

1. A 10-km radius coverage area from the Aerodrome Point (ARP). The terrain and obstacle data shall comply with the Area 2 numerical requirements.
2. Area between 10 km and the TMA boundary or 45-km radius (whichever is smaller). The terrain data that penetrates the horizontal plane above 120 m of the lowest runway where the elevation shall comply with the Area 2 numerical requirements.
3. Area between 10 km and the TMA boundary or 45-km radius (whichever is smaller). The terrain data does not penetrate the horizontal plane above 120 m of the lowest runway where the elevation shall comply with the Area 1 numerical requirements.
4. Part of the portions of Area 2 where the operation of the aircraft are prohibited due to very high terrain nature or other local limitations and/or regulations. These terrain data shall comply with the Area 1 numerical requirements.

*Note — Terrain data numerical requirements for Areas 1 and 2 are specified in **Diagram A2.***

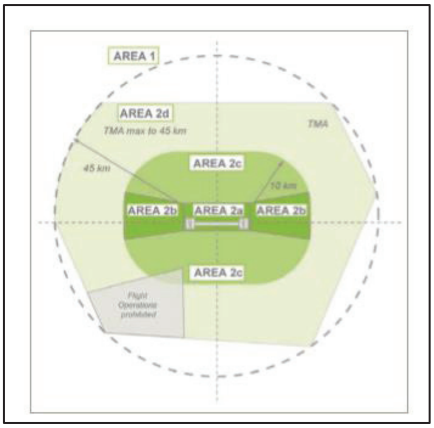


Diagram A2: Area 2, the vicinity of an aerodrome, consists of 2a – the area around runway, 2b- extending from ends of Area 2a in the direction of departure, 2c – outside of 2a and 2b up to 10km from the boundary of 2a, and 2b – outside of 2c up to 45km from the ARP or to an existing TMA boundary.

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

3.3 Area 3 – Aerodrome Area

Area 3 is the Instrument Flight Rules (IFR) which is located at the aerodrome/heliports, the point from runway edge to the movement areas as showing at **Diagram A3** below.

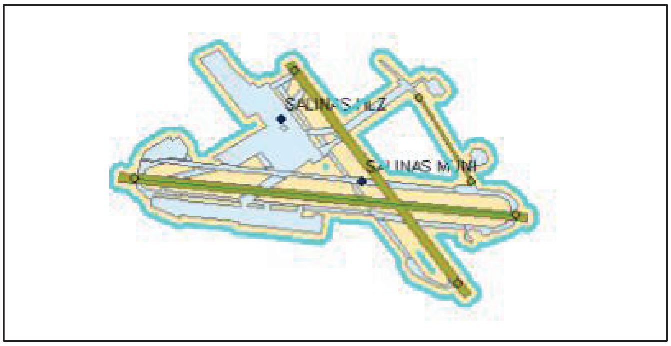


Diagram A3: eTOD Area 3

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Table 2 explains the data quality requirements for Area 3 Terrain and Obstacle Data as follows;

Type of Precision	**Terrestrial Survey**
	1cm
DTM	
Vertical	0.01 m
Horizontal	0.01 m
Obstacle	
Vertical	0.01 m
Horizontal	0.01 m

Table 2: The Precision of Area 3 eTOD Data

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier,2015)

3.4 Area 4 - CAT II and CAT III Operation Area

Area 4, specifically for category II and III runways data which is located at 120 m wide and 900 m long area at precision approach as showing at **Diagram A4** as below;

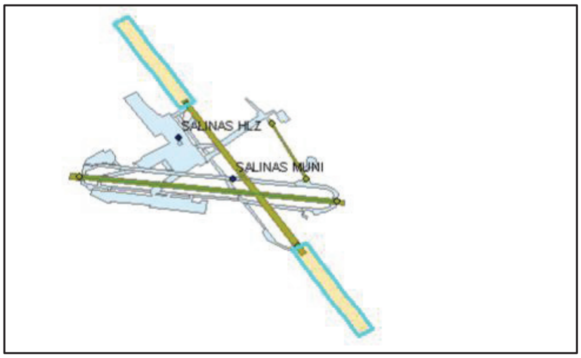


Diagram A4: eTOD Area 4

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Type of Precision		Terrestrial Survey
DTM		1 cm
Vertical	0.01 m	
Horizontal	0.01 m	
Obstacle		
Vertical	0.01 m	
Horizontal	0.01 m	

Table 3: The terrain and obstacle data precision requirements for Area 4

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

4.0 Obstacle Data Collection Techniques

There are wide ranges of technique which can be considered to collect the terrain and obstacle data. ICAO has outlined the techniques to acquire these data with the required accuracy as follows;

i. Terrestrial Survey/Global Navigation Satellite System (GNSS)
ii. Airborne Laser Scanning (ALS)
iii. Aerial Photogrammetry
iv. Interferometric Synthetic Aperture Radar (IFSAR)
v. Light Detection and Ranging (LIDAR)

Utilizing conventional terrestrial survey technique is less accurate because of the limited visibility from one point to another point due to obstructions especially in urban and highly populated areas or due to measurement limitation range in the field. For example, there is risk of not obtaining electromagnetic reflection from the targeted (thin) obstacle, but from another point behind it. It is extremely difficult to detect the error in measurements whereas there are no additional data is used for real-time validation.

Nevertheless, GPS/RTK measurements also are not suitable for obstacle data acquisition due to the need to access the high terrain area such as the peak of the hill in order to get the elevation data to be surveyed.

For laser scanning or ALS, several points shall be highly considered when acquiring the obstacle data such as follows;

a. To ensure the probability such as a thin object like antenna is captured. Thus, it is recommended that the sensor is tilted and radiometric resolution of the sensor is calibrated.
b. Meteorological condition during the acquisition of the data should be observed. The strong wind condition and the turbulences during airborne mapping shall increase the possibility of the point collection to be gathered evenly.
c. For the purpose of detecting the obstacle, different data streams (GPS, IMU, Laser Scanner) during pre-processing works shall be combined and the availability of the point cloud data for further processing steps can be made possible. These digital point clouds will be separated into ground and non-ground points where the obstacles can be easily detected.
d. For feature extraction, once the point which describes the obstacles are detected, the data shall be converted and stored in GIS objects, i.e. point, line and polygon before it can be class as GIS feature layers.
e. All processing steps and techniques can theoretically be performed and developed by an organization, whether they acquired the data independently of purchased the data from thedata provider. For practical reasons, it is highly recommended that data acquisition and pre- processing works are combined into one work package in order to ensure the first deliverables are the geo-referenced data. Feature extraction does not requires ALS capabilities and and it can be performed by a different organization using remote sensing or GIS technique respectively.

Several points should be considered for Aerial Photogrammetry as follows;

a. Digital Surface Model (DSM) can be generated using an image correlation process.This will allow a pre-processing technique similar as ALS. However, the image correlation is,in some circumstances (low texture), are not reliable and the DSM will be generated in 2.5D, not fully 3D, as ALS.

b. An operator has to define manually the objects which are to be considered asobstacles. The human interpretation and interaction may slightly impact the data homogeneity and data quality.

c. The availability of the systems which can be assisting the operator to automatically identify the object detection based on ODCS specifications in the systems and the actual runway data. The ODCS will be shown in the system where the object penetration to the ODCS, from other projects, is facilitated, differentiate and compared.The human interaction in photogrammetry technique especially in data processing compares to ALS will allow the combination of both the obstacle detection and feature extraction steps, which will give a high quality result, true 3D vectors.

However, the obstacle detection from IFSAR data greatly suffers from low reliability since the reconnaissance are largely depending on the incident angle. For instance, power transmission lines are clearly visible, if it is running parallel to the flight direction. However it is undetectable if the flight lines are running across the flight direction. The reason contributed for these deficiencies are the “layover” effect, whereby these points will be appeared in reversed order in the imagery, e.g. the location of the point A is in front of point B but in the imagery it will reverses them where point B will appears to be in front of point A.

4.1 Comparison And Recommendations

In **Figure 7,** according to Gilbert Lasnier, 2015 the surveying techniques suitable for obstacle mapping are compared using different criteria. These comparisons will provide recommendations as to which methods are most suitable, under these circumstances, for an organization. The most important factors to be considered are;

ALS	Photogrammetry	Terrestrial Survey	IFSAR
• The cost is too expensive, therefore, is less widely available. • Offers the highest degree of automation but further development is expected. • Lowest risk of missing an obstacle during data acquisition.	• The most efficient technique for data acquisition. • The degree of automation is smaller compared to ALS, but the algorithm is still evolving. • The risk of missing an obstacle is higher, compared to ALS, but thanks to human interaction, the resulting obstacle can be expected to be higher than all other techniques.	• Is the lowest capital cost to attain, but it will contribute to utilizing intensive labour. • The technology has reached it maturity with no more further improvement is expected. • The risk of missing an obstacle is higher than other techniques, and therefore, the level of effort needed for validation is high. • Validation and verification of the data is required in this technique.	• Obstacle detection suffers from low reliability and for the time being, the technique is not suitable for obstacle data collection.

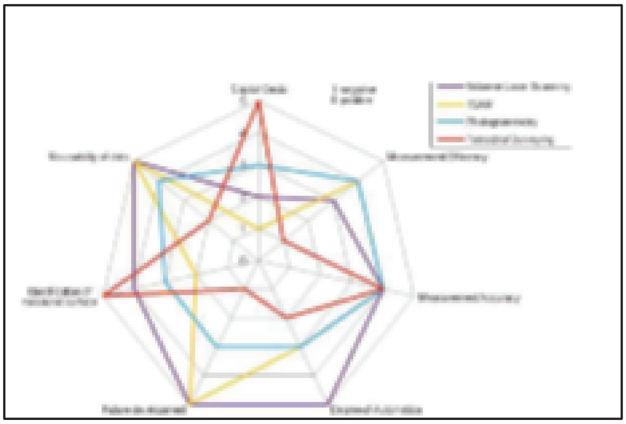


Figure 7: Comparison of Different Surveying Techniques for Obstacle Mapping

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

In the following table, Gilbert Lasnier, 2015 has recommended that the suitable survey methods to be utilized for obstacles. The symbols indicate as follows:

‘++’ – very suitable technically and very cost efficient;
‘+’ – very suitable technically well suited but the most cost efficient;
‘o’ – suitable technically but very poor cost/benefit ratio;
‘-‘ – not meeting technical requirements and very poor cost/benefit ratio.

	ALS	IFSAR	Photogrammetry	Terrestrial Survey
Area 1	o/+	-	o/+	++
Area 2	++	-	+	O
Area 3	++	-	+	+
Area 4	+	-	+	++

Table 1: Recommendation on Survey Methods for Obstacles

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Area 1	Area 2	Area 3	Area 4
3 arc second	1 arc second	0.6 arc second	0.3 arc second

Table 2: Terrain on Survey Methods for Obstacles

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Area 1	Area 2	Area 3	Area 4
1.0m	0.1m	0.01m	0.1m

Table 3: Terrain – Horizontal Resolution Requirements

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Area 1	Area 2	Area 3	Area 4
30m	3m	0.5m	1m

Table 4: Terrain – Elevation Requirements

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Area 1	Area 2	Area 3	Area 4
1m	0.1m	0.01m	0.1m

Table 5: Terrain – Vertical Resolution Requirements

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Area 1	Area 2	Area 3	Area 4
50m	5m	0.5m	2.5m

Table 6: Obstacle – Horizontal Position Requirements

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

Area 1	Area 2	Area 3	Area 4
30m	3m	0.5m	1m

Table 7: Obstacle – Elevation Requirements

(Understanding ICAO eTOD Requirement: ICAO Study Best GIS Practice by Gilbert Lasnier, 2015)

4.2 Requirement of eTOD Data in Flight Operations

There are multiple operations that required the utilization of eTOD data, as explained in Table 8, as follows;

Life Cycle Phase	**Why it requires eTOD data?**
Departure Management	● Terrain data for Engine-Outs ●Obstacle data for Engine-Outs ● Airport Maps to minimize taxiing ● Cadastral & Environment data for Departures
PBN Flight Operations	● PBN data for PBN separation ● Obstacle data for PBN Separation ● Terrain data for Drift-Down/Let down
Metroplex/Aerodrome	● Terrain data for SID/STAR ● Obstacle data for SID/STAR ● Cadastral & Environment data for SID/STAR
In-Trail Enroute	● PBN data for PBN separation ● Obstacle data for PBN Separation ● Terrain data for Drift-Down/Let down
Continuous Descent	● Terrain data for SID/STAR ● Obstacle data for SID/STAR ● Cadastral & Environment data for SID/STAR
Surface Movement	Airport Maps to minimize taxiing

The utilization of eTOD data is required in Performance Based Navigation (PBN) procedures of designing and pertaining the data for Instrument Approach, Standard Arrival Instrument and Standard Instrument Departure Charts respectively while Aerodrome Mapping also required the used of the terrain data with the higher resolution terrain data for planning and preparation of the charts in order to comply with the required accuracy set by ICAO.

5.0 Conclusion

The implementation and utilization of high resolution data for Performance Based Navigation (PBN) of designing the aeronautical charts procedures are the crucial components of AIS/AIM. Electronic Terrain and Obstacle Data (eTOD) will play an importance role to achieve that aim. Electronic terrain and obstacle data (eTOD) may be utilized in the following navigation applications;

- Ground Proximity Warning System with forward looking terrain avoidance function and Minimum Safe Altitude Warning (MSAW) system;
- Determination of contingency procedures to use in the event of an emergency during a missed approach or take-off;
- Aircraft operating limitations analysis;
- Instrument procedure design (including circling procedure);
- Determination of en-route “drift-down” procedure and en-route emergency landing location;
- Advanced Surface Movement Guidance and Control System (A- SMGCS);
- Product of Aeronautical charts production and on-board databases.

Department of Civil Aviation Malaysia (DCA) is in the final stages to conclude the procurement to obtain the eTOD data. The SAR data especially LIDAR was viewed as the suitable data to fulfil the requirement and standards outlined by ICAO. Under Malaysia Aeronautical Information Systems (my-AIM), which utilizing AviTech solution, there are Terrain and Obstacle Data (TOD) as one of its module.

Procedure of Navigation and Aircraft Operations (PANS-OPS) also utilizing the terrain data to design the specific procedure for navigation and operation such as instrument procedure, departure & arrival procedure respectively.

SWIM and ASBU are the result of the assembling data, analysis and formatting of the aeronautical data in the similar standards with the major aim is to share all aeronautical data globally via ASBU platform, as well as integrating different systems and solutions into same format in order to achieve an efficient aeronautical and safer civil aviation around the world.

One of the requirement is the application of eTOD data and it will be confirmed as ICAO is moving towards utilizing geospatial data for their protocols and will helps in decisive decision making by using high resolution of geospatial data.

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3^{RD} FIG YOUNG SURVEYORS NETWORK CONFERENCE (YSC) CHRISTCHURCH, NEW ZEALAND, 30^{TH} APRIL TO 1^{ST} MAY 2016

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The 3^{rd} FIG Young Surveyors Conference (YSC) was held on 30^{th} April to 1^{st} May 2016 in Christchurch, New Zealand. The conference was co-hosted by FIG Young Surveyors Network (YSN) and New Zealand Institute of Surveyors (NZIS) Young Professionals in conjunction with 78^{th} FIG Working Week 2016. Around 80 participants from 25 countries were gathered to join this biannual event held at Rydges Latimer Hotel. The conference's theme was all about the FIG Working Week Theme "Recovery from Disaster".

FIG Foundation had offered FIG Foundation Grants Award to support five (5) Young Surveyors to attend and participate the 3rd FIG YSC and FIG Working Week 2016. Kelvin Tang Kang Wee, YSN Malaysia was one of the lucky winners along with four other recipients from Nepal, The Philippines, Pakistan and Argentina to participate both the 3rd FIG YSC and FIG Working Week 2016. Each of them were selected and funded after scrutiny selection process carried through by FIG YSN and FIG Foundation.

First day kicked off with an opening ceremony. The ceremony entailed short welcoming speeches delivered by Mark Allan, NZIS President and John Hohol, FIG Foundation President. FIG President and the guest of honour – Chryssy Potsiou shared her hopes and dreams on how essential FIG's close collaboration with the YS Network and encouraged YS to participate actively to ensure a prosperous and sustainable future for our profession. Eva-Maria Unger, Chair of the YSN and Paula Dijkstra, the Vice Chair of Administration presented the agenda of FIG YSN and Melissa O'Brien, NZIS Young Professional gave an overview of the YSC programme.

It was a tailor made programme, equipped with a series of technical presentations, discussions and a technical visit, aims were to enable delegates to come away from Christchurch with a greater knowledge of the surveyors and allied professionals in reducing disaster risk, responding to disasters, recovery and resilience.12 innovative young surveyors and surveying professionals from the industry had delivered their stories and share their experiences of working in a high pressure and chaotic environment, the importance of geospatial information can be used as well as new technologies and innovations during the rescue and along the rebuild pathway.

Among the interesting topic presented was *“On Shaky Ground”* by Mark Myall and Nick Saunders from New Zealand. They had shared their experience *“On Shaky Ground”* when an earthquake registered 6.3 on the Richter scale hit in Christchurch on 22 February 2011. On the other hand, Nic Donelly also highlighted the new mechanisms or tools (RADAR, InSAR, etc.) have the ability to re-generate geodetic control quickly after natural disasters and post-earthquake information can be accessed immediately by the public. Besides that, Shuman Baral from Nepal did a noteworthy presentation on *“Hashtags for relief, rescue and recovery*”. She highlighted how our social media hashtags “#” can be used in post disaster information management after the devastating earthquake happened in Kathmandu a year ago.

Besides that, a noteworthy slot was arranged to discuss on what is needed most in the aftermath of a disaster when thousands of people can suddenly find themselves battling to save lives and livelihoods. Thomas Rodger from MapAction, a humanitarian mapping charity that works through skilled volunteers had highlighted that *“Information”* is needed most. Participants were later on being divided into small group to discuss about the vital information at the disaster scenes to be mapped and how young surveying professionals can get involved. Overall massage, by sharing their technical knowledge and up-to-date geospatial information and data, surveyors can make significant contribution to improve, simplify and to shorten the disaster mitigation, rehabilitation and reconstruction periods.

The 2 day YSC ended with the *Christchurch Rebuild and Quake City Tour* on Sunday morning. The half day city sightseeing tour offered a guided experience around the ever-changing post-earthquake Christchurch City Centre. YSC participants had the opportunity to visit and explore a number of different attractions such as Quake City Exhibition Centre, Re:START Container Shopping Mall, Bridge of Remembrance, Cardboard Cathedral, Christchurch Cathedral, Christchurch Arts Gallery, Christchurch Tramway, Canterbury Museum and Christchurch Botanical Gardens. The tour took on a journey through the Christchurch rebuild and provides an insight into the innovative ways that Christchurch has been carried out in reshaping itself following the devastating earthquakes.

It was a great opportunity for all the participants to learn more about their role in *"immediate response after a significant natural disaster; and once the dust has settled, the rebuild from the aftermath begins"*. The energetic participations and co-operations had shown that the young surveyors will be the ambassadors and agents of change. *"The Rapid Response to Change will be done by the Surveyor of Tomorrow"* - Chryssy Potsiou, FIG President.

LAPORAN BERGAMBAR

MESYUARAT KE-18
JAWATANKUASA TEKNIKAL NAMA GEOGRAFI KEBANGSAAN (JTNGK)

En. Zainal Abidin bin Mat Zain

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Bahagian Dasar dan Penyelarasan Pemetaan (BDPP) selaku urus setia telah menganjurkan Mesyuarat Ke-18 Jawatankuasa Teknikal Nama Geografi Kebangsaan (JTNGK) yang telah diadakan di Bilik Persidangan, Tingkat 15, Wisma JUPEM, Kuala Lumpur pada 14 Julai 2016. Mesyuarat telah dipengerusikan oleh YBhg. Dato' Sr Hassan bin Jamil, Timbalan Ketua Pengarah Ukur dan Pemetaan I selaku Pengerusi JTNGK dan telah dihadiri seramai 36 orang ahli terdiri daripada wakil-wakil Setiausaha Kerajaan Negeri dan Jabatan/Agensi Kerajaan Persekutuan.

YBhg. Dato' Sr Hassan bin Jamil selaku Pengerusi JTNGK sedang mempengerusikan Mesyuarat Ke-18 JTNGK

Dalam ucapan pembukaannya, YBhg. Dato' Pengerusi meminta agar semua ahli dapat memberi kerjasama erat dalam memastikan segala aktiviti yang dirancang berjalan dengan lancar dan teratur. Beliau turut berharap agar komitmen yang tinggi ini akan memberi natijah yang baik kepada kemajuan serta pembangunan semasa dalam proses penamaan nama-nama geografi.

Seterusnya, beliau memaklumkan bahawa JUPEM akan menjadi penganjur utama bagi mesyuarat *5th United Nations Global Geospatial Information Management for Asia and The Pacific (UN- GGIM-AP) Plenary Meeting* yang akan diadakan di Hotel Park Royal, Kuala Lumpur pada 16 hingga 20 Oktober 2016.

Beberapa program lain yang berkaitan *United Nations* juga akan turut diadakan iaitu:

i. *UN-GGIM International Forum On Policy And Framework for Geospatial Information*
ii. *Management*
iii. *4th United Nations Group of Experts on Geographical Names for Asia South East (UNGEGN-ASE)*
iv. *Workshop on STDM and Fit for Purpose Land Administratiom*
v. *Workshop on GNSS CORS and Geospatial Infrastructure*
vi. *UN-GGIM-AP Executive Board Meeting*

Selain itu, beliau turut menyentuh isu pencerobohan sekumpulan nelayan dari negara China yang dikatakan aktif melakukan aktiviti menangkap ikan dan penambakan pasir di Beting Patinggi Ali, Sarawak yang kembali hangat diperkatakan di media masa pada masa kini. Justeru itu, beliau mengingatkan kepada ahli mesyuarat bahawa pengesahan nama-nama pulau dan entiti geografi adalah amat penting dalam penyediaan dokumen sebagai tanda kedaulatan sesebuah negara. Beliau turut memaklumkan bahawa terdapat beberapa pulau di perairan Malaysia yang masih tidak diberi nama dan berharap pihak negeri yang berkenaan dapat mengambil tindakan selanjutnya.

Lanjutan daripada proses transliterasi ejaan tulisan jawi dan penyediaan data audio nama-nama geografi telah dijalankan oleh pihak MaCGDI, kerja-kerja transliterasi kepada ejaan Jawi telah dilakukan secara percuma oleh pihak Dewan Bahasa dan Pustaka (DBP). Dimaklumkan juga bahawa Modul Audio dan Modul Jawi di dalam Aplikasi MyGeoName akan dilaksanakan oleh perkhidmatan luar dan dijangka siap dalam tempoh 6 bulan lagi.

Sebahagian Ahli Mesyuarat JTNGK

Laporan Ringkas Kumpulan Kerja

Antara agenda mesyuarat pada kali ini adalah pembentangan laporan ringkas daripada tiga (3) Kumpulan Kerja yang membantu JTNGK dalam menggerakkan aktivitinya. Kumpulan-kumpulan kerja tersebut adalah seperti berikut:

i. Kumpulan Kerja Dasar dan Pengemaskinian Nama Geografi (KKDPNG)
Pengerusi: Jabatan Ukur dan Pemetaan Malaysia (JUPEM)

ii. Kumpulan Kerja Pangkalan Data Nama Geografi dan Gazetir Kebangsaan (KKPDNG)
Pengerusi: Pusat Infrastruktur Data Geospatial Negara (MaCGDI)

iii. Kumpulan Kerja Nama Pulau dan Entiti Geografi (KKNPEG)
Pengerusi: Pusat Hidrografi Nasional (PHN)

Pengerusi Kumpulan Kerja Dasar dan Pengemaskinian Nama Geografi (KKDPNG), Sr Dr. Zainal bin A Majeed (kiri) sedang membentangkan laporan kumpulan kerja

Laporan Kumpulan Kerja Pangkalan Data Nama Geografi dan Gazetir Kebangsaan (KKPDNG) dibentangkan oleh Pn. Norizam binti Che Noh

Kumpulan Kerja Kerja Nama Pulau dan Entiti Geografi (KKNPEG) diwakili oleh Kdr. Azrul Nezam bin Asri, TLDM (kiri) dan Lt. Mohammad Aizat bin Azmi, TLDM (kanan)

Mesyuarat kali ini telah memberi peluang kepada ahli-ahli mesyuarat memberi pelbagai input dan pandangan. Selain itu, ahli-ahli mesyuarat juga dapat melaporkan perancangan kerja, pelaksanaan program dan aktiviti berkaitan penamaan geografi. Terdapat juga beberapa perkara yang telah dibincangkan perlu diambil perhatian dan tindakan segera terutamanya dari segi perundangan.

LAPORAN BERGAMBAR

UN-GGIM INTERNATIONAL FORUM ON POLICY AND LEGAL FRAMEWORK FOR GLOBAL GEOSPATIAL INFORMATION MANAGEMENT AND 5TH UN-GGIM-AP PLENARY MEETING

Sr Mohd Riduan bin Mohamad @ Idris

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Jabatan Ukur dan Pemetaan Malaysia (JUPEM) telah diberi mandat oleh Kerajaan bagi menganjurkan *'International Forum on Policy and Legal Framework for Geospatial Information Management'* dan *'5th United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP) Plenary Meeting'* pada 16 hingga 20 Oktober 2016 di Hotel Parkroyal Kuala Lumpur. Program ini telah dihadiri oleh perwakilan peringkat tertinggi dari negara-negara anggota di bawah naungan *'United Nations Global Geospatial Information Management' (UN-GGIM).*

Program ini telah dirasmikan oleh YB Dato Sri Dr. Haji Wan Junaidi bin Tuanku Jaafar, Menteri Sumber Asli dan Alam Sekitar pada 18 Oktober 2016. Seramai 495 orang peserta dari 29 negara telah menyertai program ini di mana 152 orang daripadanya adalah merupakan peserta luar negara.

Perasmian oleh YB Dato Sri Dr. Haji Wan Junaidi bin Tuanku Jaafar, Menteri Sumber Asli dan Alam Sekitar

'*International Forum on Policy and Legal Framework for Geospatial Inform*ation *Management'* telah diadakan selama dua (2) hari pada 18 dan 19 Oktober 2016. Ianya adalah merupakan program yang julung-julung kalinya diadakan oleh UN-GGIM. Program ini diadakan bertujuan bagi merangka serta menggubal polisi dan perundangan berkaitan dengan pengurusan maklumat geospatial untuk dijadikan sebagai panduan dan diterima pakai oleh negara-negara anggota. Forum ini telah melibatkan pembentangan 16 kertas kerja yang turut melibatkan dua (2) pembentang daripada Malaysia iaitu YBhg. Dato' Sri Azharuddin bin Abdul Rahman, Ketua Pengarah Penerbangan Awam Malaysia dan YBhg. Dato Jagjit Singh dari Jagjit Ariff & Co. Advocates.

Di akhir forum ini, satu deklarasi yang dinamakan *'Kuala Lumpur Declaration on Policy and Legal Frameworks for Geospatial Information'* telah dihasilkan yang antara lainnya merangkumi perkara berikut:

a) Merakamkan terima kasih kepada Kerajaan Malaysia sebagai tuan rumah dalam menganjurkan *'International Forum on Policy and Legal Frameworks for Geospatial Information';*

b) Mempertimbangkan pengwujudan Kumpulan Kerja untuk meneroka kerangka polisi dan perundangan berkaitan maklumat geospatial dengan penglibatan daripada pakar-pakar perundangan dan geospatial;

c) Membangunkan pelan tindakan dan strategi berkaitan isu-isu polisi dan perundangan dalam usaha untuk memulakan proses-proses sokongan dan penggunaannya termasuk panduan bagi pelesenan dan penyebaran maklumat geospatial agar ianya boleh dijadikan sebagai panduan oleh negara-negara ahli; dan

d) Memberi sumbangan untuk meningkatkan keupayaan di kalangan negara-negara ahli berkaitan isu-isu polisi dan perundangan yang memberi kesan dalam pengumpulan, penggunaan, penyimpanan dan penyebaran maklumat geospatial.

Dato' Sri Azharuddin bin Abdul Rahman, Ketua Pengarah Penerbangan Awam Malaysia Menyampaikan Kertas Kerja di Bawah Tema "Legal And Regulatory Framework Regarding Operations Of Unmanned Aircraft Systems (UAS Or Drones) for Governmental Use"

YBhg. Dato' Jagjit Singh Membentangkan Kertas Kerja di Bawah Tema "Unique Data Protection/ Privacy Concerns Associated With Government Geoinformation"

Antara Peserta Yang Menyertai Forum

5th UN-GGIM-AP Plenary Meeting yang diadakan pada 17 dan 19 Oktober 2016 telah dihadiri oleh perwakilan daripada negara-negara anggota UN-GGIM-AP dengan kehadiran seramai 90 orang delegasi daripada 19 negara ahli. Mesyuarat ini antara lainnya telah melaporkan kemajuan projek dan aktiviti serta cadangan program kerja bagi setiap *Working Groups.* Pada masa yang sama kesemua *Working Groups* telah mengadakan perbincangan mengenai isu-isu yang dihadapi serta merangka langkah-langkah ke hadapan untuk meningkatkan keberkesanannya dalam membantu negara-negara ahli.

Dalam mesyuarat tersebut beberapa resolusi telah dicapai yang antara lainnya adalah seperti berikut:

a) Menggalakkan pakar-pakar geodetik untuk menghadiri forum serantau yang bersesuaian seperti *UN-GGIM-AP Working Group Meetings;*

b) Mempertimbangkan perkongsian maklumat cerapan data geodetik secara masa hakiki bagi menyokong pengurangan risiko bencana termasuk amaran awal tsunami;

c) Menyediakan peluang bagi meningkatkan pengetahuan teknikal melalui latihan amal dan program latihan singkat kepada saintis-saintis geospatial dan geodetik;

d) Menyokong pembangunan perundangan, institusi, pangkalan data dan peta, serta mekanisma pembiayaan yang diperlukan untuk melaksanakan dan menyelenggarakan sistem pentadbiran tanah yang berpatutan berdasarkan hak tanah, penggunaan tanah dan pembangunan tanah; dan

e) Membangunkan model pengurusan kawasan pesisir pantai untuk aplikasi GIS di negara anggota.

Antara delegasi-delegasi yang telah menghadiri 5^{th} UN-GGIM-AP Plenary Meeting

Sepanjang berlangsungnya program ini, beberapa program lain yang berkaitan dengan *United Nations* turut diadakan yang antaranya adalah seperti berikut:

i. *Workshop on STDM and Fit for Purpose Land Administration;*

ii. *Workshop on GNSS CORS and Geospatial Infrastructure;*

iii. *UN-GGIM-AP Executive Board Meeting; dan*

iv. *4^{th} United Nations Group of Expert on Geographical Names for Asia South East (UNGEGN-ASE)*

Majlis penutup program ini telah diadakan pada 19 Oktober 2016 yang menyaksikan penyerahan bendera UN-GGIM-AP oleh YBhg. Dato’ Sr Hasan bin Jamil, Timbalan Ketua Pengarah Ukur dan Pemetaan I kepada tuan rumah bagi penganjuran 6^{th} *UN-GGIM-AP Plenary Meeting* pada tahun 2017 iaitu Dr. Hiroshi Murakami, *Director General, Geospatial Information Authority of Japan* merangkap Presiden UN-GGIM-AP di hadapan semua perwakilan yang hadir.

Penyerahan Bendera UN-GGIM-AP oleh YBhg. Dato’ Sr Hasan bin Jamil Kepada Dr. Hiroshi Murakami

Satu sesi lawatan sosial ke Putrajaya yang melibatkan delegasi luar negara juga telah turut diadakan pada 20 Oktober 2016 di mana beberapa tempat menarik telah dilawati antaranya Masjid Putra, *Putrajaya International Convention Centre (PICC)*, Jambatan Seri Wawasan dan Tasik Putrajaya. Selain itu, delegasi juga di bawa ke Karyaneka bagi membeli cenderamata kenang-kenangan untuk di bawa pulang ke negara masing-masing.

KALENDAR GIS & GEOMATIK 2017

TARIKH	TAJUK	LOKASI	PENGANJUR	TALIAN PERTANYAAN
27 Januari 2017	Mesyuarat Jawatankuasa Penyelarasan Penggunaan *Drone* Bagi Agensi-Agensi di Bawah NRE (JPPDNRE)	Bilik Mesyuarat Berlian, Tingkat 17, Wisma Sumber Asli, NRE	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Sr Dr. Zainal bin A Majeed Tel : + 603-2617 0831 Fax : + 603-2697 0140 E-mail : zainal.amajeed@jupem.gov.my
14 Februari 2017	Mesyuarat Jawatankuasa Teknikal Penyelidikan Geoinformasi / Geomatik Kebangsaan (JTPGGK) Bil. 1/2017	Bilik Persidangan, Tingkat 15, Wisma JUPEM	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Sr Hj. Zulkifli bin Sidek Tel : + 603-2617 0831 Fax : + 603-2697 0140 E-mail : zulkifli.sidek@jupem.gov.my
22 Februari 2017	Mesyuarat Jawatankuasa Teknikal Dasar dan Isu-Isu Institusi (JTDII) Bil.1/2017	Bilik Persidangan, Tingkat 15, Wisma JUPEM	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Sr Hj. Zulkifli bin Sidek Tel : + 603-2617 0831 Fax : + 603-2697 0140 E-mail : zulkifli.sidek@jupem.gov.my
Februari/Mac 2017	Mesyuarat Ke-15 Jawatankuasa Kebangsaan Nama Geografi (JKNG)	Bilik Persidangan, Tingkat 15, Wisma JUPEM	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Sr Hj. Zulkifli bin Sidek Tel : + 603-2617 0831 Fax : + 603-2697 0140 E-mail : zulkifli.sidek@jupem.gov.my
14 Mac 2017	Mesyuarat Ke-68 Jawatankuasa Pemetaan dan Data Spatial Negara (JPDSN)	Bilik Persidangan, Tingkat 15, Wisma JUPEM	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Sr Hj. Zulkifli bin Sidek Tel : + 603-2617 0831 Fax : + 603-2697 0140 E-mail : zulkifli.sidek@jupem.gov.my
Jun 2017	Mesyuarat Kumpulan Kerja Dasar Pengemaskinian Nama Geografi (KKDPNG)	Bilik Mesyuarat Topez, Tingkat 10, Wisma JUPEM	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Sr Hj. Zulkifli bin Sidek Tel : + 603-2617 0831 Fax : + 603-2697 0140 E-mail : zulkifli.sidek@jupem.gov.my
Julai 2017	Mesyuarat Jawatankuasa Teknikal Nama Geografi Kebangsaan (JTNGK)	Bilik Persidangan, Tingkat 15, Wisma JUPEM	Bahagian Dasar dan Penyelarasan Pemetaan, JUPEM	Tn. Hj. Zainal Abidin bin Mat Zain Tel : + 603-2617 0631 Fax : + 603-2697 0140 E-mail :zainalzain@jupem.gov.my

SUMBANGAN ARTIKEL/ CALL FOR PAPER

Buletin GIS & Geomatik diterbitkan dua (2) kali setahun oleh Jawatankuasa Pemetaan dan Data Spatial Negara. 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.

Panduan Untuk Penulis

1. Manuskrip boleh ditulis dalam Bahasa Malaysia atau Bahasa Inggeris.

2. Setiap artikel yang mempunyai abstrak mestilah condong *(italic).*

3. Format manuskrip adalah seperti berikut:

Jenis huruf	: Arial
Saiz huruf bagi tajuk	: 12 (Huruf Besar)
Saiz huruf artikel	: 10
Saiz huruf rujukan/references	: 8
Langkau (isi kandungan)	: 1.5
Margin	: Atas, bawah, kiri dan kanan = 2.5cm
Justifikasi teks	: *Justify allignment*
Maklumat penulis	: Nama penuh, alamat lengkap jabatan/ institusi dan e-mel.

   Satu '*column'* setiap muka surat

4. Sumbangan hendaklah dikemukakan dalam bentuk softcopy dalam format Microsoft Word. Semua imej grafik hendaklah dibekalkan secara berasingan dalam format .tif atau .jpg dengan resolusi 150 dpi dan ke atas.

5. Segala pertanyaan dan sumbangan bolehlah dikemukakan kepada:

Ketua Editor
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