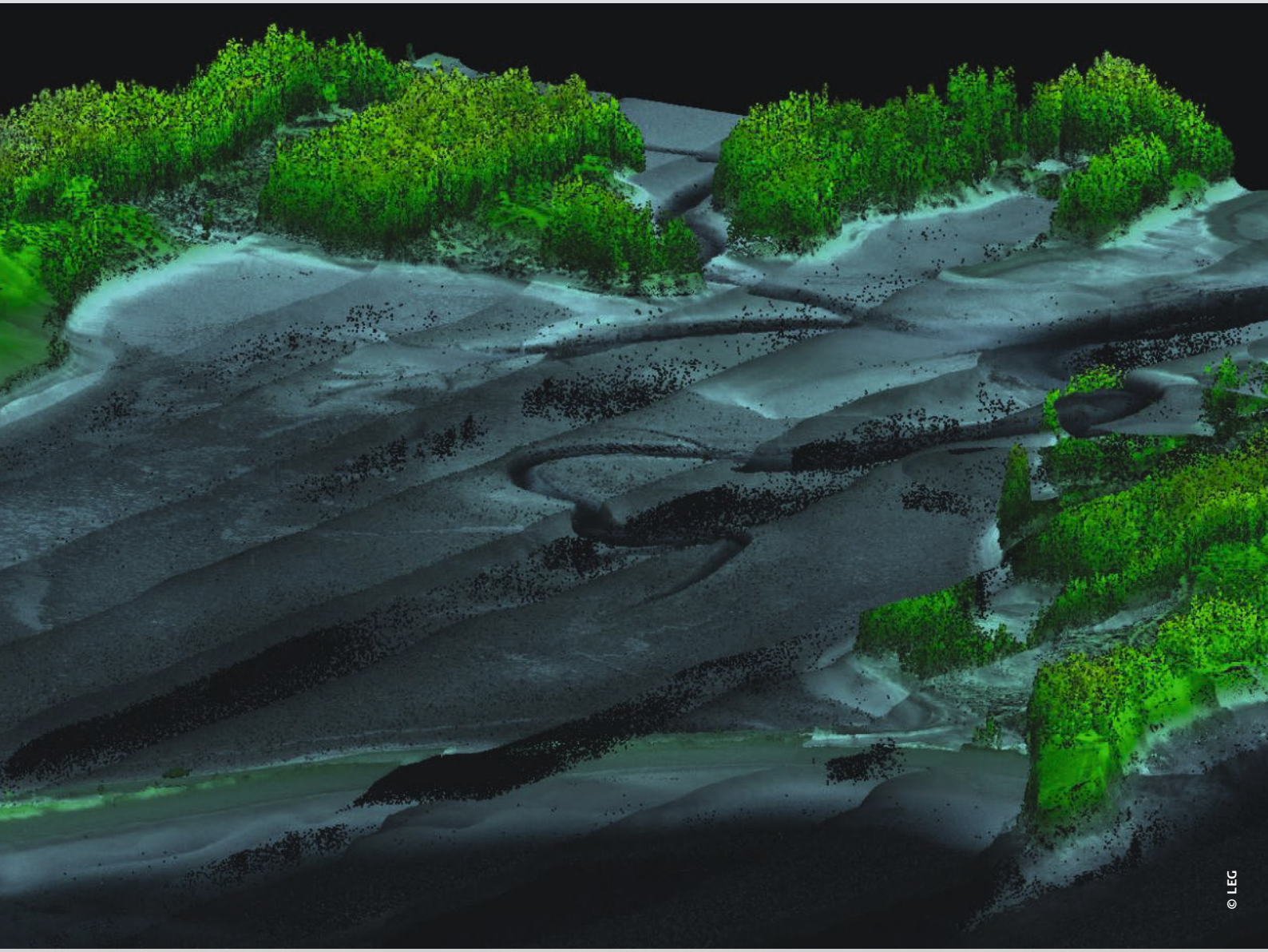
Exploring the surface below water

by Wayne Richardson

In September 2014, Leading Edge Geomatics (LEG) working together with staff from the Nova Scotia Community College (NSCC) and the Applied Geomatics Research Group (AGRG), installed the Airborne Hydrography AB (AHAB) Chiroptera II system, used for near shore environmental monitoring, into the Beechcraft King Air 90C aircraft. This was needed to perform the team's first ever point clouds using a topobathymetric system. A leading topographic LIDAR and aerial photo collection company with projects throughout North America, LEG decided to put its extensive operational and data processing expertise into using this new LIDAR scanning system, anticipating new markets and research in shallow water environments. It is hoped that this new sensor will lead the way in this area.

Anyone who has ever attempted to fly aerial surveys in the Atlantic Region of Canada will realise that it is extremely rare to find two consecutive days of cloud-free conditions. Even given the low altitudes that the system is meant to acquire data at 400 metres (1,300 feet), we were not expecting to move this initial project along as quickly as we did. Fortunately, the initial flights were launched during an unusual back-to-back series of sunny, clear days, with some of the best flying weather any of us could remember. With the exception of a few areas that had to be recollected due to muddy sediment in water columns, we were able to collect all of our priority projects in less than one week. Because the Leica Chiroptera II system is so user-friendly and easy-to-learn, the team was able to run several operators through training while capturing the data, and all of them reported an intuitive, easy-to-operate interface. The system allows operators to analyse wave-



forms sampled during flight collections to determine if the submerged ground was being recorded. This enables operators to quickly make decisions that save not only precious flight time and expenses but also guarantees the success of many flight missions.

This processing software provided by AHAB, known as LIDAR Survey Studio (LSS), enables viewing scanning results while still in the aircraft. Having used several other competitions' LIDAR data processing applications, the team found LSS capable of easily configuring, processing, and outputing the final data. The software combines the flight path, processed with any SPAN (Sychronised Postion Attitude Navigation) with the raw waveform, and presents it in an intuitive and well laid-out interface. Processing parameters are set via configuration files for system settings, processing settings (classification method), and calibration (sensor misalignment). The results of the software processing provide positioned and fully classified data. The user then examines the processed data of the bottom hits in relation to the water surface to determine if the classification was successful. If some modifications are required, changes are made and the data is run through the software again until the classification represents the data properly. Producing calibrated, correctly positioned and classified datasets is a very straight forward process.

The full 3D view displays the points quickly and smoothly, allowing the user to examine the processed results easily and work on the data to represent it as needed. The tools for display provide countless ways to represent the results. Selecting an individual return, or point from the data, displays the corresponding waveform data and image. These views aid in determining the accuracy of the data

classification. The only limitation is the lack of manual classification tools. It would be useful to be able to change the classification of points based on the wealth of data contained in the full waveform and the rapidly available QC images (images that analyse the quality of the data). In practice, this may make it easier to understand if a return is in fact a bottom hit or submerged vegetation, instead of doing the classification clean-up in a third party application without access to the waveform information.

The Chiroptera II is a well-built, solid solution for shallow water collection. Our team was able to achieve excellent penetration results, but as expected, the system is heavily dependent on good water clarity. Areas such as the St John River would immediately block return data when another stream of water enters the river. This is not unexpected and murky water will remain an obstacle to this system. However, in areas where the water clarity is acceptable, the system performs superbly. The inlets on the New Brunswick Northumberland shore yielded excellent results with almost all of the sea bottom mapped.

The Sable Island data showed surprising clarity at depth penetration to 15 metres (49 feet). The topographic scanner (sold separately as the Leica AHAB DragonEye) was tested on Sable Island in isolation from the bathymetric scanner. This scanner performed well at 1,400 metres (4,600 feet) and provided ground sampling at better than one point per metre. The multiple look angle of the system ensures minimal LIDAR shadows in the data, which could possibly eliminate the need for multiple passes. Overall, the Chiroptera II is an extremely capable, flexible and well-designed Topo-Bathymetric system. ■

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The Leica Chiroptera II

The state-of-the-art Leica Chiroptera II system combines a 500 KHz topographic scanner and a 35 KHz hydrographic scanner with a 60 MP Leica RCD30 photogrammetric camera. The purpose of this system is to collect the littoral, or water shore, boundry and shallow water, where it is difficult and expensive to capture with traditional side scan or multi-beam systems, due to the navigation difficulties in shallow waters and harbours. This system also has the potential to provide a wealth of data for inland waterways, where currently only physical measurements of the bottom of lakes and rivers are possible. The Chiroptera II is designed to penetrate to depths of up to 1.5 x Secchi depth. Depending on water clarity, it should be reasonable to expect that this system can penetrate to 15 metres (49 feet).