TELEDYNE OPTECH
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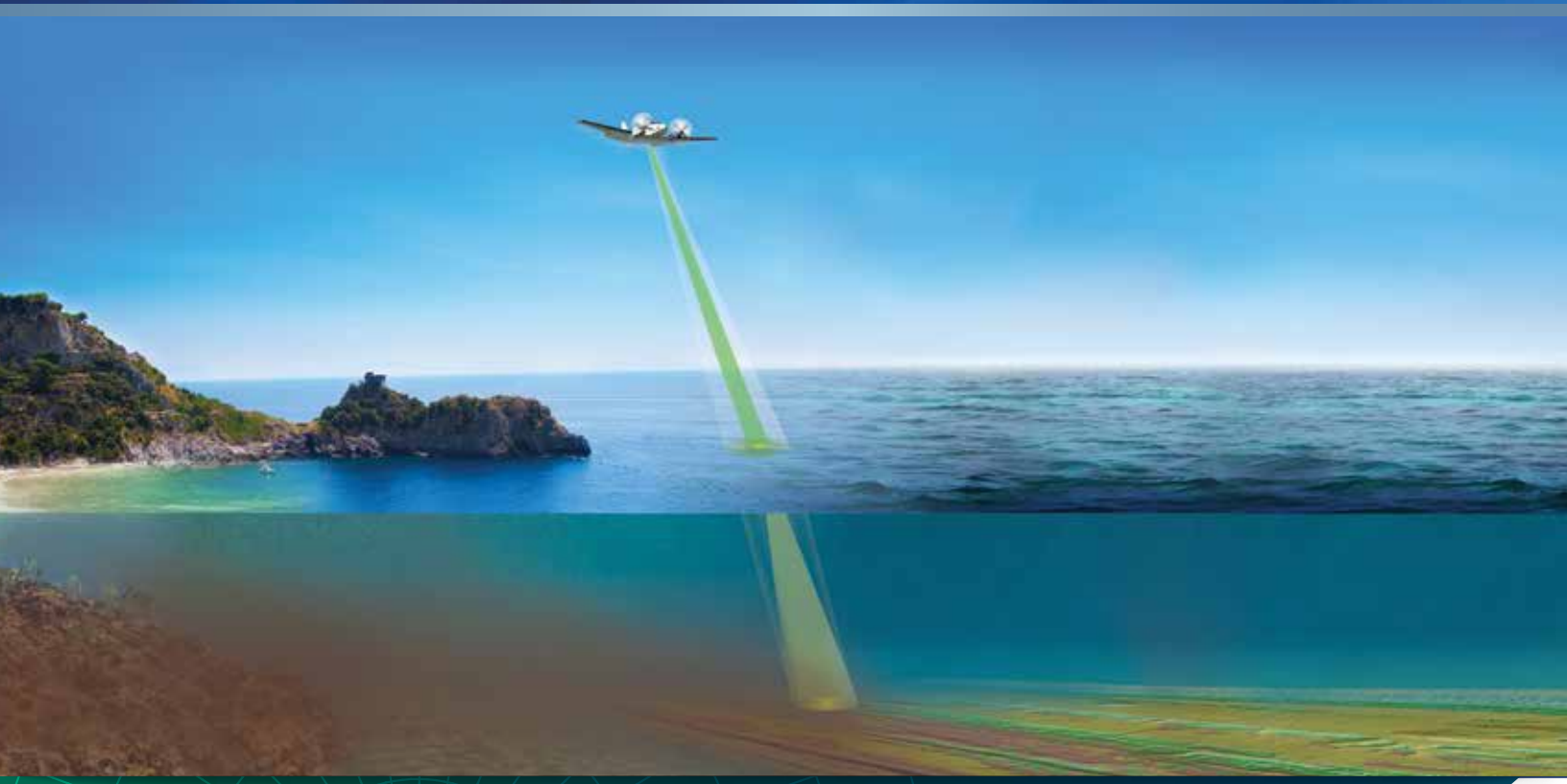
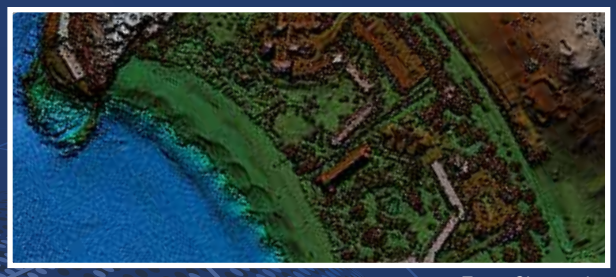
CZMIL Project Program

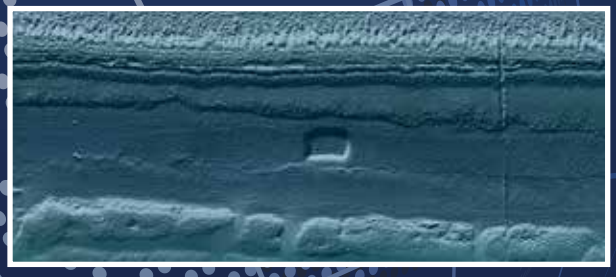


CZMIL Nova Results



Topo Channel

Shallow Channel



Deep Channel

About the CZMIL Project Program

The CZMIL Project Program puts the world's most powerful, compact, and productive airborne topo/bathy mapping system in the hands of those needing a powerful sensor for smaller projects. By offering such a program, Teledyne Optech has greatly reduced the expenditures usually associated with such an advanced system. Government agencies and supporting contractors can take on previously impossible projects, creating seamless topography bathymetry in real-world conditions using CZMIL Nova's unparalleled turbid water penetration and HydroFusion's advanced and automated data processing workflow.

CZMIL project use is on a per-diem basis, and includes a comprehensive package of sensor systems and operators that provide in-depth training and support for planning, acquisition and processing. Both experts in airborne bathymetry and non-experts with a need for the results can take advantage of what CZMIL Nova can deliver without capital equipment expenditures. Simply contract the CZMIL Project Program, and obtain the critical data you need when you need it.

About CZMIL Nova

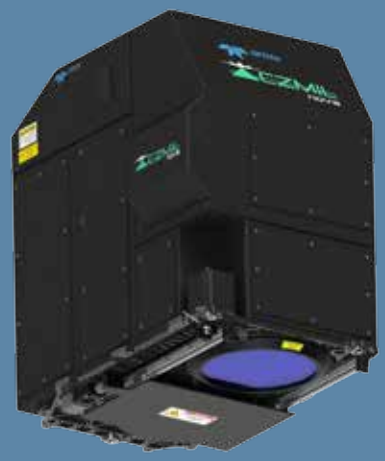
The culmination of Teledyne Optech's decades of experience in lidar bathymetry, the full-waveform Optech CZMIL Nova is the latest version of the most field-validated airborne bathymetry and water column characterization system in the world. Several are in use by government agencies performing critical work. The CZMIL Nova is optimized for weight and size, and can be mounted in aircraft as small as a Piper Navajo. Leveraging the comprehensive HydroFusion planning and automated processing workflow, CZMIL Nova produces simultaneous bathymetry, water column characterization, object detection, and seafloor classification. In addition, the HydroFusion Turbid Water module has advanced algorithms that provide clear results even in muddy conditions.

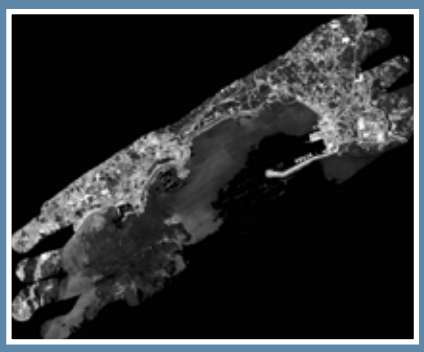
- 100% system validation in clear and turbid/muddy waters (Florida and Mississippi) meeting U.S. Government standards
- Several operational systems being used for national coastal missions in Turbid water - Mississippi and Korea, Normal water - Great Lakes and Korea, Clear water - Florida, Bahamas, Honduras and Korea
- Best K_d*Dmax in both deep and shallow channels
- CZMIL Nova pulse duration is half that of comparable systems, resulting in twice the pulse power, enabling deeper penetration in clear and optically turbid waters
- Consistent results for seamless topo/bathy in clear waters up to 80 m
- Best operational productivity with all in one HydroFusion workflow and data fusion software
- The only airborne bathymetric system fully integrating a hyperspectral camera for automated classification and extraction of water quality data within the visual region (400nm to 800nm)

Applications

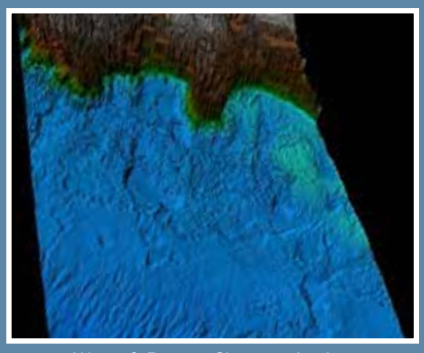
CZMIL systems have been validated and are in use by several government agencies for their high priority coastal mapping programs, and the CZMIL Project Program now makes this technology available to a wider range of organizations and applications:

- Nautical charting to IHO standards
- Climate change planning for coastal areas
- Inspecting high-value harbours and navigation channels
- Submerged object and leak detection
- Disaster planning and response
- Water quality assessment
- Seamless topography and bathymetry mapping

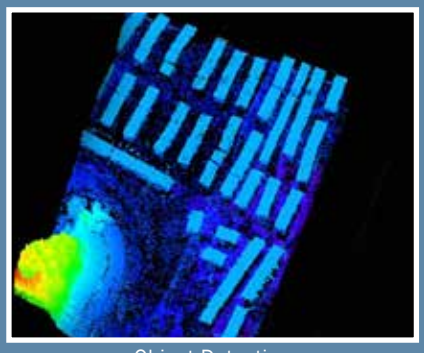




Efficient Airborne Coverage



Water & Bottom Characterization



Object Detection

Parameter	CZMIL Nova	CZMIL Nova Benefits
Deep Channel		
Deep Channel Pulse Energy (mJ)	3	CZMIL Nova has a shorter pulse, resulting in higher effective pulse power than other systems, reaching greater depths
Deep Channel Pulse Duration (ns)	2	Shorter pulse - CZMIL Nova has best depth measurement accuracy
Deep Channel Pulse Power (MW)	1.5	CZMIL Nova maps deeper in various water conditions
Deep Channel PRR (kHz)	10	Excellent PRR
Deep Channel FOV (mrad)	40	Optimized for altitude and depth
Deep Channel pupil diameter (mm)	200	CZMIL Nova captures more energy and maps deeper
Shallow Channel		
Shallow Channel Pulse Energy (mJ)	0.043	With higher PRR (70 kHz) and summation algorithms, CZMIL Nova requires less energy
Shallow Channel Pulse Duration (ns)	2	Shorter pulse - CZMIL Nova has best depth measurement accuracy
Shallow Channel Pulse Power (MW)	0.0215	With larger PRR (70 kHz) and summation algorithms, CZMIL Nova requires less power
Shallow Channel PRR (kHz)	70	Higher density of CZMIL Nova measured points enables use of summation algorithms
Shallow Channel pupil diameter (mm)	200	CZMIL Nova captures more energy and maps deeper
Topographic Channel		
Topo Channel PRR (kHz)	80	CZMIL Nova is focused on water performance per government specifications, while also able to detect power lines and other fine details on land
Topo Channel pupil diameter (mm)	200	CZMIL Nova captures high return power
Camera Systems		
Hyperspectral (CASI-1500H)	Yes	Provides environmental information extraction, including water quality (IOPs*) for visual region (400-800 nm). Measurements made possible include: Chlorophyll concentration, shallow water seafloor classification, water column spectrum characterization, spectral bottom characterization, data fusion benthic habitat classification, rapid mapping of hazardous areas.
16 Mpix RGB	Yes	Interline CCD RGB camera, with electronic shutter, and up to 2.5 fps
Unitless product/K_d = Max Depth		
K_d*Dmax for deep channel	4.0 – 4.2	CZMIL Nova consistently achieves greater depth penetration than any other system
K_d*Dmax for shallow channel	1.8	CZMIL Nova shallow water results have exceeded any other airborne bathymetry system
Parameters		
Altitude (m)	400– 1000	CZMIL Nova flies at optimal heights for efficient collection
Swath width (for altitude 400 m)	290	Efficient swath width, plus CZMIL HydroFusion processes large volumes of data with productivity
Weight (kg)	287	CZMIL Nova is designed and based on military standard DO-160F (superior resistance to airborne vibration and shock). CZMIL Nova's weight includes sensor head and all rack mounted equipment.

*Inherent Optical Properties (IOP)

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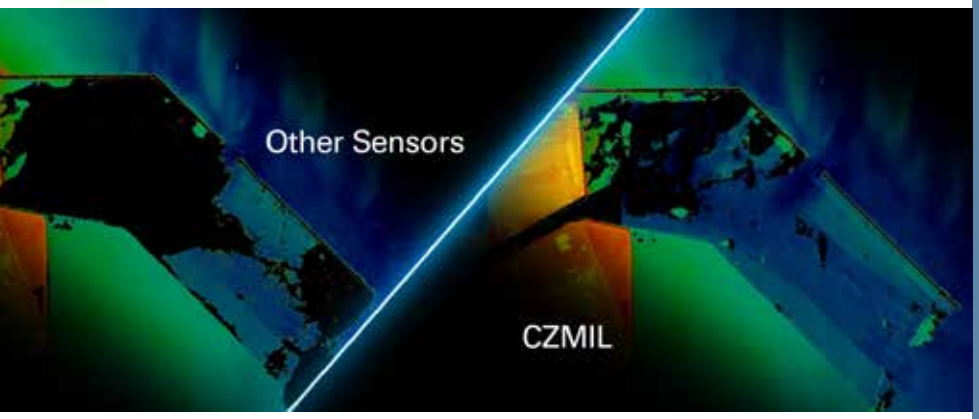
For the most efficient, accurate, and seamless topo/bathy data results, CZMIL Nova is the clear choice



The CZMIL Project Program provides the following:

1. Ready to operate CZMIL Nova system, including installation, calibration and uninstallation
2. Operator for installation, calibration, and uninstallation of system
3. Operations and data processing training
4. Shipment costs to and from project destination, including system insurance
5. Technical support included

Program Contact Information:

Please contact the **Teledyne Optech Sales Manager** for your region. They will be glad to answer any questions you may have about the **CZMIL Project Program**, and can provide information on system availability. To find your **Regional Sales Manager**, please go to **www.teledyneoptech.com** and from the main menu select **Contact/Sales & Representatives**, then select **Coastal & Marine Systems**.

If you prefer to contact the program office directly, you can also call **+1 228 252 1004** or send an email to: inquiries@teledyneoptech.com
Please specify "CZMIL Project Program" in the subject line of your email

CZMIL Project Program FAQ

How long can we rent CZMIL Nova and HydroFusion?
Adaptable to customer needs.
No minimum or maximum.

What kind of plane can it be installed in?
Twin engine with large photo port. Optech can also locate and work with an aircraft provider for the renter.

How fast can it survey?
60-150 sq km per day, depending on the type of survey.

Will Optech provide personnel?
Yes, a survey operator and pre-processor/ QA/QC personnel will provide in-depth training and support for planning, acquisition and processing.

Do we need training?
Training is available and highly recommended for survey ops and post processing.

CZMIL and its integrated HydroFusion software workflow have won numerous technology and innovation awards from organizations such as JALBTCX, MAPPS, and Geospatial World, and continues to lead the industry as the systems are enhanced each year.