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Assessment Report

Drone Magnetic Survey

Sharpe Township Property
Sharpe Township
Larder Lake Mining Division

Prepared for:
Rod Grabowski

Prepared by:
Matthew Johnston, P. Geo.

Mining Claims:
150801,186825,199545,216023,218013,274499

Sharpe Township, Larder Lake Mining District

December 1, 2021

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1.0 Introduction

A drone magnetic survey was conducted on the Sharpe Township property (see Figure 2). Mining claims covered by this survey include 150801,186825,199545,216023,218013, 274499 and are located in Sharpe Township, Larder Lake Mining Division.

On August 17, 2021 the mining claims were surveyed using a Geometrics MFAM magnetometer mounted on a DJI M600 drone. Fera UAV of Timmins, Ontario, carried out the magnetic survey on a contract basis for the client. The survey was performed in order to evaluate the potential for kimberlite within the claim group.

Data processing and maps were completed between Aug 17 and Dec 1, 2021 and the Assessment report was prepared between Aug 20 and Dec 1, 2021.

2.0 Location and Access

The property is accessed by travelling east along Hwy 101 and Hwy 11 from Timmins for 125 km to the Hwy 66 junction near Kenogami, then 22 km south-west along Hwy 66 toward Matachewan. The final 20 km is along logging roads that lead to the property. Figure 1 shows location and access.



Figure 1 – Location and Access

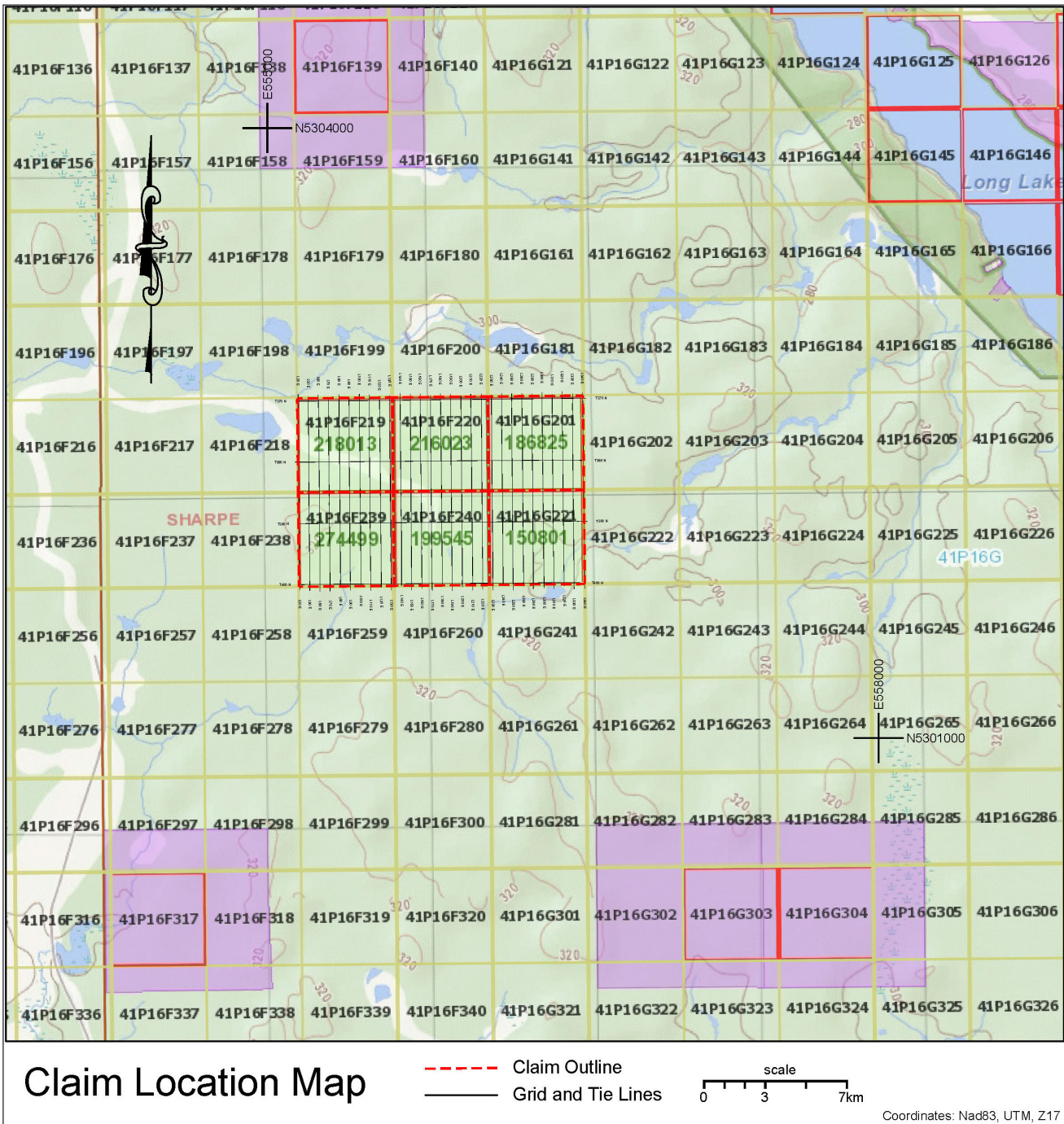


Figure 2 – Claim and Grid Location Map

3.0 Regional and Property Geology

Regional Geology

The Sharpe Township property lies near the centre of the Round Lake Batholith, an Archean age (2.685 Ga) intrusive into the southern portion of the Abitibi Greenstone belt. This area of the batholith is within the Indian Chute Stock, a granodiorite-tonalite with quartz monzonite affinities consisting of a homogenous red to mottled white rock with a weak east-west trending foliation, accentuated by oriented xenoliths which average 5% of the rock (P.J. Lafleur, 1986, unpublished MSc thesis, University of Ottawa).

In 2005, the large, diamondiferous Lapointe kimberlite pipe, located in the northeast corner of Sharpe Township, was discovered by Tre-Or Resources Inc. Also, an Open File Report by the Ontario Geological Survey in 2005 (OFR 6170), reported the recovery of a diamond from a lamprophyre dike cutting the Round Lake Batholith in Chamberlain Twp, 15 km east of the property.

Property Geology

Outcrops encountered on the property consist of granitic rocks containing mainly feldspar, quartz, biotite, and hornblende. Mafic xenoliths up to 5 cm were encountered. Matachewan Diabase dikes, trending more-or-less 180 degrees, were observed cutting the granite on the eastern part of original claim L4202093. Jointing and fractures in the rocks generally trend 070 degrees, roughly parallel to a creek-filled lineament at the north end of the claim group. This lineament can be traced for about 2 km to the east, to the north-west trending Cross Lake Fault. Diamonds have been found in kimberlite pipes and lamprophyre dikes related to this structure.

4.0 Property History

2010 – Recutting claim lines

A total of about 4,000 metres of claim lines were cut. Some areas had little growth while others were more heavily grown in with alders. A wet swampy area in the northeast corner of the claim group was not able to be cut. This area was flagged.

2012 – Stripping

Bulldozer stripping of seven areas totaling 1,800 sq. m. Three areas exposed by an excavator during a previous soil sampling program were also mapped.

2016 – Recutting claim lines

A total of about 4,500 metres of claim lines were cut. Some areas had little growth while others were more heavily grown in with alders. A wet swampy area in the northeast corner of the claim group was not able to be cut. This area was flagged.

5.0 Summary of 2021 Drone Magnetic Survey

The program consisted of 1 grid summarized as follows:

Surveyed on August 17, 2021: **Total 33.4 line kilometers**

Altitude: **50m above ground level**

The grid lines were spaced 100 m apart and flown at an azimuth of 0 degrees with 4 tie lines spaced at approximately 300 m intervals and flown at an azimuth of 90 degrees.

A Geometrics MFAM magnetometer mounted on a DJI M600 Pro hexacopter drone was used to survey all grid lines.

A Geometrics G856AX proton procession magnetometer was operated as a base station throughout the survey to provide diurnal monitoring of the local magnetic field variations. (Loc: E555748 N5302186 Nad83, UTM Zone 17).

Equipment specifications are provided in *Appendix 1, 2 and 3*.

The survey covered 6 mining claims. (Figure 2)

6.0 Processing

Magnetometer data was collected on 2 Geometrics MFAM sensors operating at 1000hz. The data was processed through a custom program operating in Python. This converts raw data from Geometrics MFAM into a format compatible with Geosoft Oasis Montaj.

Customized import templates were used within Geosoft, to identify and separate mag readings into organized grid and tie lines. This step eliminates extraneous mag data collected as the drone travels to and from the grid.

Grid and tie line data were corrected to remove heading error and lag.

Corrected grid data was then levelled based on tie lines.

7.0 Interpretation, Conclusions and Recommendations

The drone magnetic survey was successful at identifying and mapping the magnetic anomalies at the Sharpe Township project. The magnetic survey on the Sharpe Township grid indicates a very quiet magnetic background with residual magnetic values ranging between -158 and -37 nT. The background magnetic field strength is -110 nT. The overall magnetic pattern is disrupted by a few moderate anomalous magnetic highs located in the southwest and southeast area of the grid. These moderate magnetic highs are easily observed on the magnetic contour map. These magnetic anomalies may represent underlying mafic or ultramafic lithology.

The most significant magnetic feature is an interpreted fault lineament bisecting the grid at an approximate north-south azimuth. This interpreted structural lineament is located in the central portion of the grid area and trends through the entire survey area. This interpreted fault lineament may represent regional geologic structure. Several other north-south trending fault lineaments are interpreted from the magnetic data, as well as one interpreted fault lineament trending northwest-southeast. All of the interpreted lineaments are easily identified and shown on the contour maps.

The isomagnetic contour pattern suggests an underlying lithology striking in an east-west direction; notwithstanding the moderate magnetic anomalies located within the grid area. The results of the magnetic survey are presented as contoured total field and 1st vertical derivative maps.

The magnetic survey completed over the Sharpe Township grid was successful in mapping areas of anomalous magnetic anomalies and more importantly several significant magnetic lineaments. These anomalies are thought to arise from bedrock sources, and may have implications for follow-up exploration.

Any existing geological or geochemical information for the surveyed grid area will aid in further assessing any geophysical anomalies and should be incorporated into an overall assessment of the property prior to further exploration.

Magnetic data collected by drone at high density and low altitude is ideal for 3D inversion modelling. The cost for this type of advanced modelling would start at approximately \$2,000 and up to \$8,000. 3D inversion modelling is recommended as the next step for evaluating the Sharpe Township property.

Statement of Qualifications

This is to certify that: MATTHEW JOHNSTON

I am a resident of North Bay; province of Ontario since November 1, 2017.

I am self-employed as a Consulting Geophysicist, based in North Bay, Ontario.

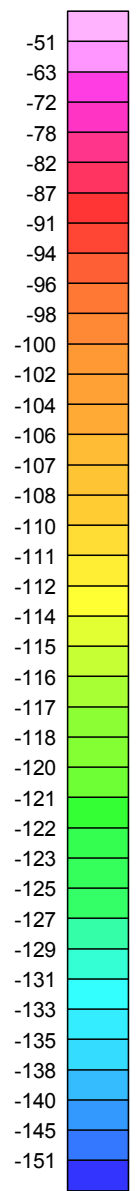
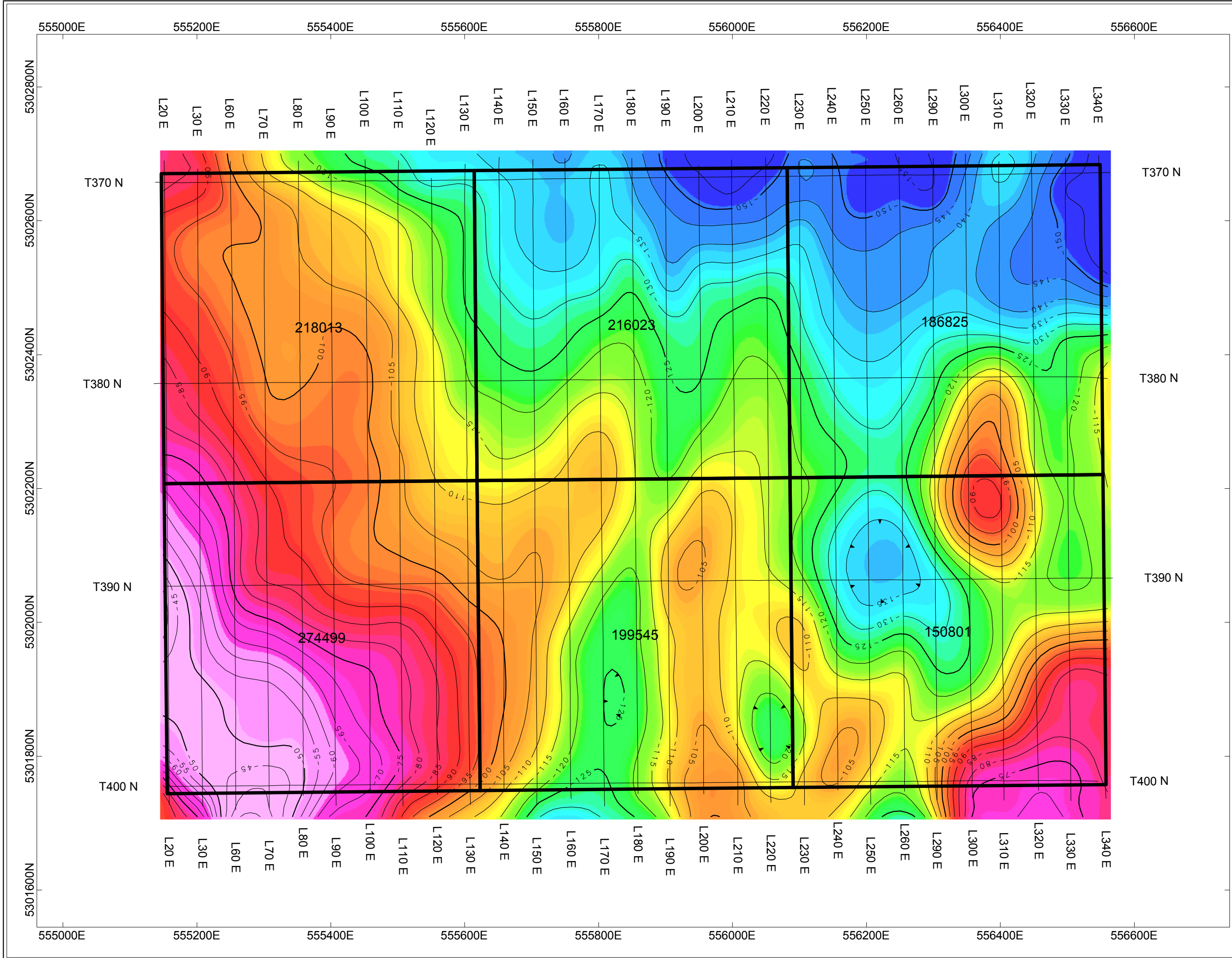
I have received a B.Sc. in geophysics from the University of Saskatchewan; Saskatoon, Saskatchewan in 1986.

I have been employed as a professional geophysicist in mining exploration, environmental and other consulting geophysical techniques since 1986.

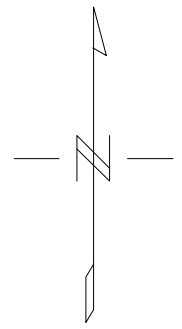
I am a member in good standing with the Association of Professional Geoscientists of Ontario as a Practicing member; membership no. 2046

Signed in North Bay, Ontario, this December 1, 2021

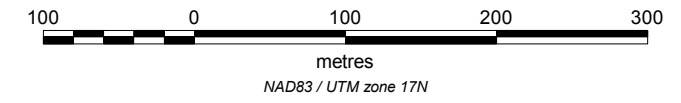
A handwritten signature in purple ink that reads "Matthew Johnston". The signature is written in a cursive style with a large initial 'M'.



TMI
nT

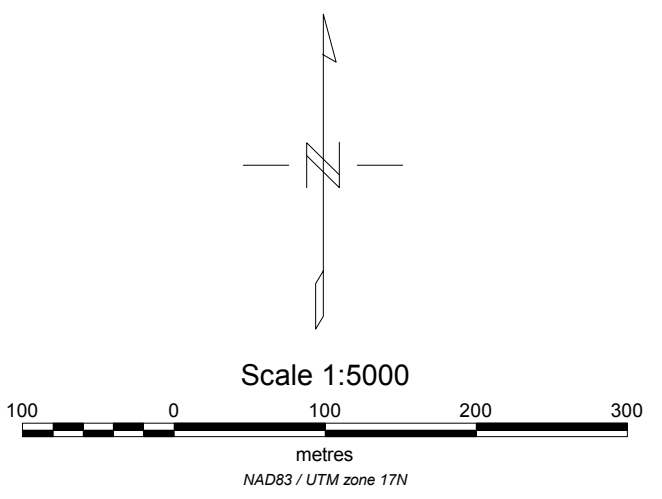
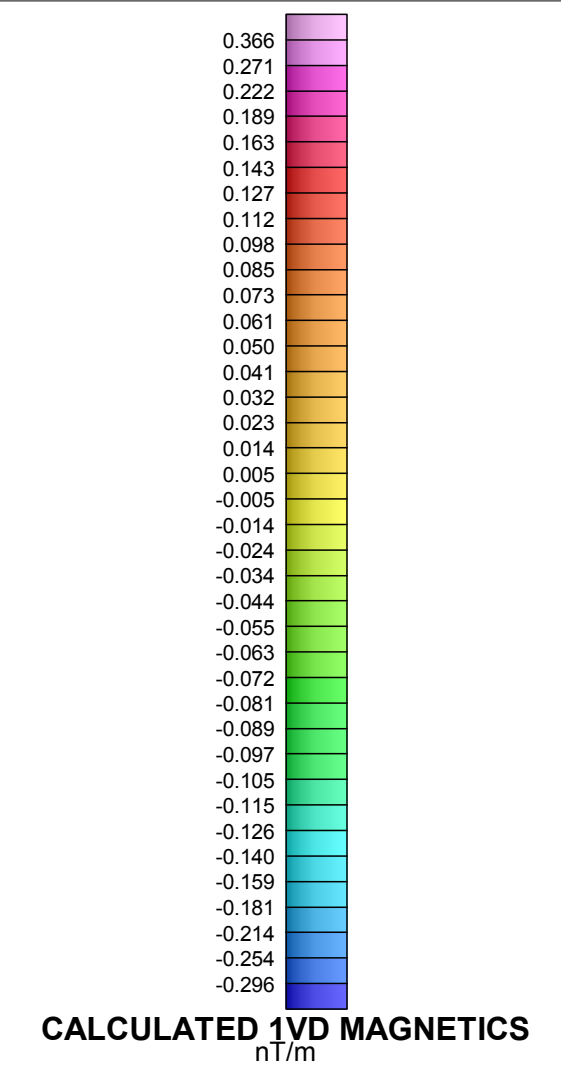
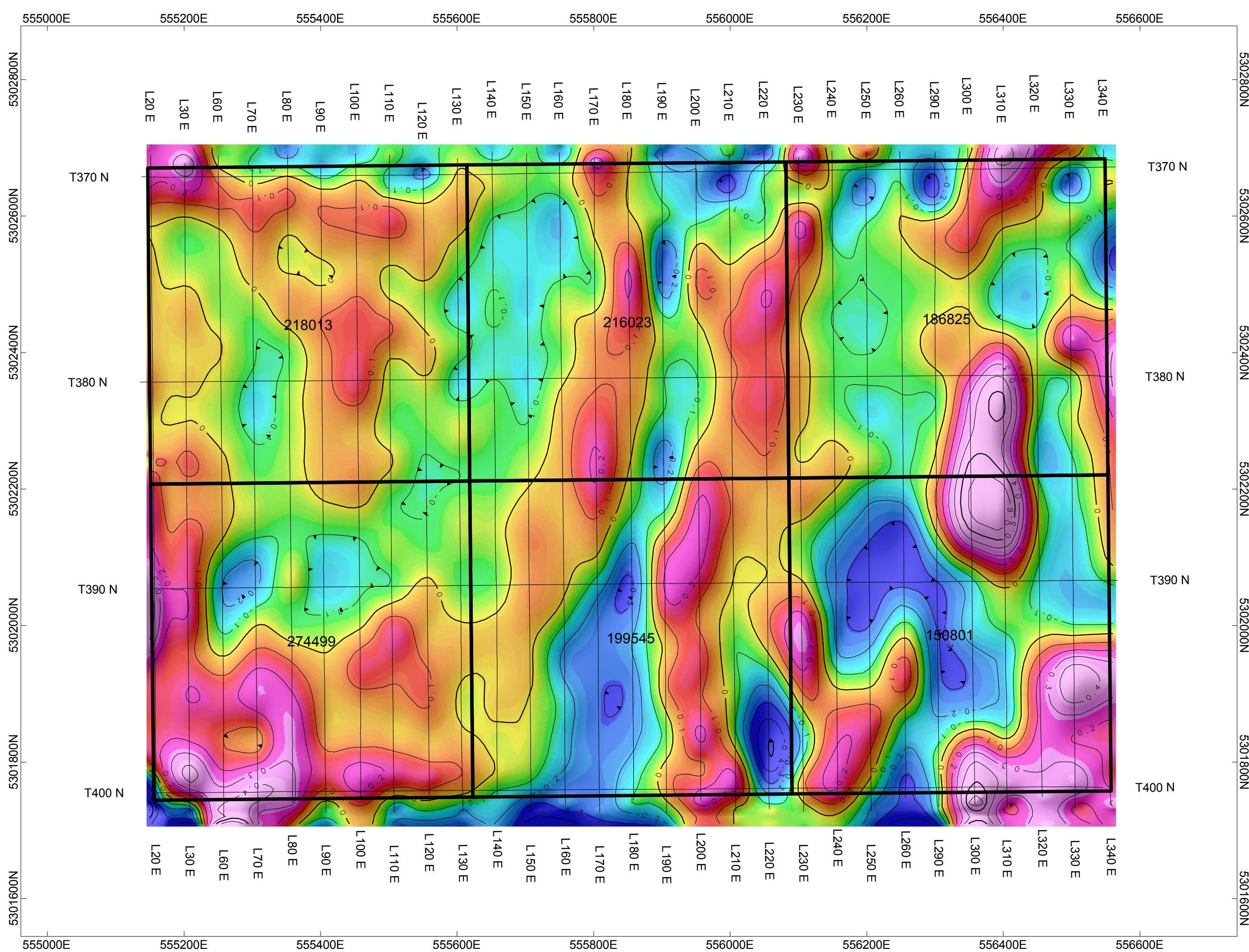


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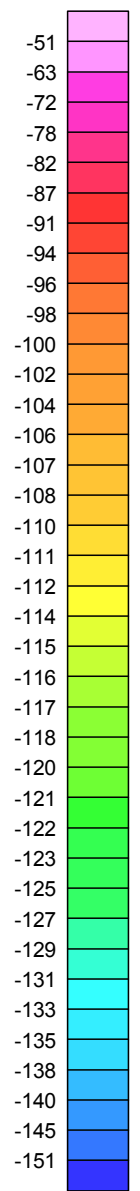
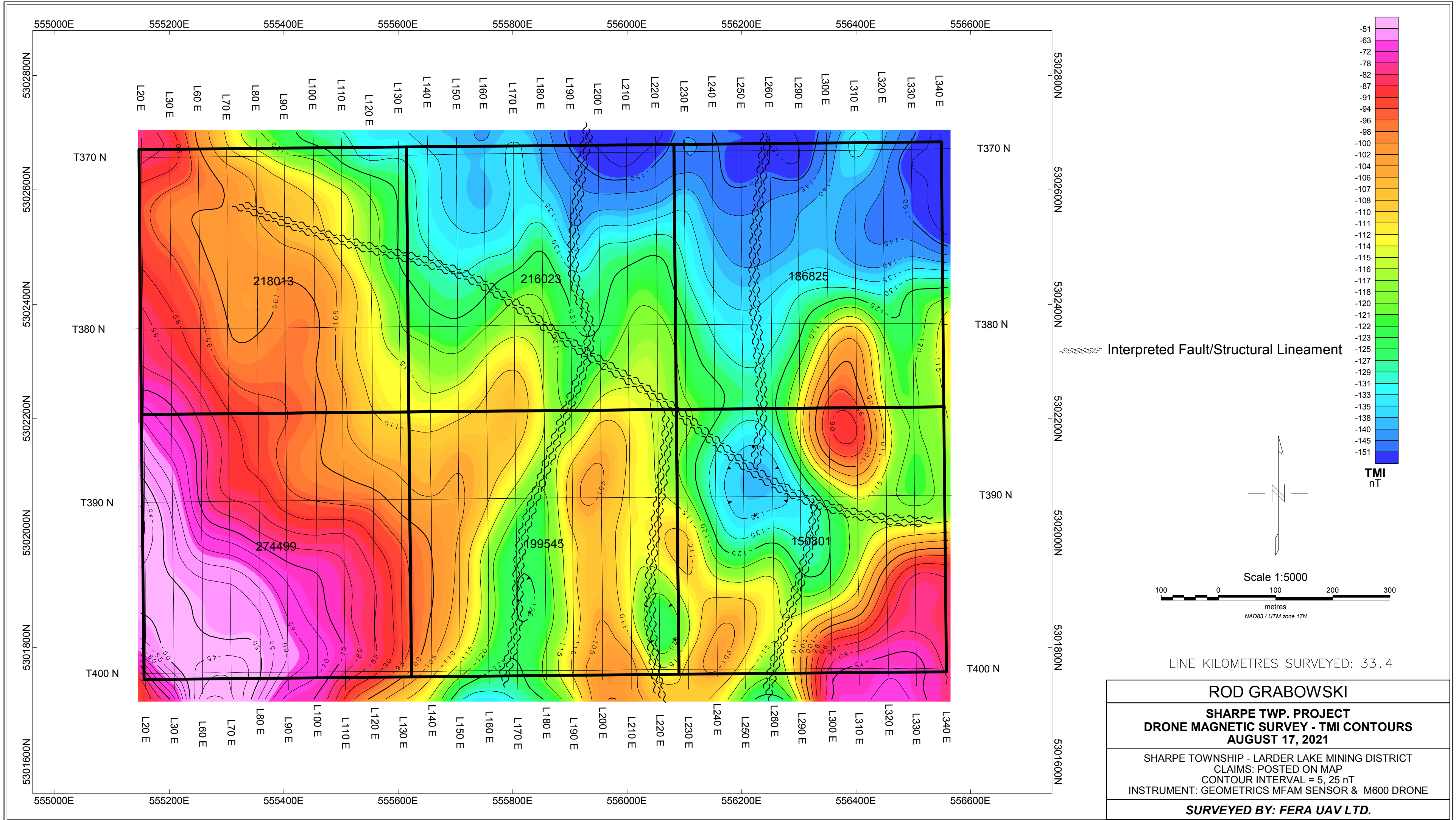
LINE KILOMETRES SURVEYED: 33.4

<p>ROD GRABOWSKI</p> <p>SHARPE TWP. PROJECT</p> <p>DRONE MAGNETIC SURVEY - TMI CONTOURS</p> <p>AUGUST 17, 2021</p>
<p>SHARPE TOWNSHIP - LARDER LAKE MINING DISTRICT</p> <p>CLAIMS: POSTED ON MAP</p> <p>CONTOUR INTERVAL = 5, 25 nT</p> <p>INSTRUMENT: GEOMETRICS MFAM SENSOR & M600 DRONE</p>
<p>SURVEYED BY: FERA UAV LTD.</p>

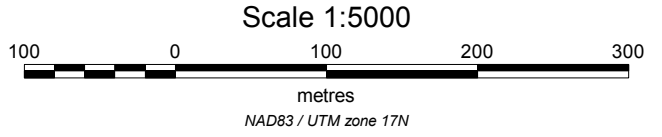
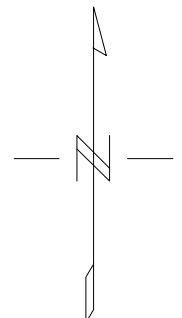


LINE KILOMETRES SURVEYED: 33.4

ROD GRABOWSKI
SHARPE TWP. PROJECT DRONE MAGNETIC SURVEY - 1VD MAGNETICS AUGUST 17, 2021
SHARPE TOWNSHIP - LARDER LAKE MINING DISTRICT CLAIMS: POSTED ON MAP CONTOUR INTERVAL = .1, .5 nT/m INSTRUMENT: GEOMETRICS MFAM SENSOR & M600 DRONE
SURVEYED BY: FERA UAV LTD.

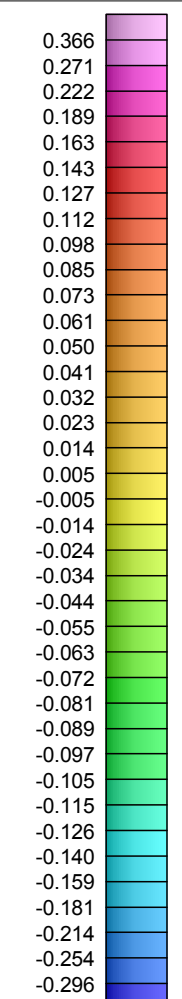
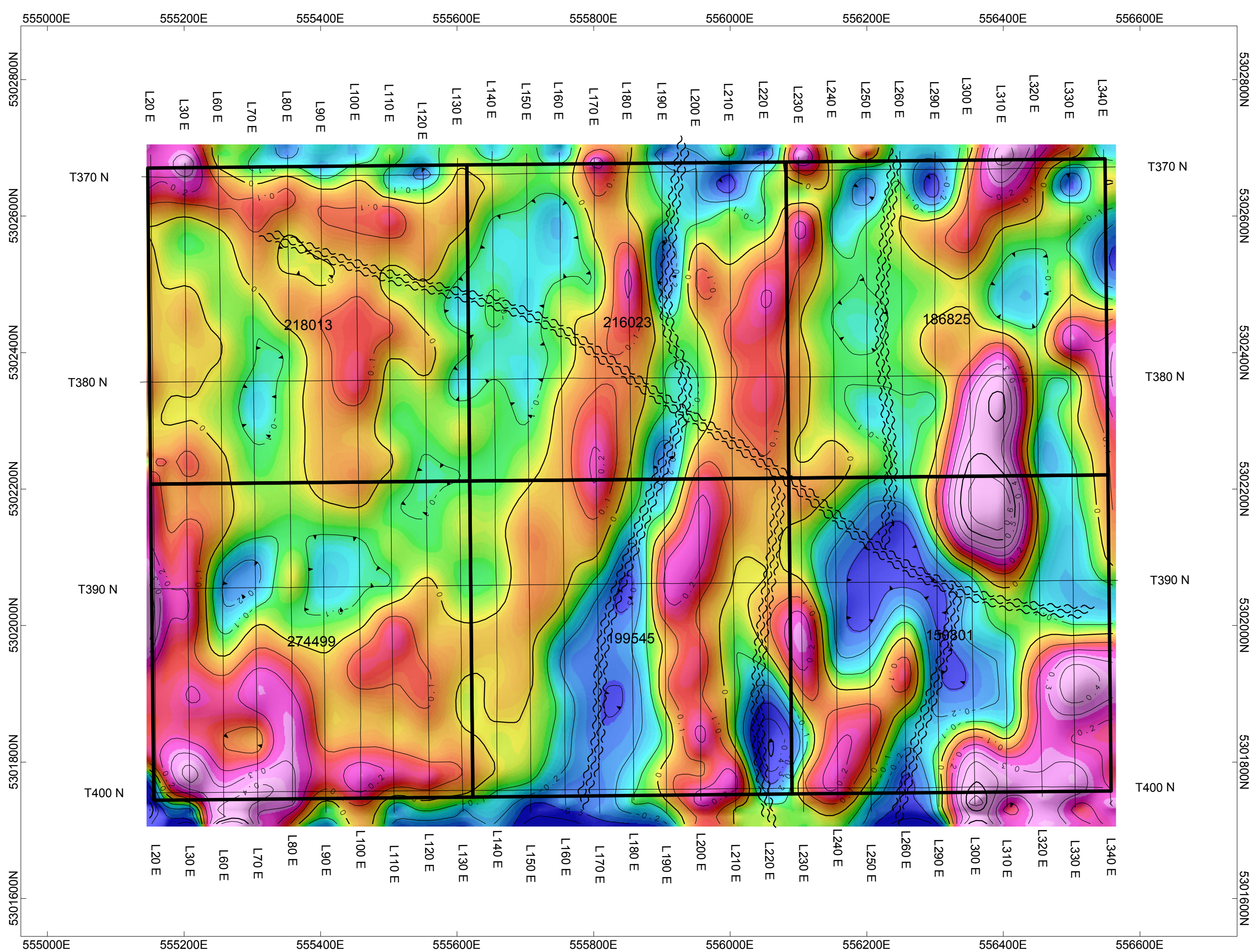


 Interpreted Fault/Structural Lineament



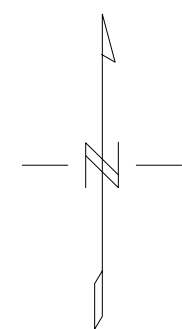
LINE KILOMETRES SURVEYED: 33.4

ROD GRABOWSKI
SHARPE TWP. PROJECT DRONE MAGNETIC SURVEY - TMI CONTOURS AUGUST 17, 2021
SHARPE TOWNSHIP - LARDER LAKE MINING DISTRICT CLAIMS: POSTED ON MAP CONTOUR INTERVAL = 5, 25 nT INSTRUMENT: GEOMETRICS MFAM SENSOR & M600 DRONE
SURVEYED BY: FERA UAV LTD.

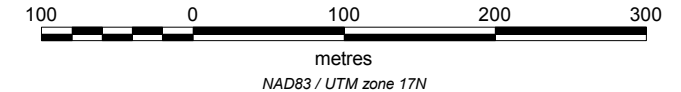


CALCULATED 1VD MAGNETICS
nT/m

 **Interpreted Fault/Structural Lineament**



Scale 1:5000



LINE KILOMETRES SURVEYED: 33.4

ROD GRABOWSKI
SHARPE TWP. PROJECT DRONE MAGNETIC SURVEY - 1VD MAGNETICS AUGUST 17, 2021
SHARPE TOWNSHIP - LARDER LAKE MINING DISTRICT CLAIMS: POSTED ON MAP CONTOUR INTERVAL = .1, .5 nT/m INSTRUMENT: GEOMETRICS MFAM SENSOR & M600 DRONE
SURVEYED BY: FERA UAV LTD.

Appendix I

Geometrics MFAM Magnetometer Specifications

System Basics

- System utilizes 2 MFAM sensors
- Sensors are controlled by 1 sensor module
- Sensor module communicates with a Texas Instruments main board
- Sensitivity: 0.00003nT
- Sensors operate at 1000Hz (collect 1000 readings per second on both sensors)

Technical Specifications

SPECIFICATIONS:

Mechanical:

Enclosure Dimensions: 9" x 6 5/8" x 1 3/16"

Sensor Cable length (Development box to Sensor): 20.5 inches

Power:

AC adapter: 13.5 to 16 Volts DC at 1.0A

Battery Pack: 12 volt 1800 mA-Hour Lithium Polymer

FEATURES:

- 1) **TIVA TM4C1294NCPDT Micro controller:** This is a 32 bit ARM Cortex-MF4 based microcontroller running at up to 120 MHz. It has 1024K of flash, with 256K bytes of RAM, and 6 KBytes of EEPROM.
- 2) **USB 2.0 Micro Connector:** USB functionality is provided by the TIVA microcontroller and TIVAWare support libraries.
- 3) **Four User LEDs:** Four user controlled LEDs are wired to TIVA microcontroller GPIO pins PK0, PK1, PN0, and PN1.
- 4) **Two User Switches:** Two user read switches are wired to the microcontroller pins PK6 and PJ1.
- 5) **One Microcontroller Reset Switch:** This switch is used to reset the microcontroller.
- 6) **Wi-Fi port for TI CC3100 Wi-Fi Booster Pack:** The Development board layout allows a TI CC3100 Wi-Fi Booster pack to be directly plugged in. Using TIVAWare libraries, software can be developed to allow Wi-Fi communication between the Development board and a computer.
- 7) **USB XDS110 Port for Firmware Downloading and Debugging:** This second USB port is used as a debug/firmware download interface between the TI Code Composer Studio development suite and the Development Kit.

- 8) **Two RS-232 Serial Ports with RJ-45 Connectors:** Two general purpose serial ports are available to the user. The first serial port is wired to TIVA microcontroller UART4, and supports RTS and CTS handshaking. The second serial port is wired to TIVA microcontroller UART5. This port supports only TxD and RxD. Both of these ports use +/- 8 volt voltage swings, and support baud rates up to 920 KBaud. Note that these two ports are wired as Data Terminal Equipment (DTE) Thus to connect either of these two ports to a computer it would need to connect through a null modem. .

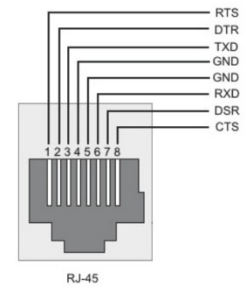
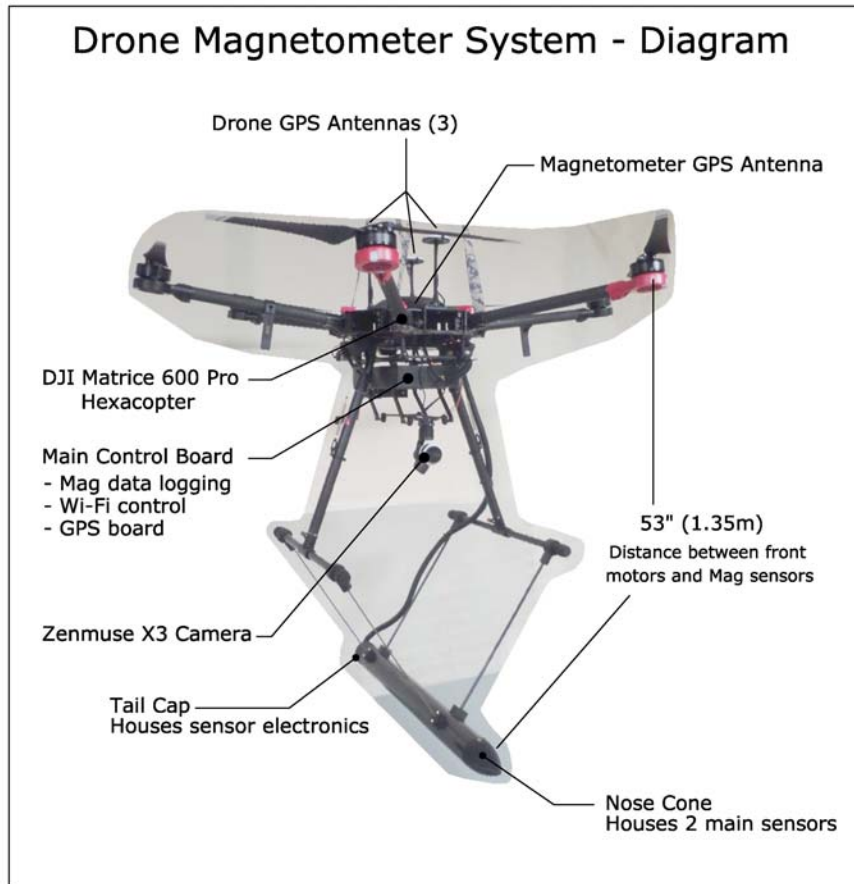


Figure 3: Serial Port Pinout

- 9) **On Board GPS Module:** An Adafruit GPS module is included with the Development Kit. It features 66 channels, -165 dBm sensitivity, and 3 Meter accuracy. An external GPS antenna is included so that signals can be received inside the box even with the cover in place. By default the GPS powers up to 9600 baud with several GPS sentences being output. The firmware that comes with the Development kit reconfigures the GPS to output only an RMC sentence at 115200 baud. This RMC string is sent with the output TCP data packet as described in the “Ethernet Data Format” section. The GPS is wired to UART7 on the TIVA microcontroller using 0-3.3 volt logic swings.

The 1PPS pulse from this GPS goes to the MFAM development module and disciplines the cycle rate to exactly 1 kiloSamples per second.

- 10) **Micro SD Card Slot for Storing Data Locally:** A micro SD card slot is available for the user to read and write data using a SPI interface. It is connected to SPI port 1 of the TIVA microcontroller.
- 11) **10 MHZ Timing Reference Input Port:** This input port takes a 10 MHz reference signal from a GPS disciplined reference oscillator, buffers and squares it up, and sends it to the MFAM module. The purpose of this signal is to lock the MFAM clocking system to this reference signal so that the Larmor frequency can be measured to an absolute standard. At this time, the MFAM does not support this feature. This function will be implemented in the future.
- 12) **Ethernet port with Power over Ethernet Compatibility:** The Tiva microcontroller contains a fully integrated Ethernet MAC and PHY. In addition, the Ethernet port can power the Development Kit via Power over Ethernet (PoE) using an Ethernet power injector.
- 13) **1.8 Amp-Hour Battery pack:** Three on board lithium/polymer batteries can power the system for 2 hours. A switch on the Development board allows the battery to be turned on/off. In addition, if the battery voltage falls below 8 volts the MFAM module will automatically shut down while keeping the microcontroller alive.
- 14) **Integrated Battery Charging system:** A lithium/polymer battery charging system is on board. If the battery switch is turned on, and the AC power adapter is plugged in, the batteries will be charged.
- 15) **Four Differential Analog Input Channels:** There are four differential analog inputs available for use. Channels 0 and 1 are +/- 2.5 volts full scale, while channels 2 and 3 are 0 to +5 volts full scale. In the firmware supplied with the Development kit (which sends MFAM/GPS data to the MFAMConsole program on the computer), all four channels are sampled synchronously with the MFAM data input to the Tiva are included in the data stream.
- 16) **On board Power/Status LEDs:** Several Status and Power LEDs are arranged along the front edge of the board. They include the four user LEDs, Power status LEDs (which power source is powering the board, and whether the battery is charging or the voltage low). They are listed in the Front and Back Panel Connection and Indicator section below.



Description and Location of components

The Geometrics MFAM magnetometer “main board” is attached directly below the central body of the DJI Matrice 600 Pro hexacopter drone. This box contains a small, Texas Instruments computer that collects and stores magnetometer readings on a micro-SD card. It also houses a 66 channel Adafruit GPS module, which operates independent of the (3) internal drone GPS modules. The Adafruit GPS collects and stores “GPS readings” (Lat / Long / Altitude / Time). The GPS readings are assigned to each mag reading, as the drone navigates along grid lines. A Wi-Fi module is attached to the Texas Instruments computer, which allows the operator to start and stop the magnetometer at a distance.

The Geometrics MFAM magnetometer operates using 2 separate mag sensors, attached to a “sensor module” with a flexible circuit board. The sensor module and 2 sensors are housed in a carbon graphite tube, which is mounted (suspended) 53 inches (1.35m) below the 2 front motors of the drone.

Magnetic shielding (mu-metal) is installed at 6 locations around the drone body, to provide additional shielding between drone components and the 2 mag sensors.

The magnetometer GPS antenna (for the internal Adafruit GPS) is mounted on top the drone body, to allow for clear signal. The vertical distance between this antenna and the 2 mag sensors, is 1.20m. This value is considered when reporting “mean terrain clearance”, by subtracting 1.2m from the elevation assigned to each mag reading.

Appendix II

Geometrics G856AX
Proton procession magnetometer specifications

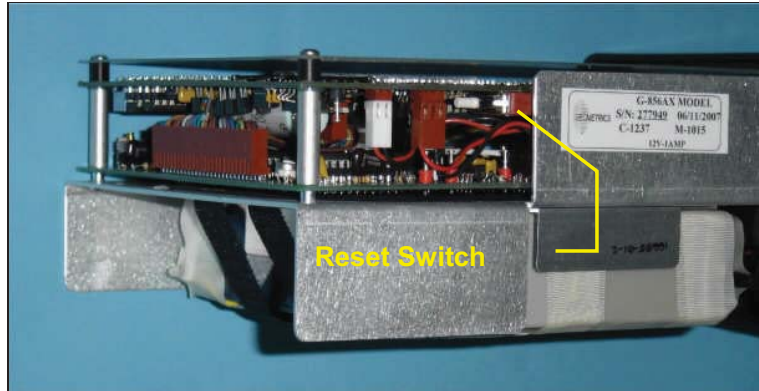


Figure 23. Internal reset switch.

Specifications

- Displays - Six digit display of magnetic field to resolution of 0.1 gamma or time to nearest second. Additional three-digit display of station, day of year, and line number.
- Resolution - Typically 0.1 gamma in average conditions. May degrade to lower resolution in weak fields, noisy conditions or high gradients.
- Absolute accuracy - One gamma, limited by remnant magnetism in sensor and crystal oscillator accuracy.
- Clock - Julian clock with stability of 5 seconds per month at room temperature and 5 seconds per day over the temperature range of -20 to +50 degrees Celsius.
- Tuning - Push button tuning from keyboard with current value displayed on request. Tuning range 20 to 90 μ T.
- Gradient - Tolerates gradients to 1800 gammas/meter. When high Tolerance gradients truncate count interval, maintains partial reading to an accuracy consistent with data.
- Cycle Time - Complete field measurement in three seconds in normal operation. Internal switch selection for faster cycle (1.5 seconds) at reduced resolution or longer cycles for increased resolution.
- Manual Read - Takes reading on command. Will store data in memory on command.
- Memory - Stores more than 5700 readings in survey mode, keeping track of

time, station number, line number day and magnetic field reading. In base station operation, computes for retrieval but does not store time of recording designated by sample interval, allowing storage of up to 12,000 readings.

- Output - Plays data out in standard RS-232 format at selectable baud rates. Also outputs data in real time byte parallel, character serial BCD for use with digital recorders.
- Inputs - Will accept an external sample command.
- Special - An internal switch allows:
 - adjustment of Functions polarization time and count time to improve performance in marginal areas or to improve resolution or speed operation
 - three count averaging
 - choice of lighted displays in auto mode.
- Physical -
 - Instrument console: 7 x 10 ½ x 3 ½ inches (18 x 27 x 9 cm), 6 LB (2.7 kg)
 - Sensor: 3 1/2 x 5 inches (9 x 13 cm), 4 LB (1.8 kg)
 - Staff: 1 inch x 8 feet (3cm x 2.5m), 2 LB (1kg)
- Environmental: Meets specifications from 1 to 40°C. Operates satisfactorily from -20 to 50°C.
- Power - Depending on version, operates from internal rechargeable Gel-cells or 9 D-cell flashlight batteries . May be operated from external power ranging from 12 to 18 volts external power. Power failure or replacement of batteries will not cause loss of data stored in memory.
- Standard system (P/N 16600-02) components:
 - Sensor (P/N 16076-01) and sensor cable (P/N 16134-01)
 - Console (P/N 16601-01)
 - Staff, one top section (P/N 16535-01), two middle sections (P/N 16536-01) and 1 bottom section (P/N 16537-01)
 - Carry harness (P/N 16002-02)
 - Two sets of rechargeable batteries (P/N 16697-01) and battery charger (P/N 16699-01)
 - Carrying case (P/N 16003-01)
 - Download cable (P/N 16492-01)
 - Hardcopy operation manual (P/N 18101-02)
 - Magnetometer CD (P/N 26648-01)
- Optional accessories:
 - Tripod kit for base-station operation (P/N 16708-02)
 - Gradiometer kit (P/N 166651-01)
 - Gradiometer carry/storage case (16003-01)

Appendix III - DJI Matrice 600 Pro Specifications

Specifications

• Aircraft

Diagonal Wheelbase	1133 mm
Dimensions	1668 mm × 1518 mm × 727 mm with propellers, frame arms and GPS mount unfolded (including landing gear) 437 mm × 402 mm × 553 mm with propellers, frame arms and GPS mount folded (excluding landing gear)
Weight (with six TB47S batteries)	9.5 kg
Weight (with six TB48S batteries)	10 kg
Max Takeoff Weight Recommended	15.5 kg
Hovering Accuracy (P-GPS)	Vertical: ±0.5 m, Horizontal: ±1.5 m
Max Angular Velocity	Pitch: 300°/s, Yaw: 150°/s
Max Pitch Angle	25°
Max Wind Resistance	8 m/s
Max Ascent Speed	5 m/s
Max Descent Speed	3 m/s
Max Speed	40 mph / 65 kph (no wind)
Max Service Ceiling Above Sea Level	2170 propellers: 2500 m, 2195 propellers: 4500 m
Hovering Time* (with six TB47S batteries)	No payload: 32 min, 6 kg payload: 16 min
Hovering Time* (with six TB48S batteries)	No payload: 38 min, 5.5 kg payload: 18 min
Flight Control System	A3 Pro
Supported DJI Gimbals	Ronin-MX; ZENMUSE™ Z30, Zenmuse X5/X5R, Zenmuse X3, Zenmuse XT, Zenmuse Z15 Series HD Gimbal: Z15-A7, Z15-BMPCC, Z15-5D III, Z15-GH4
Retractable Landing Gear	Standard
Operating Temperature	14° to 104° F (-10° to 40° C)

• Remote Controller

Operating Frequency	920.6 MHz to 928 MHz (Japan); 5.725 GHz to 5.825 GHz, 2.400 GHz to 2.483 GHz
Max Transmission Distance	FCC Compliant: 3.1 mi (5 km), CE Compliant: 2.2 mi (3.5 km) (Unobstructed, free of interference)
Transmitter Power (EIRP)	10 dBm @ 900M, 13 dBm @ 5.8G, 20 dBm @ 2.4G
Video Output Port	HDMI, SDI, USB
Operating Temperature	14° to 104° F (-10° to 40° C)
Battery	6000 mAh LiPo 2S

• Charger (Model: MC6S600)

Voltage Output	26.1 V
Rated Power	600 W
Single Battery Port Output Power	100 W



• Standard Battery (Model: TB47S)

Capacity	4500 mAh
Voltage	22.2 V
Battery Type	LiPo 6S
Energy	99.9 Wh
Net Weight	595 g
Operating Temperature	14° to 104° F (-10° to 40° C)
Max Charging Power	180 W

• Optional Battery (Model: TB48S)

Capacity	5700 mAh
Voltage	22.8 V
Battery Type	LiPo 6S
Energy	129.96 Wh
Net Weight	680 g
Operating Temperature	14° to 104° F (-10° to 40° C)
Max Charging Power	180 W

* Hovering time is based on flying at 10 meters above sea level in a no-wind environment and landing with a 10% battery level.

CE1313  **RoHS** 

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

HDMI
HIGH-DEFINITION MULTIMEDIA INTERFACE

DJI incorporates HDMI™ technology. The terms HDMI and HDMI High-Definition Multimedia Interface, and the HDMI Logo are trademarks or registered trademarks of HDMI Licensing LLC in the United States and other countries.

Download the detailed user manual at:
www.dji.com/matrice600-pro

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Designed by DJI. Printed in China.

Drone Operation and Ground Control Methods

The DJI Matrice 600 Pro drone is programmed to fly an automated flight path (the survey grid lines and tie lines), using software that is available and ready to use on a wide variety of drones. Zen Geomap uses UgCS software, Drone Deploy and Pix4D software;

- Drone Deploy and Pix4D, on simple grids that do not require advanced control with regards to following complex terrain (example – flying in relatively flat ground, using Google Earth or other simple elevation model).
- UgCS, in rugged terrain, where we obtain a detailed 3D terrain model (DEM or DTM) using photogrammetric drone prior to magnetic survey. In this case we upload our own, custom DEM into UgCS software and the DJI M600 drone will follow the terrain at a fixed offset.

Using a Drape

The automated flight path will always use (follow) a “drape” in one form or another.

- On simple grids in flat terrain, the drape is generated as an offset of a simple DEM, such as Google Earth or other coarse elevation model such as DEMs available on-line through USGS.
- In complex terrain, the drape is generated as an offset of our own, custom DEM.

All of our piloting software is capable of following a drape at a fixed offset. We typically program the drone to fly 50m above coarse DEMs, such as Google Earth, or USGS. When a custom DEM is available, we typically fly 25-30m above DEM.

The actual / final “height above terrain” (or mean terrain clearance), is determined in the field by our crews. They visually inspect and look for obstacles such as hills, trees, buildings and towers.

The height above terrain (or mean terrain clearance) is included in the logistical and assessment reports we prepare for our clients.

Ground Control Methods

The DJI M600 drone uses a combination of 3 separate GPS receivers and 3 separate barometers. This system developed by DJI is called the A3 Controller.

The A3 controller is designed to maintain a stable altitude, relative to the take-off point. Over a 5 year period (2014 to current), we have found the A3 controller to be reliable to sub-metre accuracy, when it comes to maintaining stable altitude over a typical 20 to 30 minute flight.

Based on this long-term record, we rely on the A3 controller to navigate the drone at a pre-programmed, fixed offset above DEM. Over the same 5 year period, we have observed consistent and accurate agreement between the A3 GPS locations and the Adafruit (Magnetometer) GPS locations. When plotted in plan view, the A3 GPS tracks have always agreed with the Adafruit tracks to approximately 1 metre accuracy.

The author of this report has been an active surveyor since 1990 and is familiar with real-time (RTK) GPS and post-processed GPS methods.

Appendix V

Quality Control / Tests and Calibrations / Processing Steps

Quality Control

Throughout the data acquisition phase, data are monitored closely for quality control and error-checking on all channels. Output from the Geometrics MFAM magnetometer includes a wide range of error codes, which are written to the raw data file to help diagnose problems when they occur in the field.

All data are checked on a daily basis, as field data are transferred to Zen Geomap offices in Timmins or North Bay, Ontario. When errors or problems occur, the field crew is instructed to re-fly problem areas.

Tests and Calibrations

The following tests and calibrations are carried-out on all magnetometer equipment and sensors employed by Zen Geomap Inc.;

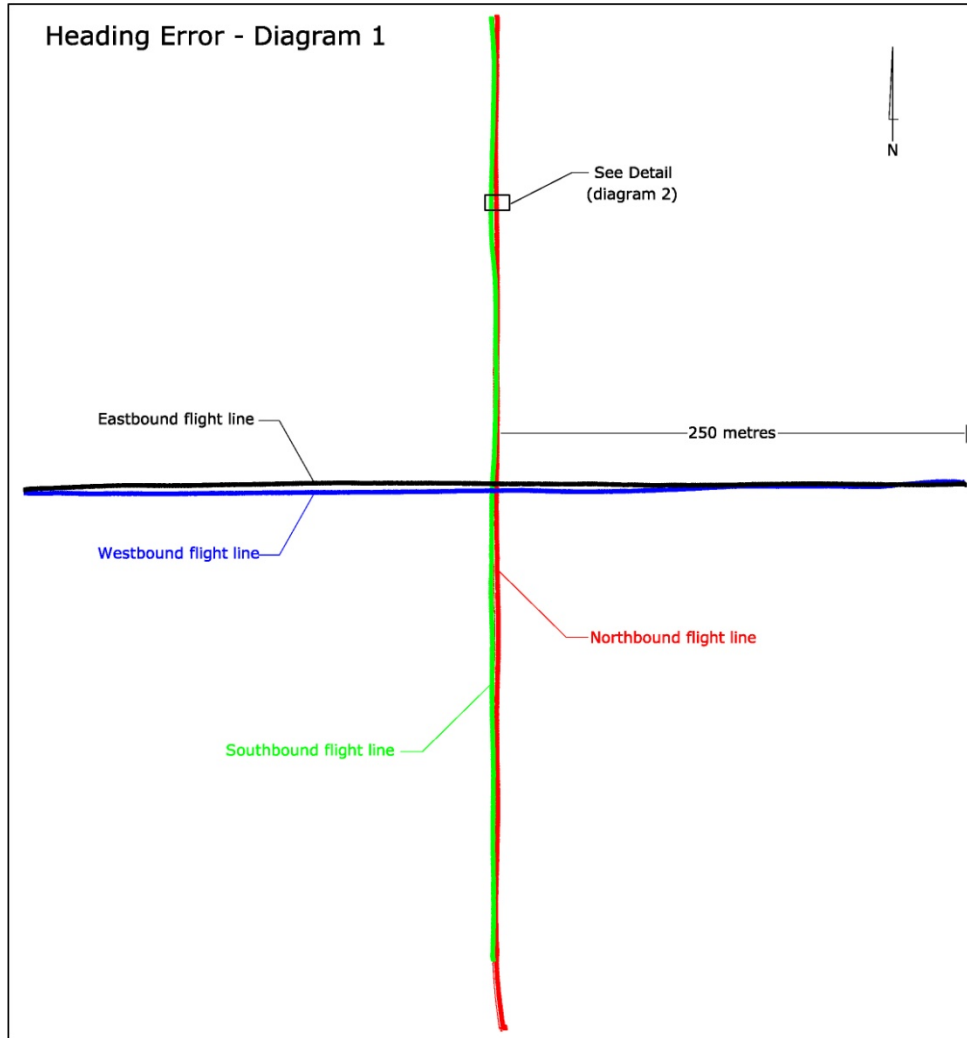
Heading Error

Upon receipt of a new magnetometer (or after significant repair or modification to any system component), a test flight is carried-out to determine heading error.

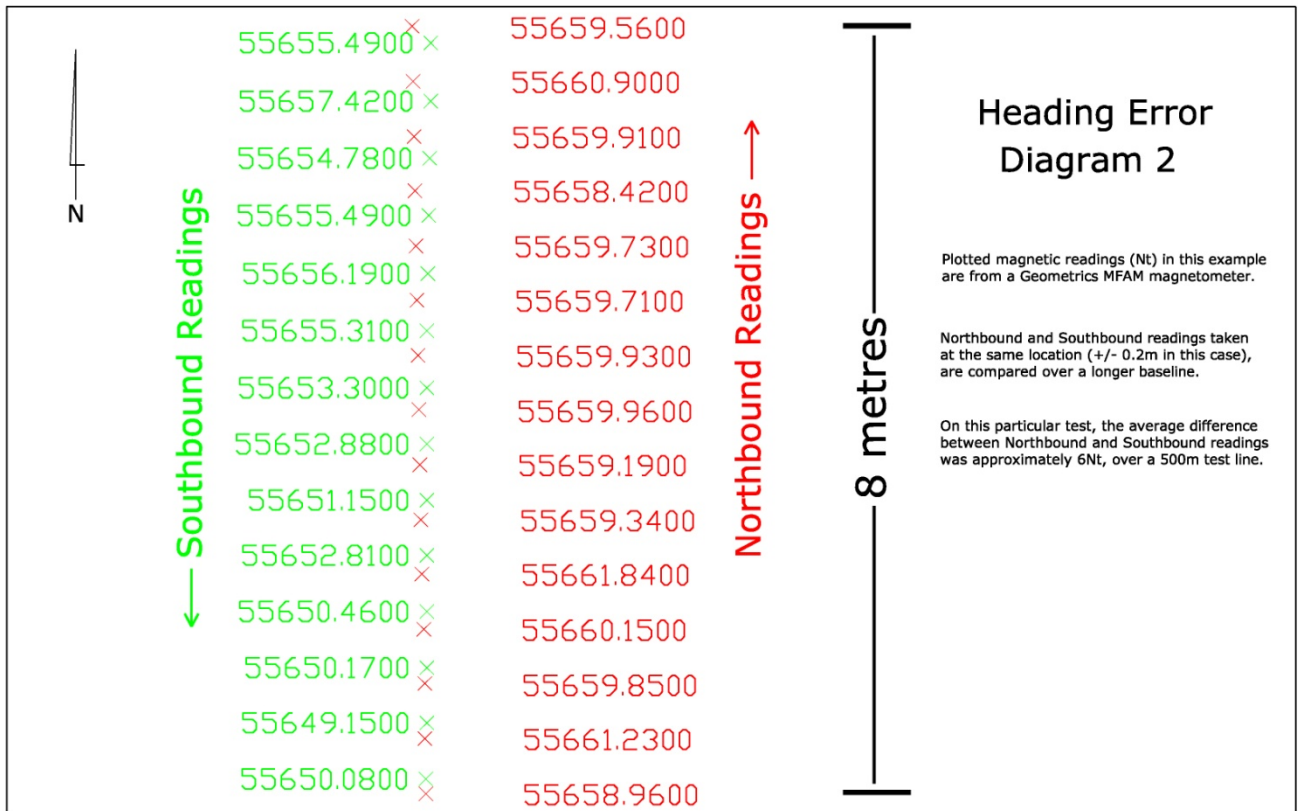
A cross-pattern is flown as shown in **Diagram 1**, with 500 metre N-S and E-W lines. Magnetic readings are collected along the same lines, flown in opposite directions.

Northbound and Southbound readings at the same location (+/- 0.2m in this example) are compared. Eastbound and Westbound readings undergo the same process.

(See: Heading Error – **Diagram 2**).



Example test flight by Zen Geomap, August, 2019



Example – Geometrics MFAM readings, August, 2019

The difference between Northbound and Southbound readings, averaged over a 500m baseline is calculated. The resulting value (6 Nt in above example), is used to apply a correction for heading error during processing.

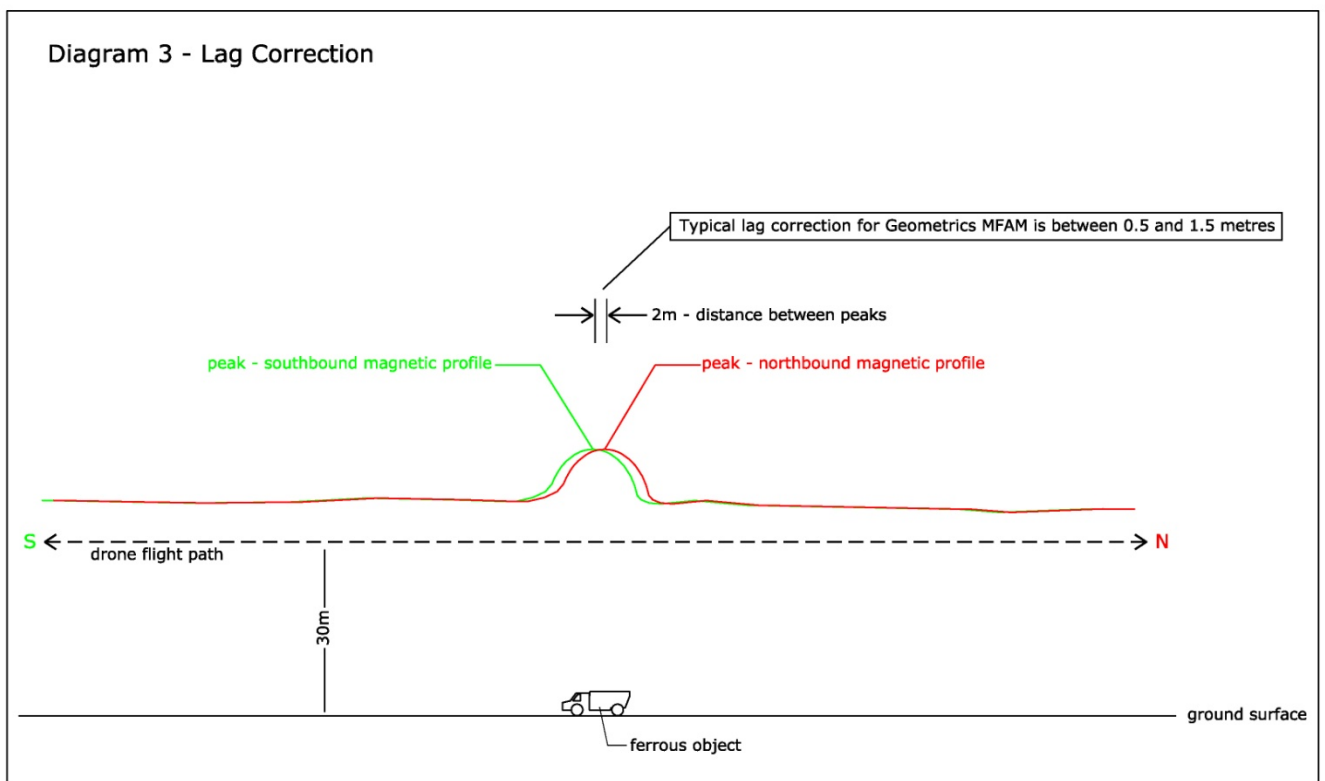
Each mag sensor will produce a unique result, however we typically apply a correction of 3Nt or less, to adjacent flight lines.

Lag Correction

Tests are performed to determine lag correction, by flying the drone magnetometer in opposite directions over top a ferrous object. Suitable objects include steel bridges, vehicles or heavy equipment.

Diagram 3 shows a typical flight test to determine lag correction.

A Geometrics MFAM magnetometer will typically have a lag error between 0.5 and 1.5 metres. Each mag sensor will produce a unique value. We typically apply a correction of 1m or less, to the location of magnetic readings on adjacent lines.



Diurnal Correction

A Geometrics G856AX proton precession magnetometer is operated as a base station on all projects, to provide diurnal monitoring of the local magnetic field variations. Adjustment may be applied to the raw MFAM readings, when variations exceed 10 or more Nt over the course of any flight. However, we typically re-fly grid lines, if the magnetic field variation is excessive.

The location (UTM coordinate) of the base station is included in the report body.

Processing Steps

Diurnal is examined for flights covering tie lines.

If magnetic field variation is excessive during tie line flights, all readings across tie lines are corrected using the base station data.

Tie lines provide a framework for leveling grid lines.

Readings on grid lines (once corrected for heading error and lag), are translated to conform to the tie lines. This process involves adjusting individual grid line segments, based on tie line intersections.

Unlike conventional airborne survey, such as fixed-wing or helicopter, a drone will take-off and land multiple times during the course of a survey. The resulting ferry lines are removed from the overall dataset prior to processing. Zen Geomap has developed import templates that run in Geosoft Oasis Montaj, to accomplish this task.

Geometrics MFAM data is not directly compatible with industry-standard software such as Geosoft. Zen Geomap has developed software (Python code) to convert raw MFAM data into a format compatible with Geosoft and other industry-standard geophysical software. The raw data from MFAM is processed through Python, prior to initial processing.

The Python code developed by Zen Geomap has been adopted by Geometrics, as the standard conversion software for drone-mounted MFAM. Geometrics has been the industry leader for airborne magnetometer equipment since 1969.