

SCANNING THE HORIZONS

A Newsletter on Leading Edge Spatial Technologies

Engineering Design Issue

TLS for Mine Expansion

Wind Farm Design

Rail Design Project

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Current Aerial Projects of Note

TLS for Mine Expansion

AAMHatch successfully used Terrestrial Laser Scanning (TLS) and SiteSee™ to assist in a feasibility study for expansion.

A two person TLS team was commissioned to scan the northern half of a concentrator building as part of a feasibility study for the expansion of a manganese mine.

This was AAMHatch's second successful TLS job at the site, with the first providing engineers with 3D as-built data for a refit of the southern section of the concentrator building.

During the two week campaign, 90 scans were completed, acquiring over 1 billion 3D points. In addition to this, 100 SiteSee photo montages were delivered, which engineers were able to use in 'before and after' comparisons of the newly refitted southern section of the building. The SiteSee imagery enabled offsite engineers working in a different state to traverse around the site from the safety and comfort of their desk. The laser scanning was vital to the engineering team and will be referred to in their CAD software, Leica Cloudworx.

Experience the benefits immediately at www.aamhatch.com/sitesee



Above: An unwrapped 360° photo montage of the site created from SiteSee

Wind Farm Design

Numerous companies are using LiDAR data for energy related projects. Here is one recent example.

Project Deliverables

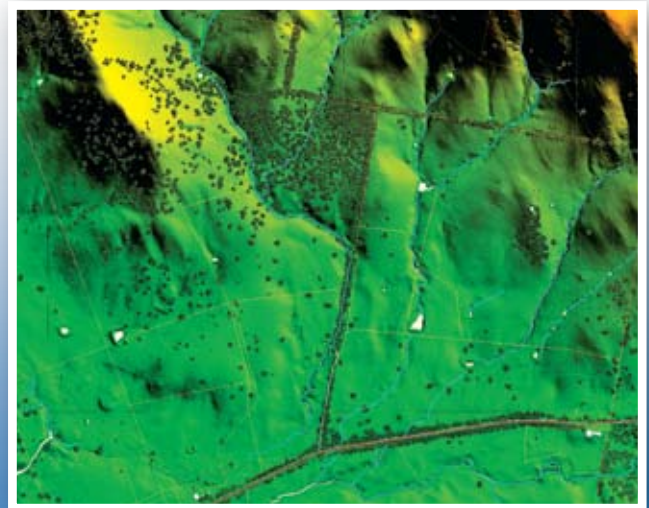
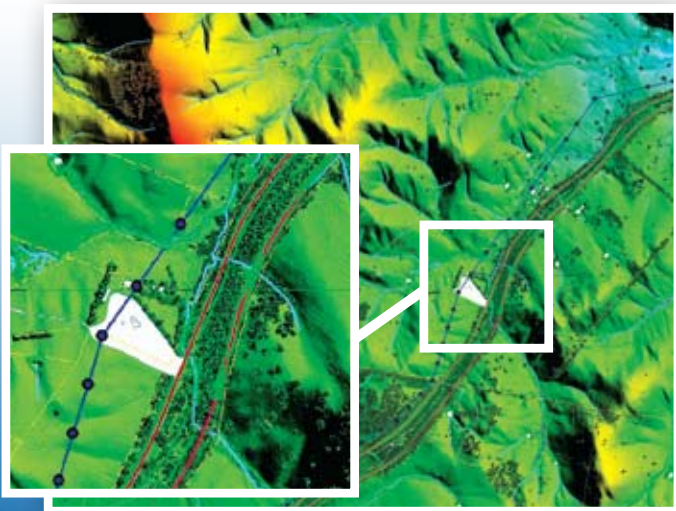
- 90km² of LiDAR data (+/- 30cm vertical accuracy)
- LiDAR deliverables included:
 - All LiDAR returns (unthinned) xyz in ASCII format in 2km x 2km tiles
 - Thinned 'bare earth' xyz point cloud data in ASCII format in 2km x 2km tiles (vertical accuracy of +/- 30cm at 1 sigma on open clear ground)
 - 'Non ground' xyz point cloud data in ASCII format in 2km x 2km tiles (aka canopy or first strike model)
 - 1m contours as 3D dxf

- Detailed topographic mapping of features including buildings, fences, creeks and roads from existing photography

About 42 million unfiltered data points were collected by the LiDAR survey for the entire project with about 4 million points present in the 'filtered ground point' dataset. Any points not contributing to the terrain definition were removed with filters and subsequently manually checked in a number of sites.

For more information on LiDAR, visit:

www.aamhatch.com/lidar



Above: LiDAR terrain and feature data used for wind farm design



Rail Design Project: LiDAR and Ortho Imagery

AAMHatch undertook an aerial survey to support a rail expansion program including an upgrade and new lines.

The scope of this project was 130 linear kilometres along a corridor width varying from 400m to 2000m. Imagery was required for the purpose of engineering design and as a backdrop for field survey data. The LiDAR derived, terrain products were for the purpose of detailed engineering design.

Project Features

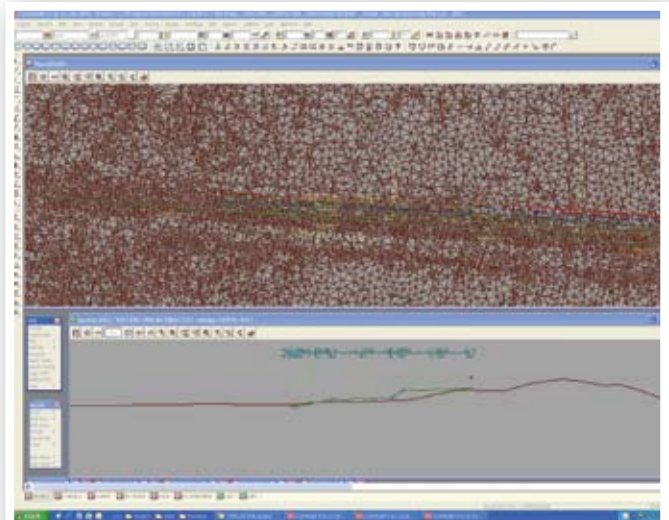
- 130 linear kilometres
- 400 - 2000m corridor width
- Terrain and cadastre of interest
- Data delivered within weeks of capture

Project Deliverables

- +/- 10cm vertical accuracy LiDAR point data
- 25cm colour ortho photo mosaic
- 25cm LiDAR derived contours
- DCDB adjusted to fit the digital terrain model

For more LiDAR case studies, visit:

www.aamhatch.com/lidar



Above: Screen shot of the final data



Above: 25cm contours derived from the LiDAR data



Above: Ortho image of the rail expansion project



High Resolution Aerial Survey for Infrastructure

Infrared and natural colour subsets



Features

- 20mm vertical accuracy possible
- Quality imagery
- Asset and feature data available
- Air Traffic Control support required

Benefits

- Rapid data capture
- Enhanced safety – less field work
- Reduced operational disruption – closures not required for aerial data capture
- Discrete – onsite access not essential

Powerline Design Project

Project Features

- 102km corridor
- 500m corridor width

Project Deliverables

- 25cm colour ortho photo mosaic
- LiDAR point data (better than +/- 20cm vertical accuracy) classified as:
 - Ground
 - Vegetation greater than 2m in height
 - Above ground features excluding vegetation
 - Existing conductors and wires of adjacent transmission lines
 - Existing structures of adjacent transmission lines

Work Required

- Detailed aerial laser survey of the entire route to determine the ground and vegetation, including towers and wires (conductors and earthwires) of adjacent transmission lines within the corridor, provided in separate files
- Ortho-corrected aerial colour photographs of the entire route providing a resolution of 25cm

The objective of the aerial survey work was to obtain digital elevation data containing ground points and vegetation and subsequent processing to enable direct input into PLS Cadd for 3D modelling of the corridor to assist in optimising tower location and transmission line design.

For more LiDAR case studies, visit:

www.aamhatch.com/lidar



Above: 3D modelling of the corridor assists in optimising tower locations

GeoEye-1 Product Accuracy – Ortho Imagery and Terrain Data

An area of ~270km² was captured in stereo by the GeoEye-1 satellite for engineering design purposes.

The GeoEye-1 satellite was used to generate accurate 50cm ortho imagery and 2m contours over the site. The purpose of the imagery was for preliminary engineering design for an energy project.

Accuracies

Survey accurate ground control points, distributed evenly across the area, were used in the image processing. These points enabled consistent accuracies to be derived throughout the project area. The accuracies achieved after generating both the ortho image and the Digital Terrain Model (DTM) exceeded the client's and AAMHatch's expectations. In both vertical and horizontal planes, accuracy results of better than 50cm were achieved.

Contours at 2m intervals are normally created from a DTM with accuracy of 0.6m RMS. The GeoEye-1 DTM was found to have an accuracy of 0.39m RMS, which is equivalent to a contour interval of around 1.3m. These results were pleasing to both our client and GeoEye.

Users should note that in practice anyone can generate contours of any interval desired, however, these products may not be 'fit for purpose'. Clients should be

confident about how accurate their products are! From a purist view, the Australian National Standard for Spatial Data Accuracy specification states that DTMs can be used to create contours with an interval approximately 3.25 times the vertical accuracy of the DTM. The results will then conform to the standard of having 90% of the contours within half the contour interval.

Client Feedback

"I have looked at the data and it looks great. The current format works perfectly with our design software. Very pleased with this format and the results it provides."
Mark, Registered Surveyor.

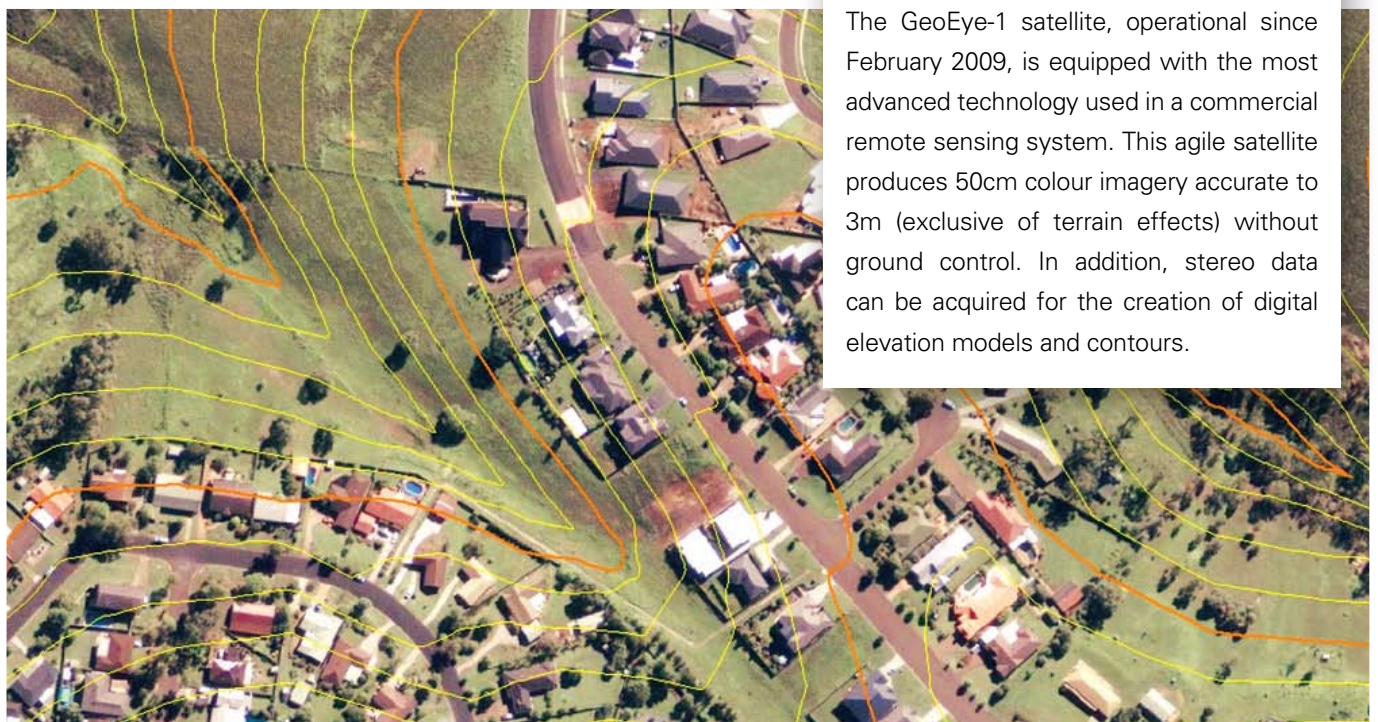
Project Details

| | |
|---------------------------------------|---------------------|
| Area Size | ~270km ² |
| Colour GeoEye-1 Stereo Pair | 4 Band |
| Pixel Resolution (Panchromatic) | 50cm |
| Client Supplied Ground Control Points | 14 |
| Independent Accuracy Check Points | 47 |

For further information on satellite imagery, visit:
www.aamhatch.com/satellite

GeoEye-1 Overview

The GeoEye-1 satellite, operational since February 2009, is equipped with the most advanced technology used in a commercial remote sensing system. This agile satellite produces 50cm colour imagery accurate to 3m (exclusive of terrain effects) without ground control. In addition, stereo data can be acquired for the creation of digital elevation models and contours.



Above: 2m contours over the site created from 50cm GeoEye-1 stereo satellite imagery (background image 50cm GeoEye-1)

Flood Risk Assessment

Council staff utilise 3D datasets for engineering planning, design and community consultation. These 3D datasets contain information about the height and location of features. In this case, the data is for use in a flood model around a town in rural New South Wales.

AAMHatch collected a 3D terrain dataset for the council using an aerial laser sensor (known as LiDAR or Aerial Laser Scanning). This new 3D terrain dataset measured terrain height at more than 44 million sites in and around the town. The density of the measurements can be seen in the image below.

Engineers and Planners will be able to use this particular dataset knowing any measurements made will be within +/-15cm of their true position on open flat ground in 70% of cases. The statistical analysis to confirm this accuracy is calculated using all measurements taken over the entire project area.

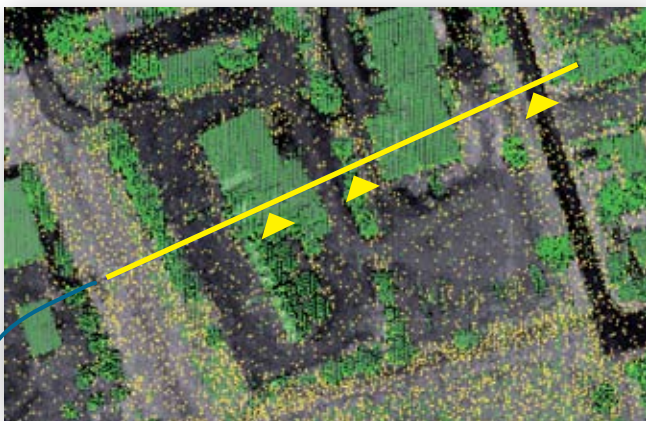
This new aerial laser survey work had some benefits over land survey as the density of measurements was very high and the delivery of products rapid by comparison.

Aerial laser surveys can be undertaken to achieve a range of accuracies: better than +/-10cm vertical accuracy to 25cm or 50cm.

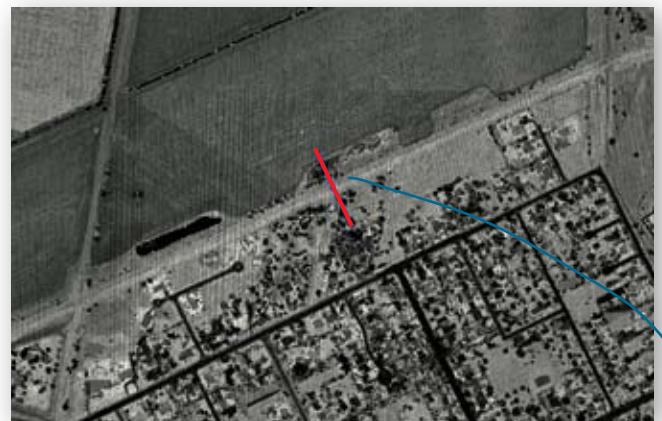
We deliver the terrain data to the accuracy your project requires.

For more LiDAR case studies, visit:

www.aamhatch.com/lidar



Above: Yellow points show location of 'key terrain data'. Each 'point' is where measurement information is available. Green points show location of 'non terrain data' (vegetation, buildings, assets etc). Many more 'terrain point' measurements are collected, however, the council requested only key points in areas necessary to identify significant changes in terrain surface.



Above: The red line shows the location of the cross section below.

Below: The blue line shows the height of the levee at this location. In the image the orange points represent the original "all points" of ground data.

Below: Cross section – The orange (non ground) and black (ground) points provide a ground view of the yellow cross section shown in the above image.



3D City Models and Oblique Imagery for Scenario Modelling

A number of Australian and New Zealand cities have commissioned high definition LiDAR derived, digital terrain models and image derived, 3D city models to bolster their operational and strategic planning. 3D city models offer greater realism and detail to the various climate change scenarios being envisaged, and are valuable in the evaluation of development applications and related tasks. Sydney, Melbourne, Geelong and Wellington are some of the cities that have commissioned these 3D models from AAMHatch.

The City of Greater Geelong in Victoria chose a 3D solution. The solution has been installed and includes a fully textured 3D model of the Geelong Central Activity Area covering approximately 5km², and Pictometry® oblique aerial imagery covering the entire extent of the urban areas of Greater Geelong including towns of the Bellarine Peninsula. The Pictometry oblique georeferenced photography facilitates measurements of height, distance and area directly from the imagery.

This solution has been installed on Geelong's Citrix Server system making it potentially available to many staff. The 3D model produced from the Pictometry oblique photography integrates with Geelong's ESRI GIS via K2vi 3D Visualisation. This provides access of the 3D model to many viewers and allows for discrete analysis functions such as shadow and line-of-sight, which are required for development assessment and master planning.

For more information on 3D city models, visit: www.aamhatch.com/3dcitymodels



Right: Inundation simulation of Hobart

Current Aerial Projects of Note

Many clients ask us about our experience with large projects. Some recent examples demonstrate our capability.

LiDAR Project A

8,000km²
+/- 15cm vertical accuracy
>2pt/m² - point density
25.4 billion - points captured

LiDAR Project B

908km²
+/- 20cm vertical accuracy
>1pt/m² - point density

Imagery Project A

48,227km²
21,302 frames of imagery
10cm, 25cm and 50cm GSD
GSD = ground sample distance/image resolution

Imagery Project B

1,720km²
3,800 frames of imagery
15cm GSD



Above: LiDAR point cloud of Sydney