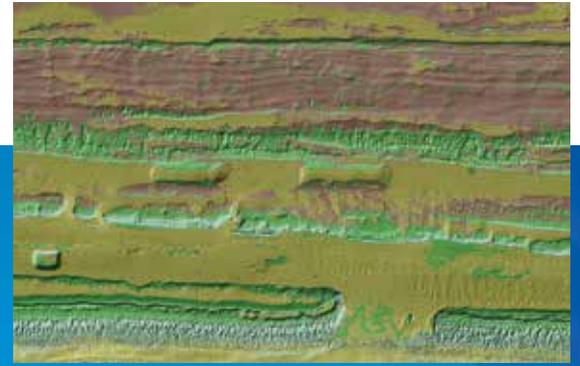


CZMIL FAQs

Airborne Bathymetric Lidar



Shaded Relief Classification

Teledyne Optech CZMIL FAQs

1. What is CZMIL?
2. What are the main applications for CZMIL?
3. Why is CZMIL unique?
4. Who should use CZMIL?
5. How does CZMIL differ from Optech's other airborne lidar bathymeters?
6. What environments can CZMIL operate in?
7. What aircraft is CZMIL installed on?
8. What are the main components and key performance specifications of CZMIL?
9. What software do I use to plan, fly, process and visualize data?
10. Where can I find out more about CZMIL?

1. What is CZMIL?

CZMIL is a breakthrough airborne system that incorporates lidar, hyperspectral and RGB camera technology. It is designed for the highly automated generation of 3D topo/bathy information for coastal zones, especially in turbid and muddy water conditions. Teledyne Optech has over 30 years of experience in designing, deploying and servicing airborne lidar bathymeters. CZMIL integrates our latest technologies to produce high-resolution 3D environmental information of the surface, sub-surface and water bottoms.

CZMIL was designed by Optech for the U.S. Government under the auspices of the U.S. Army Corps of Engineers (USACE) and the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX). It was built and tested by Optech with the assistance of the University of Southern Mississippi (USM).

2. What are the main applications for CZMIL?

With its multiple sensors, advanced engineering and sophisticated data fusion, CZMIL expands your portfolio of coastal zone mapping to include:

- » Shoreline mapping and coastal management
- » Harbor and navigation channel inspection
- » Turbid and muddy waters
- » Beach/coastal erosion monitoring
- » Nautical charting
- » Aquatic ecosystems management
- » Rapid environmental assessment
- » Submerged object detection

And more....

3. Why is CZMIL unique?

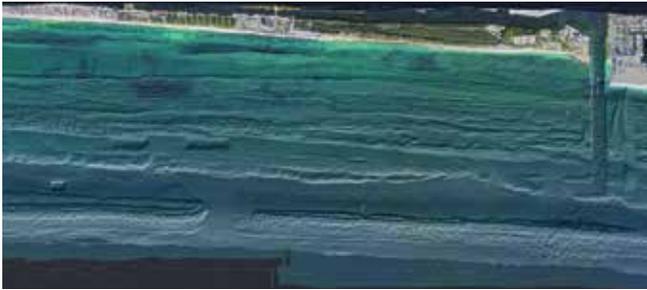
Until now, coastal areas such as the surf zone and turbid waters have been especially challenging to lidar sensors. Advances in processing bathymetric lidar signals—and in the fusion of these signals with ancillary sensor data such as hyperspectral imagery—have led to improved hardware that supports more advanced environmental applications.

With its enlarged receiver aperture (4 times the size of previous sensors) and doubled spatial resolution, CZMIL accelerates data and product delivery, and improves the quality of information products derived from fused lidar and imagery data sets. And when it comes to traditionally problematic areas, CZMIL's lidar sensor delivers unprecedented performance with innovative features such as:

- » Circular scan pattern providing two 'looks' at any target, for optimal object detection
- » Simultaneous high-density topo/bathy data from a single laser, using a segmented detector capable of up to 70,000 measurements/second.

4. Who should use CZMIL?

CZMIL is a powerful tool for government charting and mapping agencies, as well as commercial engineering and surveying companies, and military agencies.



HydroFusion

5. How does CZMIL differ from Optech's other airborne lidar bathymeters?

Building on Optech's 30-year heritage in airborne lidar bathymetry, CZMIL fuses lidar, camera and hyperspectral imagery while incorporating the latest advances in 3D data visualization techniques. CZMIL advances from Optech's earlier SHOALS system by:

- » Providing simultaneous topographic and bathymetric data, with higher data collection rates
- » Characterizing the water column and water bottom
- » Fusing lidar, hyperspectral and camera data into a single output
- » Providing a single software platform, Optech HydroFusion software, handles flight planning, in-air system monitoring and control, and data processing.

6. What environments can CZMIL operate in?

CZMIL collects simultaneous depth and topographic data in shallow-water coastal zones such as coastlines, river environments, ports and harbors, navigation channels and islands. It operates over built-up shorelines as well as pristine areas and inland, more turbid waters. CZMIL obtains depths and water bottom data down to approximately 70-75 m depending on water conditions.

7. What aircraft can Optech be installed in?

CZMIL can be installed in a variety of aircraft. Our engineering team has supported installations all over the world in a variety of aircraft, from large planes to as small as a Piper Navajo.

8. What are CZMIL's main components and key performance specifications?

CZMIL's main components are:

- » Lidar sensor
- » Digital camera
- » Hyperspectral sensor
- » Position and orientation (POS) system
- » Optech HydroFusion software.

Key Performance Specifications for Shallow Hydrographic Modes

Area coverage.....	~60 km ² /hr
Depth range	Up to 3 x Secchi depth
Accuracy	IHO Order 1 or better
Measurement rate, hydrographic mode.....	10 kHz
Measurement rate, topographic mode.....	70 kHz
Aircraft speed.....	140 knots
Aircraft altitude.....	400 m nominal
Sounding density	2x2 m nominal

Key Performance Specifications for Deep Hydrographic Modes

Area coverage.....	~60 km ² /hr
Depth range	Up to 3 x Secchi depth
Accuracy	IHO Order 1 or better
Measurement rate, hydrographic mode.....	80 kHz
Measurement rate, topographic mode.....	70 kHz
Aircraft speed.....	140 knots
Aircraft altitude.....	400 m nominal
Sounding density	2x2 m nominal

9. What software do I use to plan, fly, process and visualize data?

A single tool, Optech HydroFusion is used to plan and process, and CZMIL NAV is used for in-air system monitoring and control. HydroFusion is an all-in-one workflow tool that handles flight planning, and all sensor data processing. It uses multi-thread parallel processing to fuse lidar, hyperspectral and camera data into a single output product. HydroFusion is a Windows-based application with a workflow-based interface that displays coverage and flight lines, waveforms, system parameters, and diagnostics and QA/QC data. It includes 3D visualization and data editors.

Position and orientation data is processed using the industry-standard Applanix POSPac™ suite of tools.

10. Where can I find out more about CZMIL?

To get to the bottom of a marine environment, contact your Regional Sales Manager, who can be found at: <http://www.teledyneoptech.com/index.php/contact-2/sales-representatives/marine-czmil-system-sales/>

Or, visit <http://www.teledyneoptech.com/index.php/product/czmil/>

Or call 228-252-1004