THE 2ND ANNUAL
EXPLORATION & MAPPING IN MINING
GIS DATA INTEGRATION, DATA IMPLEMENTATION & INNOVATIONS

# CASE STUDY

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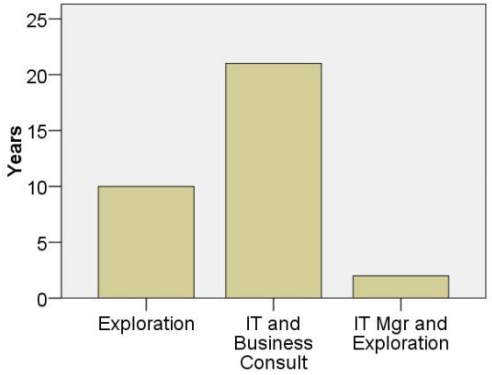
## Maximising spatial ROI during a project's lifecycle to improve business value

Garry Edser (M.Geoscience)

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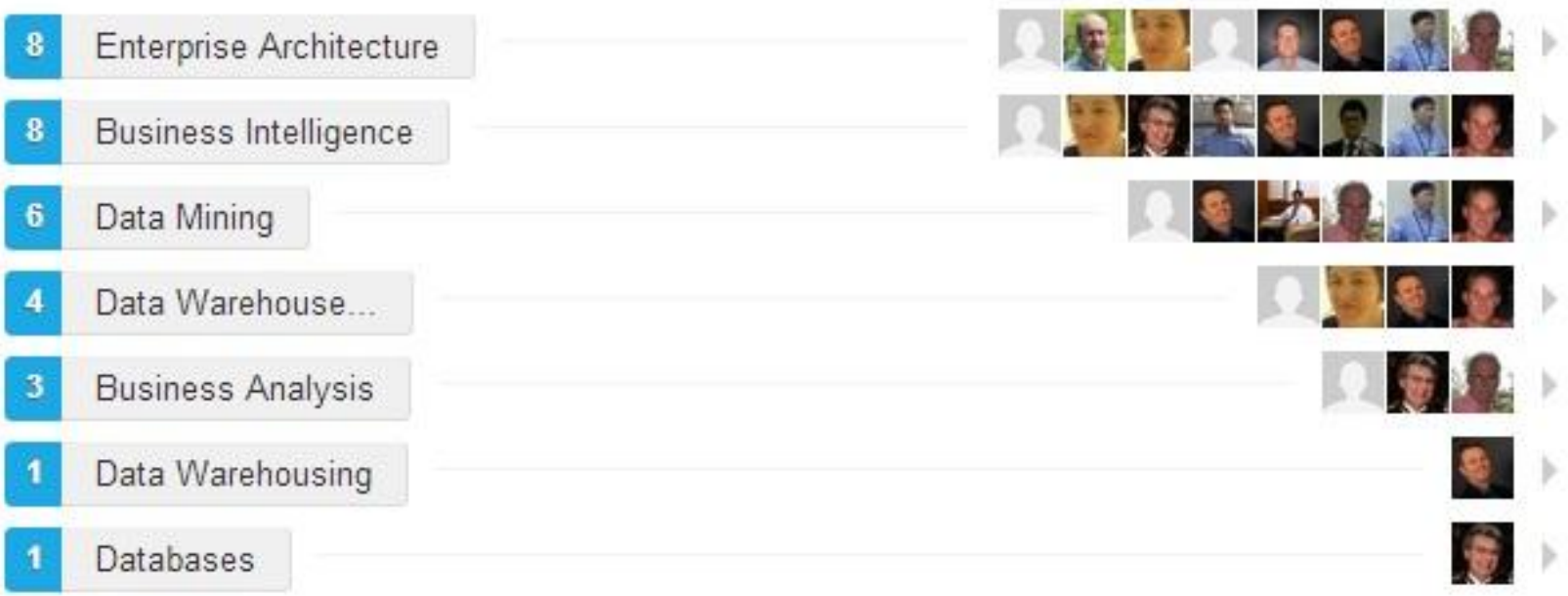
## Skills & Expertise



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# Topic

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Maximising spatial ROI during a project's lifecycle to improve business value.

ROI = Return on investment

# Which means

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- Maintaining business (shareholder) value in tough times.
- Maintaining management engagement in spite of:-
  - Reducing budgets
  - Reduced staff numbers
  - Reduced offices !
  - Ceasing exploration completely
- Optimised GIS strategies in spite of:
  - Reduced IT budget
- Working smarter
  - Automating spatial activities where feasible
  - Cheap and small can be beautiful
  - Big data and new technology are still affordable (LiDAR case studies)

# KEEPING THE FAITH ('Buy-In')

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- Enterprise Architecture aka 'big picture'
  - The Corporate Strategy does not go away in tough times
  - A 'functioning enterprise' should be dynamic enough to handle any external or internal 'shock' (refer row 6 of ZF)
  - Need a framework to begin with e.g. Zachman Framework
- Your message
  - Now is not the time to 'go backwards' with our GIS / Business Intelligence
  - BI has always delivered high ROI (> 50%)
  - Compared to replacing MYOB with AX (ROI 15%)
  - A category of methodologies and technologies for gathering, storing, analysing and providing access to data to help enterprise users make business decisions (Dresdner,1989).

# Corporate ‘Big Picture’

## Zachman Framework for Enterprise Architecture

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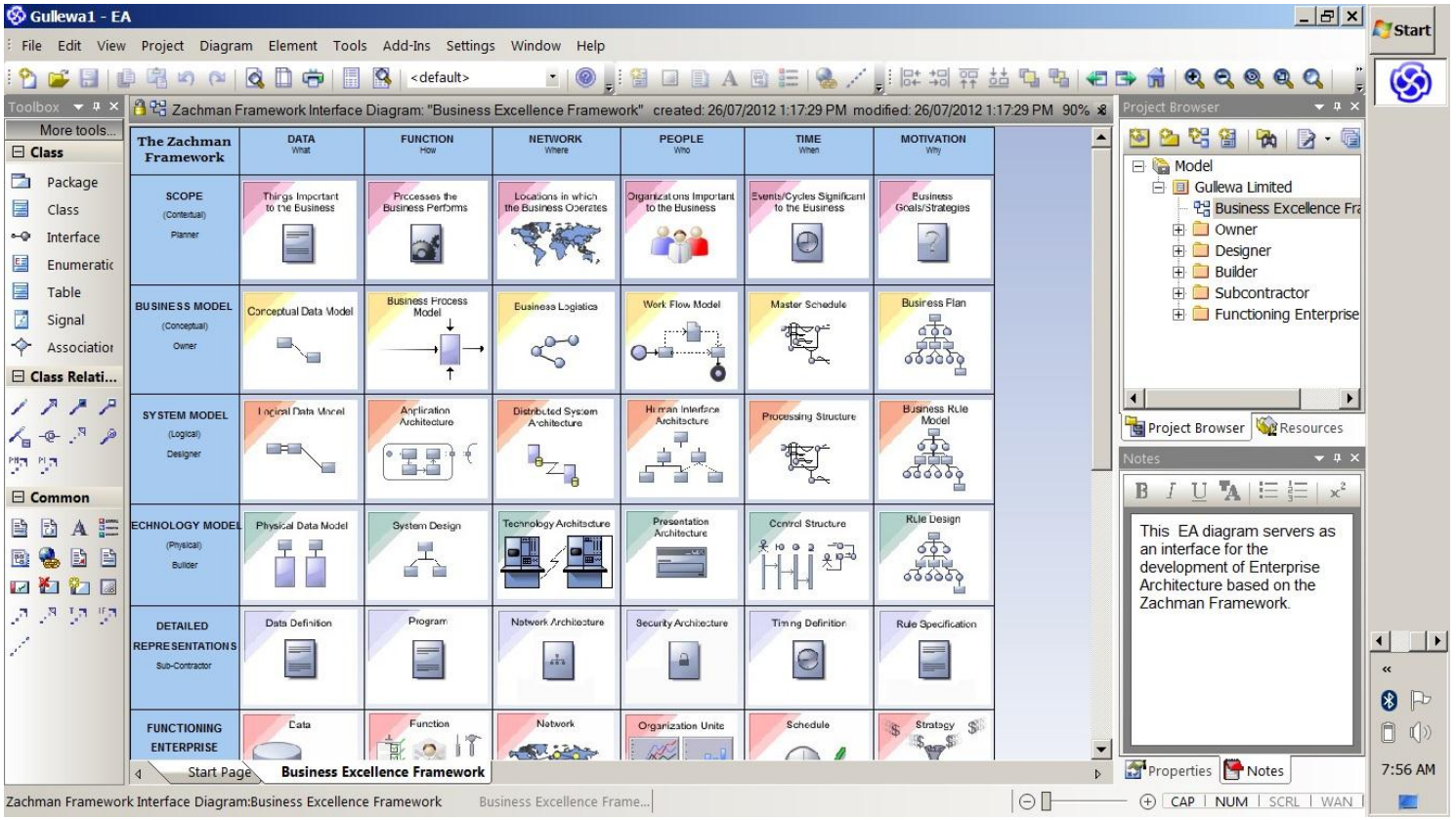

# BEST STRATEGY FOR GIS

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- It depends ….but
- Look at your overall technology architecture and your user needs
- Never engage in knee-jerk procurement , just to save money
- Always keep in touch with your user's needs
  - Mobile
  - Remote
  - Cloud
- Strategy for 'spatial data tsunami'
  - Data Integration (Ralph Kimball's book suite)
  - 'Single point of truth' (Sorry Bill, it was David Fiddyment)

# PB MapInfo “Traits” Webinars

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- Have been run over the last few months by Stacy Grant
- 6 Traits of highly successful GIS folk
- 1.Sharpen the pencil (think outside the box)
- 2.Work smarter not harder (single point of truth)
- 3.Put a map in it
- 4.Lay your foundations
- 5.Leverage what you have
- 6.Call on the experts

# PB “Happenings”

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- Steve Mann promotion
  - In charge of development world-wide
  - Revival of the MapInfo brand
- MapInfo 12 just released (better labelling etc.)
- Module changes coming
  - Parts of Vertical Mapper ,Discover /3D, Engage 3D  to be added to ‘core’ product
  - Licensing adjustments
  - MI Pro – Discover integration
  - MI 12.5 WILL use WIN 8 for tablet devices and touchscreens
- User case studies e.g. Moolarben Coal (Yancoal)
  - IT stressed out by user requests
  - Went to PB Exponare and haven’t looked back

# Requirements Analysis

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- There are good value tools to assist in collecting this vital information
  - Do not ask – What would you like ?
  - Ask – Why do you do what you do ?
- Seek out the most influential stakeholder whose problem you can solve first
- Show the business that you understand

# Automating Operational BI / Spatial

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- Spatial is part of BI or “Location Intelligence”
- IT struggled to automate BI in the 1990s
- Database vendors took over BI ~2000
- This exposed mainstream technologies
- Leverage mainstream BI developments from vendors like Microsoft

# Microsoft makes data mining self-service with BI for Office 365

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- Power BI for Office 365
- Excel is the world's most popular BI tool
- 1 billion office users out there
- First steps in 2008 with Power Pivot and Project Gemini
- Connect to Hadoop clusters in your company's data centre or..
- To Windows Azure HDInsight in the cloud (windowsazure.com)
- Power Query (e.g. spreadsheet from twitter feed)
- Power Map (rich 3D visualisations in Excel)

# Mini case studies on LiDAR

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- Small Scale – Townsville Coal Exploration
- Larger Scale – Offshore Phosphate Exploration

# AGENDA

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- LiDAR **L**et's start simply
- LiDAR **I**nformation and Data Management
- LiDAR **D**ata Visualisation and Interpretation Tools
- LiDAR **A**ccessing the power of LiDAR
- LiDAR **R**ecognising some limitations

# LiDAR Basics

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- Light Detection And Ranging
- RADAR (wavelength 100,000 times longer)
- Radio Detection And Ranging
- Light waves rather than radio waves

# LiDAR Fundamentals

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- Remote sensing technique
- Point Cloud (billions of points)

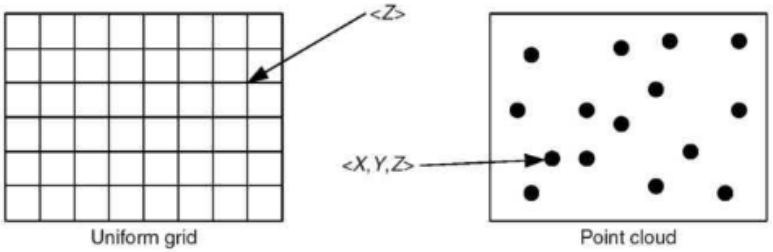
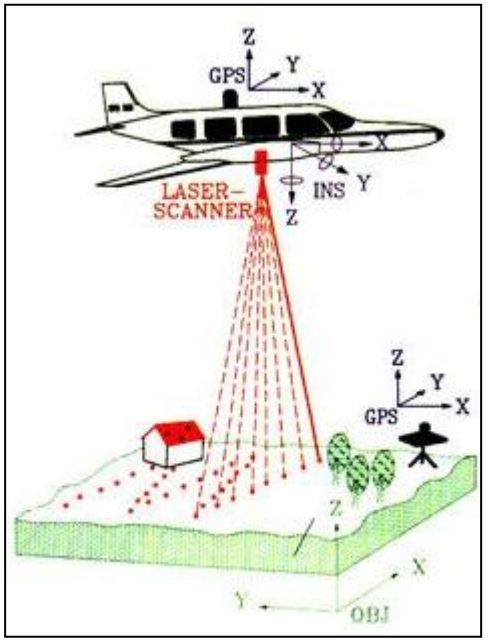



**FIGURE 10.2**
Comparing a grid to a point cloud.

Source : Shan (2009)




(Source : Helt , 2005)

Tipping point - The introduction of direct geo-referencing technology in the mid-1990s.

# Returns Concept

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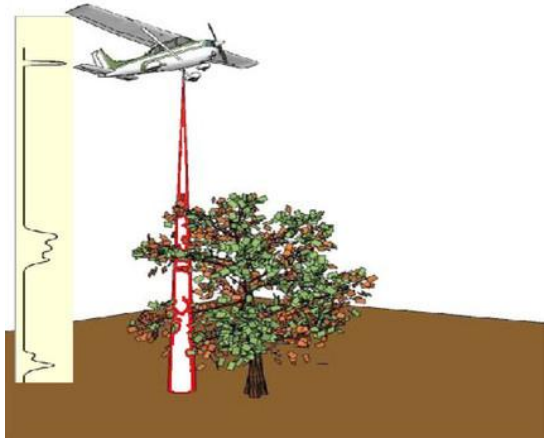

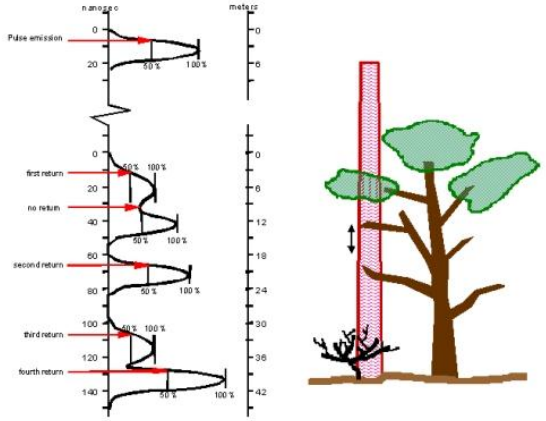


| X | Y | Z | R | X | Y | Z | R |
|---|---|---|---|---|---|---|---|
| 512548.36 | 5403119.37 | 314.29 | 10 | 512548.20 | 5403120.90 | 303.43 | 28 |
| 512548.39 | 5403120.61 | 313.73 | 20 | 512548.24 | 5403122.08 | 303.45 | 44 |
| 512548.36 | 5403122.39 | 308.73 | 48 | 512548.28 | 5403123.17 | 303.35 | 66 |
| 512548.40 | 5403123.05 | 310.07 | 26 | 512548.31 | 5403124.02 | 303.45 | 172 |
| 512548.40 | 5403123.92 | 308.46 | 0 | 512548.33 | 5403124.67 | 303.40 | 203 |
| 512548.34 | 5403125.09 | 303.43 | 290 | 512548.34 | 5403125.09 | 303.43 | 290 |
| 512548.35 | 5403125.41 | 303.47 | 319 | 512548.35 | 5403125.41 | 303.47 | 319 |
| 512548.35 | 5403125.74 | 303.47 | 319 | 512548.35 | 5403125.74 | 303.41 | 319 |
| 512548.36 | 5403125.95 | 303.46 | 290 | 512548.35 | 5403125.96 | 303.43 | 290 |

# LiDAR Data Management

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- Data Formats
  - Text (ASCII- delimited) – few million rows ($400/sq. km)
  - LAS (Stream binary – millions to billions of rows)
- Data Structure
  - X,Y and one Z (typically airborne sensor)
  - LAS point clouds with multiple ‘returns’, other attributes besides X,Y and Z.
- http://www.asprs.org/a/society/committees/lidar/lidar_format.html

asprs THE IMAGING & GEOSPATIAL INFORMATION SOCIETY

# Typical LiDAR data columns

**TABLE 10.4**

Example LiDAR per-Point Data Attributes

| Attribute | Description |
|---|---|
| *X, Y* | The planimetric ground location of the point |
| Z | The elevation of the point |
| Intensity | The laser pulse return intensity at the sensor |
| GPS time | The time (in GPS clock time) of the receipt of the return pulse |
| Number of returns | Number of returns detected for a given transmitted pulse |
| Return number | The return number of this pulse (e.g., return two of three returns) |
| Mirror angle | Angle of the scanner mirror at the time of this pulse (only applies to scanning sensors) |
| Classification | Surface (or other) attribute assigned to this point such as ground, vegetation, and so forth |
| Point source ID | A unique identifier to reference this point back to a collection source |

```
x,y,z,classification,gpstime,scan_angle,intensity,number_of_returns,return_number,point_source_ID,edge_of_flight
442000.04,4314018.69,36.41,1,165688.344000000011874,0,5,0,0,2,0,0,0,0,0,0
442000.37,4314018.98,36.41,1,165688.344000000011874,0,6,0,0,2,0,0,0,0,0,0
442000.68,4314019.25,36.42,1,165688.344000000011874,0,6,0,0,2,0,0,0,0,0,0
442001.30,4314019.79,36.46,1,165688.344000000011874,0,5,0,0,2,0,0,0,0,0,0
442000.32,4314016.42,36.44,1,165688.369000000006054,0,4,0,0,2,0,0,0,0,0,0
442000.63,4314016.69,36.47,1,165688.369000000006054,0,5,0,0,2,0,0,0,0,0,0
442000.95,4314016.98,36.45,1,165688.369000000006054,0,5,0,0,2,0,0,0,0,0,0
442001.57,4314017.53,36.50,1,165688.369000000006054,0,6,0,0,2,0,0,0,0,0,0
442002.20,4314018.09,36.51,1,165688.369000000006054,0,5,0,0,2,0,0,0,0,0,0
```

# Database storage of LiDAR data

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- Spatial databases offering native support
  - Oracle Spatial
  - ESRI Geodatabase (ArcSDE)
  - Microsoft SQL Spatial

# Microsoft SQL Spatial and LiDAR

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The spatial Index i am using:

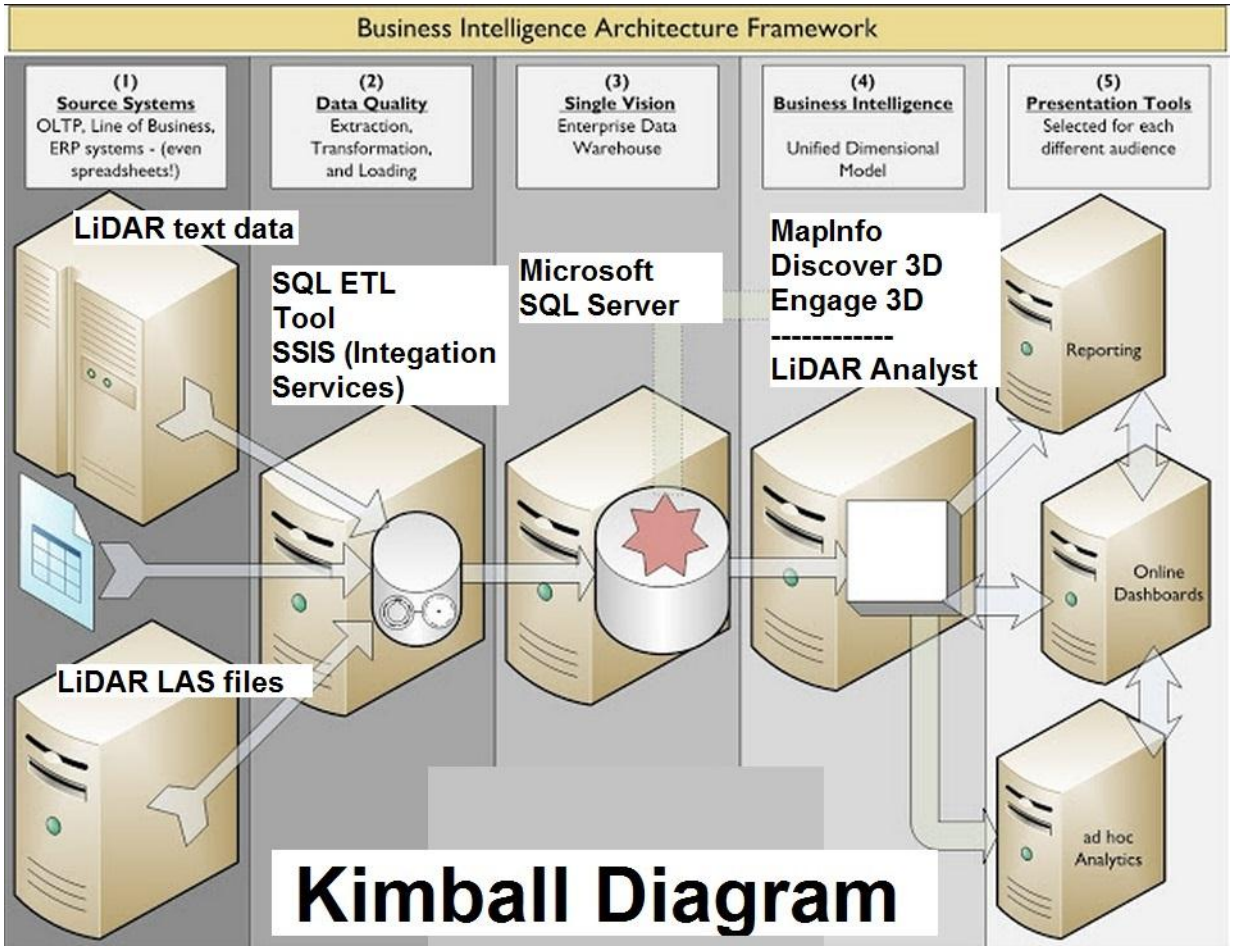
```
CREATE SPATIAL INDEX [SPATIAL_lidar] ON [dbo].[lidar] ([geom]) USING  GEOGRAPHY_GRID
WITH (
GRIDS =(LEVEL_1 = MEDIUM,LEVEL_2 = MEDIUM,LEVEL_3 = MEDIUM,LEVEL_4 = MEDIUM),
CELLS_PER_OBJECT = 16, PAD_INDEX  = OFF, SORT_IN_TEMPDB = OFF, DROP_EXISTING = OFF,
ALLOW_ROW_LOCKS  = ON, ALLOW_PAGE_LOCKS  = ON) ON [PRIMARY]
```

Here is the Query I am using:

```
declare @ms_at geography = 'POINT (-95.66 30.04)';
select TOP(1) nearPoints.geom.STAsText()as latlon
from
(
select r.geom
from lidar r With(Index(SPATIAL_lidar))
where r.geom.STIntersects(@ms_at.STBuffer(1000)) = 1
) nearPoints
```

Here is a sample of lat longs in my database . to give an idea of accuracy and density. All the 70 million records are for one city (Lidar Data)

# LiDAR and architecture framework



# LiDAR Visualisation Tools

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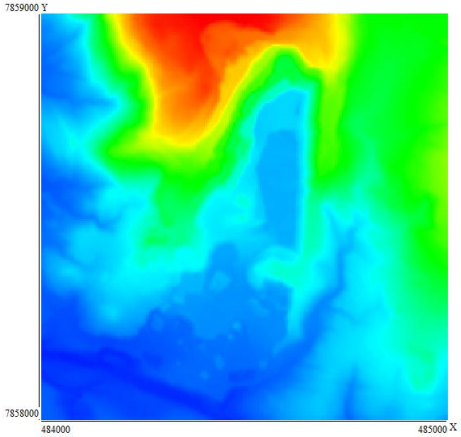
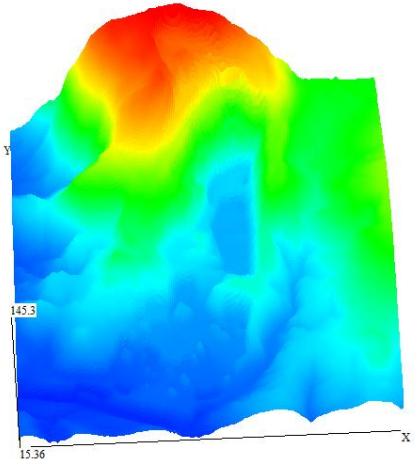
- Many open source tools are available for gridding / viewing / QA / QC





QuickGrid© freeware

1 million points
1000 rows
X,Y precision 1m
Z precision 0.1m

# MapInfo© Vertical Mapper Output

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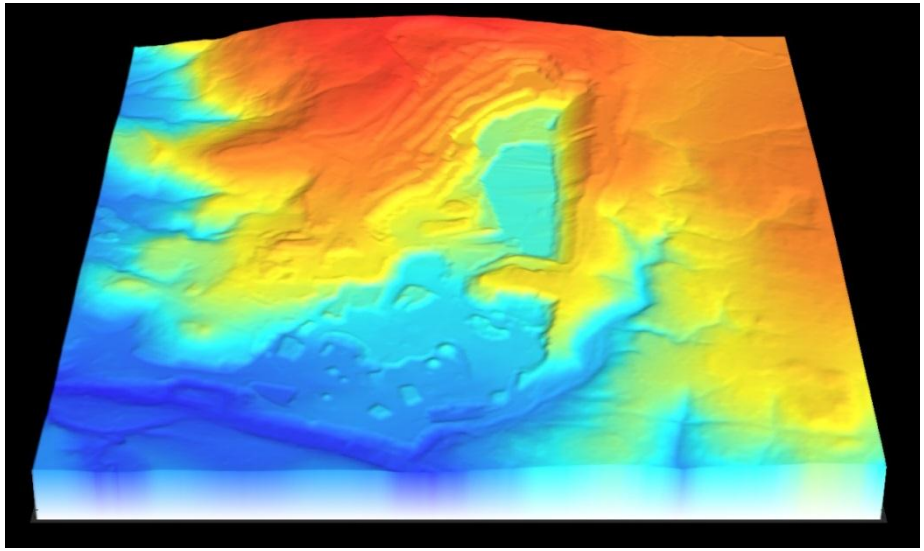

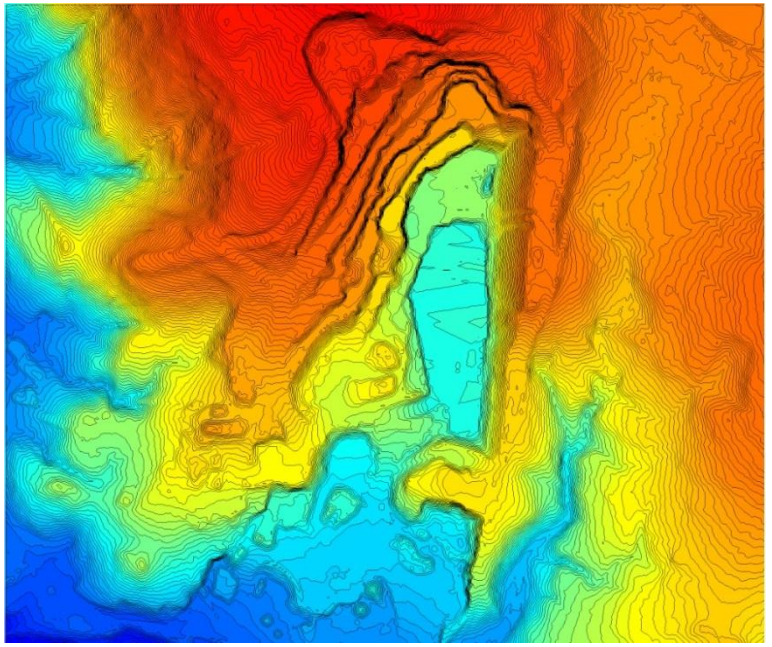

# Data Validation pays for itself

SPSS is now easy to use

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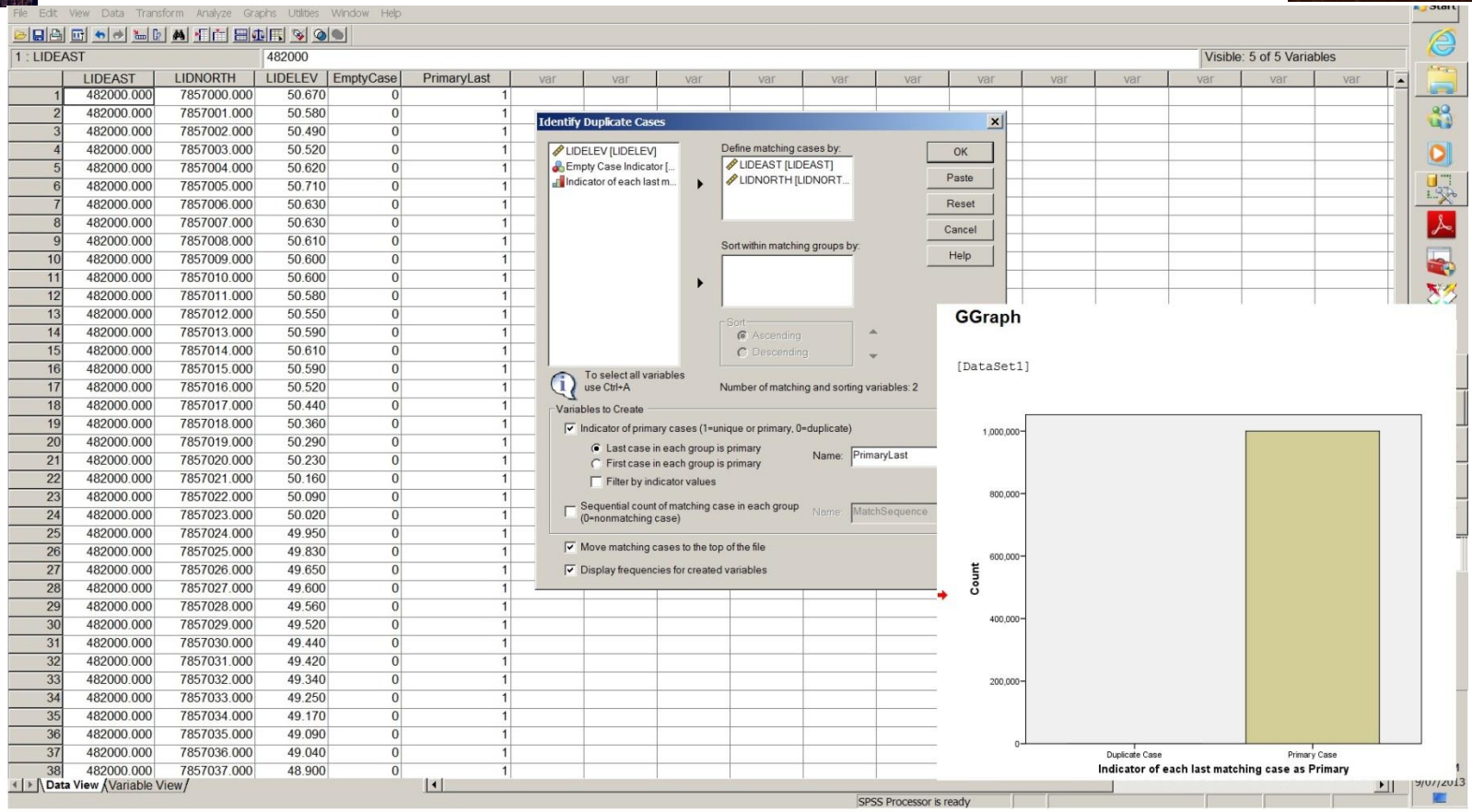


Save just 5 hours a month then you have paid for the software

# SPSS Identify duplicate cases

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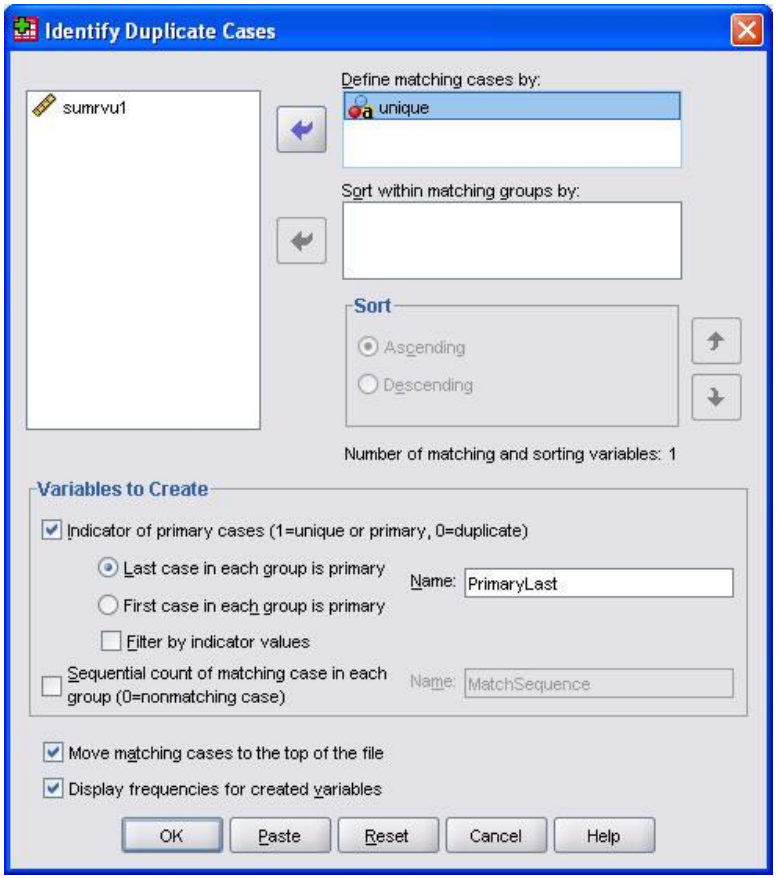
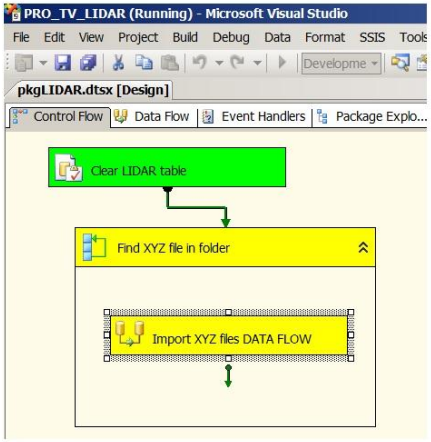
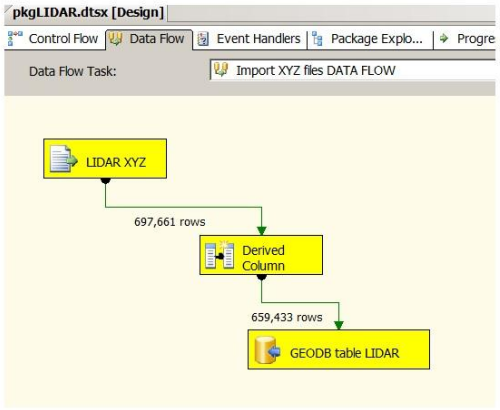


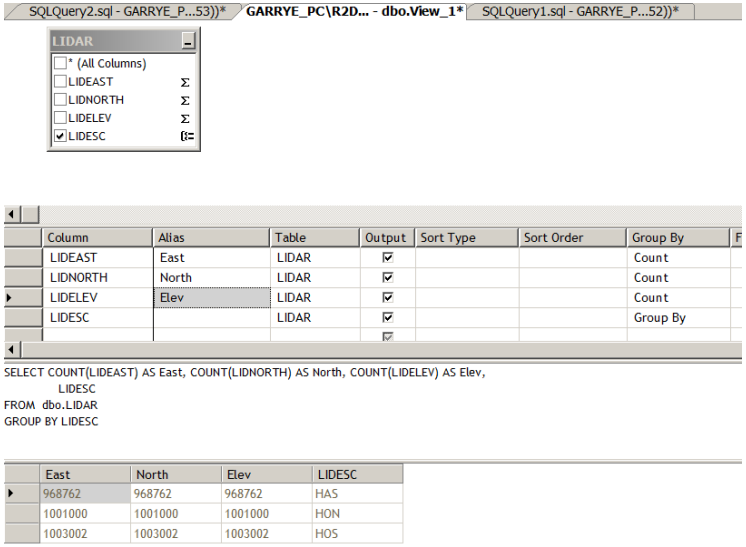
# Check before you build

Screen shots from a running data management job




- This is a data management workflow
- It loops through a number of text files in the one directory and then loads the data into a SQL Server database table.




- You can run a simple query while the SSIS package is processing to check its progress.
- Build an 'indicator field' for source system integrity using 'regex' code.
- LIDEAST <= 483000 && LIDNORTH >= 7857000 && LIDNORTH <= 7858000 ? "HOS" : LIDEAST <= 483000 && LIDNORTH >= 7858001 ? "HON" : LIDEAST >= 484000 && LIDNORTH >= 7857000 && LIDNORTH <= 7858000 ? "HAS" : LIDEAST >= 484000 && LIDNORTH <= 7858000 ? "HAN" : "xx"

SQL 2008 BIDS (Business Intelligence Design Studio)

# Data Visualisation and Interpretation Tools

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- PB MapInfo software suite
  - XYZ – simple import from database
  - LAS – A number of options
    - LAS to SHP utility (for TAB) – NOT RECOMMENDED
    - Discover and Discover 3D
    - Engage 3D Pro
    - Vertical Mapper (good for gridding and 2D contours)
  - Both Discover and Engage 3D support both the import and interpolation of terrain/DEM type LAS datasets

# Discover 3D and Engage3D Pro

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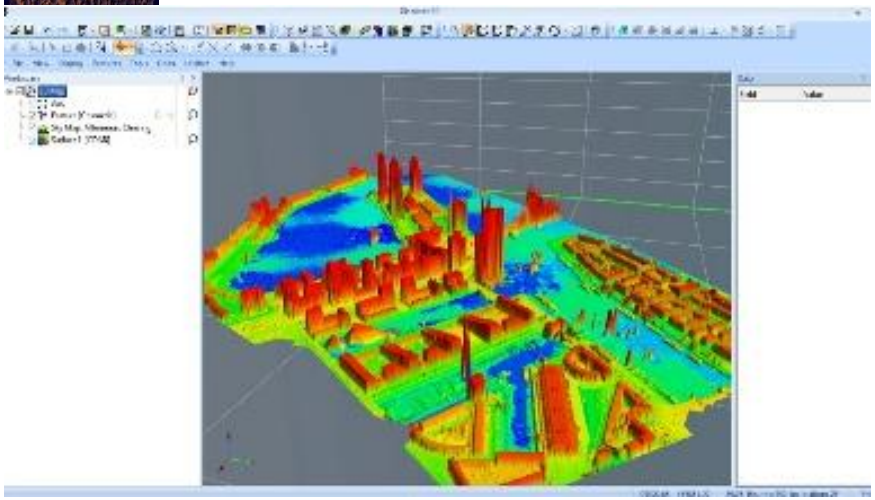

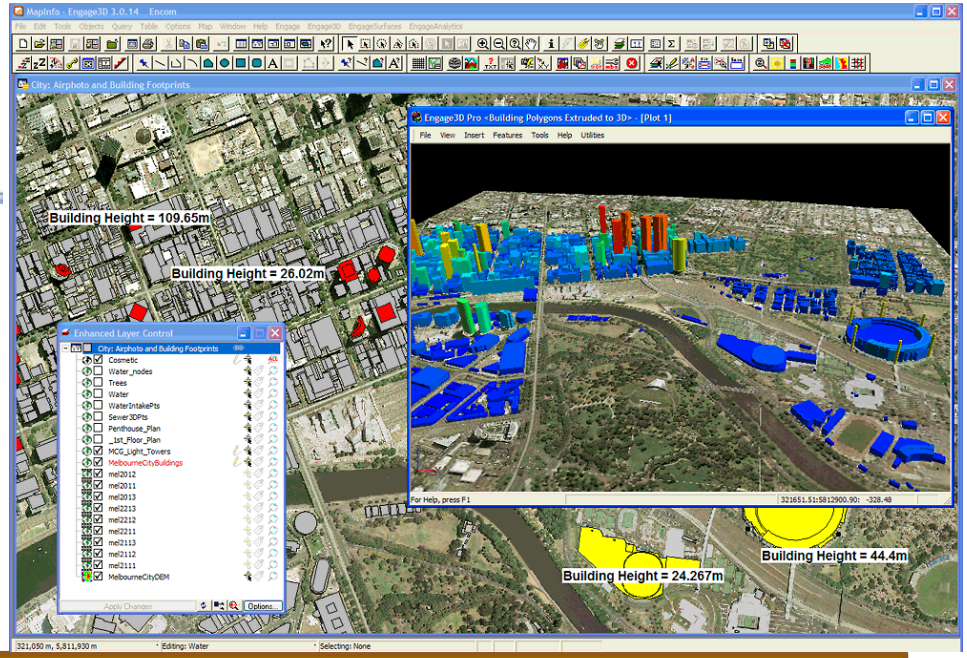

# Offshore Phosphate

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# LiDAR generated images

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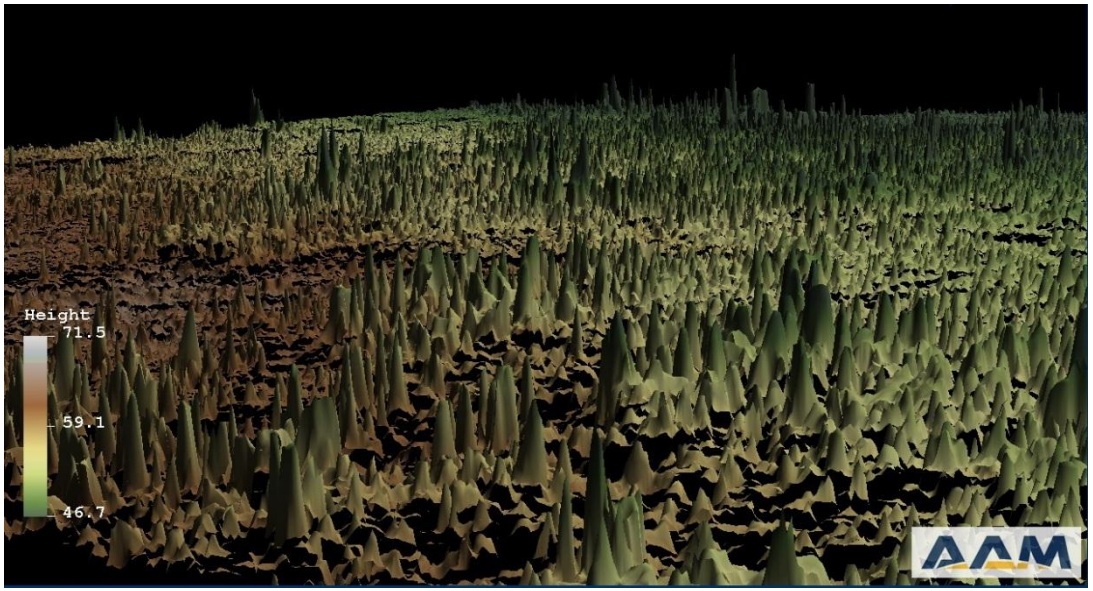


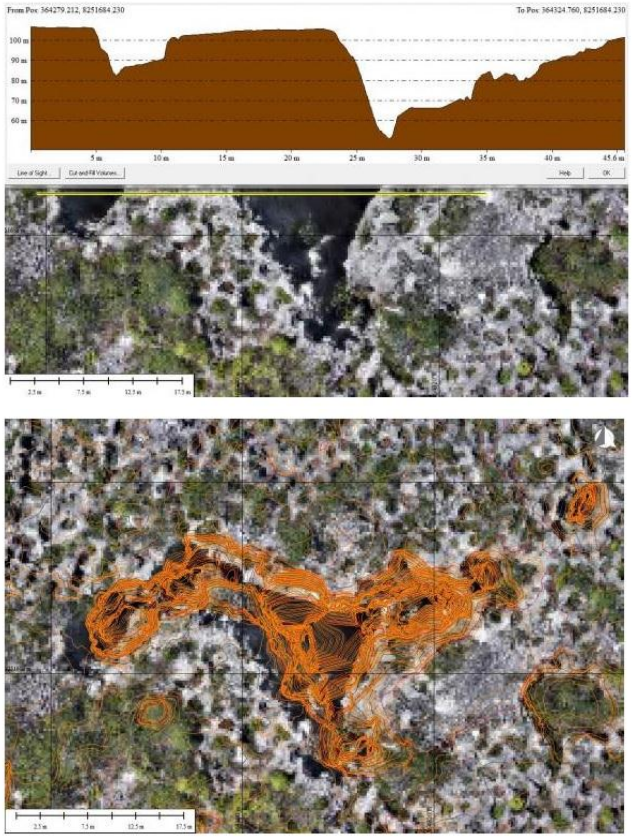

The LiDAR survey was conducted by the AAM Group.

# References


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# Further Study

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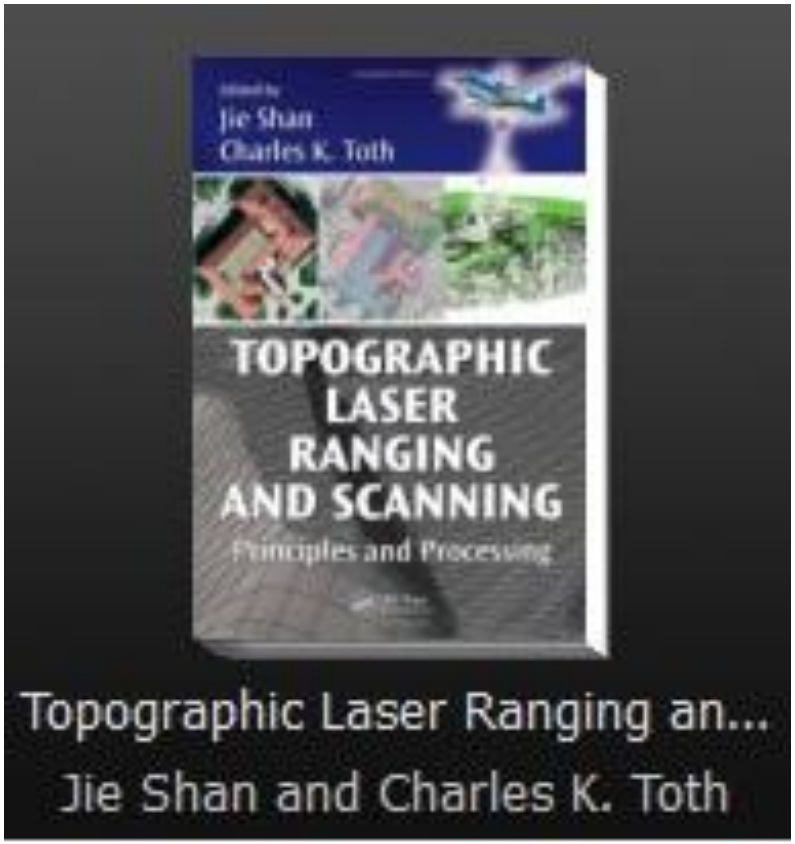

# Wrap Up

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- Maintain ROI during a period where we see convergence of :-
  - Big Data
  - Commoditisation of GIS
  - User ‘appliance’ demands
- This creates challenges for solution delivery in tough times
- But it is not impossible
  - Innovation and clear thinking
  - It’s all about the strategy delivery and having a user-focus

# Thank you

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