# Aeromagnetic surveying with a rotary-wing unmanned aircraft system: a case study from a zinc deposit in Nash Creek, NB

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The SkyLance rotary-wing unmanned aircraft system (UAS) is an aeromagnetic survey platform presently under development by Stratus Aeronautics. The system has been mainly built with carbon fibre material to reduce the magnetic interference from the UAS frame on the magnetometers; only a 0.5nT shift in total magnetic intensity (TMI) occurs when the system is powered on. It has four perpendicular arms that each carry a set of two rotors mounted vertically, allowing the system to utilize a total of eight rotors for propulsion. Lithium ion batteries power the rotors as well as the avionics and the payload electronics. The payload consists of a fluxgate magnetometer mounted at the front of the system, used for aircraft attitude and navigation, and a cesium vapour magnetometer mounted at the end of a long pole at the back of the aircraft, used to perform the aeromagnetic surveys. In October 2015, an aeromagnetic survey was performed with the SkyLance UAS over the Nash Creek zinc deposit in New Brunswick in order: (1) to test the UAS in flight and (2) to compare the aeromagnetic data acquired by the UAS with ground magnetic data collected a few weeks earlier. The Nash Creek property is located a few kilometers from the southern coast of Chaleur Bay and is composed of volcanic breccias, siltstones, limestones, mafic flows, rhyolites, and tuffs. Volcanic and sedimentary rocks were deposited in a half-graben containing shallow water, where faulting allowed hydrothermal fluids containing Zn, Pb, and Ag to deposit sulfide minerals. The UAS executed three flights at an average altitude of 80 m above ground level (AGL) where it is theoretically expected to be able to detect bodies with a magnetic susceptibility of $10^{-4}$ and a radius of 14 m down to a depth of 40 m. The flights were planned to pass over three magnetic anomalies, which were previously identified in ground magnetic data. Each of the three flights covered progressively further distances (300 m, 500 m, and 900 m) along the survey line, with the third flight covering all three magnetic anomalies. The TMI ranged between 53,550nT and 53,850nT with an average of ~53,700nT. The three flights provided highly repeatable data; there was a maximum difference of ±5nT between each re-flown location. The aeromagnetic data compared very well with the 80 m upward continued ground magnetic data. Overall the SkyLance UAS was successful in delivering high-resolution, repeatable aeromagnetic data.