Precision GeoSurveys

AIRBORNE GEOPHYSICAL SURVEY REPORT

Seattle Creek Block

Mayo, Yukon

Nevada Zinc Corporation

Shawn Walker, M.Sc., G.I.T
Jenny Poon, B.Sc., P.Geo.
Precision GeoSurveys Inc.
www.precisiongeosurveys.com
Hangar 42 Langley Airport
21330 - 56th Ave., Langley, BC
Canada V2Y 0E5
604-484-9402

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1.0 Introduction

This report outlines the geophysical survey operations and data processing procedures taken during the high resolution helicopter-borne magnetic and radiometric survey flown at the Seattle Creek survey block for Nevada Zinc Corporation. The Seattle Creek survey block area is centered 30.0 km north of Mayo, Yukon and covers a total of 19.5 km^2 (Figure 1). The geophysical survey was started and completed on September 20, 2016.

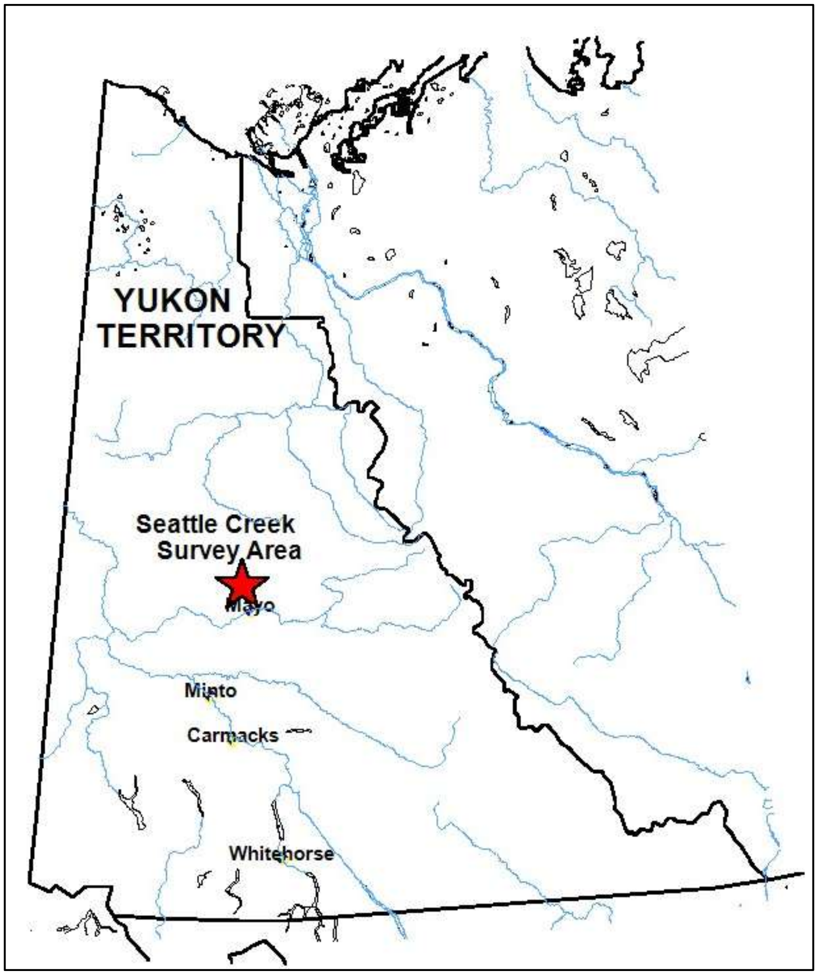

Figure 1: Seattle Creek survey block location map.

1.1 Survey Area

The Seattle Creek survey block is centered approximately 30 km north of Mayo, Yukon (Figure 2) on the south side of the South McQuesten River. The block covers a rectangular area of 6.5 km by 3.0 km and includes 20 survey lines and four tie lines.

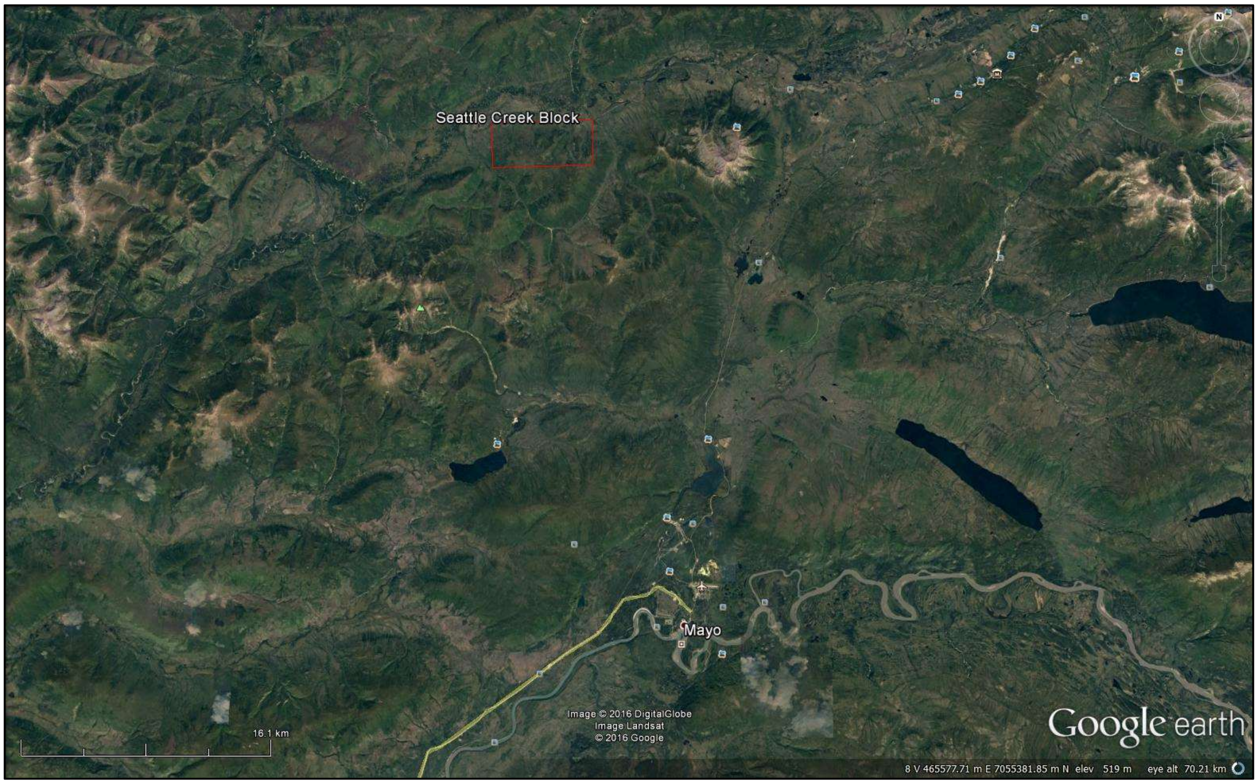

Figure 2: Seattle Creek survey block boundary in red north of Mayo, Yukon.

The Seattle Creek survey block was flown at 150 meter spacing at a 090°/270° heading; tie lines were flown at 1500 meter spacing at a heading of 000°/180° (Figures 3 and 4). A total of 142 line km of data was collected.

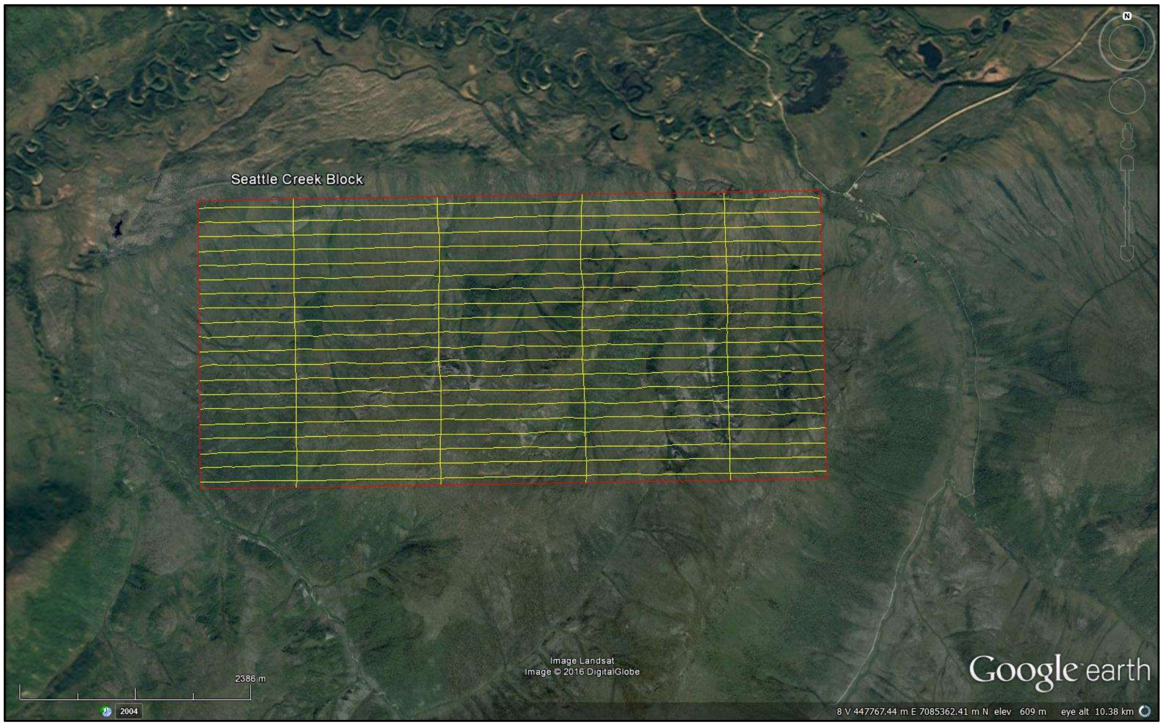

Figure 3: Plan View – Seattle Creek survey block with actual flight lines displayed in yellow and the block boundary in red.

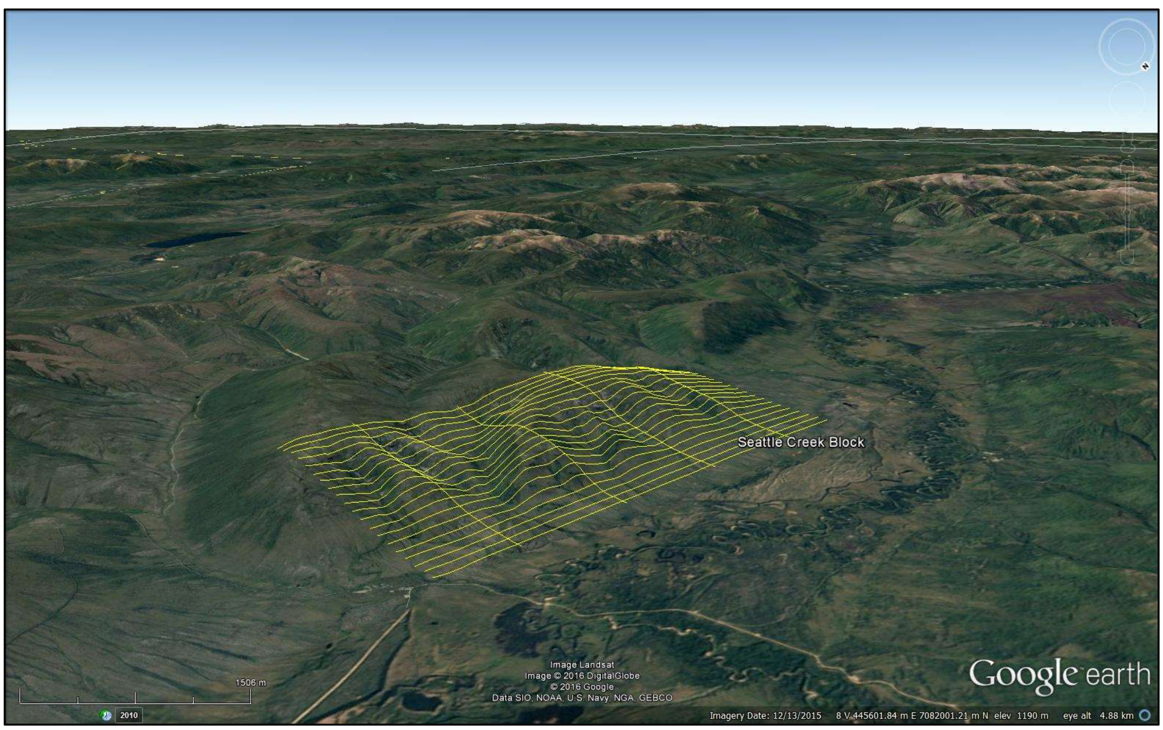

Figure 4: Terrain View – Seattle Creek survey block with actual flight lines displayed in yellow.

1.2 Survey Specifications

The geodetic system used for this survey is WGS 84 and the area is contained in zone 8N. A total of 142 line km was flown (Figure 5). The survey data acquisition specifications and coordinates for the survey are specified in Tables 1 and 2.

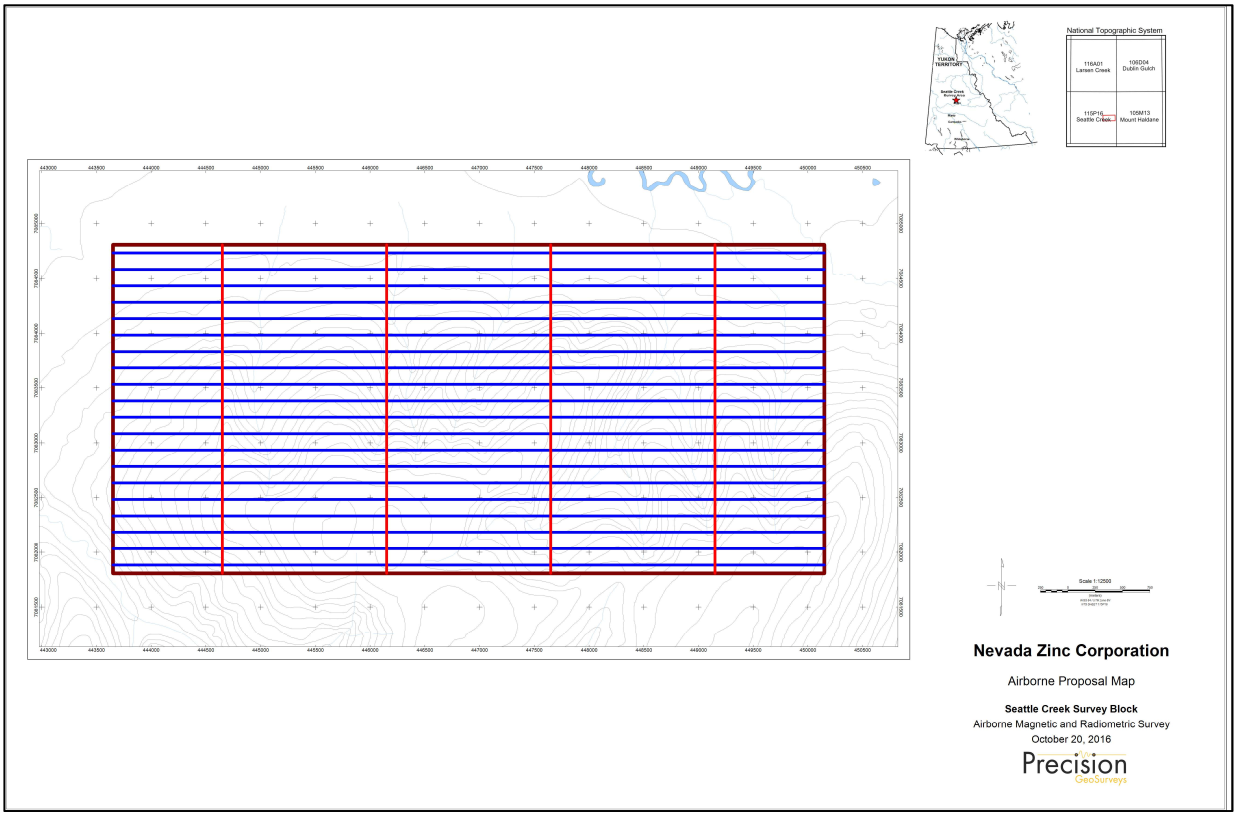

Figure 5: Survey map of Seattle Creek survey block area showing proposed survey and tie lines on digital terrain model.

Block Name	Area (km^2)	Line Type	Planned No. of Lines	Planned Line Spacing (m)	Line Orientation	Nominal Survey Height (m)	Actual Survey Height (m)	Total Planned Line km	Total Actual km Flown
Seattle Creek	19.5	Survey	20	150	090°/270°	35	36	130	130
		Tie	4	1500	000°/180°	35	35	12	12
		Total:	**24**					**142**	**142**

Table 1: Seattle Creek survey area flight line specifications.

Longitude	Latitude	Easting	Northing	N/S	E/W
136.14743613	63.88591383	443650	7084808	N	W
136.01510546	63.88690223	450150	7084808	N	W
136.01413474	63.85998391	450150	7081808	N	W
136.14633893	63.85899668	443650	7081808	N	W

Table 2: Seattle Creek survey block polygon coordinates using WGS 84 in zone 8N.

2.0 Geophysical Data

Geophysical data are collected in a variety of ways and are used to aid in determination of geology, mineral deposits, oil and gas deposits, geotechnical investigations, contaminated land sites and UXO detection.

For the purposes of this survey, airborne magnetic and radiometric data were collected to serve in the exploration for gold and copper deposits.

2.1 Magnetic Data

Magnetic surveying is the most common airborne survey type to be conducted for both mineral and hydrocarbon exploration. Aeromagnetic surveys measure and record the total intensity of the magnetic field at the magnetometer sensor, which is a combination of the desired magnetic field generated in the Earth as well as minute variations due to the temporal effects of the constantly varying solar wind and the magnetic field of the survey aircraft. By subtracting the solar, regional, and aircraft effects, the resulting aeromagnetic map shows the spatial distribution and relative abundance of magnetic minerals (most commonly the iron oxide mineral magnetite) in the upper levels of the Earth's crust, which in turn is related to lithology, structure, and alteration of bedrock. The type of survey specifications, instrumentation, and interpretation procedures depend on the objectives of the survey. Magnetic surveys are typically performed for:

1. Geological Mapping - to aid in mapping lithology, structure and alteration.
2. Depth to Basement Mapping - for exploration in sedimentary basins or mineralization associated with the basement surface.

2.2 Radiometric Data

Radiometric surveys detect and map natural radioactive emanations, called gamma rays, from rocks and soils. All detectable gamma radiation from earth materials come from the natural decay products of three primary radioelements: uranium (U), thorium (Th), and potassium (K). The purpose of radiometric surveys is to determine either the absolute or relative amounts of U, Th, and K in surface rocks and soils which are then useful in mapping lithology, alteration, and structure.

Vegetation, standing water (lakes, marshes, swamps) and/or snow can effectively attenuate gamma rays originating from underlying rocks. Therefore, variations in isotope counts must be evaluated with respect to surficial conditions before they are attributed to changes in underlying geology. An increase in soil moisture can also significantly affect gamma radiation concentrations. For example, 10% increase in soil moisture can decrease the measured gamma radiation by about the same amount. Radon, formed naturally from the decay of radioactive elements such as uranium, attaches to dust particles in the atmosphere. The radioactive precipitation of these dust particles by rain can lead to apparent increases of more than 2000% in uranium ground concentration (IAEA, 2003). Thus, gamma ray surveying should not be carried out during rainfall, or shortly after rainfall.

3.0 Survey Operations

The Seattle Creek survey was flown on September 20, 2016, in dry weather and snow-free ground conditions. The survey did not encounter any weather or technical delays. The experience of the pilot helped to ensure that the data quality objectives were met and that the safety of the flight crew was never compromised given the potential risks involved in airborne geophysical surveying. Field processing and quality control checks were done daily.

3.1 Operations Base and Crew

The base of operations for this survey was located at the Mayo airport (CYMA), 30.4 km south-southeast of the Seattle Creek survey block (Figure 6).

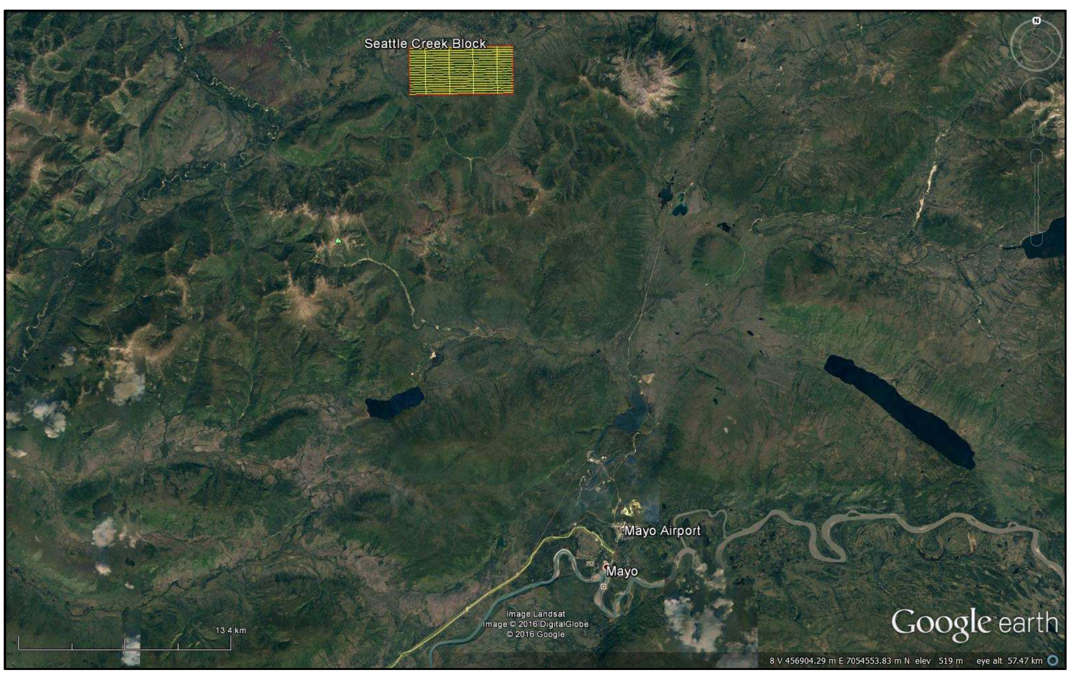

Figure 6: Map showing base of operation at Mayo airport.

The Precision geophysical crew consisted of four members:

Harmen Keyser	–	Helicopter Pilot
Melody Steele	–	Geophysical Operator
Shawn Walker (off-site)	–	Geophysicist and Data Processor
Jenny Poon (off-site)	–	Geophysicist and Data Processor

3.2 Base Station Specifications

Two GEM GSM-19T proton precession magnetometers were used to accurately record diurnal variations and geomagnetic storms in the survey area. The magnetic base stations were set up south of the Mayo airport, away from any sources of magnetic noise (Table 3; Figures 7 and 8).

Station name	Easting/Northing	Longitude/Latitude	Datum/ Projection
GEM 5 S/N 5081669	0456643E, 7054343N	135° 52' 27.91" W 63° 36' 51.84" N	WGS 84, Zone 8N
GEM 6 S/N 5087249	0456641E, 7054350N	135° 52' 28.02" W 63° 36' 52.06" N	WGS 84, Zone 8N

Table 3: Base station specifications.

Base station readings were reviewed at regular intervals to ensure that no data were collected during periods of high diurnal magnetic activity (greater than 10 nT per minute). The magnetic base stations were installed in a magnetically noise-free area, away from metallic items such as ferromagnetic objects, vehicles, or power lines that could affect the base station or survey data.

The diurnal magnetic variations recorded by the stationary base station were removed from the magnetic data recorded in flight to ensure that the anomalies seen were real and not due to solar activity.

Figure 7: GEM 5 (left) and GEM 6 (right) magnetic base stations located in the bushes, south of the Mayo airport.

Figure 8: GEM 5 and GEM 6 magnetic base stations located in the bushes, south of the Mayo airport.

3.3 Field Processing and Quality Control

On a flight-by-flight basis, the survey data were transferred from the helicopter's data acquisition system onto a USB flash drive and copied onto a field data processing laptop. The raw data files in PEI binary data format were converted into Geosoft GDB database format. Using Geosoft Oasis Montaj 9.0.2, the quality of the data was inspected to ensure that they met the contract specifications (Table 4). All flight lines (Figure 9) which did not meet survey specifications (left/right and up/down) were re-flown. Selected suspect magnetic anomalies, especially those found on a single flight line, were re-flown for confirmation. Where required, re-flight lines were a minimum of 2000 m long, so that survey line re-flights crossed at least two tie lines, and tie line re-flights crossed at least five survey lines.

Specification	Parameter	Details
Line Spacing	Position	Flight line deviation from flight path by more than 15 m left/right for 1 km or more.
Height		Nominal flight height of 35 m above ground. Flight height deviation by more than 15 m up/down for 1 km or more, provided line deviation from height is not due to tall trees, topography, cultural features, mitigation of livestock harassment, or other obstacles beyond the pilot's control.
GPS		Any flight lines where 3 or less GPS satellites received for distances of greater than 1 km, provided signal loss is not due to topography.
Diurnal Variations	Magnetics	Non-linear magnetic diurnal variations exceed 10 nT from a linear chord of length one (1) minute.
Normalized 4th Difference		Magnetic data exceeding 0.20 nT peak to peak for distances greater than 1 km or more (provided noise is not due to geological or cultural features).
Test Line Data	Radiometrics	If signal from the four spectrometer windows (K, Th, U, TC) over the test line vary by more than 12%, the flights shall be re-flown or suspended.

Table 4: Contract re-flight specifications.

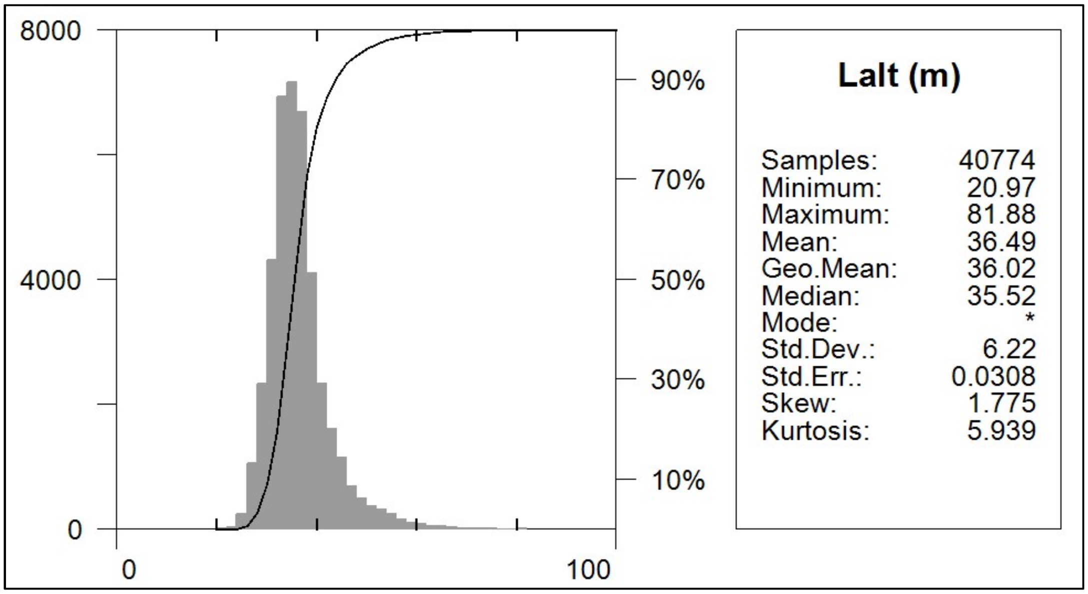

Figure 9: Histogram showing survey elevation vertically above ground.

4.0 Aircraft and Equipment

All geophysical and subsidiary equipment were carefully installed on Precision GeoSurveys aircraft. For this survey, the survey magnetometer was carried in an approved "stinger" configuration to enhance flight safety and improve data quality. The gamma spectrometer crystal packs consisted of three components: two downward-looking packs and one upward-looking pack. The four downward-looking crystals (total of 16.8 liters) were installed in the rear cabin of the aircraft and the rear cargo box. The upward-looking crystal (total of 4.2 liters) was installed in the right cargo cheek.

4.1 Aircraft

Precision GeoSurveys flew the Seattle Creek survey block using a Eurocopter AS350 helicopter, registration C-GSVY. The survey lines were flown at a nominal line spacing of one hundred and fifty (150) meters and the tie lines were flown at one thousand and five hundred (1500) meters for both the magnetometer and spectrometer.

4.2 Geophysical Equipment

The survey helicopter (Figure 10) was equipped with a magnetometer, spectrometer, data acquisition system, laser altimeter, magnetic compensation system, pilot guidance unit (PGU), and GPS navigation system. In addition, two magnetic base stations were used to record diurnal magnetic variations.

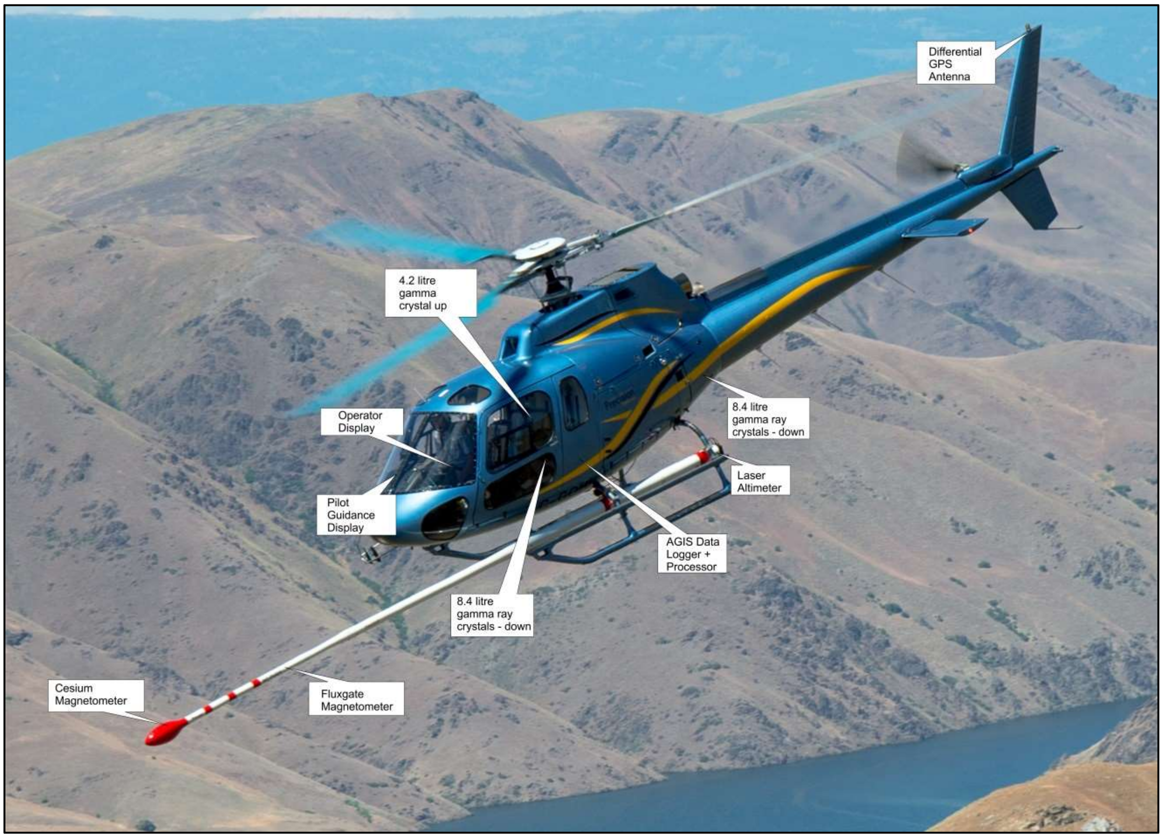

Figure 10: AS350 survey helicopter equipped with geophysical equipment.

4.2.1 AGIS

The Airborne Geophysical Information System, AGIS, (Figure 11), is the main computer used in data recording, data synchronizing, displaying real-time quality control data for the geophysical operator, and the generation of navigation information for the pilot and operator display systems. Information such as magnetic field components, total gamma count, counts of various radioelements (K, U, Th, etc.), temperature, cosmic radiation, barometric pressure, atmospheric humidity and survey altitude can all be monitored on the on-board AGIS display for immediate quality control.

The AGIS was manufactured by Pico Envirotec and uses standardized Pico software. External sensors are connected to the system via RS-232 serial communication cables. The AGIS data format is converted into Geosoft or ASCII file formats by a conversion program called PEIView. Additional Pico software allows for post or real time magnetic compensation and survey quality control procedures.

Figure 11: AGIS operator display installed in the Eurocopter AS350, with screen displaying real time flight line recording and navigation parameters. Additional windows display real time geophysical data to operator.

4.2.2 Magnetometer

The airborne magnetic sensor was a Scintrex cesium vapor CS-3 magnetometer (S/N 1107379). The system was mounted on the front of the helicopter in an approved "stinger" configuration (Figure 12) to reduce influence from the aircraft's magnetic field. The CS-3 is a high sensitivity/low noise magnetometer with automatic hemisphere switching and a wide voltage range; the static noise rating for the unit is +/- 0.01 nT. Magnetic data were recorded at 10 Hz. A separate fluxgate magnetometer determined the helicopter's attitude (pitches, rolls, and yaws) relative to the inclination and declination of the Earth's magnetic field, which was necessary to remove magnetic noise created by the movement of the helicopter through a compensation process.

Figure 12: View of the mag stinger used on the Seattle Creek survey.

4.2.3 Spectrometer

The IRIS, or Integrated Radiometric Information System, is a fully integrated gamma radiation detection system containing 16.8 litres of NaI (T1) synthetic downward-looking crystals (Figure 13) and 4.2 litres of NaI (T1) synthetic upward-looking crystals with 256 channel output at 1 Hz sampling rate. The downward-looking crystals are designed to measure gamma rays from below the aircraft and are equipped with upward-shielding high density RayShield® gamma-attenuating blankets to minimize cosmic and solar gamma noise. The upward-looking crystal measures solar gamma radiation from above the survey helicopter with a 6 mm thick lead plate used for downward-shielding.

Figure 13: GRS-10 Thallium-activated Sodium Iodide gamma spectrometer crystal pack. The open unit on the right shows two individual 4.2 liter detectors.

4.2.4 Base Station

To monitor and record the Earth's diurnal magnetic field variation, Precision GeoSurveys operates two GEM GSM-19T magnetometer base stations. The base stations were operated near the Mayo airport. The base stations were located in an area with low magnetic gradient, away from electric power transmission lines and moving ferrous objects, such as motor vehicles, that could affect the survey data integrity.

The GEM GSM-19T magnetometer (Figure 14) with integrated GPS time synchronization uses proton precession technology with a 0.5 Hz sampling rate. The GSM-19T has an accuracy of +/- 0.2 nT at 1 Hz. Base station magnetic data were recorded on internal solid-state memory, and downloaded onto a field laptop computer using a serial cable and GEMLink 5.0 software. Profile plots of the base station readings were generated, updated, and reviewed at the end of each survey day.

Figure 14: GEM GSM-19T proton precession magnetometer.

4.2.5 Laser Altimeter

The pilot is provided with terrain guidance and clearance information from an Opti-Logic RS800 laser altimeter (Figure 15). This is attached to the aft end of the magnetometer boom. The RS800 laser is a time-of-flight sensor that measures distance by a rapidly-modulated and collimated laser beam that creates a dot on the target surface. The maximum range of the laser altimeter is 700 m off of natural surfaces with an accuracy of +/- 1 meter on 1 x 1 m^2 diffuse target with 50% (+/- 20%) reflectivity. Within the sensor unit, reflected signal light is collected by the lens and focused onto a photodiode. Through serial communications and digital outputs, the ground clearance data are transmitted to an RS-232 compatible port and recorded and displayed by the AGIS and PGU at 10 Hz in meters.

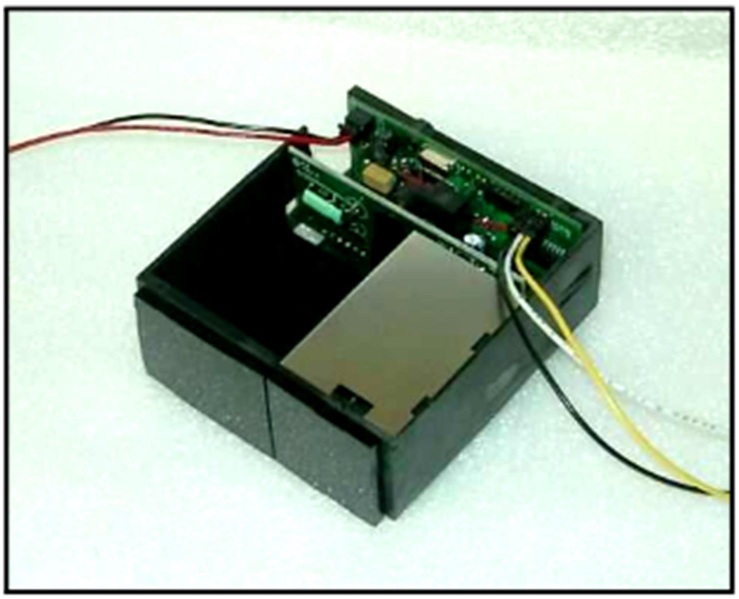

Figure 15: Opti-Logic RS800 laser altimeter.

4.2.6 Pilot Guidance Unit

The PGU (Pilot Guidance Unit) is a graphical display type unit that provides continuous steering and elevation information to the pilot (Figure 16). It is mounted remotely from the data system on top of the helicopter's instrument panel. The PGU assists the pilot in keeping the helicopter on the planned flight path and at the desired ground clearance.

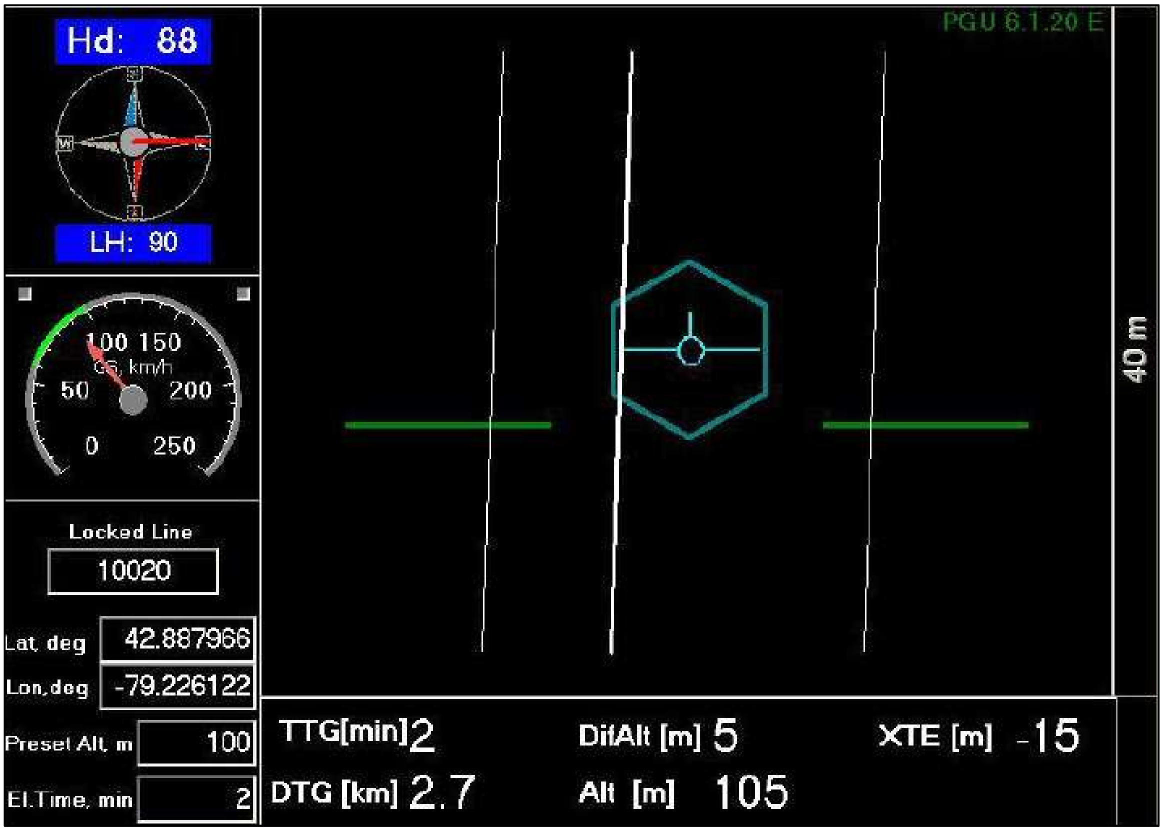

Figure 16: PGU screen displaying navigation information.

The LCD monitor measures 7 inches, with a full VGA 800 x 600 pixel display. The CPU for the PGU is contained in a PC-104 console and uses Microsoft Windows operating system control, with input from the GPS antenna, embedded drape surface profile or laser altimeter, and AGIS.

4.2.7 GPS Navigation System

A Hemisphere R120 GPS receiver (Figure 17) navigation system integrated with the pilot display (PGU) and AGIS provided navigational information and control. The R120 GPS receiver supports fast updates and outputs messages at a rate of up to 20 Hz (20 times per second); delivering sub-meter positioning. It employs COAST technology that allows continuous operation for at least 40 minutes during temporary differential signal outages.

Figure 17: Hemisphere R120 GPS Receiver.

It can track GPS, SBAS (Satellite-Based Augmentation System), and L-Band (OmniSTAR HP and XP) differential corrections to provide accurate positioning.

5.0 Data Acquisition Equipment Checks and Calibration

Airborne equipment tests and calibrations were conducted at the start of the survey. There were three tests conducted for the airborne magnetometer: compensation flight, lag test, and heading error test. Three other tests were conducted for the airborne gamma ray spectrometer: calibration pad test, cosmic flight test, and the altitude correction and sensitivity test.

5.1 Magnetometer Tests

Before acquiring magnetic data the magnetometer was tested and calibrated. A series of dedicated flights were completed to collect data specifically for removing undesired side-effects of aircraft movement, speed, and heading direction.

5.1.1 Compensation Flight Test

During aeromagnetic surveying a small but significant amount of noise is introduced to the magnetic data by the aircraft itself, as the magnetometer is within the helicopter's magnetic field. Movement of the aircraft (roll, pitch and yaw) combined with the permanent magnetization of certain aircraft parts (in particular the engine and other ferrous magnetic objects) contribute to this noise. The aircraft was degaussed prior to starting the survey and the remaining magnetic noise was removed by a process called magnetic compensation. A magnetic compensation flight was completed prior to beginning the survey (Table 5). The process consists of a series of prescribed maneuvers where the aircraft flies in the four orthogonal headings required for the survey (090°/270° and 000°/180° in the case of this survey) at a sufficient altitude (typically >

2,500 m AGL) in an area of low magnetic gradient where the Earth's magnetic field becomes nearly uniform at the scale of the compensation flight. In each heading direction, three specified roll, pitch, and yaw maneuvers (total 36) are performed by the pilot at constant elevation so that any magnetic variation recorded by the airborne magnetometer can be attributed to aircraft movement. These maneuvers provide the data that are required to calculate the necessary parameters for compensating the magnetic data and removing aircraft noise from survey data.

Pre-Compensation					Post-Compensation				
Heading	**Roll**	**Pitch**	**Yaw**	**Total**	**Heading**	**Roll**	**Pitch**	**Yaw**	**Total**
082°	7.2623	3.7082	1.6093	12.5798	082°	0.2087	0.2445	0.2027	0.6559
176°	7.4620	6.5955	1.8751	15.9326	176°	0.2546	0.2470	0.1945	0.6961
262°	5.5400	5.2855	1.9954	12.8209	262°	0.1936	0.2321	0.2977	0.7234
356°	5.8602	3.6937	1.6583	11.2122	356°	0.1760	0.2373	0.1811	0.5944
Total	26.1245	19.2829	7.1381		**Total**	0.8329	0.9609	0.8760	
FOM = 52.5455 nT					**FOM = 2.6698 nT**				

Table 5: Figure of Merit maneuver test results for compensation flight flown on September 20, 2016, east of Mayo, Yukon.

5.1.2 Lag Test

A lag test was performed to determine the relationship between the time the digital reading was recorded by the magnetic sensor instrument and the position fix time that the fiducial of the reading was obtained by the GPS system. The test was flown in the four orthogonal survey headings over an identifiable magnetic anomaly (ie. Truck, Trailer, etc.) at survey speed and height. A lag of 7 fiducials (0.7 seconds) was determined from the lag test.

5.1.3 Heading Error Test

To determine the magnetic heading effect a cloverleaf pattern flight test was conducted. The cloverleaf test was flown in the same orthogonal headings as the survey and tie lines (090°/270° and 000°/180°) at >1000 m AGL in an area with low magnetic gradient. For all four directions the survey helicopter must pass over the same mid-point all four times at the same elevation (Table 6 and Figure 18).

Line Number	Fiducials	Heading	Mag (nT)	Correction (nT)
L000	1566.9	N – 000°	57074.9759	6.5277
L090	1189.1	E – 090°	57087.1012	-5.5976
L180	1667.3	S - 180°	57086.0095	-4.5059
L270	1405.3	W - 270°	57077.9279	3.5758
		Average	**57081.5**	
		Total		**0.0000**

Table 6: Heading error test data format flown on September 20, 2016, east of Mayo, Yukon.

```
/Geosoft Heading Correction Table

/
/=Direction:real:i
/=Correction:real
/
/Direction Correction
 000    +6.5277
 090    -5.5976
 180    -4.5059
 270    +3.5758
 360    +6.5277
```

Figure 18: Heading data results in .tbl format in Geosoft table.

5.2 Gamma-ray Spectrometer Tests and Calibrations

Pre-survey calibrations and testing of the GRS-10 airborne gamma-ray spectrometry system were carried out prior to the start of the survey. The calibration of the spectrometer system involved three tests which enabled the conversion of airborne data to ground concentration of natural radioactive elements. These tests were the calibration pad test, cosmic flight test, and the altitude correction and sensitivity test. The measurements were made in accordance with IAEA technical report series No. 323, *Airborne Gamma Ray Spectrometer Surveying*, and AGSO Record 1995/60, *A Guide to the Technical Specifications for Airborne Gamma-Ray Surveys*.

5.2.1 Calibration Pad Test

The calibration pad test was conducted by Pico Envirotec using GSC (Geological Survey of Canada) portable calibration pads. The pads are slabs of concrete containing known concentrations of the radioelements (K, Th, and U) and are used to simulate ideal geological sources of gamma radiation. The measurements collected from the calibration pad test were used to determine the Compton scattering and Grasty backscatter (spectral overlap between element windows) coefficients.

5.2.2 Cosmic Flight Test

While the background source of gamma radiation from the aircraft itself is essentially constant, the amount of signal detected from ground sources varies with ground clearance. As the height of the aircraft increases, the distance between the ground and the spectrometer crystals increase, and the proportion of cosmic radiation in each spectral window increases exponentially. The cosmic flight test is conducted to determine the aircraft's background attenuation coefficients for the detector crystal packs and the cosmic coefficients. The pilot is required to fly over the same location repeatedly in opposite directions starting from 1,500 m to 3,000 m at 500 m intervals for approximately 2 minutes each to collect gamma data used to determine the amount of non-terrestrial gamma signal.

5.2.3 Altitude Correction and Sensitivity Test

The altitude and sensitivity test is similar to the cosmic flight test but is conducted at lower elevations (from ground level). The pilot is required to fly over the same location at the following elevations in meters above ground; 30, 50, 100, 150, 200, 250, and 300. As the distance of the aircraft increases away from the radioactive ground source, the source signature exponentially degrades. As a result, this test is used to determine the altitude attenuation coefficients and the radio-element sensitivity of the airborne spectrometer system.

6.0 Data Processing

After all the data were collected from a survey flight several procedures were undertaken to ensure that the data met a high standard of quality. All radiometric and magnetic data (Figure 19) were processed using Pico Envirotec software and Geosoft Oasis Montaj 9.0.2 geophysical processing software along with proprietary processing algorithms.

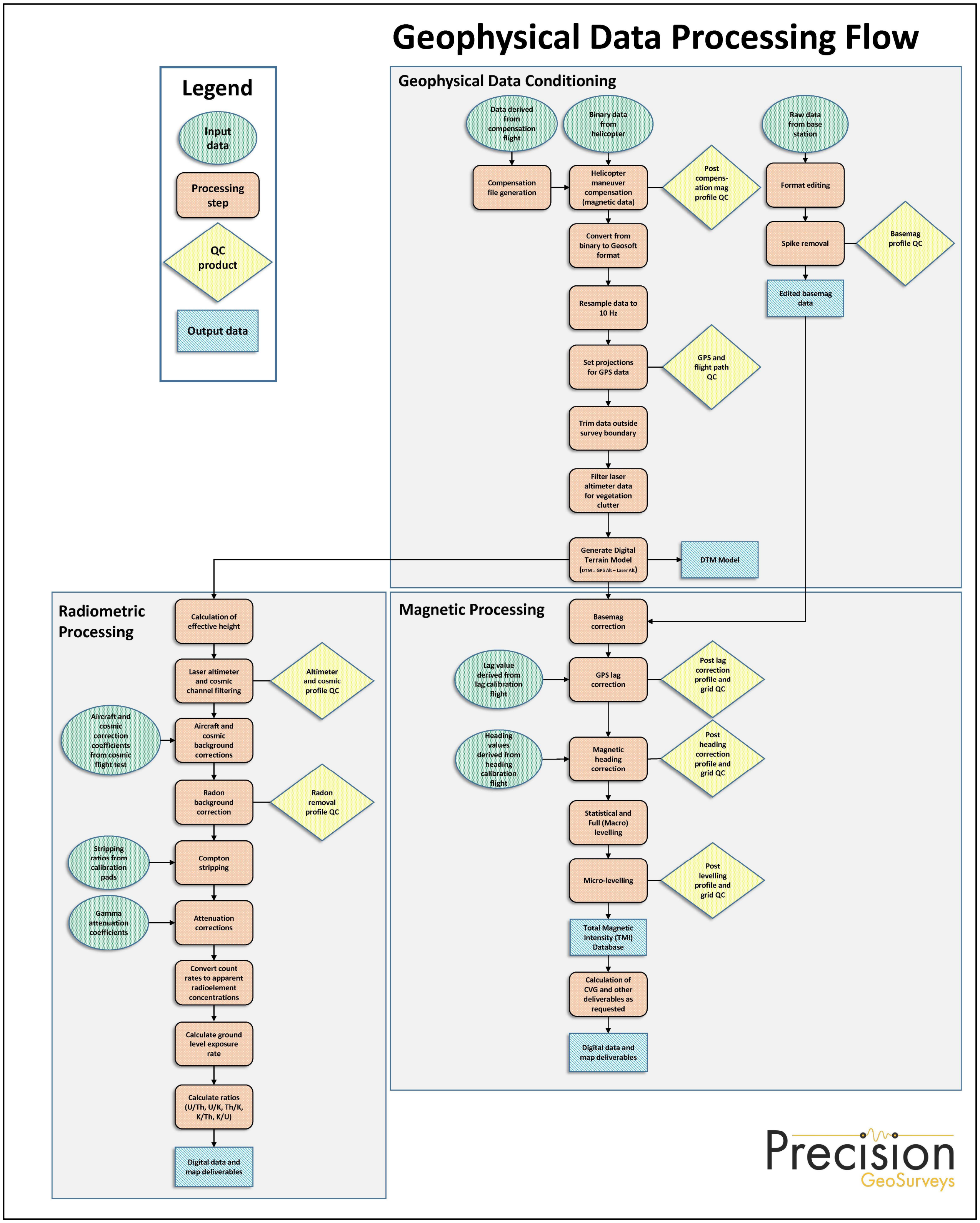

Figure 19: Magnetic and radiometric data processing flow.

6.1 Magnetic Processing

The data obtained from the compensation flight test were applied to the raw magnetic data before any further processing and editing. A computer program called PEIComp was used to create a model from the compensation flight test for each survey to remove the noise induced by aircraft movement; this model was applied to each survey flight so the data could be further processed.

The compensated raw magnetic data were then corrected for diurnal variations, lag, and heading. Any evidence of noise or spikes was removed. The initial corrected data from the survey and tie lines were then used to level the entire survey dataset. Lastly, the International Geomagnetic Reference Field (IGRF) was used to remove the background magnetic field of the earth.

6.1.1 Diurnal Correction

The first step in processing the compensated magnetic data was to correct for diurnal variations. The base station data that were used for the correction came from GEM 5 south of the Mayo airport. The diurnal data were edited, plotted and merged into a Geosoft database (.GDB) on a daily basis. The airborne magnetic data were corrected for diurnal variations by subtracting the observed magnetic base station deviations from the data collected on the helicopter, which effectively removed the effects of diurnal variation, diurnal drift, and geomagnetic storms.

6.1.2 Lag Correction

Following the diurnal correction, a lag correction of 0.7 seconds was applied to the total magnetic field data to compensate for the combination of lag in the recording system and the magnetometer sensor flying 5.4 m ahead of the GPS antenna.

6.1.3 Heading Correction

For each survey heading the magnetic instrument travels along a flight line, changes in instrument magnetic fields are detected and these systematic shifts are recorded. These values are used to construct a heading .TBL table file. An intersection table was created, containing all magnetic field values where tie lines intersected the survey lines and the overall average magnetic field value was calculated. For each of the four headings, the averages were calculated and then compared to the overall average to determine four values to be used for heading error correction.

6.1.4 Leveling and Micro-leveling

The initial Total Magnetic Intensity (TMI) data from survey and tie lines were used to level the entire survey dataset. Two forms of leveling were applied to the corrected data: conventional leveling and micro-leveling. There were two components to conventional leveling; Statistical Leveling to level tie lines and Full Leveling to level survey lines. The Statistical Leveling method corrected for mis-ties (SL/TL intersection errors) following a specific pattern or trend.

Through the error channel, an algorithm calculated a least-squares trend line and derived a trend error curve, which was then added to the channel to be leveled. The second component was Full Leveling. This adjusted the magnetic value of the survey lines so that all lines matched the trended tie lines at each intersection point.

Lastly, micro-leveling was applied to the corrected conventional leveled data. This iterative grid-based process removed low amplitude components of flight line noise that still remained in the data after tie line and survey line leveling.

6.1.5 IGRF Removal

The International Geomagnetic Reference Field (IGRF) model is the empirical representation of the Earth's magnetic field (main core field without external sources) collected and disseminated from satellite data and from magnetic observatories around the world. The IGRF is generally revised and updated every five years by a group of modelers associated with the International Association of Geomagnetism and Aeronomy (IAGA). In this case, the IGRF values were calculated from the recently updated model (IGRF – 12) year 2015 and the actual survey dates were obtained from the "Date" channel.

By subtracting the calculated IGRF from TMI, Residual Magnetic Intensity (RMI) of the Seattle Creek survey area was calculated. This created a more valid model of individual near-surface anomalies so that the data were not referenced to a specific time. This will allow for other magnetic data (historic or future) to be more easily incorporated into the survey database.

6.1.6 Calculation of the First Vertical Derivative

The first vertical derivative (1VD) was computed from the leveled Residual Magnetic Intensity (RMI) data. Long wavelengths and vertical rate of change were suppressed in the magnetic field. Therefore, the edges of magnetic anomalies were highlighted and spatial resolution was increased.

6.2 Radiometric Processing

Radiometric surveys map the concentration of radioelements at or near the earth's surface; typically up to 1.5 meters below surface. Thus, the first step which is vital before processing of the airborne radiometric data was to calibrate the spectrometer system. Once calibration of the system was complete, the radiometric data were processed by windowing the full spectrum to create channels for U, K, Th and total count.

Steps taken to process acquired radiometric data are summarized below:

- Calculation of effective height
- Aircraft and Cosmic background corrections
- Radon background correction
- Stripping ratios

- Attenuation corrections
- Conversion to apparent radioelement concentrations

6.2.1 Calculation of Effective Height

Laser/Radar altimeter data were converted to effective height (h_{ef}) in meters using the acquired laser/radar altimeter, temperature and pressure data, according to the formula below:

$$h_{ef} = h * \frac{273.15}{T + 273.15} * \frac{P}{1013.25}$$

where: h is the observed laser/radar altitude in meters
T is the measured air temperature in degrees Celsius
P is the barometric pressure in millibars

6.2.2 Intermediate Filtering

Some of the measured parameters are filtered as part of the pre-processing.

- Laser/radar altimeter is lightly filtered, a 5-point Hanning filter to smooth out rapid changes that may occur in rugged terrain.
- The Cosmic channel was smoothed with a 5-point Hanning filter to reduce statistical noise.

6.2.3 Aircraft and Cosmic Background Corrections

Aircraft background and cosmic stripping corrections are applied to all three elements, and total count, using the following formula:

$$C_{ac} = a_c + b_c * \text{Cos}_f$$

where: C_{ac} is the background and cosmic corrected channel
a_c is the aircraft background for this channel
b_c is the cosmic stripping coefficient for this channel
Cos_f is the filtered cosmic channel

6.2.4 Radon Background Correction

To strip the effects of atmospheric radon from the downward-looking detectors, calibration constants are determined through the use of an upward-looking detector. The upward-looking detector uses a crystal pack that is partially shielded from radiation from below to give the system a directional sensitivity and therefore the ability to discriminate between radiation from the atmosphere and from the ground. Procedures to determine these calibration constants in detail are outlined in the IAEA 1363 report, *Guidelines for Radioelement Mapping using Gamma Ray Spectrometry Data*.

6.2.5 Compton Stripping

Spectral overlap corrections are applied to potassium, uranium, and thorium as part of the Compton stripping process. This is done by using the stripping ratios that have been calculated for the spectrometer by prior calibration; this breaks the corrected elemental values down into the apparent radioelement concentrations.

Stripping ratios α, β, and γ are first modified according to altitude. Then an adjustment factor (derived from the cosmic flight test), the reversed stripping ratio, uranium into thorium, is calculated.

$$\alpha_h = \alpha + h_{ef} * 0.00049$$

$$\beta_h = \beta + h_{ef} * 0.00065$$

$$\gamma_h = \gamma + h_{ef} * 0.00069$$

where: α, β, γ are the Compton stripping coefficients
α_h,β_h,γ_h are the height corrected Compton stripping coefficients
h_{ef} is the effective height above ground in metres at STP

The stripping corrections are then carried out using the following formulas:

$$Th_c = Th_{bc}(1 - g\beta_h) + U_{bc}(b\gamma_h - a) + K_{bc}(ag - b) / A$$

$$U_c = Th_{bc}(g\beta_h - \alpha_h) + U_{bc}(1 - b\beta_h) + K_{bc}(b\alpha_h - g) / A$$

$$K_c = [Th_{bc}(\alpha_h\gamma_h - \beta_h) + U_{bc}(a\beta_h - \gamma_h) + K_{bc}(1 - a\alpha_h)] / A$$

where: U_c, Th_c and K_c stripping corrected uranium, thorium and potassium
α_h,β_h,γ_h height corrected Compton stripping coefficients
U_{bc}, Th_{bc} and K_{bc} background corrected uranium, thorium and potassium
a is the spectral ratio Th/U
b is the spectral ratio Th/K
g is the spectral ratio U/K
$A = 1 - g\gamma_h - a(\alpha_h - g\beta_h) - b(\beta_h - \alpha_h\gamma_h)$ is the backscatter correction

6.2.6 Attenuation Corrections

The total count, potassium, uranium and thorium data are then corrected to a nominal survey altitude (corrected to remove vegetation clutter from radar/laser altimeter data), in this case the survey height was 35 meters. This is done according to the equation:

$$C_a = C * e^{\mu(h_{ef} - ho)}$$

where: C_a is the output altitude corrected channel
C is the input channel
μ is the attenuation correction for that channel
h_{ef} is the effective altitude, usually in m
h_0 is the nominal survey altitude used as datum

6.2.7 Conversion to Apparent Radioelement Concentrations

With all corrections applied to the radiometric data, the final step is to convert the corrected potassium, uranium, and thorium to apparent radioelement concentrations using the following formula:

$$eE = C_{cor} / s$$

where: *eE* is the element concentration K(%) and equivalent element concentration of U(ppm) & Th(ppm)
s is the experimentally determined sensitivity
C_{cor} is the fully corrected channel

Finally, the natural air exposure rate is determined by using the following formula:

$$E = [(13.08 * K + 5.43 * eU + 2.69 * eTh) / 8.69]$$

where: *E* is the absorption dose rate in μR/h
K is the concentration of potassium (%)
eU is the equivalent concentration of uranium (ppm)
eTh is the equivalent concentration of thorium (ppm)

6.2.8 Radiometric Ratios

To calculate some of the common radiometric ratios (U/Th, Th/K, and U/K or their inverses) the guidelines of the IAEA are followed. Due to statistical uncertainties in the individual radioelement measurements, some care is taken in the calculation of the ratio in order to obtain statistically significant values. Following IAEA guidelines, the method of determining ratios of eU/eTh, eU/K and eTh/K is as follows:

1. Any data points where the potassium concentration is less than 0.25% are neglected.
2. The element with the lowest corrected count rate is determined.
3. The element concentrations of adjacent points on either side of each data point are summed until they exceed a pre-determined threshold value. This threshold is set to be equivalent to 100 counts of the element with the lowest count rate. Additional minimum thresholds of 1.6% for potassium, 20 ppm for thorium, and 30 ppm for uranium are established to ensure meaningful ratios.
4. The ratios are calculated using the accumulated sums.

With this method, the errors associated with the calculated ratios are minimized and comparable for all data points.

7.0 Deliverables

All digital data are presented on a USB memory stick with the logistic report. The survey data are presented as digital databases, maps, and a report.

7.1 Digital Data

The digital files will be provided in two formats, the first will be a .GDB file for use in Geosoft Oasis Montaj and the second format will be a .XYZ (text) file. Full descriptions of the digital data and contents are included in the report (Appendix B).

The digital data were represented as grids, as listed below:

- Digital terrain model (DTM)
- Total magnetic intensity (TMI)
- Residual magnetic intensity (RMI) – removal of IGRF from TMI
- Calculated vertical gradient (CVG) - first vertical derivative of RMI
- Potassium – Equivalent Concentration (%K)
- Thorium – Equivalent Concentration (eTh)
- Uranium – Equivalent Concentration (eU)
- Total Count – Equivalent Dose Rate (TCcor)
- Total Count – Exposure Rate (TCexp)
- Potassium over Thorium Ratio (%K/eTh)
- Potassium over Uranium Ratio (%K/eU)
- Uranium over Thorium Ratio (eU/eTh)
- Uranium over Potassium Ratio (eU/%K)
- Thorium over Potassium Ratio (eTh/%K)
- Ternary Map (TM)

7.1.1 Gridding

The digital data were gridded and displayed using the following Geosoft parameters:

- Grid cell size: 38 m
- Low-pass desampling factor: 3
- Tolerance: 0.001
- % pass tolerance: 99.99
- Maximum iterations: 100

All grids were drawn with a histogram-equalized color shade; sun angle inclination at 45° and declination at 045°.

7.2 KMZ Grids

The digital data represented into grids were exported into kmz files which can be displayed using Google Earth. The grids can be draped onto topography and rendered to give a 3D view.

7.3 Maps

Digital maps were created for the Seattle Creek survey block. The following map products were prepared:

Survey Overview Maps (colour images with elevation contour lines):

- Actual flight lines
- Digital terrain model

Magnetic Maps (colour images with elevation contour lines):

- Total magnetic intensity
- Total magnetic intensity with plotted flight lines
- Residual magnetic intensity
- Calculated vertical gradient of the residual magnetic intensity

Radiometric Maps (colour images with elevation contour lines):

- Potassium – Equivalent Concentration in Percentage
- Thorium – Equivalent Concentration
- Uranium – Equivalent Concentration
- Total Count – Equivalent Dose Rate
- Total Count – Exposure Rate
- Potassium over Thorium Ratio
- Potassium over Uranium Ratio

- Uranium over Thorium Ratio
- Uranium over Potassium Ratio
- Thorium over Potassium Ratio
- Ternary Map

All maps were prepared in WGS 84 and UTM zone 8N.

7.4 Report

The logistics report provides information on the acquisition procedures, magnetic and radiometric processing, and presentation of the Seattle Creek survey block data. A pdf copy of the report is included along with the digital data and maps that are provided on USB stick.

8.0 Conclusions and Recommendations

The airborne magnetic and radiometric data were acquired to help explore and possibly discover new mineral deposits. As geophysical data are not a direct indication of mineral deposits, geophysical interpretation and careful integration with existing and new geological, geochemical, and other geophysical data are recommended to maximize value from the survey investment.

Appendix A

Equipment Specifications

- GEM GSM-19T Proton Precession Magnetometer (Base Station)
- Hemisphere R120 GPS Receiver
- Opti-Logic RS800 Laser Altimeter
- HC-S3 Temperature and Relative Humidity Probe
- Barometric Pressure Setra Model 276
- Scintrex CS-3 Survey Magnetometer
- Bartington Mag-03 three-axis fluxgate magnetic field sensor
- Pico Envirotec GRS-10 Gamma Spectrometer
- Pico Envirotec AGIS data recorder system (for Navigation, Gamma spectrometer, VLF-EM and Magnetometer Data Acquisition)

GEM GSM-19T Proton Precession Magnetometer (Base Station) Specifications

Configuration Options	15
Cycle Time	999 sec to 0.5 sec
Environmental	-40°C to +60°C
Gradient Tolerance	7,000 nT/m
Magnetic Readings	299, 593
Operating Range	10, 000 to 120,000 nT
Power	12 V @ 0.62 A
Sensitivity	0.1 nT @ 1 sec
Weight (Console/ Sensor)	3.2 Kg
Integrated GPS	Yes

Hemisphere R120 GPS Receiver Specifications

GPS Sensor	Receiver Type	L1, C/A code, with carrier phase smoothing (Patented COAST technology during differential signal outage
	Channels	12-channel, parallel tracking (10-channel when tracking SBAS)
	Update Rate	Up to 20 Hz position
	Cold Start Time	<60 s
	SBAS Tracking	2-channel, parallel tracking
	Horizontal Accuracy	<0.02 m 95% confidence (RTK 1, 2) <0.28 m 95% confidence (L-Dif 1, 2) <0.6 m 95% confidence (DGPS 1,3) <2.5 m 95% confidence (autonomous, no SA1)
	Differential Options	SBAS, Autonomous, External RTCM, RTK, OmniSTAR (HP/XP)
Beacon Sensor Specifications	Channels	2-channel, parallel tracking
	Frequency Range	283.5 to 325 kHz
	MSK Bit Rates	50, 100, and 200 bps
L-Band Sensor	Channels	Single channel
	Frequency Range	1530 MHz to 1560 MHz
	Satellite Selection	Manual or Automatic (based on location)
	Startup and Satellite Reacquisition Time	15 seconds typical
Communications	Serial Ports	2 full duplex RS232C
	Baud Rates	4800 – 115200
	USB Ports	1 Communications
	Correction I/O Protocol	RTCM SC-104
	Data I/O Protocol	NMEA 0183
	Timing Output	1 PPS (HCMOS, active high, rising edge sync, 10 kΩ, 10 pF load)
	Raw Data	Proprietary binary (RINEX utility available)
Environmental	Operating Temperature	-30°C to +70°C
	Storage Temperature	-40°C to +85°C
	Humidity	95% non-condensing
Power GPS Sensor	Input Voltage Range	8 to 36 VDC
	Power Consumption	3 Watts
	Current Consumption	< 250 mA @ 12 VDC
	Antenna Voltage Output	5.0 VDC

[1]Depends on multipath environment, number of satellites in view, satellite geometry and ionospheric activity.
[2] Up to 5 km baseline length.
[3] Depends also on baseline length.

Opti-Logic RS800 Laser Altimeter Specifications

Accuracy	+/- 1 m on 1x1 m^2 diffuse target with 50% reflectivity
Resolution	0.2 m
Communication Protocol	RS232-8,N,1
Baud Rate	19200
Data Raw Counts	~200 Hz
Data Calibrated Range	~10 Hz
Calibrated Range Units	Feet, Meters, Yards
Laser	Class I (eye-safe) 905 nm +/- 10 nm
Power	7-9VDC conditioned required, current draw at full power (~ 1.8 W)
Laser Wavelength	RS100 905 nm +/- 10 nm
Laser Divergence	Vertical axis – 3.5 mrad half- angle divergence; Horizontal axis – 1 mrad half- angle divergence; (Approximate beam footprint at 100 m is 35 cm x 5 cm)
Data Rate	~200 Hz raw counts for un-calibrated operation; ~10 Hz for calibrated operation (averaging algorithm seeks 8 good readings)
Dimensions	32 x 78 x 84 mm (lens face cross section is 32 x 78 mm)
Weight	< 227 g (8 oz)
Casing	RS100/RS400/RS800 units are supplied as OEM modules consisting of an open chassis containing optics and circuit boards. Custom housings can be designed and built on request.

HC-S3 Temperature and Relative Humidity Probe Specifications

Operating Temperature	-40°C to +60°C
Temperature Output Signal Range	0 to 1.0 VDC
Temperature Resolution	0.1°C or better
Relative Humidity(RH) Measurement Range	0 to 100 % non-condensing
RH Output Signal Range	0 to 1.0 VDC
RH Accuracy At 23°C	± 1.5 % RH
RH Response Time	12 to 15 secs
RH Typical Long Term Stability	Better than 1% RH per year
Probe Length	168 mm (6.6 in.)
Probe Body Diameter	15.25 mm (0.6 in.)
Housing Material	Polycarbonate
Power Consumption	< 4 mA
Supply Voltage	3.5 to 50 VDC (typically 5 VDC)
Settling Time after power is switched on	3 secs

Barometric Pressure Setra Model 276 Specifications

Pressure Ranges	600 to 1100 hPa/mb 800 to 1100 hPa/mb 0 to 20 psia
Accuracy	±0.25% FS
Output	0.1 to 5.1 VDC 0.5 to 4.5 VDC
Excitation	12 VDC (9.0 to 14.5) 24 VDC (21.6 to 26.0) 5 VDC (4.9 to 7.1)
Size	2" dia. x 1" (5 cm x 2.5 cm)

Scintrex CS-3 Magnetometer Specifications

Operating Principal	Self-oscillation split-beam Cesium Vapor (non-radioactive Cs-133)
Operating Range	15,000 to 105,000 nT
Gradient Tolerance	40,000 nT/metre
Operating Zones	10° to 85° and 95° to 170°
Hemisphere Switching	a) Automatic b) Electronic control actuated by the control voltage levels (TTL/CMOS) c) Manual
Sensitivity	0.0006 nT √Hz rms
Noise Envelope	Typically 0.002 nT P-P, 0.1 to 1 Hz bandwidth
Heading Error	+/- 0.25 nT (inside the optical axis to the field direction angle range 15° to 75° and 105° to 165°)
Absolute Accuracy	<2.5 nT throughout range
Output	a) Continuous signal at the Larmor frequency which is proportional to the magnetic field (proportionality constant 3.49857 Hz/nT) sine wave signal amplitude modulated on the power supply voltage b) Square wave signal at the I/O connector, TTL/CMOS compatible
Information Bandwidth	Only limited by the magnetometer processor used
Sensor Head	Diameter: 63 mm (2.5") Length: 160 mm (6.3") Weight: 1.15 kg (2.6 lb)
Sensor Electronics	Diameter: 63 mm (2.5") Length: 350 mm (13.8") Weight: 1.5 kg (3.3 lb)
Cable, Sensor to Sensor Electronics	3 m (9' 8"), lengths up to 5 m (16' 4") available
Operating Temperature	-40°C to +50°C
Humidity	Up to 100%, splash proof
Supply Power	24 to 35 Volts DC
Supply Current	Approx. 1.5 A at start up, decreasing to 0.5 A at 20°C
Power Up Time	Less than 15 minutes at -30°C

Bartington Mag-03 three-axis fluxgate magnetic field sensor Specifications

Number of Axes	3
Bandwidth	0 to 3 kHz at 50 μT peak
Internal Noise	Basic version: >10 to 20 pTrms/√Hz at 1 Hz Standard version: 6 to ≤10 pTrms/√Hz at 1 Hz Low Noise version: <6 pTrms/√Hz at 1 Hz
Scaling error (DC)	<±0.5%
Orthogonality error	<0.1°
Alignment error (Z axis to reference face)	<0.1°
Linearity error	<0.0015%
Frequency response	0 to 1 kHz maximally flat, ±5% maximum at 1 kHz
Input voltage	±12 V to ±17 V
Supply current	+30 mA, -10 mA (+1.4 mA per 100 μT for each axis)
Power supply rejection ratio	5 μV/V (-106 dB)
Analog output	±10 V (±12 V supply) swings to within 0.5 V of supply voltage
Output impedance	10 Ω
Operating temperature range	-40°C to +70°C
Environmental protection	IP51
Dimensions (W x H x L)	32 x 32 x 152mm
Weight	160 g
Enclosure material	Reinforced epoxy
Connector	ITT Cannon DEM-9P-NMB
Mating connector	ITT Cannon DEM-9S-NMB
Mounting	2 x M5 fixing holes

Pico Envirotec GRS-10 Gamma Spectrometer Specifications

Crystal volume	16.8 litres of NaI (TI) synthetic downward looking crystals and 4.2 litres of NaI (TI) synthetic upward looking crystals
Resolution	256/512 channels
Tuning	Automatic using peak determination algorithm
Detector	Digital Peak
Calibration	Fully automated detector
Real Time	Linearization and gain stabilization
Communication	RS232
Detectors	Expandable to 10 detectors and digital peak
Count Rate	Up to 60,000 cps per detector
Count Capacity per channel	65545
Energy detection range:	36 KeV to 3 MeV
Cosmic channel	Above 3 MeV
Upward Shielding	RayShield® non-radioactive shielding on downward looking crystals
Downward Shielding	6 mm thick lead plate is used for downward-shielding
Spectra	Collected spectra of 256/512 channels, internal spectrum resolution 1024
Software	Calibration: High voltage adjustment, linearity correction coefficients calculation, and communication test support Real Time Data Collection: Automatic Gain real time control on natural isotopes, and PC based test and calibration software suite
Sensor	Each box containing two (2) gamma detection NaI(TI) crystals – each 4.2 liters. (256 cu in.) (approx. 100 x 100 x 650 mm) Total volume of approx 8.4 litres or 512 cu in with detector electronics
Spectra Stabilization	Real time automatic corrections on radio nuclei: Th, Ur, K. No implanted sources

Pico Envirotec AGIS data recorder system Specifications

(for Navigation, Gamma spectrometer, VLF-EM and Magnetometer Data Acquisition)

Functions	Airborne Geophysical Information System (AGIS) with integrated Global Positioning System Receiver (GPS) and all necessary navigation guidance software. Inputs for geophysical sensors - portable gamma ray spectrometer GRS-10, MMS4 Magnetometer, Totem 2A EM, A/D converter, temperature probe, humidity probe, barometric pressure probe, and laser altimeter. Output for the multi-parameter PGU (Pilot Guidance Unit)
Display	Touch screen with display of 800 x 600 pixels; customized keypad and operator keyboard. Multi-screen options for real-time viewing of all data inputs, fiducial points, flight line tracking, and GPS channels by operator.
GPS Navigation	Garmin 12-channel, WAAS-enabled
Data Sampling	Sensor dependent
Data Synchronization	Synchronized to GPS position
Data File	PEI Binary data format
Storage	80 GB
Supplied Software	PEIView: Allows fast data Quality Control (QC) Data Format: Geosoft GBN and ASCII output PEIConv: For survey preparation and survey plot after data acquisition
Software	Calibration: High voltage adjustment, linearity correction coefficients calculation, and communication test support Real Time Data Collection: Automatic Gain real time control on natural isotopes and PC based test and calibration software suite
Power Requirements	24 to 32 VDC
Temperature	Operating: -10°C to +55°C; storage: -20°C to +70°C

Appendix B

Digital File Descriptions

- Magnetic database description
- Radiometric database description
- Grids
- Maps

Magnetic Database:

Abbreviations used in the GDB files listed below:

CHANNEL	UNITS	DESCRIPTION
X_WGS84	m	UTM Easting – WGS 84 Zone 8 North
Y_WGS84	m	UTM Northing – WGS 84 Zone 8 North
Lon_deg	degree	Longitude
Lat_deg	degree	Latitude
Date	yyyy/mm/dd	Dates of the survey flight(s)
FLT		Flight Line numbers
LineNo		Line numbers
STL		Number of satellite(s)
GPSfix		GPS fix
GPStime	Hours:min:secs	GPS time (UTC)
Geos_m	m	Geoidal separation
GHead_deg	degree	Heading of the helicopter
XTE_m	m	Flight line cross distance
Galt	m	GPS height – WGS 84 Zone 8 North
Lalt	m	Laser Altimeter readings
DTM	m	Digital Terrain Model
basemag	nT	Base station diurnal data
IGRF		International Geomagnetic Reference Field 2015
Declin	Decimal degree	Calculated declination of magnetic field
Inclin	Decimal degree	Calculated inclination of magnetic field
TMI	nT	Total Magnetic Intensity
RMI	nT	Residual Magnetic Intensity

Radiometric Database:

Abbreviations used in the GDB files listed below:

CHANNEL	UNITS	DESCRIPTION
X_WGS84	m	UTM Easting – WGS 84 Zone 8 North
Y_WGS84	m	UTM Northing – WGS 84 Zone 8 North
Lon_deg	degree	Longitude
Lat_deg	degree	Latitude
Date	yyyy/mm/dd	Dates of the survey flight(s)
FLT		Flight numbers
LineNo		Line numbers
STL		Number of satellite(s)
GPStime	Hours:min:secs	GPS time (UTC)
Geos_m	m	Geoidal separation
GPSFix		GPS fix
GHead_deg	degree	Heading of the helicopter
XTE_m	m	Flight line cross distance
Galt	m	GPS height – WGS 84 Zone 8 North
Lalt	m	Laser Altimeter readings
DTM	m	Digital Terrain Model
BaroSTP_kP	KiloPascal	Barometric Altitude (Press and Temp Corrected)
Temp_degC	Degrees C	Air Temperature
Press_kP	KiloPascal	Atmospheric Pressure
COSFILT	counts/sec	Spectrometer - Filtered Cosmic
UPUFILT	counts /sec	Spectrometer - Filtered Upward Uranium
Kcor	%	Equivalent Concentration - Potassium
Thcor	ppm	Equivalent Concentration - Thorium
Ucor	ppm	Equivalent Concentration - Uranium
TCcor	μR	Equivalent Dose Rate
TCexp	μR/hour	Exposure Rate - SUM(%k, eU, eTh) * determined factors
KThratio		Spectrometer –%K/eTh ratio
KUratio		Spectrometer –%K/eU ratio
ThKratio		Spectrometer – eTh/%K ratio
UKratio		Spectrometer – eU/%K ratio
UThratio		Spectrometer – eU/eTh ratio

Grids: Seattle Creek Survey Block, WGS 84 Datum, Zone 8N

FILE NAME	DESCRIPTION
SeattleCreek_Block_DTM_38m.grd	Seattle Creek survey block digital terrain model gridded at 38 m cell size
SeattleCreek_Block_RMI_38m.grd	Seattle Creek survey block residual magnetic intensity gridded at 38 m cell size
SeattleCreek_Block_CVG_38m.grd	Seattle Creek survey block calculated vertical gradient of RMI gridded at 38 m cell size
SeattleCreek_Block_Kcor_38m.grd	Seattle Creek survey block potassium (%K) - equivalent concentration in percentage gridded at 38 m cell size
SeattleCreek_Block_Thcor_38m.grd	Seattle Creek survey block Thorium (eTh) – equivalent concentration gridded at 38 m cell size
SeattleCreek_Block_Ucor_38m.grd	Seattle Creek survey block Uranium (eU) – equivalent concentration gridded at 38 m cell size
SeattleCreek_Block_TCcor_38m.grd	Seattle Creek survey block Total Count (TCcor) – equivalent dose rate gridded at 38 m cell size
SeattleCreek_Block_TCexp_38m.grd	Seattle Creek survey block Total Count (TCexp) – exposure rate gridded at 38 m cell size
SeattleCreek_Block_KThratio_38m.grd	Seattle Creek survey block potassium over thorium ratio (%K/eTh) gridded at 38 m cell size
SeattleCreek_Block_KUratio_38m.grd	Seattle Creek survey block potassium over uranium ratio (%K/eU) gridded at 38 m cell size
SeattleCreek_Block_UThratio_38m.grd	Seattle Creek survey block uranium over thorium ratio (eU/eTh) gridded at 38 m cell size
SeattleCreek_Block_UKratio_38m.grd	Seattle Creek survey block uranium over potassium ratio (eU/%K) gridded at 38 m cell size
SeattleCreek_Block_ThKratio_38m.grd	Seattle Creek survey block thorium over potassium ratio (eTh/%K) gridded at 38 m cell size

Maps: Seattle Creek Survey Block, WGS 84 Datum, Zone 8N (jpegs and pdfs)

FILE NAME	DESCRIPTION
SeattleCreek_Block_ActualFlightLines	Seattle Creek survey block plotted actual flown flight lines
SeattleCreek_Block _DTM_38m	Seattle Creek survey block digital terrain model gridded at 38 m cell size
SeattleCreek_Block _TMI_38m	Seattle Creek survey block total magnetic intensity gridded at 38 m cell size
SeattleCreek_Block _TMI_with_FlightLines_38m	Seattle Creek survey block total magnetic intensity with plotted actual flight lines gridded at 38 m cell size
SeattleCreek_Block _RMI_38m	Seattle Creek survey block residual magnetic intensity gridded at 38 m cell size
SeattleCreek_Block _CVG_38m	Seattle Creek survey block calculated vertical gradient of RMI gridded at 38 m cell size
SeattleCreek_Block _Kcor_38m	Seattle Creek survey block potassium (%K) - equivalent concentration in percentage gridded at 38 m cell size
SeattleCreek_Block _Thcor_38m	Seattle Creek survey block Thorium (eTh) – equivalent concentration gridded at 38 m cell size
SeattleCreek_Block _Ucor_38m	Seattle Creek survey block Uranium (eU) – equivalent concentration gridded at 38 m cell size
SeattleCreek_Block _TCcor_38m	Seattle Creek survey block Total Count (TCcor) – equivalent dose rate gridded at 38 m cell size
SeattleCreek_Block _TCexp_38m	Seattle Creek survey block Total Count (TCexp) – exposure rate gridded at 38 m cell size
SeattleCreek_Block _KThratio_38m	Seattle Creek survey block potassium over thorium ratio (%K/eTh) gridded at 38 m cell size
SeattleCreek_Block _KUratio_38m	Seattle Creek survey block potassium over uranium ratio (%K/eU) gridded at 38 m cell size
SeattleCreek_UThratio_38m	Seattle Creek survey block uranium over thorium ratio (eU/eTh) gridded at 38 m cell size
SeattleCreek_Block _UKratio_38m	Seattle Creek survey block uranium over potassium ratio (%K/eU) gridded at 38 m cell size
SeattleCreek_Block _ThKratio_38m	Seattle Creek survey block thorium over potassium ratio (eTh/%K) gridded at 38 m cell size
SeattleCreek_Block _TernaryMap_38m	Seattle Creek survey block displaying ratios of all three elements (%K, eTh, eU)

Plates

Seattle Creek Survey Block Maps

- Plate 1: Seattle Creek - Actual Flight Lines (FL)
- Plate 2: Seattle Creek - Digital Elevation Model (DTM)
- Plate 3: Seattle Creek - Total Magnetic Intensity (TMI)
- Plate 4: Seattle Creek - Total Magnetic Intensity with Flight Lines (TMI_wFL)
- Plate 5: Seattle Creek - Residual Magnetic Intensity (RMI)
- Plate 6: Seattle Creek - Calculated Vertical Gradient (CVG)
- Plate 7: Seattle Creek - Potassium – Equivalent Concentration (%K)
- Plate 8: Seattle Creek - Thorium – Equivalent Concentration (eTh)
- Plate 9: Seattle Creek - Uranium – Equivalent Concentration (eU)
- Plate 10: Seattle Creek - Total Count – Equivalent Dose Rate (TCcor)
- Plate 11: Seattle Creek - Total Count – Exposure Rate (TCexp)
- Plate 12: Seattle Creek - Potassium over Thorium Ratio (%K/eTh)
- Plate 13: Seattle Creek - Potassium over Uranium Ratio (%K/eU)
- Plate 14: Seattle Creek - Uranium over Thorium Ratio (eU/eTh)
- Plate 15: Seattle Creek - Uranium over Potassium Ratio (eU/%K)
- Plate 16: Seattle Creek - Thorium over Potassium Ratio (eTh/%K)
- Plate 17: Seattle Creek - Ternary Map (TM)