Project Profile

Project Name:	Assessing the use of Unmanned Aircraft Systems (UAS) and multisensory data to monitor the reclamation of well sites
Project Number:	EI-2018-01
Proponent:	University of Victoria (Dr. Olaf Niemann)
Funding Envelope:	Environmental Impact
Timeframe:	July 1, 2017 to April 30, 2018

Project objectives

The objectives of the project are as follows:

- demonstrate the effectiveness of using UAS technologies to collect detailed datasets for relatively small areas;
- assess the effectiveness of these data in the reclamation auditing process; and
- assess the relative utility of the various data collected.

Project background

The auditing of abandoned and reclaimed well sites is mandated by provincial authorities and falls under the jurisdiction of the oil and gas regulators. Meaningful mapping and assessment of the efficacy of the reclamation process has traditionally been carried out using in-situ observations by the regulatory agencies. In such ground campaigns visual assessments of the state of recolonization by native vegetative cover and indications of possible residual contamination are conducted. Remote sensing technologies provide a toolbox to assess spatial and functional states of this vegetative cover. Unfortunately, collecting data with sufficient levels of spectral and spatial detail are prohibitively expensive in many cases. UAS-derived earth observation imagery, however, may provide an inexpensive and efficient source of evaluation data.

Project approach

The project involves two phases:

1. Acquire UAS-based data—over a selection of abandoned well sites that have been rehabilitated. UAS flights using a multisensor payload, composed of an imaging spectrometer (visible to near

infrared), LiDAR, and RGB camera, will be used. The imaging spectrometer has the capacity to acquire data between 400 and 1000 nm with a spectral sampling of ca. 2.5 to 5 nm. The spatial resolution of the spectrometer data will be from 3 to 10 cm depending on the flying height (forward velocity will be constrained to produce an equivalent along track sampling distance). The LiDAR has a pulse frequency of ca. 300,000Hz; the ground density of lidar will be dependent on flight height, speed and flight line side lap. The RGB images will have a spatial resolution of ca. 3 cm. We will fly each of the sites with a number of configurations, as conditions permit, to allow us to collect a variety of resolutions for analysis.

2. Process data—processing steps include:
    - orthorectification all of the imagery to a common base;
    - radiometric and atmospheric correction of optical data (imaging spectrometer);
    - cleaning and modeling of LiDAR data to produce digital elevation models (DEM) and canopy height models (CHM);
    - generation of elevation point clouds derived from photography (termed PhoDAR);
    - analyzing the data to assess the state of vegetation health/stress and species identification from the fusion of the different datasets; and
    - evaluating the efficacy of PhoDAR compared to LiDAR along with multispectral vs imaging spectrometer data. This final analysis will be important as PhoDAR and multispectral data are more easily and inexpensively obtained than LiDAR and imaging spectrometer data, and so therefore more readily accessible

Project deliverables

The deliverables from this project include the following:

1. A report summarizing the project procedures and results obtained.
2. Georeferenced data detailing the characteristics of the surface and cover over the reclaimed well sites.