GREAT PLAINS DEVELOPMENT COMPANY OF CANADA, LTD.

HELICOPTER BORNE GEOPHYSICAL SURVEY ON THE TAN PROPERTY, BRITISH COLUMBIA

New Westminster Mining Division
N.T.S. 92H/4W

Latitude: 49 degrees 01 minute
Longitude: 121 degrees 47 minutes

Owners of TAN, AX, SO, DANE Claims are:

M. McClaren
G. Stapley
W. A. Bell

Operator: Great Plains Development Company of Canada, Ltd.

Consultant: Michael Lewis, M.Sc., P.Eng.
Scintrex

G. L. Garratt, P. Geol.

1978 March 09

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Figure A: Claim Location Map

APPENDIX 1: Logistical Report On Airborne Geophysical Survey Chilliwack Area, British Columbia by Scintrex Limited

I. INTRODUCTION

The Tan claims, consisting of Groups A and B, are located on Tamihi Creek between Church Mountain and McGuire Mountain in the New Westminster Mining Division (Figure A). The coordinates of the property are centred at 49 degrees 01 minute latitude and 121 degrees 47 minutes longitude and the corresponding N.T.S. is 92-H-4W. Access is by gravel logging road 5 miles from the Chilliwack River road which is paved; the property is approximately 10 miles from Chilliwack.

The topography is rugged with elevations ranging from 305 metres to 1465 metres. A small part of the property has been logged and the remainder is heavily timbered up to the 1370 metre elevation where alpine vegetation takes over. The property is in an area of high annual precipitation and experiences an annual snow fall of approximately three feet.

The present owners: M. McClaren, G. Stapley, and W. A. Bell staked claims in the spring of 1972 after prospecting and trenching zinc and copper mineralization on two major showings. Subsequently, the property was optioned to Cominco who completed geochemical sampling, geologic mapping and an induced polarization survey. The property was then optioned to Great Plains who carried out programs in 1975 and 1976 consisting of: geological mapping; soil sampling and soil-profile testing; trenching; linecutting; induced polarization surveying; electromagnetic surveying; road building and clearing, and diamond drilling.

In 1977 Great Plains contracted an airborne geophysical survey to Scintrex, however no obvious anomalous EM responses were obtained.

II. GEOPHYSICAL SURVEY

Between September 20 and September 31, 1977 an airborn geophysical survey was flown by Scintrex covering 200 line kilometres under the supervision of Glen Garratt and Doug Good. For an account of that survey the reader is referred to the geophysical report by Scintrex which is found in Appendix 1.

III. ITEMIZED COST STATEMENT

A. Supervision		
Project Geologist: Glen Garratt	$ 600.00	
$100/day 6 days Sept. 21-26, 1977		
Assistant: Doug Good		
$75/day 10 days Sept. 21-30, 1977	$ 750.00	
Food and Accommodation for above		
@ $30/day 16 days	$ 480.00	
Expense Accounts - Travel	$ 147.85	
Fuel	$ 59.40	
B. Geophysical - Contract		
Crew Subsistence September 21-26		
Car Rental - local transport	$ 616.82	
Motel	$ 166.95	
Gas	$ 93.20	
Meals 4 people x 5 days x $20.00	$ 400.00	
	$ 1,276.97	
12%	$ 153.24	
	$ 1,430.21	$ 1,430.21
Daily rate of $650/day		
5 days (Sept. 22, 23, 24, 25, 26)		$ 3,250.00
Mobilization and Demobilization		$ 2,500.00
200 Line Kilometres		
Rental $16.09/Line Kilometre		$ 1,242.50
Helicopter		
19.6 hrs. @ $455.56/hr (Inc. Fuel)	$ 8,928.85	
3.0 hrs. @ $410.00/hr (No Fuel)	$ 1,230.00	
	$10,158.55	
Plus 12%	$ 1,219.06	
	$11,377.91	$11,377.91
TOTAL		$21,837.87
C. Overhead		$ 1,323.72
GRAND TOTAL		$23,161.59

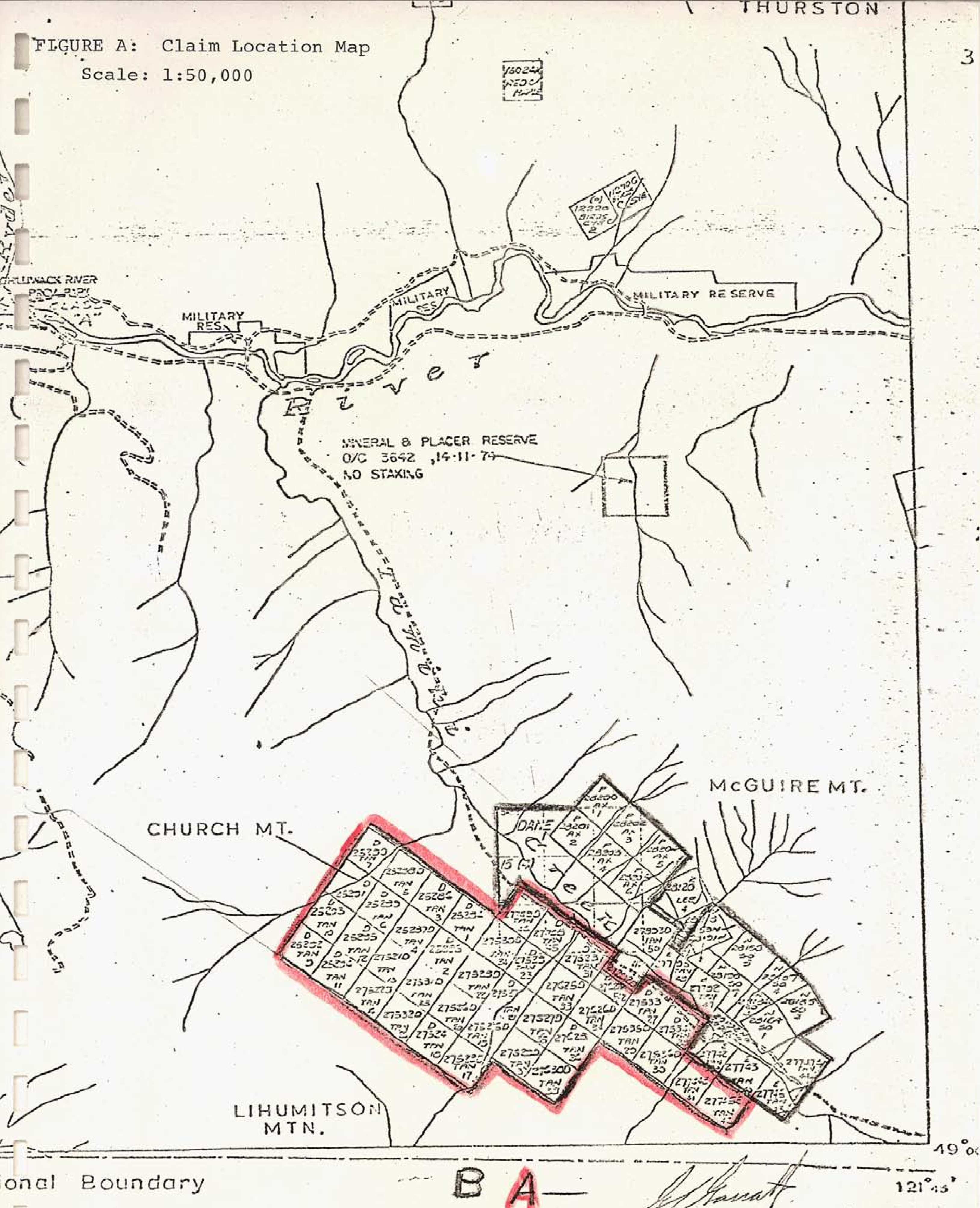
IV. AUTHOR'S QUALIFICATIONS

I, Glen L. Garratt, am a qualified Geologist having graduated from the University of British Columbia in 1972 with a Bachelor of Science degree majoring in Geology. I have worked in the mineral exploration industry in British Columbia since 1969 and am presently employed by Great Plains Development Company of Canada, Ltd., as a Regional Geologist.

G. L. Garratt, P. Geol.

1978 March 09

FIGURE A: Claim Location Map
Scale: 1:50,000



AND PETROLEUM RESOURCES

This map is prepared to serve as a guide to the positions of located mineral claims

APPENDIX I

LOGISTICAL REPORT ON
AIRBORNE GEOPHYSICAL SURVEY
CHILLIWACK AREA, BRITISH COLUMBIA

On Behalf Of

GREAT PLAINS DEVELOPMENT COMPANY OF CANADA LTD.

By

SCINTREX LIMITED

Dec. 21/77
MJL/cc

T-1156

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Figure 1 Location Map

Plates 1,2,3 Flight Path Map. Scale 1" = 1000' approx.

Appendix A Specification Sheets

SUMMARY

An airborne geophysical survey was carried out over an area located about 15 miles southeast of Chilliwack, British Columbia. A total of 124 line miles were surveyed at a nominal sensor altitude of 150 feet with a nominal interline spacing of 660 feet.

The following geophysical parameters were measured during the survey: HEM-801 In-Phase and Quadrature components of the secondary field at 938 Hz and the total magnetic field.

The data were continuously recorded on analogue charts.

The survey was flown with a turbine powered Alouette III helicopter.

LOGISTICAL REPORT ON AIRBORNE GEOPHYSICAL SURVEY CHILLIWACK AREA, BRITISH COLUMBIA

On Behalf Of

GREAT PLAINS DEVELOPMENT COMPANY OF CANADA LIMITED

1. INTRODUCTION

During the period September 20th - September 26th, 1977, an airborne geophysical survey was carried out by Scintrex Limited on behalf of Great Plains Development Company of Canada Ltd. in the Chilliwack Area, British Columbia. A total of 124 line miles were flown.

On each flight line measurements were made of the induced electromagnetic response and of the total magnetic field. The principal instrumentation consisted of an HEM-801 electromagnetic prospecting system and a total field magnetometer. The data were recorded in analogue form.

Ancillary equipment included an intervalometer, a flight path camera, a six channel analogue recorder and an altimeter. The aircraft employed was an Alouette III helicopter.

Flight line maps (overlays to the photomosaic) were compiled following completion of the survey, and are incorporated as part of this report.

Films, analogue charts and recovery mosaics are being delivered with this report.

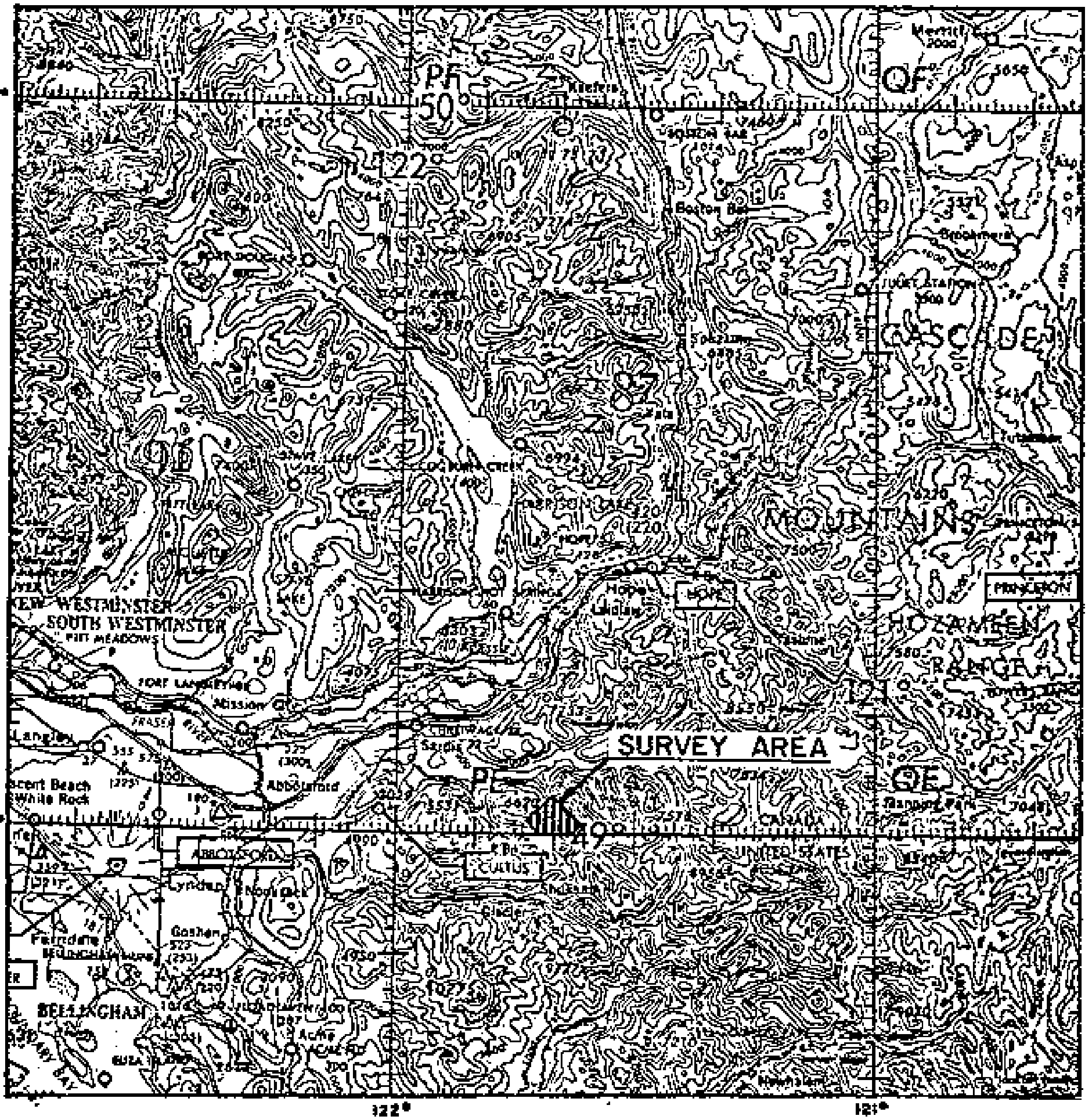
2. SURVEY AREA

The survey area is located about 15 miles southeast of Chilliwack B.C. It is irregular in shape, with a maximum length of approximately 3½ miles and a maximum width of about 2½ miles. The topography of the area is extremely rugged. The location and outline of the area are indicated in Figure 1.

Operations on the present survey were conducted from facilities in Chilliwack.

3. FLYING SPECIFICATIONS

The flying specifications applicable to the present survey are as follows:



LOCATION MAP

GREAT PLAINS DEVELOPMENT OF CANADA LTD.

CHILLIWACK AREA, BRITISH COLUMBIA

AIRBORNE GEOPHYSICAL SURVEY

Scale : 1 : 1,000,000

77 - T 1188

FIGURE 1

Nominal terrain clearance:	250 feet (aircraft) 150 feet (bird)
Nominal line spacing:	660 feet
Aircraft airspeed:	60 to 70 mph
Nominal flight direction:	Cross-Lines - N45°E and N45°W

4. INSTRUMENTATION

Each instrument used on the present survey is briefly described below. For further details see Appendix A.

4.1 Airborne Magnetometer

A Scintrex MAP-2 proton precession total field magnetometer with a range of 20,000 to 100,000 gammas and a 1 gamma accuracy was utilized. The measuring element is mounted in a 'bird' towed below the aircraft. The horizontal axis of the inducing and secondary coils is oriented perpendicular to the flight direction. The magnetometer console can provide both digital and analogue outputs. The measuring sequence can either be triggered from an internal source or by a suitable external pulse.

4.2 Electromagnetic System

A Scintrex HEM-801 helicopter-borne moving source electromagnetic prospecting system operating at a nominal frequency of 938 Hz was employed. The transmitting and receiving coils are mounted 30 feet apart in a rigid coaxial configuration in a "bird" which is towed about 100 feet below the helicopter. The recorded parameters are in-phase and out-of-phase components of the secondary field, measured in parts per million of the primary field. The primary field and aircraft generated fields are cancelled automatically at the HEM-801 system.

4.3 Camera

A Vinten MK III, 16 mm tracking camera was mounted on the aircraft. This unit is equipped with a wide angle lens providing better than 20% overlap between frames at an aircraft speed of 60 mph at an altitude of 200 feet. Each frame exposed corresponds to one fiducial interval (i.e. 1 second).

4.4 Altimeter

A Bonzer MK 10 radar altimeter was used. It measures and displays the terrain clearance from 40 feet to 2000 feet. On the present survey the altimeter did not function as specified by Bonzer. Several attempts were made to repair same.

4.5 Intervalometer - Intercom

A Scintrex IITC-2 Intervalometer generating synchronization pulses which operate the fiducial number marker and camera was used. The unit also provides an on-board communication system for the flight crew.

4.6 Analogue Recorder

A Scintrex RCM-6 six channel analogue recorder was employed. It is a direct recording device using heat-sensitive paper. It provides timing marks and continuous traces of geophysical data.

4.7 Survey Aircraft

The survey aircraft was an Alouette III, model 216B, high performance turbine powered helicopter owned and operated by Quasar Helicopters, Abbotsford, B. C.

5. PERSONNEL

The field crew employed on the present survey consisted of:

Instrument Operator/Navigator - John Glover, who installed the system in the helicopter. He also operated and maintained the equipment.

Geophysicist/Dataman - Zbynek Dvorak, who was responsible for overall supervision and quality control of data.

6. FIELD PROCEDURES

6.1 Survey Flight and Ground Procedures

The main sequence of events occurring during a normal survey flight are listed below:

- Switch-on for warm-up of HEM-801.
- Manual buck-out of primary and aircraft fields on HEM-801.
- Take-off.
- Air calibration.
- Survey lines.
- Air calibration.
- Landing.
- Data quality check.
- Film development.
- Anomaly picking.

6.2 Calibrations

The following is a list of procedures employed for air calibration:

Instrument	Electrical Simulation	Purpose
Altimeter	100 and 300 foot marks	To determine zero position and scale the traces
HEM-801		
In-Phase	100 ppm	To determine sensitivity and scale the traces.
Out-of-Phase	100 ppm	
Magnetometer	Zero and full scale	To determine zero and full scale positions.

6.3 Navigation and Flight Path Recovery

During each survey flight the aircraft course was directed by the operator/navigator. He identified features on the ground using a photomosaic of the survey area on which proposed flight lines had been marked. He marked appropriate fiducial numbers on the photomosaic as the aircraft passed over recognizable features. For the present survey the photomosaics were at a scale of 1" = 1000'. They were cut into convenient strips along the flight line direction.

A flight log was maintained by the operator during each survey flight, recording the fiducial number at the beginning and end of each line, the duration of the flight, and magnetic reading at the beginning of each line.

The flight path film was developed after each flight. This was later used in conjunction with the navigator's mosaic and the flight log to recover the actual flight path for each survey line. Recognizable features on the film were marked on a recovery mosaic, similar to the navigator's mosaic. The corresponding fiducial number was marked at each picked point. The survey lines were reconstructed by joining picked points, assuming straight flight between two adjacent points.

6.4 Operations Statistics

The following is a day-to-day account of activities on the project:

Date:	Activity
September 20 to 23,1977	Z. Dvorak and J. Glover mobilize from Toronto to Abbotsford. Carry out installation.
September 24	Helicopter and personnel arrive Chilliwack. Weather BAD.
September 25	Flight 1 - Aborted due to navigation problems and altimeter malfunction. Flights 2 and 3 - production.
September 26	Flight 4 - Aborted due to navigation and magnetometer problems. Flights 5, 6 and 7 - production. Job complete.

7. DATA RECORDING

Data were recorded in analogue form on heat-sensitive direct print chart paper. The system was synchronized throughout by the intervalometer which also provided fiducial marks on the analogue chart.

There are small shifts in the records between the data and the appropriate fiducial numbers (the HEM traces lag 2 seconds and the magnetometer trace 0.5 second behind the fiducial number). These shifts are caused by instrumental signal delays due to time constants and sample periods.

The beginning of each trace is identified by a label showing line number, flight number, date and area. Every 50th fiducial number is also labelled. The chart speed was 2 millimeters per second.

As mentioned in section 6.2, records were calibrated at the beginning and end of each flight.

8. PRESENTATION OF DATA

Data gathered during the survey are presented as follows:

8.1 Analogue Charts

All original analogue charts labelled and edited for each flight as described in Section 7. These include calibration records.

8.2 Flight Line Maps (Plates 1, 2 and 3)

These are greyflexes of the survey area showing the flight lines. The horizontal scale is approximately 1" = 1000'. The area is contained within three different photomosaics. Large distortions are evident on these due, no doubt, to the extreme ruggedness of the area.

No obvious anomalous EM responses were observed within the survey area, hence none are shown on Plates 1, 2 and 3.

8.3 All original photomosaics, films and flight logs.

9. CONCLUSION

Any questions regarding the present survey should be addressed to Scintrex Limited, 222 Snidercroft Road, Concord, Ontario, L4K 1B5.

Respectfully submitted,

SCINTREX LIMITED

Michael Lewis

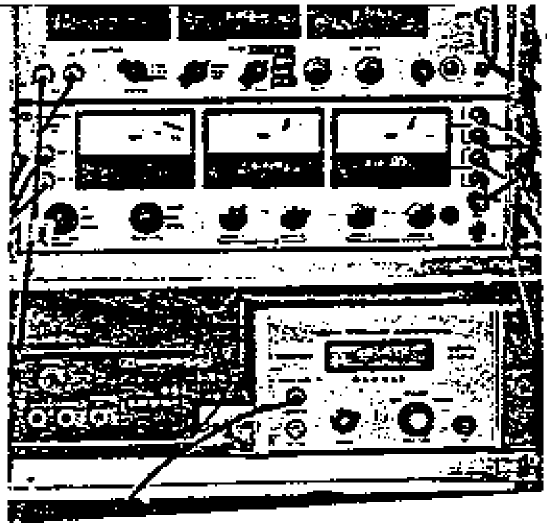
Michael Lewis, M.Sc.,P.Eng.,
Manager, Geophysical Surveys Division.

ML/cc
December 21, 1977

APPENDIX A

INSTRUMENT SPECIFICATION SHEETS

Scintrex	MAP-2 Proton Magnetometer
Scintrex	In and Out-of-Phase Electromagnetic Systems
Scintrex	IITC-2 Intervalometer
Scintrex	RCM-6 Analogue Recorder
Bonzer	MK-10 Altimeter



SCINTREX

MAP-2 AIRBORNE PROTON MAGNETOMETER

The MAP-2 is a lightweight, one gamma airborne proton-precession magnetometer with a range of 20,000 to 100,000 gammas and an automatic five digit visual display. This new instrument has several significant advantages over other instruments of this type besides its compact size and light weight.

One of its most interesting features is that, unlike other airborne magnetometers which have to be switched manually from one narrow (usually 4000-6000 gammas) range to another, the MAP-2 tracks automatically over its full 80,000 gamma range.

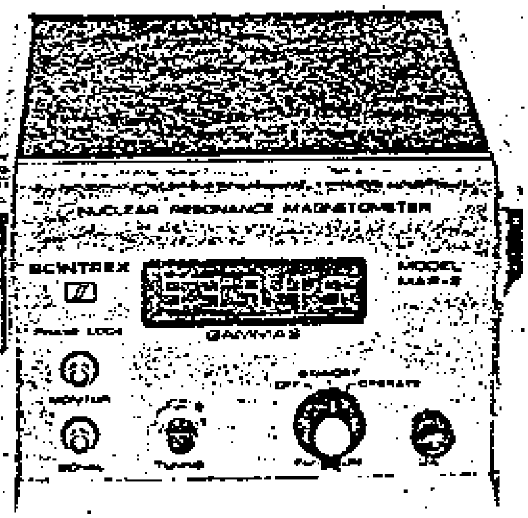
This advantage is particularly significant in surveys flown at low terrain clearances in areas of high magnetic relief, conditions which are common in mineral prospecting.

The instrument is of compact modular design (½ standard rack size) and has both digital and analogue outputs. The analogue outputs are either 100 or 1000 gammas full scale, with automatic stepping. During each step, an indication of the new stepping level is recorded, providing a permanent reference identifying each step.

The measuring sequence can either be sequentially triggered internally through its own programmer or initiated by a suitable command pulse.

In addition while on internal triggering, the instrument provides an external output command pulse enabling other instrumentation to be synchronized with the magnetometer.

The MAP-2 has an unusually wide temperature range, +50°C to —30°C, to permit operation in conditions varying from tropical to arctic without any loss of accuracy.



SPECIFICATIONS OF NUCLEAR RESONANCE MAGNETOMETER MODEL MAP-2

Range:	20-100.000 gammas (world-wide) continuous range (automatic tracking)
Sensitivity:	± 1 gamma (fully automatic)
Accuracy:	± 1 gamma
Sampling Rate:	Automatic standard 1 second, with provision for external triggering from other equipment with minimum 1 second intervals.
Readout-Visual:	Digital Display by 5 incandescent, 7 bar display lights
Digital Data Output:	BDC 1-2-4-8 DTL, TTL Compatible
Analog Data Output:	5 V full scale for 1000 gammas, 100 gammas; 1 gamma resolution
External Trigger:	Requirement: +4 V to 0 transition (as slave)
Trigger Output:	+ 4V to 0 transition at start of cycle (as master)
Power Requirements:	24-30V DC, 3.2 A max.
Temperature Range:	—30 to +50 degrees C
Dimensions and Weights:	Console 8½"x 5¼"x 13" (half-rack) (21½ cm x 13½ cm x 33 cm) 12 lbs. (5.4 kg) Tow Bird 7" x 23" (18 cm x 58 cm) 20 lbs. (9 kg)

SCINTREX LIMITED
222 Snidercroft Road • Concord, Ontario, Canada

In and Out-of-Phase Electromagnetic Systems

Application Brief 76-4.

Published by:

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THE SCINTREX
IN-AND-OUT-PHASE
ELECTROMAGNETIC SYSTEMS

Airborne electromagnetic surveying has taken on great importance for base metal prospecting since the method was introduced about 1955. Since this time, many different types of systems have been developed. These can be divided into two general groups.

SYSTEMS EMPLOYING UNSTABLE CONFIGURATIONS

These systems generally have a transmitter mounted in the aircraft and tow the receiver on a cable of up to 150 meters in length behind the aircraft. These systems require aircraft terrain clearance of 120 to 150 meters and usually only measure out-of-phase components of the electromagnetic field.

SYSTEMS EMPLOYING STABLE COIL CONFIGURATIONS

In these systems the transmitter and receiver are mounted on a mechanically rigid structure such as the wing-tips or nose and tail of a fixed wing aircraft or in a long tubular bird flown beneath a helicopter. These systems are flown at terrain clearances of between 30 and 60 meters and measure in-and-out-phase components of the electromagnetic field.

The development of moving source airborne electromagnetic systems at Scintrex has been deliberately restricted to the second group, that is, systems employing stable coil configurations. We currently provide and operate both helicopter and fixed wing aircraft borne systems of this type.

Theory and experience show that Stable Coil Configuration Systems have several advantages over Unstable Systems. Among these advantages are:

1. The terrain clearance of stable systems can be one half or less than that of unstable systems because no bird is being towed. This results in superior resolution, not only for the electromagnetic system, but also for magnetic or radiometric information which may be gathered concomitantly with the electromagnetic data.

2. The advantage of lower terrain clearance is particularly marked in the case of radiometrics where one half the crystal volume may be used to give the same figure of merit as a system which flies twice as high, all other factors being equal. In fact, stable coil systems are compatible with low level radiometric or gaseous geochemical surveys, whereas unstable systems are not.

3. The measurement of in-phase components offers relief from the problems of phase rotation of out-of-phase components caused by conductive overburden layers. This phase rotation reduces the response of conductors to out-of-phase only systems and, therefore, reduces conductor detectability for these systems.

4. The measurement of the in-phase component ensures detectability of very high conductivity conductors which may have little or no out-of-phase component.

5. For all conductors, the maximum amplitude of the in-phase component is greater than that of the out-of-phase component so that a greater depth of penetration may be expected under certain conditions through the use of in-phase measurements.

6. The measurement of both in-phase and out-of-phase components allows quantitative determinations to be made of the conductivity-thickness product (conductance) of conductors. If measurements are made at multi-frequencies, these determinations can be made accurately and in some cases the conductivity and thickness can be determined independently. This is of significant interest in the following applications:

   a) Mapping of bedrock geology, including rock types and structural features.

   b) Selection of those bedrock conductors of highest base metal potential.

   c) Mapping of surficial deposits, giving variation, distribution and thickness of unconsolidated deposits such as sand and gravel, clay and bauxite, etc. for resource location as well as civil engineering purposes.

   d) Determination of the distribution and quality of ground water.

7. Unstable systems normally employ large transmit-receive coil separations which tends to emphasize the response of flat lying conductors such as overburden or weathered zones over the responses of thin, steeply dipping tabular conductors such as most base metal targets.

SECTION 1: THE SCINTREX HEM-801 SYSTEM

INTRODUCTION

The Scintrex family of HEM systems has a successful history. Since 1967 we have been operating our HEM-701 in-and-out-of-phase helicopter system. We have built five of these systems, installed them in a wide variety of helicopters and operated them for hundreds of thousands of line kilometers of survey.

The Scintrex HEM-801 system is an improvement over the HEM-701 in that use has been made of much more sophisticated electronics. For example, the HEM-801 single frequency console is about ¼ the volume of the HEM-701 console and uses only six circuit boards instead of twelve. The HEM-801 combines higher useful sensitivity with lower electronic noise levels. The design of these consoles has been fully field proven as three similar consoles (one for each frequency) are used in our Tridem system and we have completed thousands of line kilometers of survey with the first HEM-801 system. An example of the data taken using this system is shown in Figure 4; it can be seen that noise levels in flight of the in-phase component are only a few parts per million and the out-of-phase components are less than 1 part per million.

Special atmospheric noise suppression circuitry allows operation of the HEM-801 under conditions where earlier systems would become marginal. This is very important in areas where thunder storm activity is common.

The HEM-801 is ideally suited for surveys in rugged terrain and remote areas. It combines lightweight, good penetration, excellent noise rejection, ease of installation and electronic reliability.

The system utilizes a bird, nine metres in length, containing vertical, coaxial transmitting and receiving coils. It is towed about 30 metres below the helicopter. In-phase and out-of-phase (quadrature) components of the secondary electromagnetic field are measured in parts per million of the primary field. Various operating frequencies from 500 to 8000 Hz are available for the HEM-801 system. The choice of frequencies is divided into the following two ranges; 500 to 2000 Hz, and 2000 to 8000 Hz.

Frequencies should be judiciously chosen to overcome 50 and 60 Hz power line frequencies and their harmonics. Also, a frequency should be chosen which is reasonably distant from the earth's magnetic precession frequency which ranges from about 950 to 2000 Hz (23.6 gammas per Hz).

We recommend a basic frequency of 810 Hz which is sufficiently low to ensure that there would be no interaction with most proton magnetometers having sensors installed at least 10 meters from the EM coils. Also, 810 Hz is 10 Hz removed from the 16th harmonic of any 50 Hz power line noise and 20 Hz removed from the 13th harmonic of 60 Hz, which is sufficient to preclude interference.

A frequency of about 810 Hz is well chosen to detect target conductors in the range from medium to good conductivity without introducing appreciable geological noise in most areas. It is a lower frequency than commonly used for this coil separation in Canada, but would be justified if overburden and weathered layers may be expected to be more conductive than in Canada.

Installation in helicopters is a relatively easy task--for the Alouette II, the Alouette Lama or Bell 206B the whole system can be installed in a few days without significant modification to the helicopter. The equipment can be removed in a matter of hours. This permits flexibility in exploration programs and minimum mobilization costs for surveys in remote areas. Also, the towed bird is made in four sections for ease in transportation even by air freight.

HEM-801 SPECIFICATIONS

Parameters Measured:	In-Phase and out-of-phase components of secondary field in parts per million of normal, undisturbed primary field.
Frequency:	Standard: 810 Hz; Optional: any single frequency in the range of 500 to 8000 Hz
Sensitivity:	1 part per million
Noise Level:	Dependent on atmospheric noise and air turbulence, but generally better than 2 ppm out-of-phase and 5 ppm in-phase.
Time Constants:	1, 2 or 4 seconds
Coil Orientation:	Vertical coaxial
Coil Separation:	9 metres
Bird Construction:	Four 2.4 m. sections, plus nose and tail cones and drag skirt
Power Requirements:	28V D.C., 35 watts (not including recorder)
Recommended Aircraft:	Alouette II, Alouette Lama, Bell 206B or equivalent depending altitude, temperature and humidity conditions
Altitude of Bird:	30 m. below the helicopter and approximately 30 m. above the ground.
Weight:	Total approximately 130 kg. for EM unit including bird, cable, recorder, console and racks.
Compatibility:	Compatible with all radiometric systems and fluxgate magnetometers. Proton magnetometer sensors must be installed at least 10 meters from EM coils, normally they are trailed half way down the EM bird tow cable.

SECTION 2: THE SCINTREX HEM-802 SYSTEM

INTRODUCTION

Over the past few years, geophysicists have begun to realize that the way to improve electromagnetic surveying is to measure in-phase and out-of-phase components at more than one frequency. Our Tridem system has amply demonstrated these advantages in practice.

In an HEM-802 system one frequency would probably be chosen in the range of 500 to 2000 Hz and another frequency in the range 2000 to 8000 Hz. The four channels comprising in-phase and out-of-phase data at two frequencies augmented with any desired number of mixed or conditioned (eg., cross correlation) channels, provide highly diagnostic information which is particularly amenable to automatic processing. We have developed new interpretation programs to accomodate this enlarged range of information. The simultaneous dual frequency approach will allow detection and resolution of a broader range of conductors than has yet been possible. Also, quantitative interpretations will be more precise. The different response thresholds eliminate most overburden masking problems and the measurement of the in-phase response over the wide frequency spectrum provides an unlimited detection window for highly conducting bodies. The exploration depth is not only comparable with the best AEM systems but it remains almost constant during traversing, whereas the effective exploration depth of most conventional systems changes continuously with the geo-electrical variations of the subsurface and even with the conductivity-thickness of the bedrock conductivity targets.

HEM-802 SPECIFICATIONS

Parameters Measured:	In-phase and out-of-phase components of secondary field in parts per million of the normal, undisturbed primary field at two frequencies simultaneously.
Frequencies:	Precise frequencies to be selected by client, subject to following restrictions: Low Frequency: In range 500 to 2000 Hz High Frequency: In range 2000 to 8000 Hz
Sensitivity:	1 part per million
Noise Level:	Dependent on atmospheric noise and air turbulence but generally better than 2 ppm out-of-phase and 5 ppm in-phase.
Time Constants:	1, 2 or 4 seconds
Coil Orientation:	Vertical coaxial
Coil Separation:	9 meters
Bird Construction:	Four 2.4 m sections plus nose and tail cones and drag skirt
Power Requirements:	28V D.C., approximately 60 watts not including recorder

Compatibility:	Compatible with all radiometric systems and fluxgate magnetometers. Proton magnetometer sensors must be installed at least 10 meters from the EM coils, normally they are trailed half way down the EM bird tow cable.
Recommended Aircraft:	Alouette II, Alouette Lama, Bell 206B or equivalent depending upon altitude, temperature and humidity conditions.
Altitude of Bird:	30 m below the helicopter and approximately 30 m above the ground.
Weight:	Total approximately 155 kg. for EM unit including bird, cable, recorder, console, and racks.

SECTION 3: MULTI-FREQUENCY IN-AND-OUT-OF-PHASE SYSTEM TO BE INSTALLED IN A FIXED WING AIRCRAFT

INTRODUCTION

For many years Scintrex operated an in-and-out-of-phase system at 320 Hz installed in a DeHavilland Otter aircraft. A few years ago this system was put out of service and installation of the Tridem system began. Since early 1975, we have been successfully operating our Tridem system in the Otter along with VLF, magnetometer and radiometric systems. In all, thirteen channels of independent geophysical information are recorded in digital and analogue form.

Besides the Otter, some other aircraft which would be amenable to the installation of an in-and-out-of-phase EM System would be: Norman Britten Islander, Trilander, AN-2, Canso. In these aircraft, the coil installations would be made on the nose and tail of the aircraft in "stingers" similar to those shown in Figures 5 and 6.

There may be a problem of interference between an electromagnetic receive coil and a proton magnetometer sensor installed in the tail stinger. We can suggest two alternatives to overcome this problem. The first would be to install a fluxgate magnetometer instead of the proton precession type, which could be installed much closer to the EM coils than the proton sensor. Low level surveys do not normally require sensitivities better than 1 gamma so that the fluxgate could be a reasonable alternative. Secondly, the proton precession sensor could be installed in a wing tip, away from the electromagnetic coils or towed in a bird behind the aircraft.

For further information on Tridem, including interpretation theory and case histories, see Scintrex Application Brief 76-3 "Tridem Airborne Electromagnetic System, A Multipurpose Natural Resource Mapping Tool".

In addition to analogue recording, our Tridem Otter installation uses digital recording for 13 independent channels of geophysical information. Scintrex can fully engineer a digital recording system similar to that in the Otter for any other aircraft.

SPECIFICATIONS OF IN-AND-OUT-OF-PHASE ELECTROMAGNETIC SYSTEM FOR FIXED-WING AIRCRAFT

Parameters Measured:	In-phase and out-of-phase components of the secondary field in parts per million of the normal undisturbed primary field at either one, two or three frequencies simultaneously.
Frequencies:	Single Frequency System: 500 Hz Dual Frequency System: 500 Hz and 2000 Hz Three Frequency System: 500, 2000 and 8000 Hz
Sensitivity:	1 part per million
Noise Level	Dependent on atmospheric noise and air turbulence, but generally better than 25 ppm out-of-phase and 40 ppm in-phase.
Time Constants:	1, 2 and 4 seconds
Coil Orientation:	Vertical coaxial or vertical coplanar, depending on aircraft
Coil Separation:	Approximately 14 metres, depending on aircraft
Power Requirements:	Single Frequency System: 100 watts at 28V DC Dual Frequency System: 200 watts at 28V DC Three Frequency System: 500 watts at 28V DC
Recommended Aircraft:	DeHavilland DHC-6 Twin Otter or Britten Norman Islander

Weights:	Transmitter: from 27 to 45 kg depending upon number of frequencies. Receiver: from 11 to 23 kg depending on number of frequencies. In Cabin Console: from 7 to 20 kg depending on number of frequencies.
Compatibility:	Compatible with all radiometric systems and fluxgate magnetometers. Proton magnetometer sensors must be installed at least 10 metres from the EM coils.

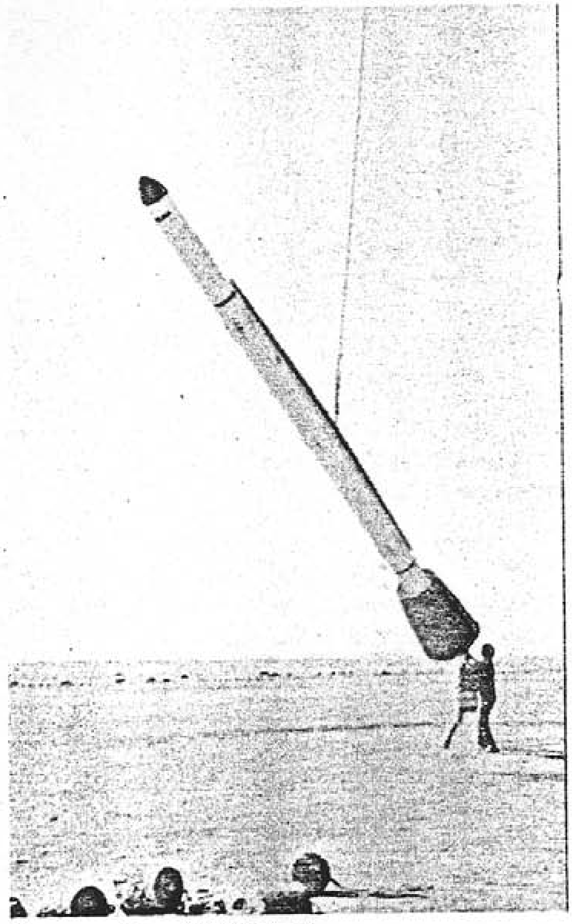


Figure 1: HEM Bird

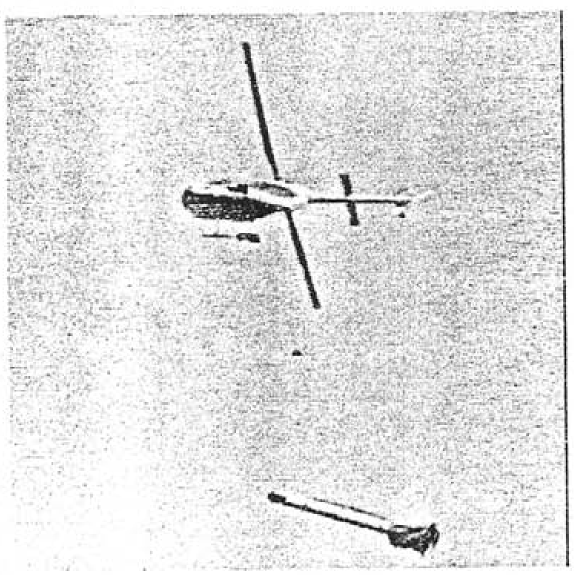


Figure 2: HEM-801 in flight with proton magnetometer sensor half way down tow cable

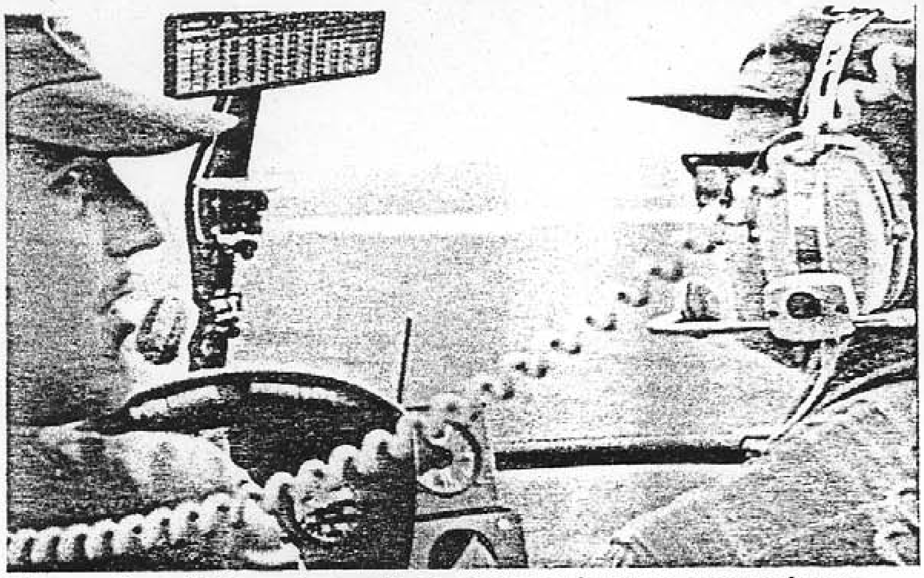


Figure 3: Helicopter pilot and navigator communicate with Scintrex IITC-2 intervalometer, communications and time share module.

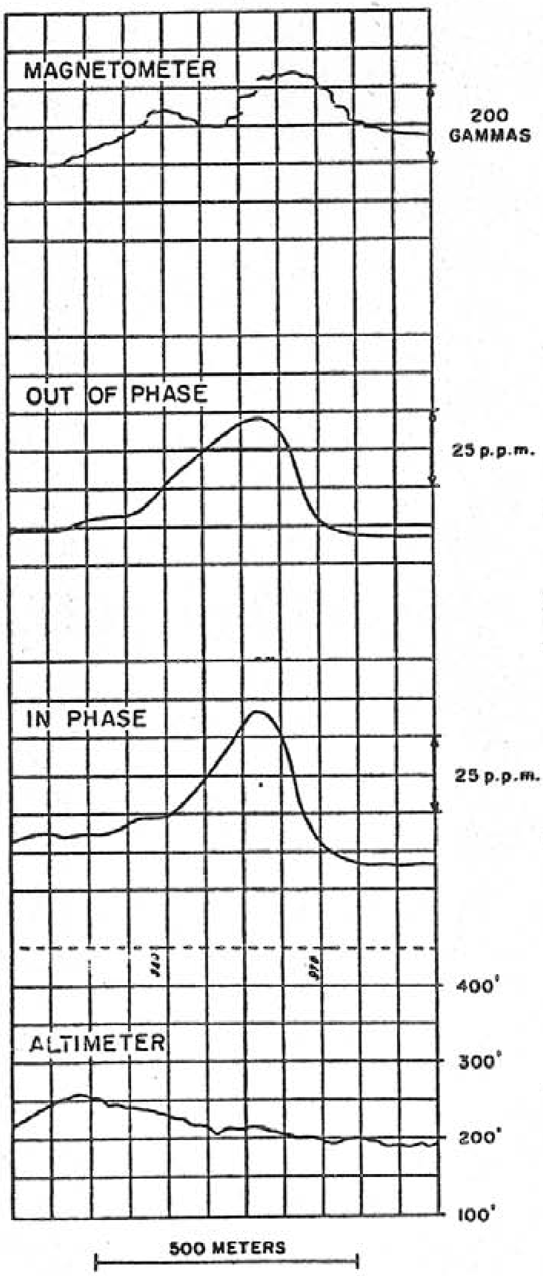


Figure 4: HEM-801 and magnetometer data

Figure 5: Nose and tail stinger on fixed wing aircraft

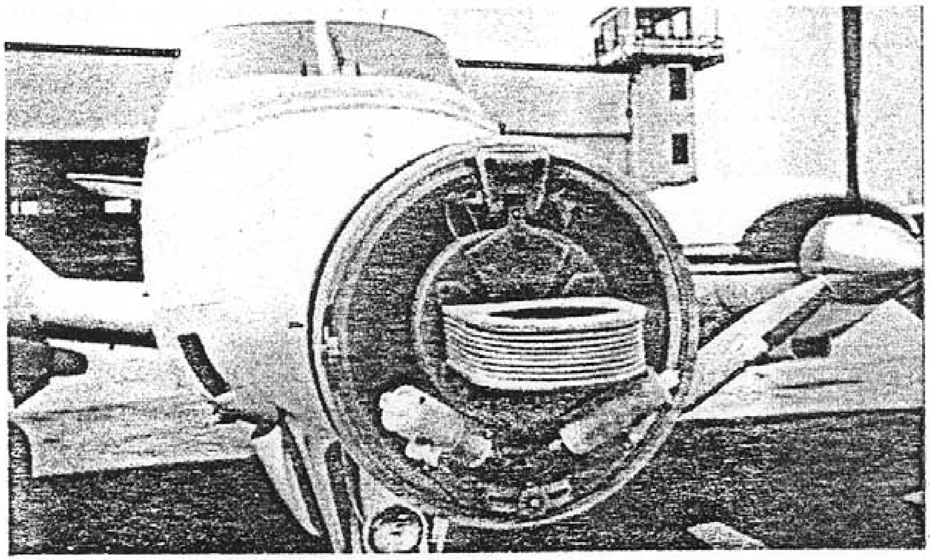


Figure 6: EM coil in nose stinger

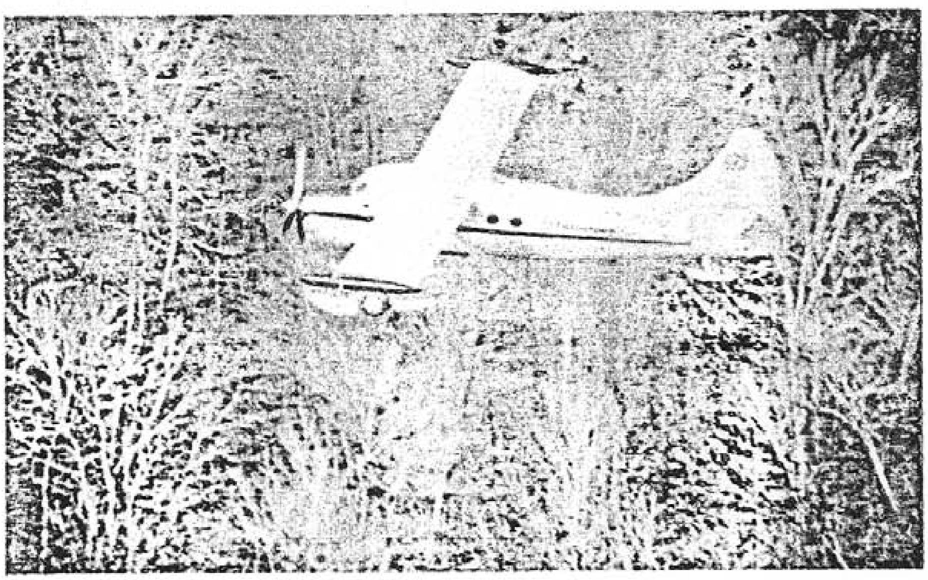
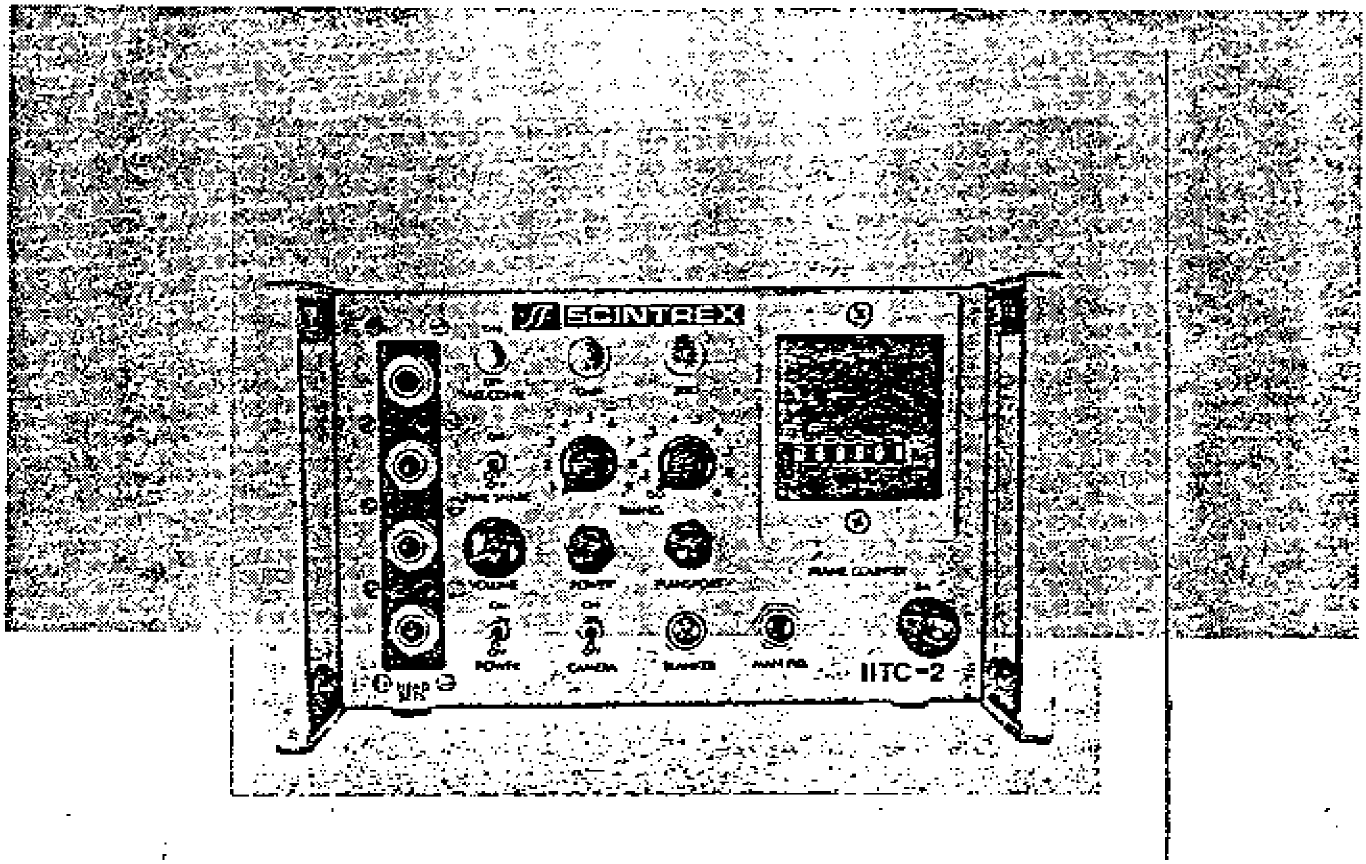


Figure 7: Tridem fixed wing EM system installed in Otter along with radiometric and magnetic systems

New Product Announcement



THE IITC-2 INTERVALOMETER

The Scintrex IITC-2 is a solid state timing device designed to provide timed pulses for synchronization between data and flight path cameras for airborne geophysical surveys.

In addition, a flight crew communications system for up to four headsets is contained in the standard half rack module.

There is also provision for data processing circuitry such as for time sharing two channels of analogue data on a single pen of an analogue recorder or for displaying an analogue trace as a variable density display using an event channel.

222 Snidercroft Rd.
Concord, Ont., Canada
(416) 669-2280

Complete Geophysical Instrumentation and Services

SCINTREX

Features:

- A single switch starts automatic camera pulsing and event marking.
- Blanking Push Button allows production of blank camera frames for positive identification of ends of flight lines.
- Manual Fiducial Push Button allows manual control of intervalometer pulsing.
- Suitable for frame or strip cameras and analogue or digital recorders with appropriate interfacing.
- Six digit fiducial counter on front panel with provision for remote fiducial counter for navigator if required.
- Film indicator light monitors correct transport of film.
- Fine and coarse, switch selectable pulsing from 0.5 to 9.9 second intervals.
- Front panel jacks for up to four headsets with microphones.
- Variable volume control.

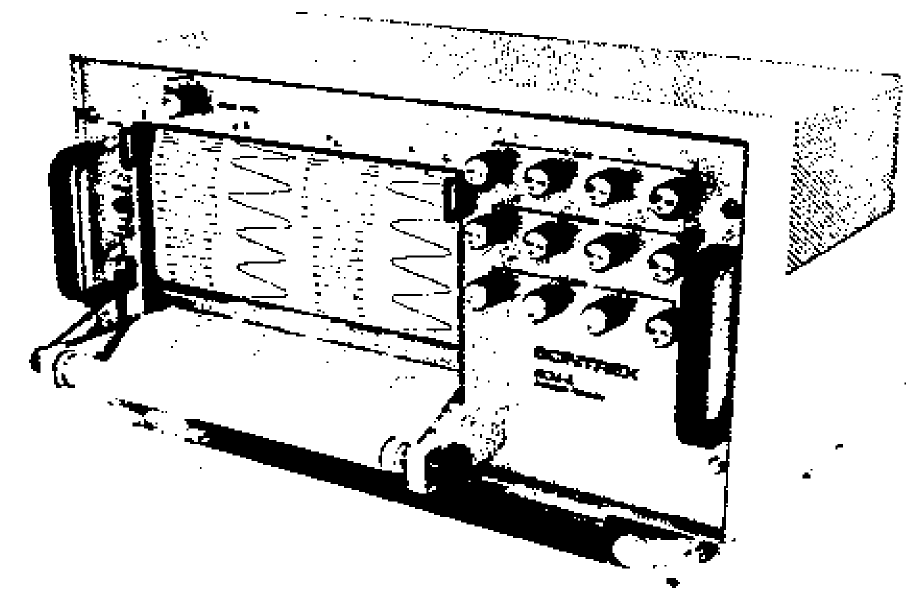
Technical Specifications:

Power Requirement:	Approximately 1 Amp at 28 V DC
Maximum allowable current drain when camera powered through intervalometer:	6 Amps average
Size:	Standard half rack, 335mm x 215mm x 135mm

SCINTREX RCM Multichannel Analogue Recorders

Function

The Scintrex RCM series of multichannel analogue recorders is designed primarily for continuously recorded aerial, vehicle or drill hole geophysical surveys. Three basic versions are available, featuring 4, 6 or 8 separate channels.



Features

Easy front loading paper supply with reliable paper take-up.

Rectilinear traces are achieved by a rugged heated stylus writing across a knife edge on heat sensitive paper.

Traces will not fade or smudge.

There is no ink to run or clog.

The pen motors are the industry standard, MFE, moving iron, limited rotation units.

The standard model will accept any signal in the range 1.0 V to 5.0 V.

Electronic limiting prevents each pen from straying out of its channel.

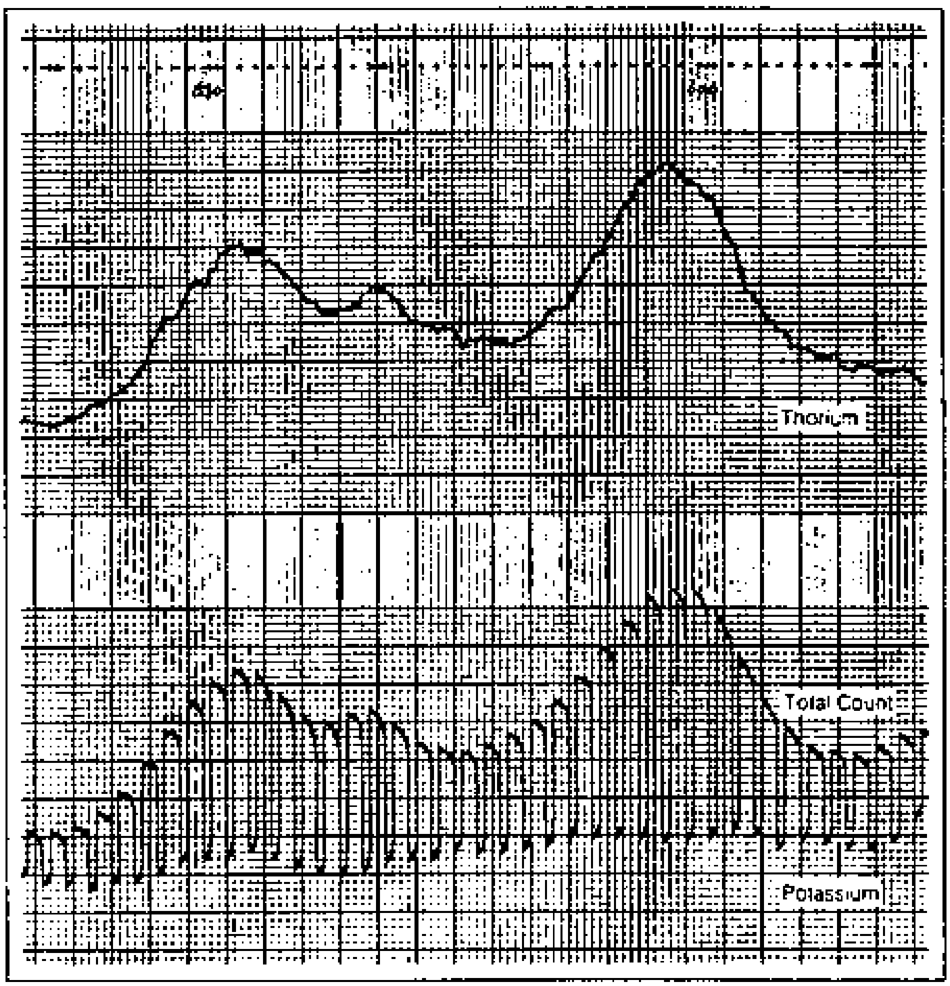
There are front panel controls for Pen Zero Position, Pen Heat, Gain and Calibrated Input Reference Voltage.

Two event markers are standard.

High sensitivity and reliability are obtained even in difficult vibrational environments such as helicopters.

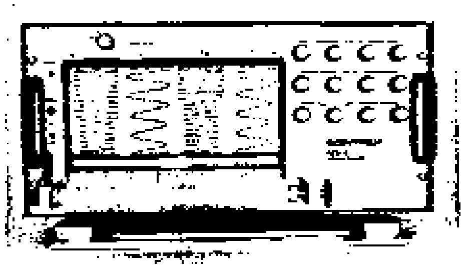
The amplifier for each channel is designed to avoid any channel "crosstalk" or pickup of signal from the chassis ground.

Recorder chassis is delivered installed on a rigid, shock mounted plate.



Sample record from a RCM-6 recorder. Lower channel shows how the "time sharing" technique can be used to record two analogue outputs on one pen.

Technical Description of RCM Multichannel Analogue Recorders

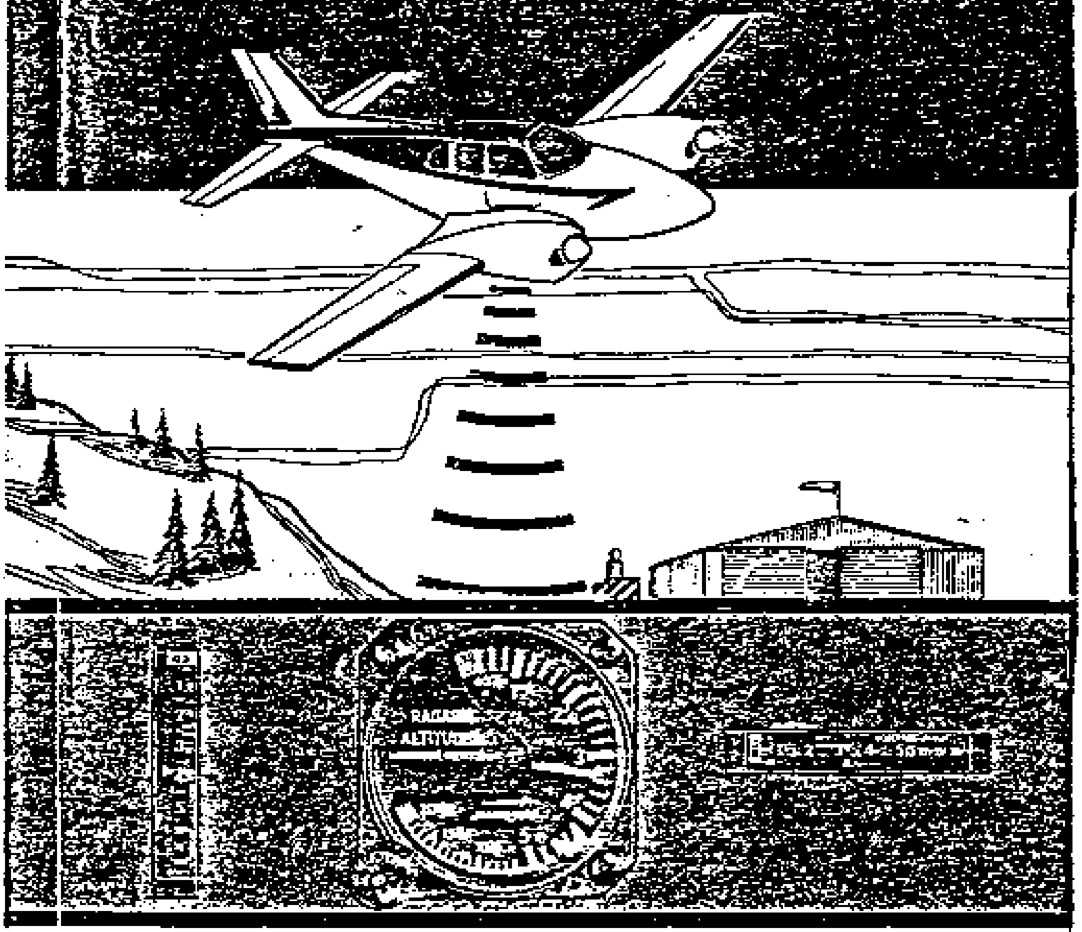


Number of Channels	RCM-4; four channels RCM-6; six channels RCM-8; eight channels
Number of Event Markers	Standard two, optionally up to the number of channels.
Chart Speeds	1 and 2 mm/second, switch selectable.
Channel Width	RCM-4 and RCM-6, 50 mm; RCM-8, 40 mm.
Input Voltage Range	Standard: 1.0 V to 5.0 V for full scale deflection. Optional: higher or lower input voltages.
Zero Position Adjustment	A front panel switch provides the ability to short circuit the input of each channel in order to check and adjust its zero position.
Gain Adjustment	Standard: Continuously variable by ten turn, lockable potentiometer. Optional: Preset, switch selectable.
Internal Calibration	A precision 1V reference source can be activated by front panel control to calibrate gain adjustment of each channel.
Frequency Response	DC to 40 Hz.
Linearity	1% of full scale
Input Impedance	100 K ohms
Paper Capacity	One 60 m roll of industrial grade paper.
Paper Graduations	Four, six or eight channels graduated laterally and longitudinally each millimeter
Power Requirements	Standard RCM-4; 12 V DC Optional RCM-4; 28 V DC Standard RCM-6; 28 V DC Optional RCM-6; 12 V DC Standard RCM-8; 115 V, 60 Hz Optional RCM-8; 28 V DC Optional models require external inverters. Typical power consumption is 25 watts per channel plus 3 watts for the chart drive.
Standard Dimensions and weights	RCM-4: 490 x 275 x 380 mm, 15 kg RCM-6: 490 x 320 x 480 mm, 19 kg RCM-8: 490 x 320 x 480 mm, 21 kg
Operating temperatures	−25°C to +50°C

222 Snidercroft Road
Concord (Toronto) Ontario
Canada L4K 1B5
Telephone: (416) 669-2280
Telex: 06-964570
Cable: Scintrex Toronto

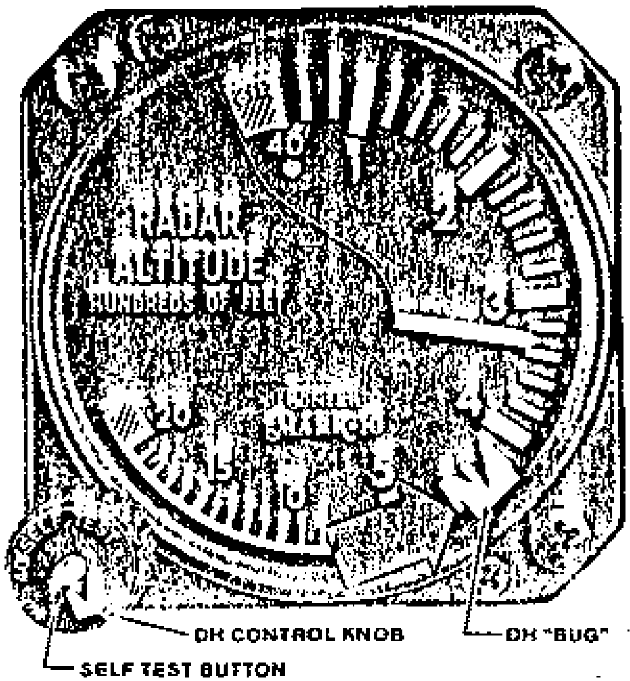
Complete Geophysical
Instrumentation
and Services

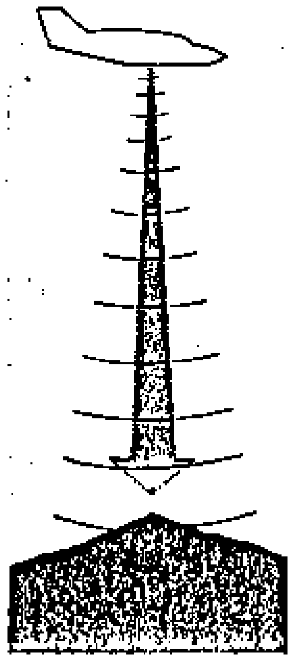
Precision Ground Contact When Inches Make The Difference



The BONZER MARK-10 Radar Altimeter

The MARK-10 How it works





The BONZER Mark-10 Radar Altimeter system consists of a transmitter-receiver unit, an indicator and an antenna. The system provides an accurate indication of height above ground from 2,000 feet to 40 feet.

A built-in self test feature is provided to insure operational capability. Operation of the Mark-10 is quite simple, requiring little more of the pilot than watching the indicator.

The BONZER Mark-10 Radar Altimeter system is a direct reading instrument which gives you instantaneous and accurate indication of height over the terrain and eliminates the possibility of your making an error while relying on the barometric altimeter alone. The Mark-10 eliminates the need for you to memorize ground elevations in order to compute altitude and provides accuracy not found in the barometric altimeter, an instrument little changed since developed some 200 years ago. In addition to the barometric altimeter's fallibility, it can be very easily mis-set or misread, causing a very dangerous situation.

Today's aircraft, equipped with an exotic array of radios, DME, transponders, ground speed indicators, Dopplers, ADF, R-NAV, etc. shouldn't be without an accurate means of monitoring height above ground – the BONZER Mark-10 Radar Altimeter system.

The Mark-10 gives absolute assurance that you're high enough to avoid obstacles and provides decision-height information (visual and aural) — all at a cost much less than you would expect for a radar altimeter system with this performance. As shown in the illustration above, when flying over mountainous terrain, the Mark-10 measures the height you are above the peaks and not height above sea level. It is not necessary to subtract the mountain height from the reading shown on the barometric altimeter to determine your exact height.

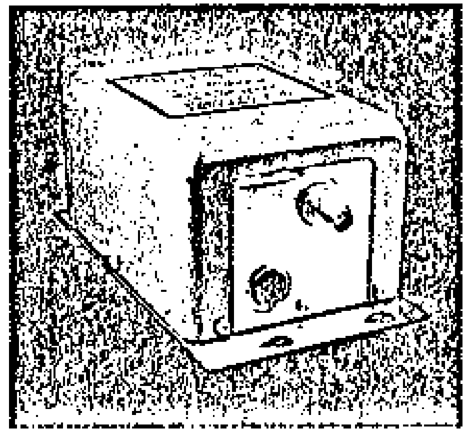
Decision Height Indicator: Visual and Aural

The Decision Height Indicator can be preset to any desired altitude from 40 to 2000 feet. When your aircraft goes below the preset altitude, the "DH" warning light comes on and an aural warning sounds through the aircraft audio system.

MARK-10

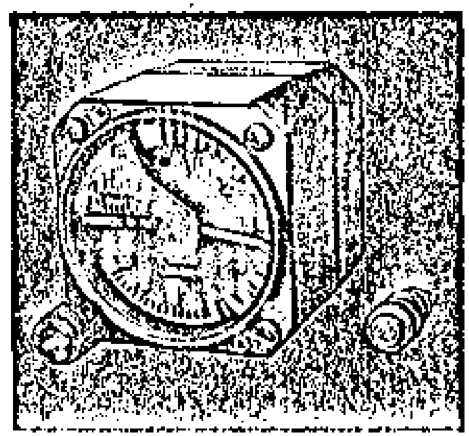
Standard Round Indicator Radar Altimeter System

Part No. 104-0120-00 $1995 Complete



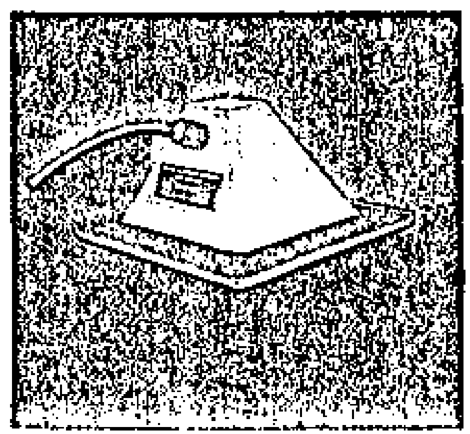
MARK-10 "T-R" UNIT

The "T-R" Unit is a modular, transistorized, radar unit. Dimensions are 8x4x3½." The unit weighs 2 lbs.
($1390)



MARK-10 AI-74 INDICATOR

The AI-74 Indicator is a professional type 3" round unit. Provides "DH" light and aural warning at decision height. The unit weighs 1 lb.
($575)



MARK-10 ANTENNA

The Mark-10 uses flush style antenna. The unit weighs 1½ lbs. Only one antenna is needed.
($160)

Operating Instructions

1. GENERAL

The MARK-10 Radar Altimeter system consists of a transmitter-receiver unit, an indicator and an antenna.

The system provides an accurate indication of altitude from 2000 feet above the terrain to 40 feet. A built-in self-test feature is provided to insure operational capability.

Operation of the MARK-10 is quite simple. It requires, of the pilot, little more than watching the indicator.

2. GROUND OPERATION

You will find that while taxiing in the vicinity of hangars and other aircraft the pointer may roam up and down the scale. This is normal.

Prior to departure, system operation should be checked by engaging SELF-TEST. SELF-TEST is engaged by pressing the red button on the front of the AI-74 indicator. The unit should read 40 feet, ± 5 feet. The "DH" light comes on if, in moving toward the self-test altitude indication, the pointer goes through the "DH" BUG setting. SELF-TEST verifies that the system is operational and capable of providing accurate altitude information.

3. DECISION HEIGHT ("DH")

The "DH" light is lit and the aural tone sounds briefly when the aircraft descends through your "DH." The light remains on as long as the aircraft is at or below the selected "DH" altitude.

The desired "DH" is selected by adjusting the "DH" control knob so that the triangular "DH" BUG is centered over the desired altitude mark on the dial. The BUG can be adjusted in either direction and to any altitude within the range of the system.

If desired, the "DH" feature can be used throughout aircraft descent and final approach to give an altitude alert at several different altitudes.

4. PREFLIGHT CHECKLIST

a. Turn on power. (after starting engines) "DH" audio will sound on first turn on.

b. Set "DH" BUG to disired altitude.

c. Perform SELF-TEST. SELF-TEST should read 40 feet, ± 5 feet.

5. IN FLIGHT OPERATION

a. SELF-TEST may be performed at any altitude.

b. Normal inflight adjustments are confined to selecting desired "DH" altitude.

c. The MARK-10 will indicate height above terrain from 40 to 2000 feet. The radar indicates the distance between aircraft and closest terrain.

d. When descending through the minimum altitude (40 feet) the pointer usually will pause and start toward the high altitude position, indicating the altimeter can no longer supply usable information.

e. When the aircraft is above 2000 feet, and usually when below 40 feet, the pointer will remain in the high altitude position. The only time the pointer should be in the "OFF" position is when the system is turned off or there is a malfunction within the system.

Technical Specifications

MARK-10 "T-R UNIT"
(Part No. 104-0112-00)

Weight:	2.0 lbs.
Size:	8x4x3¾"
Input voltage:	11 to 35 VDC
Input current:	0.5 amps @ 28 volts 1.0 amps @ 14 volts.
Frequency:	4.3 GHz
Power output:	16 watts peak
Loop gain:	115 db
Altitude range:	40' to 2000'
Accuracy:	Better than ± 5% of indicated altitude
Altitude output:	+ 10 millivolts per foot

FLUSH STYLE MARK-10 ANTENNA
(Part No. 104-0113-00)

Weight:	1.5 lbs
Size	3" high, 5" wide, 6" long
Frontal cross section.	18 square inches
Type.	Horn
Cable length:	24 inches
Mounting holes:	6 each ⁵⁄₃₂" dia.
Antenna Pattern: (3 db points)	± 30° pitch ± 30° roll

A1-74 INDICATOR
(Part No. 104-0114-00)

Weight:	1.0 lbs
Size	Fits standard 3" instrument hole. Depth behind panel 5"
Input voltage:	11 to 35 VDC
Input current:	0.5 amp maximum which includes "DH" light & internal lighting
Meter movement.	40' = 0.4v 2000' = 20.0v Resistance = 8730 ohms ± 10%
"DH" load capability:	Resistive load, 0.3 amp max. 30 volts max.
Aural "DH" output:*	2 second "CHIRP" at headphone level
Internal lighting:	White 5, 14 or 28V (by changing bulbs)

*Aural level is adjustable to pilot preference

VERTICAL INDICATOR
(Part No. 104-0117-00)

Weight:	5 ounces
Size:	3" high, ⅝" wide, 4.5" behind panel
Meter Movement:	40' = 60 ua 2000' = 1050 ua Resistance = 800 ohms, 5%

HORIZONTAL INDICATOR
(Part No. 104-0118-00)

Same as Vertical Indicator Except for Horizontal Scaleplate

A70-5 ADJUSTABLE DECISION HEIGHT SWITCH

REQUIRED TO DRIVE VERTICAL AND HORIZONTAL INDICATOR.

(Part No. 104-0116-00)

Weight:	7 ounces
Size	1⅝" x 1⅞" 5½" behind panel
Input voltage	28 volts (convertible to 14 volts)
Input current	0.4 amps maximum
"DH" load capability:	Resistive load, 0.25 amps max. 30 volts maximum
Meter output:	Provides split linear output required to drive vertical or horizontal indicator

A72-1 AURAL "DH" SYSTEM
(Part No. 104-0030-00)

Weight:	3 ounces
Size:	1⅝" dia., 1½" behind panel mounts in 1⅞" hole.
Input voltage	11-35 volts D.C.
Input current,	02 amps maximum
Audio output:	2 second 2800 Hz burst

The BONZER Radar Altimeter system employs the same oscillator circuit for both transmission and reception. Detection is accomplished by utilization of priming by the received signal of the oscillator upon starting of a transmitter pulse. Samples are taken in very small increments of distance, with the entire range of the equipment being swept at 50 Hz.

During the range sweep, replies from the ground are accumulated with the far signals being the weakest and the signals from below the aircraft the strongest. Measurement data is taken at the point where the replies are the nearest.

BONZER INC.

90th and Cody, Overland Park, Kansas 66214 USA
(913) 888-6760

Form No. 145a-15M-2-75 Effective 2-75

Printed in U S A

HORIZONTAL INDICATOR

A compact indicator designed for installation on top of glare shield. ($205)

Horizontal Indicator Radar Altimeter System
Part No. 104-0121-00 $1995 Complete
(Includes "T-R" unit and antenna shown at left)

VERTICAL INDICATOR

Thin ½" wide indicator for use on crowded panels ($205)

Vertical Indicator Radar Altimeter System
Part No. 104-0119-00
$1995 Complete
(Includes "T-R" unit and antenna shown at left)

A72-1 AURAL "DH" SYSTEM

The A72-1 provides aural "DH" tone when warning light comes on. Unit weighs 3 oz. ($35)

A70-5 ADJUSTABLE DECISION HEIGHT SWITCH

The A70-5 can be preset to any desired altitude. Warning light comes on when aircraft goes below preset altitude. ($205)

SHOWN ABOVE ARE COMPONENTS INCLUDED IN EITHER THE VERTICAL OR HORIZONTAL INDICATOR INSTALLATION

WARRANTY CERTIFICATE

MARK-10 EQUIPMENT

Bonzer Inc., Overland Park, Kansas, has provided in this equipment the finest material and components available. This equipment has been thoroughly tested and inspected before leaving the factory.

Bonzer, Inc. warrants each item of new equipment supplied by it to be free from defects in material and workmanship, under normal use for which intended. The system is warranted for 500 hours or 18 months from original date of shipment from factory, whichever occurs first.

Bonzer, Inc. will repair at its factory any original part or component which shall, within such warranty period, be returned, transportation charges prepaid.

This warranty shall not apply to any part, which in the judgment of the service department has been repaired or altered in any way so as to adversely affect its performance or reliability, or which has been subject to misuse, negligence, or accident.

This warranty is in lieu of all other guarantees or warranties, express or implied. The obligation of Bonzer, Inc. for, or with respect to, defective equipment shall be limited to that expressly provided herein.

Buyer's sole and exclusive remedy for breach of any warranty, express or implied, including any subsequently made written warranty, shall be the right to require seller to repair at place of shipment or at seller's option, to replace, F.O.B. place of shipment, any defective equipment.

Under no circumstances shall buyer be entitled to any incidental or consequential damages as defined by the Uniform Commercial Code for seller's breach of any warranty.

Warranty status of each Bonzer Radar System can be determined by observing the warranty expiration date stamped on the unit and the hour meter.

LEGEND

FLIGHT LINE, NUMBER AND DIRECTION	→ 20
CONTROL POINT	° 2498
MEAN FLIGHT LINE SPACING	660 FEET
NOMINAL TERRAIN CLEARANCE	250 FEET
NOMINAL SENSOR CLEARANCE	150 FEET

NOTE

NO ELECTROMAGNETIC ANOMALIES WERE OBSERVED ON PRESENT PROJECT.

6673

PLATE I

GREAT PLAINS DEVELOPMENT OF CANADA LTD.

CHILLIWACK AREA, BRITISH COLUMBIA

AIRBORNE GEOPHYSICAL SURVEY

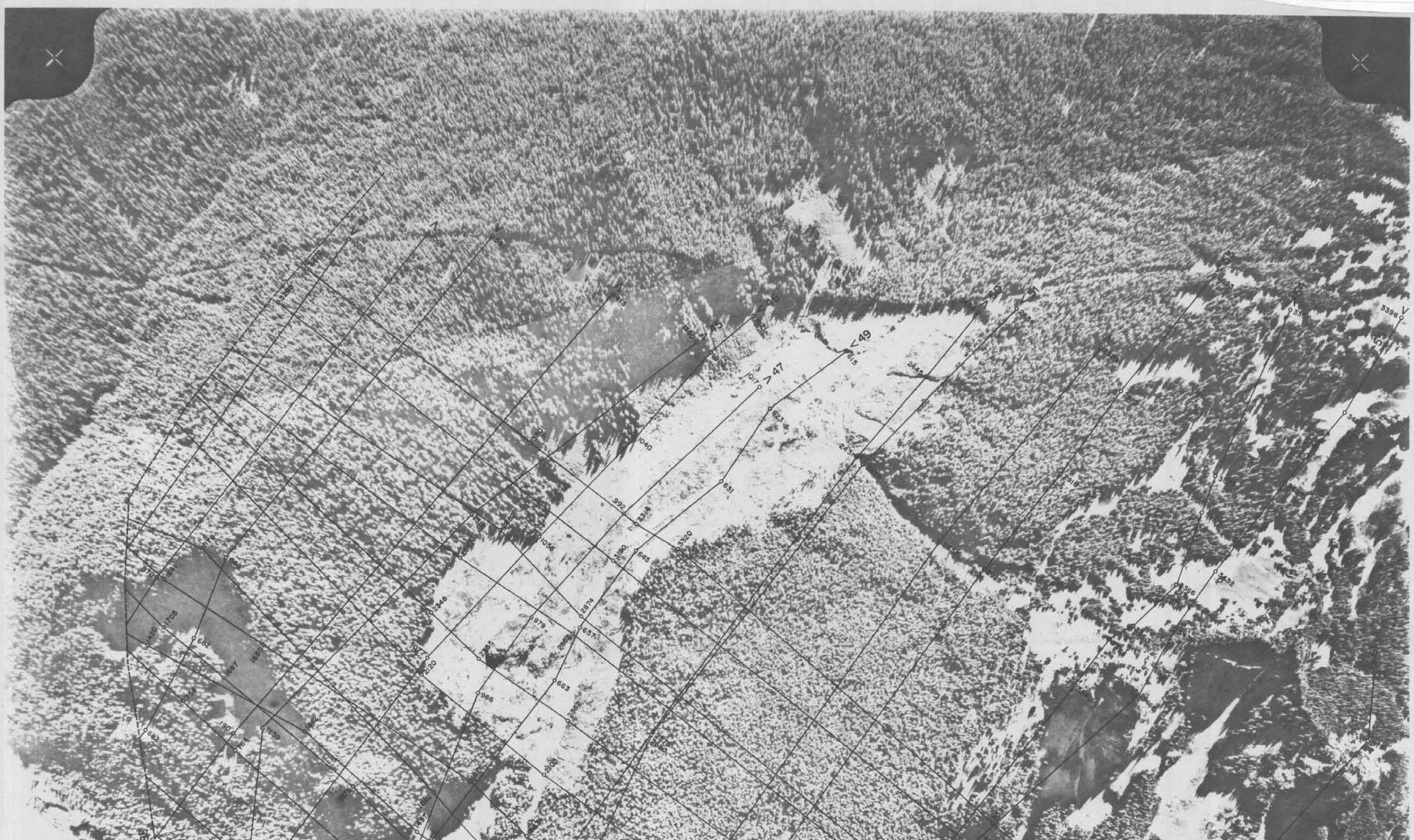
SCINTREX HEM-801 ELECTROMAGNETIC
SCINTREX MAP-2 MAGNETOMETER

Scale: 1" ≈ 1,000'

0 1000 2000 feet
0 200 400 600 meters

Flown and Compiled by
SCINTREX LIMITED
1977

77-T1156-01



LEGEND

FLIGHT LINE, NUMBER AND DIRECTION	——o——> 20
CONTROL POINT	° 2498
MEAN FLIGHT LINE SPACING	660 FEET
NOMINAL TERRAIN CLEARANCE	250 FEET
NOMINAL SENSOR CLEARANCE	150 FEET

NOTE

NO ELECTROMAGNETIC ANOMALIES WERE OBSERVED ON PRESENT PROJECT.

N

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
6673
NO.

PLATE 2

GREAT PLAINS DEVELOPMENT OF CANADA LTD.

CHILLIWACK AREA, BRITISH COLUMBIA

AIRBORNE GEOPHYSICAL SURVEY

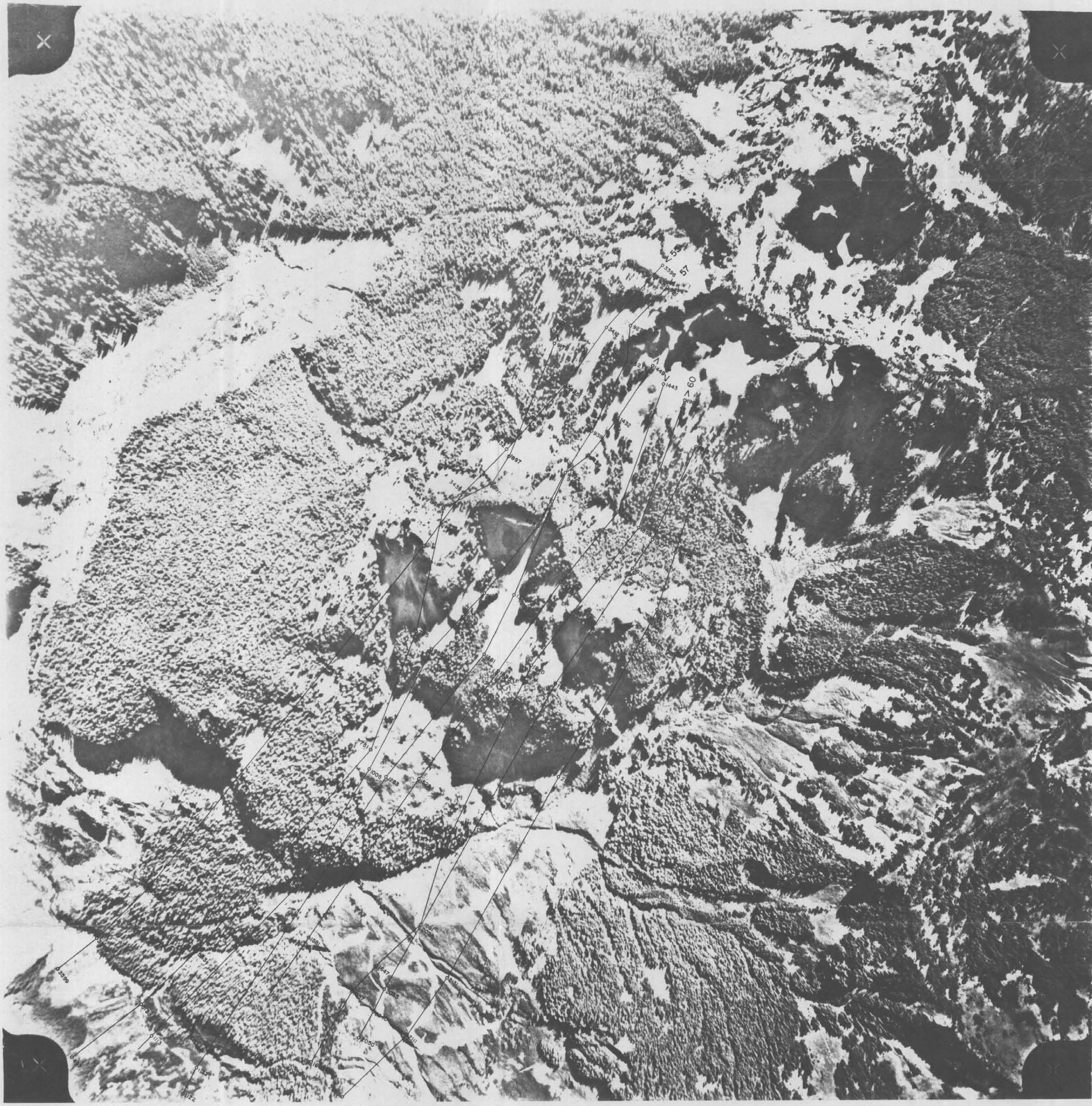
SCINTREX HEM-801 ELECTROMAGNETIC
SCINTREX MAP-2 MAGNETOMETER

Scale: 1" ≈ 1,000'

0 1000 2000 feet
0 200 400 600 meters

Flown and Compiled by
SCINTREX LIMITED
1977

77-T1156-02



LEGEND

FLIGHT LINE, NUMBER AND DIRECTION	→ 20
CONTROL POINT	○ 2498
MEAN FLIGHT LINE SPACING	660 FEET
NOMINAL TERRAIN CLEARANCE	250 FEET
NOMINAL SENSOR CLEARANCE	150 FEET

NOTE

NO ELECTROMAGNETIC ANOMALIES WERE OBSERVED ON PRESENT PROJECT.

N

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
6673
NO.

PLATE 3

GREAT PLAINS DEVELOPMENT OF CANADA LTD.

CHILLIWACK AREA, BRITISH COLUMBIA

AIRBORNE GEOPHYSICAL SURVEY

SCINTREX HEM-801 ELECTROMAGNETIC
SCINTREX MAP-2 MAGNETOMETER

Scale : 1" ≈ 1,000'

0 1000 2000 feet
0 200 400 600 meters

Flown and Compiled by
SCINTREX LIMITED
1977

77-T1156-03