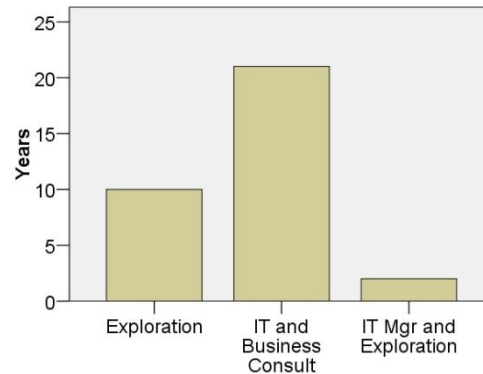


Maximising spatial ROI during a project's lifecycle to improve business value

Garry Edser (M.Geoscience)



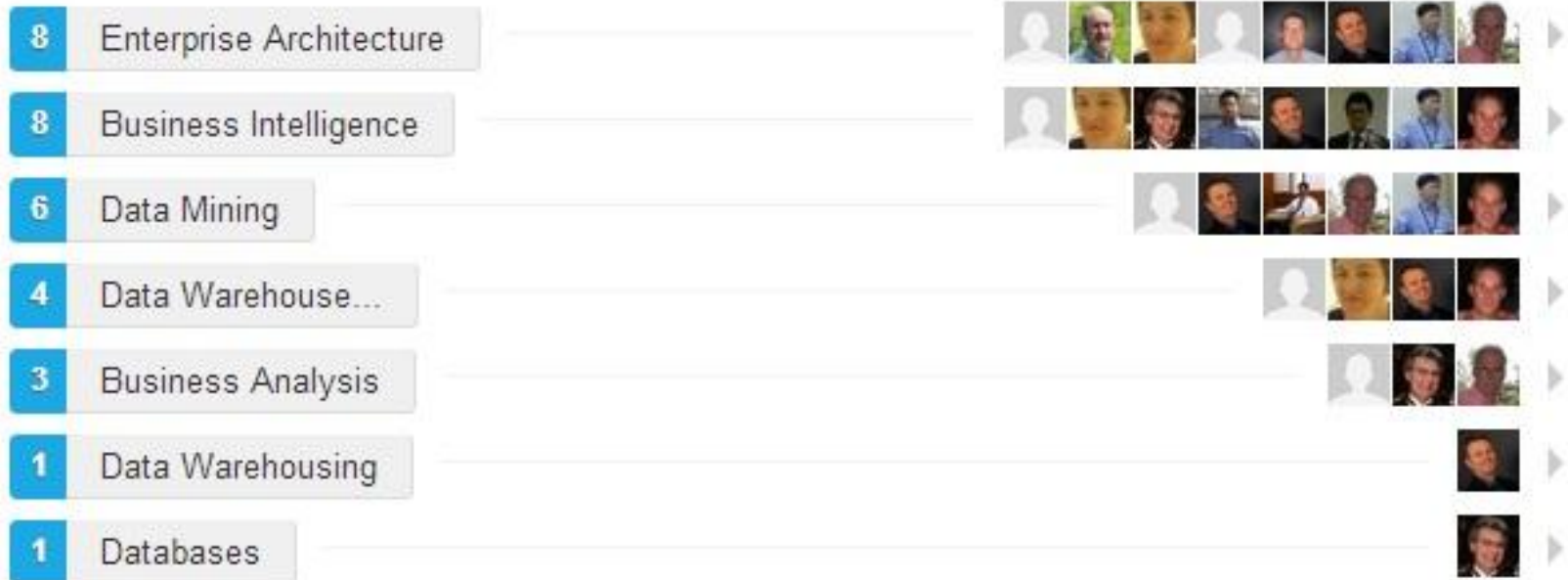


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Topic

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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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The Zachman Framework

	DATA What	FUNCTION How	NETWORK Where	PEOPLE Who	TIME When	MOTIVATION Why
SCOPE (Contextual) Planner	Things Important to the Business	Processes the Business Performs	Locations in which the Business Operates	Organizations Important to the Business	Events/Cycles Significant to the Business	Business Goals/Strategies
BUSINESS MODEL (Conceptual) Owner	Conceptual Data Model	Business Process Model	Business Logistics	Work Flow Model	Master Schedule	Business Plan
SYSTEM MODEL (Logical) Designer	Logical Data Model	Application Architecture	Distributed System Architecture	Human Interface Architecture	Processory Structure	Business Rule Model
TECHNOLOGY MODEL (Physical) Builder	Physical Data Model	System Design	Technology Architecture	Presentation Architecture	Control Structure	Rule Design
DETAILED REPRESENTATIONS Sub-Contractor	Data Definition	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification
FUNCTIONING ENTERPRISE	Data	Function	Network	Organization Units	Schedule	Strategy

Notes:
This EA diagram serves as an interface for the development of Enterprise Architecture based on the Zachman Framework.



BEST STRATEGY FOR GIS

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- It dependsbut
 - 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 Fiddymment)
-



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

The cloud for
modern business

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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)

Infrastructure

Storage, Backup
& Recovery

Web

Mobile

Identity &
Access

Windows Azure
Unlimited Possibilities

Windows Azure is an open and flexible cloud platform that enables you to quickly build, deploy and manage

Microsoft-managed datacenters.



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 Let's start simply**
 - **LiDAR Information and Data Management**
 - **LiDAR Data Visualisation and Interpretation Tools**
 - **LiDAR Accessing the power of LiDAR**
 - **LiDAR Recognising 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)

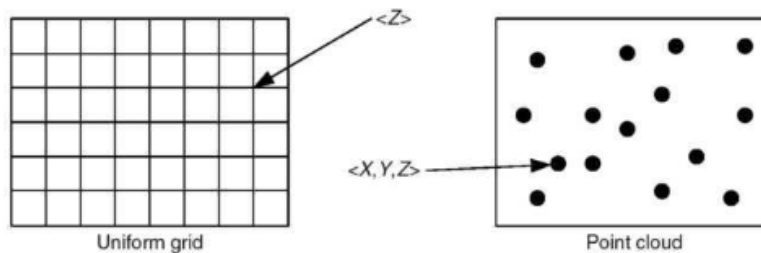
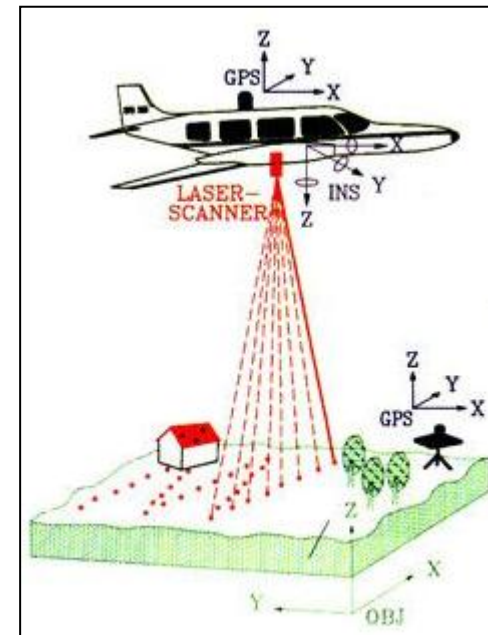


FIGURE 10.2
Comparing a grid to a point cloud.

Source : Shan (2009)



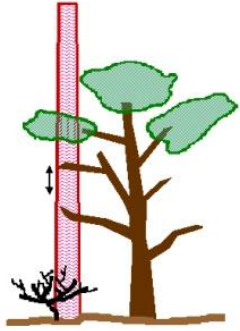
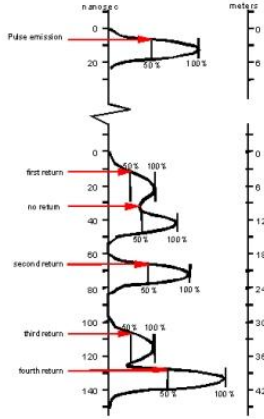
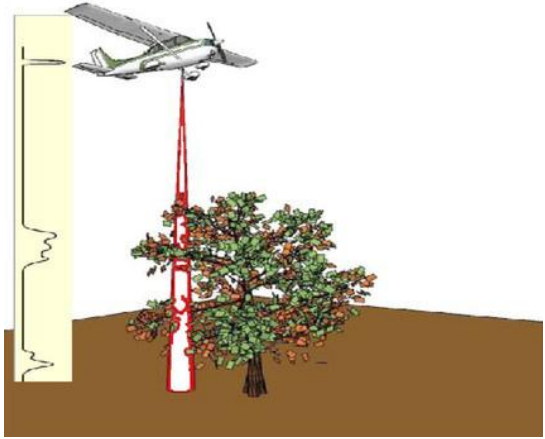
(Source : Helt , 2005)

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



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
442000.04,4314018.69,36.41,1,165688.344000000011874,0,5,0,0,2,0,0,0,0,0,0,0
442000.37,4314018.98,36.41,1,165688.344000000011874,0,6,0,0,2,0,0,0,0,0,0,0
442000.68,4314019.25,36.42,1,165688.344000000011874,0,6,0,0,2,0,0,0,0,0,0,0
442001.30,4314019.79,36.46,1,165688.344000000011874,0,5,0,0,2,0,0,0,0,0,0,0
442000.32,4314016.42,36.44,1,165688.369000000006054,0,4,0,0,2,0,0,0,0,0,0,0
442000.63,4314016.69,36.47,1,165688.369000000006054,0,5,0,0,2,0,0,0,0,0,0,0
442000.95,4314016.98,36.45,1,165688.369000000006054,0,5,0,0,2,0,0,0,0,0,0,0
442001.57,4314017.53,36.50,1,165688.369000000006054,0,6,0,0,2,0,0,0,0,0,0,0
442002.20,4314018.09,36.51,1,165688.369000000006054,0,5,0,0,2,0,0,0,0,0,0,0
```




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]
```

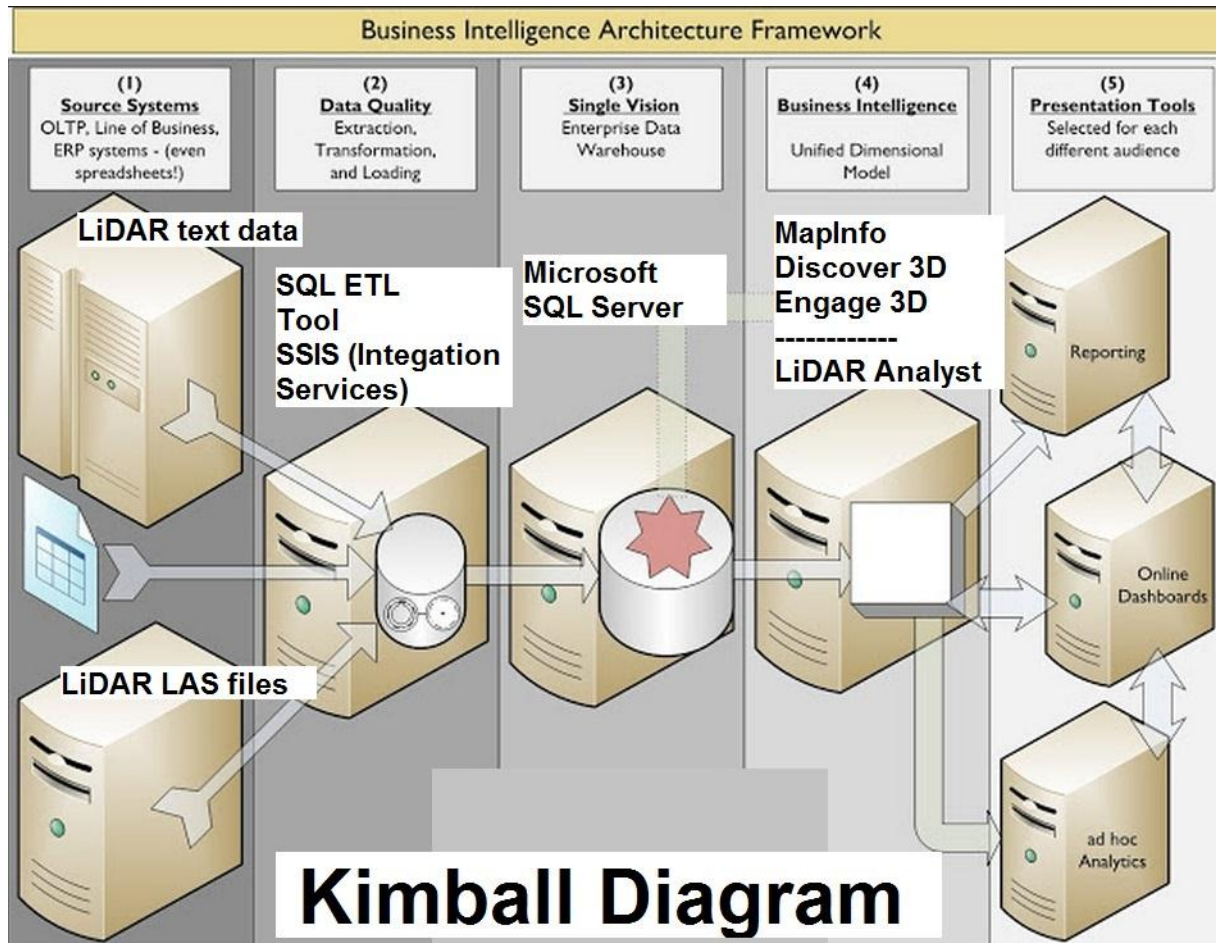
Here is the Query I am using:

```
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

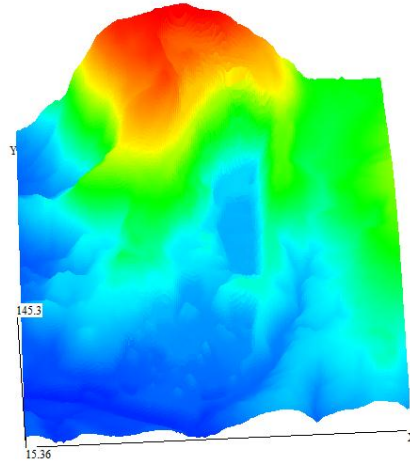
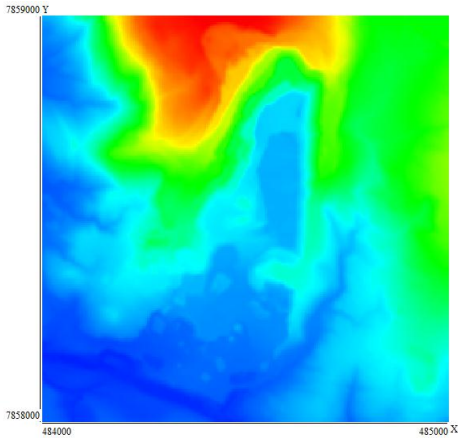
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LiDAR Visualisation Tools

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



QuickGrid©
freeware

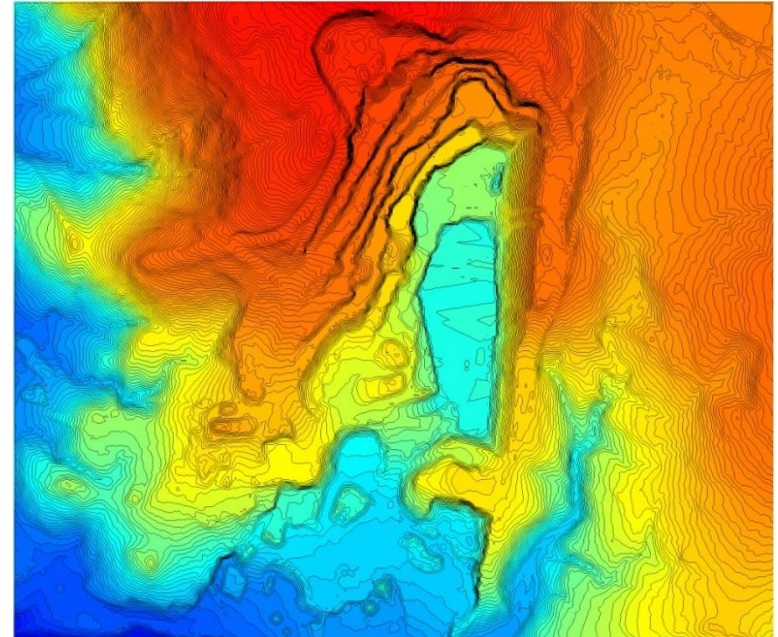
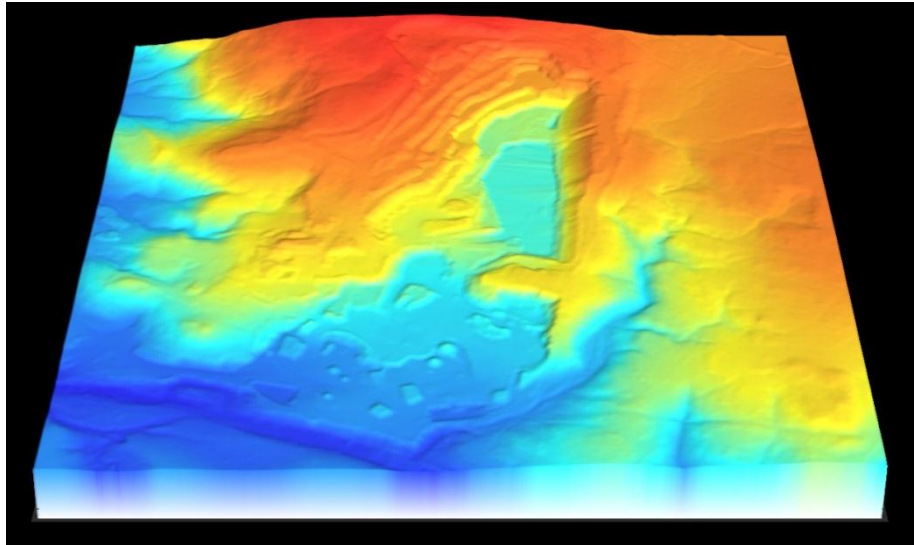


1 million points
1000 rows
X,Y precision 1m
Z precision 0.1m



MapInfo© Vertical Mapper Output

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Data Validation pays for itself

SPSS is now easy to use

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The screenshot displays the SPSS interface. On the left, a data table is visible with columns: LIDEAST, LIDNORTH, LIDELEV, EmptyCase, and PrimaryLast. The data rows show various numerical values for these variables. In the center, the 'Identify Duplicate Cases' dialog box is open. It shows 'Define matching cases by' with variables LIDELEV [LIDELEV], LIDEAST [LIDEAST], and LIDNORTH [LIDNORTH] selected. Under 'Sort within matching groups by', 'Ascending' is selected. The 'Variables to Create' section includes options for 'Indicator of primary cases (1=unique or primary, 0=duplicate)', 'Last case in each group is primary' (selected), 'First case in each group is primary', 'Filter by indicator values', 'Sequential count of matching case in each group (0=nonmatching case)', 'Move matching cases to the top of the file', and 'Display frequencies for created variables'. On the right, a bar chart titled 'GGraph' shows the distribution of the 'Indicator of each last matching case as Primary' variable. The Y-axis is labeled 'Count' and ranges from 0 to 1,000,000. The X-axis has two categories: 'Duplicate Case' and 'Primary Case'. The 'Primary Case' bar is significantly higher, reaching approximately 1,000,000, while the 'Duplicate Case' bar is much shorter, around 100,000.

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

SPSS Identify duplicate cases

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Identify Duplicate Cases

Define matching cases by:
unique

Sort within matching groups by:

Sort
 Ascending
 Descending

Number of matching and sorting variables: 1

Variables to Create

Indicator of primary cases (1=unique or primary, 0=duplicate)
 Last case in each group is primary Name: PrimaryLast
 First case in each group is primary
 Filter by indicator values

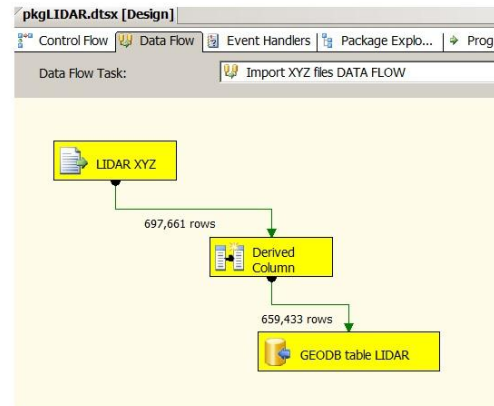
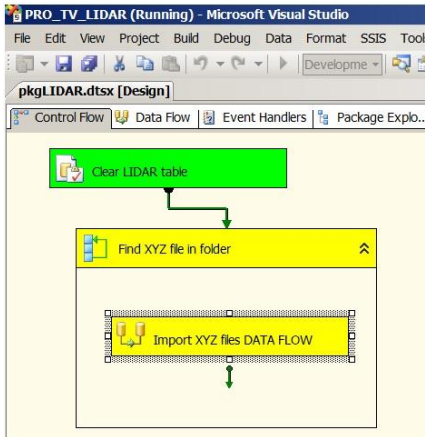
Sequential count of matching case in each group (0=nonmatching case) Name: MatchSequence

Move matching cases to the top of the file
 Display frequencies for created variables

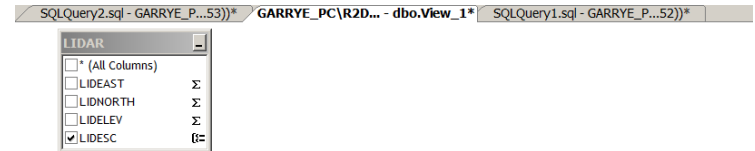
OK Paste Reset Cancel Help

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"

Column	Alias	Table	Output	Sort Type	Sort Order	Group By
LIDEAST	East	LIDAR	<input checked="" type="checkbox"/>			Count
LIDNORTH	North	LIDAR	<input checked="" type="checkbox"/>			Count
LIDELEV	Elev	LIDAR	<input checked="" type="checkbox"/>			Count
LIDESC		LIDAR	<input checked="" type="checkbox"/>			Group By

```
SELECT COUNT(LIDEAST) AS East, COUNT(LIDNORTH) AS North, COUNT(LIDELEV) AS Elev,
LIDESC
FROM dbo.LIDAR
GROUP BY LIDESC
```

East	North	Elev	LIDESC
968762	968762	968762	HAS
1001000	1001000	1001000	HON
1003002	1003002	1003002	HOS

SQL 2008 BIDS (Business Intelligence Design Studio)



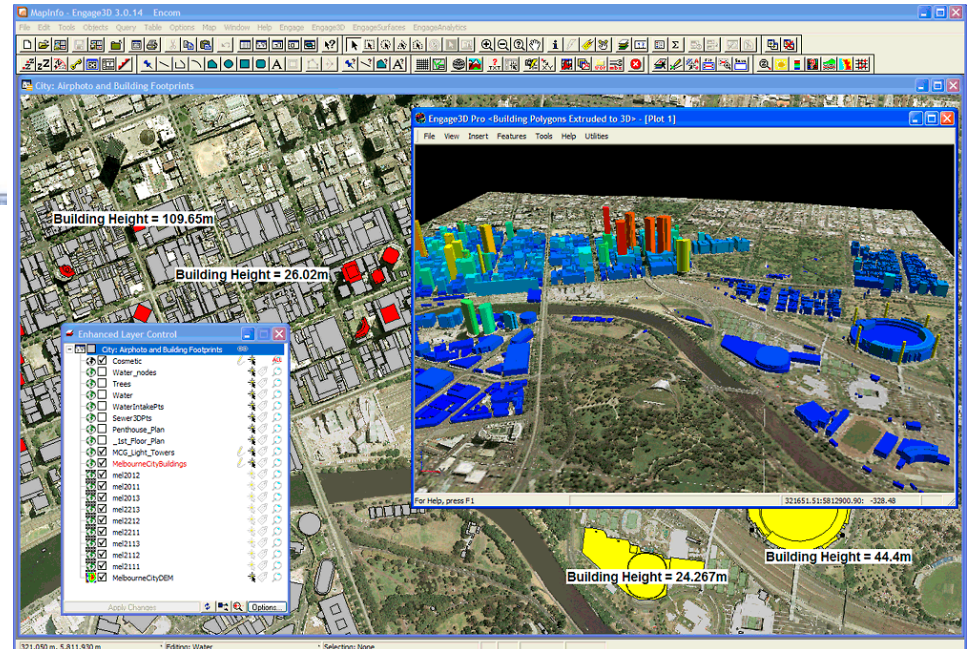
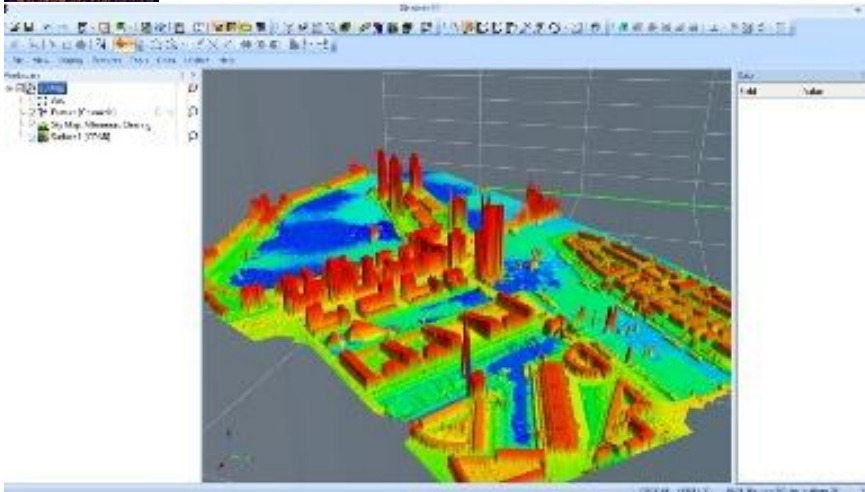
Data Visualisation and Interpretation Tools

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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

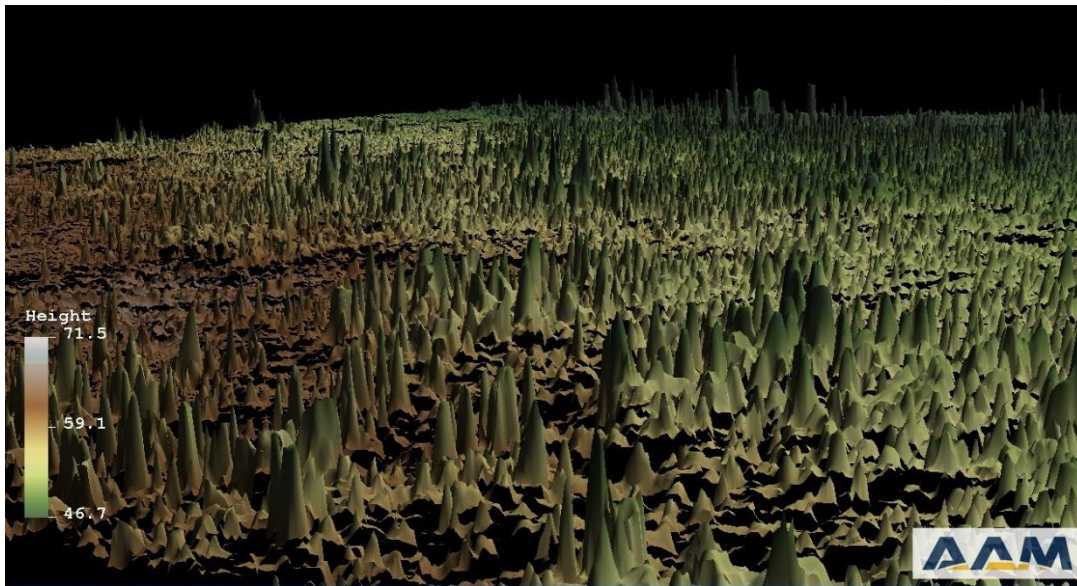
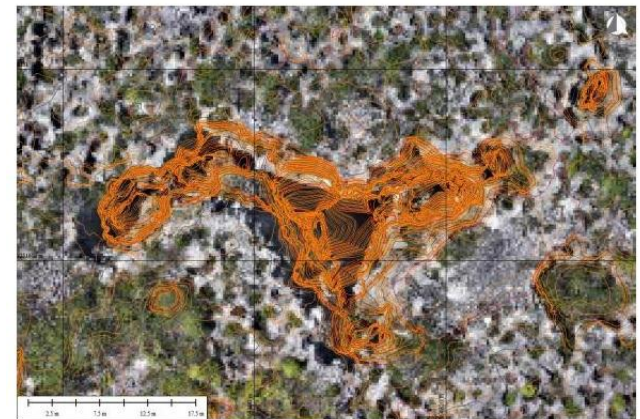
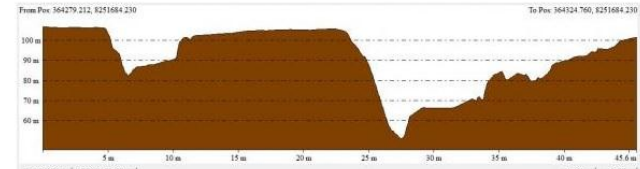
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LiDAR generated images

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The LiDAR survey was conducted by the AAM Group.



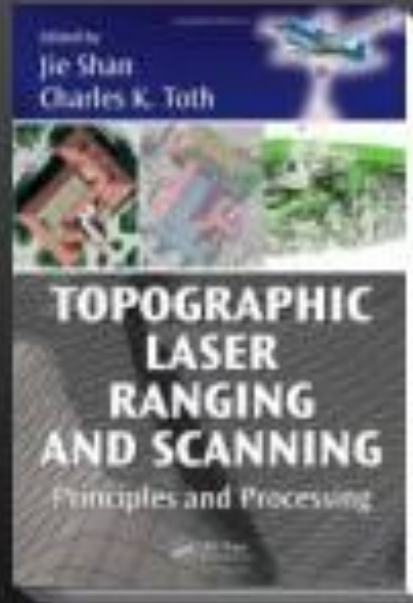
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-

Further Study

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Topographic Laser Ranging an...
Jie Shan and Charles K. Toth

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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