ASSESSMENT REPORT

BC Geological Survey Assessment Report 32078

On

AIRBORNE GEOPHYSICS

ZINGER, EDDY and PROSPECTORS DREAM Blocks

Fort Steele Mining Division, SE B.C.

UTM 565000E 5475000N

TRIM 82F.040, .050

For

Ruby Red Resources Inc. Suite 212 – 1000 – 9th Ave SW Calgary, Alberta T2P 2Y6

By Peter Klewchuk, P. Geo.

February, 2011

TABLE OF CONTENTS

| | | Page |
|---------|-------------------------------|------|
| 1.00 | INTRODUCTION | 1 |
| | 1.10 Location and Access | 1 |
| | 1.20 Property | 1 |
| | 1.30 Physiography | 1 |
| | 1.40 History | 1 |
| | 1.50 Scope of Present Program | 1 |
| | | |
| 2.00 | REGIONAL GEOLOGY | 4 |
| • • • • | | _ |
| 3.00 | AEROQUEST AIRBORNE SURVEY | 5 |
| 4.00 | DISCUSSION OF DESLUTS | F |
| 4.00 | DISCUSSION OF RESULTS | 5 |
| 5.00 | REERENCES | 5 |
| 5.00 | KEI EKEIVEES | 5 |
| 6.00 | STATEMENT OF COSTS | 6 |
| 0.00 | | 0 |
| 7.00 | AUTHOR'S QUALIFICATIONS | 6 |
| | | |

LIST OF ILLUSTRATIONS

| Figure 1. Location Map | 2 |
|------------------------|---|
| Figure 2. Claim Map | 3 |

Attached: Aeroquest Airborne Survey

1.00 INTRODUCTION

1.10 Location and Access

The Zinger, Eddy and Prospectors Dream claim blocks are part of a larger 'Purcell ' block of claims located within southeastern British Columbia between eight and 38 kilometers west of Cranbrook and centered approximately at UTM coordinates 567000E 5480000N (Fig. 1). The large claim block covers parts of the drainages of Weaver Creek, Perry Creek, Angus Creek, Hellroaring Creek and the Goat River. These drainages and their tributaries are readily accessible via a network of forest service roads from Cranbrook.

1.20 Property

The claims which comprise the Purcell block are outlined on Figure 2.

1.30 Physiography

The Purcell Block property area is within the Moyie Range of the Purcell Mountains. Elevations on the property range from about 1060 to 2310 meters and topography varies from gentle and moderate wooded slopes to steep rocky slopes. Forest cover includes mainly pine, fir and larch. Areas within the claim block have been clear-cut logged over the past 35 years and are in various stages of regeneration.

1.40 History

Historic prospecting led to early discoveries of gold-bearing quartz veins and later, road building activity related to logging exposed additional gold-bearing quartz veins in a few places. More recently, modern prospecting has led to the discovery of new lode gold occurrences within what is now the Purcell Block property. Within the area of the claims, gold mineralization is known to be associated with felsic intrusions and small felsic and syenite dikes. Gold also occurs within structural sites; in shear zones, fault zones, quartz vein breccias and quartz veins.

1.50 Scope of Present Program

In late 2010 and early 2011 a helicopter-borne AeroTEM System Electromagnetic and Magnetic survey was flown over three separate blocks within the larger Purcell Block of mineral claims. The three survey areas are Zinger, Eddy and Prospectors Dream and they included 152.0, 179.3 and 77.7 kilometers respectively of airborne survey coverage, for a total of 409 line-kilometers of surveying. The areas of survey are shown on maps which accompany the attached Aeroquest airborne survey report.





2.00 REGIONAL GEOLOGY

Mapping by Reesor (1981), Hoy and Diakow (1982), and Hoy (1984) has developed a good understanding of the geology and structure of the Cranbrook area of southeastern British Columbia. This area, which includes the 'Purcell Block' claims, is part of the Purcell Anticlinorium, a geologic sub-province which lies between the Rocky Mountain Thrust and Fold Belt to the east and the Kootenay Arc to the west.

The mesoproterozoic Purcell Supergroup which occurs within the core of the anticlinorium includes up to 11 kilometers of dominantly fine-grained clastic and carbonate rocks.

The Purcell Block claims are underlain by rocks ranging in age from Precambrian to Cambrian. These include the Aldridge, Creston, Kitchener, Cranbrook and Eager Formations. These formations are comprised of fine-grained clastic sedimentary rocks; the Aldridge Formation is a thick succession of predominantly impure quartzites and siltstones of turbidite affinity; the Creston Formation is a shallower water sequence of cleaner quartzites but with considerable siltstone and argillite; the Kitchener Formation is a sequence of siltstones and dolomitic siltstones; the Cranbrook Formation is characterized by thick, fairly clean white quartzites and the Eager Formation is made up largely of laminated siltstones and argillites with a minor carbonate component. The Aldridge Formation is intruded by a series of gabbro to diorite composition sills and dikes which are called the Moyie intrusions; a few dikes and sills extend into the Creston and Kitchener Formations.

In a broad regional manner, structure of the Cranbrook area is dominated by a series of NNE oriented faults, at least some of which are believed to have been active during sedimentation in the Precambrian and thus have locally modified the type, distribution and thickness of late Proterozoic and Paleozoic rocks (Leech, 1958; Lis and Price, 1976).

The Purcell Block claims sit within an area of increased structural complexity which is more or less centered on the three prominent placer gold streams in the Cranbrook area, namely Perry Creek and the Moyie and Wild Horse Rivers (the Wild Horse is located to the northeast in the Rocky Mountains). A series of NNE to NE oriented shear zones and a series of east to NE oriented transverse faults create the structurally complex, block-faulted area within which the placer gold occurs.

Cretaceous intrusions of granodiorite to syenite composition are scattered along a northeast trend through the general area of placer gold occurrence near Cranbrook. These young rocks may be the eastern limit of the Bayonne Magmatic Belt. Some of the syenite and quartz monzonite stocks carry appreciable pyrite, pyrrhotite and chalcopyrite and tend to be associated with anomalous gold; gold mineralization has been found within intrusions, proximal to them and at some distance from known intrusions.

3.00 AEROQUEST AIRBORNE SURVEY

In late 2010 and early 2011 a helicopter-borne AeroTEM System Electromagnetic and Magnetic survey was flown over three separate blocks within the larger Purcell Block of mineral claims. The three survey areas are Zinger, Eddy and Prospectors Dream and they included 152.0, 179.3 and 77.7 kilometers respectively of airborne survey coverage, for a total of 409 line-kilometers of surveying. The areas of survey are shown on maps which accompany the attached Aeroquest airborne survey report.

A separate attached report by Aeroquest describes the survey logistics, the data processing, presentation, and provides the specifications of the survey. The Aeroquest report does not include any detailed interpretation of the survey results.

4.00 DISCUSSION OF RESULTS

Anomalous electromagnetic and magnetic results provided by the Aeroquest survey should be correlated to known bedrock geology of the survey areas and also be correlated to known anomalous gold mineralization. Careful evaluation of the airborne survey results may provide previously undetected exploration targets.

5.00 REFERENCES

- Hoy, T., 1984. Geology of the Cranbrook sheet and Sullivan Mine area. NTS 82G/12, 82F/9. BC MEMPR Preliminary Map No. 54.
- Hoy, T., and Diakow, L., 1982. Geology of the Moyie Lake area. BC MEMPR Preliminary Map No. 49.
- Leech, G.B., 1958. Fernie Map-Area, West-half, British Columbia. Geol. Surv. Can. Paper 58-10, 40pp.
- Lis, M.G., and Price, R., 1976. Large scale block faulting during deposition of the Windermere Supergroup (Hadrynian) in southeastern British Columbia. Geol. Surv. Can. Paper 76-1A, p. 135-136.
- Reesor, J.E., 1981. Geology of the Grassy Mountain Map Sheet. NTS 82F/8. Geol. Surv. Can. Open File 820.

6.00 STATEMENT OF COSTS

| Airborne Geophysics Survey: | 409 km @ \$152/km | \$62,168 |
|------------------------------------|--------------------|----------|
| | Mobilization | 4,000 |
| | Standby Charges | 9,000 |
| Report; P Klewchuk | 2 days @ \$500/day | 1,000 |
| Total Cost | | \$76,168 |
| 12% Administration; Calgary office | e | \$9140 |
| Total Applied Cost | | \$85,308 |

7.00 AUTHOR'S QUALIFICATIONS

As author of this report I, Peter Klewchuk, certify that:

- 1. I am an independent consulting geologist with offices at 408 Aspen Road, Kimberley, B.C.
- 2. I am a graduate geologist with a B. Sc. degree (1969) from the University of British Columbia and an M. Sc. degree (1972) from the University of Calgary.
- 3. I am a Fellow of the Geological Association of Canada and a member of the Association of Professional Engineers and Geoscientists of British Columbia.
- 4. I have been actively involved in mining and exploration geology, primarily in the province of British Columbia, for the past 35 years.
- 5. I have been employed by major mining companies and provincial government geological departments.

Dated at Kimberley, British Columbia this 15th day of February, 2011.

t. Kr

Peter Klewchuk, P. Geo.

Report on a Helicopter-Borne AeroTEM System Electromagnetic Magnetic Survey



Aeroquest Job # 11001

Zinger, Eddy and Prospectors Dream Blocks

Cranbrook BC, Canada

For

PJX Resources Inc. (1532063 Alberta Inc.)

3700 – 100 King St W. 1st Canadian Place Toronto, ON, M5X 1C9

by



7687 Bath Road, Mississauga, ON, L4T 3T1 Tel: (905) 672-9129 Fax: (905) 672-7083 <u>www.aeroquest.ca</u>

Report date: January 2011



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TABLE OF CONTENTS

| TABLE OF CONTENTS | iii |
|--|--|
| LIST OF FIGURES | 4 |
| LIST OF MAPS (1:20,000) | 4 |
| 1. INTRODUCTION | 5 |
| 2. SURVEY AREA | 5 |
| 3. SURVEY SPECIFICATIONS AND PROCEDURES | 6 |
| 3.1. Navigation3.2. System Drift3.3. Field QA/QC Procedures | 6 6 7 |
| 4. AIRCRAFT AND EQUIPMENT | 7 |
| 4.1. Aircraft | 7 7 8 9 .10 .10 .10 .11 .11 |
| 5. PERSONNEL | .12 |
| 6. DELIVERABLES | .12 |
| 6.1. Hardcopy Deliverables | .12 .12 .12 .12 .13 .13 .13 .13 |
| 7. DATA PROCESSING AND PRESENTATION | .13 |
| 7.1. Base Map 7.2. Flight Path & Terrain Clearance 7.3. Electromagnetic Data 7.4. Magnetic Data | .13 .14 .14 .14 |
| 8. General Comments | .15 |
| 8.1. Magnetic Response8.2. EM Anomalies | . 15 . 15 |
| APPENDIX 1: Survey Boundaries | .18 |
| APPENDIX 2: Description of Database Fields | .19 |



| APPENDIX 3: AeroTEM Anomaly Listing | 20 |
|---|----|
| APPENDIX 4: AeroTEM Design Considerations | 21 |
| APPENDIX 5: AeroTEM Instrumentation Specification Sheet | 27 |

LIST OF FIGURES

| Figure 1. Project Area | .5 |
|---|-----|
| Figure 2 Helicopter of the type used during the survey | .7 |
| Figure 3. The magnetometer bird (A) and AeroTEM III EM bird (B) | . 8 |
| Figure 4. Schematic of Transmitter and Receiver waveforms | .9 |
| Figure 5. AeroTEM III Instrument Rack | .9 |
| Figure 6. Digital video camera typical mounting location. | 11 |
| Figure 7. AeroTEM response to a 'thin' vertical conductor | 16 |
| Figure 8. AeroTEM response for a 'thick' vertical conductor. | 17 |
| Figure 9. AeroTEM response over a 'thin' dipping conductor | 17 |

LIST OF MAPS (1:20,000)

- TMI Total Magnetic Intensity (TMI) colour grid with contours and EM anomaly symbols.
- ZOFF0– AeroTEM Z0 Off-time colour grid with contours, and EM anomaly symbols.
- EM AeroTEM off-time profiles Z0 Z10 and EM anomaly symbols.



1. INTRODUCTION

This report describes a helicopter-borne geophysical survey carried out on behalf of PJX Resources Inc. (1532063 Alberta Inc.) Zinger, Eddy and Prospectors Dream projects located near Cranbrook, B.C.

The principal geophysical sensor is Aeroquest's exclusive AeroTEM III (November) time domain helicopter electromagnetic system which is employed in conjunction with a high-sensitivity caesium vapour magnetometer. Ancillary equipment includes a real-time differential GPS navigation system, radar altimeter, video recorder, and a base station magnetometer. Full-waveform streaming EM data is recorded at 36,000 samples per second. The streaming data comprise the transmitted waveform, and the X component and Z component of the resultant field at the receivers. The streaming EM data along with ancillary data recorded with AeroDAS acquisition system.

The total survey coverage is 409 line-km, of which 377.2 line-km fell within the defined project areas (Appendix 1). The survey was made up of three blocks, flown at 75 metre line spacing and in 90°/180° and 105°/195° flight directions (Table 1). The survey flying described in this report commenced on October 13th, 2010. This report describes the survey logistics, the data processing, presentation, and provides the specifications of the survey.

2. SURVEY AREA

The Project areas (Figure 1) are located in B.C. approximately 30 km's surrounding Cranbrook, B.C. The survey consisted of three blocks Zinger, Eddy and Prospectors Dream (24.9 km²) The base of survey operations was from Cranbrook B.C.



Figure 1. Project Area



3. SURVEY SPECIFICATIONS AND PROCEDURES

The survey specifications are summarised in the following table:

| Project Name | Line Spacing (metres) | Line Direction | Survey Coverage (line-km) | Flying Commenced Date |
|----------------------|-----------------------------|-------------------|---------------------------------|---------------------------------|
| Zinger | 75 | 105°/195° | 152.0 | October 13 th , 2010 |
| Eddy | 75 | 090°/180° | 179.3 | October 13 th , 2010 |
| Prospectors Dream | 75 | 090°/180° | 77.7 | October 13 th , 2010 |

Table 1. Survey specifications summary

The survey coverage was calculated by adding up the along-line distance of the survey lines and control (tie) lines as presented in the final Geosoft database. The survey was flown with a line spacing of 75 metres. The control (tie) lines were flown perpendicular to the survey lines with 750 metre, tie line spacing.

The nominal EM bird terrain clearance is 30 metres, but can be higher in more rugged terrain due to safety considerations and the capabilities of the aircraft. The magnetometer sensor is mounted in a smaller bird connected to the tow rope 32 metres above the EM bird and 18 metres below the helicopter. Nominal survey speed over relatively flat terrain is 75 km/hr and is generally lower in rougher terrain. Scan rates for ancillary data acquisition is 0.1 second for the magnetometer and altimeter, and 0.2 second for the GPS determined position. The EM data is acquired as a data stream at a sampling rate of 36,000 samples per second and is processed to generate final data at 10 samples per second. The 10 samples per second translate to a geophysical reading about every 1.5 to 2.5 metres along the flight path.

3.1 NAVIGATION

Navigation is carried out using a GPS receiver, an AGNAV2 system for navigation control, and AeroDAS data acquisition system which records the GPS coordinates. The x-y-z position of the aircraft, as reported by the GPS, is recorded at 0.2 second intervals. The system has a published accuracy of less than 3 metres. A recent static ground test of the Mid-Tech WAAS GPS yielded a standard deviation in x and y of less than 0.6 metres and for z less than 1.5 metres over a two-hour period.

3.2 System Drift

Unlike frequency domain electromagnetic systems, the AeroTEM III system has negligible drift due to thermal expansion. The operator is responsible for ensuring the instrument is properly warmed up prior to departure and that the instruments are operated properly throughout the flight. The operator maintains a detailed flight log during the survey noting the times of the flight and any unusual geophysical or topographic features. Each flight included at least two high elevation 'background' checks. During the high elevation checks, an internal 5 second wide calibration pulse in all EM channels was generated in order to ensure that the gain of the system remained constant and within specifications.



3.3 FIELD QA/QC PROCEDURES

On return of the pilot and operator to the base, usually after each flight, the AeroDAS streaming EM and ancillary (magnetic, GPS, radar altimeter) data are carried on removable hard drives and transferred to the data processing work station. At the end of each day, the base station magnetometer data on FlashCard is retrieved from the base station unit.

Data verification and quality control includes a comparison of the acquired GPS data with the flight plan; verification and conversion of the magnetic data to an ASCII format XYZ data file; verification of the base station magnetometer data and conversion to ASCII format XYZ data; and loading, processing and conversion of the steaming EM data from the removable hard drive. All data is then merged to an ASCII XYZ format file which is then imported to an Oasis database for further QA/QC and for the production of preliminary EM, magnetic and flight path maps.

Survey lines which show excessive deviation from the intended flight path are re-flown. Any line or portion of a line on which the data quality did not meet the contract specification was noted and re-flown.

4. AIRCRAFT AND EQUIPMENT

4.1 AIRCRAFT

A Eurocopter (Aerospatiale) SA315B "Lama" helicopter - registration C-GLOV was used as survey platform. The helicopter was owned and operated by Hi-Wood Helicopters Ltd. Installation of the geophysical and ancillary equipment was carried out by Aeroquest Limited personnel in conjunction with a licensed aircraft. The survey aircraft was flown at a nominal terrain clearance of 262 ft (80 metres).



Figure 2 Helicopter of the type used during the survey

4.2 MAGNETOMETER

The AeroTEM III airborne survey system employs the Geometrics G-823A caesium vapour magnetometer sensor installed in a two metre towed bird airfoil attached to the main tow line,



32 metres above EM bird (Figure 3). The sensitivity of the magnetometer is 0.001 NanoTesla at a 0.1 second sampling rate. The nominal ground clearance of the magnetometer bird is 62 metres (203 ft.). The magnetic data is recorded at 10 Hz by the ADAS.

4.3 ELECTROMAGNETIC SYSTEM

The electromagnetic system is an Aeroquest AeroTEM III time domain towed-bird system (Figure 3). The current AeroTEM III transmitter dipole moment is 183 kNIA. The AeroTEM bird is towed 50 metres (164 ft) below the helicopter. More technical details of the system may be found in Appendix 5.

The wave-form is triangular with a symmetric transmitter on-time pulse of 1.10 ms and a base frequency of 90 Hz (Figure 4). The current alternates polarity every on-time pulse. During every Tx on-off cycle (180 per second), 200 contiguous channels of raw X and Z component (and a transmitter current monitor, itx) of the received waveform are measured. Each channel width is 27.78 microseconds starting at the beginning of the transmitter pulse. This 200 channel data is referred to as the raw streaming data. The AeroTEM system has one EM data recording streams, the newly designed AeroDAS system which records the full waveform (Figure 4).



Figure 3. The magnetometer bird (A) and AeroTEM III EM bird (B)





Figure 4. Schematic of Transmitter and Receiver waveforms

4.4 AERODAS ACQUISITION SYSTEM

The 200 channels of raw streaming data are recorded by the AeroDAS acquisition system (Figure 5) onto a removable hard drive. In addition the magnetic, altimeter and position data are also recorded in it, six channels of real time processed off-time EM decay in the Z direction and one in the X direction can be viewed on a color monitor on board, these channels are derived by a binning, stacking and filtering procedure on the raw streaming data.

The primary use of the displayed EM data (Z1 to Z6, X1), magnetic and altimeter is to provide for real-time QA/QC on board.



Figure 5. AeroTEM III Instrument Rack



The streaming data are processed post-survey to yield 33 stacked and binned on-time and off-time channels at a 10 Hz sample rate. The timing of the final processed EM channels is described in the following table:

| Channel | Sample Range | Time Width (us) | Time Center (us) | Time After TxOn (us) |
|---|---|---|--|--|
| On1 | 5 - 5 | 27.8 | 125.0 | 128.0 |
| On2 | 6 - 6 | 27.8 | 152.8 | 155.8 |
| On 3 | 7 - 7 | 27.8 | 180.6 | 183.6 |
| On4 | 8 - 8 | 27.8 | 208.3 | 211.4 |
| On 5 | 9 - 9 | 27.8 | 236.1 | 239.1 |
| On 6 | 10 - 10 | 27.8 | 263.9 | 266.9 |
| On7 | 11 - 11 | 27.8 | 291.7 | 294.7 |
| On 8 | 12 - 12 | 27.8 | 319.4 | 322.5 |
| On 9 | 13 - 13 | 27.8 | 347.2 | 350.2 |
| On10 | 14 - 14 | 27.8 | 375.0 | 378.0 |
| On11 | 15 - 15 | 27.8 | 402.8 | 405.8 |
| On12 | 16 - 16 | 27.8 | 430.6 | 433.6 |
| On13 | 17 - 17 | 27.8 | 458.3 | 461.4 |
| On14 | 18 - 18 | 27.8 | 486.1 | 489.1 |
| On15 | 19 - 19 | 27.8 | 513.9 | 516.9 |
| On16 | 20 - 20 | 27.8 | 541.7 | 544.7 |
| | | | | |
| | | | | |
| Channel | Sample Range | Time Width (us) | Time Center (us) | Time After TxOff (us) |
| Channel Off0 | Sample Range 66 - 66 | Time Width (us) 27.8 | Time Center (us) 1819.4 | Time After TxOff (us) 91.2 |
| Channel Off0 Off1 | Sample Range 66 - 66 67 - 67 | Time Width (us) 27.8 27.8 | Time Center (us) 1819.4 1847.2 | Time After TxOff (us) 91.2 118.9 |
| Channel Off0 Off1 Off2 | Sample Range 66 - 66 67 - 67 68 - 68 | Time Width (us) 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 | Time After TxOff (us) 91.2 118.9 146.7 |
| Channel Off0 Off1 Off2 Off3 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 | Time After TxOff (us) 91.2 118.9 146.7 174.5 |
| Channel Off0 Off1 Off2 Off3 Off4 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 |
| Channel Off0 Off1 Off2 Off3 Off4 Off5 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 |
| Channel Off0 Off1 Off2 Off3 Off4 Off5 Off6 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 |
| Channel Off0 Off1 Off2 Off3 Off4 Off5 Off6 Off7 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 |
| Channel Off0 Off1 Off2 Off3 Off4 Off5 Off6 Off7 Off8 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 55.6 55.6 55.6 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 |
| Channel Off0 Off1 Off2 Off3 Off4 Off5 Off6 Off7 Off8 Off9 | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 55.6 55.6 55.6 55.6 55.6 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 |
| Channel | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 80 - 82 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 2236.1 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 507.8 |
| Channel | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 80 - 82 83 - 85 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 2236.1 2319.4 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 507.8 591.2 |
| Channel | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 80 - 82 83 - 85 86 - 89 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 2236.1 2319.4 2416.7 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 507.8 591.2 688.4 |
| Channel | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 80 - 82 83 - 85 86 - 89 90 - 95 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 2236.1 2319.4 2416.7 2555.6 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 507.8 591.2 688.4 827.3 |
| Channel | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 80 - 82 83 - 85 86 - 89 90 - 95 96 - 105 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 55.6 55.6 55.6 55.6 83.3 83.3 111.1 166.7 277.8 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 2236.1 2319.4 2416.7 2555.6 2777.8 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 507.8 591.2 688.4 827.3 1049.5 |
| Channel | Sample Range 66 - 66 67 - 67 68 - 68 69 - 69 70 - 70 71 - 71 72 - 73 74 - 75 76 - 77 78 - 79 80 - 82 83 - 85 86 - 89 90 - 95 96 - 105 106 - 120 | Time Width (us) 27.8 27.8 27.8 27.8 27.8 27.8 27.8 55.6 55.6 55.6 55.6 83.3 83.3 111.1 166.7 277.8 416.7 | Time Center (us) 1819.4 1847.2 1875.0 1902.8 1930.6 1958.3 2000.0 2055.6 2111.1 2166.7 2236.1 2319.4 2416.7 2555.6 2777.8 3125.0 | Time After TxOff (us) 91.2 118.9 146.7 174.5 202.3 230.1 271.7 327.3 382.8 438.4 507.8 591.2 688.4 827.3 1049.5 1396.7 |

4.5 MAGNETOMETER BASE STATION

The base magnetometer was a Geometrics G-859 caesium vapour magnetometer system with integrated GPS. Data logging and UTC time synchronisation was carried out within the magnetometer, with the GPS providing the timing signal. The data logging was configured to measure at 1.0 second intervals. Digital recording resolution was 0.001 nT. The sensor was placed on a tripod in an area of low magnetic gradient and free of cultural noise sources. A continuously updated display of the base station values was available for viewing and regularly monitored to ensure acceptable data quality and diurnal variation.

4.6 RADAR ALTIMETER

A Terra TRA 3500/TRI-30 radar altimeter is used to record terrain clearance. The antenna was mounted on the outside of the helicopter beneath the cockpit. Therefore, the recorded data reflect the height of the helicopter above the ground. The Terra altimeter has an altitude accuracy of +/- 1.5 metres.

4.7 VIDEO TRACKING AND RECORDING SYSTEM

A high resolution digital colour 8 mm video camera is used to record the helicopter ground flight path along the survey lines. The video is digitally annotated with GPS position and time



and can be used to verify ground positioning information and cultural causes of anomalous geophysical responses.



Figure 6. Digital video camera typical mounting location.

4.8 GPS NAVIGATION SYSTEM

The navigation system consists of an Ag-Nav Incorporated AG-NAV2 GPS navigation system comprising a PC-based acquisition system, navigation software, a deviation indicator in front of the aircraft pilot to direct the flight, a full screen display with controls in front of the operator, a Mid-Tech RX400p WAAS-enabled GPS receiver mounted on the instrument rack and an antenna mounted on the magnetometer bird. WAAS (Wide Area Augmentation System) consists of approximately 25 ground reference stations positioned across the United States that monitor GPS satellite data. Two master stations located on the east and west coasts collect data from the reference stations and create a GPS correction message. This correction accounts for GPS satellite orbit and clock drift plus signal delays caused by the atmosphere and ionosphere. The corrected differential message is then broadcast through one of two geostationary satellites, or satellites with a fixed position over the equator. The corrected position has a published accuracy of less than 3 metres.

Survey co-ordinates are set up prior to the survey and the information is fed into the airborne navigation system. The co-ordinate system employed in the survey design was WGS84 [World] using the UTM zone 11N projection. The real-time differentially corrected GPS positional data was recorded by AeroDAS system in geodetic coordinates (latitude and longitude using WGS84) at 0.2 s intervals.

4.9 DIGITAL ACQUISITION SYSTEM

The AeroTEM received waveform sampled during on and off-time at 200 channels per decay, 180 times per second, was logged by the proprietary AeroDAS data acquisition system. The channel sampling commences at the start of the Tx cycle and the width of each channel is 27.78 seconds. In addition the positional and secondary geophysical data, (i.e. magnetic, radar altimeter, GPS position, and UTC time) was recorded on a removable hard-drive and later backed-up onto DVD-ROM from the field-processing computer.



5.0 PERSONNEL

The following Aeroquest personnel were involved in the project:

Project Manager of Operations: Lee Harper

Field Data Processors: Mihai Szentesy

Field Operator: John Douglas

Data Processing and Reporting: Chris Kahue, Dak Darbha, and Asif Mirza

The survey pilot, Chad Godyn and Ted Slavin, were employed directly by the helicopter operator – Hi-Wood Helicopters Ltd.

6.0 DELIVERABLES

6.1 HARDCOPY DELIVERABLES

The report includes a set of 1:20,000 maps and the following geophysical data products are delivered:

- TMI Total Magnetic Intensity (TMI) colour grid with contours and EM anomaly symbols.
- ZOFF0– AeroTEM Z0 Off-time colour grid with contours, and EM anomaly symbols.
- EM AeroTEM off-time profiles Z0 Z10 and EM anomaly symbols.

The coordinate/projection system for the maps is NAD83 – UTM Zone 11N. For reference, the latitude and longitude in WGS84 are also noted on the maps.

All the maps show flight path trace, skeletal topography, and conductor picks represented by an anomaly symbol classified according to calculated off-time conductance. The anomaly symbol is accompanied by postings denoting the calculated off-time conductance, a thick or thin classification and an anomaly identifier label. The anomaly symbol legend and survey specifications are displayed on the left margin of the maps.

6.2 DIGITAL DELIVERABLES

6.2.1 Final Database of Survey Data (.GDB)

The geophysical profile data is archived digitally in a Geosoft GDB binary format databases. A description of the contents of the individual channels in the database can be found in Appendix 2. A copy of this digital data is archived at the Aeroquest head office in Mississauga.

6.2.2 Geosoft Grid files (.GRD)

Levelled Grid products used to generate the geophysical map images. Cell size for all grid files is 15 metres.



(Job 11-001, Blocks –Zinger, Eddy, Prospectors Dream) Total Magnetic Intensity from Mag sensor on the tow cable AeroTEM Z Off time Channel 0

6.2.3 Digital Versions of Final Maps (.MAP, .PDF)

Map files in Geosoft .map and Adobe PDF format.

6.2.4 Google Earth Files (.kmz)

Flight navigation lines, EM Anomalies and geophysical grids in Google earth kmz format. Double click to view in Google Earth.

6.2.5 Free Viewing Software (.EXE)

Geosoft Oasis Montaj Viewing Software Adobe Acrobat Reader Google Earth Viewer

6.2.6 Digital Copy of this Document (.PDF)

Adobe PDF format of this document.

7.0 DATA PROCESSING AND PRESENTATION

All in-field and post-field data processing was carried out using Aeroquest proprietary data processing software and Geosoft Oasis Montaj software. Maps were generated using 36-inch and 42-inch wide Hewlett Packard ink-jet plotters.

7.1 BASE MAP

The geophysical maps accompanying this report are based on positioning in the NAD83 datum. The survey geodetic GPS positions have been projected using the Universal Transverse Mercator projection in Zone 11 North. A summary of the map datum and projection specifications is given following:

Ellipse: GRS 1980

Ellipse major axis: 6378137m eccentricity: 0.081819191

Datum: North American 1983 - Canada Mean

Datum Shifts (x,y,z): 0, 0, 0 metres

Map Projection: Universal Transverse Mercator Zone 11 (Central Meridian 123°W)

Central Scale Factor: 0.9996

False Easting, Northing: 500,000m, 0m

For reference, the latitude and longitude in WGS84 are also noted on the maps.

The background vector topography was sourced from Natural Resources Canada 1:50000 National Topographic Data Base data and the background shading were derived from NASA Shuttle Radar Topography Mission (SRTM) 90 metre resolution DEM data.



7.2 FLIGHT PATH & TERRAIN CLEARANCE

The position of the survey helicopter was directed by use of the Global Positioning System (GPS). Positions were updated five times per second (5 Hz) and expressed as WGS84 latitude and longitude calculated from the raw pseudo range derived from the C/A code signal. The instantaneous GPS flight path, after conversion to UTM co-ordinates, is drawn using linear interpolation between the x/y positions. The terrain clearance was maintained with reference to the radar altimeter. The raw Digital Terrain Model (DTM) was derived by taking the GPS survey elevation and subtracting the radar altimeter terrain clearance values. The calculated topography elevation values are relative and are not tied in to surveyed geodetic heights.

Each flight included at least two high elevation 'background' checks. These high elevation checks are to ensure that the gain of the system remained constant and within specifications.

7.3 ELECTROMAGNETIC DATA

The raw streaming data, sampled at a rate of 36,000 Hz (200 channels, 180 times per second) was reprocessed using a proprietary software algorithm developed and owned by Aeroquest Limited. Processing involves the compensation of the X and Z component data for the primary field waveform. Coefficients for this compensation for the system transient are determined and applied to the stream data. The stream data are then pre-filtered, stacked, binned to the 33 on and off-time channels and checked for the effectiveness of the compensation and stacking processes. The stacked data is then filtered, levelled and split up into the individual line segments. Further base level adjustments may be carried out at this stage. The filtering of the stacked data is designed to remove or minimize high frequency noise that cannot be sourced from the geology. The final field processing step was to merge the processed EM data with the other data sets into a Geosoft GDB file. The EM fiducial is used to synchronize the two datasets. The processed channels are merged into 'array format; channels in the final Geosoft database as Zon, Zoff, Xon, and Xoff.

Apparent bedrock EM anomalies were interpreted with the aid of an auto-pick from positive peaks and troughs in the off-time Z channel responses correlated with X channel responses. The auto-picked anomalies were reviewed and edited by a geophysicist on a line by line basis to discriminate between thin and thick conductor types. Anomaly picks locations were migrated and removed as required. This process ensures the optimal representation of the conductor centres on the maps.

At each conductor pick, estimates of the off-time conductance have been generated based on a horizontal plate source model for those data points along the line where the response amplitude is sufficient to yield an acceptable estimate. Some of the EM anomaly picks do not display a Tau value; this is due to the inability to properly define the decay of the conductor usually because of low signal amplitudes. Each conductor pick was then classified according to a set of seven ranges of calculated off-time conductance values. For high conductance sources, the on-time conductance values may be used, since it provides a more accurate measure of high-conductance sources. Each symbol is also given an identification letter label, unique to each flight line. Conductor picks that did not yield an acceptable estimate of offtime conductance due to a low amplitude response were classified as a low conductance source. Please refer to the anomaly symbol legend located in the margin of the maps.

7.4 MAGNETIC DATA

Prior to any levelling the magnetic data was subjected to a lag correction of -0.1 seconds and a spike removal filter. The filtered aeromagnetic data were then corrected for diurnal variations using the magnetic base station and the intersections of the tie lines. No corrections



for the regional reference field (IGRF) were applied. The corrected profile data were interpolated on to a grid using a bi-directional grid technique with a grid cell size of 15 metres. The final levelled grid provided the basis for threading the presented contours which have a minimum contour interval of 0.5 nT.

8.0 GENERAL COMMENTS

The survey was successful in mapping the magnetic and conductive properties of the geology throughout the survey area. Below is a brief interpretation of the results. For a detailed interpretation please contact Aeroquest Limited.

8.1 MAGNETIC RESPONSE

The magnetic data provide a high resolution map of the distribution of the magnetic mineral content of the survey area. This data can be used to interpret the location of geological contacts and other structural features such as faults and zones of magnetic alteration. The sources for anomalous magnetic responses are generally thought to be predominantly magnetite because of the relative abundance and strength of response (high magnetic susceptibility) of magnetite over other magnetic minerals such as pyrrhotite.

8.2 EM ANOMALIES

The EM anomalies on the maps are classified by conductance (as described earlier in the report) and also by the thickness of the source. A thin, vertically orientated source produces a double peak anomaly in the z-component response and a positive to negative crossover in the x-component response (Figure 7). For a vertically orientated thick source (say, greater than 10 metres), the response is a single peak in the z-component response and a negative to positive crossover in the x-component response (Figure 8). Because of these differing responses, the AeroTEM system provides discrimination of thin and thick sources and this distinction is indicated on the EM anomaly symbols (N = thin and K = thick). Where multiple, closely spaced conductive sources occur, or where the source has a shallow dip, it can be difficult to uniquely determine the type (thick vs. thin) of the source (Figure 9). In these cases both possible source types may be indicated by picking both thick and thin response styles. For shallow dipping conductors the 'thin' pick will be located over the edge of the source, whereas the 'thick' pick will fall over the downdip 'heart' of the anomaly.



Job # 11001



Figure 7. AeroTEM response to a 'thin' vertical conductor.



Figure 8. AeroTEM response for a 'thick' vertical conductor.



Job # 11001



Figure 9. AeroTEM response over a 'thin' dipping conductor.

All cases should be considered when analyzing the interpreted picks and prioritizing for follow-up. Specific anomalous responses which remain as high priority should be subjected to numerical modeling prior to drill testing to determine the dip, depth and probable geometry of the source.



APPENDIX 1: SURVEY BOUNDARIES

The following table presents the Zinger, Eddy and Prospectors Dream project boundaries. All geophysical data presented in this report have been windowed to 100m outside of these boundaries. X and Y positions are in metres: NAD83 UTM Zone 11N.

| Zinger: |
|---------|
|---------|

| х | Y |
|--------|---------|
| 560137 | 5478724 |
| 563127 | 5477939 |
| 561669 | 5475003 |
| 558843 | 5475950 |

Eddy:

| х | Y |
|--------|---------|
| 563005 | 5473400 |
| 566569 | 5473408 |
| 566564 | 5470242 |
| 563016 | 5470242 |

Prospectors Dream:

| Х | Y |
|--------|---------|
| 568434 | 5476266 |
| 571596 | 5476264 |
| 571400 | 5474746 |
| 568442 | 5474746 |



APPENDIX 2: DESCRIPTION OF DATABASE FIELDS

The GDB's files are a Geosoft binary database. In the each database, the Survey lines and Tie Lines are prefixed with an "L" for "Line" and "T" for "Tie".

| | (7 1 11 001 | | F 1 1 | 1.0 | D \ |
|-------------------------|--------------|-----------------|--------------|-----------------|-----------|
| Mag and FM databases: i | (10h 11-001) | Blocks - Tinger | Eddy a | nd Prospector | s Dream |
| mag and this addocs. | (300 11 001, | Diocks Linger, | Luuy, ui | iu i rospeciori | s Di cum) |

| COLUMN | UNITS | DESCRIPTOR |
|-------------|-------------|--|
| Line | | Line number |
| flight | | Flight # |
| emfid | | AERODAS Fiducial |
| utctime | hh:mm:ss.ss | UTC time |
| x | m | UTM Easting (NAD83, Zone 11) |
| У | m | UTM Northing (NAD83, Zone 11) |
| galt | m | GPS elevation of magnetometer bird |
| Ralt | m | Helicopter radar altimeter (height above terrain) |
| bheight | m | Terrain clearance of EM bird |
| basemag | nT | Base station total magnetic intensity |
| magU | nT | Final levelled total magnetic intensity from magnetometer sensor |
| dtm | m | Digital Terrain Model |
| Zon | nT/s | EM On-Time Z component Channels 1-16 |
| Zoff | nT/s | EM Off-Time Z component Channels 0-16 |
| Xon | nT/s | EM On-Time X component Channels 1-16 |
| Xoff | nT/s | EM Off-Time X component Channels 0-16 |
| pwrline | | powerline monitor data channel |
| Grade | | Classification from 1-7 based on conductance of conductor pick |
| Anom_Labels | | Letter label of conductor pick (Unique per flight line) |
| Off_Con | S | Off-time conductance at conductor pick |
| Off_Tau | μs | Off-time decay constant at conductor pick |
| Anom_ID | | EM Anomaly response style (K= thicK, N = thiN) |
| Off_AllCon | S | Off-time conductance |
| Off_AllTau | μs | Off-time decay constant |
| TranOff | S | Transmitter turn off time |
| TranOn | S | Transmitter turn on time |
| TranPeak | A | Transmitter peak current |
| TranSwitch | S | Transmitter peak current time |
| Off_Pick | | Anomaly pick channel |



APPENDIX 3: AEROTEM ANOMALY LISTING

Eddy:

| Line | Anom | ID | Cond | Tau | Flight | UTC Time | Bird | Easting | Northing |
|------|------|----|------|-------|--------|----------|--------|----------|-----------|
| | | | (S) | (µs) | # | | height | (m) | (m) |
| | | | | | | | (m) | | |
| 5210 | A | K | 3.3 | 180.3 | 37 | 16:35:01 | 48.7 | 563580.2 | 5471890.4 |
| 5220 | A | K | 2.6 | 162.1 | 37 | 16:42:09 | 61.6 | 563601.7 | 5471825.3 |
| 5230 | A | K | 2.7 | 164.1 | 37 | 16:43:51 | 48.6 | 563580.8 | 5471746.0 |
| 5240 | A | K | 2.9 | 171.0 | 37 | 16:50:55 | 53.1 | 563568.0 | 5471669.5 |
| 5250 | A | K | 2.9 | 169.3 | 37 | 17:07:43 | 49.6 | 563534.5 | 5471596.8 |
| 5260 | A | K | 2.3 | 152.4 | 37 | 17:14:28 | 58.8 | 563492.0 | 5471514.3 |
| 5280 | A | K | 1.1 | 106.7 | 39 | 20:32:38 | 56.4 | 562978.3 | 5471365.1 |
| 5950 | A | K | 1.8 | 135.0 | 37 | 17:03:27 | 46.2 | 563340.4 | 5471488.5 |



APPENDIX 4: AEROTEM DESIGN CONSIDERATIONS

Helicopter-borne EM systems offer an advantage that cannot be matched from a fixed-wing platform. The ability to fly at slower speed and collect dat

3a with high spatial resolution, and with great accuracy, means the helicopter EM systems provide more detail than any other EM configuration, airborne or ground-based. Spatial resolution is especially important in areas of complex geology and in the search for discrete conductors. With the advent of helicopter-borne high-moment time domain EM systems the fixed wing platforms are losing their *only* advantage – depth penetration.

Advantage 1 – Spatial Resolution

The AeroTEM system is specifically designed to have a small footprint. This is accomplished through the use of concentric transmitter-receiver coils and a relatively small diameter transmitter coil (5 m). The result is a highly focused exploration footprint, which allows for more accurate "mapping" of discrete conductors. Consider the transmitter primary field images shown in Figure 1, for AeroTEM versus a fixed-wing transmitter.





The footprint of AeroTEM at the earth's surface is roughly 50m on either side of transmitter

The footprint of a fixed-wing system is roughly 150 m on either side of the transmitter

Figure 1. A comparison of the footprint between AeroTEM and a fixed-wing system, highlights the greater resolution that is achievable with a transmitter located closer to the earth's surface. The AeroTEM footprint is one third that of a fixed-wing system and is symmetric, while the fixed-wing system has even lower spatial resolution along the flight line because of the separated transmitter and receiver configuration.

At first glance one may want to believe that a transmitter footprint that is distributed more evenly over a larger area is of benefit in mineral exploration. In fact, the opposite is true; by energizing a larger surface area, the ability to energize and detect discrete conductors is reduced. Consider, for example, a comparison between AeroTEM and a fixed-wing system over the Mesamax Deposit (1,450,000 tonnes of 2.1% Ni, 2.7% Cu, 5.2 g/t Pt/Pd). In a test survey over three flight lines spaced 100 m apart, AeroTEM detected the Deposit on all three flight lines. The fixed-wing system detected the Deposit only on two flight lines. In exploration programs that seek to expand the flight line spacing in an effort to reduce the cost of the airborne survey, discrete conductors such as the Mesamax Deposit can go undetected. The argument often put forward in favour of using fixed-wing systems is that because of their larger footprint, the flight line spacing can indeed be widened. Many fixed-wing surveys are flown at 200 m or 400 m. Much of the survey work performed by Aeroquest has been to survey in areas that were previously flown at these wider line spacings. One of the reasons for AeroTEM's impressive discovery record has been the strategy of flying closely spaced lines and finding all the discrete near-surface conductors. These higher resolution surveys are being flown within existing mining camps, areas that improve the chances of discovery.





Figure 2. Fixed-wing (upper) and AeroTEM (lower) comparison over the eastern limit of the Mesamax Deposit, a Ni-Cu-PGE zone located in the Raglan nickel belt and owned by Canadian Royalties. Both systems detected the Deposit further to the west where it is closer to surface.

The small footprint of AeroTEM combined with the high signal to noise ratio (S/N) makes the system more suitable to surveying in areas where local infrastructure produces electromagnetic noise, such as power lines

and railways. In 2002 Aeroquest flew four exploration properties in the Sudbury Basin that were under option by FNX Mining Company Inc. from Inco Limited. One such property, the Victoria Property, contained three major power line corridors.

The resulting AeroTEM survey identified all the known zones of Ni-Cu-PGE mineralization, and detected a response between two of the major power line corridors but in an area of favourable geology. Three boreholes were drilled to test the anomaly, and all three intersected sulphide. The third borehole encountered 1.3% Ni, 6.7% Cu, and 13.3 g/t TPMs over 42.3 ft. The mineralization was subsequently named the Powerline Deposit.

The success of AeroTEM in Sudbury highlights the advantage of having a system with a small footprint, but also one with a high S/N. This latter advantage is achieved through a combination of a high-moment (high signal) transmitter and a rigid geometry (low noise). Figure 3 shows the Powerline Deposit response and the response from the power line corridor at full scale. The width of power line response is less than 75 m.

Figure 3. The Powerline Deposit is located between two major power line corridors, which make EM surveying problematic. Despite the strong response from the power line, the anomaly from the Deposit is clearly detected. Note the thin formational conductor located to the south. The only way to distinguish this response from that of two closely spaced conductors is by interpreting the X-axis coil response.

Advantage 2 – Conductance Discrimination

The AeroTEM system features full waveform recording and as such is able to measure the on-time response due to high conductance targets. Due to the processing method (primary field removal), there is attenuation of the response with increasing conductance, but the AeroTEM on-time measurement is still superior to systems that rely on lower base frequencies to detect high conductance targets, but do not measure in the on-time.

The peak response of a conductive target to an EM system is a function of the target conductance and the EM system base frequency. For time domain EM systems that measure only in the off-time, there is a drop in the peak response of a target as the base frequency is lowered for all conductance values below the peak system response. For example, the AeroTEM peak response occurs for a 10 S conductor in the early off-time and 100 S in the late off-time for a 150 Hz base frequency. Because base frequency and conductance form a linear

relationship when considering the peak response of any EM system, a drop in base frequency of 50% will double the conductance at which an EM system shows its peak response. If the base frequency were lowered from 150 Hz to 30 Hz there would be a fivefold increase in conductance at which the peak response of an EM occurred.

However, in the search for highly conductive targets, such as pyrrhotite-related Ni-Cu-PGM deposits, a fivefold increase in conductance range is a high price to pay because the signal level to lower conductance targets is reduced by the same factor of five. For this reason, EM systems that operate with low base frequencies are not suitable for general exploration unless the target conductance is more than 100 S, or the target is covered by conductive overburden.

Despite the excellent progress that has been made in modeling software over the past two decades, there has been little work done on determining the optimum form of an EM system for mineral exploration. For example, the optimum configuration in terms of geometry, base frequency and so remain unknown. Many geophysicists would argue that there is no single ideal configuration, and that each system has its advantages and disadvantages. We disagree.

When it comes to detecting and discriminating high-conductance targets, it is necessary to measure the pure in phase response of the target conductor. This measurement requires that the measured primary field from the transmitter be subtracted from the total measured response such that the secondary field from the target conductor can be determined. Because this secondary field is in-phase with the transmitter primary field, it must be made while the transmitter is turned on and the transmitter current is changing. The transmitted primary field is several orders of magnitude larger than the secondary field. AeroTEM uses a bucking coil to reduce the primary field at the receiver coils. The only practical way of removing the primary field is to maintain a rigid geometry between the transmitter, bucking and receiver coils. This is the main design consideration of the AeroTEM airframe and it is the only time domain airborne system to have this configuration.

The off-time AeroTEM response for the 16 channel configuration.

The on-time response assuming 100% removal of the measured primary field.

Figure 4. The off-time and on-time response nomogram of AeroTEM for a base frequency of 150 Hz. The on-time response is much stronger for higher conductance targets and this is why on-time measurements are more important than lower frequencies when considering high conductance targets in a resistive environment.

Advantage 3 – Multiple Receiver Coils

AeroTEM employs two receiver coil orientations. The Z-axis coil is oriented parallel to the transmitter coil and

both are horizontal to the ground. This is known as a maximum coupled configuration and is optimal for detection. The X-axis coil is oriented at right angles to the transmitter coil and is oriented along the line-of-flight. This is known as a minimum coupled configuration, and provides information on conductor orientation and thickness. These two coil configurations combined provide important information on the position, orientation, depth, and thickness of a conductor that cannot be matched by the traditional geometries of the HEM or fixed-wing systems. The responses are free from a system geometric effect and can be easily compared to model type curves in most cases. In other words, AeroTEM data is very easy to interpret. Consider, for example, the following modeled profile:

Figure 5. Measured (lower) and modeled (upper) AeroTEM responses are compared for a thin steeply dipping conductor. The response is characterized by two peaks in the Z-axis coil, and a cross-over in the X-axis coil that is centered between the two Z-axis peaks. The conductor dips toward the higher amplitude Z-axis peak. Using the X-axis cross-over is the only way of differentiating the Z-axis response from being two closely spaced conductors.

HEM versus AeroTEM

Traditional helicopter EM systems operate in the frequency domain and benefit from the fact that they use

narrowband as opposed to wide-band transmitters. Thus all of the energy from the transmitter is concentrated in a few discrete frequencies. This allows the systems to achieve excellent depth penetration (up to 100 m) from a transmitter of modest power. The Aeroquest Impulse system is one implementation of this technology.

The AeroTEM system uses a wide-band transmitter and delivers more power over a wide frequency range. This frequency range is then captured into 16 time channels, the early channels containing the high frequency information and the late time channels containing the low frequency information down to the system base frequency. Because frequency domain HEM systems employ two coil configurations (coplanar and coaxial) there are only a maximum of three comparable frequencies per configuration, compared to 16 AeroTEM off-time and 12 AeroTEM on-time channels.

Figure 6 shows a comparison between the Dighem HEM system (900 Hz and 7200 Hz coplanar) and AeroTEM (Z-axis) from surveys flown in Raglan, in search of highly conductive Ni-Cu-PGM sulphide. In general, the AeroTEM peaks are sharper and better defined, in part due to the greater S/N ratio of the AeroTEM system over HEM, and also due to the modestly filtered AeroTEM data compared to HEM. The base levels are also better defined in the AeroTEM data. AeroTEM filtering is limited to spike removal and a 5-point smoothing filter. Clients are also given copies of the raw, unfiltered data.

Figure 6. Comparison between Dighem HEM (upper) and AeroTEM (lower) surveys flown in the Raglan area. The AeroTEM responses appear to be more discrete, suggesting that the data is not as heavily filtered as the HEM data. The S/N advantage of AeroTEM over HEM is about 5:1.

Aeroquest Limited is grateful to the following companies for permission to publish some of the data from their respective surveys: Wolfden Resources, FNX Mining Company Inc, Canadian Royalties, Nova West Resources, Aurogin Resources, Spectrem Air. Permission does not imply an endorsement of the AeroTEM system by these companies.

APPENDIX 5: AEROTEM INSTRUMENTATION SPECIFICATION SHEET

AEROTEM Helicopter Electromagnetic System

System Characteristics

- Transmitter: Triangular Pulse Shape Base Frequency 90 Hz
- Tx On Time 1,833 (90 Hz) µs
- Tx Off Time 3,667 (90 Hz) μs
- Loop Diameter 10 m
- Peak Current 455 A
- Peak Moment 183,131 NIA
- Typical Z Axis Noise at Survey Speed = 5 nT/s peak to peak
- Sling Weight: 1000 lb
- Length of Tow Cable: 50 m
- Bird Survey Height: 30 m nominal

Receiver

- Two Axis Receiver Coils (x, z) positioned at centre of transmitter loop
- Selectable Time Delay to start of first channel 21.3, 42.7, or 64.0 ms

Display & Acquisition

- AERODAS Digital recording at 120 samples per decay curve at a maximum of 300 curves per second (27.778 µs channel width)
- RMS Channel Widths: 52.9,132.3, 158.7, 158.7, 317.5, 634.9 µs
- Recording & Display Rate = 10 readings per second.
- On-board display six channels Z-component and 1 X-component

System Considerations

Comparing a fixed-wing time domain transmitter with a typical moment of 500,000 NIA flying at an altitude of 120 m with a Helicopter TDEM at 30 m, notwithstanding the substantial moment loss in the airframe of the fixed wing, the same penetration by the lower flying helicopter system would only require a sixty-fourth of the moment. Clearly the AeroTEM system with nearly 183.131 NIA has more than sufficient moment. The airframe of the fixed wing presents a response to the towed bird, which requires dynamic compensation. This problem is non-existent for AeroTEM since transmitter and receiver positions are fixed. The AeroTEM system is completely portable, and can be assembled at the survey site within half a day.

| Off-Time Anomaly Symbols | | | | | |
|--------------------------|-----------|--|--|--|--|
| 50S | | | | | |
| 5-50S | • | | | | |
| 0-35S | \bullet | | | | |
| 0-20S | \oplus | | | | |
| -10S | \oplus | | | | |
| -5S | ÷ | | | | |
| 1S | \times | | | | |

Traverse/Tie line direction: (90°/270°/(180°/360°) & (105°/285°)/(195°/15°) Magnetometer: Geometrics G-823A caesium vapour Navigation: Differential Global Positioning System (DGPS) Navigation equipment: AGNAV with MID-TECH RX400p receiver

PJX Resources Inc. (1532063 Alberta Inc.)

