gatewing
A TRIMBLE COMPANY

UAS for Surveyors

An emerging technology for the Geospatial Industry

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Project Overview

- Voyager Quarry , located near Perth Australia
- Typical of hard rock mines, suitable for digital terrain modeling
- Image acquisition and post processing workflow validated for volumetric survey conducted with X100
- Comparison made with terrestrial laser scan of the quarry

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Project Details

- Area is approximately 1000m x 600m
- Total of 408 images were captured to include adjacent waste dump and processing area
- Ten control points were pre-marked in and around the quarry . Used as primary and check control
- Five points served as control for terrestrial laser scan survey
- Pit area is 600m x 360m and 80m deep.

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Gatewing Output

- Outputs of the Gatewing X100 post processing are georeferenced tif files .
- Orthorectified image and digital elevation model are produced. Global Mapper was used to open the tif files. The result was of high quality with seamless joins.
- Pix4D Cloud solution was utilized for high accuracy
- The statistical report highlights the integrity of the ground control . RMS values of 0.06m in XYZ were achieved.

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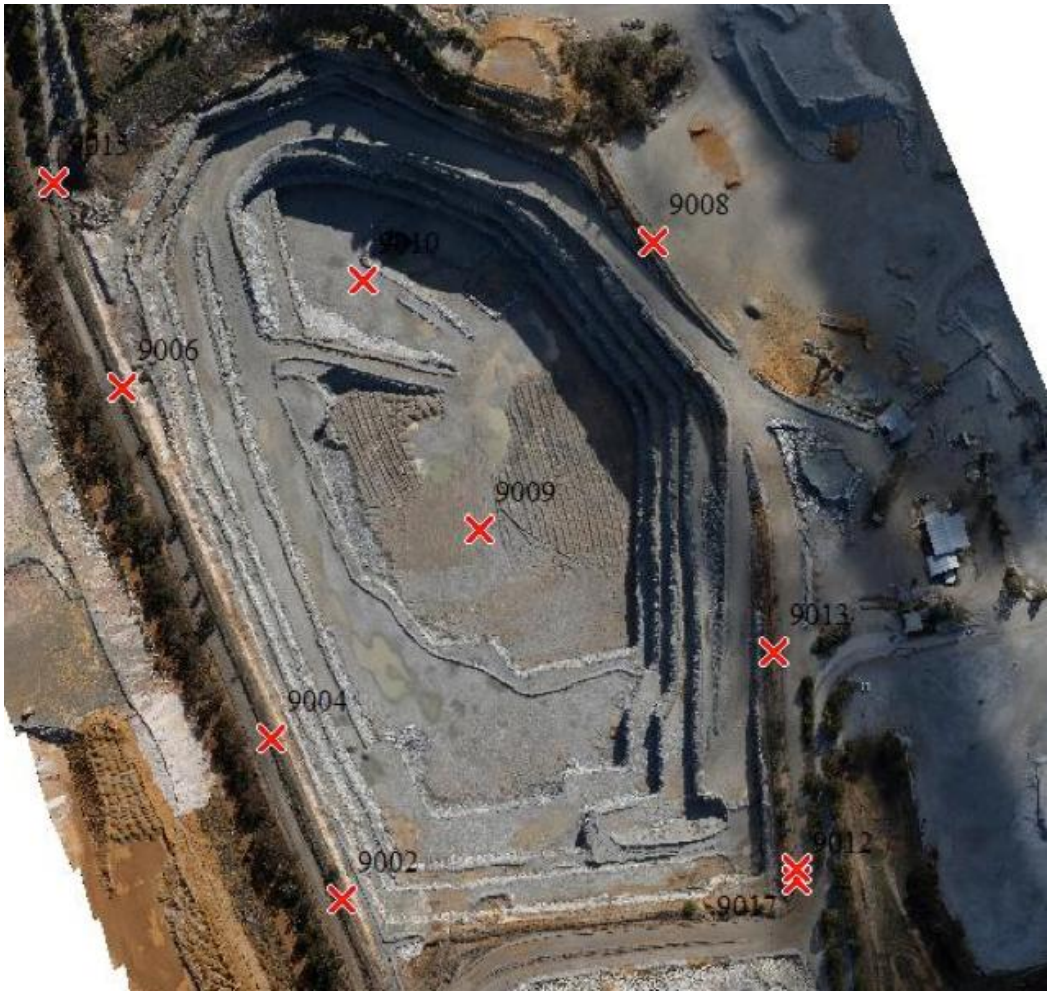
Gatewing Output Cont.



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Facts and Figures

- Check on Control
  - Each of the control points was visited and checked within Global Mapper.

Pt ID	E	N	ht
9002	-0.101	-0.007	-0.057
9004	-0.088	-0.055	-0.035
9006	-0.062	-0.071	-0.071
9008	-0.199	-0.028	-0.140
9009	0.034	-0.030	-0.083
9010	0.084	-0.125	-0.095
9012	-0.061	0.105	-0.130
9013	0.050	0.068	-0.033
9015	0.005	-0.215	-0.020
9017	-0.067	0.110	-0.160

Timing

- Approximate times to produce the Gatewing survey were :

Task	Hours
Planning	1.0
Control establishment and targeting	1.5
Preflight	0.5
Flight	0.5
Postflight	1.5
Processing via cloud	6.0
Quality checks and volume calculations	2.5

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Volume Comparson

- The DEM was exported as an XYZ points file at 1m grid interval.
- Exported into CivilCad for volume calculations
- Comparison to terrestrial scan data follows

Acquisition Method	Data Structure	Volume (m3)	Difference (m3)	Difference (%)
Gatewing X100	181776 points on 1m grid	6,524,854	70,385	1
Maptek I-Site 8800	60550 points on breaklines	6,595,239		

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So Why Gatewing?

- It’s not just a cool plane but also a sophisticated Solution for Surveyors
- Extremely good fit with Trimble Values , Strategy and Solutions
- Mature and Professional

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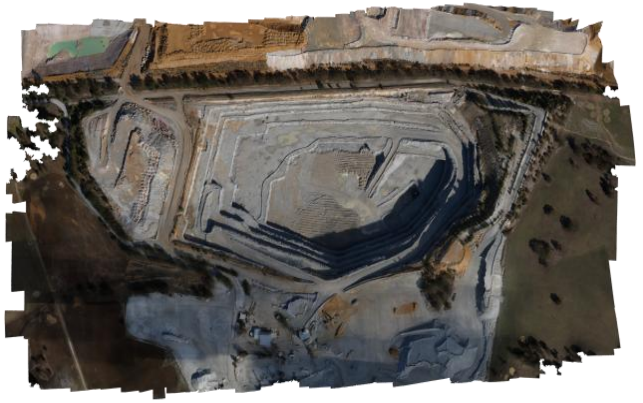
Benefits

- Economic
- Hazardous & Hard-to-Reach Areas
- Fast & Flexible
- Accessible & Easy to use
- **Aerial imagery in your hands!**



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Why UAS?

- New emerging Technology well suited for Surveyors
- Complimentary to Traditional Surveying technologies and to Traditional Photogrammetry
- Many UAV's but not many targeting the Surveying industry yet

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Introduction to Gatewing

- Image acquisition with the Gatewing X100™
- Image processing with Gatewing Stretchout™
- Final products from the data

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Rapid mapping tool

- Mapping & surveying
- Light UAS
- Compact camera
- New-generation photogrammetry
- Vision software tools & automation

[EU design patent]
[Patent pending production method]

Applications

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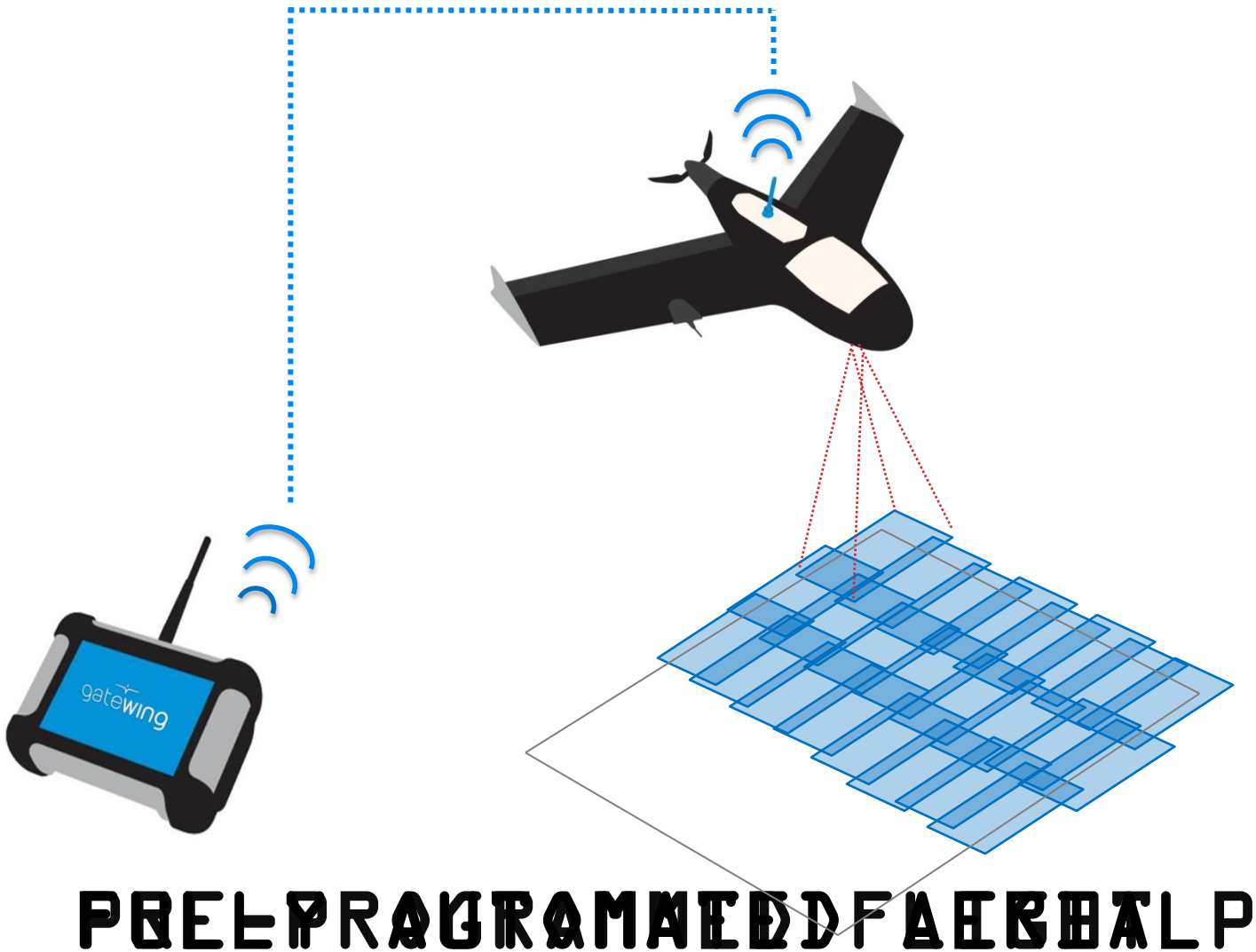
Construction, mining, plantations

What else ?

- Land reclamation
- 3D modeling, visualization
- Waste management
- Road works
- Pipelines (oil, gas …)
- Forestry
- Flooding
- Safety assessment
- Erosion monitoring
- Volume calculation (stock piles)
- Research (geology, archaeology…)
- Asset management
- …



PRE-PROGRAMMED FLIGHT PLAN

Some X100 specs

- Mass 2.0 kg
- Cruise speed 75 km/h
- Top speed 130 km/h
- Wind speed up to 65 km/h
- Endurance 45 min
- Mapping @ 5 cm 1,5 km2
- Mapping @ 10 cm 3 km2
- Foldable launcher, easy setup
- Automatic from launch to recovery

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- Rugged ground control station
- Integrated radio equipment
- Easy to use flight planning software
- Surveyor oriented

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EC14
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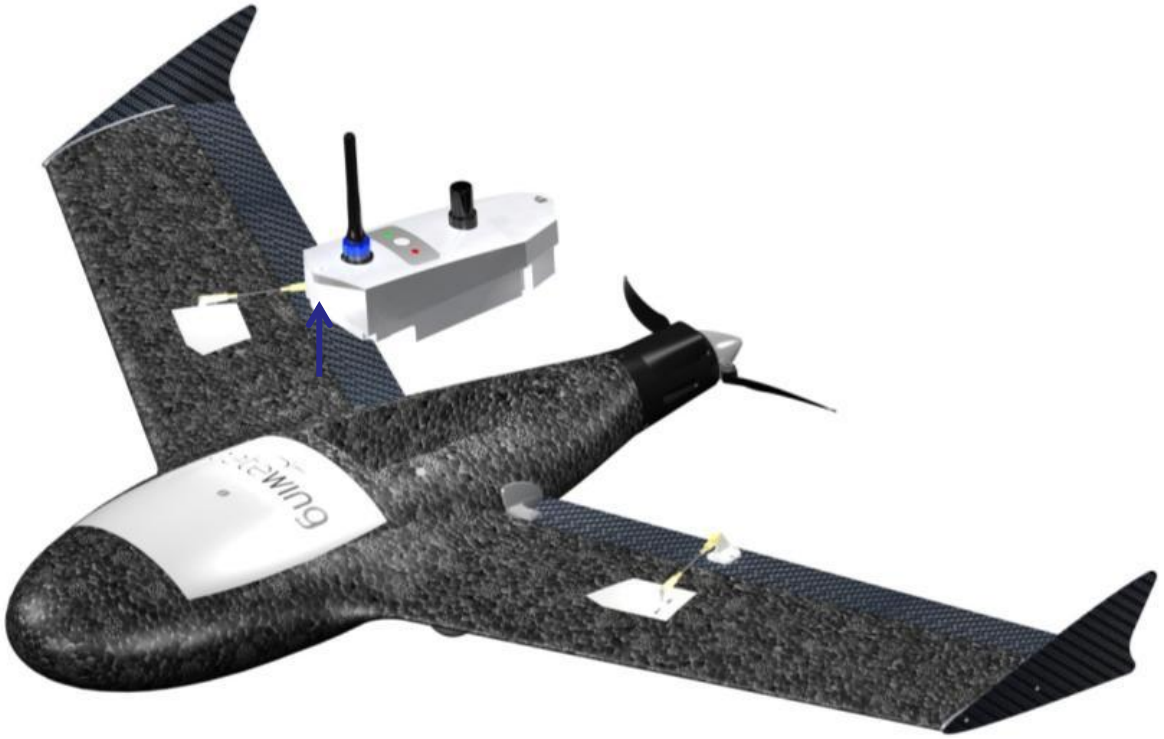
Product & servicing philosophy

High end, black box electronics in an expendable wing

"We don't repair, but we replace …"



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Overall design: focus on safety!

- Safety critical design
  < 2 kg
  Shock-absorbing structure
  Electric propulsion
  Low level of complexity

- Safety of operations
  Low altitude
  Fail-safe procedures
  Automated from start to landing
  Pre-programmed mission

Seagull, North Sea, 1.75 kg

[active member of Eurocae]

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Image processing options

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Gatewing Stretchout™

- Highly advanced vision software
- Turns your X100 image data into georeferenced orthophotos and DSMs
- Fast (hundreds of images within minutes)
- Accurate (accuracy comparable with LiDAR)
- Easy (one click solution)

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Gatewing Cloud

- Easy upload of Gatewing X100 image data set to Gatewing's cloud server
- Download your orthophoto or DSM within a few hours.
- Secure upload
- Free accuracy report

X100 also compatible with other software

- Ensomosaic & Ensomosaic 3D
- Photoscan
- Icaros
- BINGO
- INPHO
- …

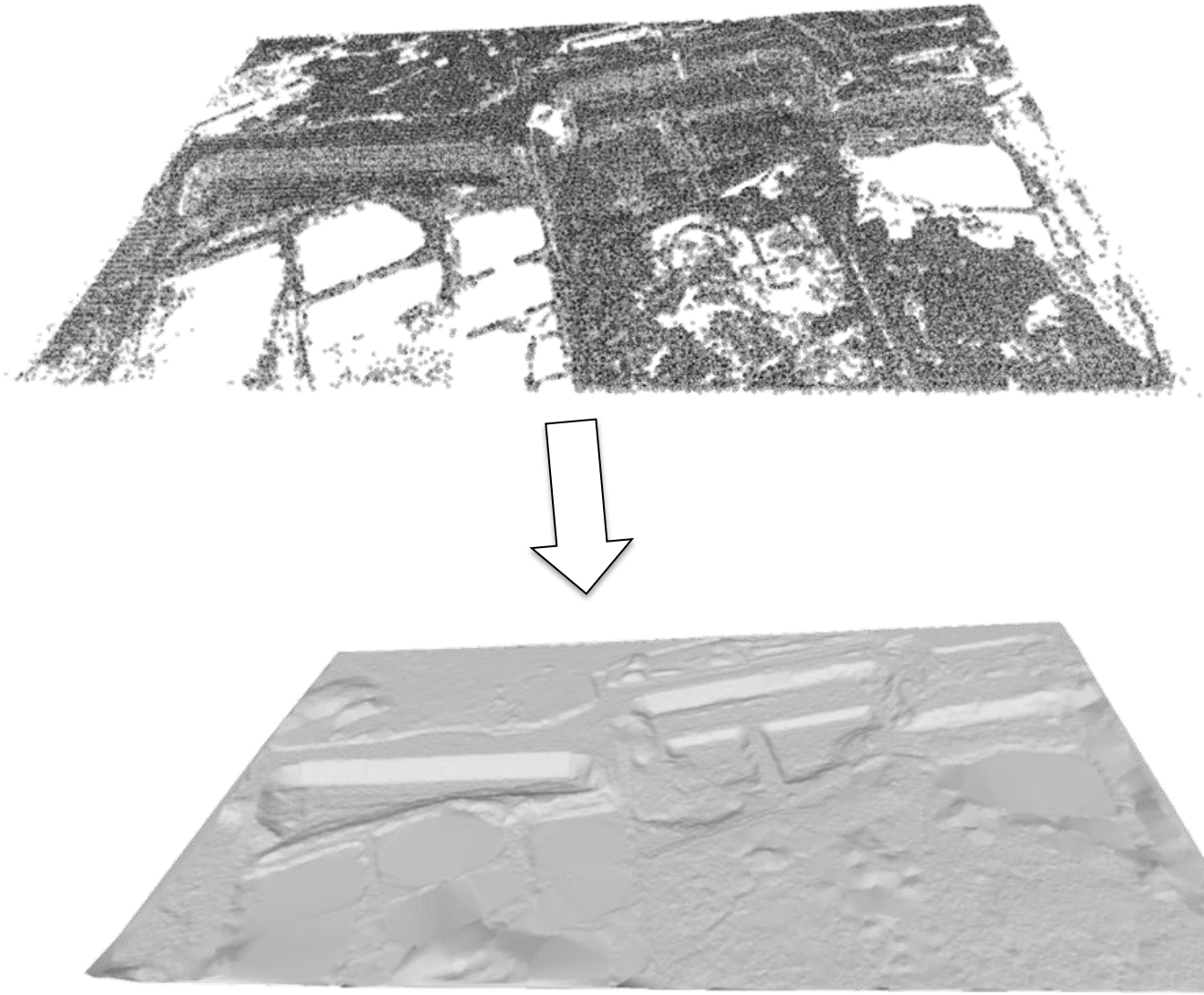
Data products

Clay Mine Site

Orthophoto

- 1500 x 1000 m
- 30 min flight
- 900 pictures @ 10 Mp
- 5 cm GSD
- 90% forward / 60% side overlap

Clay Mine Site - DSM



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Dredge Deposit

- 1500 x 300 m
- 10 min flight at 120 m
- based on 400 pictures
- 5 cm ground resolution

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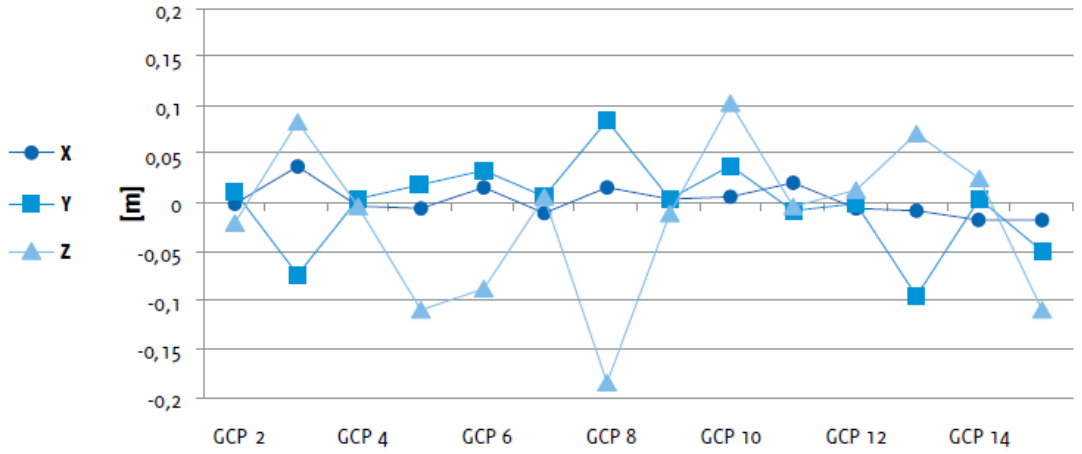
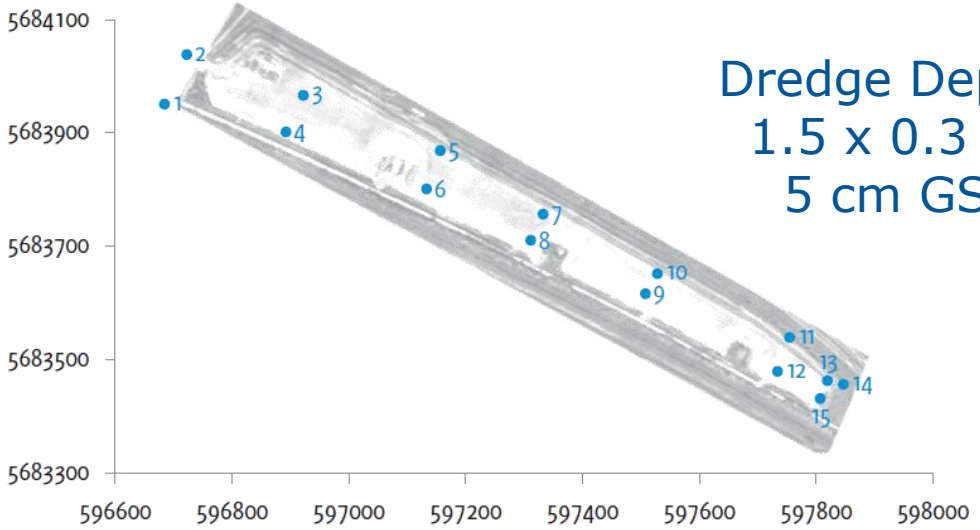
Accuracy sample





Dredge Deposit
1.5 x 0.3 km
5 cm GSD

Typical RTK Survey for Volumes or Production

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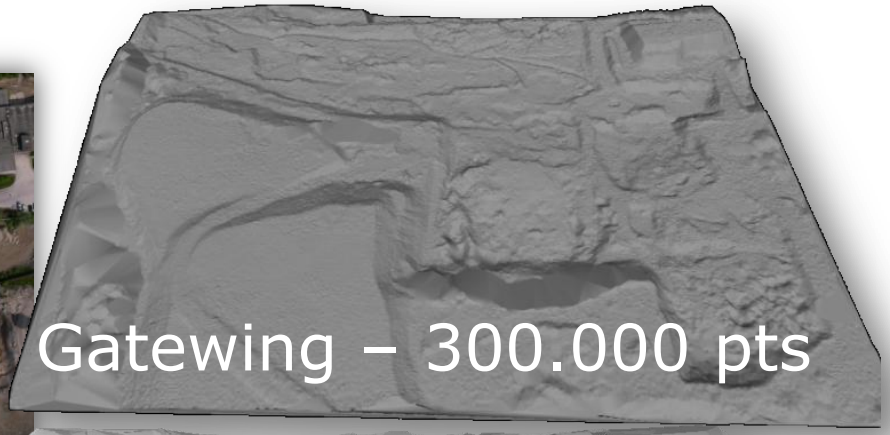
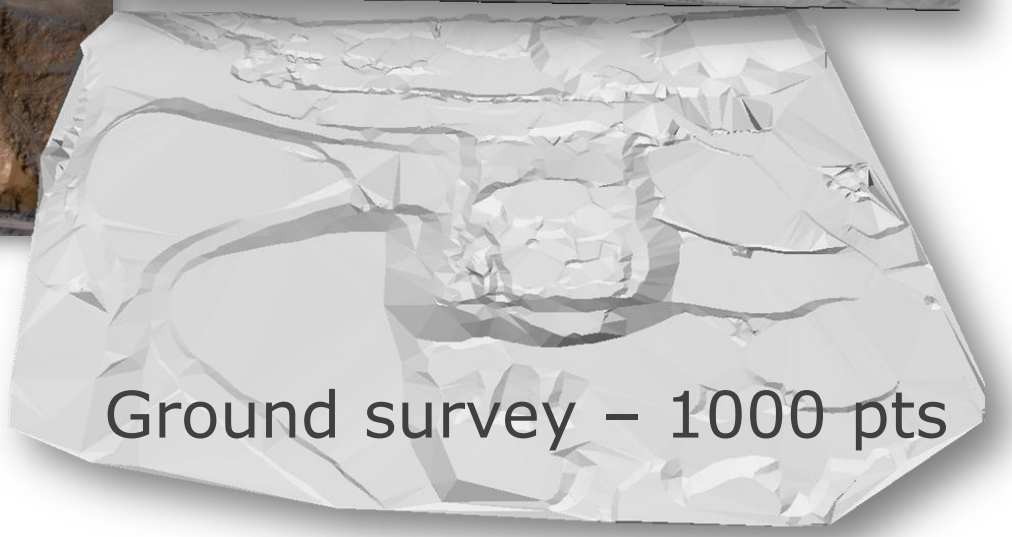
X100 vs. manual survey





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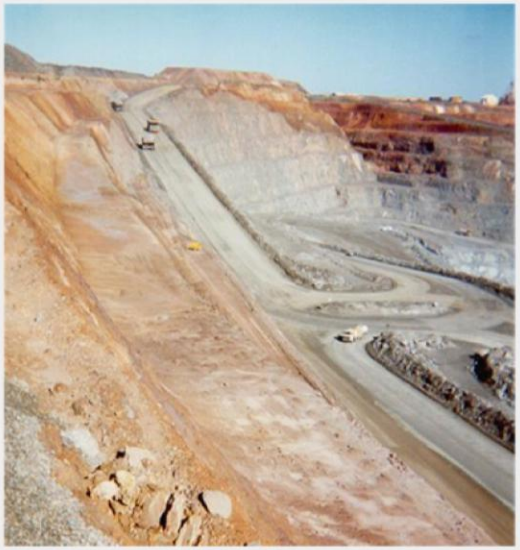
Haul Roads : Design & Maintenance

- Tradiional survey methods can now be achieved by using the Digital Terrain Model from UAS flights.



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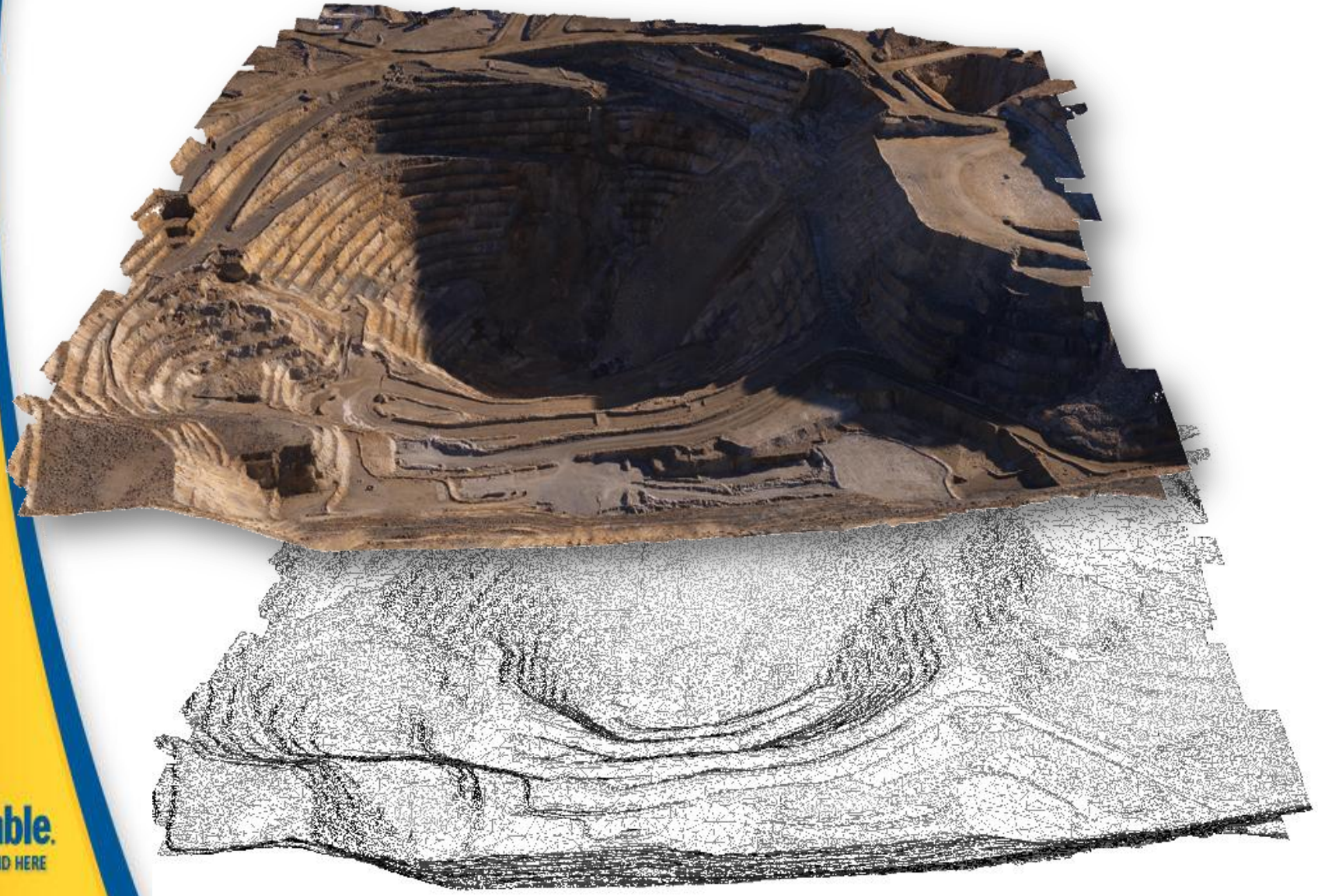
Gold mine - DSM



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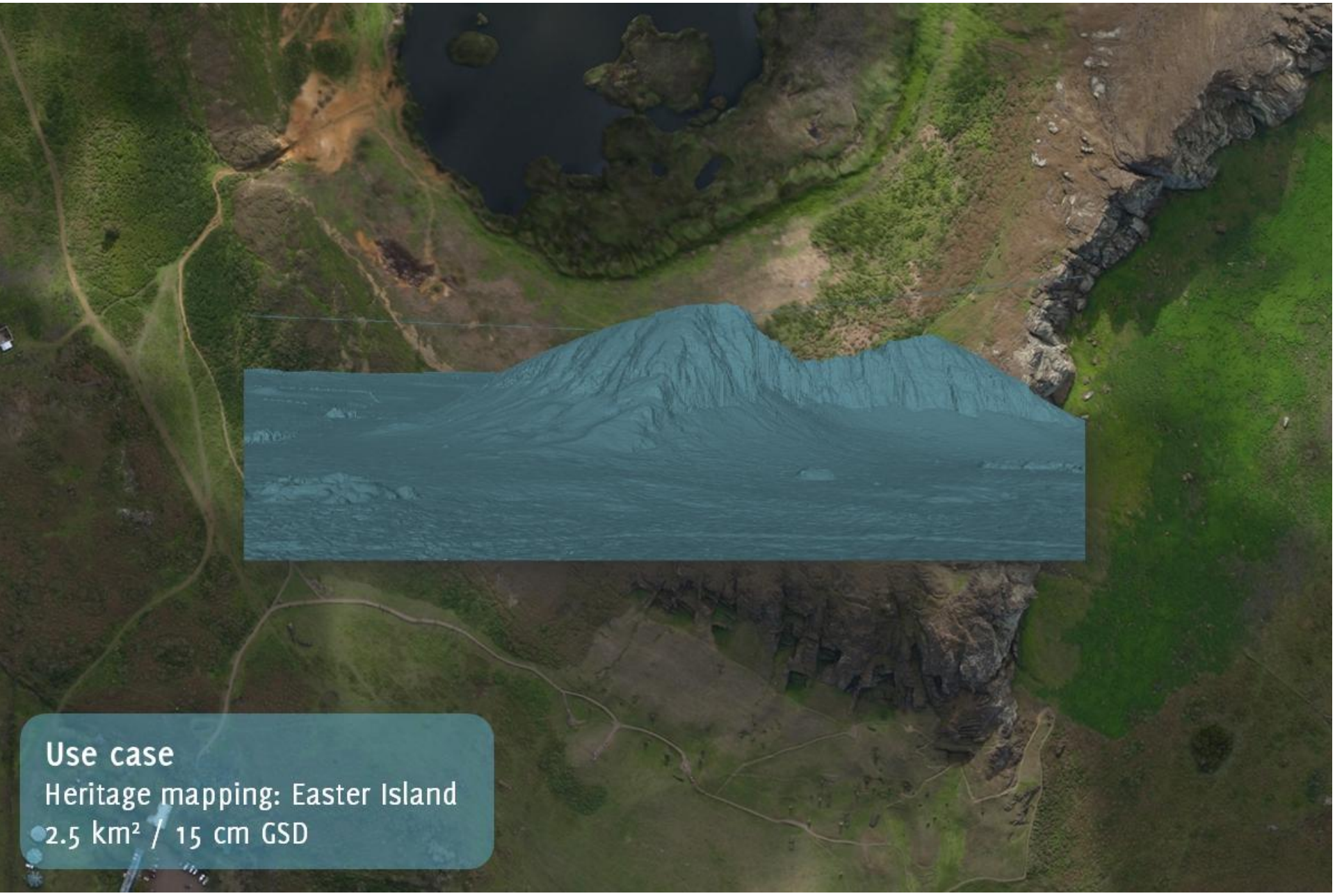
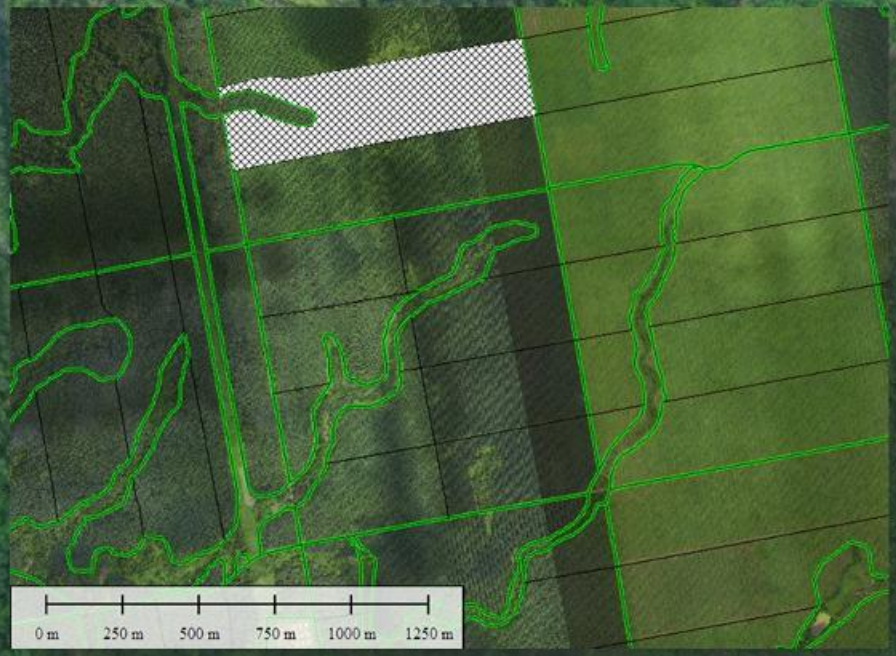
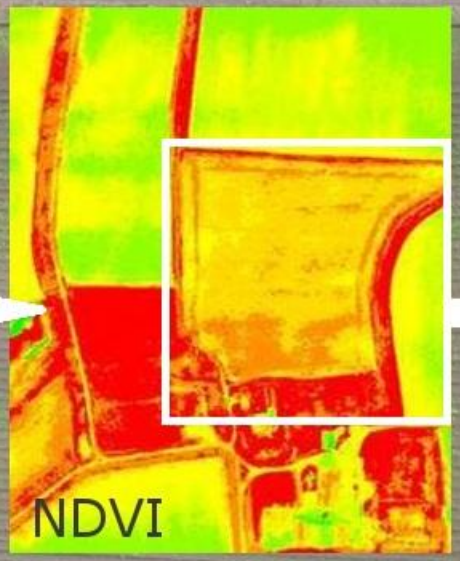
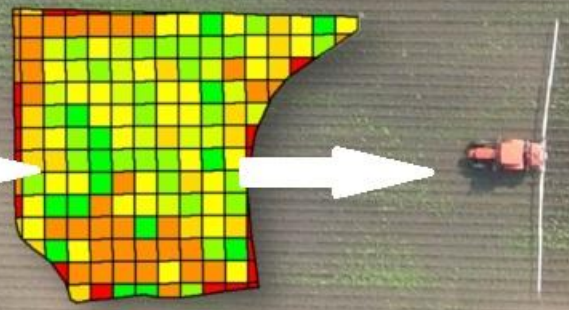

Use case
Heritage mapping: Easter Island
2.5 km² / 15 cm GSD


Use case
Inventory management



Use case
Plantation management
50 km² / 10 cm GSD





Use case
Precision farming
0.2 km² / 5 cm GSD

Use case

Road construction

0.8 km² / 5 cm GSD

Thank you for your attention

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