

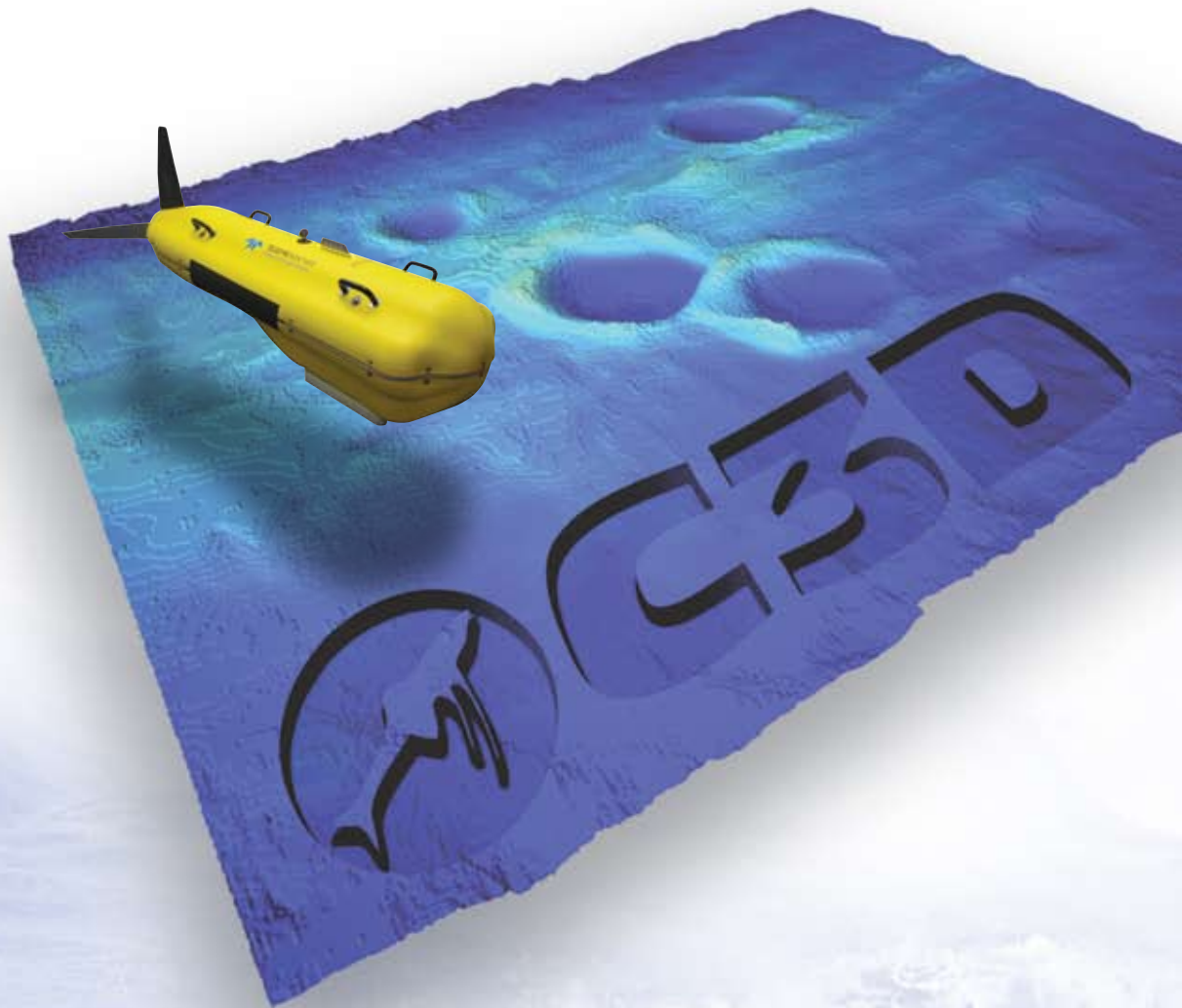
# C3D

## SONAR IMAGING SYSTEM

# Add Depth to your Side Scan Survey

Teledyne Benthos has been a pioneer in the development of underwater acoustic and side scan sonar systems.

Now Teledyne Benthos combines high resolution side scan imagery with bathymetric data to produce a 3-dimensional look at the seafloor.



INNOVATIVE UNDERSEA SYSTEMS TECHNOLOGY



**TELEDYNE  
BENTHOS**

A Teledyne Technologies Company

# The C3D Side Scan/Bathymetry System

Teledyne Benthos has been a pioneer in the development of underwater acoustic and side scan sonar system. Now Teledyne Benthos combines high resolution side scan imagery with bathymetric data to produce a 3-dimensional look at the seafloor. The C3D is manufactured to the highest quality and reliability that one should expect in the offshore environment. The C3D represents the latest in sonar technology with patented technology that incorporates a multi-array transducer and solving for multiple angles of arrival for a 3-dimensional image.

CAATI (computer angle of arrival transient imaging) is a patented technique licensed to Teledyne Benthos by Simon Fraser University. It is a method for estimating the backscatter arrival spectrum. CAATI uses an angle-of-arrival estimation similar to interferometry. However, unlike interferometry, it uses amplitude values in order to solve the problem of concurrent arrivals from multiple angles.

The C3D is the best solution for combining side scan imagery and bathymetric data. The data sets are collected at the same place and time and there is no need to merge data sets as with multi-beam and side scan sonar systems run separately. Each point along the track has X, Y and Z components. For example, at the 100 meter range there are 2000 points compared to only a few hundred using multi-beam systems. This allows for a much greater across-track resolution.

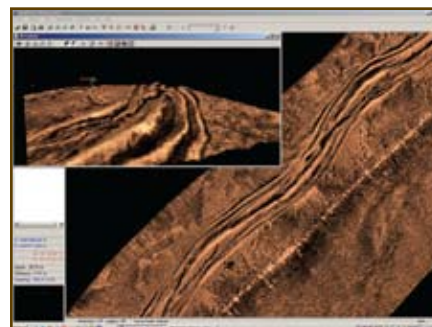
The C3D is available in towed, over-the-side and AUV configurations. The C3D also offers the integration of a subbottom profiler module, combining Chirp subbottom data operating at 2.7 kHz. For cable lengths over 6000 meters it is recommended to use a fiber optic cable.



*C3D deployment (tow vehicle)*



*Processor/display*



*Pipeline 2D and 3D imagery*

## APPLICATIONS

- Channel clearance studies
- Hydrographic charting
- Engineering and scientific studies
- Biomass for fisheries
- Object detection
- Cable/pipeline surveys
- Bridge inspection
- Bottom mapping
- Mine hunting

## SYSTEM FEATURES

### Streamlined

Tow Vehicle allows for stable operation from 1 to 10 knots (recommended speeds for normal survey operations are between 3 and 5 knots).

### Portable

The towfish is designed with stainless steel framing and a polyethylene shell (an on-board handling system is highly recommended).

### Modular Design

System interfaces easily to the topside processor via Ethernet connections.

### Expansion of Sensors

Tow vehicle is designed to interface directly to motion sensors, pressure sensors, magnetometers, CTD's etc.

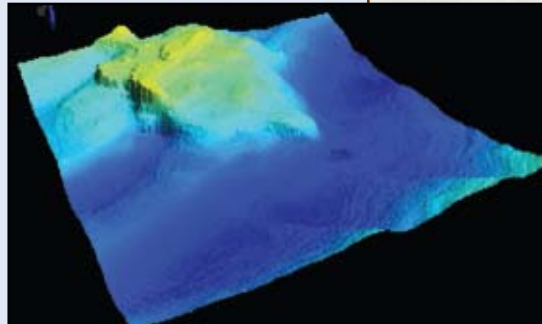
### Flexible Communications

ADSL high-speed communications link and an optional fiber optic link are available.

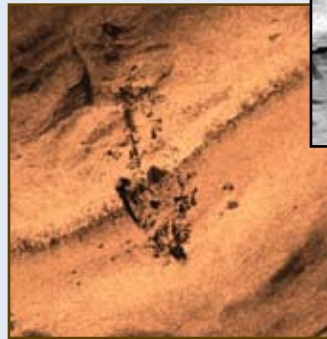
### Configurable

The tow vehicle is designed to be easily disassembled for over-the-side mounting and for AUV applications. The Topside power supply and Ethernet hub will accommodate any type of topside processor running sonar acquisition software.

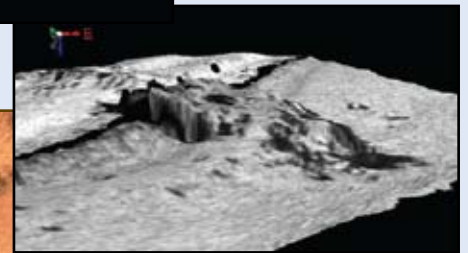
*The freighter Steven R. Jones foundered on rocks in the Cape Cod Canal in Massachusetts on June 28, 1942. Explosives were later used to flatten the wreck on the canal floor where it still sits today. The images below were obtained in a C3D survey on October 28, 2003 and are the most detailed seen of the wreck site.*



Bathymetry

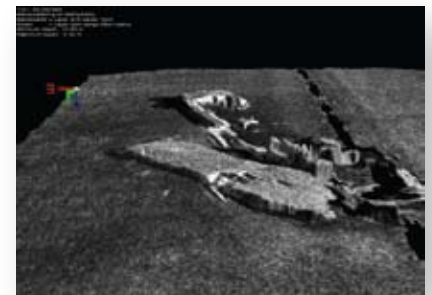


2D side scan

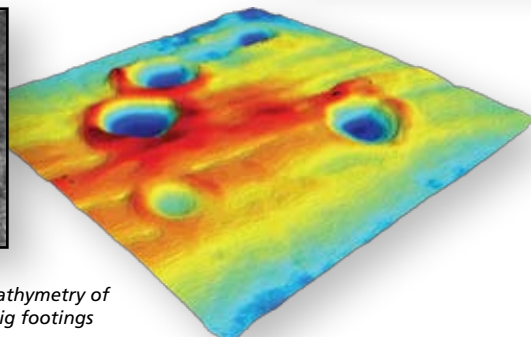


C3D

3D of barges used for fish habitat



2D side scan and bathymetry of impressions of oil rig footings



# C3D Sonar Imaging System

## SYSTEM SPECIFICATIONS

System	
Sonar Frequency:	200 kHz
Maximum Operating Depth:	2000 meters (6000 meters optional)
Side Scan Range:	25 to 300 meters per side (200 kHz) 25 to 600 meters per side (100 kHz)
Bathymetric Range:	10 to 12 times water depth
Resolution (across track)	
Side Scan Sonar:	4.5 cm
Bathymetry:	5.5 cm
Beam Width	1 degree (one-way)
Pulse Length:	25 usec to 1 msec (depending on range)
Repetition Rate:	Up to 30 pings/sec
Depression Angle:	20 degrees
Transmit Source Level:	Maximum 224dB re: 1uPa@1M
Vertical Resolution (Bathymetry):	5 cm
Auxillary Sensors:	Pressure (standard) CTD (standard) Heading (standard) Pitch (standard) Roll (standard) Altimeter (optional) Magnetometer (optional) Optical Gyro (optional) Motion Reference Unit (optional)
Tow Vehicle	
Construction:	Stainless steel, polyethylene
Length:	210.8 cm (83 in)
Diameter:	27.3 cm (10.75 in)
Front Cross Section:	38.4 cm x 53.4 cm (15 1/8 in x 21 in)
Weight (in air):	158 kg (350 lbs)
Weight (in water):	45.3 kg (100 lbs)
Electrical power:	51 watts at 300 VDC
Over-the-Side Mount	
Construction:	Stainless steel
Length:	96.5 cm (38 in)
Diameter:	25.4 cm (10 in)
Weight (in air):	40.8 kg (90 lbs)
Electrical power:	51 watts at 300 VDC
Topside Processor/Display (optional)	
Operating System:	Windows XP
Storage:	Large capacity hard drive, writable CD/DVD
Network Interface:	100base T Ethernet (compatible with ADSL high-speed communications interface)
Serial:	RS232
Display Monitor:	17" Flat Panel (built into processor)
Topside Interface Unit	
Power Supply:	Input 120/240 VAC auto sensing, output 300 VDC
Network interface:	Ethernet
Dimensions:	2U Rack mount 48.3 cm (19 inches)
Software	
CAATI:	Proprietary (standard)
Acquisition:	Triton, Hypack, OIC, QPS, Eiva
Post-Processing:	Triton, Hypak, OIC, QPS, Eiva, CARIS
Format:	XTF
Cables	
Call for specific cable requirements	
Kevlar:	100 meter coax (standard)
Double armored:	Co-axial cable (for use with ADSL communications link (optional)



Towed configuration



Side mount configuration



AUV configuration



Lightweight pole mount (see separate data sheet C3D-LPM)



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[www.benthos.com](http://www.benthos.com)

49 Edgerton Drive, North Falmouth, MA 02556 USA  
Tel +1 508-563-1000 • Fax +1 508-563-6444 • E-mail: [benthos@teledyne.com](mailto:benthos@teledyne.com)

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