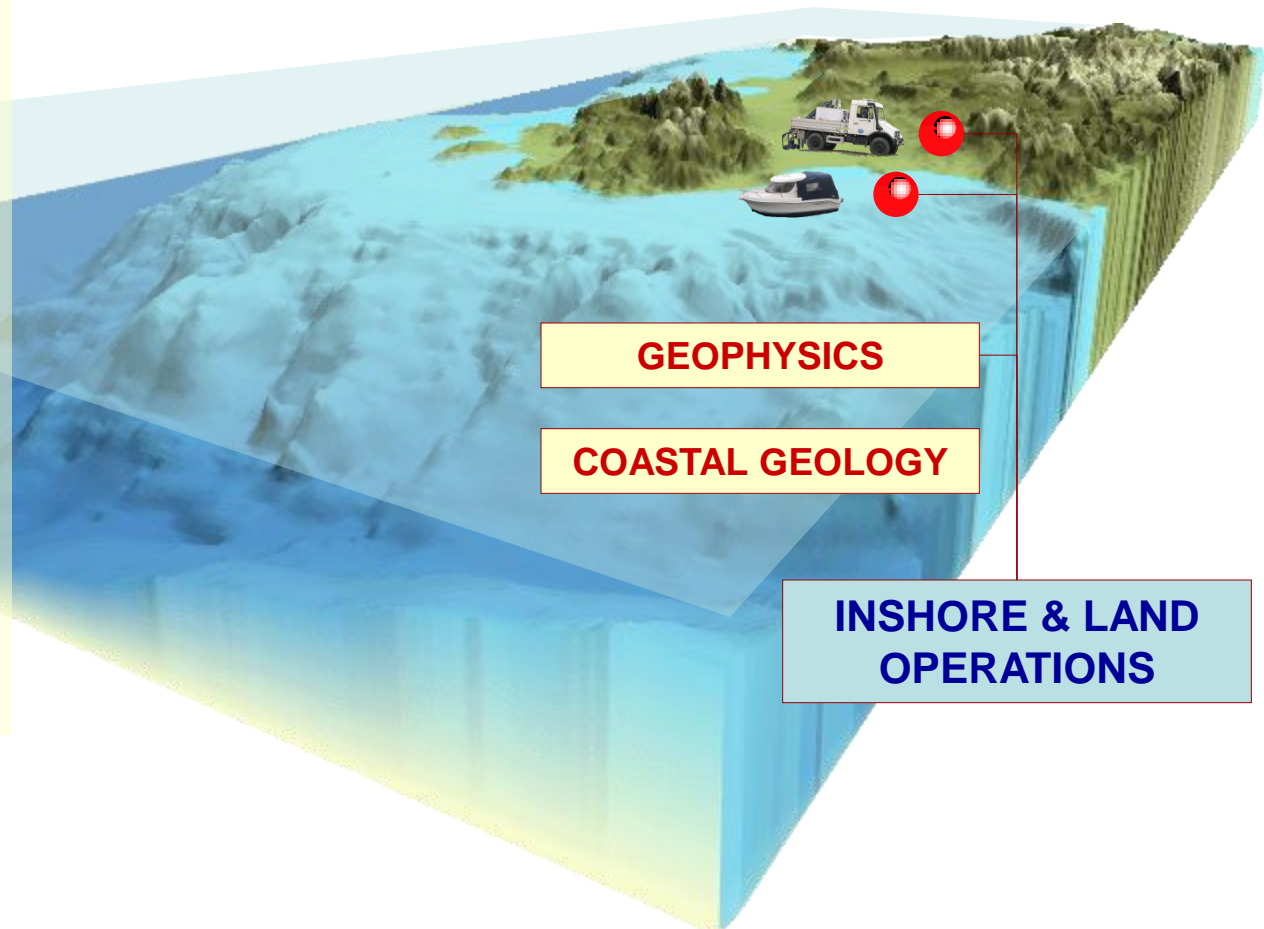


Land and Inshore Acquisition and technology Development - LIAD INSHORE & LAND SURVEY

1. *Alessandro Affatato*
 2. *Luca Baradello*
 3. *Alfio Barbagallo*
 4. *Rinaldo Belletti*
 5. *Roberto Bolis*
 6. *Diego Cotterle*
 7. *Michele Deponte*
 8. *Emiliano Gordini*
 9. *Giuseppe Falleti*
 10. *Daniel Nieto*
 11. *Lorenzo Petronio*
 12. *Marina Poropat*
 13. *Roberto Romeo*
 14. *Daniele Sorgo*
- Paolo Zennaro (aff.)*



LIAD

Geophysical/Geological investigation

Where?

- Land
- Inshore

What?

- Seismic (surface/borehole)
- ERT
- GPR
- Magnetic/Gravity
- Topography
- Bathymetry/Side scan sonar
- SBP (chirp – boomer)

Why?

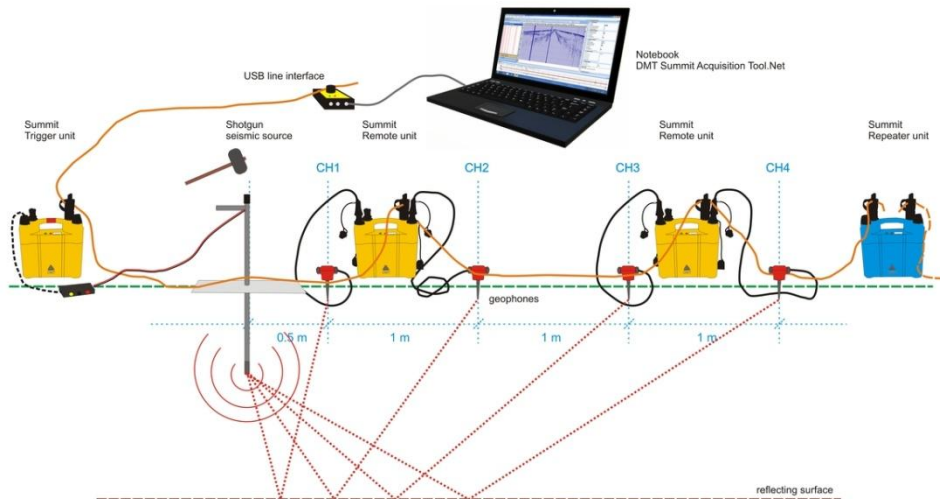
- Academic research
- Applied research
- Service

Data recording (1)

DMT Summit II – multichannel telemetric data recorder (360 channels)

Typical applications

- Reflection seismic
- Refraction seismic



■ Technical Specifications

Sampling Rate

0.03125, 0.0625, 0.125, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0 ms

Record Length

0.5, 1, 1.5, ...,
 ..., 48 K in dynamite mode
 ..., 24 K in dynamite mode incl. stacking
 ..., 16 K in vibro mode incl. stacking

Preamplification

0 dB or 18 dB

A/D Converter

24 bit Delta Sigma Technology

Instantaneous Dynamic Range

120 dB @ 2 ms sampling rate

Equivalent Input Noise

less than 0.3 μ V RMS @ 2 ms

Maximum Input Signal

2.0 Volt RMS

Gain Accuracy

better than 1% (between all RUs)

Crosstalk

better than 114 dB (between channels)

Distortion (THD)

better than 0.0008%

Input Impedance

20 kOhm

Analog Anti-Alias Filter

7,2 kHz 6 dB/Octave

Analog Low-Cut Filter

1 Hz 6 dB/Octave

Data recording (2)

**Daq Link III – 24 channels
seismograph (4 units)**



Typical applications

- Refraction seismic
- Borehole seismic
- Monitoring

ACQUISITION

Dynamic range	>118 dB (at 2 msec sampling)
Bandwidth	DC to 15 kHz
Weight	3.4 kg (7.5 lbs)
Sample rates (milliseconds)	0.0208, 0.0625, 0.125, 0.250, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0
Pre-trigger window	10 second
Trigger accuracy	±1 microsecond

GENERAL

Number of channels per unit	1 to 24 (factory set)
A/D resolution	24-bit
Record length	Up to 4 billion samples
Continuous recording	Available
GPS synchronization	Int. Clock set to GPS time, Time & position saved
Internal storage	Compact Flash media (FAT16/FAT32)
Built-in Ethernet speed	100 Mbit (8 Mbyte download)

Seismic source (1)

Vibroseis Prakla VVCA/E



Manufacturer: Prakla Geomechanik

Model: VVCA/E

Peak Force: 125000 N

Piston Area 59.55 cm²

Mass Weight: 4300 lbs

Driven Weight 135000 N

Usable Stroke: ± 35 mm

Frequency Limit 6 to 250Hz

Length: 7.350m

Width: 2.500 m

Height: 3.250 m

Wheelbase: 4.100 m

Turning Radius: 6.75 m

Speed: Up to 40 Km /h

Slope Capacity: 60%

Weights: 16000 Kg

Hold – Down: 28000 lbs

Base Plate: 3500 lbs

Shape: 4x4 Crab Tractor

Area: All terrain

Typical applications

- Reflection seismic (P)
- Borehole seismic (P)

Target depth: 300 – 2500 m

Seismic source (2)

IVI MiniVib T-2500



P- and S-waves

Typical applications

- Reflection seismic (P and S)
- Borehole seismic (P and S)

Target depth: 50 – 1000 m

Manufacturer: IVI

Model: T - 2500

Peak Force: 11120 N

Piston Area 9.7 cm²

Mass Weight: 141 kgf

Frequency Limit 10 to 550Hz

Length: 5.400 m

Width: 2.500 m

Height: 2.800 m

Speed: Up to 90 Km /h

Slope Capacity: 60%

Weights: 7000 Kg

Hold -Down: 1134 kgf

Base Plate: 168 kgf

Shape: 4x4 Unimog

Area: All terrain

Seismic source (3)

Accelerated weight drop

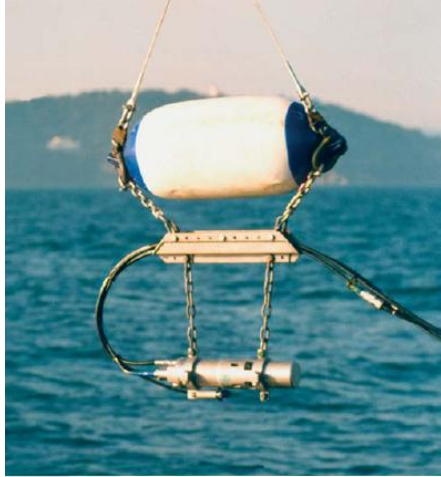


Seismic gun Isotta



Marine/borehole seismic source

Air-gun



Water-gun



Mud-gun



Typical applications

- Inshore reflection seismic (P)
- Inshore refraction seismic (P)
- Borehole seismic (P)

Target depth: 0 – 1000 m

Land sensors

- 10 Hz geophone (V), single: 300
- 10 Hz geophone (V), string of 6: 400
- 10 Hz geophone 3C: 100
- 4.5 Hz geophone (V): 50
- 4.5 Hz geophone (H): 150
- 100 Hz geophone (V): 300
- 40 Hz geophone (V): 350
- 48 ch landstreamer (V, SV, SH)

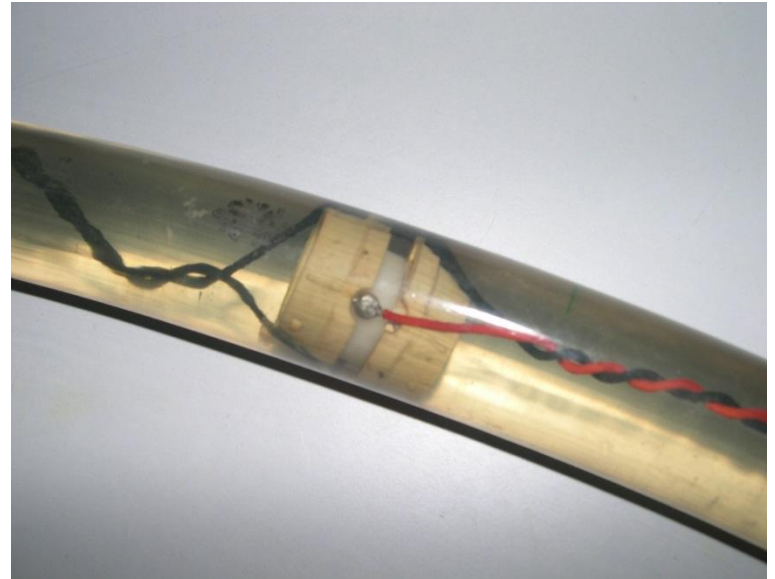


Marine/borehole sensors

Hydrophone streamer 24 ch, 120 m (5 m)

Bay cable 24 ch 120 m (5 m) + 180 m layout: 2 units

Borehole hydrophone streamer 6 ch (2 m), 50 m





CLASSE 500

Type	Pilothouse
Length	9.10 m
Width	2.95 m
Draft	0.86 m
Engine	2 x AIFO Diesel 155 HP

RUBBER DINGHY BSC 50

Length	5.00 m
Width	2.40 m
Draft	0.30 m
Engine	SUZUKI 40 HP

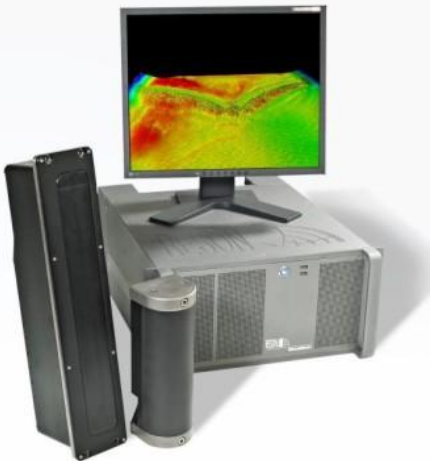
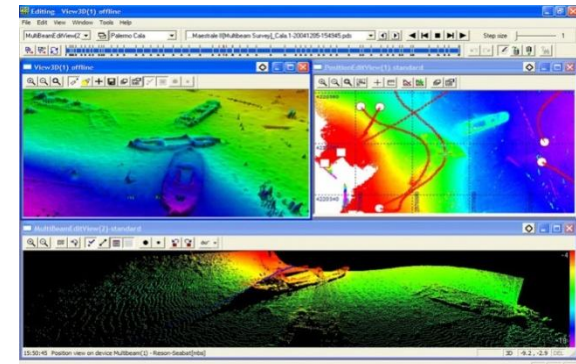


SINGLEBEAM AND MULTIBEAM ECHOSOUNDING



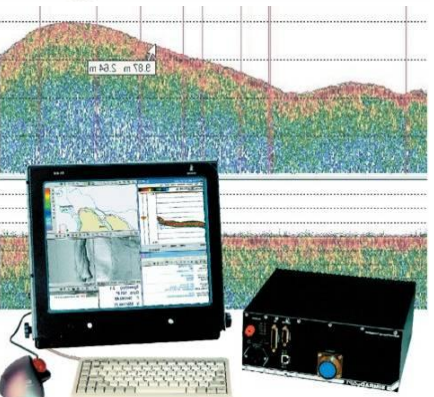
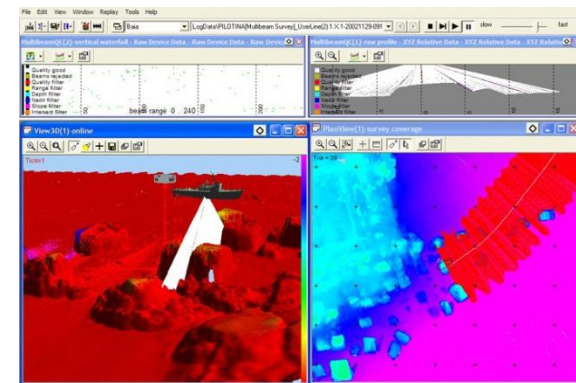
MB RESON SEABAT 8125

Operating frequency	455 kHz
Number of beams	240
Max swath	120°
Resolution	6 mm
Depth range	0 - 100 m



MB RESON SEABAT 7125

Operating frequency	200 - 400 kHz
Number of beams	512
Max swath	140°
Resolution	6 mm
Depth range	0- 400 m

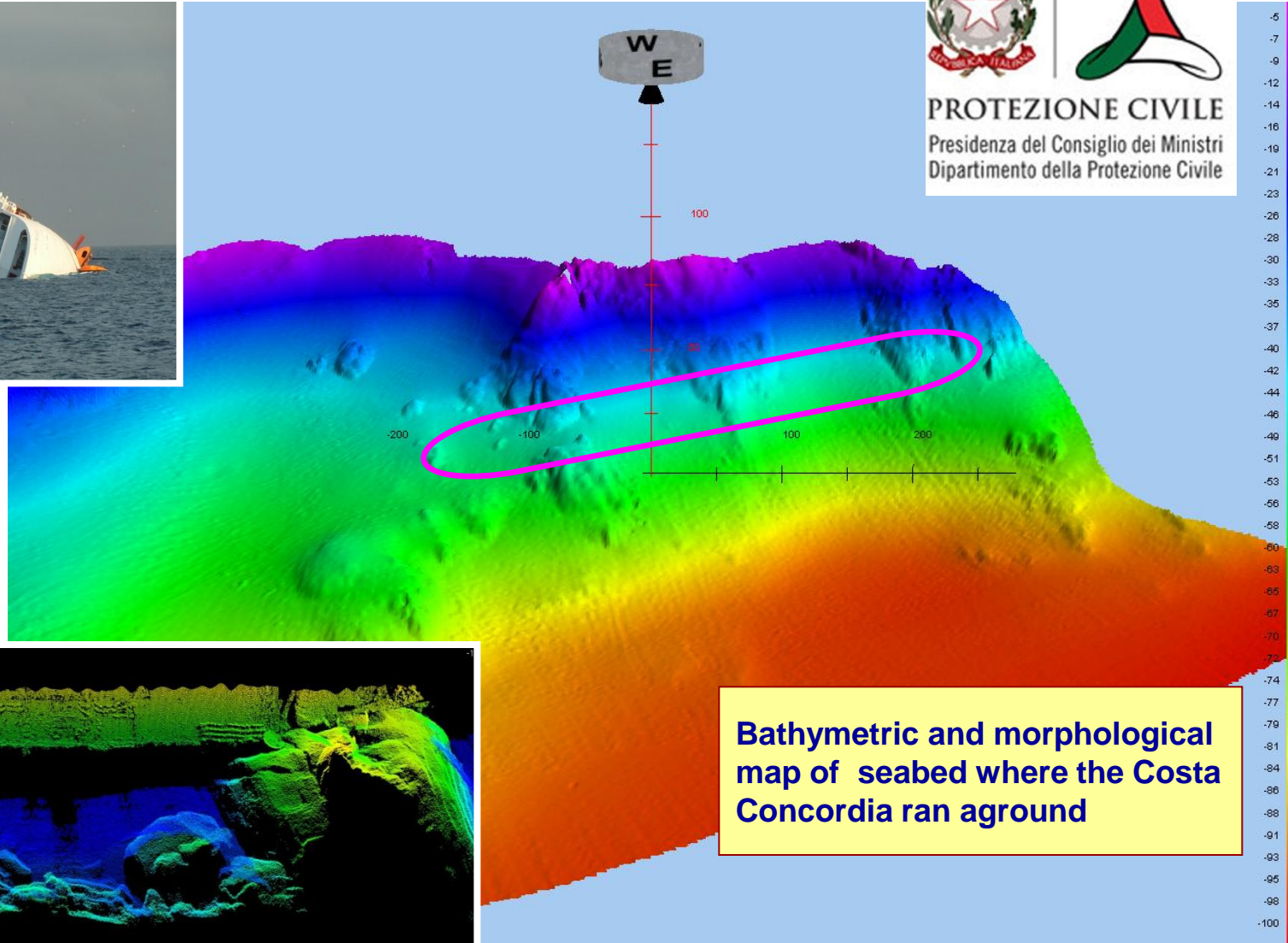


SB KONGSBERG EA400

Operating frequency	50 - 200 kHz
Beam width alongtrack	7°
Beam width acrosstrack	10°-16°
Accuracy	1 / 5 cm

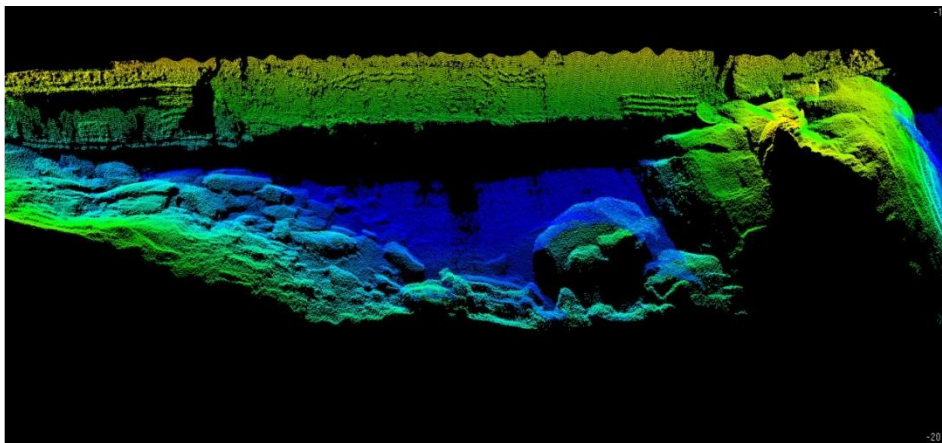
Acquisition soft.	PDS2000
Processing soft.	PDS2000

MULTIBEAM ECHOSOUNDING

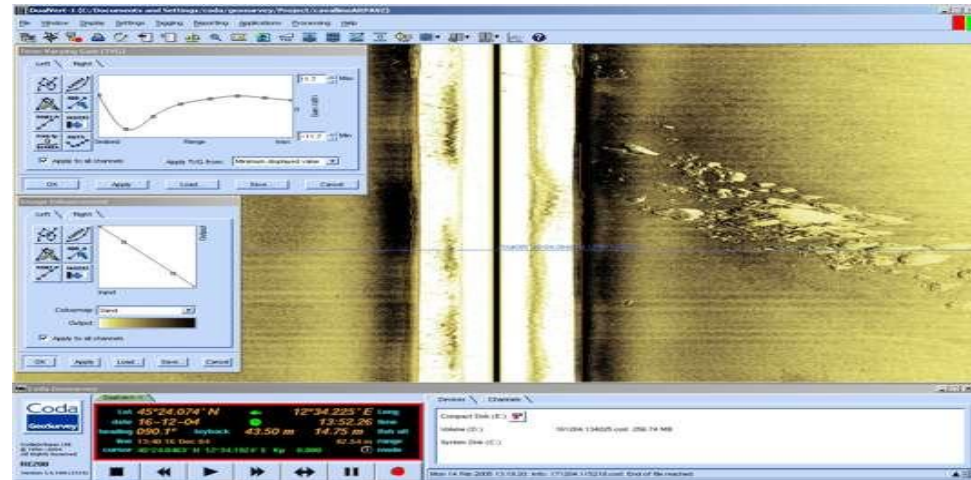


Bathymetric and morphological map of seabed where the Costa Concordia ran aground

Courtesy of D. Cotterle, E. Gordini, and M. Deponte



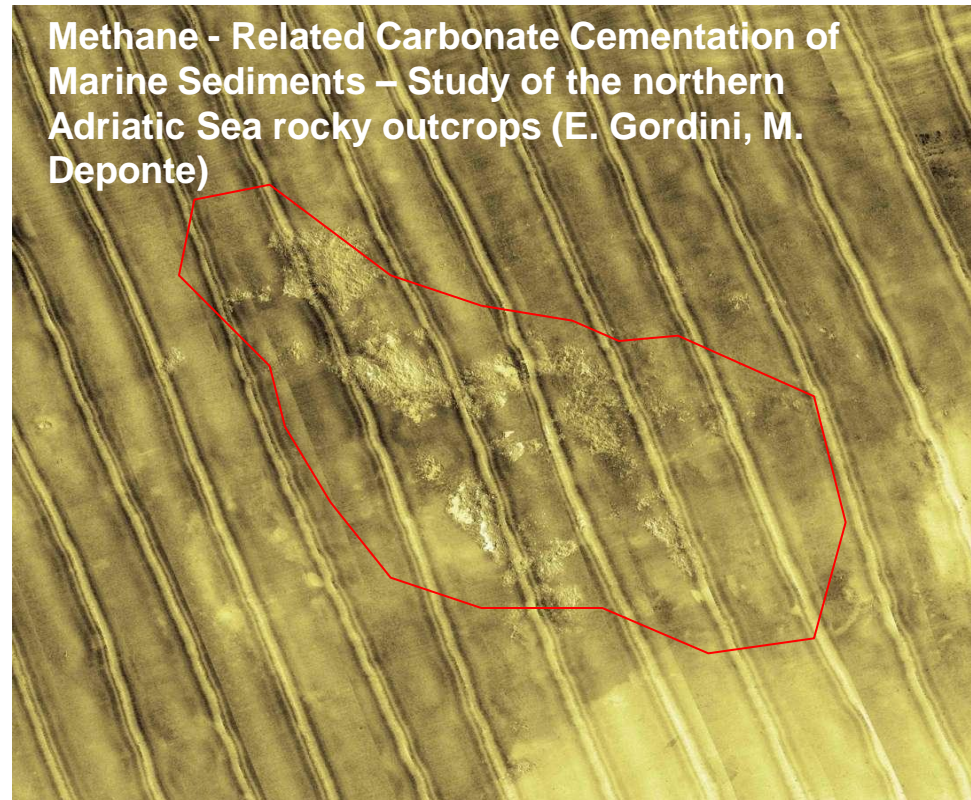
SIDE SCAN SONAR



EDGETECH DF 1000

Operating frequency	100 kHz – 400 kHz
Pulse length	0.1 - 0.01 ms
Horizontal beam width	1.2°- 0.5°
A/D Resolution	12 bits / sample
Sampling rate	24 kHz / channel
Operating depth	1000 m

Caorle (northern Adriatic Sea) SSS mosaic. local high backscatter features indicating the occurrence of rock outcrops in a dominant sandy environment.



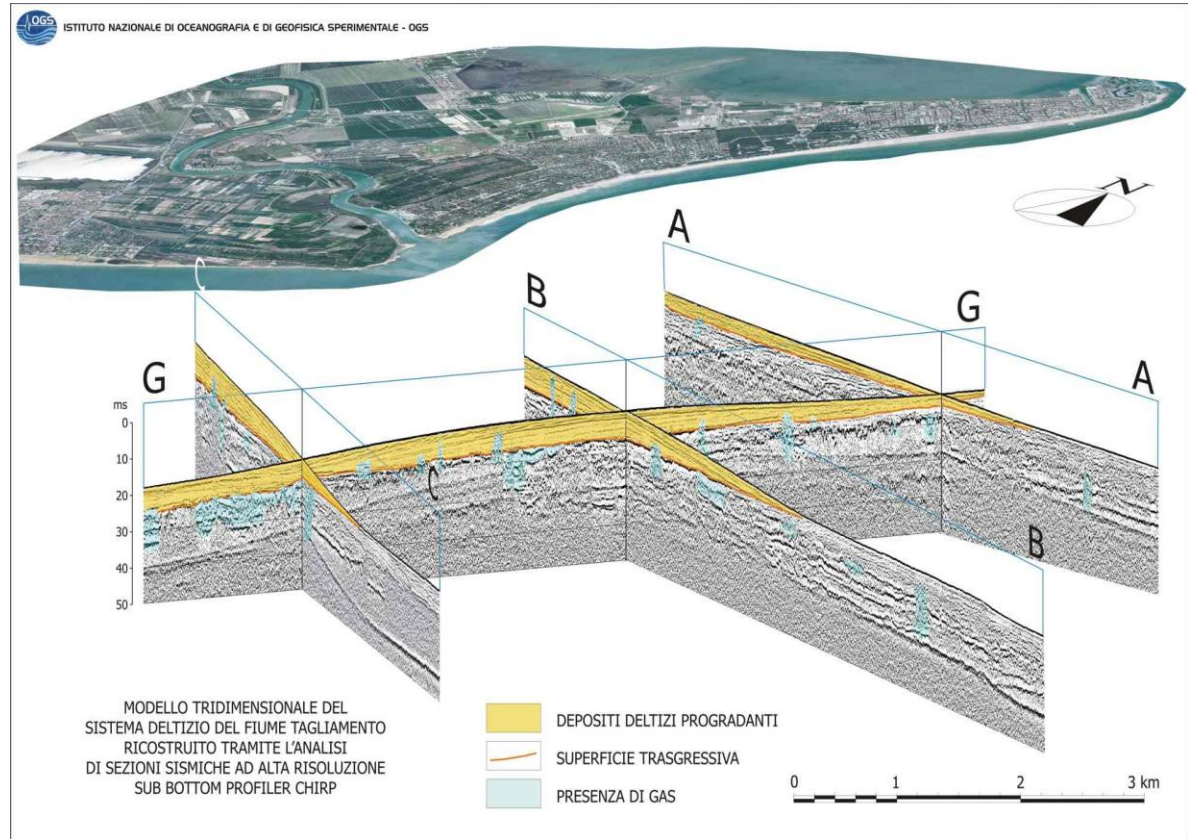
SUB BOTTOM PROFILING



EDGETECH 3200 XS

Frequency range	2 ÷ 12 kHz
Pulse type	FM
Pulse length	20 ÷ 40 ms
Beam width	16° ÷ 32°
Vertical resolution	8 ÷ 20 cm
Penetration	20 ÷ 200 m
Max depth	300 m

Sub-bottom profiler CHIRP investigations of Tagliamento River delta (northern Adriatic Sea).



Tridimensional model of the Tagliamento River delta system from sub bottom chirp analyses. Courtesy of R. Romeo

VERY HIGH RESOLUTION SEISMIC

SOURCE

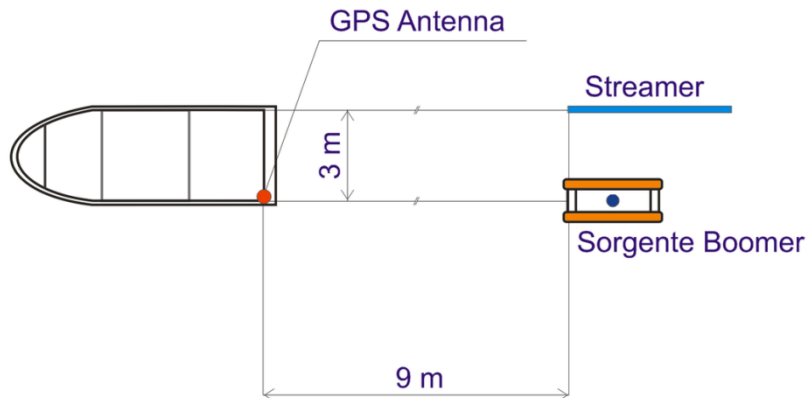
Model	Boomer
Pulse emission	2 – 8 pulse / sec
Upper frequency limit	9 kHz
Resolution	20 – 40 cm

RECEIVER

Single channel streamer

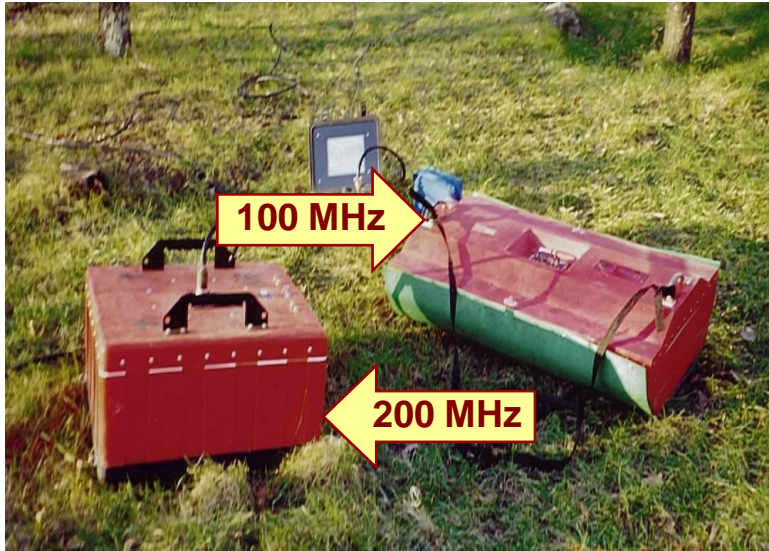


TYPICAL CONFIGURATION

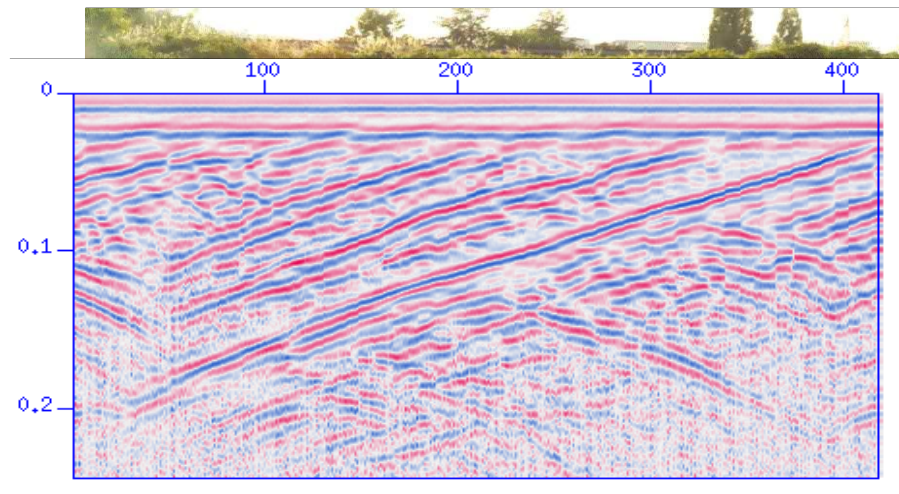
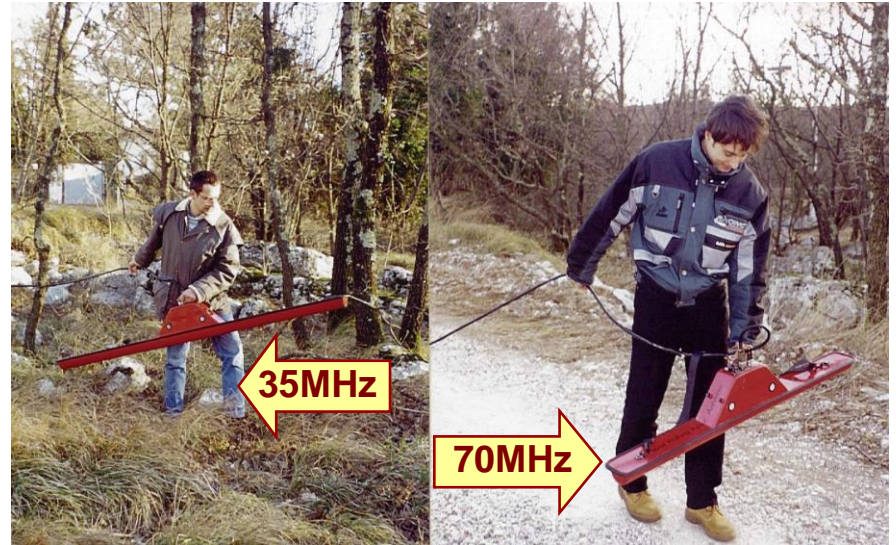


GROUND PENETRATING RADAR

GSSI HIGH FREQUENCY



GSSI LOW FREQUENCY



Courtesy of L. Baradello

EARTH RESISTIVITY TOMOGRAPHY

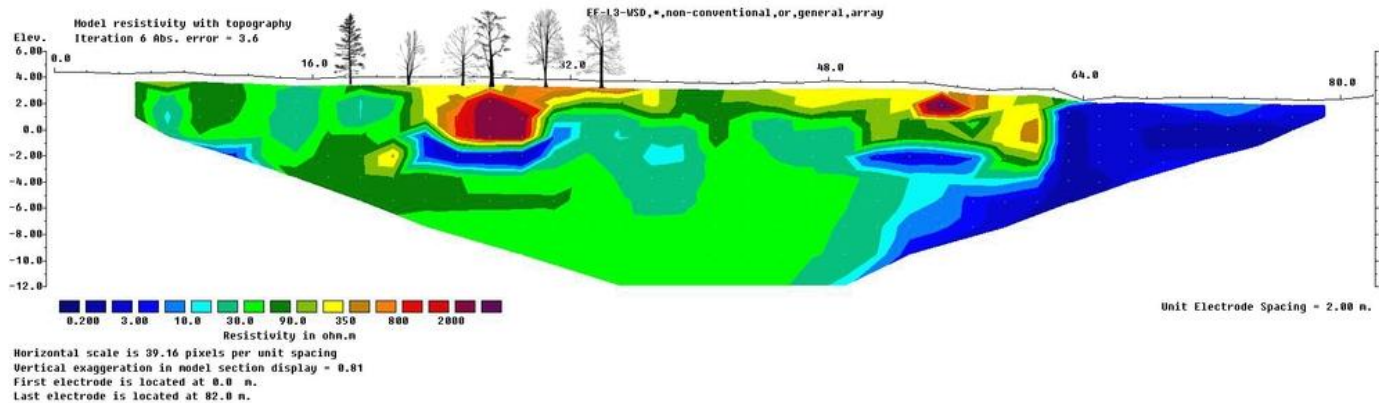


4point light hp - Lippman

Channel number	60
Software	Geotest

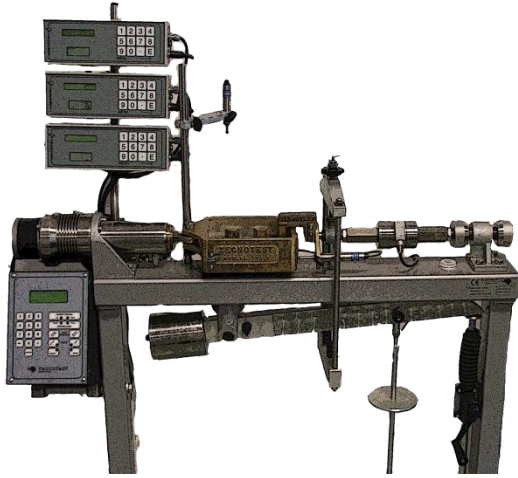
SYSCAL R2 SYSTEM

Channel number	64
Cont. Digital stack	up to 250
Software	PROSYS

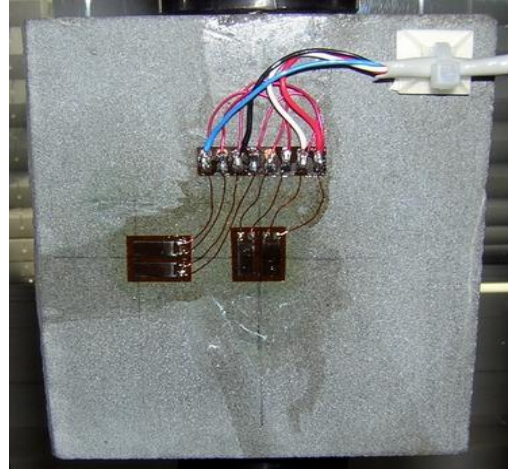


LABORATORY

The OGS is equipped with a laboratory for geotechnical, geomechanical and sedimentological analysis.



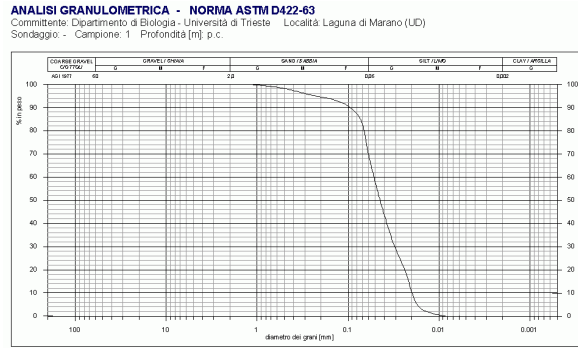
Direct shear machine



Strain gauge



Unconfined compression samples



Soil classification



Rock press

Courtesy of R. Romeo