Considerations When Seeking Terrain and Image Data

As an engineer, geologist, geophysicist or GIS specialist, how should you proceed with a project requiring specific terrain data and imagery? Here are some suggestions.

Step 1	Consult your survey and mapping adviser about the project scope and phase eg feasibility, route selection, design and construction etc
Step 2	Provide your survey and mapping adviser with a digital file of the project extent so the site characteristics and logistics can be assessed
Step 3	Let your survey and mapping adviser report on what existing data may be available or which technology may be the best tool for your project.

With the advent of high resolution satellites, digital aerial cameras and airborne LiDAR, a range of terrain and image data sources exist to generate the products your project requires. (An introduction to LiDAR is later in this document.) For 'large' projects, aerial survey by LIDAR or camera permits data capture and mapping at a pace more rapid than possible using field surveyors – especially given the current high demand on their services. Datasets derived from aerial survey assist the project, leaving the field surveyors to work in the accessible areas undertaking the higher accuracy work.

The size of some projects and the related ground access issues, immediately dictate that an aerial solution supported by field surveyors is the best way to proceed. The aerial survey tool best deployed depends on many factors, some of them listed below in the Table. For example, on some project sites the terrain, vegetation density and/or weather may dictate that a LIDAR solution would supply a more timely and accurate result. In other cases, terrain models derived from a camera will satisfy the project's requirements.

Project Considerations for Aerial Survey

- Location
- Size
- Timelines
- Accuracy required
- Project phase
- Budget available
- Vegetation density / type
- Terrain type
- Weather
- Tidal issues
- Range of deliverables
- Format of products

Data Sources and Common Products Features

Aerial Digital Cameras
- Image resolution ranges from 5 to 50cm
- Digital Terrain Model vertical accuracy ranges from 5 to 50cm @ 1sigma on clear ground

LiDAR
- Images resolution ranges from 15 to 40cm from integrated cameras
- Digital Terrain Model vertical accuracy 10 to 50cm @ 1 sigma on clear ground

High Resolution Satellite
- Image resolution from 41cm
- Digital Terrain Model +/- 2m vertical accuracy @ 1 sigma on clear ground (with control)

LIDAR sensors vary greatly in capability, eg maximum flying height, swath width. Aerial digital cameras have evolved rapidly permitting provision of 'quick-look", georeferenced mosaics and machine generated digital terrain models. Whatever the technology utilised terrain model or image quality is related to type of technology deployed given the project characteristics and the skills, software and processes of the company.

Image Resolutions

80cm pixel (satellite)

30cm pixel (camera)

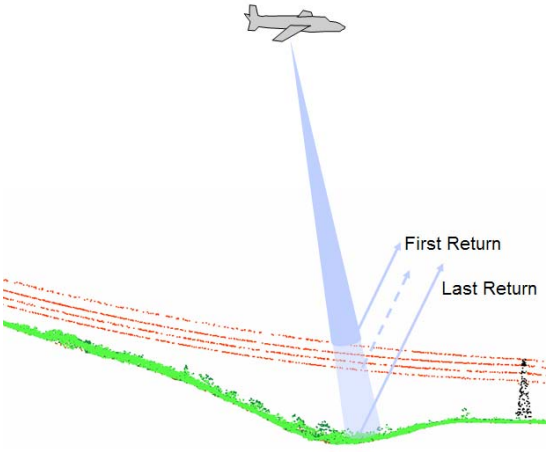
6cm pixel (camera)

What is LIDAR???

*Airborne LiDAR – **Li**ght **D**etection **a**nd **R**anging, also known as airborne laser scanning, is a technology which has been around since the late 1990's in Australia. AAM Surveys was the pioneering company to introduce this technology to the broad Australian market.*

LiDAR sensors emit and measure received light. Each laser strike return comprises information about the intensity of the 'strike' along with the vertical and horizontal height of that strike. LiDAR height data is complemented by positioning technologies to ensure a high quality product, eg. LiDAR is accompanied in flight with a direct airborne georeferencing unit and airborne GPS.

For higher accuracy products, this airborne data is complemented with a GPS base station and a number of ground reference and check points. This is important when combining your data set with other accurate datasets.



LiDAR Case Study

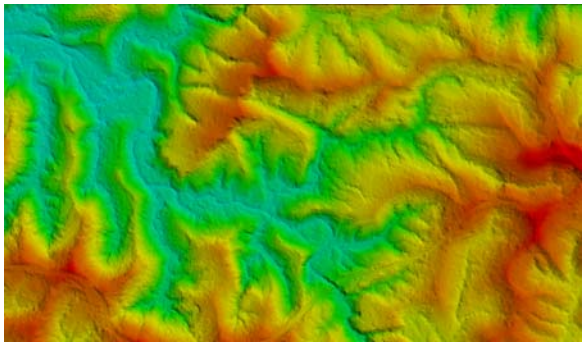
Multiple LiDAR units and a large format digital camera were deployed over the Wimmera Mallee Pipeline Project, to deliver terrain data and imagery over an area of 11,700 sq. km. The terrain datasets included a DTM +/- 0.15m vertical accuracy @ 1 Sigma on open areas with an average laser strike spacing of 1.3m. To capture this density of data over this terrain and vegetation type would not be feasible by photogrammetry alone or for field surveyors. Similar experiences apply to smaller projects, eg. pipeline corridors as small as 100 – 200km in length. It all depends on the particulars of every project.

"It is not conceivable that the Wimmera Mallee Pipeline Project could have been reduced from an initial 10 year project to 5 years, without LIDAR and orthophotography products.

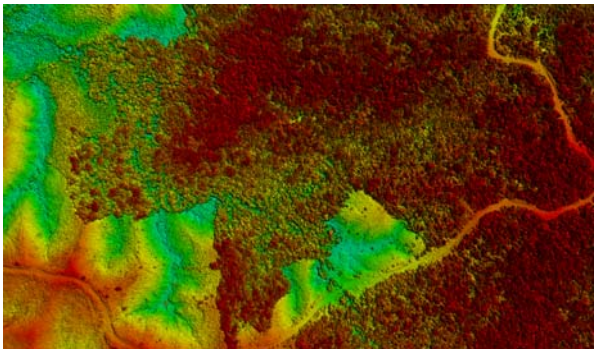
These geospatial products are providing the foundations for engineering and environmental elements of this regional significant megaproject."

John Martin, GWMWater
Manager of Technical Services

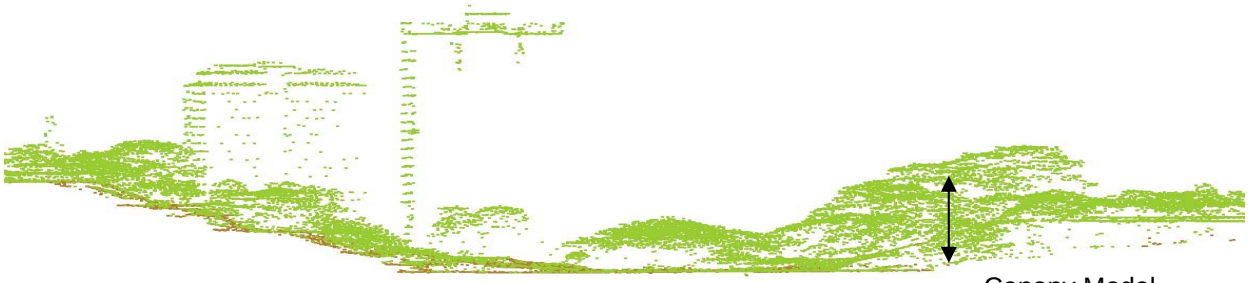
Key Terminology



Above: Digital Terrain Model



Above: Digital Surface Model for the same area to the immediate left!



Canopy Model

How we use these Terms?	
Digital Terrain Model Bare Earth Model	Ground only - elevation, e.g. AHD DTM models the surface as if the buildings and vegetation were not present.
Digital Surface Model Reflective Surface Model	Ground and non-ground - elevation, e.g. AHD The first reflection - roof tops, trees and so forth.
Canopy Model	Height of trees in metres (only vegetation) not AHD elevation
GRID average elevation	Average of laser strikes in GRID (or triangulated if no laser strike)
GRID highest elevation	Highest laser strike in GRID
GRID height of highest points	Top of trees, buildings or open ground

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