

**AIRBORNE
GEOSCIENCE**

A.C.N. 009 183 082

LOGISTICS REPORT

ARTHUR - PIEMAN AREA NORTH WEST TASMANIA

for

TASMANIA DEVELOPMENT AND RESOURCES

by

TESLA AIRBORNE GEOSCIENCE PTY LTD

June 1996

(i)

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INTRODUCTION

On the 22nd March 1996 Tesla Airborne Geoscience Pty Ltd was contracted to acquire and process airborne geophysical data for Tasmania Development and Resources.

All final processing and map production was carried out by Tesla-10 Pty Ltd in their Kariong office in New South Wales.

1. SURVEY DETAILS

The North West Tasmania airborne survey covers sections of the 1:100,000 Tasmania World Aeronautical Chart.

a) SURVEY LOCATION

A map of the survey area location can be found in Appendix A. The co-ordinates of the boundary lines, beginning at the north west corner and preceding clockwise, are as follows:

- 300719.000E 5460000.000N
- 335000.000E 5460000.000N
- 335000.000E 5442000.000N
- 337500.000E 5442000.000N
- 341500.000E 5438500.000N
- 341500.000E 5411000.000N
- 352500.000E 5405000.000N
- 352500.000E 5379000.000N
- 333000.000E 5379000.000N
- 333000.000E 5378481.000N
- 327379.000E 5378481.000N
- 325753.000E 5382638.000N
- 326536.000E 5383604.000N
- 326468.000E 5384672.000N
- 324773.000E 5388002.000N
- 325225.000E 5389395.000N
- 321983.000E 5396663.000N
- 315638.000E 5407374.000N
- 315184.000E 5408964.000N
- 311615.000E 5411872.000N
- 310437.000E 5423377.000N
- 308985.000E 5425283.000N
- 305738.000E 5432298.000N
- 306301.000E 5436537.000N
- 304462.000E 5440557.000N
- 303904.000E 5445113.000N

304791.000E 5447183.000N
 303367.000E 5451605.000N
 301195.000E 5454000.000N
 298500.000E 5457000.000N

The area traversed Australian map grid zone 55. The traverse and tie lines were flown along AMG Eastings and Northings.

The aircraft and crew were based at Smithton in Tasmania for the duration of the survey.

b) SURVEY SPECIFICATIONS

Survey Distance Flown

Traverse Lines	:	15,564.8	kilometres
Tie Lines	:	1,529.8	kilometres
TOTAL	:	17,093.8	kilometres

Traverse Spacing	:	200 metres
Traverse Direction	:	AMG Grid East/West

Tie Spacing	:	2,000 metres
Tie Direction	:	AMG Grid North/South

Flying Height	:	90 metres
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Sample Intervals

Magnetics	:	0.1 second (6-8 metres)
Gamma-Ray Spectrometer	:	1.0 second (60-80 metres)
GPS	:	1.0 second (60-80 metres)
Radar Altimeter	:	0.1 second (6-8 metres)
Barometric Pressure	:	1.0 second (60-80 metres)
Temperature/Humidity	:	1.0 second (60-80 metres)

A summary of the survey progress can be found in the Operations Report - Appendix B.

2. PERSONNEL

Pilots	:	T. Anderson (Crew Leader) R. Wright
Operators	:	B. Anderson M. Ostich
Electronics Technician	:	P. McMullen T. Grzelak
Data Processing	:	B. Merritt L. Nix
Project Supervision	:	R. Pullin

3. AIRCRAFT AND EQUIPMENT

a) SUMMARY

Aircraft

Model : Cessna 210N
Registration : VH-BNZ

Compensator

Model : RMS Instruments Automatic Aeromagnetic Digital Compensator

Magnetometer Sensor

Model : Scintrex CS-2
Mounting : Tail Stinger
Sample Interval : 0.1 seconds (6-8 metres)
Sensitivity : 0.001 nT

Vector Magnetometer

Model : Billingsley TFM100-IE (3-axis fluxgate)

Gamma-Ray Spectrometer

Model : Exploranium GR820 Self Calibrating Spectrometer
Detectors : 8 All Viewing NaI (Tl activated) Crystals
 Total Crystal Volume - 33.6 Litres
Sample Interval : 1.0 seconds
Number of Channels : 4 ROIs (TC, K, U, Th), Cosmic and 256 Channels

Computer

Model : 486 DX2/66

Acquisition Software

Programme : Custom in-house developed TAG3 acquisition software
Version : 3

Aircraft Navigation

GPS, Model : Novatel 951R
Update rate : 0.5 seconds

Radar Altimeter

Model : Bendix King KRA 10A
Sample Interval : 0.1 seconds

Temperature/Humidity

Model : Vaisala HMD 50Y
Sample Interval : 1.0 seconds

Pressure

Model : Intellisensor AIR-DB
Sample Interval : 1.0 seconds

Base Station Magnetometers

Model : Geometrics G-856
Sample Interval : 6.0 seconds

Base GPS

Model : Novatel 951R
Sample Interval : 1.0 seconds

b) MAGNETOMETER AND COMPENSATOR

A Scintrex CS-2 Magnetometer Sensor, mounted in a stinger secured to the rear of the aircraft was used for this survey. The specifications of the Magnetometer Sensor are summarised in Appendix G.

The Magnetometer Sensor was coupled to a RMS Instruments Automatic Aeromagnetic Digital Compensator (AADC). The AADC compensates the total magnetic field data in real time for the magnetic interference caused by the aircraft manoeuvring in the earth's magnetic field and by the aircraft itself.

The correction coefficients used by the AADC during compensation, were calculated from a compensation flight conducted prior to the survey commencing, or at any other time deemed necessary.

The specifications of the AADC are summarised in Appendix H.

Compensation procedures are described in Section 4.

c) GAMMA-RAY SPECTROMETER

An Exploranium GR-820 Multi-channel Gamma-Ray Spectrometer, coupled to two GPX-1024 Crystal Detectors with a total volume of 33.6 litres were used for this survey. The Crystal Detectors were mounted in two packs, side by side secured to a rack on the floor of the aircraft.

The specifications of the Gamma-Ray Spectrometer are summarised in Appendix I.

The GR-820 uses a sophisticated automatic control method to ensure crystal alignment is maintained, while stabilising on naturally occurring isotopes. The system continuously monitors each of the eight crystal signals and accumulates an individual spectra for each configured signal. The peak channel of the selected stabilisation isotope is computed when a specified number of counts have been accumulated. This peak channel is then compared to the correct peak location and the gain is subsequently adjusted.

Two hundred and fifty six channels of data between 0.3 MeV and 3.0 MeV were recorded once per second. Additionally, 4 ROIs and a cosmic channel were recorded using the following window limits:

Total Count	:	0.41 - 2.81 MeV
Potassium (K40 peak at 1.46 MeV)	:	1.37 - 1.57 MeV
Uranium (Bi214 peak at 1.76 MeV)	:	1.66 - 1.86 MeV
Thorium (Tl208 peak at 2.61 MeV)	:	2.41 - 2.81 MeV
Cosmic	:	3.00 - 6.00 MeV

The calibration procedures for the Gamma-Ray Spectrometer system are described in Section 4.

d) DATA ACQUISITION SYSTEM

The TAG3 Acquisition System runs on a 486 personal computer. The data was recorded to hard disk and dumped to DC2120 data cartridge at the completion of each flight. The system was synchronised to GPS time. The data was viewed in real time, enabling the operator to confirm that quality specifications are being met. The following parameters were recorded digitally.

- (a) Time in seconds (to 0.1 seconds)
- (b) Fiducial number, incrementing by smallest data sample interval
- (c) Navigation data including GPS height
- (d) Terrain clearance (radar altimeter)
- (e) Barometric pressure
- (f) Relative humidity
- (g) Ambient temperature outside the aircraft in degrees Celsius
- (h) Uncompensated Magnetometer reading
- (i) Fluxgate x, y, z
- (j) Fluxgate Total Field
- (k) Raw Magnetometer 4th Difference
- (l) Compensated Magnetometer reading
- (m) Full 256-channel gamma-ray spectrum
- (n) Total count reading in counts per second (uncorrected)
- (o) Potassium window reading in counts per second (uncorrected)
- (p) Uranium window reading in counts per second (uncorrected)
- (q) Thorium window reading in counts per second (uncorrected)
- (r) Cosmic window reading in counts per second (uncorrected)

e) **NAVIGATION**

The GPS position, referencing WGS84, is read by the TAG3 acquisition system. This is the first step in the TAG3 navigation cycle. The position is then transformed to the AGD84 datum using the full 7 parameters. Conversion to AMG co-ordinates follows. The navigational errors, with reference to the planned survey line, are then calculated and displayed for the pilot and operator. This completes the cycle. Two navigation cycles are performed each second.

Real time differential correction was achieved via Fugro Surveys Omni Star System.

The Novatel 951R Global Positioning System card specifications can be found in Appendix J.

f) RADAR ALTIMETER

A Bendix King KRA-10A Radar Altimeter was used to measure the aircraft height above ground level (AGL). The Radar Altimeter System is of high resolution designed for automatic continuous operation over a wide variation of terrain, target reflectivity, weather and aircraft altitude.

The Radar Altimeter data was recorded 10 times per second with an accuracy of ± 1 m (at 80 m AGL).

Bendix King KRA-10A Radar Altimeter specifications can be found in Appendix K.

g) TEMPERATURE AND HUMIDITY

A Vaisala HMD50Y Sensor was used to measure outside air temperature and relative humidity. The data was recorded once per second.

Vaisala HMD50Y Sensor specifications can be found in Appendix L.

h) BAROMETER

Atmospheric pressure was measured using a Intellisensor Air-DB Digital Barometer that was tapped into the aircraft static system. The barometric data was recorded once per second.

Intellisensor Air-DB Digital Barometer specifications can be found in Appendix M.

i) **BASE STATION MAGNETOMETER**

Diurnal variations in the earth's magnetic field were recorded using two Geometrics G856 Proton Precession Base Station Magnetometers. The Base Stations were located away from cultural influences in an area of shallow magnetic gradient. They were cycling at a 5 second sample interval at all times the aircraft was on survey.

At the completion of each days flying, the data was dumped onto an infield processing computer, where data quality and compliance with contractual specifications were checked. The data was subsequently backed up onto a data cartridge tape for shipment to the processing office.

Base Station Magnetometer specifications can be found in Appendix N. Base Station Magnetometer records can be found in Appendix E.

j) **GPS BASE STATION POSITION**

Final in-field aircraft positional information was determined post flight.

An accurate GPS Base Station position was calculated by recording latitude, longitude and height information over a seven to twelve hour period and then averaging these positions.

The final GPS Base Station position was then entered into the "Ranger" software and used to calculate post flight differentially corrected aircraft positions. This procedure was conducted at the completion of each flight.

The differentially corrected flight path was then viewed to ensure it did not exceed contractual specifications.

GPS Base Station records can be found in Appendix F.

4. CALIBRATION

a) MAGNETIC COMPENSATION

The compensation sequences were flown in a region of low magnetic relief located approximately 10 km North West of Smithton. The aircraft's altitude was 8,000 feet (above mean sea level).

Each sequence consisted of a series of manoeuvres performed on each of the cardinal headings. The manoeuvres comprised ± 10 degree rolls, ± 5 degree pitches and ± 5 degree yaws.

The coefficients used in compensating for the effects of permanent magnetism, induced magnetism, eddy currents and heading error were calculated automatically by the AADC upon completion of a sequence. The calculated coefficients were then applied to the uncompensated total field readings (collected during the sequence) in order to assess the quality of the "solution". This (now compensated) data was then statistically analysed. The resultant statistics, revealing the quality of the compensation solution, are displayed by the AADC.

A three-axis fluxgate magnetometer, mounted in the stinger, enables derivation of motion information by the AADC during a sequence.

The statistics include: standard deviation of the high-passed uncompensated (UNC), standard deviation of the high-passed compensated (CMP), improvement ratio (IR) and "vector norm of the interference set" (NRM). The IR is the result of dividing UNC by CMP.

b) GAMMA-RAY SPECTROMETER CALIBRATION

At the commencement and conclusion of each day's production, a low level test line was flown and ground calibrations performed. Statistics were calculated and recorded for each of the calibration processes.

i) The Low Level Test Line

The low level test line was located along a fence line orientated in a North/South direction, approximately 12 kilometres South East of Smithton. The test lines were flown at survey height. The start and end points were visually definable positions captured as GPS waypoints for ease of orientation and reference purposes.

The test line was always flown to the North and South.

ii) Ground Radiometric Button Checks

Crystal stabilisation using Thorium was undertaken prior to each day's acquisition. For each ground calibration, the aircraft was parked in exactly the same position. Similarly the spectrometer button samples were positioned in exactly the same location with reference to the detectors.

The precision involved in all calibrations ensured the statistics were an accurate indication of the Gamma-Ray Spectrometer system status.

The statistics for both the low level test lines and ground radiometric button checks were recorded on a calibration log with appropriate figures transferred to various spreadsheets. These statistics were compared with those from preceding flights in order to detect any irregularities and to ensure contractual requirements were being met.

This was primarily achieved through calculating the percentage difference in statistics from the most recent calibration to statistics of the running average of all previous calibrations. Some variation was occasionally noticeable in the Total Count and Uranium windows, due to the effects of daily Radon variations.

Copies of the Calibration Spreadsheets can be found in Appendix D.

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX A
Arthur - Pieman Area
North West Tasmania

TASMANIA DEVELOPMENT AND RESOURCES

ARTHUR - PIEMAN AREA NORTH WEST TASMANIA



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TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX B
Arthur - Pieman Area
North West Tasmania

TESLA AIRBORNE GEOSCIENCE
 OPERATIONS REPORT
 TASMANIA DEVELOPMENT AND RESOURCES VH-BNZ
 JOB NO. TA2294

DATE	FLT NO.	CREW PLT	OP	TIME T/O		LAND	THIS FLT PROD	REFL	TO DATE PROD	REFL	RUNNING AVERAGE	COMMENTS
TUE 02-Apr	0	TA						0.0				AIRCRAFT TRAVELS FROM DUBBO TO SMITHTON
JULIAN DAY	93 0						0.0	0.0	0.0	0.0	0.0	
WED 03-Apr	1	TA	BA	1400	1610		34.7					COMP BOX & TEST LINE
JULIAN DAY	94 1						34.7	0.0	34.7	0.0	34.7	STAND-BY BAD WEATHER 1/2 DAY
THUR 04-Apr	2	RW	MO	700	1151		864.2	26.3				
JULIAN DAY	95 2	TA	BA	1225	1730		758.5					
							1622.7	26.3	1657.4	26.3	828.7	
FRI 05-Apr	4	TA	BA	700	1200		638.5	26.3				COMP BOX
JULIAN DAY	96 3	5	RW	MO	1225	1706	619.1					
							1257.6	26.3	2915.0	52.6	971.7	
SAT 06-Apr												STAND-BY BAD WEATHER
JULIAN DAY	97 4						0.0	0.0	2915.0	52.6	728.8	
SUN 07-Apr	6	TA	BA	725	1240		989.0					
JULIAN DAY	98 5	7	RW	MO	1310	1515	249.7					STAND -BY BAD WEATHER 1/2 DAY
							1238.7	0.0	4153.7	52.6	830.7	
MON 08-Apr	8	RW	MO	657	1140		662.6					
JULIAN DAY	99 6	9	TA	BA	1215	1458	329.3					STAND -BY BAD WEATHER 1/2 DAY
							991.9	0.0	5145.6	52.6	857.6	
TUE 09-Apr	10	TA	BA	710	1045		566.7	0.0				SHORT FLIGHT DUE TO GPS CARD PROBLEMS
JULIAN DAY	100 7	11	RW	MO	1135	1620	860.2					
							1426.9	0.0	6572.5	0.0	6572.5	

WED	10-Apr	12	RW	MO	645	1150	695.4											
JULIAN	101	13	TA	BA	1220	1725	727.1	10.0										LINE 10045 COMPLETED - REFLY
DAY	8									1422.5	10.0	7995.0	10.0	999.4				
THUR	11-Apr	14	TA	BA	655	1155	701.8											
JULIAN	102	15	RW	MO	1250	1730	589.1											
DAY	9									1290.9	0.0	9285.9	10.0	1031.8				
FRI	12-Apr	16	RW	MO	1456	1800	380.0											
JULIAN	103																	
DAY	10									380.0	0.0	9665.9	10.0	966.6				
SAT	13-Apr	17	TA	BA	725	1235	894.7											
JULIAN	104	18	RW	MO	1300	1530	325.9											
DAY	11																	STAND-BY 1/2 DAY BAD WEATHER CORRECTION DUE TO ROUNDING ERRORS
SUN	14-Apr																	
JULIAN	105																	
DAY	12									0.0	0.0	10886.3	10.0	907.2				BNZ 100 HRLY
MON	15-Apr	19	TA	MO	658	1210	678.9											
JULIAN	106	20	RW	BA	1230	1500	281.9											
DAY	13																	COMP BOX STAND -BY BAD WEATHER 1/2 DAY
TUE	16-Apr	21	RW	BA	645	1150	681.6	66.1										
JULIAN	107	22	TA	MO	1216	1400	230.2											
DAY	14																	STAND-BY BAD WEATHER 1/2 DAY
										911.8	66.1	12759.0	76.1	911.4				

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX C
Arthur - Pieman Area
North West Tasmania

APPENDIX C

Specifications - Geometrics G-856 Magnetometer

- DISPLAYS : Six digit display of magnetic field to resolution of 0.1 gamma or time to nearest second. Additional three digit display of station, day of year, and line number.
- RESOLUTION : Typically 0.1 gamma in average conditions. May degrade to lower resolution in weak fields, noisy conditions or high gradients.
- ABSOLUTE ACCURACY : One gamma, limited by remnant magnetism in sensor and crystal oscillator accuracy.
- CLOCK : Julian clock with stability of five seconds per month at room temperature and five seconds per day over the temperature range of -20 to +50 degrees Celsius.
- TUNING : Push button tuning from keyboard with current value displayed on request. Tuning range 20 to 90 kilogammas.
- GRADIENT TOLERANCE : Tolerates gradients to 5000 gammas/meter. When high gradients truncate count internal, maintains partial reading to an accuracy consistent with data.
- CYCLE TIME : Complete field measurement in three second in normal operation. Internal switch selection for faster cycle (1.5 seconds) at reduced resolution or longer cycles for increased resolution.
- MANUAL READ : Takes reading on command. Will store data in memory on command.
- MEMORY : Stores more than 1000 readings in survey mode, keeping track of time, station number, line number, day and magnetic field reading. In base station operation, computes for retrieval but does not store time of recording designated by sample interval, allowing storage of over 2500 readings.
- OUTPUT : Plays data out in standard RS-232 format at selectable baud rates. Also outputs data in real time byte parallel, character serial BCD for use with digital recorders.
- INPUTS : Will accept an external sample command.

- SPECIAL FUNCTIONS** : An internal switch allows:
- 1) adjustment of polarisation time and count time to improve performance in marginal areas or to improve resolution or speed operation,
 - 2) three count averaging,
 - 3) choice of lighted displays in auto mode.
- PHYSICAL** : Instrument console: 18 x 27 x 9 cm (2.7 kg)
Sensor: 9 x 13 cm (1.8 kg)
Staff Section: 3 cm x 60.5 cm (0.4 kg)
- ENVIRONMENTAL** : Meets specifications from 1 to 40°C
Operates satisfactorily from -20 to 50°C
Weatherproof.
- POWER** : Operates from 8 D-cell flashlight batteries (or 12V external power). May be operated at 18V external power to improve resolution. Power failure or replacement of batteries will not cause loss of data stored in memory.

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX D
Arthur - Pieman Area
North West Tasmania

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX E
Arthur - Pieman Area
North West Tasmania

TESLA AIRBORNE GEOSCIENCE
 THORIUM BUTTON CHECKS
 TASMANIA DEVELOPMENT & RESOURCES VH-BNZ
 JOB No - TA2294

FLT	LINE	BUTTON STATS Th-BKG	Th-BKG % DIFFERENCE	Th-BKG RUNNING AVG	TOTAL Th-BKG
1	501	319.00	0.00	319.00	319.00
1	601	314.00	0.79	316.50	633.00
2	501	303.00	2.88	312.00	936.00
3	601	320.00	1.91	314.00	1256.00
4	501	316.00	0.51	314.40	1572.00
5	601	307.00	1.97	313.17	1879.00
6	501	317.00	1.05	313.71	2196.00
7	601	305.00	2.44	312.63	2501.00
8	501	306.00	1.89	311.89	2807.00
9	601	313.00	0.32	312.00	3120.00
10	501	315.00	0.87	312.27	3435.00
11	601	307.00	1.55	311.83	3742.00
12	501	303.00	2.62	311.15	4045.00
13	601	312.00	0.25	311.21	4357.00
14	501	311.00	0.06	311.20	4668.00
15	601	305.00	1.87	310.81	4973.00
16	501	295.00	4.80	309.88	5268.00
16	601	303.00	2.10	309.50	5571.00
17	501	320.00	3.21	310.05	5891.00
18	601	297.00	4.01	309.40	6188.00
19	501	304.00	1.66	309.14	6492.00
20	601	318.00	2.73	309.55	6810.00
21	501	315.00	1.68	309.78	7125.00
22	601	311.00	0.38	309.83	7436.00
23	501	314.00	1.29	310.00	7750.00
24	601	296.00	4.35	309.46	8046.00
25	501	288.00	6.70	308.67	8334.00
25	601	298.00	3.34	308.29	8632.00
26	501	313.00	1.48	308.45	8945.00
26	601	304.00	1.39	308.30	9249.00
27	501	303.00	1.66	308.13	9552.00
27	601	297.00	3.50	307.78	9849.00
28	501	316.00	2.59	308.03	10165.00
28	601	312.00	1.25	308.15	10477.00

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 TESTLINE RADIOMETRIC DATA
 TASMANIA DEVELOPMENT & RESOURCES VH-BNZ
 JOB No - TA2294

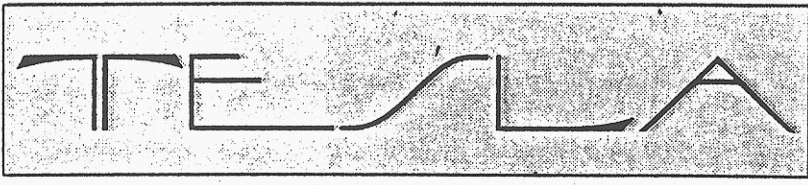
FLT	LINE	TEST LINE STATISTICS				% DIFFERENCE			
		K	U	TH	TC	K%	U%	Th%	TC%
1	0	64	24	29	744	0.0	0.0	0.0	0.0
1	608	65	23	29	748	1.6	4.2	0.0	0.5
2	508	62	23	28	727	3.9	2.1	3.4	2.5
3	608	63	23	29	746	1.0	1.4	1.2	0.9
4	508	66	27	30	784	3.9	16.1	4.3	5.8
5	608	66	24	30	779	3.1	0.0	3.4	3.9
6	508	67	24	31	767	4.1	0.0	6.3	1.6
7	608	66	24	30	763	2.0	0.0	1.9	0.9
8	508	63	22	29	896	2.9	8.3	1.7	18.3
9	608	61	23	29	725	5.7	3.3	1.5	6.2
10	508	62	23	28	738	3.6	3.0	4.8	3.9
11	608	63	24	29	734	1.7	1.5	0.9	4.1
12	508	64	25	29	756	0.0	5.6	0.9	0.9
13	608	63	24	30	754	1.6	1.0	2.6	1.1
14	508	65	25	29	756	1.7	5.1	1.0	0.7
15	608	66	26	30	790	3.1	8.9	2.5	3.8
16	508	65	25	28	757	1.4	4.2	4.5	0.8
17	508	63	22	30	783	1.8	8.6	2.6	2.7
18	608	81	44	30	1045	26.3	83.8	2.5	36.8
19	508	68	28	29	816	4.6	12.0	1.1	4.8
20	608	67	29	30	818	2.8	15.3	2.4	4.8
21	508	62	24	29	729	5.0	5.3	1.1	6.8
22	608	65	24	31	776	0.1	5.0	5.7	0.5
23	508	63	26	30	756	3.2	3.1	2.1	3.0
24	608	65	25	31	766	0.0	1.0	5.4	1.6
25	508	64	25	30	767	1.5	1.0	1.8	1.4
25	608	67	25	30	779	3.1	0.9	1.7	0.2
26	508	62	25	28	734	2.3	1.6	5.1	2.3
26	608	64	23	29	759	0.9	9.4	1.6	1.1
27	508	67	28	29	800	5.6	10.6	1.5	6.5
27	608	65	29	29	812	2.3	14.2	1.5	7.9
28	508	67	26	29	778	5.3	1.9	1.4	3.1
28	608	63	25	29	764	0.9	2.4	1.4	4.2

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX F
Arthur - Pieman Area
North West Tasmania

CLIENT NAME

APPENDIX E
Survey Area



AIRBORNE GEOSCIENCE

A.C.N. 009 183 082

BASE MAGNETOMETER RECORD

Job No: TA2294
 Client: TASMANIA DEVELOPMENT & RESOURCES
 Area: NORTH WEST TASMANIA
 Crew Leader: TIM
 Operator: BART

Aircraft: VH-BX12
 Date: 03/04/96 - 08/04/96
 Julian: 094, 1699
 Completed by: BART
 Signature: [Signature]

Magnetometer Type: G-856

Serial No. 50663

Magnetometer Location ROGER RIVER WEST

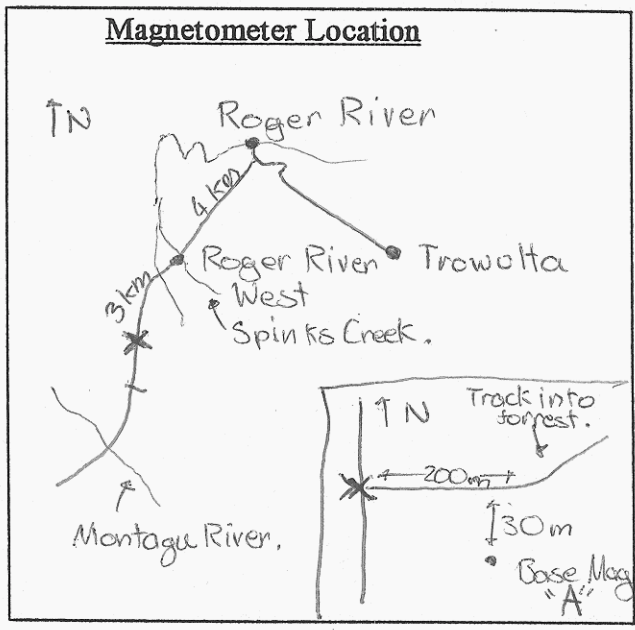
BASE
MAG
"A"

Cycle Rate: 1 READING EVERY 5 SECONDS

Sensor Height 3 POLES

Readings:

2m North	<u>61686.2</u>
2m South	<u>61687.9</u>
2m East	<u>61685.6</u>
2m West	<u>61687.5</u>
Central	<u>61687.2</u>



Magnetometer Type: G-856

Serial No. 27881

Magnetometer Location ROGER RIVER WEST

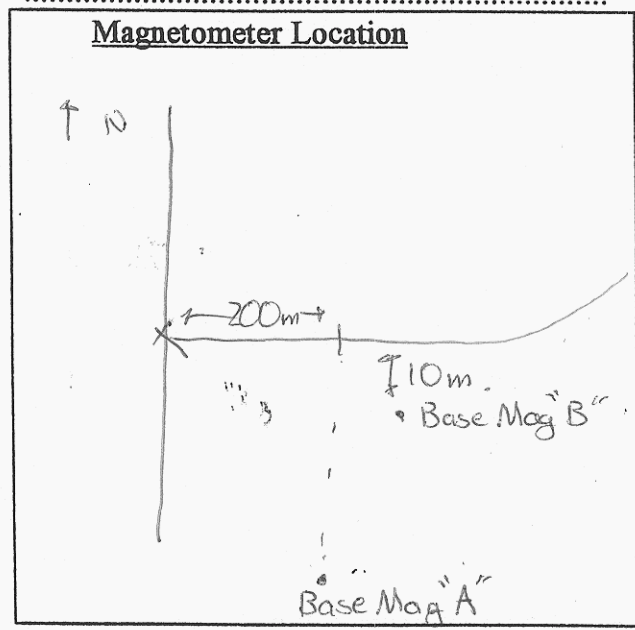
BASE
MAG
"B"

Cycle Rate: 1 READING EVERY 5 SECONDS

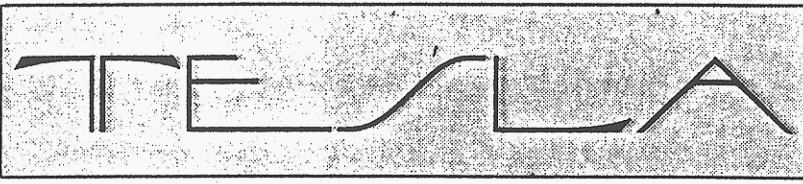
Sensor Height 2 POLES

Readings:

2m North	<u>61658.0</u>
2m South	<u>61659.6</u>
2m East	<u>61658.6</u>
2m West	<u>61659.8</u>
Central	<u>61658.9</u>



Ref: ADM1479



AIRBORNE GEOSCIENCE

A.C.N. 009 183 082

BASE MAGNETOMETER RECORD

Job No: TAD296
 Client: TASMANIA DEVELOPMENT & RESOURCES
 Area: NORTH WEST TASMANIA
 Crew Leader: TIM
 Operator: BART

Aircraft: VH-BNZ
 Date: 03/04/96 - 08/04/96
 Julian: 094/099
 Completed by: BART
 Signature: [Signature]

Magnetometer Type: ENVI

Serial No. 9403068

Magnetometer Location SMITHTON AIRPORT

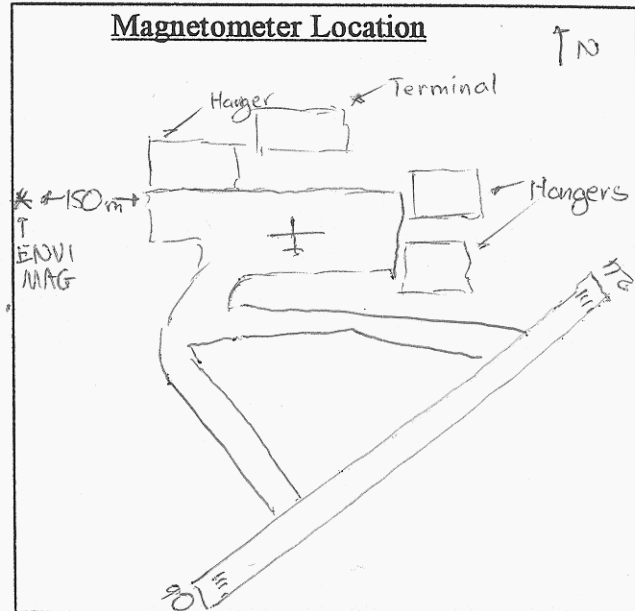
Cycle Rate: 1 READING EVERY 5 SECONDS

Sensor Height 3 POLES

Readings:

2m North 61811.0
 2m South 61810.7
 2m East 61809.3
 2m West 61810.9
 Central 61810.3

ENVI
MAG



Magnetometer Type: _____

Serial No. _____

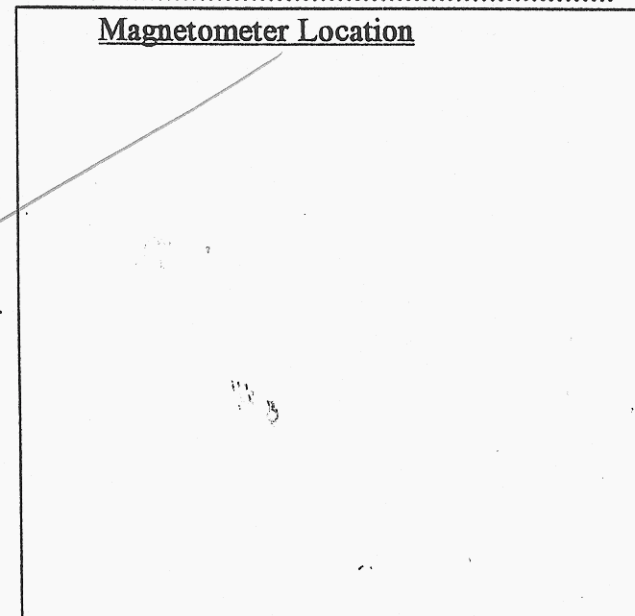
Magnetometer Location _____

Cycle Rate: _____

Sensor Height _____

Readings:

2m North _____
 2m South _____
 2m East _____
 2m West _____
 Central _____

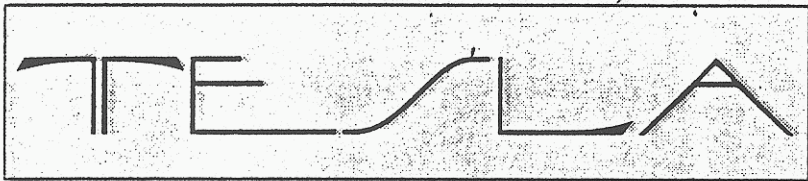


PLEASE NOTE: BASE MAG A, WAS IN ENVI MAG'S POSITION UNTILL THE 08/04/96. FROM THEN ON IT WAS IN ITS RECORDED POSITION. BASE MAG IS "NEVER" MOVED.

Ref: ADM1479

CLIENT NAME

APPENDIX F
Survey Area



AIRBORNE GEOSCIENCE

A.C.N. 009 183 082

BASE GPS RECORD

JobNo.	<u>TA2294</u>	Date:	<u>03/04/96</u>
Client:	<u>TASMANIA DEVELOPMENT & RESOURCES</u>	Julian:	<u>094</u>
Area:	<u>NORTH WEST TASMANIA</u>	Serial No:	<u>9400021.V322</u>
Aircraft:	<u>VH-BN2</u>	Completed By:	<u>BART</u>
Crew Leader:	<u>TIM</u>	Signature:	<u>[Signature]</u>
Operator:	<u>BART</u>		

Calculated Base Station Lat -40.8391520 Long 145.1193345
 Co-ordinates Height 13.86143

Ellipsoid WGS84

Method of Position Determination: *Averaging*

Number of Readings in Sample 19876 (<=16 12379)

Sample Interval 2 SECONDS

Standard Deviation of Sample 23.78

Other

Differential Correction Method: EDGE-RTCM

Location of GPS Antenna/
 Comments NEAR WATER TANK, ON TOP OF THE
BRIDGE HOTEL MOTEL, SMYTHTON.
GPS ANTENNA POLE TAPED TO
METAL STRUT NEAR TANK ABOVE
RECEPTION.

Ref:ADM1480

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX G
Arthur - Pieman Area
North West Tasmania

APPENDIX G

Specifications - Scintrex CS-2 Cesium Magnetometer Sensor

OPERATING PRINCIPLE	:	Self-oscillating Cesium Vapour Magnetometer
MEASUREMENT RANGE	:	15000 nT to 100000 nT
GRADIENT TOLERANCE	:	40000 nT/meter
TEMPERATURE LIMITATIONS	:	-40°C to 50°C
SUPPLY VOLTAGE	:	27 to 35V DC
OUTPUT	:	Continuous signals at the Larmor frequency which is proportional to the magnetic field (proportionally constant 3.498577 Hz/nT)
POWER CONSUMPTION	:	15W at 20°C
DIMENSIONS	:	Diameter - 63 mm Length - 160 mm
WEIGHT	:	1.15 kg

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX H
Arthur - Pieman Area
North West Tasmania

APPENDIX H

Specifications - RMS Instruments Automatic Aeromagnetic Digital Compensator

INPUTS	:	one to four high sensitivity magnetometers of optical absorption type.
INPUT FREQUENCY RANGE	:	70 KHz - 350 KHz - Cs sensor 140 KHz - 700 KHz - K sensor 560 KHz - 2800 KHz - He sensor 850 Hz - 4 260 Hz - Overhauser
MAGNETIC FIELD RANGE	:	20000 - 100000 nT (gamma)
RESOLUTION	:	1 pT (picotesla)
COMPENSATION PROCEDURE	:	improvement ratio 10-20 typical for total field improvement ratio 20-100 typical for gradient
ACCURACY OF COMPENSATION	:	0.035 nT (gamma) standard deviation for the entire aircraft flight envelope in the bandwidth 0-1 Hz typical.
DATA OUTPUT RATE	:	10 Hz
SYSTEM FREQUENCY RESPONSE	:	0 - 0.9 Hz
INTERNAL SYSTEM NOISE	:	less than 2 pT (standard deviation in the bandwidth 0-1 Hz)
DURATION OF CALIBRATION FLIGHT MANOEUVRES	:	5-8 minutes typical
MICROCOMPUTER	:	SBC-11/21 Plus (DEC) Front End LSI-11/73 (DEC) Main CPU
KEYBOARD	:	limited alphanumeric
DISPLAY	:	green fluorescent, 80 character self scan panel
OUTPUTS	:	serial data communication port: RS232C - max. rate 19.2 K Baud parallel output port: 16 bit with full handshaking (DRV11-J) (optional)

- POWER** : 28 ± 4 VDC, 5A, 150W (for single magnetometer) 7A, 196W
(for gradiometer system)
- ENVIRONMENTAL** : operating temperature: 0 to 50°C
storage temperature: -20 to 55°C
relative humidity: 0-99%, non-condensing
altitude: 0 to 6000 m (0 to 20000 ft)
- PHYSICAL DATA** : console dimension: 483 x 178 x 440 mm
console weight: 12.5 kg
power supply dimensions: 225 x 180 x 220 mm
power supply weight: 5.5 kg

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX I
Arthur - Pieman Area
North West Tasmania

APPENDIX I

Specifications - Exploranium GR820 Spectrometer System

Detector Controller

- Maximum number of crystals - 16. Each crystal has individual pole-zero cancellation, semi gaussian shaping and advanced base line restoration circuitry.
- Continuous, individual-crystal spectrum analysis ensures that optimum system stabilisation is achieved. Resolution is calculated by a sophisticated gaussian curve fitting algorithm to perform an accurate centroid analysis of the selected stabilisation peak.
- High energy cosmic pulses are accumulated in a separate channel.
- Accurate pile-up rejection for simultaneous pulses allows qualitative gamma-ray spectrum analysis almost independent of the system count rate. Special circuitry analyses for pulse pile-up and permits only detector signals from single events to be analysed. Simultaneous events in adjacent crystals are added to reduce the Compton effect.
- Residual pulse pile-up at 100000 counts/sec are less than 2%

Analog to digital converter (ADC)

- 50 MHz Wilkinson ramp ADC.
- Linearity - integral - less than 0.2%; -differential - less than 1%
- Average system dead-time is less than 5 microsec/pulse.
- Live-time channel records the actual system live-time. This data is output with the digital data which allows post correction for system dead-time to an accuracy of 0.1%.
- Number of channels - selection of 256 channels or 512 channel operation.
- Maximum number of counts/channel - 65535 (16 bits).
- The lower threshold - manually selectable from channel 2 to channel 50 (20-500 keV).
- The upper threshold is set to 3 MeV. All pulses above 3 MeV are accumulated in the cosmic channel as a direct measure of cosmic ray activity.
- ADC offset set from the keyboard.
- The maximum input count rate is 100000 counts/second.

System outputs

- Visual display - the front panel display is a 640 x 200 electroluminescent (EL) high contrast graphics display which allows full spectrum display, system set-up and various parameter monitoring functions. In the spectrum display mode, the region of interest and cursor may be viewed by channel number or directly in keV.
- The internal channel number to energy level (keV) conversion table compensates for non-linearity of the detector's light output.
- The front panel has a 21 button keyboard for easy operator control.
- The system's operation is fully menu driven.

- Digital outputs
 - RS-232 port (1200 to 19200 baud).
 - IEEE-488 bus output - talk listen/talk only.
 - Geometrics GR-800 output format.
 - Some system functions can be controlled remotely by an external computer via the RS-232 and the IEEE-488 digital ports.
- Analog output
 - 4 channels of roi data can be selected for output on the analog port. The outputs have 10 bit resolution (0-10V). Scaling can be set from the keyboard (100-50 K counts/sec FSD) and output data may be raw or stripped using internally stored calibration constants. Analog output wraps at fsd limits and is dead-time corrected.

Miscellaneous

- Regions of interest (ROI) 8 ROIs can be selected. The upper and lower thresholds can be individually set over the entire spectrum range.
 - The first 4 ROIs are available for digital and analog output. The second 4 ROIs are available only for digital output on the RS-232 or the IEEE-488 ports.
 - System resolution. Detector resolution is automatically computed for each (and summed crystals) during peak analysis and is displayed for operator monitoring when required. The summed down resolution is also output on the data stream.
- System test. At power on, a full system test of all internal pcb handshaking is performed. Included in the testing is the lithium back-up battery, the system ram memory, display handshaking, the systems configuration (options installed), the selected detectors (checked via ADC analysis) and peripheral handshaking response.
- Configuration menus. The configuration menus allow the selection of the number of detectors in use, confidence levels for gain analysis, maximum crystal resolution levels for each detector (with operator warning if levels exceeded), output configurations for analog and digital data and various special display/monitoring functions.
 - Maintenance. A set of special menus allows the user to test and calibrate many systems functions including system test, ADC offset, low level discriminator etc.
 - Power: 28V - 1.25amps.

Detectors

The crystals are housed in a specially designed hi-impact polystyrene cases using low background materials for minimum signal attenuation. Full thermal and internal shock protection allows the units to be directly mounted to the floor. A very low noise, high voltage power supply is housed in each pack so high voltage is not present in the connecting cables. A unique preamplifier with special processing for signal optimisation is used. The GPX-1024 has 4 crystals with a total volume of 16.78 litres.

- Outputs. Individual BNC connectors output each crystal's signal separately.
- Size: GPX-1024: 73 x 51 x 30 cm
- Weight: GPX-1024: 84 kg
- Power: 28V @ 0.5 A/crystal pack

- Temperature limitations

- Closed pack: storage -40°C to $+60^{\circ}\text{C}$, operation -40°C to 60°C
- Open pack: not recommended
- Temperature gradient:
 - Closed pack: -40°C to $+50^{\circ}\text{C}$ (instantaneous)
 - Open pack: a change of $1^{\circ}\text{C}/\text{hour}$.

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX J
Arthur - Pieman Area
North West Tasmania

APPENDIX J

Specifications - Novatel 951R Global Positioning System Card

FREQUENCY	:	L1, 1575.42 MHz
CODE TRACKED	:	C/A Code (SPS)
CHANNELS	:	12 Discrete Channels
TIME TO FIRST FIX	:	<70 seconds typical (cold start: no initial time, almanac, or position required)
RE-ACQUISITION	:	3 seconds typical
COMPUTED DATA UPDATE RATE	:	10 solutions per second
SINGLE CHANNEL PHASE ACCURACY	:	3 mm RMS, C/No> 44 dB Hz loop BW=15Hz
DIFFERENTIAL CHANNEL PHASE MEASUREMENT ACCURACY	:	0.75 mm RMS, 1 second smoothed, no multipath, C/No> 44d BHz
TIME ACCURACY (RELATIVE)	:	50 nanoseconds (SA off) 250 nanoseconds (SA on)
HEIGHT LIMIT	:	60000 ft maximum
VELOCITY LIMIT	:	Up to 575 ms ⁻¹ maximum
OPERATING TEMPERATURE	:	0° to +70°C
SIZE	:	216 mm x 107 mm x 19 mm
WEIGHT	:	220 g
MOUNTING	:	installed inside an IBM-PC Compatible

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX K
Arthur - Pieman Area
North West Tasmania

APPENDIX K

Specifications - Bendix King KRA-10A Radar Altimeter

KRA 10A Receiver/Transmitter

ALTITUDE OUTPUT RANGE	:	20 ft. to 2500 ft. max. AGL - Maximum Altitude is dependant on ground reflectivity
ACCURACY (with or without KI 250)	:	± 5 ft. 50 ft. to 100 ft. ± 5% 100 ft. to 500 ft. ± 7% 500 ft. to 2000 ft.
POWER REQUIREMENTS	:	27.5 VDC ± 20% @ 200 ma Max. Total for system
ALTITUDE	:	45000 ft. (13716 m)
TEMPERATURE	:	- 54°C to 71°C
COOLING	:	Convection
SIZE	:	7.9 x 8.9 x 20.3 cm
WEIGHT	:	0.9 kg
MOUNTING	:	Any position
AUX. ANALOG OUTPUT	:	+ 4 mv/ft.

KI250 Indicator

ALTITUDE RANGE	:	20 to 2500 ft. AGL
DECISION HEIGHT RANGE (pilot adjustable)	:	20 to 2500 ft. AGL
DH LAMP	:	Lights when descending thru DH
DH AUDIO	:	2 sec. 1 KHz tone when descending thru DH
ALTITUDE	:	15000 ft. (4,572 m)
TEMPERATURE	:	- 15°C to 71°C

COOLING : Convection
SIZE : 8.28 x 10.0 x 8.28 cm
WEIGHT : 0.4 kg

KA 131 Antenna

BEAMWIDTH
E-Plane : $40 \pm 5^\circ$
H-plane : $40 \pm 5^\circ$

MOUNTING SURFACE ANGLE FROM HORIZON
KA 131-00 (parallel) : $\pm 6^\circ$
KA 131-01 (skewed) : 6° to 20°

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX L
Arthur - Pieman Area
North West Tasmania

APPENDIX L**Specifications - Vaisala HMD50Y Temperature and Humidity Sensor**Relative Humidity

OPERATING RANGE : 0-100% RH
SENSOR : Intercap Humidity Sensor, Part No. 15778

Temperature

OPERATING RANGE : -10°C to 60°C
TOTAL ACCURACY AT 25°C : $\pm 0.3^\circ\text{C}$
SENSOR : PR 1000 DIN 43760B

General

OUTPUT SIGNAL : Equals 0 to 100% RH and -40°C to 60°C
0 to 10V
Load Resistance > 10k OHM
POWER SUPPLY : 15 to 35 VDC
CURRENT CONSUMPTION : 6mA typical
HOUSING CLASSIFICATION : IP 65

TASMANIA DEVELOPMENT AND RESOURCES

APPENDIX M
Arthur - Pieman Area
North West Tasmania

APPENDIX M**Specifications - Intellisensor Air-DB Digital Barometer**

PRESSURE RESOLUTION	:	0.01 HPa
ALTITUDE RESOLUTION	:	0.1 m
MAX. OPERATING PRESSURE	:	1300 HPa
OPERATING MODULES	:	Barometer Altimeter Altimeter Setting, Test
SELECTABLE DATA UNITS	:	Pressure - mb, in Hg, mm Hg, psia Altitude - feet, metres Altimeter Setting - in Hg
SAMPLING RATE (MAX)	:	10/second
SELECTABLE AVERAGING	:	1, 10, 100, 1000 samples/average
SELECTABLE INTERFACES	:	RS-232C or LSTTL Serial (110, 300, 1200, 9600 baud) Parallel (8-bit with handshaking)
DATA FORMAT	:	Serial ASCII, Parallel ASCII or binary
POWER REQUIREMENTS	:	RS-232C +11 to +16 and -11 to -16 VDC 14.5 mA (oper), 8.5 mA (stdby) LSTTL Serial or parallel +8 to +16 VDC 6.3 mA (oper), 10 uA (stdby)
SIZE	:	Length - 8.9 cm Diameter - 8.9 cm
WEIGHT	:	0.58 kg