CANADIAN HYDROGRAPHIC SERVICE

Using the Latest Technologies to Gather Information

Demonstrating seabed mapping using Multi-beam echosounder technology

Surveying Canada's oceans, lakes and rivers is a mainstay of the Canadian Hydrographic Service's (CHS) mandate, and has been since 1883 when CHS was established.

Long gone, though, are the days when hydrographers measured water depth with techniques like lowering a weighted line into the water.

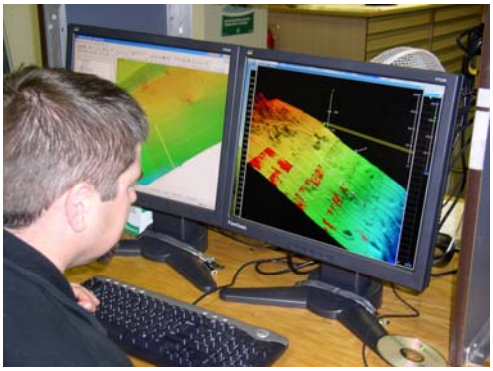
Today, CHS has an astounding array of options for gathering data.

Technology Based on Sound and Light

Sonar Devices

To study underwater depths, our hydrographers turn to sonar devices that convert electrical signals to sound pulses through a reflecting layer. These pulses are reflected off ocean and lake floors and return to the surface as echoes.

The sonar devices repeat the process again and again over a survey location, recording and analyzing time intervals between the initiation of sound pulses and the reception of echoes. This enables them to accurately determine the depth and features of the floor.



The 'echo-sounding system' consists of a transmitter, a receiver to pick up the echo, electronic time and amplification equipment, and a recorder.

Different devices have been developed for specific conditions and to deliver particular types of data. These include:

- *Single-beam sonar:* single-beam echosounders measure the time it takes for a pulse of sound from a transducer to travel from the vessel to the seabed and back. With knowledge of the speed of sound in water, water depth can then be determined.
- *Multi-beam sonar:* an array of single-beam echo-sounding (from 2 to 36) that is operated in a coordinated manner at the same time from a single ship to obtain greater detail;
- *Through-ice bathymetry:* an echo-sound transducer is placed on the ice and records water depth information;
- *Side-scan sonar:* a category of sonar system used to create an image of the sea floor in order to detect obstructions; and
- *Bathymetric side-scan sonar:* sends out narrow signals at various angles to achieve results similar to those of multi-beam sonar.

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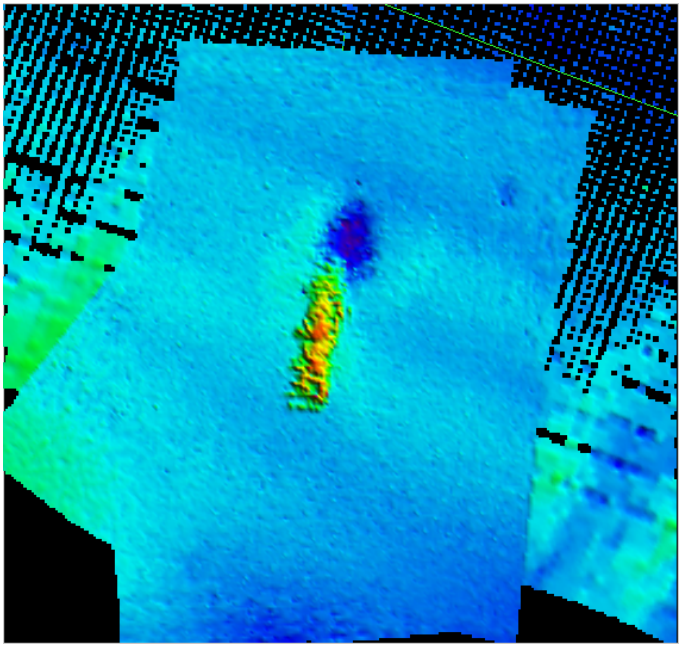
LiDAR – Light Detection and Ranging

Using light instead of sound, a LiDAR bathymeter fires co-aligned laser pulses at the water.

The infrared wavelengths are reflected by the water surface and detected by the receiver, while the blue-green wavelength penetrates the water surface and is reflected from the bottom. The time difference between the two signals indicates the water depth.

Hydrographers have used this technology for several projects since the 1970s. It is efficient and particularly appropriate for mid-to-small charting for bathymetry and topography, as well as habitat mapping and coastal zone management. It is, however, limited by water transluscence.

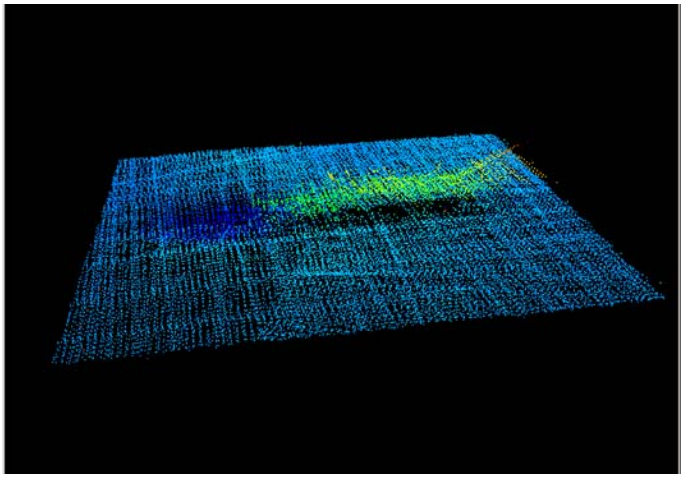


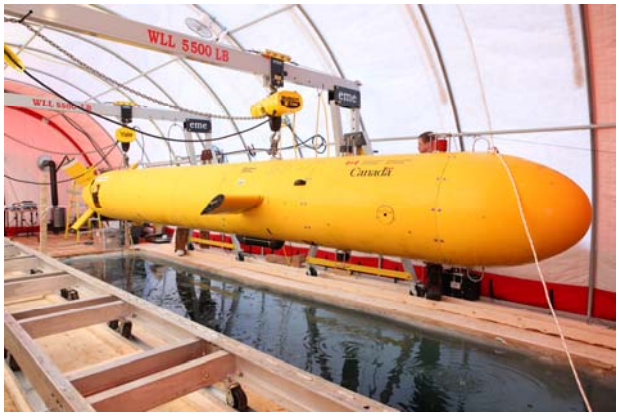
The illustration shows the wreck of the S.S. Nicoya as it lies on the seafloor of the St. Lawrence Estuary. The wreck was detected using a Kongsberg multibeam echosounder EM-1002 onboard the CCGS Frederick G. Creed. The illustration was obtained by processing the data using CARIS HIPS software.

Extending our Reach

Explorer

In April 2010, CHS hydrographers, along with colleagues from other federal departments based at an Arctic ice camp off of Borden Island, Northwest Territories, launched Explorer, an autonomous underwater vehicle (AUV) that navigates through the dark Arctic depths. Equipped with sonar and underwater echo sounder transducers, radio and GPS antennae, this AUV is capable of delivering significant bathymetric coverage.





The Arctic Explorer AUV is prepared for its first dip in the icy waters off Borden Island, NWT.
Photo courtesy of: Don Glencross, DRDC Atlantic

For more information about these and other data acquisition technologies used by the Canadian Hydrographic Service, please visit:
www.chs-shc.gc.ca

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