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National Uranium Resource Evaluation

NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF PORTIONS OF NEW MEXICO, ARIZONA, AND TEXAS

FINAL REPORT

VOLUME I

DATA ACQUISITION, REDUCTION AND INTERPRETATION

CARSON HELICOPTERS, INC.

GEOSCIENCE DIVISION 32-H Blooming Glen Rd. Perkasie, Penna. 18944

September 1981

PREPARED FOR U.S. DEPARTMENT OF ENERGY
Grand Junction Office, Colorado

DISCLAIMER

This report is a result of work performed by Carson Helicopters, Inc. through a Bendix Field Engineering Corporation Subcontract, as part of the National Uranium Resource 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.

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Instrumentation and Data Reduction

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PREPARED FOR U. S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE, COLORADO
UNDER CONTRACT NO. DE-AC13-76GJ01664
AND BENDIX FIELD ENGINEERING CORPORATION
SUBCONTRACT NO. 79-350A

ABSTRACT

As part of the Department of Energy (DOE) National Uranium Resource Evaluation Program, a rotary-wing high sensitivity radiometric and magnetic survey was flown covering portions of the State of New Mexico, Arizona and Texas. The survey encompassed six 1:250,000 scale quadrangles, Holbrook, El Paso, Las Cruces, Carlsbad, Fort Sumner and Roswell.

The survey was flown with a Sikorsky S58T helicopter equipped with a high sensitivity gamma ray spectrometer which was calibrated at the DOE calibration facilities at Walker Field in Grand Junction, Colorado, and the Dynamic Test Range at Lake Mead, Arizona.

The radiometric data was processed to compensate for compton scattering effects and altitude variations. The data was normalized to 400 feet terrain clearance. The reduced data is presented in the form of stacked profiles, standard deviation anomaly plots, histogram plots and microfiche listings. The results of the geologic interpretation of the radiometric data together with the profiles, anomaly maps and histograms are presented in the individual quadrangle reports.

The survey was awarded to LKB Resources, Inc. which completed the data acquisition. In April, 1980 Carson Helicopters, Inc. and Carson Geoscience Company agreed to manage the project and complete delivery of this final report.

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ILLUSTRATIONS

1.0 INTRODUCTION

The New Mexico Aerial Survey was performed under the United States Department of Energy's National Uranium Resource Evaluation (NURE) program, which is designed to provide reconnaissance radioelement distribution information to assist in assessing the uraniferous material potential of the United States. All phases of this work were performed for the Grand Junction Office of Bendix Field Engineering Corporation under subcontract 79-350-S.

The survey was flown during the period from December 1979 to April 1980 and covered the following 1:250,000 scale quadrangles. (Figure 1, Page 8.)

QUADRANGLE	STATE
El Paso	Texas
Las Cruces	New Mexico
Carlsbad	New Mexico
Roswell	New Mexico
Fort Sumner	New Mexico
Holbrook	Arizona

This report constitutes Volume I (Narrative Report) which discusses the instrumentation data reduction methods and interpretation concepts. The interpretation results and graphic data are contained in separate volumes as follows:

Volume	Quadrangles
2A	Fort Sumner
2B	Roswell
2C	Carlsbad
2D	Las Cruces
2E	Holbrook
2F	El Paso

The radiometric and ancilliary data were digitally recorded and processed. The results are presented in the form of stacked profiles, standard deviation anomaly maps, flight path maps, statistical tables and frequency distribution histograms. These graphical outputs are presented at a scale of 1:500,000 and are contained in the individual Volume 2 reports.

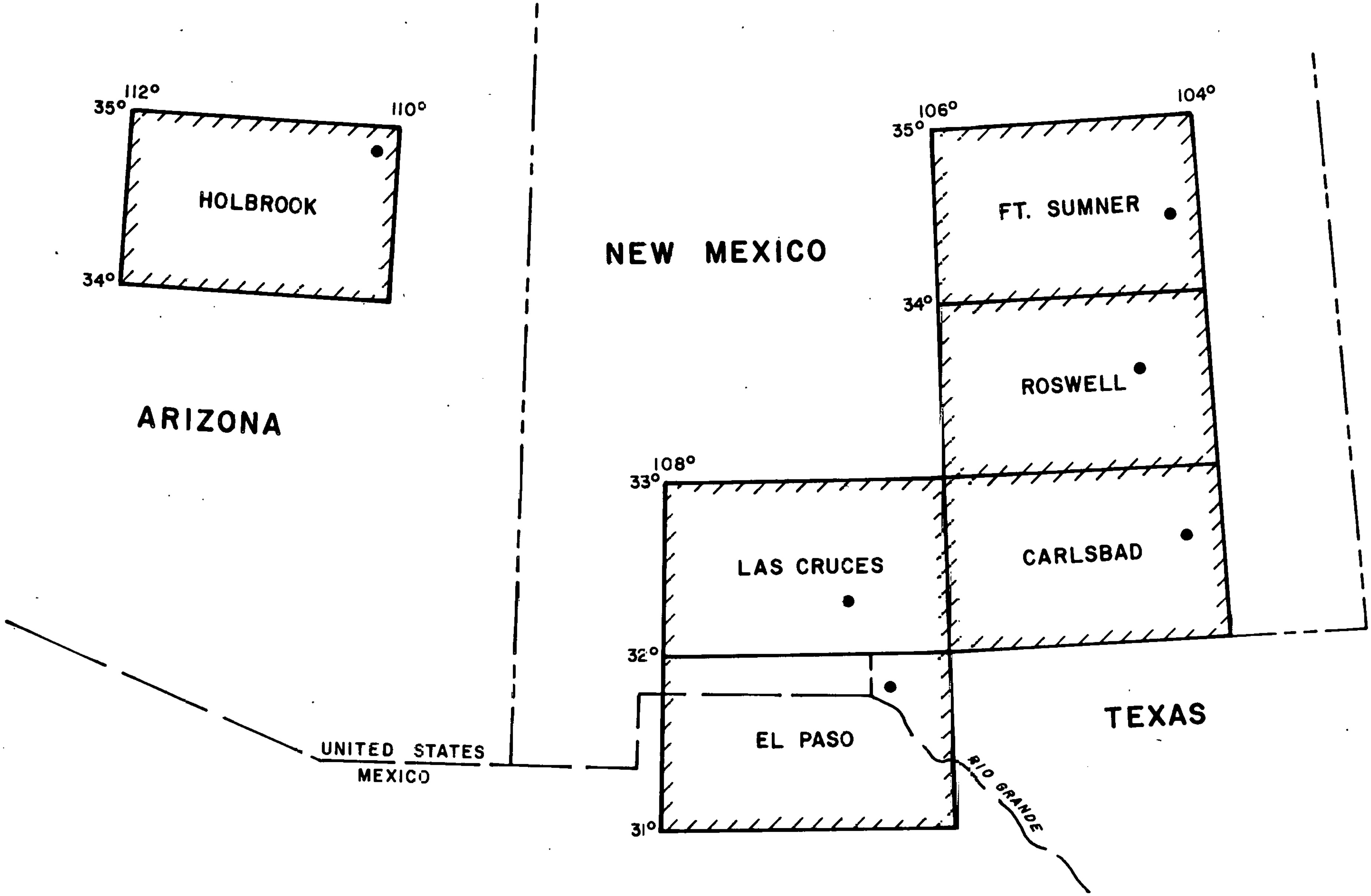

FIGURE I LOCA‾ION OF QUADRANGLES

2.0 THE AIRBORNE SYSTEM

2.1 ROTARY-WING-AIRCRAFT

A Sikorsky S-58T Twin Turbine helicopter was utilized as the survey platform for the airborne radiometric survey. (See Figure 2, Page 10).

All equipment was located within the cabin of the aircraft with the exception of the magnetometer which was rigidly mounted to the exterior. (See Figure 3, Page 11).

2.2 INSTRUMENTATION

The primary system components include the following: (See Figure 4, Page 15/16).

(1) Terrestrial Gamma-Ray Sensor
(2) Atmospheric Gamma-Ray Sensor
(3) Magnetometer
(4) Barometric Pressure Altimeter
(5) Radar Altimeter
(6) Temperature Sensor
(7) Data Acquisition System
(8) Recording System
(9) 35mm Tracking Camera

2.2.1 Terrestrial Sensor

This sub-system consists of two identical Scintrex GSA-77 Sensors, each containing seven crystals measuring 7 inches in diameter X 4 inches thick. The seven NaI (Tl) crystals in each sensor are arranged with six crystals mounted in a circle around one in the center. Each sensor incorporates an ultrastable high voltage supply, seven preamplifiers, a temperature control unit and a detector signal mixing circuit.

The detectors are housed in an appropriately insulated container. A heating element inside each container provides temperature stabilization to maintain detector balance. A temperature range control offers six switch-selectable temperature settings, and a temperature meter permits continued monitoring. A temperature setting of 27.5 C was maintained for most of the survey.

FIG.-2 S-58T HELICOPTER

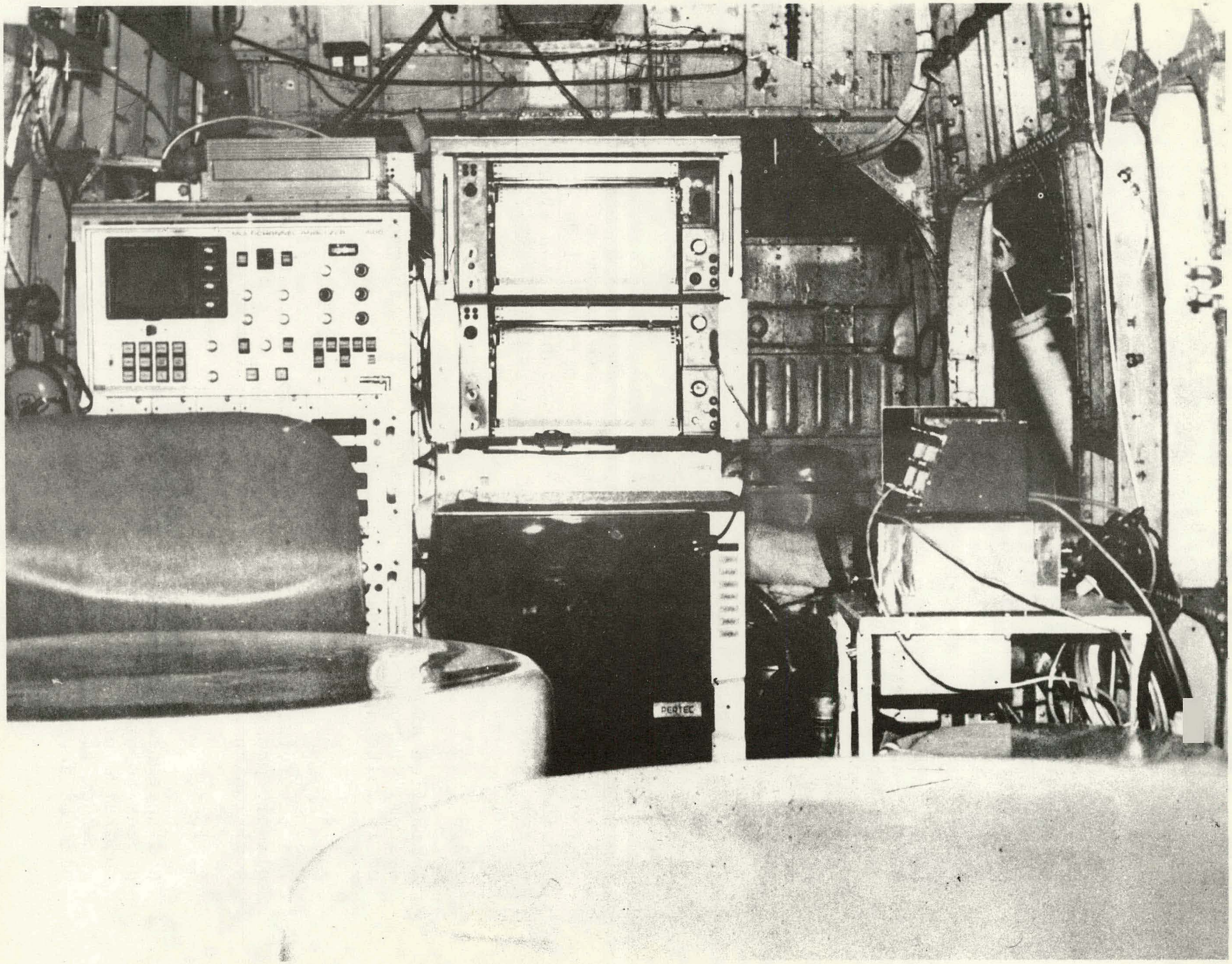

FIG.-3 S-58T HELICOPTER (CABIN LAYOUT)

The central detector in each sensor contains a light emitting diode which allows the injection of a stabilization pulse which can be monitored and stabilized at any location on the pulse height spectrum. Although two such stabilization sources are available (one in each sensor) only one is used at any given time. A location above 6 MeV is used for this LED pulse.

Each of the two sensors provides a sensitive volume of 1077 $inches^3$ and weighs 350 lbs. These sensors draw power from the 28V helicopter system when in flight. When not flying, the sensor heaters are plugged into an external 115V power source through a 28V D.C. converter to maintain temperature control.

2.2.2 Atmospheric Sensor

This sub-system is mounted directly over a lead slab measuring 12 inches X 12 inches X 3 inches such that its field of view is limited to a solid angle of approximately 2π in the upward direction.

The detector consists of one 9 inch diameter X 5 inch thick NaI (Tl) crystal having a total sensitive volume of 318 cubic inches, and containing a light emitting diode source to provide a stabilization pulse. The weight of the atmospheric detector, including the lead shield is approximately 300 lbs.

2.2.3 Magnetometer

A modified ASQ-10 fluxgate magnetometer was employed in this system, with the observed magnetic field measurements obtained in units of 0.1 gamma.

2.2.4 Barometric Altitude Transducer

The barometric pressure instrumentation consists of an elastic pressure sensing element acting as a prime mover for positioning an electro-mechanical transducer.

2.2.5 Radar Altimeter

A Minneapolis Honeywell altimeter is used to measure helicopter to ground distance. The antenna is mounted on the underside of the helicopter. Altitude measurements are recorded to 1.0 foot. The recording range is 0-5,000 feet with an accuracy of 5 feet + 3% of actual altitude.

2.2.6 Temperature Sensor

A platinum resistance thermometer was utilized to record outside air temperature with an accuracy of 0.01° C.

2.2.7 Data Acquisition System

Signals from the terrestrial and atmospheric sensors are amplified, digitized and stored in the digital processor contained in the 1024 channel pulse height analyzer. Each sensor calibration is such that a 400 channel block contains gamma-ray intensity information for the energies 0-3 MeV and 3-6 MeV. The last 112 channels in each block are reserved for storing the stabilization pulses for the individual LED's. Two independent digital stabilizers are latched onto their appropriate LED pulse to achieve stability of the entire gamma-ray energy calibration. An oscilliscope display is available to monitor the accumulation of gamma-ray pulses during each acquisition period.

Data from the magnetometer, temperature probe, barometric altimeter, radar altimeter, clock and the present data is fed through an A/D converter into the 1024 channel digital processor.

2.2.8 Recording System

The collected data is fed through a magnetic tape control to the tape unit. The data was recorded in 7 track BCD code at 800 BPI density. After each readout cycle, the system is automatically reset and a new data acquisition cycle is begun.

A permanent record of the following information is obtained for each acquisition cycle.

1. Acquisition Identification
   Four sets of six digit presettable data for
   a. Julian Day
   b. Line number
   c. Reference number (job no.)
   d. Azimuth (Flight direction)
2. Record number - (Sequential Record Count)
3. Time of day (correlates with camera fiducials)
4. Temperature
5. Barometric altitude
6. Radar altitude
7. Scan time

8. Observed aeromagnetic reading
9. Live time in milliseconds for both terrestrial and atmospheric sensors
10. Full gamma-ray spectrum for each sensor package

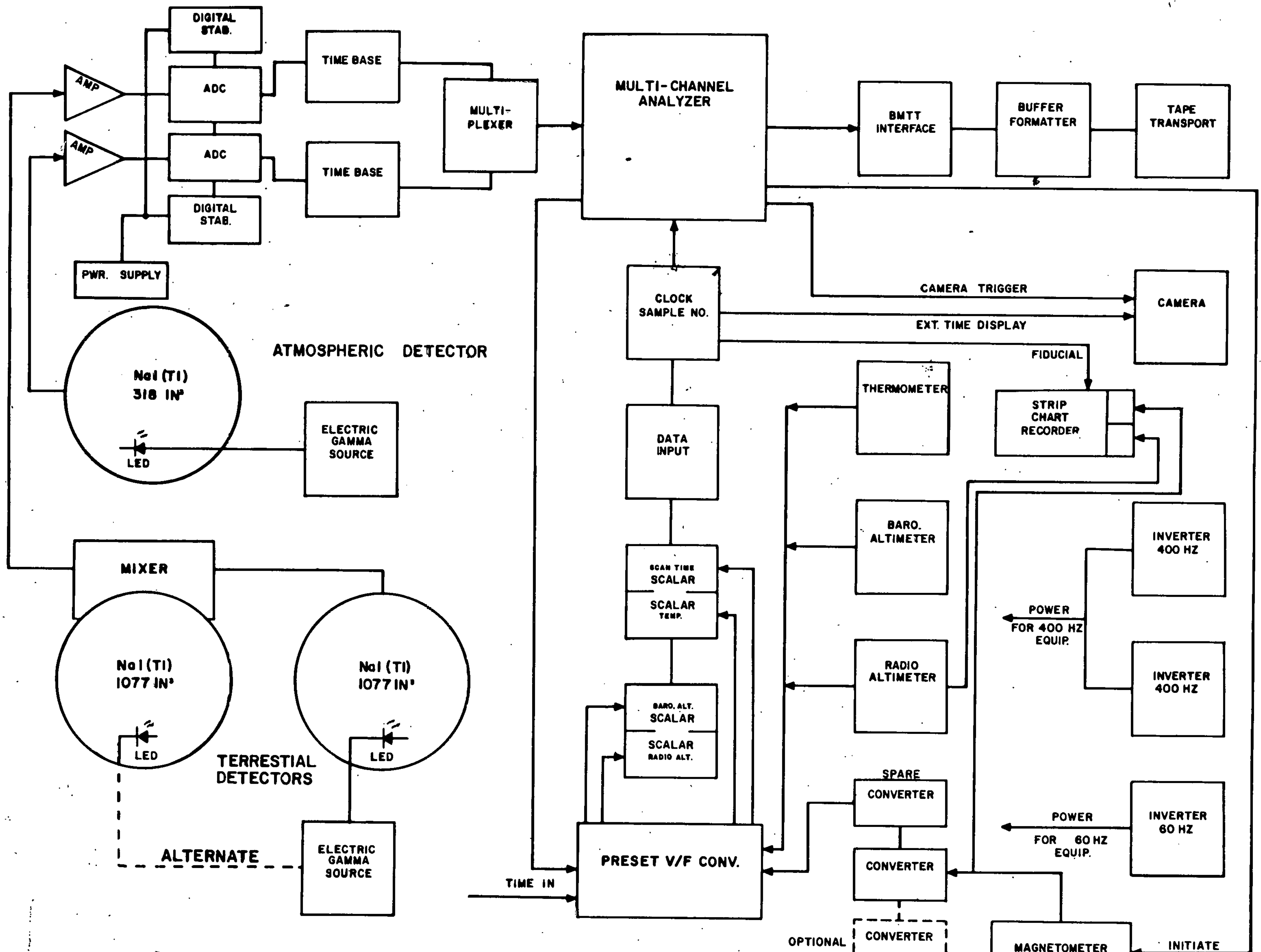

FIGURE-4
SYSTEM BLOCK DIAGRAM

3.0 DATA ACQUISITION

3.1 FIELD OPERATIONS

Field operations were initiated on the 17th of December 1979. Aircraft N870, which was assigned to the survey, which was completed on the 14th of April 1980. A total of 48 production flights were flown at an average production rate of 298 line miles per flight.

Aircraft navigation was accomplished by visual methods using large scale flight charts on which the traverse and tie lines were plotted. The charts were used by the navigator in directing the pilot down line. A tracking camera was used to provide film coverage of the line flown. The tracking film and large scale maps were utilized to identify the precise aircraft track.

Terrain clearance was held as close to 400 feet as terrain and safety conditions permitted. Air speed was kept to a mean of 90 mph, in accordance with the requirement to maintain a crystal volume/air speed ratio of 20 or greater.

The system was thoroughly checked before each day's flight. In addition a test line, near the base of operations was flown prior to and following each production flight. The purpose of this test line flight, was to provide data so as to monitor ground moisture effects. The principle requirement being that the measured count rate be reproducible to within 20 percent.

A summary of the test line results is presented in the production summary. (Appendix A, Page 41).

4.0 DATA REDUCTION

4.1 GENERAL

Figure 5, page 29/30, outlines the processing sequence followed to locate, identify and reduce the gamma-ray survey data. The following sections describe the main data reduction steps consisting of the following principle operations:

4.2 Path recovery and geologic correlation
4.3 Digital data edit
4.4 Radiometric corrections
4.5 Statistical analysis
4.6 Magnetic data processing

4.2 PATH RECOVERY AND GEOLOGIC CORRELATION

The aircraft track was established by manual identification and correlation of the 35mm tracking camera imagery with existing USGS topographic map sheets. The film images were identified on 1:62,500 and 1:24,000 scale maps from which the X and Y coordinates were read.

The coordinate data was edited by plotting the recovered path from the scaled X, Y coordinates. This was accomplished via the card edit plot program. The plotted path was inspected, any erratic variations were checked and if found in error, corrected and replotted.

The edited positional data was then transferred to the geologic map sheets from which the geologic rock units were read and correlated with the digital data by means of the digitized UTM coordinates.

4.3 DIGITAL DATA EDIT

The airborne data tapes are processed by the edit program which decodes and translates the recorded data. The multichannel spectra for both atmospheric and terrestrial gamma-ray sensors are summed over the entire time interval required to traverse the surveyed line. The resulting spectrum is smooth enough to fit a least square polynomial to the potassium and thorium photopeaks so as to accurately locate the channels corresponding to the maximum power points. The energy per channel is determined and the channel limits corresponding to the primary energy bands are computed.

K = 1.365 - 1.575 MeV
U = 1.650 - 1.860 MeV
T = 2.400 - 2.805 MeV

The computation of the photopeak limits effectively compensates for any spectrum drift.

The counts/channel within each photopeak are summed, as are the total count (.4 - 3.0 MeV) and the cosmic counts (3.0 - 6.0 MeV). The summed counts are all normalized to counts per second by dividing each sum by the recorded net live time.

The ancilliary data (barometric, radar, temperature and magnetometer) are all converted to appropriate units and tested for validity. The standard deviation of the median values of the first and second differences and of the absolute values are computed for groups of 56 samples. All samples within a given group for which three or more data words deviate more than six times the standard deviation of the appropriate median are flagged as being of suspect data quality.

Program outputs consist of a raw spectral data file and a single record data file containing the summed, normalized raw spectral data. In addition, a comprehensive edit listing is generated which is reviewed for possible corrections and further provides a detailed list of the magnetic field data which is utilized for the determination of the magnetic level corrections.

4.4 RADIOMETRIC CORRECTIONS

The reformatted data, having been summed and normalized to counts per second, was further processed to remove the effects of aircraft background, cosmic radiation and atmospheric bismuth. In addition, the Compton scattering of the higher energy levels into the lower spectral windows was corrected using the spectral stripping method. The net reduced count was then tested for statistical adequacy and normalized to 400 feet altitude at standard temperature and pressure. The normalized count was converted to apparent concentration units utilizing the sensitivity factors derived from the Lake Mead Calibration Range.

4.4.1 Background Corrections

The effects of aircraft background and cosmic radiation was removed by computing their contribution to each of the primary energy windows, from empirically derived correction parameters.

The parameters, defining the contribution of these non-terrestrial radiation sources to the airborne gamma-ray measurements were determined from data obtained from high altitude overwater flights.

To derive the cosmic and aircraft background correction parameters several assumptions must be made:

(1) The background radiation, emanating from onboard sources, is a constant.

(2) Atmospheric and terrestrial radiation are effectively eliminated by flying at high altitudes over deep bodies of water.

(3) The observed count rate varies linearly with respect to the cosmic count as measured by summing over the energy band from 3.0 to 6.0 MeV.

Using these assumptions, the spectrums obtained are considered to be composed of only two components, cosmic radiation and aircraft background.

The count rate for any given window may then be expressed by the following equation:

$$C_{ij} = B_i + R_i \, Cos_j$$

where:

i, j	are the subscripts identifying the window and observation respectively.
C_{ij}	is the mean count for window i, observation j
B_i	is the background constant corresponding to window i.
R_i	is the cosmic ratio corresponding to window i

Cos_j is the summed cosmic count corresponding to observation j.

A system of observation equations was formed for each of the principal windows and solved simultaneously for the most probable values of the cosmic and background correction parameters.

4.4.2 Compton Scatter Corrections

The effects of the Compton scattering of the higher energy radiation into the lower energy bands of interest were removed by computing the scattered radiation count utilizing the following correction equations.

(1) $T_c = T_o - bUc$

(2) $U_c = U_o - T_c\alpha_o - T_c\alpha_1 H$

(3) $K_c = K_o - T_c B_o - U_c\gamma$

where:

U_c = Corrected uranium count

U_o = Uranium count corrected for aircraft background and cosmic radiation

T_o = Thorium count corrected for aircraft background and cosmic radiation

T_c = Thorium count corrected for aircraft background, cosmic radiation and scattered uranium at 2.43 MeV appearing in the thorium window

K_o = Potassium count corrected for aircraft background and cosmic radiation

K_c = Corrected potassium count

b = Fraction of uranium counts appearing in the thorium window (R. L. Grasty - A Calibration Procedure for an Airborne Gamma-ray Spectrometer)

α_o = Stripping ratio (uranium counts per thorium count at zero altitude)

α_1 = Rate of change of the uranium stripping ratio with altitude H

β_o = Stripping ratio (potassium counts per thorium count at zero altitude

γ_o = Stripping ratio (potassium counts per uranium count)

The stripping ratios α_o, β_o, γ_o and b were determined from data obtained at the Walker Field test pads. The five test pads, each having known concentrations of K, U, T, provided the necessary redundant data for the solution of the stripping ratios α_o, β_o, γ_o and the system sensitivities K_1, K_2, K_3. The several equations relating the count rates with their corresponding concentrations are as follows:

$$(4) \quad T = K_1 \times Tppm + U_c \times b$$

$$(5) \quad U = K_2 \times Uppm + T_c \times \alpha_o$$

$$(6) \quad K = K_3 \times K_{pct} + T_c \, \beta_o + U_c \times \gamma_o$$

where:

T, U, K = Observed counts corrected for the local background as measured at Matrix Pad No. 1

Tppm, Uppm, Kpct = Concentration values after subtracting the Matrix Pad concentration values.

α_o, β_o, γ_o, b = Unknown stripping ratios

K_1, K_2, K_3 = Unknown sensitivities

4.4.3 Atmospheric Bismuth Correction

The atmospheric detector data was sampled at the same time interval as the terrestrial detector data, 1.0 seconds per scan. However, the relative precision of the atmospheric data is significantly less than the terrestrial data. This results from the fact that the volume of the atmospheric detector is approximately one seventh that of the terrestrial system.

Since the precision index varies directly as the square root of the number of observations, the atmospheric precision was increased by averaging over a 49 sample period. This period provides a seven fold increase in the precision of the atmospheric data which approaches the precision of the terrestrial sensor.

The averaged atmospheric data was then corrected for aircraft background, cosmic radiation and Compton scatter effects resulting from thorium photons scattering into the atmospheric uranium window. Additionally, correction was made for terrestrial uranium shine-around which was considered to vary exponentially with altitude.

The actual calculations are defined by the following expression:

$$\text{Bi AIR} = (\text{AUC} - \text{TUC} \times \text{SH}) / (\text{R} - \text{SH})$$

where:

AUC = Atmospheric uranium count corrected for cosmic radiation, aircraft background and Compton scattering of thorium into the uranium window.

TUC = Terrestrial uranium count corrected for cosmic radiation, aircraft background, Compton scattering of thorium into the uranium window and corrected for atmospheric bismuth.

SH = Exponential shine-around equation

$$\text{SH} = \text{A} \times \text{EXP}(-u\text{H})$$

where: A and u are empirically derived exponential coefficients.

R = Response ratio equating the atmospheric and terrestrial counts.

$$R = 1./(A + B \times H)$$

where: A and B are empirically derived linear coefficients.

4.4.4 Statistical Adequacy Test

The reduced single record count rates, (K, U, T) derived as described in the preceding sections, were tested to determine the significance of the net count rate values.

In this case significance is measured in terms of whether the net count exceeds some specified multiple of the computed standard deviation of the net count. From the paper presented by Currie (Analytical Chemistry 1968) the standard deviation of the net count may be expressed as:

$$NET = 1.41 \ (B)^{1/2}$$

where B is the total background which in the context of this discussion is considered to be the sum of the corrections applied to the observed count.

The confidence level, suggested by Currie and commonly adopted as a standard statistical measure, is .95 or 95%. The standard normal variable (multiple of standard deviation) corresponding to the 95% level used to evaluate the single record data is therefore:

$$2.33 \ (\text{obs. count} - \text{net count})^{1/2}$$

In summation, if the net count is less than 2.33 times the square root of the total applied correction (background) the sample is considered statistically inadequate and is flagged. The net counts are normalized to 400 feet and the ratios, U/K, U/T and T/K, are computed for all single record samples. The single record data are presented in the form of microfiche copies of the computer listings.

4.4.5 Altitude Normalization

The intensity of gamma radiation is considered to decrease exponentially with increasing distance from the source. This decrease in intensity may be defined as follows:

$$(1) \ C_h = S \exp \ (-u_h{}^h)$$

where:

C_h = the reduced count rate measured at height h above the source.

S = Source concentration expressed in counts/second.

u_h = The total attenuation coefficient compensated for air density as derived from the observed temperature and pressure.

The count rate observed at 400 feet above the source, at standard temperature of 0°C and standard pressure of 1013 millibars, is also expressed exponentially.

$$(2)\quad C_{400} = S \exp(-u_o\, 400)$$

where:

u_o = the total attenuation coefficient at standard temperature and pressure.

Equating equations 1 and 2.

$$(3)\quad C_{400} = C_h \exp(-u_o\, 400) \exp(-u_h{}^h)$$

and since exp (u_o 400) is a constant = K

$$(4)\quad C_{400} = K\, C_h / \exp(-u_h{}^h)$$

4.4.6 Record Averaging

The averaging interval is determined by the following criteria.

(1) The interval over which the data is averaged must be less than 1200 feet.

(2) Ninety-five percent of the averaged uranium data must pass the statistical adequacy test.

$$2.33\ (\text{average correction}/N)^{1/2}$$

The average correction is determined from the reduced count prior to normalization to 400 feet. Single records failing the statistical adequacy test are included when calculating the averaged record sample; the only restriction imposed is that the single record data be within the altitude limits of 200 to 1000 feet.

The averaged data values failing the test are flagged and excluded from all further analysis. The average interval for the survey was five samples.

4.5 STATISTICAL ANALYSIS

The averaged data was statistically evaluated predicated on the assumption that the average count is normally distributed about the mean of the group to which the record belongs. The assumption is valid for all large samples consisting of 30 or more records. Statistics relating to samples consisting of fewer than 30 records are at best suspect.

The pertinent statistics defining a given sample are the mean and standard deviation. These statistics are computed for each data parameter (K, U, T, U/T, U/K, T/K) of each geologic unit utilizing only those data values determined to be statistically adequate.

Each averaged record data parameter was evaluated, relative to the appropriate geologic unit mean and standard deviation, by computing the standard normal variable Z.

$$Z_k = (X_k - M_k)/Sigma_k$$

where:

- k = subscript identifying data parameter
- X_k = Averaged record value
- M_k = Mean value of parameter k
- $Sigma_k$ = Standard deviation of parameter k
- Z_k = Standard normal variable of averaged record parameter k

The standard normal variable is considered to have a normal distribution with a mean of zero and standard deviation of ±1.00. Values of the standard normal variable greater than ±1.00 are considered potentially anomalous and are shown on the anomaly maps.

Although the departure of the averaged record count from the mean of its corresponding geologic unit may be classified as potentially anomalous, it remains for the geologic interpreter to evaluate each anomaly so as to eliminate those which are obviously caused by climatic or topographic conditions.

4.6 MAGNETIC DATA PROCESSING

The recorded magnetic total field is edited simultaneously with the gamma-ray data. The edit listing generated by the digital edit program together with the identified film intersections are the basic information required to adjust the magnetics network.

Initially a tie line is selected as a datum to which all intersecting traverses are adjusted. All other tie line and traverse line intersection values are evaluated in terms of the magnitude and linearity of the level corrections required to adjust each traverse line to agree with the corresponding tie line value.

Excessively large non-linear corrections generally indicate erroneous positional information. In practice slight positional adjustments are usually applied so as to insure the required level corrections approach linearity.

The last step in the adjustment processes was the calculation and removal of the earth's regional magnetic field component. This was computed using the 1975 IGRF Model updated to 1979. The residual magnetic field was further adjusted by adding a constant datum value of 50,000 gamma.

DATA PROCESSING FLOW CHART

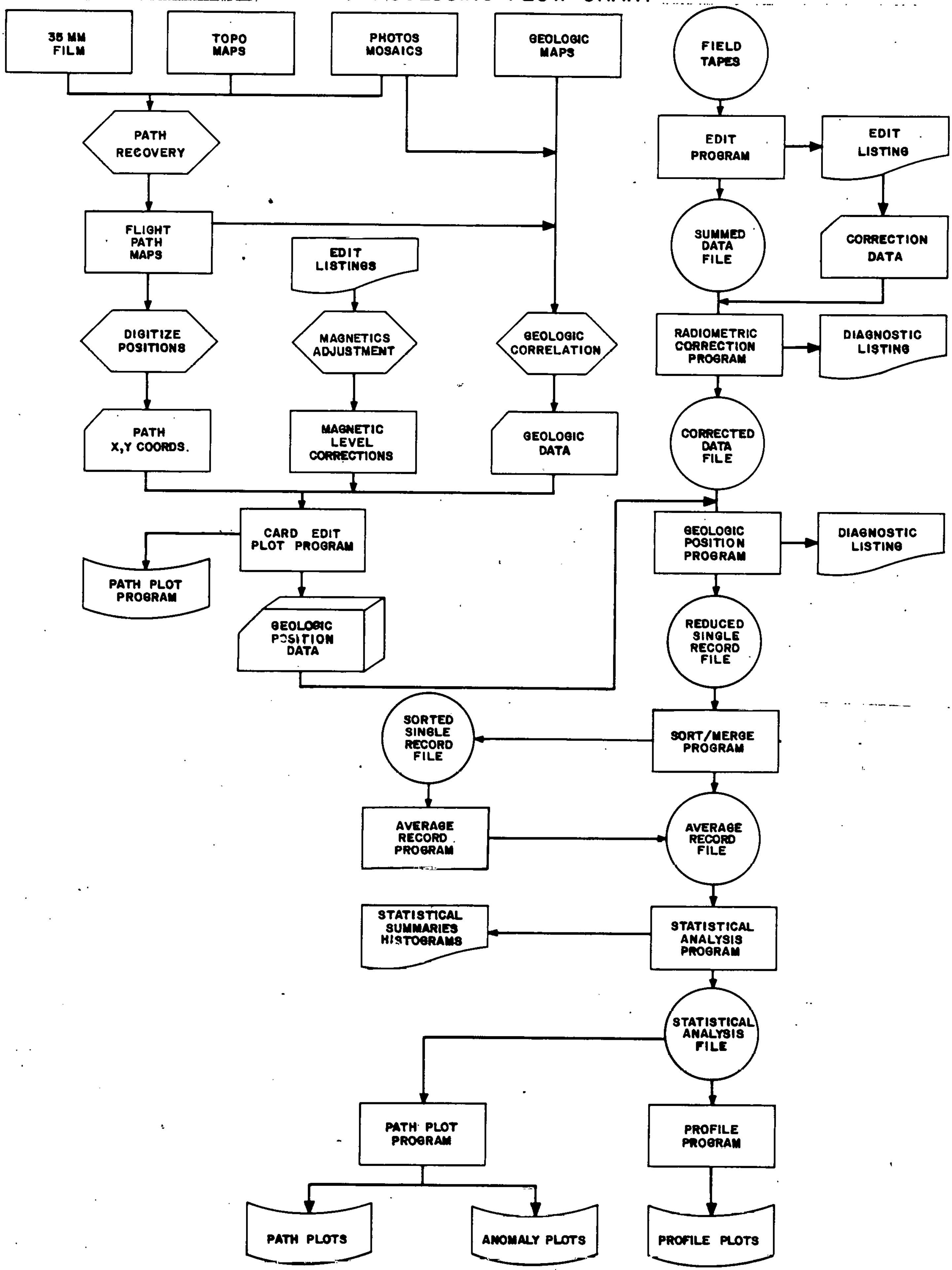

FIGURE - 5

5.0 GAMMA RAY MAGNETIC DATA PRESENTATION

5.1 GRAPHIC DATA PRESENTATION

All graphic and numeric data is organized according to individual NTMS 1:250,000 scale map sheets, and is identified by quadrangle name and number. The graphic data, produced at a scale of 1:250,000 was reduced to 1:500,000 for inclusion in the Volume II reports. The data presented consists of the following specific items:

(1) Radiometric Multiple-Parameter Stacked Profiles
(2) Magnetic Multiple-Parameter Stacked Profiles
(3) Anomaly Maps
(4) Count Rate Histograms
(5) Single Record Data Listings
(6) Averaged Record Data Listings
(7) Contour Maps

5.2 RADIOMETRIC MULTIPLE-PARAMETER STACKED PROFILES

The profiles of the averaged record data contain the following information:

Flight Line Number
Appropriate Title Information
Fiducial Numbers
Residual Magnetic Profile in gammas
Radar Altimeter in feet
Corrected total Count in CPS
Atmospheric Bismuth Correction in ppm
Apparent Concentration of U in ppm
Apparent Concentration of T in ppm
Apparent Concentration of K in %
Ratio U/K
Ratio U/T
Ratio T/K
Geologic Strip Map with Flight Path

Flags appearing under the K, U, and T traces indicate that the computed average record value for the corresponding element has failed the calculated statistical adequacy test. Flags appearing under the altitude trace indicate the averaged record has exceeded the altitude limits of 200 and 700 feet.

5.3 MAGNETIC MULTIPLE PARAMETER STACKED PROFILES

The magnetic data profiles were generated from the single record data file and contain the following information:

- Flight Line Number
- Appropriate Title Information
- Fiducial Numbers
- Barometric Altitude mmHg
- Temperature in degrees centigrade
- Radar terrain clearance in feet
- Ground station magnetic field in gammas
- Residual Magnetic Profile in gammas
- Geologic Map Strip with Flight Path

Samples obtained at terrain clearances less than 200 feet and greater than 700 feet are identified by a plotted symbol appearing at the bottom of the radar altimeter trace.

5.4 ANOMALY MAPS

Anomaly maps were generated for U, Th, K, U/Th, U/K and Th/K. The mean and its standard deviation were computed for each element and ratio of each lithologic unit. Only those averaged samples determined to be statistically adequate were used. Standard normal deviations greater than ±1.0 were considered potentially anomalous and were plotted.

Along east-west lines positive anomalies are plotted on the north side. Along north-south lines positive anomalies are plotted on the east side.

5.5 HISTOGRAMS

The histograms of the apparent concentrations of U, Th, K and their associated ratios were computed for each lithologic unit, for each quadrangle and are included in Volume II. Additional information presented are the mean, standard deviation and number of records contained in each distribution plot.

5.6 DATA LISTINGS

The data listings from the reduced data tapes covering each NTMS 1:250,000 sheet are produced on microfiche and are included in the appropriate Volume II report. Each printer page is identified by a header label specifying the NTMS quadrangle, survey company, survey area, year survey was flown, and line number.

5.6.1 Single Record Reduced Data Listings

The following elements are listed for each record:

HEADING	DESCRIPTION
REC	Fiducial Number (Time in seconds past midnight)
AF	Altitude Flag (Greater than 700 and less than 200 feet)
KF	Potassium Flag (Failed statistical adequacy test)
UF	Uranium Flag (Failed statistical adequacy test)
TF	Thorium Flag (Failed statistical adequacy test)
UNIT	Geologic Unit Code
LAT	Latitude in decimal degrees
LONG	Longitude in decimal degrees
TEMP	Temperature in Degrees Centigrade
BARM	Barometric Pressure Height in mmHg
MAG	Residual Magnetic Field in Gammas
GROSS	Total Count (.4 to 3.0 MeV) in Counts/Second
K	Apparent Concentration of K in %
U	Apparent Concentration of U in ppm
T	Apparent Concentration of T in ppm
U/K	Ratio Uranium/Potassium
U/T	Ratio Uranium/Thorium
T/K	Ratio Thorium/Potassium
COS	Cosmic Count (3 to 6 MeV) in Counts/Second
Bi	Atmospheric Bismuth Correction in ppm

5.6.2 Averaged Record Data Listings

The following elements are listed for each averaged record:

HEADING	DESCRIPTION
REC	Fiducial Number of Central Records (time in seconds past midnight)
AF	Altitude Flag (Greater than 700 or less than 200 feet)
KF	Potassium Flag (Failed statistical adequacy test)
UF	Uranium Flag (Failed statistical adequacy test)
TF	Thorium Flag (Failed statistical adequacy test)
UNIT	Geologic Unit Code
LAT	Latitude in decimal degrees
LONG	Longitude in decimal degrees
RADR	Radar Terrain Clearance in feet
MAG	Residual Magnetic Field in Gammas
TC	Total Count (.4 to 3.0 MeV) in Counts/Second
K	Apparent Concentration of K in %
U	Apparent concentration of U in ppm
T	Apparent Concentration of T in ppm
U/K	Ratio Uranium/Potassium
U/T	Ratio Uranium/Thorium
T/K	Ratio Thorium/Potassium
COS	Cosmic Counts/Second (3.0 to 6.0MeV)
Bi	Atmospheric Bismuth Correction in ppm
K	Potassium Standard Deviation units from the mean
U	Uranium Standard Deviation units from the mean
T	Thorium Standard Deviation units from the mean
U/K	Ratio Standard Deviation units from the mean
U/T	Ratio Standard Deviation units from the mean
T/K	Ratio Standard Deviation units from the mean

5.7 CONTOUR MAPS

Contours of the residual magnetic field and the six gamma ray parameters (eU, eTh, K, eU/eTh, eU/K, eTh/K) are presented at a horizontal scale of approximately 1:500,000. The maps are contained in the individual quadrangle Volume II reports.

6.0 DISCUSSION OF FORMAT - QUADRANGLES

6.1 GEOLOGICAL QUADRANGLES

This report is concerned with 6 standard two degree quadrangles located in the southwestern part of the United States. These quadrangles are located in the states of New Mexico, Arizona and Texas. All of the areas within the 1° x 2° quadrangles were studied except for the El Paso quadrangle. In the El Paso region only the area within the United States was subject to interpretation.

Each quadrangle will have its own list of geologic codes, computer codes, description of the geologic units and significant and preferred anomalies. Furthermore, each quadrangle will have an interpretation, conclusion and suggestions for further work. The surveyed quadrangles are listed below:

1.	Carlsbad	Nl 13-11
2.	El Paso	NH 13-1
3.	Holbrook	Nl 12-5
4.	Fort Sumner	Nl 13-5
5.	Roswell	Nl 13-8
6.	Las Cruces	Nl 13-10

7.0 INTERPRETATION BACKGROUND

7.1 GENERAL

The interpretation of the airborne gamma-ray spectrometer survey comprises an integrated analysis of the radiometric data with basic data from several disciplines. From the viewpoint of final interpretation, the geologic map is the most useful auxiliary parameter. The other pertinent quantities include the magnetic profiles as well as the altitude, barometric pressure, temperature, and atmospheric radon measurements. Many of these measurements are integrated with the radiometric data in the analytical stage prior to the interpretation.

In the following discussions, this analysis is divided into two principal sections dealing with the stacked radiometric profiles and the radiometric anomaly maps. It is considered that a comprehensive evaluation must encompass study of both these principal data sets, inasmuch as they are mutually complementary to the extent that neither by itself can convey the full significance of the survey results. Several examples of the complementary nature of the anomaly maps and the profiles will illustrate this point. The anomaly maps comprise the ideal medium for the definition of anomalous zones within discrete geologic units, while in contrast, information regarding regional background radiation levels pertinent to the delineation of geological districts can only be derived from the profile data. In another example, those anomalous situations exceeding three sigma, situations which may actually result from ore bodies, can only be evaluated on the profiles. Finally, "metallogenic provinces" are a rather commonly discernible feature on the anomaly maps because they frequently cut across time units and formational boundaries alike. While discernible in plan view, these provinces cannot be seen in the two dimensional profile data.

The correct interpretation of the gamma-ray spectrometer data depends on a thorough understanding of the principles and theory of the survey and data processing techniques. While the major part of this required information is included in the previous sections of this report, a number of additional factors peculiar to airborne survey operations in general, and gamma-ray spectrometer surveys in particular, should also be appreciated from the standpoint of their effects on the collected data. Such factors include the variability of low count rate statistics resulting from local terrain clearance variations which are often unavoidable in airborne surveys; similar variations in count rates over equivalent geologic units caused by surface condition variants such as degree of water saturation and soil thicknesses; inaccurate statistical accumulations due to geologic unit misclassifications; and false recordings caused by locally anomalous atmospheric conditions, particularly temperature inversions accompanied by atmospheric radon concentrations. These factors have been well-documented in previous reports on the airborne reconnaissance phases of the NURE program published by DOE, and additional comments in this text are considered redundant.

It should be recognized that the magnetic data gathered while conducting a radiometric reconnaissance survey of this type is generally not as useful as that derived from a magnetic survey conducted with typical magnetic survey specifications, first because of the wide traverse spacing usually employed. Secondly, the magnetic data suffer from the limited resolution due to an along-line sampling rate governed by a one second intergration time at a mean terrain clearance of 400 feet. That is, at an altitude of 400 feet (the radiometric survey altitude), the field should be sampled at a ground spacing of not greater than 75 feet if one intends to define surface and near-surface geologic anomalies. Data sampled in this survey averages about 132 feet between samples.

7.2 RADIOMETRIC PROFILES

The sections titled "Commentary on Radiometric Profiles" are intended to call attention to specific conditions present in the stacked radiometric profiles that can directly or indirectly relate to the radioactivity anomalies measured at the surface and that are not apparent on the radiometric anomaly maps. These conditions pertain primarily to geologic contacts, structural elements, and to radiometric level shifts suggesting geologic or geochemical change in the surface geology. In the southwest, one might expect that the N-S to NW-SE trending faults recognized on the geologic maps would certainly be indicated in the geophysical data as well. This is only partially true. Some stratigraphic boundaries that might otherwise be expected to produce sharp geophysical contrasts do not, while other zones, usually lying within the broad lithologies, are quite distinctive. Inasmuch as the regional geological character of each area will have been discussed in Volume II of this report, the comments in the "Commentary" are principally directed to the geophysical implications derived from the study of the survey data both as they apply to particular anomalous zones as well as to zones where anomalies do not occur but might be expected to.

7.3 SELECTION OF URANIUM ANOMALIES

The selection of significant eU anomalies was accomplished by identifying all individual, or groups of, statistically high data points on the equivalent uranium anomaly map on the basis of a system of statistical reliability criteria. A set of criteria was developed in a previous airborne survey by Texas Instruments for the NURE program and subsequently published by DOE (open file document No. GJBX-18 (77)).

The anomaly maps display only data that has varied above or below the statistical mean by 1.00 standard deviation (sigma).

From -0.99 sigma to +0.99 sigma	= no plot
From ±1.00 through ±1.99	= one symbol
From ±2.00 through ±2.99	= two symbols
From ±3.00 or greater	= three symbols

The definition of a reliable anomaly is based on certain groupings of adjacent statistically high points. Of these, the acceptable significant eU anomalies or anomalous zones were selected according to one or more of the following criteria, which is again an expansion of the original "Statistical reliability criteria".

1. One (averaged) data point 3 sigma or higher.

2. Two adjacent (averaged) data points between 2 and 3 sigma above the mean.

3. Three adjacent (averaged) points where two are between 1 and 2 sigma, and one is between 2 and 3 sigma above the mean.

4. Four adjacent (averaged) points between 1 and 2 sigma above the mean.

While the above criteria may be refined in the course of future analysis, they have produced satisfactory results in the case of the present survey as well as previous projects in other areas, and have the additional advantage of affording some degree of continuity and standardization with regard to the evaluation of airborne survey anomalies in the context of the NURE program.

7.4 EVALUATION OF ANOMALIES

Following the selection of significant eU anomalies on the uranium anomaly map, a transparent overlay of the outlined anomalous zones was prepared and examined in conjunction with the topographic and geologic maps, the supporting data tables, the stacked profiles, and the balance of the statistically derived anomaly maps to evaluate each eU anomaly in terms of its potential as an indication of true uranium enrichment deserving further investigation. The essential results of these comparative analyses are summarized and presented in the appropriate Volume II Report.

8.0 APPENDICES

8.1 APPENDIX A - PRODUCTION SUMMARY

Aircraft N870 was assigned to conduct the survey. The first production flight was on the 17th of December 1979. The last production flight was flown on 14 April 1980.

The entire survey required 48 production flights which averaged approximately 298 line miles per flight.

In accordance with the general specifications a short test line was flown both prior to and following each production flight. The purpose of this test line was to monitor moisture effects and/or system repeatability by measuring the percent of difference between successive test flights. The test line results are summarized in Table A-1.

Aircraft terrain clearance was maintained as close to 400 feet as safety considerations and pilot skill permitted. Airspeed was kept to a mean of approximately 90 mph so as to insure conformance to the sensitivity requirement that the ratio of the detector volume to airspeed be 20 or greater. A summary of the mean airspeed and terrain clearance for each quadrangle follows:

Quadrangles	Mean Terrain Clearance Feet	Mean Airspeed mph
Carlsbad	429	93.6
El Paso	433	95.9
Holbrook	423	90.9
Fort Sumner	414	95.6
Roswell	421	92.9
Las Cruces	431	95.8

TABLE A1

NEW MEXICO AERIAL SURVEY
TEST LINE SUMMARY

LINE	DATE	START TEST LINE SUMMED CPS	END TEST LINE SUMMED CPS	PREVIOUS AVERAGE	DIFFERENCE % START	DIFFERENCE % END
6003	12/17/79	978540	1026579	1002560	- 2.4	+ 2.4
6003	12/28/79	910152	915181	1002560	- 9.2	- 8.7
6003	12/29/79	887636	-----	1002560	-11.5	---
6003	12/30/79	883826	weather	1002560	-11.8	---
6003	01/04/80	900018	weather	1002560	-10.2	---
6001	01/10/80	954697	954419	990074	- 3.5	- 3.6
6001	01/13/80	1003851	976298	990074	+ 1.4	- 1.4
6001	01/14/80	1044981	975887	990074	+ 5.5	- 1.4
6001	01/15/80	960789	-----	990074	- 3.0	---
6001	01/17/80	1066890	985709	990074	+ 7.8	- 0.4
6001	01/18/80	1011928	-----	990074	+ 2.2	---
6001	01/19/80	1002900	1018603	990074	+ 1.3	- 2.8
6001	01/25/80	1083484	1010600	990074	+ 9.4	+ 2.1
6001	01/26/80	1002883	974365	990074	+ 1.3	- 1.6
6001	01/27/80	1028613	1016225	990074	+ 3.9	+ 2.6
6001	01/28/80	1015511	969302	990074	+ 2.6	- 2.1
6002	02/02/80	738263	737031	737647	+ 0.1	- 0.1
6002	02/03/80	760208	749639	737647	+ 3.0	+ 1.6
6002	02/04/80	775030	-----	737647	+ 5.0	---
6002	02/10/80	750048	748552	737647	+ 1.7	+ 1.5
6003	02/19/80	764591	782293	769442	- 0.6	+ 1.7
6001	02/19/80	953534	961938	990074	- 3.7	- 2.8
6003	02/20/80	765840	777817	769442	- 0.5	+ 1.1
6003	02/21/80	785247	789848	769442	+ 2.0	+ 2.6
6003	02/22/80	792445	810333	769442	+ 3.0	+ 5.3
6003	02/23/80	812653	794565	769442	+ 5.6	+ 3.3
6003	02/24/80	829269	812980	769442	+ 7.8	+ 5.7
6003	02/25/80	816603	804447	769442	+ 6.1	+ 4.5
6003	02/26/80	854736	820428	769442	+11.1	+ 6.6
6003	02/27/80	843662	811541	769442	+ 9.6	+ 5.5
6003	02/28/80	860840	-----	769442	+11.9	---
6003	03/06/80	864973	817178	769442	+12.4	+ 6.2
6003	03/08/80	816787	804026	769442	+ 6.2	+ 4.5
6003	03/09/80	813293	807565	769442	+ 5.7	+ 5.0
6003	03/10/80	805853	810231	769442	+ 4.7	+ 5.3

INE	DATE	START TEST LINE SUMMED CPS	END TEST LINE SUMMED CPS	PREVIOUS AVERAGE	DIFFERENCE % START	END
6004	03/11/80	624355	629799	627077	- 0.4	+ 0.4
6004	03/12/80	607002	621694	627077	- 3.2	- 0.9
6004	03/13/80	591224	605163	627077	- 5.7	- 3.5
6004	03/14/80	624368	606528	627077	- 0.4	- 3.3
6004	03/15/80	662996	604595	627077	+ 5.7	- 3.6
6006	04/04/80	894711	857659	876185	+ 2.1	- 2.1
6006	04/06/80	839303	839247	876185	- 4.2	- 4.2
6006	04/07/80	816616	-----	----	- 6.8	---
6006	04/08/80	840736	839174	876185	- 4.0	- 4.2
6006	04/09/80	877279	850837	876185	+ 0.1	- 2.9
6006	04/10/80	867948	859646	876185	- 0.9	- 1.9
6006	04/13/80	844843	861801	876185	- 3.6	- 1.6
6006	04/14/80	897753	855832	876185	+ 2.5	- 2.3

8.2 APPENDIX B - TAPE FORMATS

DATA TAPES

Five types of data tapes are generated for each NTMS quadrangle surveyed:

1. Raw spectral
2. Single-record reduced
3. Statistical analysis
4. Magnetic
5. Statistical analysis summary

All data tapes are IBM-compatible, nine-track, 800-bpi (NRZI), odd parity, and EBCDIC coded.

A gummed label attached to each tape reel contains the following information:

- Survey project name, month, and year of survey
- Data tape type
- Subcontractor name
- Tape creation date
- Tape reel count
- Tape recording characteristics
- Block size in bytes
- Tape format information

Single-record reduced, statistical analysis and magnetic data are organized on the tape by flight line. Within a given flight line or tie line, data are organized sequentially by location (latitude and longitude). Within a given survey area, flight lines and tie lines are organized sequentially by location, and all flight line data precede tie line data. Processed data from any individual flight line or tie line are completely contained on one tape. The raw spectral data are organized on tape exactly as are processed data.

The content of each physical block on tape for all five types of data tapes are:

Physical Block Number	Description
1	Format description block
2	Tape identification block
3	First data block
4	Second data block
5	Third data block
.	. . .
.	. . .
.	. . .
.	. . .
EOF	Last data block

The format description block is a literal alphanumeric listing of the Fortran formats and data-item description required to read and identify the contents of the tape. The tape identification block identifies the survey area, the subcontractor, the aerial system used, etc., and summarizes the flight line data recorded on the tape.

Data blocks contain records of data. Formats for each type of data tape are specified below.

All data blocks are recorded in fixed physical block lengths with the following block sizes, record lengths, and blocking factors:

TAPE CODE	TAPE NAME	Block Size (bytes)	Record Length (bytes)	Blocking Factor
01	Raw spectral	6,600	1,100	6
02	Single record reduced	6,900	138	50
03	Statistical analysis	8,000	160	50
04	Magnetic	8,000	80	100
05	Statistical analysis summary	7,000	140	50

RAW SPECTRAL DATA TAPES

The raw spectral data tape provides properly formatted raw spectral data for data bank deposition without normalization, reduction, or correction.

The first physical block on this tape is the format description block, providing information needed to read the tape. The first 4248 characters on this block are 59 consecutive 72-character lines, literally written as shown in Table B-1. The remaining 2352 characters in the block are blank.

Table B-1

Format Description Block Contents

Line Number	Character Number 12345678901234567890123456789012345678901234567890123456789012		
1	01 0978 (DATA TAPE TYPE AND FØRMAT SPECIFICATION DATE CØDES)		
2			
3	RAW SPECTRAL DATA TAPE		
4			
5	FØRMAT FØR TAPE IDENTIFICATIØN BLØCK (SECØND BLØCK ØN TAPE)		
6			
7	ITEM	FØRMAT	DESCRIPTIØN
8	1	A40	QUADRANGLE NAME AS PRØJECT IDENTIFICATIØN
9	2	A20	NAME ØF SUBCØNTRACTØR
10	3	I4	APPRØXIMATE DATE ØF SURVEY (MØNTH,YEAR)
11	4	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE
12	5	A20	AIRCRAFT IDENTIFICATIØN BY TYPE AND FAA NUMBER
13	6	I3	BFEC CALIBRATIØN REPØRT NUMBER
14	7	F6.3	4PI SYSTEM DATA CØLLECTIØN INTERVAL TØ THREE DECIMAL
15			PLACES IN SECØNDS
16	8	F6.3	2PI SYSTEM DATA CØLLECTIØN INTERVAL TØ THREE DECIMAL
17			PLACES IN SECØNDS
18	9	I3	NUMBER ØF CHANNELS (0-3 MEV) FØR 4PI SYSTEM
19	10	I3	NUMBER ØF CHANNELS (0-3 MEV) FØR 2PI SYSTEM
20	11	I3	NUMBER ØF FLIGHT LINES ØN THIS TAPE
21	12	I4	FIRST FLIGHT LINE NUMBER ØN THIS TAPE
22	13	I6	FIRST RECØRD NUMBER ØF FIRST FLIGHT LINE
23	14	I3	JULIAN DATE (DAY ØF YEAR) FIRST FLIGHT LINE WAS
24			CØLLECTED
25	15-17	I4,I6,I3	REPEAT ØF ITEMS 12-14 FØR SECØND FLIGHT LINE ØN THIS
26			TAPE
27	*	*	*
28	*	*	*
29	*	*	*
30	306-308	I4,I6,I3	REPEAT ØF ITEMS 12-14 FØR 99TH FLIGHT LINE ØN THIS
31			TAPE
32			
33	FØRMAT FØR RAW SPECTRAL DATA RECØRD (THIRD THRU LAST BLØCK ØN TAPE)		
34			
35	ITEM	FØRMAT	DESCRIPTIØN
36	1	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE
37	2	I4	FLIGHT LINE NUMBER
38	3	I6	RECØRD IDENTIFICATIØN NUMBER
39	4	I6	GMT TIME ØF DAY (HHMMSS)
40	5	F8.4	LATITUDE TØ FØUR DECIMAL PLACES IN DEGREES
41	6	F8.4	LØNGITUDE TØ FØUR DECIMAL PLACES IN DEGREES
42	7	F6.1	TERRAIN CLEARANCE TØ ØNE DECIMAL PLACE IN METERS
43	8	F7.1	TØTAL MAGNETIC FIELD INTENSITY TØ ØNE DECIMAL PLACE
44			IN GAMMAS
45	9	A8	SURFACE GEØLØGIC MAP UNIT CØDE
46	10	I4	QUALITY FLAG CØDES
47	11	F4.1	ØUTSIDE AIR TEMPERATURE TØ ØNE DECIMAL PLACE IN
48			DEGREES CELSIUS
49	12	F5.1	ØUTSIDE AIR PRESSURE TØ ØNE DECIMAL PLACE IN MMHG
50	13	F5.3	LIVE TIME CØUNTING PERIØD TØ THREE DECIMAL PLACES IN
51			SECØNDS
52	14	I4	SUMMED RAW ØUTPUT FRØM CØSMIC CHANNELS (3-6 MEV) IN
53			CØUNTS

Line Number	Character Number 12345678901234567890123456789012345678901234567890123456789012345678901		
54	15	I4	RAW ØUTPUT FRØM CHANNEL 1 IN CØUNTS
55	16	I4	RAW ØUTPUT FRØM CHANNEL 2 IN CØUNTS
56	*	*	*
57	*	*	*
58	*	*	*
59	270	I4	RAW ØUTPUT FRØM CHANNEL 256 IN CØUNTS

The second block on tape is the tape identification block. It provides information identifying the survey, the approximate date of the survey, the subcontractor, etc. The data written on this block are in the format as specified in the first block of this tape as shown in Table B-1. The remaining 5204 characters on this block remain blank.

The third and all subsequent blocks on the raw spectral data tape are raw spectral data records with six records per physical block. The data written in each record are in the same format as specified in the first block of this tape.

SINGLE RECORD REDUCED DATA TAPES

The single record reduced data tape provides 1-second, summed channel information that is corrected and normalized.

The first physical block on this tape is the format description block, providing information needed to read this tape. The first 6768 characters on this block consist of 94 consecutive 72-character lines, as shown in Table B-2. The remaining 132 characters on this block remain blank.

The second block on tape is the tape identification block, providing information identifying the survey, the approximate date of the survey, the subcontractor, flight lines, etc. The data written on this block are in the same format as specified in the first block of this tape. The remaining 4978 characters on this block remain blank.

The third and all subsequent blocks on the single record reduced data tape are single record reduced data records with 50 records per physical block. The data written in each record are in the same format as specified in the first block of this tape.

Table B-2

Single Record Reduced Data Format Description Block Contents

Line Number	Character Number 123456789012345678901234567890123456789012345678901234567890123456789012		
1	02 0978 (DATA TAPE TYPE AND FØRMAT SPECIFICATIØN DATE CØDES)		
2			
3	SINGLE RECØRD REDUCED DATA TAPE		
4			
5	FØRMAT FØR TAPE IDENTIFICATIØN BLØCK (SECØND BLØCK)		
6			
7	ITEM	FØRMAT	DESCRIPTIØN
8	1	A40	QUADRANGLE NAME AS PRØJECT IDENTIFICATIØN
9	2	A20	NAME ØF SUBCØNTRACTØR
10	3	I4	APPRØXIMATE DATE ØF SURVEY (MØNTH,YEAR)
11	4	I1	NUMBER ØF AERIAL SYSTEMS USED TØ CØLLECT DATA FØR
12			THIS QUADRANGLE
13	5	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE FØR FIRST SYSTEM
14	6	A20	AIRCRAFT IDENTIFICATIØN BY TYPE AND FAA NUMBER FØR
15			FIRST SYSTEM
16	7	F6.1	NØMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TØ
17			TERRESTRIAL PØTASSIUM (K-40) TØ ØNE DECIMAL PLACE
18			IN CPS PER PERCENT K FOR FIRST SYSTEM
19	8	F6.1	NØMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TØ
20			TERRESTRIAL URANIUM (BI-214) TØ ØNE DECIMAL PLACE
21			IN CPS PER PPM EQUIVALENT U
22	9	F6.1	NØMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TØ
23			TERRESTRIAL THØRIUM (TL-208) TØ ØNE DECIMAL PLACE
24			IN CPS PER PPM EQUIVALENT TH
25	10	I6	BLANK FIELD (999999)
26	11	F6.3	4PI-SYSTEM DATA CØLLECTION INTERVAL TØ THREE DECIMAL
27			PLACES IN SECØNDS FØR FIRST SYSTEM
28	12	F6.3	2PI-SYSTEM DATA CØLLECTION INTERVAL TØ THREE DECIMAL
29			PLACES IN SECØNDS FØR FIRST SYSTEM
30	13	I3	NUMBER ØF CHANNELS (0-3 MEV) IN 4PI SYSTEM FØR FIRST
31			AERIAL SYSTEM
32	14	I3	NUMBER ØF CHANNELS (0-3 MEV) IN 2PI SYSTEM FØR FIRST
33			AERIAL SYSTEM
34	15-24	(SAME)	REPEAT ØF ITEMS 5-14 FØR SECØND AERIAL SYSTEM
35	*	*	*
36	*	*	*
37	*	*	*
38	85-94	(SAME)	REPEAT ØF ITEMS 5-14 FØR NINTH AERIAL SYSTEM
39	95	I3	NUMBER ØF FLIGHT LINES ØN THIS TAPE
40	96	I4	FIRST FLIGHT LINE NUMBER ØN THIS TAPE
41	97	I6	FIRST RECØRD NUMBER ØF FIRST FLIGHT LINE
42	98	I3	JULIAN DATE (DAY ØF YEAR) FIRST FLIGHT-LINE DATA WAS
43			CØLLECTED
44	99-101	I4,I6,I3	REPEAT ØF ITEMS 96-98 FØR SECØND FLIGHT LINE ØN THIS
45			TAPE
46	*	*	*
47	*	*	*
48	*	*	*
49	390-392	I4,I6,I3	REPEAT ØF ITEMS 96-98 FØR 99TH FLIGHT LINE ØN THIS
50			TAPE
51			

Line Number — Character Number

1234567890123456789012345678901234567890123456789012345678901234567890123456789012

FØRMAT FØR SINGLE RECØRD REDUCED DATA RECØRD (THIRD THRU LAST BLØCK)

ITEM	FØRMAT	DESCRIPTIØN
1	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE
2	I4	FLIGHT LINE NUMBER
3	I6	RECØRD IDENTIFICATIØN NUMBER
4	I6	GMT TIME ØF DAY (HHMMSS)
5	F8.4	LATITUDE TØ FØUR DECIMAL PLACES IN DEGREES
6	F8.4	LØNGITUDE TØ FØUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TØ ØNE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF REMØVED) MAGNETIC FIELD INTENSITY TØ ØNE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEØLØGIC MAP UNIT CØDE
10	I4	QUALITY FLAG CØDES
11	F6.1	APPARENT CØNCENTRATIØN ØF TERRESTRIAL PØTASSIUM (K-40) TØ ØNE DECIMAL PLACE IN PERCENT K
12	F4.1	UNCERTAINTY IN TERRESTRIAL PØTASSIUM TØ ØNE DECIMAL PLACE IN PERCENT K
13	F6.1	APPARENT CØNCENTRATIØN ØF TERRESTRIAL URANIUM (BI-214) TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
14	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
15	F6.1	APPARENT CØNCENTRATIØN ØF TERRESTRIAL THØRIUM (TL-208) TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT TH
16	F4.1	UNCERTAINTY IN TERRESTRIAL THØRIUM TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT TH
17	F6.1	URANIUM-TØ-THØRIUM RATIØ TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
18	F6.1	URANIUM-TØ-PØTASSIUM RATIØ TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
19	F6.1	THØRIUM-TØ-PØTASSIUM RATIØ TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
20	F8.1	GRØSS GAMMA (0.4-3.0 MEV) CØUNT RATE TØ ØNE DECIMAL PLACE IN CØUNTS PER SECØND
21	F6.1	UNCERTAINTY IN GRØSS GAMMA CØUNT RATE TØ ØNE DECIMAL PLACE IN CØUNTS PER SECØND
22	F5.1	ATMØSPHERIC BI-214 4PI CØRRECTIØN TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMØSPHERIC BI-214 4PI CØRRECTIØN TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
24	F4.1	ØUTSIDE AIR TEMPERTURE TØ ØNE DECIMAL PLACE IN DEGREES CELSIUS
25	F5.1	ØUTSIDE AIR PRESSURE TØ ØNE DECIMAL PLACE IN MMHG

Statistical Analysis Data Tapes

The statistical analysis tape provides averaged-record parameters for each radioelement and radioelement ratios in relation to the appropriate geologic map unit.

The first physical block on this tape is the format description block, providing information needed to read this tape. The first 7560 Characters on this block consist of 105 consecutive 72-character lines, literally written as shown in Table B-3. The remaining 440 characters on this block remain blank.

The second block on tape is the identification block, providing information identifying the survey, the approximate date of the survey, the subcontractor, flight lines, etc. The data written on this block are in the same format as specified in the first block of this tape. The remaining 6078 characters on this block remain blank.

The third and all subsequent blocks on the statistical analysis data tape are statistical analysis data records with 50 records per physical block. The data written in each record are in the same format as specified in the first block of this tape.

Magnetic Data Tapes

The purpose of the magnetic data tape is to provide industry and other government agencies magnetic data separate from radiometric information.

The first physical block on each magnetic data tape is the format description block, providing information needed to read this tape. The first 3384 characters on this block consist of 47 consecutive 72-character lines, literally written as shown in Table B-4. The remaining 4616 characters on this block remain blank.

Table B-3

Statistical Analysis Format Description Block Contents

Line Number	Character Number 1234567890123456789012345678901234567890123456789012345678901234567890123456789012		
1	03 0978 (DATA TAPE TYPE AND FØRMAT SPECIFICATIØN DATE CØDES)		
2			
3	STATISTICAL ANALYSIS DATA TAPE		
4			
5	FØRMAT FØR TAPE IDENTIFICATIØN BLØCK (SECØND BLØCK)		
6			
7	ITEM	FØRMAT	DESCRIPTIØN
8	1	A40	QUADRANGLE NAME AS PRØJECT IDENTIFICATIØN
9	2	A20	NAME ØF SUBCØNTRACTØR
10	3	I4	APPRØXIMATE DATE ØF SURVEY (MØNTH,YEAR)
11	4	I1	NUMBER ØF AERIAL SYSTEMS USED TØ CØLLECT DATA FØR
12			THIS QUADRANGLE
13	5	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE FØR FIRST SYSTEM
14	6	A20	AIRCRAFT IDENTIFICATIØN BY TYPE AND FAA NUMBER FØR
15			FIRST SYSTEM
16	7	F6.1	NØMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TØ
17			TERRESTRIAL PØTASSIUM (K-40) TØ ØNE DECIMAL PLACE
18			IN CPS PER PERCENT K
19	8	F6.1	NØMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TØ
20			TERRESTRIAL URANIUM (BI-214) TØ ØNE DECIMAL PLACE
21			IN CPS PER PPM EQUIVALENT U
22	9	F6.1	NØMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TØ
23			TERRESTRIAL THØRIUM (TL-208) TØ ØNE DECIMAL PLACE
24			IN CPS PER PPM EQUIVALENT TH
25	10	I6	BLANK FIELD (999999)
26	11	F6.3	4PI-SYSTEM DATA CØLLECTIØN INTERVAL TØ THREE DECIMAL
27			PLACES IN SECØNDS FØR FIRST SYSTEM
28	12	F6.3	2PI-SYSTEM DATA CØLLECTIØN INTERVAL TØ THREE DECIMAL
29			PLACES IN SECØNDS FØR FIRST SYSTEM
30	13	I3	NUMBER ØF CHANNELS (0-3 MEV) IN 4PI SYSTEM FØR FIRST
31			AERIAL SYSTEM
32	14	I3	NUMBER ØF CHANNELS (0-3 MEV) IN 2PI SYSTEM FØR FIRST
33			AERIAL SYSTEM
34	15-24	(SAME)	REPEAT ØF ITEMS 5-14 FØR SECØND AERIAL SYSTEM
35	*	*	*
36	*	*	*
37	*	*	*
38	85-94	(SAME)	REPEAT ØF ITEMS 5-14 FØR NINTH AERIAL SYSTEM
39	95	I3	NUMBER ØF FLIGHT LINES ØN THIS TAPE
40	96	I4	FIRST FLIGHT LINE NUMBER ØN THIS TAPE
41	97	I6	FIRST RECØRD NUMBER ØF FIRST FLIGHT LINE
42	98	I3	JULIAN DATE (DAY ØF YEAR) FIRST FLIGHT LINE DATA WAS
43			CØLLECTED
44	99-101	I4,I6,I3	REPEAT ØF ITEMS 96-98 FØR SECØND FLIGHT LINE ØN THIS
45			TAPE
46	*	*	*
47	*	*	*
48	*	*	*
49	390-392	I4,I6,I3	REPEAT ØF ITEMS 96-98 FØR 99TH FLIGHT LINE ØN THIS
50			TAPE
51			

Line Number — Character Number

12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

FØRMAT FØR STATISTICAL ANALYSIS DATA RECØRD (THIRD THRU LAST BLØCK)

ITEM	FØRMAT	DESCRIPTIØN
1	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE
2	I4	FLIGHT LINE NUMBER
3	I6	RECØRD IDENTIFICATIØN NUMBER
4	I6	GMT TIME ØF DAY (HHMMSS)
5	F8.4	LATITUDE TØ FØUR DECIMAL PLACES IN DEGREES
6	F8.4	LØNGITUDE TØ FØUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TØ ØNE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF REMØVED) MAGNETIC FIELD INTENSITY TØ ØNE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEØLØGIC MAP UNIT CØDE
10	I5	QUALITY FLAG CØDES
11	F6.1	AVERAGED CØNCENTRATIØN ØF TERRESTRIAL PØTASSIUM (K-40) TØ ØNE DECIMAL PLACE IN PERCENT K
12	F4.1	UNCERTAINTY IN TERRESTRIAL PØTASSIUM TØ ØNE DECIMAL PLACE IN PERCENT K
13	F5.1	PØTASSIUM STANDARD DEVIATION FRØM THE MEAN TØ ØNE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
14	F6.1	AVERAGED CØNCENTRATIØN ØF TERRESTRIAL URANIUM (BI-214) TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
16	F5.1	URANIUM STANDARD DEVIATION FRØM THE MEAN TØ ØNE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
17	F6.1	AVERAGED CØNCENTRATIØN ØF TERRESTRIAL THØRIUM (TL-208) TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT TH
18	F4.1	UNCERTAINTY IN TERRESTRIAL THØRIUM TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT TH
19	F5.1	THØRIUM STANDARD DEVIATION FRØM THE MEAN TØ ØNE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
20	F8.1	GRØSS GAMMA (0.4-3.0 MEV) CØUNT RATE TØ ØNE DECIMAL PLACE IN CØUNTS PER SECØND
21	F6.1	UNCERTAINTY IN GRØSS GAMMA CØUNT RATE TØ ØNE DECIMAL PLACE IN CØUNTS PER SECØND
22	F5.1	ATMØSPHERIC BI-214 4PI CØRRECTIØN TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMØSPHERIC BI-214 4PI CØRRECTIØN TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U
24	F6.1	AVERAGED URANIUM-TØ-THØRIUM RATIØ TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
25	F5.1	URANIUM-TØ-THØRIUM RATIØ STANDARD DEVIATIØN FRØM THE MEAN TØ ØNE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
26	F6.1	AVERAGED URANIUM-TØ-PØTASSIUM RATIØ TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
27	F5.1	URANIUM-TØ-PØTASSIUM RATIØ STANDARD DEVIATIØN FRØM THE MEAN TØ ØNE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
28	F6.1	AVERAGED THØRIUM-TØ-PØTASSIUM RATIØ TØ ØNE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
29	F5.1	THØRIUM-TØ-PØTASSIUM RATIØ STANDARD DEVIATIØN FRØM THE MEAN TØ ØNE DECIMAL PLACE AND ALGEBRAICALLY SIGNED

The second block on tape is the tape identification block, providing information identifying the survey, the approximate date of the survey, the subcontractor, flight-lines, etc. The data written on this block are in the same format as specified in the first block of this tape as shown on Table B-4. The remaining 5062 characters on this block remain blank.

The third and all subsequent block on the magnetic data tape are magnetic data records with 100 records per physical block. The data written in each record are in the same format as specified in the first block of this tape.

Statistical Analysis Summary Tape

The statistical analysis summary tape provides a condensation of the information contained in the statistical analysis data tape, divided according to the geologic map unit. .

The first physical block on the statistical analysis summary data tape is the format description block, providing information needed to read this tape. The first 4320 characters on this block are 60 consecutive 72-character lines, literally written as shown in Table B-5. The remaining 2680 characters on this block remain blank.

The second block on tape is the tape identification block, providing information identifying the survey, the approximate date of the survey, the subcontractor, etc. The data written on this block are in the same format as specified in the first block of this file. The remaining 6930 characters on this block remain blank.

The third and all subsequent blocks on the statistical analysis summary tape are statistical analysis summary records with 50 records per physical block. The data written in each record are in the same format as specified in the first block of this tape.

Table B-4

Magnetic Tape Format Description Block Contents

line Number	Character Number 123456789012345678901234567890123456789012345678901234567890123456789012		
1	04 0978 (DATA TAPE TYPE AND FØRMAT SPECIFICATIØN DATE CØDES)		
2			
3	MAGNETIC DATA TAPE		
4			
5	FØRMAT FØR TAPE IDENTIFICATIØN BLØCK (SECØND BLØCK)		
6			
7	ITEM	FØRMAT	DESCRIPTIØN
8	1	A40	QUADRANGLE NAME AS PRØJECT IDENTIFICATIØN
9	2	A20	NAME ØF SUBCØNTRACTØR
10	3	I4	APPRØXIMATE DATA ØF SURVEY (MØNTH,YEAR)
11	4	I3	NUMBER ØF FLIGHT LINES ØN THIS TAPE
12	5	I4	FIRST FLIGHT LINE ØN THIS TAPE
13	6	I6	FIRST RECØRD NUMBER ØF FIRST FLIGHT LINE
14	7	I3	JULIAN DATA (DAY ØF YEAR) FIRST FLIGHT LINE DATA WAS
15			CØLLECTED
16	8	F8.4	LATITUDE ØF GRØUND BASE STATIØN TØ FØUR DECIMAL
17			PLACES IN DEGREES FØR FIRST FLIGHT LINE
18	9	F8.4	LØNGITUDE ØF GRØUND BASE STATIØN TØ FØUR DECIMAL
19			PLACES IN DEGREES FØR FIRST FLIGHT LINE
20	10-14	(SAME)	REPEAT ØF ITEMS 5-9 FØR SECØND FLIGHT LINE ØN THIS
21			TAPE
22	*	*	*
23	*	*	*
24	*	*	*
25	495-499	(SAME)	REPEAT ØF ITEMS 5-9 FØR 99TH FLIGHT LINE ØN THIS
26			TAPE
27			
28	FØRMAT FØR MAGNETIC DATA RECØRD (THIRD THRU LAST BLØCK)		
29			
30	ITEM	FØRMAT	DESCRIPTIØN
31	1	I1	AERIAL SYSTEM IDENTIFICATIØN CØDE
32	2	I4	FLIGHT LINE NUMBER
33	3	I6	RECØRD IDENTIFICATIØN NUMBER
34	4	I6	GMT TIME ØF DAY (HHMMSS)
35	5	F8.4	LATITUDE TØ FØUR DECIMAL PLACES IN DEGREES
36	6	F8.4	LØNGITUDE TØ FØUR DECIMAL PLACES IN DEGREES
37	7	F6.1	TERRAIN CLEARANCE TØ ØNE DECIMAL PLACE IN METERS
38	8	F5.1	ØUTSIDE AIR PRESSURE TØ ØNE DECIMAL PLACE IN MMHG
39	9	A8	SURFACE GEØLOGIC MAP UNIT CØDE
40	10	F7.1	TØTAL MAGNETIC FIELD INTENSITY TØ ØNE DECIMAL PLACE
41			IN GAMMAS
42	11	F7.1	RESIDUAL (IGRF REMØVED) MAGNETIC FIELD INTENSITY
43			TØ ØNE DECIMAL PLACE IN GAMMAS
44	12	F7.1	DIURNAL MAGNETIC INTENSITY VARIATIØN TØ ØNE DECIMAL
45			PLACE IN GAMMAS
46	13	F7.1	MAGNETIC DEPTH-TØ-BASEMENT TØ ØNE DECIMAL PLACE
47			IN METERS (IF REQUIRED)

Table B-5

Statistical Analysis Summary Tape Format Description Block Contents

```
 Line                        Character Number
Number  12345678901234567890123456789012345678901234567890123456789012

  1     05 0978  (DATA TAPE TYPE AND FØRMAT SPECIFICATIØN DATE CØDE)
  2
  3     STATISTICAL ANALYSIS SUMMARY TAPE (ØR FILE)
  4
  5     FØRMAT FØR TAPE IDENTIFICATIØN BLØCK (SECØND BLØCK)
  6
  7     ITEM      FØRMAT    DESCRIPTIØN
  8     1         A40       QUADRANGLE NAME AS PRØJECT IDENTIFICATIØN
  9     2         A20       NAME ØF SUBCØNTRACTØR
 10     3         I4        APPRØXIMATE DATE ØF SURVEY (MØNTH,YEAR)
 11     4         I6        NUMBER ØF GEØLØGIC MAP UNITS USED FØR THIS
 12                         QUADRANGLE
 13
 14     FØRMAT FØR STATISTICAL ANALYSIS SUMMARY DATA RECØRD (THIRD THRU LAST
 15     BLØCK)
 16
 17     ITEM      FØRMAT    DESCRIPTIØN
 18     1         A8        SURFACE GEØLØGIC MAP UNIT IDENTIFYING CØDE
 19     2         I6        TØTAL RECØRDS FØR GEØLØGIC MAP UNIT
 20     3         I6        NUMBER ØF PØTASSIUM RECØRDS CØMPUTED FØR GEØLØGIC
 21                         UNIT
 22     4         F6.1      PØTASSIUM CØNCENTRATIØN MEAN TØ ØNE DECIMAL PLACE
 23                         IN PERCENT K
 24     5         F6.1      PØTASSIUM CØNCENTRATIØN STANDARD DEVIATIØN TØ ØNE
 25                         DECIMAL PLACE IN PERCENT K
 26     6         A3        PØTASSIUM CØNCENTRATIØN DISTRIBUTIØN CØDE
 27     7         I6        NUMBER ØF URANIUM RECØRDS CØMPUTED FØR GEØLØGIC UNIT
 28     8         F6.1      URANIUM CØNCENTRATIØN MEAN TØ ØNE DECIMAL PLACE
 29                         IN PPM EQUIVALENT U
 30     9         F6.1      URANIUM CØNCENTRATIØN STANDARD DEVIATIØN TØ ØNE
 31                         DECIMAL PLACE IN PPM EQUIVALENT U
 32     10        A3        URANIUM CØNCENTRATIØN DISTRIBUTIØN CØDE
 33     11        I6        NUMBER ØF THØRIUM RECØRDS CØMPUTED FØR GEØLØGIC UNIT
 34     12        F6.1      THØRIUM CØNCENTRATIØN MEAN TØ ØNE DECIMAL PLACE IN
 35                         PPM EQUIVALENT TH
 36     13        F6.1      THRØIUM CØNCENTRATIØN STANDARD DEVIATIØN TØ ØNE
 37                         DECIMAL PLACE IN PPM EQUIVALENT TH
 38     14        A3        THØRIUM CØNCENTRATIØN DISTRIBUTIØN CØDE
 39     15        I6        NUMBER ØF URANIUM-TØ-THØRIUM RATIØ RECØRDS CØMPUTED
 40                         FØR GEØLØGIC UNIT
 41     16        F6.1      URANIUM-TØ-THØRIUM RATIØ MEAN TØ ØNE DECIMAL PLACE
 42                         IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
 43     17        F6.1      URANIUM-TØ-THØRIUM RATIØ STANDARD DEVIATIØN TØ ØNE
 44                         DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT
 45                         TH
 46     18        A3        URANIUM-TØ-THØRIUM RATIØ DISTRIBUTIØN CØDE
 47     19        I6        NUMBER ØF URANIUM-TØ-PØTASSIUM RATIØ RECØRDS
 48                         CØMPUTED FØR GEØLØGIC UNIT
 49     20        F6.1      URANIUM-TØ-PØTASSIUM RATIØ MEAN TØ ØNE DECIMAL PLACE
 50                         IN PPM EQUIVALENT U PER PERCENT K
 51     21        F6.1      URANIUM-TØ-PØTASSIUM RATIØ STANDARD DEVIATIØN TØ ØNE
 52                         DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
 53     22        A3        URANIUM-TØ-PØTASSIUM RATIØ DISTRIBUTIØN CØDE
```

Line Number	Character Number 1234567890123456789012345678901234567890123456789012345678901234567890123456789012		
54	23	I6	NUMBER ØF THRØIUM-TØ-PØTASSIUM RATIØ RECØRDS
55			CØMPUTED FØR GEØLØGIC UNIT
56	24	F6.1	THØRIUM-TØ-PØTASSIUM RATIØ MEAN TØ ØNE DECIMAL PLACE
57			IN PPM EQUIVALENT TH PER PERCENT K
58	25	F6.1	THØRIUM-TØ-PØTASSIUM RATIØ STANDARD DEVIATIØN TØ ØNE
59			DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
60	26	A3	THØRIUM-TØ-PØTASSIUM RATIØ DISTRIBUTIØN CØDE

8.3 APPENDIX C - REDUCTION PARAMETERS

Aircraft N870

	4 π	2 π
Background Corrections		
T_c	145.1	----
K	21.1	----
U	4.9	.55
Th	4.2	0.65
Cosmic Ratios		
T_c	3.7910	----
K	.2040	----
U	.1750	.1890
Th	.2090	.2090
Stripping Ratios		
Alpha (U/Th)	0.3664	0.3710
Beta (K/U)	0.4594	
Gamma (K/Th)	0.9558	
Delta (Th/U)	0.098	
Sensitivity Factors at 400 Feet		
K	78.72	CPS/%
U	10.90	CPS/PPM
Th	5.28	CPS/PPM