AECOM Unmanned Aerial Systems (UAS)

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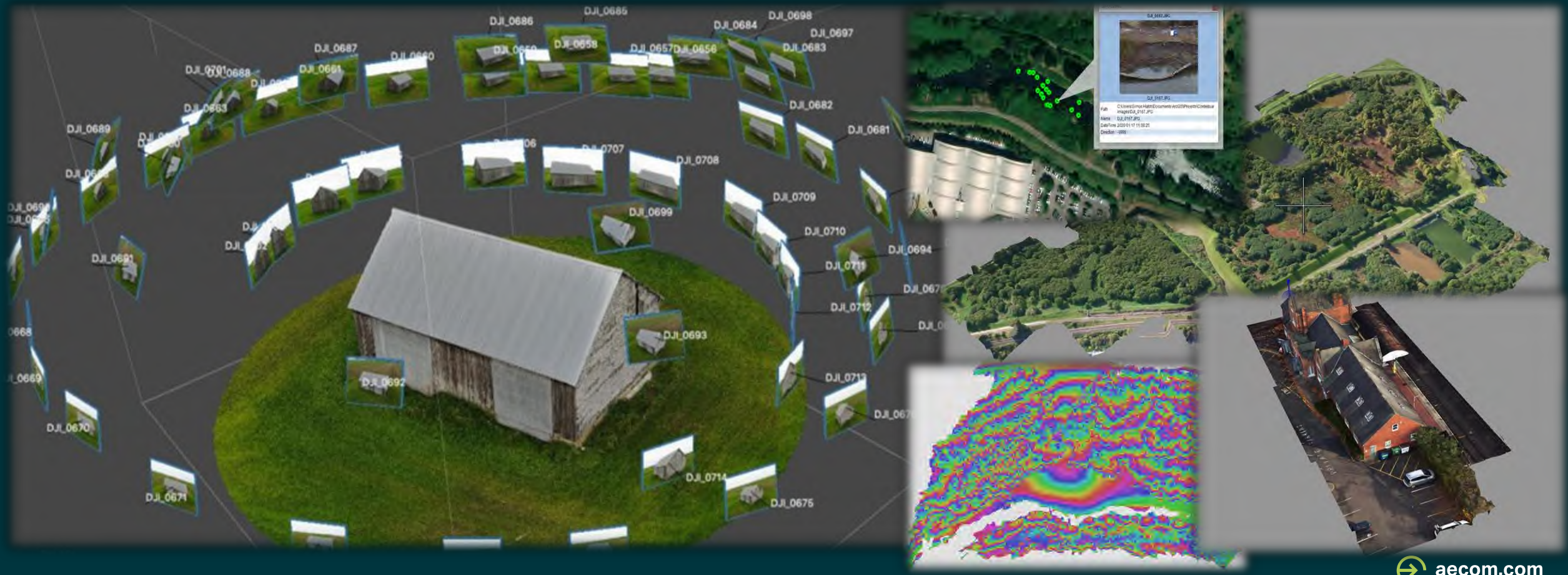
UAS Services on offer

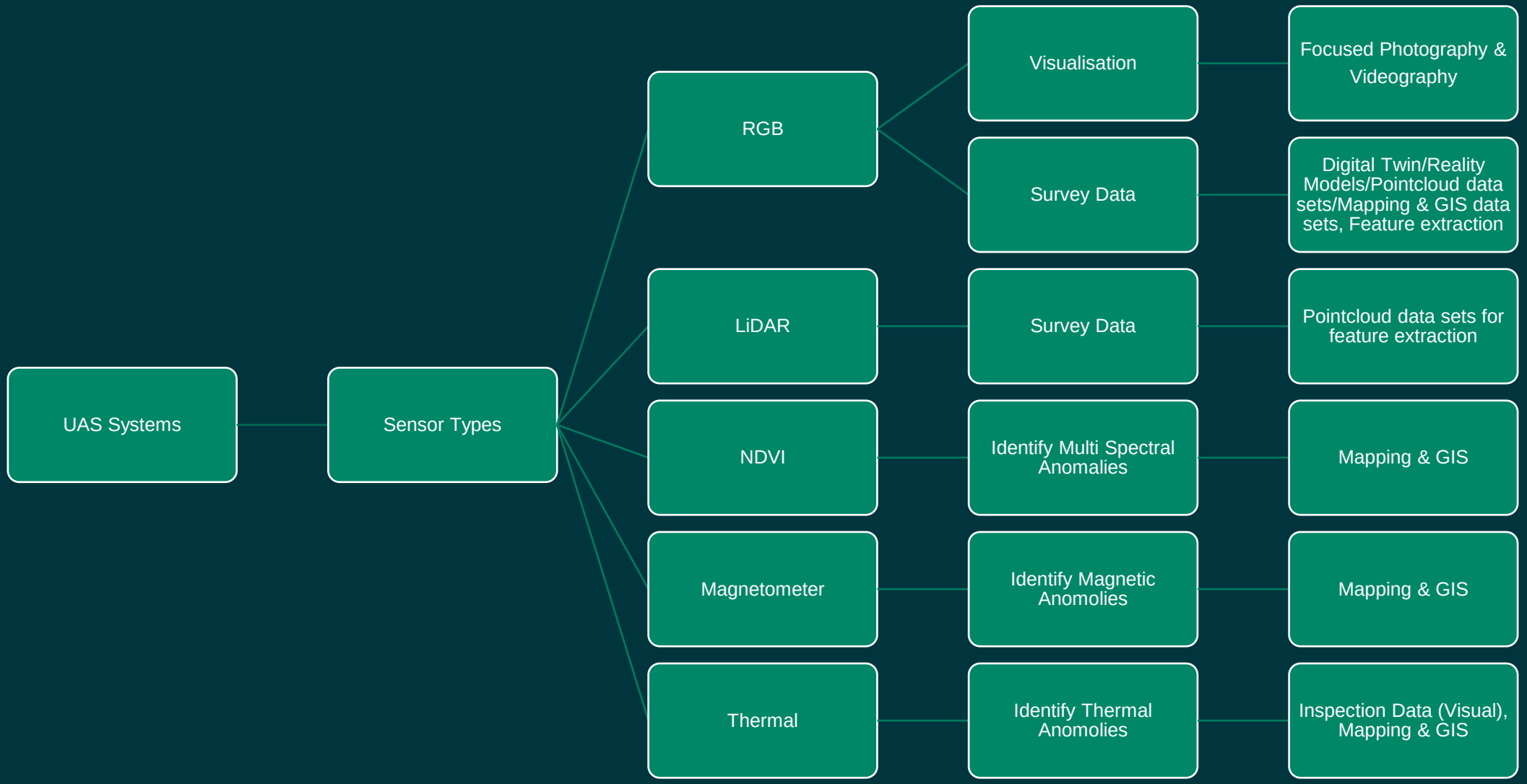
Geospatial Engineering can provide a full range of UAS services ranging from Structural Inspections or Digital Twin Reality Models right through to Measured Surveys making use of market leading technologies and experienced Pilots.

So what is Photogrammetry

Photogrammetry can be defined as **the science of making reliable measurements using photographs or digital photo imagery to locate features on or above the surface of the earth**. ... Photogrammetry has evolved into a reliable substitution of ground surveying activities when large area mapping is necessary



Uses and Outputs of Aerial Digital Data



Typical Sensors utilised by Aecom

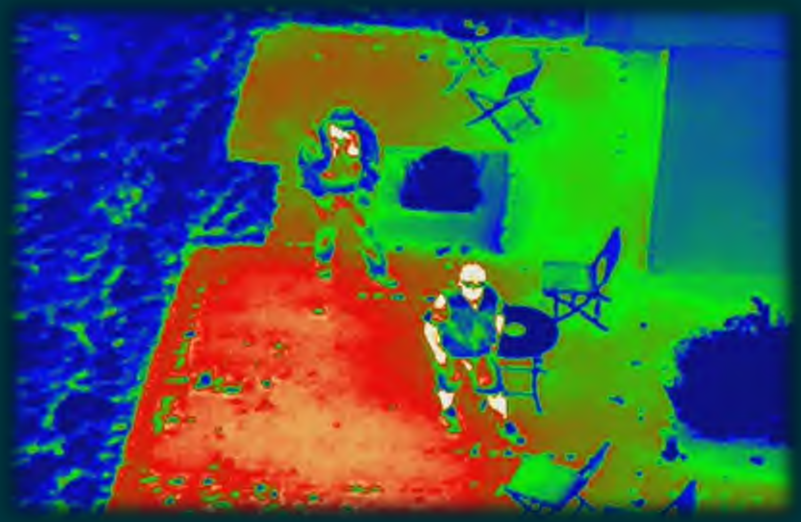
RGB Sensors are the primary sensor type found on most UAS systems providing the user with the ability to capture digital images as raw data which can then be interpreted in several different ways depending on the end user's requirements.

Our RGB sensors hold resolutions from 12mp up to 36mp which can provide significant levels of detail in support of the project.

RGB sensors also hold the ability to collect both still images and video footage.

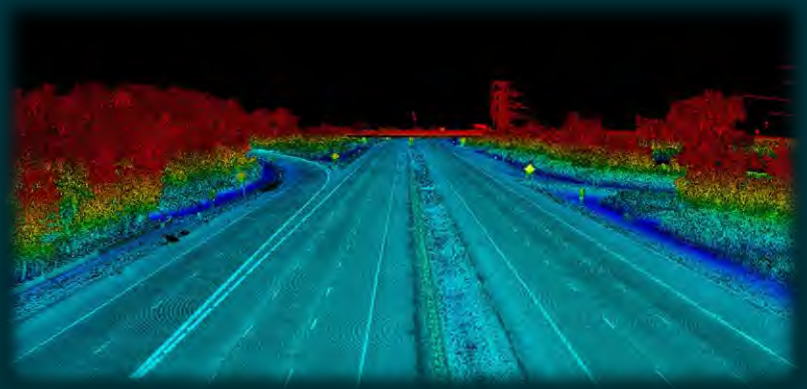
Thermal Sensors

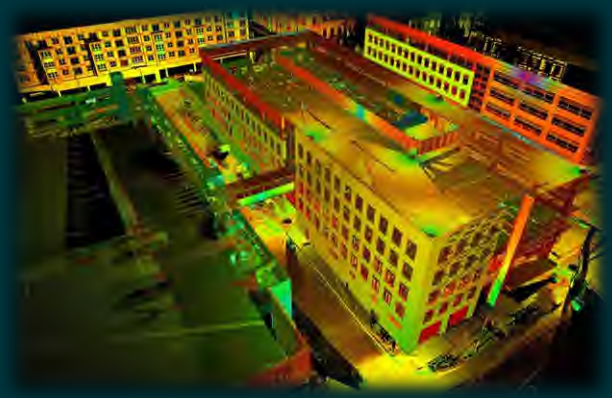
Thermal sensors have seen numerous developments in quality in recent years, these developments have aligned with UAS technologies to provide users with the ability to gather thermal imagery from the air for a wide variety of applications. Thermal sensors provide visual indications of thermal anomalies within their environment, this is especially useful for visualising data which is invisible to the naked eye with the ability of detecting anomalies to within +/- 0.2° Celsius in a number of different palette's.



LiDAR Sensors

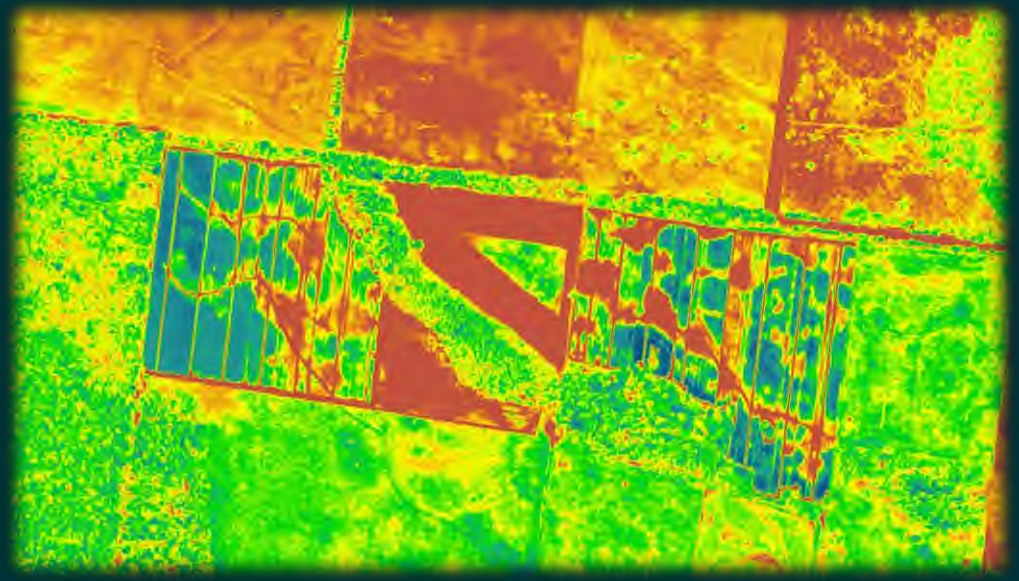
Light detection and ranging devices are traditionally terrestrially operated instruments unless accompanied by full sized aviation to cater for large scale mapping exercises; in more recent years, LiDAR sensors have been the subject of numerous advances in technology and are now frequently used with UAS systems. LiDAR sensors hold a number of benefits over traditional photogrammetry. The nature of the sensors allow for a certain degree of penetration in heavily vegetated areas which enables the technique to be a worthwhile means of survey where soft features such as vegetation dominate the survey landscape.
Whilst the use of LiDAR is slightly more time consuming the outputs speak for themselves offering the end user dense, detail rich point clouds for further processing.





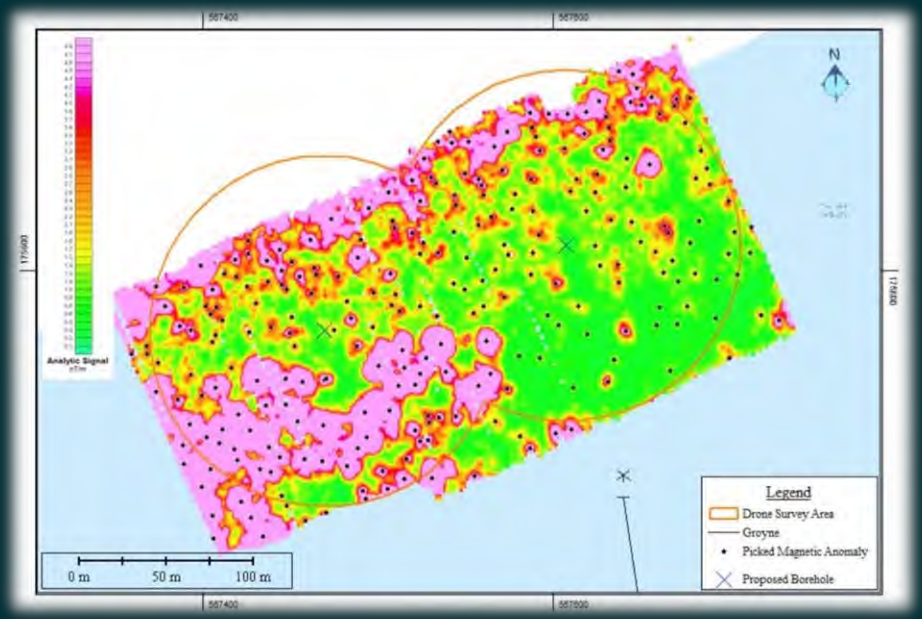
NDVI Sensors

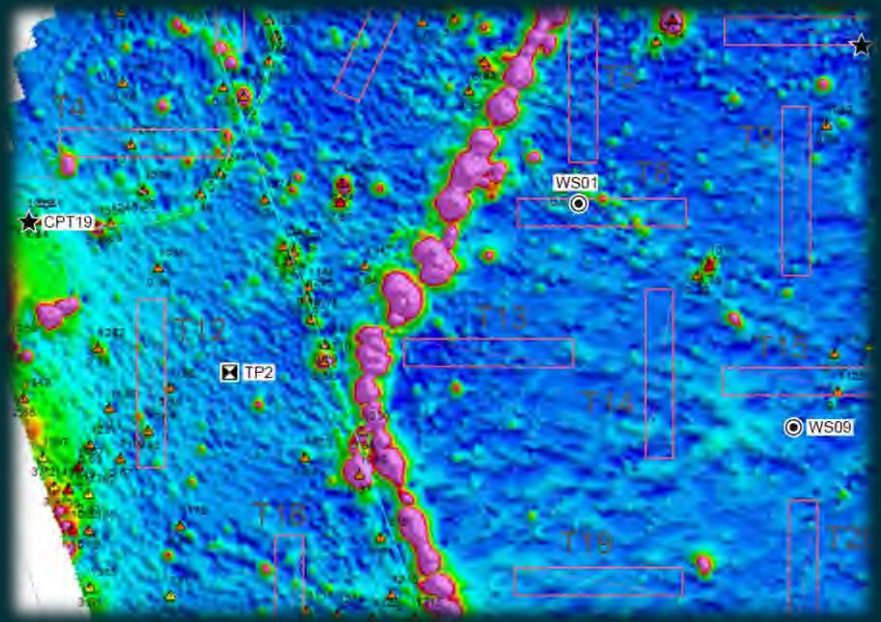
Normalized Difference Vegetation Index (NDVI) sensors collect data that is invisible to the human eye operating within multispectral light range. NDVI sensing is a tool that is generally used commercially within agriculture sectors, these sensors allow the user to monitor crop health when data sets are interpreted graphically. As technology has advanced in recent years these sensors have been used in support of ecology, agriculture and irrigation projects over the globe.



Magnetometer Sensors

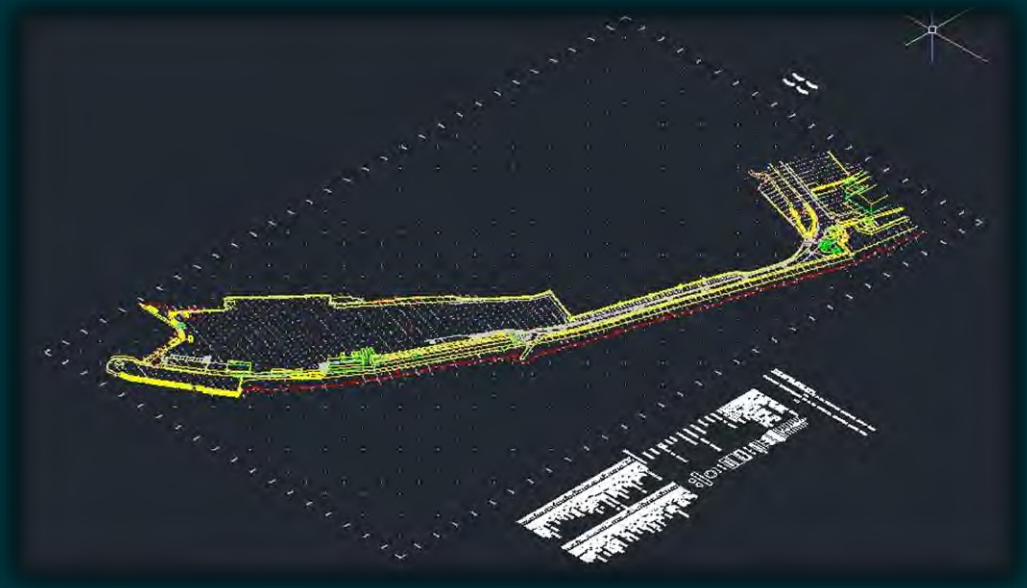
Magnetometers are complex instruments which allow the user to detect magnetic anomalies that are below the surface of the ground being surveyed, UAS magnetometers are generally smaller but powerful devices which are flown slowly at low altitudes and provide mapping outputs displaying areas where magnetic anomalies exist within the area flown; this technique is primarily used in UXO detection, archaeology and the exploratory mining industries amongst other geophysical investigative areas.



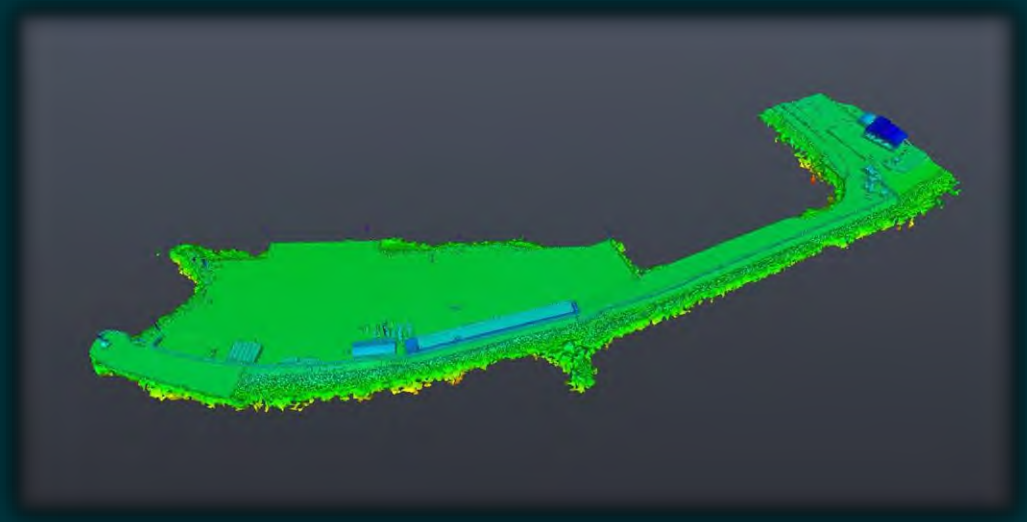


Traditional outputs if required

- UAV Aerial Survey captured in approx. 2 hours as opposed to 3 days for traditional method of survey.



Topographical Survey



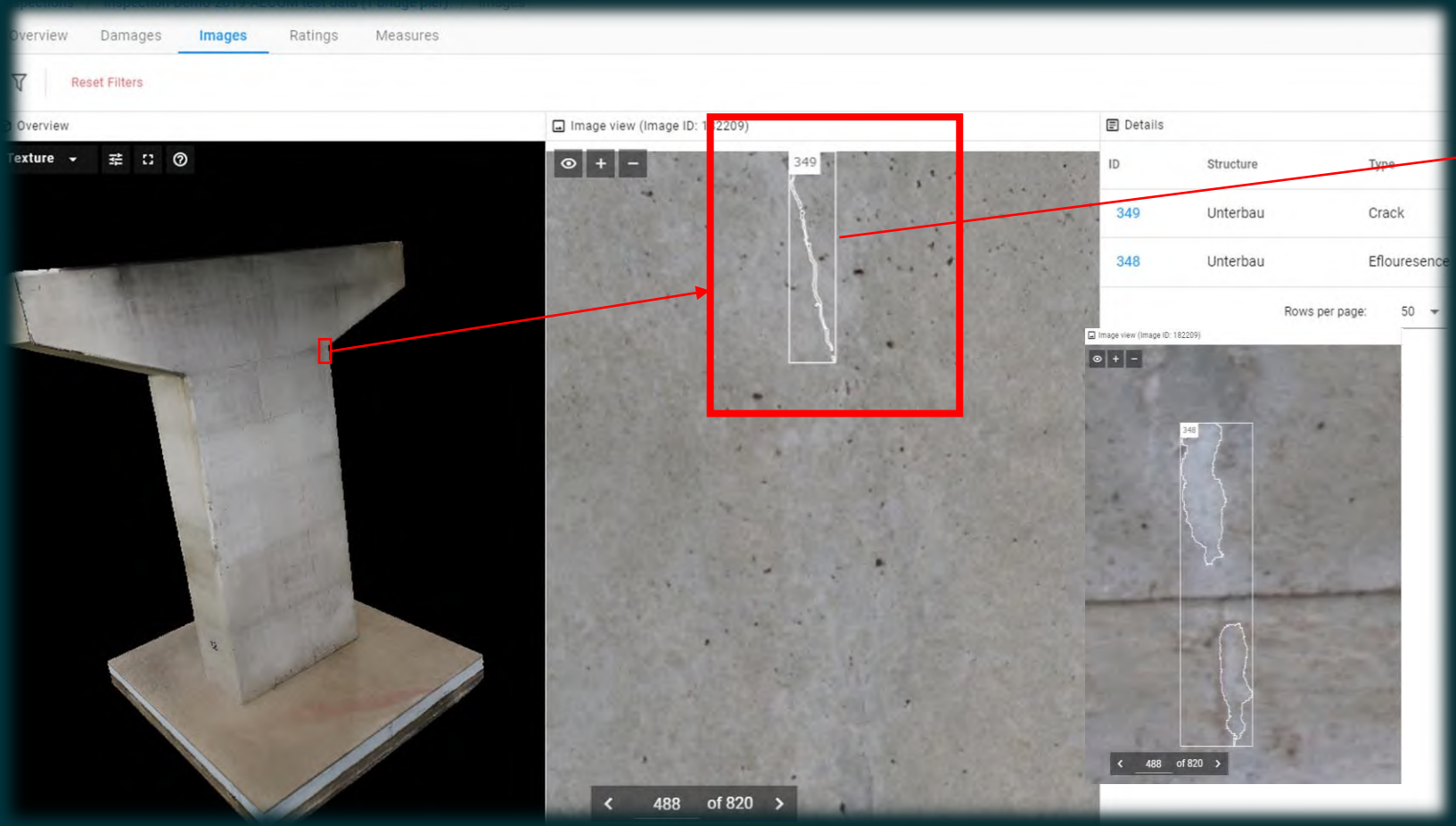
Point Cloud Survey

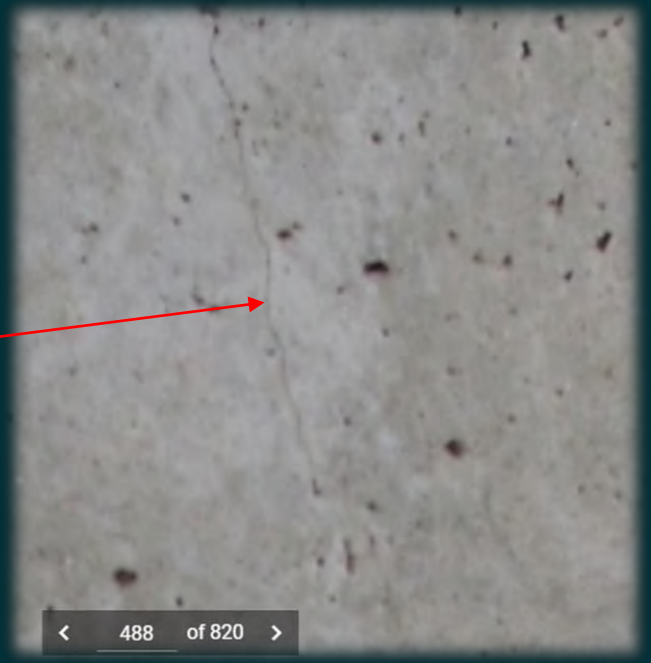
- From one reality model we can generate traditional survey deliverables such as a CAD topographical survey and laser scanned point cloud as shown in these images.
- Data capture once and use multiple times scenario, reduction in site time drives efficiency and enables competitive edge.
- These outputs can form the basis for 3D Asset BIM modelling and Digital Twins.

Future Bridge Inspections

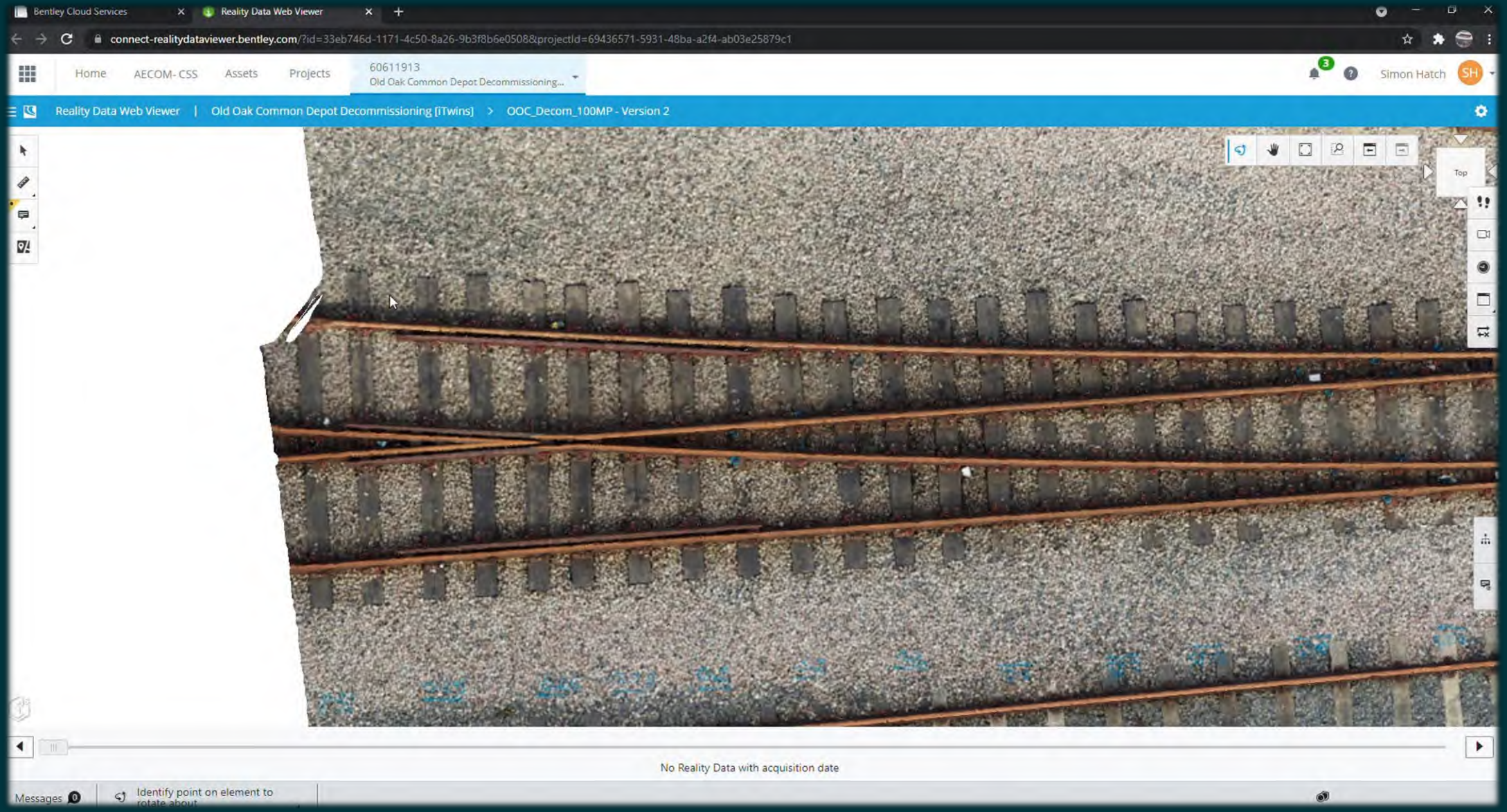
Imagery taken from UAV Surveys.

Automated damage detection





Levels of Detail Old Oak Common

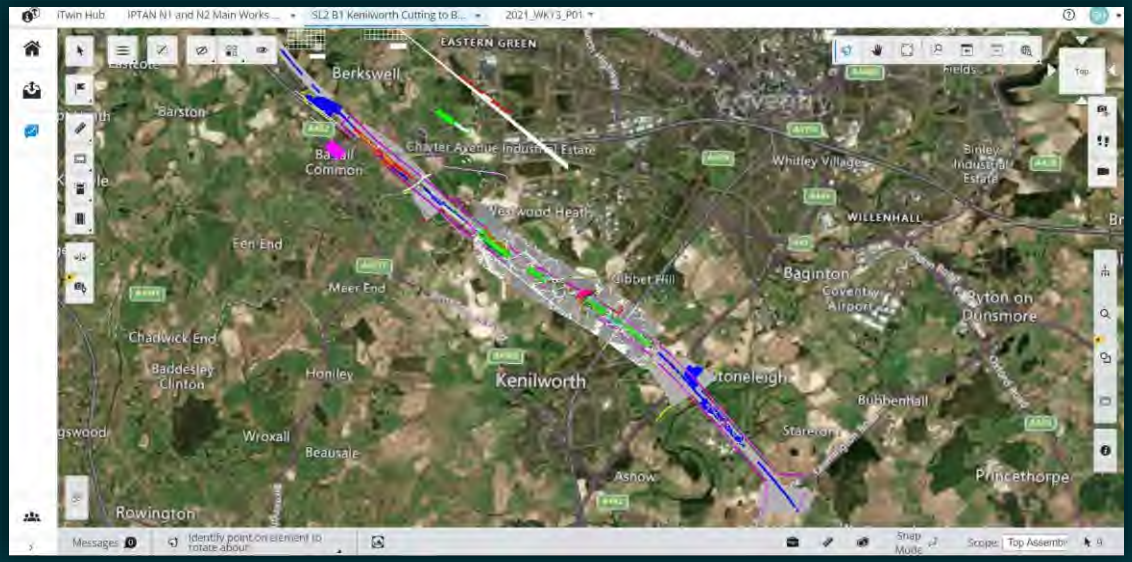


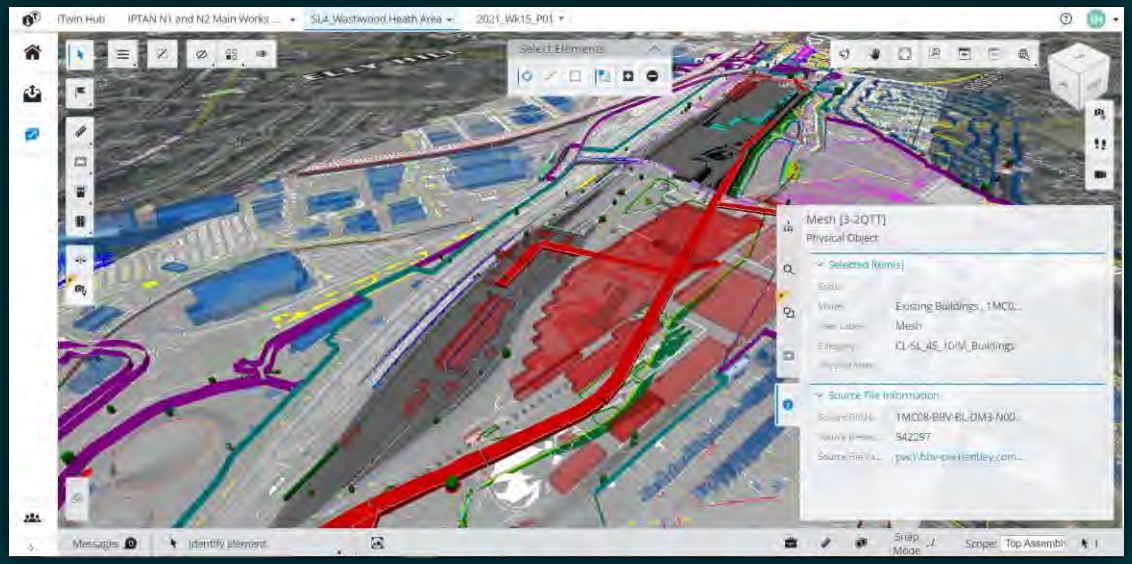
Levels of Detail Roof Inspections

Online CDE’s

Why iTwin?

In late 2019 the Project team raised a clear **challenge** for the project, which was **accessing the model information**. The iTwin allows access to models over **90%** **faster** than the current method through ProjectWise. Allowing you quicker access to information to enable more information decision making.





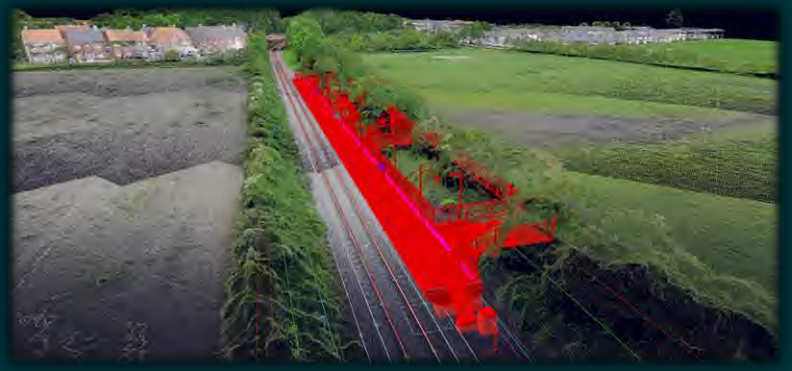
Northumberland Line Project

Reintroduction of former Ashington, Blyth & Tyne Line.

- Mix of Point Cloud & RGB Orthomosiac
- Intrusive Surveys
- Surveys & Inspections
- 22km Aerial Survey

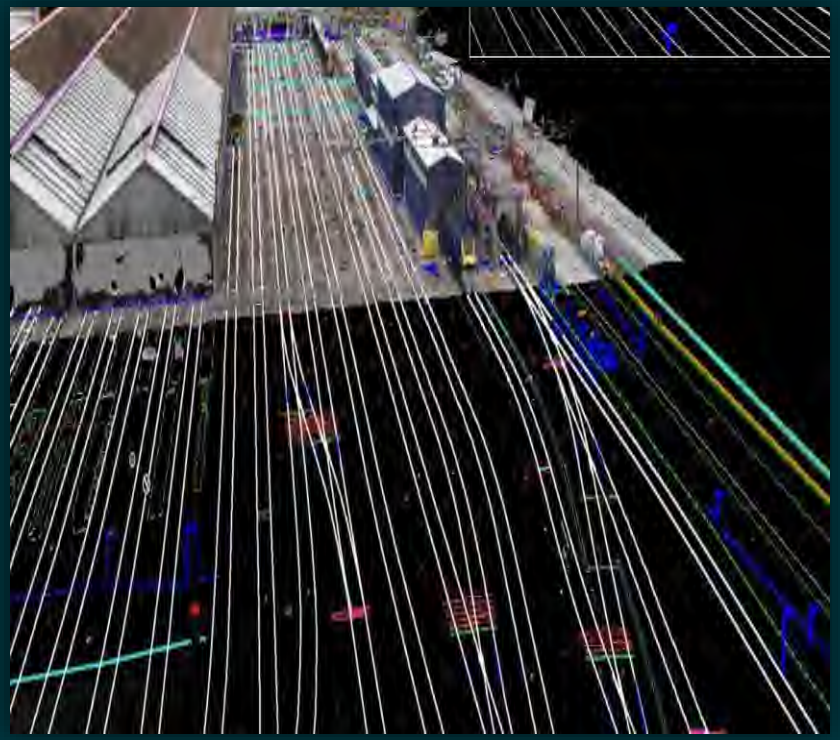
Images show outputs from Aerial Survey Works. Orthomosiacs generated and Point Clouds extracted.

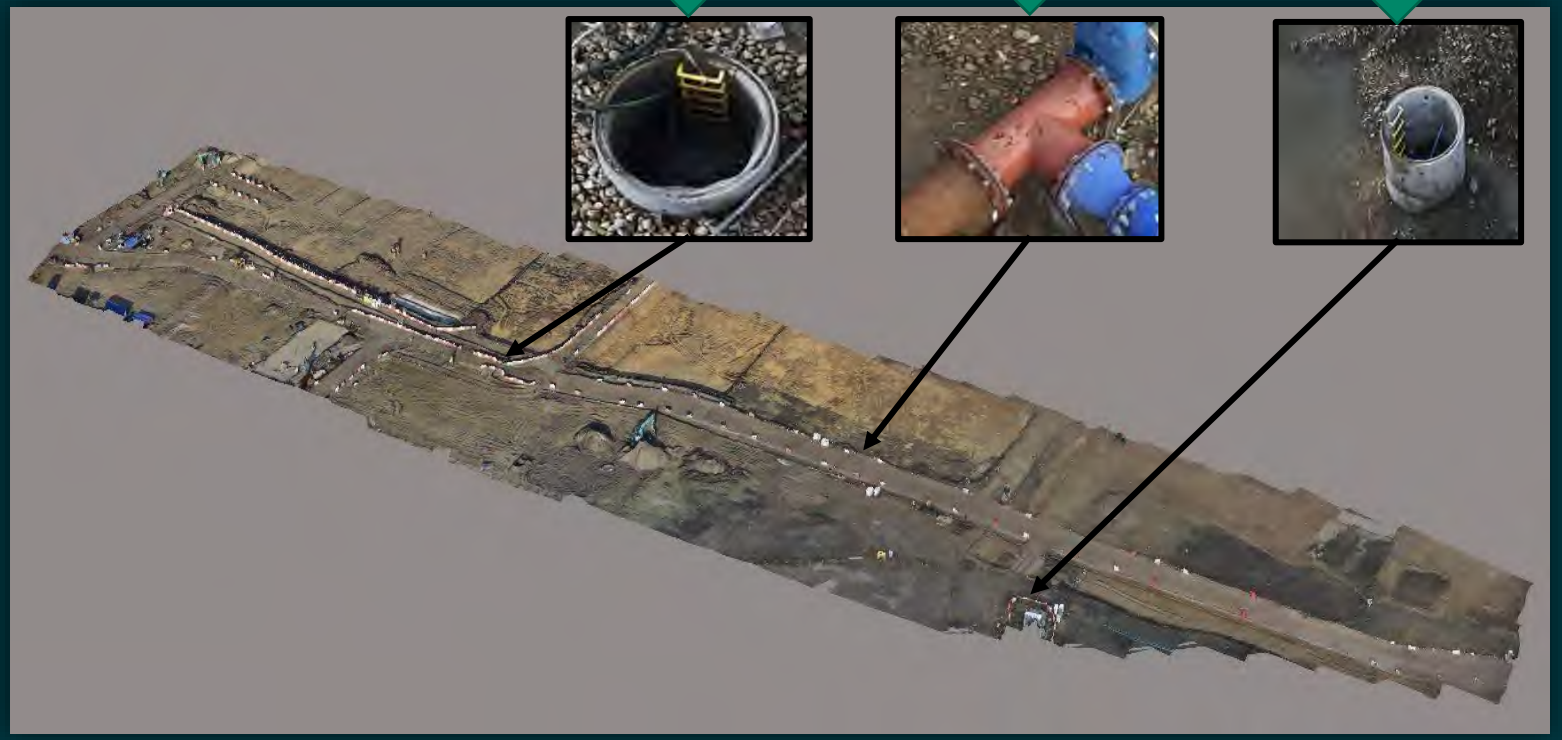
Capture Method	Fixed Wing UAV
Captured Projection	WGS84
Delivered Projection	SnakeGrid
Ground Sampling Distance (GSD in cm/px)	2.5
Absolute Accuracy (RMSE in m)	X:0.014, Y:0.016, Z:0.049
Total Area (km ^{2})	6.8
Total Images	11825



Aerial Data for use with GIS

- UAV aerial survey
- GIS platform
- Geo located intrusive/condition surveys
- BIM model overlays to attach data
- Environmental Impact Assessments





So how are our Competitors utilising UAS Systems?

ARCADIS

Putting an eye in the sky to innovate inspections

The team knew from the start that the traditional elevated platform approach could be improved upon. Even a properly operated manlift can put personnel and operations at risk, and the process can be tedious when trying to inspect cables across multiple facilities.

Instead, Arcadians suggested that they take to the skies. Drones equipped with high-definition cameras could provide engineers with real-time views of cables from multiple angles without anyone leaving the ground. Abilities such as geotagging and switching between photography and video would allow for better insights into cable conditions. Plus, a drone unit would cost less than a one-day lift rental and eliminate the need to relocate lift equipment and personnel throughout a site.

The client, eager to innovate its assessment strategy, cleared the way for takeoff at multiple facilities. Our FAA-certified drone pilots flew patterns that gave the organization more detailed assessments than traditional inspections had ever allowed.

WSP's UAVs

SenseFly eBee Plus RTK

Maximum flight time	50 minutes
Nominal cruise speed	40-90 km/h (11-25 m/s or 25-56 mph)
Radio link range	Up to 3 km (1.86 miles)
Maximum coverage (single flight)	20 km² / 5 mi² (at 974 m / 3,195 ft altitude AGL)
Wind resistance	Up to 45 km/h (12m/s or 28 mph)
Ground Sampling Distance (GSD)	Down to 1.5 cm (0.6 in) per pixel
Relative orthomosaic/3D model accuracy	1-3x GSD
Absolute horizontal/vertical accuracy (w/GCPs)	Down to 3 cm (1.2 in) / 5 cm (2 in)
Absolute horizontal/vertical accuracy (no GCPs)	1-5 m (3.3-16.4 ft)
Multi-drone operation	Yes (inc. mid-air collision avoidance)

DJI Phantom 4 Pro

Operating Specifications:	Phantom 4
Maximum flight distance from the PIC	500 meters
Maximum Operating Height above ground level (agl)	400 feet
Maximum Operating Altitude above mean sea level (amsl)	1000 ft
Visibility	5km uninterrupted
Maximum wind speed	10m/s (18kts)
Maximum Outside Air Temperature (OAT)	40 degrees Celsius
Minimum Outside Air Temperature	0 degrees Celsius
Maximum continuous flight operation	28 minutes
Maximum Take Off Mass	1380g
Speed	20 m/s (36 kts/44mph)

sensat

Data		Delivery time
UAV Surveys + CAD	£127,890	10 days + 5 - 7 for CAD
Driven LIDAR + CAD	£70,000	10 days + 5 - 7 for CAD
Platform	£24,000	Instant - delivery mechanism
Admin 15%	£33,283.5	
Total	**£255,173.5**	**10 days + 5 - 7 for CAD**

Mapp	
Mapp tier	Pro
Mapp license term	12
Primary Mapp use case	Data sharing, user collaboration, common visual environment, data integrations, public consultation & engagement
Mapp Users	Unlimited

All costs are exclusive of VAT

Capability: High Resolution Aerial Photos

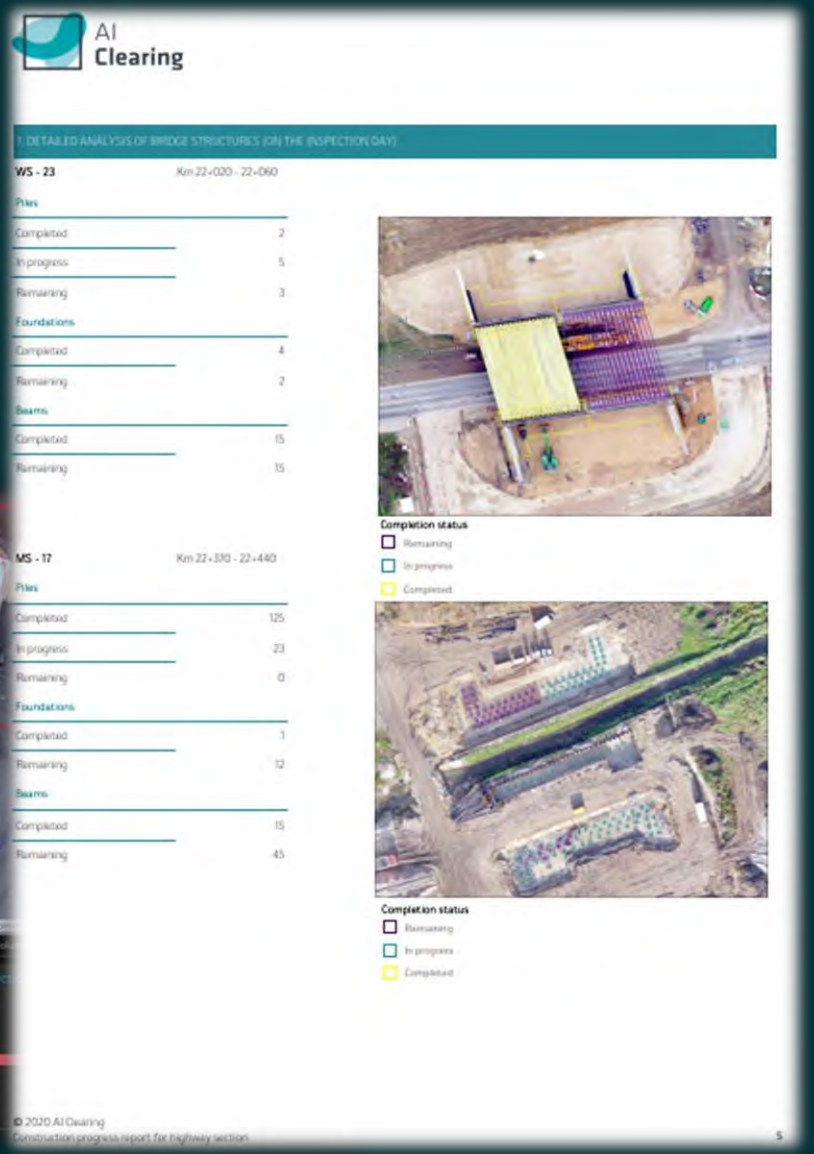
- Very high resolution aerial imagery:
  - Typical specification: down to 1.5cm per pixel
  - Compare to Google Maps typical best at 15 cm per pixel.
- Able to capture up to 100-200 hectares in a day

Max resolution/zoom: Google Maps

1.5cm Resolution from UAV

Future Potential?

Possible partner with AI Clearing who offer a fully automated field construction progress tracking solution to decrease rework and mitigate dispute risks, 100% data based.



Thank you.

Any Questions? Please contact Simon.Hatch@aecom.com

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