



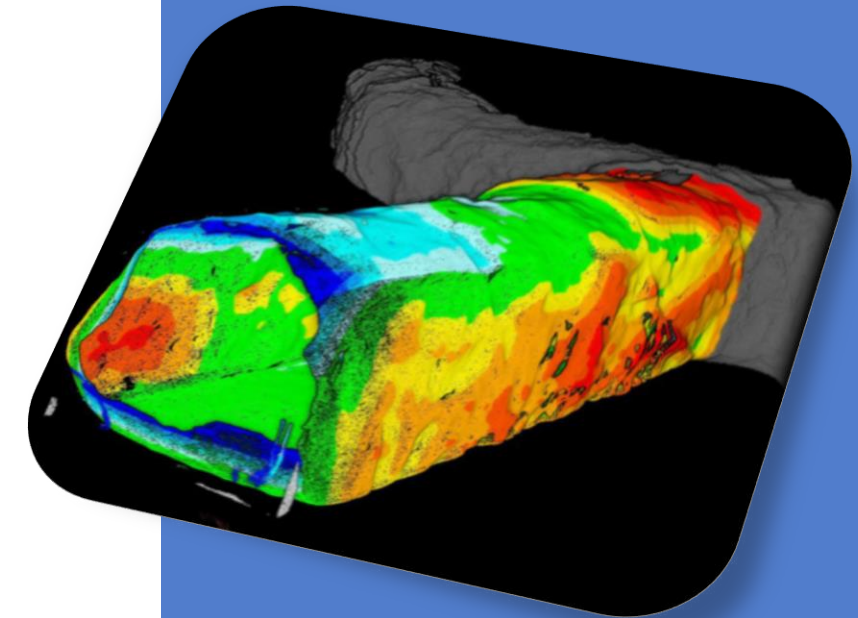
SQUADRONE

INFRA & MINING PVT. LTD.

Bangalore, India



DRONE TECHNOLOGY - DIGITAL TRANSFORMATION AI & ML IN MINING & TUNNELING

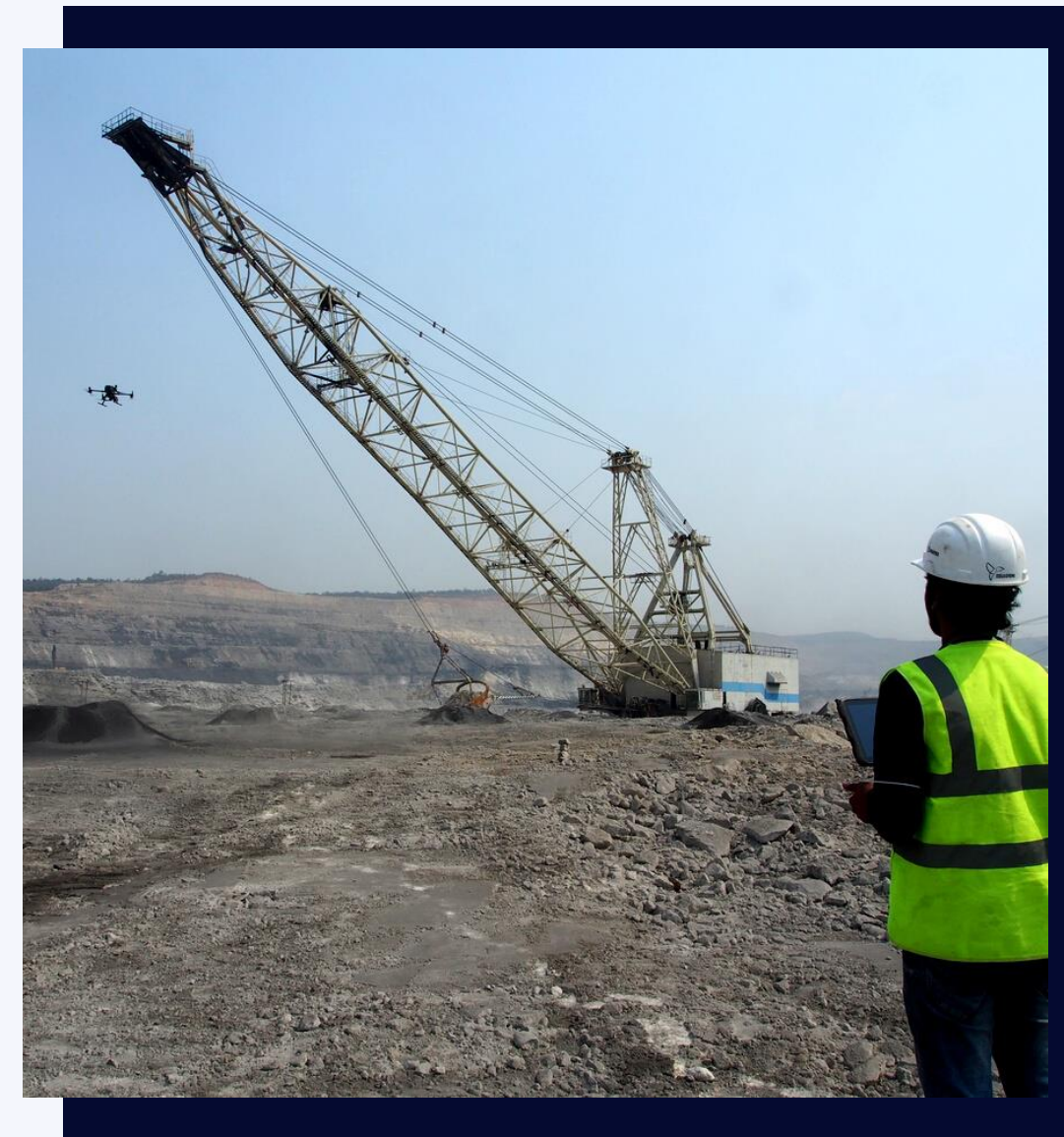




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SQUADRONE EXPERTISE

- We have our expertise in the mining and infrastructure business with over **30 years of experience**
- Integrating our strong domain expertise and **deep knowledge of drone technology**, we can jointly customize focused application of this technology in mining and infrastructure



WE'LL BE YOUR PROGRESS PARTNERS ON THIS TRANSFORMATIONAL PATH.

SQUADRONE & STRAYOS COLLABORATION



**SQUADRONE INFRA AND MINING PRIVATE LIMITED, Bangalore, India
BELIEVES IN DIGITAL TRANSFORMATION OF MINING & INFRASTRUCTURE SECTOR IN INDIA
THROUGH AI & ML.**

**STRAYOS INC. USA, A TECHNOLOGY DRIVEN COMPANY
WITH EXPERTISE IN APPLICATION OF AI & ML IN MINING
HAS PARTNERED WITH
SQUADRONE'S STRONG DOMAIN EXPERTISE IN MINING AND DRONE APPLICATIONS.**



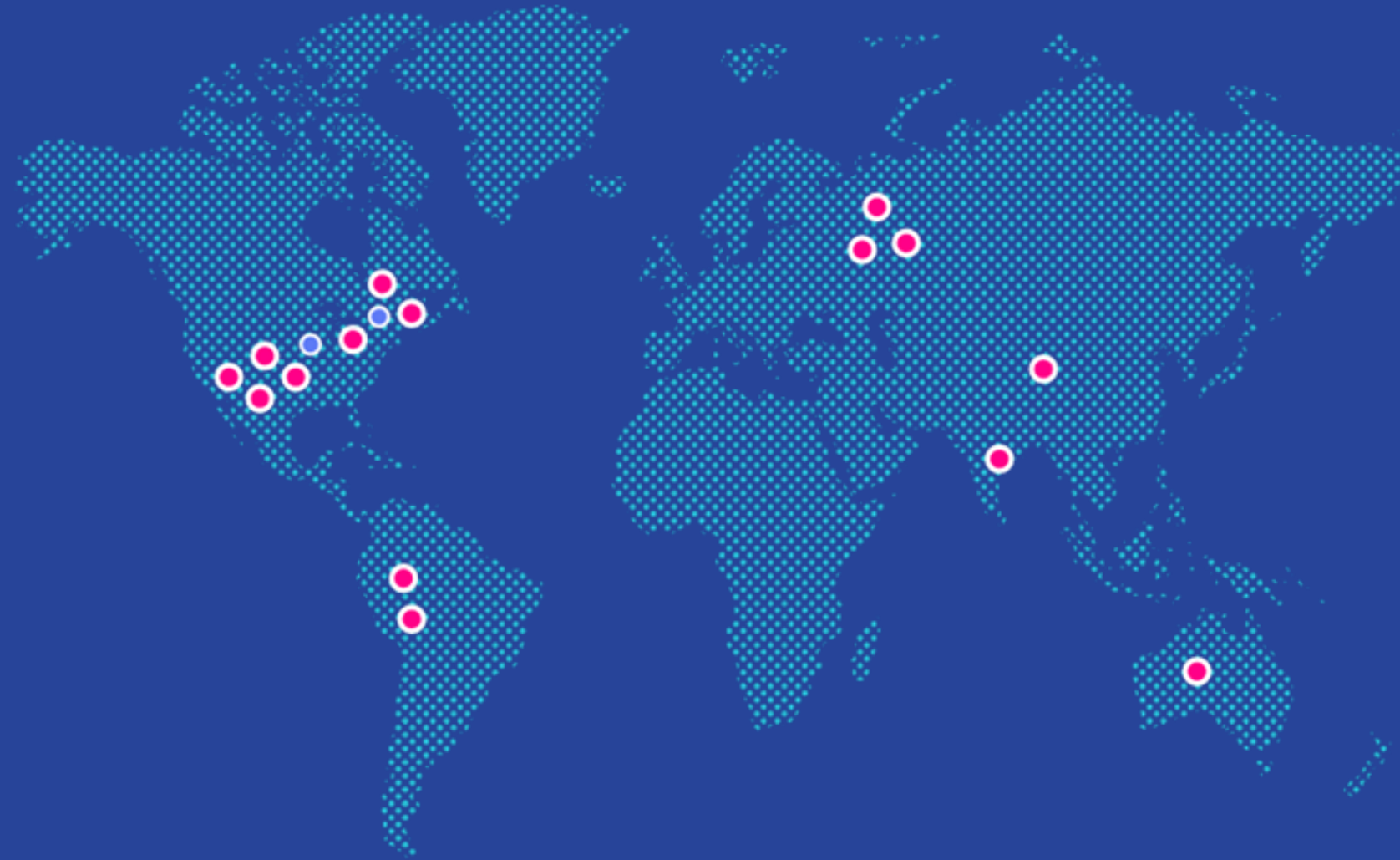
Strayos overview

Founded in 2016

10
COUNTRIES

800+
MINES

50+
CUSTOMERS



GLOBAL PRESENCE

AMERICAS

Buffalo, NY (HQ)
St Louis, MO

ASIA

Bangalore, India

EUROPE

Poland

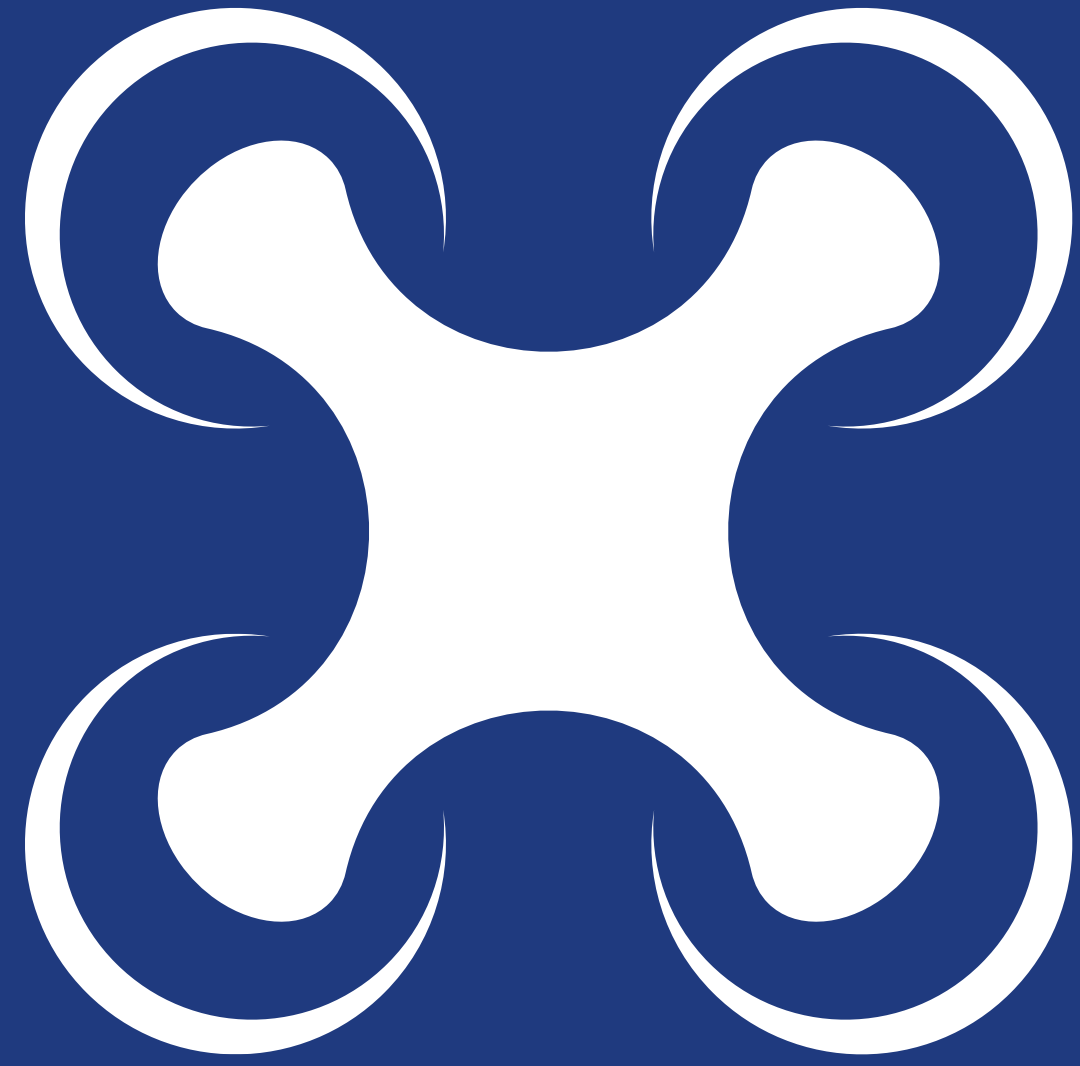
AUSTRALIA

Sydney, NSW

24/7

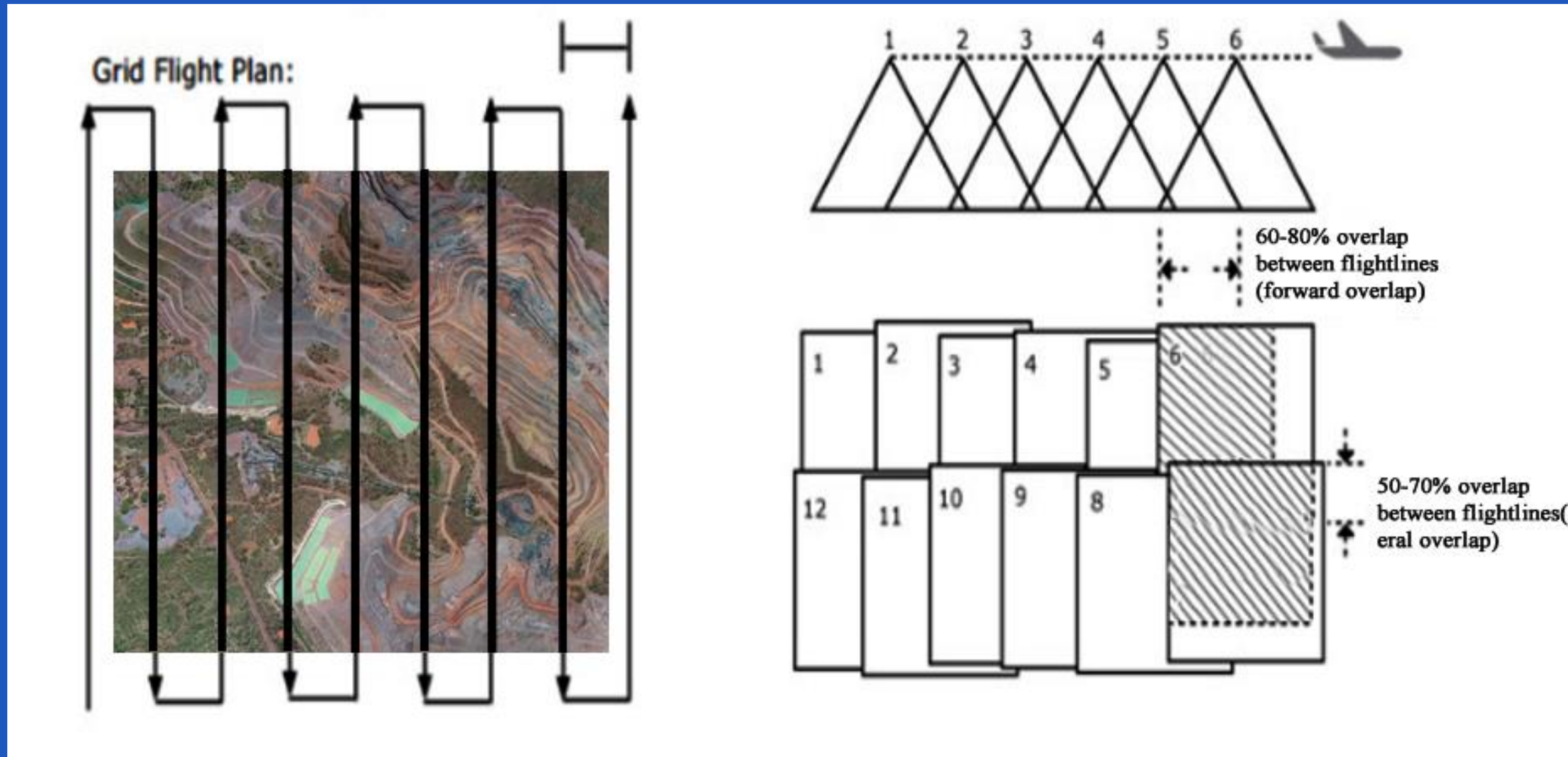
Live customer support





INTRODUCTION TO DRONE SURVEYS

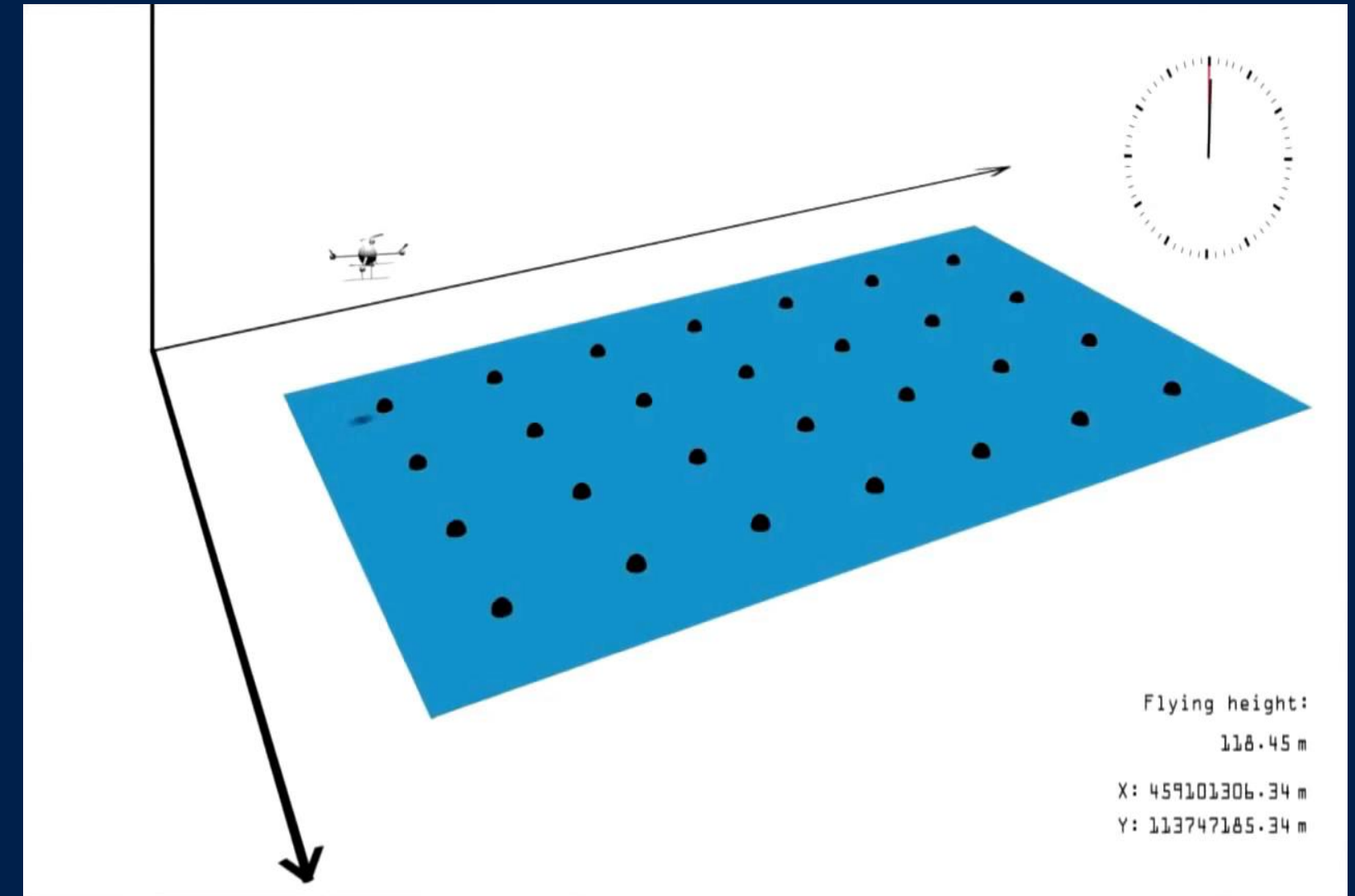
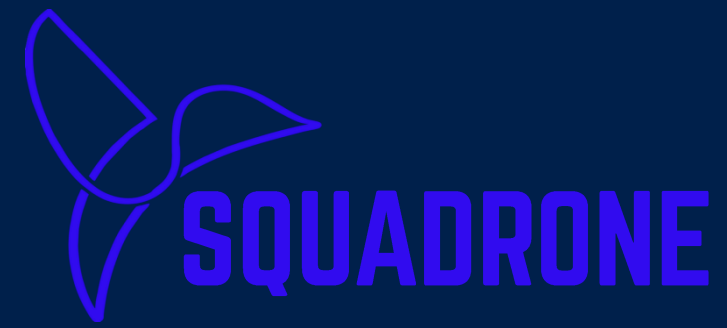




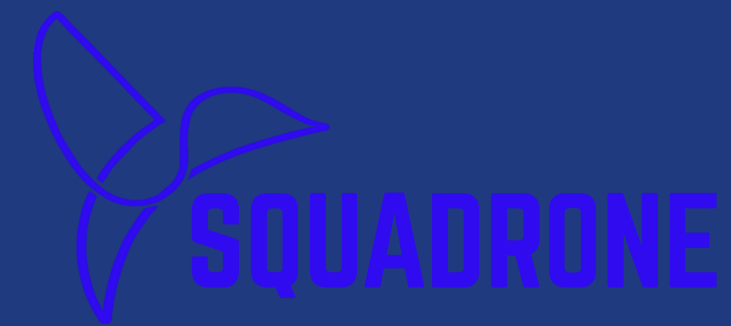
DRONE FLYING PATH AND FLYING HEIGHT

- Forward Overlap should be minimum 80%
- Lateral Overlap should be minimum 70%
- The resolution of the Drone image will be very high i.e., upto 2.5 cm-5 cm GSD or 2.5cm per pixel.

FLIGHT PATH & THE OVERLAP



PHOTGRAMMETRY



Photogrammetry work by capturing pictures that overlap so that post-processing software can stitch them together and produce a 3D point cloud to generate

- **orthomosaic maps,**
- **digital elevation models,**
- **digital surface models,**
- **3D models and more.**

METHODS OF DRONE SURVEY



- **DRONE SURVEY BY PLACING PHYSICAL GCPs**



- 2. DRONE SURVEY BY PPK METHODS**

METHOD 1

ESTABLISHING THE GCP POINTS & FLY THE DRONE

- Establish a Base station with DGPS
- Establish GCP Points
- Set up the drone flight path
- Fly the drone
- Download the data
- Process the data
- Get the output



METHOD 2

DRONE WITH PPK (POST-PROCESSING KINEMATIC)

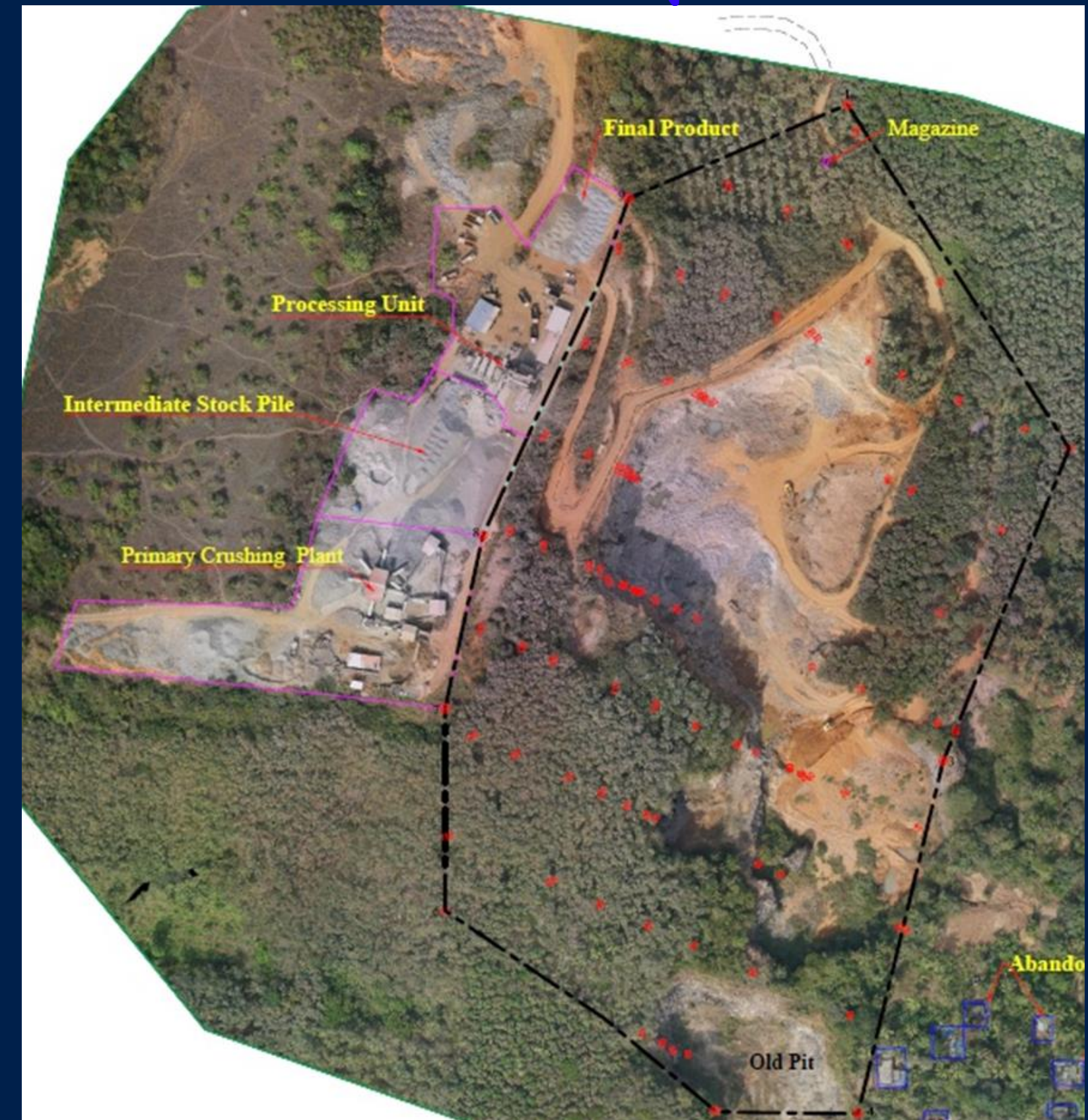
- The satellite data from a GNSS receiver on a nearby Base station, is collected
- Onboard GNSS PPK receiver (Rover) is mounted on the drone that gathers data from satellites and logs it for retrieval after the flight.
- After the flight, the base station and the onboard rover is factored in to correct satellite signal error, bringing accuracy down to cm level range.
- Base station can be placed at a centralised point upto 40-50 km distance.



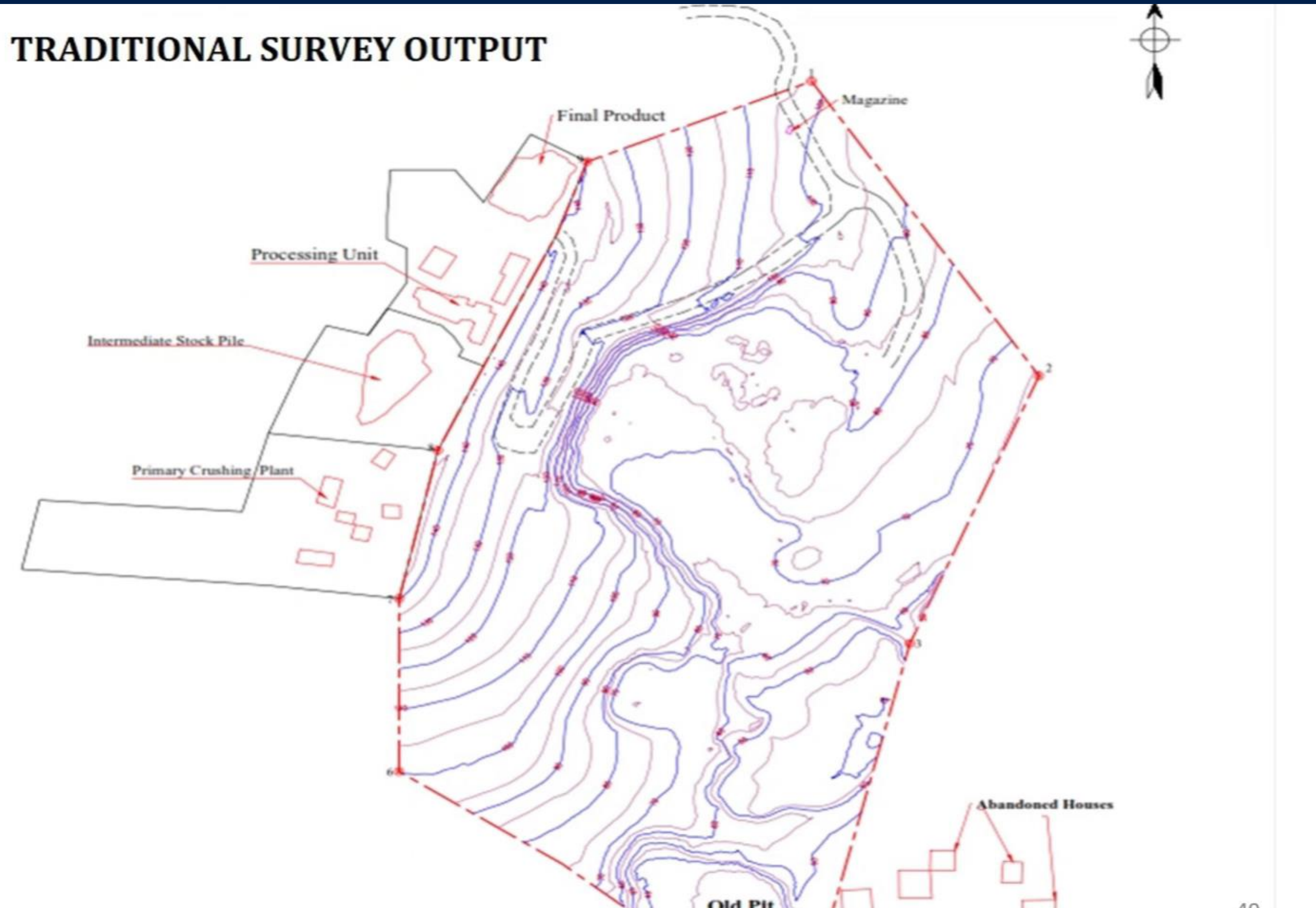
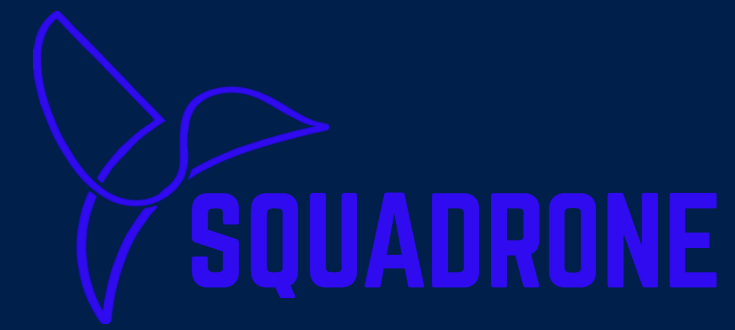
ORTHOMOSAIC MAP



- An 'ortho-image' is aerial imagery which has been processed in a special way to appear like a map, from which measurements can be taken.
- The ortho maps produced from our drone data are typically accurate to 1 cm to 5 cms, which means you can see an individual golf ball or matchbox if you know where to look.



TRADITIONAL SURVEY OUTPUT VS DRONE SURVEY - ORTHOIMAGE



SATELLITE IMAGE VS DRONE IMAGE



Point Clouds



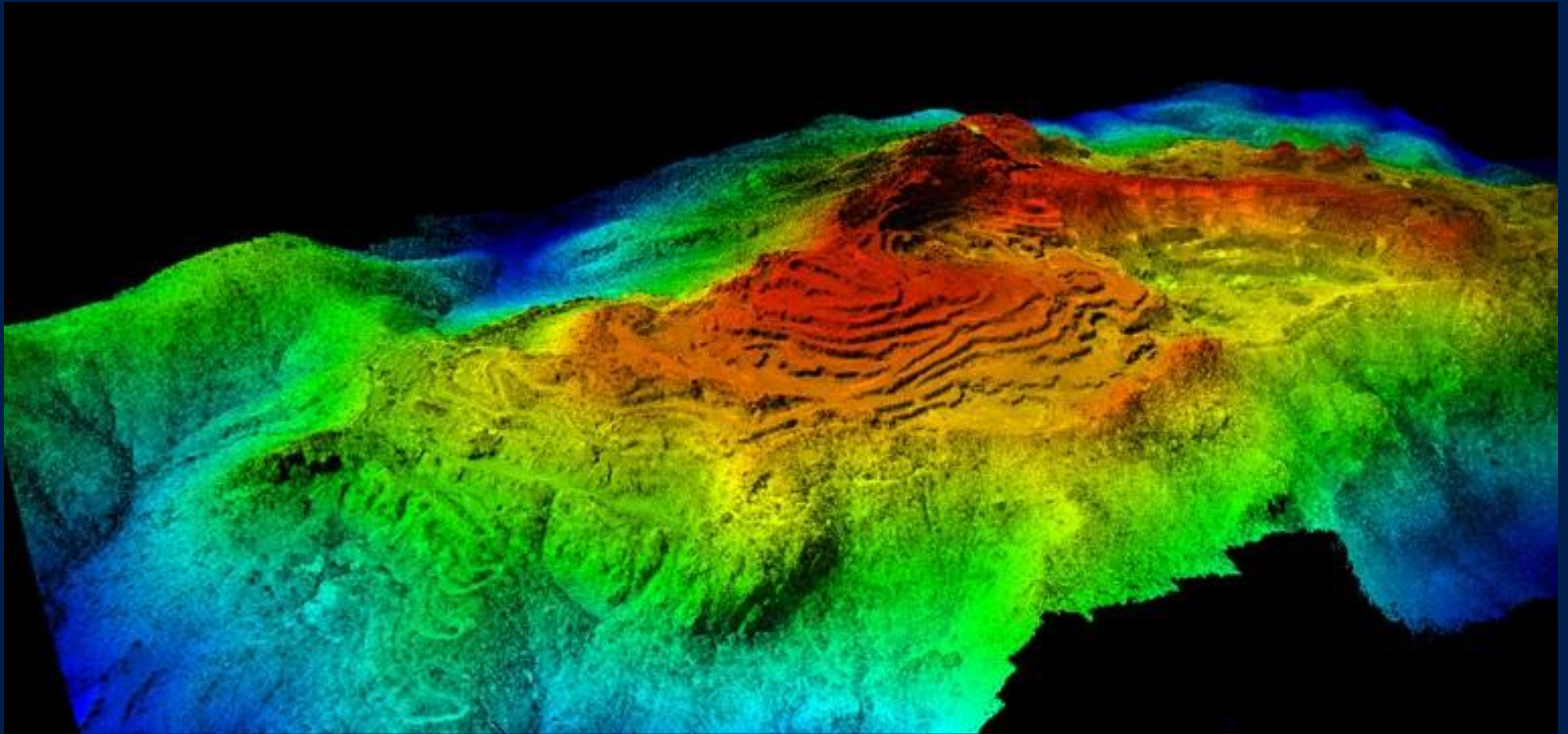
3D Reality Models



3D Reality Models

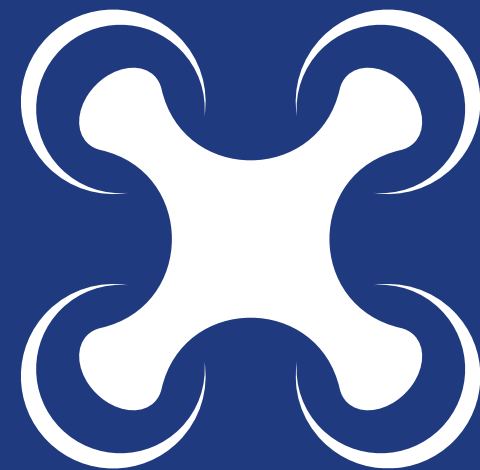


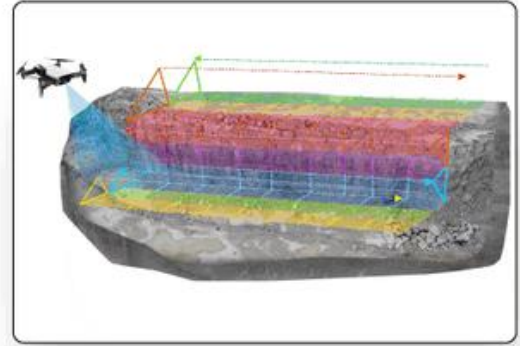
DIGITAL ELEVATION MODEL



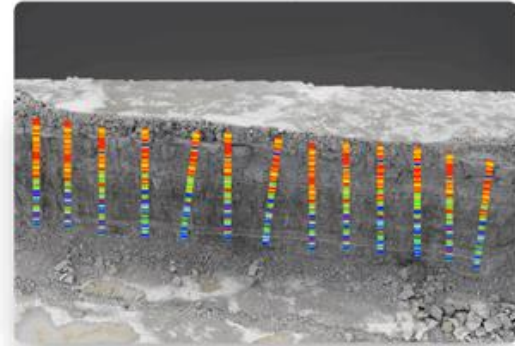


**APPLICATION OF DRONES IN SURFACE
MINES USING
AI & ML -
STRAYOS CLOUD BASED PLATFORM**

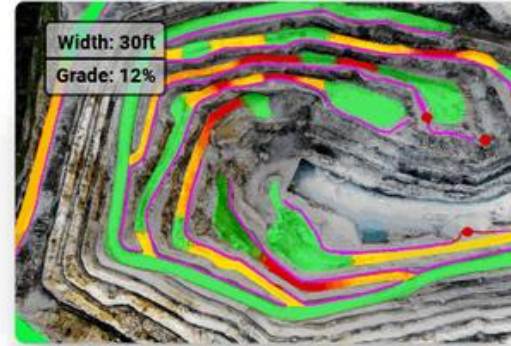




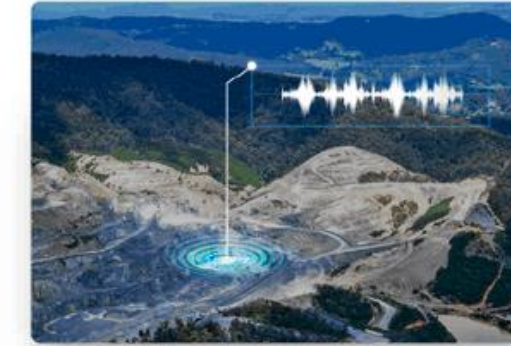
3D Photogrammetry Engine and Pit Planning Tools



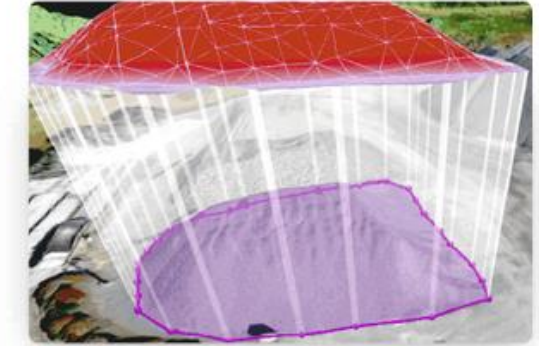
Drilling Design and Measure While Drilling Analytics



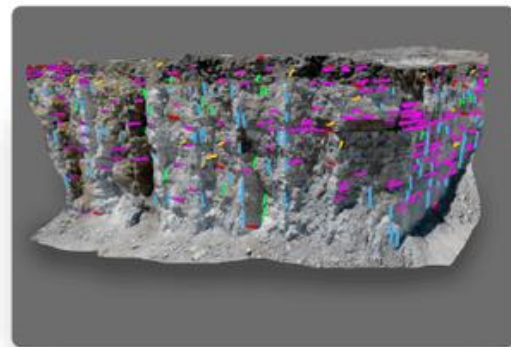
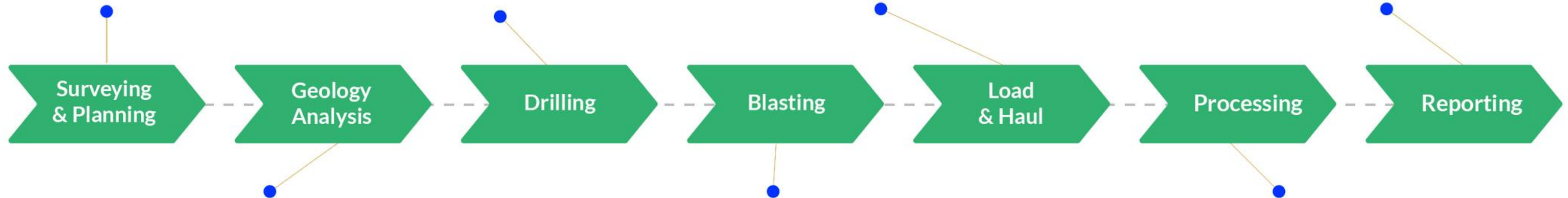
Haul Road Assessment AI



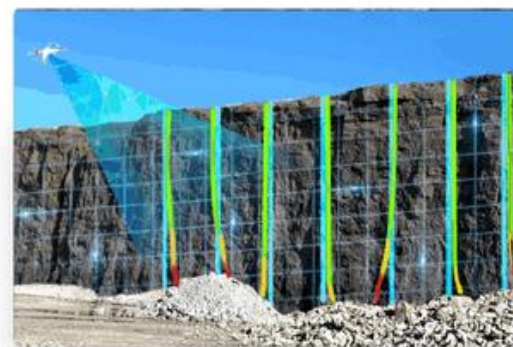
Vibration / Airblast Management



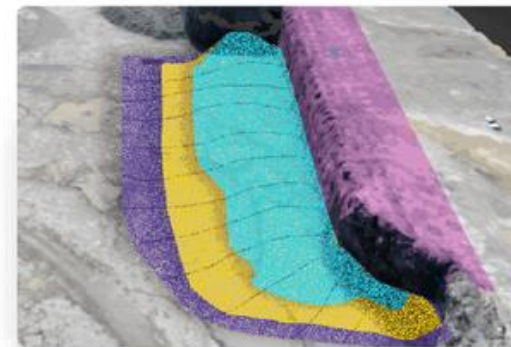
Automated Stockpile Reporting



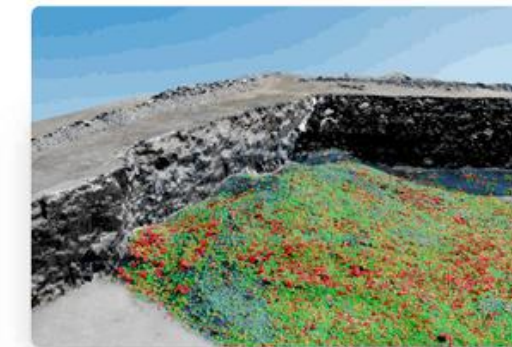
Rock Mass AI



Blast Loading and Timing Design Suite



Muckpile Prediction



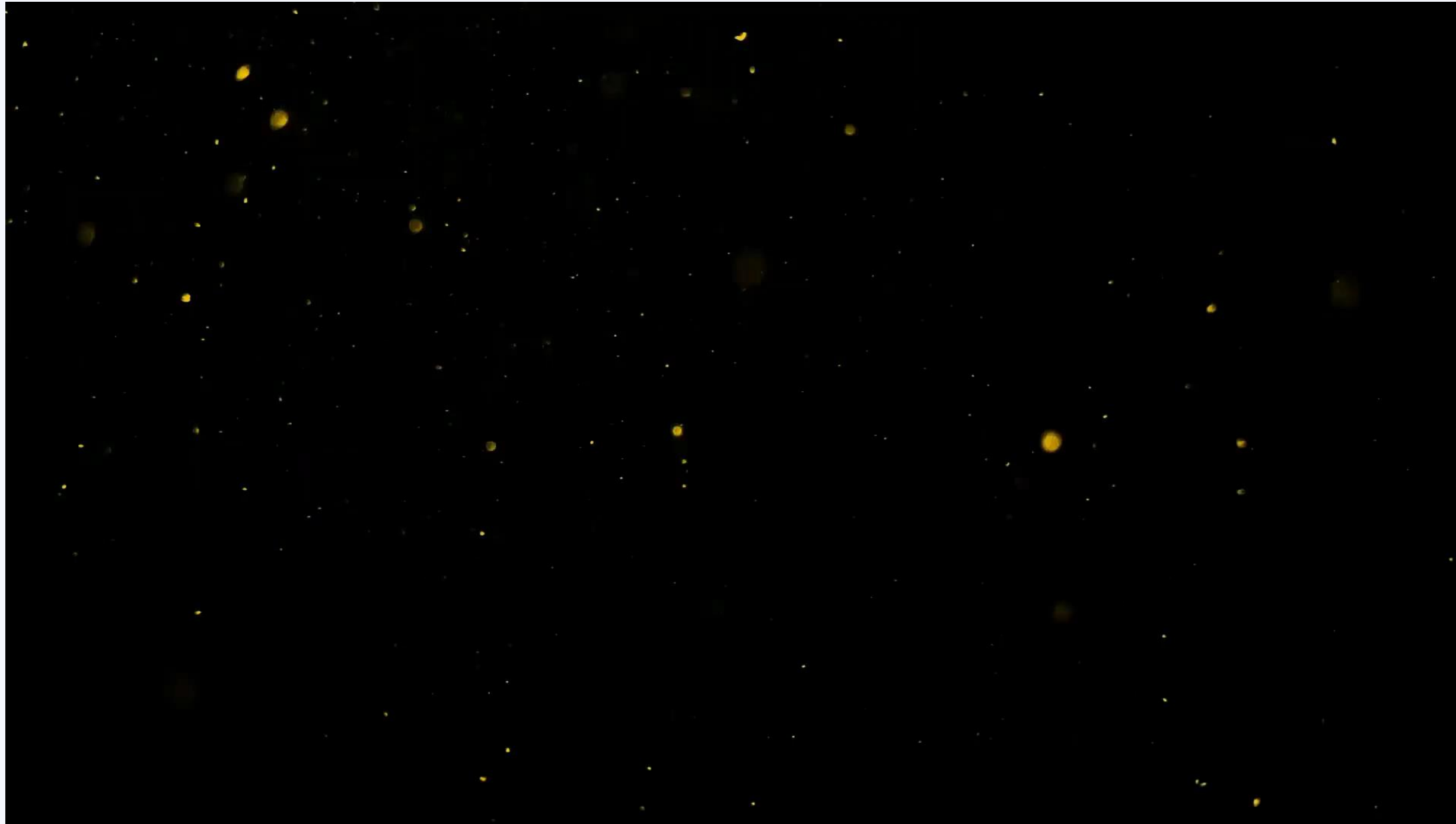
Fragmentation AI

Key-Benefits of Drone Survey

- **Drone Data Capture**
20%
- **Drone Data Analytics**
80%



STRAYOS PLATFORM



Strayos Methodology

- **Plan - Automated Flight path**
- **Upload the images on the Strayos Platform**
- **Outputs are generated and Analytics can be made through AI & ML.**





TRADITIONAL iMAGE PROCESS

VS

Strayos Platform for mining

TRADITIONAL IMAGE PROCESS

ADD PHOTOS



ALIGN PHOTOS



**INPUT GCP
MARKERS**



**BUILD DENSE
CLOUD**



GENERATE DSM



**GENERATE
ORTHOMOSAIC**



**GENERATE
CONTOURS**



GENERATE DTM

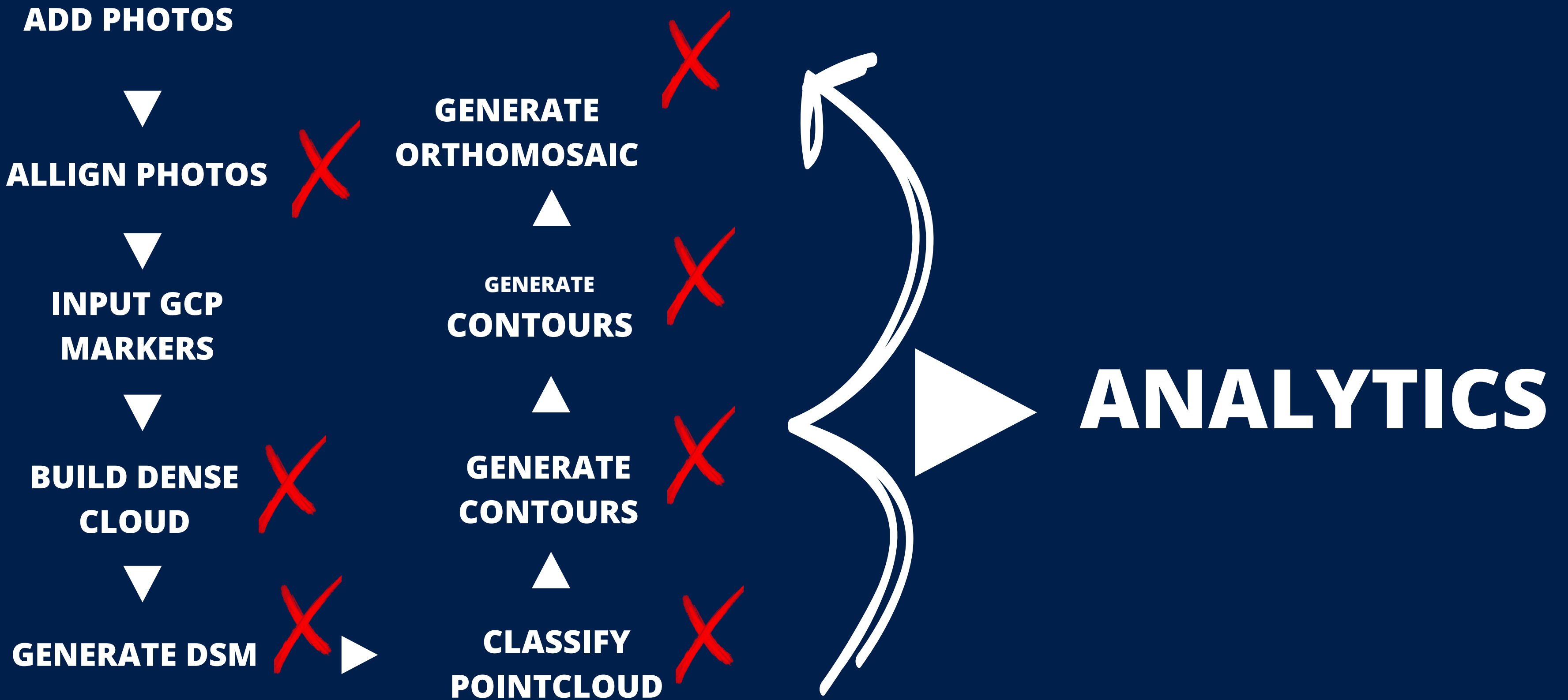


**CLASSIFY
POINTCLOUD**



ANALYTICS

TRADITIONAL IMAGE PROCESS - SOFTWARES



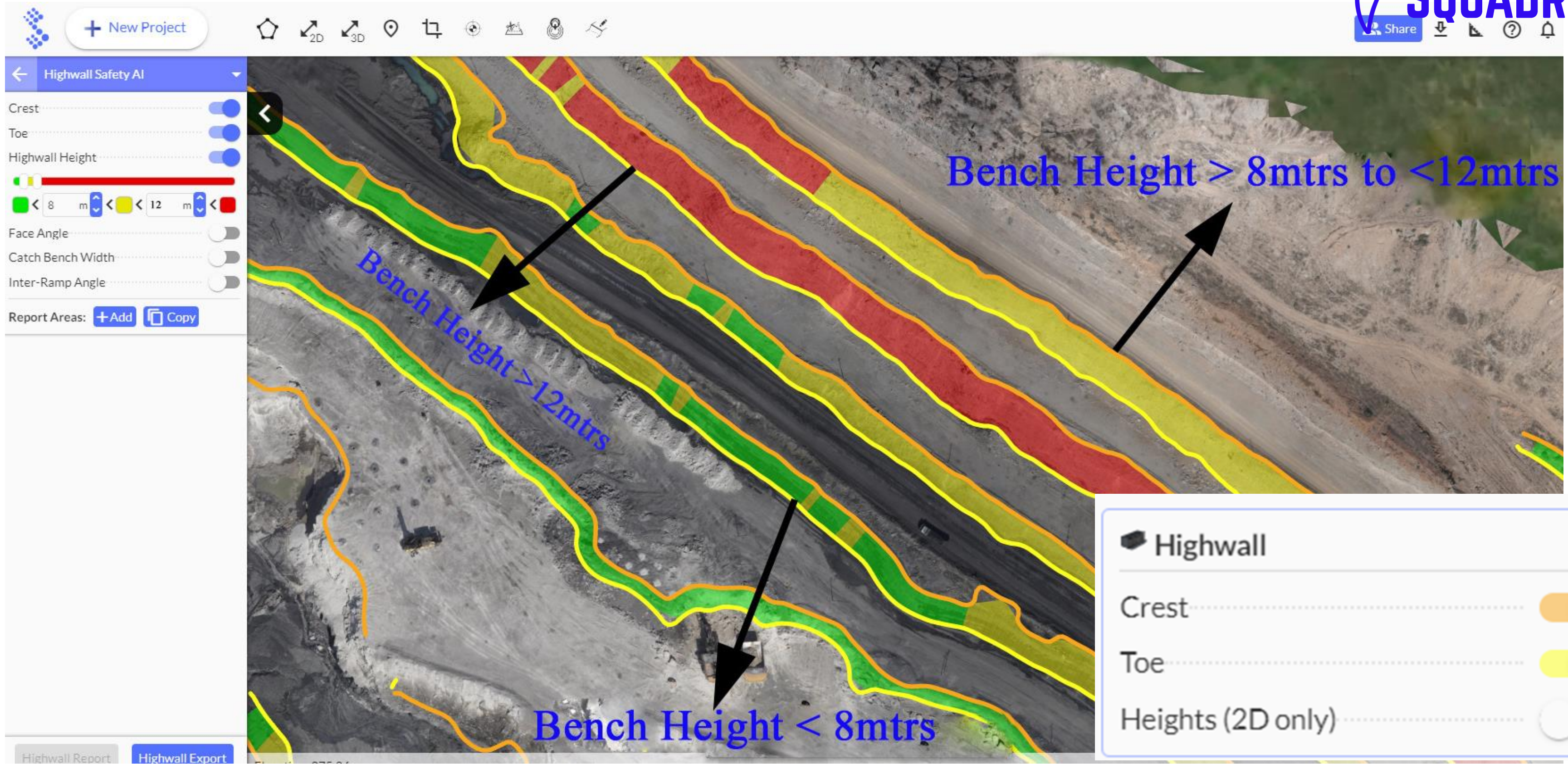
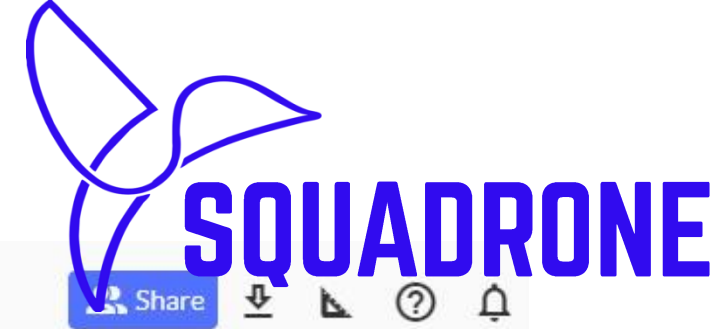
STRAYOS CLOUD PROCESS



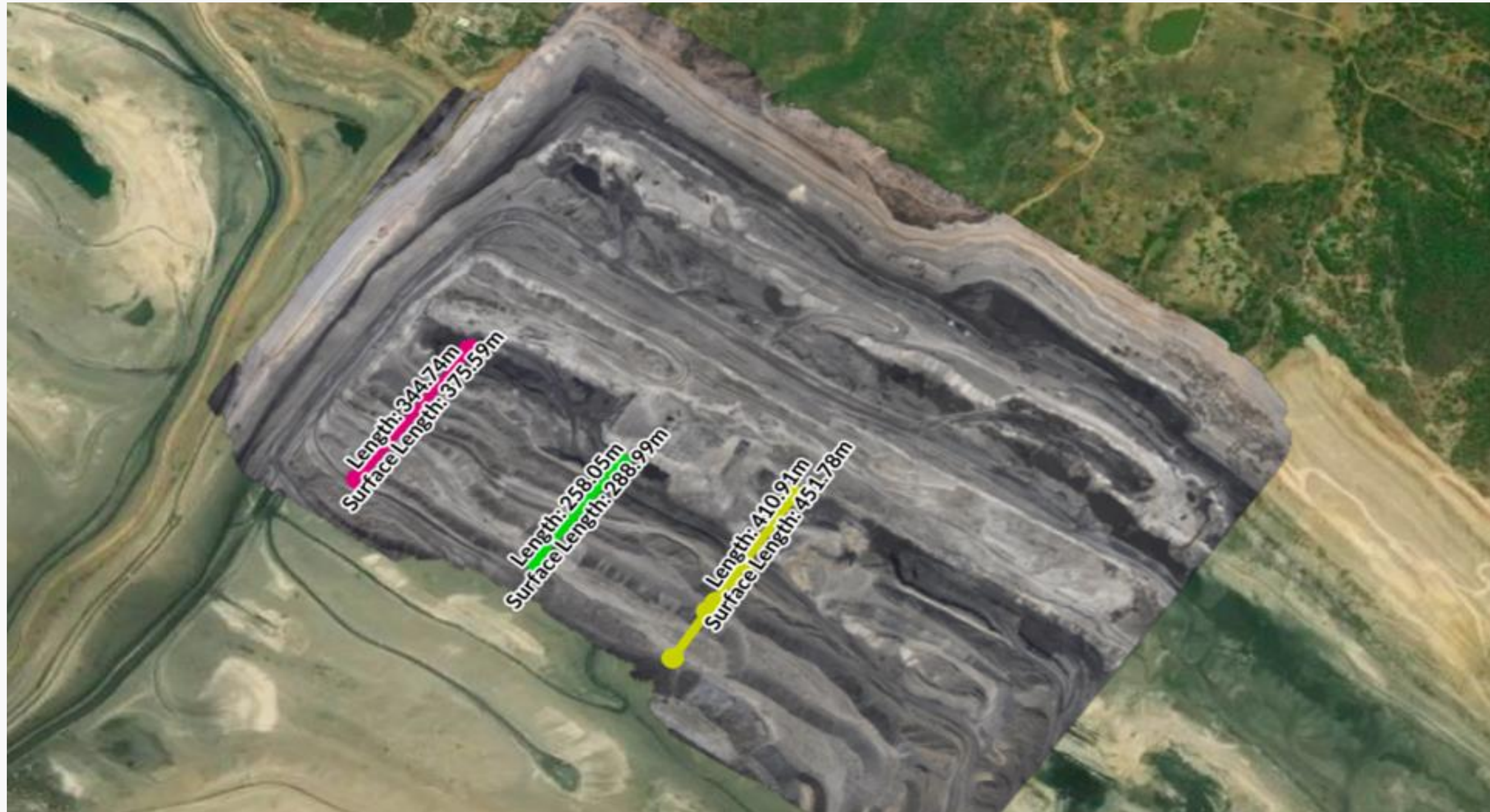
HAUL ROAD ANALYSIS (WIDTH)



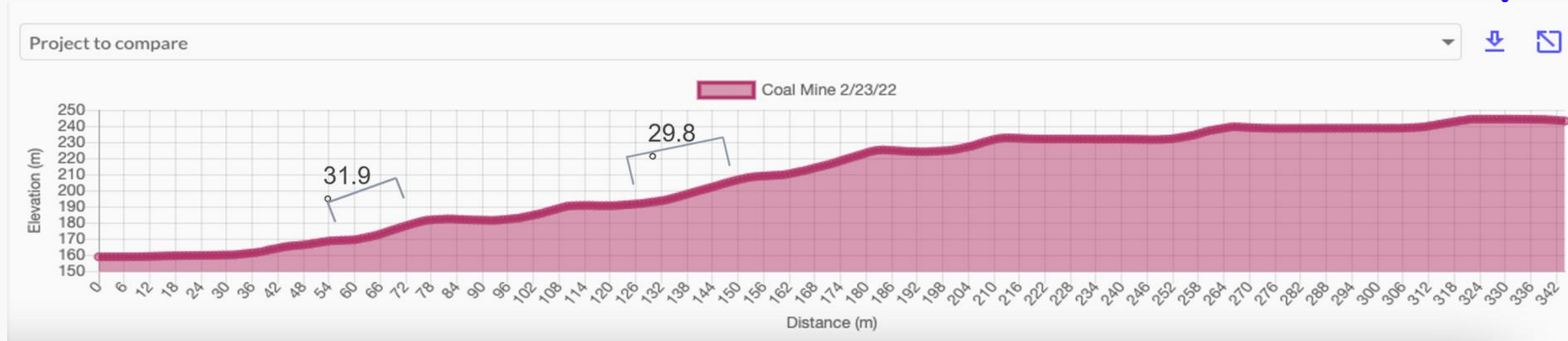
BENCH ANALYSIS



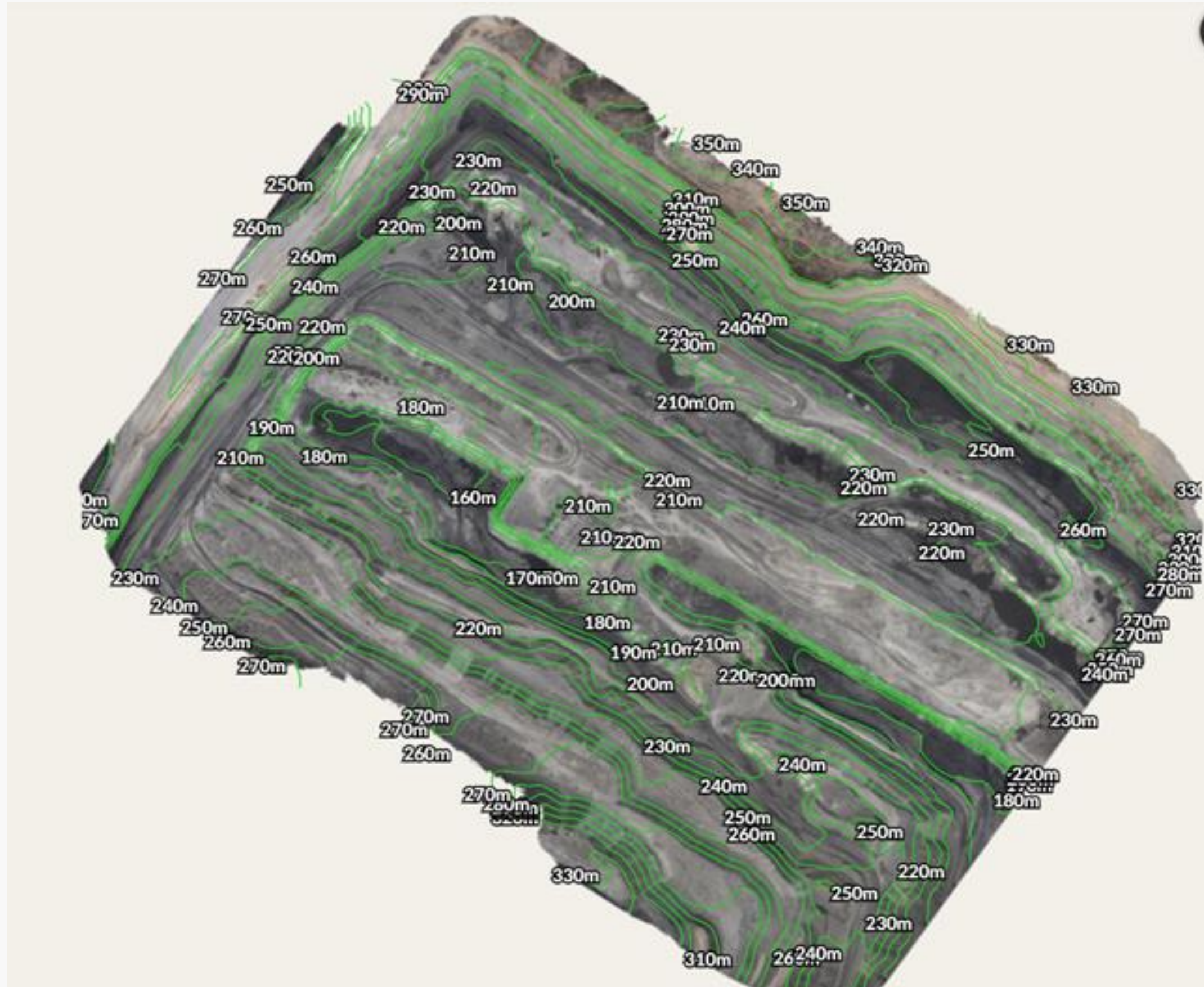
CROSS SECTION VIEWS OF WORKING AREA & DUMPS



CROSS SECTION VIEWS OF WORKING AREA & DUMPS



CONTOURS



STOCKPILE VOLUME CALCULATION REPORT



Stockpile (Polygon)

Dataset Name	Annotation Name	Annotation Tool	Horizontal Length (meter)	Surface Length (meter)	Area (meter2)	Surface Area (meter2)	Fill Volume (meter3)	Net Volume (meter3)	Cut Volume (meter3)	Latitude	Longitude	Altitude (meter)
Coal Mine	Stockpile	Polygon	959.1	1002.31	54913.47	NA	-59179.64	49622.7	108802.33	NA	NA	NA

Stockpile Measurement and Monitoring
Measure your stockpiles frequently to track quantity in and quantity out



500m SAFETY ZONE



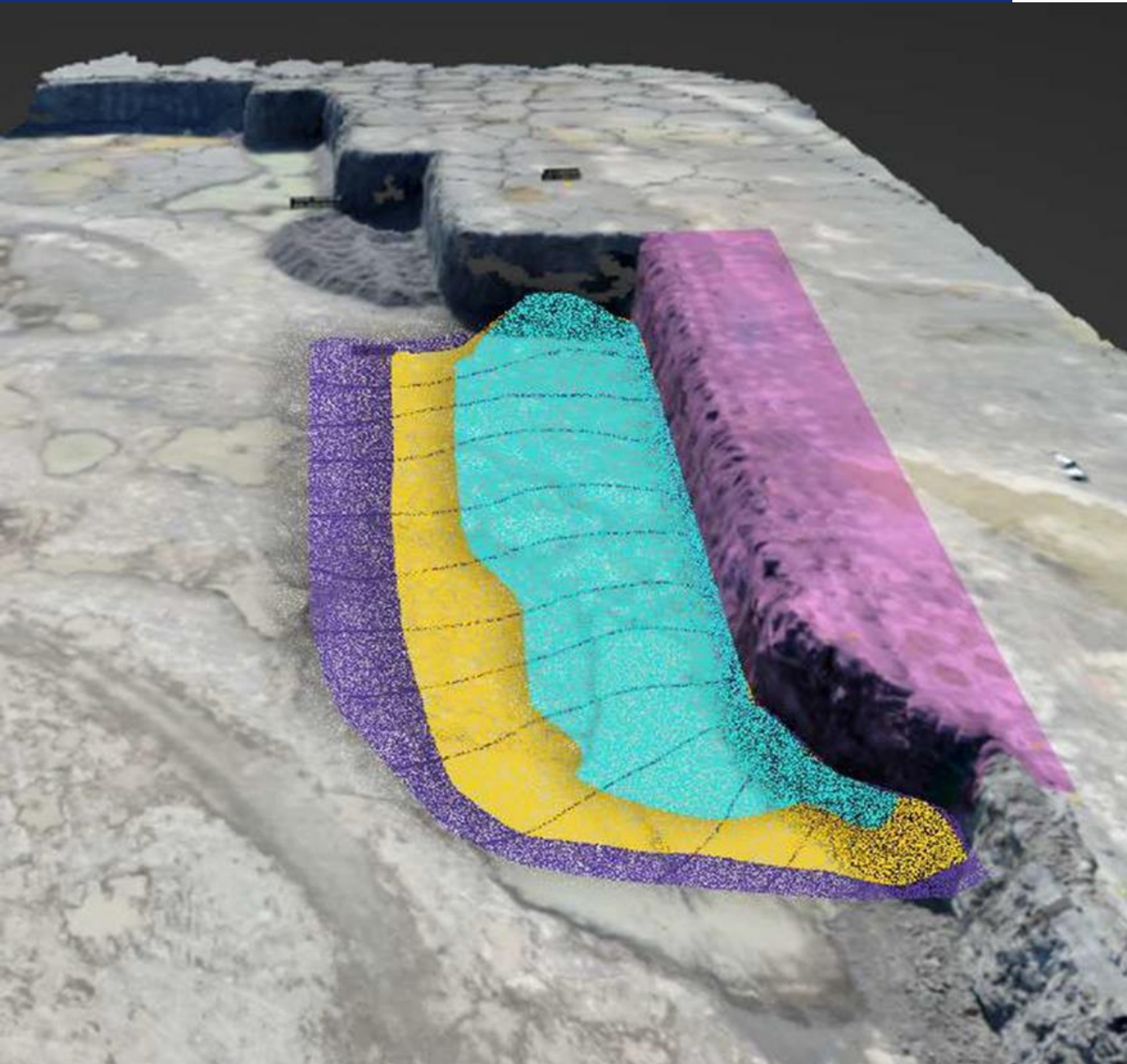
IMPROVE SITE SAFETY AND COMPLIANCE



Monitoring and Management Haul Roads

- Measure their width and plan for traffic needs.
- Measure their slope and compare it to engine efficiency- see grade recommendations for optimal engine performance.
- Identify maintenance needs like potholes, rock falls, or undulations.
- Track water flow and puddles on your site.

Optimize Site Operations



Muck pile movement/Cast Blasting Prediction and Planning

- Get the muck pile you want, or at least know what you're getting before you blast.
- Put your rocks where you want them to know which machines to bring in and where to put them.

Fragmentation Prediction, Identification, and Analysis

- Predict the fragmentation size you'll get before you Blast.
- After a blast, the AI automatically detects the fragmentation size and spread.
- Save on downstream costs like additional processing, increase dig ability, and reduce waste from fines.

IMPROVE SITE SAFETY AND COMPLIANCE

Model, Measure, and Monitor

- High wall, slopes, detect deformations and predict slope failures as often as you can fly a drone or get satellite data.
- No more laborious boots on the ground spending hours visually inspecting.

Reduce Fly Rock, Vibration, Noise, Air Blasts

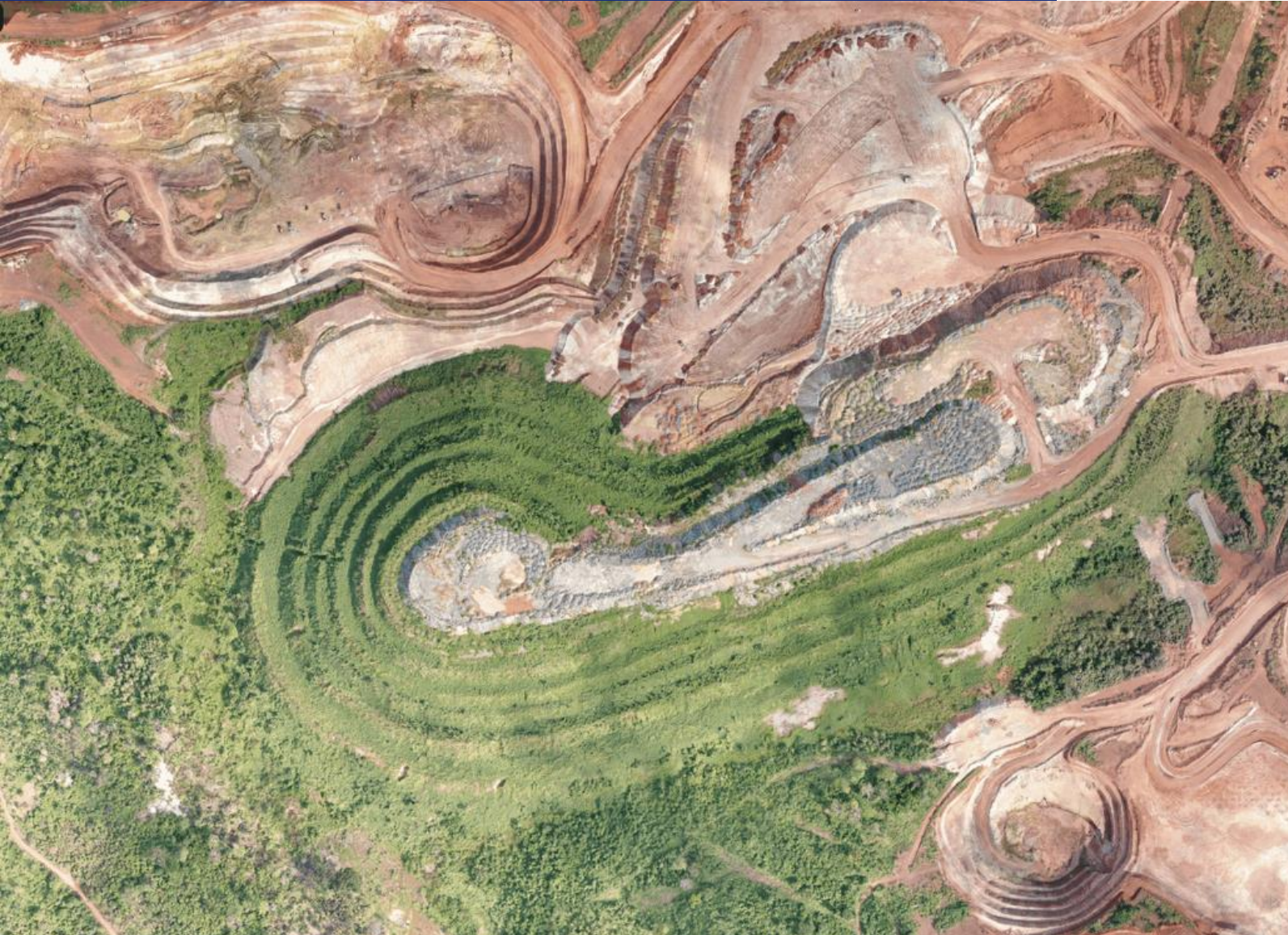
- The AI can help you optimize your blast and avoid expensive compliance and liability generating issues.

Pre and Post Blast Volume Comparison

- Compare the pre and post-blast volume for enhanced analysis and future operations planning.



REDUCE ENVIRONMENTAL IMPACT



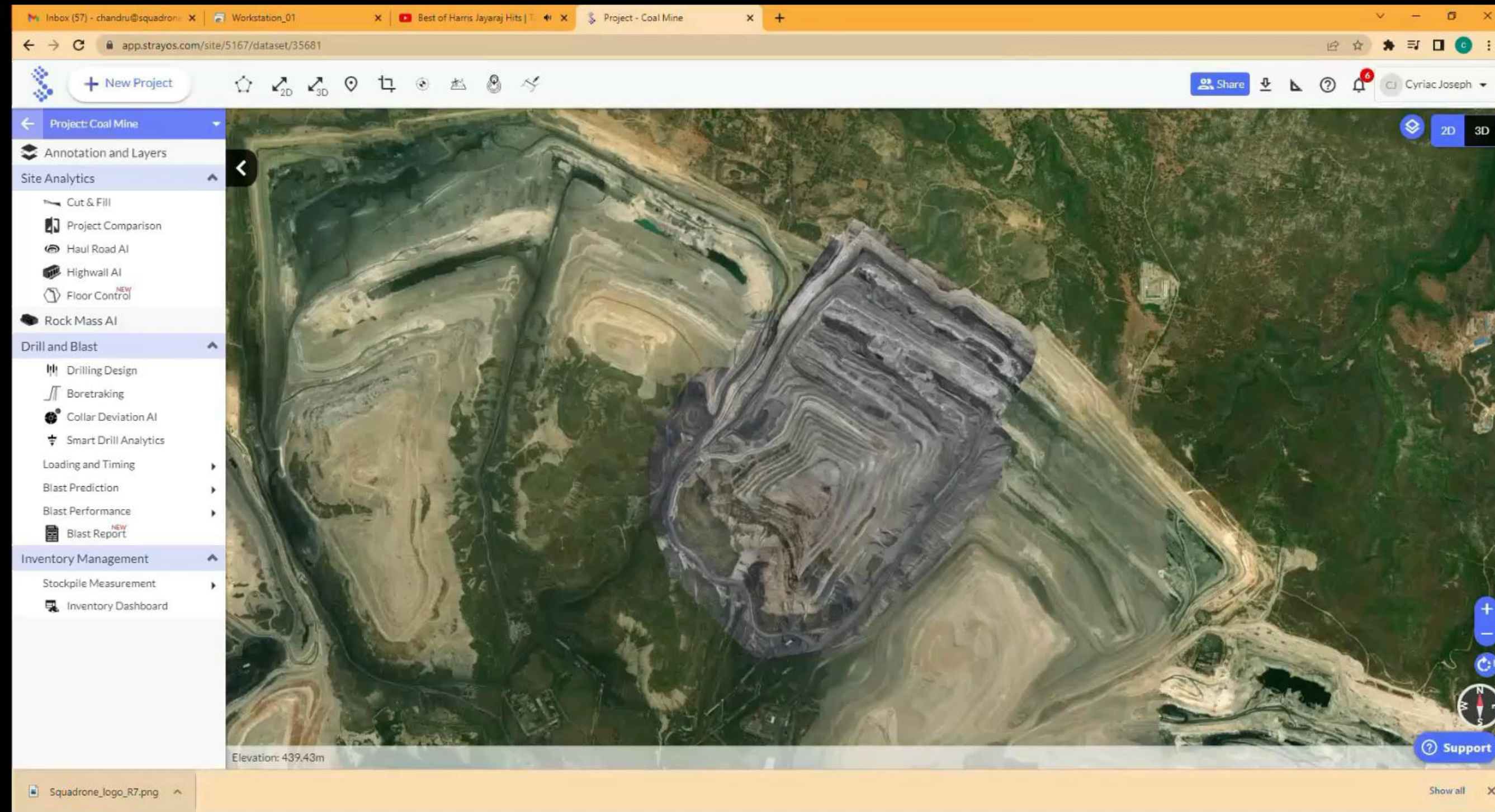
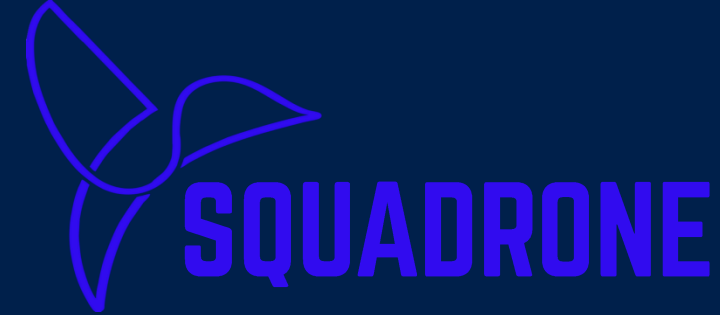
Plan and Monitor Reclamation Sites

- Use the AI to track stability, deformations, seepage, survey and measure the area to be reclaimed and generate interactive 2D and 3D models for use in planning and maintaining reclamation sites.

Habitat and Biomass Monitoring

- Use the AI to measure and monitor plant biomass to ensure the site is thriving post reclamation.

STRAYOS PLATFORM





Demonstration

DRILL AND BLAST

- Design the drill pattern in **Strayos**
- Mark out holes with GPS rover using mobile app
- Capture drilling data with mobile app
- Check drilling accuracy with AI/rover
- Design charging and timing
- Measure blast results
- Analyse the Blast with the AI & ML Tools
- Optimize design for future blasts

Strayos-Mobile app



Strayos captures and manages blast data to enable continuous improvement

Blast **reports and dashboards** for managing historical data

Mobile app for capturing digital field data and analyzing performance

BLAST REPORT

GENERAL	LOCATION OF BLAST	CONDITIONS	SERVICE LOCATION
Blast # CAT 1 Date/Time 4/19/22 Order # 101 Customer Mine Address	Location Kusmunda Bench CAT-1 Lat 22.332256418° Lon 82.653500971° Rock Type Overburden Rock Density 2.5mt/m³	Weather Sunny Temp 42° Wind Direction Wind Speed 10kmph Ceiling Altitude N/A	Name Location Address

BLASTER	EXPLOSIVES & BOOSTERS
Name admin admin State License Signature	Brand Name Count Weight Code AEL S100 75775kg AEL 250g Pentolite Primer 87 21.8kg Total Weight 75796kg

BLAST	DETONATORS
Hole Count 87 Row Count 7 Hole Diameter 259mm Hole Length 15.8 - 17.8m Bench Height 15.8 - 17.8m Max Ex. Decks 1 Subdrill 0m Face Burden Pattern Burden 6.5m Face Spacing 7m Pattern Spacing 7m Total Drill Length 1431m Total Volume 69386m³ Tonnage 173465mt	Brand Name Length Count Code AEL Multi SPD 18m 19 AEL Multi SPD 20m 68

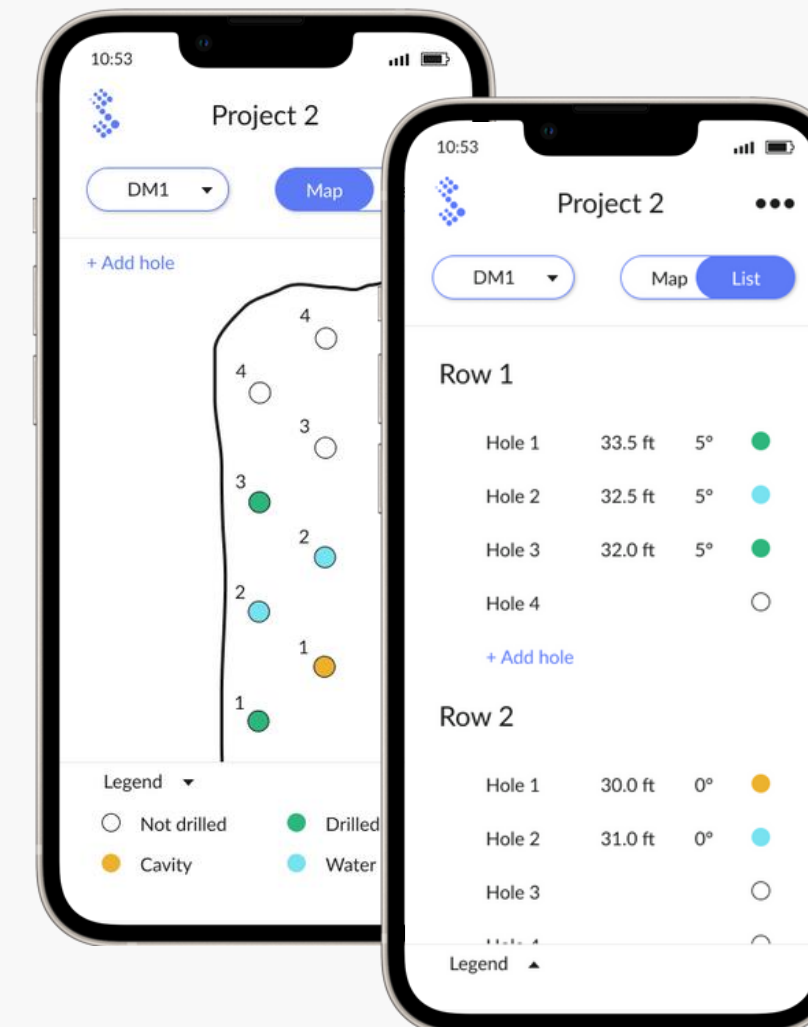
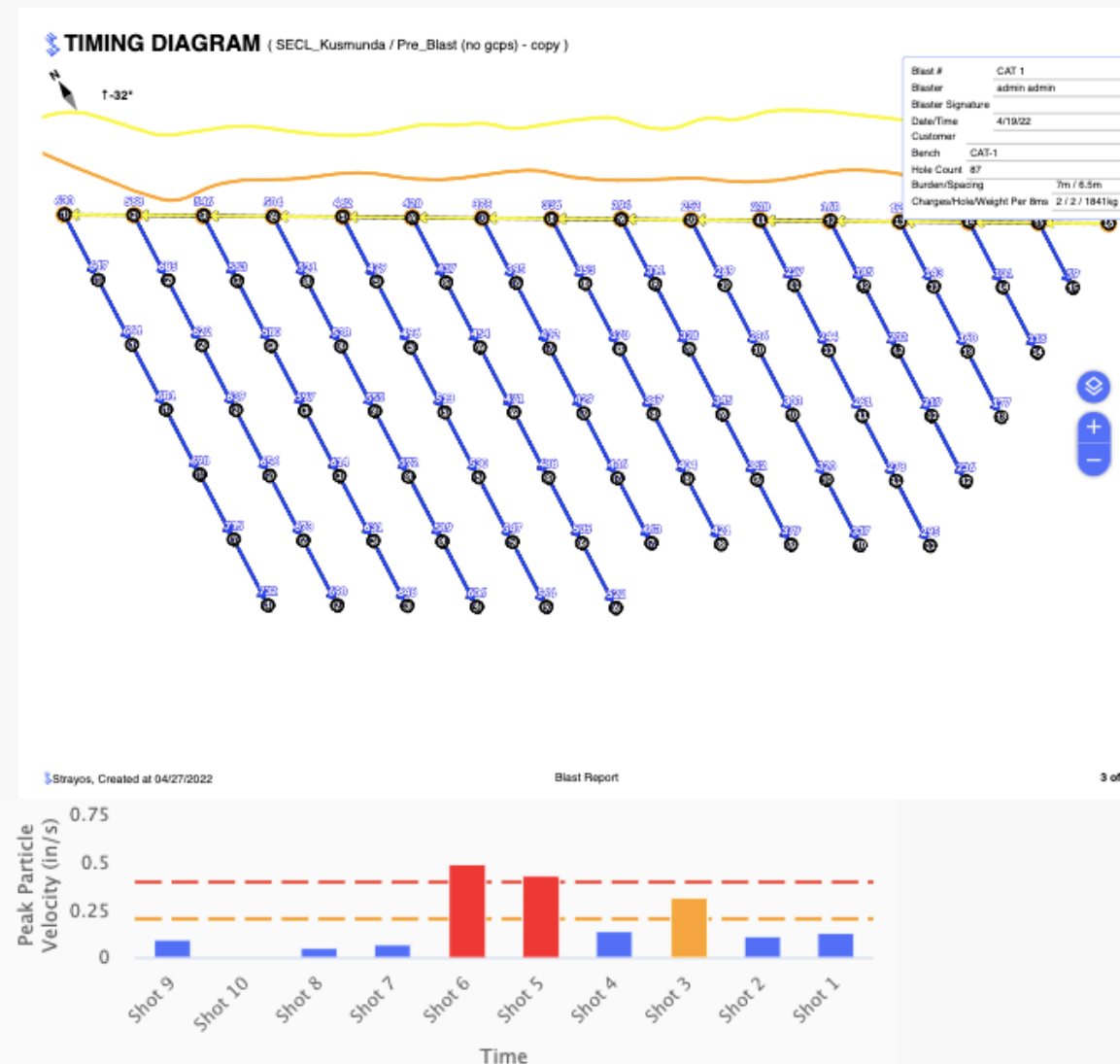
HOLE LOADING
Face Holes Stem 1.75m Back Holes Stem 1.75m Powder Factor Volume 1.09kg/m³ Powder Factor Weight 0.437kg/mt Stem Type Cuttings Max Kg / Delay (8ms) 1841kg Max Charges / Delay (8ms) 2 Max Holes / Delay (8ms) 2 Average Kg/Hole 871kg

SEISMOGRAPH DATA

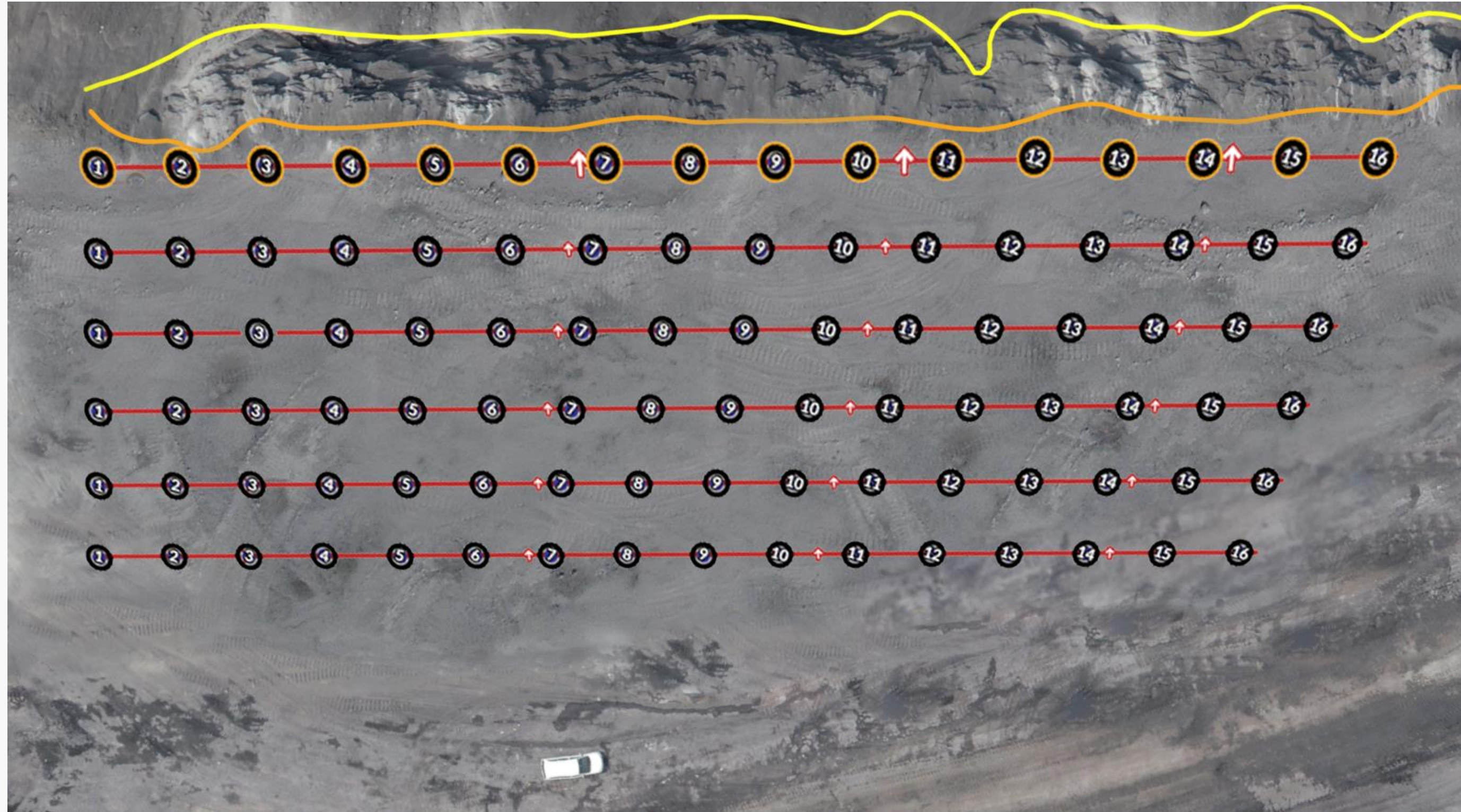
Location	Distance	Lat	Lon	Serial	Cal. Date

COMMENTS

none

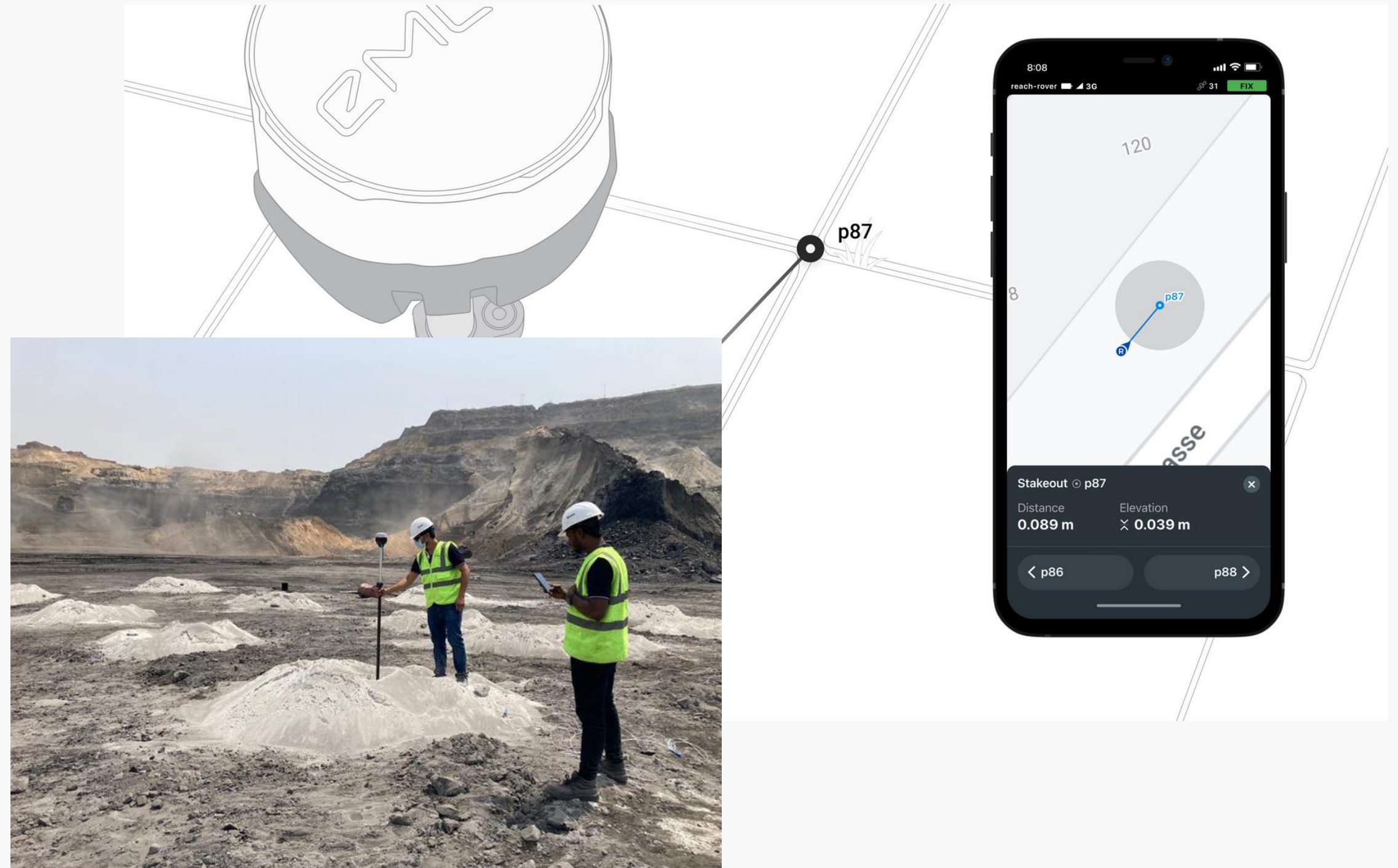


MARKING THE DRILL HOLES AS PER DESIGN

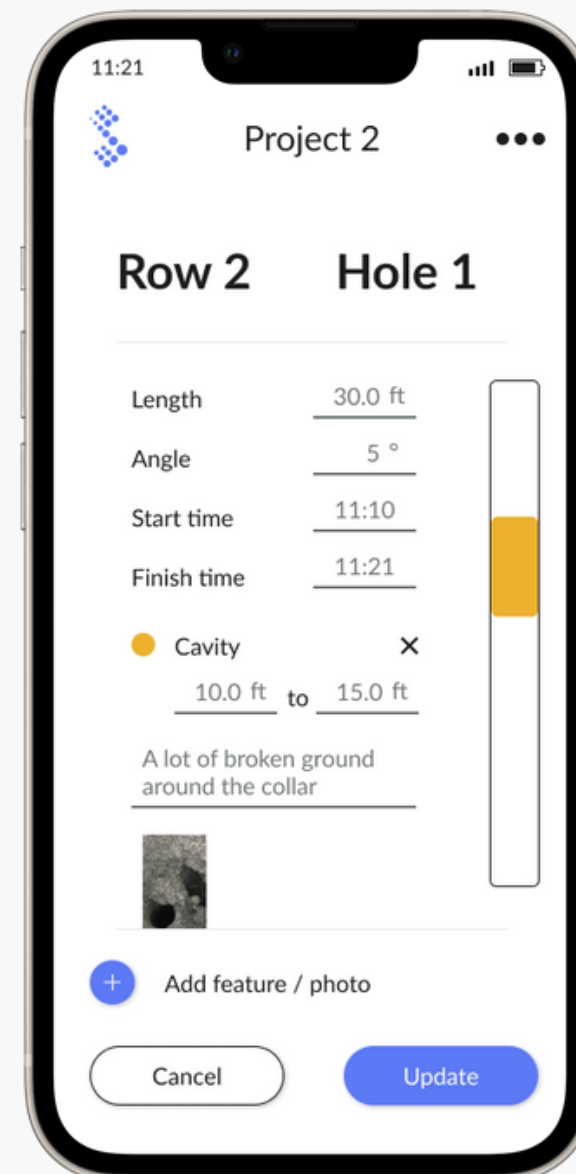
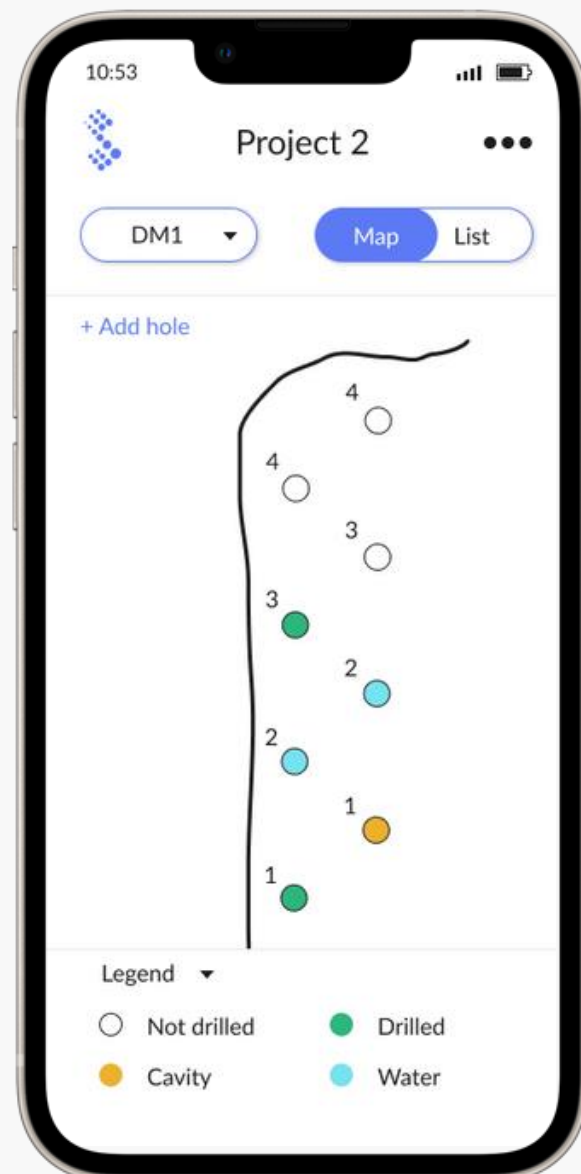
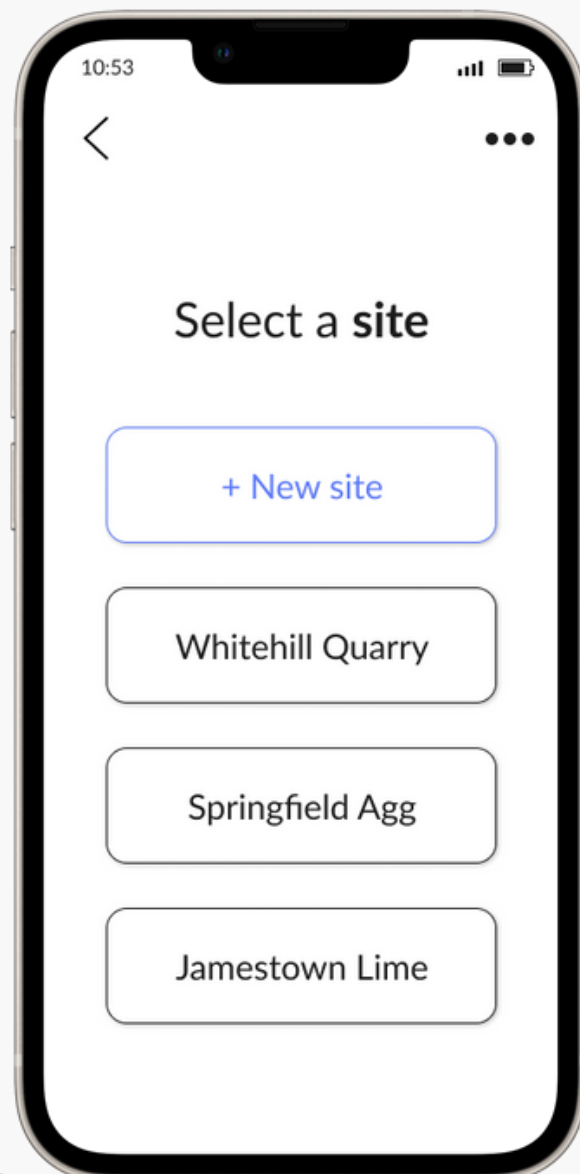


Emlid RS2 GPS rover for hole layout/measurement

- Centimeter level accuracy any place on earth
- Rugged design built for mining environments
- Easy-to-use mobile app for laying out holes and measuring as-drilled positions

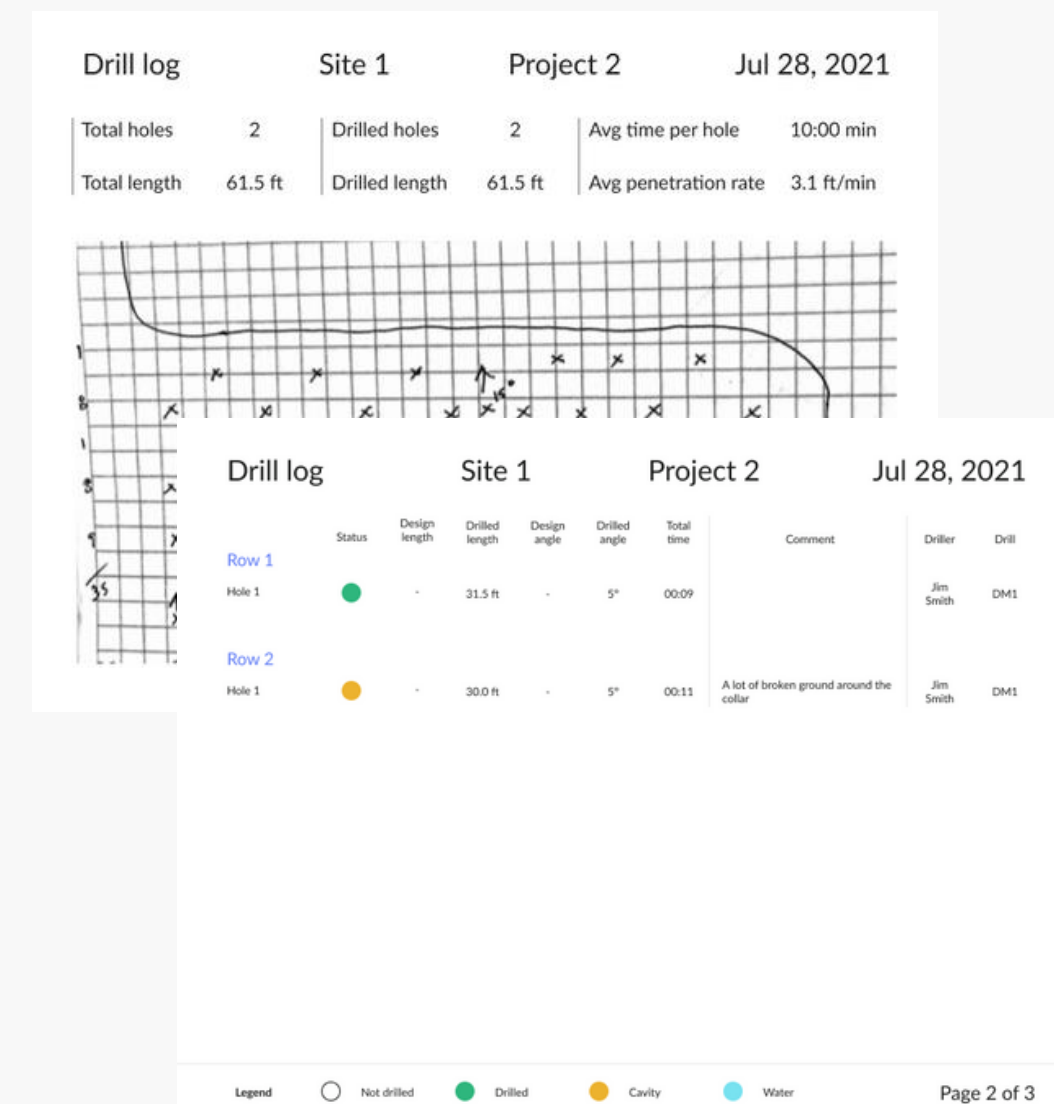
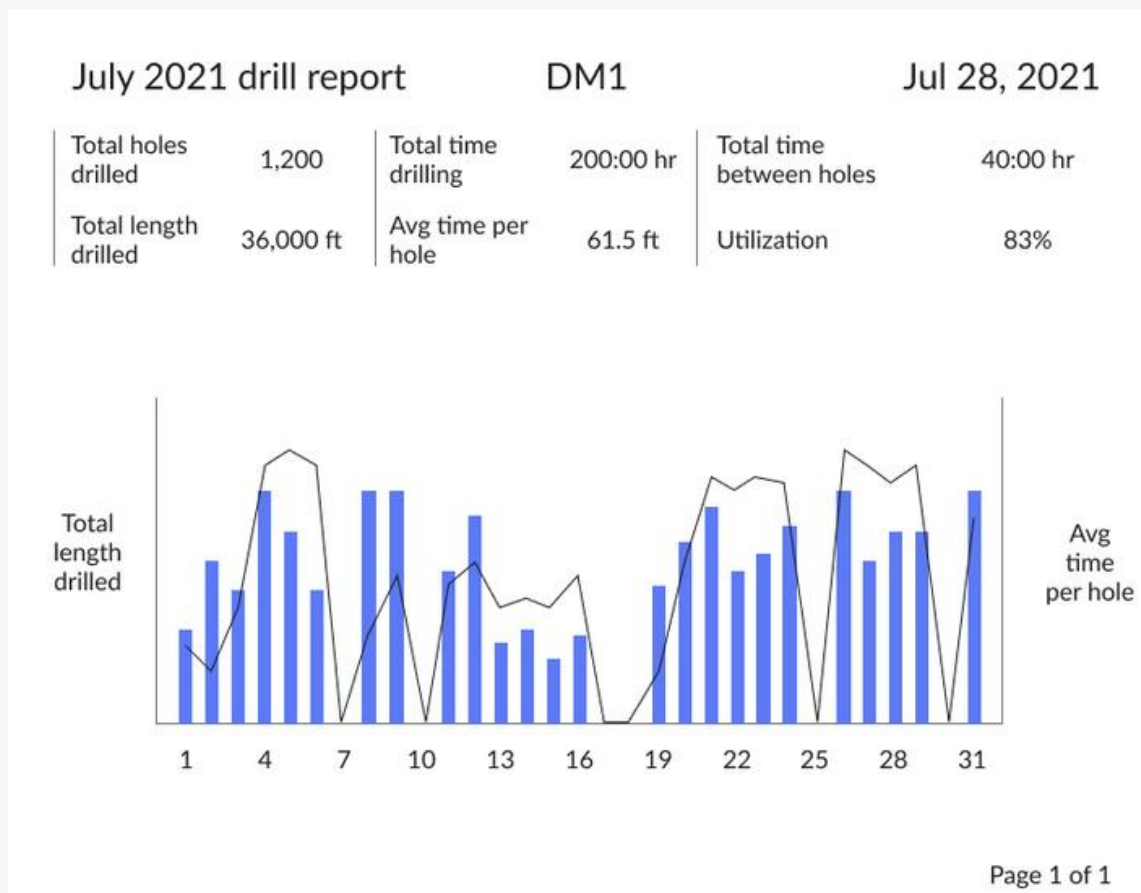


Collaborate with others in the field and the office



- All drill logs in one place
- Manage all drill log data across the organization in a single platform.
- Real-time view of progress
- **Log in from anywhere** to check what's been drilled so far and ensure drilling **stays on track**.
- See real-time updates from multiple drills on the same blast
- Works even without internet.
- **Save data locally** and synchronize with the cloud when reconnected to the internet.

■ Create instant reports on drilling utilization and performance

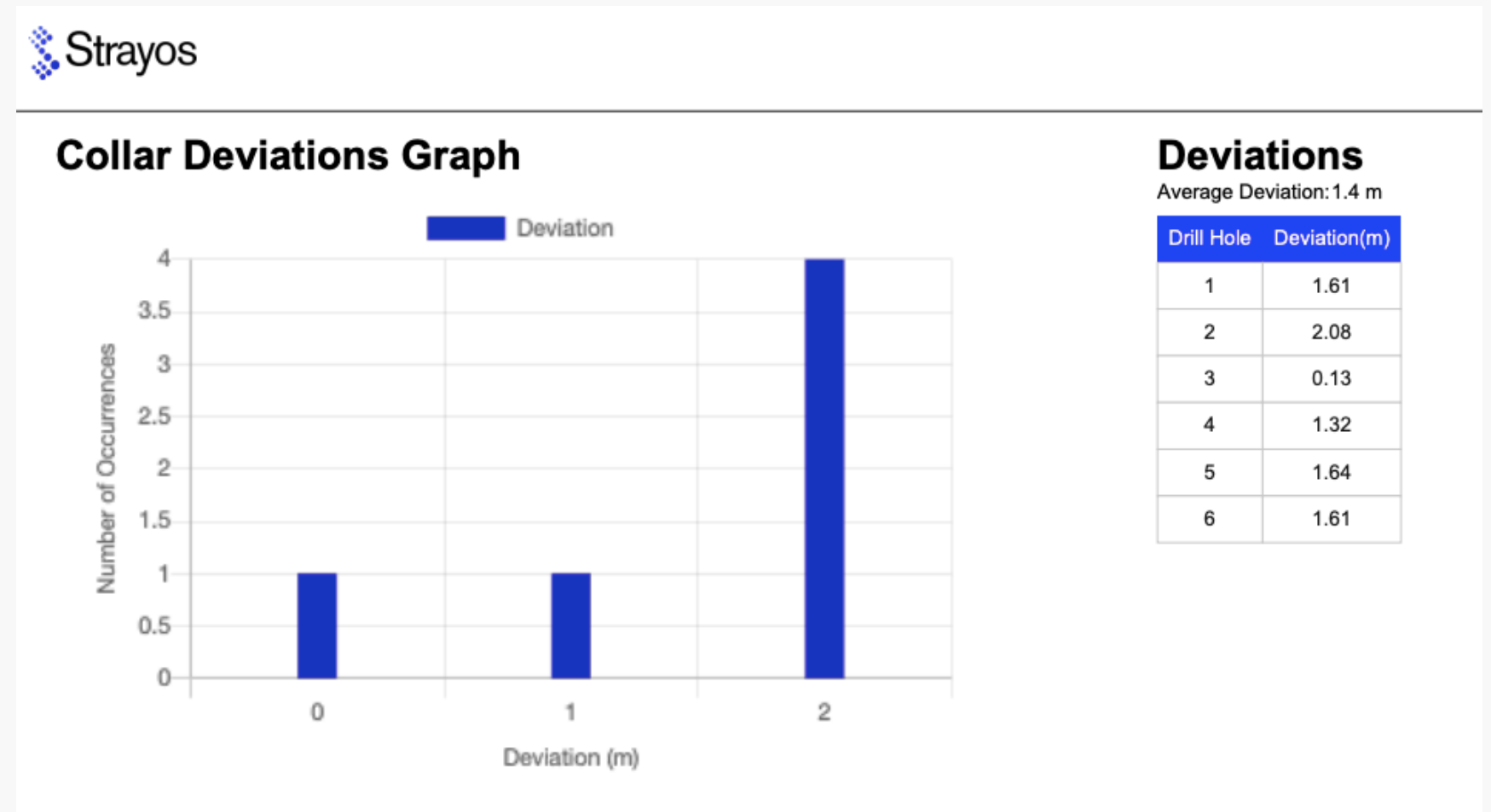
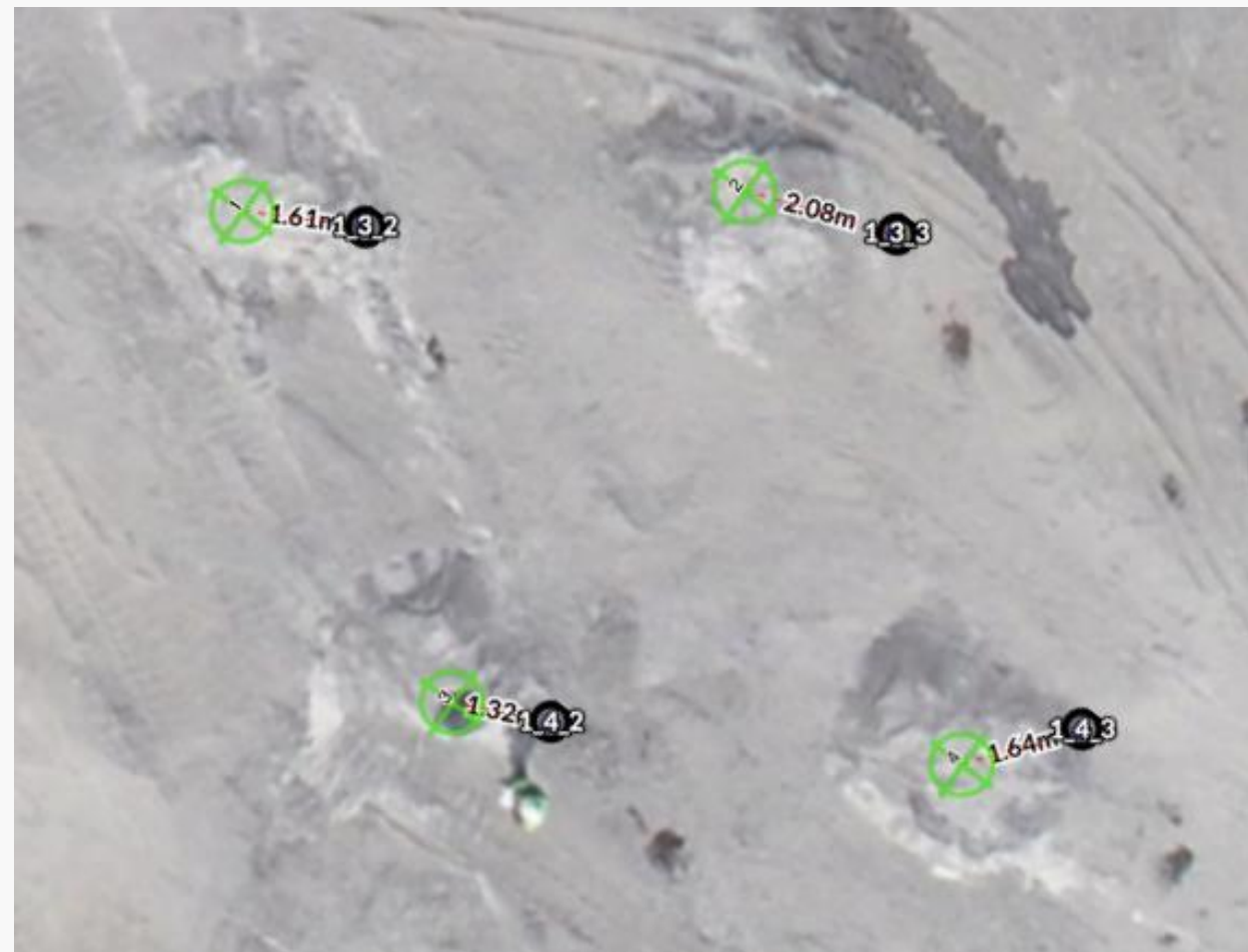


- Automatically track performance to improve operations.
- Print the **drill logs** for a specific shot with all the rich hole-by-hole information recorded.
- See **automated calculations** on the drilling performance for that shot.
- Instant sharing
- **Email PDF reports** directly from the app to save time keeping everyone in the loop.
- Monthly drill reports

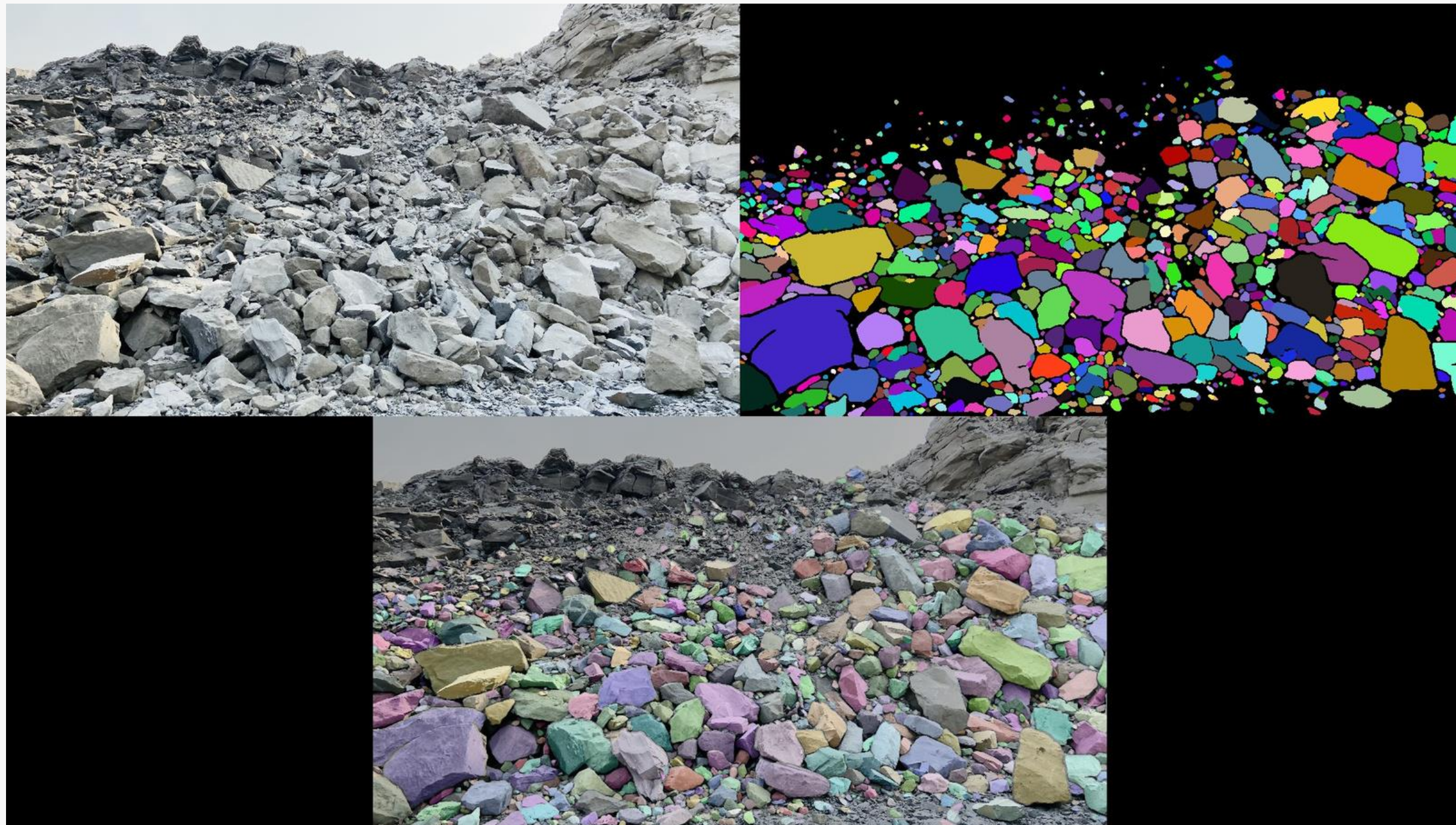
■ GPS marked holes can be automatically compared with design to measure accuracy

AI / GPS rover located as-drilled hole collars and compared design

Strayos produced **automated report** showing 1.4m avg deviation



Muckpile can also be surveyed using a smart phone instead of a drone



POC found Strayos can increase drill rates by up to 40% through digital shot design

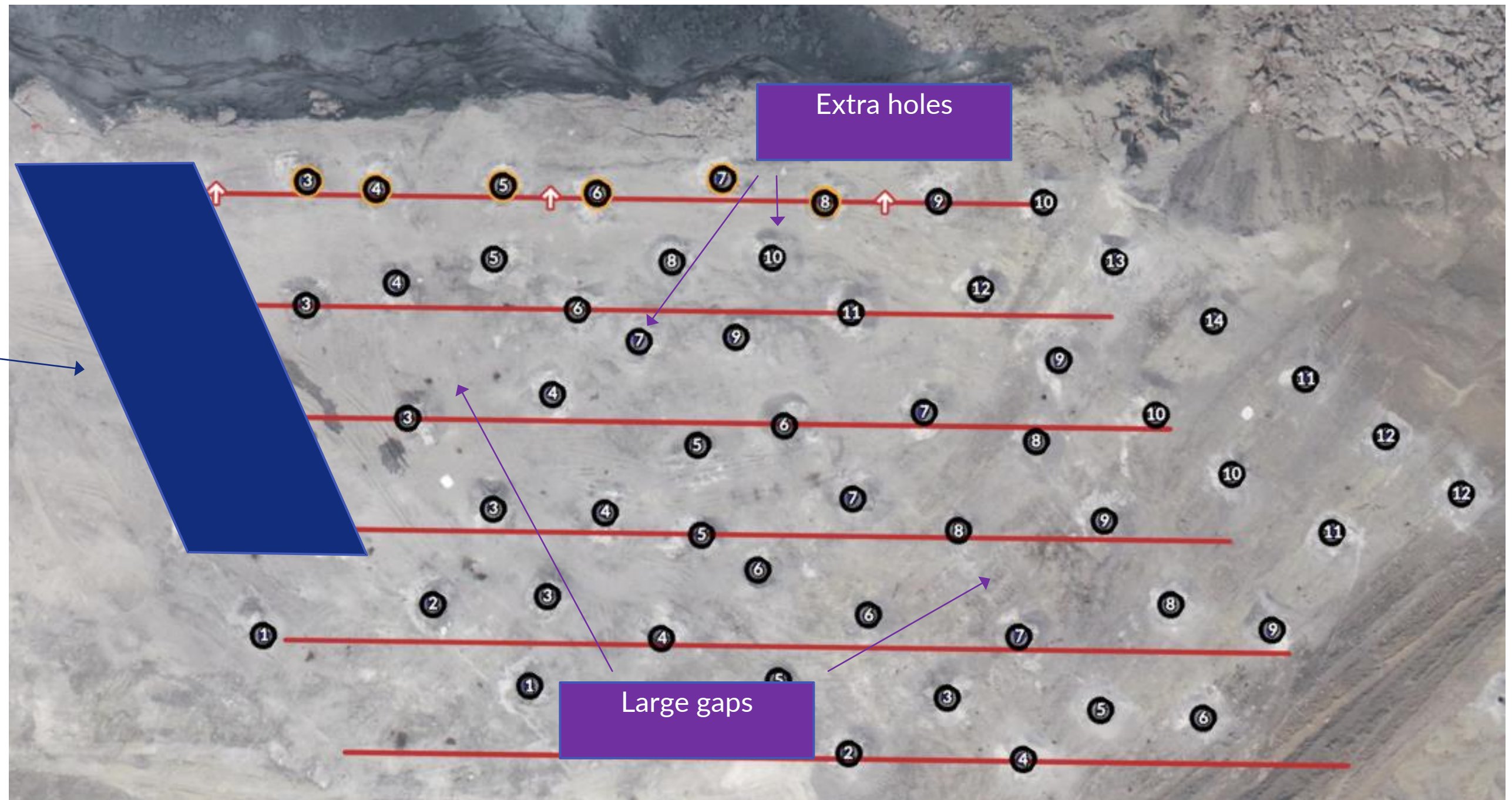
Same blast outcome could have been achieved with 40% less drilling



	Ideal Design	As-drilled	+/-
B x S	6.5 x 7	6 x 6.2	-10%
# holes	87	107	+25%
Depth	17-19m	20m	+10%
Drill Meters	1,518m	2,140m	+40%

Extra holes were at the edges, so ideal pattern would produce same fragmentation as drilled pattern

■ Drilling control was greatly improved by marking out holes with a GPS rover

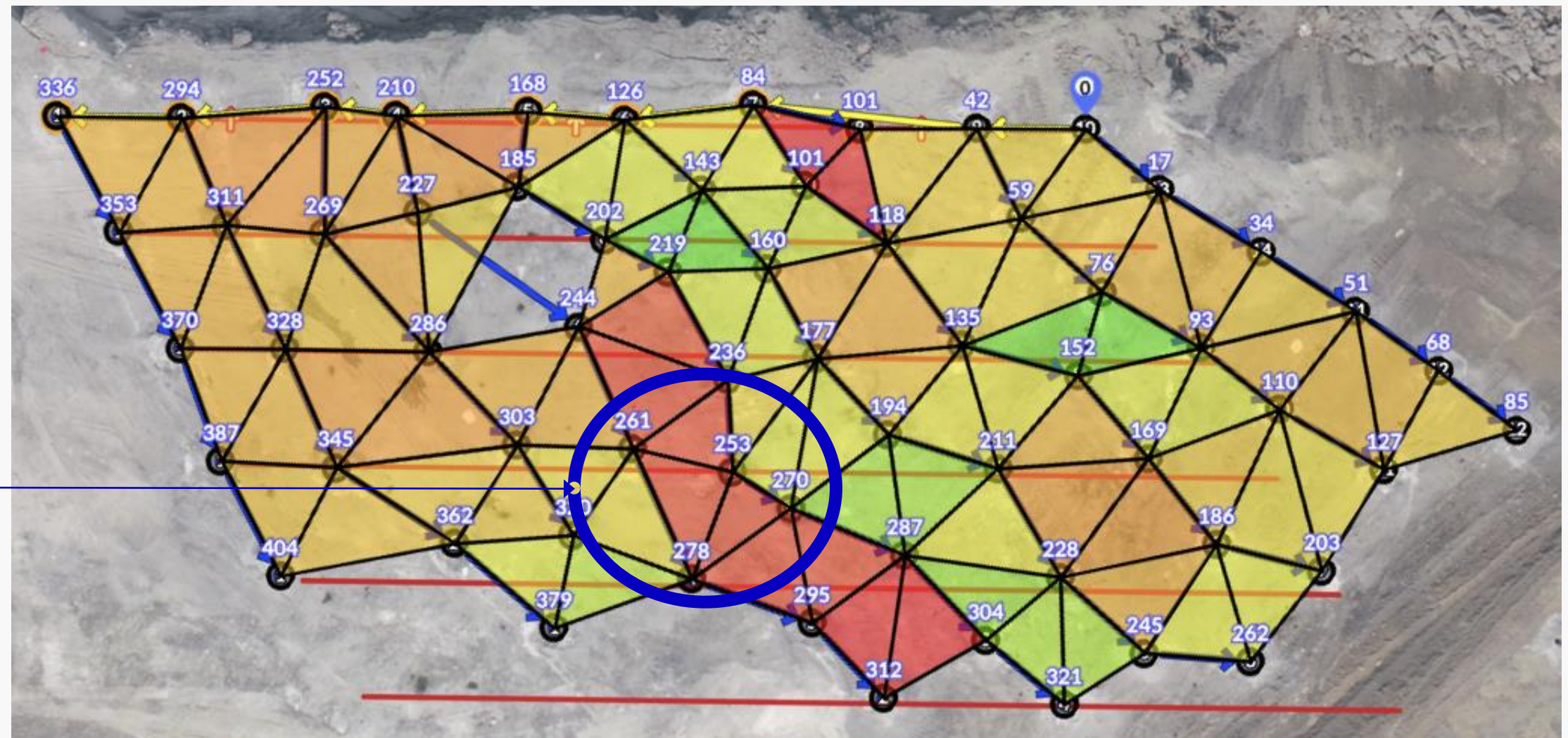


Area marked out with GPS rover was **much more consistent** than rest of pattern

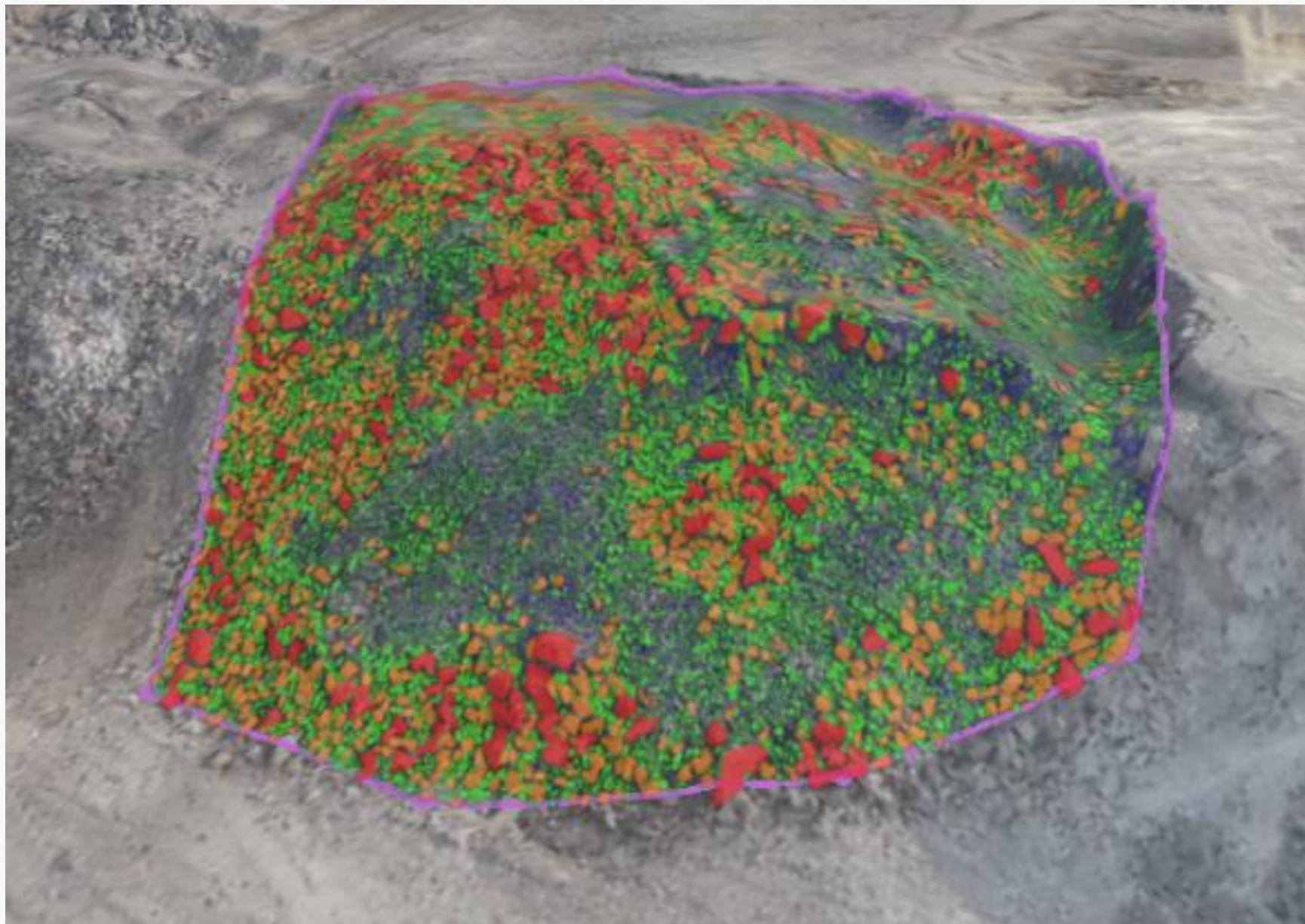
Blast Time map : Timing analysis

Low burden relief can lead to ejection/cratering causing **wasted energy** and **poor fragmentation**

Cluster of 5 holes firing within 25ms of each other



AI identified potential to reduce boulders >1m by 25% by adjusting pattern to 6x6m



24% of material measured >1m



Project - Day_01_Pre_Blast - copy x +

app.strayos.com/site/5410/dataset/49059

+ New Project

Share

Cyriac Joseph

Timing Design

Show Surface Delays Angle of Initiation Throw direction Burden Relief 2D 3D

Non-electric Timing

Add Initiation Point

Delete Initiation Point

Draw Ties

Change Selected Ties

Delete Selected Ties

Edit Selected Holes

17ms Trunkline

Analysis

Visualize Timing Speed 1/20x

Reporting

Timing Plan Timing Logger Loading Usage

Elevation: 191.18m

Support

Output formats from Strayos

- **Autocad format (.dwg, .dxf).**
- **.las, .xyz, Surpac, Datamine, Autocad or any other file format**
- **No additional or sophisticated softwares are required for using the survey data.**

The Major Advantage of Strayos

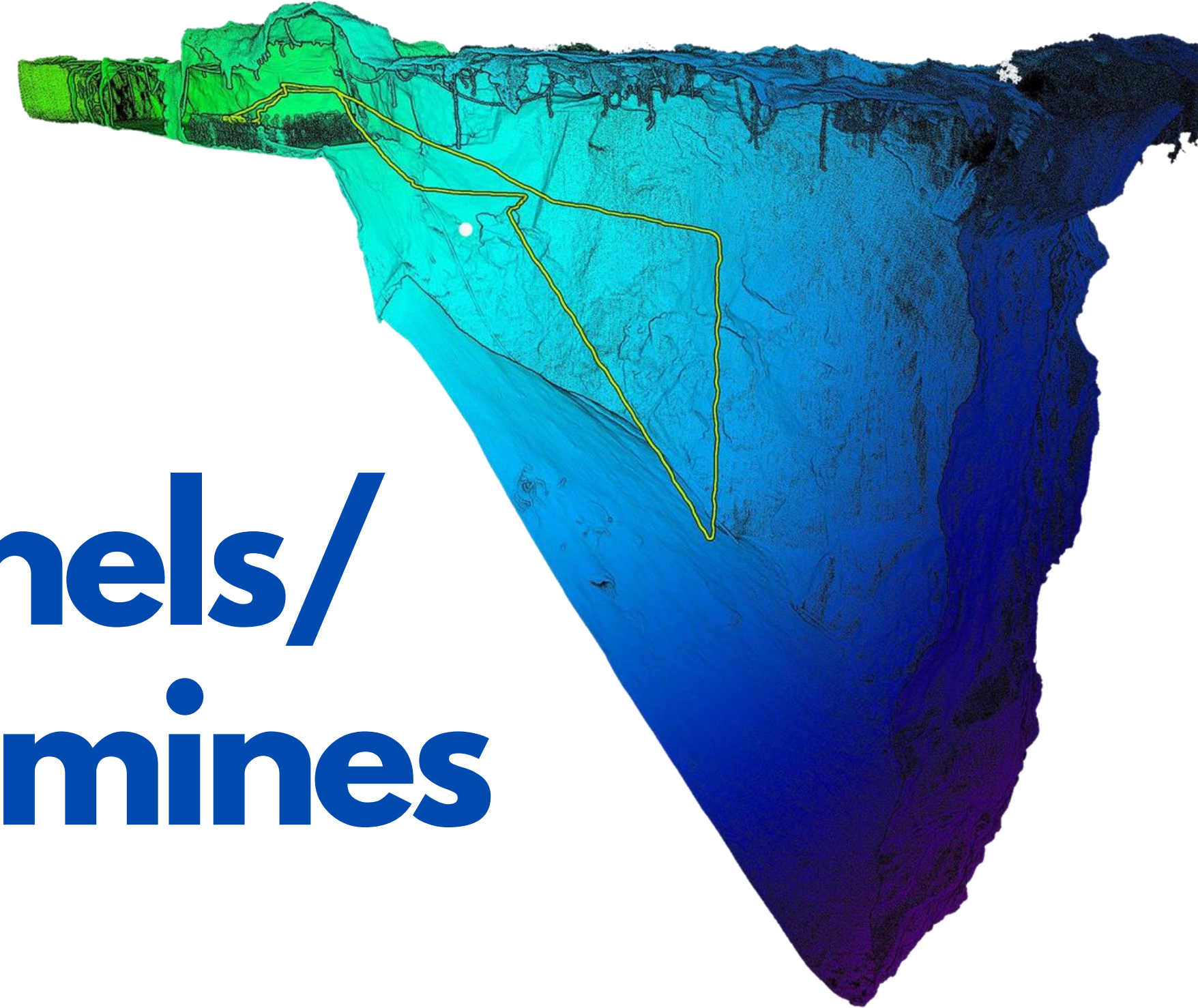
AI & ML tools keeps the model learning and upgrading over time to reach more and more precision.



APPLICATION OF DRONES IN UNDERGROUND MINES



Squadrone
is 1st to fly
autonomous
drones in tunnels/
underground mines
in India



HOVERMAP OPERATION





- **Hovermap is a SLAM-based LiDAR mapping system.**
- **It enables data capture of critical underground mine excavations and**
- **Captures new insights to optimize mine development and operations.**





**When mounted to a drone,
Hovermap enables **autonomous
flight Level 2 (AL2)****

- **Beyond line-of-sight and communication range,**
- **In hazardous,**
- **GPS denied environments.**

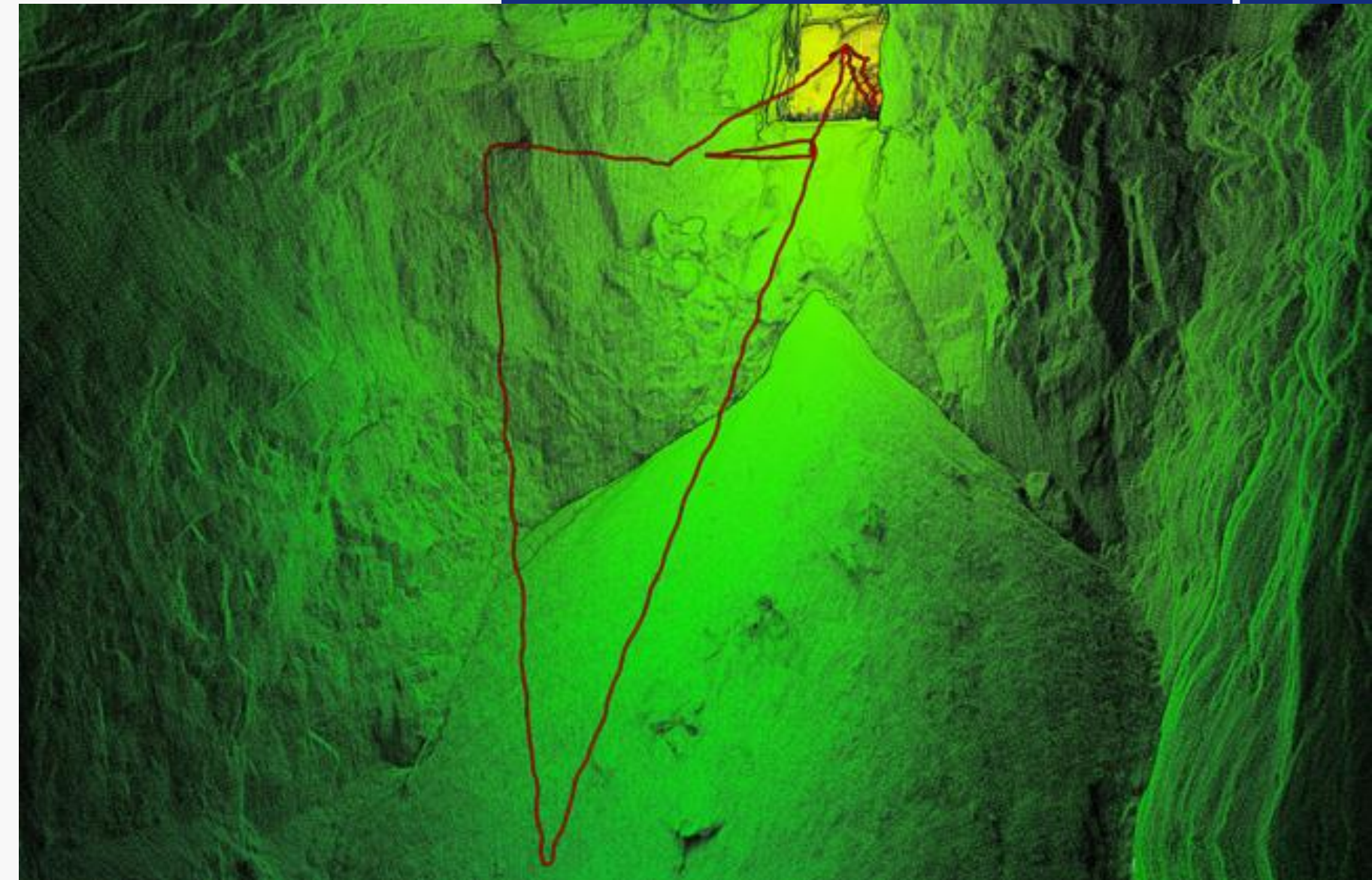
Operators can capture

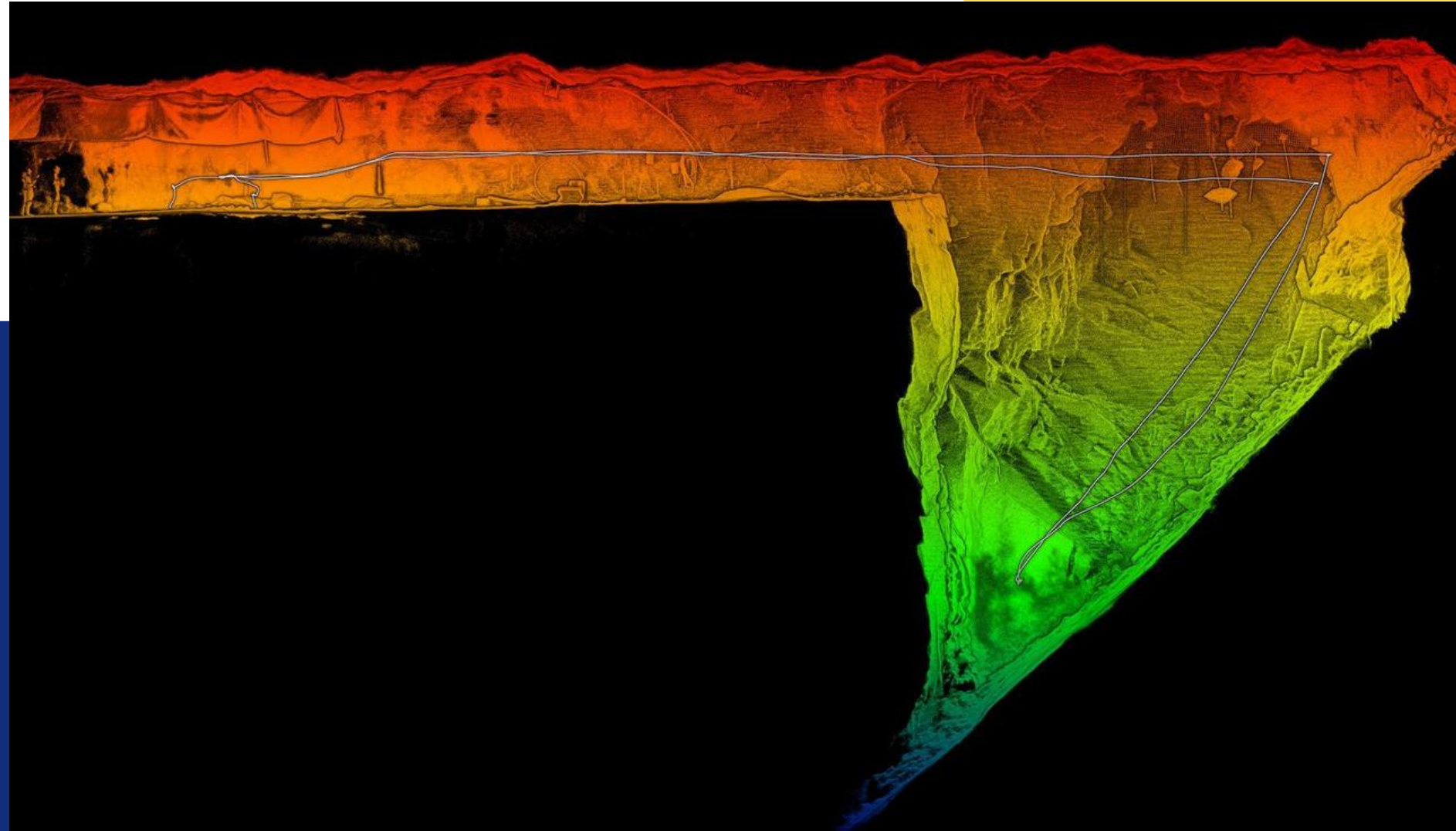
- **high quality data from inaccessible underground voids**
- **While personnel remain safe under controlled-ground.**



Hovermap pilots can

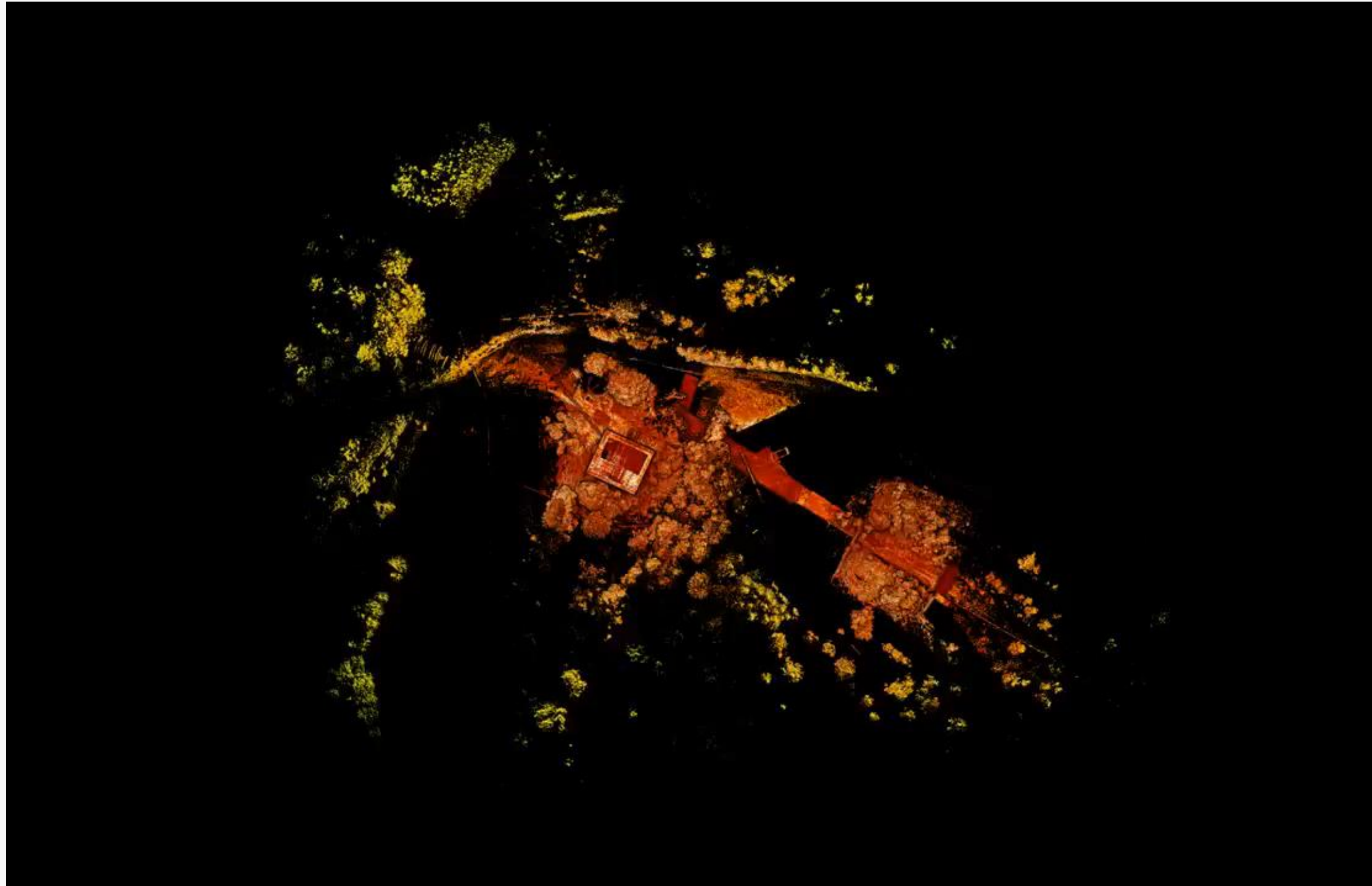
- fly an entire mission, from **take-off to landing**, using a tablet.
- **Data is processed on-board,**
- **Providing the operator with a 3D map of the environment in real time.**
- **Waypoints are set with a preset *bag of words* or simple tap on the map and Hovermap takes care of the rest**





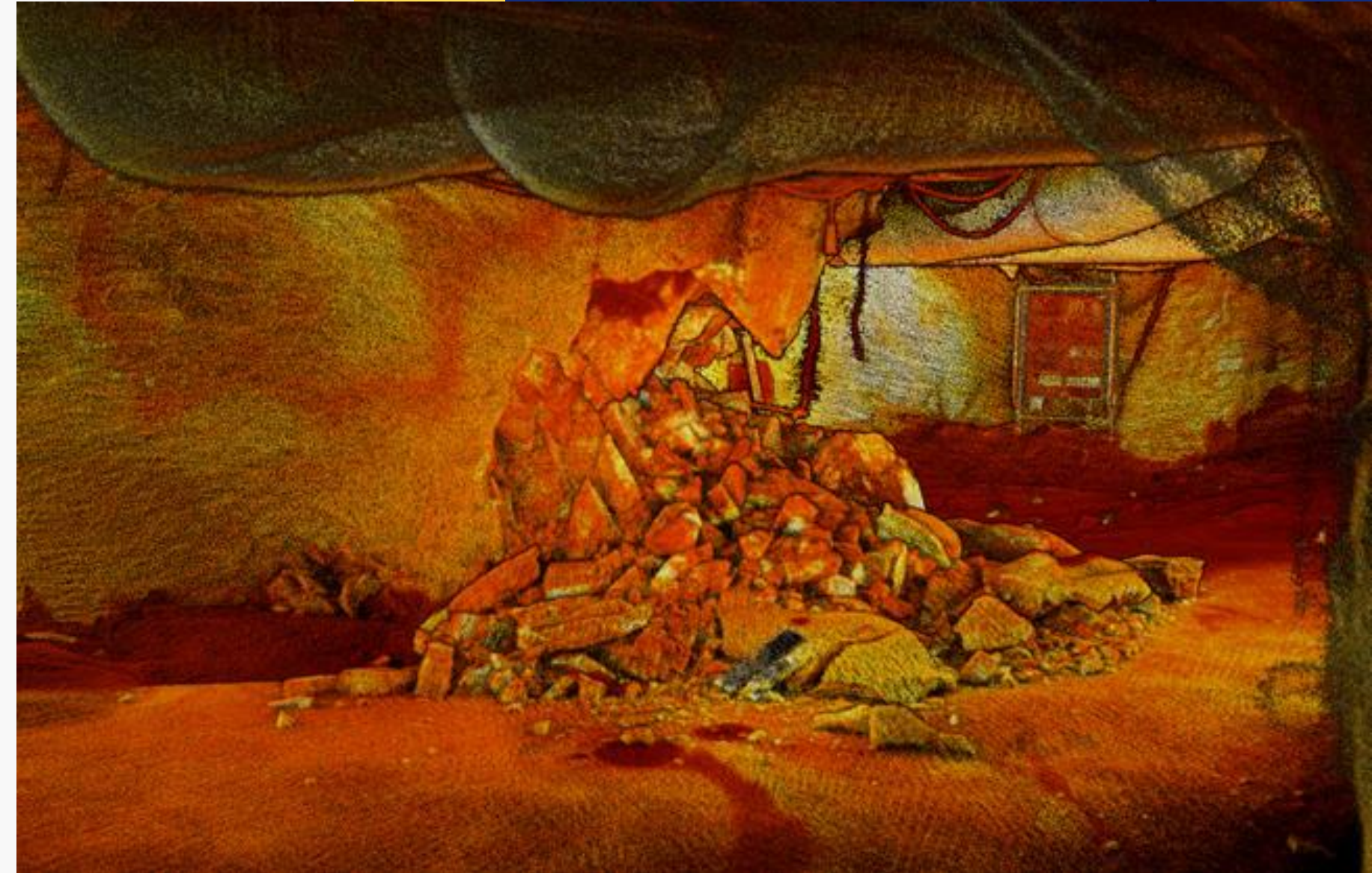
- **MAPPING OF ALL THE UNDERGROUND TUNNELS, DRIVES, RAISE, OREPASS, ROADWAYS, CROSS CUTS AND ALL THE OTHER FEATURES OF THE UNDERGROUND MINE**

HOVERMAP OUTPUT



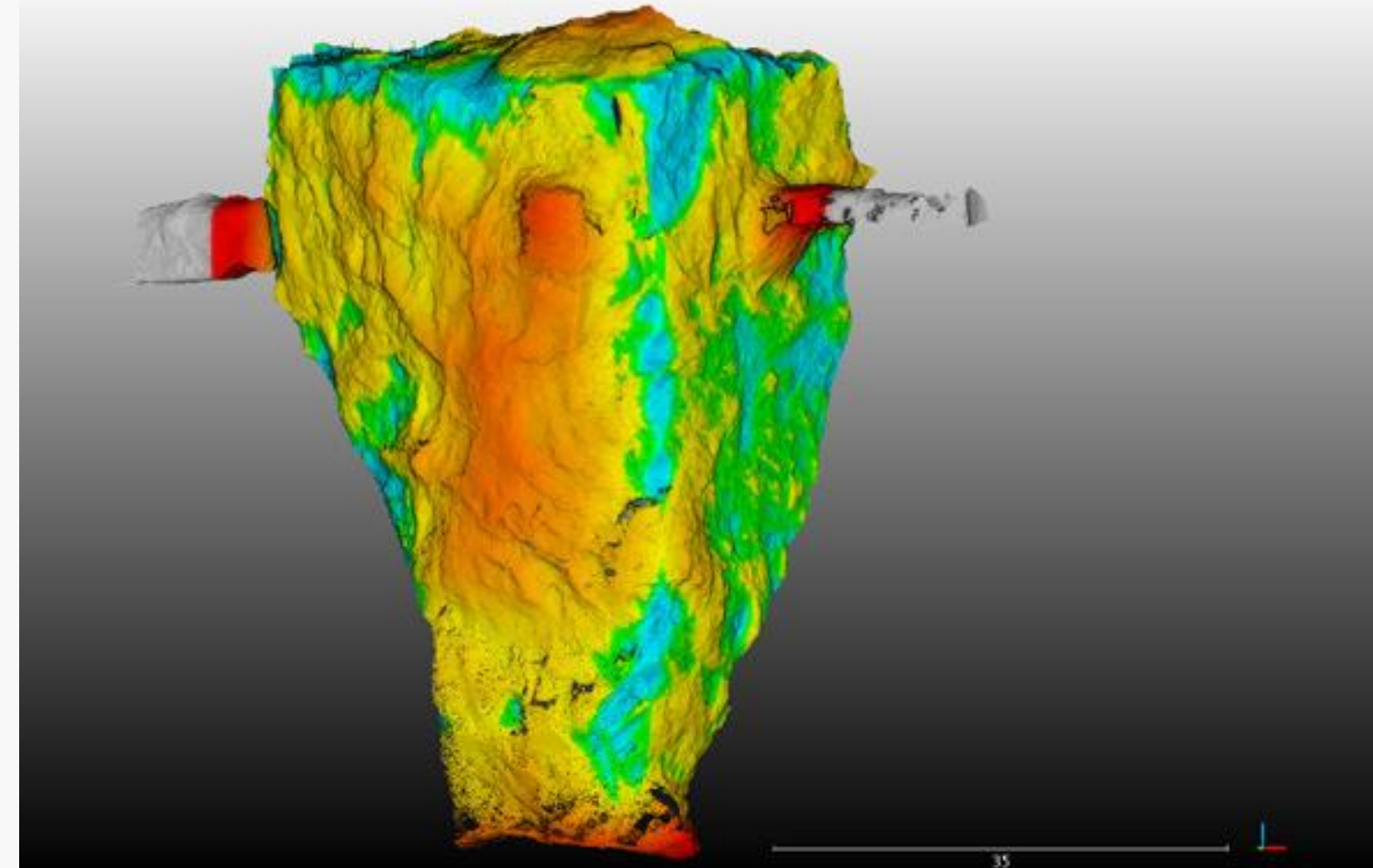
2. ACCESS FALLS-OF-GROUND

- **Captured data can be used to produce visualizations, calculate the volume and surface area of the collapse.**
- **After a significant geotechnical event, assessing the area and developing a rehabilitation plan to make it safe to re-enter.**
- **Hovermap can be deployed to scan the area, without putting personnel at risk.**

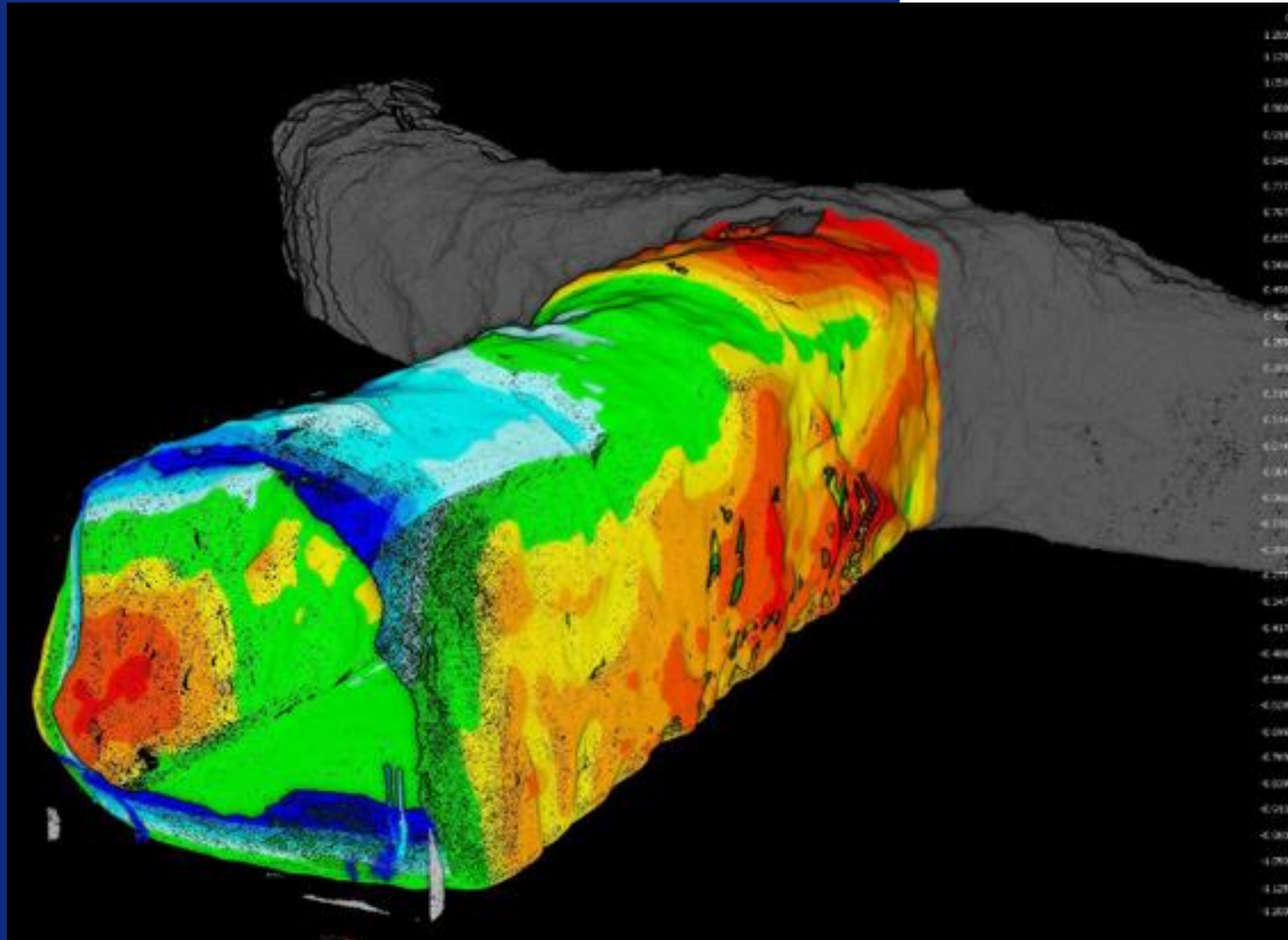


4. STOPE SHAPE, STOPE VOLUME & STOPE DIMENSIONS

- **Hovermap can deliver high resolution stope shape point clouds.**
- **Accurate stope data can improve mine efficiency by allowing drill and blast engineers to see how their initial drill pattern has performed.**
- **Subsequent patterns can be refined, to maximize ore body extraction, and improve material flow.**



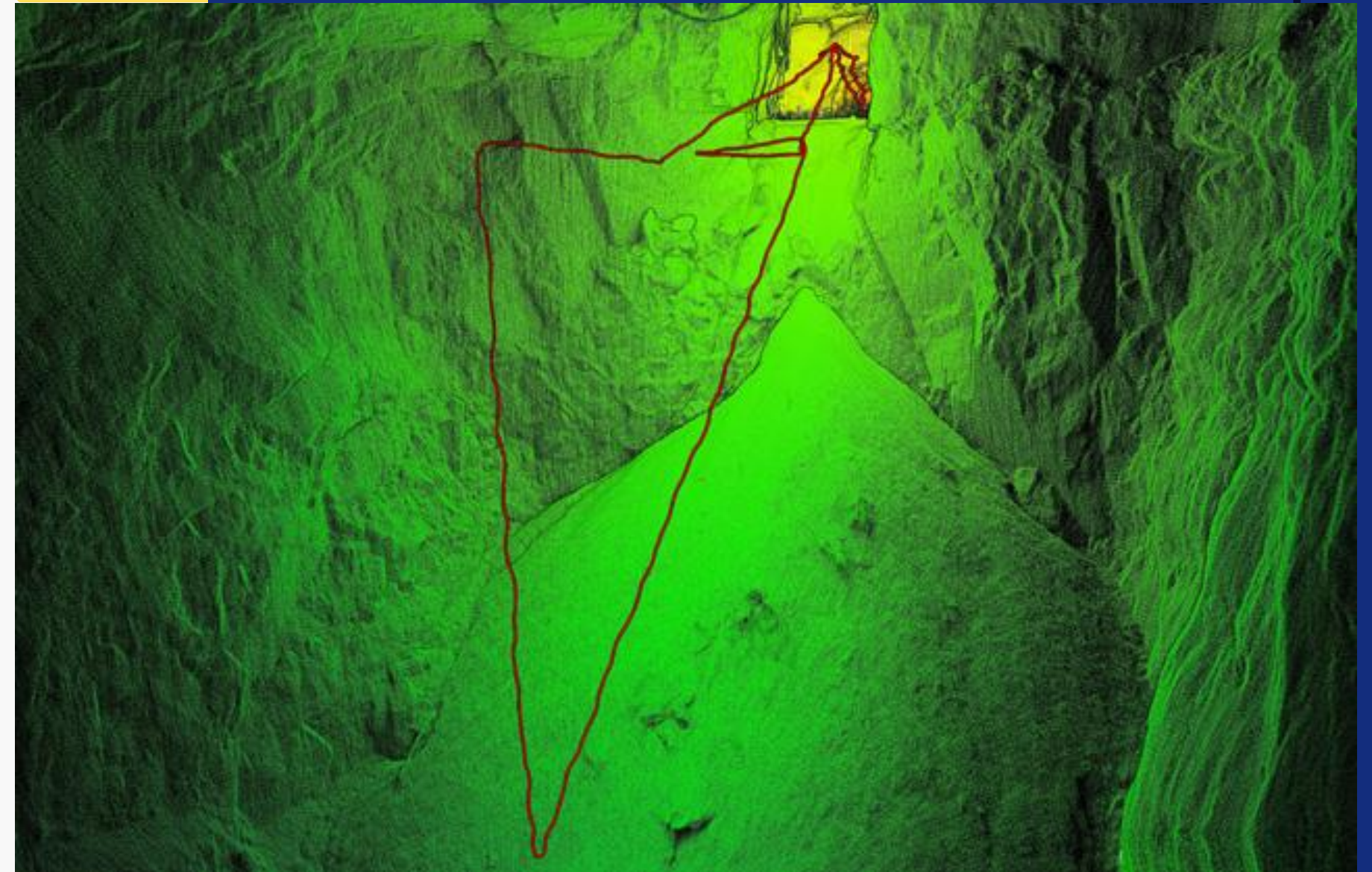
5. OVER AND UNDER-BREAK



- **The value extracted from a stope is one of the key metrics for an underground operation.**
- **The dilution of the ore can be assessed using the map.**
- **Comparing the as-built to the as-design**
- **Provides a detailed over-break & under-break analysis**

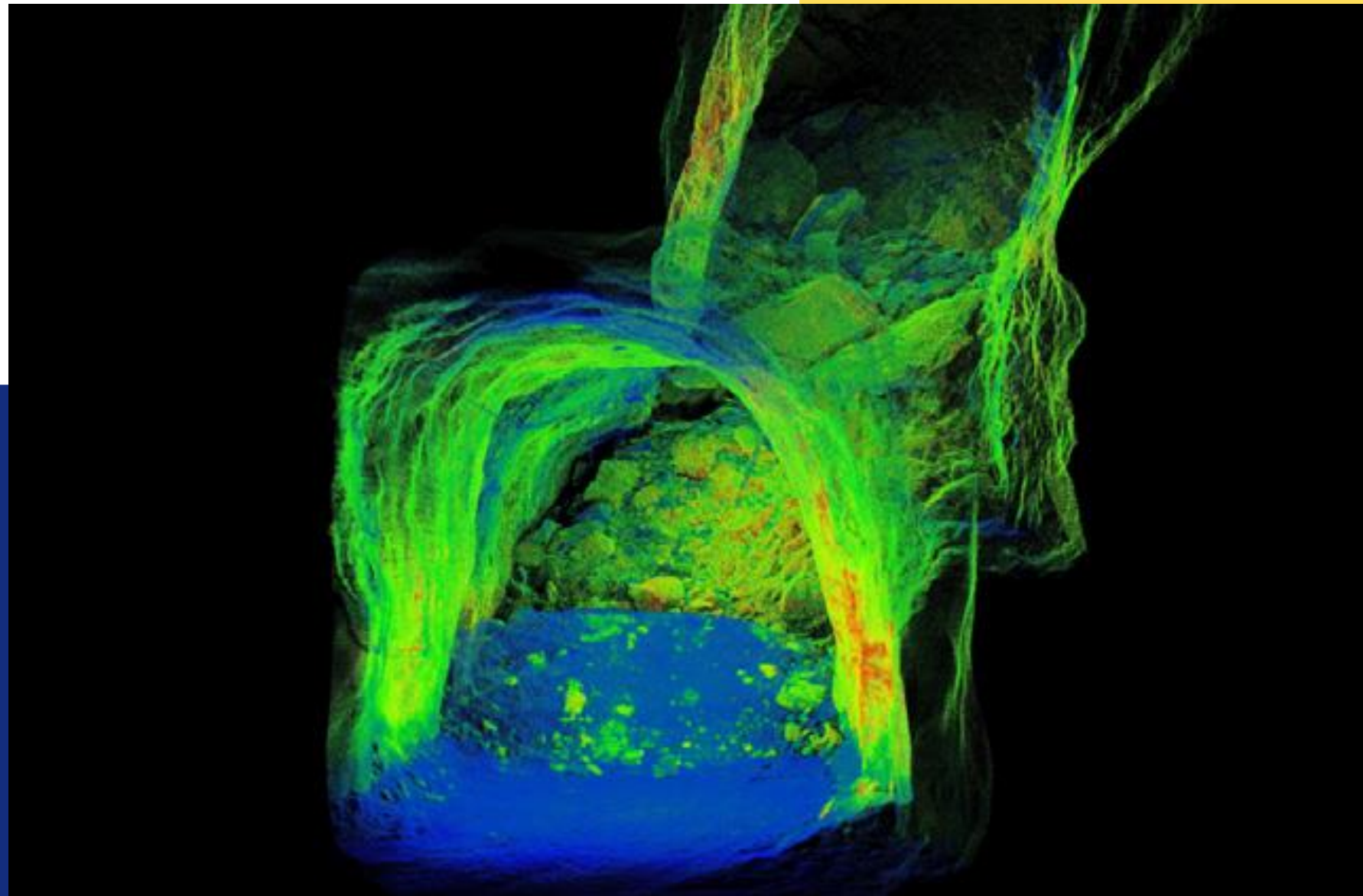
6. BACKFILL HEIGHT / VOLUME

- **Hovermap scans can be used to monitor backfill heights and ensure backfill types are installed correctly.**
- **Rather than relying on bucket counts, schedulers are able to obtain an accurate measure of remaining stope volumes and can direct material accordingly**



7. DRAWPOINT INSPECTION

- **Hovermap scans can provide engineers with superior insight into oversize material and hang-ups at drawpoints, in stoping and caving mines.**
- **These phenomena weeds out safety hazard to personnel and to the equipment used to clear them.**
- **Flown scans provide a better perspective of the blockage than those obtained via traditional CMS methods.**



8. OREPASS INSPECTION

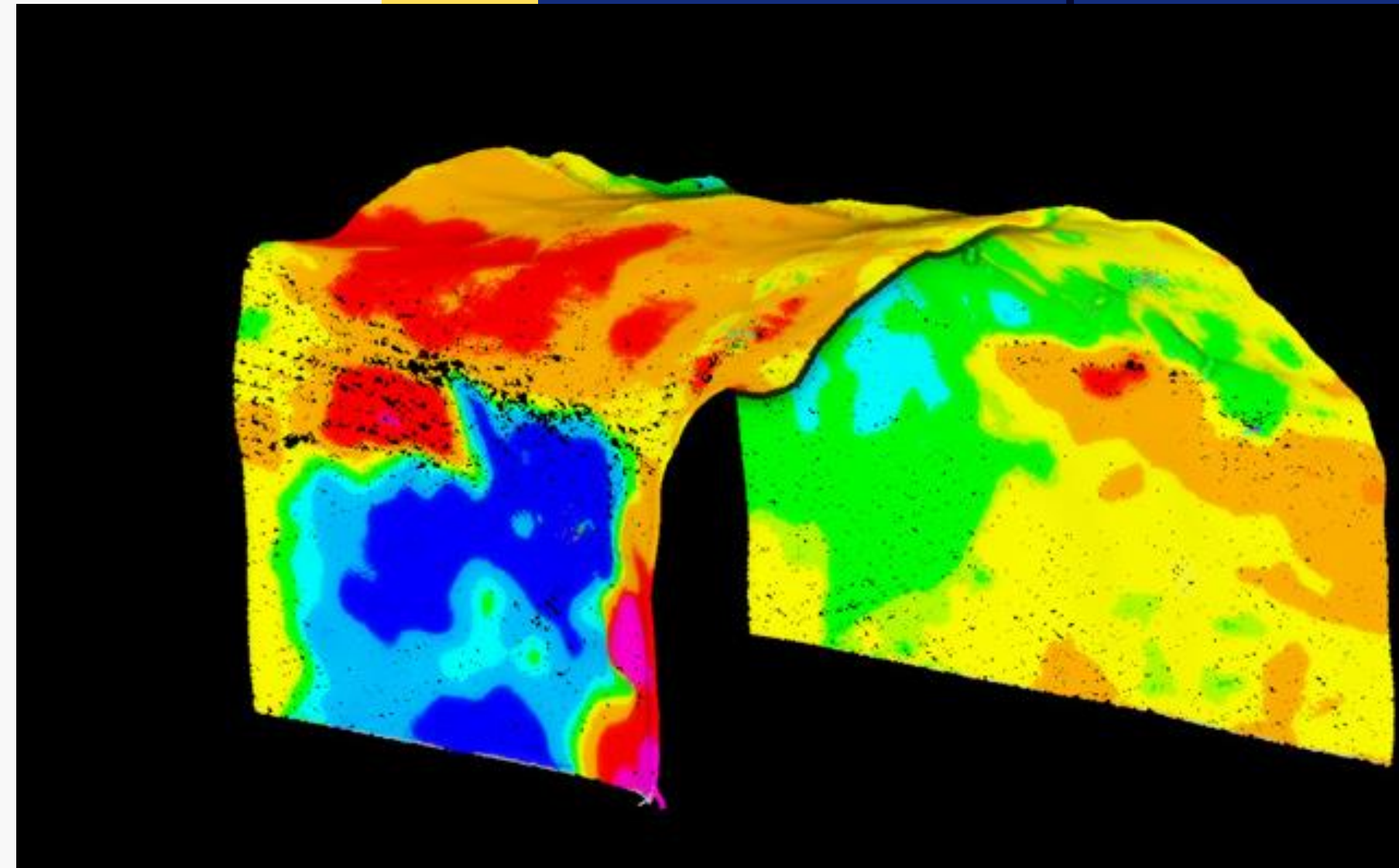
Regular inspections enable engineers to

- **Detect changes,**
- **Deformation and blockages promptly,**
- **To ensure no undercut is present at the tip head location.**

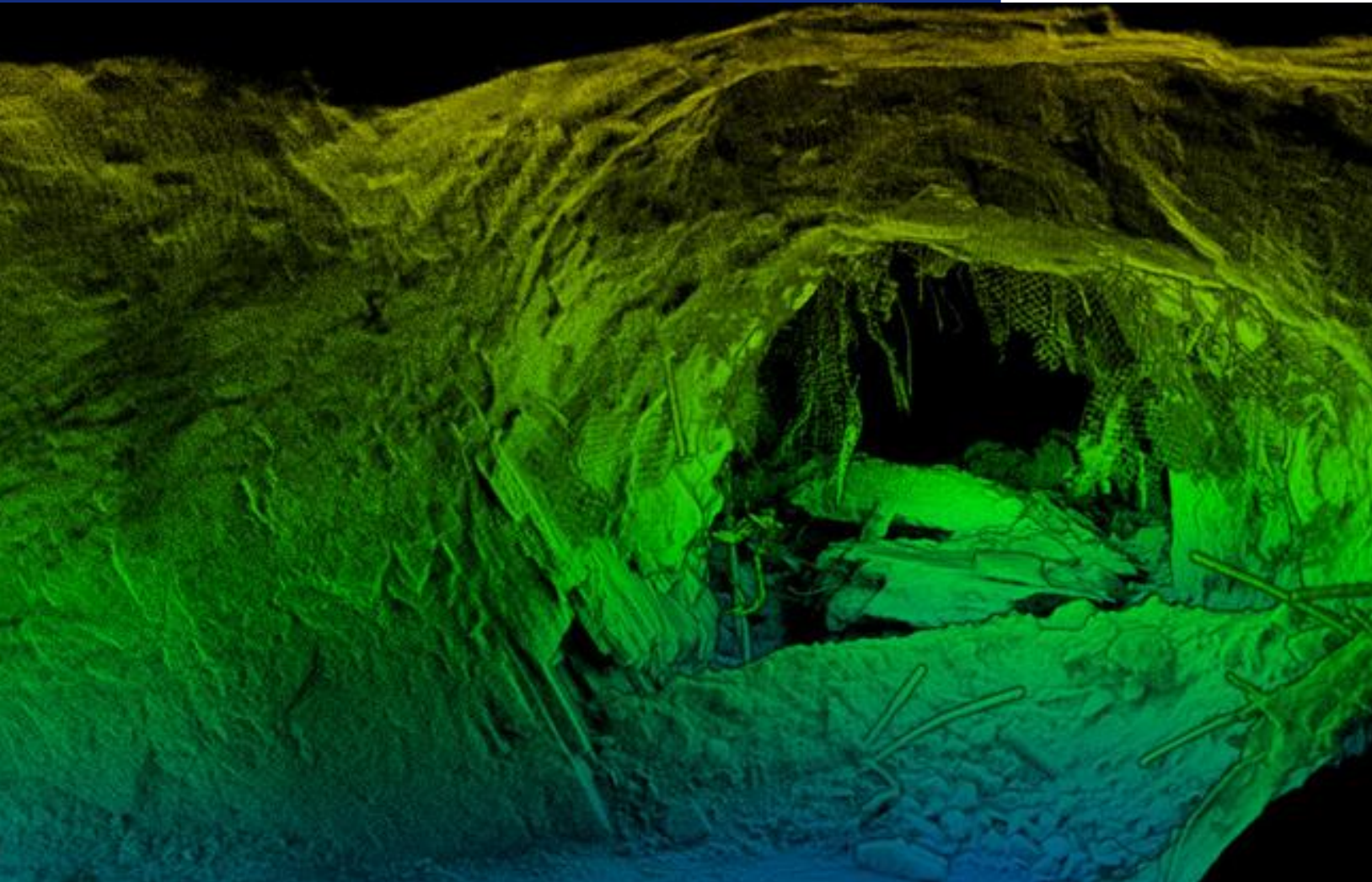


9. CONVERGENCE MONITORING

- **Hovermap accuracy is sufficient to identify changes exceeding 5 mm.**
- **Rapid scanning methods enable data collection to occur at regular intervals.**
- **This leads to improved recognition of convergence trends and closure rates.**



10. EXPLORATION OF OLD WORKINGS



- **Abandoned mines are now being reassessed for recommencement, due to price increases in some commodities.**
- **Typically, these old mines have substandard ground support, which has further deteriorated over time.**
- **Sending in Hovermap to capture data reduces the unknowns, by allowing engineers to complete a comprehensive risk assessment safely.**
- **They can assess the rock mass and structural conditions to identify and mitigate hazards, before personnel enter the area**

11. INFRASTRUCTURE AS-BUILTS



- **Hovermap can capture built environment in a flight.**
- **Accurate and detailed as-built point clouds can be transformed into CAD plans of complex 3D structures quickly and easily.**
- **Comparing consecutive scans allows engineers to detect whether changes have occurred between scans.**
- **Assessment for accommodating the new machinery becomes simple.**



Underground Tunnel Mapping





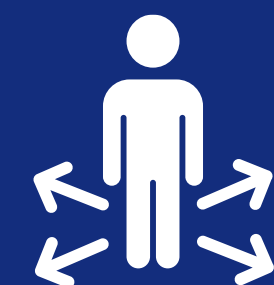
IMPROVED SAFETY

Personnel are not exposed to hazards during data capture and inspections. Timely actions can be taken quickly bringing about a huge difference in Safety



COST SAVING WITH ENHANCED EFFICIENCY

Quick and accurate data facilitates timely decisions in house to obtain the information they need to move forward enhancing productivity and safety.



INFORMED DECISION-MAKING

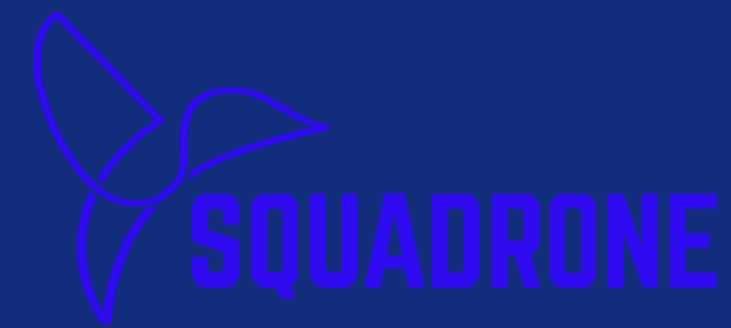
Accurate & Quick data collected allows mine managers to make data driven decisions that optimize planning and production across the lifecycle of a mine.



DRONE-BASED MAGNETOMETERS FOR GEOPHYSICAL SURVEYS



Applications of Magnetometers



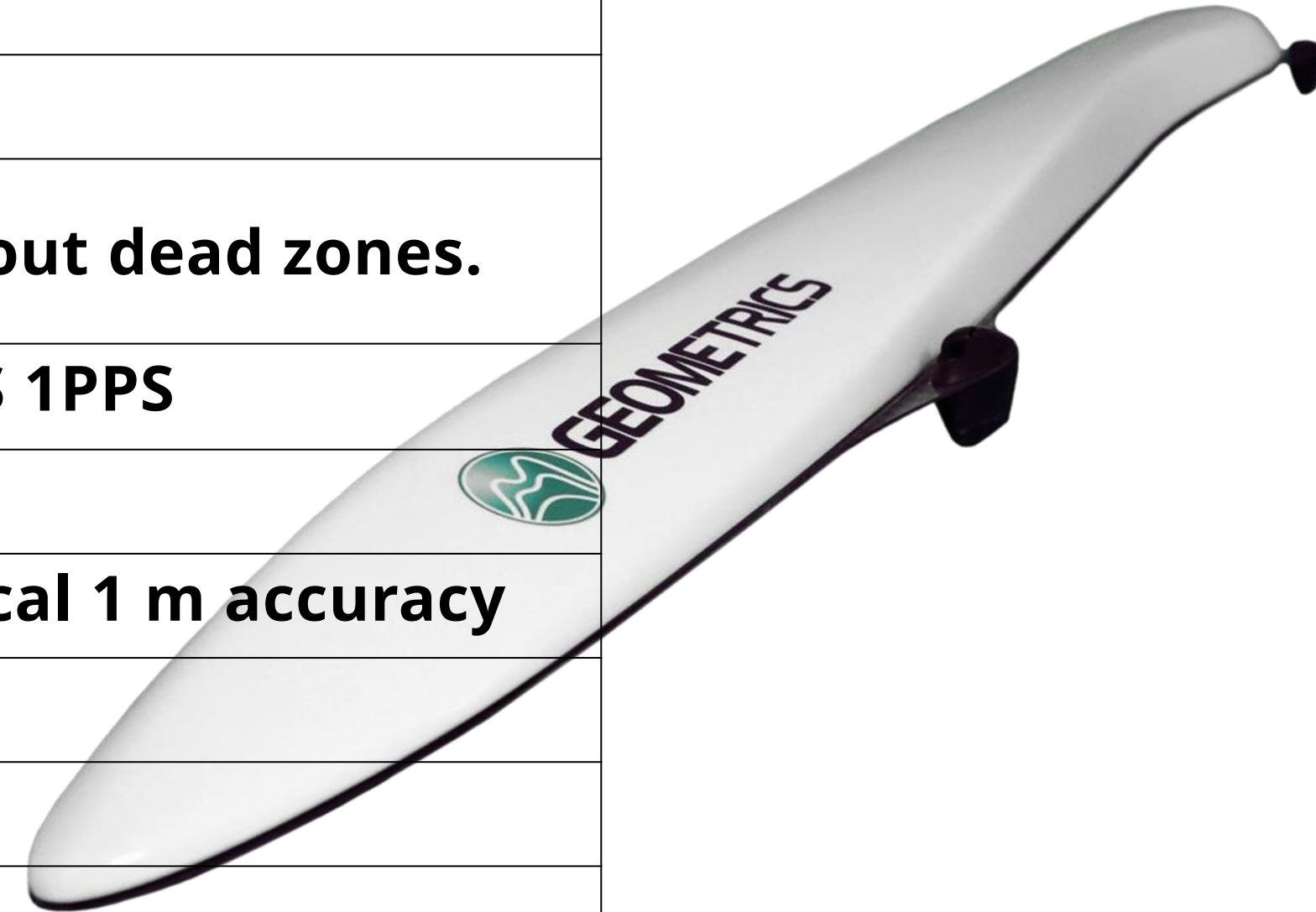
- **Mineral Exploration** - To detect mineralization and geological structures.
- **In Coal Exploration** - For locating the sills and other obstructions.
- **Mine Rescue** of buried objects during slope failures.
- **Groundwater exploration**
- **Oil and Gas Exploration** -For drilling the discovered wells.
- **As metal detector** - **Underground Pipeline Mapping , Ship wreck, etc.**
- **UXO detections**



MAGARROW – SPECIFICATIONS



1	Operating Principle	Laser pumped cesium vapor (Cs133 non-radioactive) total field scalar magnetometer.
2	Operating Range	20,000 to 100,000 nT
3	Operating Zones	Configured for operation anywhere in the world without dead zones.
4	Sample Rate	1000 Hz synchronized to GPS 1PPS
5	Bandwidth.	400Hz
6	GPS	Commercial grade with typical 1 m accuracy
7	Data Logger	Built in Data Logger
8	Total Weight	1kg without batteries.
9	Length	1m.
10	Operating Temperature	-10°C to +50°C (+14°F to +122°F)
11	Humidity	Non-condensing.



- **UAS**-enabled magnetometer can easily prospect **rough and inaccessible areas.**
- Can prospect in **thick forests without disturbing the eco system**
- **Can prospect in densely populated areas-villages, towns etc.**
- Avoid hostility from local people
- **Survey of small parcels** also can be undertaken **quickly.**

Advantages of Drone based Magnetometer

- Does **not need making of approach roads** which by itself is the biggest hassle of any prospecting project, that sucks **both time and resources.**
- Could be integrated with EM and MMR to be able to identify and **capture deep seated Mineral deposits and Deep acquifers**
- **Huge saving in Cost & Time**

Advantages of Drone based Magnetometer

- **High number** of measurements can be taken in **a short amount of time**
- Simplify surveys that are difficult due to the various limitations of **pilot-on-board surveys** and **ground surveys**.
- Does not require **complicated licensing** like an aeroplane or helicopter.

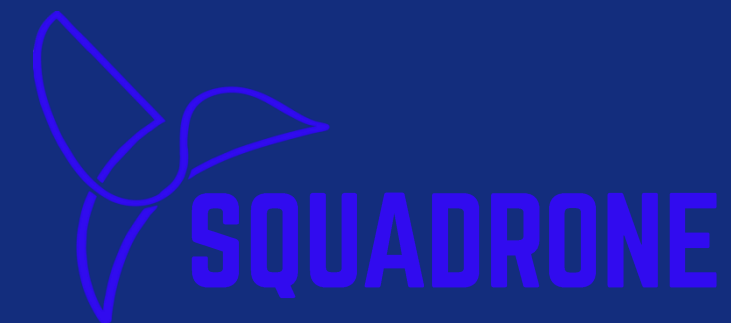
Advantages of Drone based Magnetometer



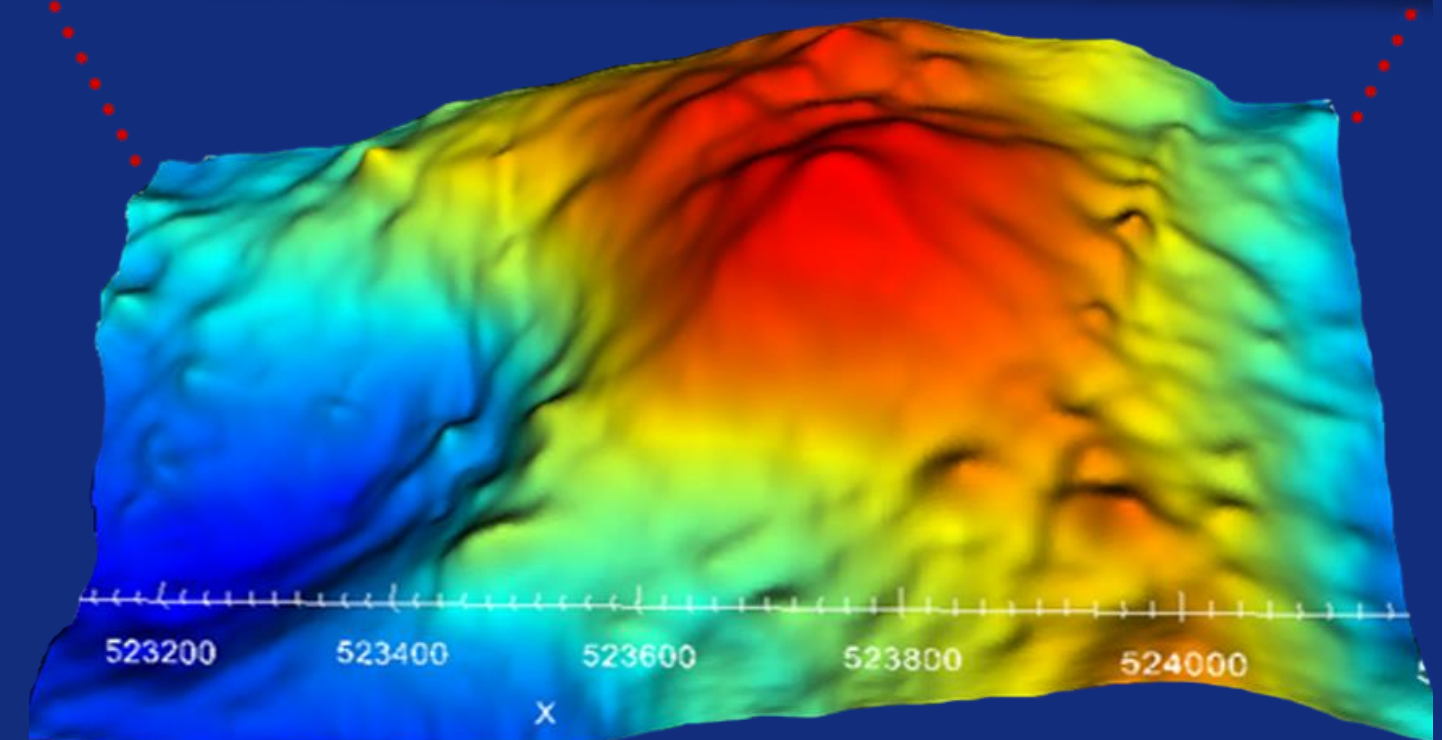
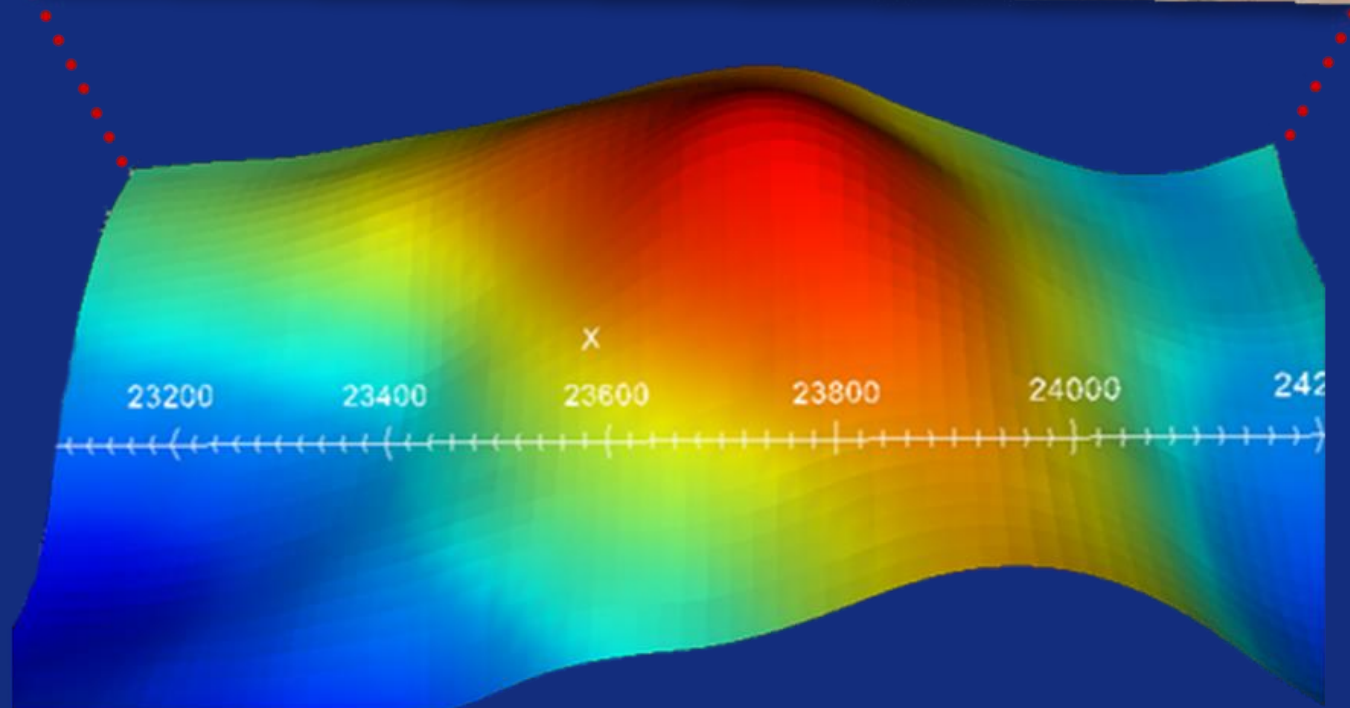
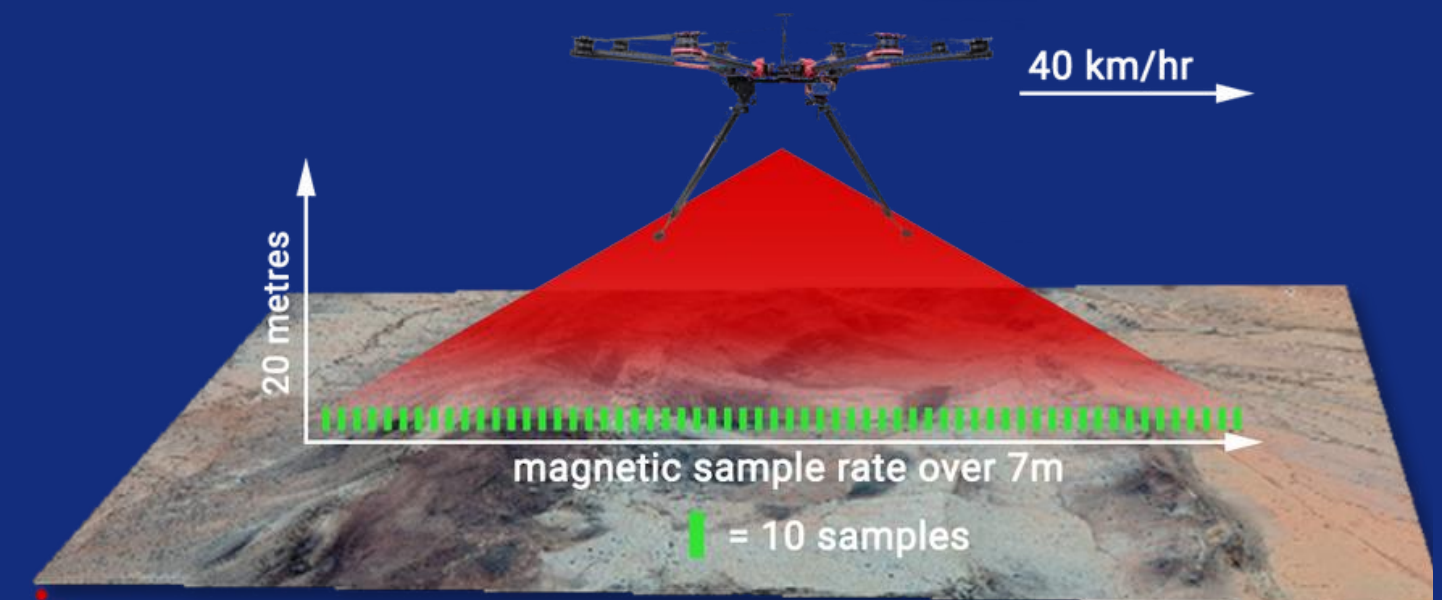
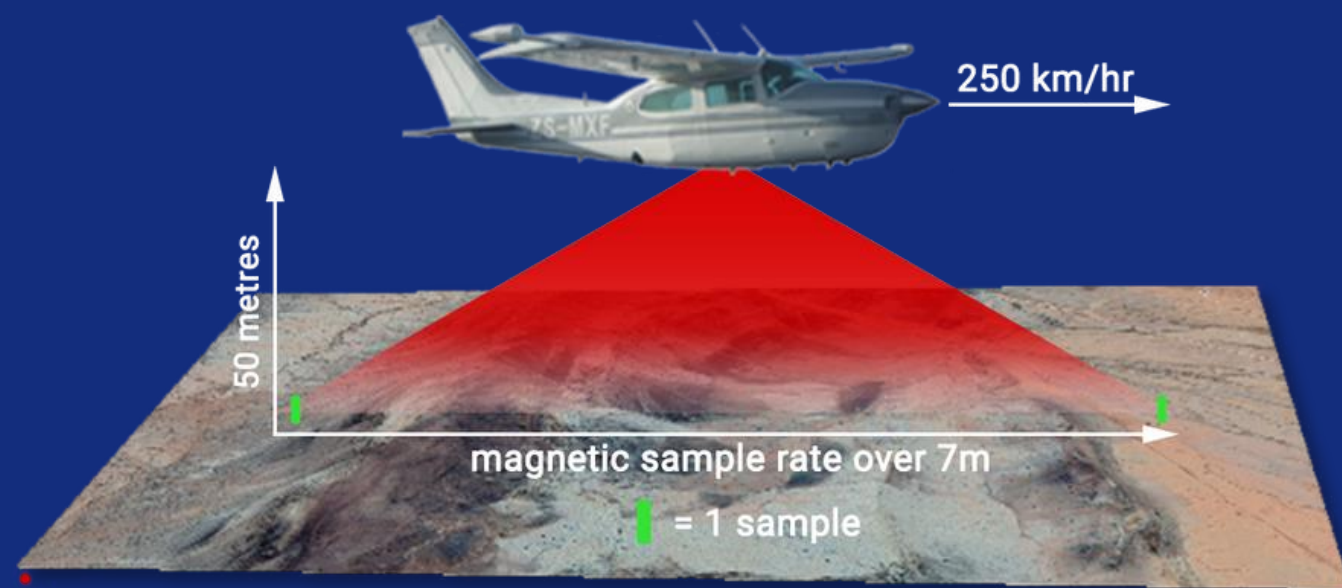
- Can reduce the survey time by up to **10x** that of a terrestrial survey.
- If a **terrestrial survey** takes **1 year** a **drone magnetic survey** takes just **1 month** to complete the same survey area.
- A project that may take **3 - 4 years** to Complete by traditional Terrestrial mapping **Magnetic Geophysical survey** , will be **completed just in 5-6 months by Drone Magnetics**

Advantages of Drone based Magnetometer

FIXED WING (Manned) Vs UAV MAGNETIC



Lower flying height, slower flying speed and the MagArrow magnetometer sampling at 1000 Hz, **100 times faster than current magnetometers, results in a more detailed map.**



FIXED-WING DATA SAMPLING

- 100-200m flying height
- 100m line spacing
- **10 samples per second**

UAV DATA SAMPLING

- 25M flying height
- 25m spacing
- **1000 samples per second**

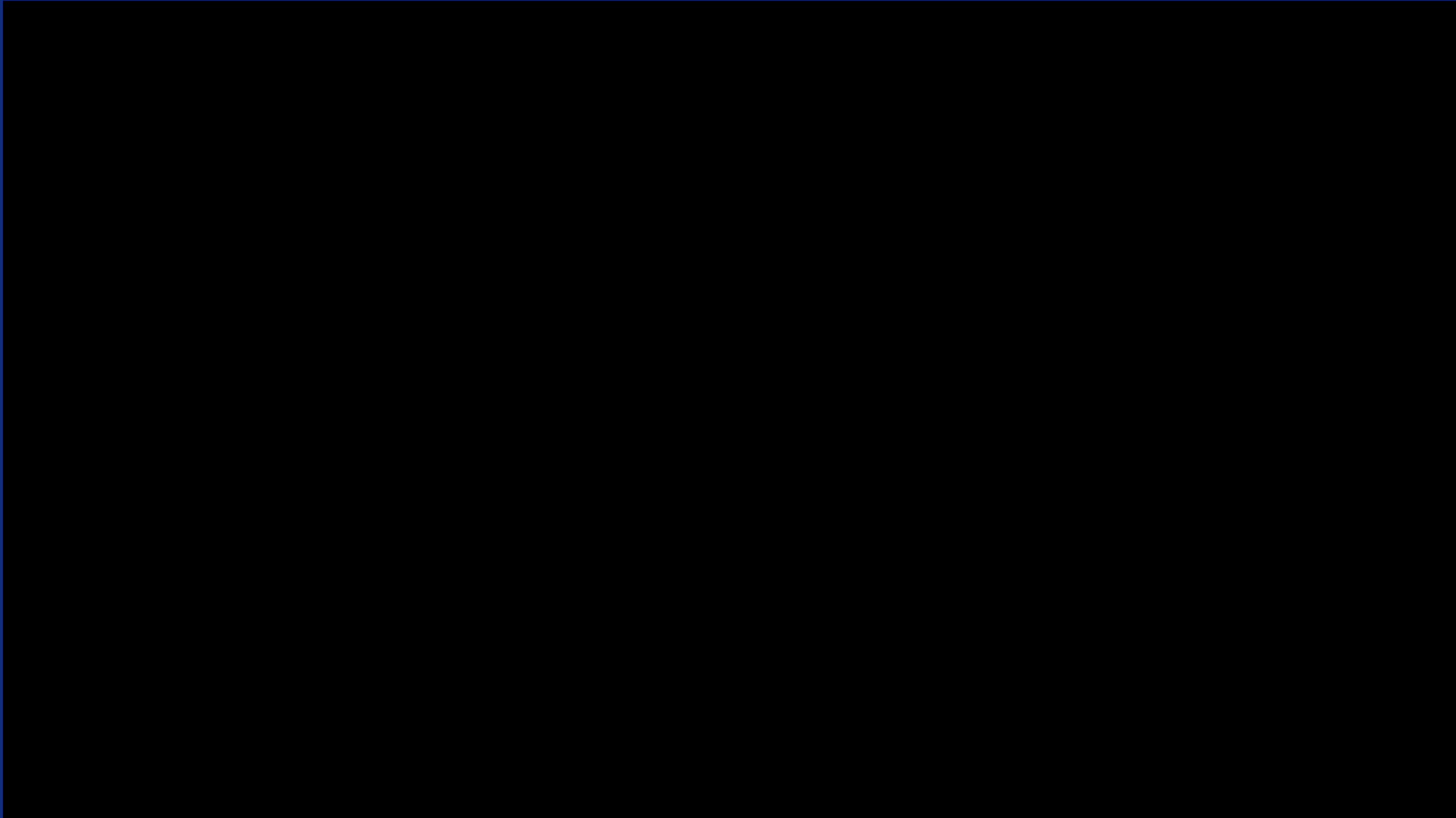
Drone Base Magnetometer



- Centimetre data sampling intervals
- Slow acquisition speeds
- Total system integration
- Excellent redundancy systems
- Green (low) Risk rating for Safety and Risk assessments

- Full autonomous flight
- Terrain following
- Precision flying in severe terrain
- Capable of flying at night
- Excellent for high detailed magnetic surveys, water detection, boreholes, well detection
- Magnetic sampling at 1000 times a second





**MAGARROW
DRONE BASED
GEOPHYSICAL SURVEY**

MAGARROW-DRONE BASED GEOPHYSICAL SURVEY





DRONES ARE HERE TO SHAPE THE MINES OF THE FUTURE

WE COULD JOINTLY MAKE THE FUTURE OF YOUR MINE SAFER, SMARTER & SUSTAINABLE.



//////
DRONES ARE HERE TO SHAPE THE MINES OF THE FUTURE

**....WE CAN TOGETHER SHAPE
THE FUTURE OF your MINes**




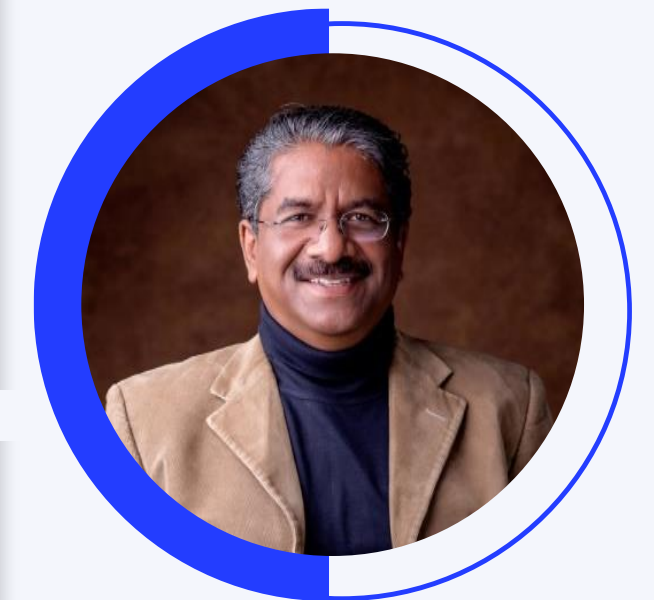
 **www.squadrone.co.in**

THANK YOU

Team SQUADRONE

 **services@squadrone.co.in**
+91 98807 88836

 **Bellandur,**
Bangalore, India 560103



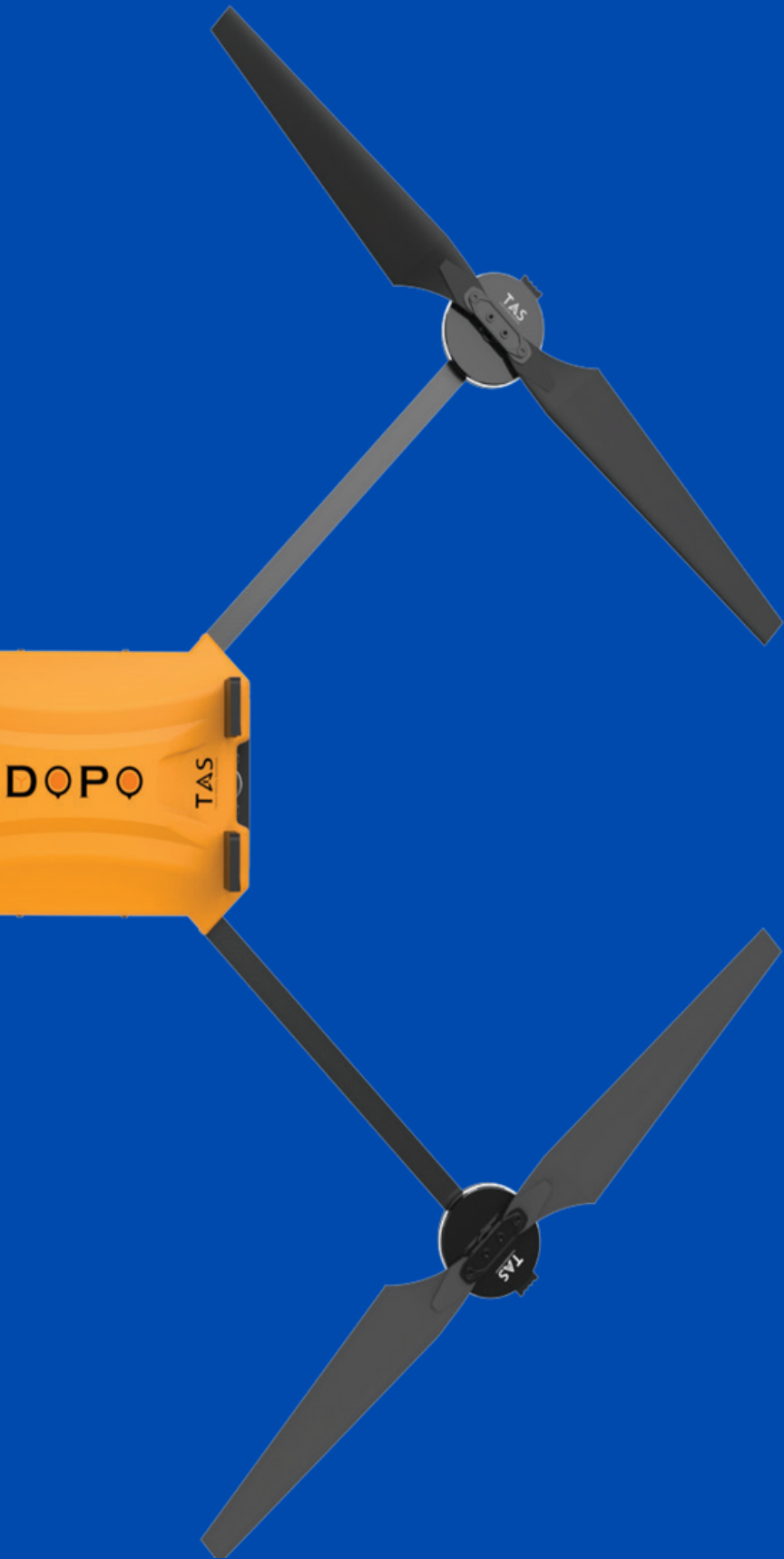
CYRIAC JOSEPH
FOUNDER &
CEO



DRONE SPECIFICATIONS

DGCA APPROVED DRONES

- **MODEL - : Lookout VTOL TALV 2400 (DOPO)**
- **ENDURANCE - 40 minutes per flight**
- **RANGE - 5-6 km can be extended up to 10kms**
- **SENSOR - Sony Alpha 600, 24 Mega Pixels RGB Camera**
- **TYPE - PPK DRONES.**
- **The drone has Return To Home feature.**



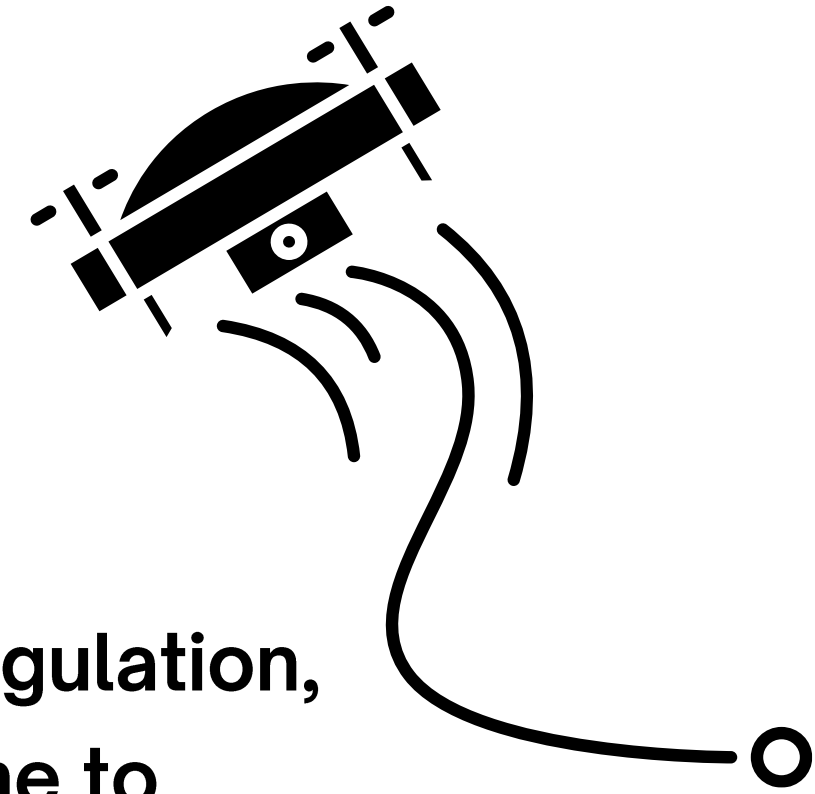
STANDARD OPERATING PROCEDURE

DGCA REQUIREMENTS



DRONE AGENCY REGISTRATION & PERMISSIONS

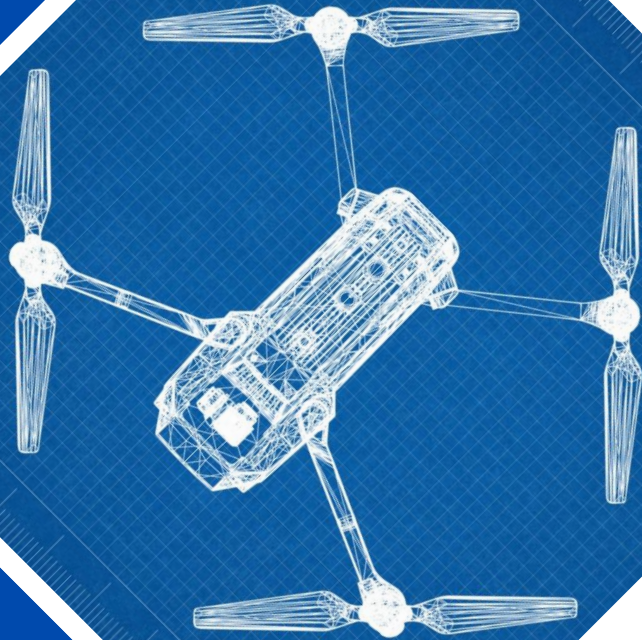
Drone agencies adhere to all the rules, regulation, guidelines etc., notified by DGCA from time to time





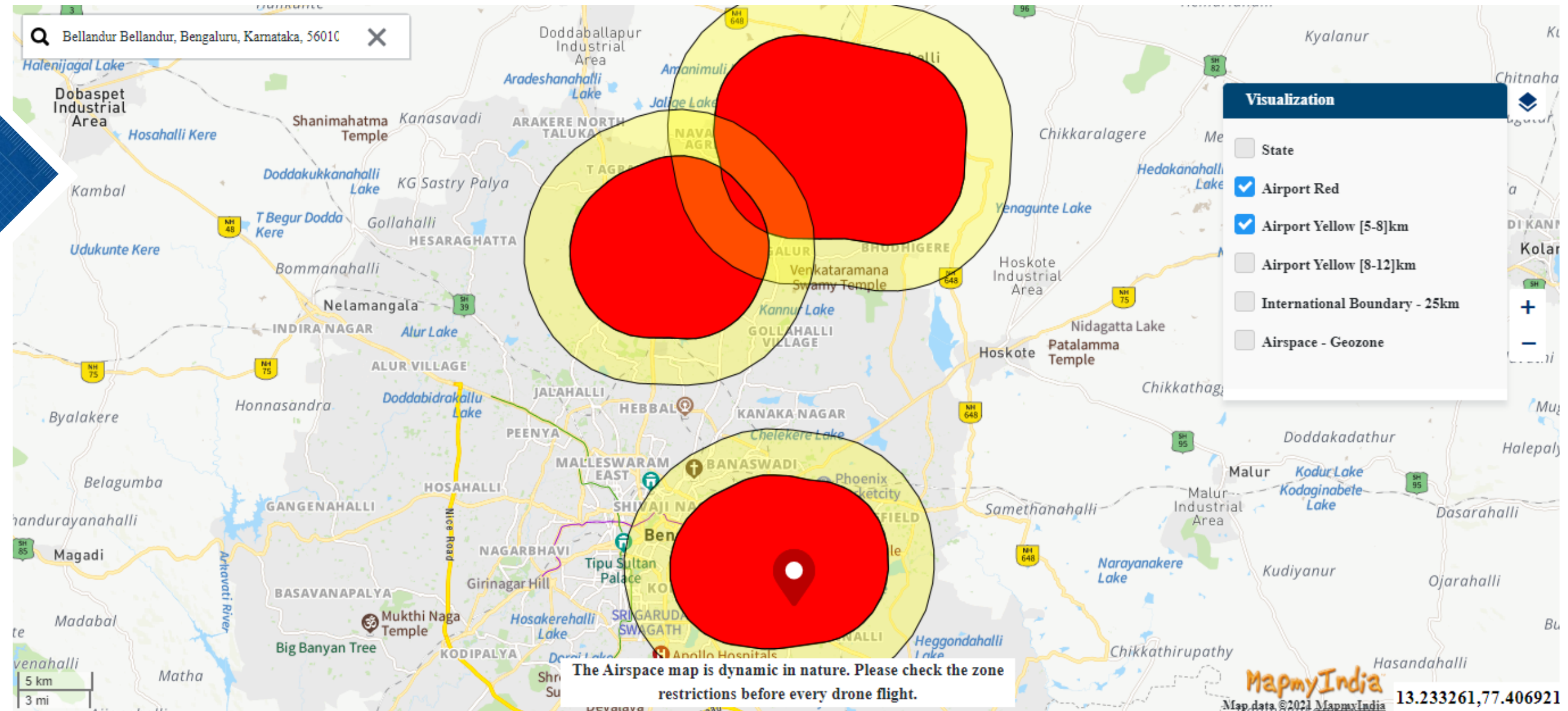
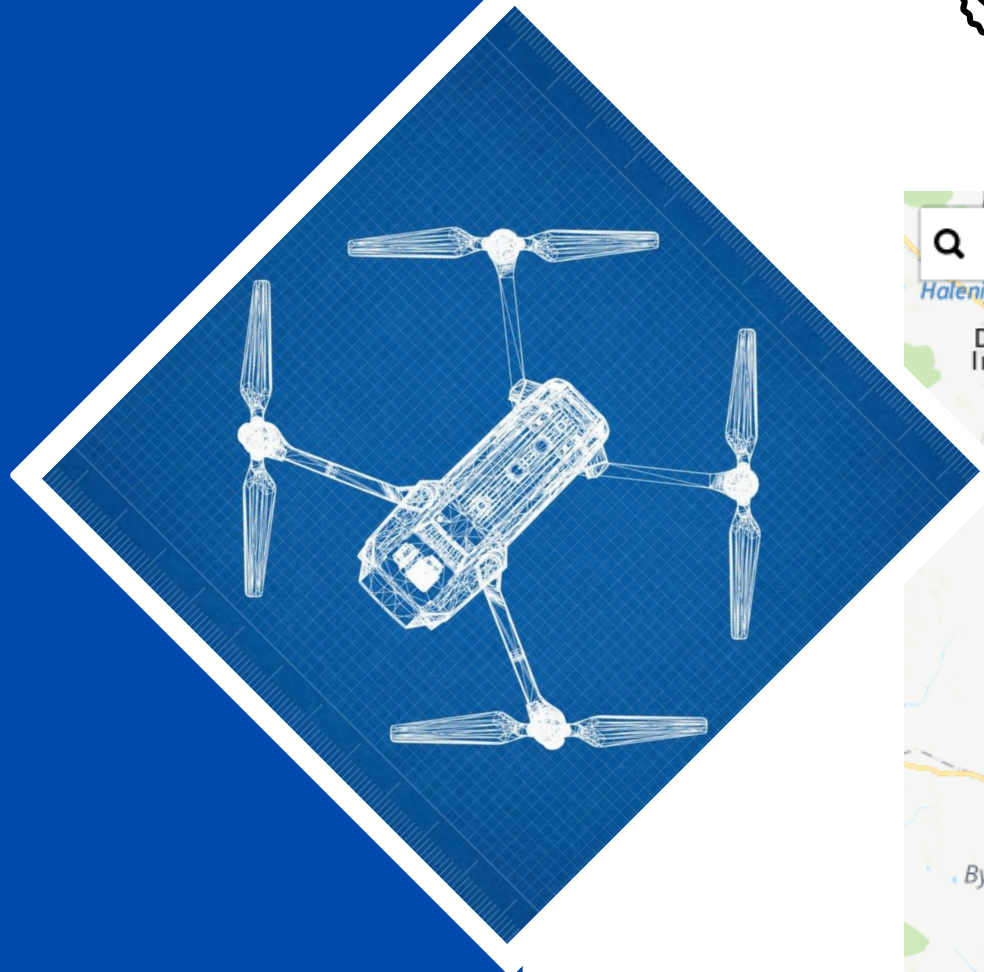
DGCA REQUIREMENTS

- Only DGCA Approved drones must be used for the survey
- Remote pilot licence by DGCA is required.
- Drones Should have an UIN issued by DGCA.
- Maximum flying height - **120 m agl.**
- Permission from central government is required to fly in **RED ZONE**



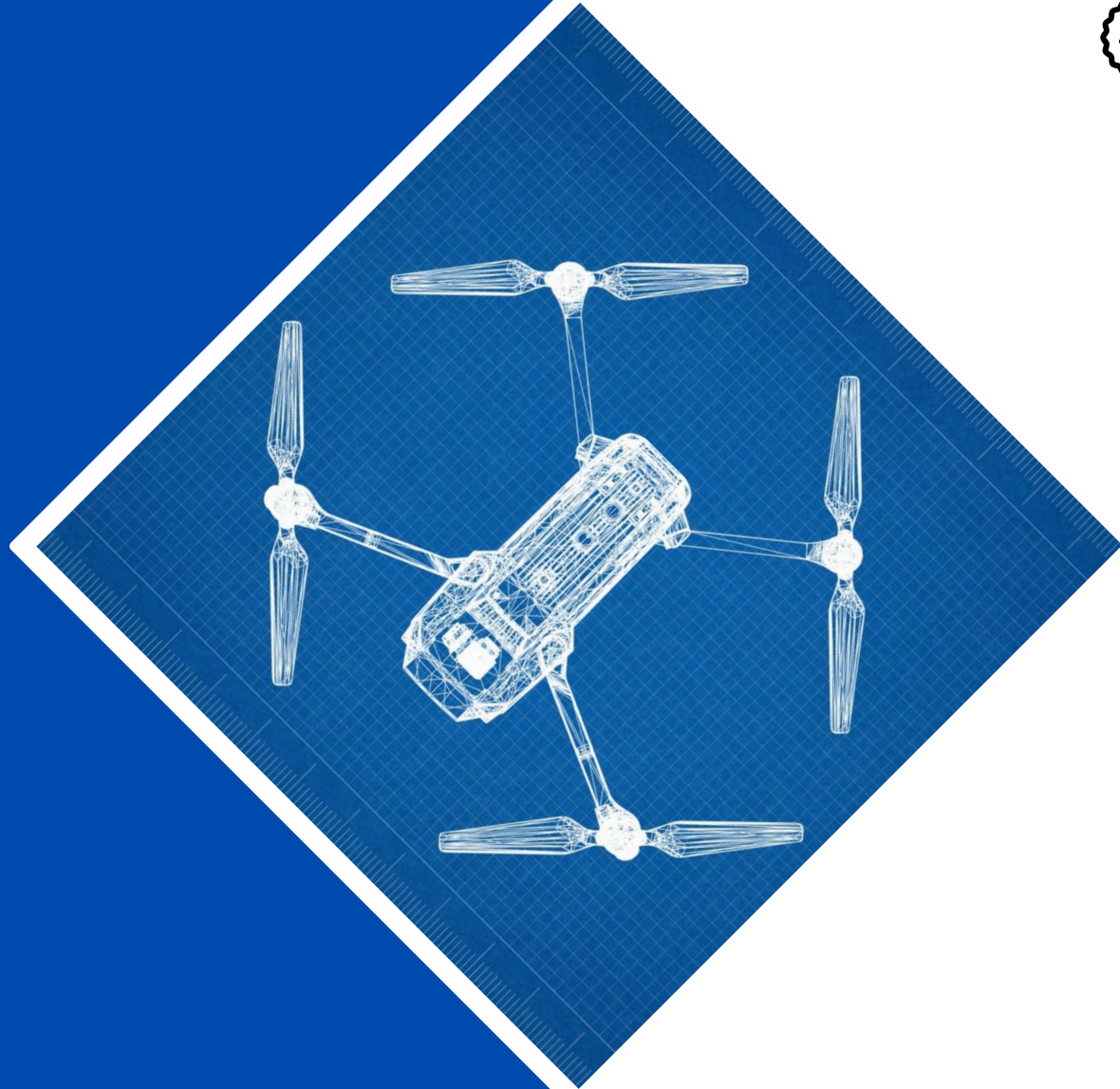


DGCA REQUIREMENTS





DGCA REQUIREMENTS



RED ZONE -

- No Free Fly-zone in Designated /sensitive areas
- upto 5 km from Airports.

GREEN ZONES - Free to fly Upto 120 meters AGL.

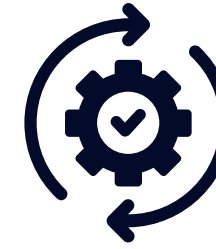
YELLOW ZONE -

- Any Flying within 5 - 8 km from perimeter of any operational Airport.
- above 60 metres in the area located between the lateral distance of 8 km and 12 km from the perimeter of an operational airport.
- The airspace above 120 metres in the designated **GREEN ZONE**

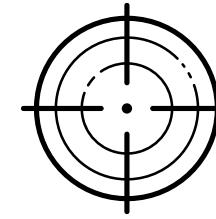




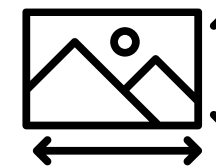
ADVANTAGES OF DRONE SURVEY



Improve the overall efficiency accurate and comprehensive data



The data accuracy and authenticity is far superior than the traditional survey.



High resolution (cm level) data of Drone



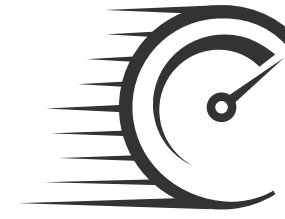
Stockpiles of irregular shape and exhibiting craters can be easily surveyed with great precision than using traditional methods.



Enhanced safety and Less human intervention in mine



ADVANTAGES OF DRONE SURVEY



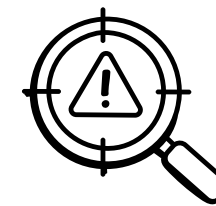
Drones surveys are faster



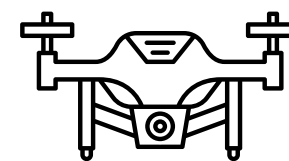
Survey of Inaccessible/ Hazardous areas



Easily repeatable mining surveys at low cost.



Changes between two surveys can be tracked and highlighted automatically.



Drone aerial images can be used to generate point clouds, DSMs, DEMs and a 3D reconstruction of a mining site

