Seismic2021

THE ROLE OF SEISMIC IN UNLOCKING VALUE IN THE ENERGY MIX

Organiser
SPE
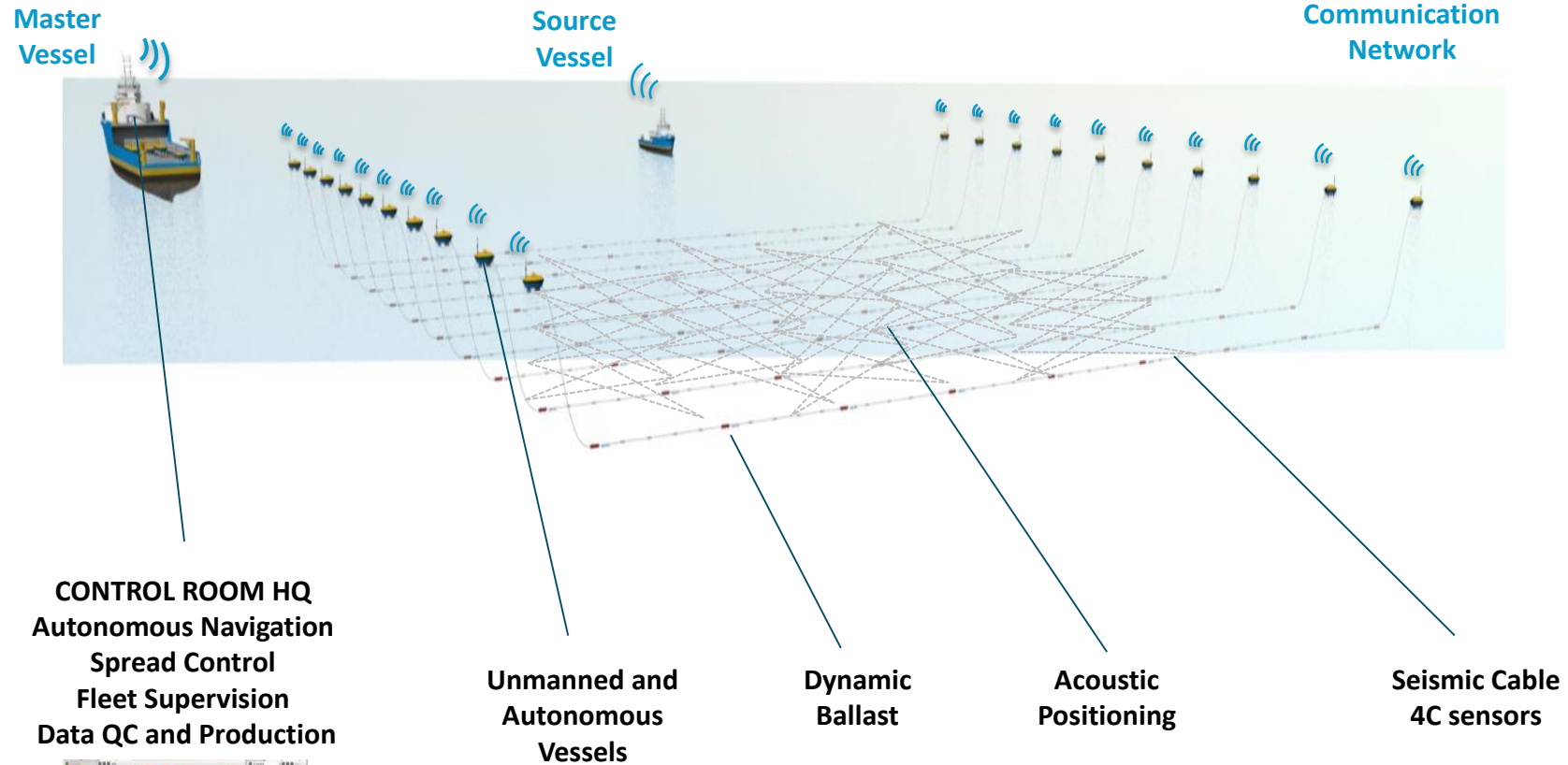Aberdeen Section

Supported by
PES GB
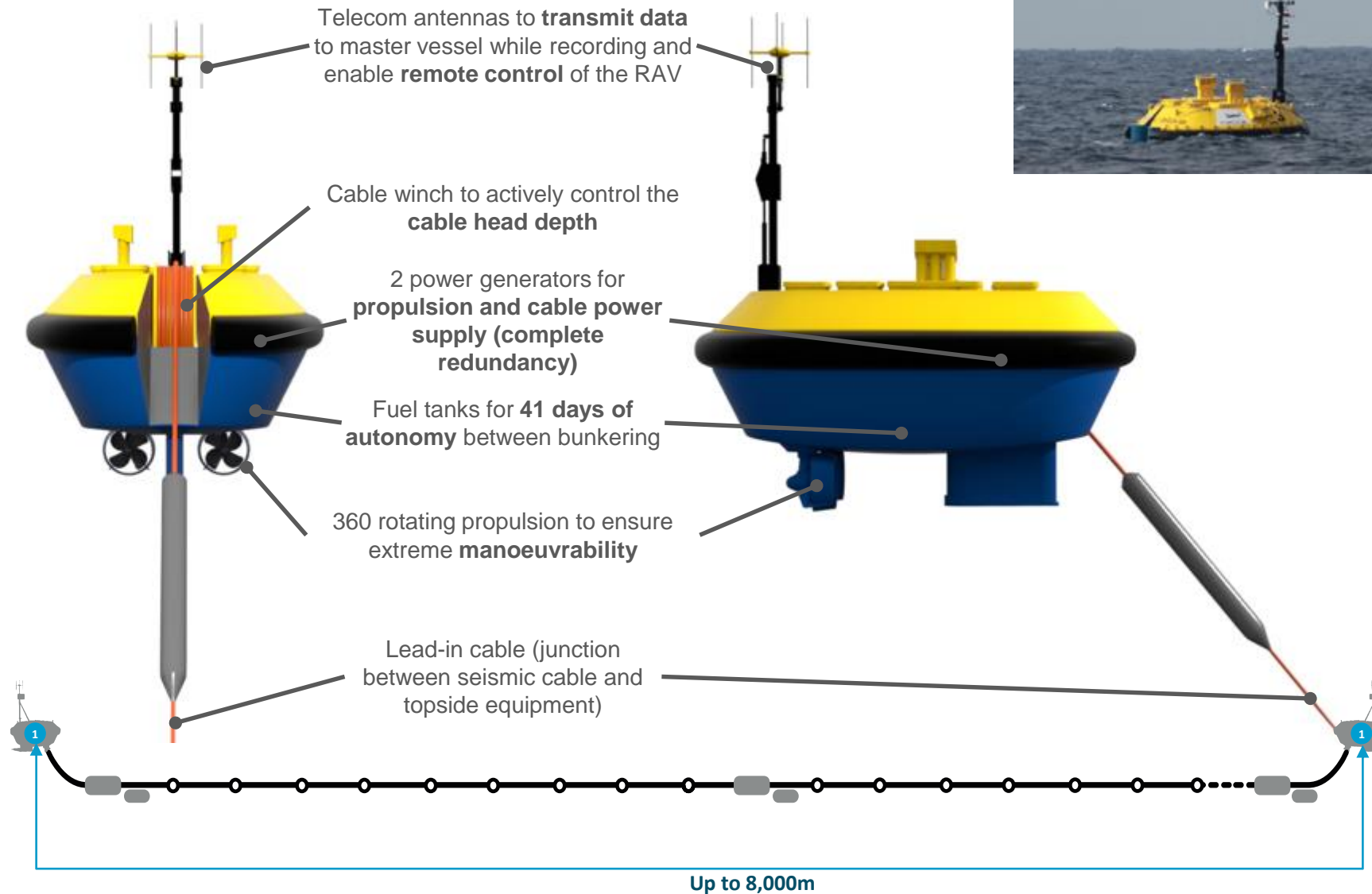LOCAL CHAPTER
EAGE
ABERDEEN

Kietta

**Autonomous and Unmanned Geophysical Acquisition for Offshore Renewables Development and CCS**
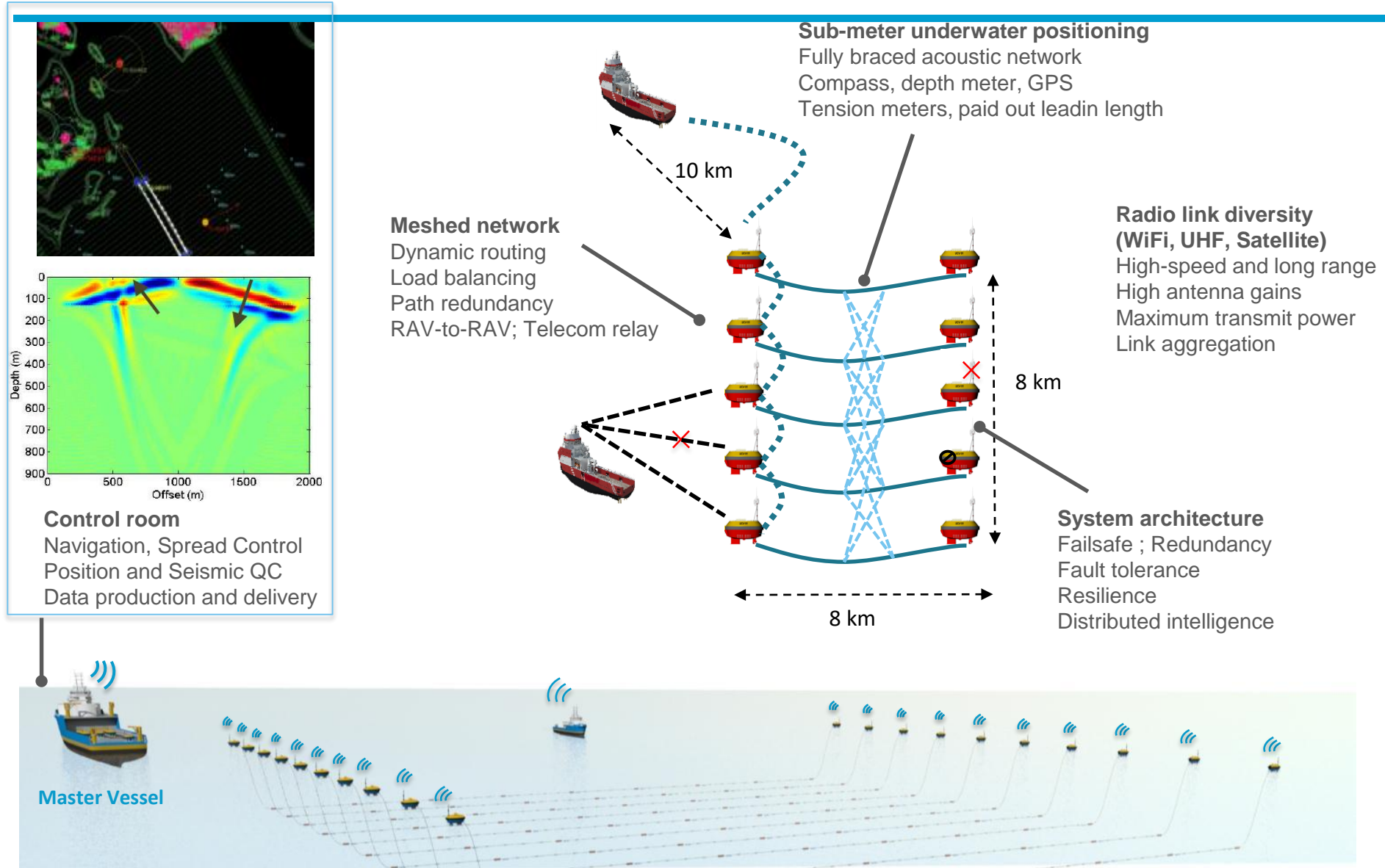
**Eric Bathellier, Monday 17TH May @14:40**

# Autonomous Marine Seismic Acquisition using a Fleet of Unmanned Vessels



Master Vessel

Source Vessel

Communication Network

**CONTROL ROOM HQ**
**Autonomous Navigation**
**Spread Control**
**Fleet Supervision**
**Data QC and Production**

**Unmanned and Autonomous Vessels**

**Dynamic Ballast**

**Acoustic Positioning**

**Seismic Cable 4C sensors**

# Recording Autonomous Vessel (RAV)

Telecom antennas to **transmit data** to master vessel while recording and enable **remote control** of the RAV

Cable winch to actively control the **cable head depth**

2 power generators for **propulsion and cable power supply (complete redundancy)**

Fuel tanks for **41 days of autonomy** between bunkering

360 rotating propulsion to ensure extreme **manoeuvrability**

Lead-in cable (junction between seismic cable and topside equipment)

**Up to 8,000m**

# Real-time Spread and Quality Control



**Sub-meter underwater positioning**
Fully braced acoustic network
Compass, depth meter, GPS
Tension meters, paid out leadin length

10 km

**Meshed network**
Dynamic routing
Load balancing
Path redundancy
RAV-to-RAV; Telecom relay

**Radio link diversity
(WiFi, UHF, Satellite)**
High-speed and long range
High antenna gains
Maximum transmit power
Link aggregation

8 km

8 km

**Control room**
Navigation, Spread Control
Position and Seismic QC
Data production and delivery

**System architecture**
Failsafe ; Redundancy
Fault tolerance
Resilience
Distributed intelligence

**Master Vessel**

# What We Bring to The Seismic Market

- **High productivity**
  - **Reduced acquisition time** compared to existing technologies for a given data quality
  - **Potential for improvement**: ready for simultaneous operations

- **HSE higher standards and environmentally friendly**
  - Autonomous vessels leading to less people on-site
  - Less fuel consumption / Less pollution
  - No impact on sea bottoms, no damage on sea flora, no risk with sea bottom installations

- **Streamlined operational expenses**
  - Only vessels of opportunities required for operations
  - Optimized set up of operations thanks to system flexibility

- **Superior Data Quality**
  - Full azimuth illumination, full band
  - Low Acquisition Noise
  - Real Time Data Access (Superior Data Quality Control)
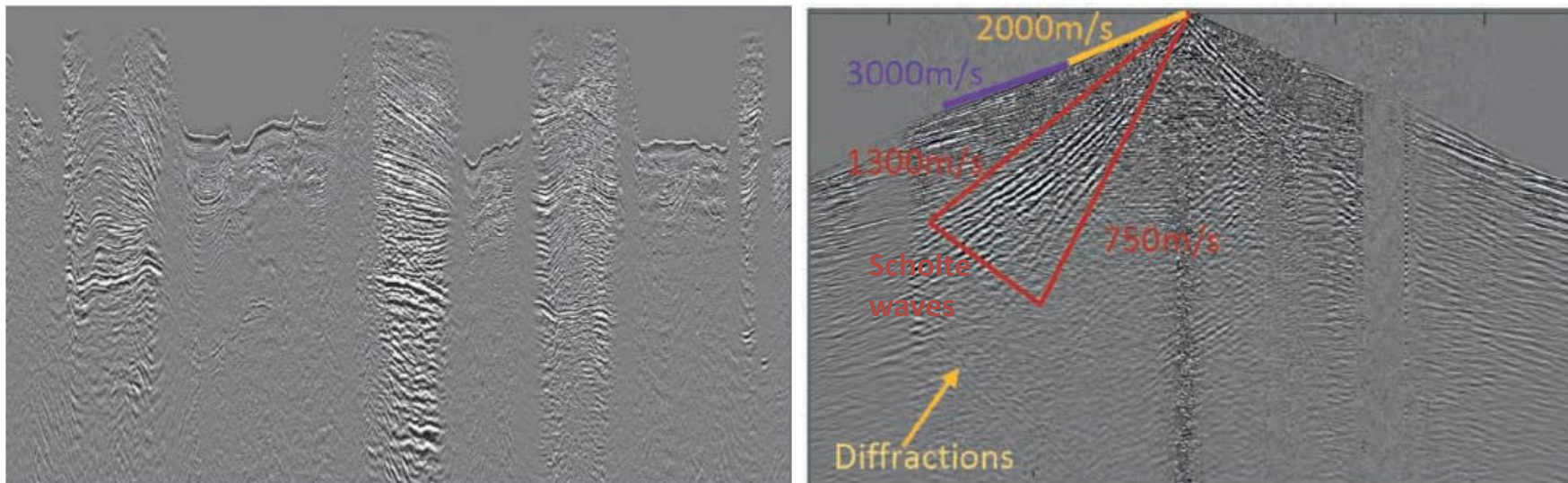  - ⇒ Resulting in more precise subsurface imaging
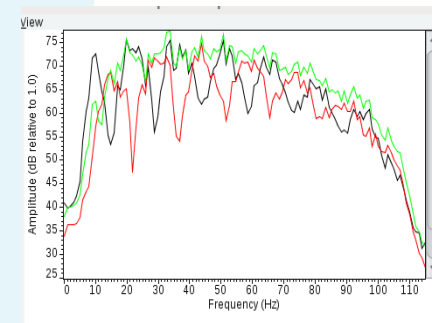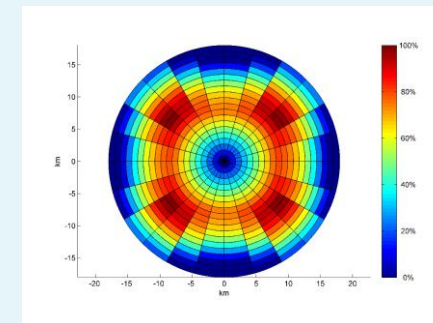
# Superior Subsurface Image from Seabed Downwards

**Homogeneous image with high quality**
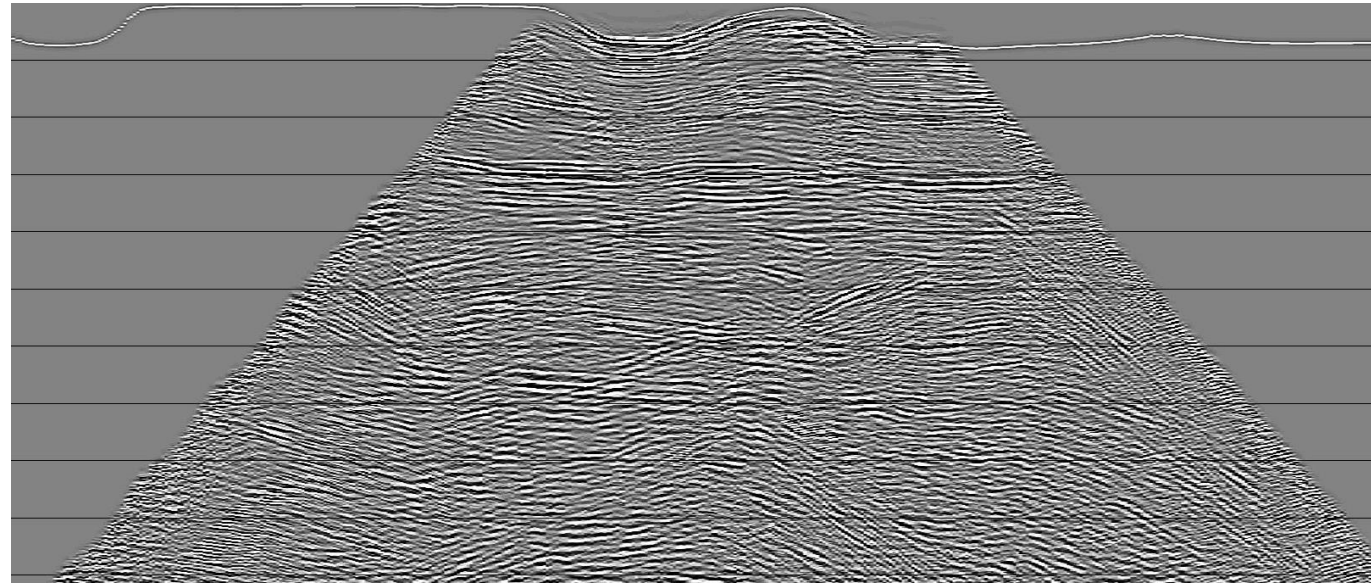
**FreeCable acquisition**



**Heterogeneous quality with noise degradations**

**OBS acquisition in the same area**
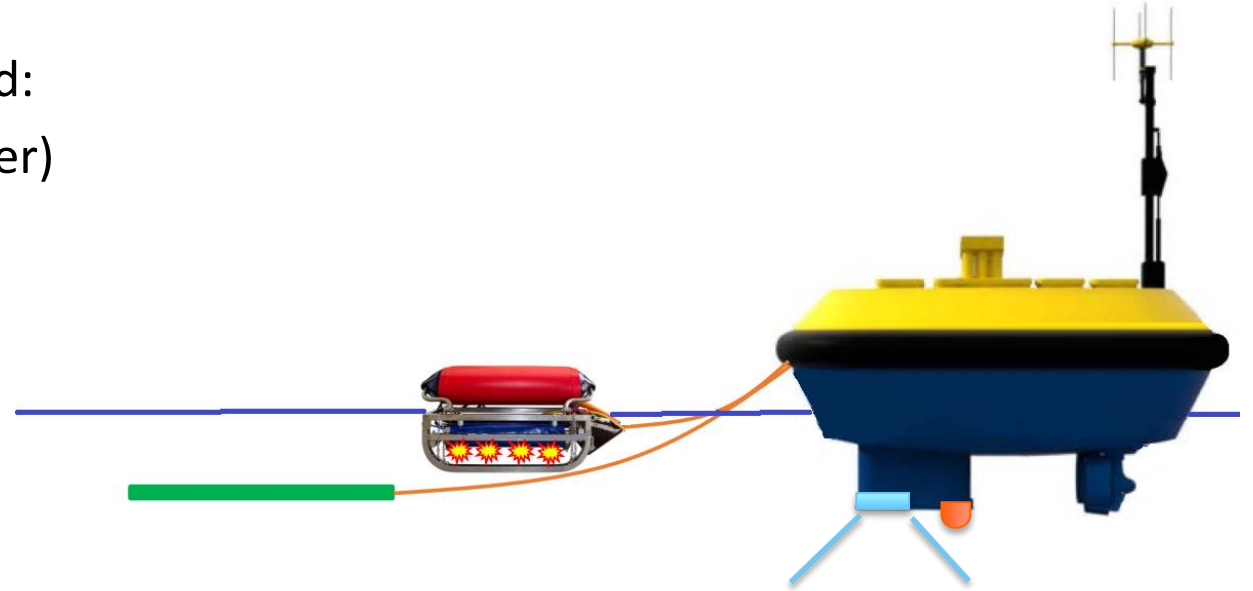
Source: First Break, volume 35, Nov. 2017





2000m/s

3000m/s

1300m/s

750m/s

Scholte waves

Diffractions

# …By Integrating Multi-Physics Measurements

Multiple instruments can be mounted or towed:

- High resolution seismic (source and streamer)

- Magnetometer

- Multi-Beam Echo Sounder

- Side Scan Sonar

- Sub Bottom Profiler

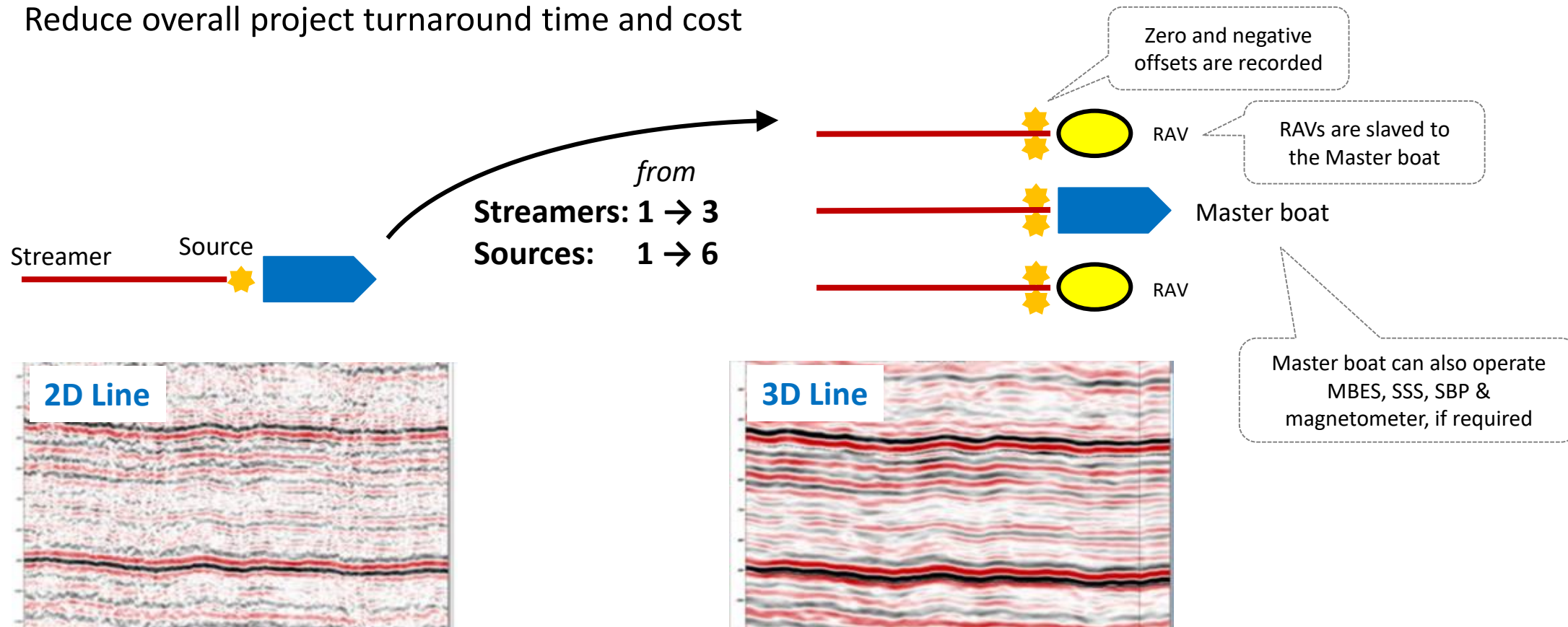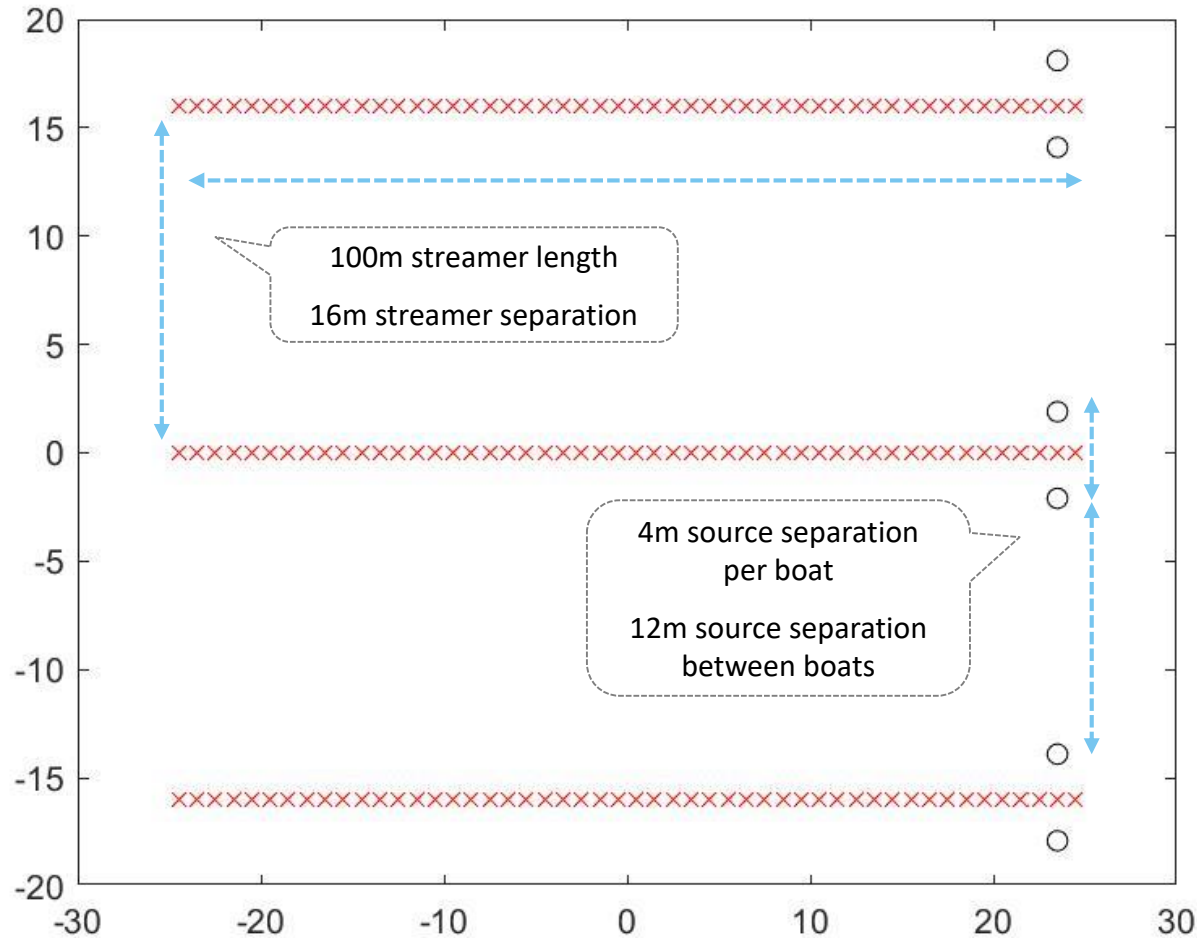- Acoustic Doppler Current Profiler



UHRS streamer

Boomer

Sparker

Kietta replaces the usual 2 surveys of 2D seismic acquisition by 1 survey of 3D using 2 RAVs alongside the usual boat

**Key benefits:**

- Deliver a 3D subsurface image to help in foundation micro-siting and subsea cable route
- Get site investigation results without need of a second survey
- Reduce overall project turnaround time and cost

Zero and negative offsets are recorded

RAVs are slaved to the Master boat

*from*
**Streamers: 1 → 3**
**Sources:     1 → 6**

Streamer     Source

RAV

RAV

Master boat

Master boat can also operate MBES, SSS, SBP & magnetometer, if required

**2D Line**

**3D Line**

100m streamer length

16m streamer separation

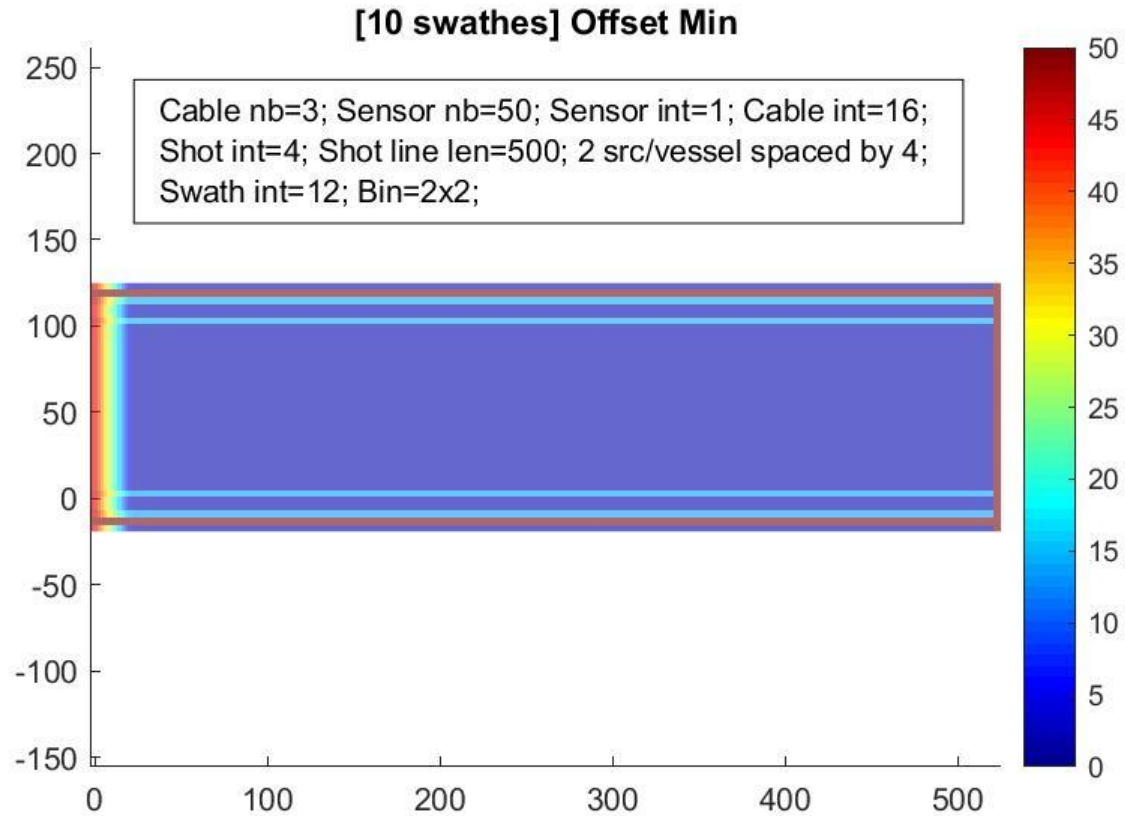4m source separation per boat

12m source separation between boats

- Deliverable is a 3D swath over the foundation areas

- … and also ultra high-resolution 2D CMP lines.

CMP Lines (2D stack of data)



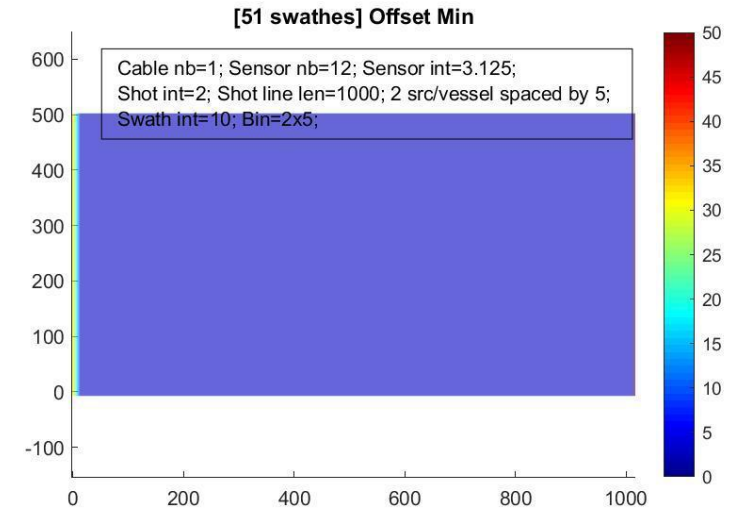Minimum offset
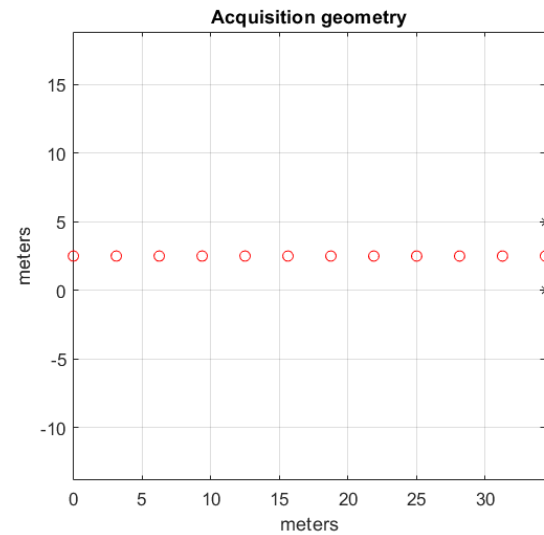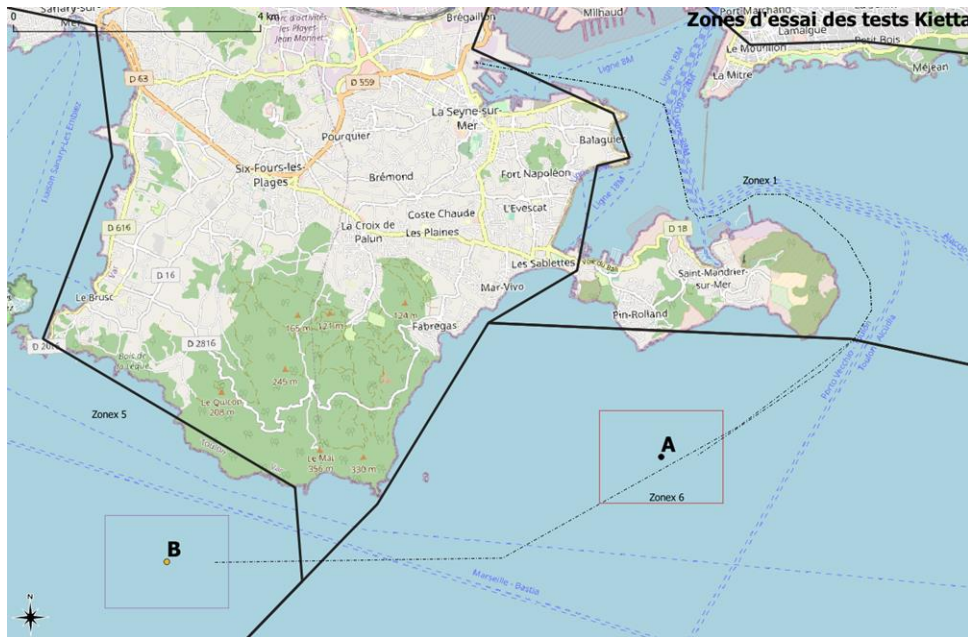
5 m

5 m

10 m

15 m

10 m

5 m

5 m

# Geophysical Attributes
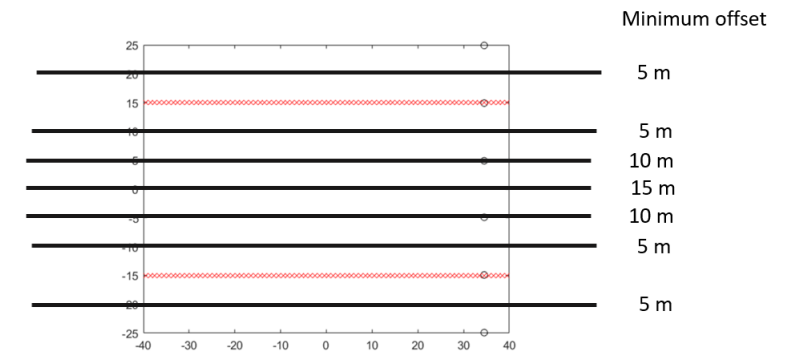
## Very Near-Offset Range



## High-Azimuthal Richness
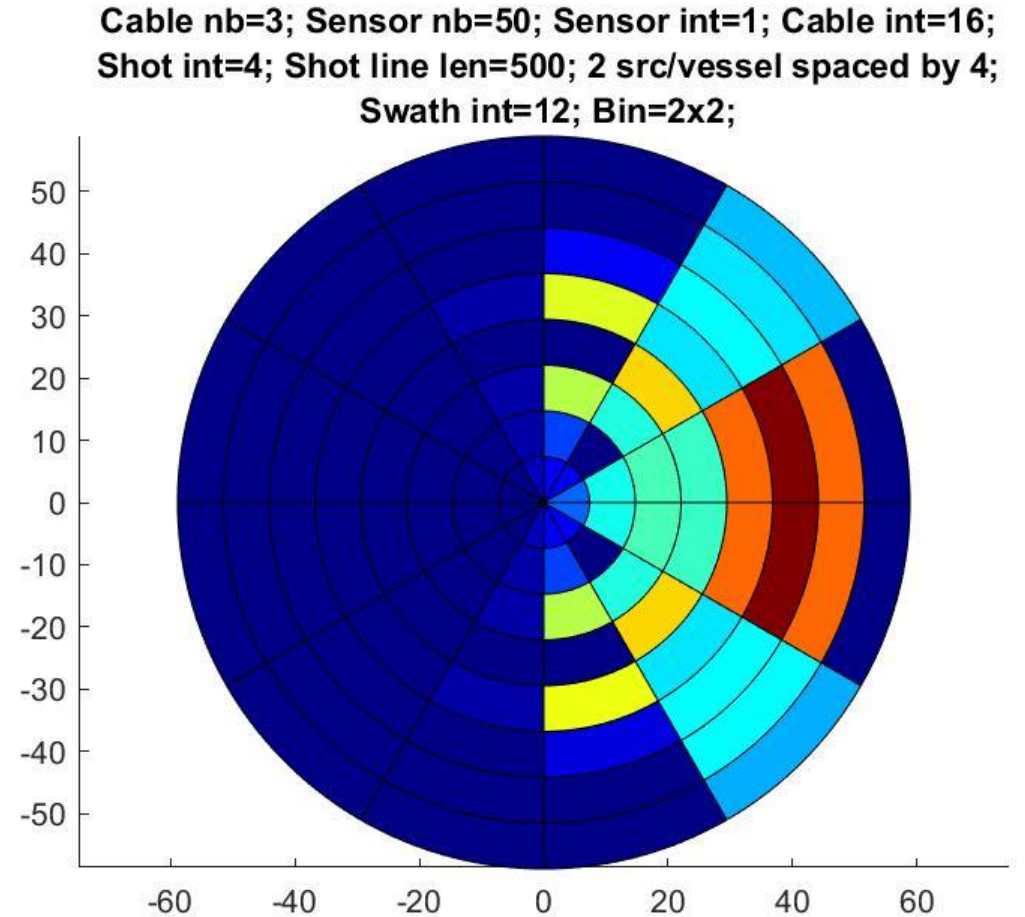
Acquisition geometry

[51 swathes] Offset Min

Cable nb=1; Sensor nb=12; Sensor int=3.125;
Shot int=2; Shot line len=1000; 2 src/vessel spaced by 5;
Swath int=10; Bin=2x5;

Cable nb=1; Sensor nb=12; Sensor int=3.125;
Shot int=2; Shot line len=1000; 2 src/vessel spaced by 5;
Swath int=10; Bin=2x5;
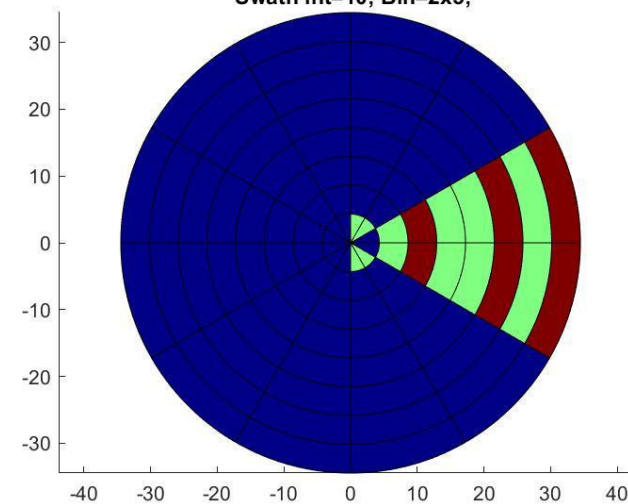
- Deliver a 3D seismic volume to build a high-resolution subsurface model

- Flexible acquisition configuration to match client needs

- Competitive offer thanks to combined use of autonomous and vessel of opportunity boats

- Decreased HSE risk / reduced crew #.

**Thank you for your attention!**

**Any questions?**