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 Falletti
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 0.3μV 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

<table>
<thead>
<tr>
<th>ACQUISITION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic range</td>
<td>&gt;118 dB (at 2 msec sampling)</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>DC to 15 kHz</td>
</tr>
<tr>
<td>Weight</td>
<td>3.4 kg (7.5 lbs)</td>
</tr>
<tr>
<td>Sample rates (milliseconds)</td>
<td>0.0208, 0.0625, 0.125, 0.250, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0</td>
</tr>
<tr>
<td>Pre-trigger window</td>
<td>10 second</td>
</tr>
<tr>
<td>Trigger accuracy</td>
<td>±1 microsecond</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GENERAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of channels per unit</td>
<td>1 to 24 (factory set)</td>
</tr>
<tr>
<td>A/D resolution</td>
<td>24-bit</td>
</tr>
<tr>
<td>Record length</td>
<td>Up to 4 billion samples</td>
</tr>
<tr>
<td>Continuous recording</td>
<td>Available</td>
</tr>
<tr>
<td>GPS synchronization</td>
<td>Int. Clock set to GPS time, Time &amp; position saved</td>
</tr>
<tr>
<td>Internal storage</td>
<td>Compact Flash media (FAT16/FAT32)</td>
</tr>
<tr>
<td>Built-in Ethernet speed</td>
<td>100 Mbit (8 Mbyte download)</td>
</tr>
</tbody>
</table>
**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: 7.350 m  
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
IVI MiniVib T-2500

**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

**P- and S-waves**

**Typical applications**
- Reflection seismic (P and S)  
- Borehole seismic (P and S)

**Target depth:** 50 – 1000 m
Seismic source (3)

Accelerated weight drop  Seismic gun Isotta
Marine/borehole seismic source

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
INSHORE BOATS

CLASSE 500

<table>
<thead>
<tr>
<th>Type</th>
<th>Pilothouse</th>
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<tbody>
<tr>
<td>Length</td>
<td>9.10 m</td>
</tr>
<tr>
<td>Width</td>
<td>2.95 m</td>
</tr>
<tr>
<td>Draft</td>
<td>0.86 m</td>
</tr>
<tr>
<td>Engine</td>
<td>2 x AIFO Diesel 155 HP</td>
</tr>
</tbody>
</table>

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

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**Acquisition soft.** | **Processing soft.**
---|---
PDS2000 | PDS2000
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

Methane - Related Carbonate Cementation of Marine Sediments – Study of the northern Adriatic Sea rocky outcrops (E. Gordini, M. Deponte)

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

**VERY HIGH RESOLUTION SEISMIC**

**SOURCE**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td>Model</td>
<td>Boomer</td>
</tr>
<tr>
<td>Pulse emission</td>
<td>2 – 8 pulse / sec</td>
</tr>
<tr>
<td>Upper frequency limit</td>
<td>9 kHz</td>
</tr>
<tr>
<td>Resolution</td>
<td>20 – 40 cm</td>
</tr>
</tbody>
</table>

**RECEIVER**

Single channel streamer

**TYPICAL CONFIGURATION**

![Diagram of typical configuration]
GROUND PENETRATING RADAR

**GSSI HIGH FREQUENCY**

- 100 MHz
- 200 MHz

**GSSI LOW FREQUENCY**

- 35 MHz
- 70 MHz

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

*Model resistivity with topography*
- Iteration 6 acc. mean = 2.6
- Resistivity in ohm.m
- Horizontal scale is 59.16 pixels per unit spacing
- Vertical exaggeration in model section display = 0.91
- First electrode is located at 5.0 m
- Last electrode is located at 87.0 m
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