

## **Magnetic Surveying for Mineral Exploration Using Unmanned Fixed and Rotary Wing Systems**

**M. Cunningham<sup>1</sup>, C. Samson<sup>1</sup>, A. Wood<sup>2</sup>, I. Cooke<sup>2</sup>, B. Doyle<sup>2</sup>**

<sup>1</sup>Department of Earth Sciences, Carleton University, Ottawa, Ontario; <sup>2</sup>Stratus Aeronautics, 628-138, 4<sup>th</sup> Avenue SE, Calgary, Alberta

Typically aeromagnetic surveying is performed by manned fixed-wing and rotary wing (i.e. helicopters) aircraft. However, there has been increasing interest in the use of unmanned aircraft systems (UAS) for this application. These UASs provide an opportunity to conduct low-altitude high-resolution surveys in remote areas, such as offshore and polar regions, while also having smaller personnel requirements and avoiding the safety risks for pilots. Until recently, surveying with a UAS (defined as a commercial aircraft that is flown remotely) needed approval from Transport Canada in the form of a Special Flight Operations Certificate (SFOC). Safety requirements depend on the mass of the UAS: 2kg or below, between 2kg and 25kg, or greater than 25kg. Since November 2014, however, the regulatory framework has been simplified for UASs under 25 kg. As a result of this, there is increased momentum for the use of small UASs in surveying for mineral exploration. Stratus Aeronautics is at the forefront of this effort. The company is currently developing two UASs intended for aeromagnetic surveying. The “Venturer” is a 55kg (with fuel) fixed-wing UAS which has a wingspan of 4.95m and a length (nose-to-tail) of 2.75m, and is in the advanced development and testing stages. It carries two magnetometers, in pods at each wing tip, allowing for magnetic gradiometry. It is capable of flying for up to 10 hours at approximately 100km/h. Subject to terrain, the preferred altitude is 50m above ground level. Data from test flights have shown that fourth-difference noise levels are  $\pm 0.05\text{nT}$ , well within industry standards. The second platform, an unmanned helicopter, is currently in its early stages of development. It is designed to fly as low as 2m above ground level (depending on terrain) and is intended to become a cost-effective alternative to ground surveying. The system weighs less than 25 kg, so it should therefore qualify for Transport Canada’s simplified regulatory process. It carries a payload including a magnetometer, forward and downward facing cameras, as well as an altimeter.