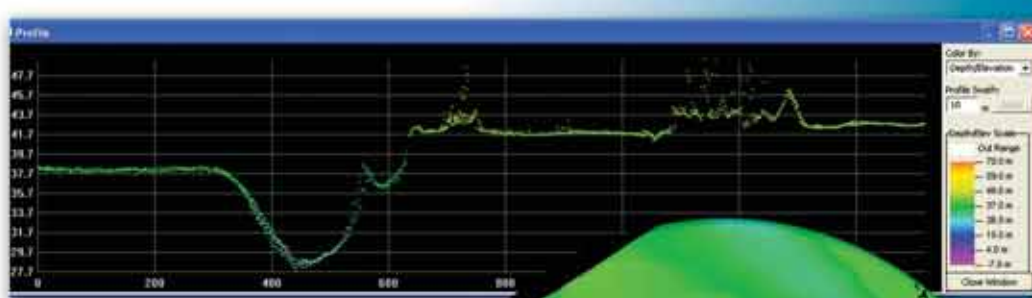


Post-Flight Operations

SHOALS airborne data is downloaded from the removable hard drives and processed in the SHOALS GCS. The GCS includes a fully-integrated third-party software suite, IVS Fledermaus, to edit and clean 3D data.



Data Cross-Section Profile

Applications and Outputs

Applications for SHOALS data include:

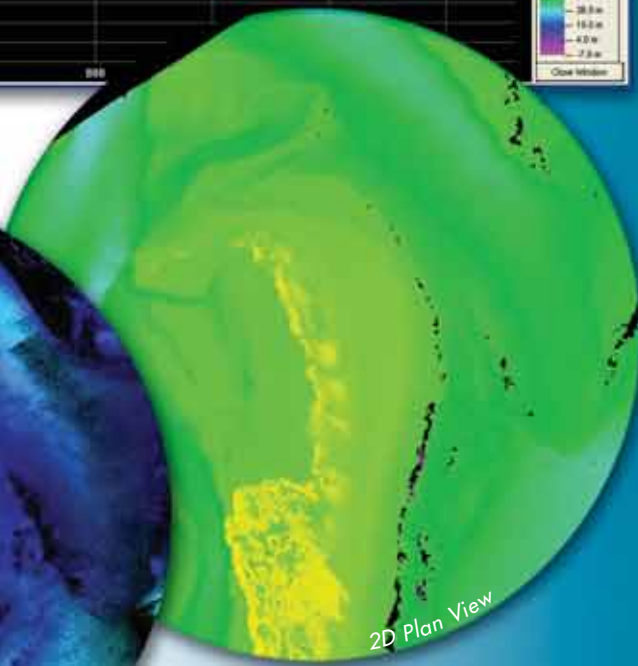
- Nautical chart production
- Shoreline mapping
- Navigation projects
- Emergency response
- Cost-effective support for oil and gas exploration and environmental monitoring
- Beach and coral reef management.

SHOALS also derives sea floor reflectance information (at right) from the lidar return signal. This information is a qualitative estimated measurement of the amount of energy returned from the sea floor. The brighter and thus more reflective the sea floor is, the more energy is returned. For example, an area of bright white sand is represented high on the color scale in comparison to a darker sea bottom of weeds or rock.

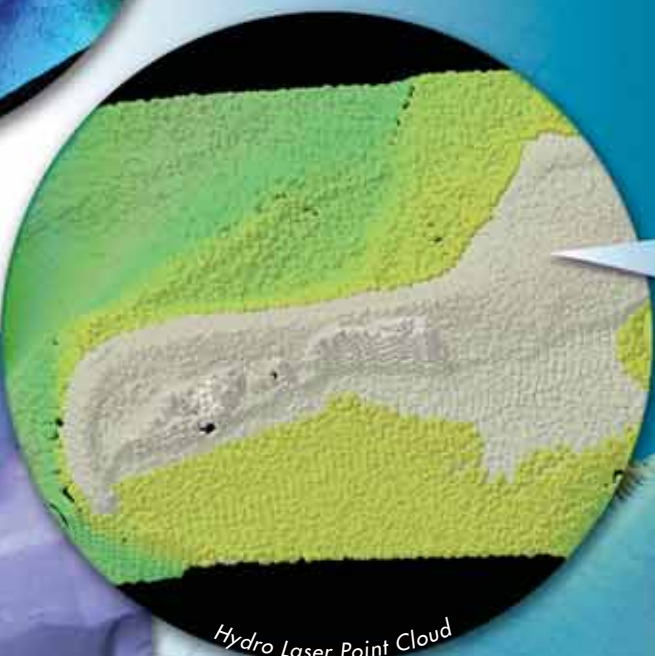
Optech has been the world leader in airborne laser bathymetry for more than 20 years, with approximately 90% market share of systems sold around the globe. Trust Optech to deliver the most advanced bathymetry systems in the world, offering rapid coverage, flexibility, and mobility.



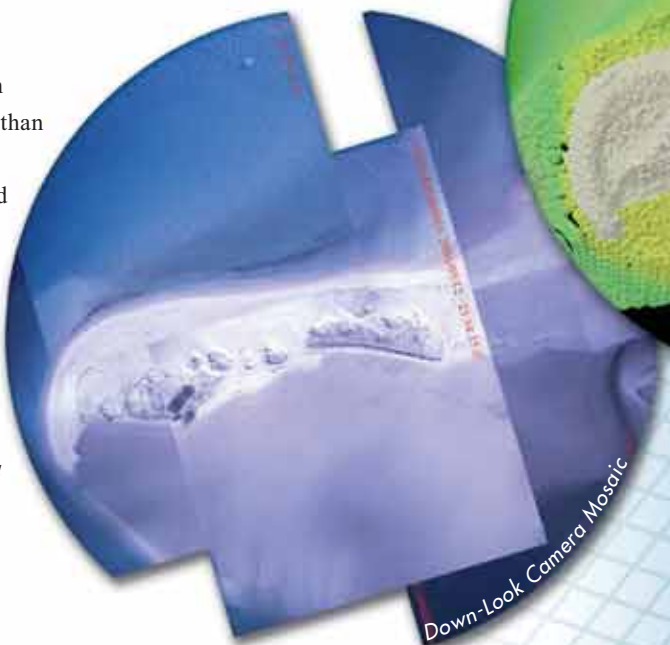
Sea Floor Reflectance Image



2D Plan View



Hydro Laser Point Cloud



Down-Look Camera Mosaic

SHOALS generates many types of information outputs from just one survey! Shown is a survey of Swan Bay, Australia. From top: Data cross-section profile, 2D plan view, bottom reflectance image, hydro laser point cloud and mosaic of down-look camera images. All information was captured simultaneously in one data collection. Imagery courtesy of AAMHatch.



SHOALS

HYDROGRAPHIC CHARTING and MORE...

Challenging scientific limits to meet future needs.

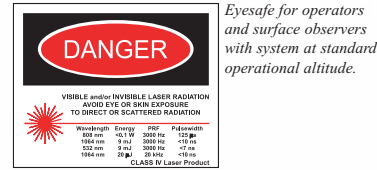
SHOALS, 3D surface digital elevation model highlighting survey detail area of Swan Bay, Australia.



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Web: www.optech.ca/shoals4 • Email: shoals4@optech.ca

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Eyesafe for operators and surface observers with system at standard operational altitude.

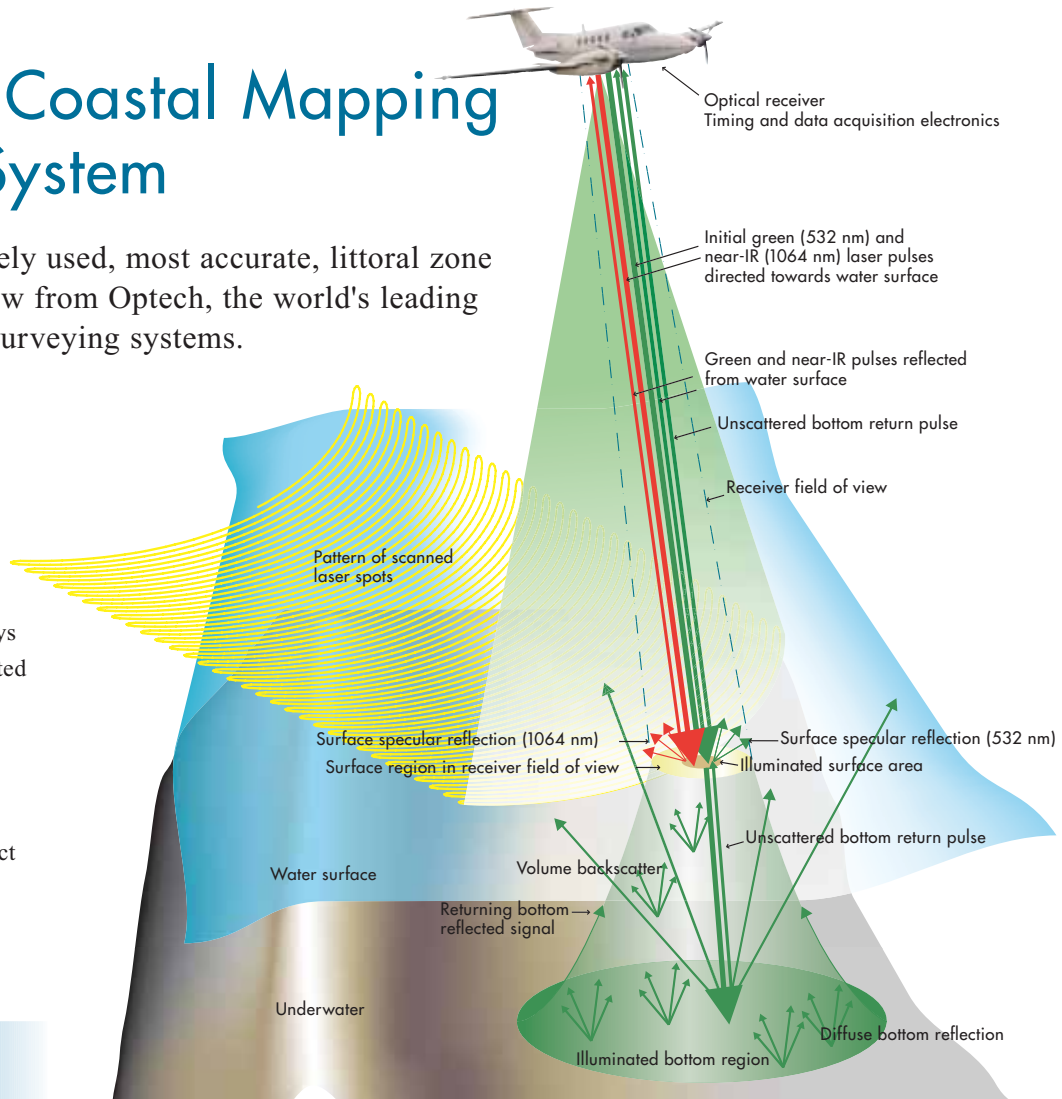
DEM Airborne Coastal Mapping and Charting System

SHOALS, the world's most widely used, most accurate, littoral zone mapping system, is available now from Optech, the world's leading manufacturer of airborne laser surveying systems.

SHOALS is a complete airborne laser bathymetry survey instrument for shallow water and coastal regions. Coupled with a fully integrated flight planning and data processing software subsystem, SHOALS is the cost-effective total coastal survey management solution. It is ideal for surveys where conventional systems are most limited — shallow water, the land/water interface, hazardous areas, and areas requiring rapid environmental assessment.

From start to finish, SHOALS is the perfect solution for your coastal survey needs.

Right: Illustration shows physical principle of operation for an airborne laser bathymeter.



Introduction to Airborne Laser Bathymetry

Airborne laser bathymetry relies on the differential timing of laser pulses reflected from the water surface and the underwater surface to determine the water depth at the point where the laser pulses strike the water surface. The integrated SHOALS sensor and processing systems implement this simple strategy accurately and robustly, maximizing utility for marine surveying.

The figure at right above shows the primary optical processes — specular reflection at the water surface, diffuse reflection from the underwater surface, and absorption and scattering within the water column — that act to produce the green and near-IR surface, green bottom and green volumetric signals measured by the sensor system. The signals are processed and interpreted to yield accurate measurements of the water depth for each laser pulse.

Right: Airborne laser bathymetry and mapping using SHOALS-1000T in a Dynamic Aviation King Air A200. SHOALS-1000T operator rack, and sensor with racks installed in airplane.

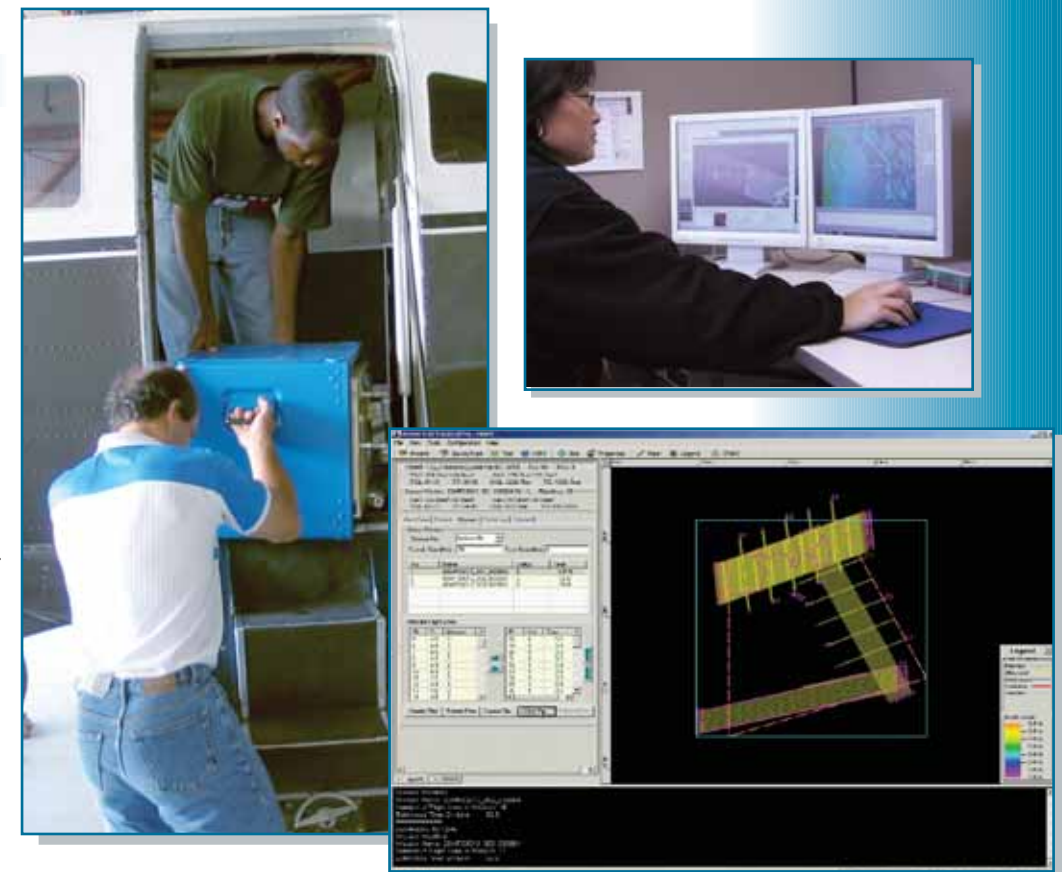


Pre-Flight Operations

SHOALS survey operations are synchronized by the fully integrated SHOALS Ground Control System (GCS). The GCS is a user-friendly solution for mission planning, and for the processing, cleaning, 3D visualization and output of a seamless bathymetric and topographic dataset.

Before flight operations, survey projects are created and individual missions planned in the GCS. Mission plans are uploaded to the SHOALS airborne computer for survey flights.

Pre-flight operations, clockwise from top left: Installation of the SHOALS-1000T into a small aircraft. Dual monitor display for efficient SHOALS GCS operation. Mission planning software, showing the planned flight paths for the new mission.



Airborne Operation

SHOALS is capable of coverage rates as high as 70 km² per hour. SHOALS-1000T collects 1,000 water depth soundings per second at IHO Order 1 standard (or better), and 10,000 coastal terrain elevation measurements per second.

SHOALS-3000 collects 3,000 water depth soundings per second and, when mounted together with Optech's Airborne Laser Terrain Mapper (ALTM), can acquire topographic data at greater than 100,000 measurements per second. All the depth and elevation data is captured with a high-accuracy laser, mounted and measuring through a hole in the aircraft floor. The laser scans beneath the aircraft, sending out pulses in a swath over which the position of the water surface and sea floor is measured.

To correct for the aircraft's movements, the motions of the aircraft are measured by an inertial reference system (IRS). This data is used for real-time pitch and roll compensation, and recorded for post-processing. A GPS receiver records the aircraft's position simultaneously.



The laser pulse, waveforms, scan angle, GPS data and IRS data are combined to produce accurate real-time and post-processed sounding positions or terrain elevations.

The raw SHOALS sensor data collected by the airborne system is stored on mirrored removable hard drives, along with mission planning information and mission log information.

Airborne operation, above: Operator interface. Pilot at controls using the SHOALS-1000T pilot display.