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Operations and Processing Report

Airborne Geophysical Survey
Henty, Tasmania

EL29/94

February 2000

See Folio 27

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(opsrep/Goldfields-Henty)

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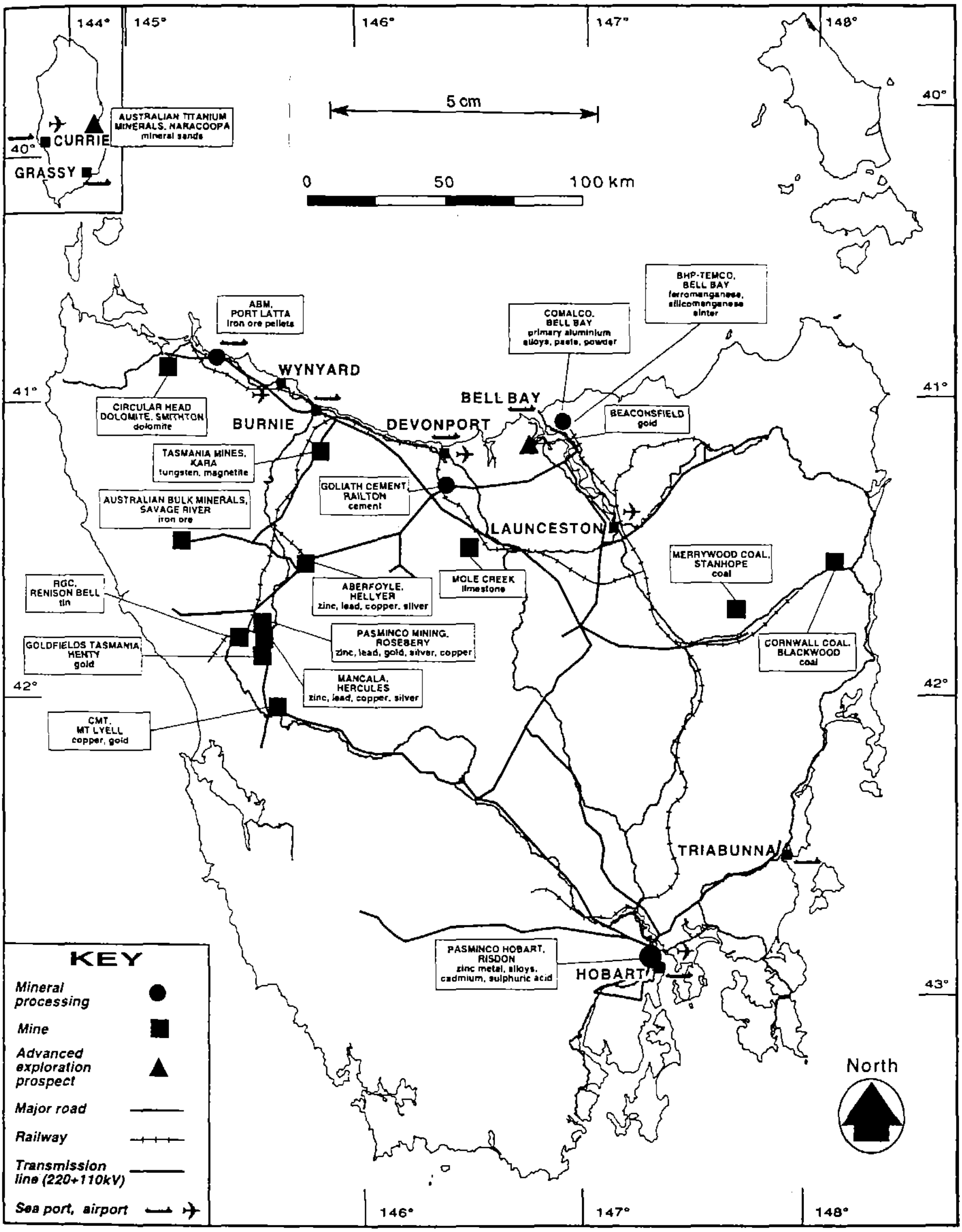
1. INTRODUCTION

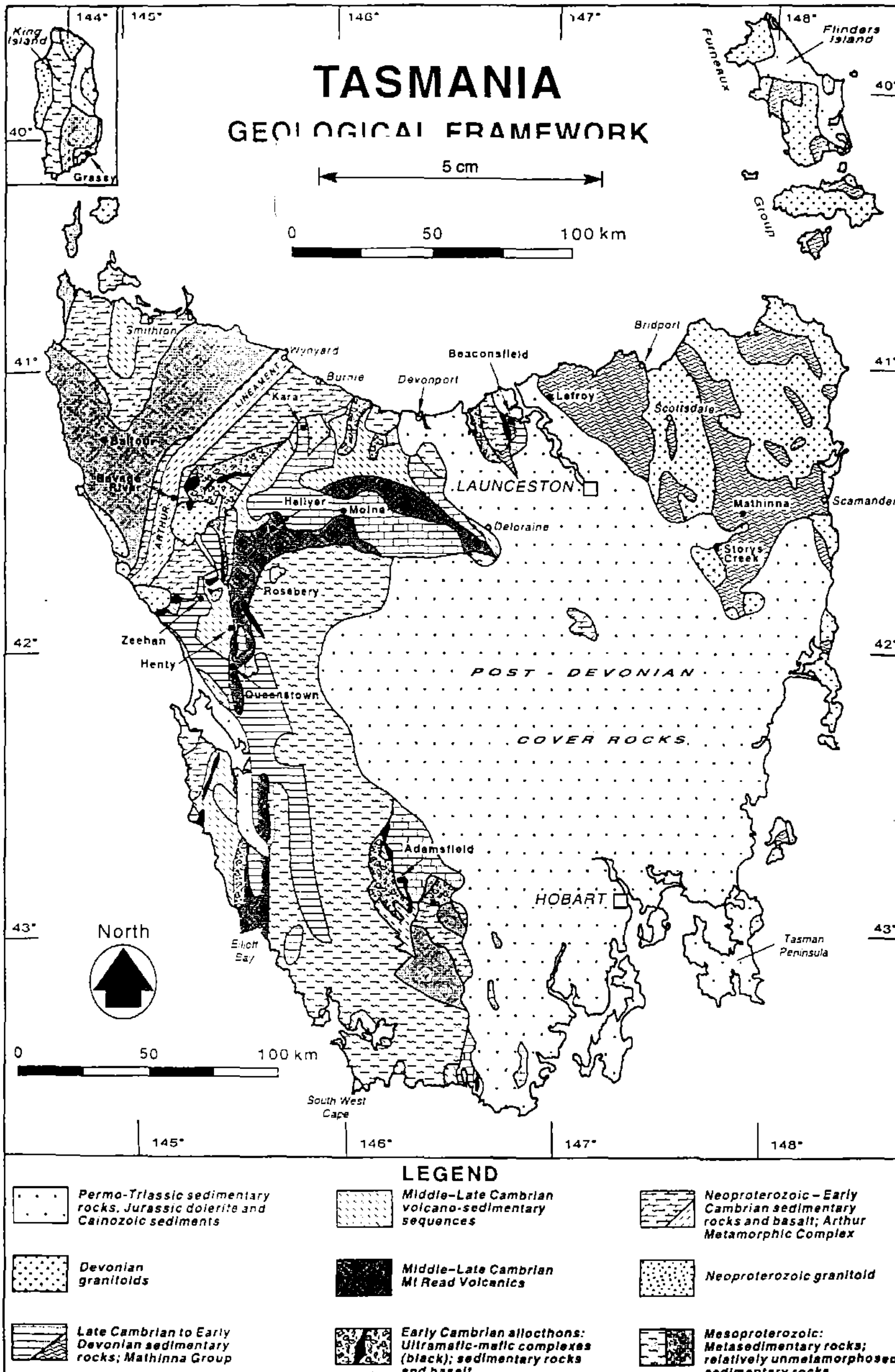
This report covers the operations for the helicopter geophysical survey covering the Henty project located 10km southeast of Renison Bell, Tasmania, which was flown for Goldfields Exploration Pty Ltd in February 2000 to assist in geological mapping, structural interpretation and delineation of zones of potential hydrothermal alteration.

The survey collected magnetic, radiometric, elevation, temperature and barometric pressure data totalling 885 kilometres, and yielded images of the fully processed geophysical parameters at a 12.5m grid cell size. This program entailed two and a half full days of surveying during 24-27 February 2000.

Geo Instruments Pty Ltd provided the survey personnel, instrumentation and data processing geophysicist. The aircraft and pilot were contracted from Heli-Aust Pty Ltd of Bankstown.

Tasmania Major Mining and Mineral Processing Operations




TASMANIA
GEOLOGICAL FRAMEWORK
5 cm
0
50
100 km
King Island
Grassy
Flinders Island
Furneaux
Group
144°
145°
146°
147°
148°
40°
41°
42°
43°
Smithton
Wynyard
Burnie
Devonport
Beaconsfield
Bridport
Lefroy
Scottsdale
Kara
LINEAMENT
ARTHUR
Balfour
Savage River
Hellyer
Moina
LAUNCESTON
Deloraine
Mathinna
Scamander
Storys Creek
Rosebery
Zeehan
Henty
Queenstown
POST - DEVONIAN
COVER ROCKS
Adamsfield
HOBART
Tasman Peninsula
North
Elliott Bay
South West Cape
LEGEND
Permo-Triassic sedimentary rocks, Jurassic dolerite and Cainozoic sediments
Middle-Late Cambrian volcano-sedimentary sequences
Neoproterozoic - Early Cambrian sedimentary rocks and basalt; Arthur Metamorphic Complex
Devonian granitoids
Middle-Late Cambrian Mt Read Volcanics
Neoproterozoic granitoid
Late Cambrian to Early Devonian sedimentary rocks; Mathinna Group
Early Cambrian allocthons: Ultramafic-mafic complexes (black); sedimentary rocks and basalt
Mesoproterozoic: Metasedimentary rocks; relatively unmetamorphosed sedimentary rocks

2. SURVEY SPECIFICATIONS

The project comprised airborne geophysical mapping over the Henty project located southeast of Renison Bell in Tasmania. Data acquisition totalled 885 line kilometres of airborne magnetic, gamma-ray spectrometer, elevation, temperature and barometric pressure data during six individual sorties.

The location of the Henty project area is shown in Figure 1 "Tasmanian Major Mining and Mineral Processing Operations", and also in Figure 2 "Tasmania, Geological Frame work".

2.1 LINE SPECIFICATIONS

Traverse Line Direction	090°-270° AMG
Traverse Line Spacing	50 metres
Tie Line Direction	000°-180° AMG
Tie Line Spacing	500 metres

2.2 INSTRUMENTAL SPECIFICATIONS

Magnetics	
Sampling Interval	0.1 second
Manoeuvre Noise	Compensated to < 0.5nT peak to peak for 10° manoeuvres
Total Noise	0.5nT
Heading Error	Corrected by calibration

Base Station Magnetometer	
Sampling Interval	5 seconds
Noise Level	0.5nT
Resolution	Better than or equal to 0.1nT

Radiometrics	
Sampling Interval	1.0 second
Dead Time	<15%
Detector Volume	16.4 litres
Detector Resolution	Better than 7% based on full width at half amplitude of the ^{208}Tl peak at 2.615 MeV

Radar Altimeter	Output 13.1mV/m
Barometer	Output 2.2mV/m
Thermometer	Precision of 0.1°C

2.3 FLYING SPECIFICATIONS

Magnetometer Sensor Nominal Terrain Clearance	30 metres
Spectrometer Sensor Nominal Terrain Clearance	30 metres
Flying Speed	40m / second

The magnetic and gamma ray spectrometer data were collected in such a manner as to allow comprehensive reprocessing with the advent of new technology. Details of the formats of the processed data records are given in Appendix 2.

3. SURVEY OPERATIONS

3.1 SURVEY BASE

The helicopter survey crew arrived in Zeehan on 22 February 2000 and completed survey operations in a Bell "Jet Ranger" helicopter leased from Heli-Aust Pty Ltd on 27 February.

3.2 FLIGHT PLANNING

Flight planning for the survey area was implemented using proprietary software and reviewed with the Client's representative prior to commencement of operations. A flight path plot of the area is contained in Appendix 1. The project is located in UTM Zone 55.

3.3 FLIGHT PATH CONTROL

Navigation was determined in flight, based on real time differential GPS, by using an Ashtech G12 receiver and Geo Instruments software for pilot guidance. The position solution from the receiver was obtained using signals from the U.S. Global Positioning System (GPS) with differential corrections supplied by the Omnistar differential service. Altitude control is derived from the radar altimeter.

The flight navigation data recorded in the helicopter were post processed at the survey base using the commercial software package "GRAFNAV" by Waypoint Consulting. Positional data recorded at a GPS base are used to differentially correct the helicopter's navigation data. This new positional information is accurate to one metre for X and Y and five metres for Z, and is the basis for the further data processing.

3.4 SURVEY PLATFORM

Helicopter: Bell Helicopter 206B "Jet Ranger"
Registration: VH-JWF
Contracted From: Heli-Aust Pty Ltd, Bankstown, NSW
Endurance: 3.2 hours fully loaded
Survey Speed: 40 m/sec

3.5 WEATHER DETAILS

The Henty survey area experienced rain and low cloud precluding airborne operations on 22, 23, 24 (morning only) and 26 February. Strong winds were observed on 25 February.

3.6 SAFETY MANAGEMENT

Geo Instruments considers that flying safety results from the conscientious application of the Air Navigation Regulations in regard to Rules of the Air and observance of aircraft maintenance requirements.

Heli-Aust is required by law to have an Operations Manual approved by the relevant Civil Aviation Authority before any flying operation can be carried out and this document is available for inspection at each company's office. Routine checks by the Civil Aviation Authority ensure that all operations and maintenance meet the requirements of the law. Further, each pilot has been extensively trained in low level and instrument flying. Pilots are only employed after comprehensive assessment of experience and ability.

There were no aviation incidents during the implementation of the Henty airborne survey.

Vehicle usage and driving habits are constantly under review by the company's management and particular attention is paid to remote area survival techniques. Geo Instruments believes there is no substitute for experience, and no inexperienced staff are used in any phase of the operations unless they are accompanied by an experienced equivalent.

There were no vehicle-related accidents during this program.

3.7 ENVIRONMENTAL MANAGEMENT

The aircraft operations are generally non-polluting except for noise associated with take-off and landing. All operations were conducted during normal day time and no complaints were received regarding noise. Extreme care was maintained during all refuelling operations to eliminate the risk of fuel spillage or fire.

Ground operations are minor, usually focused around the survey bases. Common sense rules apply to these tasks with particular reference to religious buildings or sites, traditional sites, residential areas, access paths, etc. Any staff responsible for damaging property or land are liable for dismissal.

4. PERSONNEL

Survey management and geophysical personnel were provided by Geo Instruments Pty Ltd of Sydney. All helicopter survey pilots were provided by Heli-Aust Pty Ltd of Bankstown Airport, NSW. In field quality control was undertaken at the survey base and data corrections, image processing and map production were undertaken by Geo Instruments Pty Ltd.

Field Operations

Field Project Manager	Zoltan Beldi
Pilot	Sam Borg
Operator	Pat Healy

Data Processing

Data Processor	Anton Rada

Supervision

Client's Representative	Michael House

5. GEOPHYSICAL EQUIPMENT

5.1 MAGNETOMETER

The helicopter survey was flown using a Geometrics G-822A ultra-high sensitivity Caesium Vapour Magnetometer sensor system. This sensor provides a Larmor signal that is processed by high precision counters embedded within the automatic compensator described in 5.2 below, to provide an operating range of 20,000 to 100,000 nT.

The sensor, pre-amplifier and three axis fluxgate magnetometer for compensation were mounted in a "boom", made entirely from aluminium, attached to the front of the helicopter. The distance from the sensor to the forward extremity of the helicopter was 3m. Real time compensation for the aircraft's magnetic field was achieved with the automatic digital compensation described below.

Magnetometer specifications:

Nominal Sensitivity	0.001 nT
Still Air RMS Noise	0.05 nT
Digital Recording Resolution	0.01 nT
Magnetic Gradient Tolerance	>20,000 nT / metre
Sample Time	0.10 sec.
Sample Distance	4 metres

5.2 AUTOMATIC COMPENSATOR

An RMS Instruments, automatic digital compensator, model AADCII, was used to correct for the magnetic interference caused by the aircraft itself and the effects of it manoeuvring in the earth's magnetic field. The signal from the magnetometer is compensated in real time and preserved without aliasing or phase distortion. The raw, uncompensated magnetic data also are recorded.

5.3 SPECTROMETER

An Exploranium GR-820 Gamma Ray Spectrometer was used to sample the full energy spectrum by 256 channels in addition to the standard energy windows (regions of interest or ROI's) for the gamma radiation from Tl^{208}, Bi^{214}, K^{40}, Total Count and Cosmic sources. Values were recorded at the end of each second, corresponding to each fiducial.

The gamma ray spectrometer was interfaced to a NaI (TI) thermally insulated detecting crystal pack with a total volume of 16.4 litres. The detector pack was mounted in the rear baggage compartment of the helicopter.

The GR-820 measures the pulses generated by the crystal detector and controls the gain of each individual detector element by reference to the natural radiation emanating from the ground. The isotope selected for the gain control is determined during the survey and depends on the concentration observed during flights covering tie lines. Thorium was chosen as the stabilising element for the spectrometer in the helicopter.

All 256 channels of radiometric data were recorded in addition to the five differential ROI windows, defined as follows:

Element	Energy Level (MeV)	Channel No.
Total Count	0.40 - 2.81	34 - 224
K - 40	1.37 - 1.57	109 - 125
Bi - 214	1.66 - 1.86	133 - 149
Tl - 208	2.41 - 2.81	194 - 224
Cosmic	3.0 - 6.0	

The ROI window data have been corrected for instrument dead time and the raw digital 256 channel recording contains uncorrected values.

5.4 ALTIMETER, BAROMETER AND THERMOMETER

A Collins ALT-50 radar altimeter system was installed in the helicopter. This controls the pilot's analogue indicator and provides a terrain clearance display from 0 to 750 metres (0 to 2,500 ft.) above ground level. This is the primary instrument used to maintain a consistent terrain clearance. The output of the altimeter is 4 mV/ft and it can be read to a resolution of 1 mV for 0.305 metres.

The reference height above the geoid (WGS84) used for data purposes, was derived from the differentially corrected height value provided by the GPS receiver. The GPS altitude was recorded in digital format by the acquisition system, in synchronisation with the spectrometer, every second. The radar altimeter height was recorded every 0.1 second.

A Sentra barometric altimeter with a precision of 0.1 Hpa was mounted within the cabin.

A Geo Instruments thermometer with a resolution of 0.1°C was mounted underneath the helicopter cowling.

5.5 GPS NAVIGATION SYSTEM

An Ashtech G12 receiver was used for navigation. The accuracy is better than 5m rms using Differential GPS post processing. The GPS antenna was mounted approximately one metre behind the Caesium Vapour Magnetometer sensor on the boom.

Navigation data recorded at a GPS base site were used to differentially correct the aircraft's positional data. GPS co-ordinates were referenced to the WGS84 spheroid and converted to AGD66 coordinates during data processing.

5.6 DATA ACQUISITION SYSTEM

The Geo Instruments G2002 digital acquisition system is based on the IBM PC AT architecture. The system is fitted with several modules tailored to condition the input data from the various sensing instruments. A custom written software package facilitates the following;

(a) Correct synchronisation of the data streams,
(b) Formatting of all data received,
(c) Extended error checking of all parameters,
(d) Visual data presentation for monitoring purposes,
(e) Generation and distribution of synchronising fiducial numbers,
(f) Recording of data to magnetic media,
(g) Calculation of position and provision of steering display for pilot.

5.7 BASE STATION MAGNETOMETER

Two Geometrics G-823 caesium vapour magnetometers were used as the base station magnetometer and back-up base magnetometer. The base stations were located 300m east of the Heemskirk Motel in Zeehan. These instruments were used to record the diurnal variations in the earth's magnetic field, and were run continuously throughout periods of survey flying. Power was provided by a bank of external batteries and solar panels.

Digital recordings from this instrument were made every 5 seconds with a resolution of 0.001nT and an accuracy of better than 0.1nT. The base station time was synchronised with the airborne magnetometer. All diurnal base station magnetometer data form part of the delivered digital information and individual records are not included in this report.

Diurnal activity was classed as active throughout the survey.

6. CALIBRATIONS

6.1 MAGNETOMETER

The Geometrics G-822A Caesium vapour magnetometer operates on a split-beam principle with a constant relationship between the earth's magnetic field and the Larmor frequency (the frequency with which gyromagnetic moments precess in a magnetic field). It is therefore not subject to instrumental drift and does not require calibration.

6.2 HEADING AND PARALLAX ERRORS

The heading error correction was determined by flying a clover leaf pattern, on survey line headings, at high altitude (nominally 6,000ft), using the GPS to control precise line positioning.

A flight was performed prior to the survey to determine the parallax error in the system, by flying at survey altitude over a magnetic body in opposite directions. Additional corrections may be applied during the processing to eliminate any herringbone effect visible in the data.

6.3 MAGNETIC COMPENSATION PROCEDURE

Magnetic compensation was undertaken prior to the start of the survey and after each aircraft maintenance check, or whenever any equipment was changed. The procedure for deriving the compensation for the automatic airborne digital compensator (AADC) is as follows:

The aircraft is configured in the mode which will be used for the survey, that is, all survey equipment is switched on. The aircraft battery must be in fully charged state and no extraneous objects must be on board which may affect the magnetic signature of the aircraft.

The aircraft is flown at an altitude which ensures sufficient terrain clearance to provide a geomagnetic gradient of less than 20nT/km. Once this parameter is achieved the aircraft is manoeuvred in the pitch, roll and yaw planes successively whilst heading in all four cardinal directions. During these manoeuvres, the AADC acquires the data from the magnetometer sensor and the three component fluxgate magnetometer in a special calibration mode. At the conclusion of the manoeuvres, the AADC performs a series of calculations and derives a set of coefficients which are then applied to all successive magnetometer readings on survey to remove the varying effect of the aircraft's manoeuvres in the earth's magnetic field.

A final set of 10° pitch, roll and yaw manoeuvres is flown for 30 seconds on each heading, in the opposing flight directions of both the survey traverse lines and the tie lines in order to verify the improvement provided by the compensation. A typical compensation box is presented in Appendix 4.

6.4 RADIOMETRICS

6.4.1 Calibration Factors

The spectrometer system was calibrated over the AGSO calibration pads at Canberra on 6 January 2000. The Bairnsdale Hover Range in Victoria was surveyed on January 8 to establish aircraft background and radio-element conversion coefficients. Details of all calibration procedures and results are presented in Appendix 3.

6.4.2 Daily, Pre and Post Flight Checks

The detector was aligned prior to each day's flight using a thorium source and checked for drift at the conclusion of the day. In flight, drift is kept to a minimum by the automatic gain control mechanism built into the GR-820 spectrometer. This constantly monitors the selected reference peak and adjusts the gain of the crystal detector. An alarm is generated whenever the gain drift exceeds nominal tolerances and the GR-820 is unable to correct the drift.

Pre and post flight checks of sensitivity and stability were undertaken using a pure uranium and a pure thorium sample. The background was recorded first with the samples well out of detection range, then with the thorium and uranium sources in range in turn, and then background again. The average background is deducted from the source readings. The thorium sample responses were reviewed routinely and the sensitivities were generally well within the +/- 5% specifications.

Both pre and post flight sample measurements are recorded in analogue and digital forms.

6.4.3 Daily Test Line

A test line of at least 100 seconds duration was established over flat ground along a north-south road to the north of Zeehan airstrip. The test line is flown before and following each day's surveying to assess the repeatability of the system pre- and post- data collection.

The helicopter test line data files are prefixed by "E" for the pre-survey test line and "G" for the post-survey test line.

76.5 POSITION

6.5.1 Positional Control of Survey Data

The GPS base station was located at the Heemskirk Motel in Zeehan.

6.5.2 Altimeters

The radar altimeter and barometric altimeter were calibrated against GPS height and a laser altimeter by multi-level flights at Bruthen and Lake King in Victoria, prior to the flying program at Henty.

7. DATA PROCESSING

7.1 IN-FIELD DATA VERIFICATION

The field party leader at the survey base conducted an analysis of the newly acquired data using both proprietary company software and commercial software including "Geosoft "and "ChrisDBF". At the survey base the post-processed GPS position information was merged with the geophysical data and then subjected to the following checks:

a) Speed correlation,
b) Identification of spikes
c) Verification that adequate flight path coverage was achieved,
d) Checking flight line spacing and terrain clearance tolerances.
e) Conformity to Contract specifications.

The various QC products and on-screen multi-parameter profile displays were reviewed each evening throughout the field data acquisition.

7.2 FINAL PROCESSING

The final data processing was undertaken by Kevron Geophysics Pty Ltd using proprietary Kevron software. All data had previously been checked for abnormalities by the in-field data verification system described in 7.1 above.

7.2.1 Flight Path Recovery

Processing of the differential GPS location data entailed the following steps:

a) Post-flight differential GPS corrections using "GRAFNAV" differential position processing software.
b) No fiducial synchronisation is required as both range data and fiducials are synchronised to GPS time.
c) Merging of positional data with geophysical data.

7.2.2 Magnetic Processing

Having verified all data in the field, the final processing sequence is reduced to the following steps:

a) Diurnal variation removal.
b) System parallax removal.
c) IGRF removal.
d) Tie line levelling.
e) Micro levelling.
f) Addition of the mean diurnal value.
g) Addition of 5,000 nT datum shift.
h) Gridding using a 12.5 metre cell size.

The magnetic data have been corrected for regional gradient by subtraction of the IGRF Model for 2000.2 derived from the year 2000 secular variation model The IGRF was calculated at 100m intervals along the lines and interpolated for each data observation. Diurnal variations and system parallax have been removed. Tie line levelling and microlevelling has been applied as described below. The mean diurnal value has been added to the data and a 5,000 nT datum shift applied. No filters were applied to the data prior to gridding, which was accomplished using the Akima spline gridding algorithm.

Tie-line levelling

The data were levelled using standard tie line levelling procedures in the Intrepid software. The steps involved in the tie line levelling were as follows:

a) A primary tie line was chosen as a reference tie.
b) All other ties were levelled to this tie line using 2nd degree polynomial adjustments.
c) Lines were adjusted on a flight by flight basis to minimise the differences at line/tie crossover points, using 2nd degree polynomial adjustments.
d) Finally the lines were adjusted individually to minimise crossover differences, using 2nd degree polynomial adjustments.

7.2.3 Radiometric Data Processing

Correction of radiometric data involves the reduction of the 256 channels of raw gamma spectrometer data using the guidelines of Grasty and Minty (1995) and the Noise-Adjusted Singular Value Decomposition (NASVD) noise reduction method. The specific processing steps are described below:

(a) <u>Noise-Adjusted Singular Value Decomposition (NASVD) Smoothing</u>
The signal to noise ration of the multi channel spectra can be substantially enhanced using Noise-Adjusted Singular Value Decomposition (NASVD) as described by Hovgaard and Grasty (1997), Schneider (1998) and Minty (1998). This method involves a general linear transformation of groups of spectra (a whole line or flight), using NASVD to compute the different spectral shapes that make up the measured multi-channel spectra. New multi-channel spectra are created by recombining the statistically significant spectral components. Each spectral component contributres an unequal amount to the features observed in the measured multi-channel spectrum, until a point is reached where the spectral components represent only noise.

The 1st spectral component is the spectral shape that represents most of the features in the measured multi-channel spectra. The 2nd spectral component represents those features not described by the 1st spectral component, etc. By excluding from the recombination those spectral components that do not represent significant features in the measured multi-channel spectra, the resulting reconstructed multi-channel spectra have a much larger signal to noise ratio than the measured multi-channel spectra.

(b) Dead Time Corrections

The raw 256 channel spectra were corrected for spectrometer dead time using the recorded live time and the standard formula.

$$N = \frac{n}{1 - t}$$

where:

N = corrected counts in each second;

n = all counts processed in each second by the ADC; and

t = the recorded dead time, the time taken to process all pulses reaching the detector in one second.

Where the live time (L) is recorded, the dead time t is replaced by ($1-L$).

(c) Energy Calibration

Energy calibration was undertaken line by line using a maximum of 3 calibration peaks; and a minimum of 2 calibration peaks dependent upon their clear identification in the spectra. The 3 calibration peaks used were Bi 609 at 0.609 Mev, potassium at 1.46 Mev and thorium at 2.615 Mev.

(d) Cosmic and Aircraft Background Correction

Cosmic and aircraft background removal utilised the data recorded in Bairnsdale during January 2000, and required smoothing of the cosmic channel using a 20 point moving average filtered version of the cosmic channel. The combined correction is calculated using:

$$N = a + bC,$$

where:

N = the combined cosmic and aircraft background in each spectral window;

a = the aircraft background in the window (plus a possible small radon component);

C = the cosmic channel count; and

b = the cosmic stripping factor for the window.

The values of *a* and *b* for each window are determined from the calibration flights over the sea. Cosmic coefficients and aircraft background count are tabulated below:

Element	**Cosmic Coefficients**	**Aircraft Background (CPS)**
Total Count	0.88604	46.6
Potassium	0.76580	2.1
Uranium	0.88110	2.3
Thorium	0.51887	4.6

(e) Atmospheric Radon

The indluence of atmospheric radon has been minimised using the spectral ratio method described by Minty (1992).

The radon coefficients used in the Minty method were:

AREA	**Calibration Constant C1**	**Calibration Constant C2**	**Integration Time**
Henty	1.95	0.71	400

(f) Extraction of Four Standard Windows

The fully processed 256 channel spectra were reduced to the four IAEA (1991) standard windows or Regions of Interest (ROI):

Total Count	0.41 to 2.81 Mev (channels 33 to 239)
Potassium	1.37 to 1.57 Mev (channels 116 to 133)
Uranium	1.66 to 1.86 Mev (channels 141 to 158)
Thorium	2.41 to 2.81 Mev (channels 205 to 239)

g) Spectral Stripping of Standard Window Data

Corrections for Compton stripping and height attenuation (to 25 metres AGL) were applied to the windowed data using constants derived from the pad tests in Canberra and the hover test in Victoria and calculated STP-height. The stripping coefficients were determined by measurement over the AGSO calibration pads and are presented below and in Appendix 5 of this report. Due to the scattering of gamma rays in the air, the three principle stripping ratios (α, β and γ) increase with altitude above the ground. The rate of increase is given by Grasty and Minty (1995) as follows:

Stripping Ratio	**Increase per metre**
α	0.0417
β	0.0066
γ	0.0097

Following adjustment of the stripping ratios for altitude, the corrected (stripped) count rates in the potassium, uranium and thorium channels (N_{KC}, N_{UC} and N_{ThC}) are given by Grasty and Minty (1995) as follows:

$$N_{KC} = \frac{[N_{Th}(\alpha\gamma - \beta) + N_u(a\beta - \gamma) + N_K(1 - a\alpha)]}{A},$$

$$N_{UC} = \frac{[N_{Th}(g\beta - \alpha) + N_U - N_K g)]}{A},$$

$$N_{ThC} = \frac{[N_{Th}(1 - g\gamma) - N_U a + N_K ag]}{A},$$

where

$$A = 1 - g\gamma - a(\alpha - g\beta).$$

and N_{Th} , N_U and N_K are counts measured in the thorium, uranium and potassium channels respectively.

The Compton coefficients were:

alpha	0.2589	a	0.0053
beta	0.3610	b	-0.0000
gamma	0.7559	g	-0.0005

(h) Calculation of Effective Height

The Effective Height, which is the aircraft terrain clearance corrected to Standard Temperature and Pressure was determined as follows:

- Filtering of the temperature field was applied to remove spikes and smooth out the instrument noise.
- Filtering of the barometric pressure field was not required to remove spikes but was applied to smooth out the instrument noise.
- Filtering of the radar altimeter was applied to remove spikes, spurious reflections from groups of tree and very narrow gullies and to smooth out the instrument noise.
- The formula option in the spread sheet editor was used to combine the terrain clearance, pressure and temperature.

$$h_e = \frac{h \times P \times 273}{1013 \times (T + 273)}$$

where:

h_e = the effective height;
h = the observed radar altitude in metres;
T = the measured air temperature in degrees C;
P = the barometric pressure in millibars.

(i) Height Corrections

The stripped count rates vary exponentially with aircraft altitude. Adjustments for variation in altitude were made using the formula:

$$N_c = N_o e^{-\mu (H - h)}$$

Where N_o = uncorrected counts,
N_c = count rate normalised to height H,
h = measured height above the ground,
H = nominal flight height,
μ = attenuation coefficient for the channel being corrected.

The height attenuation factors per metre were:

Total count	0.006205
Potassium	0.007540
Uranium	0.005060
Thorium	0.006410

(j) Conversion to Ground Radioelement Concentrations

The corrected windowed counts were converted to equivalent ground concentrations of potassium, uranium and thorium using the following expression:

$$C = \frac{N}{S}$$

where:
C = equivalent concentration of the radioelement (K%, U ppm or Th ppm);
S = broad source sensitivity for the window; and
N = count rate for each window, after deadtime, background stripping and height correction.

The broad source sensitivities were derived from the hover measurements conducted in Bairnsdale. The factors were:

Total Count	20.28
Potassium	74.87
Uranium	9.50
Thorium	3.99

(k) Gridding and Microlevelling

The Henty data were gridded at 12.5 metres mesh size for all areas using the Akima spline gridding algorithm. These grids were viewed in ERMapper to detect and rectify any residual levelling problems. Where appropriate the grids were decorrugated to remove double line busts. The line data were then microlevelled.

7.2.4 Digital Terrain Model (DTM) Processing

The digital terrain model is computed from the difference in GPS height of the aircraft above the ellipsoid as measured by GPS and the height above the ground as measured by the radar altitude.

The raw GPS range data recorded internally every one second and ground GPS receivers were post-processed on a daily basis using Waypoint Consulting's "Grafnav" software. Grafnav calculates the position of the aircraft GPS antenna, including longitude, latitude and height relative to the WGS84 reference ellipsoid for each set of range data (every one second). No fiducial synchronisation correction is required as the fiducials and GPS are synchronised to GPS time.

A radar altimeter provided the aircraft's ground clearance, the altimeter data being sampled every tenth of a second. The radar altimeter results are corrected for any drift and lightly smoothed to remove any spikes, spurious reflections or instrument noise.

The raw ground elevation data were then calculated as the difference between the height of the aircraft above the ellipsoid and the height of the aircraft above the ground. These raw elevation data calculated every one second are relative to the WGS84 reference ellipsoid, which were then converted to AHD (Australian Height Datum) values.

The elevation data did not require correction for the vertical separation between the antenna of the aircraft's GPS receiver. The GPS antenna and the radar altimeter sensor are both located on the boom. The digital terrain model information was gridded using the Akima spline gridding algorithm, and 12.5m grid cell size.

DISCLAIMER Not to be used for navigation

This digital terrain model (DTM) has been computed from data generated during the course of an airborne geophysical survey flown at a nominal line spacings and data has been interpolated/gridded between such lines. Every effort has been made to make the model a useful general reference. No guarantee can be made that this model is a true representation of height above sea level and it does contain radar altimeter responses from buildings and dense timber.

Users of this product should be aware of the topographic limitations mapped here within. **Do not use this DTM for navigation purposes.**

8. DELIVERED ITEMS

Maps

1:20,000 flight path map (in field)
Stacked magnetic profiles at 1:20,000 scale (in field)

Grids

Total Magnetic Intensity
Digital Elevation Model
Radiometrics (TC, K, U, Th)

Located Data

Final magnetic, radiometric, topographic and positional data in ASCII format

Digital data delivered on CD-ROM

9. REFERENCES

Grasty, R.L., 1975 - Uranium measurement by airborne gamma-ray spectrometry. *Geophysics*, **40**, 503-519.

Grasty, R.L. and Minty, B.R.S., 1995 - A guide to the technical specifications for airborne gamma-ray surveys. Australian Geological Survey Organisation Record 1995/60

Hovgaard, J. and Grasty, R.L., 1997 - Reducing statistical noise in airborne gamma-ray data through spectral component analysis. In "Proceedings of Exploration 97: Fourth Diennial Conference on Mineral Exploration" edited by A.G. Gubins, 1997, 753-764.

IAEA, 1991 - Airborne gamma ray spectrometer surveying. Technical report series 323, International Atomic Energy Agency, Vienna.

Minty, B.R.S., Morse, M.P., and Richardson, L.M., 1990 - Portable calibration *sources for airborne gamma-ray spectrometers. Exploration Geophysics*, **21**, 187-195.

Minty, B.R.S., 1992 - Airborne gamma-ray spectrometric background estimation using full spectrum analysis. *Geophysics*, **57**, 279-287.

Minty, B.R.S., 1997 - Multi-channel models for the estimation of radon background in airborne gamma-ray spectrometry. Preprint of publication in press.

Minty, B.R.S., 1998 - Recent developments in the processing of airborne gamma-ray spectrometric data. *Preview,* Issue No. 75 August/September 1998, 12-24.

Schneider, M., (1998) Multi-channel Gamma-ray Spectrometric Correction and Calibration Techniques. *Preview*, Issue 73, April 1998, 15-19.

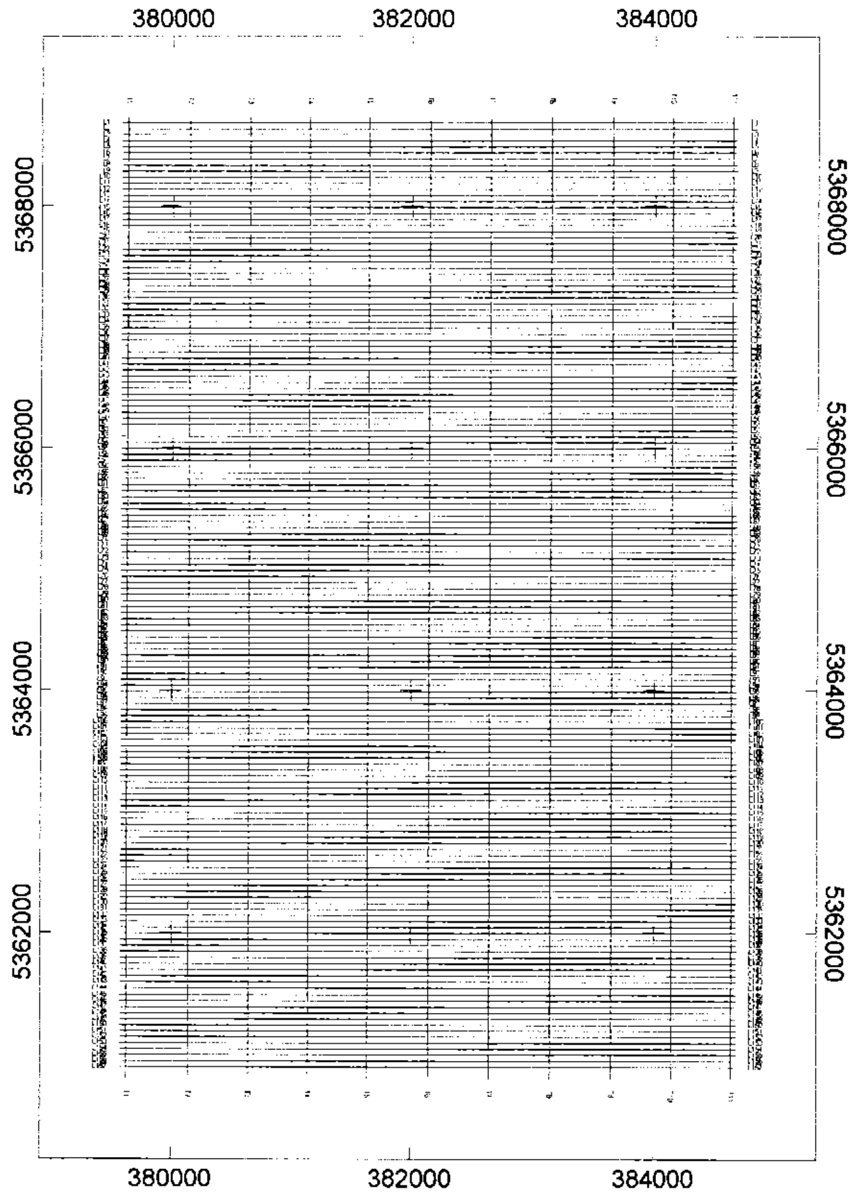
644028

Jet Ranger Helicopter VH-JWF with Boom Magnetometer, GPS and Radar Altimeter Installation

APPENDIX 1

Flight Plan of Area Flown
List of Coordinates of Survey Boundary Lines
Daily Flight Logs

644030



WGS 84

Scale 1:61000

1000 0 1000

metre

GoldFields Exploration Pty Ltd

Red Hills Area Western Tasmania
Magnetics and Radiometric Airborne Survey
Feb 2000

GeoInstruments Pty Ltd 2000

File: C:\KEV\REDHILLS\REDHILLS.SUM 2/23/0, 11:36:16PM

Job : C:\KEV\REDHILLS\REDHILLS
Area :
Client :

Run by : Z.BELDI

FILE: C:\KEV\REDHILLS\REDHILLS.INP

VALUES SPECIFIED :-	Traverse	Ties
Minimum Dead Segment	3000.0 m	3000.0 m
Coverage Threshold Percentage	100.0 %	
Line Positioning	AUTO	AUTO
Overfly extension	50.0 m	100.0 m

Supplementary Tieline: Y

AMG Zone 51

WGS 84 COORDS

Boundary lines used...

379638.0, 5360892.0 to 379638.0, 5368642.0
379638.0, 5368642.0 to 384638.0, 5368642.0
384638.0, 5368642.0 to 384638.0, 5360892.0
384638.0, 5360892.0 to 379638.0, 5360892.0

Type	Dir	Spc	Shortest	Longest	Lines	Tot. Dist
TRAVERSE	90.0	50.0 m	5.1 Km	5.1 Km	157	800.7 Km
TIES	0.0	500.0 m	8.0 Km	8.0 Km	11	87.5 Km
TOTAL						888.2 Km

FLIGHT LOG FOR FLIGHT 01 DOY 55 LocalTime 09:55:37 Area 1 Datum = WGS84

Line		File	Fid	Time	East	North	Len	Alarms
PRE1.GND	1	A0100113	0	10:39:46	363101	5361294		
			241	10:41:47	363102	5361294	0.001	0
PRE.THOR	2	B0100211	241	10:44:08	363101	5361294		
			256	10:44:15	363101	5361294	0.000	0
PRE.THOR	2	B0100213	256	10:46:40	363101	5361294		
			496	10:48:40	363102	5361294	0.001	0
PRE.URNM	3	C0100311	496	10:50:17	363101	5361294		
			736	10:52:17	363101	5361294	0.000	0
PRE2.GND	4	D0100411	736	10:53:14	363101	5361294		
			976	10:55:14	363101	5361294	0.000	0
PRE.TEST	5	E0100511	976	11:08:10	364865	5364084		
			1196	11:09:59	363036	5361808	2.920	1
PRE.ALTB	6	F0100611	1196	11:12:34	364788	5361303		
			2046	11:20:38	369727	5360875	4.958	1787
TIE.LINE	1	T0100111	2046	11:29:39	379493	5369042		
			2681	11:34:56	379643	5360720	8.323	6
TIE.LINE	2	T0100211	2681	11:35:56	380140	5360809		
			3261	11:40:46	380143	5368780	7.971	0
TIE.LINE	3	T0100311	3261	11:41:27	380635	5368749		
			3916	11:46:55	380644	5360739	8.010	0
TIE.LINE	4	T0100411	3916	11:47:45	381141	5360789		
			4596	11:53:25	381142	5368801	8.012	0
TIE.LINE	5	T0100511	4596	11:54:07	381637	5368742		
			5151	11:58:45	381641	5360735	8.007	0
TIE.LINE	6	T0100611	5151	12:00:41	382145	5360792		
			5811	12:06:11	382139	5368814	8.022	0
TIE.LINE	7	T0100711	5811	12:07:11	382643	5368749		
			6476	12:12:43	382644	5360732	8.017	0
TIE.LINE	8	T0100811	6476	12:13:52	383142	5360790		
			7171	12:19:40	383139	5368787	7.997	0
TIE.LINE	9	T0100911	7171	12:20:26	383646	5368750		
			7881	12:26:21	383644	5360760	7.990	0

TIE.LINE	10	T0101011	7881 12:27:23	384140	5360790		
			8506 12:32:35	384139	5368773	7.983	0
TIE.LINE	11	T0101111	8506 12:33:48	384644	5368725		
			9066 12:38:28	384644	5360704	8.021	0
TIE.LINE	1	T0100112	9066 12:38:49	384288	5360290		
			9416 12:41:45	376826	5360391	7.463	483

File: L:\RedHills\F02\FLOG\F02.LOG 4/3/0, 3:09:11PM

FLIGHT LOG FOR FLIGHT 02 DOY 55 LocalTime 13:39:48 Area 1 Datum = WGS84

Line		File	Fid	Time	East	North	Len	Alarms
TRAVERSE	1	L0200111	0	13:53:56	379588	5368702		
			566	13:58:38	384715	5368690	5.127	0
TRAVERSE	2	L0200211	566	13:58:57	384695	5368634		
			1091	14:03:19	379499	5368646	5.196	0
TRAVERSE	3	L0200311	1091	14:03:53	379587	5368597		
			1671	14:08:43	384716	5368588	5.129	0
TRAVERSE	4	L0200411	1671	14:09:05	384693	5368533		
			2206	14:13:32	379554	5368540	5.139	0
TRAVERSE	5	L0200511	2206	14:14:01	379600	5368495		
			2771	14:18:44	384721	5368496	5.121	0
TRAVERSE	6	L0200611	2771	14:19:12	384679	5368439		
			3251	14:23:12	379550	5368443	5.129	0
TRAVERSE	7	L0200711	3251	14:25:05	379595	5368392		
			3836	14:29:57	384717	5368391	5.122	0
TRAVERSE	8	L0200811	3836	14:30:23	384696	5368338		
			4356	14:34:43	379503	5368343	5.193	0
TRAVERSE	9	L0200911	4356	14:35:12	379603	5368296		
			4921	14:39:55	384753	5368294	5.150	0
TRAVERSE	10	L0201011	4921	14:40:21	384691	5368240		
			5456	14:44:49	379516	5368243	5.175	0
TRAVERSE	11	L0201111	5456	14:45:17	379584	5368194		
			6071	14:50:25	384717	5368194	5.133	0
TRAVERSE	12	L0201211	6071	14:50:56	384700	5368141		
			6586	14:55:13	379561	5368141	5.139	0
TRAVERSE	13	L0201311	6586	14:55:42	379591	5368094		
			7176	15:00:37	384740	5368092	5.149	0
TRAVERSE	14	L0201411	7176	15:02:00	384689	5368039		
			7666	15:06:05	379541	5368042	5.148	0
TRAVERSE	15	L0201511	7666	15:06:23	379586	5367994		
			8191	15:10:46	384730	5367991	5.144	0
TRAVERSE	16	L0201611	8191	15:11:12	384682	5367937		
			8671	15:15:13	379549	5367942	5.133	0
TRAVERSE	17	L0201711	8671	15:15:33	379584	5367895		
			9236	15:20:15	384716	5367886	5.132	0

TRAVERSE	18	L0201811	9236	15:20:45	384692	5367838		
			9781	15:25:17	379552	5367837	5.140	0
TRAVERSE	19	L0201911	9781	15:25:40	379604	5367794		
			10256	15:29:37	384717	5367788	5.113	0
TRAVERSE	20	L0202011	10256	15:30:50	384687	5367739		
			10716	15:34:40	379503	5367743	5.184	0
TRAVERSE	21	L0202111	10716	15:35:05	379598	5367693		
			11156	15:38:46	384721	5367689	5.123	0
TRAVERSE	22	L0202211	11156	15:39:09	384686	5367638		
			11561	15:42:31	379526	5367637	5.160	0
TRAVERSE	23	L0202311	11561	15:42:48	379587	5367597		
			11991	15:46:23	384743	5367594	5.156	0
TRAVERSE	24	L0202411	11991	15:46:39	384697	5367538		
			12421	15:50:14	379552	5367536	5.145	0
TRAVERSE	25	L0202511	12421	15:50:31	379576	5367489		
			12691	15:52:46	382818	5367497	3.242	1
POST.TST	8	G0200811	12691	16:00:22	364857	5364077		
			12916	16:02:15	362996	5361752	2.978	0
PST1.GND	9	I0200911	12916	16:06:17	363101	5361296		
			13156	16:08:17	363101	5361296	0.000	0
POST.THM	10	J0201011	13156	16:09:59	363101	5361295		
			13396	16:11:59	363102	5361296	0.001	0
POST.URN	11	K0201111	13396	16:13:38	363101	5361296		
			13636	16:15:38	363101	5361297	0.001	0
PST2.GND	12	M0201211	13636	16:17:00	363101	5361297		
			13876	16:19:00	363101	5361296	0.001	0

FLIGHT LOG FOR FLIGHT 03 DOY 56 LocalTime 08:33:05 Area 1 Datum = WGS84

Line		File	Fid	Time	East	North	Len	Alarms
PRE1.GND	1	A0300111	0	08:34:36	363101	5361294		
			241	08:36:36	363101	5361294	0.000	0
PRE.THOR	2	B0300211	241	08:38:43	363101	5361294		
			481	08:40:43	363101	5361294	0.000	0
PRE.URNM	3	C0300311	481	08:42:16	363101	5361294		
			726	08:44:18	363101	5361294	0.000	0
PRE2.GND	4	D0300411	726	08:45:13	363101	5361294		
			966	08:47:13	363101	5361294	0.000	0
PRE.TEST	5	E0300512	966	08:56:34	363040	5361815		
			1191	08:58:26	364888	5364116	2.951	0
TRAVERSE	25	L0302512	1191	09:06:11	379591	5367492		
			1471	09:08:31	382196	5367498	2.605	1
TRAVERSE	40	L0304011	1471	09:10:45	379586	5366738		
			1986	09:15:03	384780	5366737	5.194	0
TRAVERSE	41	L0304111	1986	09:15:33	384691	5366694		
			2446	09:19:22	379531	5366693	5.160	0
TRAVERSE	42	L0304211	2446	09:19:47	379579	5366641		
			2921	09:23:45	384722	5366639	5.143	0
TRAVERSE	43	L0304311	2921	09:24:08	384674	5366591		
			3396	09:28:05	379547	5366591	5.127	0
TRAVERSE	44	L0304411	3396	09:28:42	379585	5366538		
			3846	09:32:27	384766	5366543	5.181	0
TRAVERSE	45	L0304511	3846	09:32:57	384684	5366488		
			4326	09:36:57	379544	5366491	5.140	0
TRAVERSE	46	L0304611	4326	09:37:35	379572	5366441		
			4741	09:41:02	384727	5366441	5.155	0
TRAVERSE	47	L0304711	4741	09:41:31	384680	5366389		
			5141	09:44:51	379562	5366388	5.118	0
TRAVERSE	48	L0304811	5141	09:47:06	379587	5366341		
			5531	09:50:21	384756	5366342	5.169	0
TRAVERSE	49	L0304911	5531	09:50:48	384679	5366289		
			5926	09:54:06	379559	5366288	5.120	0
TRAVERSE	50	L0305011	5926	09:54:43	379579	5366239		
			6326	09:58:03	384753	5366238	5.174	0

TRAVERSE	51	L0305111	6326	09:58:28	384697	5366191		
			6696	10:01:33	379555	5366188	5.142	0
TRAVERSE	52	L0305211	6696	10:01:58	379580	5366140		
			7081	10:05:11	384716	5366141	5.136	0
TRAVERSE	53	L0305311	7081	10:06:23	384701	5366079		
			7476	10:09:41	379554	5366090	5.147	25
TRAVERSE	54	L0305411	7476	10:10:11	379572	5366040		
			7831	10:13:09	384720	5366037	5.148	0
TRAVERSE	55	L0305511	7831	10:13:35	384676	5365985		
			8196	10:16:38	379550	5365989	5.126	0
TRAVERSE	56	L0305611	8196	10:18:47	379586	5365943		
			8566	10:21:52	384725	5365946	5.139	0
TRAVERSE	57	L0305711	8566	10:22:27	384696	5365886		
			8936	10:25:32	379545	5365892	5.151	0
TRAVERSE	58	L0305811	8936	10:25:58	379596	5365841		
			9276	10:28:48	384755	5365841	5.159	0
TRAVERSE	59	L0305911	9276	10:29:06	384697	5365786		
			9621	10:31:58	379513	5365792	5.184	0
TRAVERSE	60	L0306011	9621	10:32:19	379576	5365741		
			9976	10:35:17	384718	5365741	5.142	0
TRAVERSE	61	L0306111	9976	10:35:43	384664	5365689		
			10331	10:38:41	379558	5365690	5.106	0
TRAVERSE	62	L0306211	10331	10:39:07	379583	5365637		
			10671	10:41:57	384758	5365640	5.175	3
TRAVERSE	63	L0306311	10671	10:42:25	384690	5365589		
			11006	10:45:13	379556	5365590	5.134	0
TRAVERSE	64	L0306411	11006	10:45:37	379584	5365541		
			11356	10:48:31	384759	5365540	5.175	0
TRAVERSE	25	L0302513	11356	10:51:27	384692	5367493		
			11761	10:54:50	379558	5367493	5.134	0
TRAVERSE	26	L0302611	11761	10:55:13	379594	5367446		
			12196	10:58:51	384720	5367442	5.126	0
TRAVERSE	27	L0302711	12196	10:59:18	384698	5367392		
			12651	11:03:05	379505	5367394	5.193	0
TRAVERSE	28	L0302811	12651	11:03:26	379576	5367352		
			13081	11:07:01	384732	5367341	5.156	0
TRAVERSE	29	L0302911	13081	11:07:27	384686	5367281		
			13531	11:11:12	379539	5367290	5.147	3
TRAVERSE	30	L0303011	13531	11:11:35	379593	5367246		

TRAVERSE 132	L0413211	6236 14:30:11	384705 5362139		
		6636 14:33:31	379548 5362140	5.157	0
TRAVERSE 133	L0413311	6636 14:34:07	379595 5362094		
		7126 14:38:12	384735 5362094	5.140	0
TRAVERSE 134	L0413411	7126 14:38:45	384696 5362040		
		7516 14:42:00	379502 5362039	5.194	0
TRAVERSE 135	L0413511	7516 14:42:48	379593 5361992		
		8036 14:47:08	384713 5361993	5.120	0
TRAVERSE 136	L0413611	8036 14:47:43	384701 5361941		
		8436 14:51:03	379561 5361941	5.140	0
TRAVERSE 137	L0413711	8436 14:51:46	379585 5361895		
		8901 14:55:39	384721 5361891	5.136	0
TRAVERSE 138	L0413811	8901 14:56:15	384690 5361843		
		9311 14:59:40	379548 5361846	5.142	0
TRAVERSE 139	L0413911	9311 15:01:52	379608 5361791		
		9731 15:05:22	384718 5361791	5.110	0
TRAVERSE 140	L0414011	9731 15:06:01	384704 5361742		
		10146 15:09:29	379543 5361740	5.161	0
TRAVERSE 141	L0414111	10146 15:10:08	379599 5361693		
		10566 15:13:38	384717 5361693	5.118	0
TRAVERSE 142	L0414211	10566 15:14:09	384680 5361653		
		10971 15:17:31	379504 5361641	5.176	0
TRAVERSE 143	L0414311	10971 15:18:16	379603 5361594		
		11416 15:21:58	384735 5361592	5.132	0
TRAVERSE 144	L0414411	11416 15:22:47	384693 5361545		
		11796 15:25:57	379534 5361541	5.159	0
TRAVERSE 145	L0414511	11796 15:26:46	379582 5361496		
		12246 15:30:32	384718 5361495	5.136	0
TRAVERSE 146	L0414611	12246 15:31:40	384673 5361448		
		12621 15:34:48	379556 5361442	5.117	0
TRAVERSE 147	L0414711	12621 15:35:30	379600 5361393		
		13091 15:39:25	384754 5361393	5.154	0
TRAVERSE 148	L0414811	13091 15:40:02	384668 5361343		
		13501 15:43:27	379545 5361341	5.123	0
TRAVERSE 149	L0414911	13501 15:44:08	379585 5361294		
		13956 15:47:56	384749 5361293	5.164	0
TRAVERSE 150	L0415011	13956 15:48:47	384692 5361244		
		14346 15:52:02	379537 5361243	5.155	0
TRAVERSE 151	L0415111	14346 15:52:40	379586 5361192		

			14786	15:56:20	384771	5361189	5.185	0
TRAVERSE	152	L0415211	14786	15:56:58	384668	5361139		
			14801	15:57:06	384421	5361131	0.247	1
TRAVERSE	152	L0415212	14801	16:00:40	384659	5361140		
			15176	16:03:47	379560	5361141	5.099	0
TRAVERSE	153	L0415311	15176	16:04:29	379579	5361093		
			15621	16:08:12	384730	5361091	5.151	0
TRAVERSE	154	L0415411	15621	16:08:50	384677	5361038		
			15996	16:11:57	379511	5361044	5.166	0
TRAVERSE	155	L0415511	15996	16:12:44	379599	5360990		
			16416	16:16:14	384716	5360990	5.117	0
TRAVERSE	156	L0415611	16416	16:16:53	384678	5360933		
			16766	16:19:48	379550	5360939	5.128	0
TRAVERSE	157	L0415711	16766	16:20:39	379596	5360892		
			17216	16:24:24	384786	5360892	5.190	0
TRAVERSE	78	L0407811	17216	16:26:55	384688	5364843		
			17646	16:30:30	379547	5364839	5.141	0
TRAVERSE	79	L0407911	17646	16:31:27	379582	5364794		
			18051	16:34:50	384750	5364793	5.168	0
TRAVERSE	80	L0408011	18051	16:35:31	384671	5364741		
			18441	16:38:46	379560	5364744	5.111	0
TRAVERSE	81	L0408111	18441	16:39:20	379587	5364689		
			18851	16:42:45	384767	5364695	5.180	0
TRAVERSE	82	L0408211	18851	16:43:14	384692	5364638		
			19286	16:46:52	379527	5364639	5.165	0

File: L:\RedHills\F05\FLOG\F05.LOG 4/3/0, 3:09:35PM

FLIGHT LOG FOR FLIGHT 05 DOY 56 LocalTime 17:07:08 Area 1 Datum = WGS84

Line	File	Fid	Time	East	North	Len	Alarms
TRAVERSE 66	L0506611	0	17:18:35	379599	5365442		
		336	17:21:22	384717	5365442	5.118	0
TRAVERSE 67	L0506711	336	17:23:02	384691	5365388		
		671	17:25:50	379556	5365388	5.135	0
TRAVERSE 68	L0506811	671	17:26:26	379591	5365341		
		1026	17:29:23	384725	5365337	5.134	0
TRAVERSE 69	L0506911	1026	17:29:51	384683	5365292		
		1406	17:33:01	379535	5365287	5.148	0
TRAVERSE 70	L0507011	1406	17:33:26	379602	5365244		
		1811	17:36:48	384717	5365241	5.115	0
TRAVERSE 71	L0507111	1811	17:37:16	384674	5365191		
		2231	17:40:46	379531	5365192	5.143	0
TRAVERSE 72	L0507211	2231	17:41:09	379580	5365142		
		2656	17:44:42	384722	5365141	5.142	0
TRAVERSE 73	L0507311	2656	17:45:14	384692	5365094		
		3116	17:49:05	379562	5365089	5.130	0
TRAVERSE 74	L0507411	3116	17:49:34	379577	5365038		
		3531	17:53:01	384743	5365041	5.166	0
TRAVERSE 83	L0508311	3531	17:54:04	384682	5364589		
		4016	17:58:06	379561	5364590	5.121	0
TRAVERSE 84	L0508411	4016	17:58:56	379589	5364538		
		4451	18:02:34	384725	5364539	5.136	0
TRAVERSE 85	L0508511	4451	18:02:59	384696	5364484		
		4986	18:07:27	379548	5364489	5.148	0
TRAVERSE 114	L0511411	4986	18:08:35	379595	5363042		
		5341	18:11:33	384721	5363041	5.126	0
TRAVERSE 113	L0511311	5341	18:12:07	384684	5363095		
		5736	18:15:25	379484	5363089	5.200	0
TRAVERSE 112	L0511211	5736	18:15:58	379595	5363141		
		6091	18:18:55	384746	5363146	5.151	0
TRAVERSE 111	L0511111	6091	18:19:26	384692	5363191		
		6501	18:22:51	379532	5363195	5.160	0
TRAVERSE 110	L0511011	6501	18:23:20	379600	5363245		
		6851	18:26:15	384760	5363240	5.160	0

TRAVERSE	109	L0510911	6851	18:27:59	384677	5363293		
			7271	18:31:30	379550	5363291	5.127	0
TRAVERSE	108	L0510811	7271	18:32:05	379611	5363340		
			7656	18:35:17	384759	5363345	5.148	2
TRAVERSE	107	L0510711	7656	18:36:40	384694	5363394		
			8126	18:40:34	379526	5363388	5.168	0
TRAVERSE	106	L0510611	8126	18:41:06	379592	5363441		
			8571	18:44:49	384765	5363444	5.173	0
TRAVERSE	105	L0510511	8571	18:45:22	384681	5363492		
			9086	18:49:40	379526	5363489	5.155	0
POST.TST	8	G0500811	9086	18:55:17	364866	5364085		
			9296	18:57:02	363019	5361786	2.949	0
PST1.GND	9	I0500911	9296	18:59:40	363102	5361294		
			9536	19:01:40	363102	5361296	0.002	0
POST.THM	10	J0501011	9536	19:04:32	363102	5361295		
			9776	19:06:32	363101	5361294	0.001	0
POST.URN	11	K0501111	9776	19:08:38	363101	5361294		
			10016	19:10:38	363102	5361294	0.001	0
PST2.GND	12	M0501211	10016	19:12:05	363101	5361294		
			10256	19:14:05	363101	5361295	0.001	0

FLIGHT LOG FOR FLIGHT 06 DOY 58 LocalTime 08:08:22 Area 1 Datum = WGS84

Line		File	Fid	Time	East	North	Len	Alarms
PRE1.GND	1	A0600111	0	08:12:42	363101	5361295		
			241	08:14:42	363101	5361295	0.000	0
PRE.THOR	2	B0600211	241	08:21:12	363101	5361296		
			481	08:23:12	363101	5361294	0.002	0
PRE.URNM	3	C0600311	481	08:25:58	363101	5361296		
			726	08:28:01	363101	5361296	0.000	0
PRE2.GND	4	D0600411	726	08:30:57	363101	5361295		
			976	08:33:01	363101	5361294	0.001	0
PRE.TEST	5	E0600511	976	08:41:10	363035	5361811		
			1206	08:43:05	364890	5364115	2.958	0
TRAVERSE	86	L0608611	1206	08:54:40	379582	5364440		
			1721	08:58:57	384748	5364439	5.166	34
TRAVERSE	87	L0608711	1721	08:59:19	384697	5364390		
			2251	09:03:44	379530	5364391	5.167	74
TRAVERSE	88	L0608811	2251	09:04:07	379577	5364339		
			2716	09:08:00	384735	5364342	5.158	89
TRAVERSE	89	L0608911	2716	09:08:21	384689	5364292		
			3231	09:12:39	379558	5364290	5.131	121
TRAVERSE	90	L0609011	3231	09:13:08	379576	5364241		
			3711	09:17:08	384752	5364240	5.176	76
TRAVERSE	91	L0609111	3711	09:17:35	384688	5364191		
			4261	09:22:09	379556	5364193	5.132	86
TRAVERSE	92	L0609211	4261	09:23:16	379580	5364139		
			4711	09:27:01	384783	5364135	5.203	98
TRAVERSE	93	L0609311	4711	09:27:27	384679	5364093		
			5171	09:31:17	379549	5364093	5.130	71
TRAVERSE	94	L0609411	5171	09:31:49	379590	5364041		
			5676	09:36:02	384795	5364045	5.205	66
TRAVERSE	95	L0609511	5676	09:36:31	384686	5363991		
			6121	09:40:14	379548	5363989	5.138	104
TRAVERSE	96	L0609611	6121	09:40:41	379577	5363941		
			6586	09:44:34	384785	5363939	5.208	89
TRAVERSE	97	L0609711	6586	09:45:04	384680	5363890		

			7041	09:48:51	379520	5363890	5.160	115
TRAVERSE	98	L0609811	7041	09:49:18	379598	5363839		
			7491	09:53:03	384744	5363838	5.146	80
TRAVERSE	99	L0609911	7491	09:53:31	384680	5363789		
			7946	09:57:19	379525	5363791	5.155	122
TRAVERSE	100	L0610011	7946	09:58:11	379600	5363742		
			8391	10:01:54	384723	5363740	5.123	90
TRAVERSE	101	L0610111	8391	10:02:23	384697	5363689		
			8861	10:06:18	379554	5363691	5.143	115
TRAVERSE	102	L0610211	8861	10:06:47	379597	5363641		
			9311	10:10:32	384781	5363642	5.184	106
TRAVERSE	103	L0610311	9311	10:10:58	384685	5363589		
			9756	10:14:41	379498	5363589	5.187	79
TRAVERSE	104	L0610411	9756	10:15:10	379589	5363539		
			10191	10:18:47	384802	5363541	5.213	66
POST.TST	8	G0600811	10191	10:27:53	364870	5364090		
			10401	10:29:37	362993	5361750	3.000	0
PST1.GND	9	I0600911	10401	10:34:06	363102	5361294		
			10641	10:36:06	363102	5361294	0.000	0
POST.THM	10	J0601011	10641	10:37:19	363102	5361295		
			10881	10:39:19	363102	5361295	0.000	0
POST.URN	11	K0601111	10881	10:40:25	363102	5361295		
			11121	10:42:25	363102	5361295	0.000	0
PST2.GND	12	M0601211	11121	10:43:52	363102	5361295		
			11361	10:45:52	363102	5361294	0.001	0

APPENDIX 2

Processed Data Formats

Digital Data Format for 256 Channel Spectrometer Data

```
Column  1   1-4   flight
Column  2   5-10  lineNo
Column  3  11-14  julian day
Column  4  15-22  fid
Column  5  23-32  easting  (AMG Zone 55, AGD66)
Column  6  33-42  northing (AMG Zone 55, AGD66)
Column  7  43-48  raw total count (cps)
Column  8  49-54  raw potassium (cps)
Column  9  55-60  raw uranium (cps)
Column 10  61-66  raw thorium (cps)
Column 11  67-72  cosmic (cps)
Column 12  73-78  live_time (milliseconds)
Column 13  79-86  raw radar altimeter (meters)
Column 14  87-94  raw gps height (meters)
Column 15  95-102 spectrum channel 0
Column 16 103-110 spectrum channel 1
Column 17 111-118 spectrum channel 2
Column 18 119-126 spectrum channel 3
Column 19 127-134 spectrum channel 4
Column 20 135-142 spectrum channel 5
Column 21 143-150 spectrum channel 6
Column 22 151-158 spectrum channel 7
Column 23 159-166 spectrum channel 8
Column 24 167-174 spectrum channel 9
Column 25 175-182 spectrum channel 10
Column 26 183-190 spectrum channel 11
Column 27 191-198 spectrum channel 12
Column 28 199-206 spectrum channel 13
Column 29 207-214 spectrum channel 14
Column 30 215-222 spectrum channel 15
Column 31 223-230 spectrum channel 16
Column 32 231-238 spectrum channel 17
Column 33 239-246 spectrum channel 18
Column 34 247-254 spectrum channel 19
Column 35 255-262 spectrum channel 20
Column 36 263-270 spectrum channel 21
Column 37 271-278 spectrum channel 22
Column 38 279-286 spectrum channel 23
Column 39 287-294 spectrum channel 24
Column 40 295-302 spectrum channel 25
Column 41 303-310 spectrum channel 26
Column 42 311-318 spectrum channel 27
Column 43 319-326 spectrum channel 28
Column 44 327-334 spectrum channel 29
Column 45 335-342 spectrum channel 30
Column 46 343-350 spectrum channel 31
Column 47 351-358 spectrum channel 32
Column 48 359-366 spectrum channel 33
Column 49 367-374 spectrum channel 34
Column 50 375-382 spectrum channel 35
Column 51 383-390 spectrum channel 36
Column 52 391-398 spectrum channel 37
Column 53 399-406 spectrum channel 38
Column 54 407-414 spectrum channel 39
Column 55 415-422 spectrum channel 40
Column 56 423-430 spectrum channel 41
Column 57 431-438 spectrum channel 42
Column 58 439-446 spectrum channel 43
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Column 59 447-454 spectrum channel 44
Column 60 455-462 spectrum channel 45
Column 61 463-470 spectrum channel 46
Column 62 471-478 spectrum channel 47
Column 63 479-486 spectrum channel 48
Column 64 487-494 spectrum channel 49
Column 65 495-502 spectrum channel 50
Column 66 503-510 spectrum channel 51
Column 67 511-518 spectrum channel 52
Column 68 519-526 spectrum channel 53
Column 69 527-534 spectrum channel 54
Column 70 535-542 spectrum channel 55
Column 71 543-550 spectrum channel 56
Column 72 551-558 spectrum channel 57
Column 73 559-566 spectrum channel 58
Column 74 567-574 spectrum channel 59
Column 75 575-582 spectrum channel 60
Column 76 583-590 spectrum channel 61
Column 77 591-598 spectrum channel 62
Column 78 599-606 spectrum channel 63
Column 79 607-614 spectrum channel 64
Column 80 615-622 spectrum channel 65
Column 81 623-630 spectrum channel 66
Column 82 631-638 spectrum channel 67
Column 83 639-646 spectrum channel 68
Column 84 647-654 spectrum channel 69
Column 85 655-662 spectrum channel 70
Column 86 663-670 spectrum channel 71
Column 87 671-678 spectrum channel 72
Column 88 679-686 spectrum channel 73
Column 89 687-694 spectrum channel 74
Column 90 695-702 spectrum channel 75
Column 91 703-710 spectrum channel 76
Column 92 711-718 spectrum channel 77
Column 93 719-726 spectrum channel 78
Column 94 727-734 spectrum channel 79
Column 95 735-742 spectrum channel 80
Column 96 743-750 spectrum channel 81
Column 97 751-758 spectrum channel 82
Column 98 759-766 spectrum channel 83
Column 99 767-774 spectrum channel 84
Column 100 775-782 spectrum channel 85
Column 101 783-790 spectrum channel 86
Column 102 791-798 spectrum channel 87
Column 103 799-806 spectrum channel 88
Column 104 807-814 spectrum channel 89
Column 105 815-822 spectrum channel 90
Column 106 823-830 spectrum channel 91
Column 107 831-838 spectrum channel 92
Column 108 839-846 spectrum channel 93
Column 109 847-854 spectrum channel 94
Column 110 855-862 spectrum channel 95
Column 111 863-870 spectrum channel 96
Column 112 871-878 spectrum channel 97
Column 113 879-886 spectrum channel 98
Column 114 887-894 spectrum channel 99
Column 115 895-902 spectrum channel 100
Column 116 903-910 spectrum channel 101
Column 117 911-918 spectrum channel 102
Column 118 919-926 spectrum channel 103
Column 119 927-934 spectrum channel 104
Column 120 935-942 spectrum channel 105
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Column 121 943-950 spectrum channel 106
Column 122 951-958 spectrum channel 107
Column 123 959-966 spectrum channel 108
Column 124 967-974 spectrum channel 109
Column 125 975-982 spectrum channel 110
Column 126 983-990 spectrum channel 111
Column 127 991-998 spectrum channel 112
Column 128 999-1006 spectrum channel 113
Column 129 1007-1014 spectrum channel 114
Column 130 1015-1022 spectrum channel 115
Column 131 1023-1030 spectrum channel 116
Column 132 1031-1038 spectrum channel 117
Column 133 1039-1046 spectrum channel 118
Column 134 1047-1054 spectrum channel 119
Column 135 1055-1062 spectrum channel 120
Column 136 1063-1070 spectrum channel 121
Column 137 1071-1078 spectrum channel 122
Column 138 1079-1086 spectrum channel 123
Column 139 1087-1094 spectrum channel 124
Column 140 1095-1102 spectrum channel 125
Column 141 1103-1110 spectrum channel 126
Column 142 1111-1118 spectrum channel 127
Column 143 1119-1126 spectrum channel 128
Column 144 1127-1134 spectrum channel 129
Column 145 1135-1142 spectrum channel 130
Column 146 1143-1150 spectrum channel 131
Column 147 1151-1158 spectrum channel 132
Column 148 1159-1166 spectrum channel 133
Column 149 1167-1174 spectrum channel 134
Column 150 1175-1182 spectrum channel 135
Column 151 1183-1190 spectrum channel 136
Column 152 1191-1198 spectrum channel 137
Column 153 1199-1206 spectrum channel 138
Column 154 1207-1214 spectrum channel 139
Column 155 1215-1222 spectrum channel 140
Column 156 1223-1230 spectrum channel 141
Column 157 1231-1238 spectrum channel 142
Column 158 1239-1246 spectrum channel 143
Column 159 1247-1254 spectrum channel 144
Column 160 1255-1262 spectrum channel 145
Column 161 1263-1270 spectrum channel 146
Column 162 1271-1278 spectrum channel 147
Column 163 1279-1286 spectrum channel 148
Column 164 1287-1294 spectrum channel 149
Column 165 1295-1302 spectrum channel 150
Column 166 1303-1310 spectrum channel 151
Column 167 1311-1318 spectrum channel 152
Column 168 1319-1326 spectrum channel 153
Column 169 1327-1334 spectrum channel 154
Column 170 1335-1342 spectrum channel 155
Column 171 1343-1350 spectrum channel 156
Column 172 1351-1358 spectrum channel 157
Column 173 1359-1366 spectrum channel 158
Column 174 1367-1374 spectrum channel 159
Column 175 1375-1382 spectrum channel 160
Column 176 1383-1390 spectrum channel 161
Column 177 1391-1398 spectrum channel 162
Column 178 1399-1406 spectrum channel 163
Column 179 1407-1414 spectrum channel 164
Column 180 1415-1422 spectrum channel 165
Column 181 1423-1430 spectrum channel 166
Column 182 1431-1438 spectrum channel 167
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Column 183 1439-1446 spectrum channel 168
Column 184 1447-1454 spectrum channel 169
Column 185 1455-1462 spectrum channel 170
Column 186 1463-1470 spectrum channel 171
Column 187 1471-1478 spectrum channel 172
Column 188 1479-1486 spectrum channel 173
Column 189 1487-1494 spectrum channel 174
Column 190 1495-1502 spectrum channel 175
Column 191 1503-1510 spectrum channel 176
Column 192 1511-1518 spectrum channel 177
Column 193 1519-1526 spectrum channel 178
Column 194 1527-1534 spectrum channel 179
Column 195 1535-1542 spectrum channel 180
Column 196 1543-1550 spectrum channel 181
Column 197 1551-1558 spectrum channel 182
Column 198 1559-1566 spectrum channel 183
Column 199 1567-1574 spectrum channel 184
Column 200 1575-1582 spectrum channel 185
Column 201 1583-1590 spectrum channel 186
Column 202 1591-1598 spectrum channel 187
Column 203 1599-1606 spectrum channel 188
Column 204 1607-1614 spectrum channel 189
Column 205 1615-1622 spectrum channel 190
Column 206 1623-1630 spectrum channel 191
Column 207 1631-1638 spectrum channel 192
Column 208 1639-1646 spectrum channel 193
Column 209 1647-1654 spectrum channel 194
Column 210 1655-1662 spectrum channel 195
Column 211 1663-1670 spectrum channel 196
Column 212 1671-1678 spectrum channel 197
Column 213 1679-1686 spectrum channel 198
Column 214 1687-1694 spectrum channel 199
Column 215 1695-1702 spectrum channel 200
Column 216 1703-1710 spectrum channel 201
Column 217 1711-1718 spectrum channel 202
Column 218 1719-1726 spectrum channel 203
Column 219 1727-1734 spectrum channel 204
Column 220 1735-1742 spectrum channel 205
Column 221 1743-1750 spectrum channel 206
Column 222 1751-1758 spectrum channel 207
Column 223 1759-1766 spectrum channel 208
Column 224 1767-1774 spectrum channel 209
Column 225 1775-1782 spectrum channel 210
Column 226 1783-1790 spectrum channel 211
Column 227 1791-1798 spectrum channel 212
Column 228 1799-1806 spectrum channel 213
Column 229 1807-1814 spectrum channel 214
Column 230 1815-1822 spectrum channel 215
Column 231 1823-1830 spectrum channel 216
Column 232 1831-1838 spectrum channel 217
Column 233 1839-1846 spectrum channel 218
Column 234 1847-1854 spectrum channel 219
Column 235 1855-1862 spectrum channel 220
Column 236 1863-1870 spectrum channel 221
Column 237 1871-1878 spectrum channel 222
Column 238 1879-1886 spectrum channel 223
Column 239 1887-1894 spectrum channel 224
Column 240 1895-1902 spectrum channel 225
Column 241 1903-1910 spectrum channel 226
Column 242 1911-1918 spectrum channel 227
Column 243 1919-1926 spectrum channel 228
Column 244 1927-1934 spectrum channel 229
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Column 245 1935-1942 spectrum channel 230
Column 246 1943-1950 spectrum channel 231
Column 247 1951-1958 spectrum channel 232
Column 248 1959-1966 spectrum channel 233
Column 249 1967-1974 spectrum channel 234
Column 250 1975-1982 spectrum channel 235
Column 251 1983-1990 spectrum channel 236
Column 252 1991-1998 spectrum channel 237
Column 253 1999-2006 spectrum channel 238
Column 254 2007-2014 spectrum channel 239
Column 255 2015-2022 spectrum channel 240
Column 256 2023-2030 spectrum channel 241
Column 257 2031-2038 spectrum channel 242
Column 258 2039-2046 spectrum channel 243
Column 259 2047-2054 spectrum channel 244
Column 260 2055-2062 spectrum channel 245
Column 261 2063-2070 spectrum channel 246
Column 262 2071-2078 spectrum channel 247
Column 263 2079-2086 spectrum channel 248
Column 264 2087-2094 spectrum channel 249
Column 265 2095-2102 spectrum channel 250
Column 266 2103-2110 spectrum channel 251
Column 267 2111-2118 spectrum channel 252
Column 268 2119-2126 spectrum channel 253
Column 269 2127-2134 spectrum channel 254
Column 270 2135-2142 spectrum channel 255
Column 271 2143-2150 spectrum channel 256
Column 272 2151-2158 spectrum channel 257
           2159-2159 <endline>
```

Digital Data Format for Magnetometer, Radiometric and DTM Data

```
Column  1   1-4    flight
Column  2   5-10   lineNo
Column  3  11-14   julian day
Column  4  15-22   fid
Column  5  23-32   easting  (AMG Zone 55, AGD66)
Column  6  33-42   northing (AMG Zone 55, AGD66)
Column  7  43-48   raw total count (cps)
Column  8  49-54   raw potassium (cps)
Column  9  55-60   raw uranium (cps)
Column 10  61-66   raw thorium (cps)
Column 11  67-72   cosmic (cps)
Column 12  73-78   live_time (milliseconds)
Column 13  79-86   raw radar altimeter (meters)
Column 14  87-94   raw gps height (meters)
Column 15  95-100  final total count (cps)
Column 16 101-106  final potassium (cps)
Column 17 107-112  final uranium (cps)
Column 18 113-118  final thorium (cps)
Column 19 119-126  final total count (dose rate)
Column 20 127-134  final potassium (percent)
Column 21 135-142  final uranium (ppm)
Column 22 143-150  final thorium (ppm)
Column 23 151-158  dtm (meters)
          159-159  <endline>
```

Digital Data Format for Magnetometer and DTM Data

```
Column 1   1-4   flight
Column 2   5-10  lineno
Column 3  11-14  julian day
Column 4  15-22  fid
Column 5  23-32  time (decimal hours)
Column 6  33-42  easting  (AMG Zone 55, AGD66)
Column 7  43-52  northing (AMG Zone 55, AGD66)
Column 8  53-62  raw mag (nT)
Column 9  63-70  gps height (meters)
Column 10 71-78  radar altimeter (meters)
Column 11 79-86  final mag (nT)
Column 12 87-94  dtm (meters)
          95-95  <endline>
```

APPENDIX 3

Radiometric Calibration

Radiometric Calibration Utilising Test Pads and Hover Range

1. Rationale

Procedures for the calibration of gamma ray spectrometer systems are based on *Grasty R L and Minty B R S 1995* **A Guide to the Technical Specifications for Airborne Gamma-Ray Surveys** AGSO Record 1995/60.

Radiometric test pads are used to determine the Compton scattering coefficients to be applied to the raw spectrometer data. A minimum of four pads are required to determine potassium, uranium and thorium spectra and to remove the background.

The four test pads are owned by AGSO and consist of 1m x 1m x 0.3m concrete blocks. Three pads have high concentrations of either K, U or Th, while the fourth pad has low background values. The AGSO set is one of four similar sets manufactured by Bruce Dickson of CSIRO Division of Exploration Geoscience, the others being owned by SADME, Kevron Geophysics and Geoterrex. The radio-element concentrations are provided by Bruce Dickson for calculation of the calibration coefficients.

A hover test range is required for the determination of sensitivity factors which relate the concentration of radioactive elements in the ground to the number of counts measured at survey altitude. The test range should be free of vegetation, relatively flat but well drained, and have a relatively high and uniform concentration of the three radioactive elements. Minimal flight restrictions and easy navigation are also important.

A suitable site, close to Bairnsdale, has been established on a dairy flat SE of Bruthen. The test site had been previously surveyed with a calibrated ground spectrometer and was re-surveyed on the day of the hover range test.

Multiple elevation measurements over a large expanse of water were used to determine the radiometric contribution from the aircraft itself and from cosmic radiation. Although this is frequently difficult to achieve over much of Australia, in this case Lake King, part of the Gippsland Lakes, is conveniently situated close to the Bairnsdale test area.

The aircraft was in normal survey configuration for all calibration measurements.

2. Test Procedures

(a) The test pad site at Canberra airport has been established previously using scintillometer traverses to determine an area of uniform and low radiometric signal which can be conveniently occupied by the heavy pads and an aircraft, and readily relocated for subsequent use. After marking and measuring out the site a detailed spectrometer grid covering 8m by 8m was surveyed around the centre point. In addition a north-south profile and an east-west profile was surveyed across the site.

These two profiles were each 2m in length. The operator first ensured that the spectrometer was stabilised. Weather conditions were noted. The helicopter was parked (facing N) and each of the calibration pads was placed, in turn, directly beneath the spectrometer crystal in the aircraft, commencing with the background pad. Data were recorded for five minutes with each pad in place. Each pad was positioned in exactly the same place and the same orientation for the observations, with the other pads placed well away from the aircraft (approx. 50m).

(b) The weather in the Gippsland coast area was monitored to identify a favourable day for the hover range test. This requires low wind, preferably not from the north or northwest, and dry conditions over at least the preceding two days. The standard pre-flight calibration was performed at the Euroa operational base, and then the local test line was flown before departing to Bairnsdale.

(c) The aircraft proceeded to the hover test range and was positioned directly above the central marker peg. While hovering, the operator recorded data from 100ft (30m) to 600ft (180m) above ground level (agl) in 50ft (15m) increments, for intervals of 2 minutes at each elevation.

(d) The aircraft was then flown out over Lake King (about 5 minutes flying time south of Bairnsdale) and data recorded in hover for 5 minutes between 100ft and 600ft in 50 ft increments. While still over water, the aircraft climbed between 1000ft and 10,000ft, with the operator recording data at each 1000ft level.

(e) Ground radiometric count rates were measured over the hover range using a calibrated ground spectrometer - this entailed 5 minute observation periods at *intervals of 10m, 30m, 40m, 50m, 65m, 80m, 95m, 120m and 160m along profiles north, east, south and west of* the centre point of the hover range *(Grasty and Minty 1995 page 88).*

(f) A high altitude test was undertaken out over the ocean with data being recorded from 1000ft to 10,000 ft in 1000ft increments. Data were recorded for 10 minutes at each altitude.

(g) The validity of the data was verified before returning to the survey area. Calibration sheets for all of the helicopter measurements at the test range were retained for future reporting.

(h) On return to the survey base, the crew re-flew the test line and performed a full post-flight calibration.

A comprehensive description of the AGSO test pad site and the Bruthen hover range is available on request from Geo Instruments Pty Ltd. The derived calibration coefficients are presented in the following table.

Geo Instruments Pty Ltd

Bruthen Hover Range Test Data Jan 2000

JET RANGER VH-JWF GR820 Ser#173 16.8 litre detector #AGSO137

	Cosmic Coeff	Aircraft Bgrnd	Height Att Coefficient (u)
Total count	0.88604	46.6	0.006205
Potassium	0.7658	2.1	0.00754
Uranium	0.8811	2.3	0.00506
Thorium	0.51587	1.6	0.00641

System Sensitivities	
K Sensitivity	5.71
U Sensitivity	0.478
Th Sensitivity	0.2317

System Stripping Coefficients		
Alpha	0.2589	T / U
Beta	0.361	T / K
Gamma	0.7559	U / K
a	0.0053	U / T
g	-0.00054	K / U

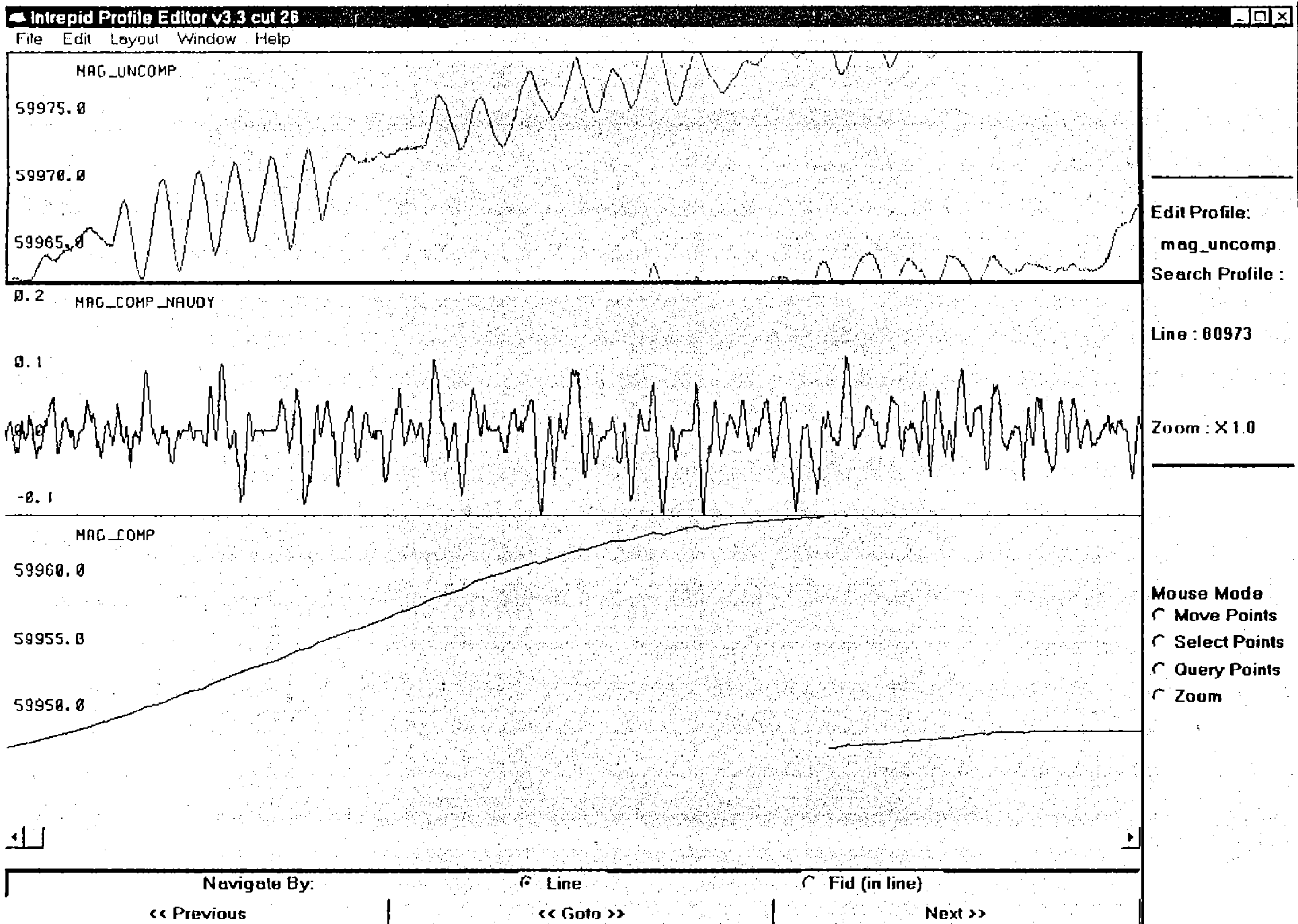
Hover Range Concentrations		
K40	1.89	%k
Un	2.28	ppm
Th	14.58	ppm

Alt(AGL mtrs)	Measured Counts			Stripped Brnd corr Counts			Concentrations			Acc Time
	K40 Cnts	U Cnts	Th Cnts	K40 Str/s	Un Str/s	Th Cnts/s	K40 %	U ppm	Th ppm	Secs
21.4	210.6	42.4	65.2	163.74	23.51	63.11	86.64	10.31	4.33	1
35.9	185.1	39.2	60.7	141.50	21.67	58.23	74.87	9.50	3.99	1
51.6	162.3	34.8	51.7	124.21	19.36	49.75	65.72	8.49	3.41	1
65.6	144.7	33.0	47.7	108.59	18.46	45.86	57.46	8.10	3.15	1
81.7	125.0	30.2	42.3	92.41	17.12	40.57	48.90	7.51	2.78	1
95.5	113.6	28.1	38.2	83.60	16.45	36.18	44.23	7.22	2.48	1
112.9	100.2	25.1	33.6	72.51	14.61	31.69	38.37	6.41	2.17	1
127.7	89.4	23.3	32.2	63.66	13.37	30.30	33.68	5.86	2.08	1
142.5	78.9	22.5	28.6	54.39	13.55	26.50	28.78	5.94	1.82	1
167.1	71.0	20.6	25.7	48.28	12.30	23.61	25.55	5.39	1.62	1
176.6	64.8	19.0	24.3	44.01	11.03	22.32	23.28	4.84	1.53	1

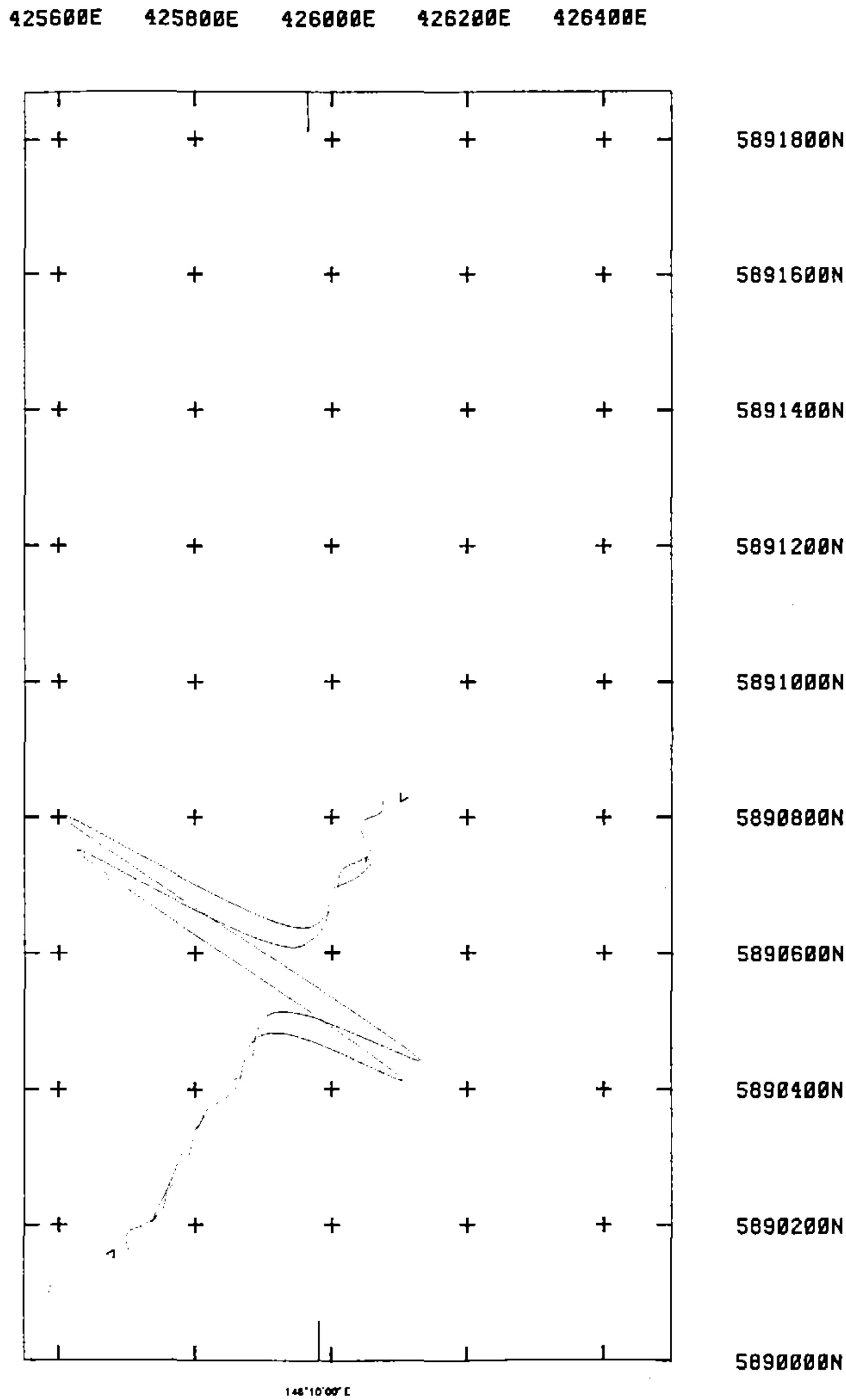
Lake Hover Background Raw and corrected counts/sec						
Alt(m)	K40 cps	Un cps	Th cps	K40 cor	Un cor	Th cor
22.0	6.3	2.6	1.9	4.02	2.11	1.89
36.9	6.2	2.5	2.3	3.93	1.91	2.29
51.4	5.5	2.6	1.8	3.24	2.14	1.79
65.4	5.6	2.7	1.7	3.28	2.26	1.69
81.6	5.0	2.6	1.6	2.77	2.19	1.59
96.6	4.5	2.3	1.9	2.45	1.81	1.89
110.3	5.2	2.3	1.8	3.17	1.84	1.79
126.1	4.7	2.1	1.8	2.82	1.64	1.79
140.5	4.7	2.1	2.0	2.78	1.58	1.99

APPENDIX 4

Magnetometer Compensation Box and Heading Tests



Sample of Magnetic Compensation Box



MAGNETIC PARALLAX ERROR PROFILES
HELCOPTER VH-JWF