The Geological Society of Zimbabwe

Drones in Mining

Speaker: Tatenda S. Mafara

General Manager - Iron Mask Aerotech (Pvt.) (Ltd.)

Speaker:
Tatenda S. Mafara

An avid drone enthusiast with an extensive background in land survey and geomatics. From architecture to production, this passion for disruptive technologies coupled with a BSc. Honors Degree in Geo-Informatics and Surveying has helped Tatenda gain international work experience in cadastral and engineering surveying. He is a driven individual with vast knowledge and skill in a variety of geospatial analysis and management applications. A Licensed drone pilot with experience operating fixed-wing and multi-rotor systems.

His great love for the RPAS technology and its broad applications in Remote Sensing and surveying has seen him start **Iron Mask Aerotech (Private) Limited** – a company that is focused on bringing Land Surveying and Geomatics industry in Zimbabwe & Africa into the 21st Century.

The Ultimate
Geospatial Data Partner

We are a Zimbabwean registered company with our main office of operations located in Harare. We specialize in drone-based digital photogrammetry and remote sensing solutions for mapping and exploration works in the mining, construction, and agriculture industries, with adaptive capacity for other sectors that include forestry, emergency response, disease response and biosecurity.

Who We Are

Registered

COMPLIANCE

Drone

Equipment

Personnel

Operations

Geospatial-Data

Data Collection

Data Analysis

Data Solutions & Insights

IRON MASK
AEROTECH (PVT) LTD

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What We Do

2021

At Iron Mask Aerotech (Private) Limited

01 Aerial Surveying & Mapping

02 3D Modelling & Infrastructure Inspections

03 Unmanned LiDAR Surveys

04 Stockpile & Pit Volumetric Analysis

05 Unmanned Aeromagnetic Surveys

06 Precision Agriculture Surveys

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OUR MINING SOLUTION

Drone technology is no-longer in the future – it is here, today and we are exploring its unlimited potential in mining. Our mining solutions deliver significant value for mining businesses. The cost – effective solutions have replaced labour intensive methods of inspection, mapping, exploration and surveying. These solutions include:

- **Drone Magnetic Surveys for Exploration** have proved to be effective in mapping of possible trends of mineral deposits. The insights that complement other geophysical exploration tools e.g., seismic, ground penetrating radar & induced polarization
- **Mapping & Surveying** of the entire mining area and ensure up-to-date site plans and change detection in the structure of the mine (landslides, damages to infrastructure)
- **Pit & Pile Inventory Management** – Volume assessments of stockpiles, dumps and pits that allow for reliable tracking of the movement of material.

OUR PRODUCTS

1. Total Magnetic Intensity Maps
2. Topographical Plans
3. High Resolution Orthomosaic Maps
4. Stockpile & Pit Volumetric Assessments
5. As-Built/ Digital Twin Surveys
6. Deformation & Structural Integrity Monitoring

HIGH RESOLUTION

GEOREFERENCED ORTHOMOSAICS

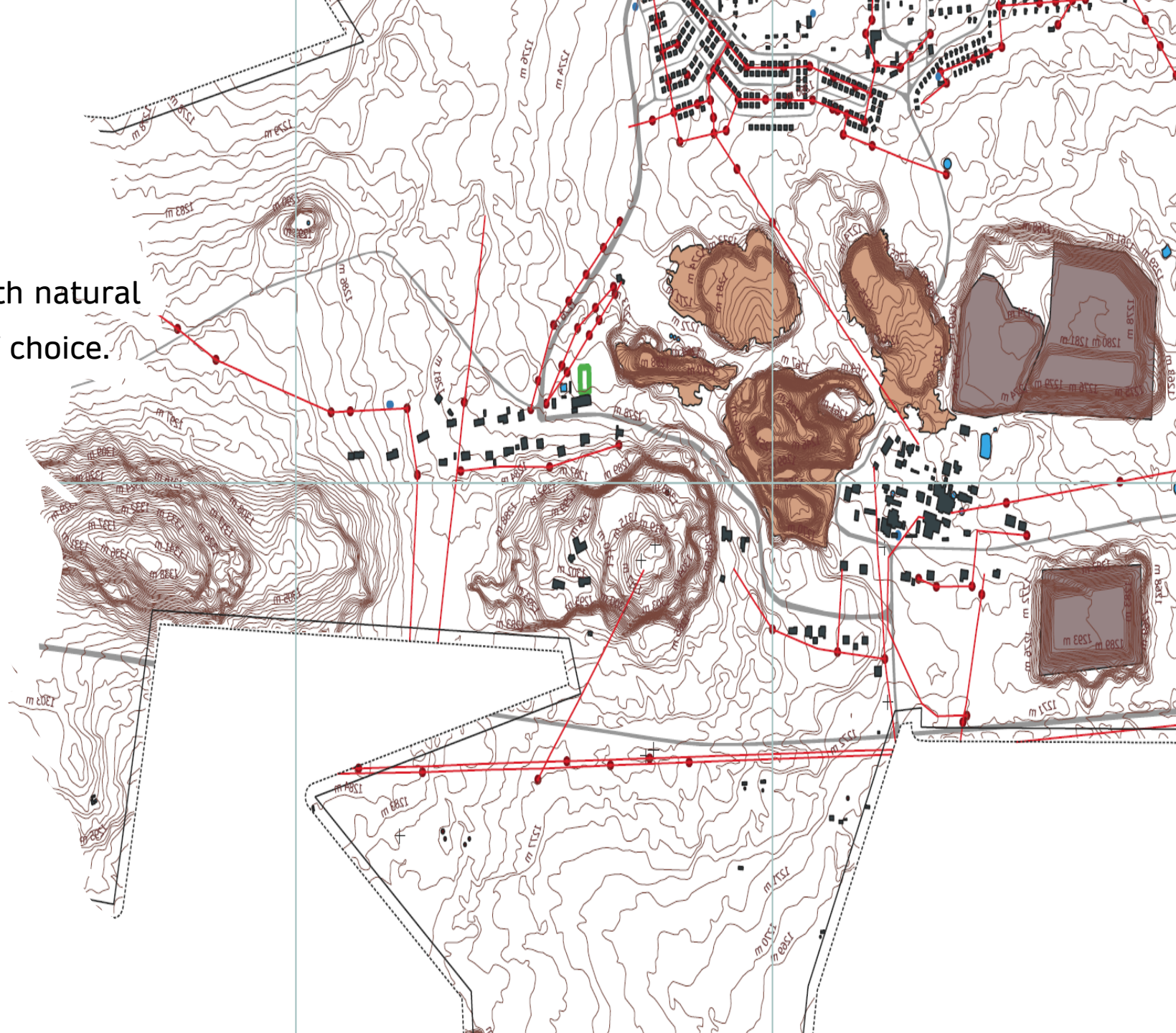
- Full colour
- Up to 2cm/pixel ground resolution
- Measurable & to-scale
- 2-3 x GSD horizontal accuracy

DETAILED

TOPOGRAPHICAL PLANS

Engineering standard maps defining both natural and man-made structures in the area of choice.

- Detailed feature map
- Measurable & to - scale
- High point density

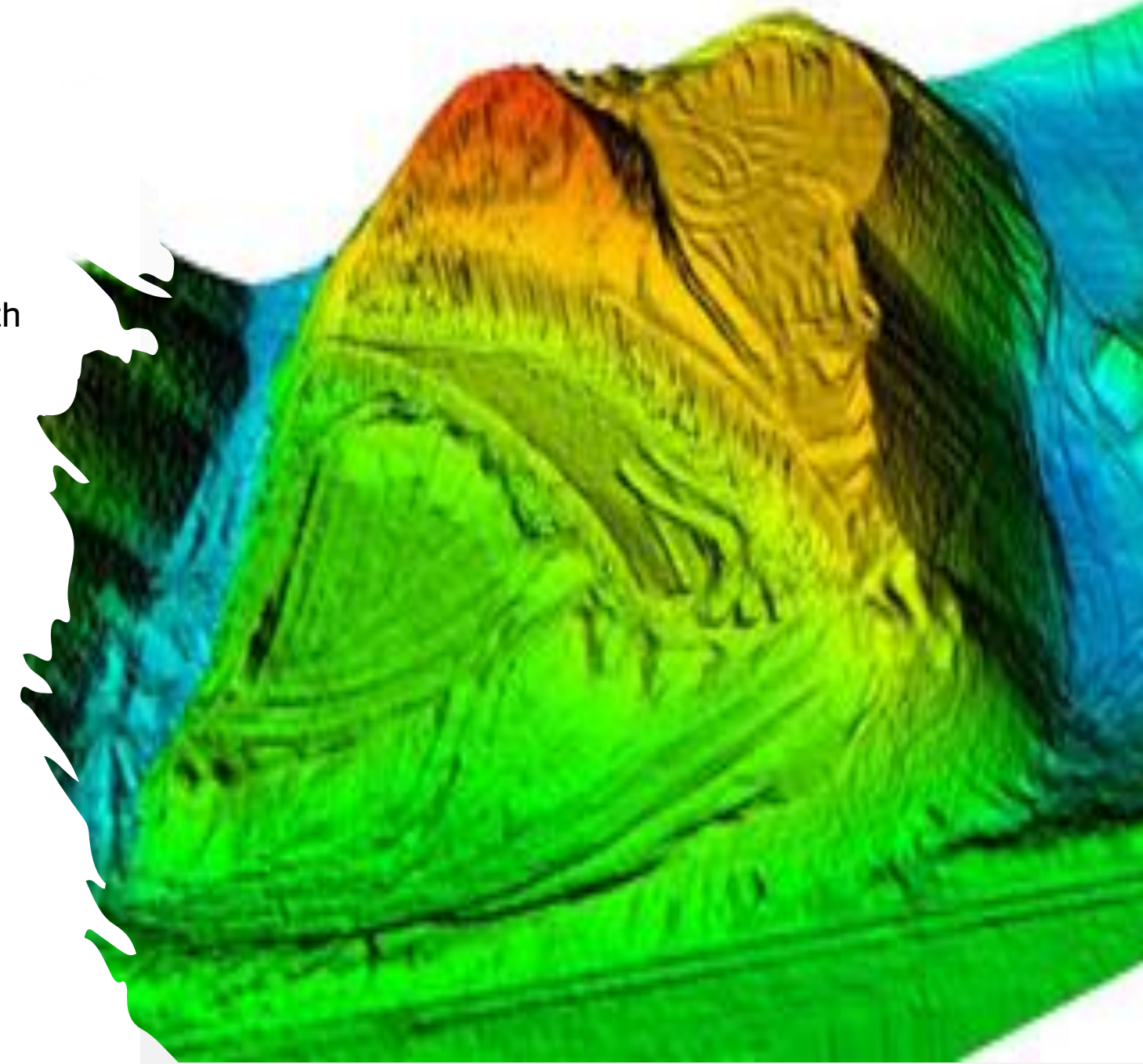


STOCKPILE & PIT

VOLUMETRIC ASSESSMENTS

Our stockpile & pit analysis grants you the opportunity to compare your current stockpile with the previous surveys to track site progress.

- 100% coverage of surface
- Slope & stability analysis
- Monthly reports with detailed change analysis
- High positional accuracy



DRONES FOR MINERAL EXPLORATION

- Understanding Drones
- Understanding Geophysical Magnetic Surveys
- Why choose drone mag
- Immense Opportunities

UNDERSTANDING
Drones

The term “drone” usually refers to any unpiloted aircraft. Sometimes referred to as “Unmanned Aerial Vehicles" (UAVs), these crafts can carry out an impressive range of tasks, ranging from military operations to package delivery. Drones have of late been developed to perform geophysical surveys; more specifically aeromagnetic surveys.

- Fixed Wing

- Multi- Rotor

- Hybrid (VTOL)

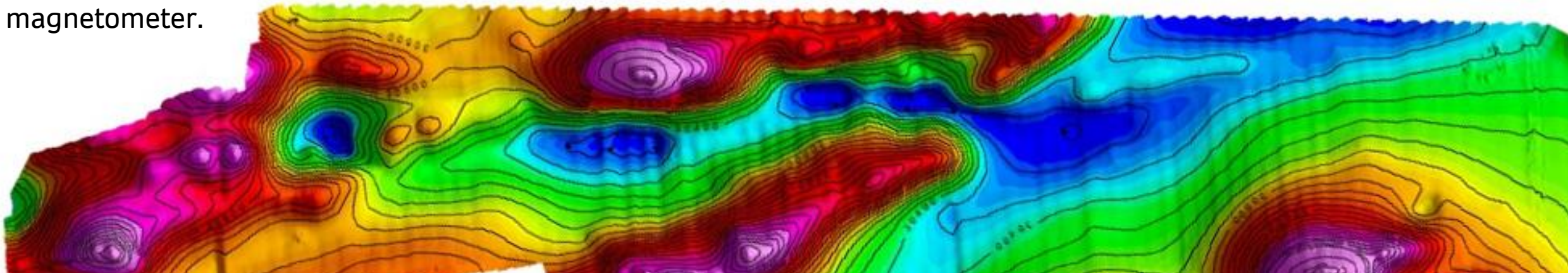
UNDERSTANDING

Geophysical Magnetic Surveys

The interaction of the Earth's Magnetic Field with magnetically susceptible bodies introduces variations (high of Low) of the earth's local magnetic field resulting from the magnetic properties of the underlying rocks and minerals.

Magnetic Surveys are performed to investigate the subsurface to improve understanding of the regional or local geological setting and history or to identify POTENTIAL ECONOMIC RESOURCES.

To measure the Earth's magnetic field intensity and vector components Magnetometers are used. A few different types of magnetometers are currently in use and these include: fluxgate, proton precision and optically pumped magnetometer.



MAGNETIC SURVEY
METHODS

An **aeromag** survey is a common type of geophysical survey carried out using a magnetometer aboard or towed behind an aircraft. The principle is like a magnetic survey carried out with a drone (**Drone Mag**), but allows much larger areas of the Earth's surface to be covered quickly for regional reconnaissance.

The main difference between the two airborne magnetic surveys and **ground mag** is that ground magnetics relates to the use of a hand-held magnetometer and pacing on the ground to cover the area of interest.

- Ground Mag

- Drone Mag

- Aeromag

Why Choose

Drone mag offers numerous advantages over both Aeromag & Ground magnetics and is posed to be the go-to Geophysical Survey solution of the future.

Drone Magnetics offers among others the following:

Ground Mag

- Eliminates need to clear obstacles to open survey lines
- 10x faster coverage of Survey Areas (15 minutes to cover 10 Ha)
- More consistent straight survey lines & line Spacing
- Comparable resolution with ground mag data
- Less in-field Man hours
- Safer data collection operations

AeroMag

- Easier to deploy within Survey Area
- Less operational overheads for areas below 3500 hectares
- More consistent straight survey lines & line Spacing
- Much higher resolution with ground mag data
- More Affordable
- Tighter Terrain following capabilities to maintain height above ground

OUR DroneMag
OFFER

1. 200 Hectares Per Day
2. 55m Terrain Clearance with terrain following
3. 25m Line Spacing
4. 3.5m Sample Spacing
5. Image overlay with up-to-date Aerial Image

Sensor Specs

Specifications	
Magnetometer	SAS-35U/25U
Sensitivity	0.0002nT @ 1Hz
Resolution	0.0001nT
Absolute accuracy	0.1nT
Heading Error	0.05nT
Dynamic range	15000 to 120000
Gradient tolerance	50000nT/m
Sampling intervals	1 2 5 10 20Hz
Operating temperature	Minus 40 to 50

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OUR PROCESS

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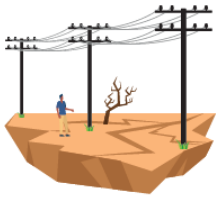
1. Client Liaison

2. Project Planning

3. Flight Planning

4. Mobilization



5. Field Reconnaissance

6. Site Calibration

7. Ground Survey

8. Aerial Data Capture

9. In-Field Data QA

10. Data Processing

11. Delivering & Reporting

12. Feedback

IMMENSE

OPPORTUNITIES

- Gain insights that complement other geophysical exploration tools e.g., seismic, ground penetrating radar & induced polarization
- Track movement of material from pit to plant to dumps and stay up to date with inventory data.
- Accurately plan and make evidence-based decisions on structural developments within your mining operations.

Our Team

Tatenda Mafara

General Manager

Terence Tarusida

Operations Manager

Melissa Afeki

Accountant

Nyasha Chigume

GIS Analyst

Denzel Hobwana

Surveyor Pilot

Summertime Ncube

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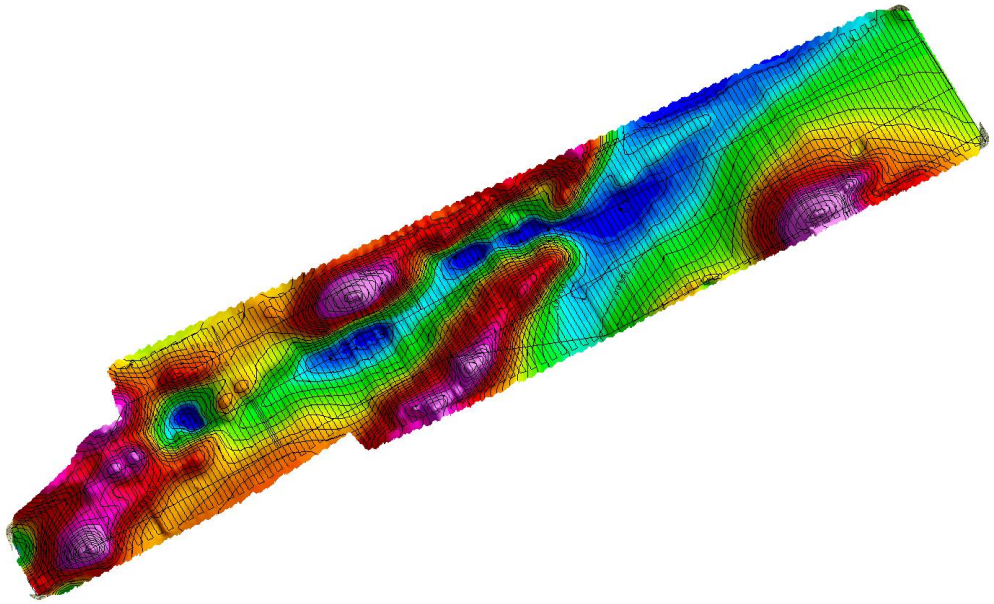
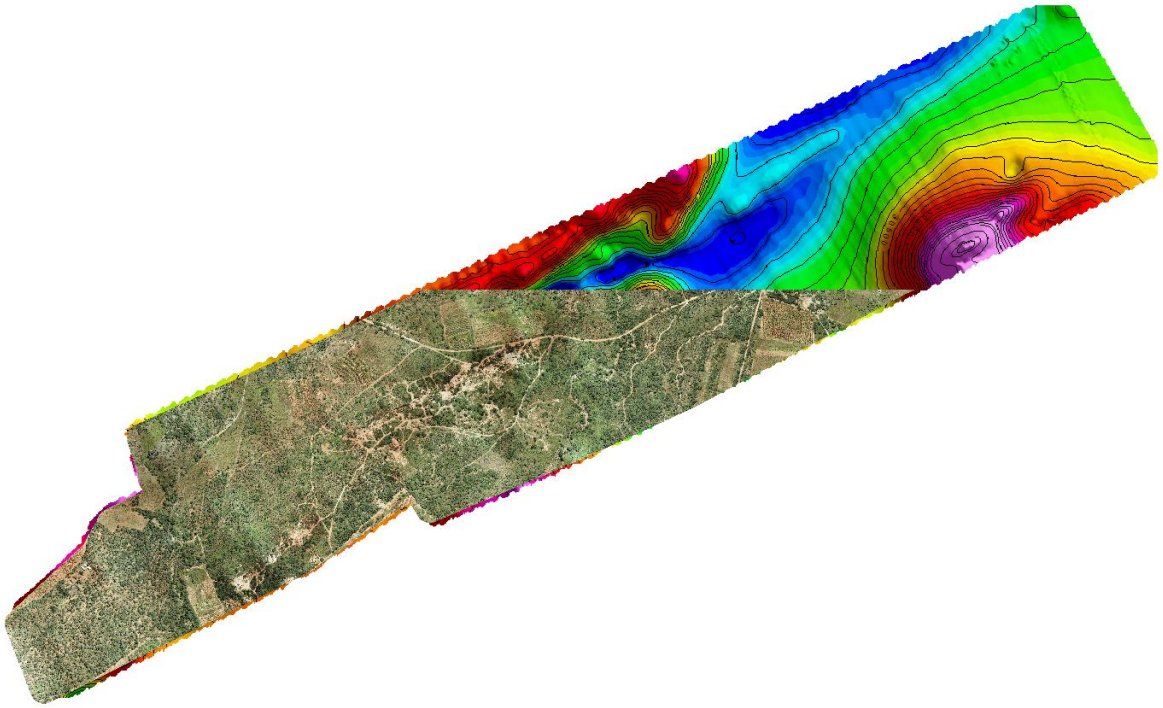
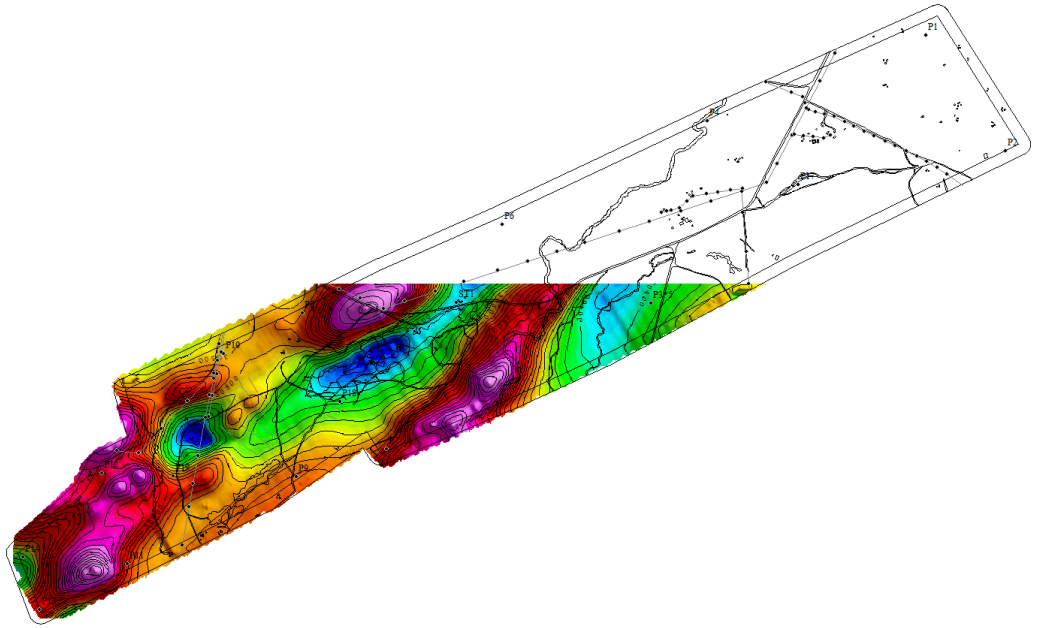
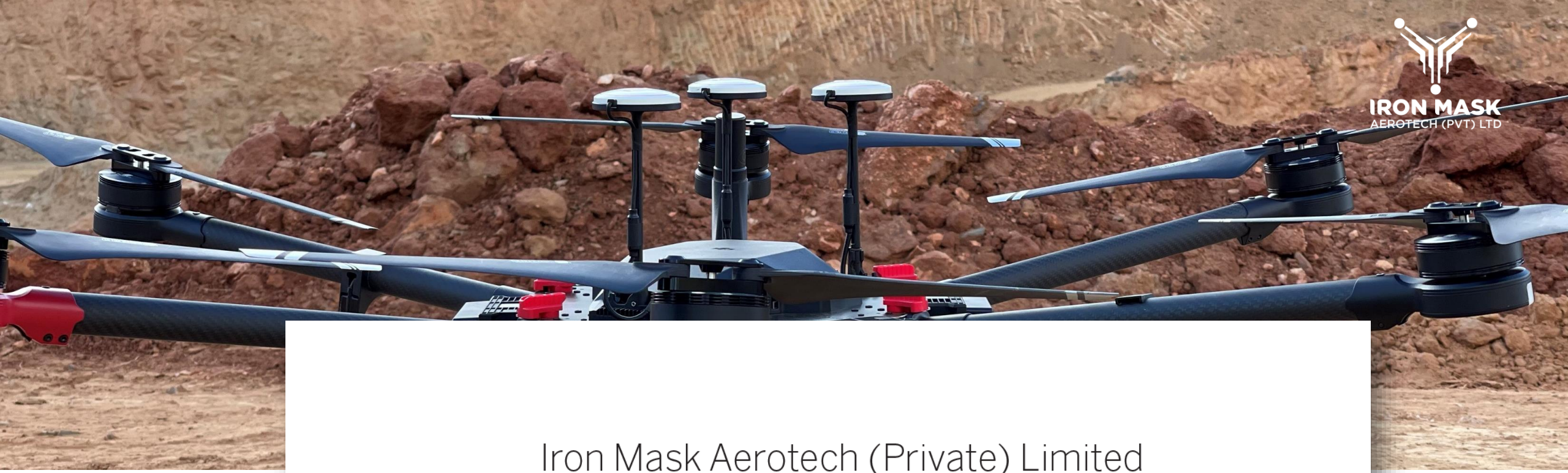
Sample Images







Our Gallery



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