INTERPRETATION REPORT

INPUT MK VI ELECTROMAGNETIC/MAGNETIC SURVEY

ANDAUREX RESOURCES

CONGLOMERATE LAKE AREA

PROJECT # 28010 MAY 1986

RECEIVED

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MINING LANDS SECTION

Questor Surveys Limited, 6380 Viscount Road, Mississauga, Ontario L4V 1H3

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APPENDICES

1. INTRODUCTION

This report details the operations and interpretation of a fixed-wing airborne INPUT electromagnetic and magnetic survey flown for Andaurex Resources Inc. (A.R.I.). The system used was Questor/Barringer MK VI, 2 ms, INPUT system. The standard specifications for the INPUT transmitter and receiver are outlined in Appendix A.

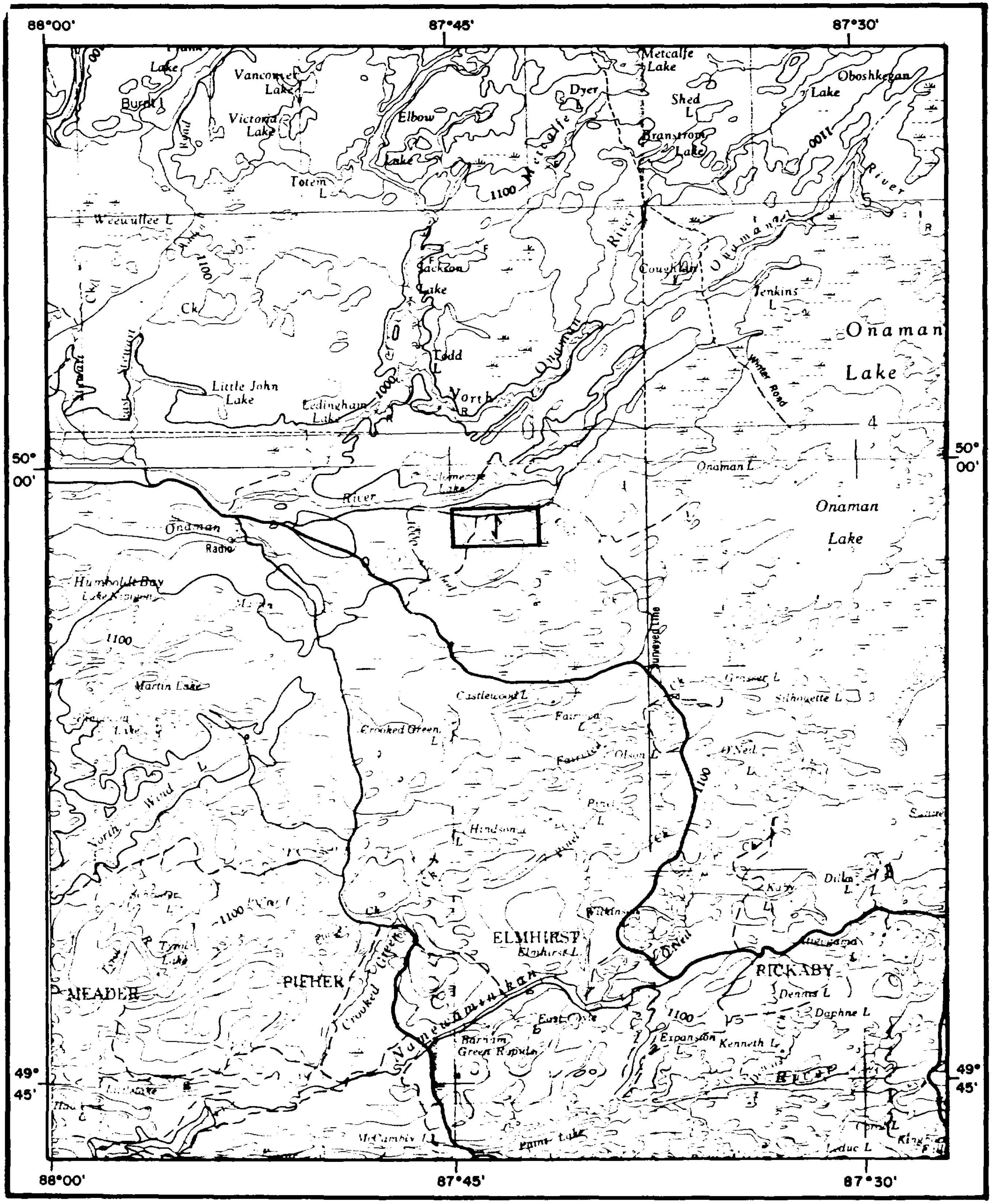
The survey was commissioned by Mr. Paul Hammond of A.R.I. on April 4, 1986. Philip Salib, Geophysicist for Questor, supervised the data compilation and interpretation through to the completion of the project in May 1986.

The survey objective is the detection and location of base metal sulphide conductors as well as any structures and conductivity patterns which could have a positive influence on gold and base metal exploration.

The primary survey area consists of 51 kilometres of traverse and control lines. These were flown between the dates of April 30, 1986 and May 4, 1986 using Geraldton as the survey operations base.

2. PROJECT LOCATION

The survey area lies within the Province of Ontario, approximately 60 kilometres northwest of the Town of Geraldton. The area is located between latitudes 49°58' and 49°59' and longitudes 87°41' and 87°45' (figure 1). Map sheet Longlac, Ontario (N.T.S. 42E) includes the survey site which is approximately 60 kilometres northwest of Geraldton.



SURVEY LOCATION MAP

Scale 1: 250000

5 0 10 Kilometres

Figure 1

3. SURVEY OPERATIONS

3a. Survey Personnel

The survey crew was made up of experienced Questor employees:

Crew Manager/Data Technician - K. Sherk
Pilot/Captain of Aircraft - W. Swantek
Navigator - B. Walker
INPUT Equipment Technician - R. Kasper
Aircraft Engineer - P. Meers

The flight path recovery was completed at the survey base, while the final data compilation and drafting was carried out by Questor at its Mississauga, Ontario office. The magnetic and electromagnetic processing was carried out using Questor software and computer drafted. The INPUT interpretation and report was completed by Philip Salib.

Mr. Paul Hammond, President of Andaurex Resources Inc. for A.R.I. was the technical authority for the project. A preliminary compilation of results was presented to A.R.I. after the completion of the field data acquisition.

3b. Instruments

A Shorts Skyvan, C-GDRG, equipped with the following instruments was used for the survey:

1. Mark VI INPUT Electromagnetic System;
2. Geometrics G-813 Proton Magnetometer (0.1 gamma sensitivity);
3. Sonotek SDS 1200 Data Acquisition System;
4. RMS GR33 Analogue Recorder;
5. 35mm Camera, Intervalometer and Fiducial System;
6. Sperry Radar Altimeter.

A Geometrics G-826 Base Magnetometer was used to monitor the diurnal magnetic changes.

The equipment, such as the INPUT system, magnetometer and radar altimeter were regularly calibrated at the beginning and end of each survey flight as well as in mid-flight, whenever necessary. Details of the calibration procedures are given in Appendix C.

The continuous chart speed of the RMS recorder was set at 15 cm./minute.

3c. Production

The flight line spacing over the block was 100 metres. Table 1 summarizes the kilometres flown during the survey operation.

Table 1

Traverse lines	45.0 km.
Control lines	6.0 km.
Total lines	51.0 km.

The survey was completed in two production flights. No days were lost during the survey due to weather or magnetic storms.

3d. Products

The following list are the products delivered by Questor to Andaurex Resources Inc. with four copies of the report:

1. one unscreened master photo mosaic, scale 1:10,000;
2. one master photo mosaic with electromagnetic and magnetometer information and interpretation shown thereon, scale 1:10,000;
3. one magnetic contour overlay, scale 1:10,000;
4. one contour overlay of the 1st derivative, scale 1:10,000;
5. four white prints of (2);
6. one computer processed analogue charts of the electromagnetic and magnetometer flight analogues;
7. one sheet of colour contoured magnetics, scale 1:10,000;
8. the negative of the flight path film;

9. anomaly data sheets;

10. the flight log;

3e. Survey Procedure

During the survey, the aircraft maintained a terrain clearance as close to 122 metres as possible, with the receiver coil (bird) at approximately 55 metres above the ground surface. In areas of substantial topographic relief and large population, the aircraft height may exceed 122 metres for safety reasons. The height of the bird above the ground is also influenced by the aircraft's air speed (see figure C1 in Appendix C), which was maintained at 110 to 120 knots, while on survey.

Whenever possible, the traverse lines were flown in alternate flight directions (e.g., north then south) to facilitate the interpretation of dipping conductors. When the traverse line spacing exceeded twice the normal spacing interval over a 2.2 kilometre distance, the gap is normally filled with an appropriately spaced fill-in line at a later date.

The details of each production flight are documented on the flight logs by the equipment technician. The logs include the survey times, line numbers and fiducial intervals, as well as a record of equipment irregularities and atmospheric conditions. One may refer to these logs in order to relate the flight path film to the geophysical data.

During the course of the survey the following data were recorded:

1. INPUT Electromagnetic results represented by six channels of successively increasing time delays after cessation of the exciting pulse (Appendix A);
2. a record of the terrain clearance as provided by radar altimeter;
3. a photographic record of the terrain passing below the aircraft as obtained from a 35 mm. camera;
4. time markers impressed synchronously on the photographic and geophysical records to facilitate accurate positioning on photomosaics;
5. airborne magnetometer data;
6. ground base station magnetometer data.

3f. Magnetic Diurnal

Diurnal variations in the earth's magnetic field had been recorded to an accuracy of ± 1 nT using a base station equipped with a Geometrics G-816 Proton Precession Magnetometer. It was monitored periodically during the day for severe diurnal changes (magnetic storms). A variation of 20 nT over a 5 minute time period was considered to be a magnetic storm. During such an event, the survey would normally have been discontinued or postponed and the survey data would have been scrubbed.

The base station magnetometer was set up at Park Bay View Hotel, Geraldton.

4. DATA COMPILATION

4a. Data Recovery

The flight path of the aircraft is recorded by a strip camera on black and white, 125ASA, 35mm. film which is exposed continuously during flight at a rate of 5 mm/sec. The apperture setting on the camera can be manually adjusted by the operator during flight, assuring the proper exposure of the film. The camera is fitted with a wide angle 18 mm. lens.

The camera is controlled by the fiducial time system of the data acquisition system once every 2 seconds. Fiducial numbers are imprinted on the film, marked onto the analogue records and recorded digitally at the same instant.

The flight line headings are opposite on adjacent lines, which are normally flown sequentially in an "S" pattern. The navigation references are flight strips at a scale of 1:10,000 which are made from the base maps. The equipment operator enters the flight details information into the digital data system which are recorded and verified (read-after-write). The information includes line number, time, fiducial range and other pertinent flight information. This information is compared to the film, analogue records and the magnetic base station recording at the completion of the survey flight.

The film is developed and all records are edited and checked at the completion of each flight. Recovery of the flight track is carried out by comparing the negative of the 35mm. film to the topographic features of the base map. Coincident features are picked and plotted on exact copies of the stable mosaic base map on which the final results are drafted. Points are picked at an average interval of 1 kilometre which corresponds to one whole fiducial unit or 20 seconds. The picked points will not necessarily fall on whole fiducial numbers, but on the final presentation, only the first and last whole fiducial numbers on a line are marked on each flight line. By interpolation, the whole numbers are marked as ticks along the flight path.

These procedures are performed on the survey site daily by the data technician so that the data quality and progress may be measured objectively. Reflights for covering navigational gaps and other deficiencies are usually flown on the following day.

The analogue records are inspected for coherence with specifications, and anomalies are selected for classification and plotting. Selected anomalous conductors are positioned by plotting their fiducial positions, less the lag factor (Appendix C). These resultant positions are located by interpolating between fiducial points established by the flight path recovery process.

The survey results are presented as an INPUT anomaly map with interpretation and a magnetic contour overlay. The following chapters describe the interpretation of INPUT results and present recommendations for ground follow-up surveys. A colour presentation of the magnetic contours was included.

4b. Computer Processing

The completed flight path is accurately digitized on a flat-bed digitizer at Questor's offices using the picked point co-ordinates. The recovery is then routinely verified by a computer programme 'speed check', which flags any abnormalities in the distance per fiducial unit between picked points on a traverse line. As a final check, the rough magnetic contour maps are examined for contour irregularities that could be attributed to recovery errors.

5. INPUT DATA PRESENTATION

The base maps for the survey area are photomosaics constructed from 1:15,840 air photographs supplied by Ontario Ministry of Natural Resources and taken in 1975. The photomosaic was used to construct the navigation flight strips and also the base onto which the flight path was recovered. The mosaics are uncontrolled at a scale of 1:10,000.

The INPUT anomaly map presents the information extracted from the analogue records. This consists chiefly of the peak anomaly positions and response characteristics, surficial responses, up-dip responses, and magnetic anomaly locations. In effect, these represent the primary data analysis. The symbols are explained in the map legend, but the following observations are presented:

- position of peak anomaly;
- conductance or conductivity-thickness;
- amplitude of channel 2 response;
- position and peak amplitude of associated magnetic anomalies;
- where present, surficial, up-dip, poorly defined responses have been identified with a unique symbol.

The interpretation maps outline the geophysical-geological interpretation of the INPUT electromagnetic, magnetic, geological and physiographic data. Bedrock conductors have axis locations and dip directions, when they are interpretable. The anomalous zones which are recommended for follow-up have a reference label assigned, to which additional comments and recommendations are directed in the Interpretation Section of this report. The following list summarizes the interpretation presentation:

- bedrock conductor axis, probable and possible;
- conductor dip;
- surficial conductor;
- anomalous conductors selected for ground evaluation with reference number.

6. INTERPRETATION - GENERAL

6a. Geological Perspective

The area is formed of mafic and intermediate metavolcanics with some scattered outcrops of tuffaceous rocks. These are foliated in some parts of the survey area. To the north metasedimentary younger rocks were recorded.

Northeast-southwest step faults were observed to the southwest of the survey area.

Reference:

Geological map of Conglomerate Lake; published by Ontario Geological Survey, Map 2429.

6b. Conductivity Analysis

The conductivity-thickness products of planar horizontal and thin, steeply dipping conductors are proportional to the time constant of the secondary field electromagnetic transient decay. This transient may be closely approximated by an exponential function for which the conductivity-thickness product (TCP) is inversely proportional to the log of the difference of two channel amplitudes at their respective sample times.

These response functions are presented in the form of graphs in which the amplitudes of the 6 channels of INPUT response are plotted on a logarithmic scale against conductivity. The relative amplitudes of the secondary response, at any given conductivity, may be accurately related to the depth of a conductor below the surface. These are typically referred to as

Palacky nomograms. These are available for a number of conductor geometries. It has been found that the shape of the decay transient and its amplitude is usually unique to a particular geometry. Therefore, if the origin of a conductive response is in question, a good "fit" of the peak response amplitude to one nomogram will define its origin.

The 90° nomogram was utilized exclusively to determine the apparent conductances of the responses obtained from the survey. This procedure is valid for near vertical conductors, within a dip range of 45-135°, relative to the aircraft flight direction.

Although the conductor depth can be interpreted from nomograms, the short strike lengths and the variability of conductor geometry may result in the over-estimation of depths. The INPUT system depth capability is typically 200 metres for a vertical, 600 metre strike length by 300 metre depth extent target. The effective penetration depth increases for a dipping target and decreases for a smaller size conductor.

Depths were only determined for responses which appear to fit the interpretation model (thin near vertical plate with a strike length of greater than 500 metres). Qualifications for these determinations are summarized in the interpretation section.

The depths for 5 and 6 channel anomalies were corrected for the interpreted conductor strike intersection relative to the line direction and the effects of aircraft altitude deviations from a flight altitude of 120 metres.

An anomaly listing at the back of this report summarizes each anomalous response in a numerical sequence. In addition to the standard anomaly parameters, an "anomaly type" classification has been added. The letters correlate with the plotted symbols according to the following table.

ANOMALY TYPE	RESPONSE SOURCE	SYMBOL
BLANK	bedrock conductors	circular
S	surficial (overburden or lakebottom) conductivity	diamond
U	up-dip accessory peak to main response	half circular, half diamond, symbolically "pointing" in dip direction
P	poorly defined response	asterisk "*" in lower left quadrant
C	cultural source	square

The "P" poorly defined response may not yield signatures diagnostic of a discrete bedrock anomaly to standard electromagnetic prospecting equipment. Interpreted axis locations may be approximate for these intercepts.

7. INPUT INTERPRETATION

The area, in general, is considered resistive. Some channel 1 responses were recorded and attributed to bedrock origin. Two conductive zones were interpreted. The interpreted zones were assigned reference numbers which are formed of three parts, for example: A23A

A indicates the survey block number (in case of more than one block);

23 indicates the line number along which the best defined intercept occurs;

A indicates the sequential anomaly letter.

Some of our selective criteria for the target zones are:

- isolated horizon;
- structure;
- magnetic correlation.

Follow-up recommendations for the selective targets should be based on favourable geology.

CONDUCTIVE ZONE A23A

Line	10230S
Terrain Clearance	120 m.
Dip	80°-90° S
Strike Intersection	90°
Strike Length	350 m.
Conductance	8 S
Depth	?
Magnetic Coincidence	31 nT
Related Responses	10210A, 10270B, 10230A, 10240A, 10240B

CONDUCTIVE ZONE A23 is located outside the boundary of the survey area and about 1 km. north of the northern boundary. It is believed that it is parallel to the contact between the metavolcanic and metasediment rock units to the north and the older mafic-to-intermediate metavolcanics to the south. It appears that this zone has an east-west extension beyond the flight lines.

CONDUCTIVE ZONE A4C

Line	10041S
Terrain Clearance	138 m.
Dip	90^{o}
Strike Intersection	90^{o}
Strike Length	600 m.
Conductance	22S
Depth	80 m.
Magnetic Coincidence	172 nT
Related Responses	10041C, 10051A, 10061A, 10071B, 10071C, 10080B, 10091A, 10091B

CONDUCTIVE ZONE A4C is located west of the survey area. It is well represented by intercept 10041C. The zone is represented along lines 10071N, 10080N and 10091B by a pair of intercepts, the up-dip and main conductor. The response shape displays the same characteristics as the vertical plane conductive-plate model. ZONE A4C is associated with a high magnetic trend. The estimated depth for this zone is approximately 80 metres using the vertical plate depth nomograms. It is believed that ZONE A4C has a further extension to the west of the survey area.

8. CONCLUSIONS AND RECOMMENDATIONS

The combined INPUT/magnetic survey in the Conglomerate Lake area has resulted in the delineation of two target zones. These zones, in general, display the general characteristics of deep steeply dipping to a vertical plate model. No surficial response has been recorded.

Since the recommended conductive zones are of a rather short strike length, ground reconnaissance survey should be conducted to verify their exact strike and position.

Respectfully submitted,

QUESTOR SURVEYS LIMITED,

Philip Salib,
Geophysicist.

APPENDIX A

BARRINGER/QUESTOR MARK VI INPUT$^{(R)}$ AIRBORNE ELECTROMAGNETIC SYSTEM

INPUT (INduced PUlse Transient) is a time domain airborne electromagnetic survey system which has been used for over two million kilometres of survey, accounting for over 70 percent of all airborne electromagnetic (A.E.M.) flown world-wide.

The INPUT apparatus consists of a vertical axis transmitting loop surrounding the aircraft, a towed 'bird' containing a horizontal axis receiving coil oriented parallel with the direction of flight, and inboard electronics which control the system timing as well as performing the required signal processing and recording. Electric current pulses are applied to the transmitter coil in alternating polarity directions (Figure A2). The resultant electromagnetic field induces eddy currents in conductive terrestrial materials which in turn generate secondary, time varying, magnetic fields which induce electrical currents in the receiver coil. The decaying secondary magnetic field is repeatedly detected and measured by the receiver coil during the intervals when no current is circulating through the transmitting loop, ie: in the absence of the primary electromagnetic field. This measurement technique achieves a high signal-to-noise ratio.

The time-amplitude relationship of the transient secondary field is controlled by the conductor dimensions, conductivity, orientation, and position, or distance relative to the INPUT system. Terrestrial materials which have a higher conductivity-thickness demonstrate a longer secondary field decay persistence. This physical quality is often associated with massive sulphides as well as with graphite. In comparison, horizontally layered surficial conductive materials usually exhibit a more rapid secondary field decay. A quantitative evaluation of the conductance of an INPUT anomaly can therefore be made by a comparison of the associated secondary field decay with an empirically-derived standard. For purposes of decay-time analysis and conductance evaluation, the secondary field is sampled over six consecutive and discrete time intervals (Figure A3). The average value of the secondary field during each of these intervals is averaged over a number of measurement cycles, and the resultant running-average value for each time-channel is systematically recorded in analogue and digital formats.

INPUT System Characteristics

The INPUT receiver sensor is towed approximately 93 metres behind and 68 metres below the aircraft at a survey airspeed of 110 knots. The actual position of the bird is dependent on the airspeed of the survey aircraft, as can be seen in Figure A1. For the Trislander, Skyvan and DC-3 aircrafts, airspeeds average 110 knots.

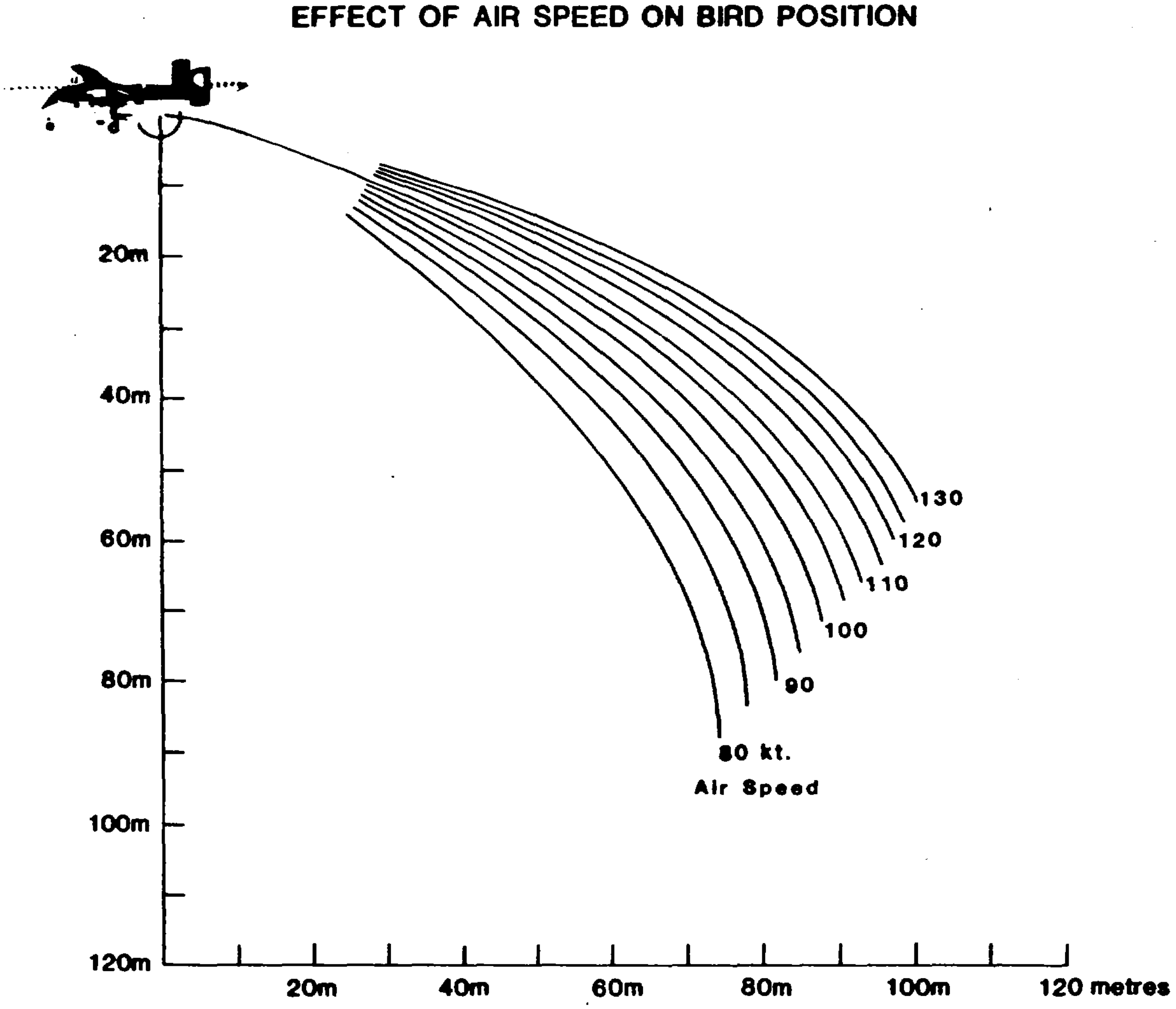


Figure A1

INPUT TRANSMITTER SPECIFICATIONS

Pulse Repetition Rate	180 pps.
Pulse Shape	half-sine
Pulse Width	2.0 ms.
Off Time	3.56 ms.
Output Voltage	75 V.
Output Current	240 A.
Output Current Average	54 A.
Coil Area	186 $m.^2$
Coil Turns	6
Electromagnetic Field Strength (peak)	267,840 amp-turn-meter^2

INPUT SIGNAL

TRANSMITTED PRIMARY FIELD

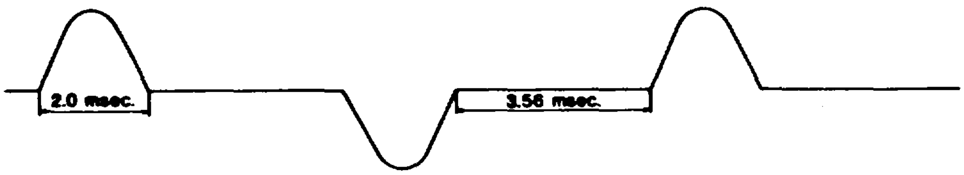


Figure A2

INPUT RECEIVER SPECIFICATIONS

Sample Gate	Windows (centre positions)	Widths
CH 1	300 μsec.	200 μsec.
CH 2	500	200
CH 3	800	400
CH 4	1200	400
CH 5	1700	600
CH 6	2300	600

Integration Time Constant 1.2 sec.

Receiver Features:
- Power Monitor 50 or 60 Hz
- 50 or 60 Hz (and harmonic) Filter
- VLF Rejection Filter
- Spheric Rejection (tweak) Filter

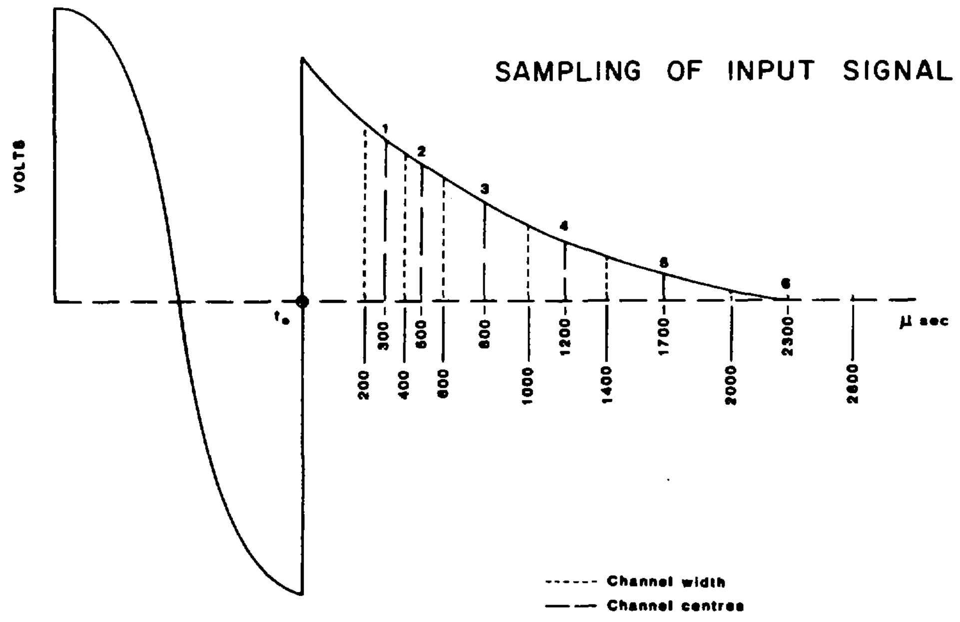


Figure A3

DATA ACQUISITION SYSTEM

Sonotek SDS 1200

Includes time base Intervalometer, Fiducial System

CAMERA

Geocam 75 SF

35 mm continuous strip or frame

TAPE DRIVE

DIGIDATA MODEL 1139

9 TRACK 800 BBI ASCII

OSCILLOSCOPE

Tektronix Model 305

ANALOGUE RECORDER

RMS GR-33

Heat Sensitive Paper (33cm)

Recording 10 Channels: 50-60 Hz Monitor, 6 INPUT Channels, fine and coarse Magnetics and Altimeter. Also, time, fiducial numbers, latitude and longitude (optional), timing lines, centimetre spaced vertical scale marks and line numbers are imprinted on the paper.

ALTIMETER

Sperry Radar Altimeter

GEOMETRICS MODEL G-813 PROTON MAGNETOMETER

The airborne magnetometer is a proton free precession sensor which operates on the principle of nuclear magnetic resonance to produce a measurement of the total magnetic intensity. It has a sensitivity of 0.1 gamma and an operating range of 17,000 gammas to 95,000 gammas. The G-813 incorporates fully automatic tuning over its entire range with manual selection of the ambient field starting point for quick startup. The instrument can accurately track field changes exceeding 5,000 nT and for this survey has an absolute accuracy of 0.5 nT at a 1 second sample rate. The sensor is a solenoid type, oriented to optimize results in a low ambient magnetic field. The sensor housing is mounted on the tip of the tail boom supporting the INPUT transmitter cable loop. A 3 term compensating coil and perma-allow strips are adjusted to counteract the effects of permanent and induced magnetic fields in the aircraft.

Because of the high intensity electromagnetic field produced by the INPUT transmitter, the magnetometer and INPUT results are sampled on a time share basis. The magnetometer head is energized while the transmitter is on, but the read-out is obtained during a short period when the transmitter is off. Using this technique the sensor head is energized for 0.80 seconds and subsequently the precession frequency is recorded and converted to gammas during the following 0.20 second when no current pulses are induced into the transmitter coil.

APPENDIX B

THE SURVEY AIRCRAFT

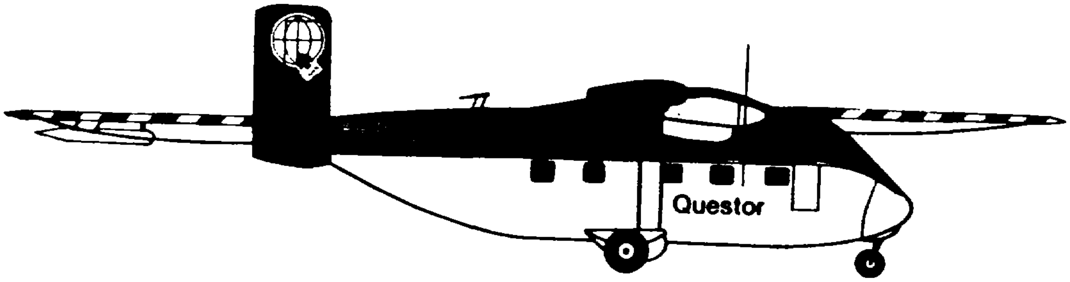


Figure B1

Manufacturer	Short Brothers Ltd.,
Type	SHORT SKYVAN
Model	SH-7 Series 3
Canadian Registration	C-GDRG
Dat of INPUT Installation	October 1981

Modifications:

1) Nose, tail and wing booms for coil mounting;
2) Long range cabin fuel tank: 8 hours of air time;
3) Winch, camera and altimeter ports;
4) Sperry C-12 navigational system;
5) Doppler navigationsal system (optional);
6) Capable of spectrometry;
7) Modified hydraulic driven generator system.

The SKYVAN is a short take-off and landing aircraft. It is powered by two low maintenance turbine engines. The configuration of the aircraft provides for easy installation of equipment and extra fuel capability. These factors have made the SKYVAN a reliable and efficient geophysical survey aircraft.

APPENDIX C

CALIBRATION OF THE SURVEY EQUIPMENT

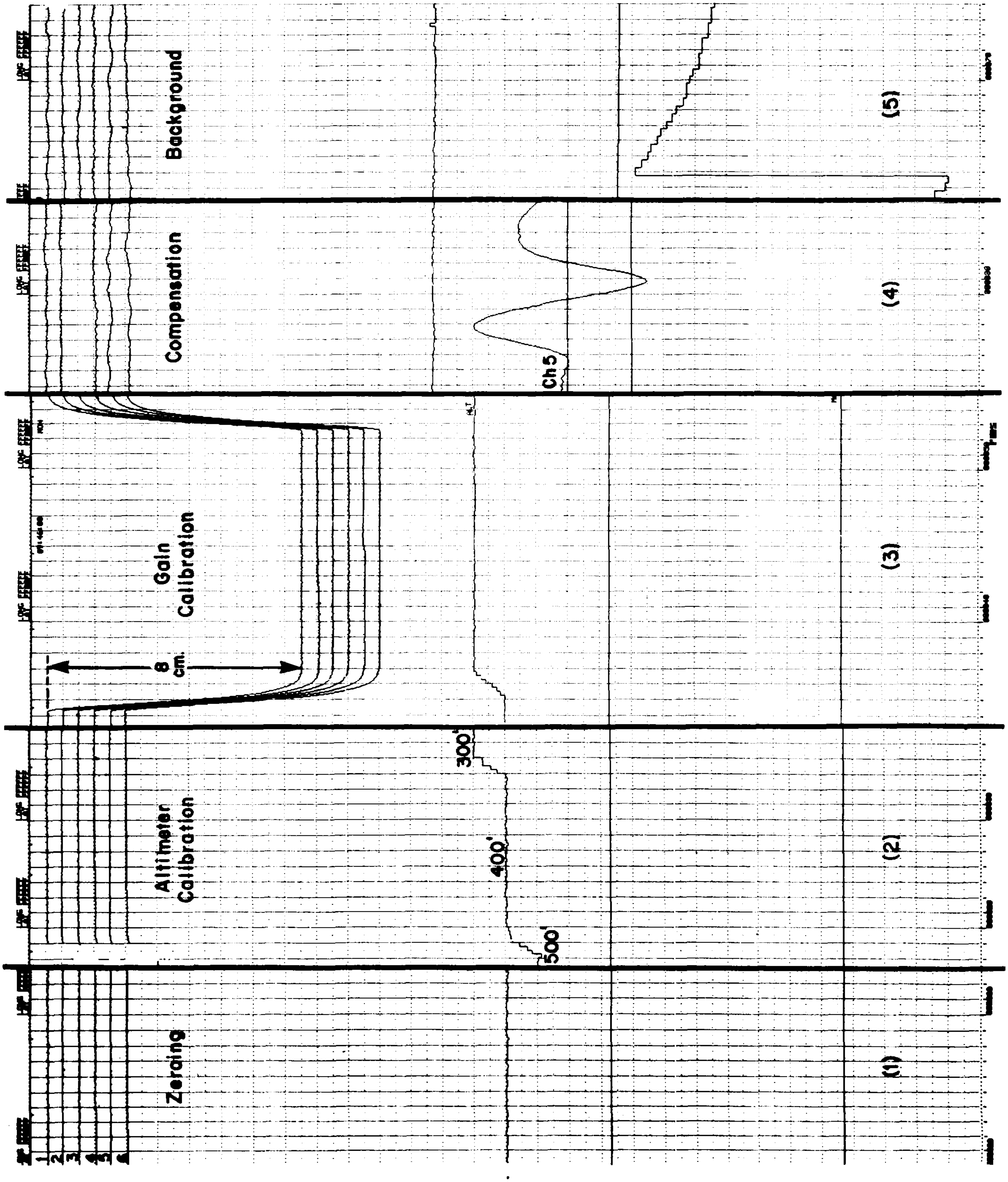
The major advance made during the transition from the INPUT MK V to the MK VI Model has been the ability to calibrate the equipment accurately and consistently.

At the beginning of each survey flight, the calibration of the survey equipment is performed by the following tests:

1) zero the 6 channel levels;
2) altimeter calibration;
3) calibration of INPUT receiver gain;
4) aircraft compensation;
5) record background E.M. levels at 600m;

This sequence of tests are recorded on the analogue records and may be repeated in midflight given that the duration of the flight is sufficiently long (Figure C1). At the termination of every flight, the calibration of the equipment is checked and recorded for any drift that may have occurred during the flight.

Channels 1 to 6 are zeroed on the analogue record by first placing the INPUT receiver into calibration mode, which isolates the receiver from any bird signal. Then, the channels are adjusted so that they are evenly spaced 5mm. apart with channel 6 positioned on the first half cm. line at the top of the record.


Zeroing
(1)
Altimeter Calibration
(2)
500'
400'
300'
Gain Calibration
8 cm.
(3)
Compensation
Ch 5
(4)
Background
(5)
1
2
3
4
5
6

(Figure C1)

The magnetic data is recorded on two scales, a fine and a coarse scale. The two scales are permanently set so that a full scale deflection of 100 nanoTeslas is equivalent to 10 cm. on the fine scale and a shift of 2 cm. indicates a 1000 nanoTesla change on the coarse scale.

The aircraft altimeter is calibrated so that an altitude of 122 m. is positioned at the centre of the analogue records, on the 15 cm. line. This is the nominal flying height of INPUT surveys, wherever relief and aircraft performance are not limiting factors. A cm. above the 122 m. level corresponds to an altitude of 153 m. and a cm. below correlates with 91 m. in altitude.

The INPUT receiver gain is expressed in parts per million of the primary field amplitude at the receiver coil. At the 'bird', the primary field strength is maintained at 1.05 volts peak. The gain of the receiver is calibrated by introducing a calibration signal at the input stage of 4.0 mV. This signal should cause an 8 cm. deflection on all 6 traces, which translates to a sensitivity of:

$$((4 \times 10^{-3} \text{ volts}/1.05 \text{ volts})/8 \text{ cm}) \times 10^{6} \text{ ppm} = 475 \text{ ppm/cm}$$

In most towed-receiver airborne E.M. systems, variations in the position of the receiving coil 'bird' in relation to the aircraft generates a source of noise and needs to be taken account of before every survey flight is initiated.

The noise is the result of spurious eddy currents in the frame of the aircraft, which have been induced by the primary electromagnetic field of the INPUT system.

Compensation is the technique by which the effects of the noise are minimized. A reference signal obtained from the primary field at the receiver coil is utilized to compensate each channel of the receiver for coupling differences caused by bird motion relative to the aircraft. This signal is proportional to the inverse cube of the distance between the bird and aircraft.

Compensation procedures are carried out at an altitude of 600 metres in order to eliminate the influence of external geological and cultural noise. Coupling changes are induced by pitching the aircraft up and down to promote bird motion. The gain of channel 5 is increased to dramatize the effect of the bird swing. The compensation circuitry is then appropriately tuned to minimize the effect of bird motion on the remaining channels. Phase considerations of channel 5 relative to the other channels dictates whether sufficient compensation has been applied. If the channels are in-phase with channel 5 during this procedure, an over-compensated situation is indicated, whereas, out-of-phase would be indicative of an under-compensation case.

The background levels of the E.M. channels are recorded at the 600 metre altitude. They are used to determine the drift that may occur in the E.M. channels during the progression of a survey flight. If drift has occurred, the E.M. channels are brought back to a levelled position by use of the linear interpolation technique during the data processing.

TIME CONSTANT OF THE INPUT SYSTEM

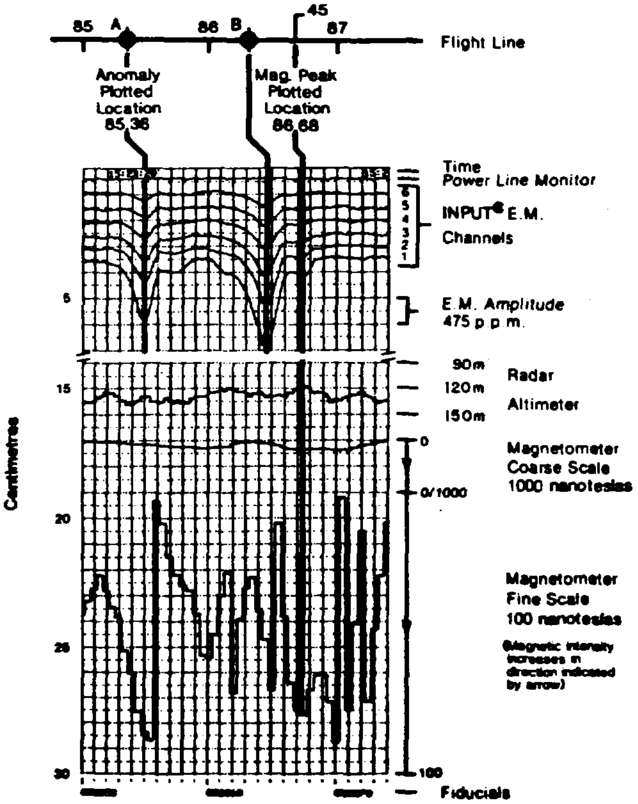
The time constant, is defined as the time for a receiver signal (voltage) to build up or decay to 63.2% of its final or initial value. A longer time constant reduces background noise but also has the effect of reducing the amplitude of a signal as well as the resolution of the system. A time constant of 1.1 sec. has been found to be the optimum value.

The time constant is periodically verified for continuity. It can be measured from the exponential rise or decay of the calibration signal, recorded during the calibration of the receiver gain (figure C1,(3)).

THE LAG FACTOR

The bird's spatial position, along with the time constant of the system, introduces a lag factor (Figure C2) or shift of the response past the actual conductor axis in the direction of the flight line. This is due to fiducial markers being generated and imprinted on the film in real time and then merged with E.M. data which has been delayed due to the two aforementioned parameters. This lag factor necessitates that the receiver response be normalized back to the aircraft's position for the map compilation process. The lag factor can be calculated by considering it in terms of time, plus the elapsed distance of the proposed shift and is given by:

$$\text{Lag (seconds)} = \text{time constant} + \frac{\text{bird lag (metres)}}{\text{ground speed (metres/sec)}}$$



The time constant of the system introduces a 1.1 second lag while, at an aircraft velocity of 110 knots, the 'bird' lag is 1.7 seconds. The total lag factor which is to be applied to the INPUT E.M. data at 110 knots is 2.8 seconds (1.4 fiducials). It must be noted that these two parameters vary within a small range dependent on the aircraft velocity, though they are applied as constants for consistency. As such, the removal of this lag factor will not necessarily position the anomaly peaks directly over the real conductor axis. The offset of a conductor response peak is a function of the system and conductor geometry as well as conductivity.

The magnetic data has a 1.0 second lag factor introduced relative to the real time fiducial positions. This factor is software controlled with the magnetic value recorded relative to the leading edge (left end) of each step 'bar', for both the fine and coarse scales. For example, a magnetic value positioned at fiducial 10.00 on the records would be shifted to fiducial 9.95 along the flight path.

A lag factor of 2 seconds (1.0 fiducial) is introduced to correct 50-60 Hz monitor for the effects of bird position and signal processing. In cases where a 50-60 Hz signal is induced in a long formational conductor, a 50-60 Hz secondary electromagnetic transient may be detected as much as 5 km. from the direct source over the conductive horizon.

The altimeter data has no lag introduced as it is recorded in real time relative to the fiducial markings.

APPENDIX D

INPUT DATA PROCESSING

The QUESTOR designed and implemented computer software for automatic interactive compilation and presentation, may be applied to all QUESTOR INPUT Systems. Although many of the routines are standard data manipulations such as error detection, editing and levelling, several innovative routines are also optionally available for the reduction of INPUT data. The flow chart on the following page (Figure D1) illustrates some of the possibilities. Software and procedures are constantly under review to take advantage of new developments and to solve interpretational problems.

a) INPUT Data Entry and Verification

During the data entry stage, the digital data range is compared to the analogue records and film. The raw data may be viewed on a high-resolution video graphics screen at any desirable scale. This technique is especially helpful in the identification of background level drift and instrument problems.

b) Levelling Electromagnetic Data

Instrument drift, recognized by viewing compressed data from several hours of survey flying, is corrected by an interactive levelling program. Although only two or three calibration sequences are normally recorded, levelling can be

INPUT DATA PROCESSING

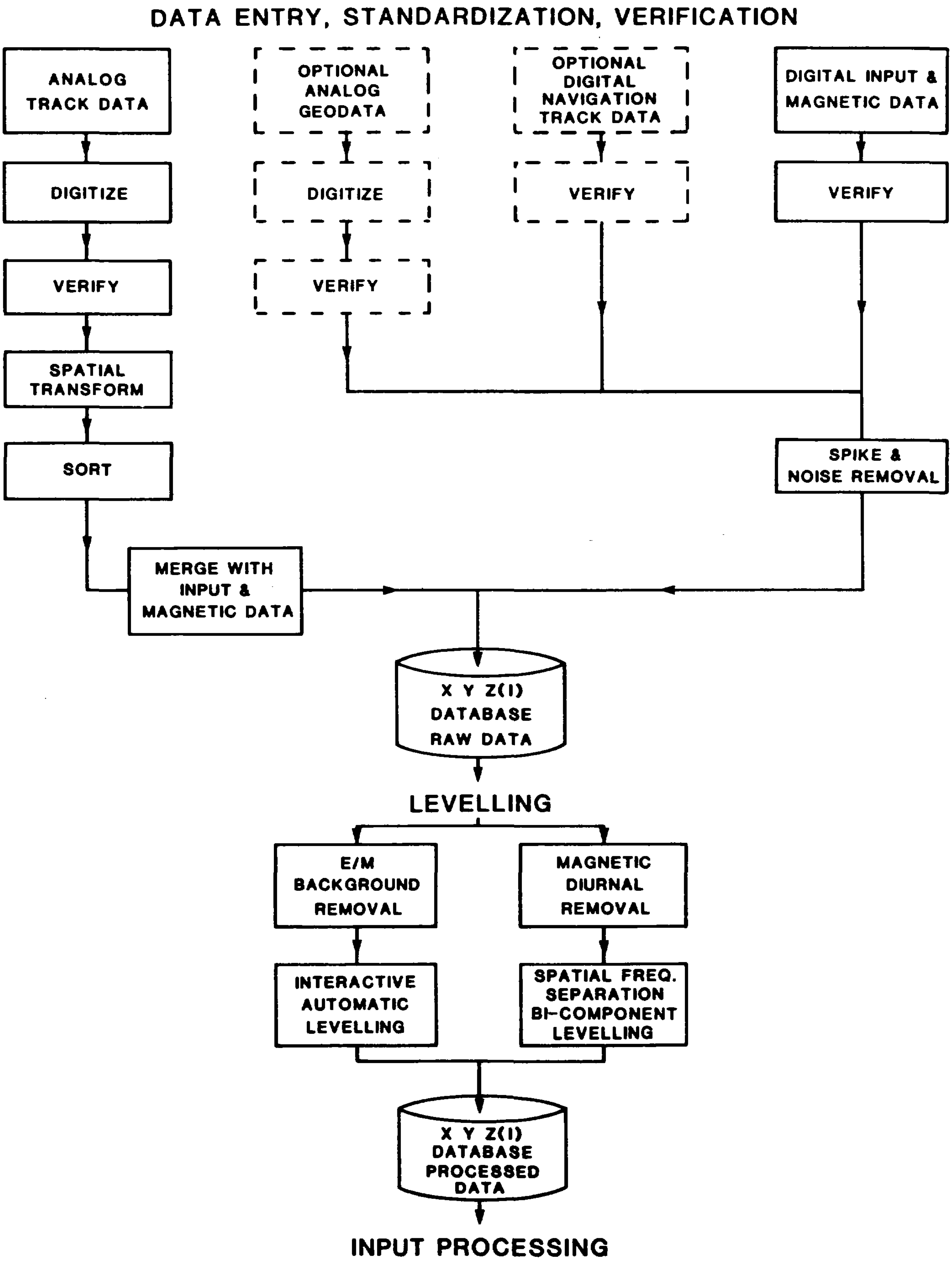


Figure D1

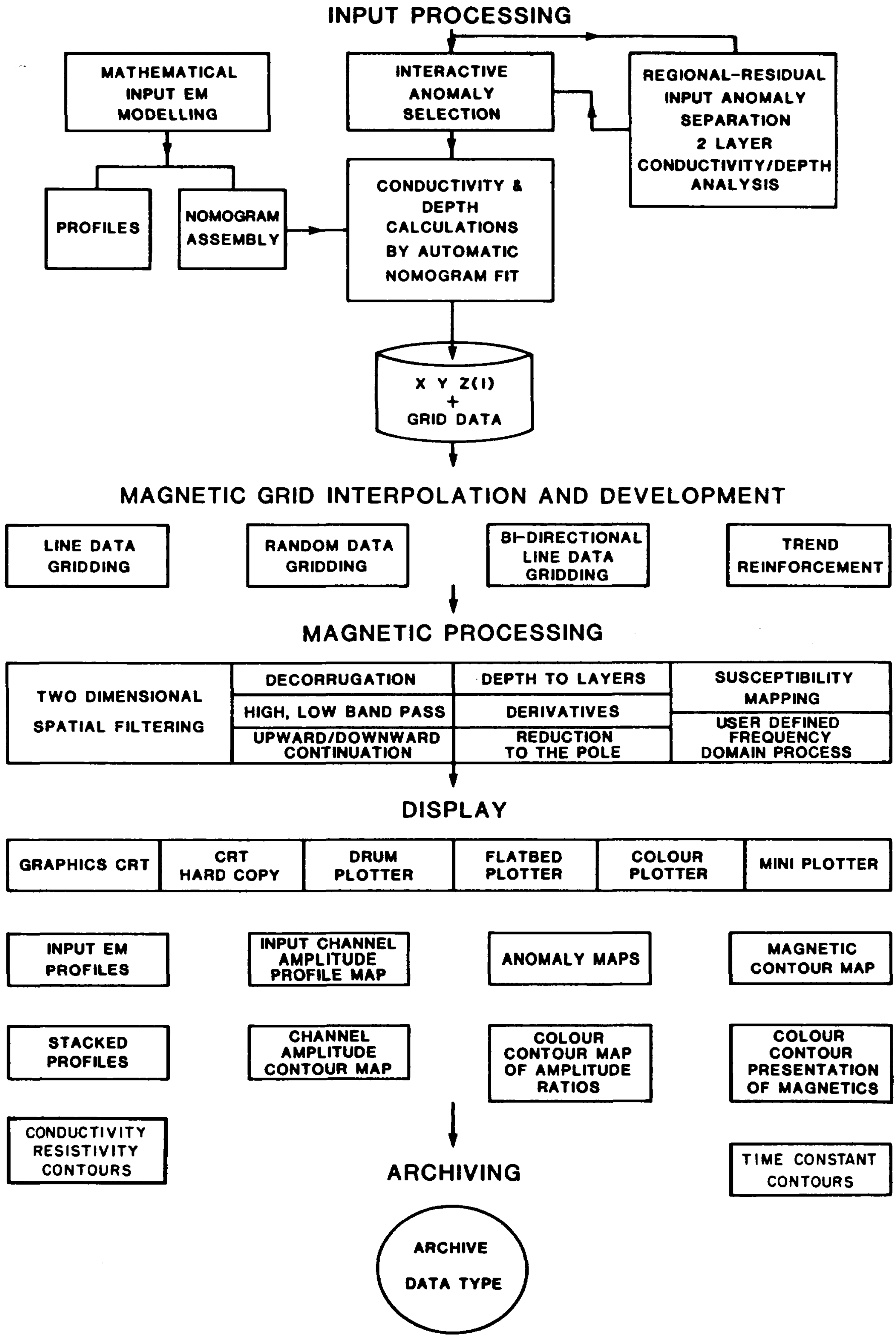

INPUT PROCESSING
MATHEMATICAL INPUT EM MODELLING
INTERACTIVE ANOMALY SELECTION
REGIONAL-RESIDUAL INPUT ANOMALY SEPARATION 2 LAYER CONDUCTIVITY/DEPTH ANALYSIS
PROFILES
NOMOGRAM ASSEMBLY
CONDUCTIVITY & DEPTH CALCULATIONS BY AUTOMATIC NOMOGRAM FIT
X Y Z(I) + GRID DATA
MAGNETIC GRID INTERPOLATION AND DEVELOPMENT
LINE DATA GRIDDING
RANDOM DATA GRIDDING
BI-DIRECTIONAL LINE DATA GRIDDING
TREND REINFORCEMENT
MAGNETIC PROCESSING
TWO DIMENSIONAL SPATIAL FILTERING
DECORRUGATION
DEPTH TO LAYERS
SUSCEPTIBILITY MAPPING
HIGH, LOW BAND PASS
DERIVATIVES
UPWARD/DOWNWARD CONTINUATION
REDUCTION TO THE POLE
USER DEFINED FREQUENCY DOMAIN PROCESS
DISPLAY
GRAPHICS CRT
CRT HARD COPY
DRUM PLOTTER
FLATBED PLOTTER
COLOUR PLOTTER
MINI PLOTTER
INPUT EM PROFILES
INPUT CHANNEL AMPLITUDE PROFILE MAP
ANOMALY MAPS
MAGNETIC CONTOUR MAP
STACKED PROFILES
CHANNEL AMPLITUDE CONTOUR MAP
COLOUR CONTOUR MAP OF AMPLITUDE RATIOS
COLOUR CONTOUR PRESENTATION OF MAGNETICS
CONDUCTIVITY RESISTIVITY CONTOURS
ARCHIVING
TIME CONSTANT CONTOURS
ARCHIVE DATA TYPE

Figure D1

performed with any multiple non-anomalous background recordings to divide a possible problematic situation into segments. Each of the 6 INPUT channels are levelled independently. The sensitivity of the levelling process is normally better than 15 ppm on data with a peak-to-peak noise level of 30 ppm.

c) Data Enhancement

Normal INPUT processing does not include the filtering of electromagnetic data. The residual high frequency variations often apparent on analogue INPUT data, are due almost entirely to atmospheric static discharge "spherics". In conductive environments, spherics are apparently grounded and effectively filtered. In resistive environments, frequency spectrum analysis and subsequent FFT (Fast Fourier Transform) filters may be applied to data to reduce the noise envelope.

d) Selection of EM Anomalies

E.M. anomalies are normally picked by an automatic anomaly peak selection program, which also determines the number of channels for the anomaly. In certain circumstances, particularly when conductive overburden responses are concerned, it may be preferable that the anomalies be manually selected. The E.M. data can be viewed sequentially on a graphic screen terminal for manual anomaly picking. An anomaly 'type' classification is ascribed during the manual selection or entered after the cross-correlation procedure, in the case of the automatic selection.

APPENDIX E

INPUT INTERPRETATION PROCEDURES

In the analysis of INPUT responses, the following parameters are considered:

a) Anomaly Characteristics

- amplitude, number of channels, decay rate, symmetry;
- half width and the overall relationships to adjacent and along strike responses, plus the ground-to-aircraft distance.

b) Geological Relationships

- known geological strike and dip patterns;
- host rock, overburden and saprolite conductivity.

c) Cultural Relationships

- as directed by the power line monitor;
- correlation with known features such as buried pipelines, fence lines, farm and industrial buildings, etc.

For each anomaly selected the following are documented:

- line number and anomaly letter;
- fiducial location on line;
- interpreted source type of the anomaly - bedrock, surficial, cultural;
- number of channels of response;
- amplitudes in parts-per-million of channels 1 through 6;
- apparent conductance in siemens based on the appropriate source model;

- corresponding magnetic association in nanoTeslas with fiducial location;
- altitude (ground-to-aircraft) in metres.

From the anomaly characteristics, interpretative aspects such as up-dip responses, dip direction and altitude are made. Anomalies are then grouped into linear trends for bedrock conductors, and zones for horizontal conductivity contrasts, by correlation with adjacent on-strike responses.

Also, the interpreted source of the INPUT response is categorized as bedrock, surficial, accessory (up-dip) or cultural.

Bedrock conductors are caused by massive sulphides, graphite bearing formations, serpentinized peridotites and in some instances by faults or shear zones. Magnetite concentrations may also, in some circumstances, yield anomalous INPUT responses. INPUT responses have been well documented by Macnae (1979), and Palacky and Sena (1979).

MASSIVE SULPHIDE DEPOSITS

The conductivity characteristic of massive sulphides is due to intergranular connections forming elongated sheet-like masses which permit the induction of eddy currents. These produce a secondary electromagnetic field which can be detected and quantitatively measured.

In most sulphide bodies the conductivity is caused by pyrrhotite and chalcopyrite. Pyrite, which often forms the greater quantity of sulphides present, usually occurs as isolated, albeit closely spaced grains or crystals, and therefore, only produces moderate or weak responses. Sphalerite does not provide anomalous responses and can even insulate the better sulphide conductivity portion of a deposit. The resultant overall conductivity response from a massive sulphide deposit is in the range of 5 to 30 Siemens/metre, although individual lenses or mineral aggregates may have much higher conductivities.

Massive sulphide deposits occur as injections, veins and stratiform bodies of variable size, geometry and conductivity. Given these variables, there are no universal rules for all sulphide deposits; however, there are some general observations regarding the INPUT responses. These are:

- Amplitudes primarily increase in response to conductor strike and depth extent up to an "infinite" size of some 600 metres by 300 metres. Thereafter, source conductor width contributes to amplitudes, that is, amplitude is dependant on sulphide mass.
- Conductance varies independantly with the overall integrated mineralogy and form of the sulphide components.

INPUT is often utilized in the search for volcanogenic copper-zinc sulphide deposits. These deposits are usually associated with felsic volcanic sequences, often at the interface of felsic-mafic rocks or with intercalated tuffs and/or sedimentary rocks. Many of these deposits have stringer sulphide zones in the footwall rocks related to feeder vent alteration systems and these can also contribute to the INPUT response. Laterally, the main sulphide deposits can lens out quickly or continue as minor bands, lenses or disseminated sulphides within more regionally extensive coeval tuffs or sediments and also provide INPUT responses along a considerable strike extent. All these variables must be considered in the explorationist's depositional model and in the analysis and interpretation of the geophysical responses. A careful analysis of the conductances, apparent widths (half peak width) and magnetic responses will often reveal the geometry-source aspects of the deposit. Stratiform base metal sulphides of up to 2,000 metres strike extent are known, although most sizeable deposits have strike lengths between 500 and 1,000 metres.

The magnetic response of a sulphide deposit is the most deceiving information available to the explorationist. Although many large economic deposits have a strong direct magnetic association, some of the largest base metal deposits have no magnetic association. Others have flanking magnetic anomalies caused by pyrrhotite/magnetite deposits in volcanic vent systems flanking the main sulphide body. Essentially non- homogeneous conductivities and magnetic responses may be favourable parameters.

GRAPHITIC SEDIMENTARY CONDUCTORS

Graphitic sediments are usually found within the sedimentary facies of greenstone belts. These represent a low energy, subaqueous sedimentary environment. Graphites are often located in basins of the subaqueous environment, producing the same geometrical shape as sulphide concentrations. Most often however, they form long, homogeneous planar sequences. These may have thicknesses from a metre to hundreds of metres. The recognition of graphite in this setting is often straightforward because conductivities and apparent widths may be very consistent along strike. Strike lengths of tens of kilometres are common for individual horizons.

The conductivity of a graphite formation is a function of two variables:

a) the quality and quantity of the graphite, and
b) the presence of pyrrhotite as an accessory conductive mineral

Pyrite is the most common sulphide mineral occuring within graphitic sequences. It does not contribute significantly to the overall conductivity as it will normally be found as disseminated crystals. Amphibolite facies metamorphism will often be sufficient to convert carbonaceous sediments to graphitic beds. Likewise, pyrite will often be transformed to pyrrhotite.

Without pyrrhotite, most graphitic conductors have less than 10 S conductivity-thickness value as detected by the INPUT system or 1 to 10 S/m conductivity from ground geophysical measurements. With pyrrhotite content, there may be little difference from other sulphide conductors.

It is not unusual to find local concentrations of sulphides within graphitic sediments. These may be recognized by local increases in apparent width, conductivity or as a conductor offset from the main linear trends.

Graphite has also been noted in fault and shear zones which may cross geological formations at oblique angles.

SERPENTINIZED PERIDOTITES

Serpentinized peridotites are very distinguishable from other anomalies. Their conductivity is low and is caused partially by serpentine. They have a fast decay rates, large amplitudes and strong magnetic correlation. Large profile widths with a shape similarity to surficial conductors are a common charactreristic.

MAGNETITE

INPUT anomalies over massive magnetites correlate to the total Fe content. Below 25-30% Fe, little or no response is obtained. However, as the Fe percentage increases, strong anomalies may result with a rate of decay that usually is more pronounced than those for massive sulphides.

Negative INPUT responses may occur in a resistive but very magnetic iron formation, the result of a very high permiability, however, these are extremely rare.

SURFICIAL CONDUCTORS

Surficial conductors are characterized by fast decay rates and usually have a conductivity-thickness of 1-5 siemens. This value is much higher in saline conditions. Overburden responses are broad, more so than bedrock conductors. Anomalies due to surficial conductivity are dependent on flight direction. This causes a staggering effect from line-to-line as the INPUT response is much stronger for the leading edge of the flat lying surface materials than for the trailing edge. When the surficial response has the form of a thin horizontal ribbon, anomalies may be very difficult to distinguish from weak bedrock conductors. A unique identification for all geometries of horizontal ribbon, sheet and layer conductivity contrasts is best accomplished by matching of transient decay amplitudes to the appropriate response nomogram.

CULTURAL CONDUCTORS

Cultural conductors are identifiable by examining the power line monitor and the film to locate railway tracks, power lines, buidings, fences or pipe lines. Power lines produce INPUT anomalies of high conductivity that are similar to bedrock responses. The strength of cultural anomalies is dependent on the grounding of the source. INPUT anomalies usually lag the power line monitor by 1 second, which should be consistent from line-to-line. If this distance between the INPUT response and the power line monitor differs between lines, then there is the possibility of an additional conductor present. The amplitude and conductivity-thickness of anomalies should be consistent from line-to-line.

APPENDIX F

INPUT RESPONSE MODELS

To the interpreter, one of the main advantages of the INPUT system geometry is the variation of the secondary response with conductor shape, size, depth and conductivity (Palacky 1976, 1977).

When we discuss the recognition parameters, one of the variables which is often omitted, is the plotting position of the main peaks in opposite flight directions on adjacent lines. In many cases, the responses may appear similar, but the plotting positions will show significant differences. These situations will be illustrated in the following section.

A third conductor identification factor is the INPUT decay transient for the main response peak. The decays may be used to identify the type of source, independent of the geometrical response which is dependent on the mutual coupling.

MODEL AND PHYSICAL CONDUCTORS

Economic conductive mineral deposits have no unique feature which would make their identification a straightforward process. Most ore bodies do have conductivity contrasts and at least one dimension which is significantly small. A conductivity contrast is necessary to overcome the "skin depth" attenuation effects of conductive overburden or lateritic soils on the primary electromagnetic field (West and Macnae 1982). The recognition of dipping conductors is possible, mainly due to the double peaks encountered in an updip flight direction (Figure F4). A horizontal mineral deposit is potentially the most difficult to select because the horizontal sheet model also applies to conductive overburden and lateritic soils. The theoretical shapes may be matched to physical-geological situations as has been done in the following summary:

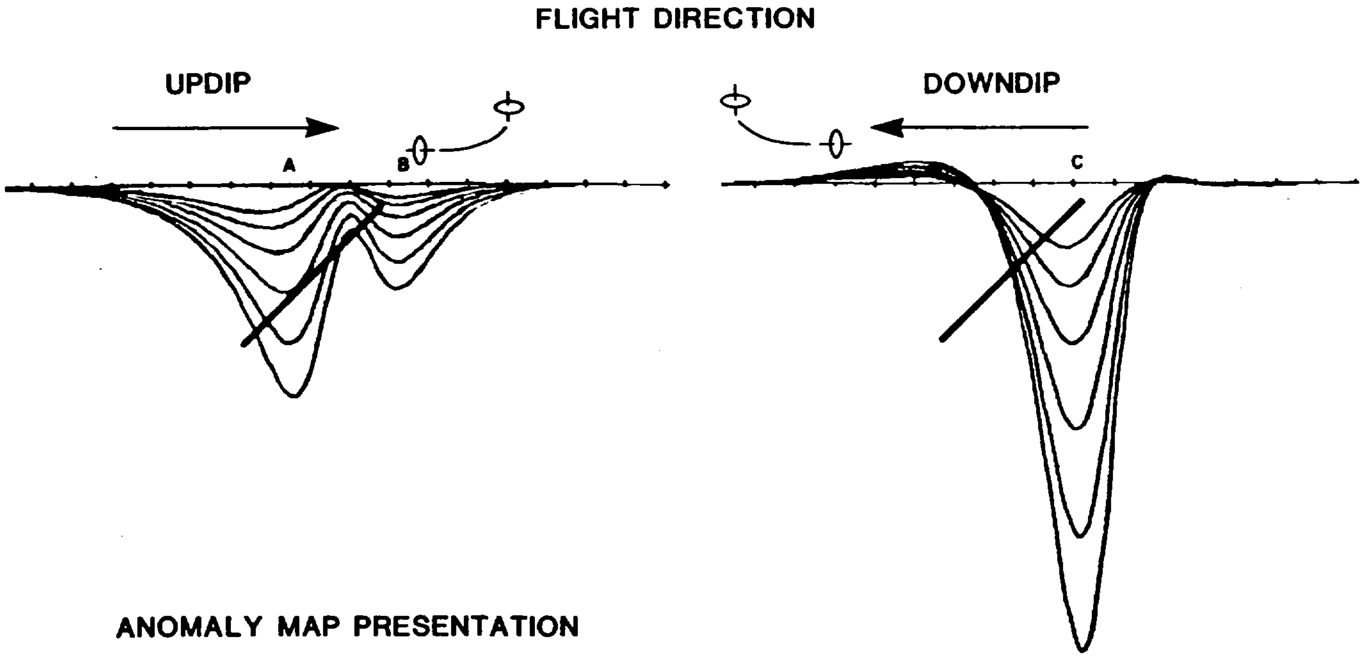
a) THE THIN DIPPING PLATE RESPONSE

economic - stratibound tabular ore body, dyke, vein, fault,
fracture mineralization;

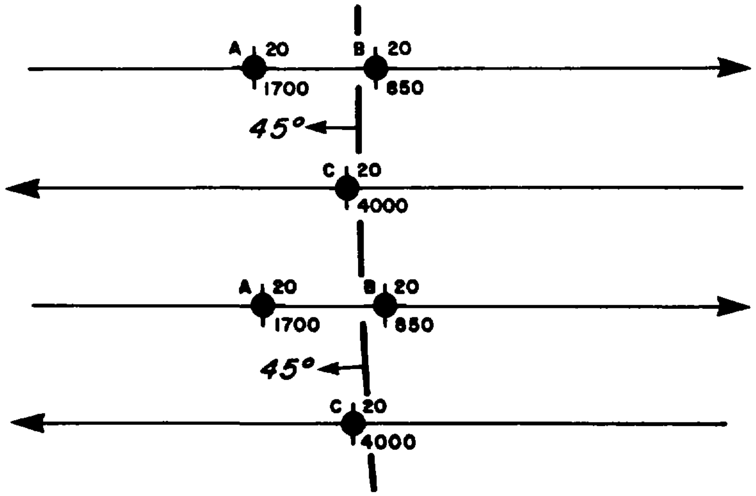
non economic - graphitic-carbonaceous shales, barren sulphides;

cultural - some grounded power lines, fences.

THE THIN DIPPING PLATE RESPONSE



ANOMALY MAP PRESENTATION



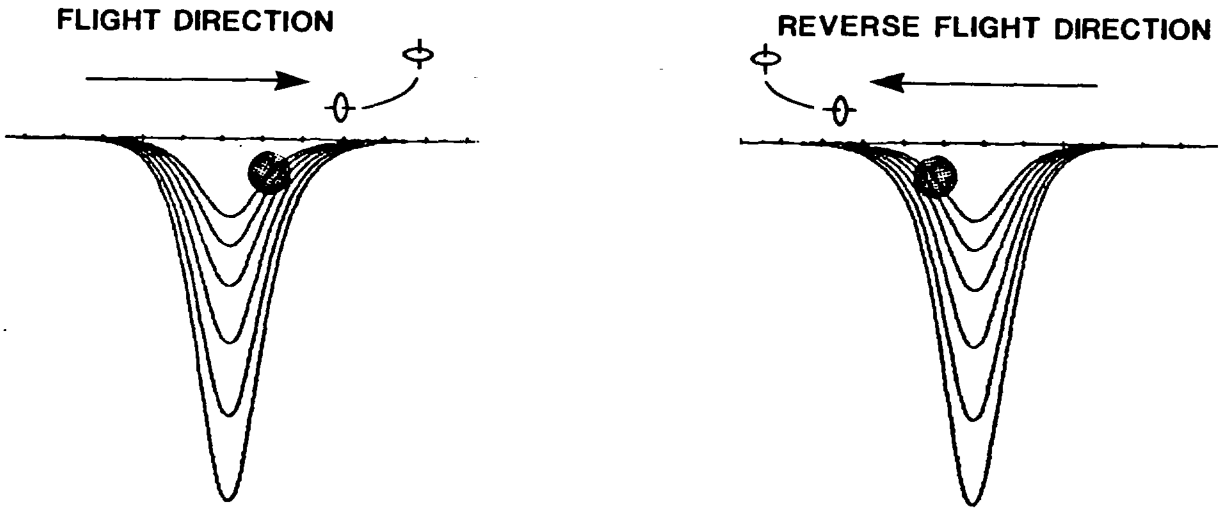
The interpreted conductor axis location varies with the source dip, conductivity, depth, thickness, depth extent and angle of intersection of the flight line to the conductor (strike direction).

b) THE SPHERE OR CYLINDER RESPONSE

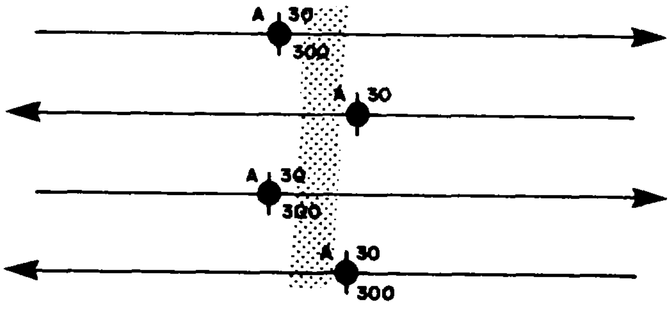
economic - compact massive orebody; horizontal pipe-shaped conductor;

cultural - some pipelines

THE SPHERE OR CYLINDER RESPONSE



ANOMALY MAP PRESENTATION



The response of a cylinder may be quite difficult to recognize from a thin strip. A cylinder or spherical model does not show a pronounced negative or upward peak following the main response. Due to the effect of the time constant of the INPUT receiver, the negative peaks which follow the theoretical response do not appear on the INPUT records (Mallick 1972, Morrison et al 1969). As the illustrations show, the sphere-cylinder response is perfectly symmetrical, but not centered over the body. The plotting position of the main peak leads the actual axis location because the most favourable mutual coupling occurs just before the transmitter coil passes the conductive body. The amplitude of the responses will be similar in both flight directions for a perfect cylinder.

c) THE HORIZONTAL SHEET

economic - some stratabound massive sulphides;

- regolith conductivity alteration haloes over some uranium deposits;

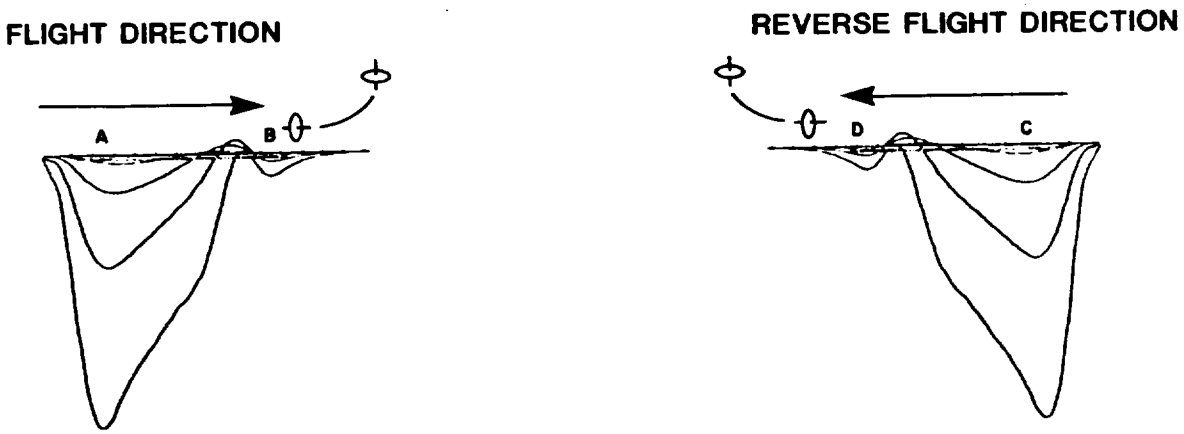
non

economic - overburden, lateritic soils;

- weathered rock;

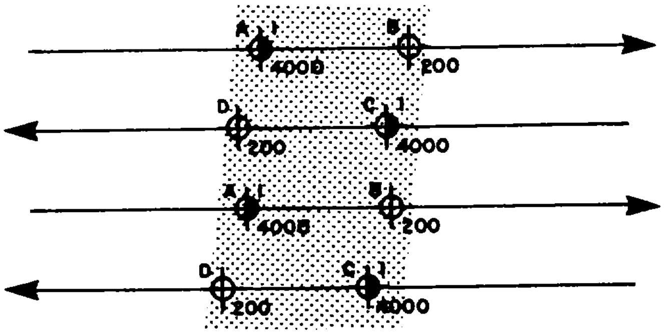
- sea water or saline formations;
- graphitic metasediments.

THE HORIZONTAL SHEET


FLIGHT DIRECTION

REVERSE FLIGHT DIRECTION

ANOMALY MAP PRESENTATION



The horizontal conducting sheet has many variations but it is essentially simple to recognize. The amplitudes of the earlier channels may reach 30,000 ppm where saline solutions are present, however, horizontal sheet responses of channels 4, 5 and 6 attenuate, more rapidly than for a vertical or steeply dipping plate.

The edge effect is a common interpretational problem where a conductive layer is encountered. A secondary peak may occur as the receiver coil crosses the trailing edge of the layer. These responses are always very sharp and often have very high apparent conductivities.

The edges of the sheet are positioned approximately at the half-peak width positions which are usually the inflection points of the profile.

The variations in plotting positions observed for dipping sheets are not as evident for the plate.

It is not unusual to see a shift in the peaks, with the latter channels migrating towards a section of improved conductance and/or increasing thickness. Another characteristic of poorly conducting sheets which respond only on channels 1 through 4 is the inversion of responses on channels 5 and 6. This is a reaction of the compensation circuits to changes in the primary field in the presence of a strong conductor and it serves no practical end except as a recognition aid.

The horizontal sheet model also applies to residual soils or laterite as well as conducting rock units. As the thin overburden situation changes to a thick overburden or two layer case and finally to a half space or a uniformly conductive earth, the responses also vary. The latter cases will have progressively broader responses which would seldom be mistaken for true discrete conductive zones.

When flight lines in opposite directions cross a conductive sheet, an asymmetric mirror image response occurs when the sheet is uniform. If there are variations in the geometry or conductance across the sheet, it may be necessary to compare responses with a shallow dipping sheet conductor to determine the effects, which would not be similar when compared with adjacent lines.

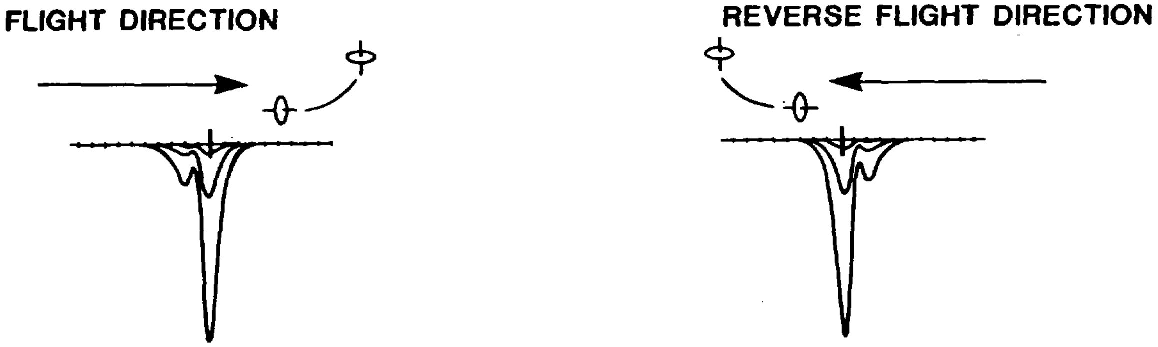
d) THE VERTICAL STRIP (RIBBON) RESPONSE

non

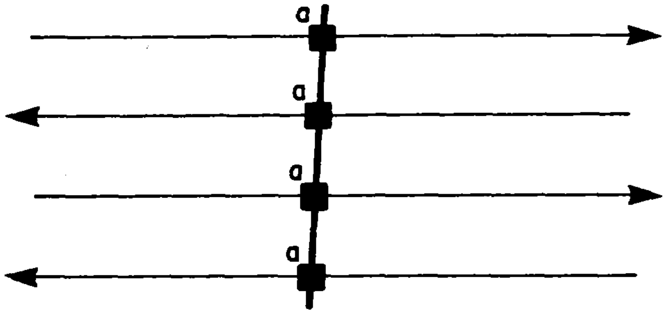
economic - rarely encountered in nature;

cultural - grounded hydro lines, lightning arrestor lines, fences.

THE VERTICAL STRIP (RIBBON) RESPONSE



ANOMALY MAP PRESENTATION

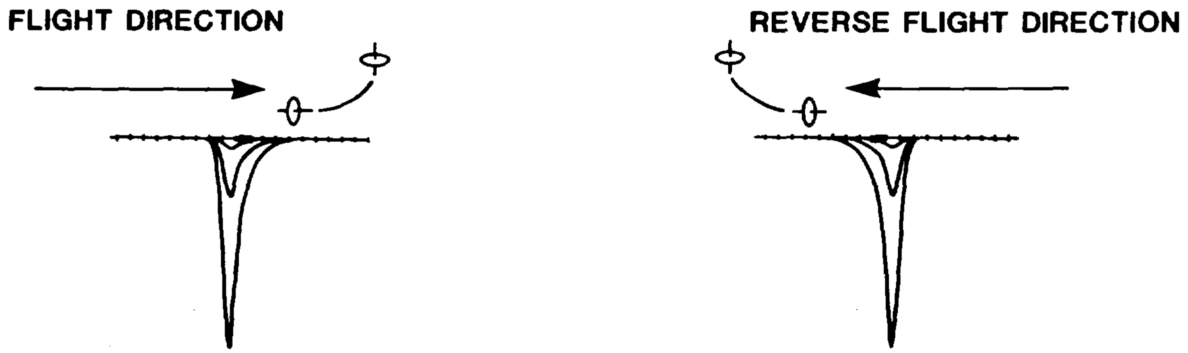


Due to the fact that this type of response is most commonly caused by fences, lightning protection lines and grounded power lines, the customary cultural presentation is a square symbol. This cultural response symbol may or may not have a power monitor (50-60 cycle) response but these will normally follow pipelines, fences, power lines, roads, railroads and other man made structures. The amplitude and apparent conductivity of such responses varies with the ground conductivity. In residual soils or conductive overburden, it is often possible to see a positive (up-dip type) peak followed by a small negative immediately before the main conductive response. The presence and amplitudes of such responses is normally very consistent. The cause of such responses is interpreted to be current gathering within the surficial sediments (West and Macnae 1982).

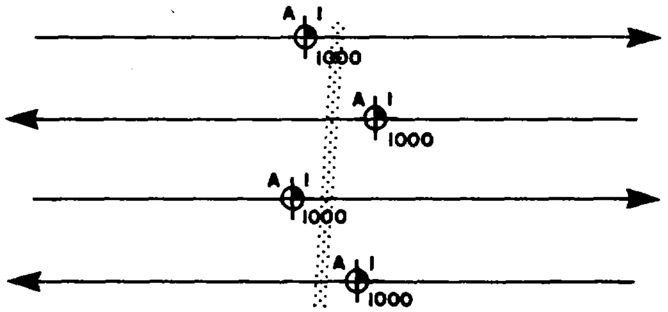
e) THE HORIZONTAL STRIP (RIBBON) RESPONSE

economic - some stratabound massive sulphides;
non
economic - some stratabound mineral deposits;
geological- weathering of narrow basic rock units with a high amphibolite content;
cultural - grounded and interconnected fences, pipes.

THE HORIZONTAL STRIP (RIBBON) RESPONSE



ANOMALY MAP PRESENTATION



The plotting positions of the responses could easily be mistaken for a vertical plate conductor, however, careful consideration must be given to the flight direction. The horizontal ribbon is a degeneration of the horizontal conducting sheet. It can be easily distinguished from a sphere or cylindrical body by its peak asymmetry, whereas the sphere model has a single symmetric main response.

APPENDIX G

QUANTITATIVE INTERPRETATION

The quantitative interpretation of the INPUT data is normally accomplished by comparing the resultant responses with type curves obtained from theoretical calculations, scale model studies and actual field measurements. A variety of results are available in literature for different conductor geometries and system configurations (see Ghosh 1971, Palacky 1974, Becker et al., 1972, Lodha 1977, Ramani 1980). They have also examined the effects of varying such parameters as conductance, conductor depth, dip and depth extent. Their approach has been successfully applied in interpretation of past field surveys.

The nomograms which are currently available for the INPUT system are the Vertical Half-Plane, Homogeneous Half-Space, Thin Overburden and 135° Dipping Half-Plane nomograms. The first is particularly useful for the interpretation of vertical dyke-like conductors frequently found in the Precambrian Shield type environments. In the case of a thick, homogeneous, flat-lying (less than 30 dip) source, the Homogeneous Half-Space nomogram should be applied. While in a thin overburden or tropically weathered rock environment, the Thin Overburden nomogram may be referenced to determine the depth and conductance of the overburden (Palacky and Kadekaru, 1979).

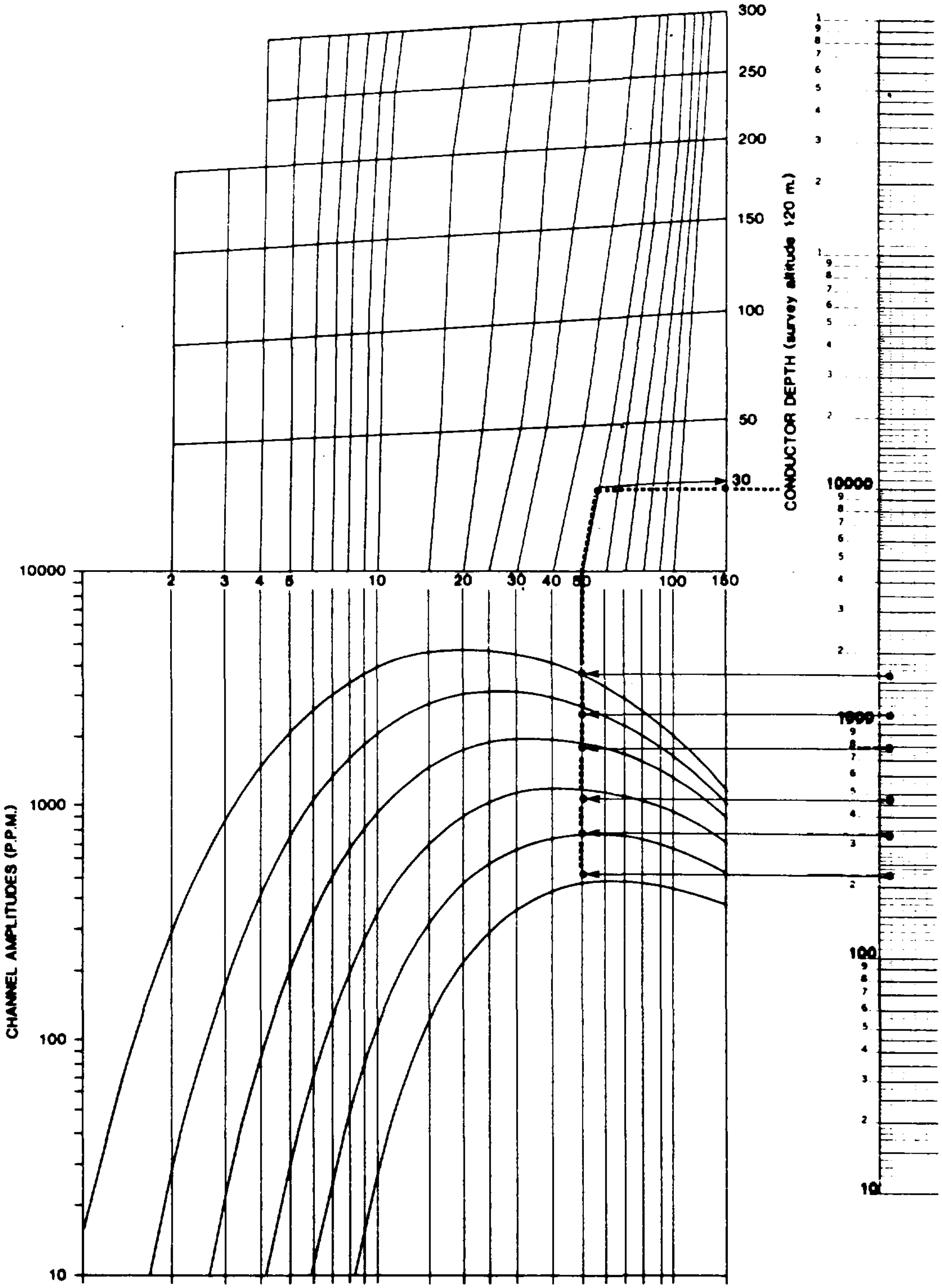
As an example, INPUT anomalies due to vertical dyke-like conductors, are asymmetric and independent of the flight direction.

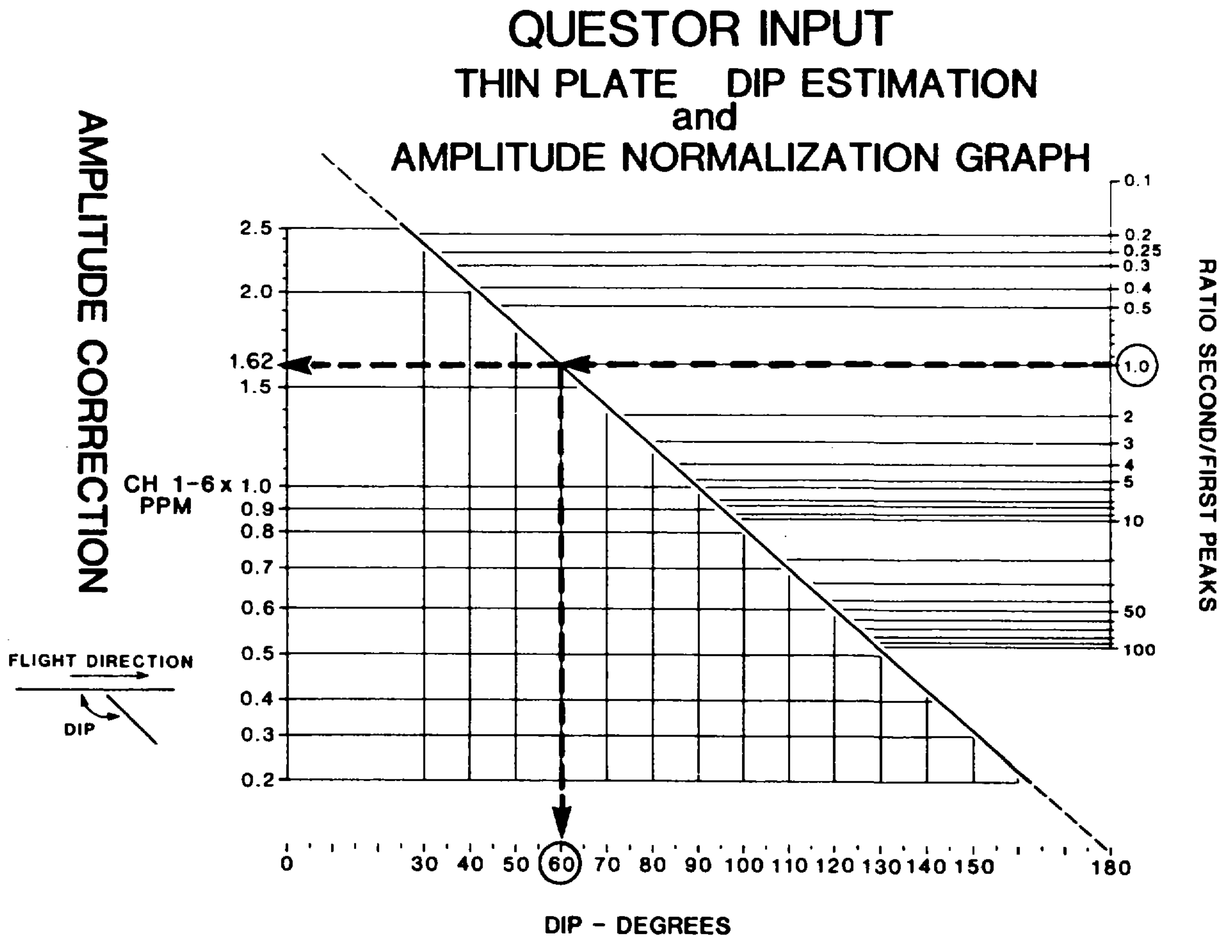
Their shape is characterized by a minor first peak and a major second peak and their channel amplitudes are a function of the conductivity-thickness product and depth of the source. Anomaly B in Figure G1 illustrates one of these responses.

The channel amplitudes of anomaly A can be used in quantitative interpretation in the following way. Their values are plotted for each of the six channels on logarithmic (5 cycles K+E 46 6213) tracing paper in a straight line using the vertical logarithmic scale in parts per million as given on the right side of Figure G2. The six channel amplitudes for anomaly **A**, in ppm, are 1657, 1108, 821, 500, 356, 237, respectively. The amplitudes are measured in ppm (1cm = 475 ppm) from the flight records with reference to the normal background levels on respective channels. Those responses which do not provide at least three channels of deflection, or whose first channel amplitude is less than 50 ppm over the normal background, should not be subjected to this analysis. The six points on the semi-logarithmic paper are then fitted to the curves of the vertical half-plane nomogram (Figure G2) without any rotation. Having accomplished this, the lateral placement of the plot indicates the apparent conductivity-thickness value, in siemens, and the position of the 10,000 ppm line on the logarithmic paper indicates the conductor depth, in metres. In the example shown (Figure G2), the apparent conductivity-thickness value is 50 siemens and the depth is 30 metres.

QUESTOR SURVEYS LIMITED

FIXED WING 2ms PULSE
VERTICAL 600m x 300m PLATE
CONDUCTANCE / DEPTH NOMOGRAM





QUESTOR INPUT
THIN PLATE DIP ESTIMATION
and
AMPLITUDE NORMALIZATION GRAPH

Figure I3

The asymmetric Tx-Rx configuration is very sensitive to changes of dip, particularly in the case of conductors dipping against the flight direction. In this circumstance, there is a change in the magnitude of the second/first peak ratio for all channels. The ratio of the amplitudes of the two peaks is a function of dip. The dip should be the first parameter determined in the quantitative interpretation of a dipping conductor. Before the amplitude is further used for an estimate of conductivity-thickness and depth, it must be normalized to a dip of 90°. This correction is performed by means of the Thin Plate Dip Estimation and Amplitude Normalization Graph, Figure G3.

From the graph, it can be seen that a vertical dyke conductor should have a second/first peak ratio of approximately 6, i.e., that the first peak will have 16% of the amplitude of the second peak. In the case of anomaly A, this condition is true. Conversely, should the dyke dip at 60°, the ratio will decrease to 1.0. Thus, the dip of a conductor can be estimated from the peak ratios of channel two by using the graph in Figure G3.

An example of amplitude correction determination is shown in Figure G3. A dipping conductor has an up-dip second-first peak ratio of 1.0 i.e., that the channel amplitudes of the minor first peak and major second peak of channel two are equal. Taking this ratio of 1.0 and applying the graph, a dip of 60° is obtained for the conductor showing an amplitude correction of approximately 1.62. Consequently, the correction factor is applied to the six channel amplitudes of the associative down-dip response.

This response is then fitted to the vertical half-plane nomogram for the determination of its apparent conductivity-thickness value and depth. It should be mentioned that without the dip correction, the depth would be overestimated.

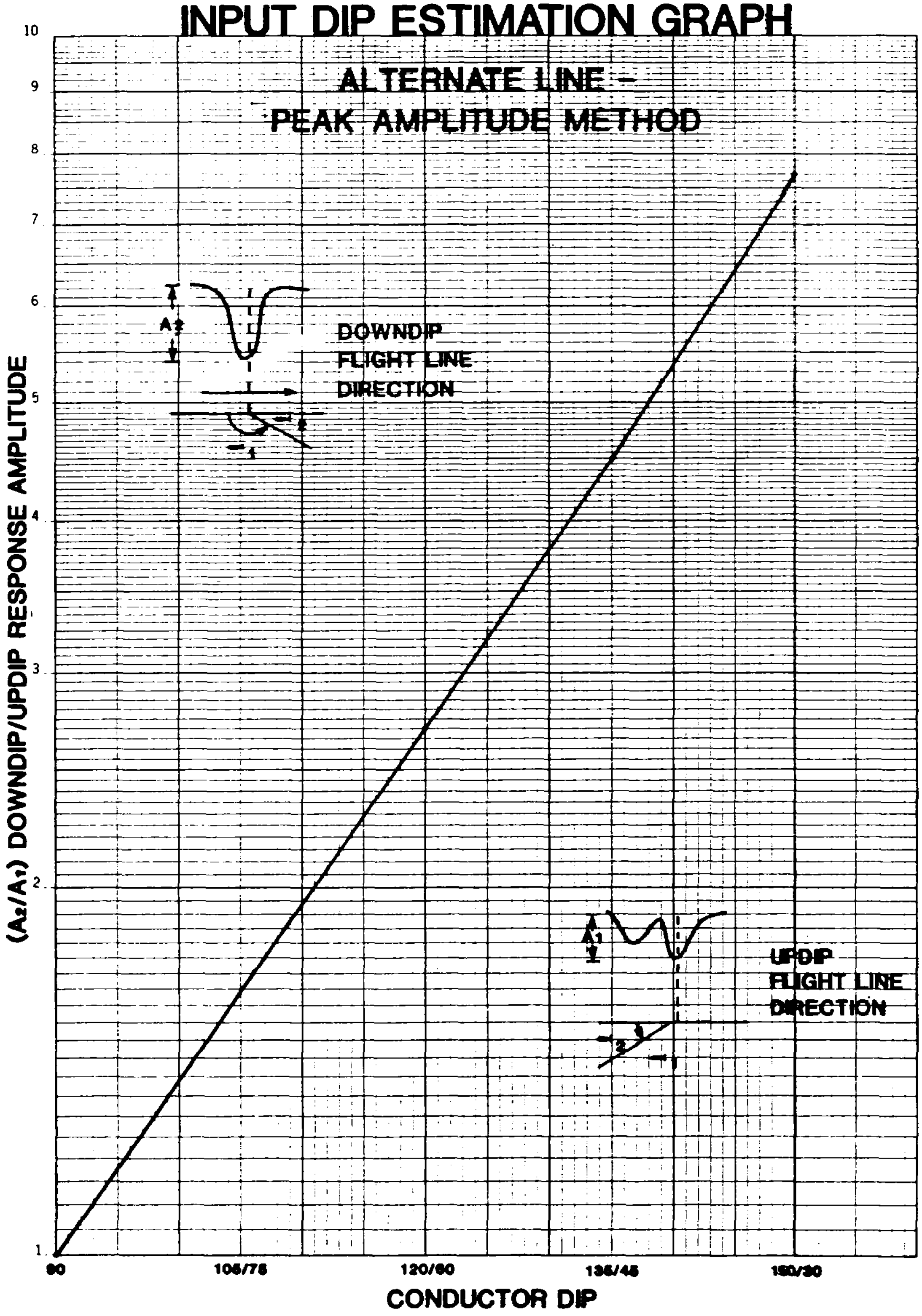
An alternate method for estimating the dips of longer, tabular conductors, utilizes the peak amplitudes on adjacent lines, see Figure G4. It is especially useful in multiple conductive zones where the up-dip responses may be obscured or yield false values due to the superposition of other nearby anomalies.

Note that the depth determination is made with the assumption that the aircraft is at 120 metres above the ground surface at the time of measurement. If the aircraft is above or below the altitude of 120 metres, the depth determination can be corrected by respectively, subtracting or adding the difference in altitude, within limits. In the case of Anomaly B, Figure G1, the anomaly was intercepted at an aircraft altitude of 131 metres. Therefore, a correction factor of 9 metres must be subtracted from the depth of the conductor, placing it at 21 metres below the ground surface.

The homogeneous half-space, thin overburden and the dipping half-plane 135° nomograms are used in the same fashion as that described above for the vertical half-plane.

To estimate the apparent strike length of a conductor, the ends of the conductive trend must be determined. Modelling has shown that the conductor ends are delineated by INPUT responses having channel amplitudes not less than 40% of those typical for the conductor. Responses with less than that of 40% are attributive to lateral coupling effects and are not considered as intercepts of the conductor. This is especially true for conductors of higher conductivity. Subsequently, the strike length of a conductor is equal to the distance between those responses representing the ends of the conductor.

INPUT DIP ESTIMATION GRAPH



APPENDIX H

MAGNETOMETER: COMPENSATION, SURVEY AND PROCESSING

Aircraft Magnetic Compensation

In order for a high sensitivity magnetometer system to function without interference from the aircraft, it must be magnetically compensated. The sources of magnetic interference, produced by the aircraft are: a) eddy currents; b) aircraft electrical system; c) induced magnetism; and d) permanent magnetism. These sources of magnetic noise have distinguishable characteristics on the analogue records and a ground and airborne test will indicate the capabilities of the magnetometer installation. By following established procedures most of the noise sources are eliminated.

a) Eddy currents are caused by movements of the larger conducting surfaces of the aircraft in the earth's magnetic field, whereby electric currents are generated, causing magnetic fields. By placing the sensor at the greatest practical distance from these surfaces and by not flying in turbulent wind conditions, eddy current noise can be minimized.

b) Aircraft electrical systems with varying loads can lead to serious noise problems if consistent operations procedures and circuit layout are not properly designed. The switching of the aircraft's 28 volt DC to almost any component during survey will create a variation in the static field existing under normal operating conditions. The three component compensator in the aircraft will see electrical system noise as DC level shifts from a heading invariant datum.

c) Induced magnetic fields are produced by ferromagnetic parts (mainly engines) in the earth's magnetic field. For a major change in magnetic latitude, it is necessary to check for variation of the aircraft's induced magnetic field. This is also dependant on the aircraft's heading and altitude. Compensation is accomplished by critical positioning of permalloy strips near the sensor. These produce fields opposite to the induced magnetic field of the aircraft, effectively cancelling it.

d) Permanent magnetism is produced by ferromagnetic parts within the aircraft. Compensation is accomplished with three orthogonal coils, through each of which an electrical current is passed, to create a resultant stable field opposite in polarity to the permanent field.

The compensation process has as its main objective the reduction of heading errors. These may be checked by flying the aircraft at survey altitude over a well defined non-anomalous landmark in the four cardinal headings. In addition, the effects of aircraft flight characteristics on the magnetometer installation are simulated by performing roll, pitch and yaw manouvers.

The aircraft has been originally compensated in Toronto, Ontario, where the induced field has been cancelled. In the survey area, a check is made to ensure that the permanent field does not induce heading dependant, magnetic field errors.

MAGNETOMETER SURVEY AND DATA ACQUISITION

The magnetometer survey is an integral part of INPUT operations, with no special procedures being required; with the exception of a ground magnetic recording station to monitor daily diurnal variations. The diurnal survey specifications relate to the control line spacing to minimize the possibilities of erroneous contours in area of low magnetic gradient.

The maximum diurnal gradient permitted is 20 gammas change within 5 minutes. The maximum control line spacing allowed is 8 kilometres. Where possible, control lines are routed through areas of low magnetic gradient over easily identified topographic points. As the time for the survey aircraft to span two control lines is approximately 2 minutes, a maximum diurnal anomaly of 4 nT (nanoTeslas) may exist after the data has been levelled.

The daily variation of the earth's magnetic field is monitored and recorded with a Geometrics G-826 Base Station Magnetometer and a GULTON or Hewlett Packard Strip Chart Recorder. The recorder has a 10 cm. chart width with a 100 nT full scale deflection, providing scaling of 1 nT/MM. An event marker provides time reference marks every minute. The chart speed is set to 20 cm/hour, with magnetometer readings taken every 4 or 10 seconds.

These readings may be digitally recorded using a portable data acquisition system synchronized with the aircraft data system, if required.

The magnetometer readings in the aircraft are recorded every second onto industry standard, 9-track tapes using the IBM NRZI Format.

APPENDIX I

Bibliography

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```
JOB NO: 28010
  INPUT EM             ANOMALY     PEAK   RESPONSE   AMPLITUDES  (PPM)   TCP  ALT     MAGNETIC
LINE    FIDUCIAL     TYPE  CHS    CH1    CH2    CH3    CH4    CH5    CH6  (S)  (M)  FIDUCIAL VALUE
-----------------------------------------------------------------------------------------------


19010 A   164.089     P    1      97     -      -      -      -      -    NC  121      -
19010 B   164.299     P    1      99     -      -      -      -      -    NC  117      -

10041 A   170.255          5     853    333    209    187    109     -    45  154   170.30    26
10041 B   171.155          4      68     65     26     21     -      -    14  122   171.25    30
10041 C   171.757          5     578    302    159    110     61     -    22  138   171.75   172
10041 D   173.516     P    1      52     -      -      -      -      -    NC  124   173.77    11

10051 A   124.316          1     158     -      -      -      -      -    NC  133   124.28   146

10061 A   128.396          2     172     15     -      -      -      -    NC  126   128.50    66
10061 B   128.859     P    2      72     46     -      -      -      -    NC  124   128.90    30

10071 A   132.711     P    2     107     57     -      -      -      -    NC  122   132.73    18
10071 B   133.456     U    2      90     46     -      -      -      -    NC  126      -
10071 C   133.599          3     652    202     81     -      -      -     8  118   133.57   275

10080 A   137.211     U    1      90     -      -      -      -      -    NC  129      -
10080 B   137.396          3     382    139     54     -      -      -     7  129   137.38   317

10091 A   141.117     U    1     139     -      -      -      -      -    NC  126      -
10091 B   141.319          2     283    103     -      -      -      -    NC  129   141.30   325

10121 A    39.602          2     132     47     -      -      -      -    NC  146      -

10130 A    41.354          2     129     41     -      -      -      -    NC  122      -

10150 A    51.173     P    1      65     -      -      -      -      -    NC  121      -

10190 A    90.069          2      55     45     -      -      -      -    NC  128    89.95    69

10200 A    94.438          1      82     -      -      -      -      -    NC  127      -
10200 B    97.072          2      78     37     -      -      -      -    NC  140    96.95    45

10210 A    98.653          1      82     -      -      -      -      -    NC  124    98.85    38

10220 A   105.600          1      74     -      -      -      -      -    NC  133   105.75    24
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 JOB NO: 28010
     NPUT EM          ANOMALY     PEAK  RESPONSE  AMPLITUDES  (PPM)  TCP  ALT    MAGNETIC
 LINE     FIDUCIAL  TYPE  CHS    CH1   CH2    CH3   CH4   CH5   CH6  (S)  (M) FIDUCIAL VALUE
--------------------------------------------------------------------------------------------
10220 B   105.915          2    137    64     -     -     -     -    NC  138      -

10230 A   107.775          3    236    71    15     -     -     -     4  120   107.82     31

10240 A   115.280    U     3    105    68    29     -     -     -     8  140      -
10240 B   115.431          3    298   103    43     -     -     -     8  140   115.38     22

10250 A   118.110          1     59     -     -     -     -     -    NC  132      -

10272 A   135.106    P     1     50     -     -     -     -     -    NC  124      -

10280 A   139.256          1     86     -     -     -     -     -    NC  140   139.18     45

10310 A   153.069    P     1    145     -     -     -     -     -    NC  122   153.20     80

10320 A   156.611    P     1    131     -     -     -     -     -    NC  126      -
10320 B   156.905    P     2    106    45     -     -     -     -    NC  129      -
10320 C   157.591    P     1     63     -     -     -     -     -    NC  130   157.88     79
--------------------------------------------------------------------------------------------
```

#266 Land Management

Ministry of Natural Resources
Ontario

Report of Work
(Geophysical, Geological, Geochemical and Expenditures)

File: 880136

42E13NE0034 2.9405 CASTLEWOOD LAKE

900

Type of Survey(s): Airborne Mag & EM — CASTLEWOOD LK (G22)

Claim Holder(s): Andaurex Resources Inc — Prospector's Licence No.: T 4620

Address: 1 First Canadian Place, P.O. Box 173, Toronto, Ontario M5X 1C7

Survey Company: Questor Surveys Limited

Date of Survey (from & to): 30 04 86 — 04 05 86 (Day Mo. Yr. — Day Mo. Yr.)

Total Miles of line Cut:

Name and Address of Author (of Geo-Technical report): Philip Salib - 630 Viscount Rd. Mississauga, Ontario

Credits Requested per Each Claim in Columns at right

Special Provisions

For first survey:
Enter 40 days. (This includes line cutting)

For each additional survey: using the same grid:
Enter 20 days (for each)

Geophysical	Days per Claim
Electromagnetic	
Magnetometer	
Radiometric	
Other	
Geological	
Geochemical	

RECEIVED

Man Days

Complete reverse side and enter total(s) here

Geophysical	Days per Claim
Electromagnetic	
Magnetometer	
Radiometric	
Other	
Geological	
Geochemical	

Airborne Credits

Note: Special provisions credits do not apply to Airborne Surveys.

	Days per Claim
Electromagnetic	35.19
Magnetometer	35.19
Radiometric	

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

Calculation of Expenditure Days Credits

Total Expenditures: $ ÷ 15 = Total Days Credits:

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Date: Sept /86 — Recorded Holder or Agent (Signature):

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.	Prefix	Number	Expend. Days Cr.
TB	880136		TB	880159	
	880137			880160	
	880138			880161	
	880139			880162	
	880140			880163	
	880141				
	880142				
	880143				
	880144				
	880145				
	880146				
	880147				
	880148				
	880149				
	880150				
	880151				
	880152				
	880153				
	880154				
	880155				
	880156				
	880157				
	880158				

Total number of mining claims covered by this report of work: 28

For Office Use Only

Total Days Cr. Recorded: 1970.64 — Date Recorded: Sept 19/86 — Mining Recorder: Audrey M. Hayes

Approved as Recorded: See Revised Statement

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying:
W.P. Hammond, 1 First Canadian Place, P.O. Box 173, Toronto, Ontario. M5X 1C7

Date Certified: Sept 16 /86 — Certified by (Signature):

GEOCHEMICAL SURVEY – PROCEDURE RECORD

Numbers of claims from which samples taken ____________________

Total Number of Samples ____________________
Type of Sample ____________________ (Nature of Material)
Average Sample Weight ____________________
Method of Collection ____________________

Soil Horizon Sampled ____________________
Horizon Development ____________________
Sample Depth ____________________
Terrain ____________________

Drainage Development ____________________
Estimated Range of Overburden Thickness ____________________

SAMPLE PREPARATION
(Includes drying, screening, crushing, ashing)

Mesh size of fraction used for analysis ____________________

General ____________________

ANALYTICAL METHODS

Values expressed in:
per cent ☐
p. p. m. ☐
p. p. b. ☐

Cu, Pb, Zn, Ni, Co, Ag, Mo, As,-(circle)

Others ____________________
Field Analysis (__________ tests)
Extraction Method ____________________
Analytical Method ____________________
Reagents Used ____________________
Field Laboratory Analysis
No. (__________ tests)
Extraction Method ____________________
Analytical Method ____________________
Reagents Used ____________________

Commercial Laboratory (__________ tests)
Name of Laboratory ____________________
Extraction Method ____________________
Analytical Method ____________________
Reagents Used ____________________

General ____________________

Ontario

Ministry of Natural Resources

File ____________________

GEOPHYSICAL – GEOLOGICAL – GEOCHEMICAL TECHNICAL DATA STATEMENT

TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT
FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT
TECHNICAL REPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.

Type of Survey(s) Airborne EM & MAG.
Township or Area CASTLEWOOD LAKE AREA (G22)
Claim Holder(s) Andaurex Resources Inc.

Survey Company Questor Surveys Limited
Author of Report Philip Salib
Address of Author 630 Viscount Rd, Mississauga Ont.
Covering Dates of Survey April 30 to May 4, 1986 (linecutting to office)
Total Miles of Line Cut ____________________

SPECIAL PROVISIONS CREDITS REQUESTED

ENTER 40 days (includes line cutting) for first survey.

ENTER 20 days for each additional survey using same grid.

DAYS per claim
Geophysical
–Electromagnetic ______
–Magnetometer ______
–Radiometric ______
–Other ______
Geological ______
Geochemical ______

AIRBORNE CREDITS (Special provision credits do not apply to airborne surveys)
Magnetometer 35.19 Electromagnetic 35.19 Radiometric ______ (enter days per claim)

DATE: Sept. /86 SIGNATURE: ____________________ Author of Report or Agent

Res. Geol. __________ Qualifications 2.9268

Previous Surveys

File No.	Type	Date	Claim Holder

OFFICE USE ONLY

MINING CLAIMS TRAVERSED
List numerically

(prefix) (number)

SEE ATTACHED LIST

If space insufficient, attach list

TOTAL CLAIMS 28

GEOPHYSICAL TECHNICAL DATA

GROUND SURVEYS – If more than one survey, specify data for each type of survey

Number of Stations ______ Number of Readings ______
Station interval ______ Line spacing ______
Profile scale ______
Contour interval ______

MAGNETIC

Instrument ______
Accuracy – Scale constant ______
Diurnal correction method ______
Base Station check-in interval (hours) ______
Base Station location and value ______

ELECTROMAGNETIC

Instrument ______
Coil configuration ______
Coil separation ______
Accuracy ______
Method: ☐ Fixed transmitter ☐ Shoot back ☐ In line ☐ Parallel line
Frequency ______
(specify V.L.F. station)
Parameters measured ______

GRAVITY

Instrument ______
Scale constant ______
Corrections made ______
Base station value and location ______
Elevation accuracy ______

INDUCED POLARIZATION RESISTIVITY

Instrument ______
Method ☐ Time Domain ☐ Frequency Domain
Parameters – On time ______ Frequency ______
– Off time ______ Range ______
– Delay time ______
– Integration time ______
Power ______
Electrode array ______
Electrode spacing ______
Type of electrode ______

SELF POTENTIAL

Instrument ______ Range ______
Survey Method ______
Corrections made ______

RADIOMETRIC

Instrument ______
Values measured ______
Energy windows (levels) ______
Height of instrument ______ Background Count ______
Size of detector ______
Overburden ______
(type, depth – include outcrop map)

OTHERS (SEISMIC, DRILL WELL LOGGING ETC.)

Type of survey ______
Instrument ______
Accuracy ______
Parameters measured ______
Additional information (for understanding results) ______

AIRBORNE SURVEYS

Type of survey(s) E. M. | Mag.
Instrument(s) Mark VI Input E.M. | Geometrics G-813 Proton Mag.
(specify for each type of survey)
Accuracy 50ppm per centimeter | .01 gamma
(specify for each type of survey)
Aircraft used Short Brothers Skyvan Model SH-7 Series 3
Sensor altitude 180 feet
Navigation and flight path recovery method Manual. Based on 35mm film. assisted by electronic Navigation System
Aircraft altitude 400 feet Line Spacing 328 feet
Miles flown over total area 31.69 Over claims only 24.63

Andaurex Resources Inc., List of Claims

T.B. 880136
880137
880138
880139
880140
880141
880142
880143
880144
880145
880146
880147
880148
880149

T.B. 880150
880151
880152
880153
880154
880155
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880157
880158
880159
880160
880161
880162
880163

November 28, 1986

Your File: 266
Our File: 2.9405

Mining Recorder
Ministry of Northern Development and Mines
435 James Street South
P.O. Box 5000
Thunder Bay, Ontario
P7C 5G6

Dear Madam:

RE: Notice of Intent dated November 7, 1986
Airborne Geophysical (Electromagnetic & Magnetometer) Surveys on Mining Claims
TB 880136, et al, in the Castlewood Lake Area

The assessment work credits, as listed with the above-mentioned Notice of Intent, have been approved as of the above date.

Please inform the recorded holder of these mining claims and so indicate on your records.

Yours sincerely,

J.C. Smith, Supervisor
Mining Lands Section

Whitney Block, 6th Floor
Queen's Park
Toronto, Ontario
M7A 1W3

Telephone: (416) 965-4888

SH/mc

cc: Audaurex Resources Inc
1 First Canadian Place
P.O. Box 173
Toronto, Ontario
M5X 1C7
Attention: W.P. Hammond

Philip Salib
630 Viscount Road
Mississauga, Ontario
L4V 1H3

Mr. G.H. Ferguson
Mining & Lands Commissioner
Toronto, Ontario

cc: Resident Geologist
Thunder Bay, Ontario

Encl.

Ministry of
Northern Development
and Mines
Ontario

Technical Assessment Work Credits

		File 2.9405
Date November 7, 1986	Mining Recorder's Report of Work No. 266	

Recorded Holder
ANDAUREX RESOURCES INC

Township or Area
CASTLEWOOD LAKE AREA

Type of survey and number of Assessment days credit per claim	Mining Claims Assessed
Geophysical	
Electromagnetic 36.5 days	
Magnetometer 36.5 days	TB 880136 to 162 inclusive
Radiometric ___ days	
Induced polarization ___ days	
Other ___ days	
Section 77 (19) See "Mining Claims Assessed" column	
Geological ___ days	
Geochemical ___ days	
Man days ☐ Airborne ☒	
Special provision ☐ Ground ☐	
☐ Credits have been reduced because of partial coverage of claims.	
☐ Credits have been reduced because of corrections to work dates and figures of applicant.	

Special credits under section 77 (16) for the following mining claims

No credits have been allowed for the following mining claims

☒ not sufficiently covered by the survey ☐ insufficient technical data filed

TB 880163

The Mining Recorder may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical - 80; Geological - 40; Geochemical - 40; Section 77(19) - 60.

828 (85/12)

April 25, 1986.

Andaurex Resources Inc.,
1 FIrst Canadian Place,
Suite #4800,
P. O. BOX 173,
TORONTO, Ontario
M5X 1C7

INVOICE #502

Re: Airborne Geophysical Survey as outlined in the Agreement between our two companies dated April 4th, 1986.

INPUT Survey - Project #28010

Approximately 45 line kilometres	$10,000.00
50% Due on Signing Agreement	5,000.00
Total	$ 5,000.00
Less Paid to Date	5,000.00
Total this Invoice	$ 0.0

ALDTON
PROPERTY

$5000.00 CK# 151
Advance Paid April 17/86

General Delivery, Connaught, Ont. P0N 1A0	Jan.22/86 8:00 a.m.

ASSESSMENT WORK CREDITS ASSIGNED TO OTHER CLAIMS	OFFICE USE ONLY	DAYS RECORDED	BALANCE

DESCRIPTION OF CLAIM

CASTLEWOOD LAKE AREA (G22)

RESERVATIONS — 400 FOOT SURFACE RIGHTS RESERVATION AROUND ALL LAKES AND RIVERS. SAND AND GRAVEL RESERVED. PEAT RESERVED

FILE NO
880136

DATE	DAYS WORK		RECEIPT NO.
Apr. 21/86		Transfers all interest to ANDAUREX RESOURCES INC.	A574841
		(T4620) (880136)	

This abstract is a copy of the entries in the Record Book and is not to be considered as assurance of the validity of the claim.

MAY 12 1986

Mining Recorder
THUNDER BAY MINING DIVISION

Licence No.

T 4620

640 (5-80)

Ministry of Natural Resources
Ontario

Report of Work
(Geophysical, Geological, Geochemical and Expenditures)

Mining Act

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.

Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

Type of Survey(s): Airborne Mag & E.M.

Township or Area: CASTLEWOOD LK (G22)

Claim Holder(s): Andaurex Resources Inc.

Prospector's Licence No.: T 4620

Address: 1 First Canadian Place, P.O. Box 173, Toronto, Ontario M5X 1C7

Survey Company: Questor Surveys Limited

Date of Survey (from & to): 30 04 86 | 04 05 86 (Day | Mo. | Yr. | Day | Mo. | Yr.)

Total Miles of line Cut:

Name and Address of Author (of Geo-Technical report): Philip Salib - 630 Viscount Rd. Mississauga, Ontario

Credits Requested per Each Claim in Columns at right

		Days per Claim
Special Provisions	Geophysical	
For first survey: Enter 40 days. (This includes line cutting)	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	
Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	
Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	35.19
	Magnetometer	35.19
	Radiometric	

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

Calculation of Expenditure Days Credits

Total Expenditures $ ÷ 15 = Total Days Credits

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Date: Sept /86

Recorded Holder or Agent (Signature):

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.	Prefix	Number	Expend. Days Cr.
TB	880136	✓	TB.	880159	✓
	880137	✓		880160	✓
	880138	✓		880161	✓
	880139	✓		880162	✓
	880140	✓		880163	NC
	880141	✓			
	880142	✓			
	880143	✓			
	880144	✓			
	880145	✓			
	880146	✓			
	880147	✓			
	880148	✓			
	880149	✓			
	880150	✓			
	880151	✓			
	880152	✓			
	880153	✓			
	880154	✓			
	880155	✓			
	880156	✓			
	880157	✓			
	880158	✓			

Total number of mining claims covered by this report of work. 28

For Office Use Only		
Total Days Cr. Recorded	Date Recorded	Mining Recorder
	Date Approved as Recorded	Branch Director

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying: V.P. Hammond, 1 First Canadian Place, P.O. Box 173, Toronto, Ontario. M5X 1C7

Date Certified: Sept 16/86

Certified by (Signature):

1362 (81/9)

File

Ministry of Natural Resources

Ontario

GEOPHYSICAL – GEOLOGICAL – GEOCHEMICAL
TECHNICAL DATA STATEMENT

TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT
FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT
TECHNICAL REPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.

Type of Survey(s) [illegible] EM & MAG
Township or Area CASTLEWOOD LAKE AREA (G22)
Claim Holder(s) Ardaurey [illegible] Inc.

Survey Company [illegible] Surveys Limited
Author of Report Philip [illegible]
Address of Author 630 [illegible] Rd, [illegible] Ont
Covering Dates of Survey April [illegible] to [illegible] 86
(linecutting to office)
Total Miles of Line Cut

SPECIAL PROVISIONS CREDITS REQUESTED

ENTER 40 days (includes line cutting) for first survey.

ENTER 20 days for each additional survey using same grid.

	DAYS per claim
Geophysical	
–Electromagnetic	
–Magnetometer	
–Radiometric	
–Other	
Geological	
Geochemical	

AIRBORNE CREDITS (Special provision credits do not apply to airborne surveys)

Magnetometer 35.19 Electromagnetic 35.19 Radiometric
(enter days per claim)

DATE: Sept. /86 SIGNATURE:
Author of Report or Agent

Res. Geol. Qualifications

Previous Surveys

File No.	Type	Date	Claim Holder

MINING CLAIMS TRAVERSED
List numerically

(prefix)	(number)
SEE ATTACHED LIST	

If space insufficient, attach list

TOTAL CLAIMS 28

Andauren Resources Inc.,
List of Claims

T.B. 880136
880137
880138
880139
880140
880141
880142
880143
880144
880145
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SELF POTENTIAL

Instrument ______ Range ______

Survey Method ______

Corrections made ______

RADIOMETRIC

Instrument ______

Values measured ______

Energy windows (levels) ______

Height of instrument ______ Background Count ______

Size of detector ______

Overburden ______

(type, depth – include outcrop map)

OTHERS (SEISMIC, DRILL WELL LOGGING ETC.)

Type of survey ______

Instrument ______

Accuracy ______

Parameters measured ______

Additional information (for understanding results) ______

AIRBORNE SURVEYS

Type of survey(s)	E.M.	Mag.
Instrument(s)	Mark VI Input E.M.	Geometrics G-813 Proton Mag.
	(specify for each type of survey)	
Accuracy	[illegible]	.01 gamma

(specify for each type of survey)

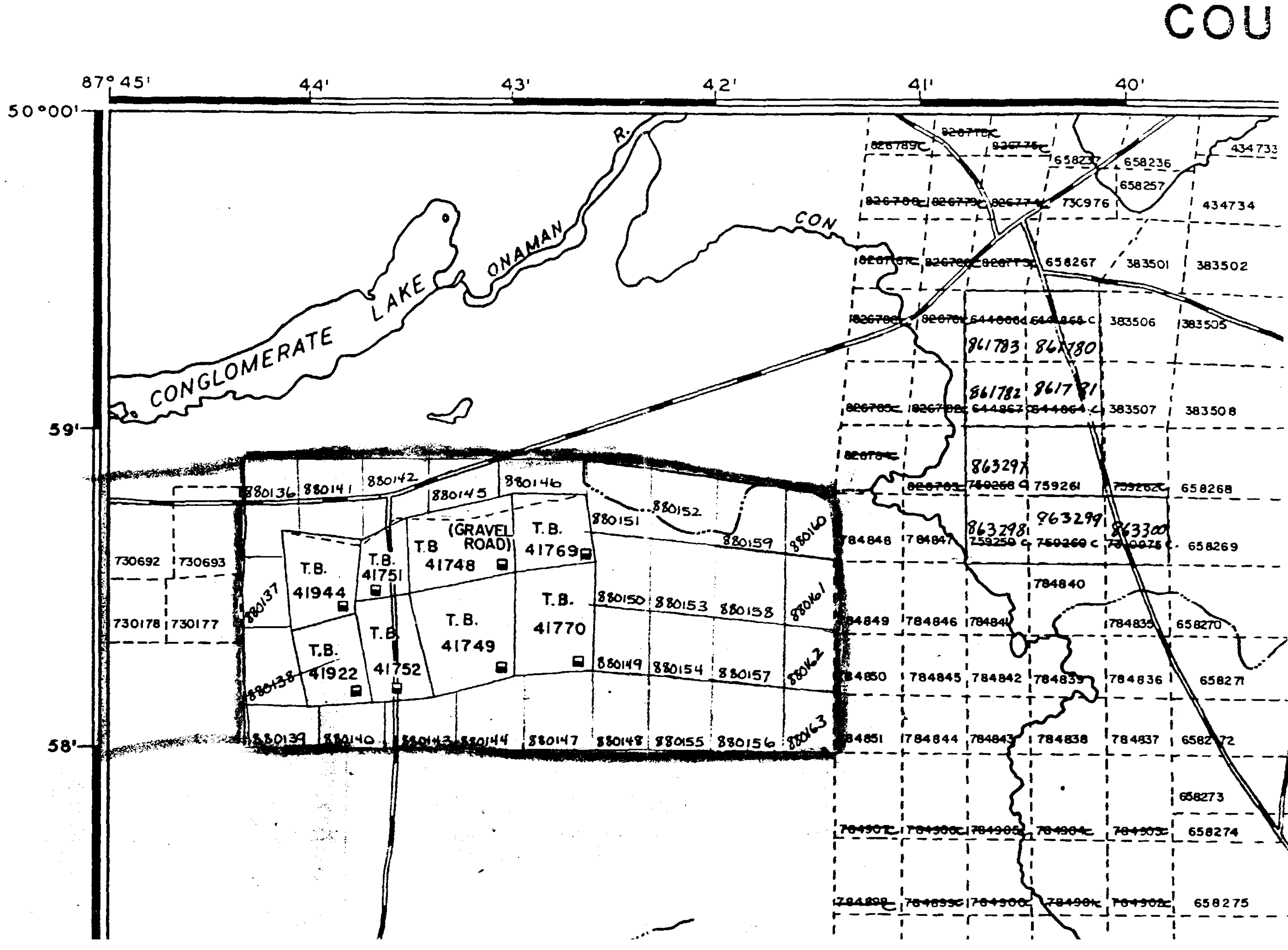
Aircraft used Short Brothers Skyvan Model 3M Series 3

Sensor altitude 150 feet

Navigation and flight path recovery method Manual. Based on 35mm film assisted by a Decca Navigation System

Aircraft altitude 400 feet Line Spacing 330 feet

Miles flown over total area 31.69 Over claims only 24.63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87°45'
44'
43'
42'
41'
40'
50°00'
59'
58'
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CON
(GRAVEL ROAD)
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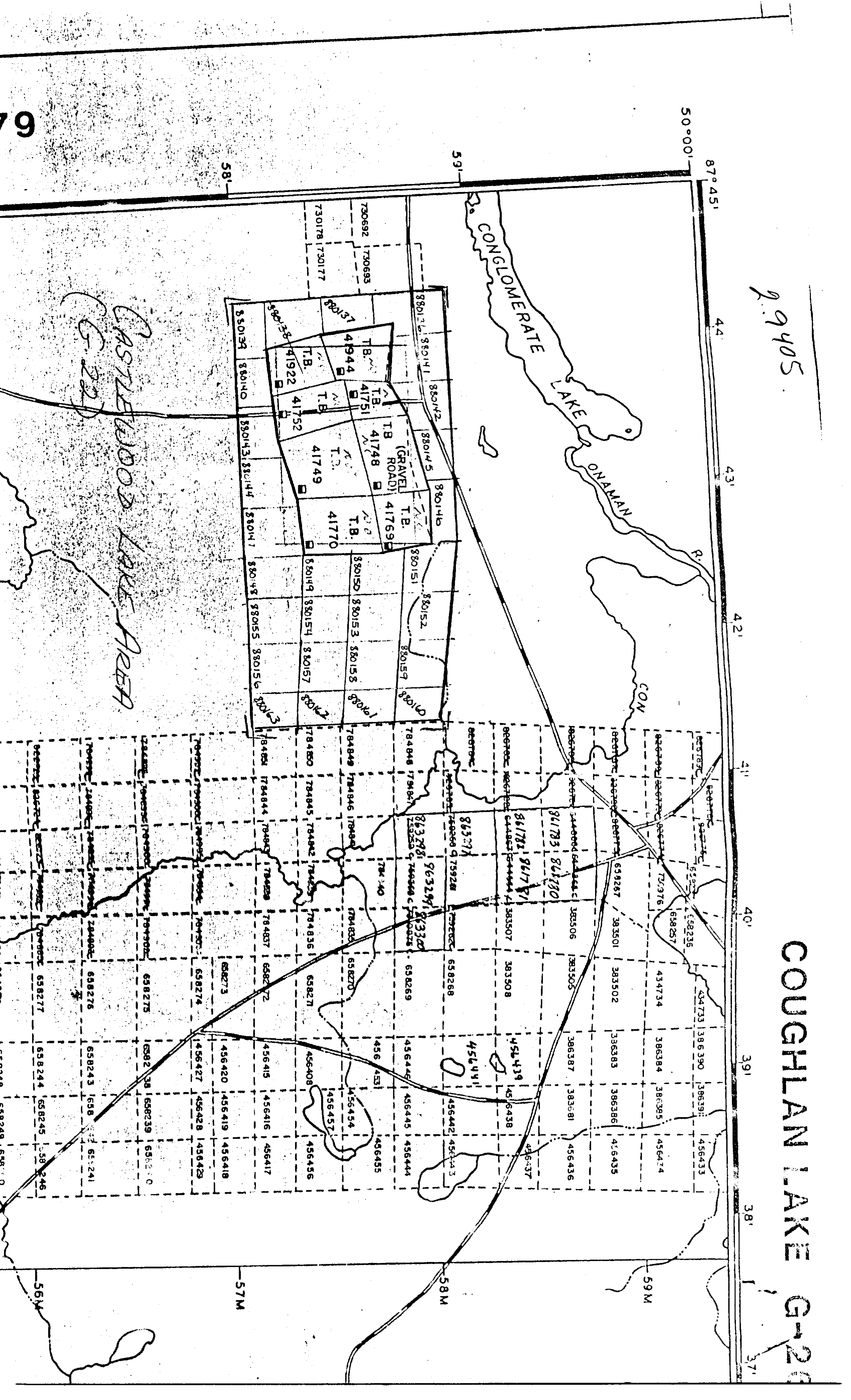79
2.9405
COUGHLAN LAKE G-2
CASTLEWOOD LAKE AREA
G-22
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87°45'
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59'
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43'
42'
41'
40'
39'
38'
37'
56M
57M
58M
59M
CONGLOMERATE LAKE
ONAMAN R.
CON
(GRAVEL ROAD)
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T.B. 41922
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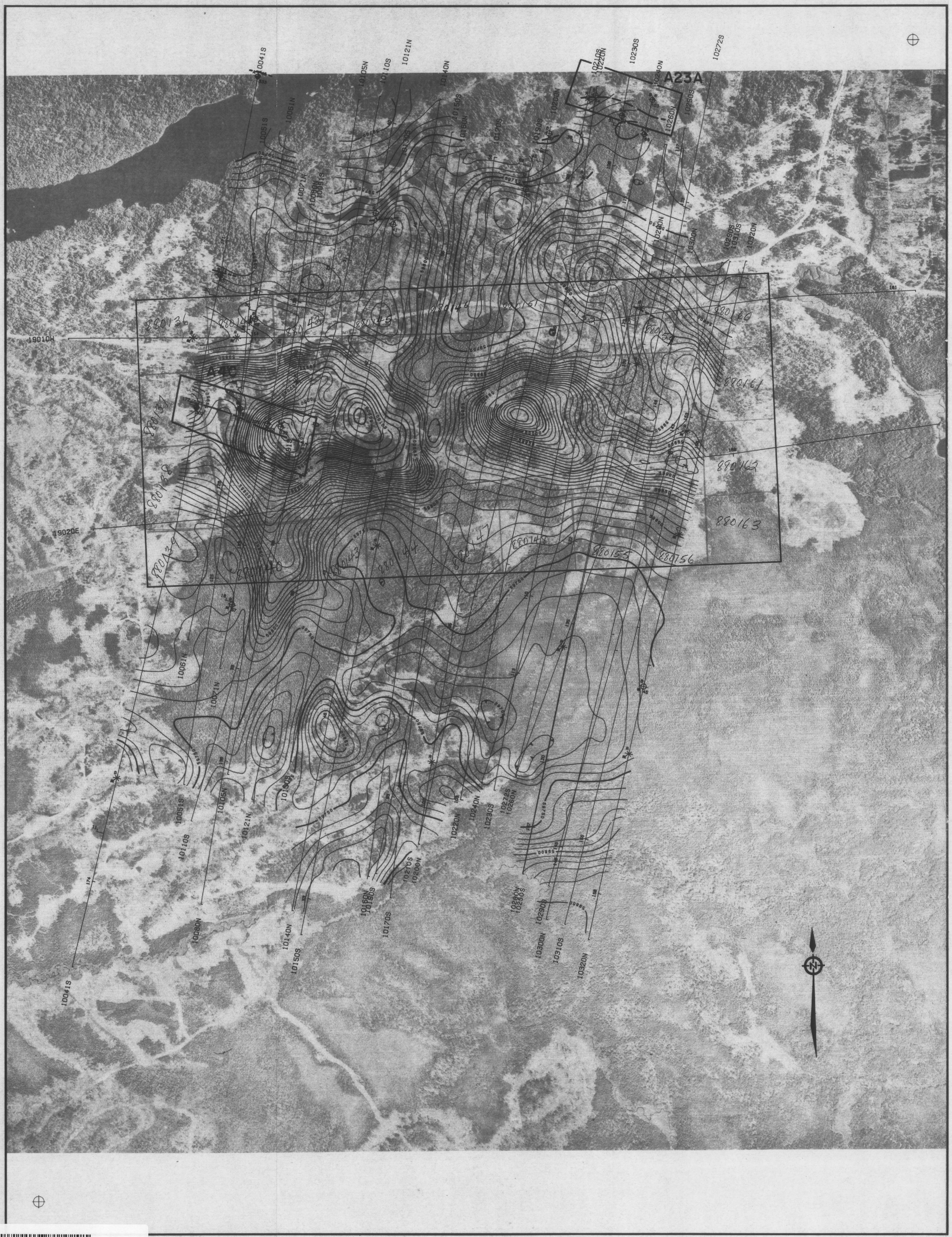


INPUT® PEAK RESPONSE SYMBOLS 2ms PULSE

SURFICIAL RESPONSE | UP-DIP PEAK RESPONSE | BEDROCK RESPONSE | DECAY INTERVAL CLASSIFICATION

1 Channel (300 microseconds)
2 Channel (500 microseconds)
3 Channel (800 microseconds)
4 Channel (1200 microseconds)
5 Channel (1700 microseconds)
6 Channel (2300 microseconds)

Culture Response

50 Associated Magnetic Response

Anomaly Letter — B 5 — Apparent Conductivity Width (siemens) (N.C. – No Calculation)
Poorly Defined Response — * 1800 — Ch. 2 Amplitude (p.p.m.)

MAGNETIC CONTOURS

10 Gamma Contour Line
50 Gamma Contour Line
250 Gamma Contour Line

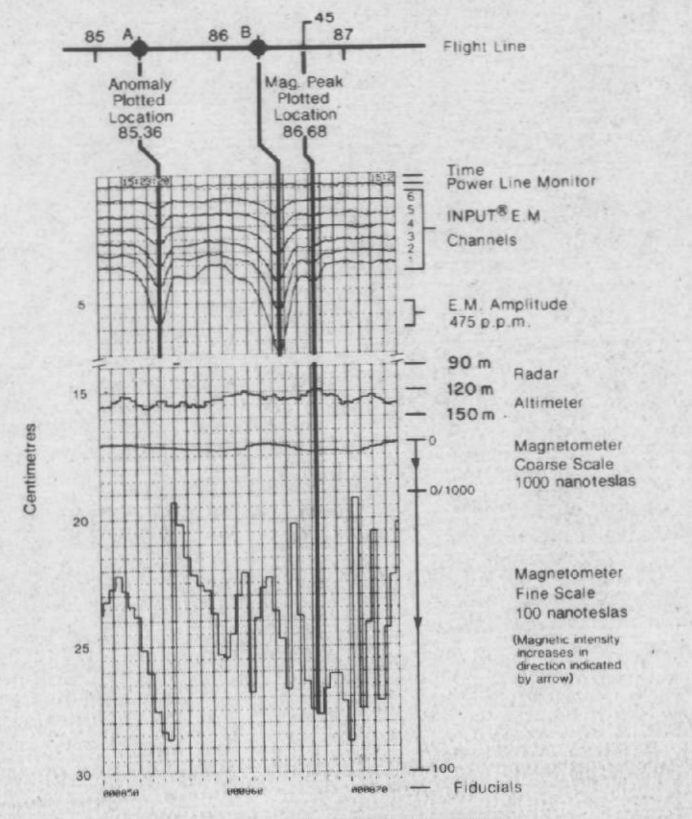
Magnetic Depression

1 Gamma = 1 Nanotesla in SI Units

INTERPRETATION

20 Conductor Axis, with reference number (good definition)
20 Conductor Axis, with reference number (poor definition)
Vertical Conductor
60° Conductor Dip (magnitude and direction known)
Conductor Dip (direction known)
A4C Selected Zone, with reference number
Conductive Zone
Fault Zone

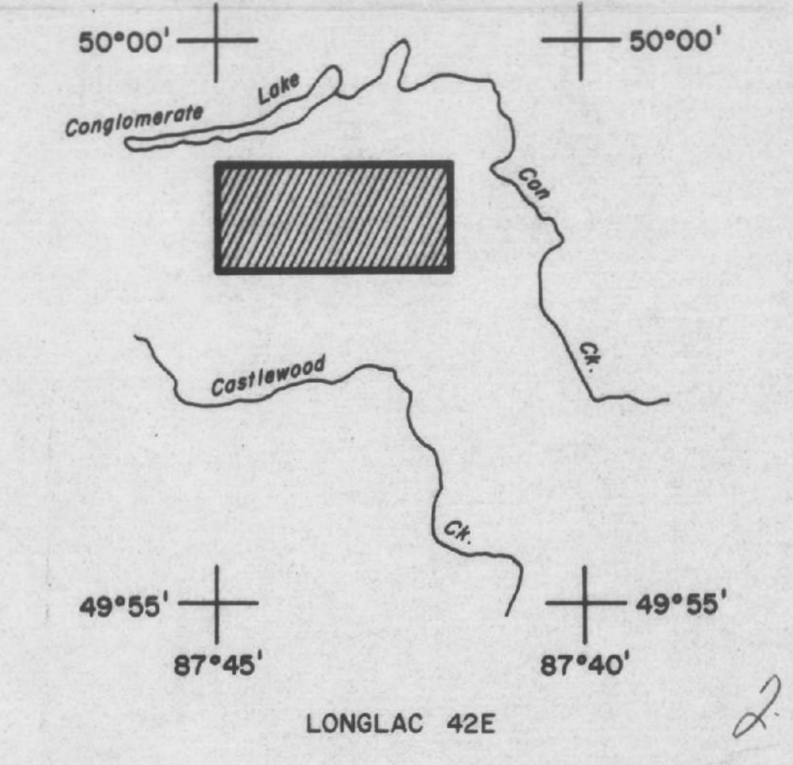
Representative INPUT® Magnetometer and Altimeter Recording



DESCRIPTIVE NOTES

The aircraft is equipped with the Barringer/Questor Mark VI INPUT* airborne E.M. System and the Sonotek PMH 5010 Proton Precession Magnetometer and Sonotek SDS-1200 Series Data Acquisition System. The INPUT* system will respond to conductive overburden and near-surface horizontal conducting layers in addition to bedrock conductors. Discrimination of conductors is based on the rate of transient decay, magnetic correlation and the anomaly shape, together with the conductor pattern and topography.

* Registered Trade Mark of Barringer Research Limited



LONGLAC 42E

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AIRBORNE MK VI INPUT® SURVEY
TOTAL MAGNETIC INTENSITY SURVEY

ANDAUREX RESOURCES INC.

CONGLOMERATE LAKE

Province of ONTARIO

Scale 1: 10 000

1000 0 3000 Ft.
200 0 1000 M

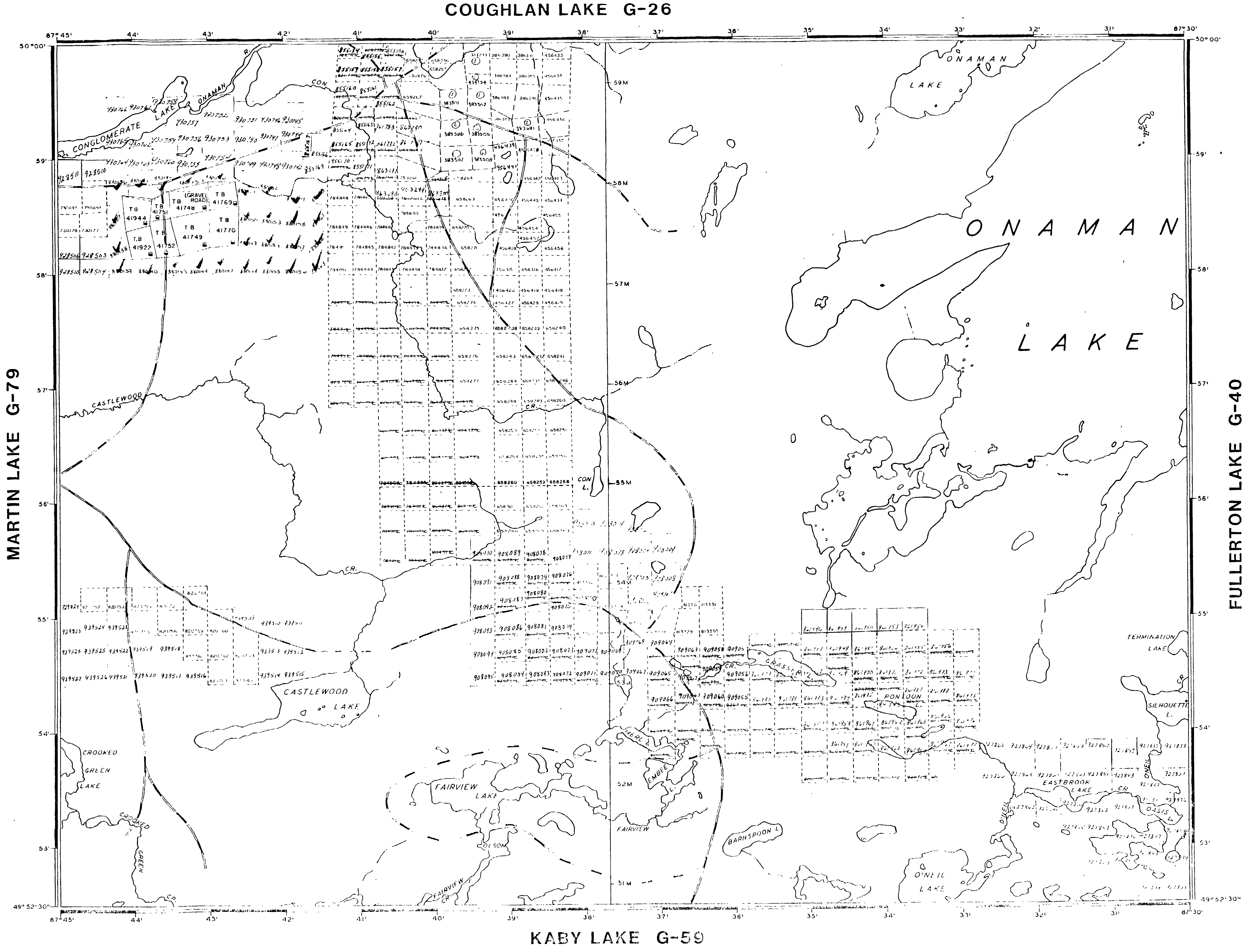
FILE NO.	SHEET NO.	DATE
28010	1 of 1	May, 1986

Questor Surveys Limited
Mississauga Ontario Canada

NOTES

42E13NE0034 2.8405 CASTLEWOOD LAKE

200



TOPOGRAPHY

LAKES RIVERS ETC. FROM FOREST RESOURCES INVENTORY SHEET No 498873

SURVEYS

MERIDIAN LINE SURVEYED BY PHILLIPS AND BENNER, O.L.S'S, 1916 FIELD NOTE BOOK No. 2474.

THUNDER BAY
MINING DIVISION
RECEIVED
SEP 26 1986
AM PM
7|8|9|10|11|12|1|2|3|4|5|6

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	◒
" , MINING RIGHTS ONLY	◓
LEASE SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	⬒
" , MINING RIGHTS ONLY	⬓
LICENCE OF OCCUPATION	▼
ORDER IN COUNCIL	OC
RESERVATION	Ⓡ
CANCELLED	⊗
SAND & GRAVEL	⦿

NOTE MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6 1913 VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, RSO 1970, CHAP 380, SEC 63 SUBSEC 1

LEGEND

PAVED ROAD
GRAVEL ROAD
OTHER ROADS
TRAIL OR PATH
HIGHWAY ROUTE No
ELECTRIC POWER LINE
TELEPHONE LINE T T T T T T
RAILROAD & RIGHT OF WAY
RAPIDS PORTAGE
NON PERENNIAL STREAM
EDGE OF CLEARING
TREELESS MUSKEG OR MARSH
BRIDGE, BUILDINGS

SCALE 1 INCH = 40 CHAINS

FEET 0 1000 2000 4000 6000 8000
METRES 0 200 1000 (1 KM) 2000 (2 KM)

AREA
CASTLEWOOD LAKE

M N R ADMINISTRATIVE DISTRICT
NIPIGON

MINING DIVISION
THUNDER BAY

LAND TITLES / REGISTRY DIVISION
THUNDER BAY

Ministry of Natural Resources
Ontario
Land Management Branch

Date MAY 1981
August 30, 1985

Number G-22