

Logistics Report



Flown for

Haddington Resources

Attention:
Keith Mayes

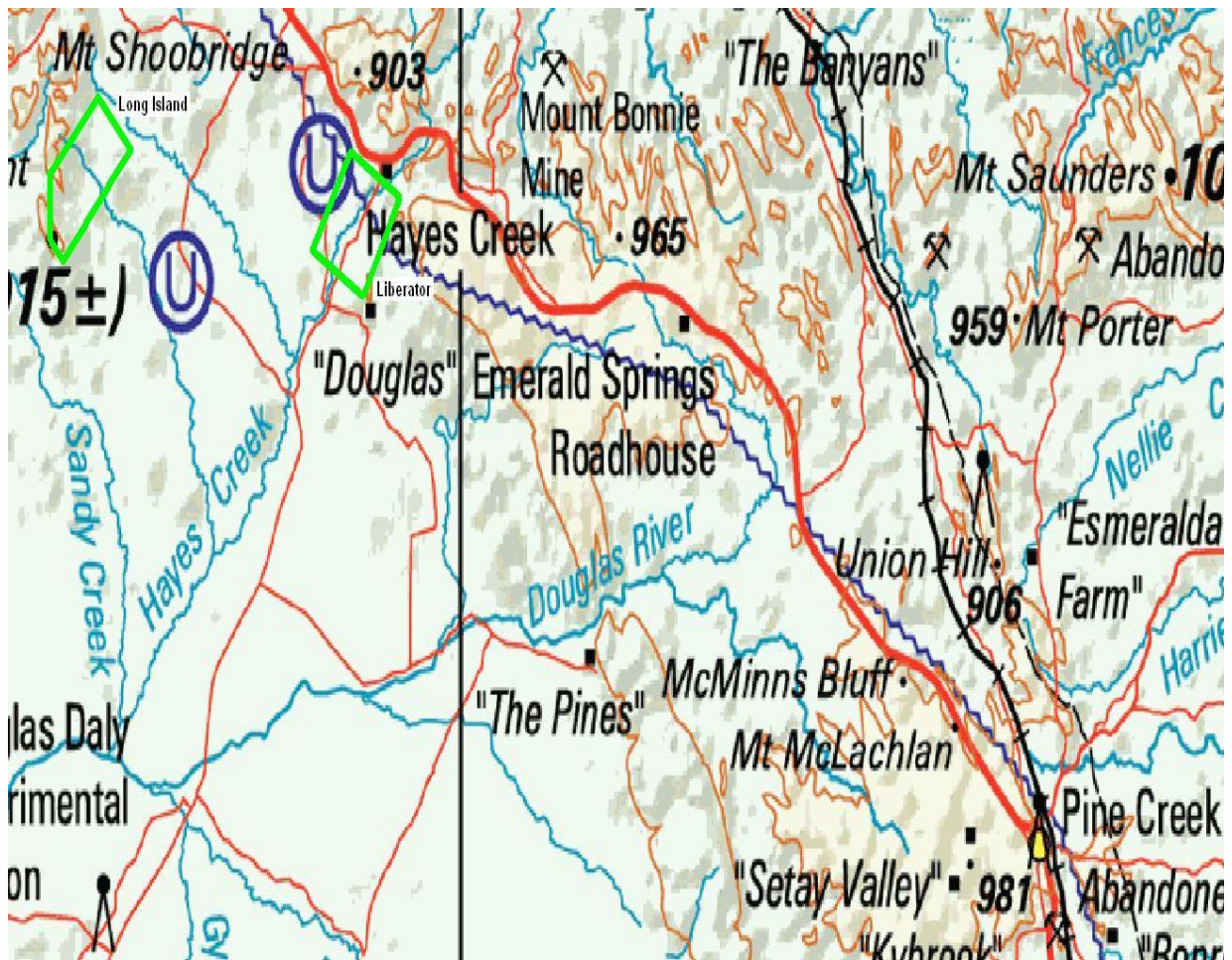
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SPECIFICATIONS FOR AIRBORNE GEOPHYSICAL SURVEY

1. SURVEY AREA

Thomson Aviation carried out a Fixed Wing Geophysical Survey of a combined total of 711 line km north of Pine Creek, NT. For the survey our Air Tractor 502B – Data Boss aircraft was based out of the Pine Creek Airfield. The survey was planned and delivered in GDA94 (Zone 52), a map of the survey areas, flight plan and specifications can be found below.



FLYING SPECIFICATIONS

Liberator

Flight line direction	45 - 225
Flight line spacing	50 m
Tie line direction	135- 315
Tie line spacing	500 m
Sensor mean terrain clearance	30 metres
Time base - for magnetics	0.05 sec. (< 4m)
Time base - for radiometrics	.5 sec
Total Line Kilometers	362 Km

Boundary Lines Used	
GDA94 Zone 52	
748122	8500149
750106	8498153
745805	8493827
745074	8494591
745055	8497054
748122	8500149



Long Island

Flight line direction	120 - 300
Flight line spacing	50 m
Tie line direction	30 - 210
Tie line spacing	500 m
Sensor mean terrain clearance	30 metres
Time base - for magnetics	0.05 sec. (< 4m)
Time base - for radiometrics	.5 sec
Total Line Kilometers	349 Km

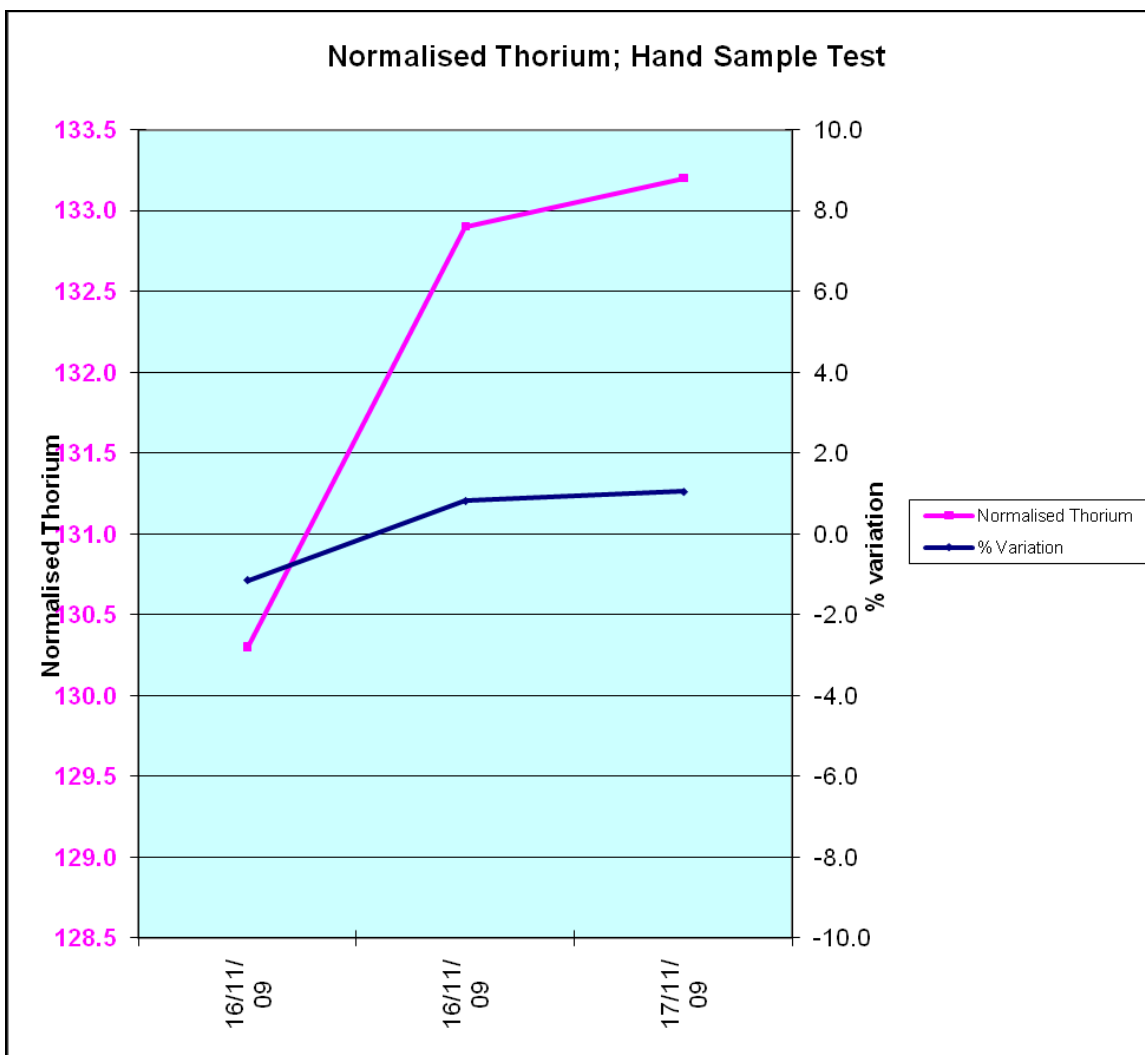
Boundary Lines Used	
GDA94 Zone 52	
766766	8496078
763743	8497836
761384	8494023
764396	8492287
766766	8496078



2. CALIBRATION

The radiometric system was calibrated using Geoscience Australia's calibration range in Carnamah, WA, within 12 months of the commencement of this survey. The following calibrations were carried out before and after each days flying:

- a) Verification of the gamma ray spectrometer system response using hand sample checks. System was exposed to a Thorium sample for a minimum period required to accumulate 10,000 counts in the Thorium window. All background corrected counts fell within a 10% envelope ($\pm 5\%$ from the mean over the survey period).



- b) A Test Line was flown at the same height as the survey specified height to verify magnetometer, spectrometer and barometric altimeter baselines. The test line was flown over a repeatable line of five kilometers and was flown in either direction. The test line Thorium window counts fell within a 10% envelope ($\pm 5\%$ of the mean over the survey period).

Prior to the commencement of the survey, a parallax check was flown to verify the correct parallax values for all of the recorded parameters.



HEADING CHECKS.

A series of lines were flown to check the magnetic heading of the aircraft at the end of the survey

Two lines were flown North- South and two lines flown East- West

To review this data, intersections were calculated at of each of the cross over points, the lines did not cross over the same point, which is nearly impossible, and Diurnal was not collected on the day and was not removed. As the lines were only several minutes long and not separated by a large time difference then we can assume that the diurnal was near constant during the time period. The IGRF was removed with the appropriate filed and using the gps height as the height control

Lines 10010 was flown East, line 2020 flown North, line 20030 flown South and line 10040 flown West

From the analysis we computed the following results:

Line	Valid number	Heading crossings correction
10010	2	1.28
10040	2	-0.69
20020	2	1.75
20030	2	-0.73

RADAR ALTIMETER/BAROMETRIC ALTIMETER CHECK

VH- AVN

Radar Altimeter (metres)	Barometric Height (hPa)	GPS Height (metres)	$H_{\text{gps}} - H_{\text{radalt}}$ (metres)
96.25	1375	95.35	-0.9
139.5	1364	140.25	0.75
188.36	1357	189.96	1.6
231.62	1352	234.2	2.58
276.45	1346	274.35	-2.1
326.79	1344	328.69	1.9
373.36	1337	369.89	-3.47
442.58	1333	440.36	-2.22
489.25	1326	487.36	-1.89
520.56	1322	518.65	-1.91

3. IN-FIELD VERIFICATION AND PROCESSING

Stringent real time data validity checks were employed. Thomson Aviation conducted a daily post-flight verification of all acquired data. The following products were generated on site by a mixture of ChrisDBF and Thomson Aviation proprietary software:

- 1) Flight path plots, to demonstrate quality of navigation
- 2) Magnetic stacked profiles, to demonstrate character of magnetic data
- 3) Statistical summary of line data
- 4) Magnetometer base station plots
- 5) Progressive image presentation of magnetic and topographic data
- 6) Plots of daily parking site of the aircraft to verify GPS position.

4. NAVIGATION AND POSITIONING

Navigation was by electronic means using a mobile Novatel OEMV-1 VBS receiver to provide flight guidance to the pilot as well as recording the flight path for subsequent processing. Differential GPS data was obtained in real time using static GPS data obtained from the “Omnistar” wide area GPS service. Position relative to the survey line was displayed to the pilot by a system proprietary to Thomson Aviation which has proven highly effective.

Under normal circumstances differential GPS is expected to yield positional accuracies in the order of 5 metres RMS or better.

5. DIURNAL MONITOR

The base station magnetometer was positioned at Pine Creek, NT for the block. It recorded to a sensitivity of 0.1 nT every 5 seconds. Noise levels on the base station magnetometer did not exceed +/- 1.0 nT and the non-linear variations of the diurnal field did not exceed 10 nT in 5 minutes.



6. DAILY REPORTS OF AIRCRAFT VH-AVN

Line Kms flown: 711 line kms

<u>Date</u>	<u>Block</u>	<u>Aircraft</u>	<u>Flight</u>	<u>Operator</u>	<u>Comments</u>
16/11/09	Liberator	AVN	1	Aaron McCarthy	Good Weather
16/11/09	Long Island	AVN	2	Aaron McCarthy	Good Weather
17/11/09	Liberator	AVN	3	Aaron McCarthy	Good Weather
17/11/09	Long Island	AVN	4	Aaron McCarthy	Good Weather

AIRCRAFT AND SURVEY INSTRUMENTATION



1. AIRCRAFT

Our Air Tractor 502B – Data Boss, VH-AVN was used as the survey platform. This aircraft combines good maneuverability with the benefits of a magnetically clean base for minimal interference with the magnetic performance of the sensor.

Details:

Engine	Turbine PT6
Fuel Type	Jet A1
Fuel Burn	220lt per hour
Cruise Speed	115 Knots
Survey Speed	115 Knots
Stall Speed	65 Knots
Total Time Airframe	7,707 Hours

2. SURVEY INSTRUMENTATION

MAGNETOMETER AND COMPENSATOR

The Geometrics G822A Magnetometer is a highly sensitive unit incorporating an optically pumped sensor. The constant harmonic frequency from the sensor is proportional to the surrounding scalar magnetic field. This frequency is resolved by the Counter / Processor which provided the magnetic field to a nominal accuracy of 0.01nT at 20 times per second both in analog and digital forms.

The sensor and pre-amp are stinger mounted, attached to the rear of the aircraft.

A Pico Envirotec MMS-4 processor was used to correct, in real time, for the magnetic interference caused by the aircraft itself and the effects of it maneuvering in the earth's magnetic field. The signal from the magnetometer is preserved without aliasing or phase distortion. The raw uncompensated data was also recorded.

2.1. RADAR ALTIMETER

A King KR 495B Radar Altimeter was used, this unit is a high resolution, short pulse ratio altitude system designed for automatic continuous operation over a wide variation of terrain, target reflectivity, weather and aircraft altitude. The radar altimeter indicator provided a terrain clearance display from 0 – 650 metres (0 – 2,000 feet) above ground.

2.2. BAROMETRIC ALTIMETER

Barometric pressure was recorded using a Vaisala pressure transducer with a range of 600 to 1600 Hpa and a resolution of 0.04 Hpa (equivalent to 0.4 metres). The sensor was calibrated to the height given by the GPS.

2.3. DATA ACQUISITION SYSTEM

The GeOZ_DAS digital data acquisition system recorded all system parameters to removable Flash Cards and provided both pilot guidance and error reporting diagnostics for the pilot or operator. Data was transferred to a field computer for both verification and archiving prior to being shipped to the processing centre.

2.4. NAVIGATION EQUIPMENT

The GPS receiver was a Novatel OEMV-1VBS 12 channel parallel tracking receiver capable of providing sub-metre resolution at five times per second. The GPS receiver was integrated within the GeOZ-DAS acquisition unit.

2.5. BASE STATION MAGNETOMETER

Two Geometrics G-856 magnetometers with analog and digital recording were used as diurnal monitors and run continuously during the survey periods.

2.6. GAMMA RAY SPECROMETER SYSTEM

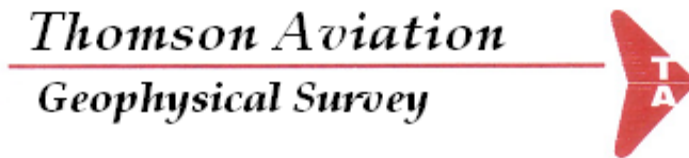
Two Radiations Solutions Inc. RSX-4 Gamma detector systems delivered high-resolution spectral information from 0.33 MeV to 3.0 MeV. In addition, the five primary regions of interest; Total Count, Potassium, Uranium, Thorium and Cosmic were provided. The Gamma Ray Spectrometer was interfaced to a NaI (TI) crystal detector pack with a total volume of 33 litres (2048 cubic inches). The detector packs embody the latest techniques whereby the elimination of dead time in the counting process yields up to 30% more counts over competing systems.

Superior calibration facilities included the visual real time monitoring of full spectrum data and in flight monitoring of gain drift relative to the selected isotope window, to ensure that long-term data quality was maintained.

Enhancement of the spectrometer data was achieved by noise reduction techniques (NASVD or MNF), followed by dead time correction, energy calibration, cosmic/aircraft background correction and atmospheric radon removal all applied to the 256 channel data. Spectral stripping, height correction and conversion to radio-element concentrations were then applied prior to gridding and microlevelling.

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BAIGENT GEOSCIENCES



Haddington Resources Limited Liberator and Long Island Geophysical Survey Processing Report

December 2009

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Datum Specification

The output survey coordinates are based on the Geocentric Datum of Australia 1994 (GDA94), zone 52.

It has the following parameters:

Projection name:	Map Grid of Australia
Datum:	Geocentric Datum of Australia (GDA94)
Reference Frame:	ITRF92 (International Terrestrial Reference 1992)
Epoch:	1994.0
Ellipsoid:	GRS80
Semi-major axis:	6,378,137.0 metres
Inverse flattening:	298,257,222.101
False Northing:	10,000,000 m N
False Easting:	500,000 m E
Scale Factor:	0.9996

Parallax

Parallax corrections were applied as follows:

1. 0 fiducials (at 20 hertz) for magnetics data.
2. 0 fiducials (at 20 hertz) for elevation data.
3. 0.25 seconds for radiometrics

Magnetic processing

Processing Flow

The diurnal base station data was checked for spikes and steps, and suitably filtered prior to the removal of diurnal variations from the aircraft magnetic data.

The diurnal data was filtered with a second difference filter to identify and remove spikes of less than 0.05nT. A second smoothing filter, a 13 point moving average filter is used to reduce noise levels.

The filtered diurnal are then applied to the survey data by synchronising the diurnal data time with the aircraft survey time. The average diurnal base station value was added to the survey data.

An eighth difference filter was run on the raw magnetic survey data in order to identify any remaining spikes in the data, which were manually edited from the data.

The X and Y positioning of the data was then checked for spikes before applying the IGRF correction. Any spikes in the positions were manually edited.

The IGRF 2005 (updated to (2009.87) correction was calculated at each data point taking into account the height above sea level using the gps altitude. This regional magnetic gradient was subtracted from the survey data points.

The data was then tie-line levelled and micro-levelled.

Compensation

The data was compensated post flight using a 16 term model based on the work done by C.D. Hardwick.

Magnetic compensation sequences were flown after acquisition completed and after routine maintenance was performed, as required. The resulting coefficients were used for post flight magnetic compensation:

Aircraft	Date	Flight	StDev (UNC)	StDev (Cmp)	IR
VH-AVN	10/11/09	1	4.698	0.146	32.11

UNC: Standard deviation of uncompensated TMI (nT)

CMP: Standard deviation of compensated TMI (nT)

IR: Improvement ratio (UNC/CMP)

A qualitative measure of the effectiveness of the compensation is to examine the standard deviation of the high passed total magnetic field before and after the compensation coefficients have been applied. The higher the improvement ratio the better the compensation model has removed the aircraft induced manoeuvre signal. This may not always the case, as a very clean aircraft will have a low improvement ratio. Also if the manoeuvres are smaller than specified then the IR ratio will be small. After reviewing the data, the compensation was deemed to be successful.

Magnetic Model

IGRF was removed using the N-value corrected gps altitude.

The magnetic model for the centre of the area is detailed below:

Model	IGRF 2005 updated to 2009.87
Declination	3.57941 degrees
Inclination	-41.67359 degrees
Field strength	46947.88 nT
Grid zone	52
Grid central meridian	129.00000 degrees
Input latitude	-13.59216 degrees
Input longitude	131.36366 degrees
Grid convergence	0.55548 degrees
Grid magnetic angle	4.13489 degrees
Secular variation	-0.01150 degrees

Diurnal Base Value

The average diurnal base value was 46,962.96 nT

Tie Line levelling Method

Tie line levelling was applied to the data by least squares minimisation, using a polynomial fit of order 0, of the differences in elevation values at the crossover points of the survey traverse and tie line data.

The least squares tie line levelling process employs a two pass Gauss-Seidel iterative scheme. The essential steps in this process are:

In the first pass the tie lines were first adjusted to minimise, in the least squares sense, the crossover values with the traverse line values being held constant.

The second pass held the levelled tied line values constant, and minimised in the least squares sense, the crossover values with traverses.

The DC correction values to be applied to the traverse lines and tie lines were then applied to the magnetic data.

To reduce the effects of radar altimeter and gps errors on the recorded elevation data at the crossover points, data having a radar altimeter difference greater than

15 metres in a radius of 50 metres on the traverse or tie lines were excluded from the tying process.

Micro-levelling Method

Micro-levelling techniques were then selectively applied to the tie line levelled data to remove minor residual variations in profile intensity. Selective micro-levelling was applied in order to leave unaffected any data having no residual levelling artefacts. Selective micro-levelling proceeds using the following steps:

Areas of interest that required micro-levelling were identified through the use of image processing visualisation.

Polygons were used to define areas requiring micro-levelling.

“Pseudo-ties” were constructed from the gridded data by extracting traverses from the grid normal to the flight direction.

Line dependent artefacts were removed from the pseudo lines using custom filters.

Crossover values were calculated between traverse lines and pseudo tie lines.

The traverse lines were adjusted in the pre-defined sections to minimise the crossover values.

This process was repeated in order to remove various wavelength line dependent artefacts from the pseudo-ties. The object of each micro-levelling iteration was to produce a smooth control surface to which the traverse lines are levelled. This control surface was provided through the use of “pseudo-ties”.

Interpolation Method

The interpolation used is a minimum curvature algorithm. The algorithm is based on the work published by Briggs 1974, Briggs I. C.: Machine contouring using minimum curvature. *Geophysics*. Vol. 39, No. 1. February 1974. pp. 39-48.

The algorithm has been modified to include a tension parameter based on the work published by Smith and Wessel. Smith, W. H. F, and P. Wessel, 1990, Gridding with continuous curvature splines in tension, *Geophysics* 55, 293-305.

A tension factor of 0 was used to interpolate the data.

The mesh size for data interpolation was 10 x 10 metres.

Radiometric Processing

Processing Flow

The processing steps radiometric data were as follows:

Application of necessary parallax corrections to data

Check radar altimeter data for spikes

NASVD spectral smoothing

- Examine the output to determine the number of components required.
- Select 7 components for spectral reconstruction.

Standard 256 channel radiometric corrections:

- Dead-time correction performed on 256 channel data.
- Check if energy recalibration required
- Remove 256 channel aircraft and cosmic backgrounds from the data
- Remove background radon from window data using Minty's method (1996)
- Perform STP height corrected spectral stripping
- Perform STP height correction of window data to specified survey height (25m).

Micro-levelling

.

Window Energy Limits

The energy bounds for the windows were

Window Name	Energy Range (Mev)
Potassium	1.374 – 1.566
Thorium	2.416 – 2.799
Uranium	1.662 – 1.854
Total Count	0.414 – 2.799

Spectral Stripping Ratios

The stripping ratios used in the processing were:

Alpha	0.277
Beta	0.408
Gamma	0.776
a	0.045
b	0.001
g	0.000

Aircraft, Cosmic Backgrounds and Height Attenuation coefficients

	Total Count	Potassium	Uranium	Thorium
Aircraft Bkg	399.3	44.3	18.5	6.0
Cosmic Bkg	1.484	0.084	0.075	0.059
Height Attn	-0.007434	-0.009432	-0.008428	-0.007510

The above values are for the windows only. During processing the equivalent 256 channel aircraft and cosmic backgrounds are removed.

Conversion to Ground Concentrations

	Total Count Cps to Dose rate	Potassium Cps to Percent	Uranium Cps to PPM	Thorium Cps to PPM
Conversion Factor	86.042	350.696	22.740	16.456

Tie Line Levelling

No tie line levelling was applied.

Micro-levelling Method

Micro-levelling techniques were then selectively applied to the tie line levelled data to remove minor residual variations in profile intensity. Selective micro-levelling was applied in order to leave unaffected any data having no residual levelling artifacts. Selective micro-levelling proceeds using the following steps:

Areas of interest that required micro-levelling were identified through the use of image processing visualisation.

Polygons were used to define areas requiring micro-levelling.

“Pseudo-ties” were constructed from the gridded data by extracting traverses from the grid normal to the flight direction.

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The algorithm has been modified to include a tension parameter based on the work published by Smith and Wessel. Smith, W. H. F, and P. Wessel, 1990, Gridding with continuous curvature splines in tension, *Geophysics* 55, 293-305.

A tension factor of 0 was used to interpolate the data.

The mesh size for data interpolation was 25 x 25 metres

Elevation Processing

Processing Flow

The processing steps for digital elevation data were as follows:

Application of necessary parallax corrections to data

Calculation of raw digital elevation data by subtracting the radar altimeter from the gps altitude

Tie line levelling

Micro-levelling

Tie Line levelling Method

Tie line levelling was applied to the data by least squares minimisation, using a polynomial fit of order 0, of the differences in elevation values at the crossover points of the survey traverse and tie line data.

The least squares tie line levelling process employs a two pass Gauss-Seidel iterative scheme. The essential steps in this process are:

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The DC correction values to be applied to the traverse lines and tie lines were then applied to the magnetic data.

To reduce the effects of radar altimeter and gps errors on the recorded elevation data at the crossover points, data having a radar altimeter difference greater than 15 metres in a radius of 50 metres on the traverse or tie lines were excluded from the tying process.

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A tension factor of 0 was used to interpolate the data.

The mesh size for data interpolation was 10 x 10 metres.

Deliverable Items

The deliverable items included all digital data. The located data conformed to ASEG-GDF format and the gridded data was supplied in ERMapper format. The description of the located data is below.

There were two area processed:

Liberator

Long Island

Located data supplied in ASEG GDF

File name	Definition
*_magdtm	Magnetics and Elevation data
*_rads	Radiometric data
*_rad256	Raw 256 channel data

Gridded data supplied in ER Mapper format

File name	Definition	Units
*_tmi	Final magnetic gridded data	nT
*_elev	Final dtm gridded data	m
*_tot	Final radiometric dose rate gridded data	nGy/hr
*_pot	Final radiometric potassium gridded data	percent
*_ura	Final radiometric uranium gridded data	ppm
*_th	Final radiometric thorium gridded data	ppm

* denotes the area name

Also provided were grids of both areas combined

Magnetic and elevation Located Data file

```

COMM
COMM  Baigent Geosciences Pty. Ltd.
COMM  -----
COMM
COMM  LOCATED DATA
COMM  -----
COMM  Area      :   Liberator
COMM  Company Flown by:   Thomson Aviation Pty. Ltd.
COMM  Company Flown for:   Haddington Resources
COMM  Company Processed:   Baigent Geosciences Pty. Ltd.
COMM
COMM  AIRBORNE SURVEY EQUIPMENT:
COMM  -----
COMM
COMM  Aircraft                :   Airtractor
COMM  Magnetometer            :   Geometrics G822 Cesium Vapour
COMM  Magnetometer Resolution :   0.001 nT
COMM  Magnetometer Compensation :   Post Flight
COMM  Magnetometer Sample Interval :   20 Hz, Approx 3.00 metres
COMM  Data Acquisition         :   GeoOZ Model 2007
COMM  Spectrometer             :   Radiation Solutions RS 500
COMM  Crystal Size             :   64 lt downward array
COMM  Spectrometer Sample Interval :   0.5 Seconds (approx 30 metres)
COMM  GPS Navigation System     :   Novatel 951R GPS Receiver
COMM
COMM
COMM
COMM
COMM  AIRBORNE SURVEY SPECIFICATIONS
COMM
COMM  Flight Line Direction    :       045 - 225 degrees
COMM  Flight Line Separation    :              50 metres
COMM  Tie Line Direction       :       135 - 315 degrees
COMM  Tie Line Separation      :              500 metres
COMM  Terrain Clearance        :              30 metres (MTC)
COMM
COMM
COMM  Survey flown              :              November 2009
COMM
COMM
COMM  Flight path calculated from differentially
COMM  corrected GPS Data using a Novatel 951R GPS Receiver.
COMM
COMM
COMM  Grid notation refers to GDA/MGA Zone  52
COMM
COMM
COMM  MAGNETIC DATA CORRECTIONS:
COMM  -----
COMM  Diurnal variations removed
COMM  IGRF(2005) updated to 2009.87 removed
COMM  Average survey base station value added to datum
COMM
COMM  RADIOMETRIC CORRECTIONS AND COEFFICIENTS:
COMM  -----
COMM  Spectral data preprocessed using NASVD
COMM  Data has been corrected for aircraft and cosmic backgrounds.
COMM  Height corrected to a constant datum of 35 metres,

```

COMM minimum height of 20 and a maximum of 300 metres.
COMM Data has also been corrected for radon using the method described
by Minty
COMM and corrected for channel interaction.

COMM	Tot.Count	Potassium	Uranium	Thorium
COMM Arcft Bkg	155.53	23.58	6.047	0
COMM Cosmic Bkg	0.986	0.0514	0.041	0.0549
COMM Height Attn	0.007434	0.009432	0.008428	0.007510
COMM CPS to equivalents	57.789	230.992	19.669	11.896

COMM
COMM
COMM STRIPPING RATIOS:

COMM -----
COMM Alpha = 0.276, Beta = 0.418, Gamma = 0.759,
COMM a = 0.048, b = 0.003, g = 0.001

COMM	Field Name	Format	Units	Null Value
COMM	BGS Job Number	a5		
COMM	Line number	a8		
COMM	Flight number	i4		
COMM	Flight date	a8		
COMM	fiducial	f12.1		-
999999.0				
COMM	mga_east	f10.2	METRES	-
99999.00				
COMM	mga_north	f11.2	METRES	-
99999.00				
COMM	wgs84_lat	f12.7	DEGREES	-
99.000000				
COMM	wgs84_long	f13.7	DEGREES	-
999.00000				
COMM	raw_mag	f10.3	nT	-9999
COMM	mag_gammas	f10.3	nT	-
9999.000				
COMM	diurnal_gammas	f10.3	nT	-
9999.000				
COMM	igrf_gammas	f10.3	nT	-
9999.000				
COMM	mag_level	f10.3	nT	-
9999.000				
COMM	rad_alt	f8.2	METRES	-
999.00				
COMM	gps_height	f8.2	METRES	-
999.00				
COMM	dtm	f8.2	METRES	-
999.00				

Radiometric Located Data file

COMM
COMM Baigent Geosciences Pty. Ltd.
COMM -----
COMM

```

COMM  LOCATED DATA
COMM  -----
COMM  Area      :   Liberator
COMM  Company Flown by:   Thomson Aviation Pty. Ltd.
COMM  Company Flown for:   Haddington Resources
COMM  Company Processed:   Baigent Geosciences Pty. Ltd.
COMM
COMM  AIRBORNE SURVEY EQUIPMENT:
COMM  -----
COMM
COMM  Aircraft                :   Airtractor
COMM  Magnetometer            :   Geometrics G822 Cesium  Vapour
COMM  Magnetometer Resolution :   0.001 nT
COMM  Magnetometer Compensation :   Post Flight
COMM  Magnetometer Sample Interval :   20 Hz, Approx 3.00 metres
COMM  Data Acquisition         :   GeoOZ Model 2007
COMM  Spectrometer            :   Radiation Solutions RS 500
COMM  Crystal Size             :   64 lt downward array
COMM  Spectrometer Sample Interval :   0.5 Seconds (approx 30 metres)
COMM  GPS Navigation System    :   Novatel 951R GPS Receiver
COMM
COMM
COMM
COMM
COMM  AIRBORNE SURVEY SPECIFICATIONS
COMM
COMM  Flight Line Direction    :   045 - 225  degrees
COMM  Flight Line Separation   :   50  metres
COMM  Tie Line Direction       :   135 - 315  degrees
COMM  Tie Line Separation      :   500 metres
COMM  Terrain Clearance        :   30 metres (MTC)
COMM
COMM
COMM  Survey flown             :   November 2009
COMM
COMM
COMM  Flight path calculated from differentially
COMM  corrected GPS Data using a Novatel 951R GPS Receiver.
COMM
COMM
COMM  Grid notation refers to GDA/MGA Zone  52
COMM
COMM
COMM  MAGNETIC DATA CORRECTIONS:
COMM  -----
COMM  Diurnal variations removed
COMM  IGRF(2005) updated to 2009.87 removed
COMM  Average survey base station value added to datum
COMM
COMM  RADIOMETRIC CORRECTIONS AND COEFFICIENTS:
COMM  -----
COMM  Spectral data preprocessed using NASVD
COMM  Data has been corrected for aircraft and cosmic backgrounds.
COMM  Height corrected to a constant datum of 30 metres,
COMM  minimum height of 10 and a maximum of 300 metres.
COMM  Data has also been corrected for radon using the method described
COMM  by Minty
COMM  and corrected for channel interaction.
COMM
COMM
COMM
COMM  Tot.Count   Potassium   Uranium   Thorium
COMM  Arcft Bkg   399.3       44.3     18.5     6.0

```

```

COMM Cosmic Bkg          1.484          0.084          0.075          0.059
COMM Height Attn         0.007434       0.009432       0.008428       0.007510
COMM CPS to equivalents  86.042          350.696       22.740         16.456
COMM
COMM
COMM STRIPPING RATIOS:
COMM -----
COMM   Alpha = 0.276,   Beta = 0.418, Gamma = 0.759,
COMM   a = 0.048,   b = 0.003,   g = 0.001
COMM
COMM Field Name          Format          Units          Null Value
COMM
COMM BGS Job Number      a5
COMM Line number         a8
COMM Flight number       i4
COMM Flight date         a8
COMM fiducial            f12.1          -
999999.0
COMM mga_east            f10.2          METRES         -
99999.00
COMM mga_north           f11.2          METRES         -
99999.00
COMM wgs84_lat           f12.7          DEGREES        -
99.000000
COMM wgs84_long          f13.7          DEGREES        -
999.00000
COMM rad_alt             f8.2           METRES         -
999.00
COMM temp_air_deg_c      f5.1           DEG            -9.0
COMM baro_pressure       f8.2           hPa            -999.0
COMM gps_height          f8.2           METRES         -
999.00
COMM live_time           f6.0           MSEC           -9999
COMM raw_tot_cps         f8.0           CPS            -99.
COMM raw_pot_cps         f7.0           CPS            -99.
COMM raw_ura_cps         f7.0           CPS            -99.
COMM raw_th_cps          f7.0           CPS            -99.
COMM cosmicd_cps         f6.0           CPS            -999
COMM dose_rate           f10.4          nGy/h          -
999.0000
COMM pot_percent         f9.4           PERCENT        -
99.0000
COMM ura_ppm             f9.4           PPM            -99.
COMM th_ppm              f9.4           PPM            -
99.000

```

256 Radiometric Located Data file

```

COMM
COMM Baigent Geosciences Pty. Ltd.
COMM -----
COMM
COMM LOCATED DATA
COMM -----

```

COMM Area : Liberator
 COMM Company Flown by: Thomson Aviation Pty. Ltd.
 COMM Company Flown for: Haddington Resources
 COMM Company Processed: Baigent Geosciences Pty. Ltd.
 COMM
 COMM AIRBORNE SURVEY EQUIPMENT:
 COMM -----
 COMM
 COMM Aircraft : Airtractor
 COMM Magnetometer : Geometrics G822 Cesium Vapour
 COMM Magnetometer Resolution : 0.001 nT
 COMM Magnetometer Compensation : Post Flight
 COMM Magnetometer Sample Interval : 20 Hz, Approx 3.00 metres
 COMM Data Acquisition : GeoOZ Model 2007
 COMM Spectrometer : Radiation Solutions RS 500
 COMM Crystal Size : 64 lt downward array
 COMM Spectrometer Sample Interval : 0.5 Seconds (approx 30 metres)
 COMM GPS Navigation System : Novatel 951R GPS Receiver
 COMM
 COMM
 COMM
 COMM AIRBORNE SURVEY SPECIFICATIONS
 COMM
 COMM Flight Line Direction : 045 - 225 degrees
 COMM Flight Line Separation : 50 metres
 COMM Tie Line Direction : 135 - 315 degrees
 COMM Tie Line Separation : 500 metres
 COMM Terrain Clearance : 30 metres (MTC)
 COMM
 COMM
 COMM Survey flown : November 2009
 COMM
 COMM
 COMM Flight path calculated from differentially
 COMM corrected GPS Data using a Novatel 951R GPS Receiver.
 COMM
 COMM
 COMM Grid notation refers to GDA/MGA Zone 52
 COMM
 COMM
 COMM MAGNETIC DATA CORRECTIONS:
 COMM -----
 COMM Diurnal variations removed
 COMM IGRF(2005) updated to 2009.87 removed
 COMM Average survey base station value added to datum
 COMM
 COMM RADIOMETRIC CORRECTIONS AND COEFFICIENTS:
 COMM -----
 COMM Spectral data preprocessed using NASVD
 COMM Data has been corrected for aircraft and cosmic backgrounds.
 COMM Height corrected to a constant datum of 30 metres,
 COMM minimum height of 10 and a maximum of 300 metres.
 COMM Data has also been corrected for radon using the method described
 COMM by Minty
 COMM and corrected for channel interaction.
 COMM

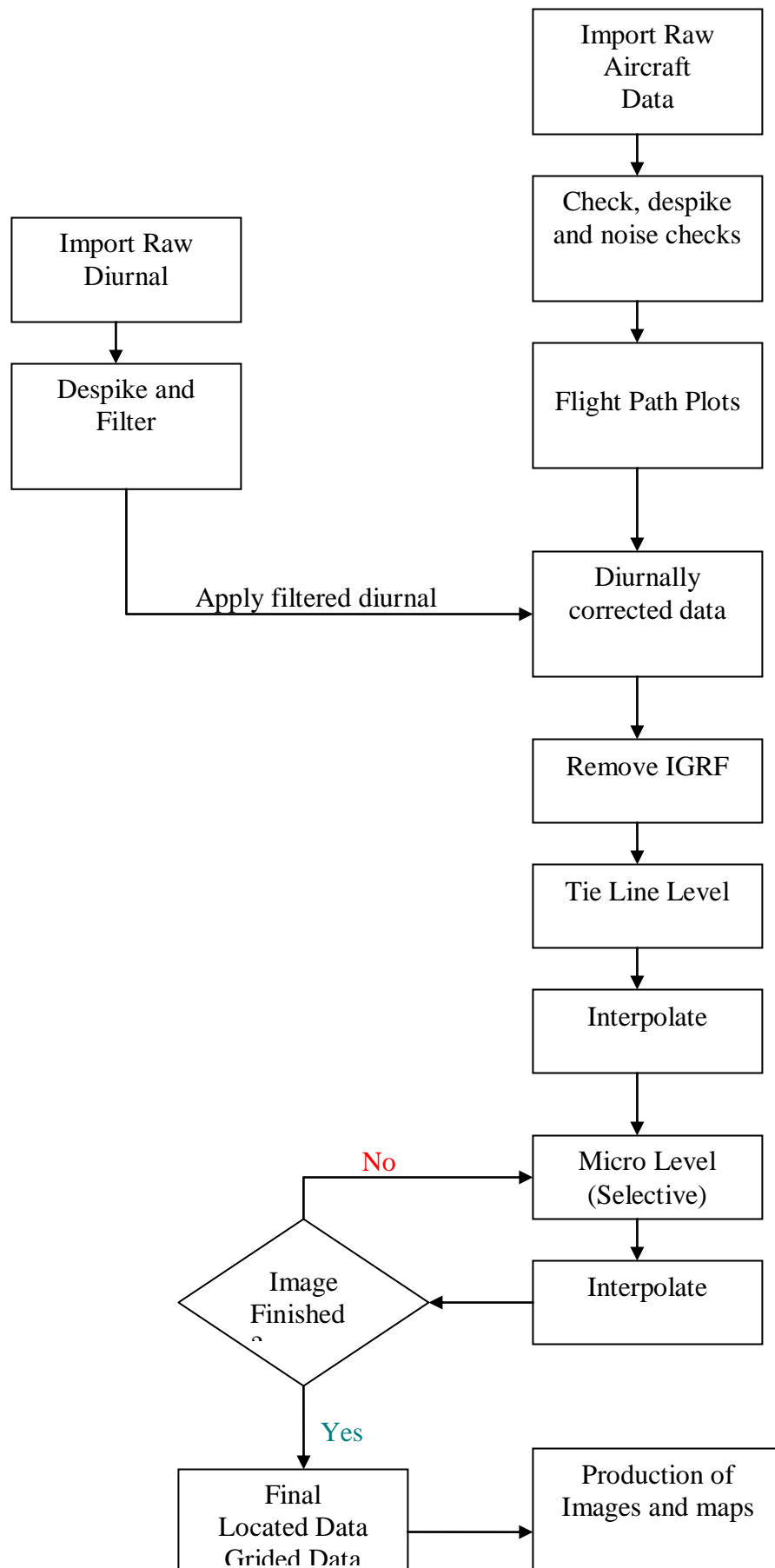
COMM		Tot.Count	Potassium	Uranium	Thorium
COMM	Arcft Bkg	399.3	44.3	18.5	6.0
COMM	Cosmic Bkg	1.484	0.084	0.075	0.059
COMM	Height Attn	0.007434	0.009432	0.008428	0.007510


```

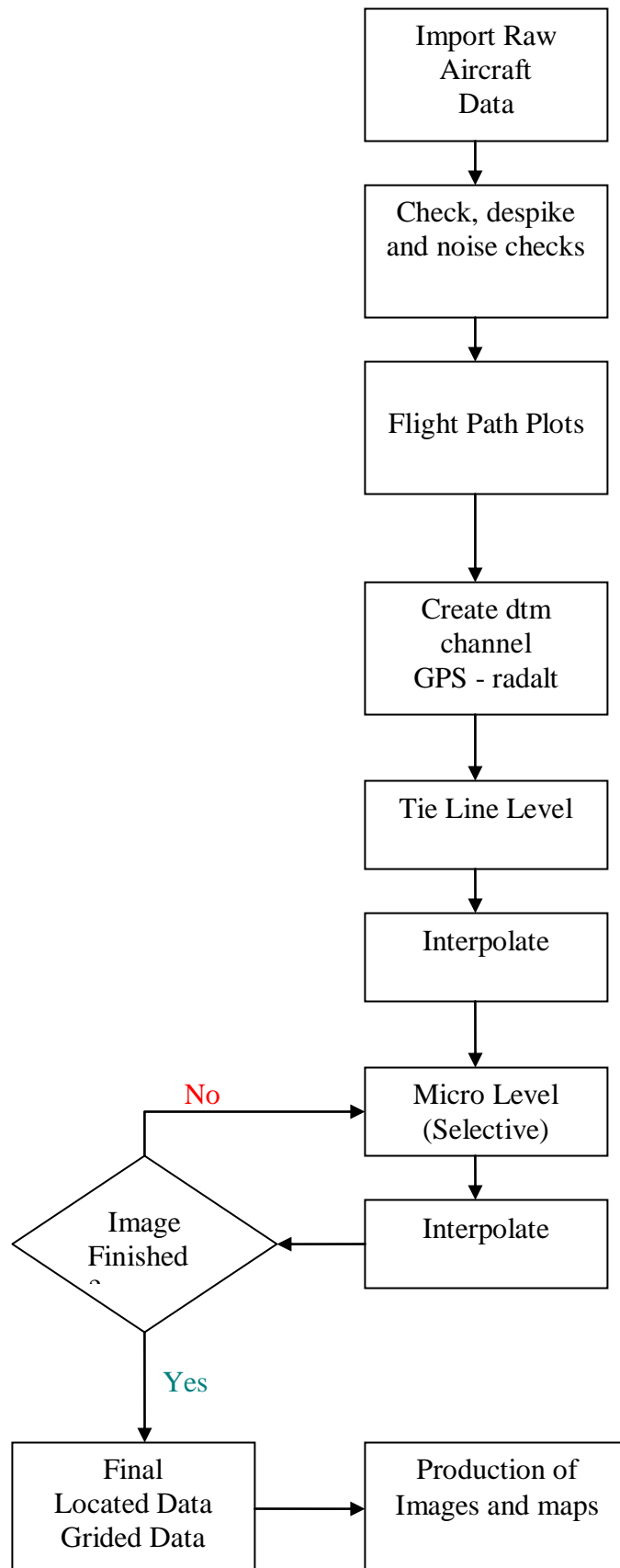
COMM CPS to equivalents    86.042      350.696      22.740      16.456
COMM
COMM
COMM STRIPPING RATIOS:
COMM -----
COMM   Alpha = 0.276,   Beta = 0.418,   Gamma = 0.759,
COMM   a = 0.048,   b = 0.003,   g = 0.001
COMM
COMM   Field Name                Format          Units      Null Value
COMM
COMM   BGS Job Number            a5
COMM   Line number               a8
COMM   Flight number             i4
COMM   Flight date              a8
COMM   fiducial                  f12.1              -
999999.0
COMM   mga_east                  f10.2             METRES      -
99999.00
COMM   mga_north                 f11.2             METRES      -
99999.00
COMM   wgs84_lat                 f12.7             DEGREES     -
99.000000
COMM   wgs84_long                f13.7             DEGREES     -
999.00000
COMM   rad_alt                   f8.2              METRES      -
999.00
COMM   temp_air_deg_c            f5.1              DEG          -9.0
COMM   baro_pressure             f8.2              hPa         -999.0
COMM   gps_height                f8.2              METRES      -
999.00
COMM   live_time                 f6.0              MSEC        -9999
COMM   cosmicd_cps               f6.0              CPS          -999
COMM   256 channel raw spectra   256f6.0           CPS          -9

```

Magnetic Data Processing Flow Chart



Elevation Data Processing Flow Chart



Radiometric Processing Flow Chart

