Wings Over Alberta

Unmanned aerial systems help reduce environmental impacts in Canada's oil fields.

One of the world's six largest oil-producing nations, Canada produces roughly 3.5 million barrels of oil each day. Much of Canada's oil comes from the Athabasca oil sands in Alberta, the world's third-largest proven crude oil reserve. Just over 50 percent of Alberta's oil is produced using Steam-Assisted Gravity Drainage (SAGD), an in-situ technique that uses a pair of parallel wells drilled horizontally into an oil sand formation. Because SAGD eliminates the need for open pit mining, it presents a more environmentally friendly approach to extracting the oil. It's expected that SAGD will provide most of the future growth in production from Canada's oil sands.

The Taiga Project

Based in Calgary, Osum Oil Sands Corp. is a major in-situ oil producer. One of Osum's projects is the Taiga Project in the Cold Lake area of northeast Alberta, where Osum is developing its leases on roughly 2,600 acres (1,050 hectares) of land. When the Taiga is operating at full capacity, Osum expects to produce 45,000 barrels per day.

The Taiga project lies on lands that have been used by aboriginal people for hundreds of years. Osum assigned Aboriginal Relations Coordinator Marie Robidoux to coordinate the gathering of data representing the current state of the site. A Canada Lands Surveyor, Robidoux needed maps and detailed information for planning and construction as well as archeological and environmental assessments for reclamation purposes. Although some earlier high-altitude LiDAR data existed, Robidoux wanted imagery with higher resolution.

"We needed detailed information on the pre-construction conditions," Robidoux said. "I had read about unmanned aerial systems (UAS) for mapping and was interested in using it for Taiga." After discussing the project with Paul DeGraff, Vice President of International Operations for LW Survey Company (LWS), Robidoux was convinced that UAS could provide the needed information. The companies agreed on deliverables that included color orthophotos, a digital surface model (DSM) and infrared imagery. "The high-resolution photos will let me see what is on the site," Robidoux explained. "The area has been used by aboriginal groups for centuries. The ortho imagery gives us bird's-eye views and lets us see existing trails and try to preserve them if possible."

LWS project manager Neil Robicheau conducted the field operations. Robicheau used two different UAS aircraft: a Trimble Gatewing X100 and the Trimble UX5 Aerial Imaging Solution. In the field, both aircraft were controlled using the Trimble Yuma® Tablet. Robicheau used the photogrammetry module in Trimble Business Center (TBC) software for office processing.

An Unusual Airspace

To gain authorization for the flights, LWS worked with Transport Canada to obtain a Special Flight Operations Certificate (SFOC), which spelled out the times and dates, location and purpose of the flights as well as the operator and type of aircraft. Robicheau needed special permission to fly the UASs in the airspace between two military installations, which comprised Canada's largest air force base and its weapons training ground.

Limited by the dense vegetation at the Taiga sites, Robicheau selected five different locations from which the aircraft could cover the needed areas. A typical flight lasted 35 to 45 minutes, with the aircraft staying within 1.2 km (3,900 ft) of its takeoff site and control station.

Robicheau flew the project twice. The first flights used the Trimble Gatewing X100 to capture imagery in the near-infrared wavelengths and supply information on the site's vegetation. The remaining flights used the Trimble UX5 to collect color images for orthophotos and 3D surface models.

Using the Trimble UX5 controlled by the Aerial Imaging module for Trimble Access™ software, Robicheau conducted 18 flights in four and one-half days. The aircraft made the work go quickly; it needed only 10 minutes to download data from a flight and upload the next flight plan and install a freshly charged battery. Robicheau said that the short turnaround time between flights is an important aspect to successful flight operations.

In addition to the short turnaround time, Robicheau said that the ability of the Trimble UX5 to fly and land in confined areas provided needed flexibility in choosing takeoff and landing sites. "It felt like the UX5 could land on a dime," he said. He also cited the larger, wide-angle image sensor, faster speed and longer flight endurance as contributing to the UX5 performance.

The heavy vegetation provided challenges in producing ground elevations. "With the photogrammetry, you're getting predominantly the tree tops," Robicheau said. "By analyzing the photography and the point cloud, we could check the areas where there was an opening and see spot elevations."

The image resolution of 5 cm (2 inch) per pixel provided exceptional clarity and delivered resolution much higher than could be obtained from high altitude flights. "At that resolution, you can see individual leaves on the ground," Robidoux said. She added that because the UAS captures "everything," it eliminates missing data as the cause for revisits by survey crews. "It's very helpful in getting additional data, including information that you didn't know you needed until after the field work was done."

Robicheau sees the long-term potential of UAS. When combined with technologies such as mobile LiDAR, he thinks that aerial systems can dominate mapping applications. "The accuracy is there and it beats doing a whole topo with a survey crew," he said. "The application market for this is wide open. We're going to find ways to use it to save our clients time and money."

See the feature article in Professional Surveyor Aerial Mapping Spring 2014: www.profsurv.com

Robicheau compares the X100 and UX5 airframes. The UX5's larger wing area allows for better flight performance and shorter landings.

LW Survey Canada Chief Pilot Zak Bland recovers the X100 after a flight. The aircraft automatically descends and lands at a specified location.

Technicians prepare to launch the Trimble UX5.

A colorized 3D point cloud from the Taiga site. The 3D model was developed using aerial imagery from the Trimble UX5.