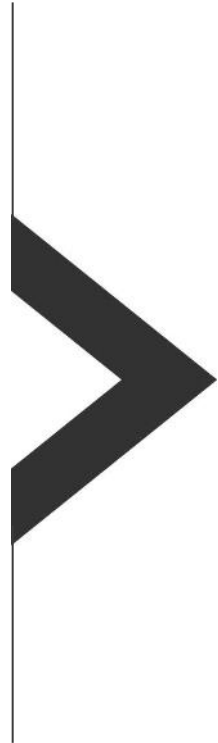




Introduction to Survey and Positioning – Giovanni De Vita

Geophysics





Agenda

Introduction

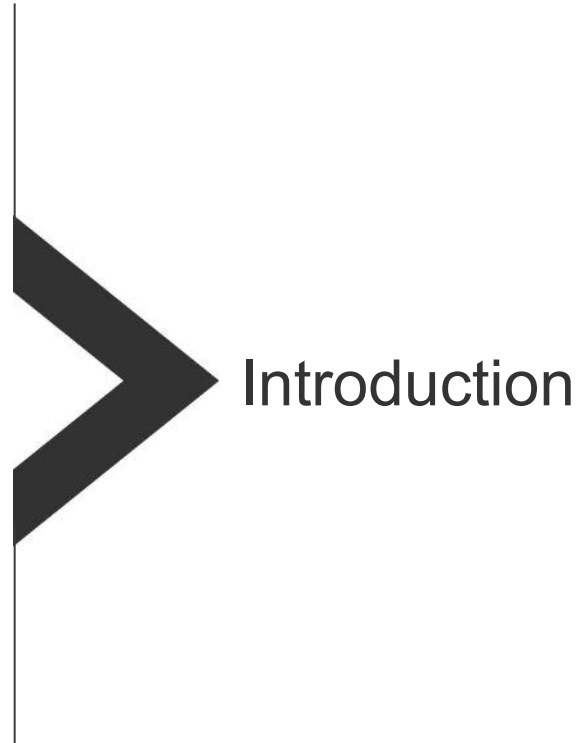
What is Geophysics and Why?

Methodologies

Platforms

Practical and Commercial considerations

Q/A



A trusted partner for offshore operations

Positioned globally

- Operating from 6 continents
- 20 offices near key O&G markets
- 57 vessels (12 on management / chartered in)
- Head office in Norway

Total of 4,108 employees *

- Offshore 3,227
- Onshore 881

Vessels & subsea equipment *

- Subsea 32
- AHTS 14
- PSV 11
- **Total fleet 57**
- ROV / AUV 74

* All totals as of 31.12.2023

“No matter where DOF operates in the world, safety is held as the highest priority.”

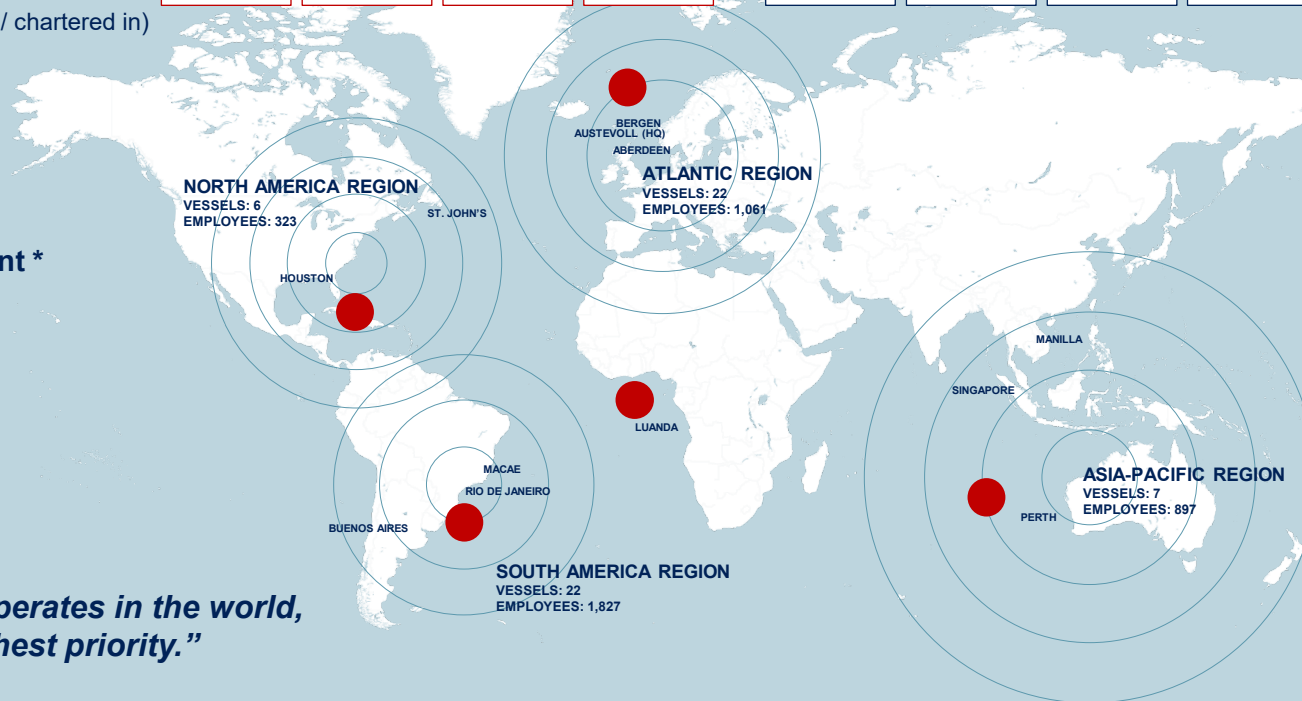
Marine services

Bringing award-winning capability to the offshore sector.

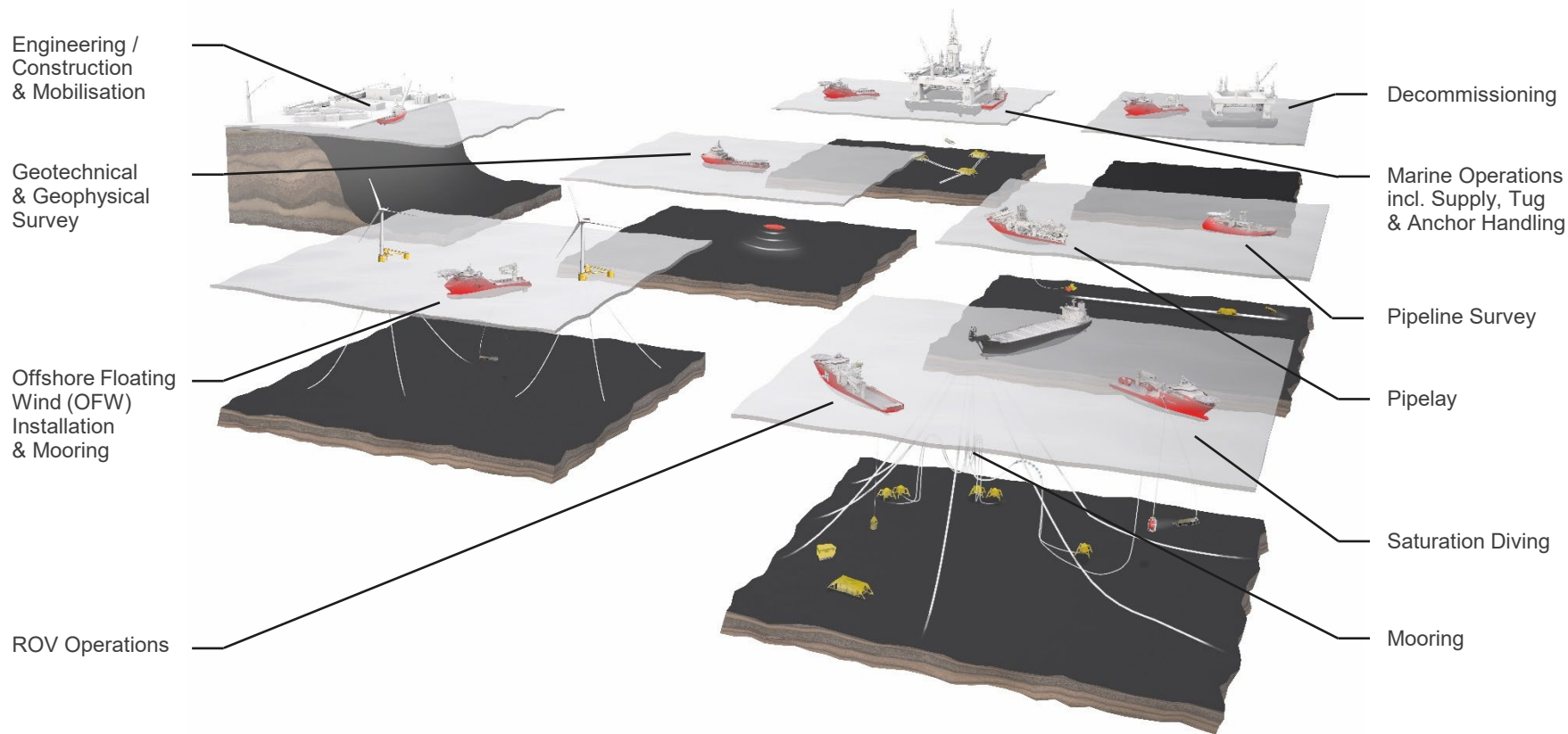


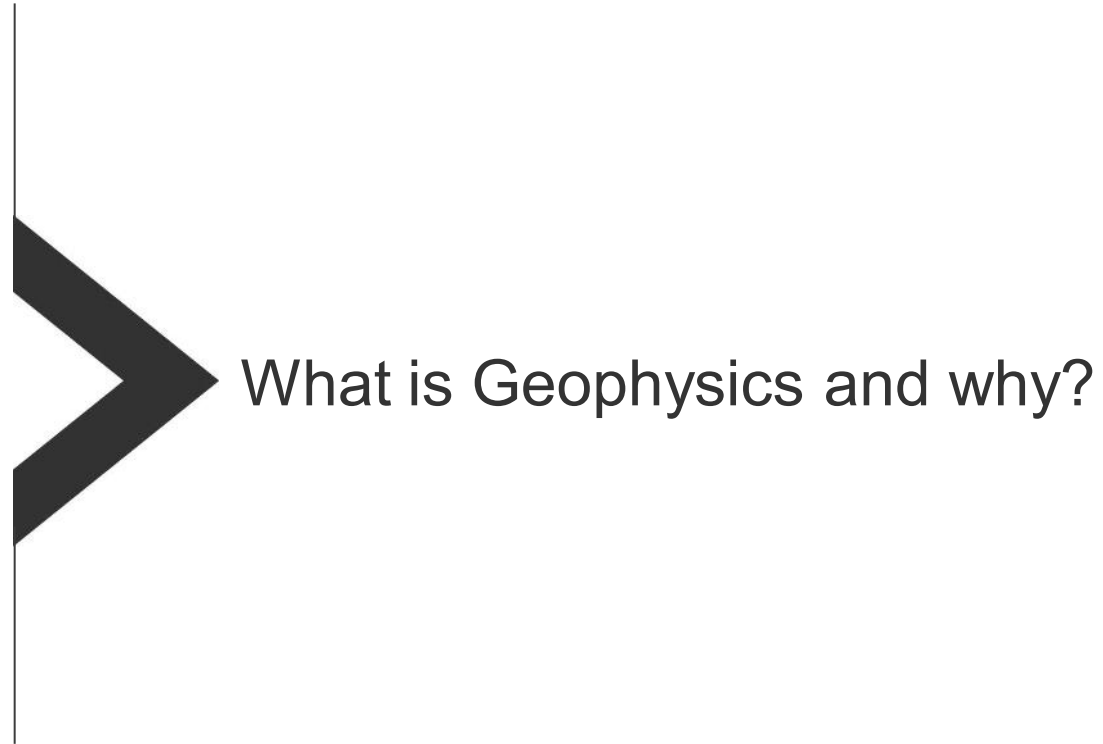
Subsea services

Integrated subsea services; wherever, whenever you need them.



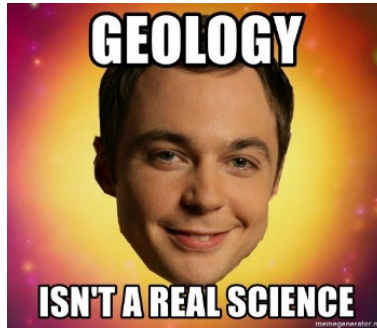
Total solutions from a single partner





What is Geophysics and Why?

“Marine geophysics is a scientific discipline which uses the quantitative observation of physical properties to understand the seafloor and sub-seafloor geology”



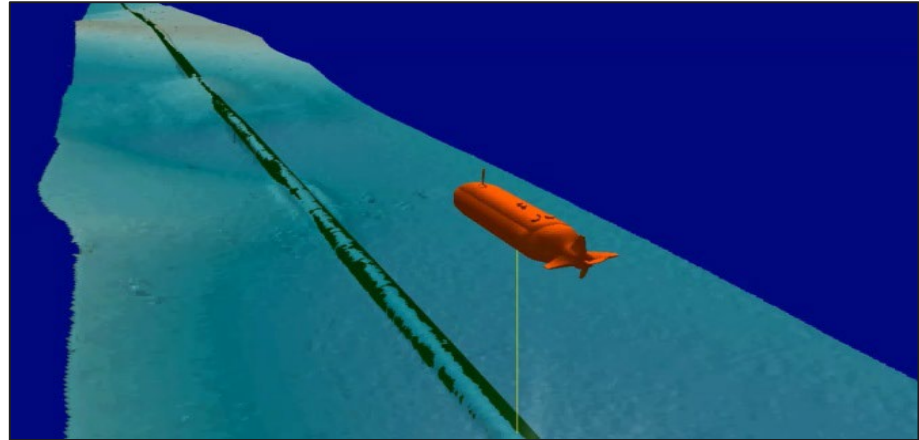
What is Geophysics and Why?

- To position, explore (O&G, science) and locate
- Routine inspection, integrity
- Safety! Infrastructure, environment and us
- Simply we like data...

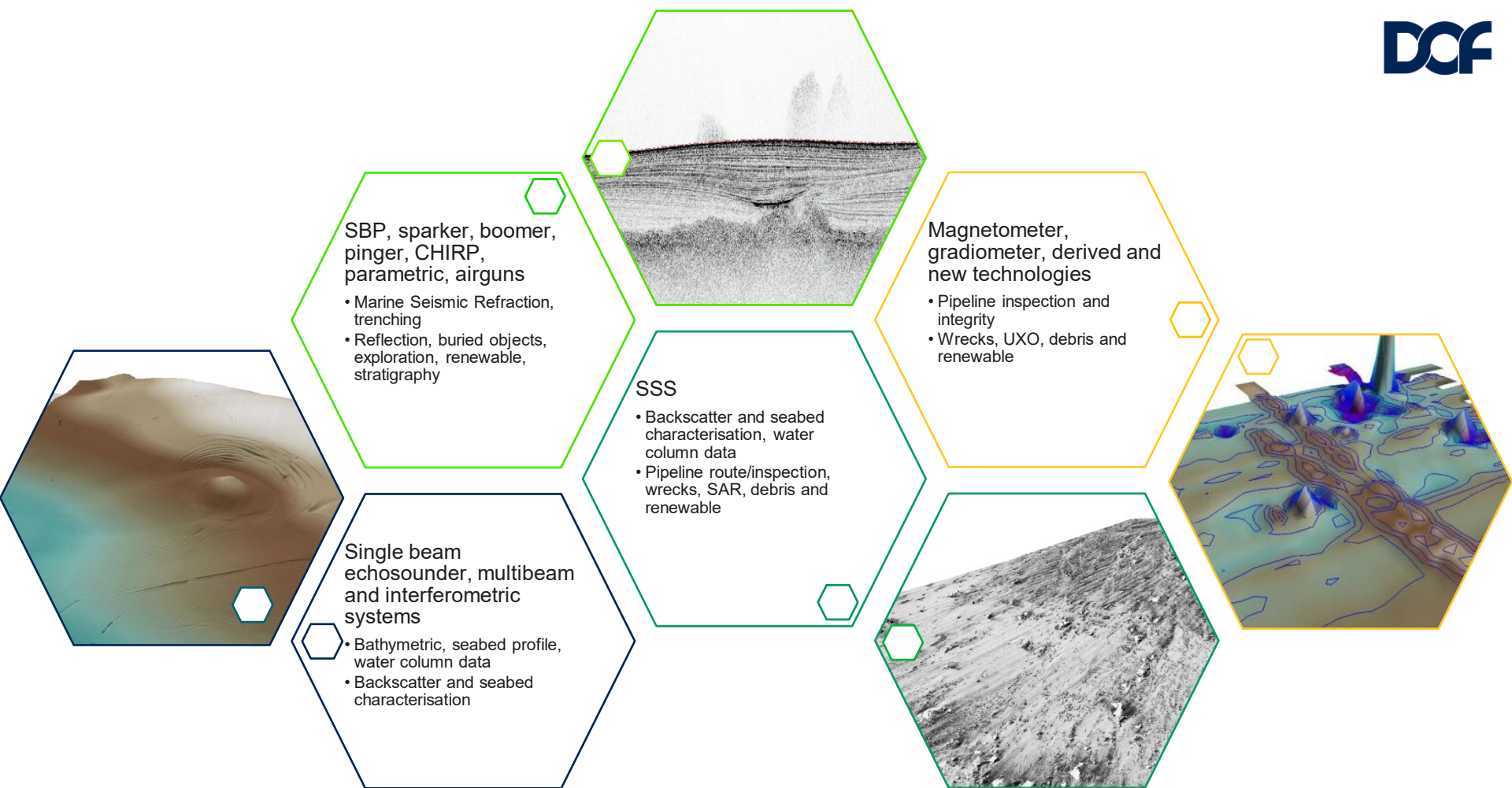


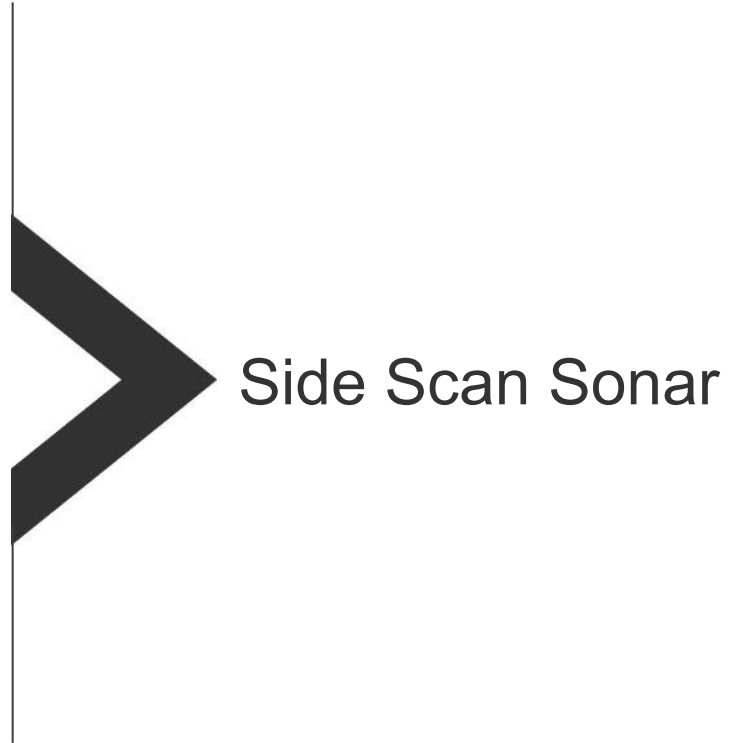
What is the data utilised for?

- Engineering and Design
 - Pipelines, platforms, anchors, piles, renewables (windfarms)
 - Seabed stability
 - FEED and geohazard
- IRM
 - Pipeline Inspection (IRM)
- Drilling Operations
 - Rig emplacement
- Life of field
 - From the exploration phase to the decommissioning









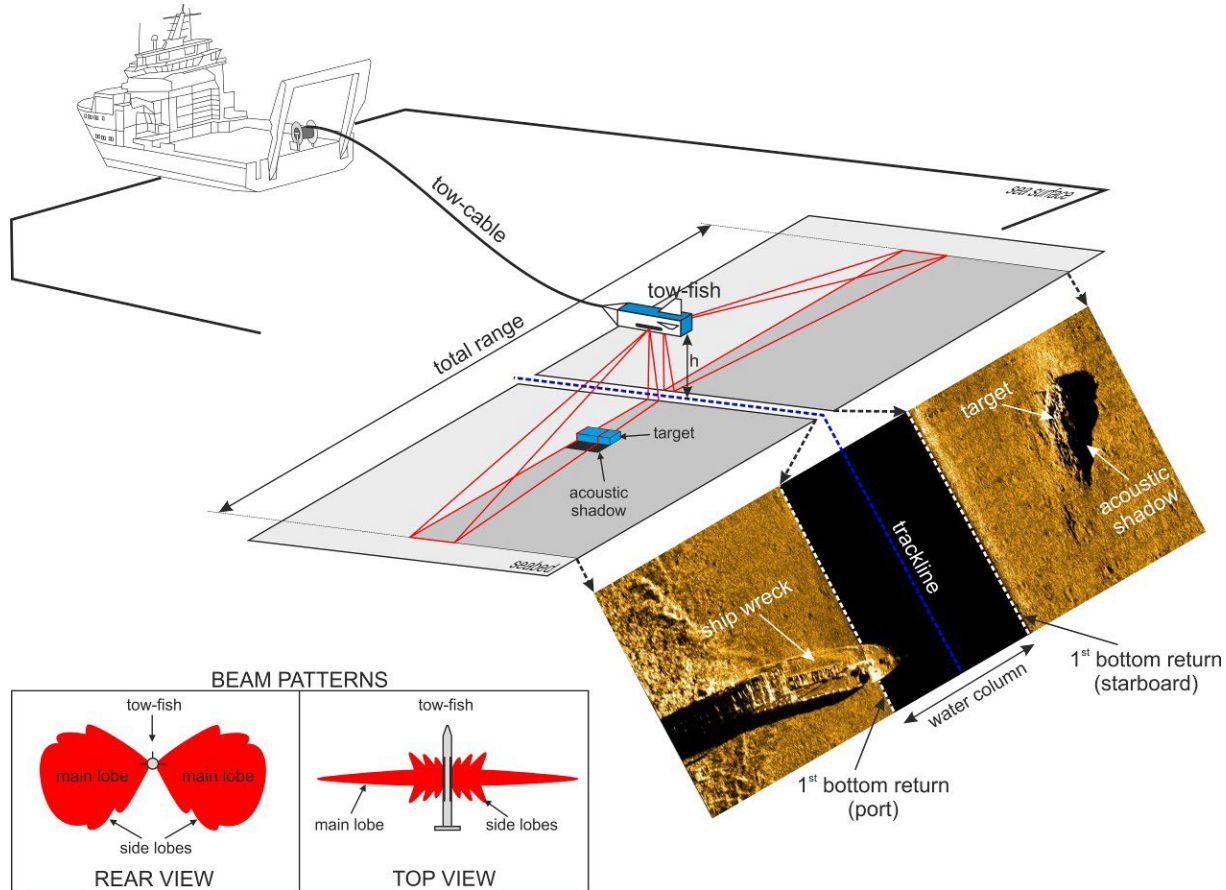
Side Scan Sonar

Side scan sonar is an acoustic system designed to look sideways and at a downward angle from both sides of a towed unit, called a "towfish".

- Two transducers mounted back-to-back to scan sideways
- High frequency, high resolution, low penetration
- 100 to 1600 kHz
- CHIRP pulse or Synthetic Aperture Sonar (SAS)
- ROV, AUV, Deep Tow



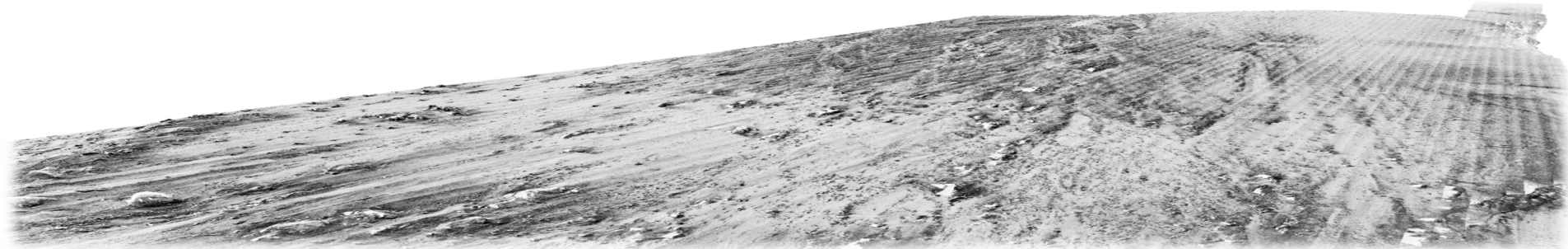
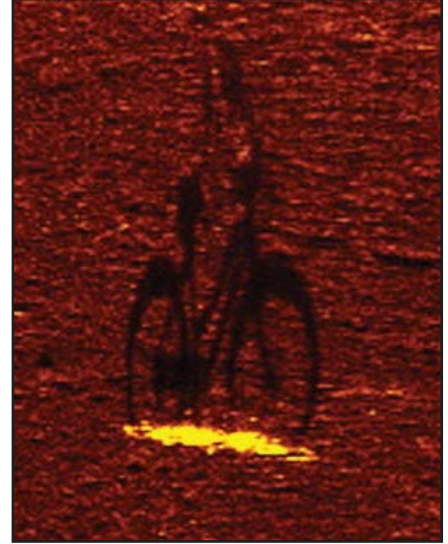
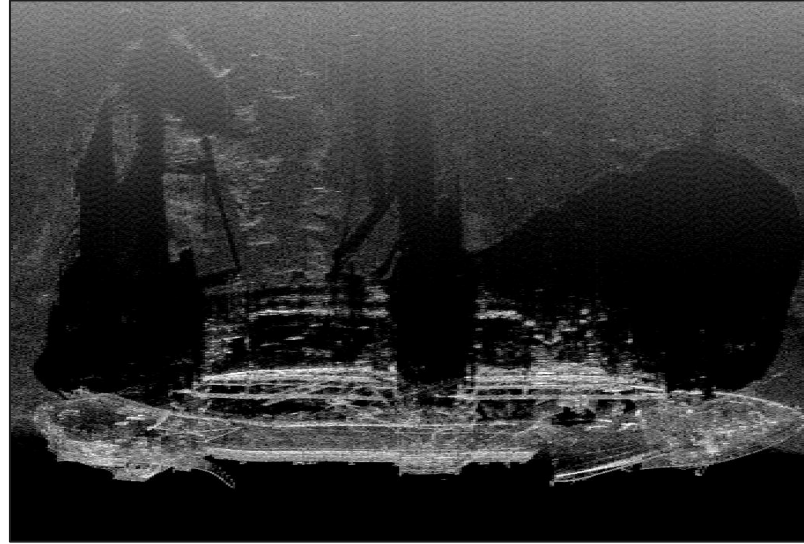
Side Scan Sonar



Side Scan Sonar

Applications:

- Geology/Morphology
- Renewables
- Pipeline surveys
- Wreck and treasure hunting
- Reef monitoring
- Harbor inspection
- SAR





Side Scan Sonar



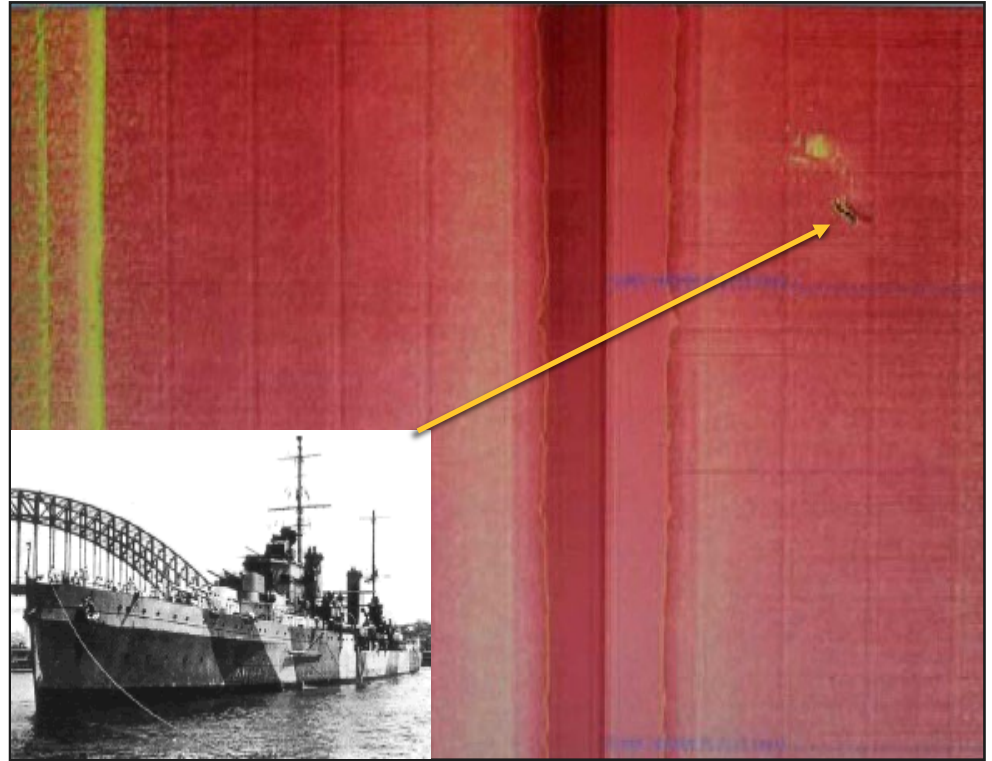
Side Scan Sonar

HMAS Sydney II Search

Synthetic Aperture Sonar (SAS) System

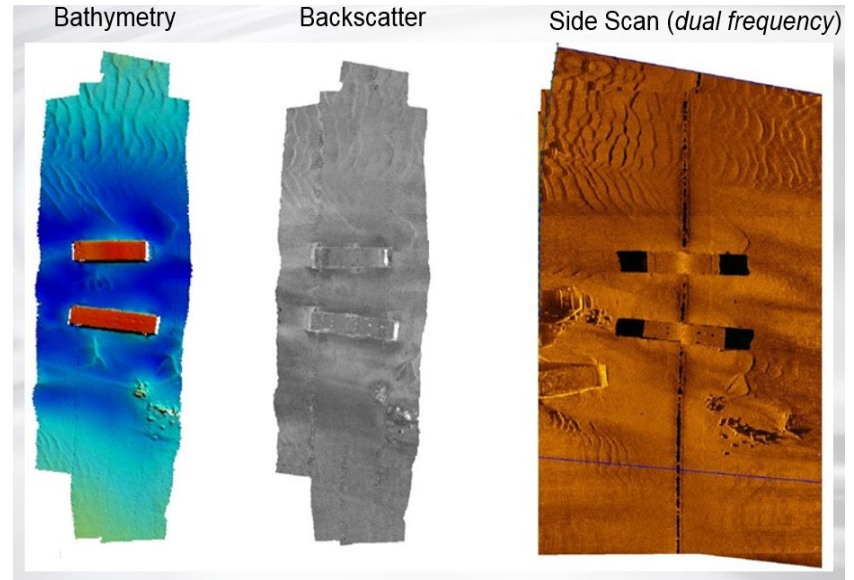
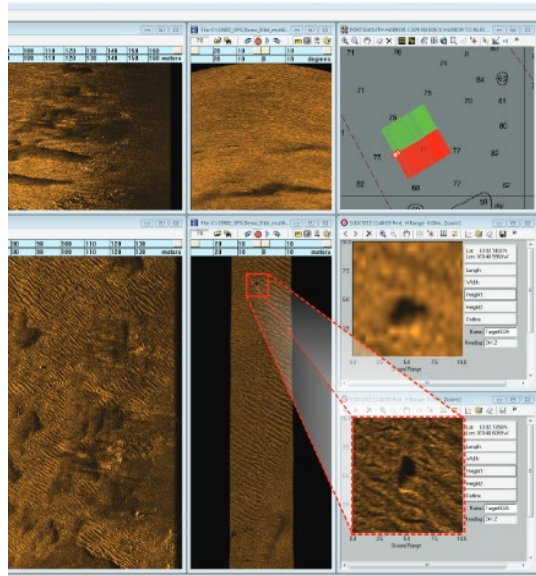
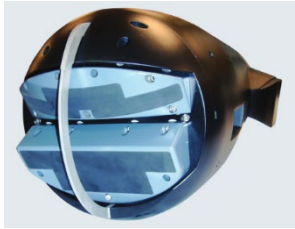
Very High-Resolution SSS data

Deep tow – several Km of cable out



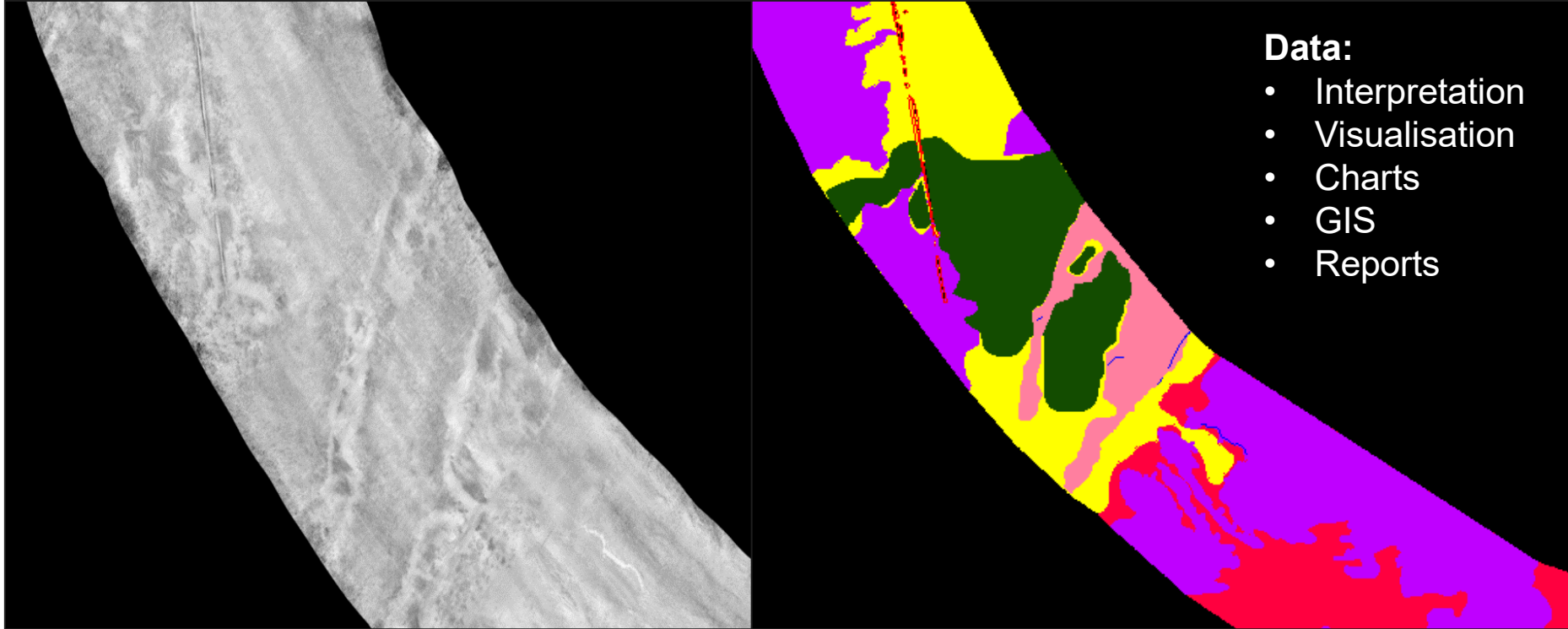
Side Scan Sonar

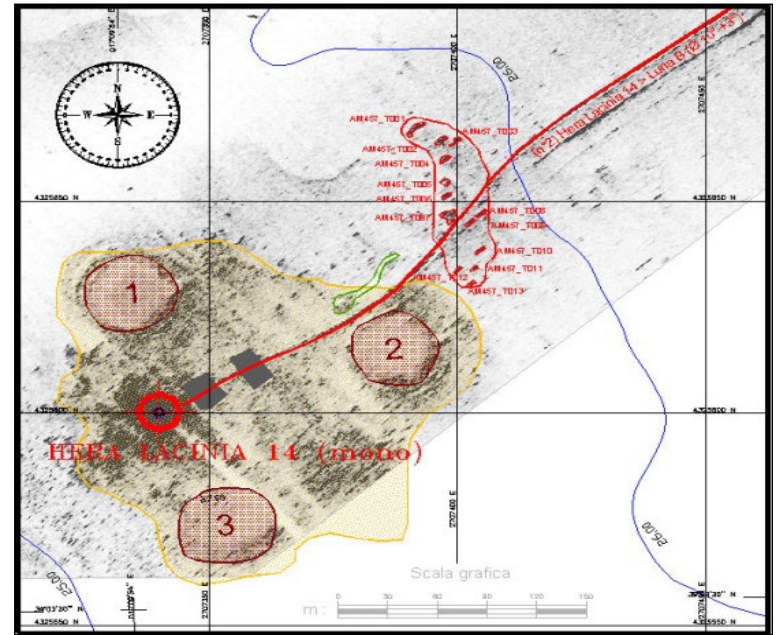
- MPES (Multi-Phase) technology
- SSS Nadir gap filler
- Bathymetry
- MBES Backscatter



From: www.kleinmarinesystems.com/

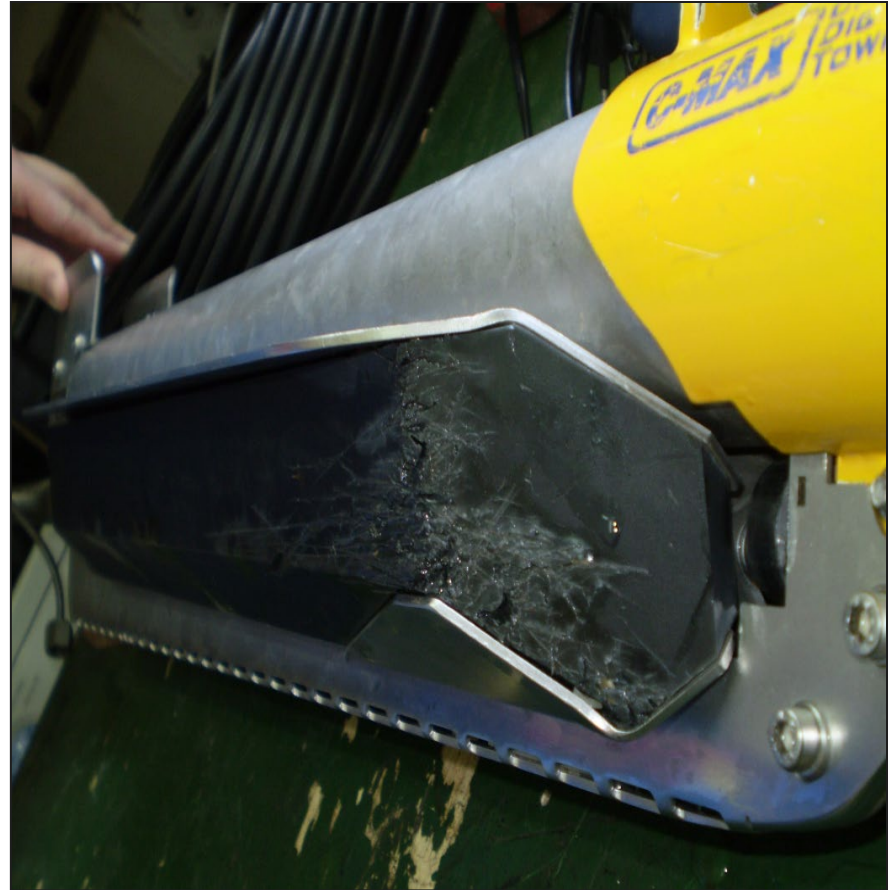
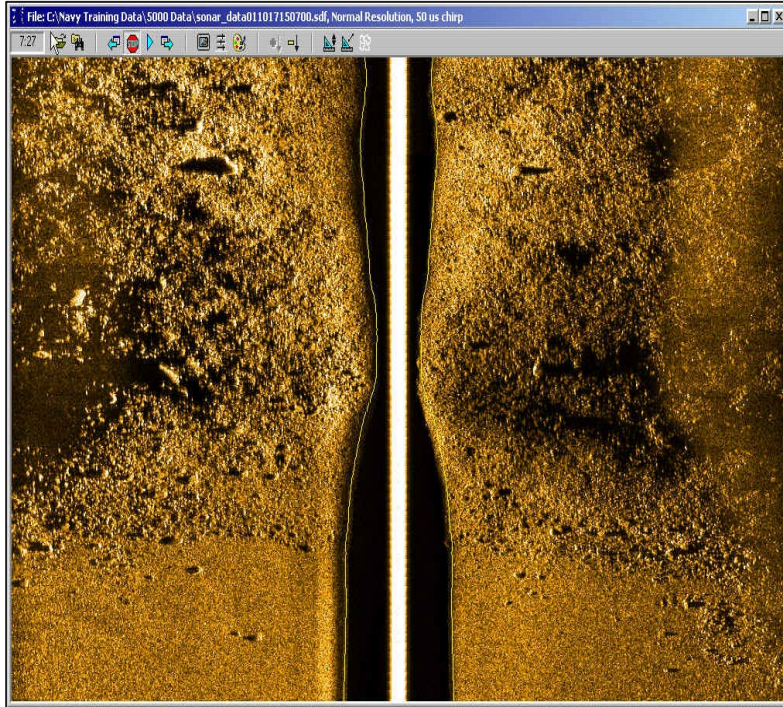
From: www.edgetech.com

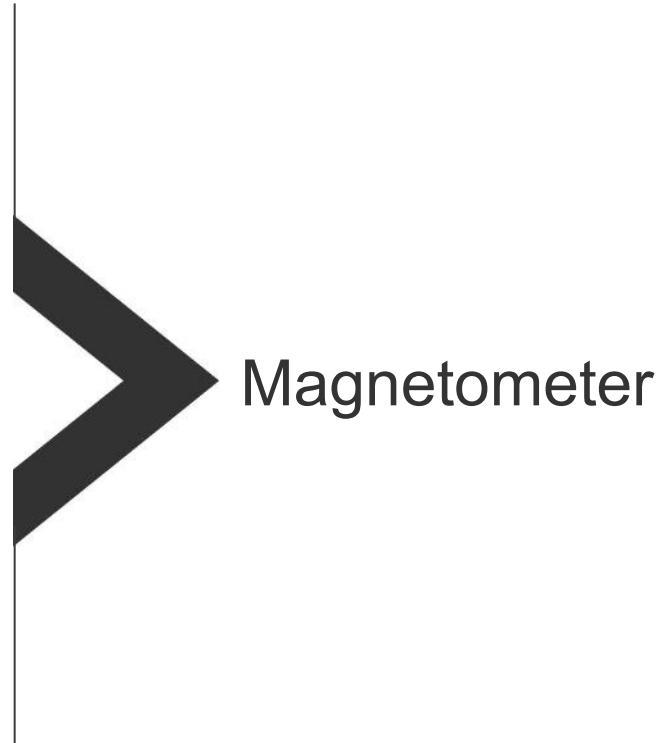




Side Scan Sonar

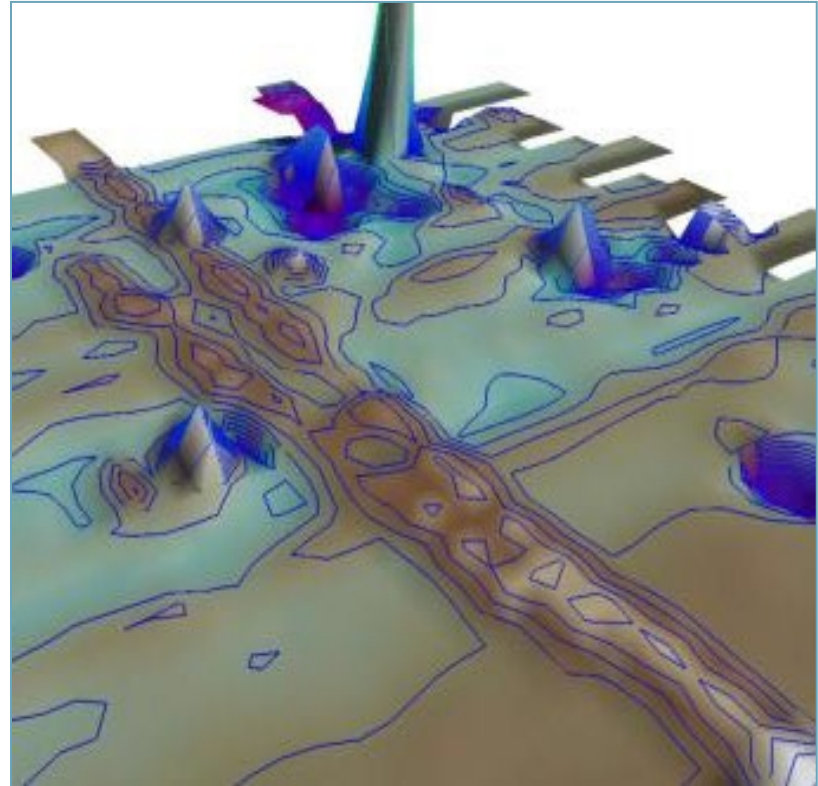
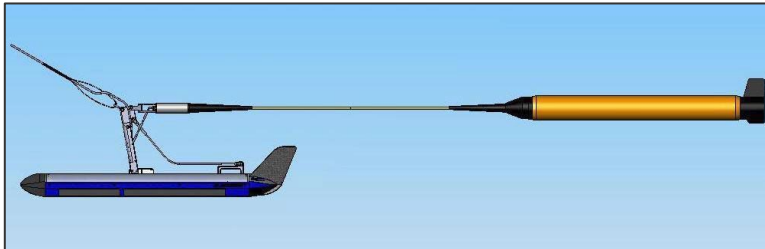
Risks!
Close call!

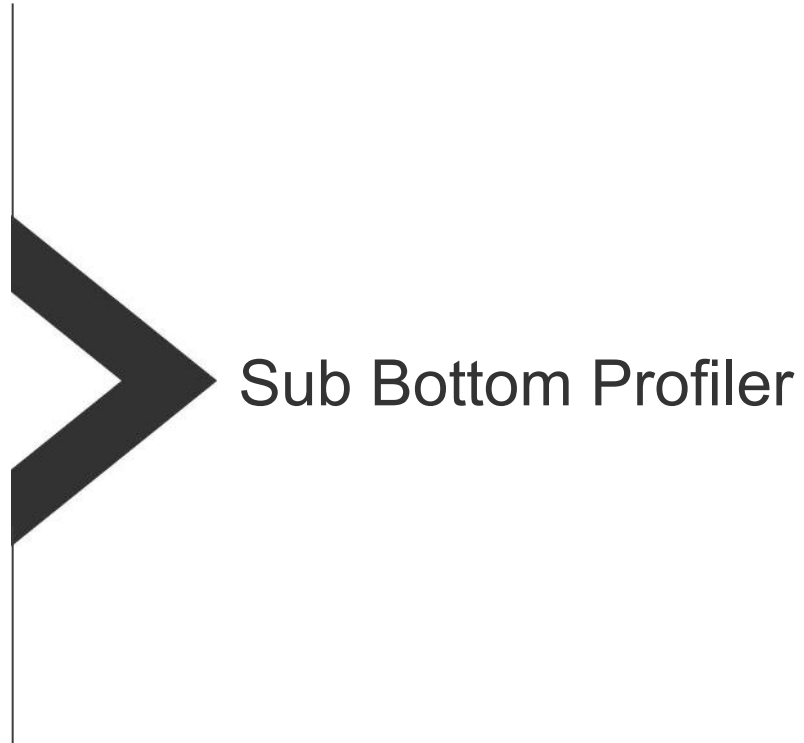




Characteristics:

- Measures the ambient magnetic field
- Buried objects, wrecks, exploration geophysics, seafloor mineral mapping, UXO, Cable and Pipeline Survey (Gradiometer)
- Integrated with SSS, AUV





Sub-bottom Profiler (SBP)

Type 1:
Combined Source and Receiver

A transducer array, operating at different frequencies, transmits and receive the signal.

Advantages:

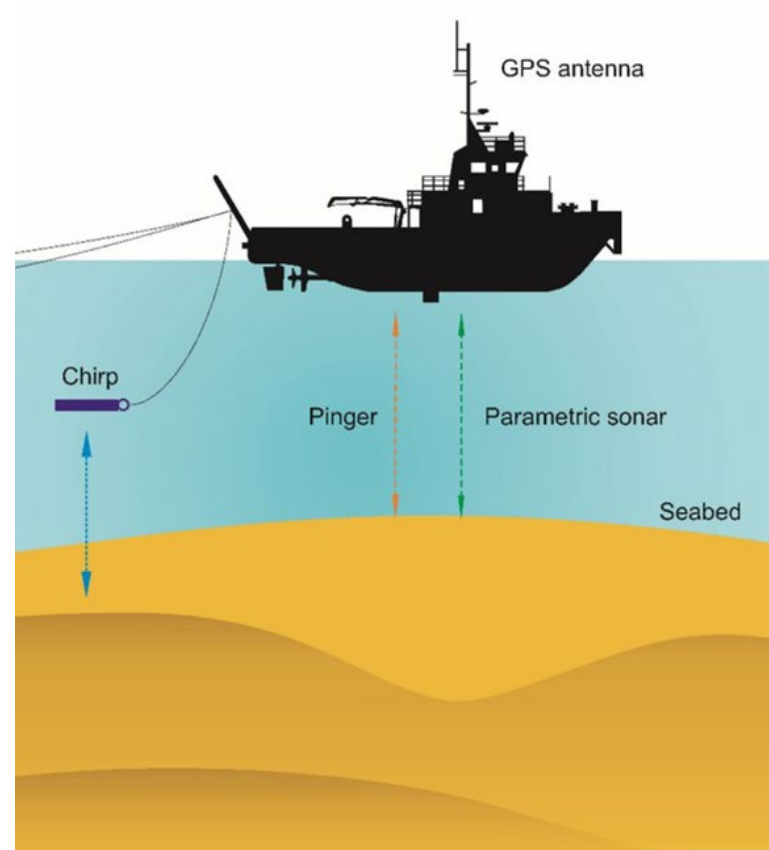
- No offset between Source/Receiver
- Relatively lightweight, shallow to deep water

Limits:

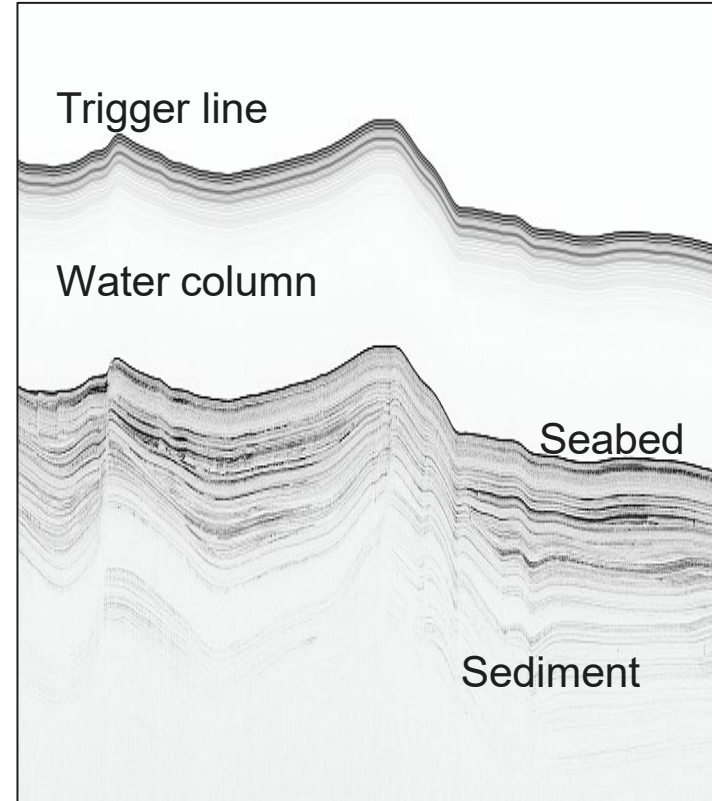
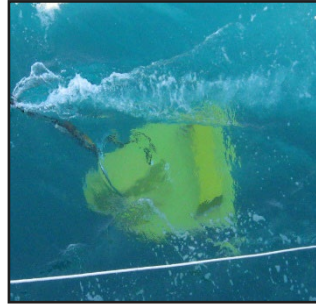
- Low penetration (up to 50-100m)

Examples :

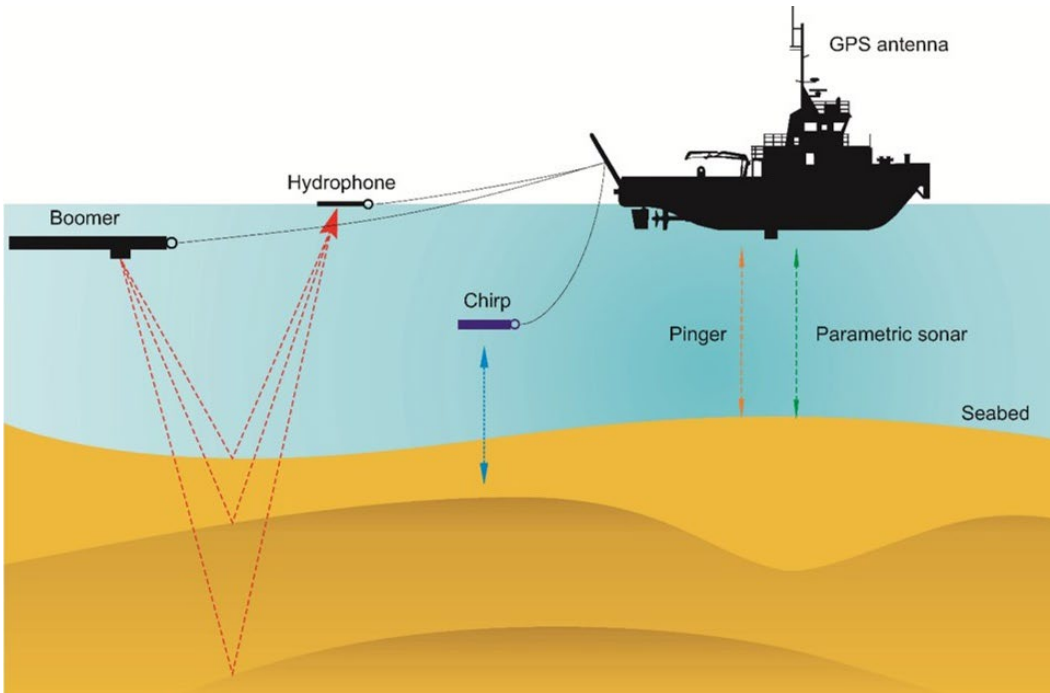
- Parametric SBP
- CHIRP profilers



Sub-bottom Profiler (SBP)



Sub-bottom Profiler (SBP)



Type 2:
Separate source and Receiver

Source and receiver (hydrophone) are different parts of the equipment.

Advantages:

- High penetration

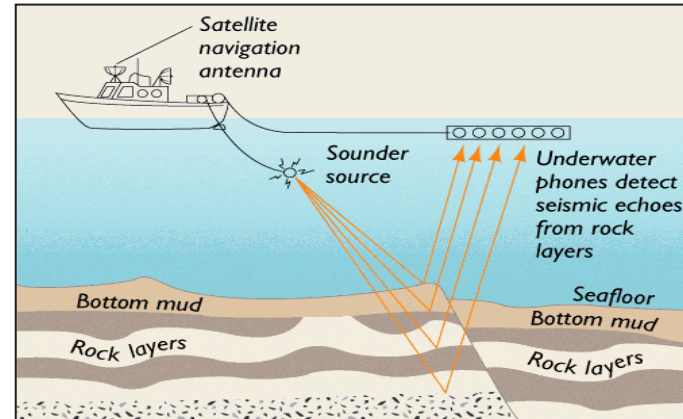
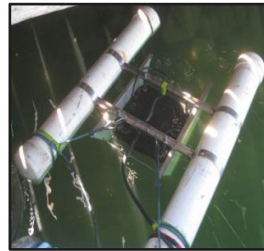
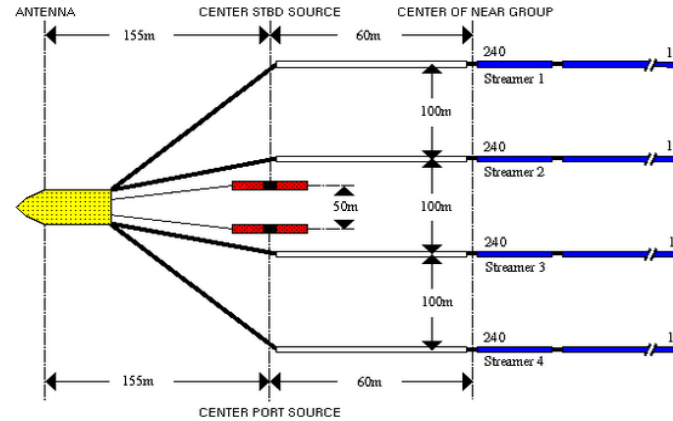
Limits:

- Safety (HV) and resolution

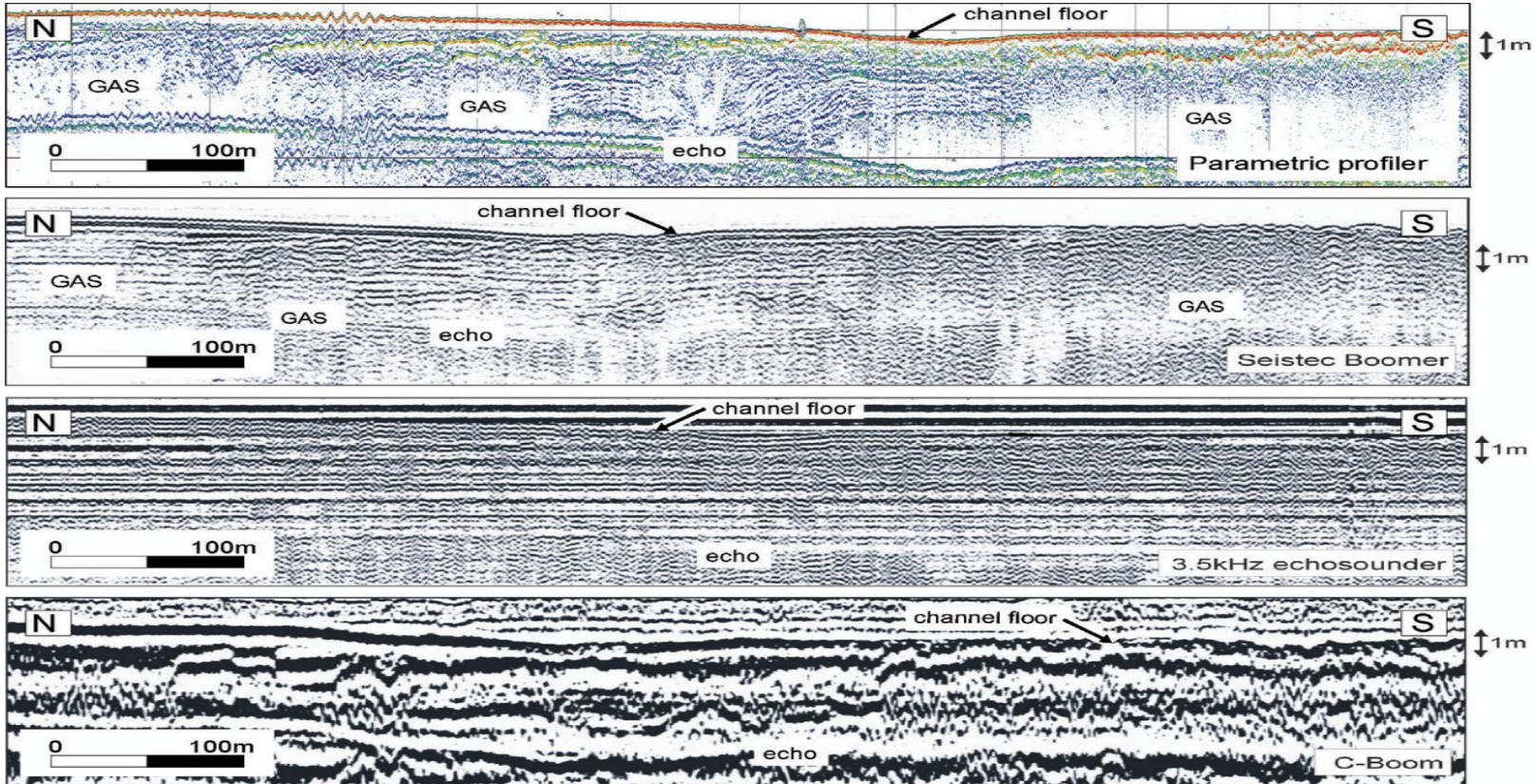
Examples :

- Sparker, boomer
- Air Gun

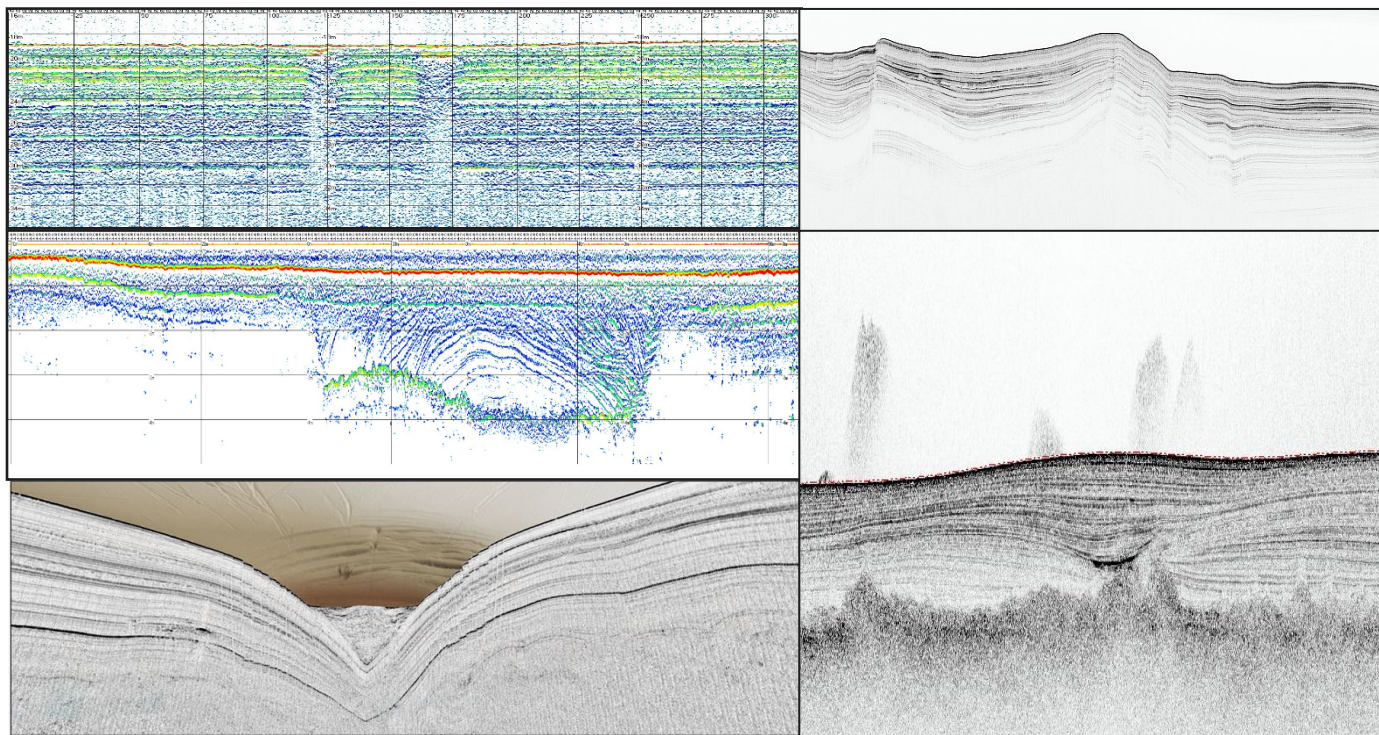
Sub-bottom Profiler (SBP)



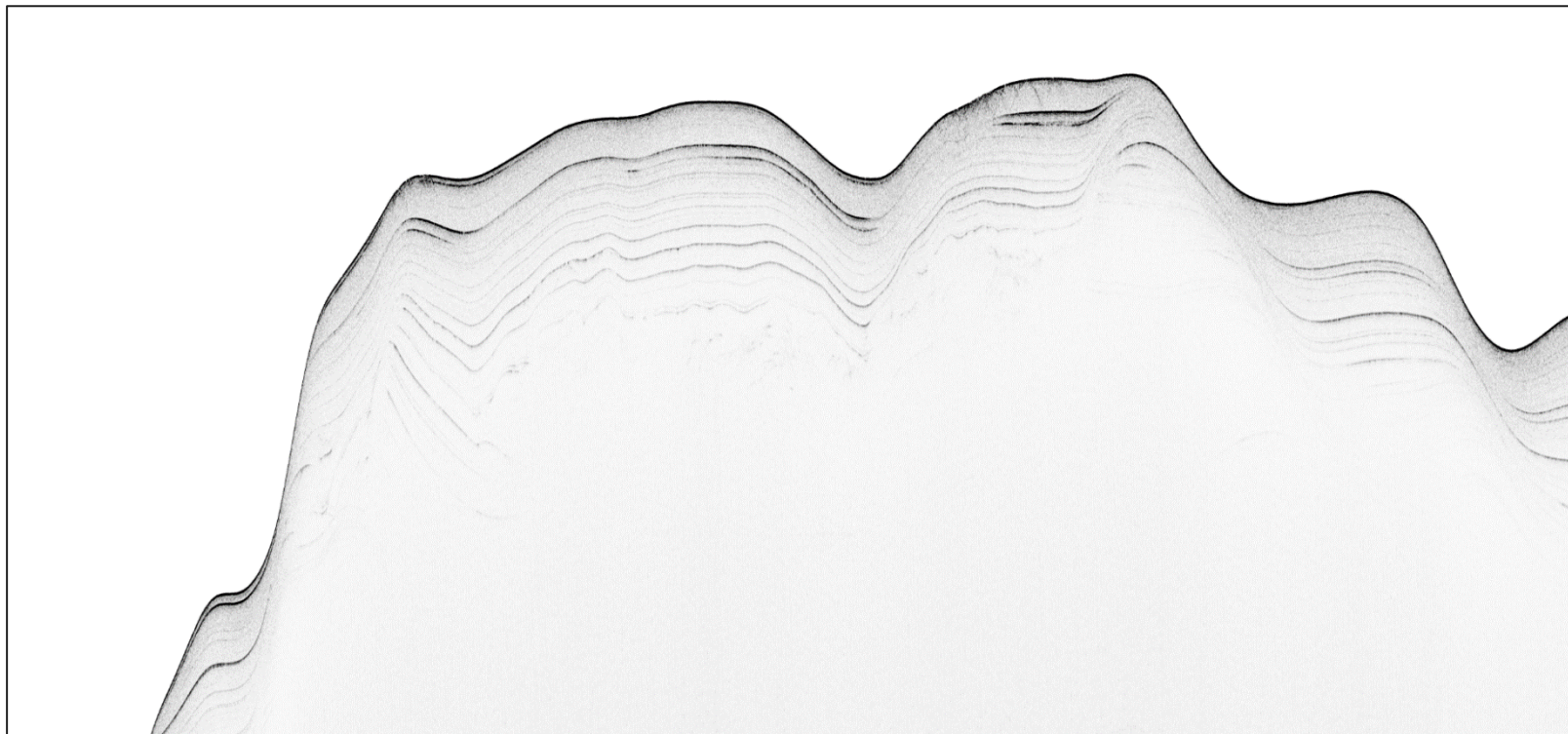
Sub-bottom Profiler (SBP)



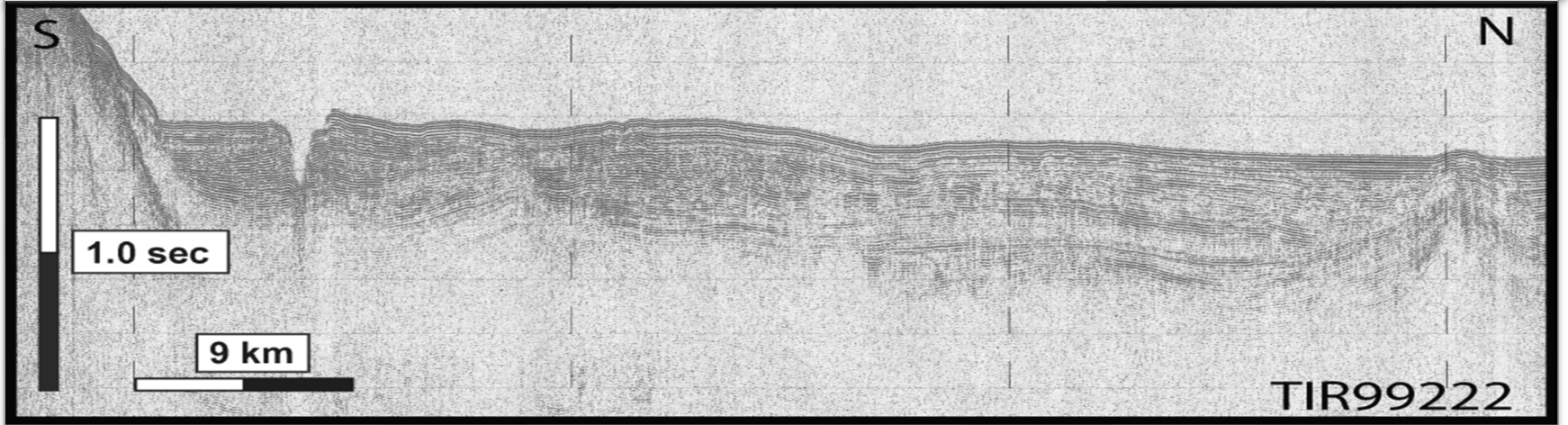
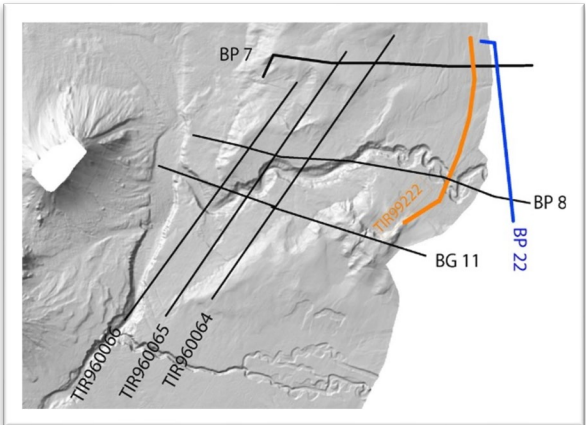
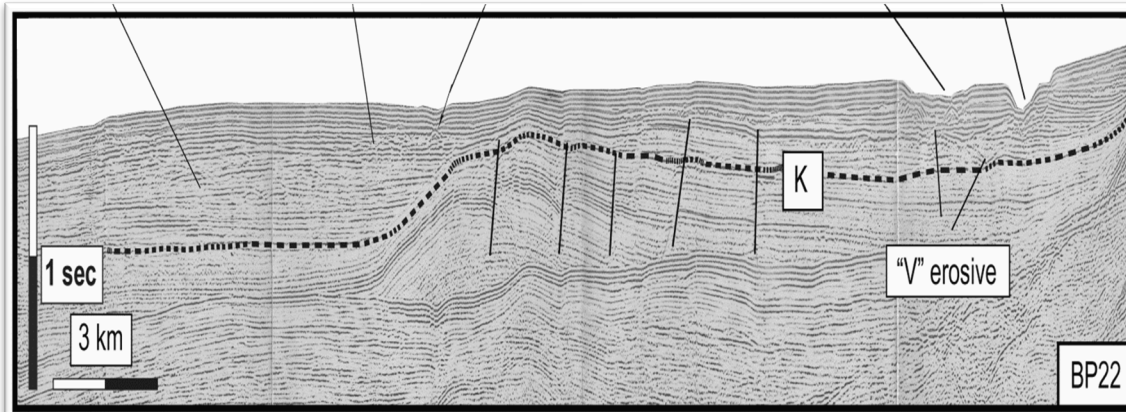
Sub-bottom Profiler (SBP)

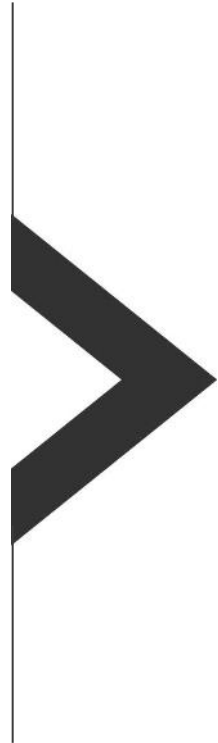


Sub-bottom Profiler (SBP)



Sub-bottom Profiler (SBP)



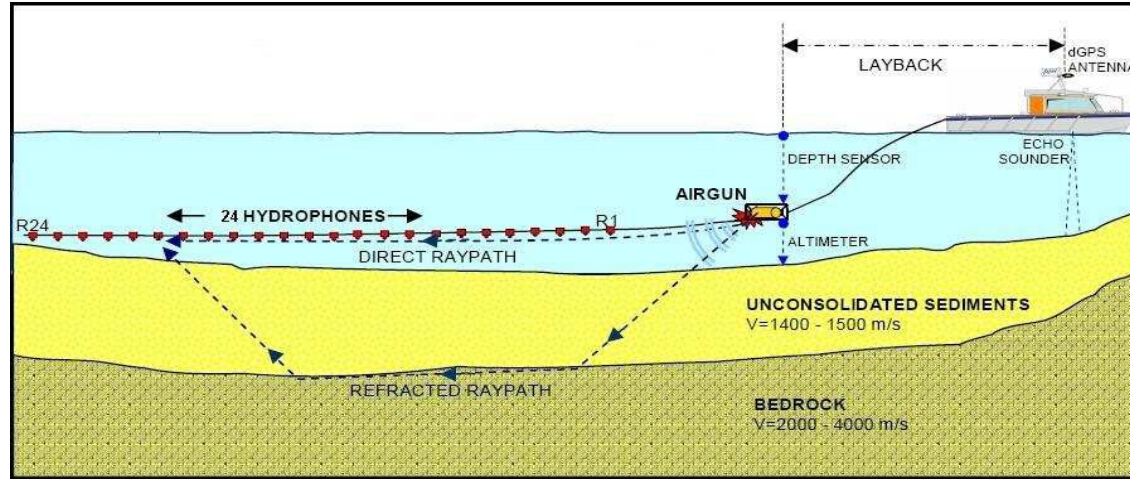


Marine Seismic Refraction

Marine Seismic Refraction

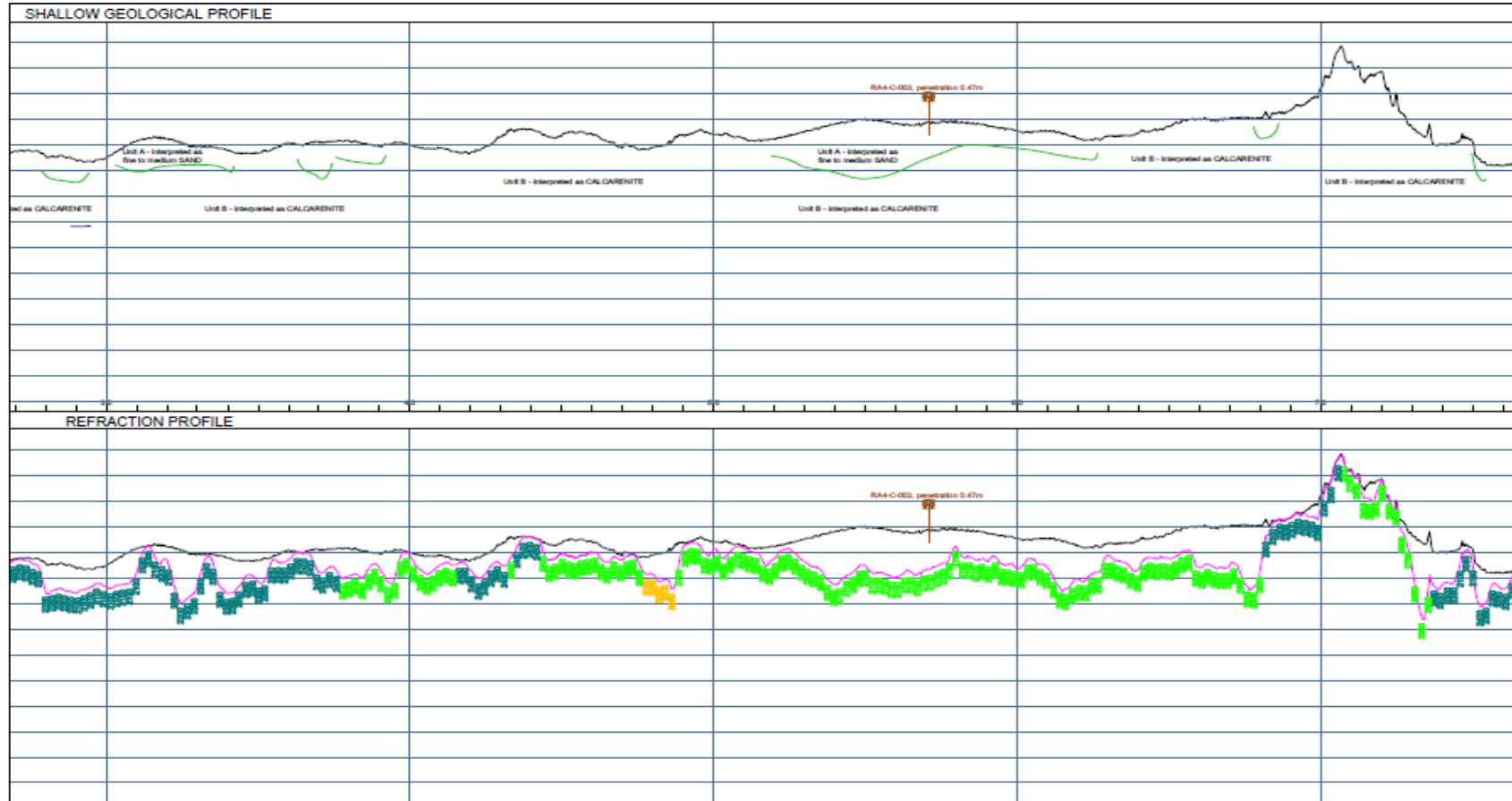


Marine Seismic Refraction



Seismic velocity (m/s) (under water)	Typical interpretation Of seismic velocities
1500 - 1650	Water Low velocity layer Soft sediments
1650 - 2000	Compacted and/or consolidated sediments Very weathered and/or fractured rock
2000 - 2500	Highly compacted sediments Weathered and/or fractured rock
2500 - 3000	Slightly weathered and/or fractured rock
3000 - 3500	Sound rock, slightly fractured
> 3500	Sound rock

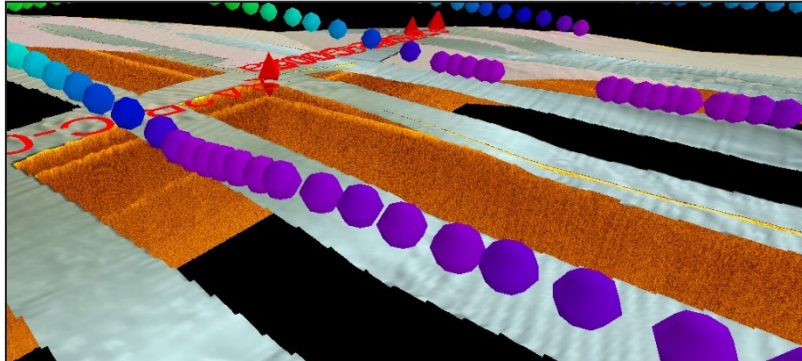
Marine Seismic Refraction VS Reflection

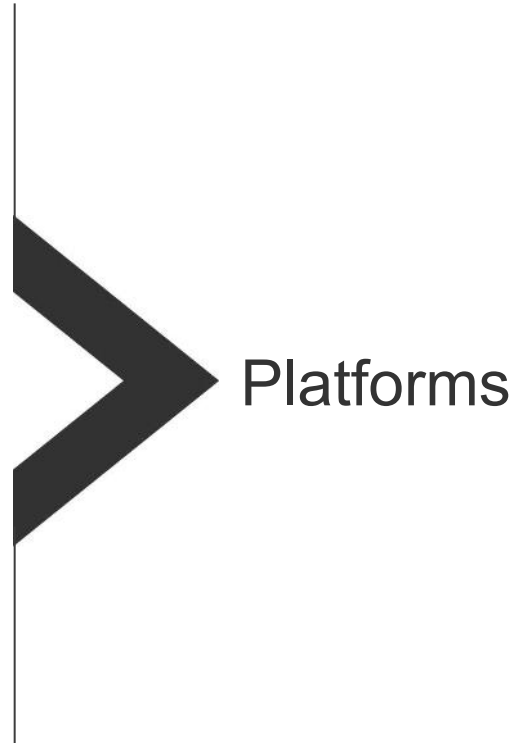


A Database Back On Deck

- Bathy, backscatter, SBP, SSS
- Seabed characterisation
- Mag data, reflection and refraction data
- Geotech, coring and video
- Environmental sensors

All in ONE GIS database (e.g., SSDM, PODS, APDM)







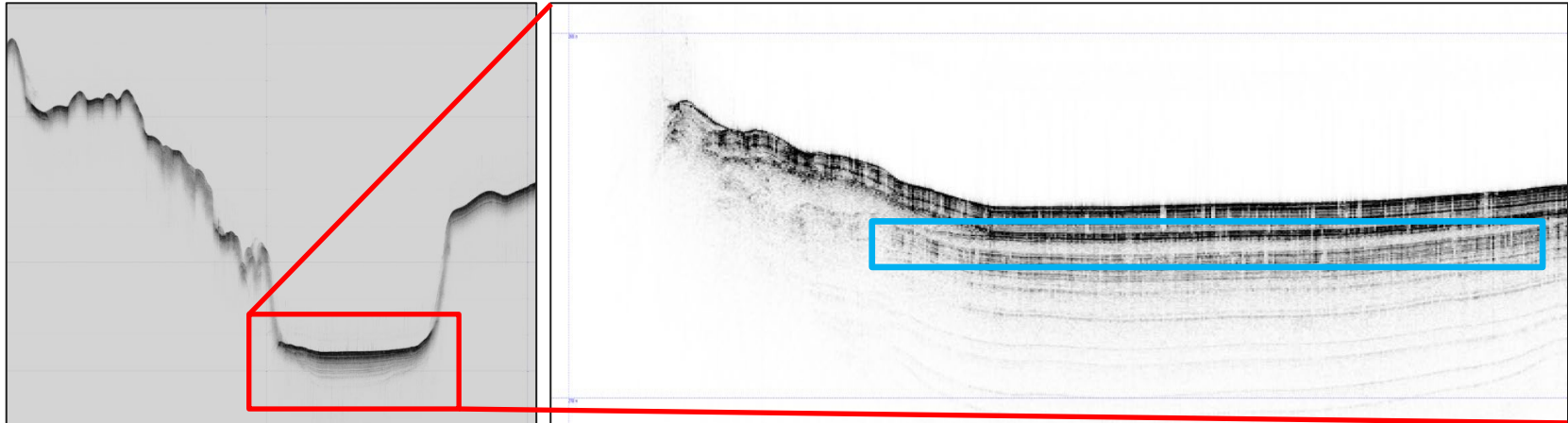
Which one - again?

- Vessel Based Systems
- ROV, ROTV, Fast ROV ...
- AUV, ASV, USV ...
- More acronyms to come ...

Vessel Based Systems

Characteristics:

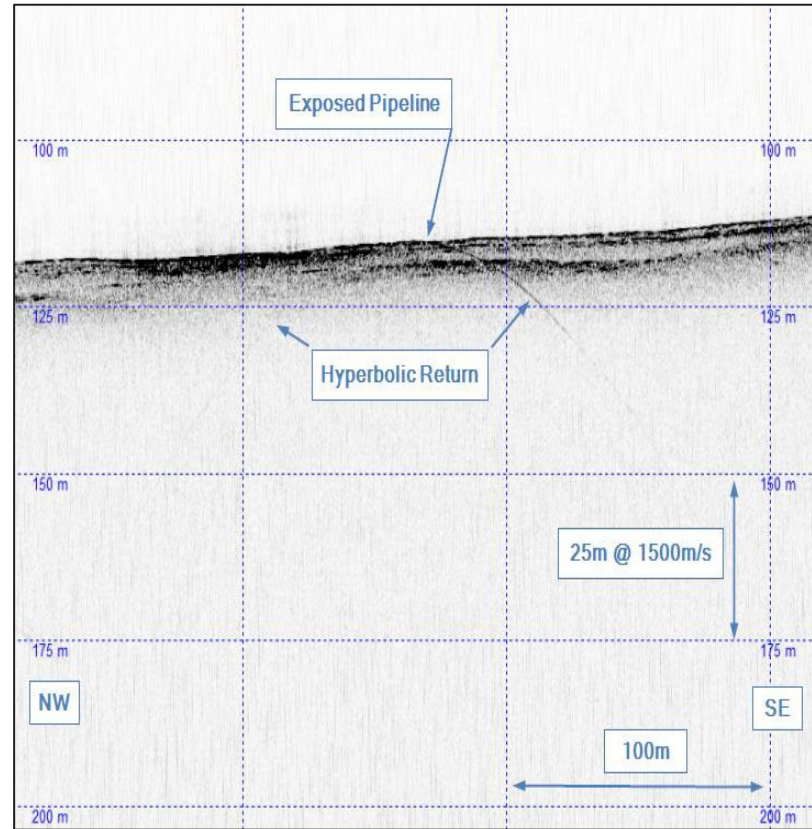
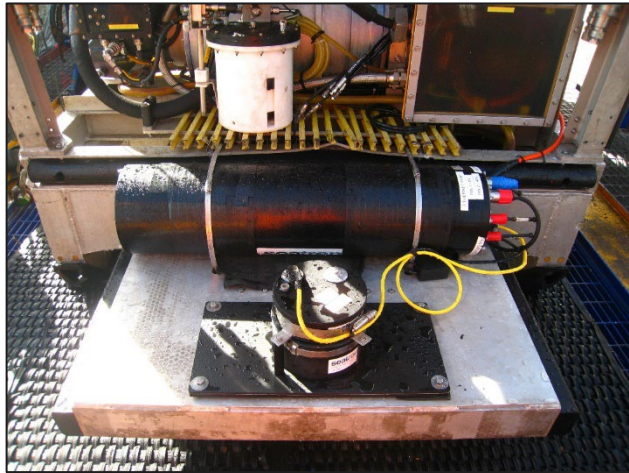
- Hull mounted or over the side pole
- Deep water or shallow water
- Resolution and frequency considerations
- Costs (installation)



Remotely Operated Vehicle - ROV

Characteristics:

- Inspection system
- Deep water – High resolution
- Low speed and tether dependent



Autonomous Underwater Vehicle - AUV

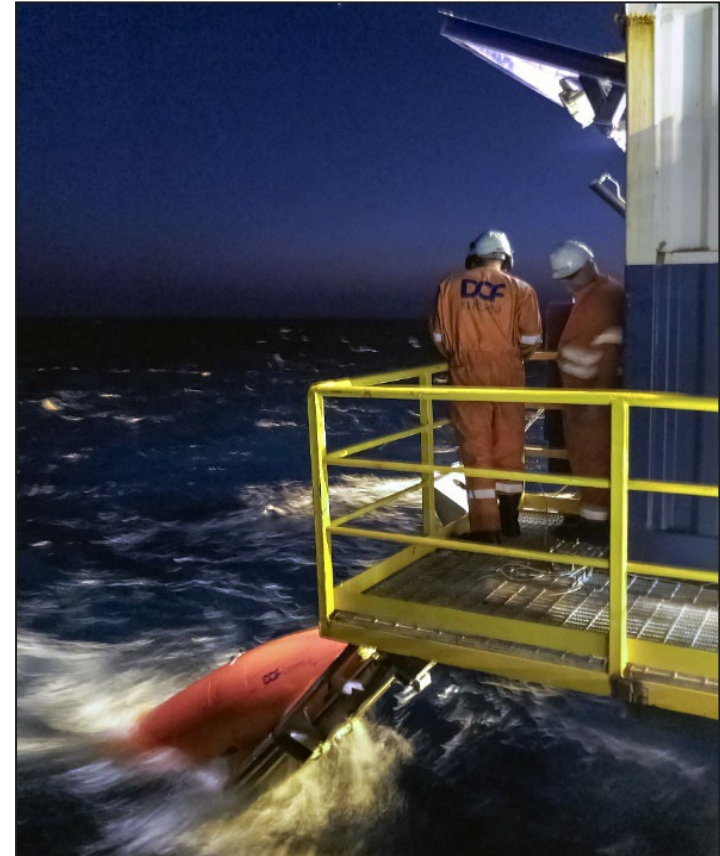
DOF Subsea & AUVs

2001: **HUGIN 3000** (Chemical Batteries)

2012: **HUGIN 1000** (SV1)

2016: **HUGIN 3000** (SV2)

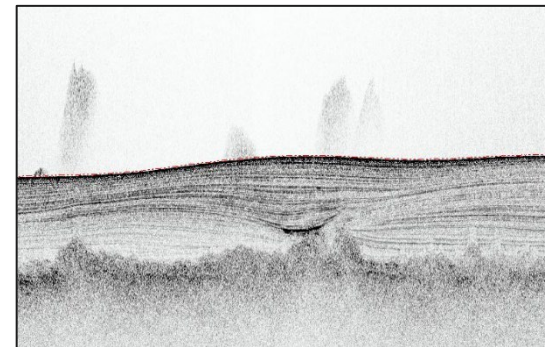
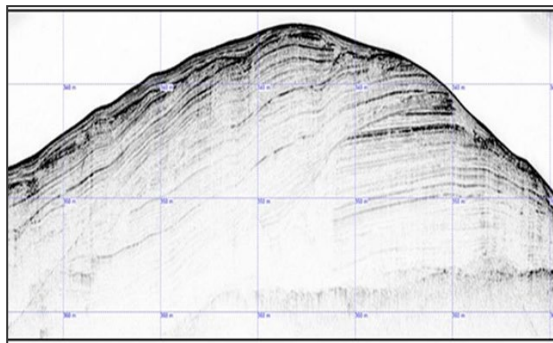
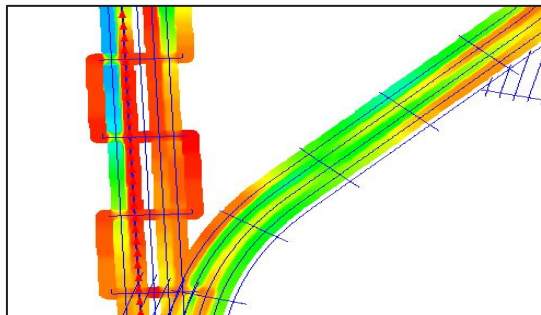
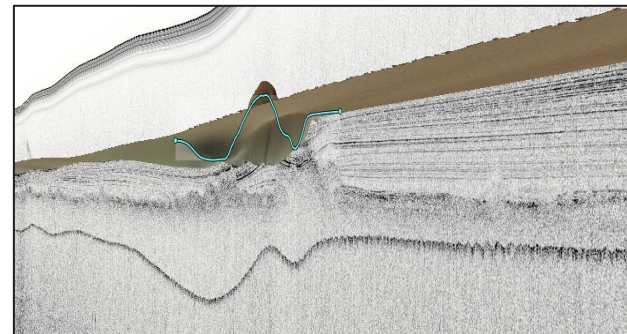
2023: SV1 **upgrade** with SAS

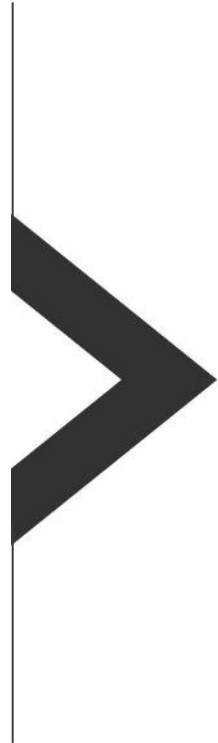


Autonomous Underwater Vehicle - AUV

Characteristics:

- Speed (up to 7x ROV)
- Deep water – High resolution
- Payload / Sync
- Data quality!





Practical and Commercial considerations

Practical and Commercial considerations

- Different systems – different results
- Sensor consideration
- Over the side pole mounting
- Tow points, winches, A-Frame
- Sea-fastening of winches, containers etc.



MOVE TO IMPROVE



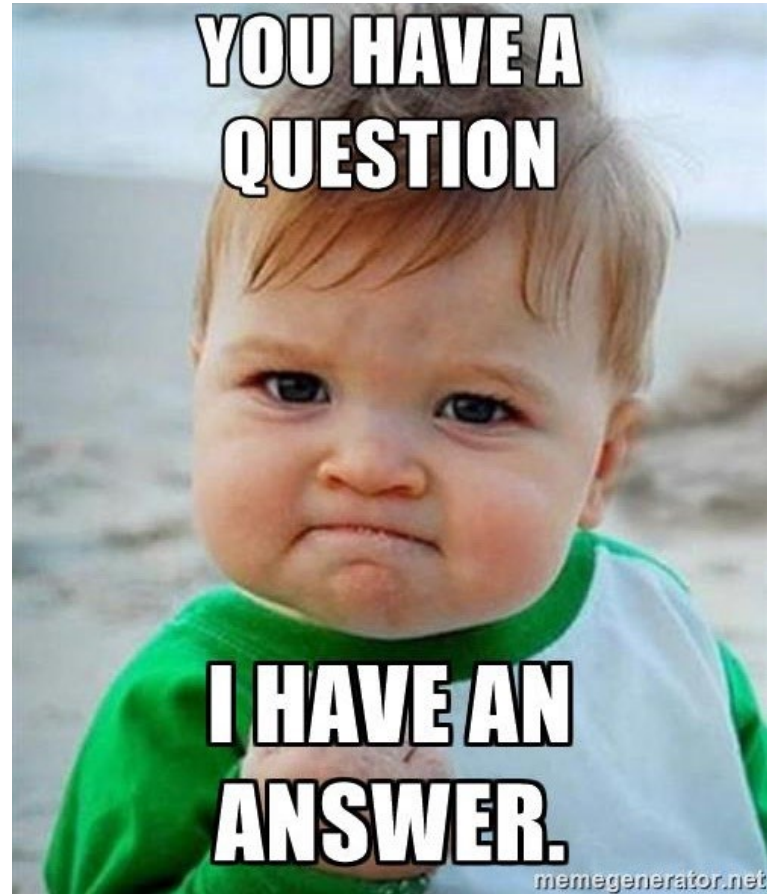
Preparation / PME

- Personnel required
- Preparation time
- Data for?

Project

- Remote or offshore?
- AUV or ROV, vessel etc?
- Post-processing







Presented by
Giovanni De Vita - Survey and Geomatics Lead

giovanni.devita@dof.com