



Drone Technologies for Inspection in the Oil and Gas Industry

Session Code: M-L2

March 24, 2025

Greg Mann

Director of Advanced Services

Ranger Inspection

**27th California Unified Program
Annual Training Conference
March 24-27, 2025**



About Me

- Greg Mann, B.Sc.
- Director of Advanced Services
- Ranger Inspection
- 10+ Years Oil and Gas Experience
- Specialty in Drones, 3D Imaging and Modeling, Storage Tank Calibration
- API COLM Committee
- Ex-professional volleyball player



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Drone Inspection

- Inspection of Tanks, Pressure Vessels, Piping, Towers, Stacks (internal / external capabilities for all; not limited to these structures)
- Inspection of Welds, Corrosion, Coatings, Rafters, Supports
- Pre-Human Entry Confined Space Inspection

Benefits

- Reduced risk to personnel
- Inspect difficult-to-reach areas
- Reduction in temporary structures
- Reduction of mobile equipment
- Reduced downtime
- Collection of in-depth and higher detail data
- Increased inspections

More Drone Applications

- Environmental Monitoring
- Search and Rescue
- Map and Model Inaccessible Terrain
- Photogrammetry
- 3D Imaging & Modelling
- Site Mapping and Monitoring
- Surveying
- Ultrasonic Thickness (UT) Measurements





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Pre-Entry Inspection



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Pre-Entry Inspection



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Pre-Entry Inspection



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Pre-Entry Inspection



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Pre-Entry Inspection



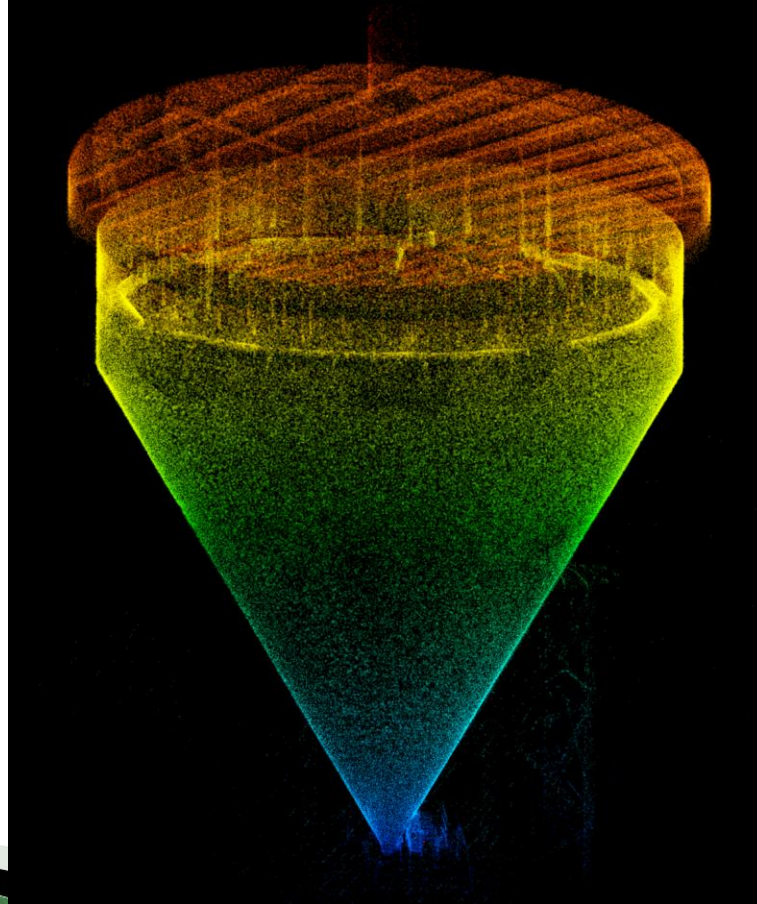
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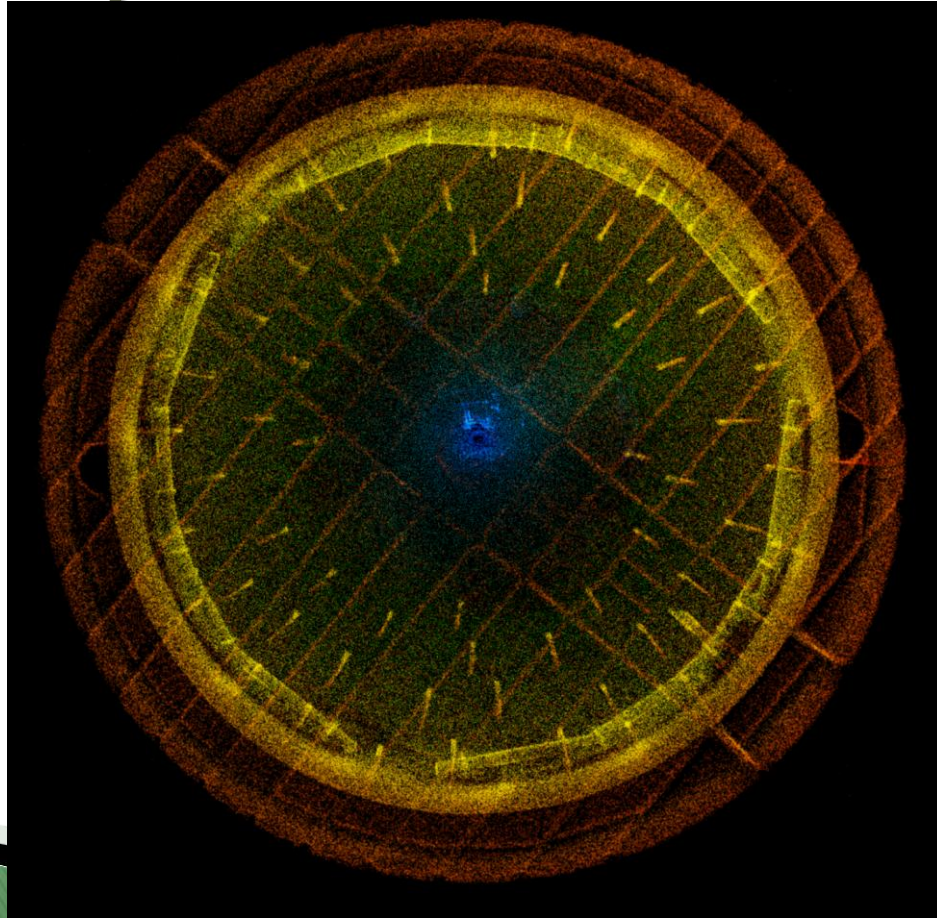
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No-Entry Inspection



No-Entry Inspection



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No-Entry Inspection



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No-Entry Inspection

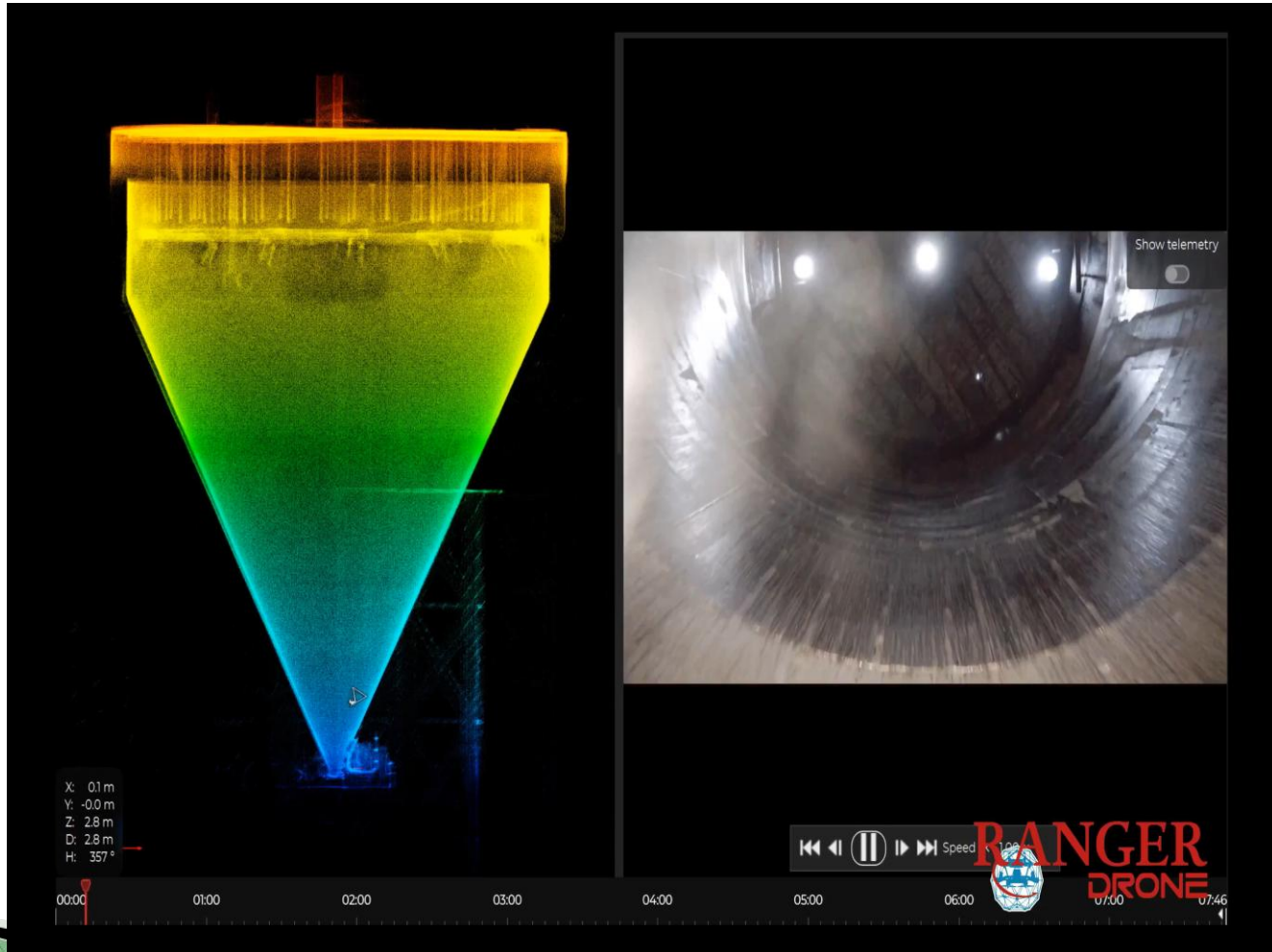


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No-Entry Inspection

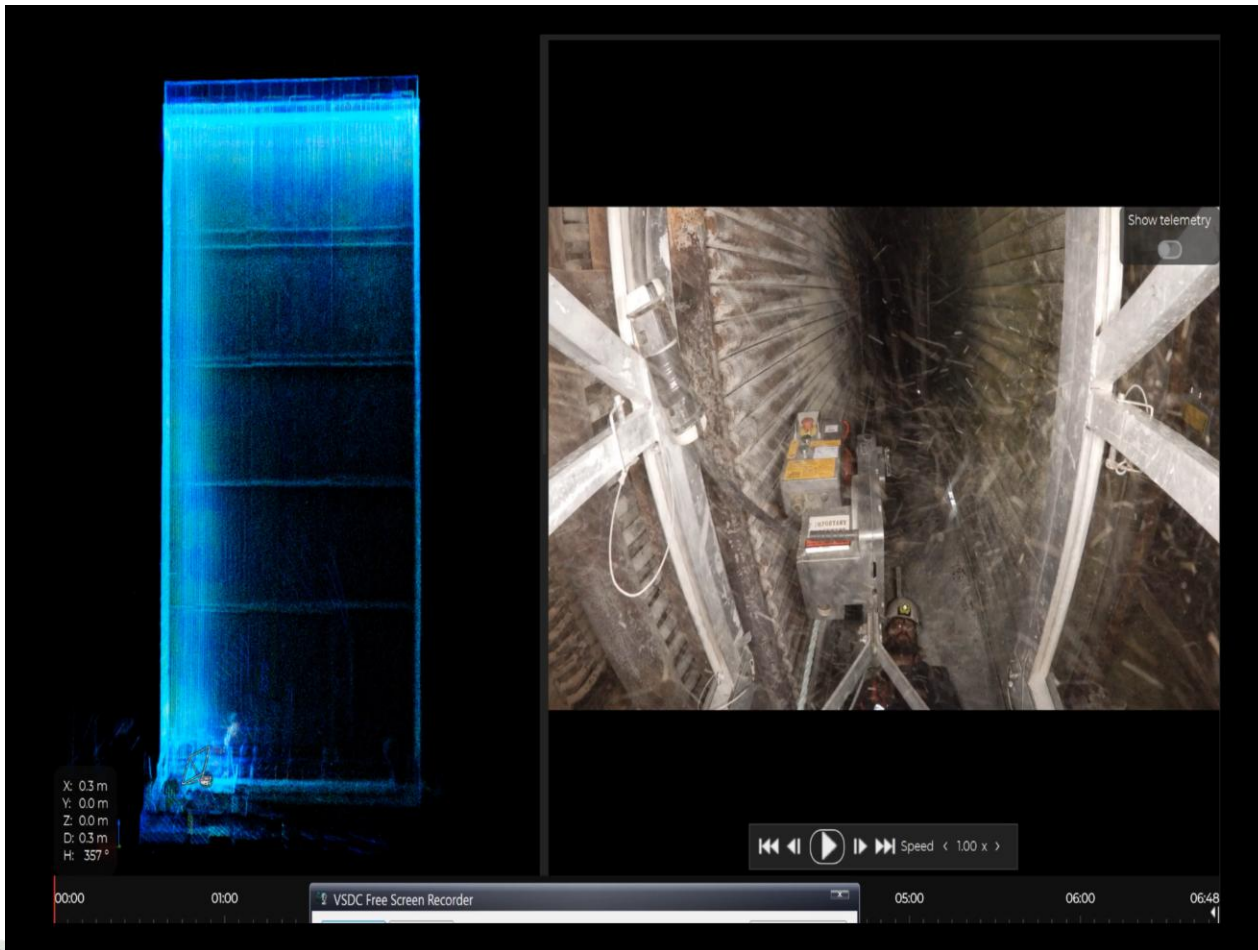


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X: 0.4 m
Y: -0.0 m
Z: 0.0 m
D: 0.4 m
H: 5°



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Pipe Inspection



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Pipe Inspection



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Ultrasonic Thickness Measurements



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Ultrasonic Thickness Measurements

The screenshot displays a drone's ultrasonic sensor interface. At the top, a status bar shows system information: CONFIG, 33°C, 72% battery, 67% signal strength, 23.0V, IN FLIGHT 4:36, UPTIME 8:18, ASSIST, FLIGHT 5004101P037, Flight: Outofsp..., and Asset: POLAR... The main view is a live video feed of a textured surface. On the left, a vertical scale indicates a 56° angle. At the bottom center, a 'BOOST' indicator shows a 11cm range. On the right, a graph plots AMPLITUDE (0-100) against DISTANCE (MM). Two data points are highlighted: a green bar at 30.5 mm and an orange bar at 54.2 mm. Below the graph are 'RESET', 'DELAY', and 'START' buttons. At the bottom right, a 3D point cloud view shows the sensor's field of view with coordinates: x-2.2m y-16.5m z-1.9m ø16.7m L114.6m H2.9m. A compass indicates a 26° heading. The bottom of the screen features a video player with a progress bar and a -0:15 timestamp.



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Ultrasonic Thickness Measurements



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Ultrasonic Thickness Measurements

The screenshot displays a drone's ultrasonic sensor interface. At the top, a status bar shows system information: CONFIG, LIDAR UT, 33°C, 72% battery, 67% signal strength, 23.0V, IN FLIGHT 4:36, UPTIME 8:18, ASSIST, FLIGHT 500-410 (P37), Flight: Outofsp..., Asset: POLAR..., and a settings icon. The main view is a live video feed of a textured surface with a white sensor probe. A vertical scale on the left indicates a 56° angle. A graph in the top right plots AMPLITUDE (0-100) against DISTANCE (MM), showing a green bar at 30.5 and an orange bar at 54.2. A 3D point cloud view in the bottom right shows a red and blue surface with a yellow star and a 26° angle. A 'BOOST' indicator is visible at the bottom center. The bottom status bar shows 2.11, 4K, 109.62/119GB, ISO181, EV0.7, EXP1/250, and a video player control bar with a -0:15 timer.



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Coating Analysis



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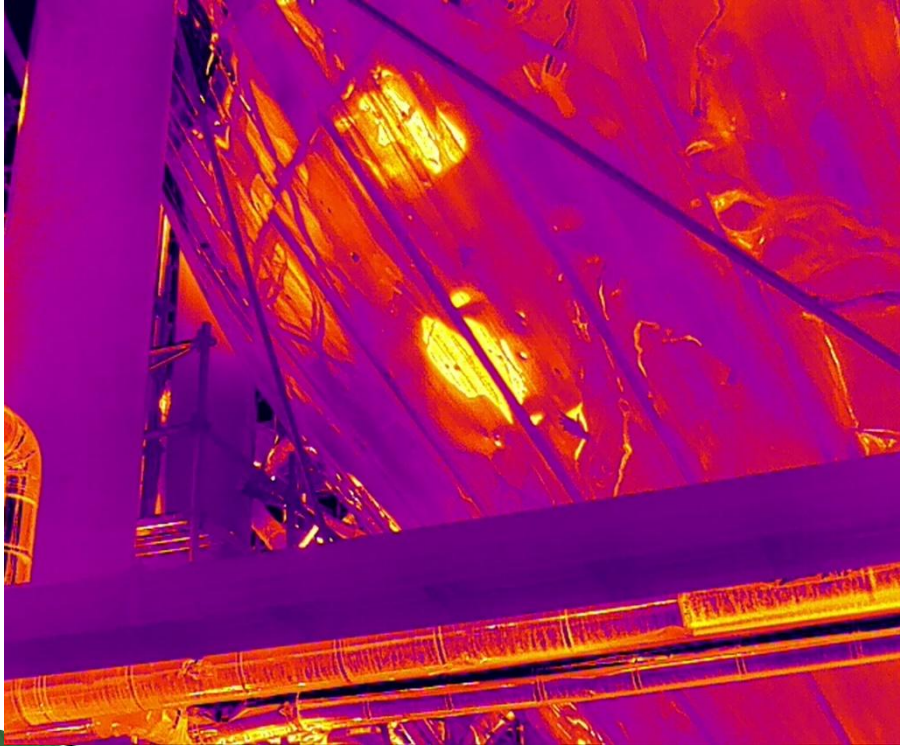




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Insulation Inspection



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Mapping and Monitoring

- Calculate volumes of stockpiles, trenches, and tank berms more efficiently than traditional surveying methods
- Eliminate the need for workers to access potentially hazardous areas
- Cost-effectiveness
- Increase measurement intervals for tracking of inventory
- High accuracy measurements
- Create digital twin

Photogrammetry

- The process of obtaining data using a series of photographs
- Need hundreds or thousands of images
- Quality influenced by light, cloud cover, camera angle, shadows
- More efficient and lower cost compared to LiDAR
- 50 to 100 points per square meter
- Accuracy ± 2 to 5 %

LiDAR

- Light Detection and Ranging
- Utilizes laser sensors to measure distances between the drone and surfaces
- Emits laser pulses and measures the time it takes for the pulses to return
- Better for irregularly shaped stockpiles
- Less influenced by environment
- Less efficient but more accurate
- 500 points per square meter
- Accuracy less than $\pm 1\%$

Flight Plan



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Photogrammetry



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Photogrammetry

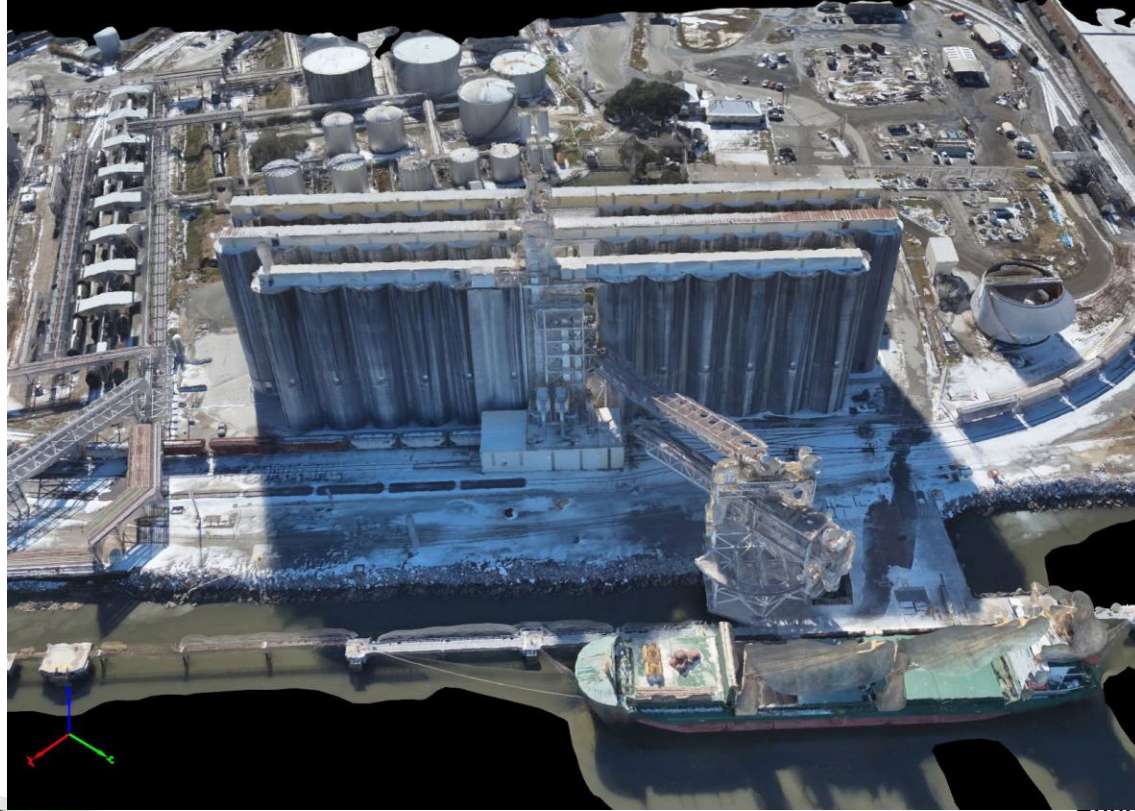


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Photogrammetry



Photogrammetry



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Photogrammetry



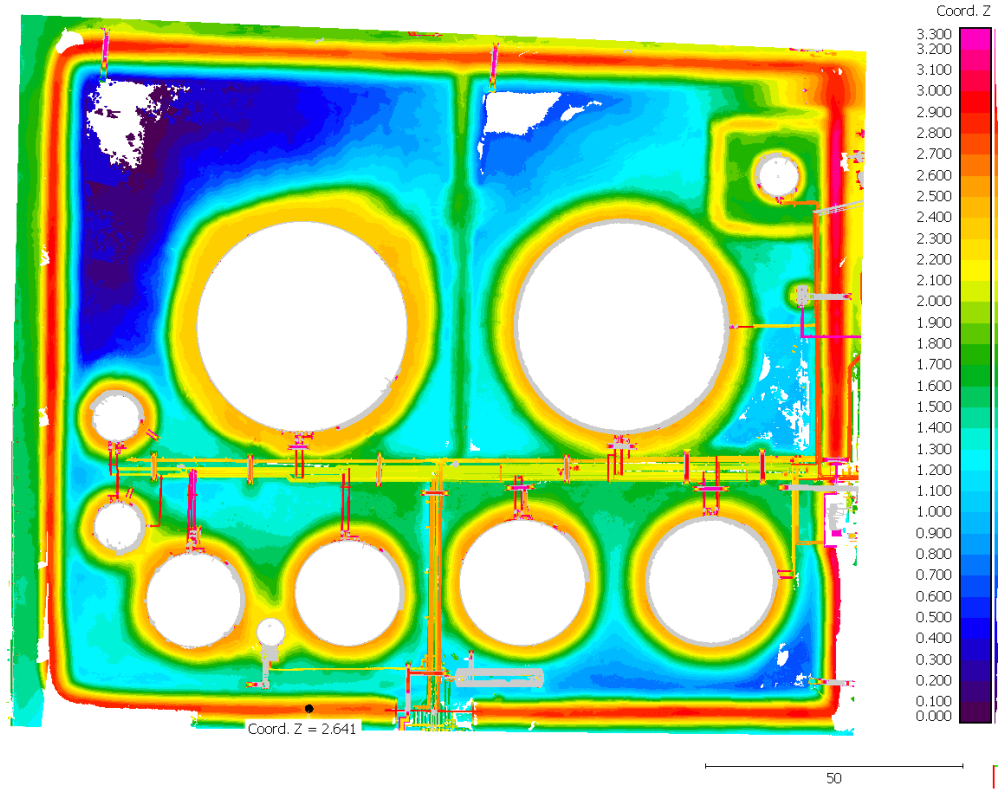
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Photogrammetry



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LiDAR



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LiDAR



Gross Berm Volume	27 863.47 m ³
Net Berm Volume (including largest tank)	27 672.77 m ³
Net Berm Volume (excluding largest tank)	26 693.36 m ³
Tank Displacement	979.41 m ³

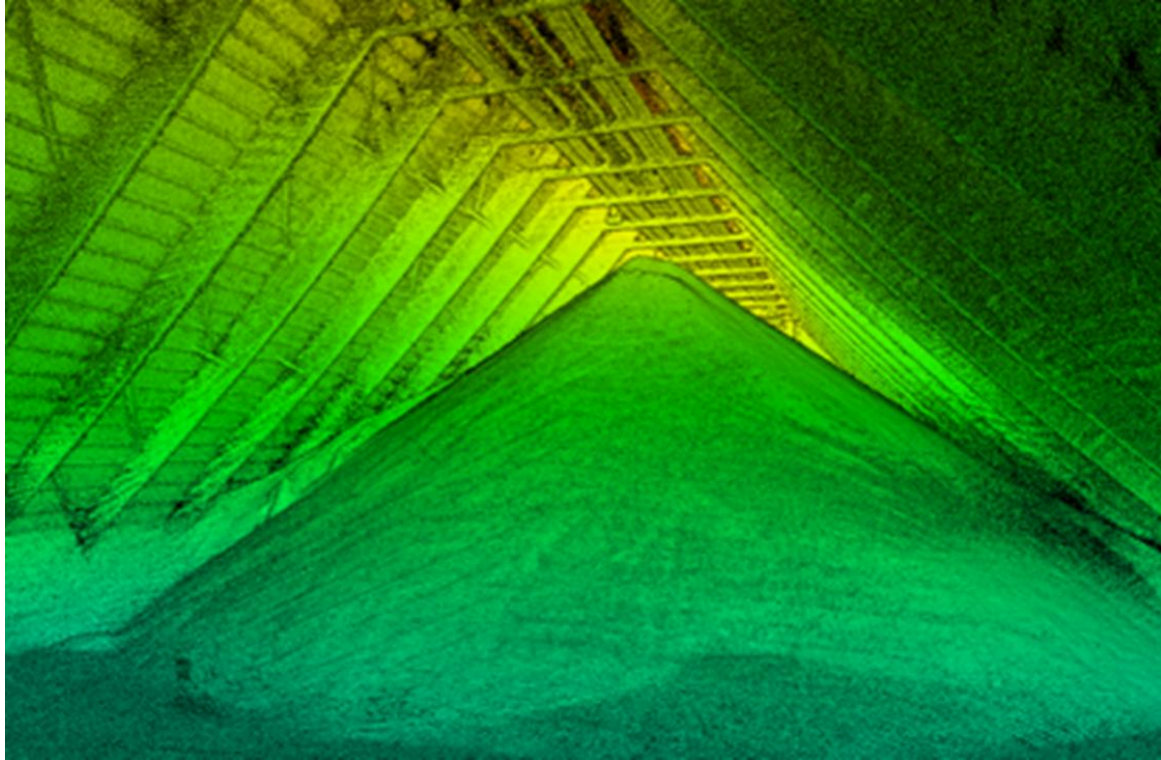
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LiDAR



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LiDAR



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OGI Camera

- Detect hydrocarbon gases such as methane, propane, and octane
- Handheld and drone mounted options
- Efficiently inspect large areas for gas leaks
- Map areas for further investigation
- Track changes in gas leaks through time
- Keep personnel out of hazardous areas
- Accuracy 30 to 50 %

OGI Camera



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OGI Camera

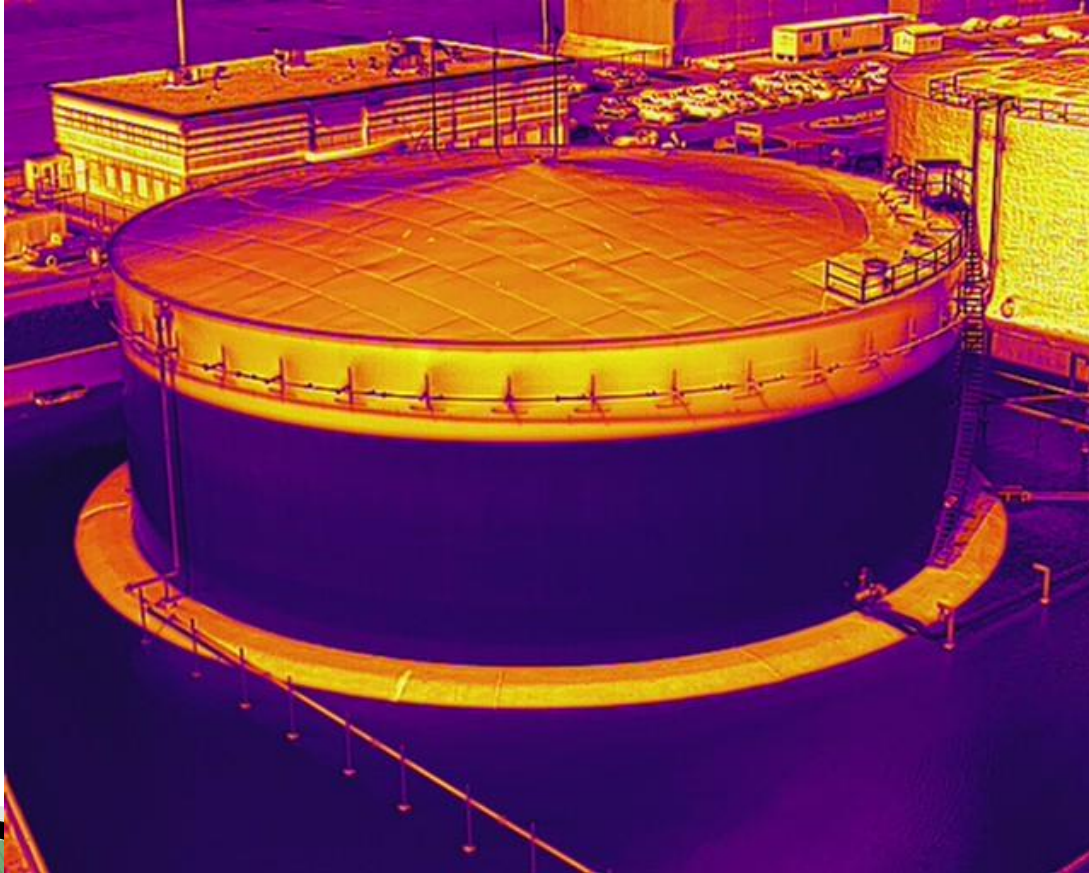


OGI Camera



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Infrared Camera



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Any Questions?

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