Booroloola and Yiyintyi, Northern Territory Airborne Magnetic and Radiometric Geophysical Survey

Acquisition and Processing Report

for

Sandfire Resources NL

Prepared by :

D. Gay L. Stenning

Authorised for release by :

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Survey flown: September - October 2011

by



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FAS JOB # 2251

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1. SURVEY OPERATIONS AND LOGISTICS

1.1 Introduction

Between the 23rd of September and the 4th October 2011, Fugro Airborne Surveys Pty. Ltd. (FAS) undertook an airborne magnetic and radiometric survey for Sandfire Resources N.L., over the Booroloola and Yiyintyi Project areas in the Northern Territory. The survey consisted of 3 areas flown in 13 flights. Total coverage of the survey area amounted to 3966.3 line kilometres. The survey was flown using an Aerocommander Shrike 500-S aircraft, registration VH-FGZ owned and operated by FAS. This report summarises the procedures and equipment used by FAS in the acquisition, verification and processing of the airborne geophysical data.

1.2 Survey Base

The survey was based out of Booroloola, Northern Territory. The survey aircraft was operated from Booroloola Airstrip with the aircraft fuel available on site. A temporary office was set up at the Booroloola Hotel/Motel, where all survey operations were run and the post-flight data verification was performed.

1.3 Survey Personnel

The following personnel were involved in this project:

Project Supervision - Acquisition	Peter Johnson	
- Processing	Denis Cowey	
On-site Crew Leader	Dave Little	
Pilot/s	Wayne Saunders	
System Operator/s	Dave Little	
Data Processing	Doug Gay	

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1.4 Survey Equipment

Survey Platform Data Acquisition System Total Field Magnetometer Vector Magnetometer Magnetometer Compensator Gamma-ray Spectrometer Gamma-ray Detector Navigation System GPS

Base Station Magnetometers Altimeter Barometer Thermometer

- Aerocommander Shrike 500-S VH-FGZ
- FAS digital acquisition system
- Scintrex CS-2 Caesium vapour
- Billingsley TFM100-1E 3-axis
- Fugro FÁSDAS Mag Decoupler Unit Aeromagnetic Digital
- Exploranium GR820 256 Channels
- 8 Nal(TI) crystals; 33.56 L down
 - Fugro Omnistar in VBS (Virtual Base Station) mode, Novatel OEM4 GPS receiver
- 2 x Scintrex Envi Mag
- Collins ALT-50 radio altimeter
- Vaisala PMB100 altimeter
- Honeywell HIH-3602-C temperature and humidity sensor

1.5 Area Map

Borroloola Flight Plan



Yiyintyi East and Yiyintyi West Flight Plan



1.6 General Disclaimer

It is Fugro Airborne Survey's understanding that the data and report provided to the client is to be used for the purpose agreed between the parties. That purpose was a significant factor in determining the scope and level of the Services being offered to the Client. Should the purpose for which the data and report is used change, the data and report may no longer be valid or appropriate and any further use of, or reliance upon, the data and report in those circumstances by the Client without Fugro Airborne Survey's review and advice shall be at the Client's own or sole risk.

The Services were performed by Fugro Airborne Survey exclusively for the purposes of the Client. Should the data and report be made available in whole or part to any third party, and such party relies thereon, that party does so wholly at its own and sole risk and Fugro Airborne Survey disclaims any liability to such party.

Where the Services have involved Fugro Airborne Survey's use of any information provided by the Client or third parties, upon which Fugro Airborne Survey was reasonably entitled to rely, then the Services are limited by the accuracy of such information. Fugro Airborne Survey is not liable for any inaccuracies (including any incompleteness) in the said information, save as otherwise provided in the terms of the contract between the Client and Fugro Airborne Survey.

2. SURVEY SPECIFICATIONS AND PARAMETERS

2.1 Area Co-ordinates

The areas were located within GDA94 MGA Zone 53, Central Meridian = 135 (Note - Co-ordinates in GDA94/MGA Zone 53)

Booroloola

Easting	Northing
640000	8271000
640000	8262000
633000	8262000
631000	8259000
620000	8265000
620000	8275000
634000	8275000

Yiyintyi East

Easting	Northing
573746	8318658
577070	8317825
575913	8311631
572444	8312539

Yiyintyi West

Easting	Northing
559476	8312704
565423	8309318
563111	8306510
557577	8310226

Survey Area Parameters

Job Number	-	2251
Survey Company	-	Fugro Airborne Surveys Pty Ltd
Date Flown	-	23 rd September 2011 – 4 th October 2011
Client	-	Sandfire Resources NL
Project Name	-	Booroloola and Yiyintyi Project, Northern Territory
Nominal Terrain Clearance	-	40 m
Traverse Line Spacing	-	100 m (Booroloola)
1 0		50 m (Yiyintyi East and West)
Traverse Line Direction	-	000 – 180 degrees (Booroloola)
		105 – 285 degrees (Yiyintyi East)
		039 – 219 degrees (Yiyintyi West)
Tie Line Spacing	-	975 m (Booroloola)
		520 m (Yiyintyi East)
		500 m (Yiyintyi West)
Tie Line Direction	-	090 – 270 degrees (Booroloola)
		012 – 192 degrees (Yiyintyi East)
		120 – 300 degrees (Yiyintyi West
Traverse Line Numbers	-	1000101 – 1020101 (Booroloola)
		2000101 – 2012801 (Yiyintyi East)
		3000101 – 3013601 (Yiyintyi West)
Tie Line Numbers	-	1900101 – 1901701 (Booroloola)
		2900101 – 2900801 (Yiyintyi East)
		3900101 – 3900801 (Yiyintyi West)
Line Kilometres	-	2823.2 km (Booroloola)
		553.73 km (Yiyintyi East)
		589.40 km (Yiyintyi West)
Total Line Kilometres	-	3966.33 km

2.2 Data Sample Intervals

Nominal data sample intervals.		
Magnetometer	-	7 m (@10 Hz)
Radar Altimeter	-	7 m (@10 Hz)
Thermometer	-	70 m (@1 Hz)
Barometer	-	70 m (@1 Hz)
GPS	-	70 m (@1 Hz)
Spectrometer	-	70 m (@1 Hz)
Magnetic Base Station (ENVI Mag)	-	5 s

2.3 Survey Tolerances

As specified in the contract the following tolerances were used:

•	0	
Traverse line deviation	-	+/- 50% of nominated line spacing over 1 km or more
Tie line deviation	-	+/- 50% of nominated tie line spacing over 1 km or more
Terrain clearance deviation	-	+/-10 m of nominal terrain clearance over 1 km or more, except where such lines breach air regulations, or in the opinion of the pilot, put aircraft and crew at risk.
Total magnetometer system noise	-	More than 0.1 nT continuously for more than 1 km
Magnetic diurnal variation	-	More than 10 nT in 10 minutes non-linear either on flight lines or tie lines.

3. AIRCRAFT EQUIPMENT AND SPECIFICATIONS

3.1 Aircraft

Manufacturer	-	Aerocommander
Model	-	Shrike 500S
Registration	-	VH-FGZ
Ownership	-	Fugro Airborne Surveys Pty Ltd

3.2 Navigation System

The GPS receiver was integrated as part of the acquisition system. Navigation displays were generated by the acquisition system software that displayed to the pilot a graphical representation of the line being flown. A pre-defined flight plan, with area boundaries and the start and end of the line co-ordinates, was loaded into memory and used for real-time navigation information. Position co-ordinates and other relevant GPS information were output and recorded by the acquisition computer.

3.3 Aircraft Magnetometers

The survey was flown using a Scintrex CS-2 ultra-high sensitivity Caesium vapour magnetometer sensor with the sensor mounted in the tail stinger of the aircraft. The sensor provides a Larmor signal that is processed by high precision counters embedded within the FASDAS to provide an operating range of 20,000 to 100,000 nT.

Specifications

Nominal Sensitivity:	-	0.001 nT
Still Air RMS Noise:	-	0.05 nT
Digital Recording Resolution:	-	0.001 nT
Magnetic Gradient Tolerance	-	>20,000 nT/m

3.4 Automatic Compensator

The magnetometer data, together with data from the 3-axis fluxgate, was integrated in the acquisition system to produce real time compensation for the effects of the aircraft's motion, i.e. from changes in attitude and heading. The compensation coefficients were calculated from compensation flights carried out before the survey commenced. The compensated output data, with a resolution and sensitivity of 0.001 nT at a sampling rate of 10 times per second, were recorded digitally.

3.5 Gamma Ray Spectrometer System

The radiometric acquisition system consisted of a 256 channel gamma-ray spectrometer and detector system with the following specifications:

Manufacturer:	Exploranium	Inc.
Model:	GR-820	
Number of channels:	256	
Crystal Volume:	33.56 L down	ward looking (thermally insulated)
Sampling interval:	1 s	
Windows (keV):	Potassium:	1370 to 1570
	Uranium:	1660 to 1860
	Thorium:	2410 to 2810
	Total Count:	410 to 2810
	Cosmic:	4000 to >6000

Data checking in the survey system was carried out by the use of resolution procedures using known radiometric sources. To verify the system, real time display of individual crystal resolutions and system resolutions, real time display peak channel tracking information, real time display of the energy spectrum showing counts, cosmic level and system livetime were available. The survey system displayed to the operator any errors encountered in the spectrometer system.

3.6 Radar Altimeter

A Collins ALT-50 radio altimeter system was used to measure ground clearance. The radio altimeter indicator provides an absolute altitude display from 0 - 750 metres (0 - 2,500 feet) with a sensitivity of 4 mV/ft. Radar altimeter data were digitally recorded every 0.1 seconds.

Specifications

Range:	-	0 - 2500 ft
Accuracy:	-	1%
Resolution:	-	4 mV/ft

3.7 Barometric Altimeter

The output of the Paroscientific Digibaro Barometric Altimeter was used for calculating the barometric altitude of the aircraft. The atmospheric pressure was taken from a probe and fed to the transducer. The transducer uses a precise quartz crystal resonator whose frequency of oscillation varies with pressure induced stress. The temperature of the pressure sensor was also recorded. In conjunction with the area QNH pressure and ambient temperature, the barometric altitude was calculated.

Specifications

Range:	-	sea level to 10,000 ft
Accuracy:	-	5 ft
Resolution:	-	1 mV/ft

3.8 Flight Data Recording

All data recorded by the data acquisition system were stored in a digital format on the removable media drive located in the DAS. This data were then transferred to the field office computers for post-flight quality control examination.

3.9 Flight Following

An integral part of the Safety Management System provides for the installation of a Flight Following System that transmits a position via satellite at pre determined intervals. The Fugro OmniTRACK system is fitted to the aircraft and position information is transmitted every 4 minutes to the Omnistar Network control centre. This information can be monitored by accessing the Fugro web page where the updated flight path is displayed. The aircraft is also fitted with an emergency switch and activation of this by the pilot or crew will notify the Omnistar Network control centre immediately. They in turn will contact FAS personnel as per the Emergency Response Plan.

4. GROUND DATA ACQUISITION EQUIPMENT AND SPECIFICATIONS

4.1 Magnetic Base Station

Two Scintrex Envi Mag magnetometers were used to measure the daily variations of the Earth's magnetic field. The base stations were established in an area of low gradient, away from cultural influences. The base stations were run continuously throughout the survey flying period with a sampling interval of 2 seconds at a sensitivity of 0.01 nT. The base station data were closely examined after each day's production flying to determine if any data had been acquired during periods of out-of-specification diurnal variation. The base stations were located at Booroloola Airport, and positioned approximately 100 m apart.



4.2 GPS Base Station

A GPS base logging station was set up at the Booroloola Hotel/Motel. The GPS antenna was located outside room 3.

The GPS base system was comprised of a GPS receiver, a logging computer, an antenna and a power supply. Data was logged and displayed in real time on the logging computer screen. The logged base data was processed with the airborne GPS data to calculate the differentially post-processed position of the aircraft.

The GPS base station position was calculated by logging data continuously at the base position over a period of approximately 24 hours. These data were then statistically averaged to obtain the position of the base station.

The calculated GPS base position was (in WGS84): 16° 4' 19.19" S, 136° 18' 29.80" E, 69.46 m.

5. EQUIPMENT CALIBRATIONS AND DATA ACQUISITION CHECKS

5.1 Survey Calibrations

A series of calibrations were performed as follows:

5.1.1 Dynamic Magnetometer Compensation

Carrying a magnetometer through a varying field in a non-uniform orientation produces manoeuvre noise. To compensate for this manoeuvre noise a standard compensation test flight called a "comp box" was flown. The compensation file produced also removed the majority of the heading error. Aircraft compensation tests were flown on the 4 survey line headings and also at +/- $7\frac{1}{2}$ and 15° to the line headings (to accommodate for cross wind flying conditions). The data

+/- 7½ and 15° to the line headings (to accommodate for cross wind flying conditions). The data for each heading consists of a series of aircraft manoeuvres with large angular excursions: specifically pitches, rolls and yaws. This was done to artificially create the worst possible attitudes and rates of attitudinal change likely to be encountered while on line and compensate for any magnetic noise created by the aircraft's motion within the earth's magnetic field. The data was processed to obtain the real-time compensation terms. These coefficients were applied in real-time or later during post-processing if required. Note that this form of compensation will only remove those noise effects modelled in the manoeuvre test flight. Random motions of the stinger with respect to the aircraft airframe generally establish the noise floor for this type of installation. Details of the comp boxes flown for this survey are shown in the table below.

Flown	Flights covered	
23/09/2011	All Flights	
Table 1: Magnetometer Compensation Deta		

 Table 1: Magnetometer Compensation Details

5.1.2 Parallax

Parallax error is caused by the physical difference in distance between the various sensors, the electronic delay and software timing in the acquisition system. Hence all variables are subjected to a displacement from the GPS co-ordinates. If these variables are processed without a position offset a parallax error will usually occur. The most suitable way to treat this problem is to use the 1 second radiometric data as a base with a zero correction. This will prevent interpolation of important variables (a filtering process). The co-ordinates were moved by linear interpolation and other data variables were displaced onto the radiometric data, without change.

Data	Parallax
GPS	-0.5 second
Magnetics	0 second
Radar Altitude	0 second
Pressure	0 second
Temperature	0 second
Table 2: Parallax Values	

Table 2: Parallax Values

5.1.3 Pad Calibrations

A series of tests were taken using a set of radiometric pads of known concentrations of Potassium, Uranium and Thorium. Each crystal pack was tested individually, with data accumulated for 15 minutes. The pad calibration data were processed to determine the radiometric stripping coefficients for each crystal pack. Where aircraft had more that one crystal pack installed, the average of the stripping coefficients were used in final data processing.

5.1.4 Background and Cosmic Calibration Stacks

High-level stacks were flown over the ocean away form the effects of any land based radon. Data were collected for ten minutes at altitudes starting at 1000 feet above sea level and incrementing to 10000 feet above sea level. The high-level stack data were processed to determine the cosmic and aircraft background coefficients.

5.1.5 Height Attenuation Calibrations

Low-level stacks were flown over the Carnamah Dynamic Test Range, Western Australia. Data were collected at altitudes of 130 feet above sea level (asl), 200 ft asl, 260 ft asl, 330 ft asl, 400 ft asl and 650 ft asl. The neighbouring salt lake was flown at the same altitudes, and the data were used as a radon test. A ground survey was carried out on the same day using a calibrated gamma-ray spectrometer.

The airborne and ground data were processed to determine radioelement sensitivity and height attenuation coefficients.

5.1.6 Daily Calibrations

A set of calibrations were performed each survey day as follows: Magnetic base station time check Spectrometer resolution test Spectrometer button test

5.1.6.1 Magnetic Base Station Time Check

Prior to each day's survey all magnetic base stations were time checked and synchronised with the time on the aircraft survey system GPS receiver.

5.1.6.2 Spectrometer Resolution Test

Once the spectrometer had stabilised a Thorium source resolution check was carried out by placing the source in a cradle specially designed to ensure precisely repeatable locations.

5.1.6.3 Spectrometer Button Test

Thorium sample checks were performed on the spectrometer before and after each day's survey acquisition. Each sample was placed in a predetermined location and data recorded for 180 sec. Relative count rates above background were within +/- 5% of the average sample checks for the duration of the survey.

6. DATA VERIFICATION AND FIELD PROCESSING

All data verification was conducted at the field office at Booroloola for the duration of the survey. At the conclusion of each days survey all magnetic, radiometric, altimeter, flight path and diurnal data were downloaded onto the field office computer for preliminary verification. All raw aircraft data were backed up at the end of each day's survey. One copy was sent to the FAS office in Perth, the other copy remaining at the field office.

6.1 Magnetic Diurnal Data

Diurnal data recorded from the primary base station was downloaded onto the field office computer. The data was checked for spikes and erroneous readings. If invalid diurnal data occurred whilst survey data was being acquired the affected section was re-flown. The diurnal data was also checked to see that the change in diurnal readings during the course of the survey did not exceed the specified tolerances. When this occurred the affected part of the survey line was re-flown. The diurnal data was merged with the aircraft data and used in the verification of the magnetic data. Diurnal data recorded on the secondary base station was also downloaded onto the field office computer.

6.2 Height Data

Radar altimeter, barometric altimeter and GPS height data from the aircraft were transferred onto the field office computer.

6.2.1 Radar Altimeter Data

The radar altimeter data was verified to check that a reasonably constant height above the terrain was flown, readings during the course of the survey did not exceed the specified tolerances and for equipment reliability.

6.2.2 GPS Height Data

The aircraft's height above the WGS84 ellipsoid each second was determined by differentially post-processing the synchronised GPS data from the aircraft and GPS base station data. The GPS height of the aircraft was verified to check for data masking and for equipment reliability.

6.2.3 Barometric Altimeter Data

As a backup to the aircraft's GPS height, barometric height was also recorded. The barometric height of the aircraft was verified to check for equipment reliability. The barometric data were also used in the processing of the radiometric data.

6.2.4 Topographical Data

After verification parallax corrections were applied, the radar altitude was subtracted from the GPS height to give the elevation of the terrain above the WGS84 ellipsoid. It was not considered necessary to make any further corrections as this data was for verification purposes only.

6.2.5 Gridding and Inspection

The topographical data was gridded and grid image enhancements were computed and displayed on screen. These were inspected for inconsistencies and errors.

6.3 Flight Path Data

The flight path data from the aircraft and the GPS base station were transferred onto the field office computer. The aircraft's precise location each second was determined by differentially post-processing the synchronised GPS data from the aircraft and GPS base station data. The flight path was recovered and plotted daily to ensure it was within specification. Any data not within specification was re-flown. The flight path data was then merged with the rest of the aircraft and diurnal data. Both the aircraft and GPS base station recorded the data in the WGS84 datum.

6.4 Magnetic Data

The real-time compensated and uncompensated magnetic data from the aircraft recorded every 0.1 second were transferred onto the field office computer. The raw magnetic data was checked to identify noise and spikes. If the noise exceeded the specified tolerances the part of the line affected was re-flown. After the magnetic data were merged with the digital flight path the following sequence of operations were carried out to allow inspection and verification of the data:

6.4.1 Diurnal Correction

The synchronised digital diurnal data collected by the base station was first subtracted from the corresponding airborne magnetic readings to calculate a difference. The resultant difference was then subtracted from the base value to produce diurnally corrected magnetic data.

6.4.2 Parallax Correction

The diurnally corrected magnetic data was corrected for system parallax using the calculated value.

6.4.3 Preliminary Gridding and Inspection

The magnetic data were gridded and grid image enhancements were computed and displayed on screen. These were inspected for inconsistencies and errors.

6.5 Spectrometer Data

Spectrometer data from the aircraft were transferred onto the field office computer. The data was verified to check that readings during the course of the survey did not exceed the specified tolerances and for equipment reliability.

6.5.1 Parallax Correction

The raw window data were corrected for system parallax using the calculated value.

6.5.2 Preliminary Gridding and Inspection

The spectrometer data were gridded and grid image enhancements were computed and displayed on screen. These were inspected for inconsistencies and errors.

7. FINAL DATA PROCESSING

7.1 Aircraft Location

The aircraft's location each second was determined by differentially post-processing the synchronised GPS data recorded on both the aircraft and GPS base station. This data is recorded in the WGS84 datum.

7.2 Magnetic Data Processing

The processing procedures applied to the magnetic data are summarised below:

- a) Apply any spike corrections to the compensated magnetic variables.
 - b) Interpolate undefined magnetic values.
 - c) Co-ordinate the data with post-processed GPS data.
 - d) Filter diurnal values and subtract them from individual compensated magnetic readings.

Area	Base	Base Value
All Areas	Booroloola Airstrip	48088 nT

Table 3: Diurnal Base Values

e) Apply parallax correction.

f) Correct for regional effects of the earth's magnetic field by calculating the IGRF value at each fiducial using IGRF model 2010 and secular variation model. A base value was added back.

Area	IGRF Model	Base Value
All Areas	24/9/2011	47803 nT

Table 4: IGRF Base Values

- g) The data was height corrected using Taylor Drape to 40 m.
- h) Using the tie lines (flown at 90 degrees to the traverse lines) a set of miss-tie values were determined. These miss-tie values reflected the differences in the magnetic value between the tie lines and traverse lines over the same geographical point. Using a least squares fit algorithm, which also takes into account the statistical variation inherent in DGPS positioning, a series of corrections were applied to the traverse line data. These allowed the data to be levelled to the same base value.
- i) Following this, a Fugro proprietary micro-levelling process was applied in order to more subtly level the data.

7.2.1 Gridding

The final levelled magnetic data were gridded using a bi-directional spline algorithm. The Booroloola data was gridded with a cell size of 25 m and the Yiyintyi areas were gridded with a cell size of 12.5 m.

7.3 Radiometric Data Processing

The radiometric data was processed using the standard IAEA window processing technique as summarised below.

- a) Co-ordinate the data with post-processed GPS data.
- b) Apply spike corrections to the radar altimeter, temperature and pressure values.
- c) Apply parallax corrections to altimeter, temperature and pressure values.
- d) Apply NASVD filtering to the 256 channel radiometric data.
- e) Apply Energy Recalibration to the NASVD filtered 256 channel radiometric data.
- f) Correct for dead time.
- g) Calculate the equivalent terrain clearance at STP (standard temperature and pressure).
- h) Remove aircraft background.
- i) Remove cosmic background.
- j) Window the 256 channel data using the IAEA standard energy windows.
- k) Remove radon background.
- I) Apply stripping ratios.
- m) Apply height corrections.

- n) Using the tie lines (flown at 90 degrees to the traverse lines) a set of miss-tie values were determined. These miss-tie values reflected the differences in the value between the tie lines and traverse lines over the same geographical point. Using a least squares fit algorithm, which also takes into account the statistical variation inherent in DGPS positioning, a series of corrections were applied to the traverse line data. These allowed the data to be levelled to the same base value.
- o) Following this, a Fugro proprietary micro-levelling process was applied in order to more subtly level the data.

7.3.1 NASVD Filtering

The radiometrics were produced with NASVD smoothing. Using the NASVD technique, the raw spectra were first smoothed using 7 principal components for the Booroloola and Yiyintyi East areas, and 5 principal components for the Yiyintyi West area. Eigenvectors and statistics on the NASVD processing results were used for analysis.

7.3.2 Energy Recalibration

The spectral drift was checked by monitoring the position of the Potassium, Uranium and Thorium peaks on average spectra along flight lines. The peak positions were determined by using a Gaussian fitting method. Energy recalibration was applied to the spectra using a linear regression (LSQ fit) to determine the slope and intercept.

7.3.3 Dead Time

Gamma-ray spectrometers require a finite time to process each pulse from the detectors. While one pulse is being processed, any other pulse that arrives will be rejected. Consequently the 'live time' of a spectrometer is reduced by the time taken to process all pulses reaching the spectrometer. The spectra are normalised to counts per second by dividing by the live time.

7.3.4 STP Altitude

The radar altimeter data was converted to effective height at standard temperature and pressure using the expression:

STPAIt = RAIt * (P/1013) * (273 / (T+273)) where: RAIt = the observed radar altitude in m T = the measured air temperature in deg C P = the barometric pressure in hPa

7.3.5 Cosmic and Aircraft Background Removal

The 256 channel aircraft and cosmic spectra for the aircraft were calculated from the high-level test data with the aircraft and cosmic backgrounds derived using least squares fitting applied on a channel by channel basis.

The aircraft background was removed by subtracting the computed aircraft background spectra from the dead time corrected spectra. The 256 channel cosmic background spectrum that is removed is calculated by multiplying the 256 channel cosmic factor values by the cosmic counts recorded. The effect of cosmic radiation is removed from the spectra by subtracting the resultant cosmic spectrum.

Window	Aircraft Background	Cosmic Stripping Ratio
Total Count	21.0	0.9000
Potassium	6.20	0.0530
Uranium	0.70	0.0420
Thorium	0.90	0.0510

Table 5: Aircraft Background and Cosmic Stripping Ratios

7.3.6 Window Definitions

The 256 channel data were summed into the standard IAEA windows.

Window	Peak Energy (keV)	Energ (y Wir keV)	ndow	GR-820) Chann	el Window
Total Count	-	410	-	2810	34	-	234
Potassium	1460	1370	-	1570	115	-	131
Uranium	1765	1660	-	1860	139	-	155
Thorium	2614	2410	-	2810	201	-	234
Cosmic	-	4000	-	6000		-	

Table 6: IAEA Window Definitions

7.3.7 Radon Correction

Radon corrections were applied using the spectral ratio method.

Stripping	Value
Total Count	13.154
Potassium	0.783
Thorium	0.061
Radon	1.875
Ground (1)	0.370
Ground (2)	0.677
Ground (3)	0.701

Table 7: Radon Stripping Values

7.3.8 Spectral Stripping

Spectral stripping was applied to the Potassium, Uranium and Thorium windows. The stripping coefficients were corrected for STP altitude.

Stripping	Value	STP adjustment (/m)
Alpha	0.2569	0.00049
Beta	0.3736	0.00065
Gamma	0.7416	0.00069
А	0.0591	0
В	0.0002	0
G	-0.0169	0

Table 8: Spectral Stripping Ratios

7.3.9 Height Correction

The background corrected and stripped window data were corrected for variations in the density altitude of the detector.

Window	Attenuation coefficient (m ⁻¹)
Total Count	-0.0072
Potassium	-0.0099
Uranium	-0.0086
Thorium	-0.0067

Table 9: STP Altitude Coefficients

7.3.10 Gridding

The final radiometric data were gridded using a minimum curvature algorithm. The Booroloola and Yiyintyi East data was gridded with a cell size of 25 m and the Yiyintyi West data was gridded with a cell size of 12.5 m.

7.4 Digital Terrain Model

The processing procedures applied to the terrain data are summarised below:

- a) Apply any spike corrections to the raw radar altimeter data. The radar altimeter was extensively de-spiked due to trees in the survey area.
- b) Interpolate undefined values.
- c) Co-ordinate the data with post-processed GPS data.
- d) Apply parallax corrections.
- e) Subtract the aircraft's height above ground from the aircraft's height above the WGS84 ellipsoid and correct for radar altimeter/GPS sensor separation.
- f) Derive surface topography values with respect to mean sea level (referenced to the geoid) by correcting the WGS84 ellipsoid values with geoid-ellipsoid separation values.
- g) Using the tie lines (flown at 90 degrees to the traverse lines) a set of miss-tie values were determined. These miss-tie values reflected the differences in the value between the tie lines and traverse lines over the same geographical point. Using a least squares fit algorithm, which also takes into account the statistical variation inherent in DGPS positioning, a series of corrections were applied to the traverse line data. These allowed the data to be levelled to the same base value.
- h) Following this, a FAS proprietary micro-levelling process was applied in order to more subtly level the data.

7.4.1 Gridding

The final levelled digital terrain data were gridded using a bi-directional spline algorithm. The Booroloola and Yiyintyi East data was gridded with a cell size of 25 m and the Yiyintyi West data was gridded with a cell size of 12.5 m.

The accuracy of the elevation calculation is directly dependent on the accuracy of the two input parameters, radar altitude and GPS altitude. The radar altitude value may be erroneous in areas of heavy tree cover, where the altimeter reflects the distance to the tree canopy rather than the ground. The GPS altitude value is primarily dependent on the number of available satellites. Although post-processing of GPS data will yield X and Y accuracies in the order of 1-2 metres, the accuracy of the altitude value is usually much less, sometimes in the ± 5 metre range. Further inaccuracies may be introduced during the interpolation and gridding process.

Because of the inherent inaccuracies of this method, no guarantee is made or implied that the information displayed is a true representation of the height above sea level. Although this product may be of some use as a general reference, THIS PRODUCT MUST NOT BE USED FOR NAVIGATION PURPOSES.

APPENDIX I – Weekly Operations Report

System: Aircraft:	FASDAS VH-FGZ]		I	17966.1	Hrs - Pro	ogressive I	//R Hrs	at the start	of job, prio	r to mobilisatic	on		Jo Contrac	b Number: ct Number: Job Name:	2251 CM6784 Borroloola
Total Job kms:	4002.37	1 Kms			18031.0	Hrs - The	e hours the	e Periodi	c Inspectio	n is actally	due at start of	the job		Are	ea Names:	Borroloola, Yiyintyi_East, Yiyintyi_West
Plan Kms Remain [.]	0.00	0 Kms	I												Client:	Sandfire Resources P/L
% Complete:	100.00	0%														
Date	Flt	Pilot	On	Production	FAS	Ti	me	Engine	Hours to	Job	Prod.	FAS				COMMENTS
		initials	board	inc. Reflights	Scrub	Start	End	Hours	Periodic	Hrs	4.0	Scrubs	Stdby	Activity	Activity	Weather, Data delivery
			oper	Exc. Scrubs				M/R	inspectio	Date	to Date	το Date	Days	Contribution		Aircrait movement, etc
#######################################				2.001 001 000						Bato	Dato	Date				
Julian Day 262																
Monday																
									64.9							
Date 20-Sep														1.00	MO	D.Little arrives Kununurra from Perth
Julian Day 263																
Tuesday																
									64.9							
Date 21-Sep														0.50	MO	D.Little Kununurra to Katherine N.T
Julian Day 264														0.50	MO	W.Saunders arrives Kununurra
Wednesday																
weanesday									64.9							
Date 22-Sep									01.0					0.50	МО	D.Little arrives Borroloola
Julian Day 265		W.S				11:00:00	14:00:00	3.0						0.50	MO	W.Saunders arrives Borroloola
Thumaday																
Thursday									61.0	2.0						
Date 23-Sep	1	W.S	D.L			7:30:00	8:40:00	1.2	01.9	3.0				0.30	SAF	Area1 recce - comp box, returned GPS failure
Julian Day 266	2	W.S	D.L			10:00:00	11:15:00	1.3						0.50	SAF	Area 2 and 3 recce, awaiting PTW
F all days														0.20	MA	50 hour engine oil change
Friday									50.4	E						
Date 24-Sep	3	ws			392 118	7:30:00	10.22.00	29	59.4	5.5				0.50	S	Elt data scrubbed due GR820 failure on start-un
Julian Day 267	4	W.S		307.873	125.737	11:20:00	14:35:00	3.3						0.50	P & R & S	Tie lines and reflights scrubbed due GPS
Saturday									52.0	447	207.072	547 055				
Date 25-Sep									53.Z	11.7	307.873	517.855		1.00	PDO	W Saunders PDO, used due GPS failure
Julian Day 268														1.00	Comment	FGZ to ferry to Darwin for GPS repairs
Sunday																
		Tatala Thia \	Nooki N	207 072	E47 0EF	Week		11.6	53.2	11.7	<u>307.873</u>	517.855		6.00		1

System Aircraft	n: FASDA t: VH-FG	S Z				17966.1	Hrs - Pro	gressive I	//R Hrs	at the start	of job, prio	r to mobilisatic	n		Jo Contrac	b Number: ct Number:	2251 CM6784
Total Job kms	. 4002	.371 Kms		_		18031.0	Hrs - The	e hours the	e Periodi	ic Inspectio	n is actally	due at start of	the job		Are	ea Names:	Borroloola, Yiyintyi_East, Yiyintyi_West
							-									Client:	Sandfire Resources P/L
Plan Kms Remain % Complete	:: 0 :: 100	.000 Kms .000 %															
Date	Flt	Pilo	ot	On	Production	FAS	Ti	me	Engine	Hours to	Job	Prod.	FAS				COMMENTS
		initia	als b	board	inc. Reflights	Scrub	Start	End	Hours	Periodic	Hrs		Scrubs	Stdby	Activity	Activity	Weather, Data delivery
			0	Oper					on	Inspectio	to	to	to	Days	Contribution	<i>i</i> to the set of the	Aircraft movement, etc
			ir	nitials	Exc. Scrubs				M/R		Date	Date	Date				
#######################################	<i>‡</i>						10:00:00	12:55:00	2.9						1.00	E	Ferry to Darwin for GPS repairs
Julian Day 269	9																
Monday																	
wonuay										50.3	1/ 6	307 873	517 855				
Date 27-Se	n						11.00.00	13.20.00	2.8	30.3	14.0	307.073	517.000		1.00	F	Return ferry to Borroloola
Julian Day 27	0						11.00.00	10.00.00	2.0						1.00		
Tuesday																	
-										47.5	17.4	307.873	517.855				
Date 28-Se	р 5	W.	S		379.749		6:35:00	11:50:00	5.3						0.50	Р	Area 2
Julian Day 27	1 6	W.	S		295.216	34.296	13:00:00	15:25:00	2.4						0.50	P & R & S	Reflight lines from flt3 Area 1.
Wednesday																	
			_			15.0.11	0.05.00	10.05.00		39.8	25.1	982.838	552.151		0.50		
Date 29-Se	p /	W.	S		777.560	45.641	6:35:00	12:05:00	5.5						0.50	P&R&S	Refly lines due GPS and diurnal.
Julian Day 27.	2 8	VV.	5		234.439	30.628	13:30:00	15:30:00	2.0						0.50	PARAS	Reny lines due GPS. Renights due poor GPS.
Thursday																	
marcuay		_								32.3	32.6	1994.837	628,420				
Date 30-Se	p 9	W.	S		651.201		8:00:00	13:55:00	5.9						0.60	Р	Completed Area 2. continued Area 1
Julian Day 27	3														0.40	LOG	delayed take-off due to fog and fuel problems.
Friday																	
										26.4	38.5	2646.038	628.420				
Date 1-Oc	^t 10	W.	S		448.000		6:30:00	12:05:00	5.6						1.00	P	
Julian Day 274	4																
Saturday	<u> </u>									├───┤							
Saturuay										20.0	44.4	2004.028	629 420				
Date 2-Oc	t									20.0	44.1	3094.030	020.420		1.00	PDO	S Saunders P.D.O
Julian Dav 27	5						1								1.00	100	0.0ddinders 1.D.0
							1										
Sunday							1										
										20.8	44.1	3094.038	628.420				
		Totals T	his We	ek: 🕨	2786.165	110.565	Week	Hours:►	32.4	▲: A/C H	rs to Next S	Service			7.00		

System: Aircraft:	FASDAS VH-FGZ			[17966.1	Hrs - Pro	gressive N	៧/R Hrs a	at the start	of job, prior	to mobilisatio	n		Jol Contrac	b Number: t Number:	2251 CM6784
Total Job kms:	4002.371	Kms		[18031.0	Hrs - The	e hours the	e Periodi	c Inspectio	n is actally o	due at start of	the job		Are	ea Names: Client	Borroloola Borroloola, Yiyintyi_East, Yiyintyi_West Sandfire Resources P/I
Plan Kms Remain: % Complete:	0.000 100.000	Kms %													Chieffi	
Date	Flt	Pilot initials	On board Oper initials	Production inc. Reflights Exc. Scrubs	FAS Scrub	Tir Start	me End	Engine Hours on M/R	Hours to Periodic Inspectio	Job Hrs to Date	Prod. to Date	FAS Scrubs to Date	Stdby Days	Activity Contribution	Activity	COMMENTS <u>Weather</u> , <u>Data delivery</u> <u>Aircraft movement</u> , etc
03-October-2011	11	W.S		654.892		6:40:00	12:15:00	5.6						0.50	P&R	Reflys due poor GPS solution.
Julian Day 276	12	W.S		253.441		13:00:00	15:00:00	2.0						0.50	P	
Monday				-												
,									13.2	51.7	4002.371	628.420				
Date 4-Oct	13	W.S	D.L			7:00:00	8:10:00	1.2						0.25	TF	Compensation and check box
Julian Day 277														0.25	MO	D.Little de-mob to Daly Waters
Tuesday						17:30:00	20:24:00	2.9						0.25	MO	W.S ferries FGZ to Kununurra
Tuesday						21:22:00	1:49:00	4.4	4 7	<u> </u>	4000.074	CO0 400		0.25	MO	W.S ferries FGZ to Newman
Date 5-Oct									4.7	60.2	4002.371	628.420		0.50	MO	D Little Daly Waters to Kununurra
Julian Dav 278						2.37.00	3.26.00	13						0.30	MO	W S ferries FGZ to Meekatharra
						6:37:00	9:00:00	2.4						0.25	MO	W.S ferries FGZ to Jandakot
Wednesday																
									1.0	63.9	4002.371	628.420				
Date 6-Oct														1.00	MO	Airnorth flts cancelled due maint issues.
Julian Day 279																
Thursday																
Thursday									1.0	63.0	4002 371	628 420				
Date 7-Oct									1.0	00.0	4002.071	020.420				
Julian Day 280																
Friday																
									1.0	63.9	4002.371	628.420				
Date 8-Oct											I					
Julian Day 281																
Saturday																
culuiuuy									1.0	63.9	4002.371	628.420				
Date 9-Oct																
Julian Day 282																
Sunday																
	-	Asta Thi M	Maalu K			14/		40.0	1.0	63.9	4002.371	628.420		1.00		
	lo	otais i nis V	vеек: 🕨	908.333		vveek	Hours:►	19.8	▲: A/C H	rs to Next S	ervice			4.00	l	

APPENDIX II – Thorium Button Test

AIRCRAFT VH-FGZ

Flt#	Pre/Post Flt	Th in 501/601	Th in 502/602	Th Counts Actual	Th Counts Used	Running Average	Allowed Min	Allowed Max	% Change
4	post	202.3	695.5	493.1	493.1	493.1	468.5	517.8	0.0%
6	post	200.8	696.2	495.4	495.4	494.3	469.6	519.0	0.2%
7	pre	194.4	687.4	493.0	493.0	493.9	469.2	518.5	-0.2%
8	post	202.5	693.9	491.4	491.4	493.2	468.6	517.9	-0.4%
9	post	204.4	698.5	494.1	494.1	493.4	468.8	518.1	0.1%
12	post	199.4	686.1	486.7	486.7	492.3	467.7	516.9	-1.1%



APPENDIX III – Final Located Data Formats

Headers for final data files

Booraloola

Description File for 0.1 sec Magnetics Data COMM JOB NUMBER: 2251 COMM AREA NUMBER: 1 COMM SURVEY COMPANY: Fugro Airborne Surveys Sandfire Resources NL COMM CLIENT: Magnetic and Radiometric COMM SURVEY TYPE: COMM AREA NAME: Booraloola COMM STATE: Western Australia COMM COUNTRY: Australia 23 September - 03 October 2011 COMM SURVEY FLOWN: COMM LOCATED DATA CREATED: 02 November 2011 COMM COMM DATUM: GDA94 COMM PROJECTION: MGA COMM ZONE: 53 COMM COMM SURVEY SPECIFICATIONS COMM COMM TRAVERSE LINE SPACING: 100 m COMM TRAVERSE LINE DIRECTION: 000 - 180 deg COMM TIE LINE SPACING: 975 m 090 - 270 deg COMM TIE LINE DIRECTION: COMM NOMINAL TERRAIN CLEARANCE: 40 m COMM FINAL LINE KILOMETRES (in the 10 Hz dataset): 2838.14 km COMM COMM LINE NUMBERING COMM COMM TRAVERSE LINE NUMBERS: 1000103 - 1020101 1900101 - 1901701 COMM TIE LINE NUMBERS: COMM COMM AREA BOUNDARY COMM EASTING COMM NORTHING COMM 640000 8271000 COMM 640000 8262000 COMM 633000 8262000 COMM 631000 8259000 COMM 620000 8265000 8275000 COMM 620000 COMM 634000 8275000 COMM COMM SURVEY EQUIPMENT COMM COMM AIRCRAFT: VH-FGZ Aerocommander AC500S COMM COMM MAGNETOMETER: Scintrex CS2 Cesium Vapour COMM INSTALLATION: Stinger COMM 0.001 nT COMM RESOLUTION: COMM RECORDING INTERVAL: 0.1 s COMM COMM RADAR ALTIMETER: Collins Alt-50 COMM RECORDING INTERVAL: 0.1 s COMM COMM NAVIGATION: real-time differential GPS COMM RECORDING INTERVAL: 1.0 s

COMM COMM ACQUISITION SYSTEM: Fugro DAS COMM COMM BASE MAGNETOMETER: Scintrex Envi-Mag COMM RECORDING INTERVAL: 5 s COMM COMM DATA PROCESSING COMM COMM CO-ORDINATES 0.5 s COMM PARALLAX CORRECTION APPLIED COMM COMM MAGNETIC DATA base value 48088 nT COMM DIURNAL CORRECTION APPLIED COMM COMM PARALLAX CORRECTION APPLIED 0 s COMM IGRF CORRECTION APPLIED base value 47803 nT COMM IGRF MODEL 2010 extrapolated to 2011/09/24 COMM COMM DATA HAVE BEEN HEIGHT CORRECTED (TAYLOR DRAPE) to 40m AGL COMM DATA HAVE BEEN TIE LINE LEVELLED COMM DATA HAVE BEEN MICROLEVELLED COMM COMM RADAR ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0 s COMM COMM GPS ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0 s COMM COMM DIGITAL TERRAIN DATA COMM DTM CALCULATED [DTM = GPS ALTITUDE - (RADAR ALT + SENSOR SEPARATION)] COMM DATA CORRECTED TO AUSTRALIAN HEIGHT DATUM COMM DATA HAVE BEEN TIE LINE LEVELLED COMM DATA HAVE BEEN MICROLEVELLED COMM COMM -----COMM DISCLAIMER COMM -----COMM It is Fugro Airborne Survey's understanding that the data provided to COMM the client is to be used for the purpose agreed between the parties. COMM That purpose was a significant factor in determining the scope and COMM level of the Services being offered to the Client. Should the purpose COMM for which the data is used change, the data may no longer be valid or COMM appropriate and any further use of, or reliance upon, the data in COMM those circumstances by the Client without Fugro Airborne Survey's COMM review and advice shall be at the Client's own or sole risk. COMM COMM The Services were performed by Fugro Airborne Survey exclusively for COMM the purposes of the Client. Should the data be made available in whole COMM or part to any third party, and such party relies thereon, that party COMM does so wholly at its own and sole risk and Fugro Airborne Survey COMM disclaims any liability to such party. COMM COMM Where the Services have involved Fugro Airborne Survey's use of any COMM information provided by the Client or third parties, upon which COMM Fugro Airborne Survey was reasonably entitled to rely, then the COMM Services are limited by the accuracy of such information. Fugro COMM Airborne Survey is not liable for any inaccuracies (including any COMM incompleteness) in the said information, save as otherwise provided COMM in the terms of the contract between the Client and Fugro Airborne COMM Survey. COMM COMM With regard to DIGITAL TERRAIN DATA, the accuracy of the elevation COMM calculation is directly dependent on the accuracy of the two input COMM parameters, radar altitude and GPS altitude. The radar altitude value

COMM may be erroneous in areas of heavy tree cover, where the altimeter COMM reflects the distance to the tree canopy rather than the ground. The COMM GPS altitude value is primarily dependent on the number of available COMM satellites. Although post-processing of GPS data will yield X and Y COMM accuracies in the order of 1-2 metres, the accuracy of the altitude COMM value is usually much less, sometimes in the ±5 metre range. Further COMM inaccuracies may be introduced during the interpolation and gridding COMM process. Because of the inherent inaccuracies of this method, no COMM guarantee is made or implied that the information displayed is a true COMM representation of the height above sea level. Although this product COMM may be of some use as a general reference, COMM THIS PRODUCT MUST NOT BE USED FOR NAVIGATION PURPOSES. COMM ------COMM COMM LINE DATA FORMAT COMM A space is left between fixed fields so that a field of, for example, COMM A8 should only ever have a maximum of 7 characters in it, even when it COMM is a null, thus: COMM COMM FIELD UNITS NULL FORMAT -99999 COMM Line Number Ι7 -99 COMM Flight Number Ι4 -9999999 COMM Date (yyyymmdd) I9 COMM Fiducial Number -9999.9 F8.1 COMM Time (UTC seconds past midnight) -9999.9 F8.1 S COMM Easting -99999.99 F10.2 m COMM Northing -999999.99 F11.2 m COMM Longitude -999,9999999 F13.7 deg -99.9999999 F12.7 COMM Latitude deg COMM GPS Altitude -999.99 F8.2 m -999.99 F8.2 COMM Radar Altitude m nT -99999.999 F11.3 COMM Compensated TMI -9999.99 F9.2 COMM Diurnal nT F11.3 COMM Final TMI -99999.999 nT COMM Digital Terrain Model -999.99 F8.2 m Description File for 1.0 sec Windowed Radiometrics Data COMM JOB NUMBER: 2251 COMM AREA NUMBER: 1 COMM SURVEY COMPANY: Fugro Airborne Surveys COMM CLIENT: Sandfire Resources NL COMM SURVEY TYPE: Magnetic and Radiometric COMM AREA NAME: Booraloola COMM STATE: Western Australia COMM COUNTRY: Australia COMM SURVEY FLOWN: 23 September - 03 October 2011 COMM LOCATED DATA CREATED: 02 November 2011 COMM COMM DATUM: GDA94 COMM PROJECTION: MGA COMM ZONE: 53 COMM COMM SURVEY SPECIFICATIONS COMM COMM TRAVERSE LINE SPACING: 100 m COMM TRAVERSE LINE DIRECTION: 000 - 180 deg COMM TIE LINE SPACING: 975 m COMM TIE LINE DIRECTION: 090 - 270 deg COMM NOMINAL TERRAIN CLEARANCE: 40 m COMM FINAL LINE KILOMETRES (in the 1 Hz dataset): 2823.2 km COMM COMM LINE NUMBERING

COMM

COMM TRAVERSE LINE NUMBERS: 1000103 - 1020101 COMM TIE LINE NUMBERS: 1900101 - 1901701 COMM COMM AREA BOUNDARY COMM EASTING NORTHING COMM COMM 640000 8271000 COMM 640000 8262000 COMM 633000 8262000 631000 8259000 COMM 620000 8265000 COMM 620000 8275000 COMM 634000 8275000 COMM COMM COMM SURVEY EQUIPMENT COMM COMM AIRCRAFT: VH-FGZ Aerocommander AC500S COMM COMM SPECTROMETER: 256 Channel Exploranium GR820 COMM CRYSTAL VOLUME: 33.56 1 COMM RECORDING INTERVAL: 1.0 s COMM COMM RADAR ALTIMETER: Collins Alt-55 COMM RECORDING INTERVAL: 0.1 s COMM real-time differential GPS COMM NAVIGATION: COMM RECORDING INTERVAL: 1.0 s COMM COMM ACOUISITION SYSTEM: Fugro DAS COMM COMM DATA PROCESSING COMM COMM CO-ORDINATES 0.5 s COMM PARALLAX CORRECTION APPLIED COMM COMM RADAR ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM GPS ALTITUDE DATA 0.0 s COMM PARALLAX CORRECTION APPLIED COMM COMM RADIOMETRIC DATA COMM NASVD FILTERING APPLIED TO 256 CHANNEL DATA COMM WINDOW DATA EXTRACTED USING IAEA STANDARD WINDOWS COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COSMIC, AIRCRAFT AND RADON BACKGROUNDS REMOVED COMM STRIPPING CORRECTIONS APPLIED COMM HEIGHT CORRECTED TO 40 m AGL COMM COMM AIRCRAFT BACKGROUND COEFFICIENTS COMM TOTAL COUNT 21.0 COMM POTASSIUM 6.2 COMM URANIUM 0.7 COMM THORIUM 0.9 COMM COSMIC COEFFICIENTS COMM TOTAL COUNT 0.900 COMM POTASSIUM 0.053 COMM LIRANTIM 0.042 COMM THORIUM 0.051 COMM STRIPPING COEFFICIENTS COMM ALPHA 0.2569 COMM BETA 0.3736 COMM GAMMA 0.7416 COMM a 0.0591

COMM COMM	b C STRIDDING HEIGHT ATTENHAT	TON COPERIATENTS		0.0002 -0.0169
COMM COMM COMM	ALPHA BETA GAMMA RADON STRIPPING COEFFICIE	NTS		0.00049 0.00065 0.00069
COMM COMM COMM	TOTAL COUNT POTASSIUM THORIUM	1110		13.150 0.782 0.061
COMM COMM COMM	RADON (C1) GROUND (C2)			1.875 0.370
COMM COMM	ALTITUDE COEFFICIENTS TOTAL COUNT POTASSIUM			-0.0072
COMM COMM COMM	URANIUM THORIUM			-0.0086 -0.0067
COMM	DISCLAIMER			
COMM COMM	It is Fugro Airborne Surv the client is to be used	ey's understandin for the purpose a	g that the data provi greed between the par	ided to cties.
COMM COMM COMM	level of the Services bei for which the data is use	ng offered to the dat change, the dat	Client. Should the r a may no longer be va	purpose alid or
COMM COMM COMM	appropriate and any furth those circumstances by th review and advice shall b	er use of, or rel e Client without e at the Client's	lance upon, the data Fugro Airborne Survey own or sole risk.	ın /'s
COMM COMM COMM COMM COMM	The Services were perform the purposes of the Clien or part to any third part does so wholly at its own disclaims any liability t	ed by Fugro Airbo t. Should the dat y, and such party and sole risk an o such party.	rne Survey exclusive a be made available f relies thereon, that d Fugro Airborne Surv	ly for in whole party vey
COMM COMM COMM	Where the Services have i information provided by t	nvolved Fugro Air he Client or thir	borne Survey's use of d parties, upon which	E any 1
COMM COMM COMM	Fugro Airborne Survey was Services are limited by t Airborne Survey is not li incompleteness) in the sa	reasonably entit he accuracy of su able for any inac id information, s	led to rely, then the ch information. Fugro curacies (including a ave as otherwise prov	e o any vided
COMM COMM	in the terms of the contr Survey.	act between the C	lient and Fugro Airbo	orne
COMM COMM				
COMM COMM COMM	LINE DATA FORMAT A space is left between f A8 should only ever have is a null, thus:	ixed fields so th a maximum of 7 ch	at a field of, for ex aracters in it, even	kample, when it
COMM COMM COMM	FIELD Line Number Flight Number	UNITS	NULL -99999 -99	FORMAT I7 I4
COMM	Date (yyyymmdd) Fidugial Number	a	-9999999 -9999999	I9 E8 1
COMM	Time (local)	S	-9999.9	F8.1
COMM	Easting	m	-99999.99	F10.2
COMM	Northing	m dea	-999999.99 -999 999999	F11.2 F13 7
COMM	Latitude	deg	-99.9999999	F12.7
COMM	GPS Altitude	m	-999.99	F8.2
COMM	Radar Altitude	m	-999.99	F8.2

<u>Boorolo</u>	ola and Yiyintyi, Northern Territory Mag/Spo	ec Survey	– Sandfire Resources NL	Job No. 2251 Page 29
COMM	Uncorrected Total Count	cps	-9999.9	F8.1
COMM	Uncorrected Potassium	cps	-999.9	F7.1
COMM	Uncorrected Uranium	cps	-999.9	F7.1
COMM	Uncorrected Thorium	cps	-999.9	F7.1
COMM	Raw Cosmic	cps	-99	I4
COMM	Final Total Count	cps	-9999.9	F8.1
COMM	Final Potassium	cps	-999.9	F7.1
COMM	Final Uranium	cps	-999.9	F7.1
COMM	Final Thorium	cps	-999.9	F7.1
_				
COMM	TOP NUMBED:	aw 256	Channel Radiometrics	
COMM	ADEA NUMBER.			2251
COMM	AREA NUMBER.		Fugre	Airborno Survova
COMM	CLIENT:		rugi	dfire Resources NL
COMM	SURVEY TYPE:		Magnet	ic and Radiometric
COMM	AREA NAME:		magnee	Booraloola
COMM	STATE:			Western Australia
COMM	COUNTRY:			Australia
COMM	SURVEY FLOWN:		23 September	- 03 October 2011
COMM	LOCATED DATA CREATED:			02 November 2011
COMM				
COMM	DATUM:			GDA94
COMM	PROJECTION:			MGA
COMM	ZONE:			53
COMM				
COMM	SURVEY SPECIFICATIONS			
COMM				
COMM	TRAVERSE LINE SPACING:			100 m
COMM	TRAVERSE LINE DIRECTION:			000 - 180 deg
COMM	TIE LINE SPACING:			975 m
COMM	TIE LINE DIRECTION:			090 - 270 deg
COMM	NOMINAL TERRAIN CLEARANCE	:		40 m
COMM	FINAL LINE KILOMETRES (in	the 1	Hz dataset):	2823.2 km
COMM				
COMM	LINE NUMBERING			
COMM				1000100 1000101
COMM	TRAVERSE LINE NUMBERS:			1000103 - 1020101
COMM	TIE LINE NUMBERS:			1900101 - 1901/01
COMM				
COMM	AREA BOUNDARI			
COMM	FASTING NORTHING			
COMM	640000 8271000			
COMM	640000 8262000			
COMM	633000 8262000			
COMM	631000 8259000			
COMM	620000 8265000			
COMM	620000 8275000			
COMM	634000 8275000			
COMM				
COMM	SURVEY EQUIPMENT			
COMM				
COMM	AIRCRAFT:		VH-FGZ Ae	rocommander AC500S
COMM				
COMM	SPECTROMETER:		256 Channel	Exploranium GR820
COMM	CRYSTAL VOLUME:			33.56 1
COMM	RECORDING INTERVAL:			1.0 s
COMM				
COMM	RADAR ALTIMETER:			Collins Alt-50
COMM	RECORDING INTERVAL:			0.1 s
COMM				
COMM	NAVIGATION:		real-time	e aifferential GPS

COMM	RECORDING INTERVAL:	1.0 s
COMM	ACQUISITION SYSTEM:	Fugro DAS
COMM	DATA PROCESSING	
COMM COMM COMM	CO-ORDINATES PARALLAX CORRECTION APPLIED	0.5 s
COMM COMM	RADAR ALTITUDE DATA PARALLAX CORRECTION APPLIED	0.0 s
COMM COMM COMM	GPS ALTITUDE DATA PARALLAX CORRECTION APPLIED	0.0 s
COMM COMM	BAROMETRIC DATA	
COMM COMM	PARALLAX CORRECTION APPLIED	0.0 s
COMM COMM COMM	TEMPERATURE DATA PARALLAX CORRECTION APPLIED	0.0 s
COMM COMM	RADIOMETRIC DATA NO PROCESSING APPLIED TO RAW 256 CHANNEL RADIOMETRIC DATA	
COMM COMM	AIRCRAFT BACKGROUND COEFFICIENTS	
COMM COMM COMM	TOTAL COUNT POTASSIUM URANIUM THORIUM	21.0 6.2 0.7 0.9
COMM COMM COMM	COSMIC COEFFICIENTS TOTAL COUNT POTASSIUM URANIUM	0.900 0.053 0.042
COMM	STRIPPING COEFFICIENTS	0.051
COMM COMM COMM COMM COMM	ALPHA BETA GAMMA a b c STRIPPING HEIGHT ATTENUATION COFFEICIENTS	0.2569 0.3736 0.7416 0.0591 0.0002 -0.0169
COMM COMM COMM	ALPHA BETA GAMMA	0.00049 0.00065 0.00069
COMM COMM COMM	RADON STRIPPING COEFFICIENTS TOTAL COUNT POTASSIUM THORIUM	13.150 0.782 0.061
COMM COMM COMM	RADON (C1) GROUND (C2)	1.875 0.370
COMM COMM COMM COMM COMM	ALTITUDE COEFFICIENTS TOTAL COUNT POTASSIUM URANIUM THORIUM	-0.0072 -0.0099 -0.0086 -0.0067
COMM	DISCLAIMER	·
COMM COMM COMM	It is Fugro Airborne Survey's understanding that the data pr the client is to be used for the purpose agreed between the That purpose was a significant factor in determining the sco	ovided to parties. pe and

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Yiyintyi East

Description File for 0.1 sec Magnetics Data	1
COMM JOB NUMBER:	2251
COMM AREA NUMBER:	2
COMM SURVEY COMPANY:	Fugro Airborne Surveys
COMM CLIENT:	Sandfire Resources NL
COMM SURVEY TYPE:	Magnetic and Radiometric
COMM AREA NAME:	Yiyintyi East
COMM STATE:	Western Australia
COMM COUNTRY:	Australia
COMM SURVEY FLOWN:	23 September - 04 October 2011
COMM LOCATED DATA CREATED:	02 November 2011
COMM	
COMM DATUM:	GDA94
COMM PROJECTION:	MGA
COMM ZONE:	53
COMM	
COMM SURVEY SPECIFICATIONS	

COMM COMM TRAVERSE LINE SPACING: 50 m COMM TRAVERSE LINE DIRECTION: 105 - 285 deg COMM TIE LINE SPACING: 520 m COMM TIE LINE DIRECTION: 012 - 192 deg COMM NOMINAL TERRAIN CLEARANCE: 40 m COMM FINAL LINE KILOMETRES (in the 10 Hz dataset): 562.84 km COMM COMM LINE NUMBERING COMM 2000101 - 1012801 COMM TRAVERSE LINE NUMBERS: 2900101 - 2900801 COMM TIE LINE NUMBERS: COMM COMM AREA BOUNDARY COMM COMM EASTING NORTHING COMM 573746 8318658 COMM 577070 8317825 COMM 575913 8311631 572444 8312539 COMM COMM COMM SURVEY EQUIPMENT COMM COMM AIRCRAFT: VH-FGZ Aerocommander AC500S COMM Scintrex CS2 Cesium Vapour COMM MAGNETOMETER: COMM INSTALLATION: Stinger COMM COMM RESOLUTION: 0.001 nT COMM RECORDING INTERVAL: 0.1 s COMM COMM RADAR ALTIMETER: Collins Alt-50 COMM RECORDING INTERVAL: 0.1 s COMM real-time differential GPS COMM NAVIGATION: COMM RECORDING INTERVAL: 1.0 s COMM Fugro DAS COMM ACQUISITION SYSTEM: COMM COMM BASE MAGNETOMETER: Scintrex Envi-Mag COMM RECORDING INTERVAL: 5 s COMM COMM DATA PROCESSING COMM COMM CO-ORDINATES COMM PARALLAX CORRECTION APPLIED 0.5 s COMM COMM MAGNETIC DATA COMM DIURNAL CORRECTION APPLIED base value 48088 nT COMM COMM PARALLAX CORRECTION APPLIED 0 s COMM IGRF CORRECTION APPLIED base value 47803 nT COMM IGRF MODEL 2010 extrapolated to 2011/09/24 COMM COMM DATA HAVE BEEN HEIGHT CORRECTED (TAYLOR DRAPE) to 40m AGL COMM DATA HAVE BEEN TIE LINE LEVELLED COMM DATA HAVE BEEN MICROLEVELLED COMM COMM RADAR ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0 s COMM COMM GPS ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0 s COMM

COMM DIGITAL TERRAIN DATA COMM DTM CALCULATED [DTM = GPS ALTITUDE - (RADAR ALT + SENSOR SEPARATION)] COMM DATA CORRECTED TO AUSTRALIAN HEIGHT DATUM COMM DATA HAVE BEEN TIE LINE LEVELLED COMM DATA HAVE BEEN MICROLEVELLED COMM COMM ------COMM DISCLAIMER COMM ------COMM It is Fugro Airborne Survey's understanding that the data provided to COMM the client is to be used for the purpose agreed between the parties. COMM That purpose was a significant factor in determining the scope and COMM level of the Services being offered to the Client. Should the purpose COMM for which the data is used change, the data may no longer be valid or COMM appropriate and any further use of, or reliance upon, the data in COMM those circumstances by the Client without Fugro Airborne Survey's COMM review and advice shall be at the Client's own or sole risk. COMM COMM The Services were performed by Fugro Airborne Survey exclusively for COMM the purposes of the Client. Should the data be made available in whole COMM or part to any third party, and such party relies thereon, that party COMM does so wholly at its own and sole risk and Fugro Airborne Survey COMM disclaims any liability to such party. COMM COMM Where the Services have involved Fugro Airborne Survey's use of any COMM information provided by the Client or third parties, upon which COMM Fugro Airborne Survey was reasonably entitled to rely, then the COMM Services are limited by the accuracy of such information. Fugro COMM Airborne Survey is not liable for any inaccuracies (including any COMM incompleteness) in the said information, save as otherwise provided COMM in the terms of the contract between the Client and Fugro Airborne COMM Survey. COMM COMM With regard to DIGITAL TERRAIN DATA, the accuracy of the elevation COMM calculation is directly dependent on the accuracy of the two input COMM parameters, radar altitude and GPS altitude. The radar altitude value COMM may be erroneous in areas of heavy tree cover, where the altimeter COMM reflects the distance to the tree canopy rather than the ground. The COMM GPS altitude value is primarily dependent on the number of available COMM satellites. Although post-processing of GPS data will yield X and Y COMM accuracies in the order of 1-2 metres, the accuracy of the altitude COMM value is usually much less, sometimes in the ±5 metre range. Further COMM inaccuracies may be introduced during the interpolation and gridding COMM process. Because of the inherent inaccuracies of this method, no COMM guarantee is made or implied that the information displayed is a true COMM representation of the height above sea level. Although this product COMM may be of some use as a general reference, COMM THIS PRODUCT MUST NOT BE USED FOR NAVIGATION PURPOSES. COMM ------COMM COMM LINE DATA FORMAT COMM A space is left between fixed fields so that a field of, for example, COMM A8 should only ever have a maximum of 7 characters in it, even when it COMM is a null, thus: COMM COMM FIELD NULL FORMAT UNITS COMM Line Number -99999 Ι7 COMM Flight Number -99 I4 COMM Date (yyyymmdd) -9999999 Ι9 COMM Fiducial Number -9999.9 F8.1 COMM Time (UTC seconds past midnight) s -9999.9 F8.1 -99999.99 F10.2 COMM Easting m -999999.99 COMM Northing F11.2 m -999.9999999 COMM Longitude F13.7 deg

<u>Booroloo</u>	ola and Yiyintyi, Northe	rn Territory Mag/Spec Survey –	Sandfire Resour	ces NL	lob No. 2251	Page 34
COMM	Latitude		dea	-99,9999999	न	12.7
COMM (GPS Altitude		m	-999.99	- F	8.2
COMM 1	Radar Altitude	2	m	-999.99	- F	8.2
COMM	Compensated TN	MI	nT	-99999.999	F	11.3
COMM ?	Diurnal		nT	-9999.99	F	9.2
COMM !	Final TMI		nT	-99999.999	F	11.3
COMM 1	Digital Terra:	in Model	m	-999.99	- F	8.2
					-	0.2
Descr	iption File fo	or 1.0 sec Windowed	Radiometri	.cs Data		
COMM .	JOB NUMBER:				2	251
COMM 7	AREA NUMBER:					2
COMM S	SURVEY COMPANY	ζ:		Fugro Airbo	orne Surv	reys
COMM	CLIENT:			Sandfire R	Resources	\mathbf{NL}
COMM S	SURVEY TYPE:			Magnetic and	Radiomet	ric
COMM 7	AREA NAME:			Yi	yintyi E	ast
COMM S	STATE:			Wester	n Austra	lia
COMM	COUNTRY:				Austra	lia
COMM S	SURVEY FLOWN:		23	September - 04 C	october 2	011
COMM 3	LOCATED DATA (CREATED:		02 No	ovember 2	011
COMM						
COMM J	DATUM:				GD	A94
COMM 1	PROJECTION:					MGA
COMM 2	ZONE :					53
COMM						
COMM S	SURVEY SPECIF	ICATIONS				
COMM						
COMM	TRAVERSE LINE	SPACING:			5	0 m
COMM	TRAVERSE LINE	DIRECTION:		10)5 - 285	deg
COMM	TIE LINE SPACE	ING:			52	0 m
COMM	TIE LINE DIRE(CTION:		01	.2 - 192	deg
COMM 1	NOMINAL TERRA	IN CLEARANCE:			4	0 m
COMM 1	FINAL LINE KI	LOMETRES (in the 1 H	z dataset)	:	553.73	km
COMM						
COMM 3	LINE NUMBERING					
COMM						
COMM	TRAVERSE LINE	NUMBERS:		200010)1 - 2012	801
COMM	TIE LINE NUMBI	ERS:		290010)1 - 2900	801
COMM						
COMM 2	AREA BOUNDARY					
COMM						
COMM	EASTING	NORTHING				
COMM	573746	8318658				
COMM	577070	8317825				
COMM	575913	8311631				
	5/2444	0377232				
COMM		איזיי				
COMM	SURVEY EQUIPME	SIN 1				
						000
	AIRCRAFI.			VH-FGZ AELOCOIIIIIa	inder ACS	005
			25	(Channel Ermler	anium CD	0.2.0
	ODVOTAL VOLUM	7.	20	o channel Explor	anitum GR	.020
	DECODDING INT				33.3	
COMM	RECORDING INI	SKVAL.			1.	05
COMM	סאראס או הידאים ארחאס	·D•		0-1	ling Nl+	_50
	RECODING INTIG			01	LIIS AIL A	1 9
	VECONDING INII	• LTA V JIE			υ.	тЭ
COMM	NAVIGATION			real-time diffe	rential	CDC
	DEGUDUING INUU NYYATGAIION •	PUAL.		TEAT CIME UTILE	a1	
COMM	VECONDING THII	лт v т т v			1.	0 0
COMM	ACOULSTATION S	YSTEM:			Fuaro	DAS
COMM					1 ugt U	2110
COMM	DATA PROCESSI	NG				

COMM		
COMM	CO-ORDINATES	0 5 9
COMM	PARALLAX CORRECTION APPLIED	0.5 5
COMM	RADAR ALTITUDE DATA	
COMM	PARALLAX CORRECTION APPLIED	0.0 s
COMM		
COMM	GPS ALTITUDE DATA	0 0
COMM	PARALLAX CORRECTION APPLIED	0.0 s
COMM	RADIOMETRIC DATA	
COMM	NASVD FILTERING APPLIED TO 256 CHANNEL DATA	
COMM	WINDOW DATA EXTRACTED USING IAEA STANDARD WINDOWS	
COMM	PARALLAX CORRECTION APPLIED	0.0 s
COMM	COSMIC, AIRCRAFT AND RADON BACKGROUNDS REMOVED	
COMM	STRIPPING CORRECTIONS APPLIED	40 m ACT
COMM	HEIGHI CORRECTED IO	40 III AGL
COMM	AIRCRAFT BACKGROUND COEFFICIENTS	
COMM	TOTAL COUNT	21.0
COMM	POTASSIUM	6.2
COMM	URANIUM	0.7
COMM	THORIUM	0.9
COMM	COSMIC COEFFICIENTS	0 900
COMM	POTASSTUM	0.900
COMM	URANIUM	0.042
COMM	THORIUM	0.051
COMM	STRIPPING COEFFICIENTS	
COMM	ALPHA	0.2569
COMM	BETA	0.3736
COMM	GAMMA	0.7416
	a b	0.0591
COMM	c	-0.0169
COMM	STRIPPING HEIGHT ATTENUATION COEFFICIENTS	
COMM	ALPHA	0.00049
COMM	BETA	0.00065
COMM	GAMMA	0.00069
	TOTAL COUNT	13 150
COMM	POTASSIUM	0.782
COMM	THORIUM	0.061
COMM	SPECTRAL RATIOS	
COMM	RADON (C1)	1.875
COMM	GROUND (C2)	0.677
COMM	ALTITUDE COEFFICIENTS	-0 0072
COMM	POTASSTIM	-0.0072
COMM	URANIUM	-0.0086
COMM	THORIUM	-0.0067
COMM		
COMM		
COMM	DISCLAIMER	
COMM	It is Eugro Airborne Survey's understanding that the data m	covided to
COMM	the client is to be used for the purpose agreed between the	parties.
0000		
COMM	That purpose was a significant factor in determining the sco	ope and
COMM	That purpose was a significant factor in determining the sco level of the Services being offered to the Client. Should the	ppe and ne purpose
COMM COMM COMM	That purpose was a significant factor in determining the sco level of the Services being offered to the Client. Should th for which the data is used change, the data may no longer be	ppe and ne purpose e valid or
COMM COMM COMM	That purpose was a significant factor in determining the sco level of the Services being offered to the Client. Should the for which the data is used change, the data may no longer be appropriate and any further use of, or reliance upon, the data these since upon, the data the client without Face and any further use of a second s	ppe and le purpose e valid or ata in
COMM COMM COMM COMM	That purpose was a significant factor in determining the sco level of the Services being offered to the Client. Should the for which the data is used change, the data may no longer be appropriate and any further use of, or reliance upon, the dat those circumstances by the Client without Fugro Airborne Sur review and advice shall be at the Client's own or sole rick	ope and ne purpose e valid or ata in rvey's

COMM The Services were performed by Fugro Airborne Survey exclusively for COMM the purposes of the Client. Should the data be made available in whole COMM or part to any third party, and such party relies thereon, that party COMM does so wholly at its own and sole risk and Fugro Airborne Survey COMM disclaims any liability to such party. COMM COMM Where the Services have involved Fugro Airborne Survey's use of any COMM information provided by the Client or third parties, upon which COMM Fugro Airborne Survey was reasonably entitled to rely, then the COMM Services are limited by the accuracy of such information. Fugro COMM Airborne Survey is not liable for any inaccuracies (including any COMM incompleteness) in the said information, save as otherwise provided COMM in the terms of the contract between the Client and Fugro Airborne COMM Survey. COMM ------COMM COMM LINE DATA FORMAT COMM A space is left between fixed fields so that a field of, for example, COMM A8 should only ever have a maximum of 7 characters in it, even when it COMM is a null, thus: COMM COMM FIELD UNITS NULL FORMAT COMM Line Number -99999 Ι7 COMM Flight Number -99 I4 -9999999 I9 COMM Date (yyyymmdd) COMM Fiducial Number s COMM Time (local) s COMM Easting m -9999.9 -9999.9 F8.1 -999999.99 -999.9999999 -99.9999999 -99.9999999 -999.99 -999.99 F8.1 F10.2 COMM Easting m F11.2 COMM Northing m COMM Longitude deg F13.7 F12.7 COMM Latitude deg COMM GPS Altitude F8.2 m COMM Radar Altitude COMM Uncorrected Total Count cps F8.2 cps -9999.9 F8.1 COMM Uncorrected Potassium COMM Uncorrected Uranium COMM Uncorrected Thorium COMM Raw Cosmic -999.9 F7.1 -999.9 F7.1 cps -999.9 -99 F7.1 cps I4 cps COMM Final Total Count COMM Final Potassium COMM Final Uranium -9999.9 F8.1 cps -999.9 F7.1 cps -999.9 F7.1 cps COMM Final Thorium cps -999.9 F7.1 Description File for 1.0 sec Raw 256 Channel Radiometrics Data COMM JOB NUMBER: 2251 COMM AREA NUMBER: 2 Fugro Airborne Surveys COMM SURVEY COMPANY:

Sandfire Resources NL COMM CLIENT: Magnetic and Radiometric COMM SURVEY TYPE: COMM AREA NAME: Yiyintyi East COMM STATE: Western Australia Australia COMM COUNTRY: 23 September - 04 October 2011 COMM SURVEY FLOWN: COMM LOCATED DATA CREATED: 02 November 2011 COMM COMM DATUM: GDA94 COMM PROJECTION: MGA COMM ZONE: 53 COMM COMM SURVEY SPECIFICATIONS COMM COMM TRAVERSE LINE SPACING: 50 m COMM TRAVERSE LINE DIRECTION: 105 - 285 deg

520 m COMM TIE LINE SPACING: COMM TIE LINE DIRECTION: 012 - 192 deg 40 m COMM NOMINAL TERRAIN CLEARANCE: COMM FINAL LINE KILOMETRES (in the 1 Hz dataset): 553.73 km COMM COMM LINE NUMBERING COMM 2000101 - 2012801 COMM TRAVERSE LINE NUMBERS: COMM TIE LINE NUMBERS: 2900101 - 2900801 COMM COMM AREA BOUNDARY COMM COMM EASTING NORTHING COMM 573746 8318658 COMM 577070 8317825 COMM 575913 8311631 COMM 572444 8312539 COMM COMM SURVEY EQUIPMENT COMM VH-FGZ Aerocommander AC500S COMM AIRCRAFT: COMM COMM SPECTROMETER: 256 Channel Exploranium GR820 COMM CRYSTAL VOLUME: 33.56 1 COMM RECORDING INTERVAL: 1.0 s COMM Collins Alt-50 COMM RADAR ALTIMETER: COMM RECORDING INTERVAL: 0.1 s COMM COMM NAVIGATION: real-time differential GPS COMM RECORDING INTERVAL: 1.0 s COMM COMM ACQUISITION SYSTEM: Fugro DAS COMM COMM DATA PROCESSING COMM COMM CO-ORDINATES 0.5 s COMM PARALLAX CORRECTION APPLIED COMM COMM RADAR ALTITUDE DATA 0.0 s COMM PARALLAX CORRECTION APPLIED COMM COMM GPS ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM BAROMETRIC DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM TEMPERATURE DATA 0.0 s COMM PARALLAX CORRECTION APPLIED COMM COMM RADIOMETRIC DATA COMM NO PROCESSING APPLIED TO RAW 256 CHANNEL RADIOMETRIC DATA COMM COMM AIRCRAFT BACKGROUND COEFFICIENTS COMM TOTAL COUNT 21.0 COMM POTASSIUM 6.2 COMM URANIUM 0.7 COMM THORIUM 0.9 COMM COSMIC COEFFICIENTS COMM TOTAL COUNT 0.900 COMM POTASSIUM 0.053 COMM URANIUM 0.042 COMM THORIUM 0.051

COMM	STRIPPING COEFFICIENTS			
COMM	ALPHA			0.2569
COMM	BETA			0.3736
COMM	GAMMA			0.7416
COMM	a			0.0591
COMM				0.0002
COMM	STRIPPING HEIGHT ATTENIIATI	ION CORFEICIE	NTS	-0.0109
COMM	ALPHA	ION COBFFICIES	MID	0.00049
COMM	BETA			0.00065
COMM	GAMMA			0.00069
COMM	RADON STRIPPING COEFFICIEN	NTS		
COMM	TOTAL COUNT			13.150
COMM	POTASSIUM			0.782
COMM	SPECTRAL RATIOS			0.061
COMM	RADON (C1)			1.875
COMM	GROUND (C2)			0.677
COMM	ALTITUDE COEFFICIENTS			
COMM	TOTAL COUNT			-0.0072
COMM	POTASSIUM			-0.0099
COMM	URANIUM			-0.0086
COMM	THORIUM			-0.006/
COMM				
COMM	DISCLAIMER			
COMM				
COMM	It is Fugro Airborne Surve	ey's understa	nding that the data	provided to
COMM	the client is to be used f	for the purpo	se agreed between th	ne parties.
COMM	That purpose was a signifi	icant factor	in determining the s	scope and
COMM	level of the Services being	ng offered to	the Client. Should	the purpose
COMM	appropriate and any furthe	er use of or	reliance upon, the	data in
COMM	those circumstances by the	e Client with	out Fugro Airborne S	Survey's
COMM	review and advice shall be	e at the Clie	nt's own or sole ris	sk.
COMM				
COMM	The Services were performe	ed by Fugro A	irborne Survey exclu	sively for
COMM	the purposes of the Client	. Should the	data be made availa	ble in whole
COMM	does so wholly at its own	, and such pa	arty relies thereon, k and Eugro Airborne	Survey
COMM	disclaims any liability to	such party.	k and Fugio Allboine	; Burvey
COMM		b buon purcy.		
COMM	Where the Services have in	nvolved Fugro	Airborne Survey's u	use of any
COMM	information provided by the	ne Client or	third parties, upon	which
COMM	Fugro Airborne Survey was	reasonably e	ntitled to rely, the	n the
COMM	Services are limited by th	ne accuracy of	f such information.	Fugro
COMM	Airborne Survey is not lia	able for any .	inaccuracies (incluc	ling any
COMM	in the terms of the contra	act between t	he Client and Fugro	Airborne
COMM	Survey.		ine effente and fagro	mindorme
COMM				
COMM				
COMM	LINE DATA FORMAT			
COMM	A space is left between fi	ixed fields s	o that a field of, f	or example,
COMM	As should only ever have a	a maximum of	/ characters in it,	even when it
	IS A HUII, LHUS.			
COMM	FIELD	UNITS	NULL	FORMAT
COMM	Line Number	011210	-99999	17
COMM	Flight Number		-99	I4
COMM	Date (yyyymmdd)		-9999999	I9
COMM	Fiducial Number	S	-9999.9	F8.1
COMM	Time (local)	S	-9999.9	F8.1
COMM	Lasing	m	-99999.99	FIU.Z

<u>Boorolc</u>	ola and Yiyintyi, Norther	n Territory Mag/Spec Su	<u>ırvey – Sandfire Resc</u>	ources NL	Job No. 225	Page 39
COMM	Northing		m	-999999.99	9 F11	.2
COMM	Longitude		dea	-999.99999	999 F13	.7
COMM	Latitude		dea	-99 99999	99 F12	7
COMM	GPS Altitude		m	-999 99	F8	2
COMM	Podor Altitudo		m	_000_00	го. го	2
	Rauar Altitude		ill an a	-999.99	го. т4	2
	Raw Cosmic		cps	-99	14	2
COMM	Barometric Pre	ssure	nPa	-999.99	F8.	2
COMM	Temperature		deg C	-9.9	F5.	1
COMM	Livetime		S	-9.999	F7.	3
COMM	Raw 256 Channe	l Radiometrics	counts	-999	256	15
Yivin	tvi West					
Desci	ription File fo	r 0.1 sec Magne	etics Data			
COMM	JOB NUMBER:					2251
COMM	AREA NUMBER:					3
COMM	SURVEY COMPANY	:		Fuar	o Airborne Sur	vevs
COMM	CLIENT.			Sand	dfire Resource	a NI.
COMM	CHIENI''			Magnati	ia and Padiomo	tria
COMM	SURVEI TIPE.			Magnet.	IC allu Kaulolle	Weat
COMM	AREA NAME.				riyincyi	west
COMM	STATE:				Western Austr	alia
COMM	COUNTRY:				Austr	alia
COMM	SURVEY FLOWN:			01 October	- 03 October	2011
COMM	LOCATED DATA C	REATED:			03 November	2011
COMM						
COMM	DATUM:				G	DA94
COMM	PROJECTION:					MGA
COMM	ZONE:					53
COMM						
COMM	SURVEY SPECIFI	CATIONS				
COMM	Sonver Brederr	011110110				
COMM	TRAVERSE LINE	SDACING:				50 m
COMM	TRAVERSE LINE	DIDECTION.			020 210	dog
COMM	TRAVERSE LINE	DIRECTION.			039 - 219	aeg
COMM	TIE LINE SPACE	NG			5	00 m
COMM	TIE LINE DIREC	TION:			300 - 120	deg
COMM	NOMINAL TERRAL	N CLEARANCE:				40 m
COMM	FINAL LINE KIL	OMETRES (in the	e 10 Hz datase	et):	599.0	7 km
COMM						
COMM	LINE NUMBERING					
COMM						
COMM	TRAVERSE LINE	NUMBERS:			3000101 - 301	3601
COMM	TIE LINE NUMBE	RS:			3900101 - 390	0801
COMM						
COMM	AREA BOUNDARY					
COMM						
COMM	EACTINC	ΝΟΡΨΗΤΝΟ				
COMM	EASIING EE0476	0212704				
COMM	559470	0312704				
COMM	565423	8309318				
COMM	563111	8306510				
COMM	557577	8310226				
COMM						
COMM	SURVEY EQUIPME	NT				
COMM						
COMM	AIRCRAFT:			VH-FGZ Aei	rocommander AC	500S
COMM						
COMM	MAGNETOMETER:			Scintrex	CS2 Cesium Va	pour
COMM	INSTALLATION:				Sti	- nger
COMM					501	
COMM	RESOLUTION:				0 00	1 nT
COMM	DECUDUTION .	PVAT. ·			0.00	1 ~
COMP	VECONDING INTE	ICVALI.			0	. 1 2
COMM	השביעים אינייים איניייייייייי	. .			0c114	+ 50
COMM	RADAR ALTIMETE	K·			COLLINS AL	L-5U
COMM	RECORDING INTE	KVAL:			0	.⊥ s
COMM						

real-time differential GPS COMM NAVIGATION: COMM RECORDING INTERVAL: 1.0 s COMM COMM ACOUISITION SYSTEM: Fugro DAS COMM COMM BASE MAGNETOMETER: Scintrex Envi-Mag COMM RECORDING INTERVAL: 5 s COMM COMM DATA PROCESSING COMM COMM CO-ORDINATES 0.5 s COMM PARALLAX CORRECTION APPLIED COMM COMM MAGNETIC DATA COMM DIURNAL CORRECTION APPLIED base value 48088 nT COMM COMM PARALLAX CORRECTION APPLIED 0 s COMM IGRF CORRECTION APPLIED base value 47803 nT COMM IGRF MODEL 2010 extrapolated to 2011/09/24 COMM COMM DATA HAVE BEEN HEIGHT CORRECTED (TAYLOR DRAPE) to 40m AGL COMM DATA HAVE BEEN TIE LINE LEVELLED COMM DATA HAVE BEEN MICROLEVELLED COMM COMM RADAR ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0 s COMM COMM GPS ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0 s COMM COMM DIGITAL TERRAIN DATA COMM DTM CALCULATED [DTM = GPS ALTITUDE - (RADAR ALT + SENSOR SEPARATION)] COMM DATA CORRECTED TO AUSTRALIAN HEIGHT DATUM COMM DATA HAVE BEEN TIE LINE LEVELLED COMM DATA HAVE BEEN MICROLEVELLED COMM COMM -----COMM DISCLAIMER COMM -----COMM It is Fugro Airborne Survey's understanding that the data provided to COMM the client is to be used for the purpose agreed between the parties. COMM That purpose was a significant factor in determining the scope and COMM level of the Services being offered to the Client. Should the purpose COMM for which the data is used change, the data may no longer be valid or COMM appropriate and any further use of, or reliance upon, the data in COMM those circumstances by the Client without Fugro Airborne Survey's COMM review and advice shall be at the Client's own or sole risk. COMM COMM The Services were performed by Fugro Airborne Survey exclusively for COMM the purposes of the Client. Should the data be made available in whole COMM or part to any third party, and such party relies thereon, that party COMM does so wholly at its own and sole risk and Fugro Airborne Survey COMM disclaims any liability to such party. COMM COMM Where the Services have involved Fugro Airborne Survey's use of any COMM information provided by the Client or third parties, upon which COMM Fugro Airborne Survey was reasonably entitled to rely, then the COMM Services are limited by the accuracy of such information. Fugro COMM Airborne Survey is not liable for any inaccuracies (including any COMM incompleteness) in the said information, save as otherwise provided COMM in the terms of the contract between the Client and Fugro Airborne COMM Survey. COMM COMM With regard to DIGITAL TERRAIN DATA, the accuracy of the elevation

F8.2

0051

COMM calculation is directly dependent on the accuracy of the two input COMM parameters, radar altitude and GPS altitude. The radar altitude value COMM may be erroneous in areas of heavy tree cover, where the altimeter COMM reflects the distance to the tree canopy rather than the ground. The COMM GPS altitude value is primarily dependent on the number of available COMM satellites. Although post-processing of GPS data will yield X and Y COMM accuracies in the order of 1-2 metres, the accuracy of the altitude COMM value is usually much less, sometimes in the ± 5 metre range. Further COMM inaccuracies may be introduced during the interpolation and gridding COMM process. Because of the inherent inaccuracies of this method, no COMM guarantee is made or implied that the information displayed is a true COMM representation of the height above sea level. Although this product COMM may be of some use as a general reference, COMM THIS PRODUCT MUST NOT BE USED FOR NAVIGATION PURPOSES. COMM ------COMM COMM LINE DATA FORMAT COMM A space is left between fixed fields so that a field of, for example, COMM A8 should only ever have a maximum of 7 characters in it, even when it COMM is a null, thus: COMM COMM FIELD UNITS NULL FORMAT COMM Line Number -99999 Ι7 COMM Flight Number -99 I4 COMM Date (yyyymmdd) -9999999 I9 COMM Fiducial Number -9999.9 F8.1 COMM Time (UTC seconds past midnight) -9999.9 F8.1 S -99999.99 F10.2 COMM Easting m -999999,99 F11.2 COMM Northing m -999.9999999 F13.7 COMM Longitude deg -99.9999999 F12.7 COMM Latitude deg -999.99 F8.2 COMM GPS Altitude m -999.99 F8.2 COMM Radar Altitude m nT -99999.999 F11.3 COMM Compensated TMI nT -9999.99 F9.2 COMM Diurnal F11.3 COMM Final TMI -99999.999 nT

Description File for 1.0 sec Windowed Radiometrics Data

COMM Digital Terrain Model

COMM	JOB NUMBER:		2251
COMM	AREA NUMBER:		3
COMM	SURVEY COMPANY:		Fugro Airborne Surveys
COMM	CLIENT:		Sandfire Resources NL
COMM	SURVEY TYPE:		Magnetic and Radiometric
COMM	AREA NAME:		Yiyintyi West
COMM	STATE:		Western Australia
COMM	COUNTRY:		Australia
COMM	SURVEY FLOWN:	01	October - 03 October 2011
COMM	LOCATED DATA CREATED:		03 November 2011
COMM			
COMM	DATUM:		GDA94
COMM	PROJECTION:		MGA
COMM	ZONE:		53
COMM			
COMM	SURVEY SPECIFICATIONS		
COMM			
COMM	TRAVERSE LINE SPACING:		50 m
COMM	TRAVERSE LINE DIRECTION:		039 - 219 deg
COMM	TIE LINE SPACING:		500 m
COMM	TIE LINE DIRECTION:		300 - 120 deg
COMM	NOMINAL TERRAIN CLEARANCE:		40 m
COMM	FINAL LINE KILOMETRES (in the 1 Hz	dataset):	589.40 km
COMM			

m

-999.99

COMM LINE NUMBERING COMM 3000101 - 3013601 COMM TRAVERSE LINE NUMBERS: COMM TIE LINE NUMBERS: 3900101 - 3900801 COMM COMM AREA BOUNDARY COMM COMM EASTING NORTHING COMM 559476 8312704 565423 8309318 COMM 563111 8306510 COMM 557577 8310226 COMM COMM COMM SURVEY EQUIPMENT COMM COMM AIRCRAFT: VH-FGZ Aerocommander AC500S COMM COMM SPECTROMETER: 256 Channel Exploranium GR820 COMM CRYSTAL VOLUME: 33.56 1 COMM RECORDING INTERVAL: 1.0 s COMM COMM RADAR ALTIMETER: Collins Alt-50 COMM RECORDING INTERVAL: 0.1 s COMM real-time differential GPS COMM NAVIGATION: COMM RECORDING INTERVAL: 1.0 s COMM COMM ACOUISITION SYSTEM: Fugro DAS COMM COMM DATA PROCESSING COMM COMM CO-ORDINATES COMM PARALLAX CORRECTION APPLIED 0.5 s COMM COMM RADAR ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM GPS ALTITUDE DATA 0.0 s COMM PARALLAX CORRECTION APPLIED COMM COMM RADIOMETRIC DATA COMM NASVD FILTERING APPLIED TO 256 CHANNEL DATA COMM WINDOW DATA EXTRACTED USING IAEA STANDARD WINDOWS COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COSMIC, AIRCRAFT AND RADON BACKGROUNDS REMOVED COMM STRIPPING CORRECTIONS APPLIED COMM HEIGHT CORRECTED TO 40 m AGLCOMM COMM AIRCRAFT BACKGROUND COEFFICIENTS COMM TOTAL COUNT 21.0 COMM POTASSIUM 6.2 COMM URANIUM 0.7 COMM THORIUM 0.9 COMM COSMIC COEFFICIENTS COMM TOTAL COUNT 0.900 COMM POTASSIUM 0.053 COMM URANIUM 0.042 COMM THORIUM 0.051 COMM STRIPPING COEFFICIENTS COMM ALPHA 0.2569 COMM BETA 0.3736 COMM GAMMA 0.7416 0.0591 COMM a COMM b 0.0002

COMM	С			-0.0169		
COMM	STRIPPING HEIGHT ATTENUAT	ION COEFFICIENTS		0 00040		
COMM	ALPHA			0.00049		
	CAMMA			0.00065		
COMM	RADON STRIPPING COEFFICIEN	JTS		0.00009		
COMM	TOTAL COUNT	10		13.150		
COMM	POTASSIUM			0.782		
COMM	THORIUM			0.061		
COMM	SPECTRAL RATIOS					
COMM	RADON (C1)			1.875		
COMM	GROUND (C2)			0.701		
COMM	ALTITUDE COEFFICIENTS					
COMM	TOTAL COUNT			-0.0072		
	IDANTIM			-0.0099		
COMM	THORIUM			-0.0080		
COMM	montom			0.0007		
COMM						
COMM	DISCLAIMER					
COMM						
COMM	It is Fugro Airborne Surve	ey's understanding	g that the data provi	ded to		
COMM	the client is to be used f	for the purpose a	greed between the par	ties.		
COMM	That purpose was a signif	icant factor in d	etermining the scope	and		
COMM	level of the Services beir	ng offered to the	Client. Should the p	ourpose		
COMM	for which the data is used change, the data may no longer be valid or					
	appropriate and any further use of, or reliance upon, the data in					
COMM	those circumstances by the Client without Fugro Airborne Survey's					
COMM	icvicw and advice shall be		own of bote fisk.			
COMM	The Services were performe	ed by Fugro Airbo	rne Survey exclusivel	y for		
COMM	the purposes of the Client	. Should the data	a be made available i	n whole		
COMM	or part to any third party, and such party relies thereon, that party					
COMM	does so wholly at its own and sole risk and Fugro Airborne Survey					
COMM	disclaims any liability to	o such party.				
COMM						
COMM	Where the Services have in	ivolved Fugro Air	borne Survey's use of	any		
	Information provided by the Client or third parties, upon which					
	I Fugro Airborne Survey was reasonably entitled to rely, then the					
COMM	Airborne Survey is not liable for any inaccuracies (including any					
COMM	(incompleteness) in the said information, save as otherwise provided					
COMM	in the terms of the contract between the Client and Fugro Airborne					
COMM	Survey.					
COMM						
COMM						
COMM	LINE DATA FORMAT			_		
COMM	A space is left between fixed fields so that a field of, for example,					
COMM	As should only ever have a	a maximum of / ch	aracters in it, even	wnen it		
	is a null, thus:					
COMM	T.T.T.T.	UNITS	NITIT.T.	FORMAT		
COMM	Line Number	ONTID	-99999	T7		
COMM	Flight Number		-99	I4		
COMM	Date (yyyymmdd)		-9999999	19		
COMM	Fiducial Number	S	-9999.9	F8.1		
COMM	Time (local)	S	-9999.9	F8.1		
COMM	Easting	m	-99999.99	F10.2		
COMM	Northing	m	-999999.99	F11.2		
COMM		dea	_999 9999999			
· · · · · · · ·	Longitude	acg		F13.7		
COMM	Longitude Latitude	deg	-99.9999999	F13.7 F12.7		
	Longitude Latitude GPS Altitude Radar Altitude	deg m	-99.9999999 -999.99 -999.99	F13.7 F12.7 F8.2 F8.2		
	Longitude Latitude GPS Altitude Radar Altitude Incorrected Total Count	deg m m	-99.9999999 -999.99 -999.99 -999.99	F13.7 F12.7 F8.2 F8.2 F8.2 F8.1		

Booroloola and Yiyintyi, Northern Territory Mag/S	Job No. 2251 Page 44		
COMM Uncorrected Potassium	cps	-999.9	F7.1
COMM Uncorrected Uranium	cps	-999.9	F7.1
COMM Uncorrected Thorium	cps	-999.9	F7.1
COMM Raw Cosmic	cps	-99	I4
COMM Final Total Count	cps	-9999.9	F8.1
COMM Final Potassium	cps	-999.9	F7.1
COMM Final Uranium	cps	-999.9	F7.1
COMM Final Thorium	cps	-999.9	F7.1

Description File for 1.0 sec Raw 256 Channel Radiometrics Data COMM JOB NUMBER: 2251 COMM AREA NUMBER: 3 COMM SURVEY COMPANY: Fugro Airborne Surveys COMM CLIENT: Sandfire Resources NL COMM SURVEY TYPE: Magnetic and Radiometric COMM AREA NAME: Yiyintyi West COMM STATE: Western Australia COMM COUNTRY: Australia COMM SURVEY FLOWN: 01 October - 03 October 2011 03 November 2011 COMM LOCATED DATA CREATED: COMM GDA94 COMM DATUM: COMM PROJECTION: MGA COMM ZONE: 53 COMM COMM SURVEY SPECIFICATIONS COMM COMM TRAVERSE LINE SPACING: 50 m 039 - 219 deg COMM TRAVERSE LINE DIRECTION: COMM TIE LINE SPACING: 500 m COMM TIE LINE DIRECTION: 300 - 120 deg COMM NOMINAL TERRAIN CLEARANCE: 40 m 589.40 km COMM FINAL LINE KILOMETRES (in the 1 Hz dataset): COMM COMM LINE NUMBERING COMM 3000101 - 3013601 COMM TRAVERSE LINE NUMBERS: 3900101 - 3900801 COMM TIE LINE NUMBERS: COMM COMM AREA BOUNDARY COMM COMM EASTING NORTHING COMM 559476 8312704 COMM 565423 8309318 COMM 563111 8306510 557577 8310226 COMM COMM COMM SURVEY EQUIPMENT COMM VH-FGZ Aerocommander AC500S COMM AIRCRAFT: COMM COMM SPECTROMETER: 256 Channel Exploranium GR820 COMM CRYSTAL VOLUME: 33.56 1 COMM RECORDING INTERVAL: 1.0 s COMM COMM RADAR ALTIMETER: Collins Alt-50 COMM RECORDING INTERVAL: 0.1 s COMM COMM NAVIGATION: real-time differential GPS COMM RECORDING INTERVAL: 1.0 s COMM COMM ACQUISITION SYSTEM: Fugro DAS COMM

COMM DATA PROCESSING COMM COMM CO-ORDINATES COMM PARALLAX CORRECTION APPLIED 0.5 s COMM COMM RADAR ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM GPS ALTITUDE DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM BAROMETRIC DATA 0.0 s COMM PARALLAX CORRECTION APPLIED COMM COMM TEMPERATURE DATA COMM PARALLAX CORRECTION APPLIED 0.0 s COMM COMM RADIOMETRIC DATA COMM NO PROCESSING APPLIED TO RAW 256 CHANNEL RADIOMETRIC DATA COMM COMM AIRCRAFT BACKGROUND COEFFICIENTS COMM TOTAL COUNT 21.0 COMM POTASSIUM 6.2 0.7 COMM URANIUM 0.9 COMM THORIUM COMM COSMIC COEFFICIENTS 0.900 COMM TOTAL COUNT COMM POTASSIUM 0.053 COMM URANIUM 0.042 COMM THORIUM 0.051 COMM STRIPPING COEFFICIENTS COMM ALPHA 0.2569 0.3736 COMM BETA COMM GAMMA 0.7416 COMM a 0.0591 COMM b 0.0002 -0.0169 COMM C COMM STRIPPING HEIGHT ATTENUATION COEFFICIENTS 0.00049 COMM ALPHA 0.00065 COMM BETA 0.00069 COMM GAMMA COMM RADON STRIPPING COEFFICIENTS COMM TOTAL COUNT 13.150 COMM POTASSIUM 0.782 COMM THORIUM 0.061 COMM SPECTRAL RATIOS COMM RADON (C1) 1.875 0.701 COMM GROUND (C2) COMM ALTITUDE COEFFICIENTS COMM TOTAL COUNT -0.0072 COMM POTASSIUM -0.0099 COMM URANIUM -0.0086 COMM THORIUM -0.0067 COMM COMM ------COMM DISCLAIMER COMM ------COMM It is Fugro Airborne Survey's understanding that the data provided to COMM the client is to be used for the purpose agreed between the parties. COMM That purpose was a significant factor in determining the scope and COMM level of the Services being offered to the Client. Should the purpose COMM for which the data is used change, the data may no longer be valid or COMM appropriate and any further use of, or reliance upon, the data in COMM those circumstances by the Client without Fugro Airborne Survey's

COMM review and advice shall be at the Client's own or sole risk. COMM COMM The Services were performed by Fugro Airborne Survey exclusively for COMM the purposes of the Client. Should the data be made available in whole COMM or part to any third party, and such party relies thereon, that party COMM does so wholly at its own and sole risk and Fugro Airborne Survey COMM disclaims any liability to such party. COMM COMM Where the Services have involved Fugro Airborne Survey's use of any COMM information provided by the Client or third parties, upon which COMM Fugro Airborne Survey was reasonably entitled to rely, then the COMM Services are limited by the accuracy of such information. Fugro COMM Airborne Survey is not liable for any inaccuracies (including any COMM incompleteness) in the said information, save as otherwise provided COMM in the terms of the contract between the Client and Fugro Airborne COMM Survey. COMM ------COMM COMM LINE DATA FORMAT COMM A space is left between fixed fields so that a field of, for example, COMM A8 should only ever have a maximum of 7 characters in it, even when it COMM is a null, thus: COMM COMM FIELD UNITS NULL FORMAT COMM Line Number -99999 Ι7 COMM Flight Number -99 I4 -9999999 COMM Date (yyyymmdd) 19 COMM Fiducial Number -9999.9 F8.1 S COMM Time (local) -9999.9 F8.1 s F10.2 COMM Easting -99999.99 m -999999.99 F11.2 COMM Northing m -999.9999999 F13.7 COMM Longitude deg -99.9999999 F12.7 COMM Latitude deg -999.99 F8.2 COMM GPS Altitude m -999.99 F8.2 COMM Radar Altitude m -99 I4 COMM Raw Cosmic cps hPa F8.2 -999.99 COMM Barometric Pressure deg C F5.1 COMM Temperature -9.9 -9.999 F7.3 COMM Livetime S COMM Raw 256 Channel Radiometrics counts 256I5 -999

APPENDIX IV – List Of All Supplied Data

Final Located Data

- 0.1 second magnetics and digital terrain data
- 1.0 second windowed radiometrics data
- 1.0 second raw 256 channel radiometric data

Final located data is in ASCII format. Contents of each are shown in Appendix IV.

Raw Initial Products

Raw initial grids were produced in Geo-referenced TIFF format

- Raw Total magnetic intensity (nT)
- Raw Total count (cps)
- Raw Potassium count (cps)
- Raw Uranium count (cps)
- Raw Thorium count (cps)

Preliminary Gridded Data

Preliminary gridded data was produced in ERMapper format

- Total magnetic intensity (nT)
- Total count (cps)
- Potassium count (cps)
- Uranium count (cps)
- Thorium count (cps)
- Digital terrain model (m AHD)

Final Gridded Data

Final gridded data was produced in ERMapper format

- Total magnetic intensity (nT)
- 1VD of TMI (nT/m
- Total count (cps)
- Potassium count (cps)
- Uranium count (cps)
- Thorium count (cps)
- Digital terrain model (m AHD)

Additional Products

A logistics and processing report