

# Echoes 3500 T7

High-resolution sub-bottom profiler  
for full ocean depths



Echoes 3500 T7 is a high-performance sub-bottom profiler offering high-resolution seismic reflection data. Its 7 transducers provide unique quality data from shallow to deep sea environments regardless of the seabed topography.

## HIGH QUALITY SEISMIC DATA

- True flat bandwidth ultimate resolution capacity and power efficiency
- Chirp spectrum coverage of 1.7 to 6kHz
- Vertical resolution 20 cm
- Penetration up to 150 m in clays (@ 1,000m water depth)
- Penetration up to 40 m in sand (@ 1,000m water depth)

## DELPH SEISMIC SOFTWARE

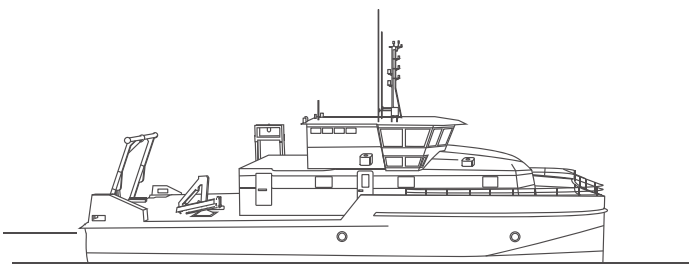
- All-in-one optimized geophysical processing and interpretation
- Easy access to all data collected for geologists and geophysicists
- Compatible with leading industry sensors and formats
- Best possible 2D/3D QC
- Visualization and reporting capabilities

## FULLY OPERATIONAL

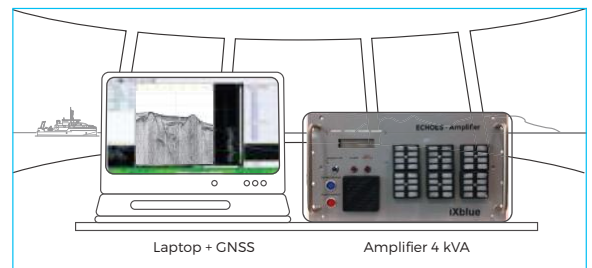
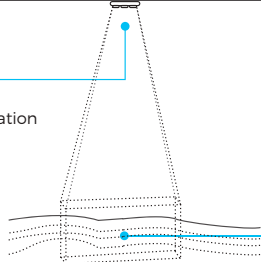
- Perfect positioning and heave compensation
- Compatible with any bathymetric echosounder
- Hull-mounted systems
- Modular configuration

## APPLICATIONS

- Deep water oceanography
- Sedimentology and paleoseismology
- Marine platforms implantation
- Route/boulder clearance
- Pockmark detection
- Seabed roughness
- Bedrock depth

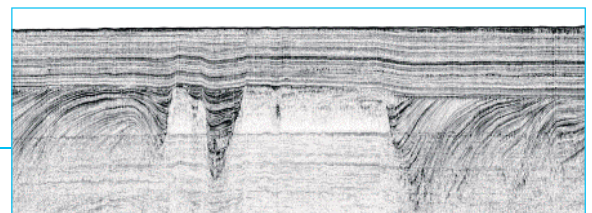


**Echoes 3500 T7**  
Full ocean depth  
Hull-mounted configuration



Laptop + GNSS

Amplifier 4 kVA



## Technical specifications

Acoustic technology

<b>Array configuration</b>	7 Tonpizl transducers mounted on a plate
<b>Operational frequency range (Hz)</b>	1,700 - 6,000
<b>Mean acoustic level</b>	208 dB (ref 1 $\mu$ Pa@1m) @ 4 kVA
<b>RVS (Receiving Voltage Sensitivity) (ref. 1<math>\mu</math>Pa)</b>	Chirp processing gain (100ms pulse) +22dB
<b>Beam aperture @ 3.5 kHz</b>	20°
<b>Vertical resolution (c = 1,500 m/s)</b>	20 cm

Echoes 3 500 T7 Array

<b>Recommendation for water depth below transducers (m)</b>	1 to 6,000
<b>Height (mm)</b>	384
<b>Diameter (mm)</b>	980
<b>Weight in air / water (kg)</b>	325 / 237

Echoes 3 500 T7 Topside Unit

<b>Signal emission power / Echoes mean power</b>	4 kVA / 850 W
<b>Length / width / height (mm)</b>	598 (incl. back panel socket) / 483 (19") / 266 (6U)
<b>Weight (kg)</b>	30
<b>Mounting</b>	Rack-mounted
<b>Deck cable length (m)</b>	50

## Case Study

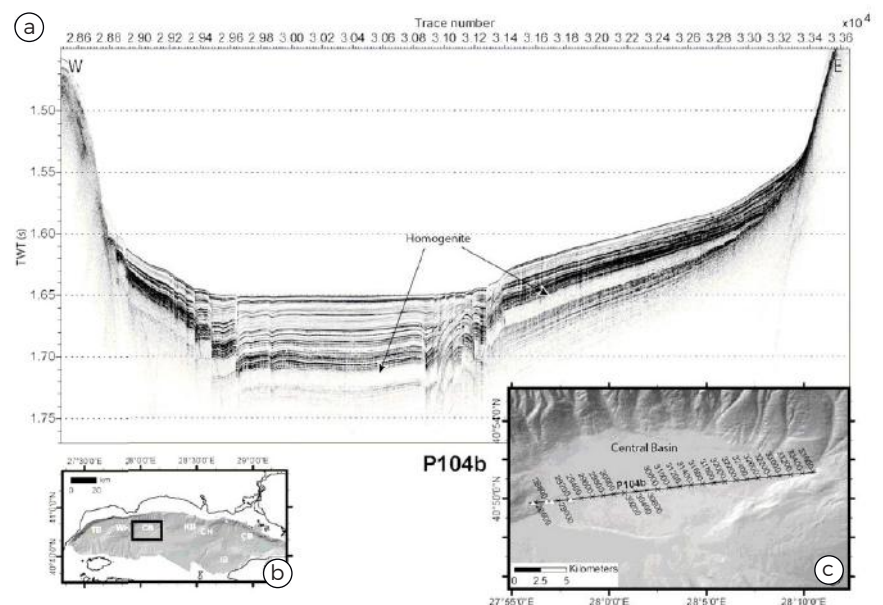
### Reconstructing millennial-scale Anatolian earthquakes history from Marmara deep sea sediments

This high-resolution seismic profile was acquired at about 2500m water depth in the Marmara Central Basin with an Echoes 3500 T7 onboard of the R/V Le Suroit Ifremer/Genavir in 2009.

a) Earthquake-derived deposit (homogenite) is indicated by black arrows.

b) Map of the Sea of Marmara showing the location of the area given in c).

Tary Jean-Baptiste (2011). Case studies on fluids and seismicity in submarine environments based on Ocean Bottom Seismometers (OBS) recordings from the Sea of Marmara and application to the Niger Delta. PhD Thesis, Université de Bretagne Occidentale.  
<https://archimer.ifremer.fr/doc/00034/14557/>



# Echoes 3500 T1-T3

## High-resolution sub-bottom profiler

Echoes 3500 offers high-resolution seismic reflexion data to characterize sedimentary architecture and geological features. Echoes 3500 is available with one (T1) or three (T3) transducers, allowing a wide range of operational conditions from shallow to deep ocean environments. Echoes 3500 systems enable river, lake and ocean surveys regardless of the seabed topography.



### FEATURES

- Spectrum coverage of 1.7 to 6 kHz
- T1 portable Chirp system
- Vertical resolution 20 cm
- Penetration up to 150 m in clays
- Penetration up to 20 m in sand
- T1 one-man portable system
- Pole- and hull-mounted systems
- 2-way T1/T3 modular configuration

### BENEFITS

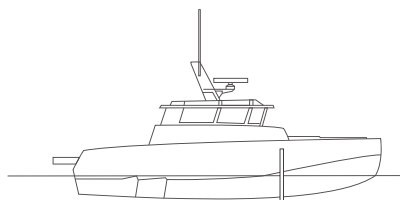
- True flat bandwidth ultimate resolution capacity and power efficiency
- Perfect positioning and heave compensation
- Compatible with any bathymetric echosounder

### DELPH SEISMIC SOFTWARE

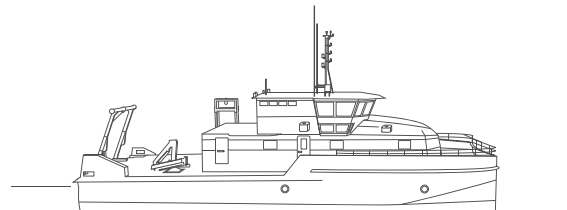
- All-in-one optimized geophysical processing and interpretation
- Easy access to all data collected for geologists and geophysicists
- Compatible with leading industry sensors and formats
- Best possible 2D/3D QC
- Visualization and reporting capabilities

### APPLICATIONS

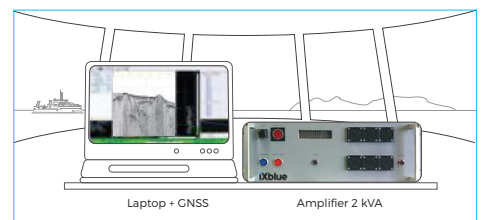
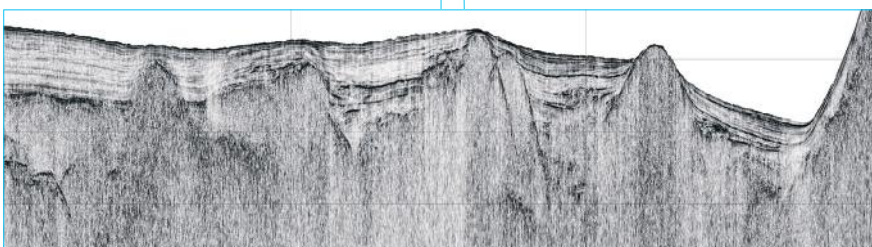
- Pre and post dredging
- Sedimentology and paleoseismology
- Archeology and Geo-archeology
- Object detection buried (boulders, pipelines)
- De-risking survey



**Echoes 3500 T1**  
Sub-bottom profiler  
(up to 200 m depth)  
Pole-mounted configuration



**Echoes 3500 T3**  
Sub-bottom profiler  
(up to 1,500 m depth)  
Hull-mounted configuration



Laptop + GNSS

Amplifier 2 kVA

## Technical specifications

<b>Array configuration T1//T3</b>	1 // 3 tonpilz transducers mounted on a plate
<b>Operational frequency range</b>	1,700 Hz - 6,000 Hz
<b>Mean acoustic level T1//T3</b>	195 // 203 dB (ref 1μPa@1m) @ 2 kVA
<b>RVS (Receiving Voltage Sensitivity) (ref. 1μPa) T1//T3</b>	-172 // -163 dB
<b>Beam aperture @ 3.5 kHz</b>	45°
<b>Vertical resolution (c=1,500 m/s)</b>	20 cm

## Mechanical specifications

Echoes 3500 Array

<b>Recommendation for water depth below transducers T1//T3</b>	1 to 200 m // 1 to 1,500 m
<b>Height</b>	384 mm
<b>Diameter T1//T3</b>	450 // 680 mm
<b>Weight in air / water T1//T3</b>	57/42 kg // 160/120 kg

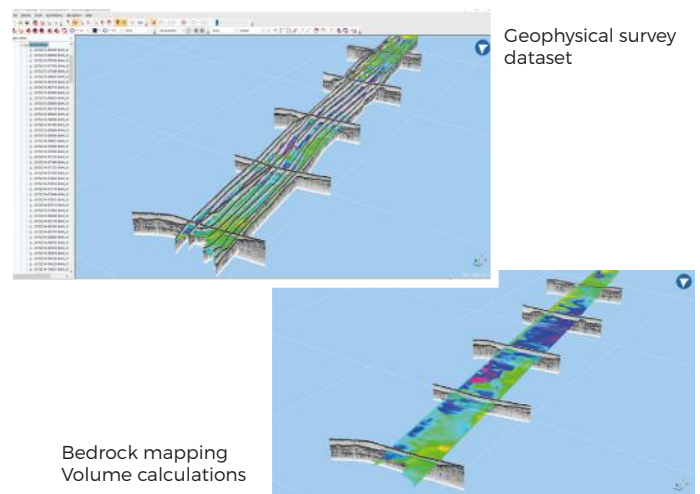
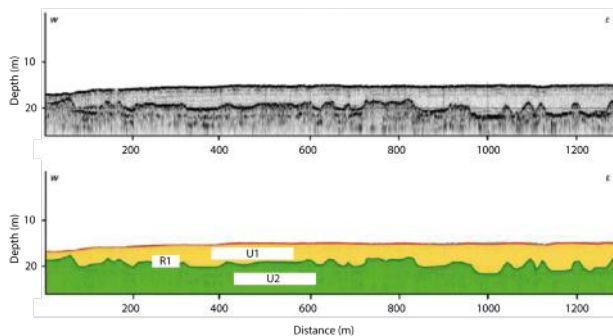
Echoes 3500 Topside unit

<b>Signal emission power / Echoes mean power</b>	2 kVA / 350 W
<b>Length / width / height</b>	482 mm / 482.6 (19") mm / 177 (4U) mm
<b>Weight</b>	15 kg
<b>Mounting</b>	Rack-mounted
<b>Deck cable length T1//T3</b>	20 m // 50 m

## Case Study in sandy environments

Geophysical characterization and reports using Delph Acquisition and Interpretation Softwares

	Echofacies description	Geological interpretation
U1	Homogeneous weak amplitude facies	Sediment deposits: soft sand and silt
R1	Irregular high amplitude reflector	Top of the bedrock
U2	Chaotic high amplitude facies	Bedrock



# Echoes 10 000

High-resolution sub-bottom profiler for shallow water

Echoes 10 000 is a high-performance sub-bottom profiler offering high-resolution of seismic reflexion profiles. Operating from 1m to 150m water depth, this portable system enables river, lake and ocean surveys regardless of the seabed topography.



## FEATURES

- Widest spectrum coverage (5 - 15 kHz)
- Portable Chirp system
- Vertical resolution < 8cm
- Penetration up to 40 m in clays
- Pole-mounted system

## BENEFITS

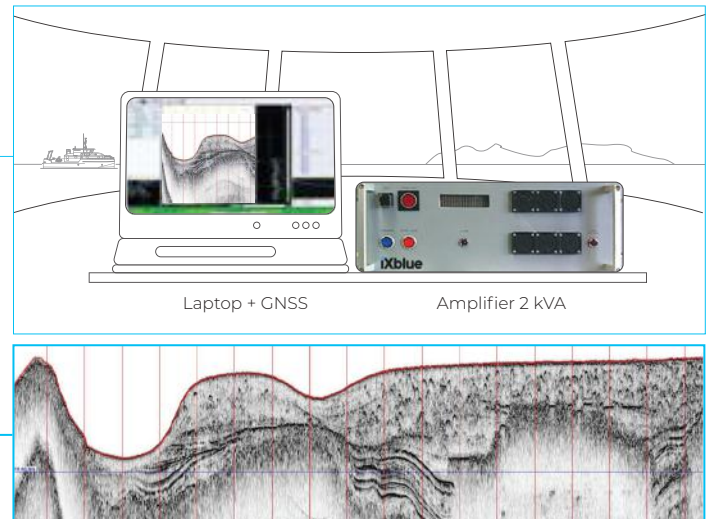
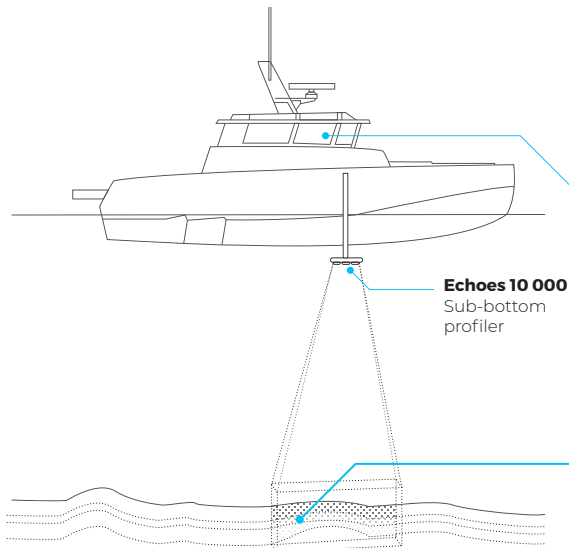
- True flat bandwidth ultimate resolution capacity and power efficiency
- One-man portable system
- Perfect positioning and heave compensation
- Compatible with any bathymetric echosounder

## DELPH SEISMIC SOFTWARE

- All-in-one optimized geophysical processing and interpretation
- Easy access to all data collected for geologists and geophysicists
- Compatible with leading industry sensors and formats
- Best possible 2D/3D QC
- Visualization and reporting capabilities

## APPLICATIONS

- Pre and post dredging
- Sedimentology / Paleoseismology
- Archeology and Geo-archeology
- Buried objects detection (boulders, pipelines)
- De-risking survey



## Technical specifications

Array configuration	7 tonpilz transducers mounted on a plate
Operational frequency range	5000 Hz - 15000 Hz
Mean acoustic level	202 dB (ref 1 $\mu$ Pa@1m) @ 2kVA
RVS (Receiving Voltage Sensitivity) (ref. 1 $\mu$ Pa)	-172 dB
Beam aperture @ 10 kHz	30°
Vertical resolution (c=1500m/s)	8 cm

## Mechanical specifications

Echoes 10 000 Array

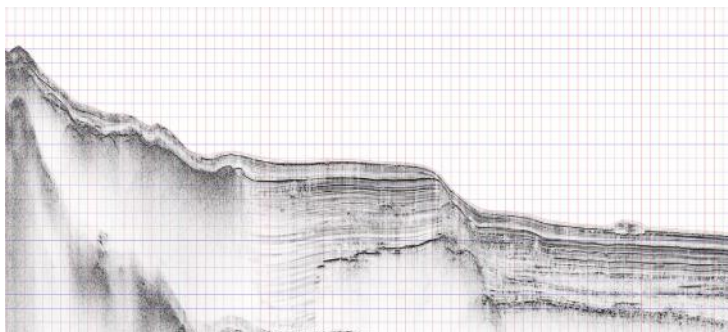
Recommendation for water depth below transducers	1 to 150 m
Height	191 mm
Diameter	380 mm
Weight in air / water	26 kg / 12 kg

Echoes 10 000 Topside unit

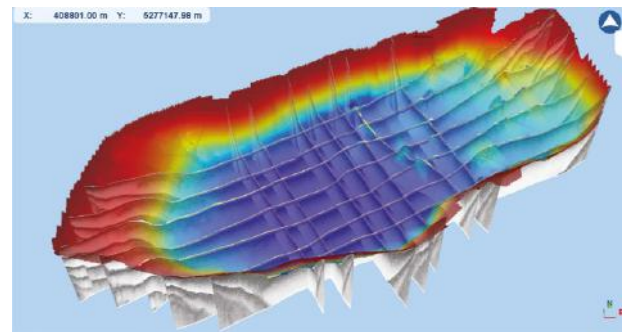
Signal emission power / Echoes mean power	2 kVA / 350 W
Length / width / height	486 mm / 483 (19") mm / 177 (4U) mm
Weight	15 kg
Mounting	Rack-mounted
Deck cable length	20 m

## Results

High-resolution sub-bottom profiling data

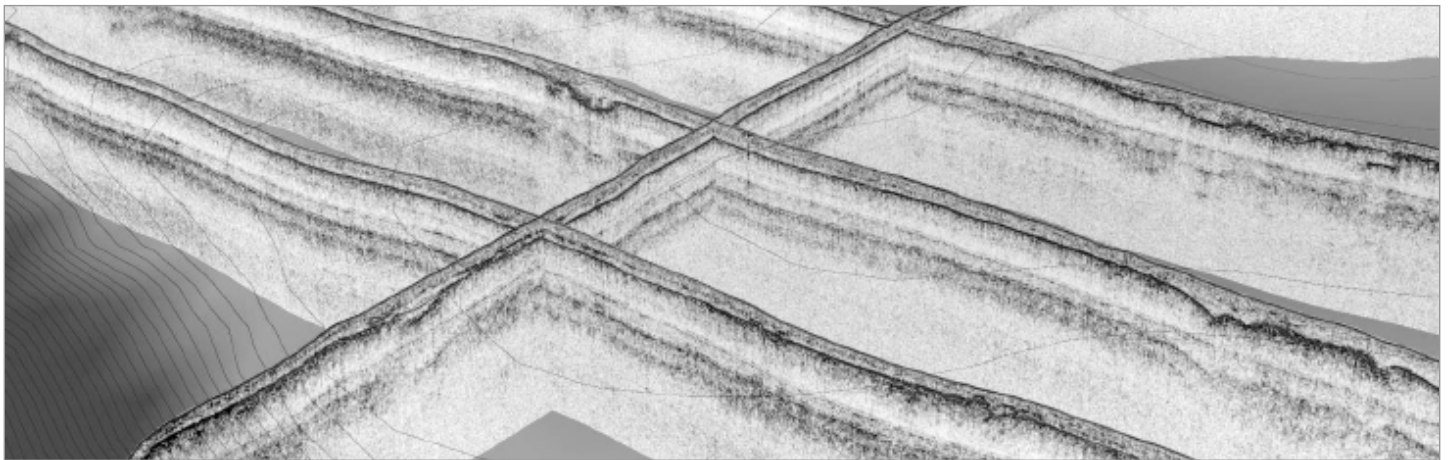
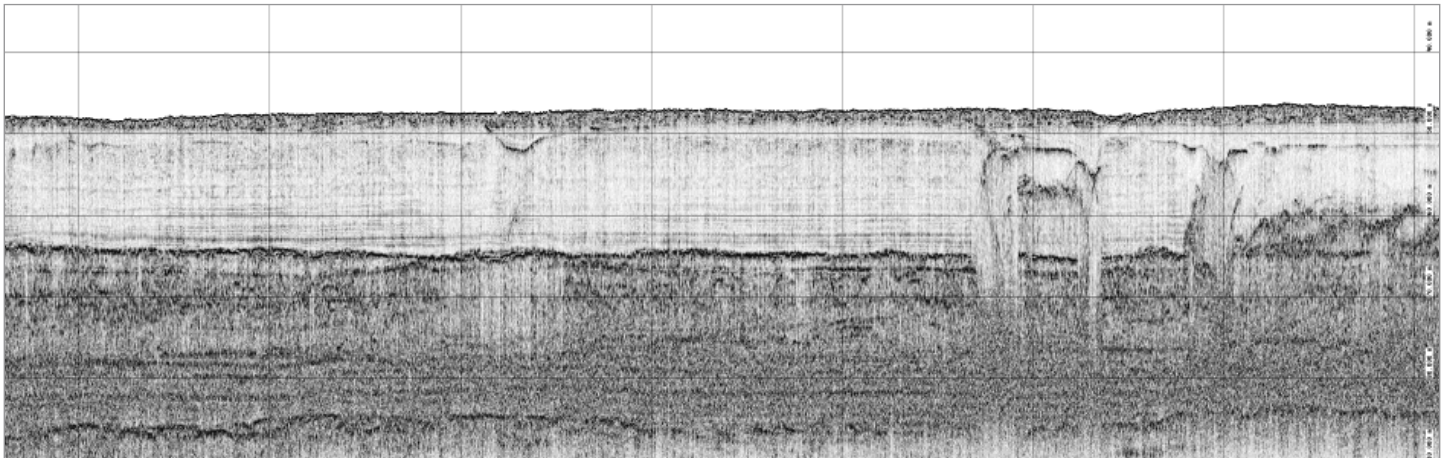


Bathymetry & layers modeling using Delph



# Echoes Series & Delph software

Sub-bottom profiler solution.  
iXblue optimized way to gather  
geophysical Georeferenced Data



## FEATURES

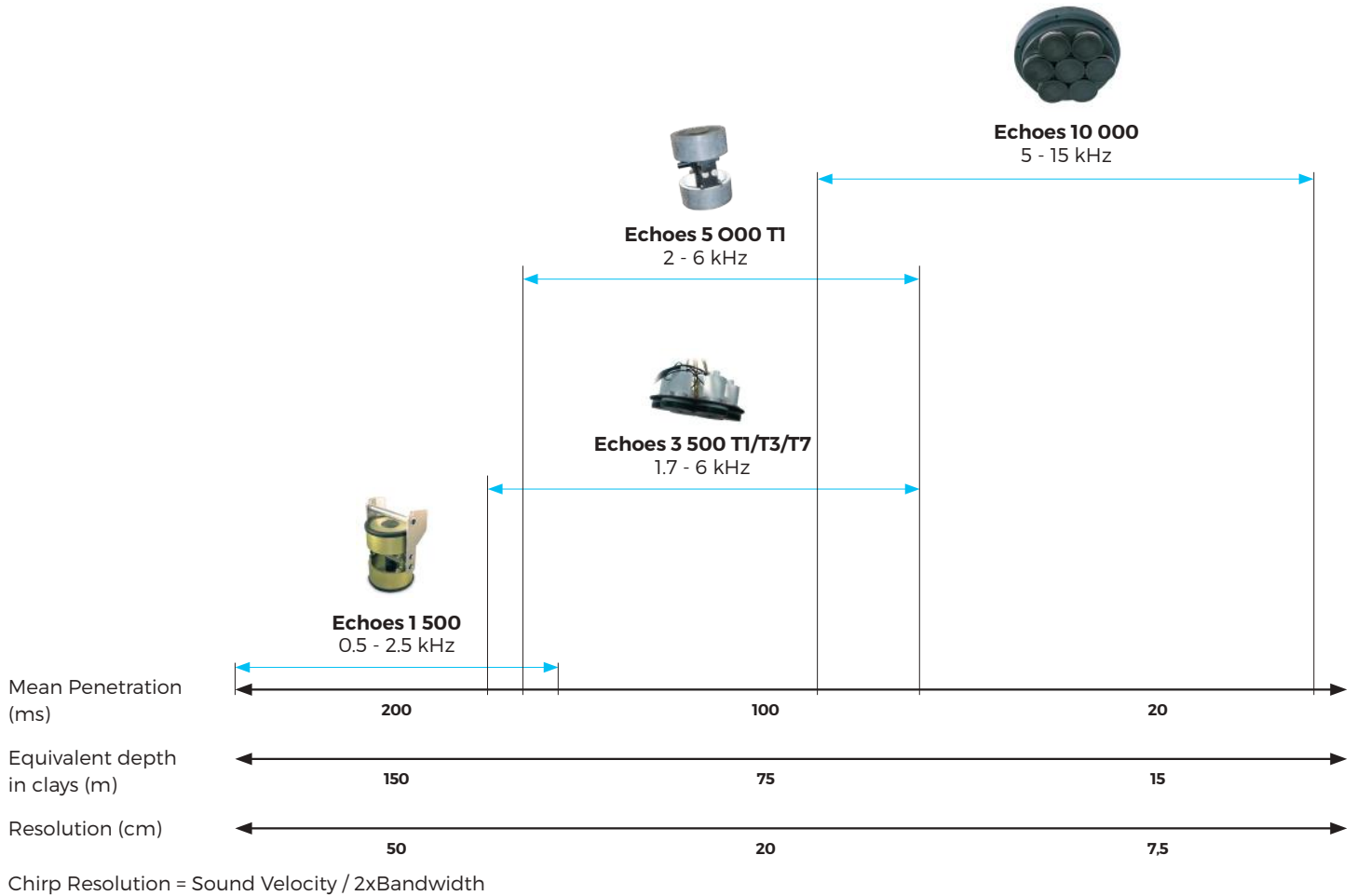
- Any integration:  
Hull or Pole Mounted, Towed  
or Autonomous Vehicle integrated
- Any application:  
Geosciences, Geo-Archaeology, Dredging,  
Offshore Energy

## BENEFITS

- The widest spectrum coverage  
(150Hz-15kHz Transducers)
- True Flat Bandwidth Ultimate resolution capacity  
& power efficiency
- Optimized processing and data interpretation software

## PRODUCT RANGE

### Echoes product range



## Software

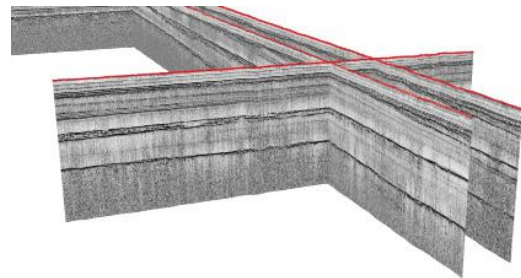
### Analog Single/ Multi-Channel Seismic

**Delph Analog Acquisition Unit**  
1 to 24 channels  
High-resolution analog seismic –  
Sparkers – Boomers – Airguns –  
Marine geology – Geophysical  
Survey



### Acquisition & Interpretation Software

Delph Acquisition Raw data logging, QC  
Delph Interpretation Processing, Interpretation, Mapping





## APPLICATIONS

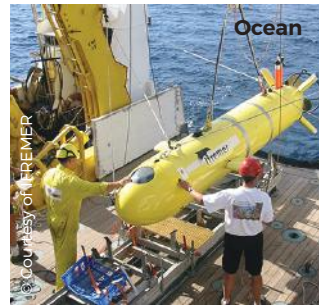
### Marine/lacustrine geosciences - Paleoclimate

#### ECHOES 5 000

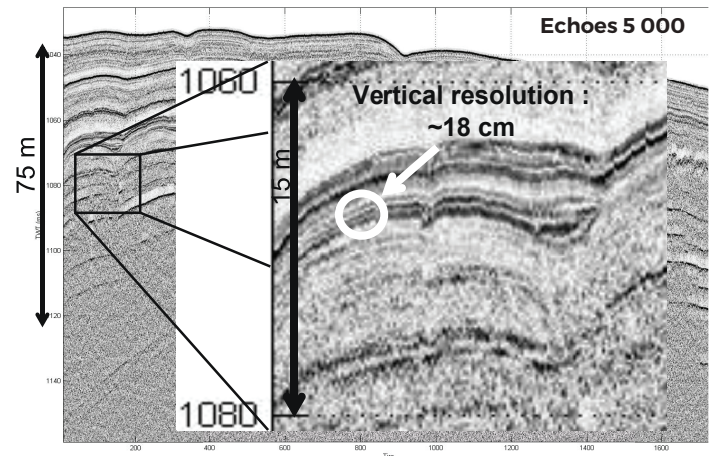
- **Frequency:** 2000-6000 Hz
- **Array:** 213/291 mm (diam x H)
- **Weight (air/water):** 11/7 kg
- **Set-up:** Pole & Tow-Fish Mounted, AUV/ROV
- **Resolution:** 18 cm
- **Mean penetration:** 50 m

#### Relevance

- High-resolution seismic reflection profiles
- Operable from shallow to deep waters
- Sedimentary dynamics related to:
  - Hydrological variability,
  - Geo-hazard,
  - Flood,
  - Earthquake,
  - Tsunami,
  - Erosion,
  - Anthropisation, etc.



Lake



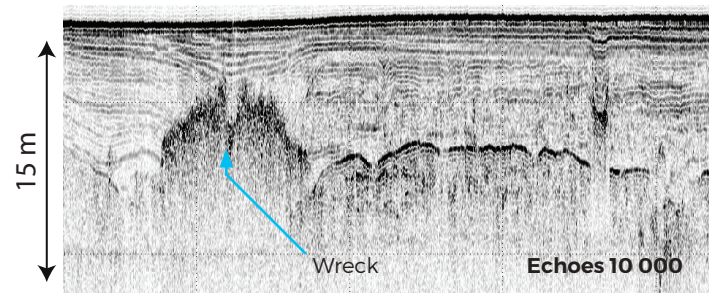
### Archaeology & Geo-Archaeology

#### ECHOES 10 000

- **Frequency:** 5000-15000 Hz
- **Array:** 380 x 191 mm (diam x H)
- **Weight (air/water):** 26/12 kg
- **Set-up:** Pole/Hull-Mounted
- **Resolution:** 8 cm
- **Mean penetration:** 20m

#### Relevance

- Identify artefact buried in sediments
- Designed for shallow waters
- High-resolution seismic reflection profiles for:
  - submerged prehistoric archaeology,
  - estimation of site volume,
  - post-excavation interpretation,
  - sedimentary processes.



## APPLICATIONS

### Pre & post dredging

#### ECHOES 10 000

- **Frequency:** 5000-15000 Hz
- **Array:** 380x191 mm (diam x H)
- **Weight (air/water):** 26/13 kg
- **Set-up:** Pole/Hull-Mounted
- **Resolution:** 8 cm
- **Mean penetration:** 20 m

#### Relevance

- High resolution seismic reflection profiles
- Operable from shallow to deep waters
- Stability and distribution of sediments
- Nature and volume of sediments to be dredged
- Estimation of consistency and strenght of sediments using Delph software



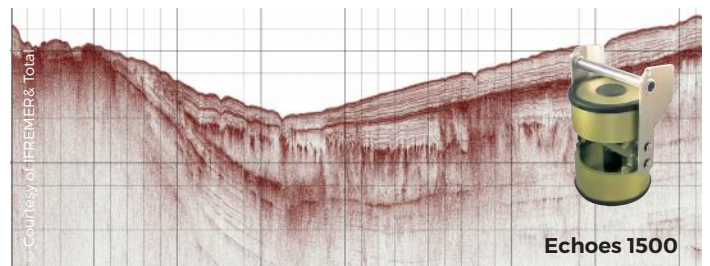
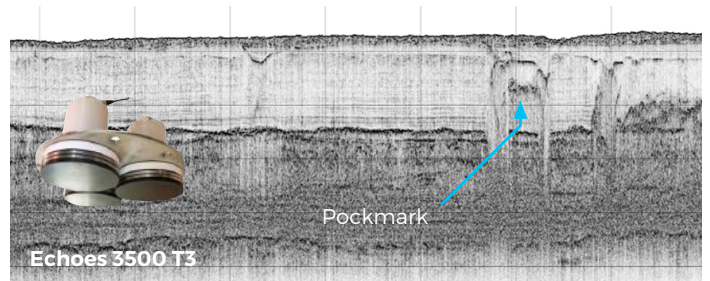
### Offshore energy

#### ECHOES 3500 T3 // 1500

- **Frequency:** 1700-5500 // 500-2500 Hz
- **Array:** 680x384 // 455x584 mm (diamxH)
- **Weight (air/water):** 161/120 // 90/60 kg
- **Set-up:** Pole/Hull Mounted // Fish, Tow-fish, AUV, ROV
- **Resolution:** 20 // 50 cm
- **Mean penetration:** 50 // 100 m

#### Relevance

- 3500 // 1500: shallow to -medium // - full ocean depth
- Nature and structure of the first 300 meters of sediments
- High-resolution seismic reflection profiles for:
- Marine platforms implantation,
- Route/boulder clearance,
- Pockmark detection,
- Seabed roughness,
- Bedrock depth,
- Geo-acoustic inversion modeling



# FOCUS ON IXBLUE TECHNOLOGY

## Echoes Natural Frequency beam opening Vs Parametric system

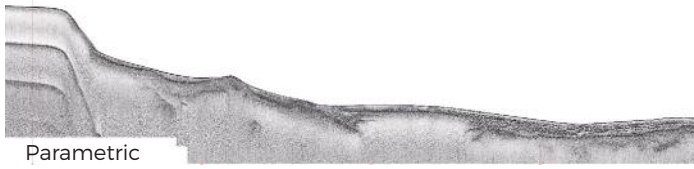
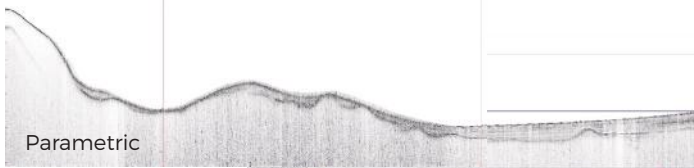
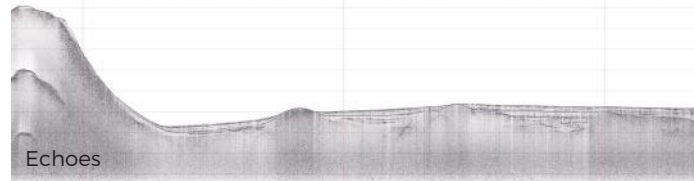
### CASE STUDY 1: GEOLOGICAL STRUCTURES

Parametric 3.5°

CHIRP 15° to 20°



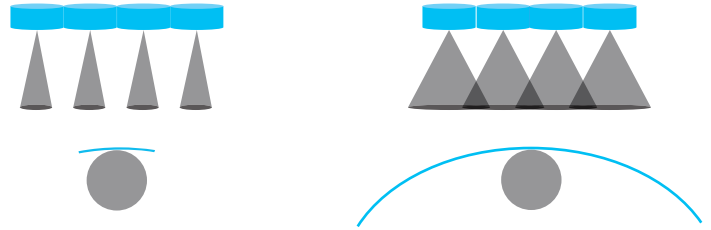
Whether through rough weather or environmental conditions, Echoes performs equally in without performance degradations.



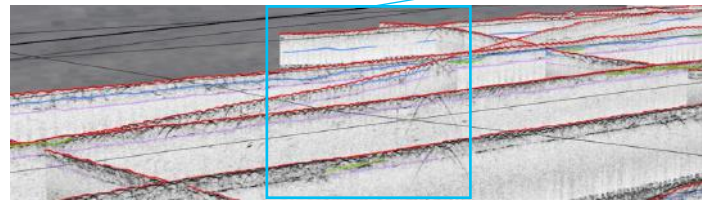
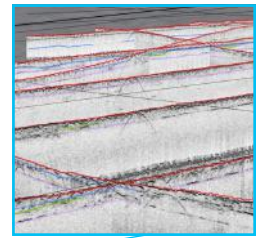
### CASE STUDY 2: BURIED OBJECT

Parametric 3.5°

CHIRP 15° to 20°



15° to 20° aperture with CW short signal at 10 Hz makes rings pipe lauder.



## ECHOES

### Penetration in sediment

- Full power on the primary frequency in the range 1.5kHz to 15kHz (shallow water models)
- Processing gain function of the bandwidth & SNR function of pulse duration

### Vertical resolution is function of the pulse acoustic bandwidth:

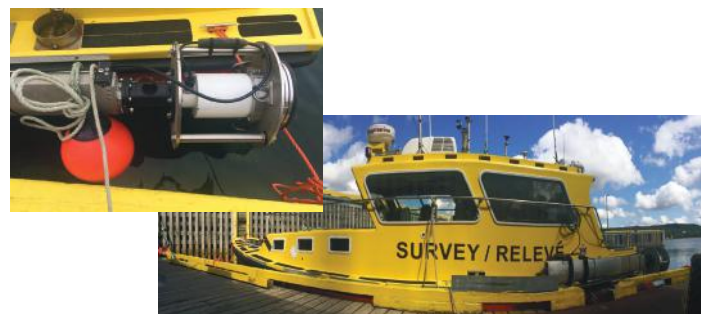
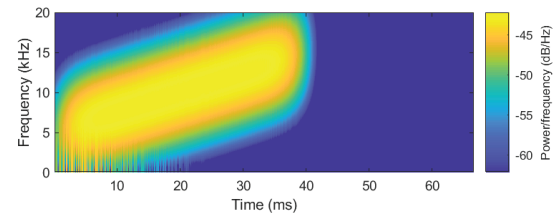
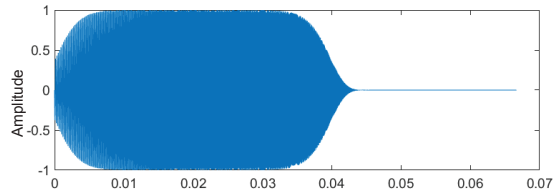
- Bandwidth must be considered at -3dB (efficient power)
- Output level must be linear on the total bandwidth (low distortion)

### Horizontal resolution is function of the directivity, pulse rate, vessel speed

- High repetition rate
- Average beam directivity (Single / multi-transducer): 10° - 30°

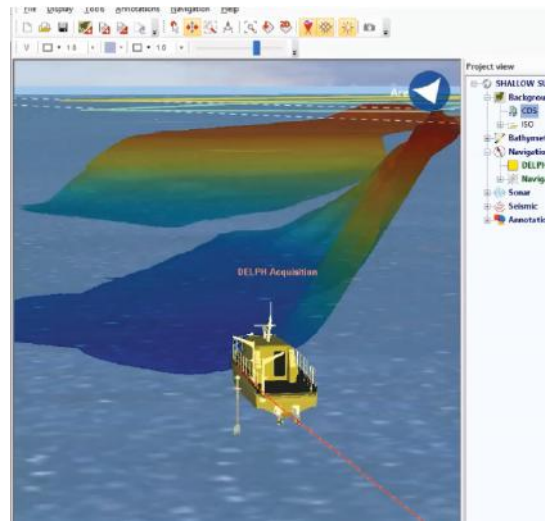
### Echoes equipment mobilization

Mechanical: Pole mounting	30'
Wiring: System interconnection	10'
Positioning: Lever arms with MRU & GPS	10'
Software: Echoes & Delph set-up	10'
Total mobilisation time	1 hour

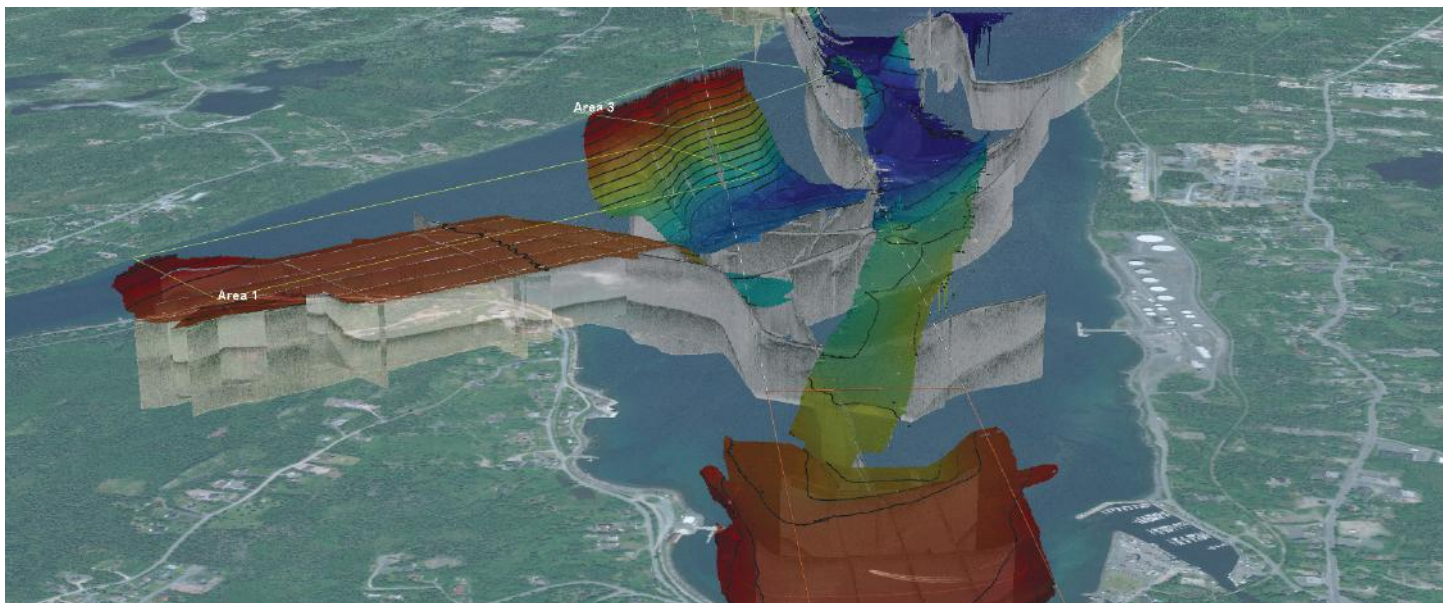


# IXBLUE SOLUTION ON THE FIELD

## Acquisition & real time monitoring software

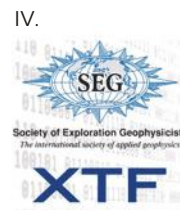
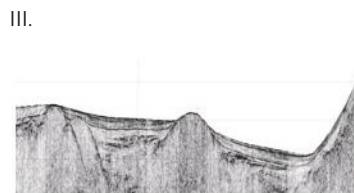


## 3D SBP data processing, interpretation, mapping software



- I - Portable & Plug & Play Sensors
- II - Perfect geo-referencing
- III - Multi-sensor & High-resolution data

- IV - Industry standard data formats
- V - Efficient data processing



# **KNUDSEN**

# PINGER

**PORTABLE SHALLOW WATER  
CHIRP SUB-BOTTOM PROFILER**



Proudly Made  
In CANADA



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

613-267-1165



# PINGER SBP

Technical Specifications (subject to change without notice)	Low Frequency Channel		High Frequency Channel
	3.5kHz	15kHz	200kHz
<i>Dry End - Echosounder</i>			
Bandwidth	User configurable (up to 20kHz)		
Output Power	up to 2kW	up to 2kW	up to 1kW
Pulse Length (min / max)	62.5µs / 64 ms		62.5µs / 4 ms
Ping Repetition Rate (max)	20 Hz		
Gain	Manual, automatic (AGC), and time varied (TVG)		
Analog Gain	96dB programmable analog gain		
Time Varied Gain (TVG)	20logR, 40logR		
Zoom Display	Dynamic Window Positioning and Sizing		
Units	Meters, Feet, or Fathoms		
User Interface	Control using standard Windows PC		
Digital Data Formats	SEG-Y, XTF, KEB (Knudsen proprietary), ASCII		
Power Supply	24 Vdc		
Operating Temperature	0 - 50 degC		
Enclosure	Portable splashproof case		
Dimensions (length x width x height)	488mm(19.2") x 386mm(15.2") x 185mm(7.3")		
Weight	10.5kg (23lb)		
<i>Wet End - Transducer</i>			
Projector	KELA5701-3.5kHz	KEL291-15kHz	KEL491-200kHz
Impedance	100 Ohms	60 Ohms	60 Ohms
Peak Transmit Voltage Response	149dB	157.5dB	176dB
Receiver	KEL-Hydrophone		KEL491-200kHz
Beamwidth	30 deg @6kHz	12 deg @15kHz	9 deg @200kHz
Peak Receive Voltage Response	-197.2 dB re 1V/uPa		-191 dB re 1V/uPa
Dimensions (length x width x height)	864mm(34") x 514mm(20.25") x 381mm(15")		
Weight	21kg (46lb) - 15kHz Option		
	29kg (64lb) - 3.5kHz Option		
Cable Length	10m(33ft)		
Installation	Pole mount -over the side		



Fiberglass Fairing Assembly



Pinger Wet End shown as shipped

