

In 2004 and 2005, Sandor Geophysics Limited completed four multi-sensor airborne geophysical surveys in the Nahanni River area of the Northwest Territories for Parks Canada (Prairie Creek, Caribou River and Flat River) and the Government of the Northwest Territories (Selkai Range). The Geological Survey of Canada provided survey supervision and quality control. The purpose of the survey was to obtain quantitative gamma-ray spectrometric and aeromagnetic data. The survey was flown over two seasons, from August 28 to October 3, 2004 and the second phase from June 13 to August 20, 2005 using the SGL ASAR 350 B helicopter, C-GSGH.

Gamma-ray Spectrometric Data
The airborne gamma-ray measurements were made with an Epsilon GM200 gamma-ray spectrometer using nine 102 x 102 x 400 mm NaI (TI) crystals. The main detector array consisted of eight crystals (total volume 33.6 litres), shielded by the main array, was used to detect variations in background radiation caused by atmospheric radon. The system constantly monitored the radon count rates for each crystal, and using a Gaussian least squares algorithm, adjusted the gain for each crystal.
Potassium is measured directly from the 1460 keV gamma-ray photons emitted by ⁴⁰K, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products (²¹⁴Pb for uranium and ²¹⁴Pb for thorium). Although these daughters are far down their respective decay chains, they are assumed to be in equilibrium with their parents, thus gamma-ray spectrometric measurements of uranium and thorium are referred to as equivalent uranium and equivalent thorium, i.e. eU and eTh. The energy windows used to measure potassium, uranium and thorium are:

Potassium (⁴⁰ K)	1360 - 1560 keV
Uranium (²³⁸ U)	1660 - 1860 keV
Thorium (²³² Th)	2410 - 2810 keV

Gamma-ray spectra were recorded at one-second intervals at a planned terrain clearance of 135 m and an air speed of 120 km/h. Noise Adjusted Singular Value Decomposition (NASVD) analysis was carried out on the full spectrum 256 channel data to reduce statistical noise in the windowed data. During processing, the spectra were energy calibrated, and counts were accumulated into the windows described above. Counts from the radon detectors were recorded in a 1600 - 1800 keV window and radiation at energies greater than 3000 keV was recorded in the cosmic window. The window counts were corrected for dead time, and for background activity from cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The window data were then corrected for spectral scattering in the ground, air and detector. Corrections for deviations of altitude from the planned terrain clearance and for variation of temperature and pressure were made prior to conversion to ground concentrations of potassium, uranium and thorium, using factors determined from flights over a calibration range near Oklae.

Potassium	56.5 cps% (2004) 50.0 cps% (2005)
Uranium	9.0 cpsppm (2004) 6.3 cpsppm (2005)
Thorium	1.7 cpsppm (2004) 3.2 cpsppm (2005)

Corrected data were filtered and interpolated to a 100m grid for both the 1:50 000 scale and 1:250 000 scale maps. The results of an airborne gamma-ray spectrometer survey represent the average surface concentrations that are influenced by varying amounts of outcrop, overburden, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentration. The total air absorbed dose rate in nanograys per hour was produced from measured counts between 400 and 2810 keV.

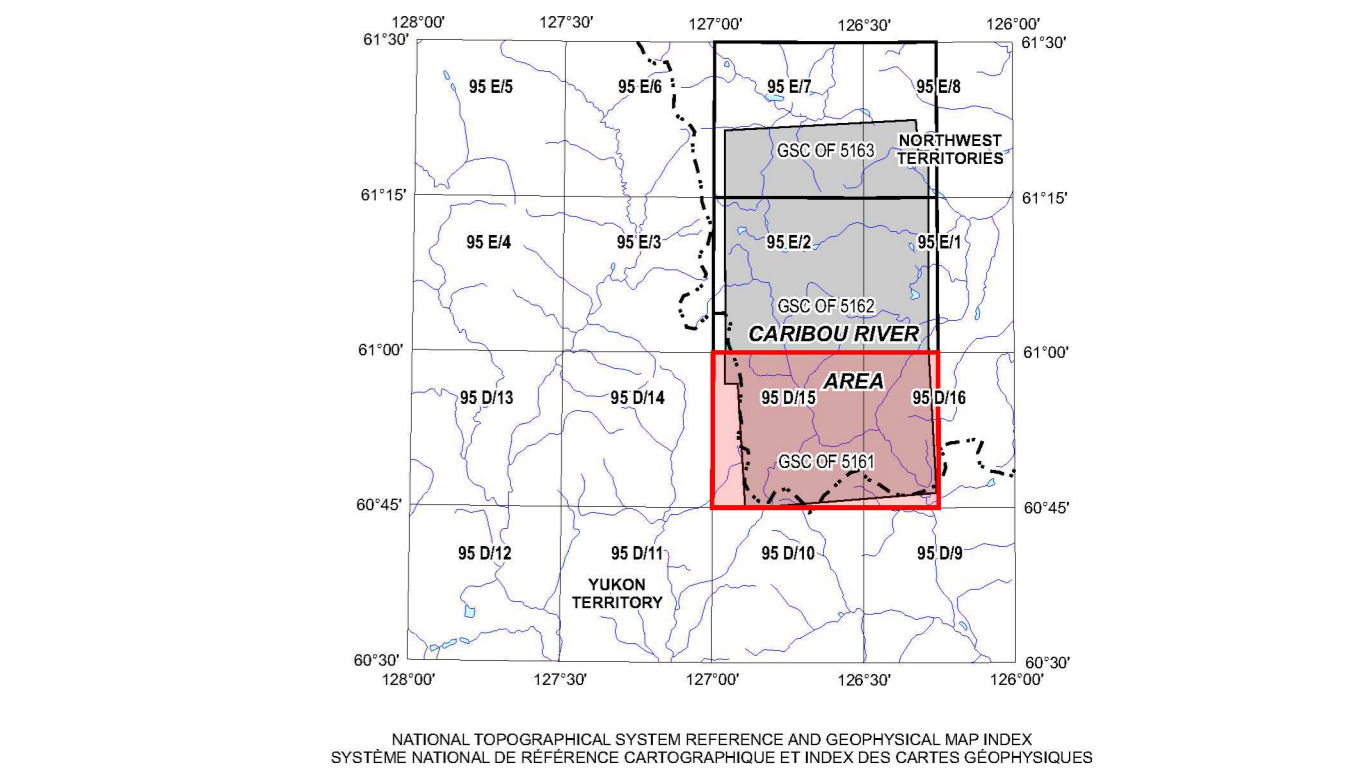
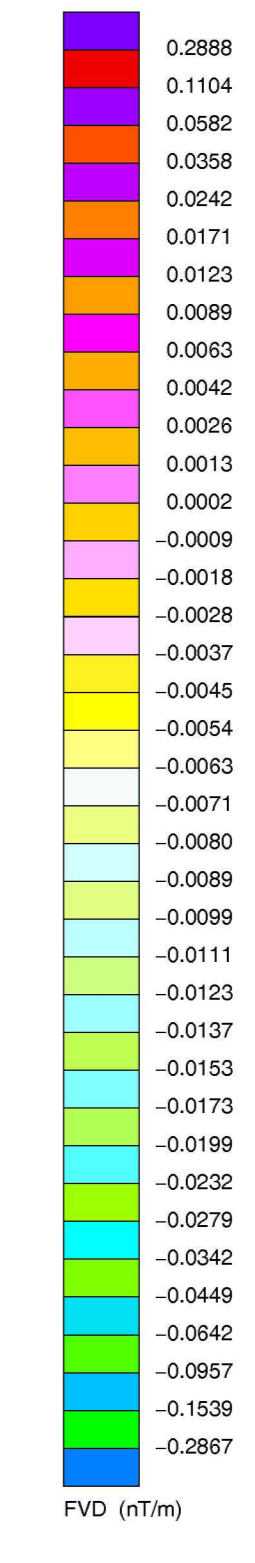
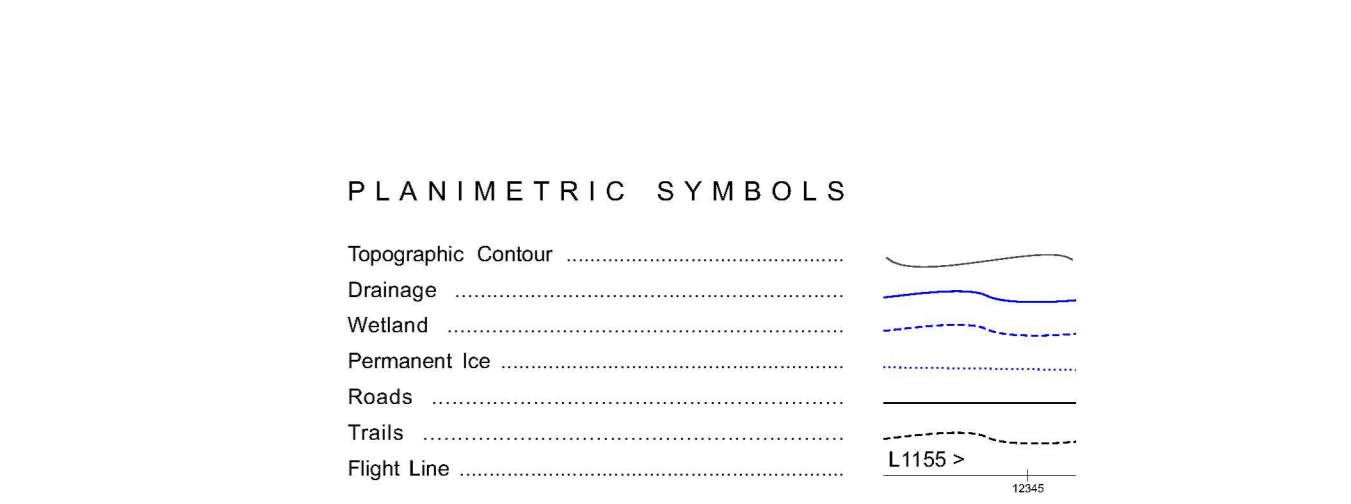
Magnetic Data
The helicopter was equipped with a Scribner CS-2 cesium vapour magnetic sensor mounted in a bird suspended 30 m below the aircraft. The system recorded readings every 0.1 seconds with a noise level of less than 0.02 nT. Magnetic interferences caused by aircraft maneuvers were compensated using an RMS A&D/C Magnetic compensator. Diurnal variations and GPS fluctuations were recorded using a Sandor Geophysics Ground Station Recording System. The International Geomagnetic Reference Field was calculated daily and removed for each flight. The airborne magnetometer data was IGRF corrected, using the location, altitude and date of each point. The IGRF was calculated using the IGRF 2000 model.

The corrected magnetic data was interpolated to a 100m grid using a minimum curvature algorithm. The first vertical derivative grid was calculated from the corrected total magnetic intensity grid using a FFT based frequency domain filtering algorithm. The shaded relief was calculated with an inclination of 10° and a declination of 60°.

Positional Data
Survey line spacing of 500 m and control line spacing of 4000 m was used for the Prairie Creek, Caribou River and Flat River survey blocks. Survey line spacing of 500 m and control line spacing of 2400 m was used for the Selkai Range survey block. Survey lines were oriented N-S for the Prairie Creek and Caribou River areas. For the Flat River area survey lines were oriented NW-SE and for the Selkai Range survey lines were oriented SW-NE. Survey and control line positions were pre-planned using Sandor Geophysics Limited, Smooth Drive software. Terrain clearance was monitored by radar altimeter. Positional data were recorded using a dual frequency Novatel Millennium system. GPS ground station data were combined with airborne GPS data to produce differentially corrected positional data with an accuracy of 2 to 5 m.

Data Presentation
Colour levels and contours were calculated for each grid and combined with map surround information to create HP RTL plot files, which were plotted using SGL's HP DesignJet colour plotters.

Project Funding
The Prairie Creek, Caribou River and Flat River surveys were funded by Parks Canada through the Mineral and Energy Resource Assessment Project. The Selkai Range survey was funded by the Northwest Territories Geoscience Office. Technical expertise and contract administration were provided by the Radiation Geophysics and Regional Geophysics Sections of the Geological Survey of Canada.



This airborne geophysical survey and the production of this map were funded by Parks Canada through the Mineral and Energy Resource Assessment Project.

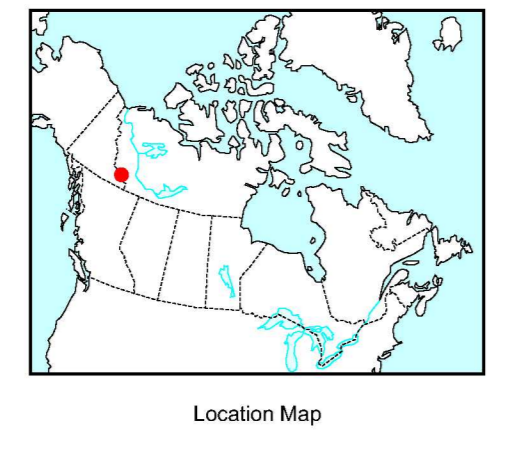
**GEOPHYSICAL SERIES - NTS 95 D/15 and 95 D/16 - LAST MOUNTAIN
NORTHWEST TERRITORIES**

**FIRST VERTICAL DERIVATIVE
OF THE MAGNETIC FIELD MAP**

Scale 1 : 50 000 - Échelle 1 / 50 000

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
NAD 83 - NORTH AMERICAN DATUM 1983
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Parks Canada
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