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National Uranium Resource Evaluation

**Airborne Gamma-Ray Spectrometer
And Magnetometer Survey;
North/South Tieline**

Final Report - Volume I

**Aero Service Division
Western Geophysical Company of America
Houston, Texas 77001**

May 1981

**PREPARED FOR U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
Grand Junction Office, Colorado**

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AIRBORNE GAMMA-RAY SPECTROMETER
AND
MAGNETOMETER SURVEY

NORTH/SOUTH TIE LINE
AIRBORNE SURVEY

FINAL REPORT
VOLUME I

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AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA
HOUSTON, TEXAS

MAY, 1981

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INTRODUCTION

During a three day period late in October, 1980, Aero Service Division Western Geophysical Company of America conducted a airborne high sensitivity gamma-ray spectrometer and magnetometer survey along the 99° longitude meridian from the Canadian border southward to the Mexican border. A total of 1555 line miles of geophysical data were acquired and, subsequently, compiled.

The north-south tieline was flown and this report is a result of work performed under Bendix Field Engineering Corporation Subcontract No. 80-449-L, Project No. IGO207-Project C, as part of the National Uranium Resources Evaluation. NURE is a program of the U. S. Department of Energy's Grand Junction, Colorado, office to acquire and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States.

The data were reduced and compiled in accordance with all applicable technical specifications of the contract as stated in BFEC 1200-C and BFEC 1250-A. The parameters used in the processing of the radiometric data have been substantiated in a previously submitted calibration report of the Douglas DC-3 installed airborne gamma-ray spectrometer system.

DATA ACQUISITION

Aircraft

The survey was conducted using a Douglas DC-3 fixed wing aircraft, registration N5000E, owned and operated by Aero Service Division Western Geophysical Company of America. The flight crew consisted of a pilot, a navigator and an electronic operator. Some of the more pertinent characteristics and specifications of the aircraft are listed below:

T A B L E I

Aircraft Specifications and Characteristics

Aircraft	Douglas DC-3 - N5000E
Power Plant	2 ea. - Pratt Whitney - R1830-94 Engines, Twin Row, Radial - 1,350 H. P.
Allowable Gross Weight	26,900 lbs.
Empty Weight - Survey Configuration .	23,000 lbs.
Avionics - Dual RT41A VHF Comm Transceiver	
Dual Collins 51V VOR/LOC/RMI Receiver	
Dual Collins Glide Scope Receiver	
1 KDM 705 DME	
1 KXP 750 Transponder	
1 618T3B H.F. Transceiver	
Sperry A-12 Autopilot System	
Bendix Doppler Navigation System	
Honeywell Radar Altimeter	
Cruise Airspeed	120 to 165 M.P.H.
Rate of Climb	1,200 f.p.m.
Service Ceiling	24,000 Feet
Fuel	100/130 Octane
Fuel Consumption	Approx. 100 Gal. Per Hour

Gamma-Ray Spectrometer System

The survey was carried out using Aero Service's HISENS A(irborne) G(amma)-R(ay) S(pectrometer) 3000F system, shown in block diagrammatic form in Figure 2, page 8.

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AERO SERVICE DIVISION
WESTERN GEOPHYSICAL
HOUSTON, TEXAS 77042

DWN
CHKD
APVD *al/m*

DATE
12/78

TITLE
BLOCK DIAGRAM.
HISENS AGRS 3000F SYSTEM

SIZE
B

DRAWING NO
230-548-002

REV SH

16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

The primary detector package consists of 14 logs of 4" x 4" x 15" of Polyscin®, NaI(Tl), each log hermetically sealed in a stainless steel container and coupled to a high quality photo-multiplier tube. The logs are assembled in 3 slabs of respectively 4, 4 and 6 logs each. Each slab is enclosed in a heated and thermally stabilized container. Total volume of the primary detector is 3360 cubic inches (55.06 liters). The upward looking (2π) detector consists of two 4" x 4" x 16" logs of Polyscin®, NaI(Tl), also hermetically sealed in a steel container and coupled to high quality photo-multiplier tubes. The two logs are enclosed as a slab in the same container that houses the slab of 6 logs of Polyscin®. The upward looking crystals are mounted on top of the 4π sensor, separated by a 0.75" slab of lead shielding, in order to obtain the prescribed shielding effect of 85% @ 3000KeV.

The preamplifiers, which with the photo-multipliers provide virtually the total signal amplification, are also enclosed in the thermally stabilized packages, to ensure maximum signal stability. The output of the preamplifiers is fed into the amplifiers, whose main function is to shape the incoming pulses into a bipolar gaussian form.

The mixer/router, the 50 MHz Wilkinson ramp analog to digital converter and the multi-channel analyzer of both the primary and 2π spectrometer systems are commercially available units, supplied by Canberra Industries. The data from the two spectrometers are output to the data controller, formed by a Hewlett Packard 21 MX minicomputer system, which stores the data, formats them, outputs them on tape and compares the tape recorded data with the data stored in memory. Additional data recorded on tape are radar altitude, barometric pressure, atmospheric temperature, magnetometer data, real time, gamma-ray spectrometer system live-time and other ancillary data such as additional navigational data. Two tape drives were employed and automatic switching between the two occurs as each tape ends. Additional ancillary equipment includes a cathode ray tube display, a Clevite Brush 6-channel analog recorder and a 35mm frame camera, triggered by the data controller at a preset interval.

Magnetometer

The magnetic sensor used for the survey was a Geometrics G-803 proton free-precession magnetometer, housed in a high-drag, fiberglass bird and towed approximately 100' behind and 25' below the aircraft, in order to assure reliable data with minimal aircraft compensation.

PRODUCTION SUMMARY

The north-south tieline, running from the U.S./Canada border south to the border with Mexico, was surveyed at the end of a Subcontract No. 80-449-L which also included operations over eleven (11) quadrangles located in Minnesota and Wisconsin, seven (7) quadrangles in North and South Dakota, and twelve (12) quadrangles in northernmost Alaska.

The tieline was flown along the 99° west longitude meridian, crossing twenty-three (23) 2° x 1° NTMS quadrangles from the Devil's Lake, North Dakota, quadrangle southward to the McAllen, Texas, quadrangle (see Index Diagram, Frontispiece). A total of 1555 line miles of high sensitivity gamma-ray spectrometer and magnetometer data were acquired.

Acquisition of the data was completed over two flights, one each on the 28th and 30th of October, 1980, (see Table II, below).

TABLE II

Daily Production Summary

<u>Date</u>	<u>Base</u>	<u>Activity</u>	<u>Flight No.</u>
10/28/80	Fargo, North Dakota Pratt, Kansas	Begin Production 49° to 37°30"	72
10/29/80	Pratt, Kansas	No flight, re-stabilize crystal packages	—
10/30/80	Pratt, Kansas	Complete Production 37°30" to 26°15"	73

Production averaged 116.6 miles per hour of flight time. An average of 777.5 miles of data was acquired per production day and per flight.

The nominal terrain clearance for the survey was 400 feet. Figure 3 shows a histogram of the terrain clearance of the aircraft as recorded by the radar altimeter. The histogram takes into account all final samples in this quadrangle. The mean terrain clearance, as observed, is approximately 420 feet. The ground speed of the aircraft, as determined from the distances between samples based on their final X-Y positions, is depicted in graphic form in the histogram of Figure 4, page 13.

AERC SERVICE
 QUAD NORTH/SOUTH TIELINE

TERRAIN CLEARANCE HISTOGRAM
 JOB 624

-12-

Figure 3

AERC SERVICE
QUAD NORTH/SOUTH TIELINE

GROUND SPEED
JOB 624

HISTOGRAM

NUMBER OF DATA POINTS

13/14

PILES
PER
HOUR

Figure 4

DATA REDUCTION

The data reduction process as used in the processing of the airborne gamma-ray spectrometer and magnetometer data obtained within the Department of Energy (DOE) National Uranium Resource Evaluation (NURE) program is shown in flow chart form in Figure 5, page 16.

Upon arrival in the Houston office, the digital data are edited and a back-up tape is generally produced. The EDIT consists partly of a data quality check, enabling the elimination of single record spikes in any field, outside a specified preselected limit. The EDIT program further checks for data continuity and flags all data acquired at terrain clearances exceeding the survey specification. The EDIT further sums a preselected number of spectral records at the beginning and end of each survey line and fits a gaussian curve to diagnostic photopeaks, such as the Tl^{208} peak at 2614.5 KeV and the K^{40} peak at 1460 KeV for low altitude lines and the annihilation peak at 511 KeV and the K^{40} peak at 1460 KeV for high altitude lines. The position of these photopeaks is determined with an accuracy of better than 0.1 of a channel and is used to determine the exact position of the energy windows with regard to channel numbers. At the same time the calculated standard deviations of the fitted gaussian curves serve to obtain the system resolution at the photopeaks used. The window count rates are normalized for live time and are calculated as follows:

K	: 1362 KeV - 1566 KeV (Channel 114 → 130, @ 12 KeV/Channel)
U	: 1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel)
T	: 2406 KeV - 2826 KeV (Channel 201 → 235, @ 12 KeV/Channel)
T.C.	: 390 KeV - 2982 KeV (Channel 33 → 248, @ 12 KeV/Channel)
Cosmic	: 2994 KeV - 6138 KeV (Channel 250 → 512, @ 12 KeV/Channel)
$\text{U}_{2\pi}$	: 1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel)

The above channel numbers are valid only if system gain corresponds exactly to 12 KeV per channel and there is no zero shift.

The CORRECT program applies the background and cosmic corrections to the single record window count rates, corrects the data for Compton scatter and atmospheric radon, and normalizes the terrain clearance. Background count rates and cosmic factors were determined from high altitude test data acquired over the Pacific Ocean, offshore California.

Potassium Background	=	32.01 counts per second
Uranium Background	=	10.09 counts per second
Thorium Background	=	6.86 counts per second
Total Count Background	=	278.04 counts per second
2 π Bismuth Background	=	1.55 counts per second

Potassium Cosmic factor	=	0.20 c.p.s. per count 4 π cosmic
Uranium Cosmic factor	=	0.165 c.p.s./cps 4 π cosmic
Thorium Cosmic factor	=	0.22 c.p.s./cps 4 π cosmic
Total Count Cosmic factor	=	3.64 c.p.s./cps 4 π cosmic
2 π Bismuth Cosmic factor	=	0.0344 c.p.s./cps 4 π cosmic

The Compton scatter functions were determined from data obtained over the Grand Junction test pads, using the radiometric analysis of the bulk sample with natural water content.

$$\begin{aligned}T/U &= \tau = 0.076 \\U/T &= \alpha = 0.35 + 0.02 + 0.000076H \\K/T &= \beta = 0.44 \\K/U &= \gamma = 0.96\end{aligned}$$

The 2 π and 4 π uranium window count rates are related through the geometric or equivalency factor. For the present system, installed in the Douglas DC-3, this factor, $f = 6.0$. Part of the terrestrial radiation of energy higher than 1662 KeV - the lower threshold of the uranium window - is detected in the uranium window of the upward looking detector, due to incomplete shielding, skyshine and shine-around. This shine-through/shine-around effect is assumed to be a function of both the intensity of the terrestrial uranium and thorium radiation and of the aircraft terrain clearance. From multi-altitude data acquired over the Lake Mead Dynamic Test Range the shine-through/shine-around effect was determined for each altitude level. The data provided a best fit for a linear terrain clearance function as follows:

$$\text{shine-through/shine-around} = (0.05 - 3.8 \times 10^{-5}H) (U_{4\pi} + 0.35T_{4\pi})$$

The shine-through/shine-around corrected Blair Count rate is then:

$$U_{2\pi c} = \frac{U_{2\pi} - (U_{4\pi} + 0.35T_{4\pi}) (0.05 - 3.8 \times 10^{-5}H)}{1 - 6.0 (0.05 - 3.8 \times 10^{-5}H)}$$

The shine-through/shine-around correction is applied to the $U_{2\pi}$ count rate at each single record. The single record $U_{2\pi}$ count rates are then averaged over 35 records to make them statistically compatible with the data of the primary system. The atmospheric radon correction is applied to both the $U_{4\pi}$ and the Total Count count rates. The equivalency factor for the $U_{4\pi}/U_{2\pi} = 6.0$, for Total Count/ $U_{2\pi}$ it is 61.75.

Within the CORRECT program the data are normalized to a common datum of 400 feet terrain clearance. An exponential formula is used, based on an air column reduced to a standard temperature and pressure of 0°C and 760mm Hg. (32°F and 29.92" Hg). The air absorption coefficients used are those derived from the multiple altitude flight over the Lake Mead Dynamic Test Range for thorium, potassium and Total Count. The air absorption factor for uranium is obtained by straight interpolation between the potassium and thorium air absorption factors. Their values are respectively:

$$\begin{aligned}\mu_K &= 2.71 \times 10^{-3} \text{ per foot} \\ \mu_U &= 2.56 \times 10^{-3} \text{ per foot} \\ \mu_T &= 2.15 \times 10^{-3} \text{ per foot} \\ \mu_{TC} &= 2.16 \times 10^{-3} \text{ per foot}\end{aligned}$$

The formula used for the altitude normalization is:

$$N_{400} = N_H \cdot e^{\mu \left(400 - \frac{273}{273+t} \cdot \frac{P}{29.92} \cdot H \right)}$$

Where N_{400} , N_H are respectively the count rates at 400 feet and at altitude H, μ is air absorption factor, t is temperature in degrees Celsius and P is barometric pressure in inches Hg.

The last operation in the CORRECT program is the determination of statistical adequacy of the data. The criteria for adequacy of the data are based on the work of Lloyd A. Currie (op.cit.). A critical level is recognized, below which all observations made fail to detect a signal, i.e. 95% of all measurements fall within the "normal" distribution of "noise". The detection level is similarly defined as the level above which 95% of the measurements made fall within the normal Poisson distribution of "signal". Currie's critical level has been adopted as the count rate level below which data are inadequate. Data with count rates above the critical level but below

the detection level are considered marginal. Above the detection level data are considered adequate. For the single record data the formulas are then:

Count Rate ≤ 2.33 (Sum Corrections)^{1/2}: data inadequate

2.33 (Sum Corrections)^{1/2} < Count Rate $\leq 2.71 + 4.65$ (Sum Corrections)^{1/2}:
data marginal

Count Rate > $2.71 + 4.65$ (Sum Corrections)^{1/2}: data adequate

No ratios have been calculated involving inadequate data in either numerator or denominator. Ratios have been calculated when the data in the numerator are marginal, provided the data in the denominator are adequate.

The thorium, uranium and potassium data are subsequently averaged over 5 records in the SPECAVG program. The output is a spectrometer master tape containing both averaged and single record data.

Parallel with the radiometric data reduction process, the magnetic data are edited and processed. Using the established ground identities, flight paths are prepared. The reduced spectrometer data are then merged with the final X-Y position of the data points and the reduced magnetic data, and a master tape is produced with data that pertain to each 2° x 1° NTMS quadrangle only. The REGROUP program then eliminates all duplicate line segments, inserts reflight segments where required, orders the remaining line segments and renumbers the fiducials of these segments such that the resulting line is directionally consistent with location sequential sample numbers. The renumbered fiducials increase from south to north for tie lines. A listing relating the renumbered fiducials to the original fiducial numbers as recorded in flight is included in this volume as Appendix H and can also be found in the back of Volume II. This listing gives both the line number as it appears on all final data and the line number as recorded in flight. Similarly, the start and end fiducials of each final line and/or line segment shown on the flight path base map are given along with the corresponding start and end fiducials as recorded in flight. When correlated with the final fiducial numbers, the original fiducials will increase sequentially for lines flown south to north and decrease for lines flown in the opposite directions.

The output of REGROUP is the Final Spectrometer Master Tape, from which the radiometric and magnetic profiles, the flight path maps, and the averaged record and single record reduced data files, as delivered on magnetic tape and microfiche, are produced.

DATA PRESENTATION

General

The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles; and in map form as flight path maps.

The multiparameter profiles are presented with flight path maps in a separate bound volume. Complete data listings of both the reduced single record and the reduced averaged record data are found in the back of this report. The format of the printout of the microfiches and the format of the data files delivered on magnetic tape are in accordance with the specifications of the BFEC 1200-C and are described in appendices A through H of this report.

Radiometric Multiple-Parameter Stacked Profiles

The radiometric profiles have been prepared at the horizontal scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. Displayed are from top to bottom: total magnetic intensity, IGRF removed, in gammas; radar altimeter, in feet; ratio of eT concentration in ppm/potassium concentration in %; ratio of eU/K; eU/eT ratio, atmospheric radon (BIAC) in counts per second, equivalenced to the 4 π count rate; apparent concentration of terrestrial eT in ppm, apparent concentration of terrestrial eU in ppm; apparent concentration of potassium in %; "Total Count" count rate. Flags are indicated, where needed, below the base line of the corresponding parameter. A short flag indicates marginal data, including terrain clearances between 700 and 1000 feet, while a long flag indicates inadequate data. Fiducial markers are plotted every 200 records, along the top of the profile, every 10 records near the bottom. The flight path is shown on the bottom of both the radiometric and magnetic multiple-parameter stacked profiles below the lower fiducial markers.

Magnetic and Ancillary Parameter Stacked Profiles

The magnetic profiles have also been plotted at scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. The plotting sequence of the profiles is, from top to bottom: barometric pressure at aircraft altitude in mm Hg; atmospheric ambient temperature in degrees Celsius, terrain clearance in feet; total magnetic intensity, IGRF removed, in gammas. Fiducial markers are again plotted every 200 records along the top of the profiles, every 10 records near the bottom.

A P P E N D I X A

Format, Single Record Data Listing

REC NO.	LAT	LONG	RESID MAG	FERR CL	FLO	GENL UNIT	CUSH CPS	AIM CPS	TOTAL COUNT CPS	FLO	ETH PPM	FLG	EU PPM	FLO	K PLT	FLG	LU/ETH	EU/K	ETH/K	TEMP CELCIUS	BARO PRES MMHG
5079	64.0086	-160.9197	55305	763	MAR	W	31	1	-12	NAD	-1.1	NAD	-0.5	NAD	0.0	NAD	0.0	0.0	0.0	12.7	746.8
5080	64.0087	-160.9189	55305	751	MAR	W	28	1	36	MAR	0.0	NAD	0.1	NAD	0.1	NAD	0.0	0.0	0.0	12.7	747.1
5081	64.0087	-160.9176	55305	741	MAR	W	26	1	4	NAD	0.2	NAD	0.1	NAD	-0.1	NAD	0.0	0.0	0.0	12.7	747.4
5082	64.0088	-160.9166	55305	730	MAR	W	35	1	-60	NAD	0.0	NAD	0.3	NAD	-0.1	NAD	0.0	0.0	0.0	12.7	747.7
5083	64.0088	-160.9154	55305	722	MAR	W	26	1	-4	NAD	-2.7	NAD	2.3		-0.4	NAD	0.0	0.0	0.0	12.7	748.0
5084	64.0089	-160.9144	55305	712	MAR	W	28	1	-12	NAD	0.5	NAD	-1.7	NAD	0.0	NAD	0.0	0.0	0.0	12.7	748.1
5085	64.0099	-160.9131	55305	702	MAR	W	23	1	37	MAR	0.0	NAD	0.4	NAD	-0.3	NAD	0.0	0.0	0.0	12.7	748.5
5086	64.0090	-160.9121	55305	691		W	22	1	50		0.3	NAD	-0.1	NAD	0.0	NAD	0.0	0.0	0.0	12.7	748.8
5087	64.0091	-160.9109	55305	680		W	23	1	46		0.3	NAD	0.0	NAD	-0.0	NAD	0.0	0.0	0.0	12.7	749.1
5088	64.0092	-160.9099	55305	673		W	17	1	72		0.6	MAR	0.3	NAD	-0.3	NAD	0.0	0.0	0.0	12.8	749.3
5089	64.0092	-160.9087	55305	668		W	20	1	156		-1.6	NAD	0.7	MAR	-0.0	NAD	0.0	0.0	0.0	12.8	749.4
5090	64.0093	-160.9075	55304	666		W	32	1	113		0.0	NAD	0.6	MAR	0.0	NAD	0.0	0.0	0.0	12.8	749.4
5091	64.0093	-160.9064	55304	667		W	30	1	247		-0.2	NAD	0.6	MAR	0.1	NAD	0.0	0.0	0.0	12.8	749.3
5092	64.0094	-160.9052	55304	671		W	29	1	343		0.2	NAD	1.1		0.3		0.0	4.0	0.0	12.8	749.2
5093	64.0094	-160.9042	55304	679		W	23	1	659		2.9		-0.8	NAD	0.8		0.0	0.0	3.5	12.8	748.9
5094	64.0095	-160.9030	55304	683		W	34	0	965		3.2		1.4		0.8		0.5	1.9	4.1	12.9	748.5
5095	64.0096	-160.9017	55305	647		KS	24	0	1208		8.6		0.0	NAD	0.5		0.0	0.0	-18.3	12.9	748.1
5096	64.0096	-160.9007	55305	463		KS	12	0	945		2.5		1.7		0.5		0.7	3.5	5.2	12.9	747.8
5097	64.0098	-160.8995	55305	455		KS	20	0	831		3.0		1.5		0.6		0.5	2.8	5.5	12.9	747.6
5098	64.0098	-160.8985	55305	457		KS	22	0	759		2.2		1.4		0.3		0.8	5.1	8.1	12.9	747.1
5099	64.0099	-160.8973	55305	465		KS	29	0	699		1.7		2.0		0.5		1.1	4.4	4.1	12.9	746.5
5100	64.0100	-160.8962	55305	479		KS	28	0	610		0.5	NAD	1.3		0.4		0.0	3.7	0.0	12.9	746.1
5101	64.0100	-160.8950	55305	497		KS	26	0	581		2.2		0.5	MAR	0.3		0.2	1.6	7.0	12.9	746.0
5102	64.0101	-160.8940	55304	518		KS	35	0	512		1.3		-0.2	NAD	0.3		0.0	0.0	4.2	12.9	745.7
5103	64.0101	-160.8928	55303	540		KS	20	0	677		2.1		1.0		0.2		0.5	5.6	11.2	12.8	745.5
5104	64.0102	-160.8918	55303	569		KS	28	0	579		1.7		1.2		0.1	MAR	0.7	12.8	17.6	12.8	745.9
5105	64.0103	-160.8905	55304	608		KS	21	-1	611		3.2		3.1		0.0	NAD	1.0	0.0	0.0	12.8	745.6
5106	64.0103	-160.8895	55303	614		KS	16	-1	551		3.7		0.2	NAD	0.3		0.0	0.0	11.1	12.8	745.5
5107	64.0104	-160.8883	55304	595		KS	37	-1	488		1.6		2.4		0.1	MAR	1.5	18.6	12.5	12.8	745.4
5108	64.0105	-160.8873	55302	575		KS	22	-1	510		0.2	NAD	1.3		0.3		0.0	5.1	0.0	12.8	745.3
5109	64.0106	-160.8860	55304	552		KS	28	-1	437		0.0	NAD	1.0		0.1	MAR	0.0	9.0	0.0	12.8	745.2
5110	64.0107	-160.8848	55305	532		KS	25	-1	405		0.9	NAD	1.1		0.3		0.0	4.0	0.0	12.8	745.1
5111	64.0107	-160.8838	55305	514		KS	25	-1	379		1.0	MAR	-0.1	NAD	0.3		0.0	0.0	3.0	12.8	744.7
5112	64.0108	-160.8826	55305	501		KS	35	-1	325		0.5	MAR	1.4		0.1	MAR	2.5	13.6	5.5	12.8	744.5
5113	64.0108	-160.8816	55305	490		KS	20	-1	411		0.0	NAD	1.1		0.0	NAD	0.0	0.0	0.0	12.8	744.3
5114	64.0109	-160.8803	55305	481		KS	22	-1	417		1.0		1.0		0.1	MAR	1.0	12.7	12.9	12.8	744.3
5115	64.0110	-160.8791	55305	477		KS	28	-1	517		0.8	MAR	1.1		0.3		1.3	4.0	3.1	12.8	744.1
5116	64.0110	-160.8781	55304	479		KS	17	0	616		1.4		0.7		0.5		0.9	1.4	2.8	12.8	744.0
5117	64.0111	-160.8769	55304	486		KS	23	0	623		4.3		0.8		0.6		0.2	1.4	7.0	12.8	743.9
5118	64.0111	-160.8759	55303	493		KS	22	0	607		2.5		1.5		0.1		0.6	10.2	17.5	12.8	744.0
5119	64.0112	-160.8746	55303	500		KS	21	0	693		3.5		0.5	MAR	0.5		0.2	1.1	7.4	12.8	744.2
5120	64.0113	-160.8734	55303	509		KS	22	-1	633		2.2		2.6		0.3		1.2	8.6	7.2	12.8	744.2
5121	64.0113	-160.8724	55302	516		KS	30	-1	636		3.7		0.2	NAD	0.3		0.0	0.0	10.9	12.8	744.5
5122	64.0113	-160.8712	55302	519		KS	25	-2	777		5.1		1.9		0.3		0.3	9.9	20.2	12.8	744.9
5123	64.0113	-160.8701	55302	518		KS	26	-2	658		3.8		0.9		0.4		0.2	2.2	9.0	12.8	745.1
5124	64.0113	-160.8689	55302	517		KS	32	-2	718		0.8	MAR	1.9		0.7		2.1	2.8	1.3	12.8	745.6
5125	64.0113	-160.8677	55302	523		KS	32	-2	763		2.7		2.2		0.2		0.8	13.0	16.0	12.8	746.1
5126	64.0114	-160.8667	55302	541		KS	25	-1	781		3.2		1.3		0.6		0.4	2.4	5.9	12.8	746.4
5127	64.0114	-160.8654	55301	559		KS	26	-1	736		1.1	MAR	2.6		0.3		2.2	8.2	3.8	12.9	746.8
5128	64.0114	-160.8644	55300	574		KS	23	-1	668		3.2		0.2	NAD	0.4		0.0	0.0	7.4	12.9	747.1
5129	64.0114	-160.8632	55300	592		KS	21	0	640		2.4		3.5		-0.0	NAD	1.4	0.0	0.0	12.9	747.3
5130	64.0113	-160.8620	55300	606		KS	14	0	696		1.9		1.9		0.3		1.0	7.1	6.9	12.9	747.3
5131	64.0113	-160.8609	55302	617		KS	27	0	595		1.4		0.7	MAR	0.3		0.5	2.4	4.4	13.0	747.7

SINGLE RECORD DATA

LINE

240

PAGE

1

FINISHED OUTPUTTING LINE 240

LINE 220 FIDS 2935 TO 4865 OUTPUT TO SRRO TAPE

A P P E N D I X B

Format Average Record Data Listing

RECORD NUMBER	LATITUDE	LONGITUDE	REL TO TJAL FIELD GAMMA	GEOL UNIT	COSM CPS	ATM. TRAN CPS	TOTAL COUNT CPS	ETH FLG	STD DEV	ETH PPM	STD DEV	POT FLG	STD DEV	ETH RATIO	STD DEV	POT RATIO	STD DEV	ETH RATIO	STD DEV
5238	64.0098	-160.7455	55295	M	33	-6	990	3.7	1	1.9	2	0.7	1	0.5	0	2.8	0	5.2	0
5239	64.0098	-160.7444	55293	KS	43	-6	952	3.7	0	1.9	0	0.7	0	0.5	1	2.9	0	5.3	0
5240	64.0099	-160.7434	55289	KS	27	-5	998	3.7	0	2.1	0	0.7	0	0.6	2	3.1	1	5.3	0
5241	64.0098	-160.7422	55287	KS	33	-5	1047	3.5	0	2.2	0	0.7	0	0.6	2	3.2	1	5.2	0
5242	64.0098	-160.7412	55298	KS	31	-5	1083	3.5	0	2.1	0	0.7	0	0.6	2	2.9	0	4.8	0
5243	64.0097	-160.7399	55287	KS	30	-4	1156	3.7	0	1.9	0	0.7	0	0.5	1	2.7	0	5.0	0
5244	64.0097	-160.7389	55287	KS	31	-4	1182	4.1	0	1.9	0	0.8	0	0.5	1	2.5	0	5.3	0
5245	64.0097	-160.7379	55286	KS	26	-4	1245	4.0	0	1.7	0	0.8	0	0.4	0	2.1	0	4.9	0
5246	64.0096	-160.7366	55285	KS	38	-4	1148	3.8	0	1.6	0	0.8	0	0.4	0	2.1	0	4.8	0
5247	64.0097	-160.7356	55289	KS	30	-3	1211	3.7	0	1.5	0	0.8	0	0.4	0	1.9	0	4.5	0
5248	64.0096	-160.7344	55295	KS	30	-3	1076	3.8	0	1.5	0	0.8	0	0.4	0	1.9	0	4.7	0
5249	64.0096	-160.7334	55284	KS	29	-3	1016	3.7	0	1.3	0	0.8	0	0.4	0	1.6	0	4.6	0
5250	64.0096	-160.7324	55283	KS	33	-3	975	3.7	0	1.2	0	0.8	0	0.3	0	1.6	0	4.8	0
5251	64.0095	-160.7311	55283	KS	23	-3	976	3.5	0	1.2	0	0.7	0	0.3	0	1.7	0	5.0	0
5252	64.0095	-160.7301	55283	KS	30	-3	948	3.7	0	1.1	0	0.7	0	0.3	0	1.6	0	5.1	0
5253	64.0095	-160.7299	55284	KS	33	-3	921	3.8	0	1.0	-1	0.7	0	0.3	0	1.4	-1	5.2	0
5254	64.0095	-160.7278	55284	KS	37	-2	803	4.0	0	1.0	-1	0.7	0	0.3	0	1.5	-1	5.6	0
5255	64.0095	-160.7266	55283	KS	23	-2	954	4.1	0	1.0	-1	0.7	0	0.3	-1	1.4	-1	5.5	0
5256	64.0094	-160.7256	55293	KS	29	-1	1006	4.3	0	1.0	-1	0.7	0	0.2	-1	1.3	-1	5.8	0
5257	64.0094	-160.7244	55283	KS	37	-1	1133	4.0	0	1.0	-1	0.7	0	0.2	-1	1.3	-1	5.5	0
5258	64.0094	-160.7233	55284	KS	23	0	1106	4.1	0	1.0	-1	0.7	0	0.2	-1	1.4	-1	5.9	0
5259	64.0094	-160.7221	55285	KS	28	0	1034	4.1	0	0.8	-1	0.7	0	0.2	-1	1.2	-1	6.1	0
5260	64.0094	-160.7211	55284	KS	21	0	963	4.1	0	0.8	-1	0.7	0	0.2	-1	1.3	-1	6.2	0
5261	64.0093	-160.7199	55294	KS	27	0	840	3.7	0	0.8	-1	0.6	0	0.2	-1	1.3	-1	6.1	0
5262	64.0093	-160.7188	55294	KS	29	0	718	3.2	0	0.9	-1	0.5	-1	0.3	0	1.7	0	6.0	0
5263	64.0092	-160.7176	55284	KS	33	0	605	2.5	-1	0.9	-1	0.5	-1	0.4	0	1.8	0	5.2	0
5264	64.0092	-160.7166	55294	KS	32	0	635	2.1	-1	0.8	-1	0.4	-1	0.4	0	1.9	0	5.2	0
5265	64.0093	-160.7156	55283	KS	35	0	507	1.7	-1	0.7	-1	0.3	-1	0.4	0	2.2	0	5.3	0
5266	64.0092	-160.7143	55283	KS	26	-1	521	1.6	-1	0.7	-1	0.3	-1	0.3	1	2.5	0	5.4	0
5267	64.0092	-160.7133	55283	KS	19	-1	465	1.4	-1	0.8	-1	0.3	-1	0.6	2	2.9	1	5.1	0
5268	64.0091	-160.7121	55283	M	34	-1	287	1.3	0	0.9	1	0.3	1	0.7	1	3.1	0	4.6	-1
5269	64.0091	-160.7110	55282	KS	29	-1	398	1.3	-1	1.0	-1	0.3	-1	0.8	3	3.4	1	4.4	0
5270	64.0092	-160.7100	55282	KS	42	-1	516	1.7	-1	1.1	0	0.3	-1	0.6	2	3.2	1	5.1	0
5271	64.0092	-160.7090	55283	KS	29	0	716	1.9	-1	1.0	-1	0.4	-1	0.6	2	2.8	0	5.1	0
5272	64.0092	-160.7078	55283	KS	25	0	781	2.1	-1	1.1	0	0.4	-1	0.5	1	2.9	0	5.2	0
5273	64.0092	-160.7068	55282	KS	32	0	738	2.4	-1	1.1	0	0.4	-1	0.5	1	2.7	0	6.0	0
5274	64.0091	-160.7057	55281	KS	25	0	853	2.5	-1	1.1	0	0.4	-1	0.5	1	2.7	0	5.9	0
5275	64.0091	-160.7047	55282	KS	22	0	796	2.5	-1	1.1	0	0.5	-1	0.4	0	2.4	0	5.8	0
5276	64.0091	-160.7037	55281	KS	21	0	904	2.9	-1	1.0	-1	0.5	-1	0.4	0	2.2	0	6.1	0
5277	64.0092	-160.7025	55281	KS	37	1	810	2.9	-1	1.0	-1	0.4	-1	0.4	0	2.3	0	6.5	0
5278	64.0092	-160.7014	55280	KS	27	2	764	3.0	0	0.9	-1	0.5	-1	0.3	0	1.9	0	6.3	0
5279	64.0092	-160.7004	55282	KS	31	1	750	2.9	-1	0.9	-1	0.5	-1	0.3	0	2.0	0	6.0	0
5280	64.0092	-160.6994	55283	KS	33	1	740	2.9	-1	1.0	-1	0.5	-1	0.3	0	2.1	0	6.2	0
5281	64.0092	-160.6984	55283	KS	32	1	745	3.3	0	0.8	-1	0.5	-1	0.2	-1	1.7	0	7.1	0
5282	64.0092	-160.6973	55283	KS	36	1	779	3.7	0	0.8	-1	0.5	0	0.2	-1	1.5	-1	6.5	0
5283	64.0092	-160.6963	55283	KS	31	1	821	3.8	0	0.8	-1	0.6	0	0.2	-1	1.4	-1	6.6	0
5284	64.0092	-160.6951	55283	KS	31	1	858	3.8	0	1.0	-1	0.6	0	0.3	0	1.8	0	6.5	0
5285	64.0092	-160.6941	55284	KS	30	1	948	3.7	0	1.2	0	0.6	0	0.3	0	2.0	0	6.0	0
5286	64.0093	-160.6931	55284	KS	26	0	1054	3.7	0	1.3	0	0.6	0	0.3	0	2.1	0	6.0	0
5287	64.0093	-160.6920	55282	KS	32	0	963	3.3	0	1.5	0	0.6	0	0.4	0	2.4	0	5.7	0
5288	64.0093	-160.6910	55281	KS	30	0	1040	3.3	0	1.3	0	0.6	0	0.4	0	2.1	0	5.5	0
5289	64.0093	-160.6900	55281	KS	25	0	997	3.3	0	1.3	0	0.6	0	0.4	0	2.2	0	5.5	0
5290	64.0093	-160.6890	55281	KS	32	0	944	3.0	0	1.5	0	0.6	0	0.5	1	2.5	0	5.0	0

A P P E N D I X C

Format, DOE SINGLE RECORD REDUCED DATA TAPE

DOE SINGLE RECORD REDUCED DATA TAPE

Line	Character Number		
Number	12345678901234567890123456789012345678901234567890123456789012		
1	02 0978		(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2			
3			SINGLE RECORD REDUCED DATA TAPE
4			
5			FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6			
7	ITEM	FORMAT	DESCRIPTION
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20	NAME OF SUBCONTRACTOR
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR
12			THIS QUADRANGLE
13	5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
14	6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR
15			FIRST SYSTEM
16	7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
17			TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE
18			IN CPS PER PERCENT K FOR FIRST SYSTEM
19	8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
20			TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE
21			IN CPS PER PPM EQUIVALENT U
22	9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
23			TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE
24			IN CPS PER PPM EQUIVALENT TH
25	10	I6	BLANK FIELD (999999)
26	11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
27			PLACES IN SECONDS FOR FIRST SYSTEM
28	12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
29			PLACES IN SECONDS FOR FIRST SYSTEM
30	13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4 PI SYSTEM FOR FIRST
31			AERIAL SYSTEM
32	14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2 PI SYSTEM FOR FIRST
33			AERIAL SYSTEM
34	15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
35	*	*	*
36	*	*	*
37	*	*	*
38	85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
39	95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
40	96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
41	97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
42	98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS
43			COLLECTED
44	99-101	I4,6, &3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS
45			TAPE
46	*	*	*
47	*	*	*
49	390-392	I4,6, &3	REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS
50			TAPE
51			

Line	Character Number
Number	12345678901234567890123456789012345678901234567890123456789012

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	I4	QUALITY FLAG CODES
11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K
12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
13	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
14	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
15	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
16	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
17	F6.1	URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
18	F6.1	URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
19	F6.1	THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
24	F4.1	OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS
25	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG

A P P E N D I X D

Format, DOE RAW SPECTRAL DATA TAPE

DOE RAW SPECTRAL DATA TAPE

Line Character number
 Number 12345678901234567890123456789012345678901234567890123456789012

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1 01 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2
3 RAW SPECTRAL DATA TAPE
4
5 FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK ON TAPE)
6
7 ITEM      FORMAT  DESCRIPTION
8 1         A40     QUADRANGLE NAME AS PROJECT IDENTIFICATION
9 2         A20     NAME OF SUBCONTRACTOR
10 3        I4      APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11 4        I1      AERIAL SYSTEM IDENTIFICATION CODE
12 5        A20     AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER
13 6        I3      BFEC CALIBRATION REPORT NUMBER
14 7        F6.3    4PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
15                PLACES IN SECONDS
16 8        F6.3    2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
17                PLACES IN SECONDS
18 9         I3      NUMBER OF CHANNELS (0-3 MEV) FOR 4PI SYSTEM
19 10        I3      NUMBER OF CHANNELS (0-3 MEV) FOR 2PI SYSTEM
20 11        I3      NUMBER OF FLIGHT LINES ON THIS TAPE
21 12        I4      FIRST FLIGHT LINE NUMBER ON THIS TAPE
22 13        I6      FIRST RECORD NUMBER OF FIRST FLIGHT LINE
23 14        I3      JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE WAS
24                COLLECTED
25 15-17    I4,6 &3 REPEAT OF ITEMS 12-14 FOR SECOND FLIGHT LINE ON THIS
26                TAPE
27 *        *              *
28 *        *              *
29 *        *              *
30 306-308  I4,6 &3 REPEAT OF ITEMS 12-14 FOR 99TH FLIGHT LINE ON THIS
31                TAPE
32
33 FORMAT FOR RAW SPECTRAL DATA RECORD (THIRD THRU LAST BLOCK ON TAPE)
34
35 ITEM      FORMAT  DESCRIPTION
36 1         I1      AERIAL SYSTEM IDENTIFICATION CODE
37 2         I4      FLIGHT LINE NUMBER
38 3         I6      RECORD IDENTIFICATION NUMBER
39 4         I6      GMT TIME OF DAY (HHMMSS)
40 5        F8.4    LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
41 6        F8.4    LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
42 7        F6.2    TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
43 8        F7.1    TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE
44                IN GAMMAS
45 9         A8      SURFACE GEOLOGIC MAP UNIT CODE
46 10        I4      QUALITY FLAG CODES
47 11        F4.1    OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN
48                DEGREES CELSIUS
49 12        F5.1    OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
50 13        F5.3    LIVE TIME COUNTING PERIOD TO THREE DECIMAL PLACES IN
51                SECONDS
  
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Line	Character Number											
Number	12345678901234567890123456789012345678901234567890123456789012											
52	14 I4 SUMMED RAW OUTPUT FROM COSMIC CHANNELS (3-6 MEV) IN											
53	COUNTS											
54	15 I4 RAW OUTPUT FROM CHANNEL 1 IN COUNTS											
55	16 I4 RAW OUTPUT FROM CHANNEL 2 IN COUNTS											
56	* *											
57	* *											
58	* *											
59	270 I4 RAW OUTPUT FROM CHANNEL 256 IN COUNTS											

A P P E N D I X E

Format, DOE STATISTICAL ANALYSIS DATA TAPE

DOE STATISTICAL ANALYSIS DATA TAPE

Line	Character Number			
Number	12345678901	2345678901	2345678901	2345678901234567890123456789012
1	03 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)			
2				
3	STATISTICAL ANALYSIS DATA TAPE			
4				
5	FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)			
6				
7	ITEM	FORMAT	DESCRIPTION	
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION	
9	2	A20	NAME OF SUBCONTRACTOR	
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)	
11	4	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR	
12			THIS QUADRANGLE	
13	5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM	
14	6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR	
15			FIRST SYSTEM	
16	7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO	
17			TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE	
18			IN CPS PER PERCENT K	
19	8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO	
20			TERRESTRIAL URANIUM (B1-214) TO ONE DECIMAL PLACE	
21			IN CPS PER PPM EQUIVALENT U	
22	9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO	
23			TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE	
24			IN CPS PER PPM EQUIVALENT TH	
25	10	I6	BLANK FIELD (999999)	
26	11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL	
27			PLACES IN SECONDS FOR FIRST SYSTEM	
28	12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL	
29			PLACES IN SECONDS FOR FIRST SYSTEM	
30	13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4 PI SYSTEM FOR FIRST	
31			AERIAL SYSTEM	
32	14	I3	NUMBER OF CHANNELS (0-30 MEV) IN 2 PI SYSTEM FOR FIRST	
33			AERIAL SYSTEM	
34	15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR AERIAL SYSTEM	
35	*	*	*	
36	*	*	*	
37	*	*	*	
38	85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM	
39	95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE	
40	96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE	
41	97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE	
42	98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS	
43			COLLECTED	
44	99-101	I4,6 &3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ONE THIS	
45			TAPE	
46	*	*	*	
47	*	*	*	
48	*	*	*	
49	390-392	I4,6 &3	REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS	
50			TAPE	
51				

Line	Character Number
Number	12345678901234567890123456789012345678901234567890123456789012

52	FORMAT FOR STATISTICAL ANALYSIS DATA RECORD (THIRD THRU LAST BLOCK)		
53			
54	ITEM	FORMAT	DESCRIPTION
55	1	I1	AERIAL SYSTEM IDENTIFICATION CODE
56	2	I4	FLIGHT LINE NUMBER
57	3	I6	RECORD IDENTIFICATION NUMBER
58	4	I6	GMT TIME OF DAY (HHMMSS)
59	5	F.84	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
60	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
61	7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
62	8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY
63			TO ONE DECIMAL PLACE IN GAMMAS
64	9	A8	SURFACE GEOLOGIC MAP UNIT CODE
65	10	I5	QUALITY FLAG CODES
66	11	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL POTASSIUM
67			(K-40) TO ONE DECIMAL PLACE IN PERCENT K
68	12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL
69			PLACE IN PERCENT K
70	13	F5.1	POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE
71			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
72	14	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM
73			(BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
74	15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL
75			PLACE IN PPM EQUIVALENT U
76	16	F5.1	URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE
77			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
78	17	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM
79			(TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
80	18	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL
81			PLACE IN PPM EQUIVALENT TH
82	19	F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE
83			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
84	20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL
85			PLACE IN COUNTS PER SECOND
86	21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL
87			PLACE IN COUNTS PER SECOND
88	22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL
89			PLACE IN PPM EQUIVALENT U
90	23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION
91			TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
92	24	F6.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL
93			PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
94	25	F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE
95			MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
96	26	F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL
97			PLACE IN PPM EQUIVALENT U PER PERCENT K
98	27	F5.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM
99			THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY
100			SIGNED
101	28	F6.1	AVERAGE THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL
102			PLACE IN PPM EQUIVALENT TH PER PERCENT K
103	29	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM
104			THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY
105			SIGNED

A P P E N D I X F

Format, DOE MAGNETIC DATA TAPE

DOE MAGNETIC DATA TAPE FORMAT

Line Number	Character Number 12345678901234567890123456789012345678901234567890123456789012											
1	04 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)											
2												
3	MAGNETIC DATA TAPE											
4												
5	FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)											
6												
7	ITEM	FORMAT	DESCRIPTION									
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION									
9	2	A20	NAME OF SUBCONTRACTOR									
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)									
11	4	I3	NUMBER OF FLIGHT LINES ON THIS TAPE									
12	5	I4	FIRST FLIGHT LINE OF THIS TAPE									
13	6	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE									
14	7	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS									
15			COLLECTED									
16	8	F8.4	LATITUDE OF GROUND BASE STATION TO FOUR DECIMAL									
17			PLACES IN DEGREES FOR FIRST FLIGHT LINE									
18	9	F8.4	LONGITUDE OF GROUND BASE STATION TO FOUR DECIMAL									
19			PLACES IN DEGREES FOR FIRST FLIGHT LINE									
20	10-14	(SAME)	REPEAT OF ITEMS 5-9 FOR SECOND FLIGHT LINE ON THIS									
21			TAPE									
22	*	*							*			
23	*	*							*			
24	*	*							*			
25	495-499	(SAME)	REPEAT OF ITEMS 5-9 FOR 99TH FLIGHT LINE ON THIS									
26			TAPE									
27												
28	FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)											
29												
30	ITEM	FORMAT	DESCRIPTION									
31	1	I1	AERIAL SYSTEM IDENTIFICATION CODE									
32	2	I4	FLIGHT LINE NUMBER									
33	3	I6	RECORD IDENTIFICATION NUMBER									
34	4	I6	GMT TIME OF DAY (HHMMSS)									
35	5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES									
36	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES									
37	7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS									
38	8	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG									
39	9	A8	SURFACE GEOLOGIC MAP UNIT CODE									
40	10	F7.1	TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE									
41			IN GAMMAS									
42	11	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY									
43			TO ONE DECIMAL PLACE IN GAMMAS									
44	12	F7.1	DIURNAL MAGNETIC INTENSITY VARIATION TO ONE DECIMAL									
45			PLACE IN GAMMAS									
46	13	F7.1	MAGNETIC DEPTH-TO-BASEMENT TO ONE DECIMAL PLACE									
47			IN METERS (IF REQUIRED)									

A P P E N D I X G

Reduced Calibration and Test Line Data .

Reduced Calibration and Test Line Data

<u>Date</u>	<u>Flight</u>	<u>Res. Thor.</u> <u>583</u>	<u>Res. Thor.</u> <u>2615</u>	<u>Low Preflight</u> <u>Alt. T.C. 2π</u>	<u>Low Postflight</u> <u>Alt. T.C. 2π</u>
10/28/80	72	Data not available		No test line flown	
10/30/80	73	Data not available		No test line flown	

A P P E N D I X H

Renumbered to Original Fiducial Correlations

99° TIE LINE

LINE 10 FLOWN AS LINE 112
MAP FIDUCIALS 19732 TO 20861 CORRESPOND TO ORIGINAL FIDUCIALS 20861 TO 19732

LINE 20 FLOWN AS LINE 112
MAP FIDUCIALS 18650 TO 19731 CORRESPOND TO ORIGINAL FIDUCIALS 19731 TO 18650

LINE 30 FLOWN AS LINE 112
MAP FIDUCIALS 16471 TO 18095 CORRESPOND TO ORIGINAL FIDUCIALS 18095 TO 16471

LINE 40 FLOWN AS LINE 112
MAP FIDUCIALS 15805 TO 16471 CORRESPOND TO ORIGINAL FIDUCIALS 16471 TO 15805

LINE 50 FLOWN AS LINE 112
MAP FIDUCIALS 13215 TO 13078 CORRESPOND TO ORIGINAL FIDUCIALS 14878 TO 13215

LINE 60 FLOWN AS LINE 109
MAP FIDUCIALS 10219 TO 11856 CORRESPOND TO ORIGINAL FIDUCIALS 11856 TO 10219

LINE 70 FLOWN AS LINE 109
MAP FIDUCIALS 8541 TO 10218 CORRESPOND TO ORIGINAL FIDUCIALS 10218 TO 8541

LINE 80 FLOWN AS LINE 109
MAP FIDUCIALS 8350 TO 6844 CORRESPOND TO ORIGINAL FIDUCIALS 6844 TO 8350

LINE 90 FLOWN AS LINE 109
MAP FIDUCIALS 5163 TO 6843 CORRESPOND TO ORIGINAL FIDUCIALS 6843 TO 5163

LINE 100 FLOWN AS LINE 109
MAP FIDUCIALS 4450 TO 5162 CORRESPOND TO ORIGINAL FIDUCIALS 5162 TO 4450

LINE 110 FLOWN AS LINE 109
MAP FIDUCIALS 1678 TO 3394 CORRESPOND TO ORIGINAL FIDUCIALS 3394 TO 1678

LINE 120 FLOWN AS LINE 106 AND 109
MAP FIDUCIALS 600 TO 1677 CORRESPOND TO ORIGINAL FIDUCIALS 1677 TO 600
MAP FIDUCIALS 1678 TO 2174 CORRESPOND TO ORIGINAL FIDUCIALS 23883 TO 23386

LINE 130 FLOWN AS LINE 106
MAP FIDUCIALS 22250 TO 23812 CORRESPOND TO ORIGINAL FIDUCIALS 23812 TO 22250

LINE 140 FLOWN AS LINE 106
MAP FIDUCIALS 15456 TO 19400 CORRESPOND TO ORIGINAL FIDUCIALS 19400 TO 15456

LINE 160 FLOWN AS LINE 106
MAP FIDUCIALS 17137 TO 18698 CORRESPOND TO ORIGINAL FIDUCIALS 18698 TO 17137

LINE 170 FLOWN AS LINE 106
MAP FIDUCIALS 15550 TO 17136 CORRESPOND TO ORIGINAL FIDUCIALS 17136 TO 15550

LINE 180 FLOWN AS LINE 103
MAP FIDUCIALS 13427 TO 15054 CORRESPOND TO ORIGINAL FIDUCIALS 15054 TO 13427

99° TIE LINE

LINE 190 FLOWN AS LINE 103

MAP FIDUCIALS 12950 TO 13426 CORRESPOND TO ORIGINAL FIDUCIALS 13426 TO 12950

LINE 200 FLOWN AS LINE 103

MAP FIDUCIALS 10174 TO 11766 CORRESPOND TO ORIGINAL FIDUCIALS 11766 TO 10174

LINE 210 FLOWN AS LINE 103

MAP FIDUCIALS 9050 TO 10174 CORRESPOND TO ORIGINAL FIDUCIALS 10174 TO 9050

LINE 220 FLOWN AS LINE 103

MAP FIDUCIALS 6894 TO 8555 CORRESPOND TO ORIGINAL FIDUCIALS 8555 TO 6894

LINE 230 FLOWN AS LINE 103

MAP FIDUCIALS 5235 TO 6893 CORRESPOND TO ORIGINAL FIDUCIALS 6893 TO 5235