November 21st, 2024

9th Dutch Exploration Day

Acquisition and Processing of the Southern North Sea's first OBN survey

Operational/Technical challenges & achievements

Part 1: Yvan Charreyron - Asset Geophysicist, Nederlandse Aardolie Maatschappij B.V.
Part 2: Jeroen Beishuizen – Processing Geophysicist, Shell Global Solutions International B.V.
Xander Campman – Contract Holder, Operations Geophysicist, Shell Global Solutions International B.V.
Dhwajal Chavan – Project Manager, Operations Geophysicist, Shell Global Solutions International B.V.

Definitions & cautionary note

Cautionary Note

The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this **presentation**"Shell", "Shell Group" and "Group" are sometimes used for convenience where references are made to Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. ''Subsidiaries'', "Shell subsidiaries" and "Shell companies" as used in this **presentation** refer to entities over which Shell plc either directly or indirectly has control. The term "joint venture", "joint operations", "joint arrangements", and "associates" may also be used to refer to a commercial arrangement in which Shell has a direct or indirect ownership interest with one or more parties. The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

Forward-Looking Statements

This **presentation** contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim"; "ambition"; ''anticipate''; ''believe''; "commit"; "commitment"; ''could''; ''estimate''; ''expect''; ''goals''; ''intend''; ''may''; "milestones"; ''objectives''; ''outlook''; ''plan''; ''probably''; ''project''; ''risks''; "schedule"; ''seek''; ''should''; ''target''; ''will''; "would" and similar terms and phrases. There are a number of factors that could affect the future operations of Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this **presentation**, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, judicial, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; (m) risks associated with the impact of pandemics, such as the COVID-19 (coronavirus) outbreak, regional conflicts, such as the Russia-Ukraine war, and a significant cybersecurity breach; and (n) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. All forward-looking statements contained in this **presentation** are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Shell plc's Form 20-F for the year ended December 31, 2023 (available at www.shell.com/investors/news-and-filings/sec-filings.html and www.sec.gov). These risk factors also expressly qualify all forward-looking statements contained in this **presentation** and should be considered by the reader. Each forward-looking statement speaks only as of the date of this **presentation**, **21 November 2024,** Neither Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this **presentation**.

Shell's Net Carbon Intensity

Also, in this **presentation** we may refer to Shell's "Net Carbon Intensity" (NCI), which includes Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell's NCI also includes the emissions associated with the production and use of energy products produced by others which Shell purchases for resale. Shell only controls its own emissions. The use of the terms Shell's "Net Carbon Intensity" or NCI are for convenience only and not intended to suggest these emissions are those of Shell plc or its subsidiaries.

Shell's net-zero emissions target

Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and NCI targets over the next ten years. However, Shell's operating plans cannot reflect our 2050 net-zero emissions target, as this target is currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans to reflect this movement. However, if society is not net zero in 2050, as of today, there would be significant risk that Shell may not meet this target.

Forward-Looking non-GAAP measures

This **presentation** may contain certain forward-looking non-GAAP measures such as **[cash capital expenditure]** and **[divestments]**. We are unable to provide a reconciliation of these forward-looking non-GAAP measures to the most comparable GAAP financial measures because certain information needed to reconcile those non-GAAP measures to the most comparable GAAP financial measures is dependent on future events some of which are outside the control of Shell, such as oil and gas prices, interest rates and exchange rates. Moreover, estimating such GAAP measures with the required precision necessary to provide a meaningful reconciliation is extremely difficult and could not be accomplished without unreasonable effort. Non-GAAP measures in respect of future periods which cannot be reconciled to the most comparable GAAP financial measure are calculated in a manner which is consistent with the accounting policies applied in Shell plc's consolidated financial statements.

The contents of websites referred to in this **presentation** do not form part of this **presentation**.

We may have used certain terms, such as resources, in this **presentation** that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

Presentation Content

- Overview
  - Business case
  - Objectives, timeline & results
- Seismic Acquisition
  - Survey Technical Requirements
  - Survey Design
  - Seismic survey overview
  - Key Operational Challenges
  - Node move
  - Survey summary
- Seismic Processing
  - Pre-processing
  - Velocity Model building and FWI
  - Imaging
- Summary

November 21st, 2024
9th Dutch Exploration Day

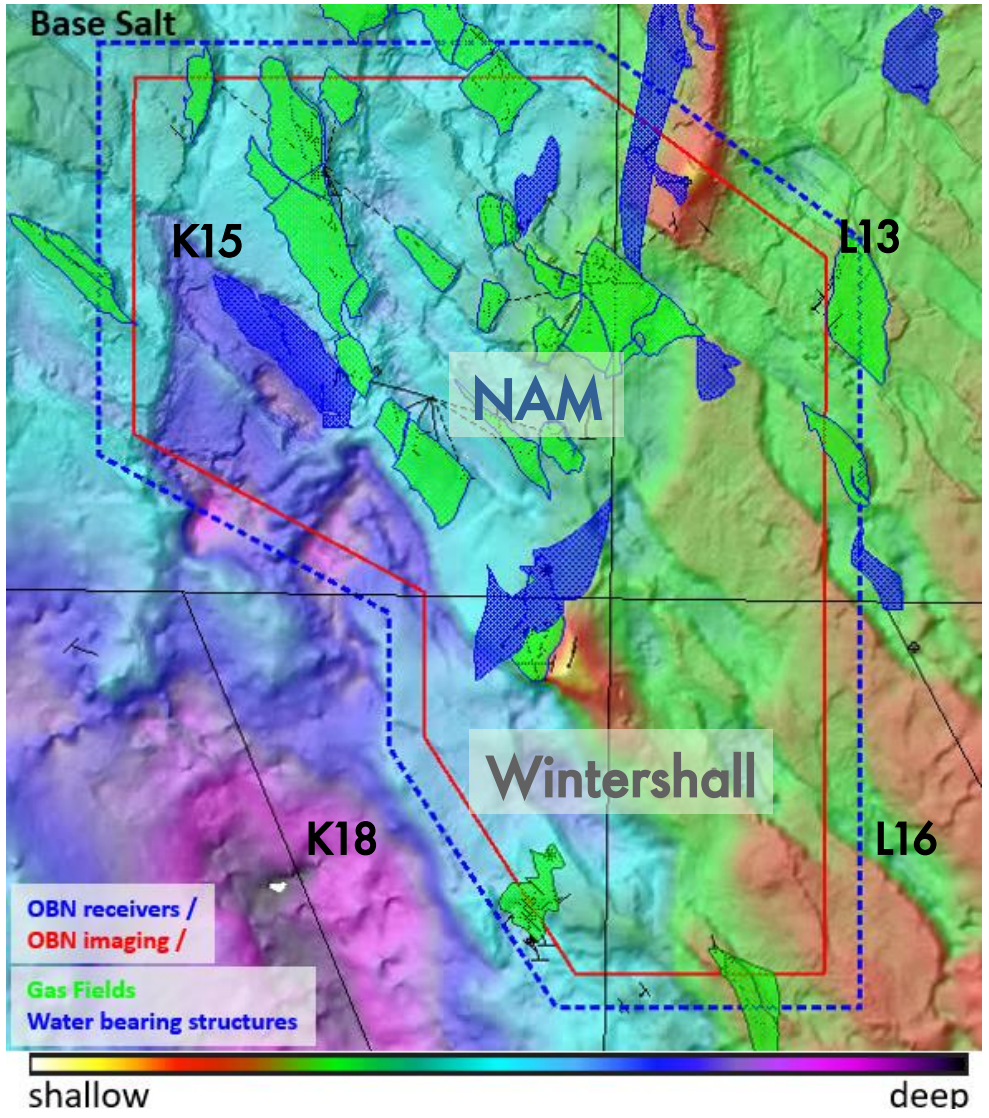
Business case

Photo credit: Marijke de Boer

Business case. Why shoot a seismic survey now?

Overall cost-benefit relation of OBN(*) for the JDA and K18-L16

- Despite a highly developed area, stranded discoveries and several prospects potentially holding significant volumes are identified by both operators.
- Opportunity portfolio is high risk – for both exploration and development. High risk because of (very) poor imaging of sub-salt Rotliegend reservoir.
- De-risking by drilling would only address a single prospect rather than an entire portfolio – 'low appetite' to invest due to cost implications.
- Relative 'low' cost (compared to drilling) of OBN that allows for the polarization of the entire portfolio; hence reduces risks.
- 'Now or never'. 'Last' opportunity to de-risk the portfolio with approaching EoFL. Further development could still benefit from existing infrastructure.
- Collaboration between EBN and the license partners: NAM (Project operator), Wintershall, RockRose Energy and ONE-Dyas

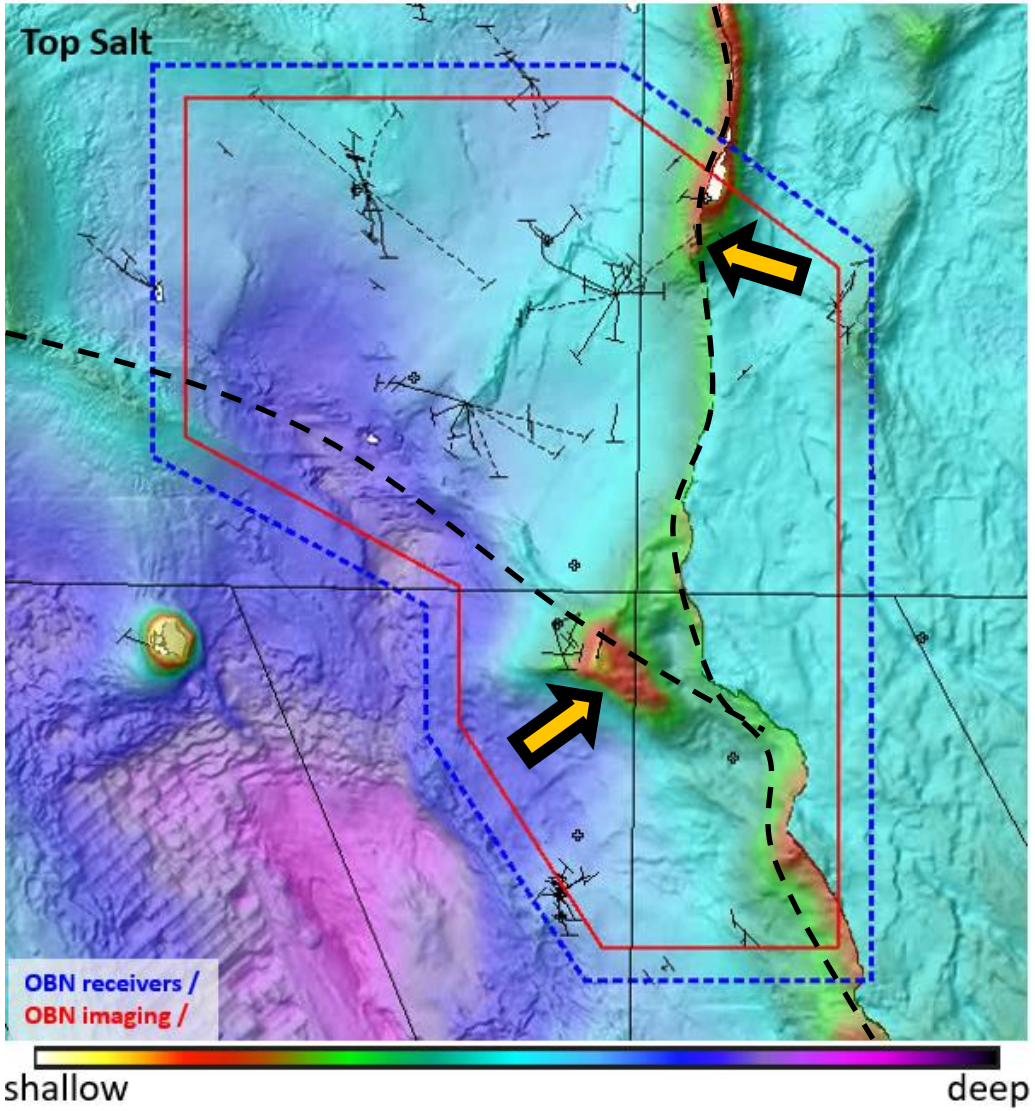


(*) OBN: Ocean Bottom Node

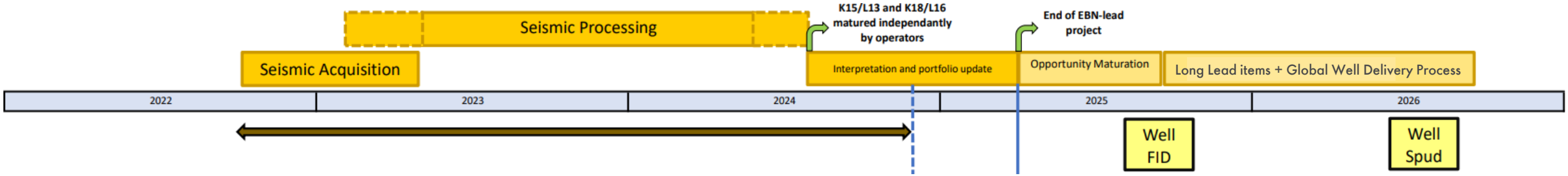
Objectives from improved 'sub-salt' imaging

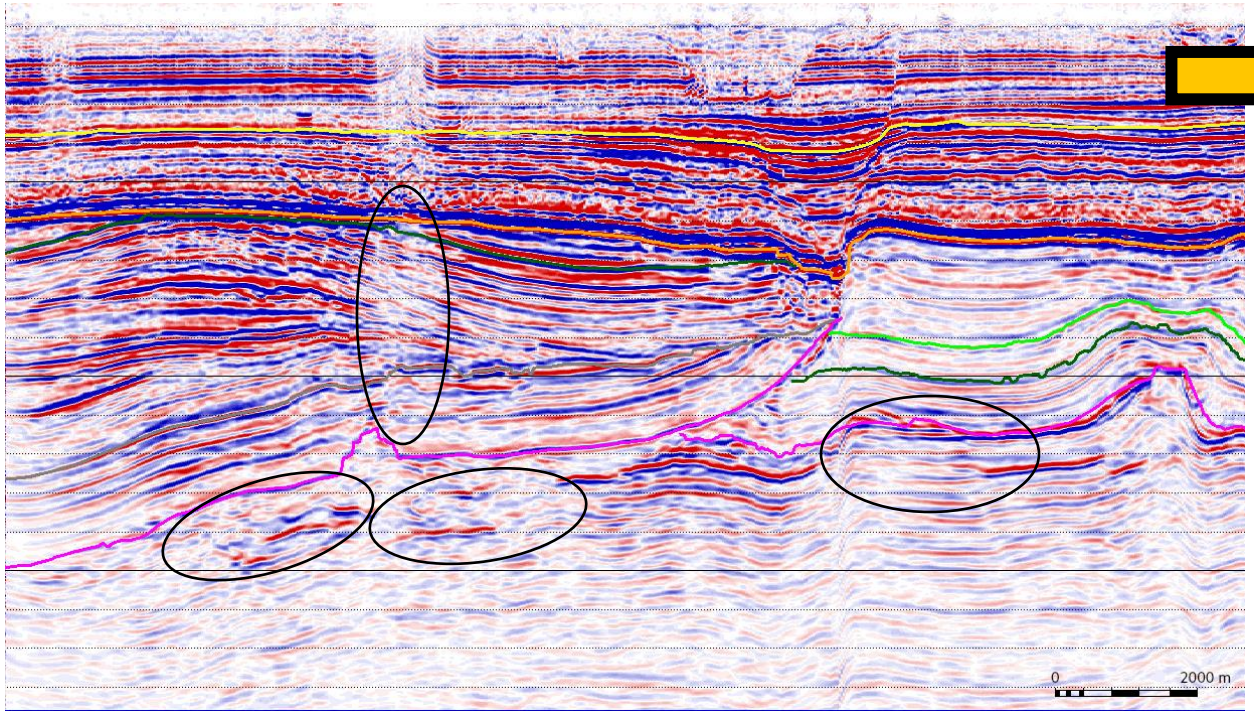
Broadband, long offset & full azimuth to tackle negative effect of complex overburden.

- Improved structural definition of the overburden. Impact on:
  - Geohazards (faults/floaters) identification (safer & 'smarter' wells)
- Improved depth prognosis. Impact on:
  - Gross Rock Volume (top structure and HC transition zone)
  - Optimum well design
- Improved structural definition of reservoir and faults. Impact :
  - Block definition, juxtaposition resolution (Gross Rock Volume)
  - Compartmentalization (Recovery Factor)
  - Optimal well placement
- Improved reliability of amplitudes. Impact on:
  - DHI signature (Common Top Depth stacks)
  - Seismically derived reservoir properties

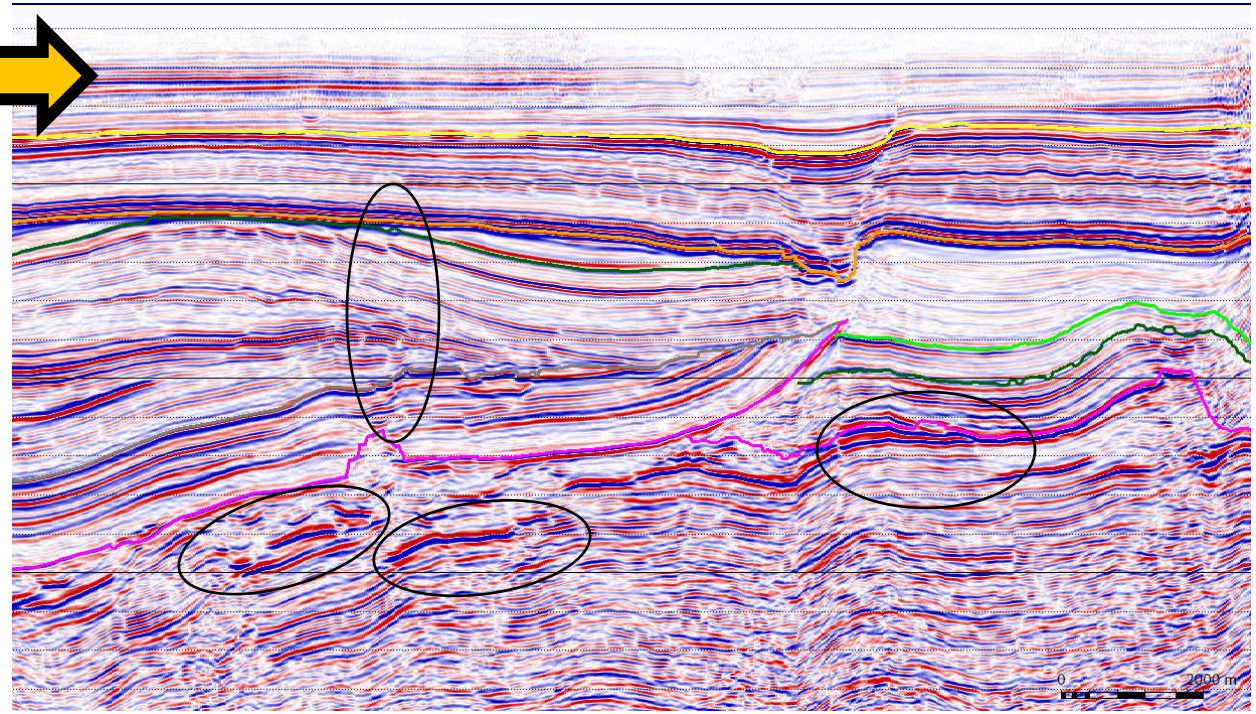


Timeline and results





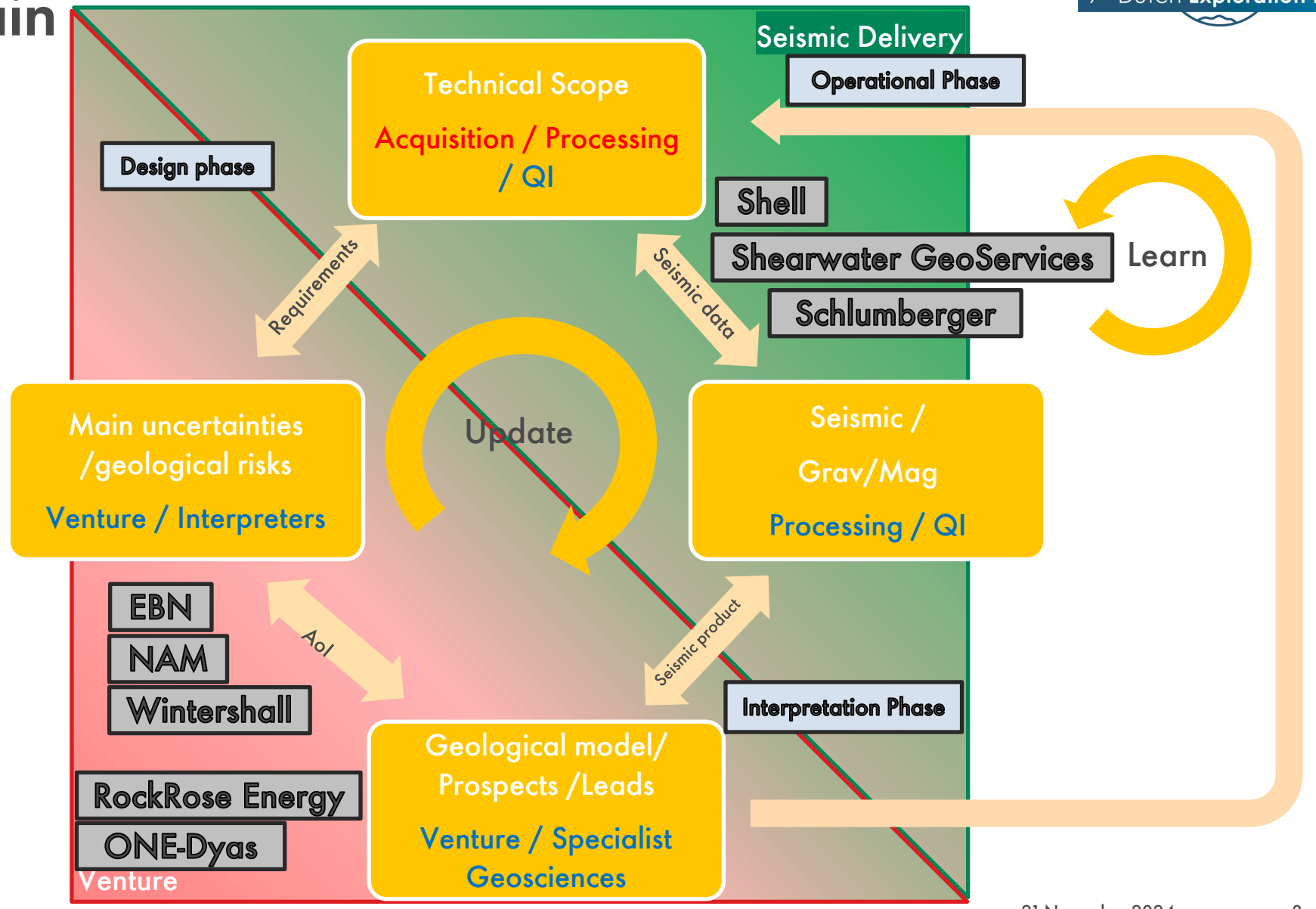
Legacy seismic (NAZ)



2024 OBN seismic (WAZ)

Seismic value chain

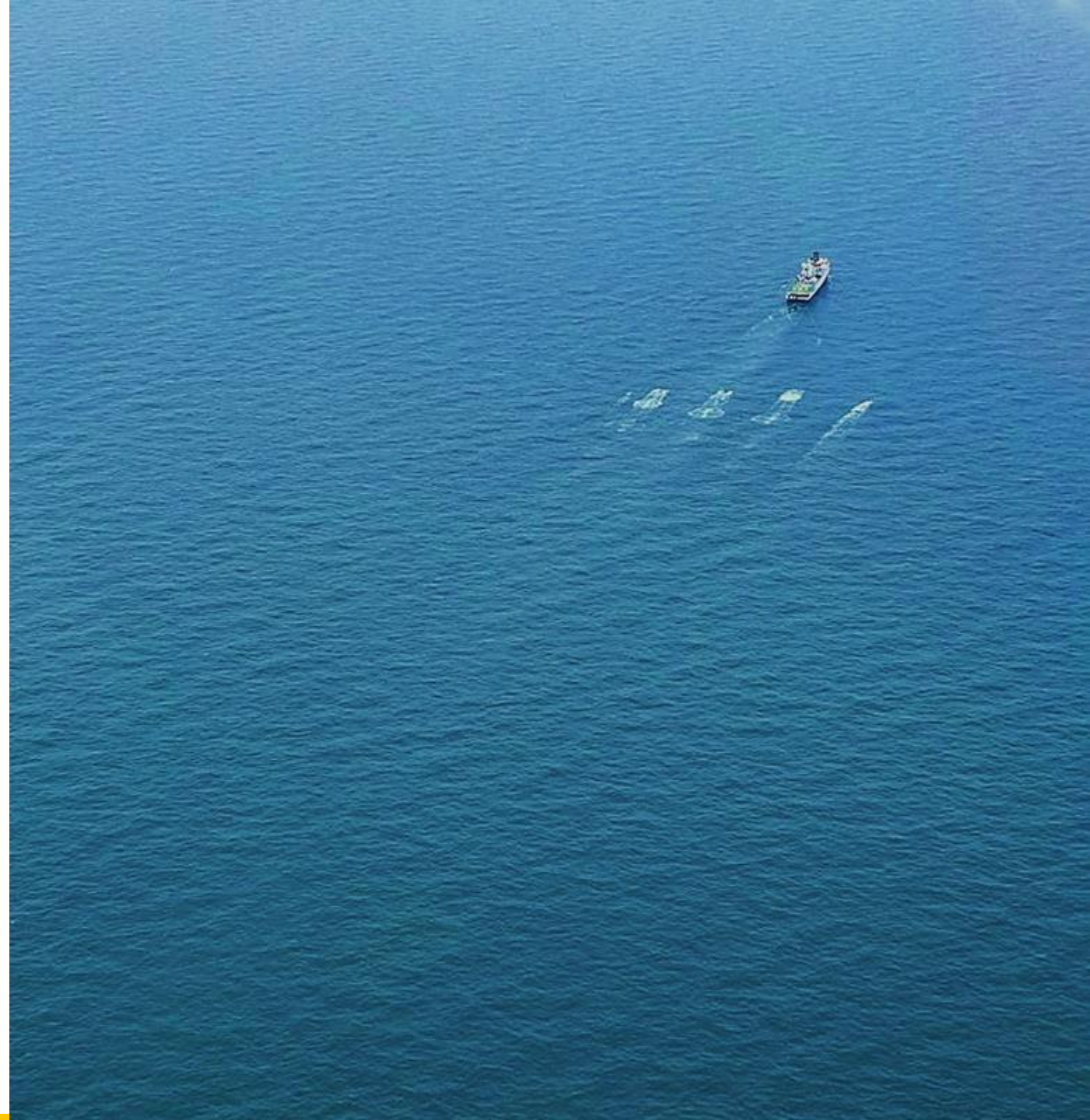
- Fully integrated team:
  - Venture/asset specifies requirements for seismic product – including AoI
  - Seismic delivery team (acquisition, processing, QI) delivers seismic volume/ potentially with attributes



November 21st, 2024
9th Dutch Exploration Day

Acquisition

Design, implementation and operations



Seismic acquisition – survey requirements

To achieve an uplift over the existing seismic vintages and processing efforts.

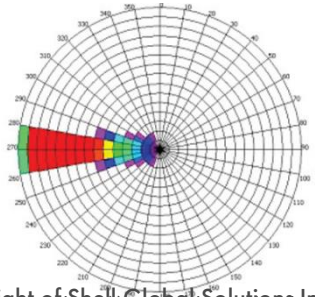
Legacy data deficiencies:

- Limited Spectrum – No specific effort on low frequency acquisition
- Narrow azimuth – Inherent in Streamer Acquisition
- Short offsets – Limited to 6 km

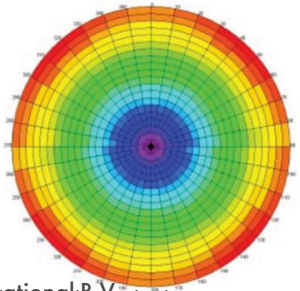
Data to be acquired over K15/L13/K18/L16 needs to address these deficiencies.

Wide Azimuth

NAZ - Streamer



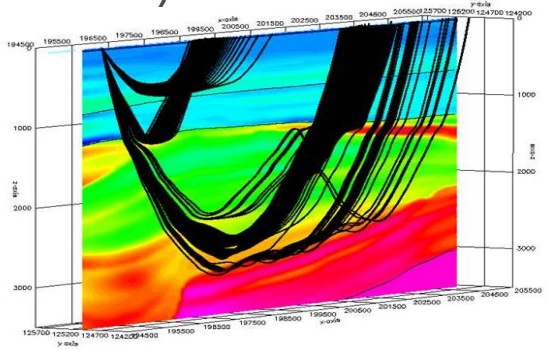
WAZ - OBN



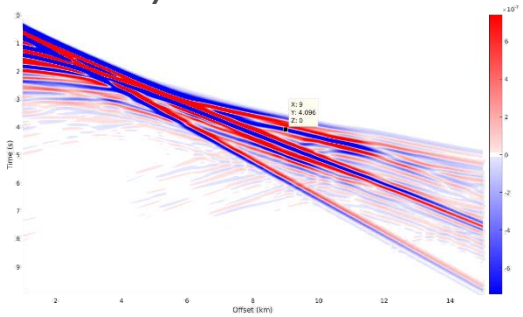
Source: https://csegrecorder.com/articles/view/recent-and-future-developments-in-marine-acquisition-technology-an-unbiased

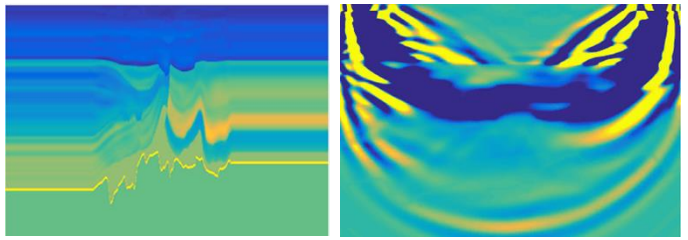
Long Offset

Ray Base Estimation



FWI Sensitivity Kernel Based Estimation



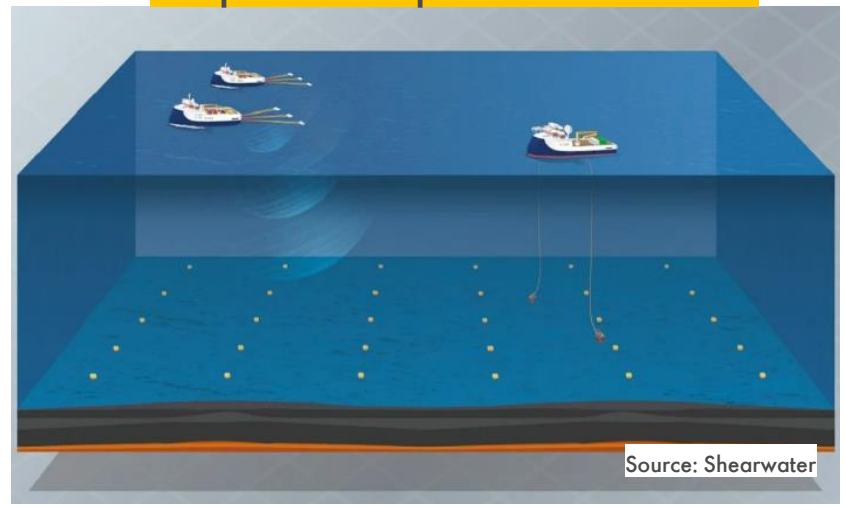


Required Offset – min. 9 km

Broad Spectrum

- Improved bandwidth at receiver
- Source array designed to enhance low frequency output

Proposed Acquisition : NOAR*



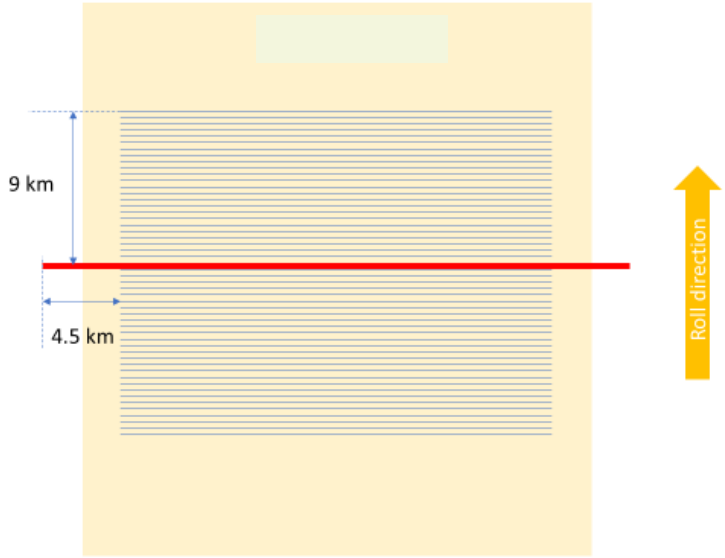
*Node-on-a-rope

Seismic acquisition – survey design

Design - I

Parallel symmetric split-spread

One source vessel

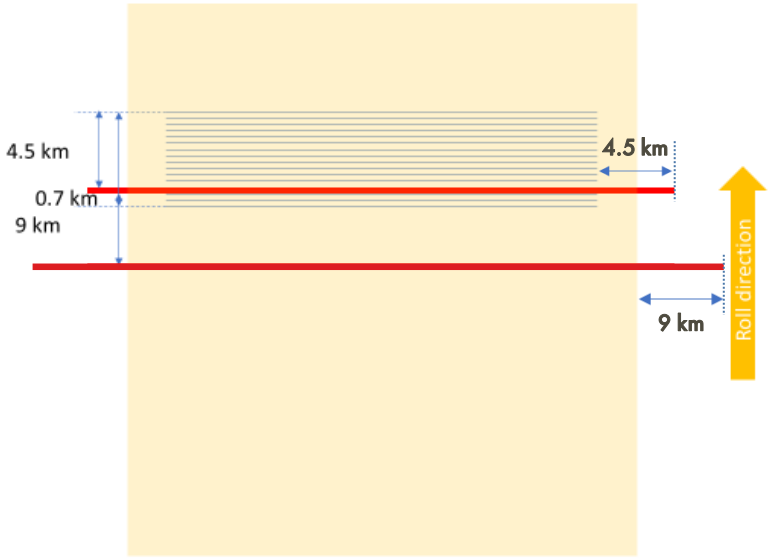


- Very high node requirement (~15,000)
- Limited node inventory with vendors

Design - II

Parallel asymmetric split-spread

Two source vessels

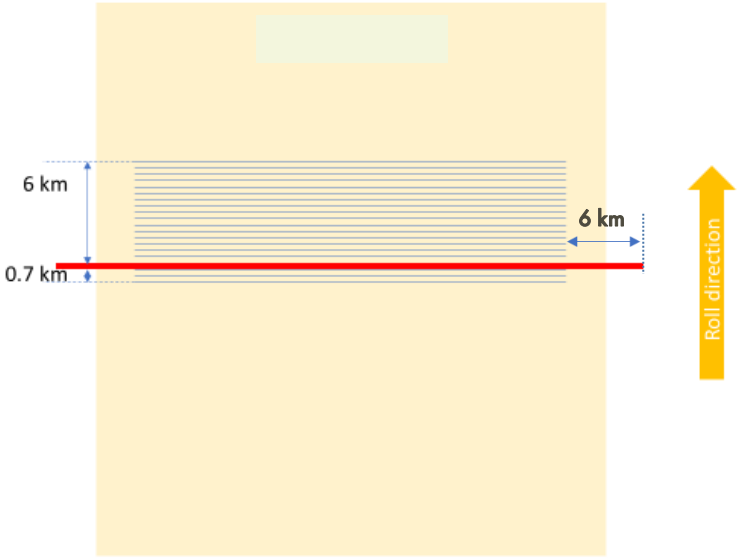


- Blended acquisition – requires high-fidelity deblending for QI objective.
- Operational complexity

Design – III (Final)

Parallel asymmetric split-spread

One source vessels

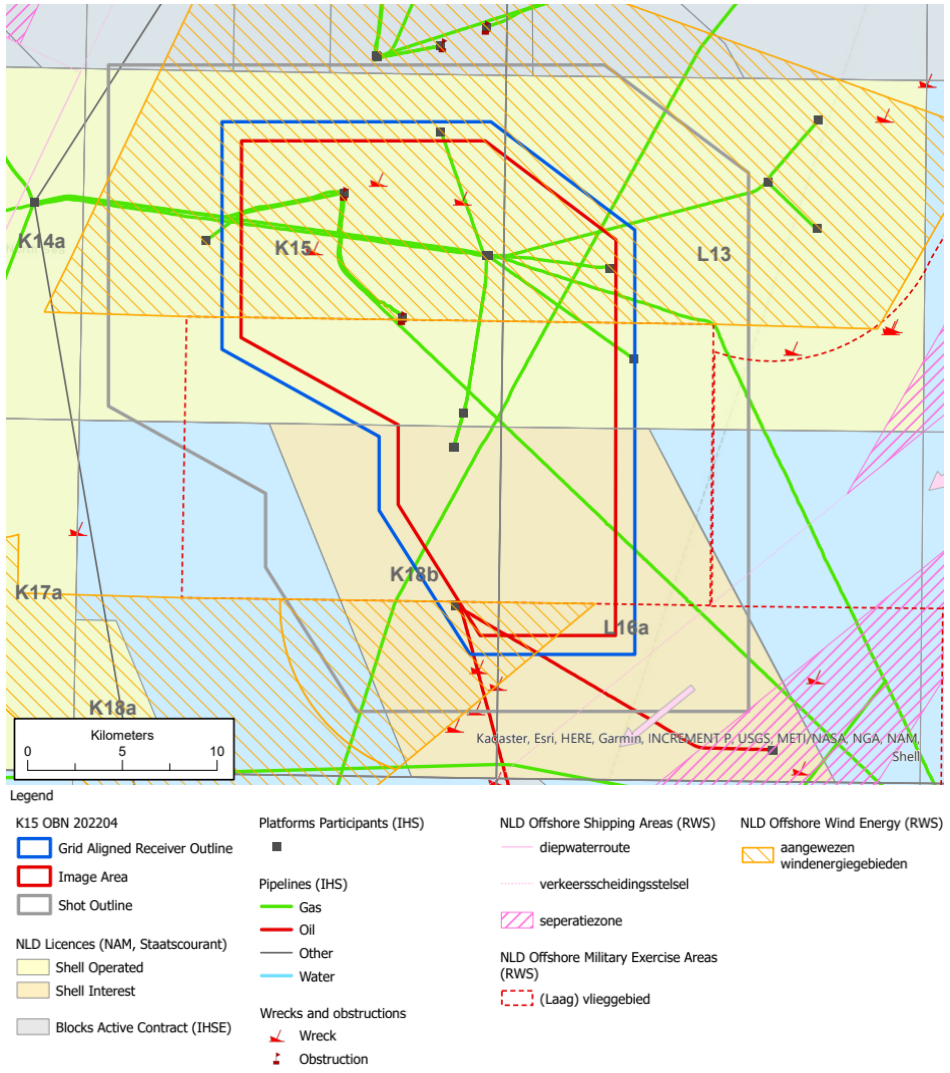


- Provides crossline offset of 6 km and inline offset of 9+ km.
- No simultaneous source.

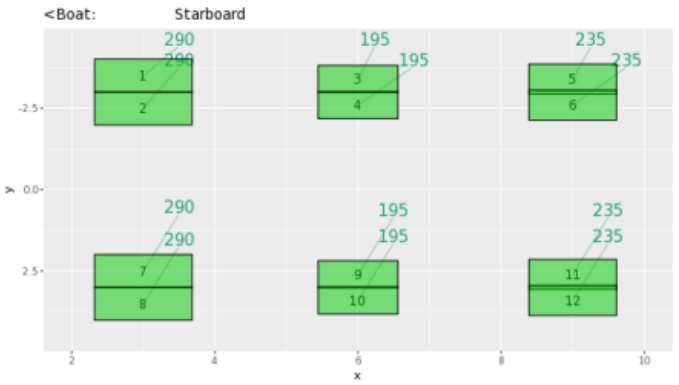
Seismic acquisition – survey parameters, outline & source design

November 21st, 2024
9th Dutch Exploration Day

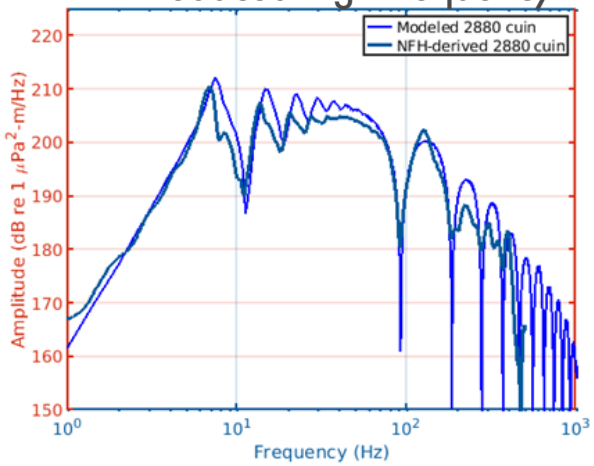
Survey Parameters	
Acquisition Geometry	Node-on-a-rope – one source vessel
Acquisition Style	Asymmetric split-spread
Max. x-line offset	6000 m
Receiver Spacing	75 m receiver point/350 m receiver line
Migration operator	6 km
Source	Triple source
Source volume	2880 cui
Source spacing	50m x 50 m
Receiver line/shot line orientation	E-W/E-W



Production Source Array2880 cui

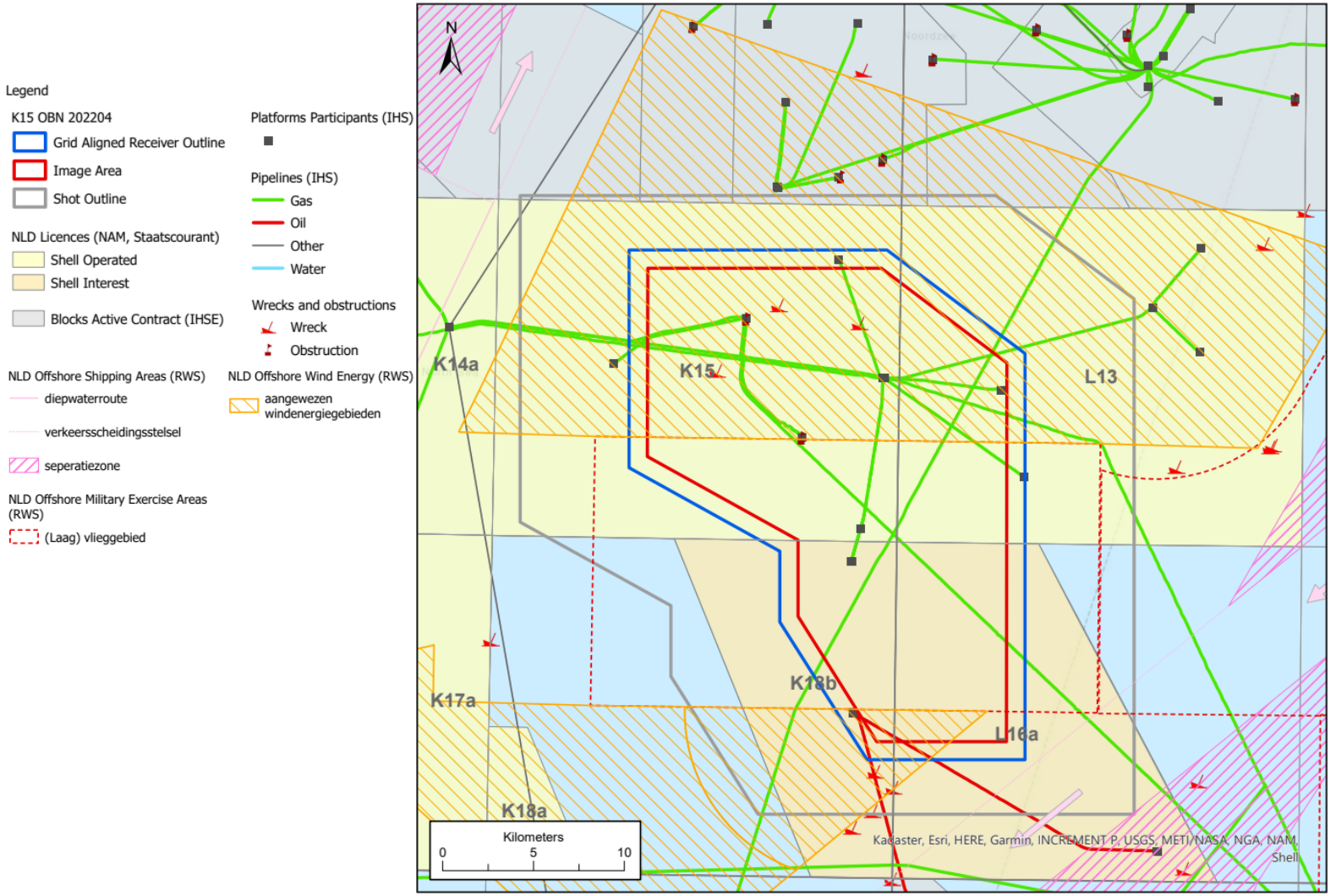


- Enhanced low frequency
- Reduced high frequency



Seismic acquisition – operational challenges

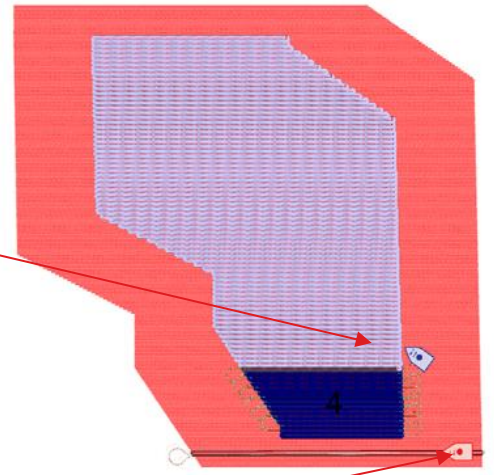
- Met ocean conditions [autumn/winter]
- Shallow water depth (25 - 30 m)
- Platforms (8)
- Subsea infrastructure
- Pipelines
- Well heads
- 3rd party infrastructure
- Wrecks
- Buoys
- Fishing Activity
- Shipping Activity (shooting in shipping lane)
- SIMOPS (x16) including (x3) diving ops
- Platform service vessels & activities
- Marine life
- Helicopter Crew change
- Military Training Area



Seismic acquisition – Fleet

Ocean Dee – Support Vessel

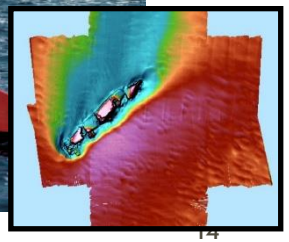
Vespucci – Node Deployer



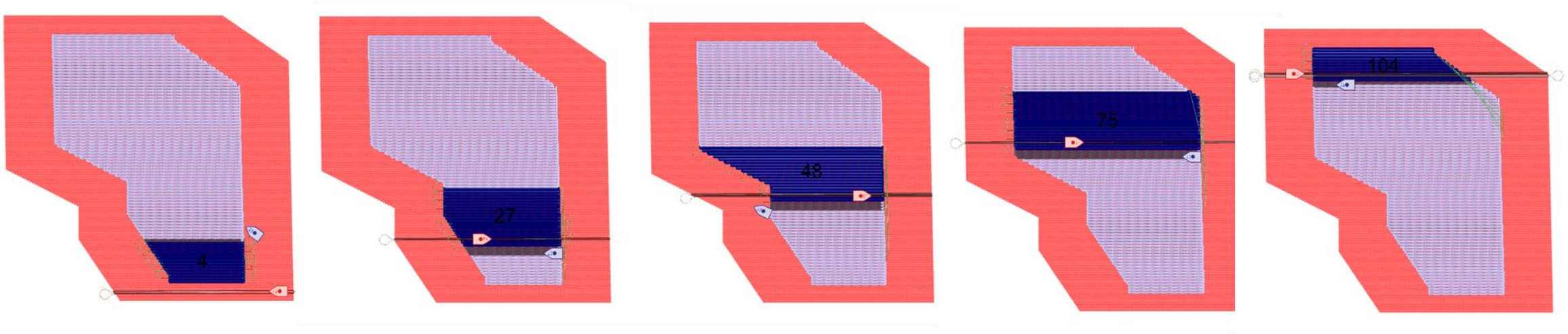
LindeG – Support Vessel

Tasman – Source Vessel

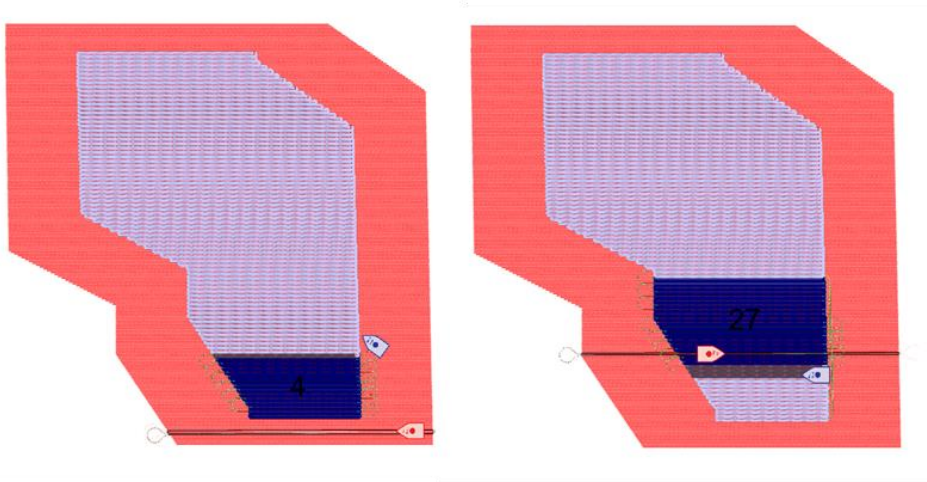
USV (Uncrewed surface vessel)



Seismic acquisition – operation & challenges



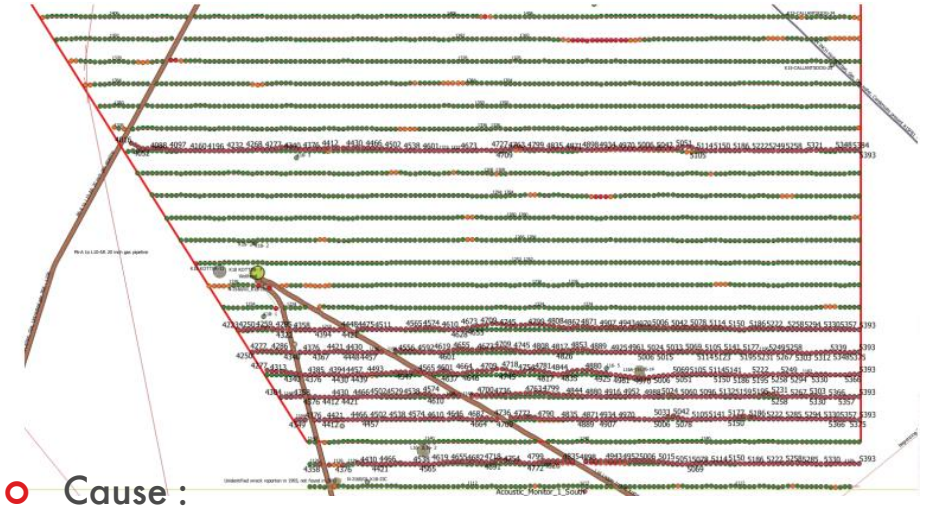
Seismic acquisition – operations & challenges



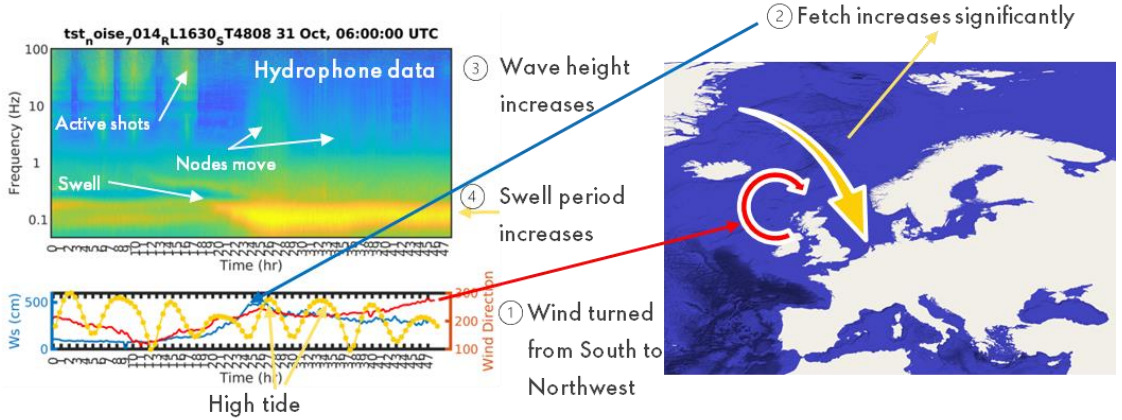
What happened?

- After a period of bad weather (strong Northwestern wind and high waves), entire node spread had moved.
- Some nodes had moved up to 100 m from deployed location.
- Node move was experienced 3 times during the survey

Node Move



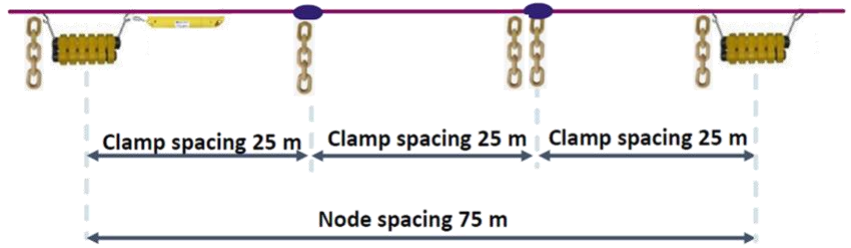
- Cause :
  - Node rope?
  - Met-ocean conditions?



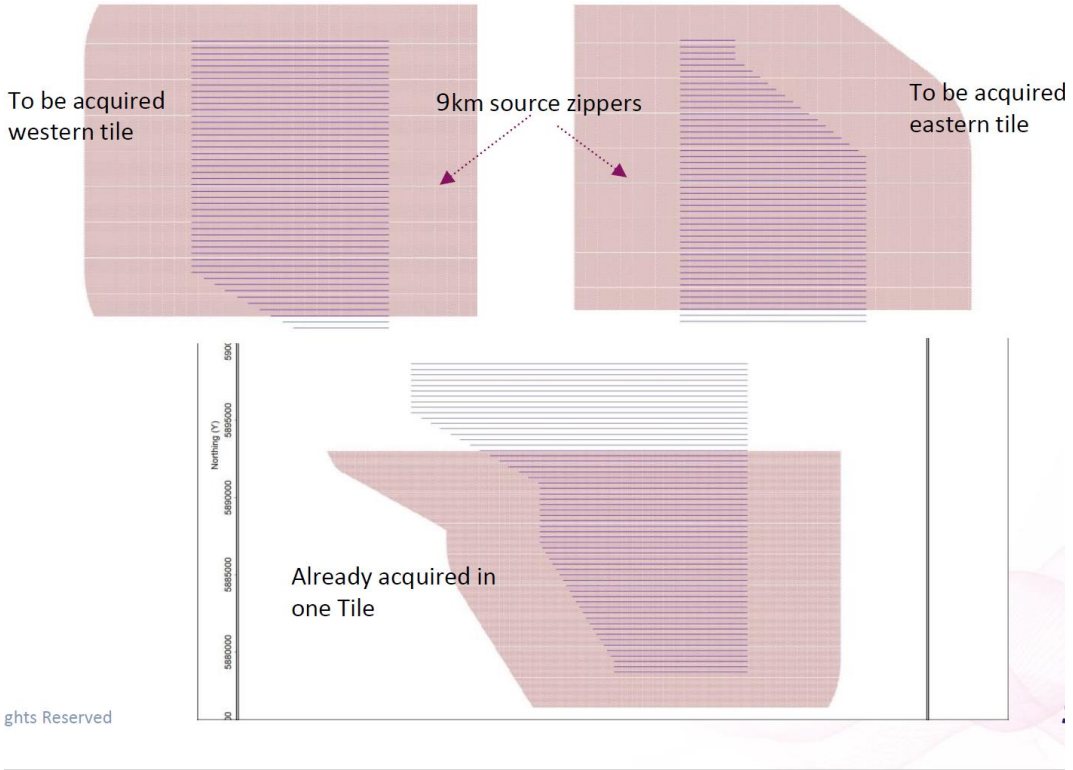
Seismic acquisition – operation & challenges

- Node Move Impact:
  - Redeploy – Reshoot
  - Change deployment scheme → more chain
  - Changed survey design
- Survey duration
  - Planned – 60 days
  - Actual – 193 Days
- Other Operational Challenges
  - Interaction with fishing vessels
  - Naval vessels
  - SIMOPS
- Strong HSSE focus maintained
- Geophysical objective and data as per contractual spec. was acquired.

Changed NOAR Deployment Schematic

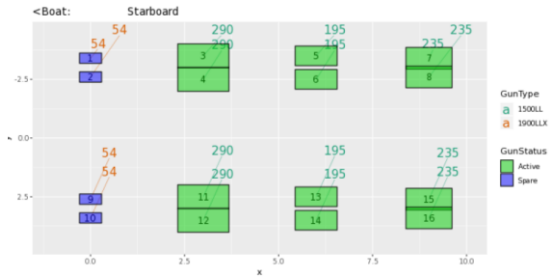


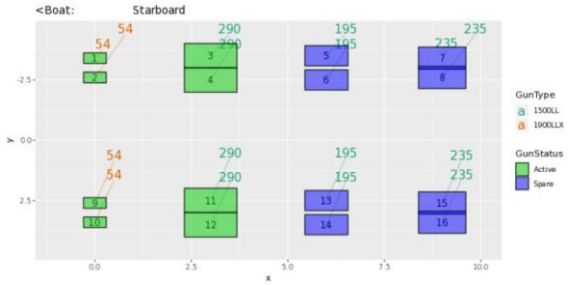
Chain Handling at back deck

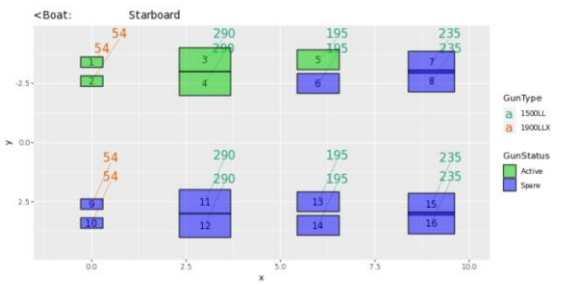


Seismic acquisition – source testing

- How to reduce underwater sound from airgun array?
  - Less elements
  - Smaller array volume
  - Modified components





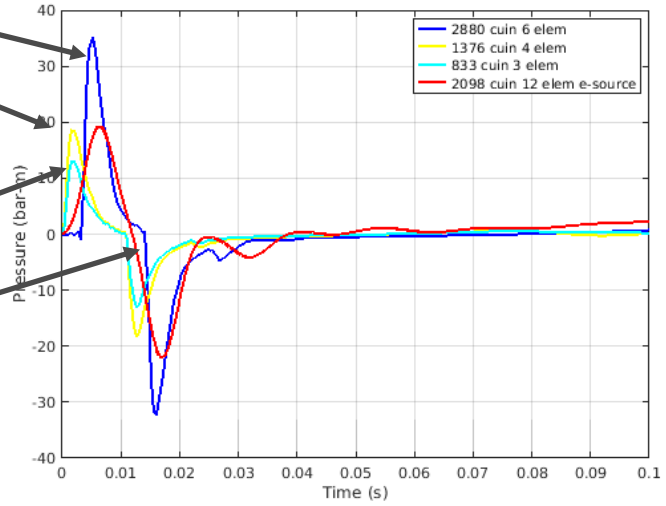


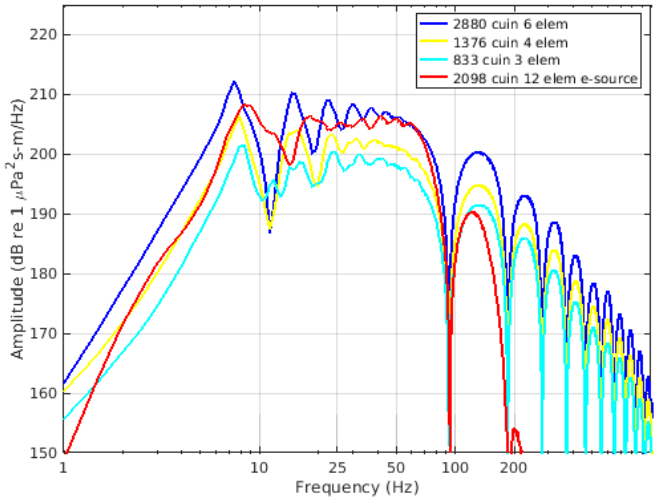
reference

smaller volume

Less elements

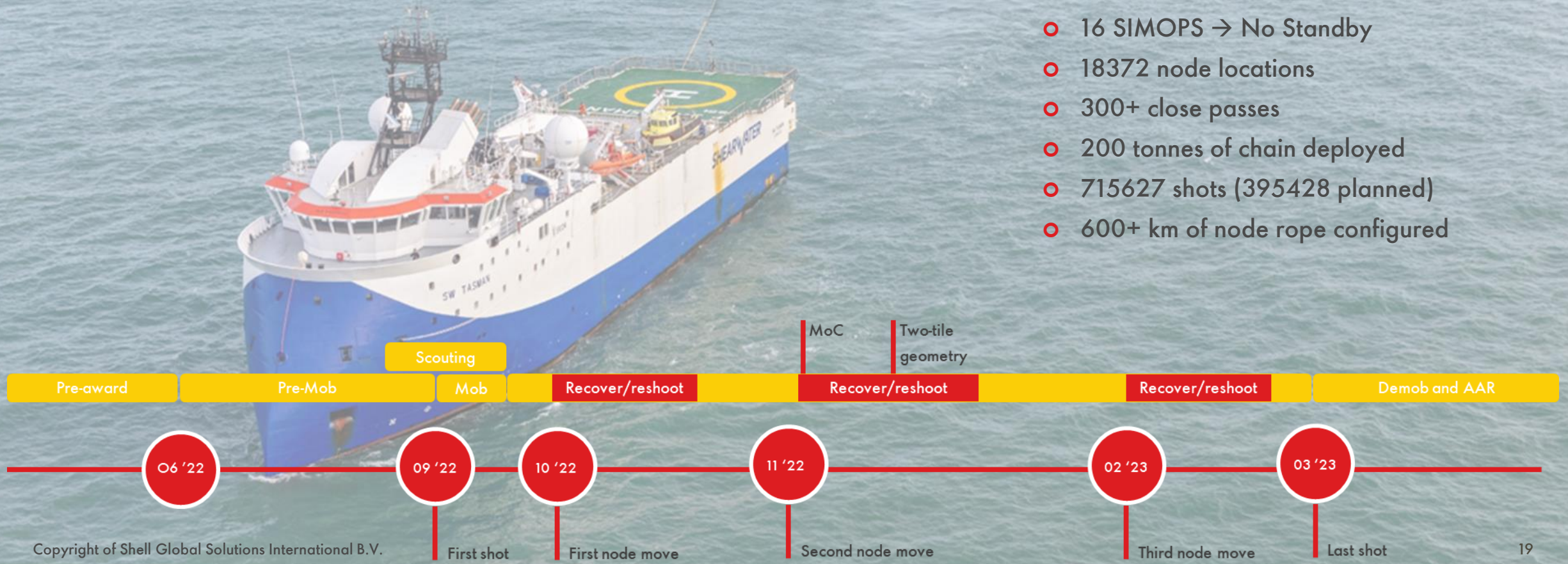
modified components





Seismic acquisition – summary and timeline

- Key Survey Statistics
  - 553627 exposure hours
  - Goal zero
  - No LTI's
  - 16 SIMOPS → No Standby
  - 18372 node locations
  - 300+ close passes
  - 200 tonnes of chain deployed
  - 715627 shots (395428 planned)
  - 600+ km of node rope configured



Part 1. Seismic Acquisition – Summary

- The OBN acquisition successfully delivered broadband, WAZ, high fold and long offset data
- Focus on maintaining data integrity and highest HSSE standards in the face of operational challenges (principaly due to the requirement of shooting seismic outside the summer season)

- Key for success was the efficient collaboration between Wintershall, EBN, NAM and Shell

Acknowledgments: EBN, NAM, Wintershall, Rock-Rose Energy, One-Dyas, Shell, Shearwater Geoservices & SLB

Sabine Korevaar	EBN
Johannes Rehling	EBN
Bas van der Es	EBN
Cees Van Eden	Shell
Jeroen Goudswaard	Shell
Xander Campman	Shell
Dhwajal Chavan	Shell
Dan Bright	Shell
Frans Smit	Shell
Jeroen Beishuizen	Shell
Juan Pi Alperin	Shell
Martin Dvorak	Shell
Ron Verrijp	Shell
Yuriy Aleksakhin	Wintershall
Marc Beller	Wintershall
SWGS marine crew and office support	Shearwater GeoServices
Galina Miasnikova, Federico Sokolowski and the SLB dedicated processing team for Shell	SLB
Katherine Ryan and subsea team	NAM
Klaas Bos	NAM
Sjouke de Boer	NAM
Hans Ardesch	NAM
Karel Bokhorst	NAM
Rob Wervelman	NAM
Abdullah Hamood	NAM
Paul Reemst	NAM
Raoul Quadvlieg	NAM
David Nunumete	NAM
Yvan Charreyron	NAM