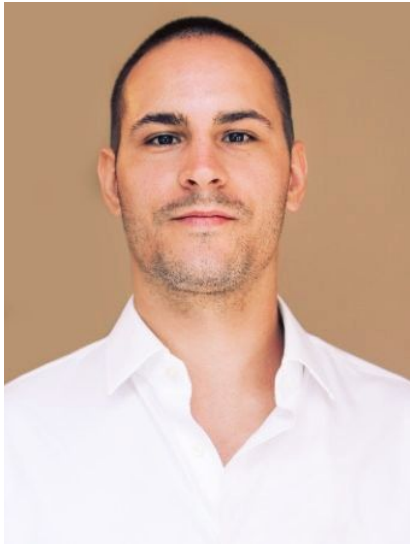
FLYABILITY
SAFE DRONES FOR INACCESSIBLE PLACES
Indoor 3D Modeling Use Cases:
Photogrammetry in action
Thursday, April 30 2020
05:30 PM - 06:30 PM CEST
11:30 AM - 12:30 PM EST

MODERATOR



Zacc Dukowitz
Content Marketing Manager
—Flyability—

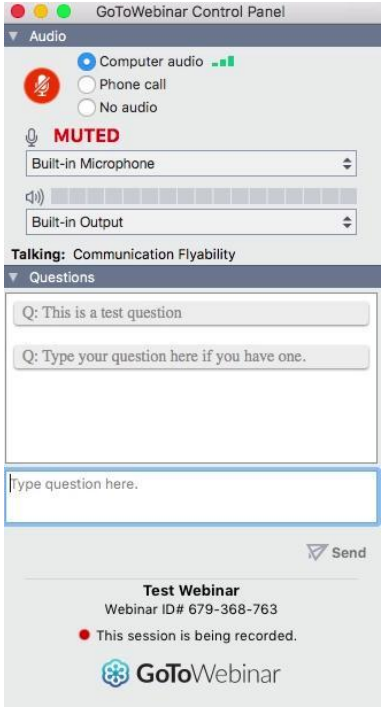
PANELISTS

Laurie McBean
Geospatial Data Specialist
—UAS Inc—

Gregory Spirlet
Professional Services Engineer
—Flyability—

WEBINAR ENGAGEMENT

Ask questions during the webinar.



AGENDA

1 5’ Introduction

2 20’ Laurie McBean, UAS Inc

Elios 2 Photogrammetry in Mining—Visual Inspection and Photogrammetric Modelling.

3 15’ Gregory Spirlet, Flyability

Photogrammetry Use Cases

4 20’ Q&A

Elios 2 Photogrammetry in Mining—Visual Inspection and Photogrammetric Modelling

Laurie McBean
Geospatial Data Specialist

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Elios 2 Photogrammetry in Mining

Visual Inspection and Photogrammetric Modelling

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Partners

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FOR INACCESSIBLE
PLACES

emesent

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Clients

BARRICK

VALE

GLENCORE

REDPATH

we are one Sibanye Stillwater

NEWMONT GOLDCORP™

DUMAS

GOLDCORP

Photogrammetry with Elios 2

- 4K Camera
- Oblique Lighting
- Setback Hold
- Photogrammetric models possible with good coverage
- Textured meshes possible with best coverage

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Videogrammetry in the Dark

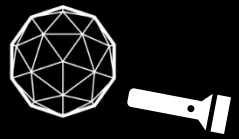
Surface

- GPS geotagging
- Flight Planning
- Even, Diffuse Illumination
- Fixed GSD

Indoor

- Frame Continuity
- Limits on Speed/ Motion
- Manual Flight Control
- Tight Spaces
- Changing GSD and Feature Geometry

Underground



- You are the Sun
- Reflection and Vignetting
- Dark Fringe / Noise
- Limited Visibility / Unfamiliarity
- Limited Access / Time
- Dust, Water, Falling Rock
- Beyond Line of Sight

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Notes on Fisheye

Benefits

- Essential for FPV navigation in tight spaces
- Provides larger FOV and great capture

Challenges

- Feature geometry changes dramatically
- Photogrammetric vectors weak at edges
- Pilots must fly more overlap than apparent

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Photogrammetry in the Dark

Ideal Flights

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Point Cloud

Textured Mesh

Blower Stack Inspection

Individual Frame

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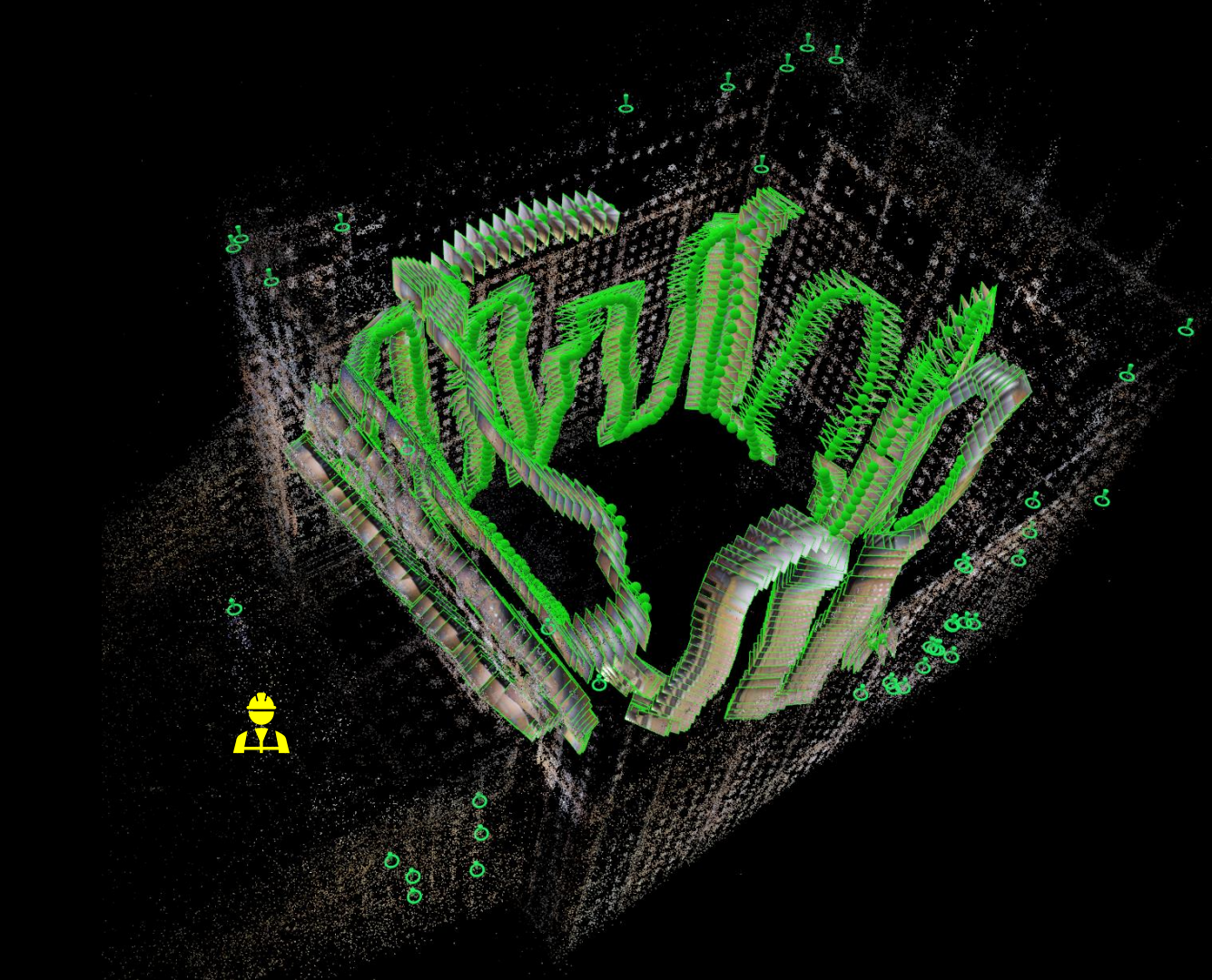

Access and clearance allows proper photogrammetric coverage

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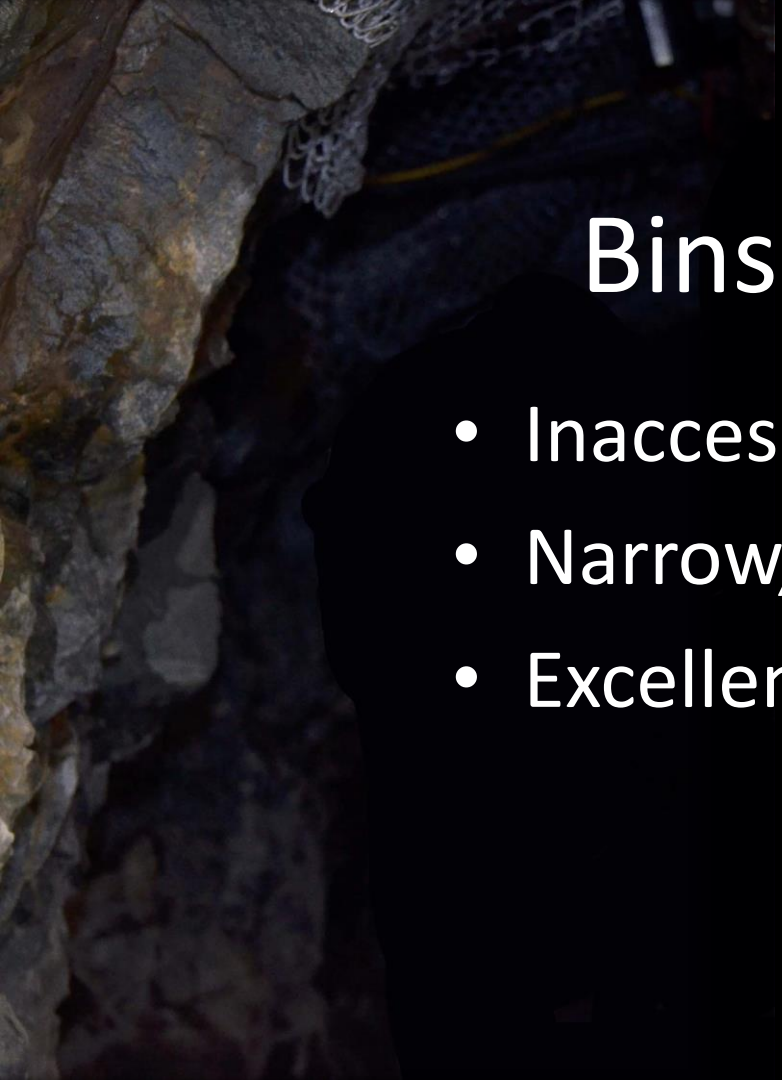

Bins and Chutes

- Inaccessible
- Narrow, non-ideal flight pattern
- Excellent visual inspections

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Bin Inspection

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Bin Inspection
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Bin Inspection
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Missing Liners

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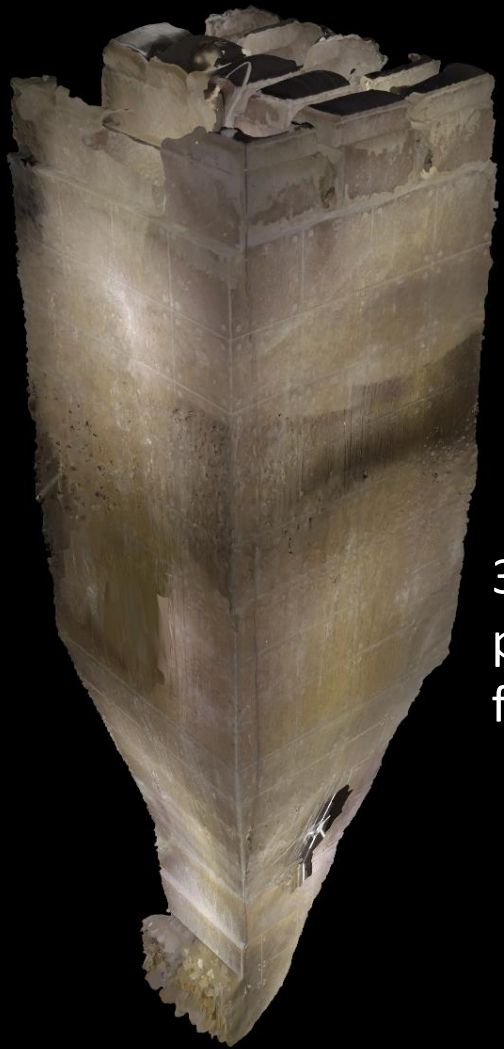
Point cloud generated photogrammetrically from inspection video



3D mesh generated photogrammetrically from inspection video

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3D mesh gives client
better spatial context

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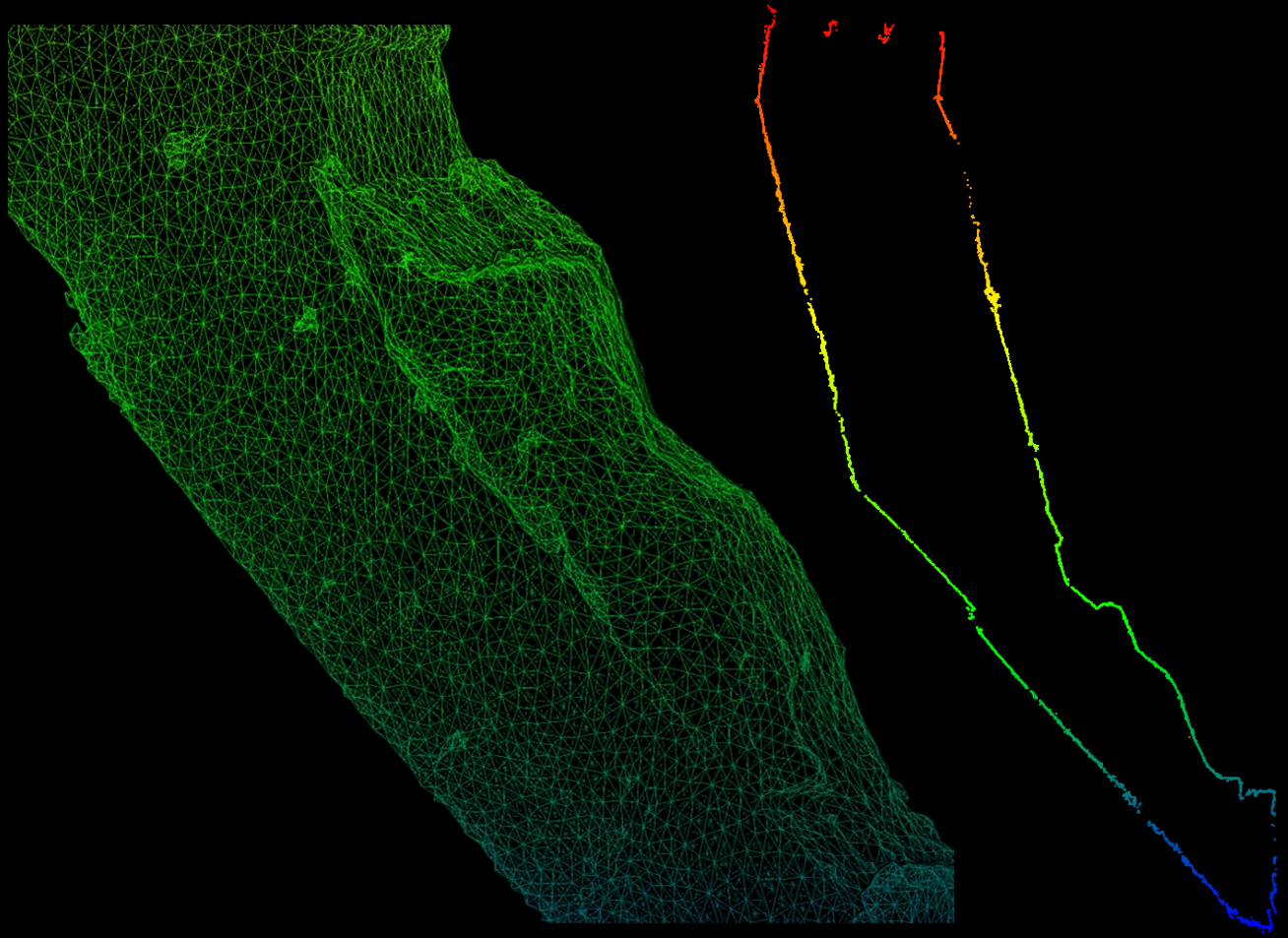

Cross sections from the point cloud can be used for CAD, or comparison to as-builts.

Point cloud or mesh can be compared to 3D design model for volume calculation.

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Rock Chute Erosion

Note Varied Frame Geometry/Scale

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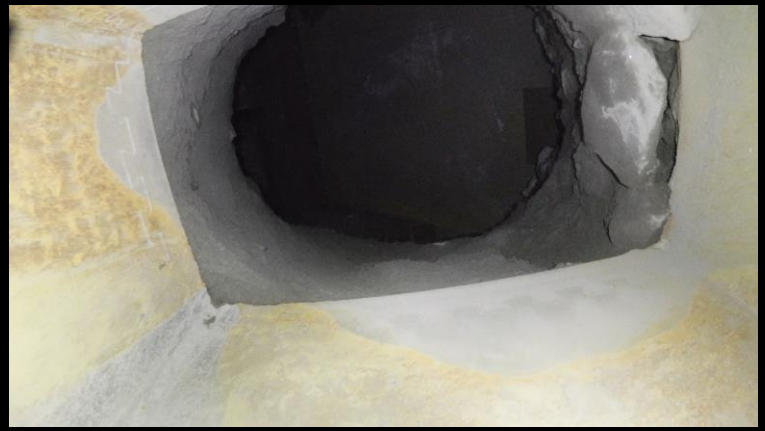
Bin and Chute Inspection



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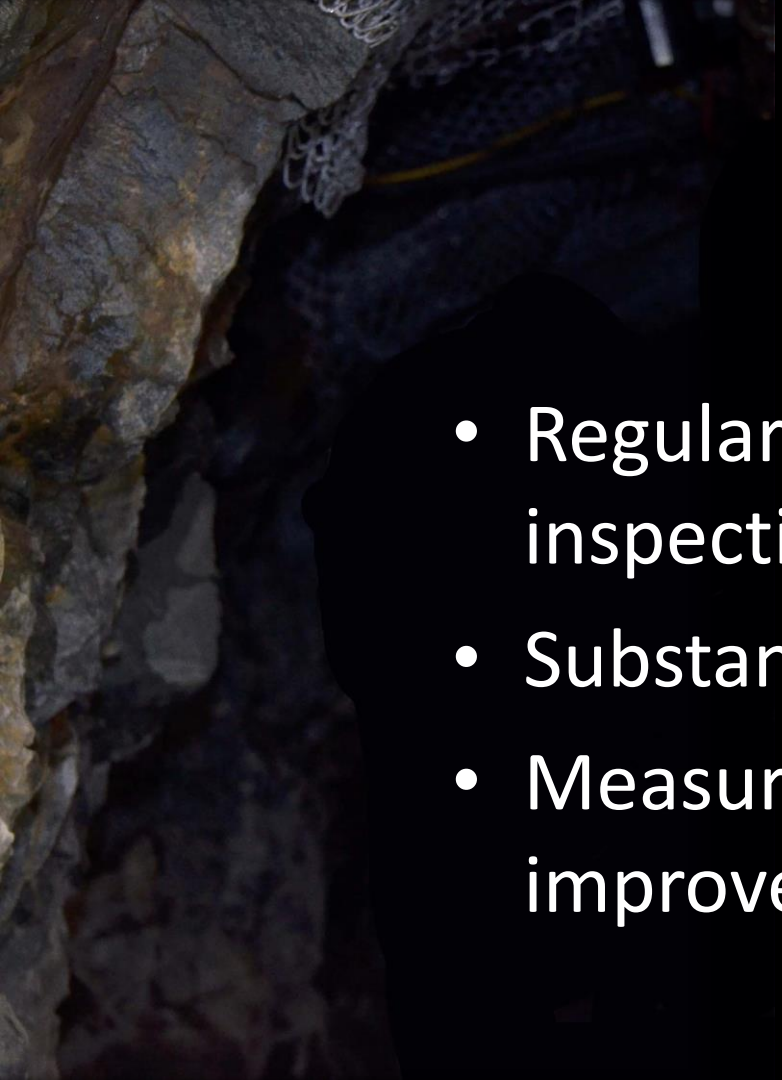

Mills

- Regularly flown with Elios for inspection
- Substantial savings in time for access
- Measuring wear would be improvement

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Identify Hangups

Inspect SAG Mill for Wear

Frame quality varies, affected by dust, water, reflections, distance

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Mesh model can be scaled and registered so areas of interest can be located

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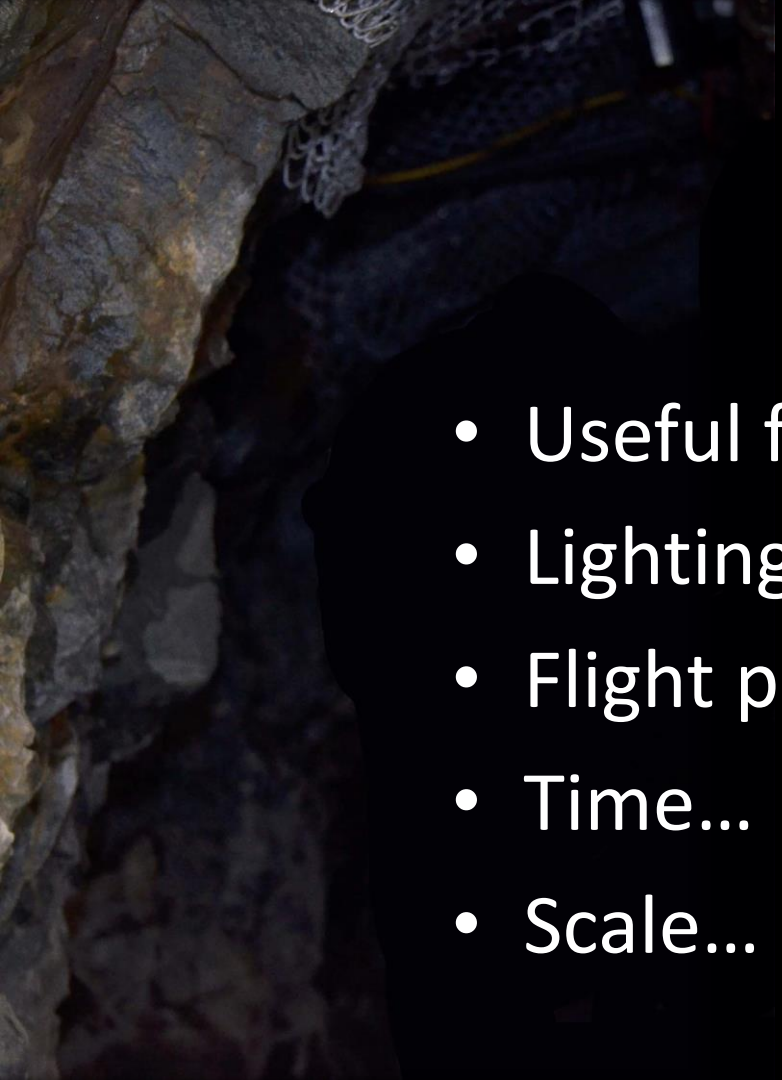

Stopes

- Useful for Geology, Operations
- Lighting has limited range
- Flight patterns
- Time…
- Scale…

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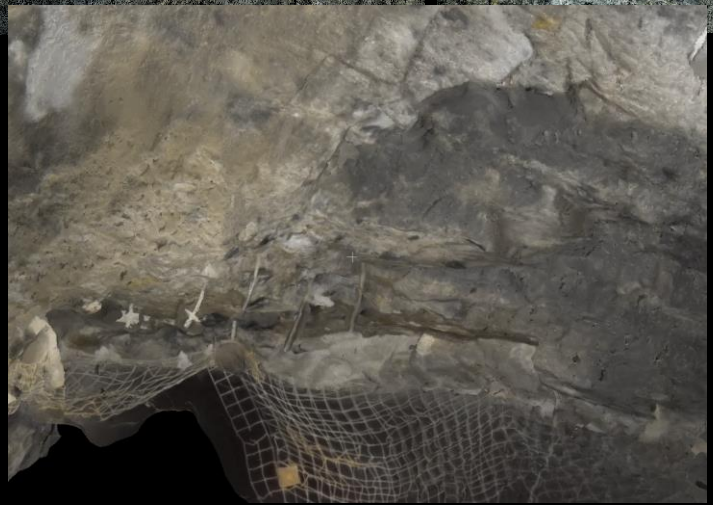

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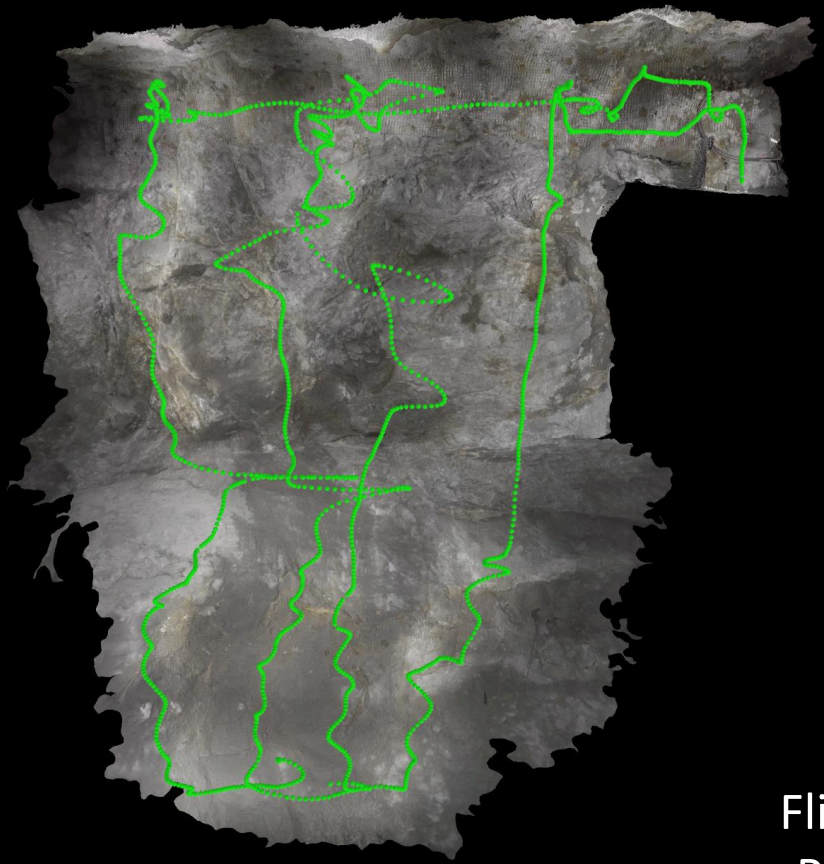

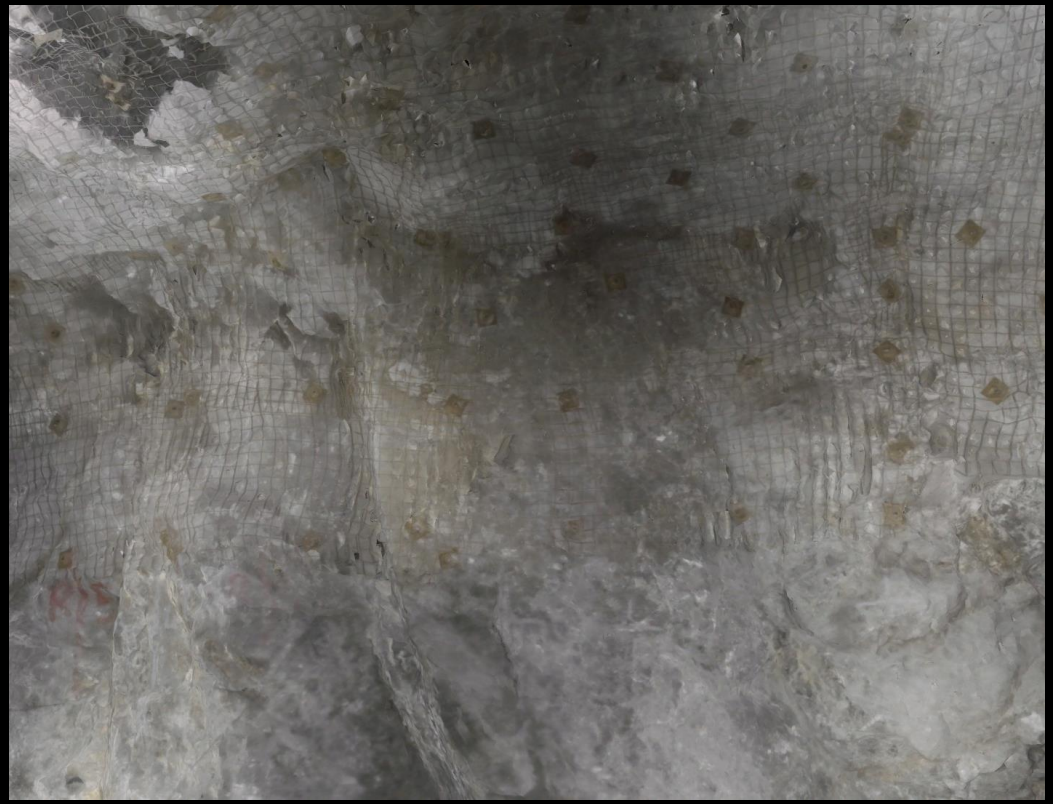

Flights Planned for
Photogrammetry

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Dark Points

Mixed with
Well Lit Points

Correlation Fringe

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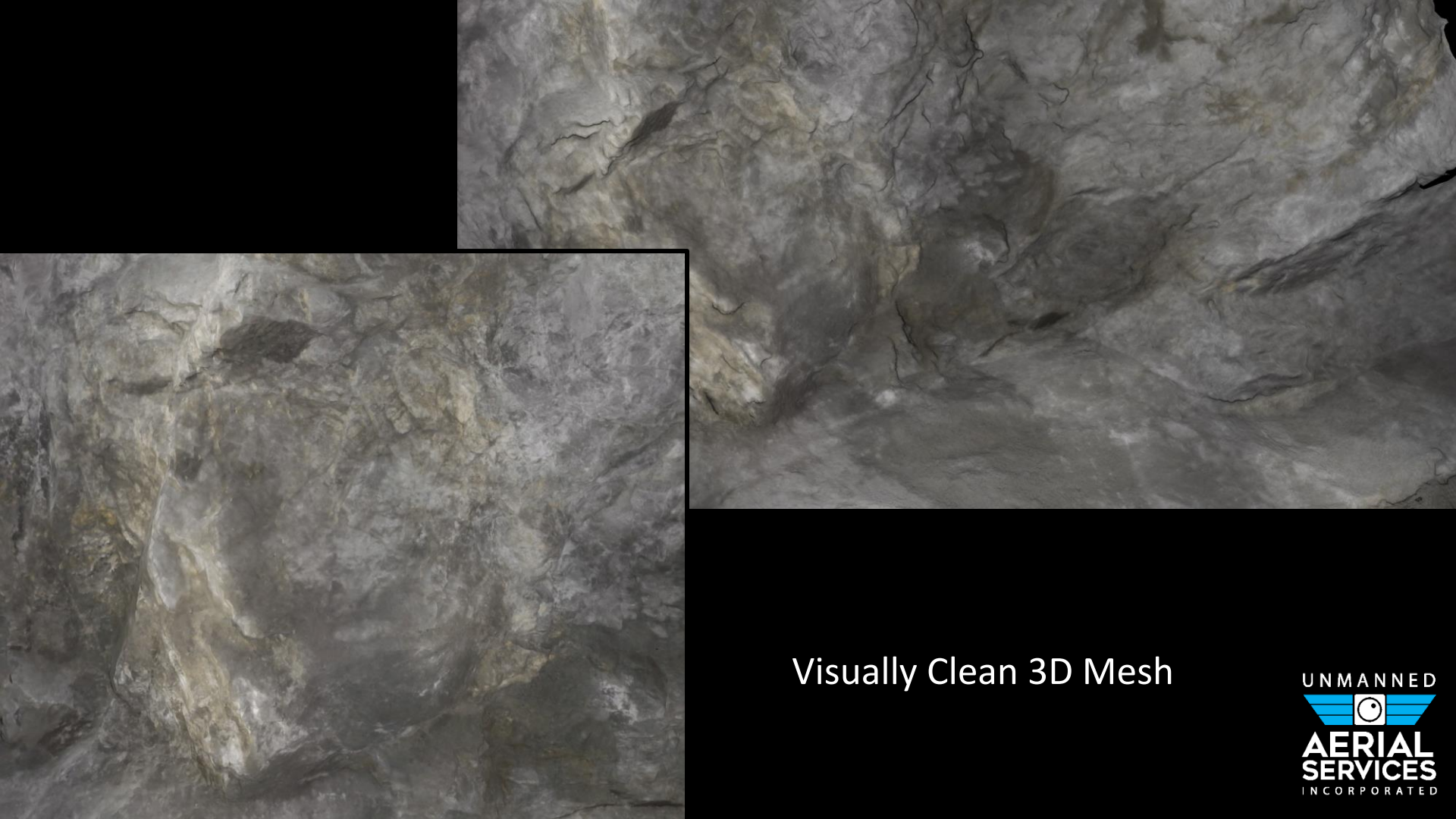

Visually Clean 3D Mesh

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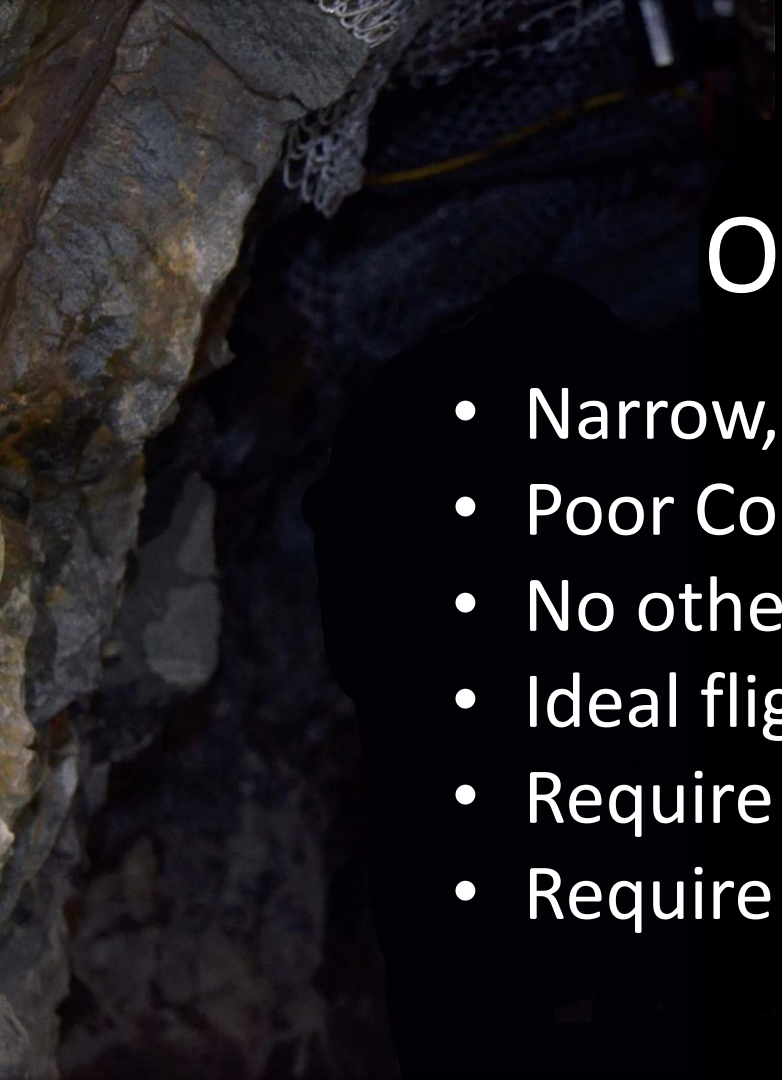

Ore Passes

- Narrow, blockages
- Poor Conditions
- No other model or data available
- Ideal flight impossible
- Require accurate georeferencing
- Require accurate scale

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Integration

- Elios 2 has small diameter
- Protective cage
- Visual Content
- Photogrammetry requires scale constraints and registration

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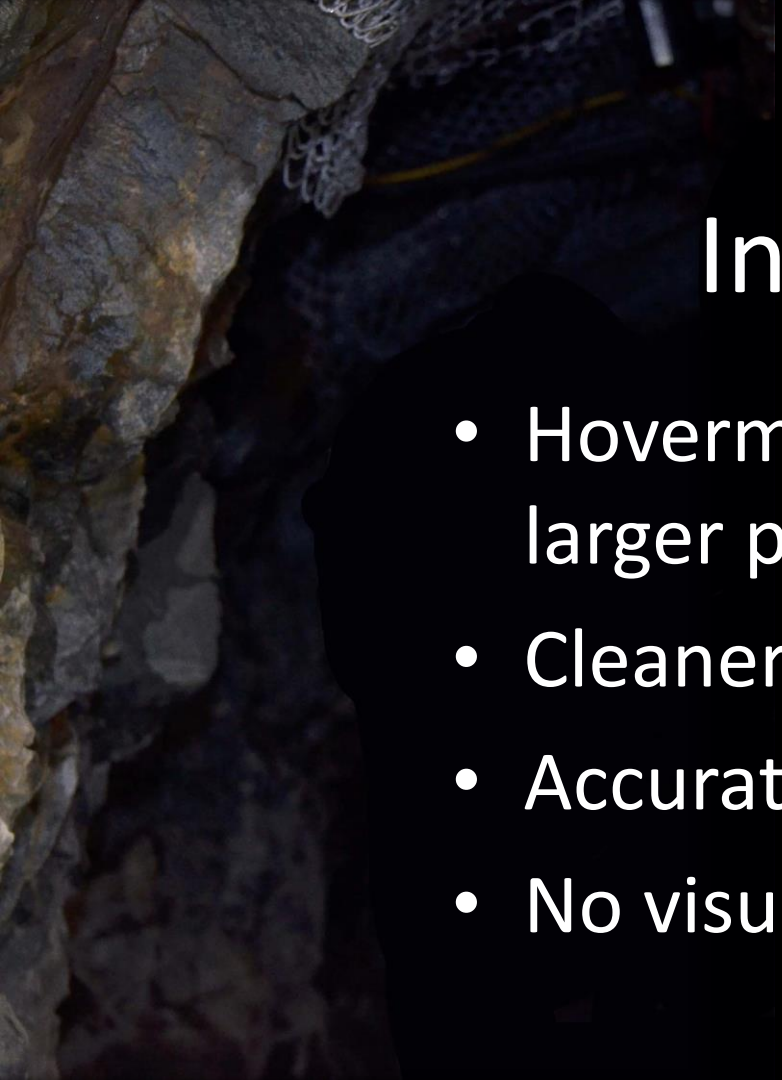

Integration

- Hovermap mobile LIDAR requires larger platform, limits to deployment
- Cleaner edges, less noise
- Accurate scale
- No visual content

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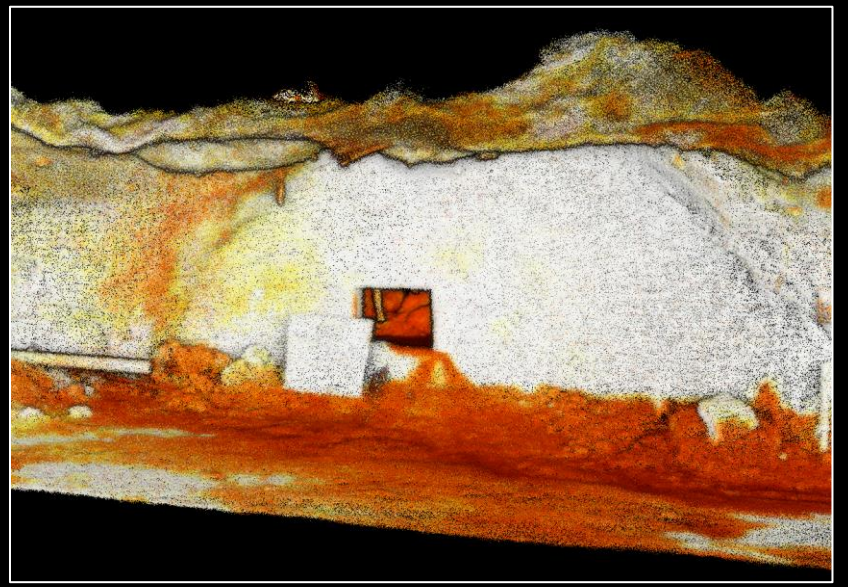
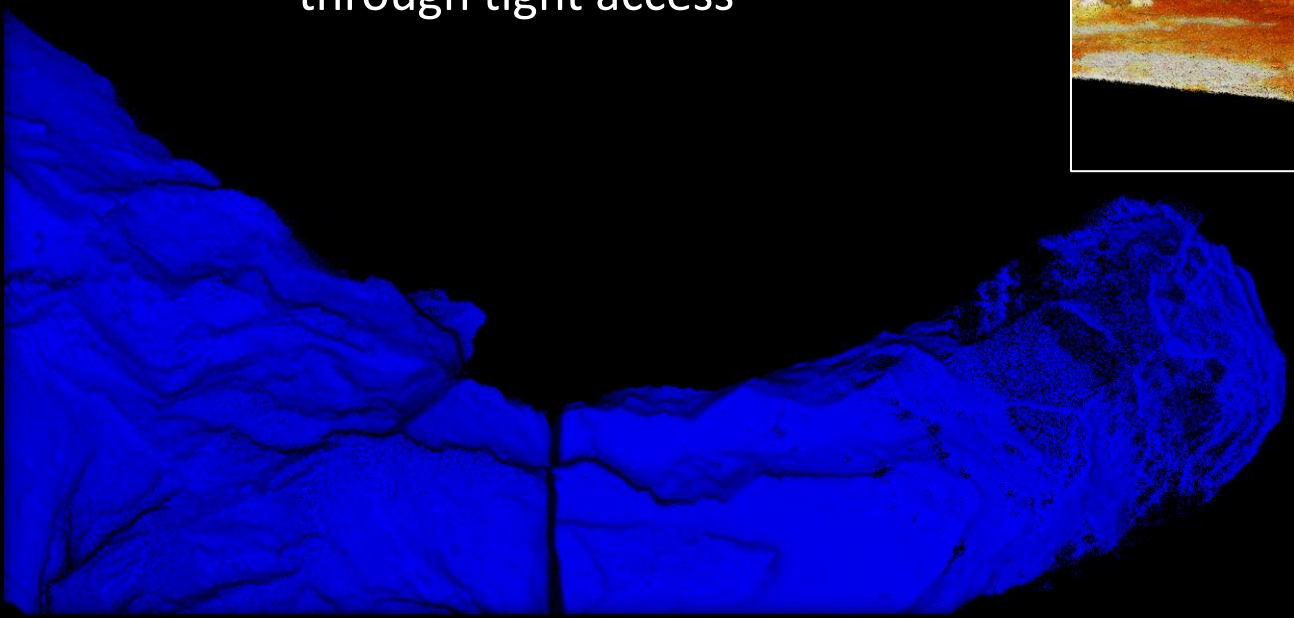
- Hovermap LIDAR scan of accessible areas
- Could not be flown through tight access





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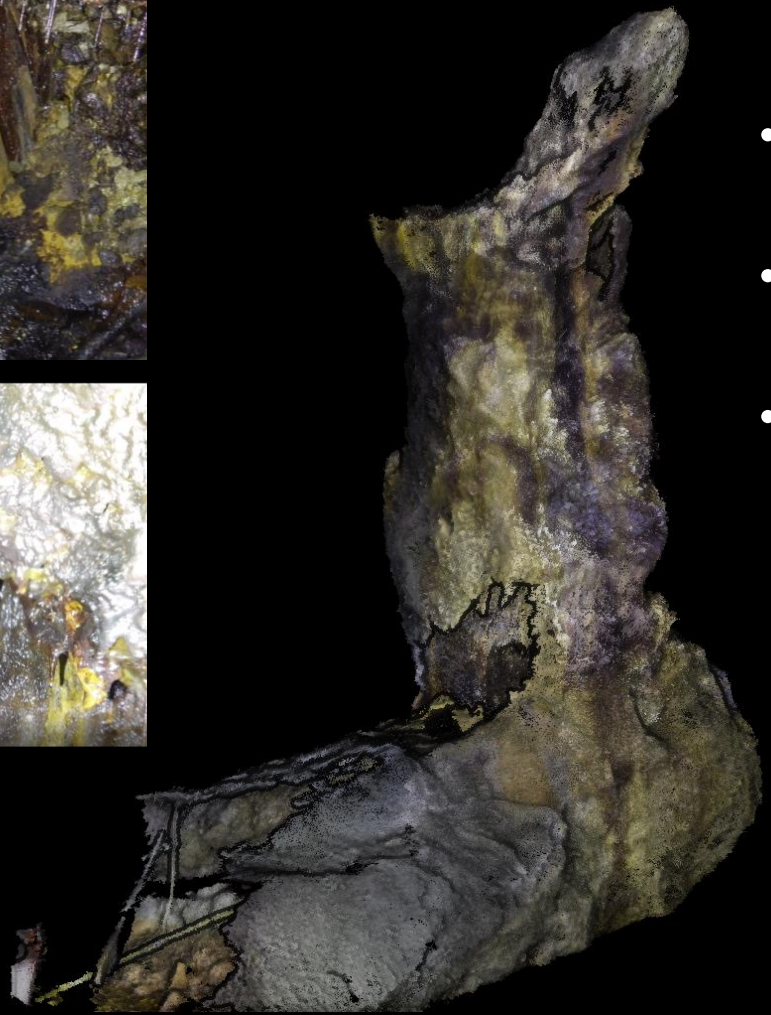

- Elios 2 flown through access and up orepass
- Model generated with no fixed scale
- Video and visual content provided detail on blockage and oxidization

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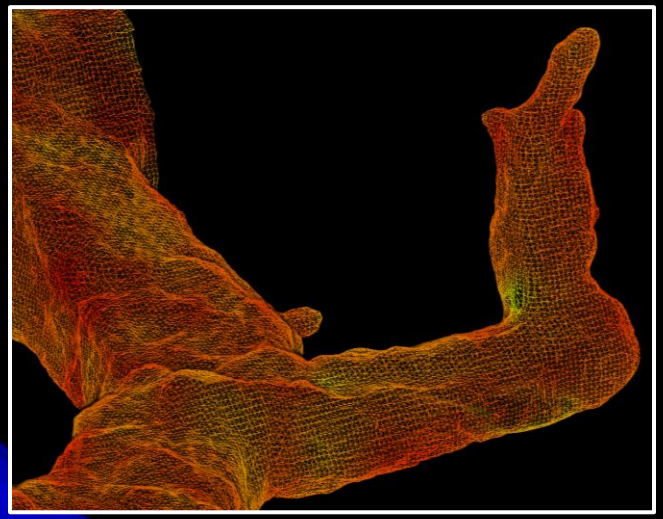

- LIDAR point cloud used for referencing and scale
- Combined model to produce mesh for engineering

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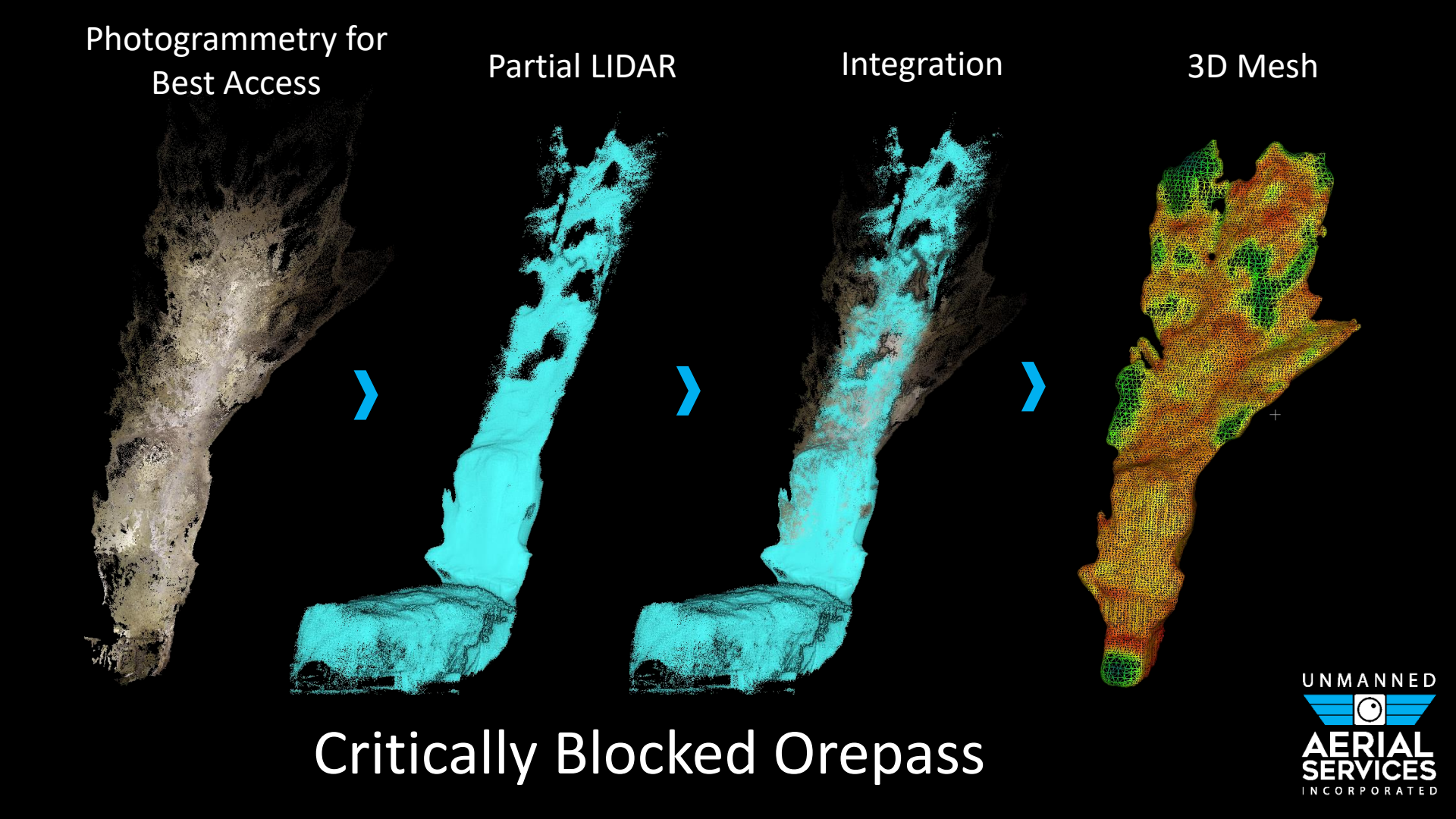
Photogrammetry for Best Access
Partial LIDAR
Integration
3D Mesh
Critically Blocked Orepass
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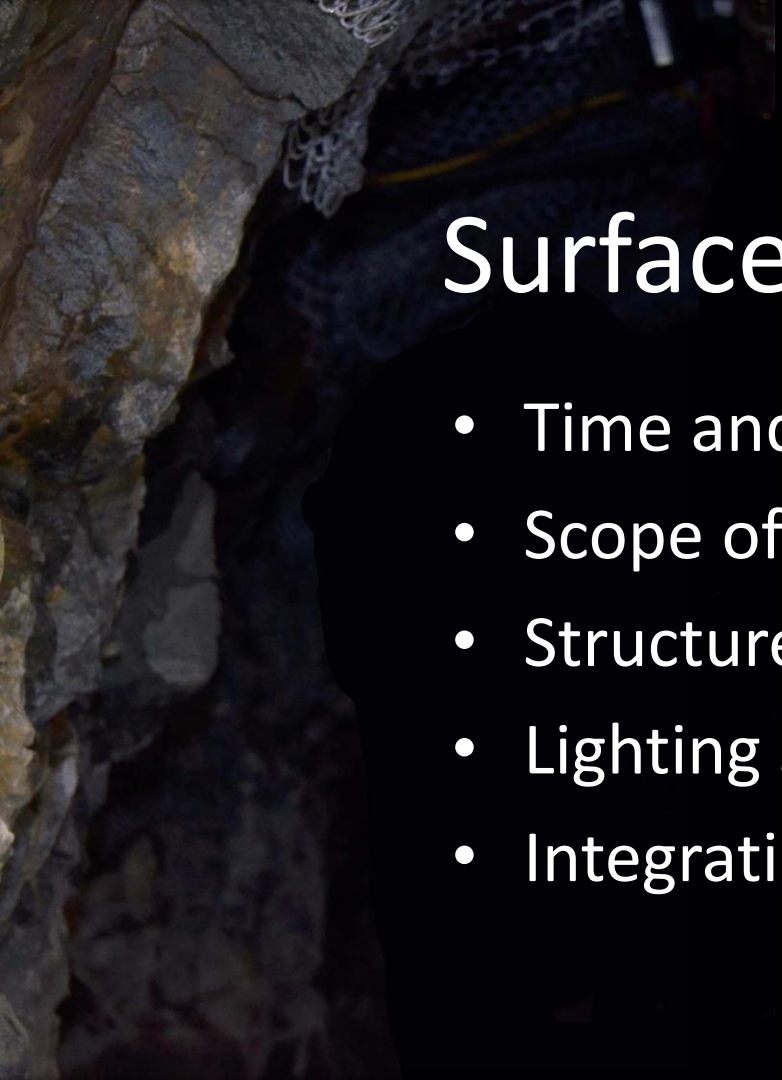

Surface Infrastructure

- Time and access restrictions
- Scope of the project
- Structure modelling challenging
- Lighting still an issue
- Integration of sensors

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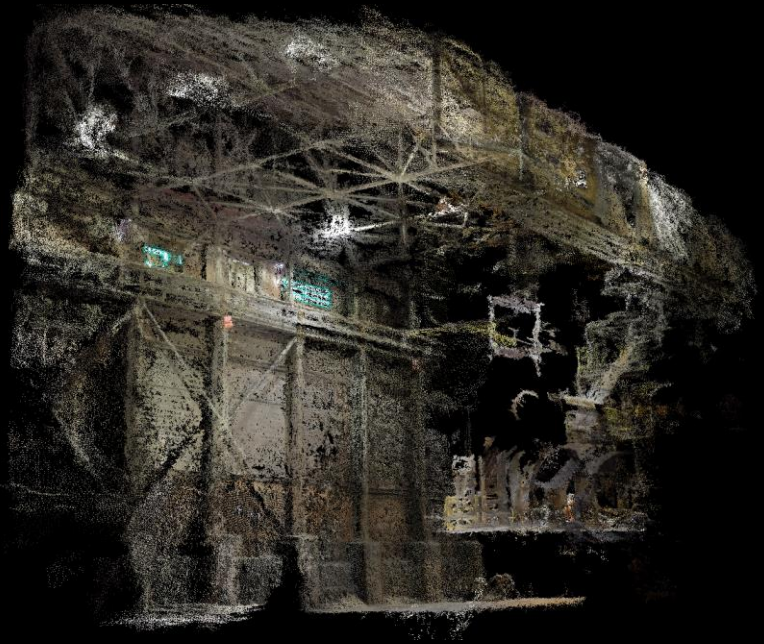

Overview of Model

Roof/Rafter Detail

Elios Model

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Rafters from Ground

Hovermap Path Shown

Hovermap Model

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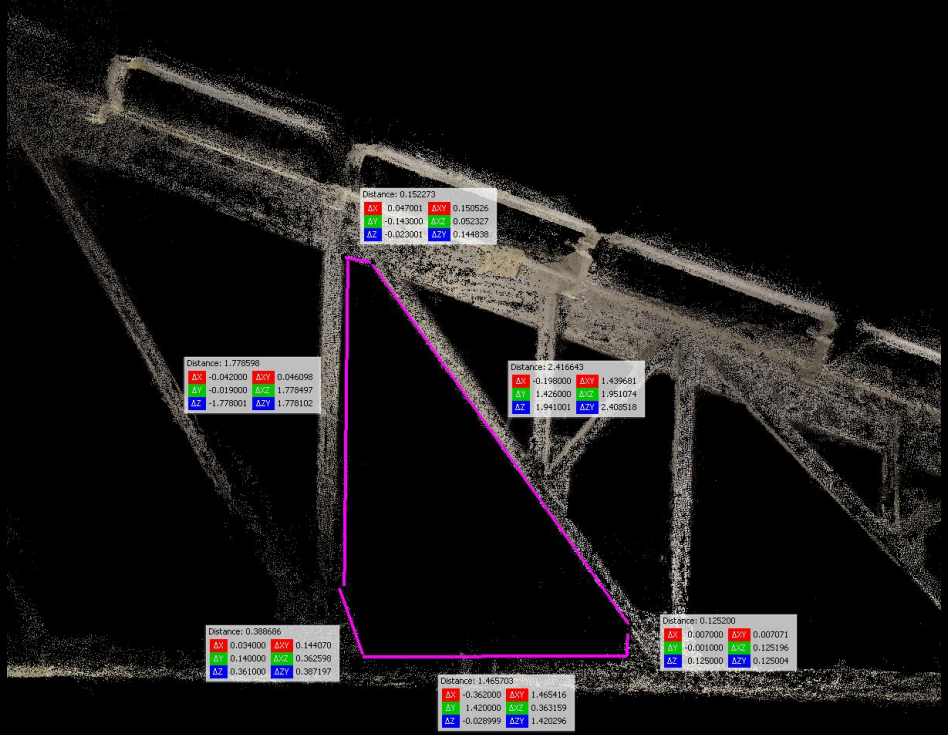
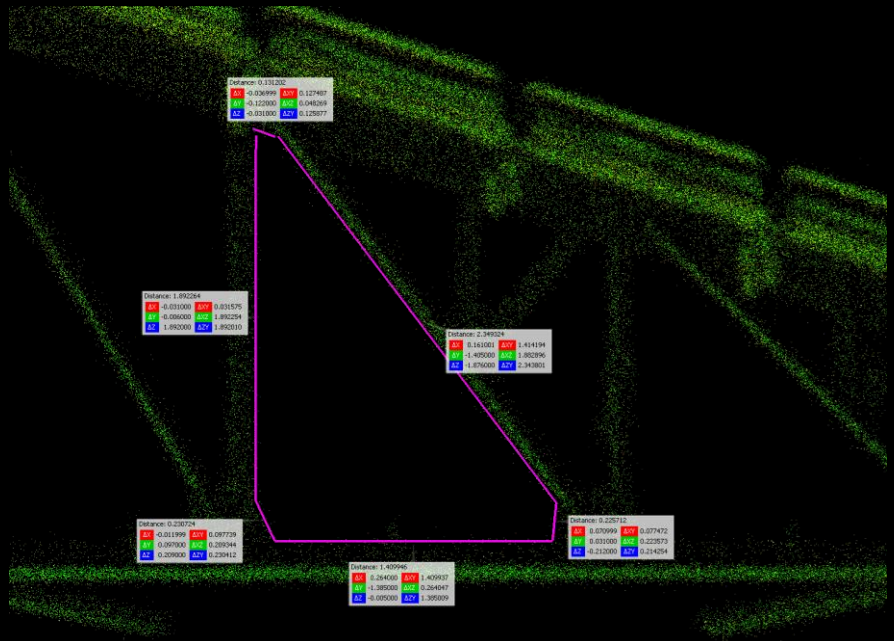


Elios 2 Cloud



Hovermap Cloud
(from ground)

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Why Model Your Inspection?

- Give features in the video spatial context
- Compare geometry to as-builts
- Accurate measurements
- Better communication

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What does your client want?

- Continuous 3D Model
- Photorealistic
- Full resolution of 4K Video
- Measure to 1/8”
- Flown in 10 minutes or less
- Just a few MB
- Viewable on any platform

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What does your client want?

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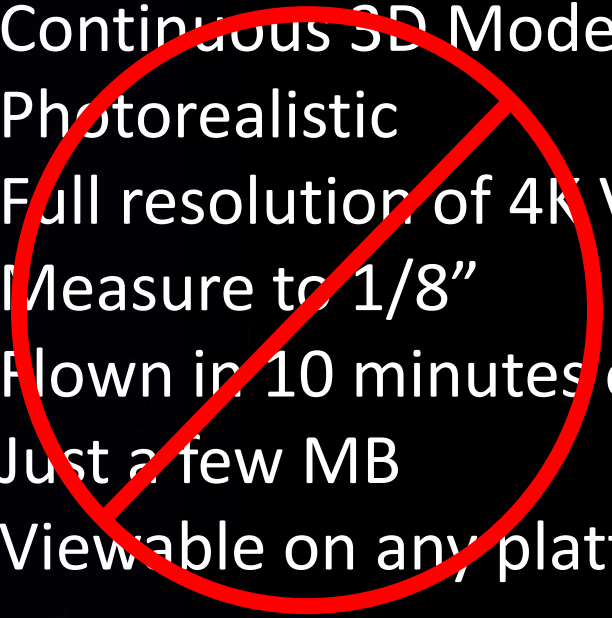

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Manage Client Expectations

- Point clouds contain excellent data for measurements or CAD, BUT are noisy, especially with fine structures
- Textured meshes useful for context, BUT not as detailed as video

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Manage Client Expectations

- Perfect capture not realistic for industrial settings, time restrictions
- Lighting will never be as consistent as outdoor photogrammetry
- Reflective metal, especially curved surfaces, remain a challenge

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Keys to Success

- Plan to fly for inspections, OR photogrammetry
- Manage overlap, consider fisheye
- Careful attention to rotation and changes in camera direction

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Photogrammetry Use Cases

Gregory Spirlet
Professional Services Engineer

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SAFE DRONES
FOR INACCESSIBLE PLACES

Photogrammetry Webinar
Use cases

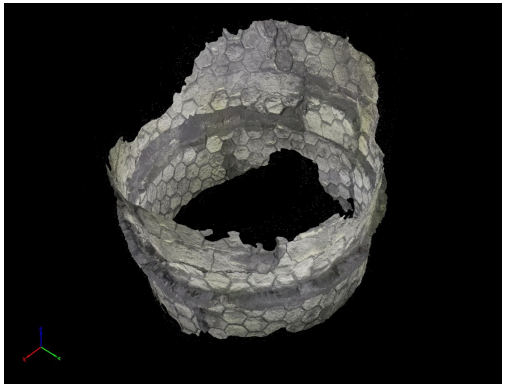
Use Cases

Sewer

Brickwork

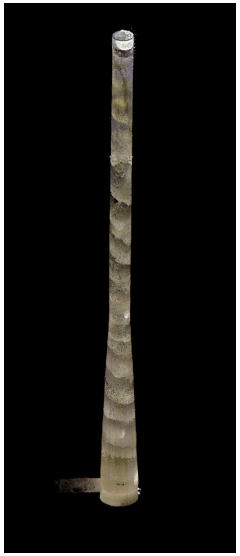
Refinery FCC

Refractory coating



Refinery Stack

Refractory coating



Sewer

Sewer - Water drain in Ohio

Inspection Objectives:

- Identify defects in brickwork
- Identify obstructions

Photogrammetry used to:

- Determine location of defects

Properties

Selection

Polyline 2 (Polyline)

Number of Vertices: 2

Measurements

Terrain 3D Length [m]:	27.05	error n/a
Projected 2D Length [m]:	27.03	error n/a

Copy to Clipboard | Apply | Cancel | Help

Images

Image Size Zoom Level

Frame331.jpg GCP: mtp52

Project Stats

1 recon flight + 6 minute mapping flight
500 images
Entrance diameter for scale

<1 hour processing time on an i7 processor + 16GB Ram + GPU

Refinery

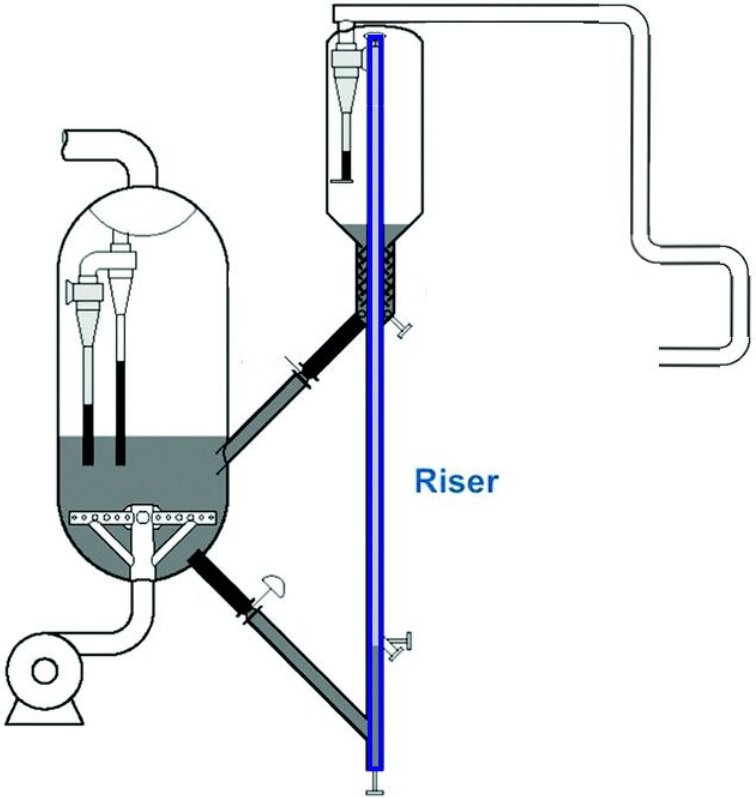
Refinery - FCC in Turkey

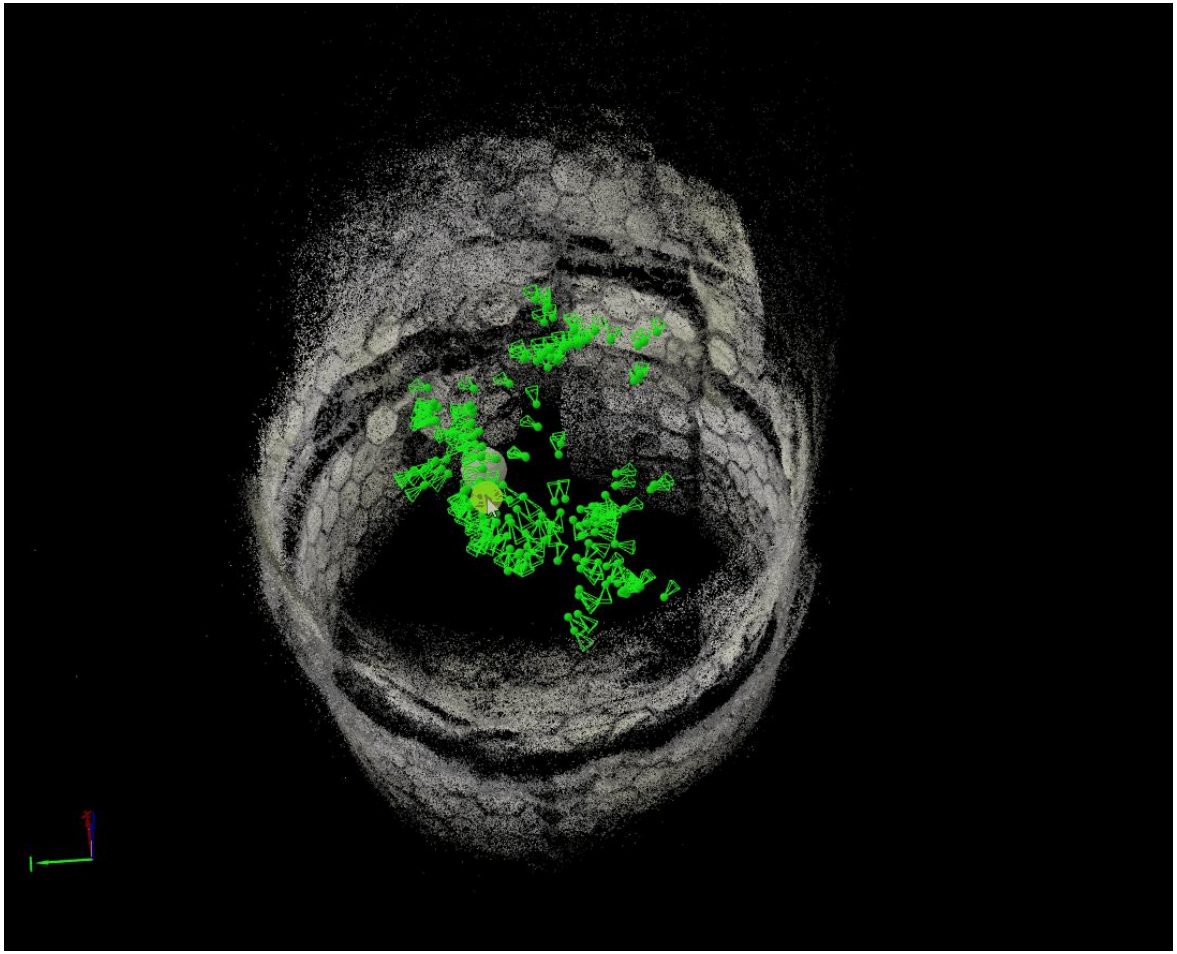
Inspection Objectives:

- Identify defects in refractory lining

Photogrammetry used to:

- Estimate depth of defects


Riser



Project Stats

1 recon flight + 6 minute mapping flight at specific area
370 images
3 hours processing time on an i5 processor + 8GB Ram
Pipe diameter for scale*

3D model evaluated by engineers the next day

Stack

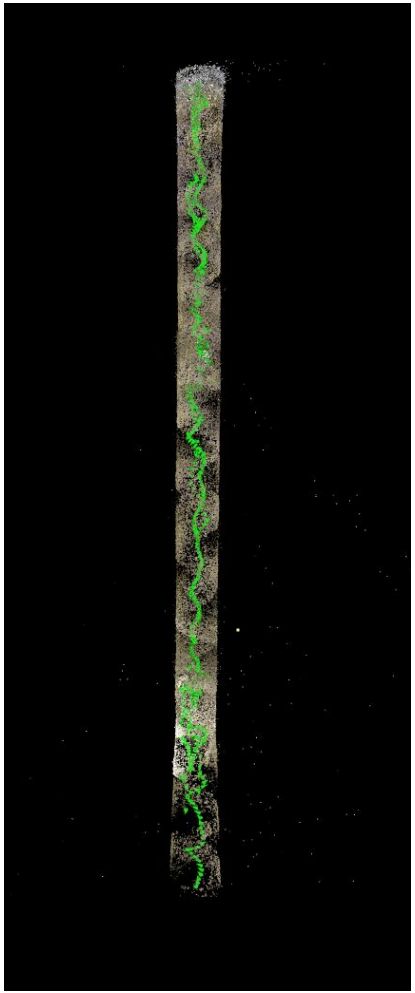
Refinery - 50m Stack in USA

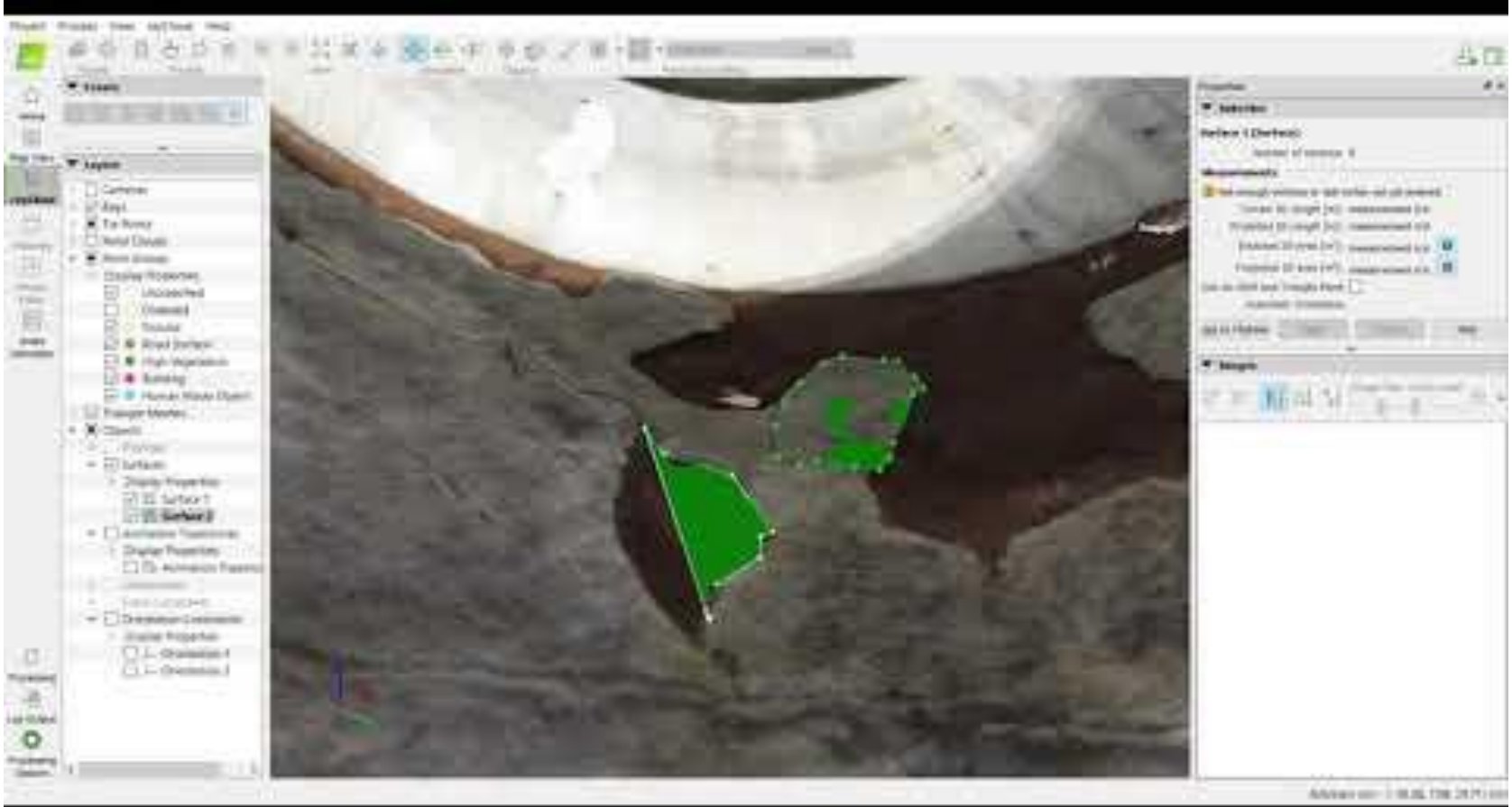
Inspection Objectives:

- Spot missing refractory

Photogrammetry used to:

- Measure surface area of defects





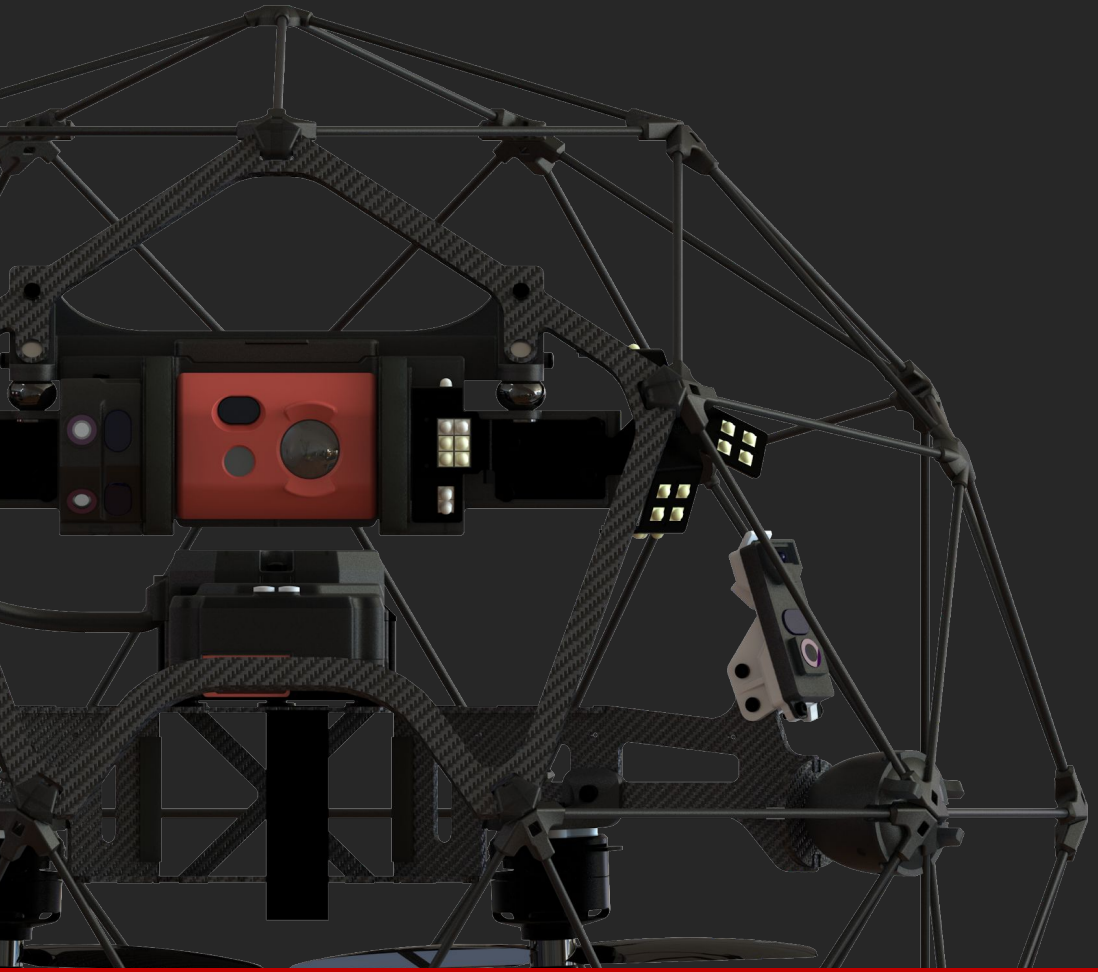
Project Stats

1 recon flight + 2x 6 minute mapping flights
1800 images
2 hours processing time on an i7 processor + 16GB Ram + GPU
Stack height for scale

Flyability Photogrammetry Training Course

Follow a two day course:
sales@flyability.com

Also available online



REPLAY

The recording of this webinar will be sent to you afterward.

PAST WEBINARS

Thursday, April 9
10:30 AM EST / 04:30 PM CEST

Learn How API and ASME Experts Are Working to Expand Drone Inspection Applications

- Suzanne Lemieux, Manager, Operations Security & Emergency Response Policy at API
- Luis Pulgarin, Project Engineering Advisor at ASME

Tuesday April 14
11:30 AM EST / 05:30 PM CEST

How Country-of-Origin Drone Bans Impact U.S. Companies & Agencies Including Public Safety Agencies Fighting COVID-19

- Jordan Gross, Senior Government Relations Lead at DJI
- Romeo Durscher, Senior Director of Public Safety Integration at DJI

Tuesday, April 21
10:30 A.M. EST / 04:30 PM CEST

3D Modeling with Indoor Drones: Applications and Implications

- Andrew McIntyre, Technical Trainer and mapping expert at Pix4D
- Marc Gandillon, Head of Marketing at Flyability

Wednesday April 22
10:30 AM EST / 04:30 PM CEST

How to Build and Scale a Drone Program at Your Company

- Calvin Rieb, Head of Global Unmanned Systems at Cargill
- James Manni, UAS Program Manager at TVA

Tuesday April 28
10:30 AM EST / 04:30 PM CEST

Drones in Oil & Gas: How Chevron Uses Drones to Improve Safety, Reduce Downtimes, and Save Money

- Mauricio Calva, Non-Destructive Examination Expert at Chevron
- Larry Barnard, Downstream & Chemicals, Manufacturing ~ UAS Governance at Chevron

UPCOMING WEBINARS

Thursday, May 14
10:30 AM EST / 04:30 PM CEST

Drones in Power Generation: How Exelon Uses Drones to Improve Safety, Reduce Downtimes, and Save Money

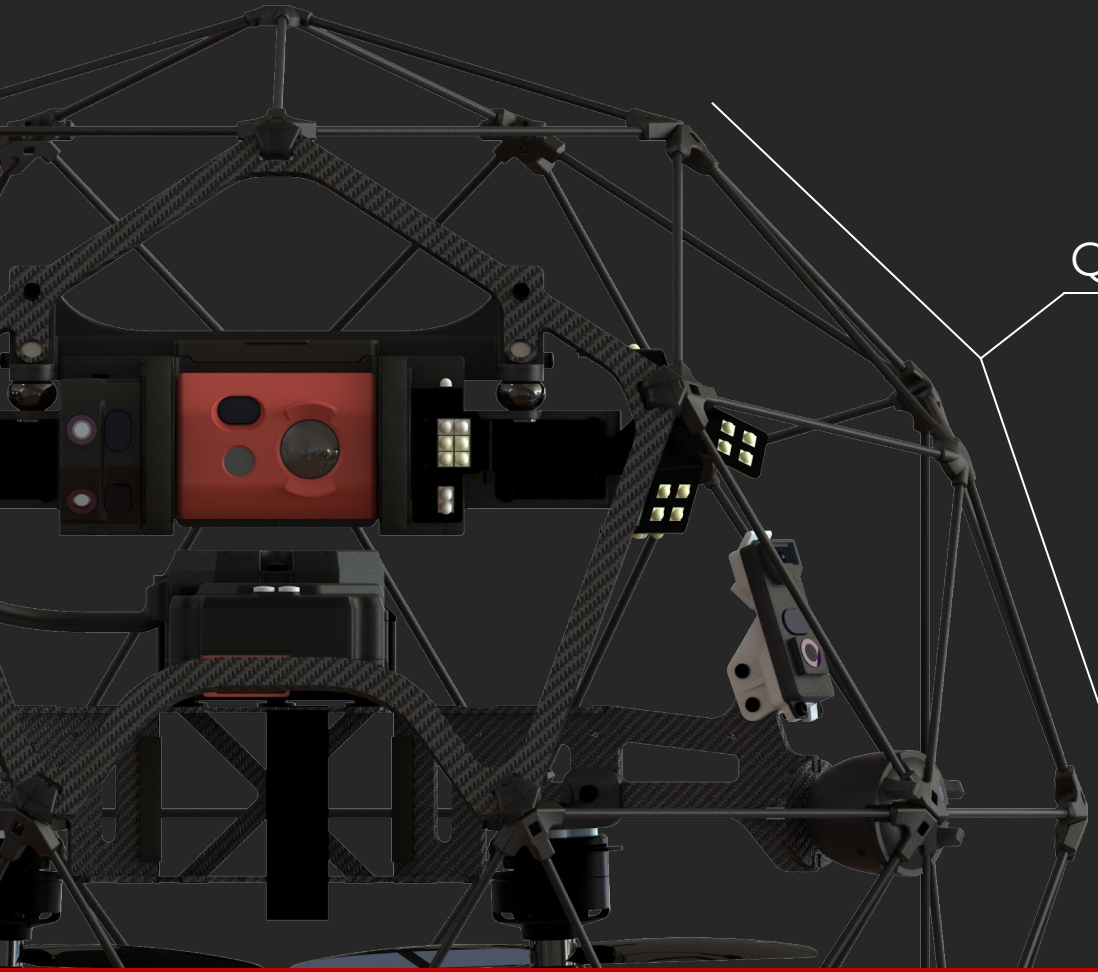
- Chris Place, Business Development Manager at Exelon Clearsight

Wednesday, May 20
2:00 PM EST / 12:00 PM MST

How to Perform Safer Confined Spaces Inspections Using Drones

- Alexandre Meldem, VP of Sales at Flyability

https://www.flyability.com/news/user-conference-webinars



Q&A

You can also send your questions to:

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