APPLIED ACOUSTICS
Underwater Technology

AAE USBL overview

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Easytrak

History

Easytrak USBL

- First delivered 2002.
- Early systems sold into defence market.
- Parallel development soon followed into commercial market.
- Supports most tone signalling schemes.
- Works with most MF beacons.
- Early & Alpha systems have surface based signal processing.
- 'MIPS' was first incarnation of new generation systems.
- 'Easytrak Nexus was full system, MIPS derived.

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'**MIPS**'

Self contained USBL

- First delivered 2008.
- All systems sold into defence market.
- Tone and Digital signal (Spread Spectrum).
- Works with most MF beacons.
- Self contained USBL system.
- Integrated MEMs Pitch / Roll sensor
- Flux gate compass.
- Sensor is factory aligned to transducer.
- Extensive type testing.
- Interfaces in a similar manner to a DVL, Gyro etc.

Full datasheet – click **here** [Web]

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Principal of operation

How it works!

- USBL transmits a signal.
- Beacon receives a signal.
- After a fixed time, beacon transmits back.
- Travel time is used to calculate distance.
- In addition – array is used to determine direction of arrival.
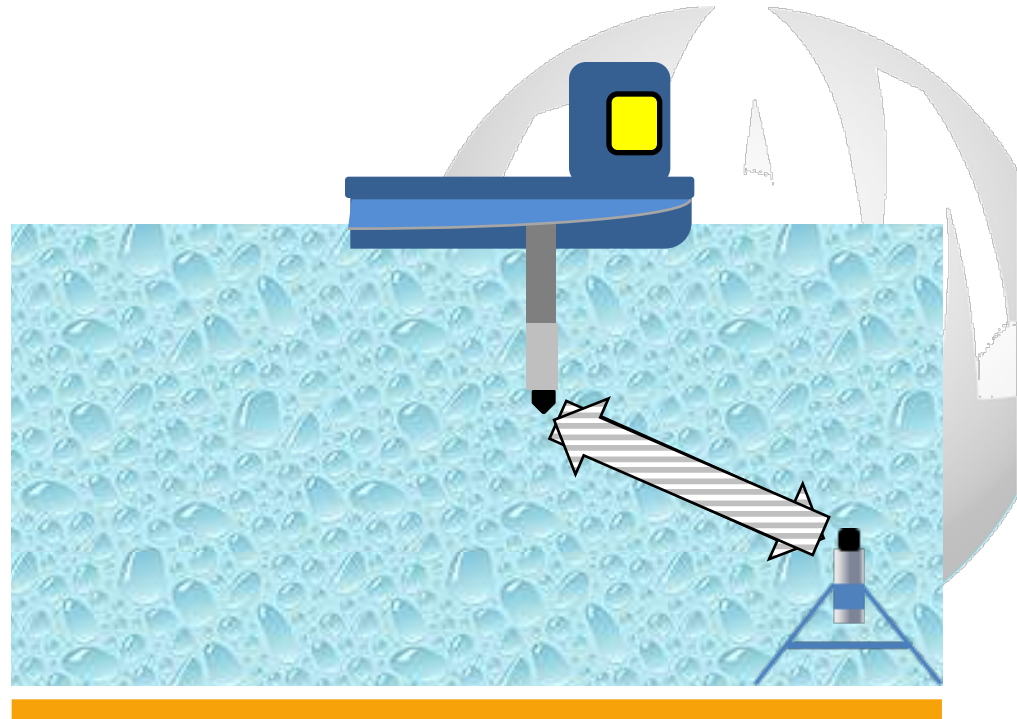
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Direction

Multiple elements

- Signal arrives at different elements at different times.
- Pattern of arrival can be used to determine azimuth & elevation.

0°
ALIGNMENT
MARK

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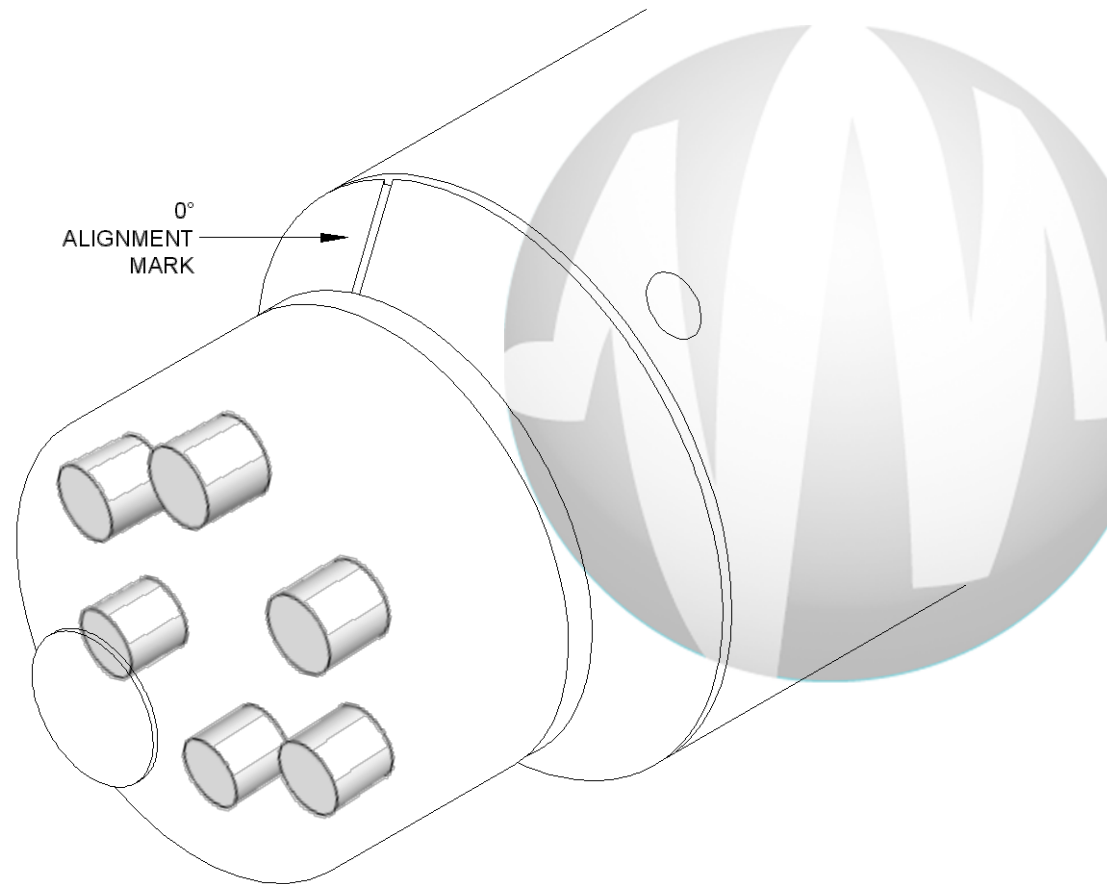
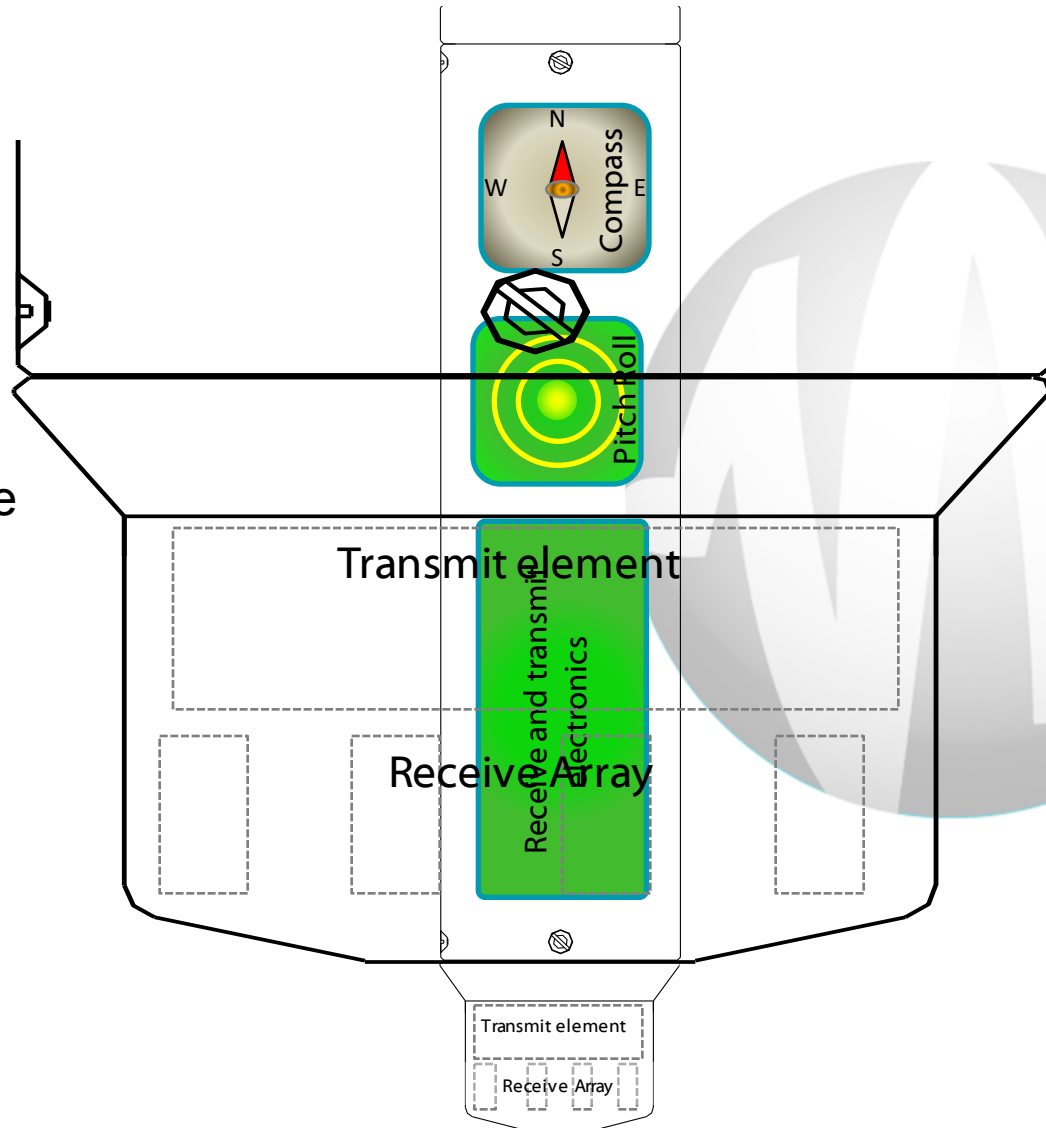# Transducer

ETM-903C

Inside the transducer:
- An acoustic transmitter .
- A dedicated transmit element.
- A receive array.
- Received Signal conditioning.
- A pitch, Roll sensor
- Magnetic compass.

Compass

Pitch Roll

Receive and transmit electronics

Transmit element

Receive Array

6

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Direction

Multiple elements

- Signal arrives at different elements at different times.
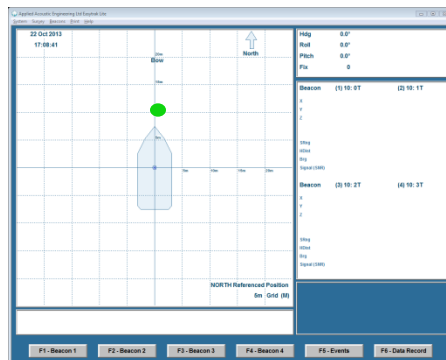- Pattern of arrival can be used to determine azimuth & elevation.

Compass

N
W E
S

Pitch Roll
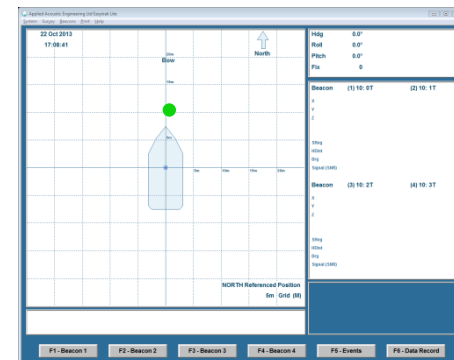
Transmit element

Receive and transmit electronics

Receive Array

Transmit element

Receive Array

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Motion sensing

Compensation

- The transducer has a motion sensor built in.
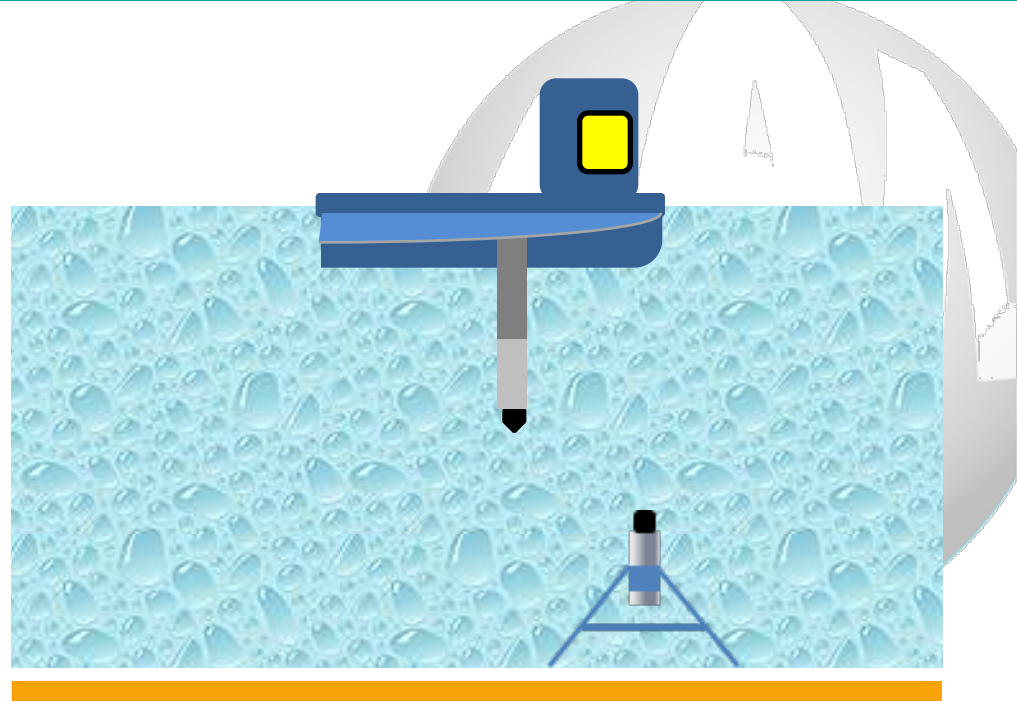
Without Compensation

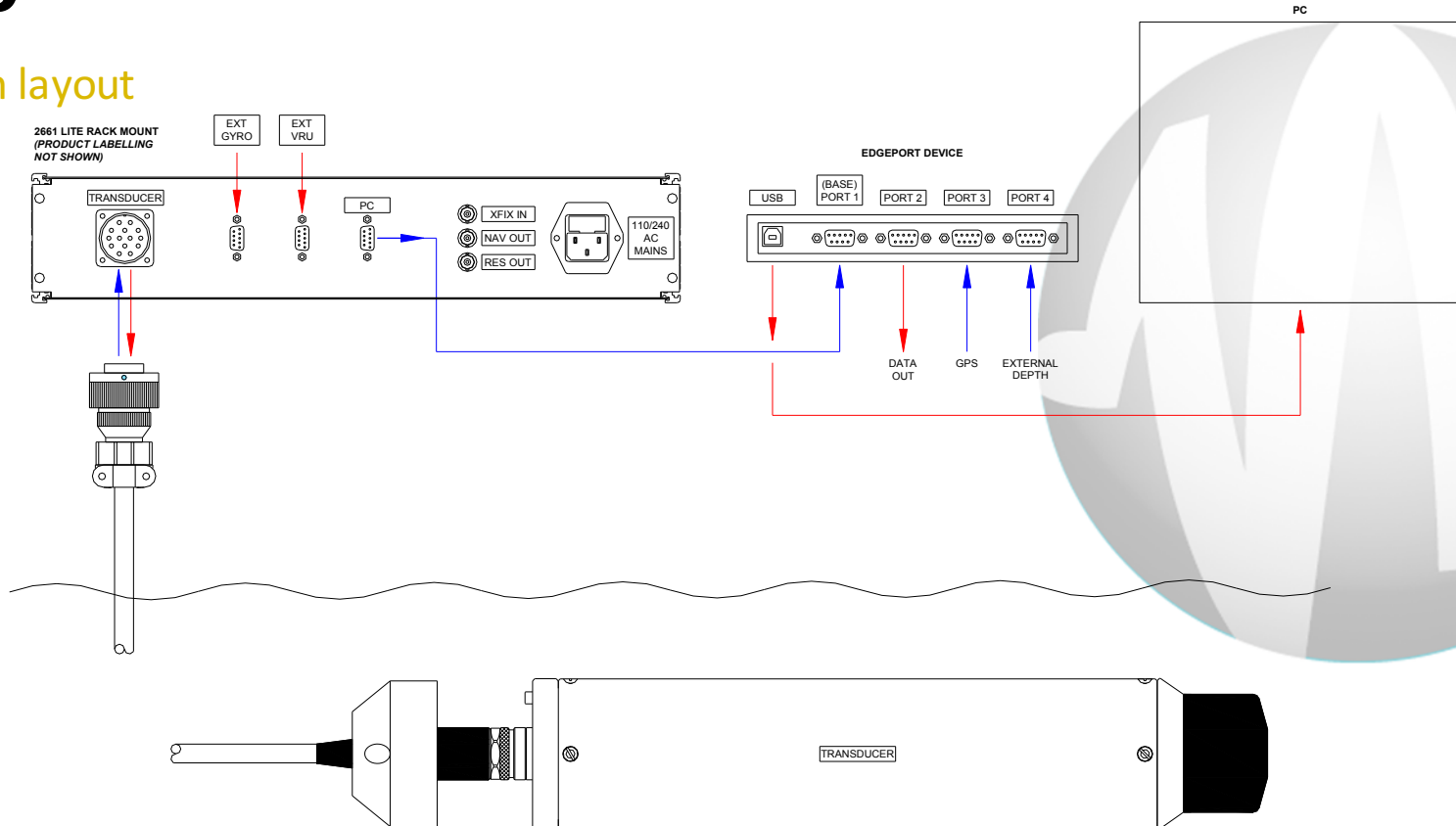With Compensation

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Alpha

Turnkey – basic system.
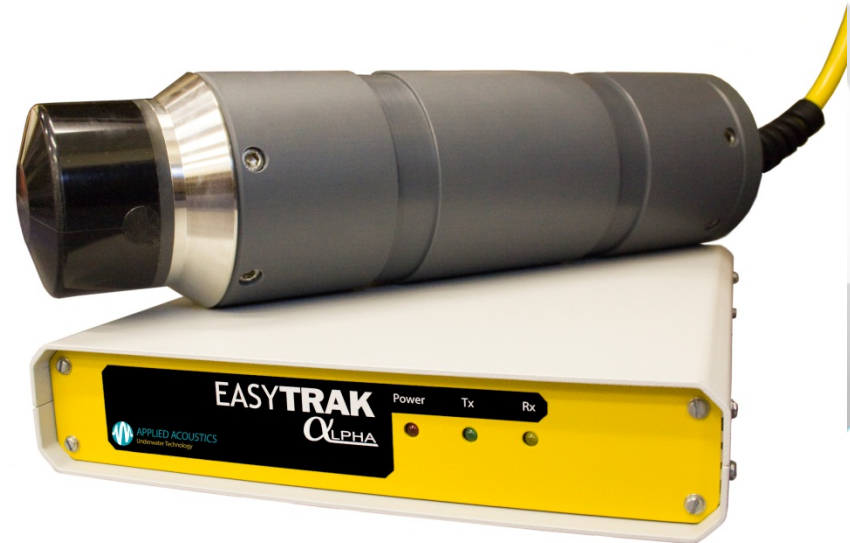
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Lite

Mid Range USBL

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Lite

System layout

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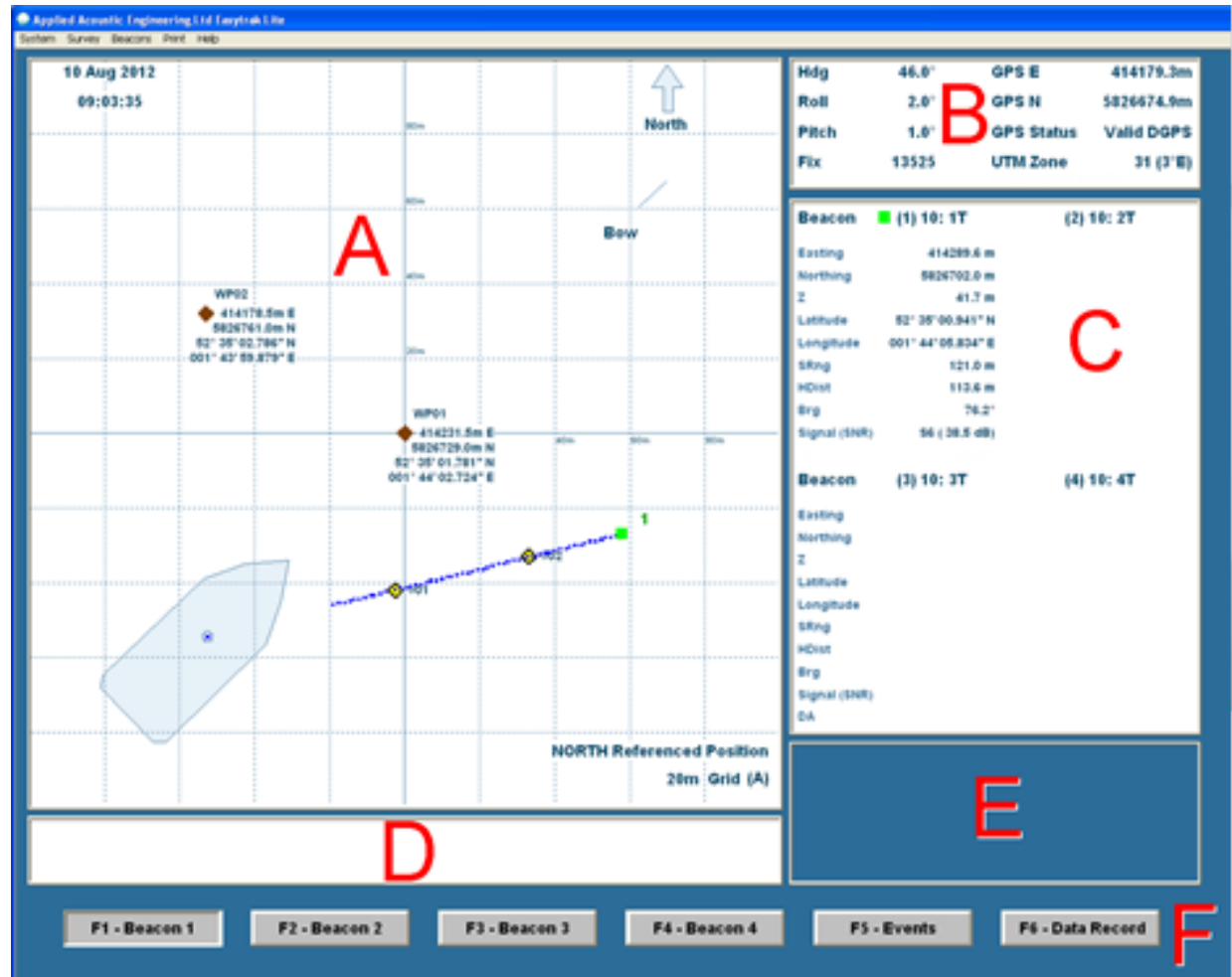
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Software

Easytrak USBL Lite

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Nexus system

Building on MIPS design experiences

- Advanced, very flexible, software.
- 10 target tracking.
- Supports digital & Tone Signals.
- PC incorporated into topside box.
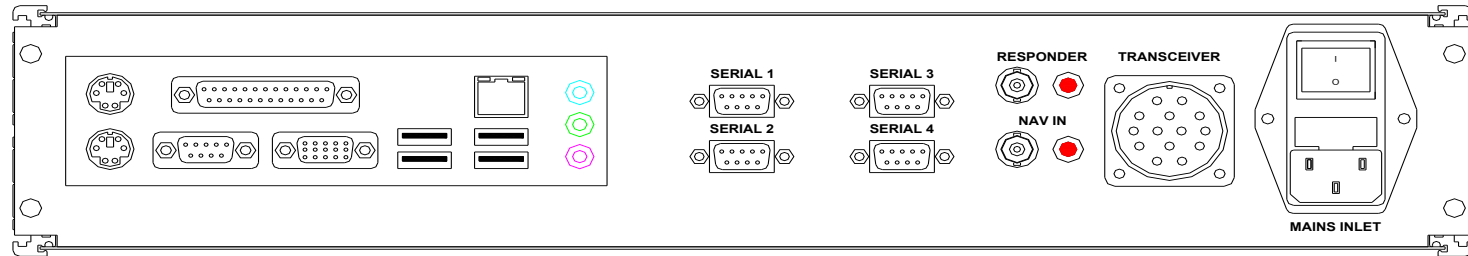- Turnkey solution.

Front Panel

• Mains Power will indicate Green when ON.

• TRANSCEIVER will indicate Green when power is ON (48vdc).

• TX / RX will indicate Green upon a beacon interrogation and valid reply received.

• SERIAL 1,2,3,4 will flash Green indicating valid activity on the serial ports.

INSTALLATION

- **SERIAL PORTS**: 4 Serial ports available for external sensor interface and aux inputs.
- **TRANSCEIVER**: Connection to the Nexus Transceiver using the Nexus Deck Cable.
- **RESPONDER:** BNC connection to beacon to triggered as a responder. LED will flash in synch indicating activity.
- **NAV IN**: BNC connection for external synchronisation key for system. LED will flash in synch indicating activity.
- **MAINS INLET**: The power supply is auto-ranging (115 – 230VAC 50/60Hz) and doesn't require user intervention. Plug into the nearest power outlet socket.
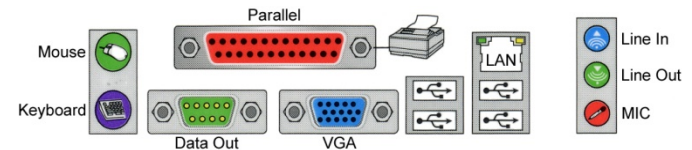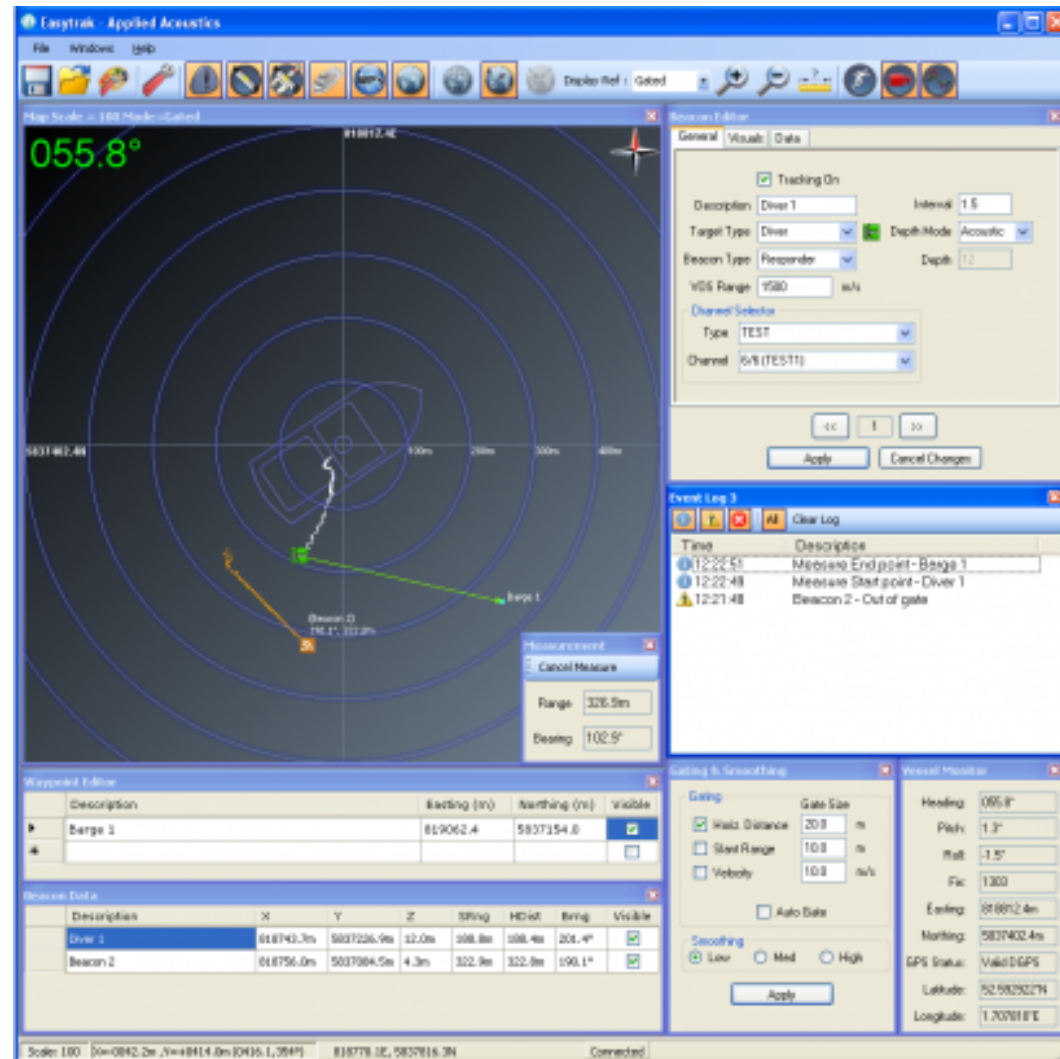
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Software

Easytrak USBL Nexus
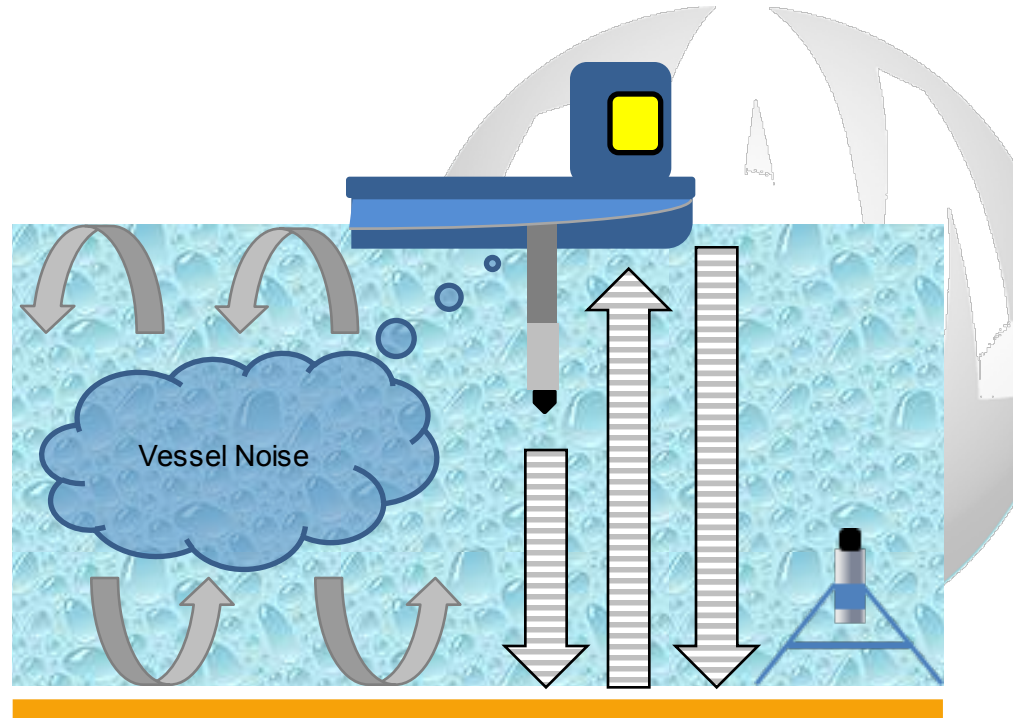
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Key challenges

Shallow water (<1,500m)

Upper water column - problematic

- Bottom may reflect sound in operating band.

- Vessel noise.

- Old transponder interrogations & replies, become noise.

- Vessel noise cannot dissipate as readily in this environment.

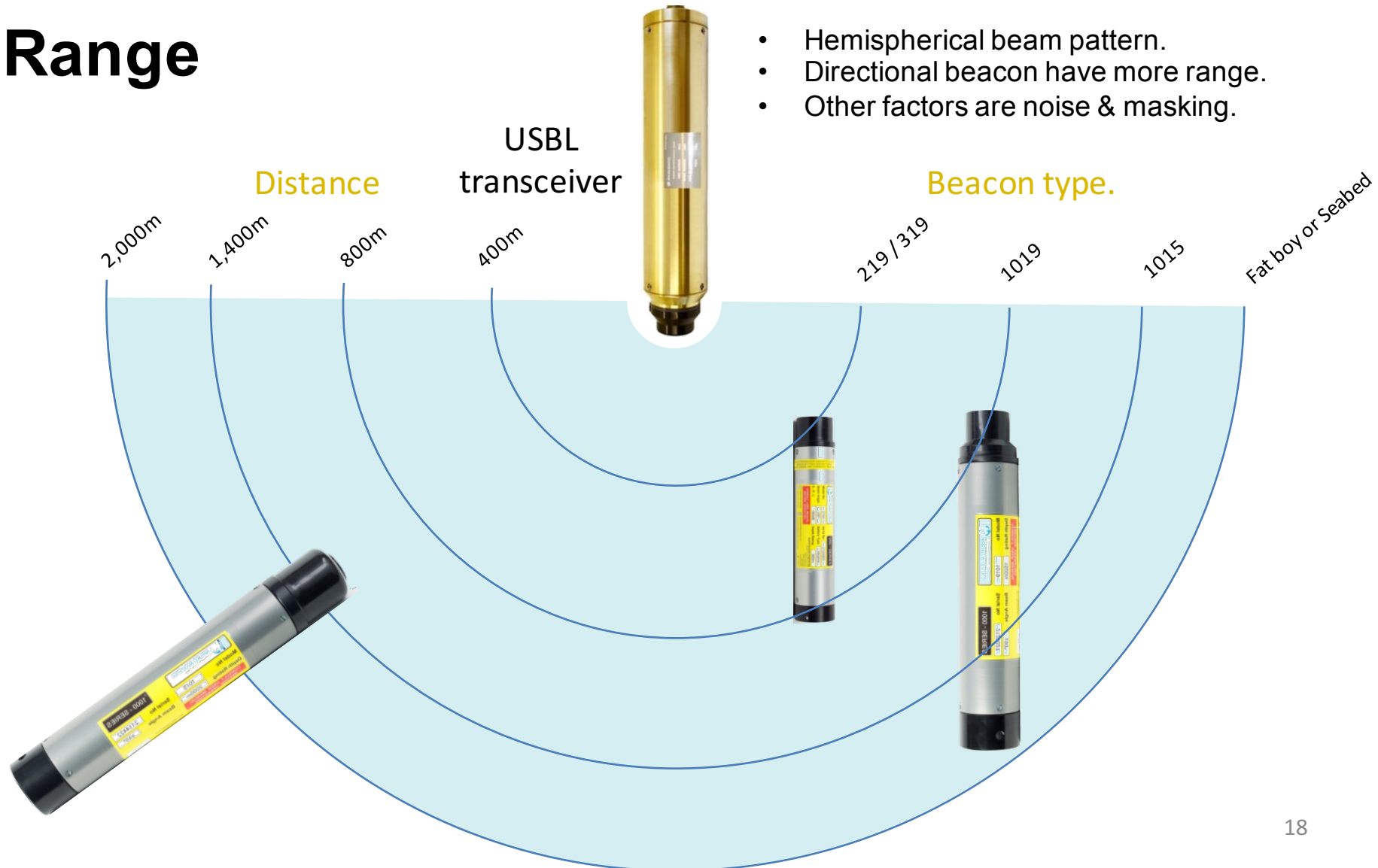- Multipath, caused by close by reflective objects.

Vessel Noise

Capability

Range

- Hemispherical beam pattern.
- Directional beacon have more range.
- Other factors are noise & masking.

USBL transceiver

Distance

Beacon type.

2,000m   1,400m   800m   400m   219/319   1019   1015   Fat boy or Seabed

Capability

Using the right beacon

Beam patterns.

- Torroidal beam pattern.
- Hemispherical
- Directional.

Directional

Hemispherical

Torroidal

Hemispherical

Analogue only

Digital beacons
(1000 series)

Calibration

EasyCal

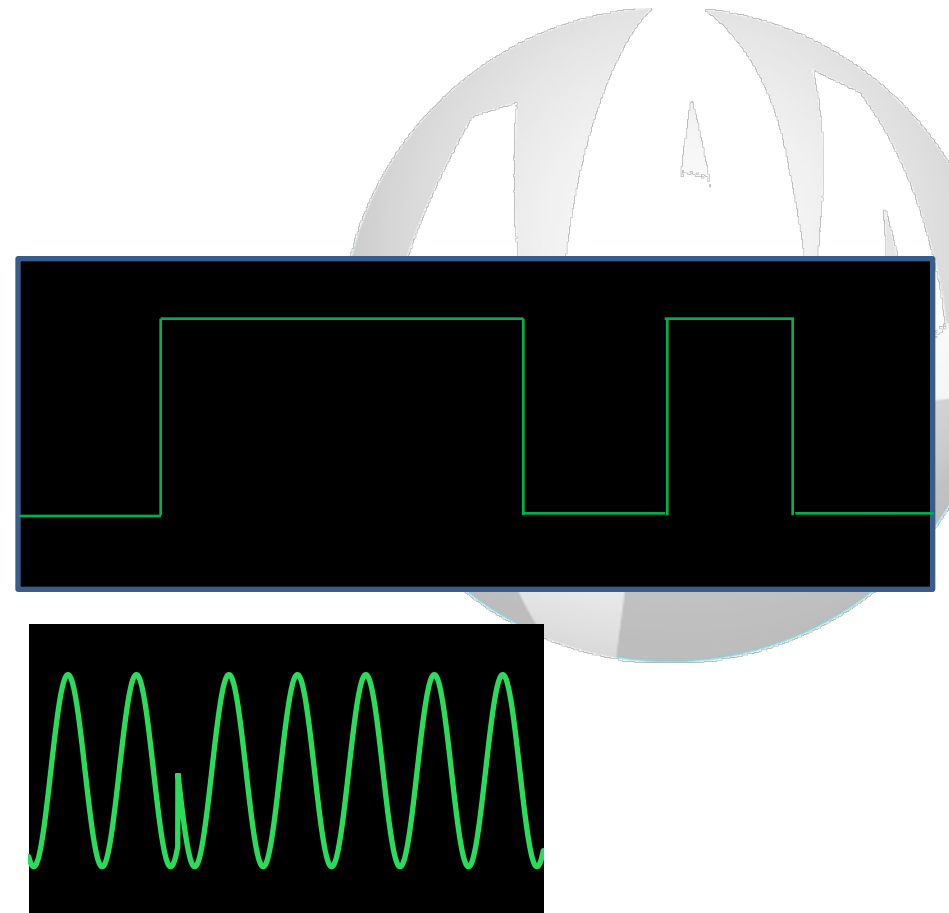Included with Nexus systems

Solutions
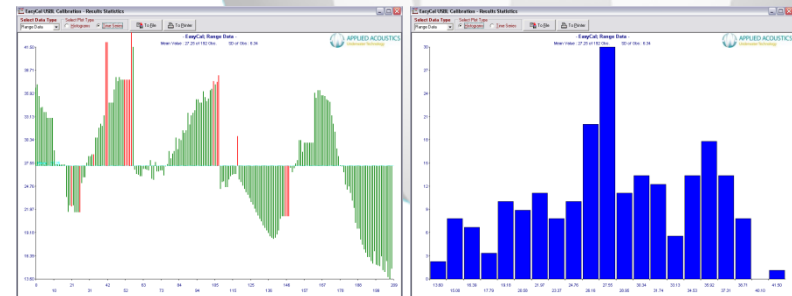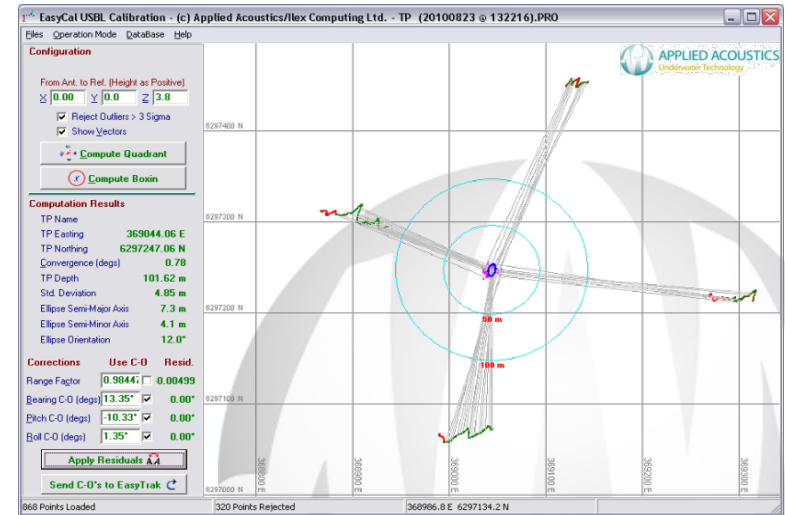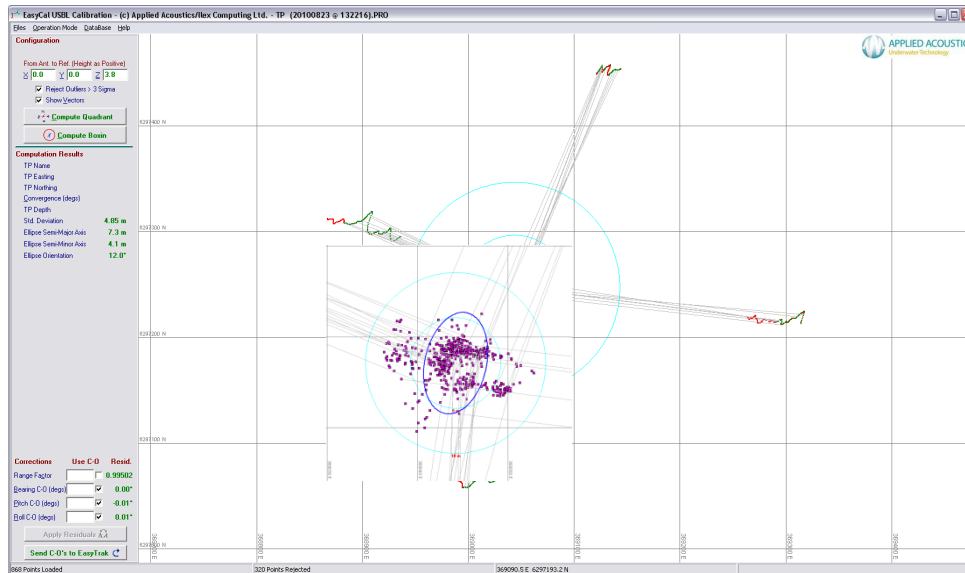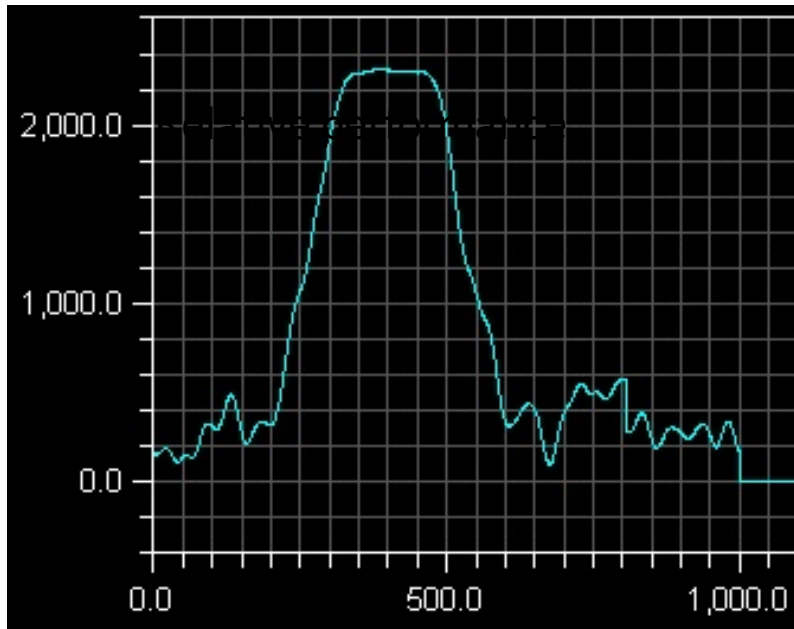
Using the right equipment

Acoustic signalling.

- Spread spectrum signalling.

- Short pulses.

- Mitigates some effects of noise.

- More precise & dependable positioning.

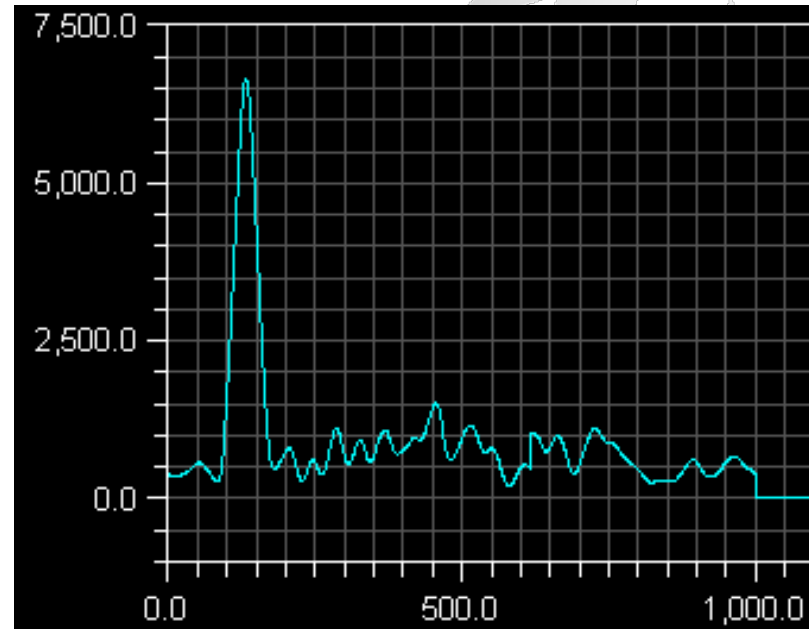- Less issues managing frequency spectrum if multiple vessels in use.

Solutions

Using the right equipment

Acoustic signalling.

Analogue

Digital

Solutions

Effect of Noise

Digital vs. Analogue signalling.

Digital

Signal Level	Bearing		DA		
	Average	Standard Deviation	Average	Standard Deviation	SNR(dB)
157	313.8	0.116	48.2	0.06	67.8
147	313.9	0.115	48.1	0.05	62.2
137	314	0.168	48	0.07	52.2
127	314.1	0.095	48.2	0.08	42.4
117	314.1	0.146	48.3	0.14	33
107	313.9	0.24	48.6	0.31	22.4

Analogue

Signal Level	Bearing		DA		
	Average	Standard Deviation	Average	Standard Deviation	SNR(dB)
157	298.3	0.691	44.3	0.63	
147	298.2	0.546	44.2	0.67	
137	298.1	0.595	44.2	0.57	
127	298	0.698	44.1	0.84	
117	298.2	1.177	44	1.89	
107	297.6	2.575	44.2	4.71	

Solutions

Deployment methods

Free hanging or over the side.

- **Free hanging** is good in low currents.

- Use internal depth, heading, pitch & roll.

- **Over the side** allows close coupling with incumbent ships sensor.

- Better for 'survey grade'.

Content

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Questions?