FINAL REPORT

on

Data Acquisition and Processing

for the

Airborne Magnetic Survey

of

The Excelsior Mountains and South Wassuk Range of Western Nevada

on behalf of the

United States Geological Survey

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Ottawa, Ontario, Canada
March, 2001

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1. INTRODUCTION

An aeromagnetic survey was flown over three conjoined areas within the Excelsior Mountains and Southern Wassuk Range of western Nevada. This same survey covered part of Death Valley, California. The flying was completed between December 5, 2000, and January 14, 2001, by Fugro Airborne Surveys on behalf of the United States Geological Survey (see figure 1). A 1:100,000 scale contour map and digital grid of the total magnetic field were produced, as well as a digital grid of radar altimeter (ground clearance) data.

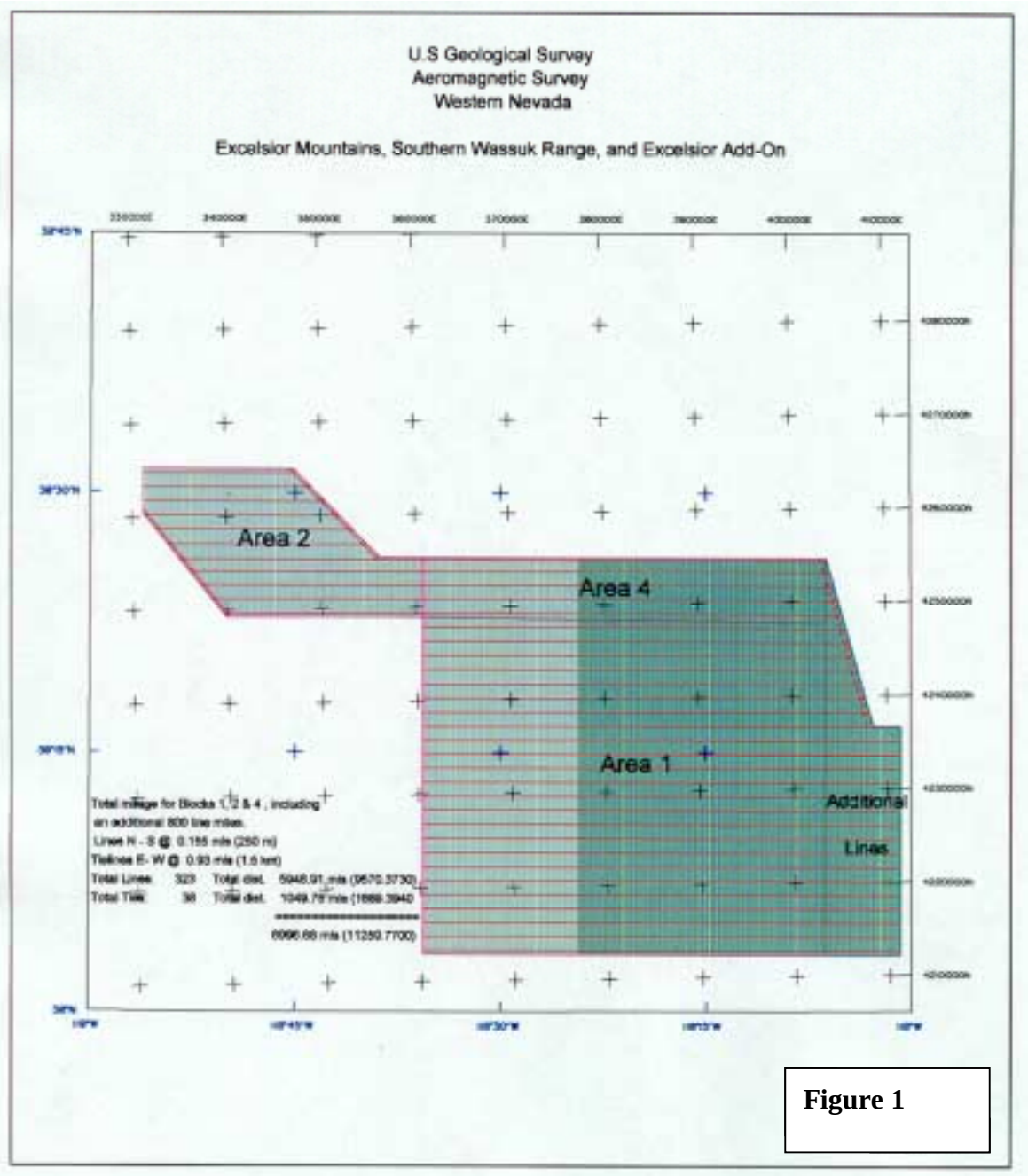


Figure 1

2. TECHNICAL SPECIFICATIONS

This section describes in detail the guidelines followed throughout the performance of the project; tolerances and instruments are also presented here.

2.1 SURVEY LOCATION

The three conjoined western Nevada areas (1, 2, & 4) are bounded by the following co-ordinates (NAD27 UTM and degrees X 1,000,000):

404000.00	4255000.00	38262393	-118055996
409100.00	4237100.00	38164519	-118022131
412000.00	4237100.00	38164623	-118002197
412000.00	4212600.00	38033142	-118001106
361100.00	4212600.00	38030844	-118345912
361100.00	4248600.00	38223605	-118352448
340200.00	4248600.00	38222349	-118494545
331300.00	4259700.00	38281754	-118560163
331300.00	4264500.00	38305318	-118560580
347200.00	4264500.00	38310352	-118450957
356400.00	4255000.00	38260094	-118384281

2.2 FLIGHT SPECIFICATIONS

Traverse Line Direction	N - S
Traverse Line Spacing	250 m
Control Line Direction	E - W
Control Line Spacing	1,500 m
Terrain Clearance	168-1217 m+ - see section 2.3 - “Flying Height”.
Line kilometers:	11,259.77
Average Sampling Interval	7.5 m

2.3 TOLERANCES

Lines (or segments of lines crossing two control lines, or segments of control lines crossing several lines) were re-flown when any of the following tolerances were exceeded:

Navigation

- Nominal line spacing must not be exceeded by more than 50% for a distance of more than 3.2 km.

Flight Height

- In order to maintain similar elevations at all traverse and control line intersections, even when climbing or descending steeply, the Fugro *ACCUDRAPE* system utilizes a pre-planned digital drape surface which the onboard computer compares with the GPS xyz to feed corrections to the pilot.
- Deviations from the pre-planned drape elevation must not exceed 100 m. The precipitous mountains flanking all survey blocks necessitated pre-planned drape surfaces with ground clearance exceeding 1217 m (4000’) over the valleys (the radar altimeter maximum is 1217 m). Less than 1% of the data could be flown

below 213 m (700').

Magnetic Diurnal

- Deviations must not be greater than 2 nT from a 40 second chord. The ground station magnetometer operated during all data acquisition.

Airborne Magnetometer Noise

- "Maneuver" noise must not exceed an envelope of ±0.1 nT over more than 10% of any line. This was monitored on the analog chart with a fourth difference and a high-pass filter.
- A standard Figure of Merit must be less than 1.5 nT.
- Heading errors must be within 1 nT between reciprocal headings.

2.4 SURVEY EQUIPMENT

Table 2.4.a lists major characteristics of the fixed-wing survey aircraft.

Registration	Endurance	Engines	Manufacturer	Type	No. of Seats	Average Speed
C-FZLK	6.5 hours	1 Turbine	Cessna	Caravan 208	3	75 m/sec

Table 2.4.a Survey Aircraft

Table 2.4.b lists the geophysical equipment installed in C-FZLK throughout the survey.

EQUIPMENT	MANUFACTURER	MODEL	TYPE
Data Acquisition System	Fugro Airborne Surveys	GeoDAS	Pentium computer based, real-time, data synchronization and recording
Magnetometer	Scintrex	CS-2	Cesium Vapour,10 Hz Sampling, 0.005 nT Sensitivity,0.001 nT Resolution
Compensator	RMS	AADC	27 Term
Digital Backup	Iomega	Zip Drive	100 Mb removable hard drive
Analogue Recorder	RMS	GR-33a-1	Dot Matrix
Radar Altimeter	TRT	AVH-8	10 Hz Sampling, Accuracy ±2%
Barometric Altimeter	Rosemount	1241M	10 Hz Sampling, Accuracy ±5 m
Omnistar Receiver	Trimble		Real-time differential GPS correction
GPS Receiver	Sercel	NR103	10 Channel
Video Camera	Panasonic	WVC 1302	Colour
Video Cassette Recorder	Panasonic	AG2400	NTSC

Table 2.4.b Airborne Geophysical Equipment

Table 2.4.c lists the components of the ground-based reference station.

EQUIPMENT	MANUFACTURER	MODEL	TYPE
Magnetometer	Scintrex	CS-2	Cesium Vapour, 2 Hz Sampling, 0.005 nT Sensitivity, 0.01 nT Resolution
GPS Receiver	Sercel	NR-103	10 Channel

Table 2.4.c Ground Reference Station

The ground magnetometer was mounted in a magnetically quiet area; its clock was synchronized with the GPS time signal. The GPS data logger records all of the raw range data stream. The *Trajecto* differential correction software matches the output from the airborne GPS system and the ground GPS system during the data reduction process.

Table 2.4.d lists the equipment and software used to perform the field processing.

EQUIPMENT	MANUFACTURER	MODEL	TYPE
PC	Dell	Inspiron 7500	800 MHz Pentium
Printer	HP	HP950C	A4 Colour
Data Processing Software	Fugro Airborne Surveys	Gmaps	DOS & Windows
Image Processing Software	ERMapper	Version 5.5	Windows 95/98
GPS Processing Software	Sercel	Trajecto	DOS

Table 2.4.d Field Processing System

3. PERSONNEL

NAME	TITLE	PROJECT POSITION
Robb, Jeff	Aircraft Maintenance	Aircraft Maintenance
Lamirande, Ken	Electronics Technician	Electronics Operator
Reed, Travis	Electronics Technician	Electronics Operator
Lyall, Ron	Operations Manager	Processor, Logistics
Williston, Mark	Pilot	Survey Pilot
Thomas, Jeff	Pilot	Survey Pilot

Table 3 Field Project Personnel

4. SURVEY OPERATIONS

4.1 GENERAL

The production phase of the project began in Bishop, California, on December 5th , 2000, and the final production flight was made on January 14th, 2001. The Comfort Inn provided crew accommodation and space for the field processing office.

4.2 DIURNAL CONDITIONS

Magnetic diurnal variation was exceptionally quiet. Deviations never reached the specification limit.

4.3 GENERAL WEATHER CONDITIONS

Weather conditions were frequently unfavourable for survey flying due to high turbulence or cloud cover in the mountains. Ten days were lost.

4.4 QUALITY CONTROL AND FIELD PROCESSING

- To check the data for adherence to contract specifications and move the data closer to the final stage, the following procedures were followed for each flight (details in section 6):

- downloading and verification of aircraft data;
- downloading and verification of GPS and magnetic base station data;
- post-processing of GPS data using SERCEL TRAJECTOGRAPHY software;
- merging of navigation data with geophysical data including transformation of coordinates from WGS84 latitude/longitude to UTM x, y coordinates in the local spheroid;
- creation of flight path plots and evaluation of compliance with contract specifications;
- spike and null value location and removal from the magnetic and altimeter data;
- computing of a drape surface quality control field for evaluation of compliance with the contract specifications;
- computing of magnetic noise channel for evaluation of data quality and compliance with contract specifications;
- evaluation of diurnal data quality, and compliance with contract specifications;
- correction of magnetic data for I.G.R.F. gradient;
- noise filtering of magnetic and altimeter fields;
- correction of magnetic field for altitude deviations;
- backing-up of all field data.

At regular intervals, the corrected magnetic data were levelled and gridded for quality inspection including real-time shade enhancement.

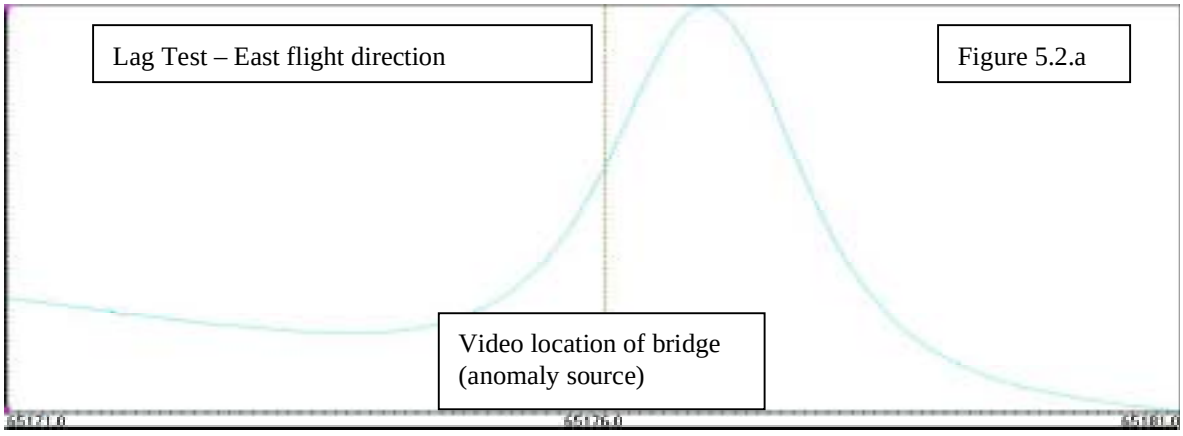
5. CALIBRATION AND TEST RESULTS

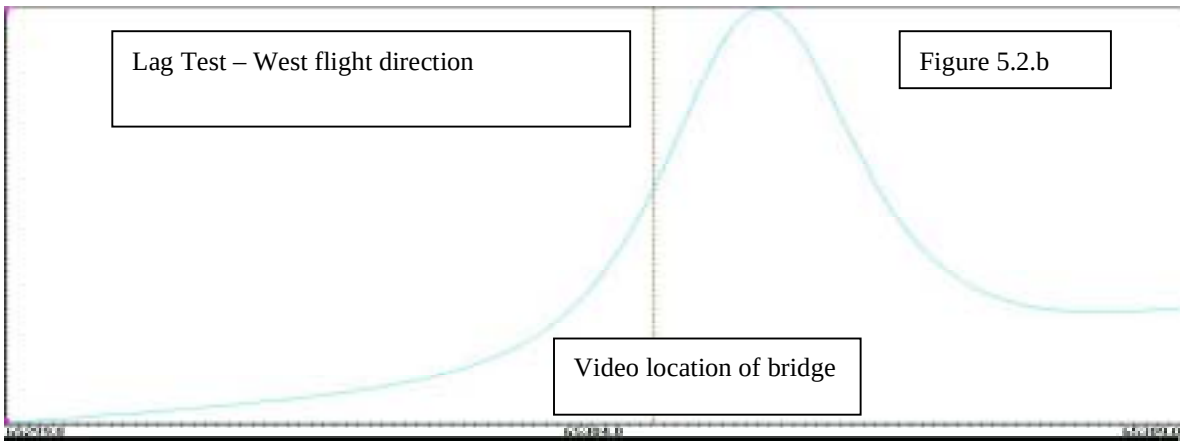
5.1 GPS BASE STATION

To apply post-flight differential GPS corrections to the survey data, a GPS base station was installed near the crew's hotel. The location of the GPS base station antenna was determined by averaging positions over a 24 hour period. The location was 37° 22' 17.28" N latitude, 118° 22' 8.46" W longitude, elevation 1,255 m, on the WGS spheroid.

5.2 MAGNETIC LAG TEST

The camera on-board the aircraft records its position, A, relative to the ground, at time t0. In fact the sensor will arrive over A at time t1 (>t0). Furthermore, because of electronic delays, the reading at time t1 will not be recorded until time t2 (>t1). The difference t2-t0 represents the lag between the actual aircraft position and the x y position tied to the magnetic reading on disk. A lag test was performed by flying the aircraft at survey altitude in opposite directions over a sharp magnetic feature. The position of the magnetic feature was referenced to a visible feature recorded by the video system, in this case a bridge, which was the anomaly source. By superimposing a plot of the east-west anomaly over the west-east anomaly, the video-picked position of the bridge can be transposed onto its counterpart; and one-half the difference between the two video-picked positions equals the magnetic system lag. The lag was 0.7 seconds, or 7 magnetic samples, for aircraft C-FZLK. These values were used to correct for magnetic system lag throughout the survey.



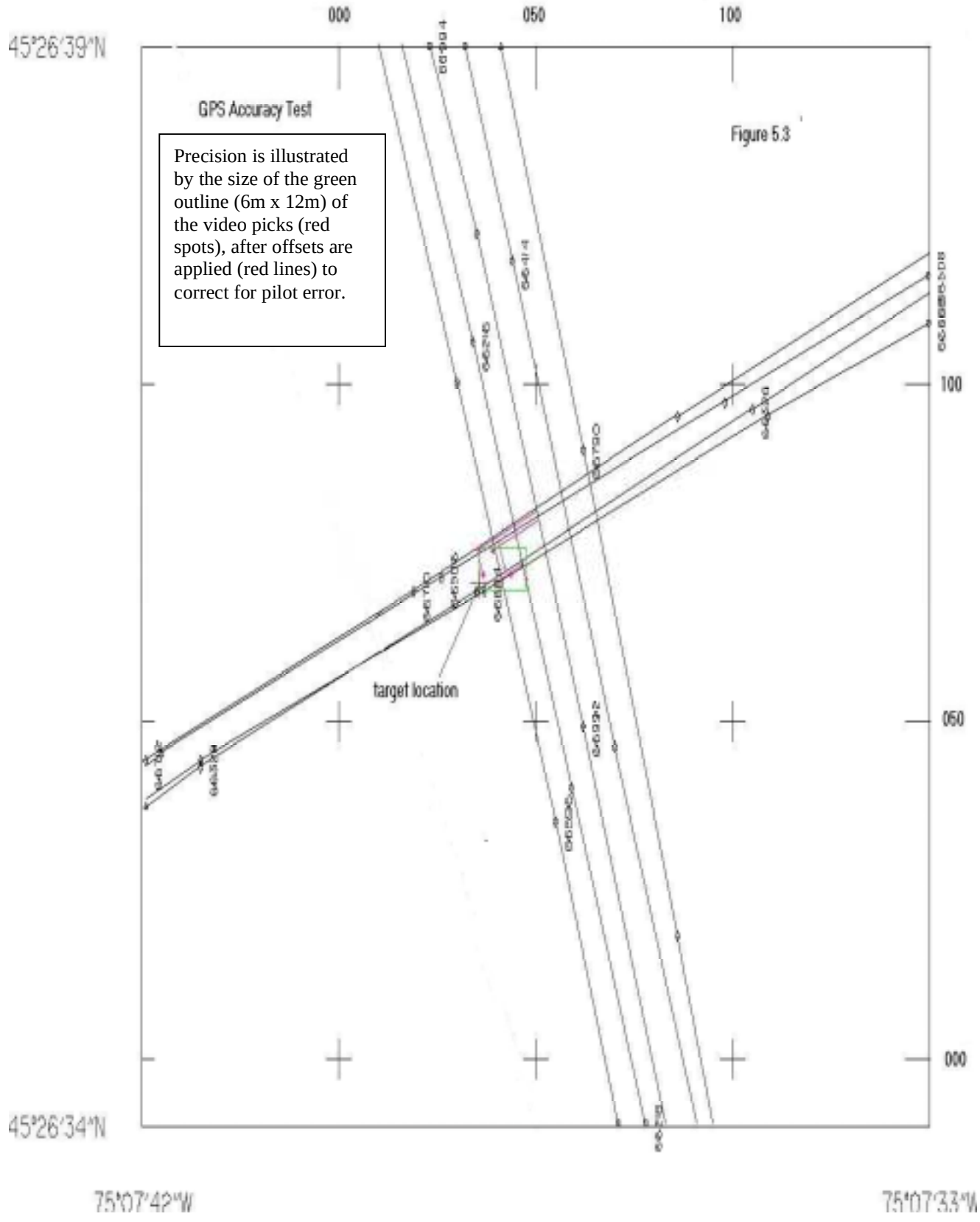


5.3 GPS LAG / ACCURACY.TEST

A cloverleaf flown over the established co-ordinates of the Canadian Geological Survey test site was used to measure the lag in the GPS positioning, with regard to the video camera position. A value of 0.2 seconds resulted in a best fit with the video position. Once the lag is applied (as in figure 5.3) the cloverleaf intersection is used to test the accuracy of the GPS positioning.

Aircraft:		Cessna Caravan	
Registration:		C-FZLK	
Date:		November 25, 2000	
Location:		Bourget, Ontario, Canada	
Altitude:		400 ft mean terrain clearance	
DIRECTION	FIDUCIAL CLOSEST TO TARGET (from video)	OFFSET FROM TARGET DUE TO PILOT ERROR (estimate in metres & direction)	Line # on Video
South	66216.56	0	Line 10
West	66326.92	3 N	Line 11
North	66413.50	20 E	Line 12
East	66506.22	5 N	Line 13
South	66595.44	5 W	Line 14
West	66709.76	5 N	Line 15
East	66884.10	0	Line 17
North	66992.44	15 E	Line 18

TABLE 5.3 GPS LAG / ACCURACY TEST


000
050
100
45°26'39"N
GPS Accuracy Test
Figure 5.3
Precision is illustrated by the size of the green outline (6m x 12m) of the video picks (red spots), after offsets are applied (red lines) to correct for pilot error.
target location
100
050
000
45°26'34"N
75°07'42"W
75°07'33"W

5.4 FIGURE OF MERIT (FOM)

The figure of merit is the measurement of the ability of the compensation system to remove the effects of aircraft maneuvers from the total field data. During the FOM test the aircraft is flown into a quiet magnetic area and put through a series of pitches ($\pm 5^o$), rolls ($\pm 10^o$) and yaws ($\pm 5^o$) to examine the noise remaining in the signal after the 27 term automatic compensation algorithm has been applied to the data.

	Figure of Merit			
Aircraft:		Cessna Caravan		
Registration:		C-FZLK		
Magnetometer:		Cesium vapor, stinger mounted		
Sampling Rate:		10 Hz		
Date:		December 2, 2000		
Location:		Bishop, California		
HEADING	MANOEUVER	VALUE (nT)	HEADING TOTAL (nT)	
NORTH	PITCH	0.18		
	ROLL	0.08		
	YAW	0.06	0.32	
EAST	PITCH	0.12		
	ROLL	0.07		
	YAW	0.08	0.27	
SOUTH	PITCH	0.08		
	ROLL	0.06		
	YAW	0.04	0.18	
WEST	PITCH	0.08		
	ROLL	0.06		
	YAW	0.06	0.20	
		FOM VALUE	0.97	nT
AVERAGE MANEUVER NOISE (FOM / 12)			0.08	nT

Table 5.4 C-FZLK Figure of Merit

5.5 ALTIMETER CALIBRATION

On November 24, 2000, the radar, barometric, and GPS altimeters were compared by flying at terrain clearances of 200', 300', 400', 500', 600', 800', and 1000' over a flat portion of the Ottawa river. The results reconfirmed that all altimeters aboard C-FZLK are functioning normally.

6. FINAL DATA PROCESSING

Final data reduction was undertaken at the Fugro Airborne Surveys processing center in Ottawa, Canada between January and February, 2001. In general, final processing consisted of the following operations:

- final levelling of the total field magnetic data;
- image and 1:100,000 scale map analysis of the total field and levelling compensations by a geophysicist for any residual levelling or positioning errors or gridding artifacts;
- correction of errors;
- final gridding and micro-levelling;
- imaging and plotting of magnetic field;
- gridding of radar altimeter data
- archiving of final data.

The final projection is Universal Transverse Mercator, using the NAD27 (Clarke 1866) spheroid. The datum shift from WGS 84 to Clarke 1866 (NAD27) was x = 8 m, y = -160 m, z = -176 m. The false easting is 500,000 m, false northing is 0 m, scale factor is 0.9996 and the central meridian is 117^{o} West.

Further details of the magnetic processing are provided below.

6.1 Noise Editing

An automatic editing routine, employing 4th differences of the magnetic field, removed nulls and spikes down to the noise level, and located abrupt level shifts.

6.2 Noise Filtering

We filtered all data in the frequency domain with a cutoff 0.061 (wavelengths per sample interval) rolloff 0.030 (wavelengths per sample interval). This filter approaches 100% removal of anomalies of wavelength 99 metres (13.2 samples x average speed of 7.5 metres/sample) or less. It approaches 0% removal of anomalies of wavelength 163 metres (21.7 samples x average speed of 7.5 metres/sample) or more. This filter should have no effect on any real, geological-source anomalies; or even the narrowest anomaly from cultural sources on the ground surface. The minimum ground clearance is about 150 metres (rarely encountered) and the minimum wavelength produced at 150 metres is roughly 2 x 150 = 300 metres. Thus all real wavelengths are a safe distance from the effective limit of the filter (163 metres).

In the relatively quiet magnetic field recorded at high ground clearance over the valleys (flight lines 101 to 167) a slightly longer wavelength noise was found – beyond the limit of the aforementioned filter. There were several days of high wind turbulence; and noise from sudden aircraft maneuvers can reach 4 second periods. Thus, a wider filter was applied to these lines: cutoff 0.0193, rolloff 0.0100. This frequency domain filter achieves near 100% removal of periods up to 4.1 seconds; and its effect is near 0% at wavelengths of 524 metres or more. The ground clearance was sufficient to ensure that all real wavelengths would significantly exceed 524 metres; and this was verified by extensive examination of profile data before and after filtering. To reduce the likelihood of this filter change being visible in any derivative image, a

block of adjacent, high-ground-clearance lines (169 to 339) was smoothed with a third frequency domain filter (cutoff 0.0313, rolloff 0.0160), intermediate between the other two. As before, the ground clearance was sufficient to ensure that all real wavelengths would significantly exceed the effective limit of the filter (322 metres); and this was verified by extensive examination of profile data before and after filtering.

6.3 Diurnal Subtraction

A test was made to verify the effectiveness of diurnal subtraction: Long period diurnal variations were subtracted from the air data, as they are more likely to correlate, and the residual magnetic field was leveled. As no improvement was noted in the required levelling compensations, diurnal subtraction was not employed.

6.4 IGRF Correction

The IGRF regional value was calculated using the 1995 model updated to the mid-survey date (2000.9) using the corrected GPS elevations. Using the actual elevations for IGRF correction has the added benefit of correcting for the magnetic effect of altitude variations within the Earth's primary field. Corrections for vertical movements within the secondary magnetic field induced by the Earth's crust is discussed in the following section, 6.5.

6.5 Upward/Downward Continuation

As the terrain clearance drops, the vertical magnetic gradients can become very high; and even minor deviations from the prescribed drape surface may produce significant changes in the measured magnetic field. The Taylor Expansion[1] applies the required upward and downward continuations to the magnetic field to simulate measurements from the prescribed altitude. The resulting magnetic field profiles were input to the levelling process.

6.6 Levelling

The lines (traverse lines) and tie-lines (control lines) of an aeromagnetic survey form a network, and the points where they cross are called intersections. At each intersection the magnetic values should be identical. In practice they differ as a result of:

- time variations of the magnetic field;
- heading effects;
- altitude differences;
- position errors;
- cultural or instrument noise.

In the levelling process, it is assumed that most of the required level adjustments will vary smoothly along each line or tie-line. The network of line minus tie-line differences at the intersections is analyzed to produce a matrix of misclosures. These misclosures were reduced to zero through an iterative process of tilting the profile baselines and moving the intersection locations. Compensation values applied at adjacent tie-lines were not allowed to differ by more than 5 nT. Intersection movements were restricted to a maximum of 4 samples (about 30

[1] Pilkington, M., and Thurston, J. B., 2001. *Draping corrections for aeromagnetic data: line versus grid based approaches*; Exploration Geophysics, in press.

metres). These maximums were very rarely required. Of the 6,717 intersections, less than 87 could not be closed with these compensations. These intersections were carefully checked and corrected manually.

6.7 Gridding

Gridding was done by the Akima method, using data from all lines and tie-lines. A gridding interval of 1/3 the line spacing was used (133 m).

6.8 Grid Levelling

The final stage of levelling consisted of applying a grid-levelling routine to the gridded data to remove small residual errors that are not properly removed by conventional levelling of the line data[2]

[2] Minty, B.R.S., 1991*: Simple micro-levelling for aeromagnetic data*; Exploration Geophysics, v.22, p. 591-592.

7. DELIVERABLES

7.1 MAPS

Two copies of the magnetic field contour map are presented at 1:100,000 scale with UTM registration plus screened flight path, in black and white, on mylar.

7.2 REPORT

This report covers data acquisition and processing, and is provided in two hard copies plus a digital archive in *Microsoft Word* format.

7.3 DIGITAL ARCHIVES

Files: raw and final processed profile data, and final magnetic and radar altitude grids;
Format: The ASCII format is used for profiles, and *Geosoft* binary format is used for grids. A full format description is included in the appendix .
Media: CD-ROM.
Copies: two

We trust this survey will assist your mapping program; and we remain available for questions at any time.

Respectfully Submitted,

Brian Schacht P. Geoph.

APPENDIX

DIGITAL ARCHIVE FORMAT DESCRIPTOR

DIGITAL ARCHIVE DESCRIPTION OF PROFILE DATA

Digital Archive is Ascii.
Ascii filename: **nevada.archive**
250 bytes I 10 format

```
       1-10 Line number X 100 + part number
      11-20 Flight number
      21-30 Latitude   NAD27 (decimal degrees)
      31-40 Longitude
      41-50 UTM metres NAD27 (CM 117 degrees west)
      51-60 UTM metres
      61-70 Latitude   WGS84 (decimal degrees)
      71-80 Longitude
      81-90 UTM metres WGS84 (CM 117 degrees west)
     91-100 UTM metres
    101-110 Fiducial (seconds UTC X 10 increments by 1)
    111-120 Date (ddmmyy)
    121-130 Radar (m X 100)
    131-140 Baro  (m X 100)
    141-150 GPS elevation (m X 100)
    151-160 Diurnal (.001 nT)
    161-170 Raw Magnetics (.001 nT) edited, lag applied.
    171-180 Filtered Magnetics (.001 nT)
    181-190 Filtered Magnetics - I.G.R.F. (.001 nT)
    191-200 I.G.R.F. (2000.9)
    201-210 Differential Up/Down corr. Magnetics (.001 nT)
    211-220 Levelled Magnetics (.001 nT)
    221-230 Final Magnetics (.001 nT)
    231-240 Compensation (.001 nT) from TL levelling
    241-250 Compensation (.001 nT) from micro levelling
```

Fugro Airborne Survey’s direction codes are as follows:

1: Northbound
2: Eastbound
3: Southbound
4: Westbound

The archive file contains the following lines:

ARCHIVE FILE: **nevada.archive**

LINE-ID	DIR	FST-FID (X10)	LST-FID (X10)	TAPE	BLOCK	REC	SAMPLES
10101	3	70026	70106	1	1	1	801
10301	1	70252	70339	1	802	1	871
10501	3	70515	70606	1	1673	1	911
10701	1	70726	70822	1	2584	1	961
10901	3	70945	71048	1	3545	1	1031

11101	1	71179	71286	1	4576	1	1071
11301	3	71438	71565	1	5647	1	1271
11502	1	76602	76709	1	6918	1	1071
11701	3	59673	59773	1	7989	1	1001
11901	1	59906	60011	1	8990	1	1051
12101	3	60146	60248	1	10041	1	1021
12301	1	60376	60490	1	11062	1	1141
12501	3	60627	60739	1	12203	1	1121
12701	1	60871	60994	1	13324	1	1231
12901	3	61131	61250	1	14555	1	1191
13101	1	61378	61510	1	15746	1	1321
13301	3	61655	61781	1	17067	1	1261
13502	3	76791	76927	1	18328	1	1361
13701	3	62202	62336	1	19689	1	1341
13901	1	62456	62604	1	21030	1	1481
14101	3	62759	62899	1	22511	1	1401
14301	1	63029	63178	1	23912	1	1491
14501	3	63330	63485	1	25403	1	1551
14702	1	77077	77252	1	26954	1	1751
14901	3	63937	64095	1	28705	1	1581
15101	1	64227	64401	1	30286	1	1741
15301	3	64739	64905	1	32027	1	1661
15501	1	65036	65213	1	33688	1	1771
15701	3	65363	65537	1	35459	1	1741
15901	1	65666	65853	1	37200	1	1871
16102	3	77382	77558	1	39071	1	1761
16301	1	66297	66486	1	40832	1	1891
16501	3	66643	66830	1	42723	1	1871

16701	1	66955	67157	1	44594	1	2021
16901	3	67308	67501	1	46615	1	1931
17101	1	67623	67829	1	48546	1	2061
17301	3	67986	68175	1	50607	1	1891
17501	1	68318	68522	1	52498	1	2041
17701	3	68949	69154	1	54539	1	2051
17901	1	69305	69509	1	56590	1	2041
18101	1	77097	77309	1	58631	1	2121
18301	3	77483	77679	1	60752	1	1961
18501	1	77823	78025	1	62713	1	2021
18701	3	78180	78377	1	64734	1	1971
18901	1	78528	78736	1	66705	1	2081
19101	3	78891	79091	1	68786	1	2001
19301	1	79269	79483	1	70787	1	2141
19501	1	78113	78319	1	72928	1	2061
19701	3	78459	78658	1	74989	1	1991
19901	1	78807	79007	1	76980	1	2001
20101	3	56671	56896	1	78981	1	2251
20301	1	57068	57301	1	81232	1	2331
20501	3	57466	57694	1	83563	1	2281
20701	1	57880	58118	1	85844	1	2381
20901	3	58563	58793	1	88225	1	2301
21101	1	58968	59206	1	90526	1	2381
21301	3	59361	59602	1	92907	1	2411
21501	1	59762	59991	1	95318	1	2291
21701	3	60210	60434	1	97609	1	2241
21901	1	60589	60815	1	99850	1	2261
22101	3	60995	61209	1	102111	1	2141

22301	1	61369	61598	1	104252	1	2291
22501	3	61771	61995	1	106543	1	2241
22701	1	62142	62371	1	108784	1	2291
22901	3	62810	63049	1	111075	1	2391
23101	1	63210	63445	1	113466	1	2351
23301	3	63636	63879	1	115817	1	2431
23501	1	64037	64253	1	118248	1	2161
23701	3	64426	64656	1	120409	1	2301
23901	1	64808	65022	1	122710	1	2141
24101	3	65206	65430	1	124851	1	2241
24301	1	65593	65800	1	127092	1	2071
24501	3	65983	66197	1	129163	1	2141
24701	1	66340	66541	1	131304	1	2011
24901	3	66820	67034	1	133315	1	2141
25101	1	67174	67360	1	135456	1	1861
25301	3	67545	67736	1	137317	1	1911
25501	1	67876	68057	1	139228	1	1811
25701	1	74360	74519	1	141039	1	1591
25901	3	74676	74844	1	142630	1	1681
26101	1	74989	75136	1	144311	1	1471
26301	3	75286	75448	1	145782	1	1621
26501	1	75580	75721	1	147403	1	1411
26701	3	75875	76032	1	148814	1	1571
26902	1	77826	77967	1	150385	1	1411
27101	3	76464	76621	1	151796	1	1571
27301	1	76750	76876	1	153367	1	1261
27501	3	77035	77178	1	154628	1	1431
27701	1	77304	77423	1	156059	1	1191

27901	3	77568	77708	1	157250	1	1401
28101	1	77838	77948	1	158651	1	1101
28301	3	78092	78224	1	159752	1	1321
28501	1	78354	78458	1	161073	1	1041
28701	3	78627	78745	1	162114	1	1181
28901	1	78875	78974	1	163295	1	991
29101	3	79114	79230	1	164286	1	1161
29301	1	79355	79446	1	165447	1	911
29501	3	79588	79695	1	166358	1	1071
29701	1	79828	79916	1	167429	1	881
29901	3	80056	80166	1	168310	1	1101
30101	1	80289	80369	1	169411	1	801
30301	3	80515	80613	1	170212	1	981
30501	1	80736	80811	1	171193	1	751
30701	3	80953	81055	1	171944	1	1021
30901	1	81182	81261	1	172965	1	791
31101	3	81398	81494	1	173756	1	961
31301	1	81622	81701	1	174717	1	791
31501	3	81843	81939	1	175508	1	961
31701	1	82067	82142	1	176469	1	751
31901	3	82273	82370	1	177220	1	971
32101	1	82488	82563	1	178191	1	751
32301	3	82699	82798	1	178942	1	991
32501	1	82918	82991	1	179933	1	731
32701	3	83135	83232	1	180664	1	971
32901	1	83364	83441	1	181635	1	771
33101	3	83583	83680	1	182406	1	971
33301	1	83810	83886	1	183377	1	761

33501	3	74089	74192	1	184138	1	1031
33701	3	76673	76774	1	185169	1	1011
33901	3	58884	58980	1	186180	1	961
34101	1	57161	57677	1	187141	1	5161
34301	3	69985	70506	1	192302	1	5211
34501	1	76005	76513	1	197513	1	5081
34701	3	80461	81036	1	202594	1	5751
34901	3	79681	80180	1	208345	1	4991
35101	1	58460	59065	1	213336	1	6051
35302	1	55198	55802	1	219387	1	6041
35501	3	68335	68939	1	225428	1	6041
35701	1	73472	73968	1	231469	1	4961
35901	3	84018	84555	1	236430	1	5371
36101	1	81171	81684	1	241801	1	5131
36301	3	81886	82457	1	246932	1	5711
36501	1	82608	83136	1	252643	1	5281
36701	3	83353	83938	1	257924	1	5851
36901	1	84190	84622	1	263775	1	4321
36902	1	75887	76000	1	268096	1	1131
37101	3	84820	85421	1	269227	1	6011
37301	1	85675	86230	1	275238	1	5551
37501	3	86433	87050	1	280789	1	6171
37701	1	84660	85143	1	286960	1	4831
37901	3	85293	85844	1	291791	1	5511
38101	1	57165	57722	1	297302	1	5571
38301	3	58326	58982	1	302873	1	6561
38501	1	59179	59738	1	309434	1	5591
38701	3	60079	60699	1	315025	1	6201

38901	1	60885	61458	1	321226	1	5731
39101	3	61619	62216	1	326957	1	5971
39301	1	62379	62978	1	332928	1	5991
39501	3	63147	63751	1	338919	1	6041
39701	1	63920	64506	1	344960	1	5861
39901	3	64864	65484	1	350821	1	6201
40101	1	65667	66254	1	357022	1	5871
40301	3	66477	67099	1	362893	1	6221
40501	1	67263	67844	1	369114	1	5811
40701	3	67992	68615	1	374925	1	6231
40901	1	68794	69365	1	381156	1	5711
41101	3	68735	69297	1	386867	1	5621
41301	1	67960	68587	1	392488	1	6271
41501	3	67214	67792	1	398759	1	5781
41701	1	66440	67039	1	404540	1	5991
41901	3	65693	66257	1	410531	1	5641
42101	1	63690	64294	1	416172	1	6041
42301	3	62946	63515	1	422213	1	5691
42501	1	62159	62784	1	427904	1	6251
42701	3	61393	62002	1	434155	1	6091
42901	1	60582	61209	1	440246	1	6271
43101	3	59844	60404	1	446517	1	5601
43301	1	58825	59427	1	452118	1	6021
43501	3	58106	58663	1	458139	1	5571
43701	1	57214	57817	1	463710	1	6031
43901	3	86452	86986	1	469741	1	5341
44101	1	85795	86310	1	475082	1	5151
44301	3	85148	85672	1	480233	1	5241

44501	1	84493	85006	1	485474	1	5131
44701	3	83607	83740	1	490605	1	1331
44702	3	83945	84374	1	491936	1	4291
44901	1	82954	83477	1	496227	1	5231
45101	3	82281	82830	1	501458	1	5491
45301	1	81623	82141	1	506949	1	5181
45501	3	80938	81489	1	512130	1	5511
45701	1	80282	80793	1	517641	1	5111
45901	3	79611	80151	1	522752	1	5401
46101	1	78961	79472	1	528153	1	5111
46301	3	78169	78707	1	533264	1	5381
46501	1	77309	77825	1	538645	1	5161
46701	3	76639	77188	1	543806	1	5491
46901	1	75993	76510	1	549297	1	5171
47101	3	75309	75864	1	554468	1	5551
47301	1	74674	75180	1	560019	1	5061
47501	3	68251	68918	1	565080	1	6671
47701	1	67511	68067	1	571751	1	5561
47901	3	66753	67350	1	577312	1	5971
48101	1	65852	66416	1	583283	1	5641
48301	3	65084	65713	1	588924	1	6291
48501	1	64339	64921	1	595215	1	5821
48701	3	63565	64194	1	601036	1	6291
48902	3	56419	56988	1	607327	1	5691
49101	3	62089	62702	1	613018	1	6131
49301	1	61160	61745	1	619149	1	5851
49501	3	60379	61007	1	625000	1	6281
49701	1	59622	60208	1	631281	1	5861

49901	3	58880	59477	1	637142	1	5971
50101	1	58113	58711	1	643113	1	5981
50301	3	57360	57973	1	649094	1	6131
50502	1	55650	56306	1	655225	1	6561
50701	3	86365	86886	1	661786	1	5211
50901	1	85708	86234	1	666997	1	5261
51101	3	84741	85278	1	672258	1	5371
51301	1	84094	84613	1	677629	1	5191
51501	3	83440	83969	1	682820	1	5291
51701	1	82784	83311	1	688111	1	5271
51901	3	82117	82657	1	693382	1	5401
52101	1	81471	81991	1	698783	1	5201
52301	3	80808	81348	1	703984	1	5401
52501	1	80147	80662	1	709385	1	5151
52701	3	79495	80021	1	714536	1	5261
52901	1	79110	79360	1	719797	1	2501
52903	3	79360	79658	1	722298	1	2981
53101	3	78167	78702	1	725279	1	5351
53301	1	77507	78030	1	730630	1	5231
53501	3	76839	77368	1	735861	1	5291
53701	1	76450	76713	1	741152	1	2631
53702	3	70320	70631	1	743783	1	3111
53901	3	75528	75790	1	746894	1	2621
53902	3	80280	80582	1	749515	1	3021
54101	1	74865	75386	1	752536	1	5211
54301	3	74199	74729	1	757747	1	5301
54501	1	73531	74044	1	763048	1	5131
54701	3	68288	68893	1	768179	1	6051

54901	1	67508	68083	1	774230	1	5751
55101	3	66736	67363	1	779981	1	6271
55301	1	65843	66408	1	786252	1	5651
55501	3	65035	65704	1	791903	1	6691
55701	1	64273	64842	1	798594	1	5691
55901	3	63493	64111	1	804285	1	6181
56101	1	62492	63079	1	810466	1	5871
56301	3	61683	62335	1	816337	1	6521
56501	1	60931	61507	1	822858	1	5761
56701	3	60128	60789	1	828619	1	6611
56901	1	59406	59955	1	835230	1	5491
57101	3	58361	59002	1	840721	1	6411
57301	1	57630	58180	1	847132	1	5501
57501	3	56850	57477	1	852633	1	6271
57701	1	56116	56670	1	858904	1	5541
57901	3	86163	86646	1	864445	1	4831
58101	1	85492	86034	1	869276	1	5421
58301	3	84865	85350	1	874697	1	4851
58501	1	84201	84745	1	879548	1	5441
58701	3	83572	84064	1	884989	1	4921
58901	1	82879	83429	1	889910	1	5501
59101	3	82018	82520	1	895411	1	5021
59301	1	81344	81891	1	900432	1	5471
59501	3	80713	81201	1	905903	1	4881
59701	1	80028	80576	1	910784	1	5481
59901	3	79396	79883	1	916265	1	4871
60101	1	78714	79266	1	921136	1	5521
60301	3	78022	78514	1	926657	1	4921

60501	1	77359	77899	1	931578	1	5401
60701	3	76704	77203	1	936979	1	4991
60901	1	76030	76320	1	941970	1	2901
60902	3	69813	70100	1	944871	1	2871
61101	3	75347	75857	1	947742	1	5101
61301	1	74647	75194	1	952843	1	5471
61501	3	69643	70238	1	958314	1	5951
61701	1	68880	69489	1	964265	1	6091
61901	3	67874	68482	1	970356	1	6081
62101	1	66893	67501	1	976437	1	6081
62301	3	66137	66729	1	982518	1	5921
62501	1	65146	65746	1	988439	1	6001
62701	3	64384	64985	1	994440	1	6011
62901	1	63499	64093	1	1000451	1	5941
63101	3	76094	76696	1	1006392	1	6021
63301	1	75068	75679	1	1012413	1	6111
63501	3	74234	74909	1	1018524	1	6751
63701	1	73441	74059	1	1025275	1	6181
63901	3	72641	73269	1	1031456	1	6281
64101	3	85335	85972	1	1037737	1	6371
64301	1	84493	85170	1	1044108	1	6771
64501	3	83720	84316	1	1050879	1	5961
64701	1	82860	83515	1	1056840	1	6551
64901	3	81936	82520	1	1063391	1	5841
65101	1	81102	81769	1	1069232	1	6671
65301	3	80341	80924	1	1075903	1	5831
65501	1	79490	80134	1	1081734	1	6441
65701	1	77666	78315	1	1088175	1	6491

65901	3	58249	58880	1	1094666	1	6311
66101	1	57440	58076	1	1100977	1	6361
66301	3	77010	77621	1	1107338	1	6111
66501	1	76125	76829	1	1113449	1	7041
66701	3	75133	75745	1	1120490	1	6121
66901	1	74301	74956	1	1126611	1	6551
67101	3	73186	73865	1	1133162	1	6791
67301	1	72350	73006	1	1139953	1	6561
67501	3	71117	71785	1	1146514	1	6681
67701	1	70291	70956	1	1153195	1	6651
67901	3	69471	70104	1	1159846	1	6331
68101	1	68651	69294	1	1166177	1	6431
68301	3	67639	68294	1	1172608	1	6551
68501	1	66862	67483	1	1179159	1	6211
68701	3	66067	66690	1	1185370	1	6231
68901	1	65324	65908	1	1191601	1	5841
69101	3	64254	64874	1	1197442	1	6201
69301	1	63538	64111	1	1203643	1	5731
69501	3	62730	63346	1	1209374	1	6161
69701	1	62000	62576	1	1215535	1	5761
69901	3	85972	86556	1	1221296	1	5841
70101	1	85324	85844	1	1227137	1	5201
70301	3	84589	85159	1	1232338	1	5701
70501	1	83911	84423	1	1238039	1	5121
70701	3	83175	83742	1	1243160	1	5671
70901	1	82505	83019	1	1248831	1	5141
71101	3	81511	82032	1	1253972	1	5211
71301	1	80936	81396	1	1259183	1	4601

71501	3	80256	80765	1	1263784	1	5091
71701	1	79697	80138	1	1268875	1	4411
71901	3	79033	79515	1	1273286	1	4821
72101	1	78453	78869	1	1278107	1	4161
72301	3	77568	78017	1	1282268	1	4491
72501	1	77022	77412	1	1286759	1	3901
72701	3	76406	76823	1	1290660	1	4171
72901	1	75831	76212	1	1294831	1	3811
73101	3	75239	75645	1	1298642	1	4061
73301	1	74632	75002	1	1302703	1	3701
73502	3	66293	66693	1	1306404	1	4001
73702	1	65675	66067	1	1310405	1	3921
73902	3	65035	65478	1	1314326	1	4431
74102	1	64386	64785	1	1318757	1	3991
74303	3	63620	64052	1	1322748	1	4321
74503	1	63023	63415	1	1327069	1	3921
500102	2	61915	62736	1	1330990	1	8211
500301	4	65300	66006	1	1339201	1	7061
500501	2	67035	67700	1	1346262	1	6651
500701	4	62953	63618	1	1352913	1	6651
500901	2	63740	64370	1	1359564	1	6301
501101	4	59654	60375	1	1365865	1	7211
501301	4	64520	65169	1	1373076	1	6491
501501	2	65290	65925	1	1379567	1	6351
501701	2	60576	61271	1	1385918	1	6951
501901	4	66012	66674	1	1392869	1	6621
502101	2	66793	67420	1	1399490	1	6271
502301	4	61575	62300	1	1405761	1	7251

502501	4	67500	68154	1	1413012	1	6541
502701	2	68268	68911	1	1419553	1	6431
502901	2	62573	63280	1	1425984	1	7071
503101	4	69013	69648	1	1433055	1	6351
503301	2	69775	70402	1	1439406	1	6271
503501	4	63456	64152	1	1445677	1	6961
503701	4	70537	71127	1	1452638	1	5901
503901	2	71255	71811	1	1458539	1	5561
504101	2	64310	64978	1	1464100	1	6681
504301	4	71915	72471	1	1470781	1	5561
504501	2	72595	73154	1	1476342	1	5591
504701	4	65177	65868	1	1481933	1	6911
504901	4	73253	74056	1	1488844	1	8031
505101	2	74167	74957	1	1496875	1	7901
505301	2	66375	67301	1	1504776	1	9261
505501	4	75056	75908	1	1514037	1	8521
505701	4	76466	76731	1	1522558	1	2651
505901	2	68908	69214	1	1525209	1	3061
506101	2	76836	77083	1	1528270	1	2471
506301	4	77253	77473	1	1530741	1	2201
506501	4	69426	69666	1	1532942	1	2401
506701	4	67706	68696	1	1535343	1	9901
506901	2	76053	76324	1	1545244	1	2711
507101	3	77751	77955	1	1547955	1	2041
507301	1	81025	81272	1	1549996	1	2471
507501	3	79185	79340	1	1552467	1	1551

DIGITAL ARCHIVE DESCRIPTION OF GRID DATA

CLIENT	U.S.G.S
NAME OF SURVEY	AEROMAGNETIC SURVEY of **WESTERN NEVADA**
AREA NAME	**EXCELSIOR MOUNTAINS, SOUTHERN WASSUK RANGE and EXCELSIOR ADD-ON**
CONTRACTOR	FUGRO AIRBORNE SURVEYS
JOB CODE	655
GRID ARCHIVE NAME	NEVADA_TF.GRD
FORMAT	GEOSOFT BINARY GRID
CONTENT	**TOTAL MAGNETIC INTENSITY**
CREATION DATE	February 15, 2001
NUMBER of ROWS and COLUMNS	640 1024
PIVOTAL POSITION (X,Y)	331087 4212084
CELL SIZE	83m
UNIT	nT
UNIT FACTOR	0.001
MINIMUM VALUE (nT)	-555.284
MAXIMUM VALUE (nT)	846.571
MEAN VALUE (nT)	-71.181

GRID ARCHIVE NAME	NEVADA_RADAR.GRD
FORMAT	GEOSOFT BINARY GRID
CONTENT	**RADAR**
CREATION DATE	March 7, 2001
NUMBER of ROWS and COLUMNS	640 1024
PIVOTAL POSITION (X,Y)	331087 4212167
CELL SIZE	83m
UNIT	m
UNIT FACTOR	0.01
MINIMUM VALUE (m)	157
MAXIMUM VALUE (m)	1217 (instrument maximum)
MEAN VALUE (m)	536

PROJECTION INFORMATION :

DATUM	NAD27
SHEROID	CLARKE 1866
PROJECTION	UTM
CENTRAL MERIDIEN	117 West
FALSE EASTING	500000 m
FALSE NORTHING	0 m
SCALE FACTOR	0.9996