

Unwrapping the potential of Ras Al Khaimah 3D offshore exploration in UAE

Finding Petroleum Opportunities In The Middle East

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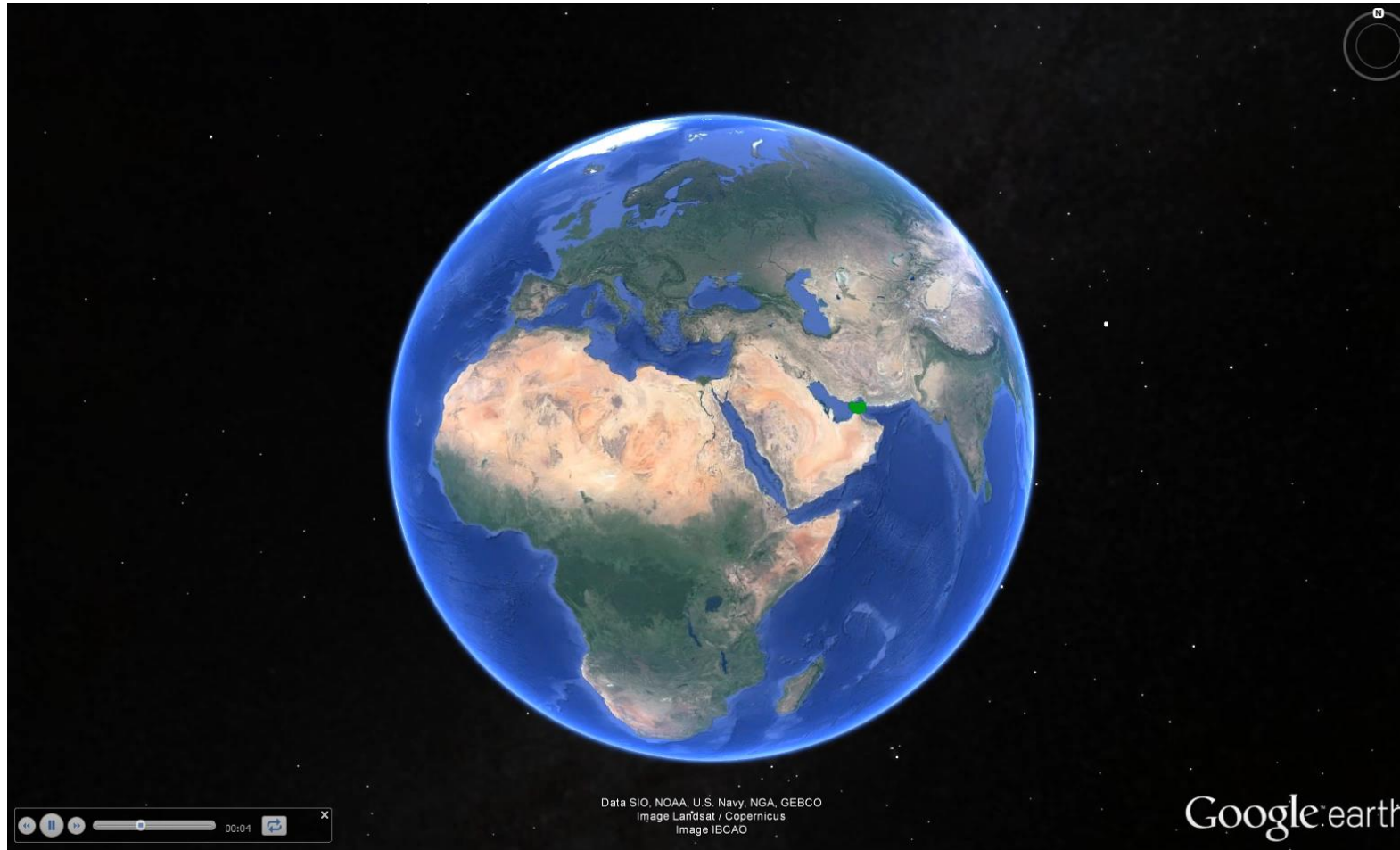
Introduction – The case study



“One of the most rewarding moments for a Geoscientist is the opportunity to interpret a new dataset. It satisfies the very human need to discover the unknown. Perhaps it also satisfies something more basic, the child-like feeling when you are just about to open your birthday gifts.” D. Contreras Diaz

- Location and History
- Challenges and Survey Design
- The Plan vs The Actual
- Onboard Processing
- Final Result and Conclusion

Ras Al Khaimah - Location



Seventh Emirate of UAE

Joined UAE in 1972

Ruler Sheikh Saud bin Saqr al Qasimi

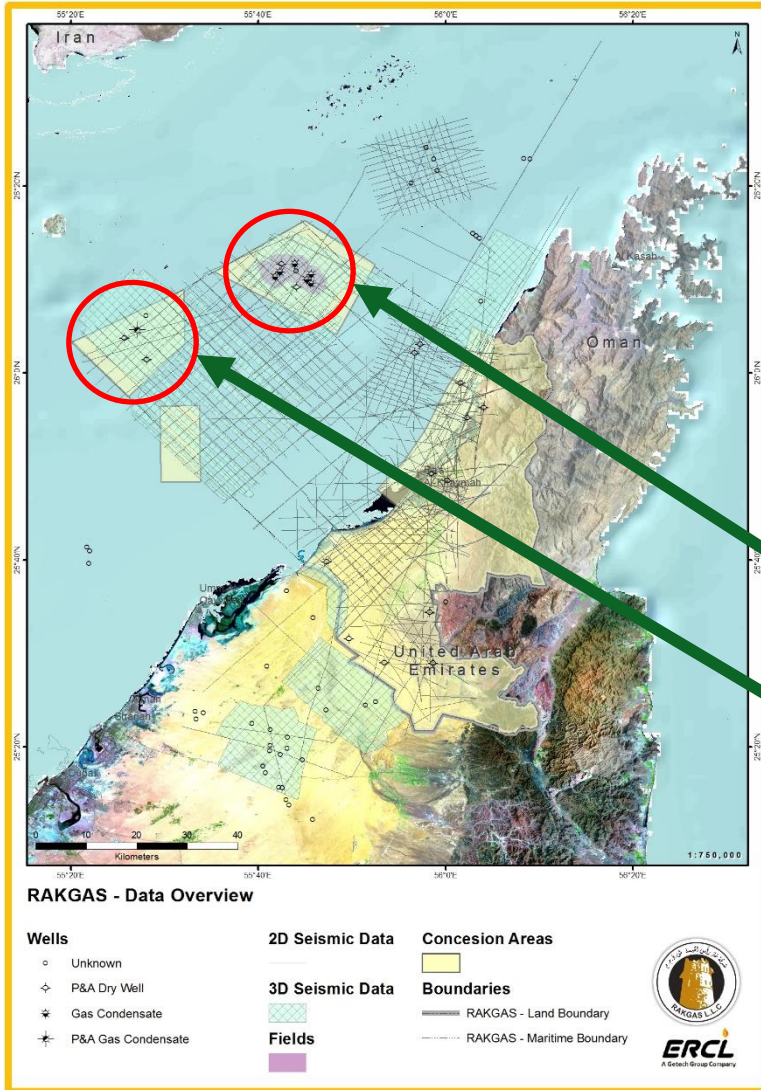
Approx. 3% UAE land area

Approx. 3% UAE total population

Capital Ras Al Khaimah

Top 10 proven global crude oil reserves

Ras Al Khaimah – Exploration History



Number of vintage exploration 2D surveys

Vintage 3D (towed streamer and ocean bottom)

Two main fields: Saleh and RAK B

SALEH: Gas and condensate field

RAK B: Proven oil discovery

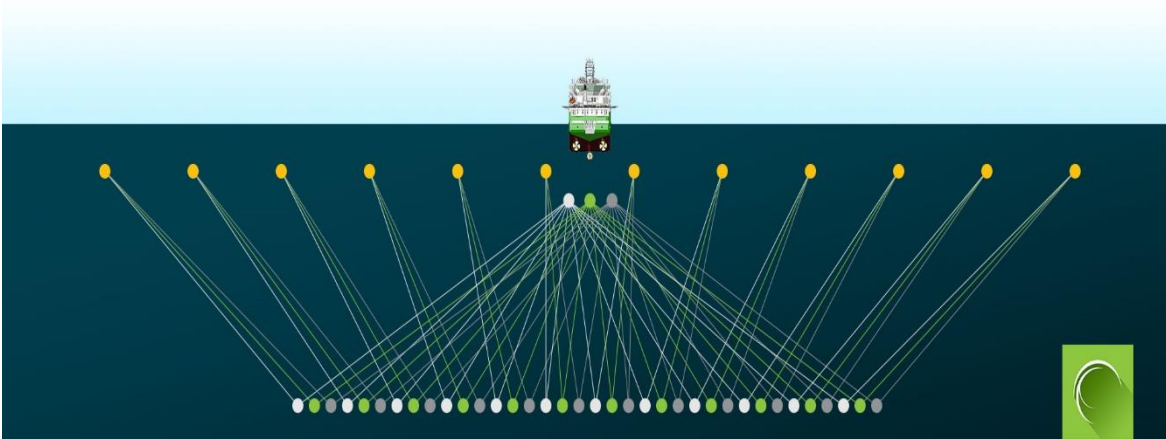
Large areas without seismic coverage and unexplored

The Challenge



- Acquire towed streamer where ocean bottom is the popular choice
- Multi-Client Business Model
- Safe and efficient with high data quality
- Entire width and breadth, from 15m contour to offshore extents (80m), maximizing coverage around Saleh and shallows
- Acquisition and processing delivered in time for 2018 licensing round (March)

Survey Design - XArray™



- Designed to provide closer cross-line sampling and more unique ray-paths than dual sources on the same streamer configurations, or allow wider tow.

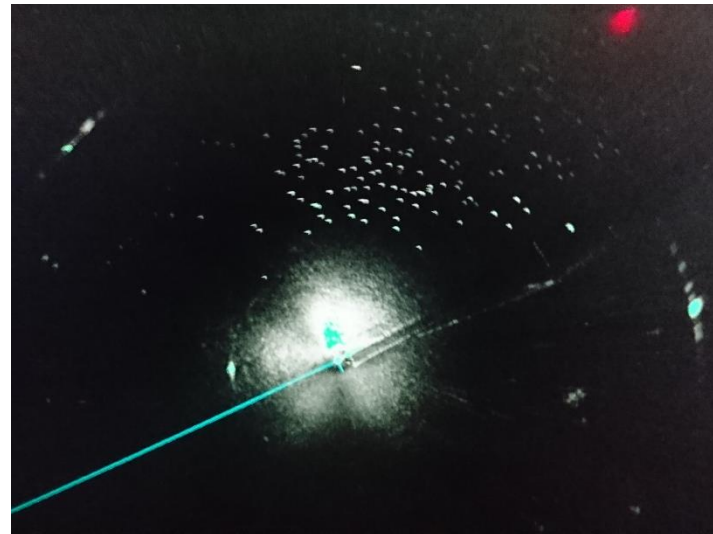
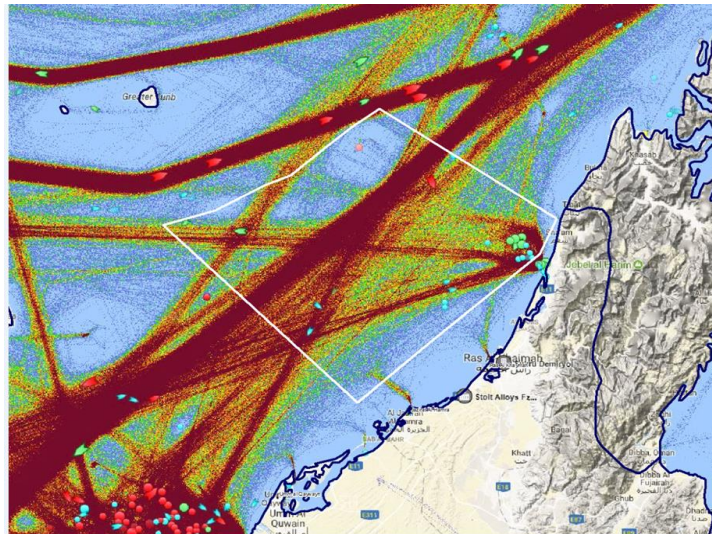
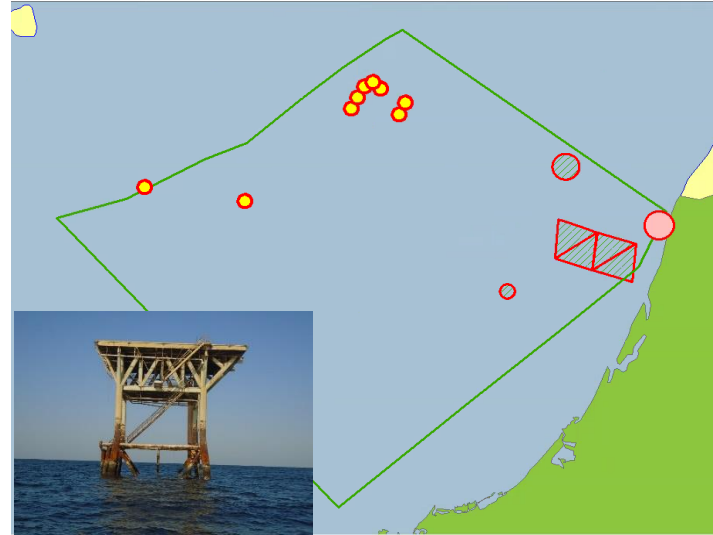
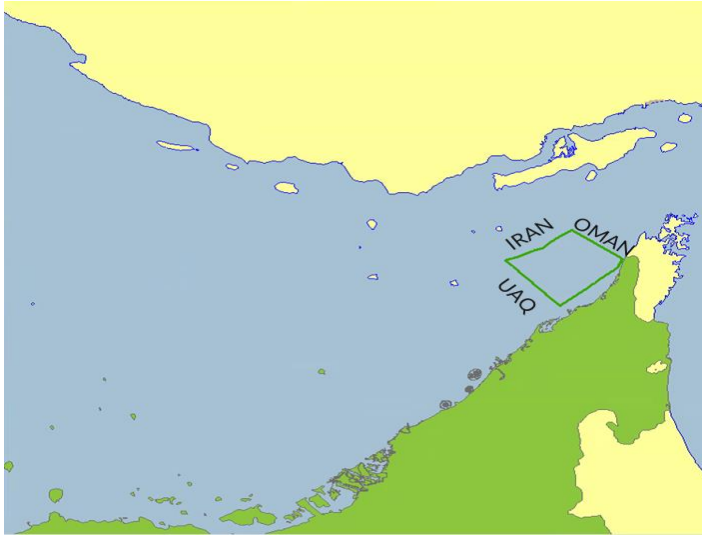
- Dual-source cross-line sampling = $1/4$ of streamer separation

- Triple-source cross-line sampling = $1/6$ of streamer separation

- Gun cycle time set at **12.5m**:

Inline Fold 80, Trace density 680k, Overlap $\sim 5.5s$

Survey Constraints

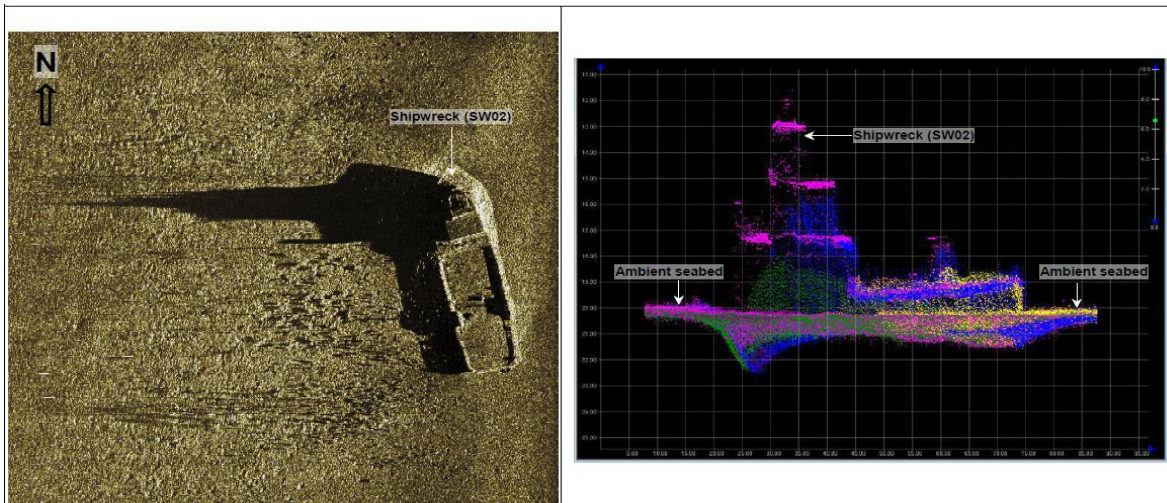


- Constrained by borders
- 7 installations in Saleh field
- Installation in RAK-B field
- Marker buoy
- Mina Saqr port with anchorage
- Major shipping lanes and fishing

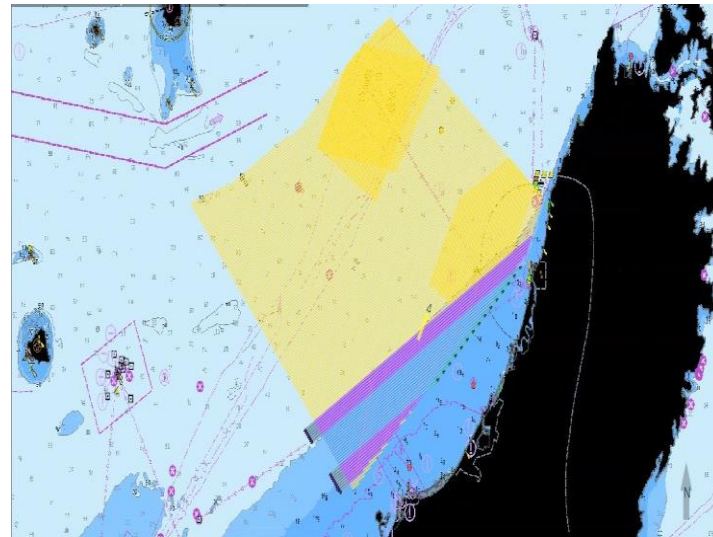
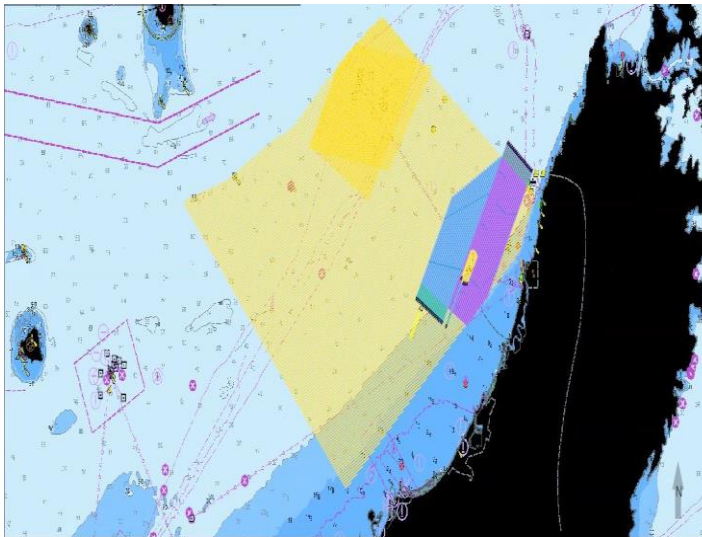
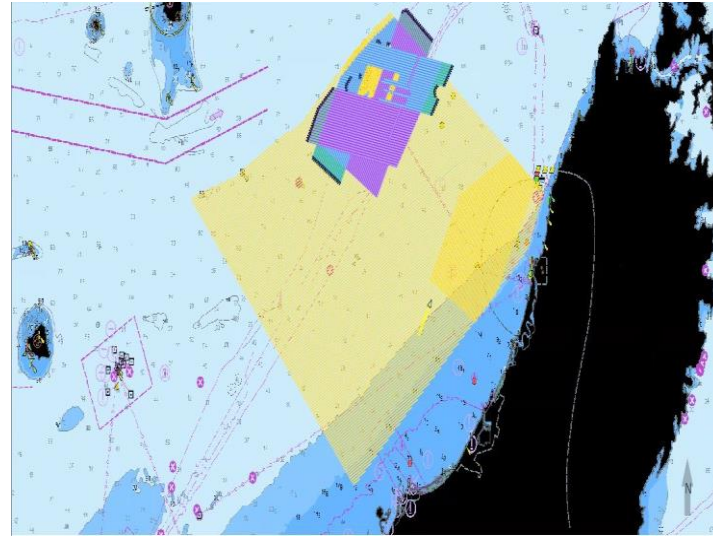
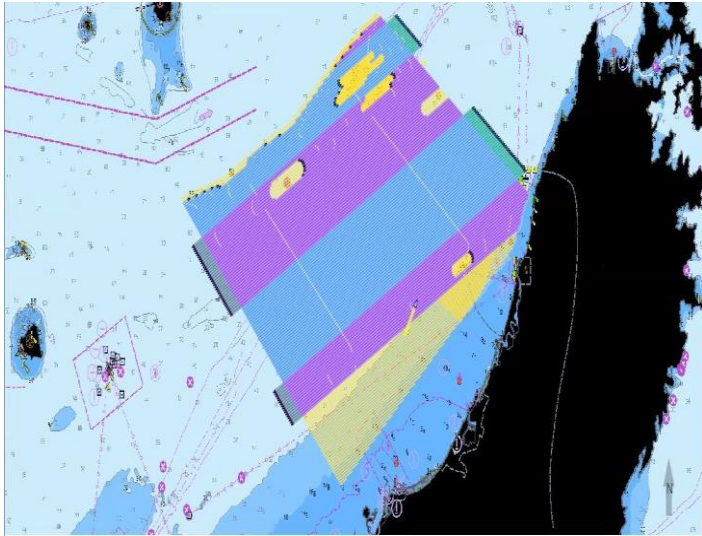
SIMOPS – Shallows and wrecks



- Bathymetry & Side Scan Sonar Hazard Survey acquired in parallel with 3D seismic
- Aim to map the 15m contour and identify seafloor obstructions
- Nine (9) shipwrecks
- Eighty eight (88) boat wrecks
- One hundred and twenty six (126) coral heads

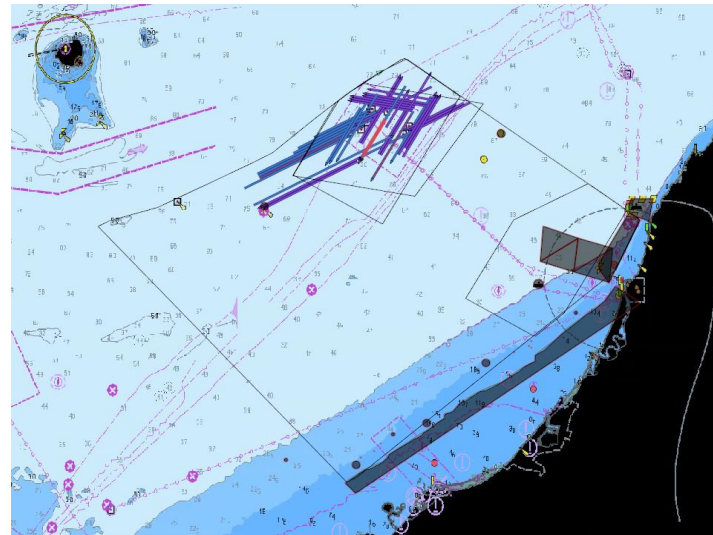
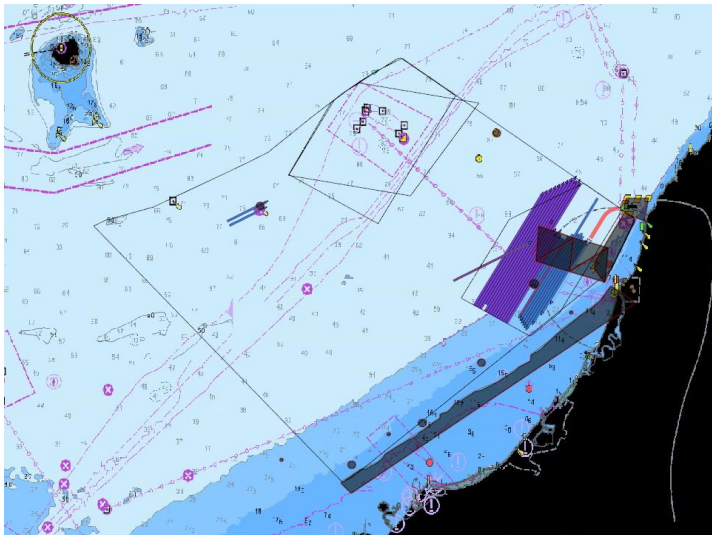
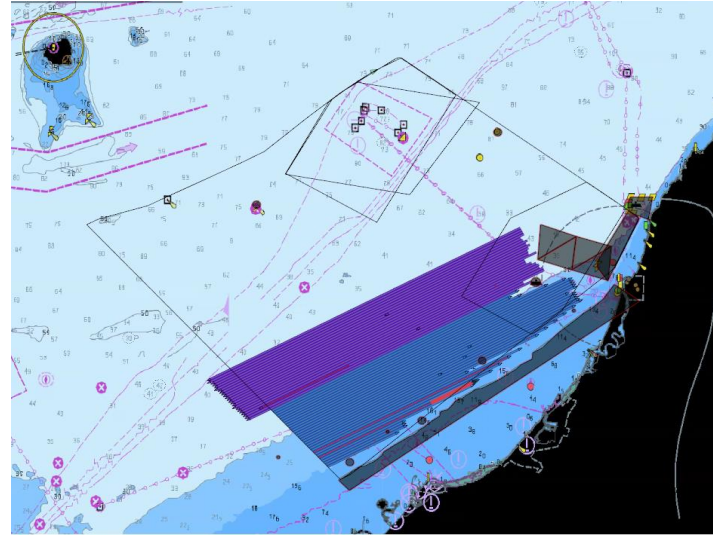
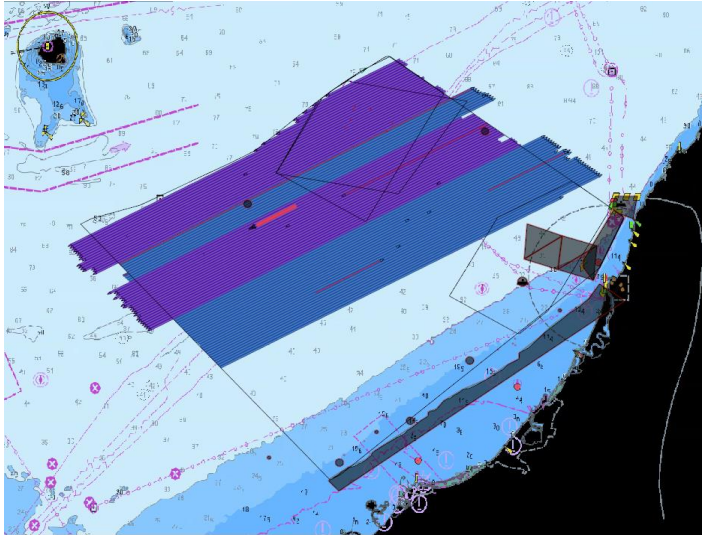


Shooting Strategy - Planned



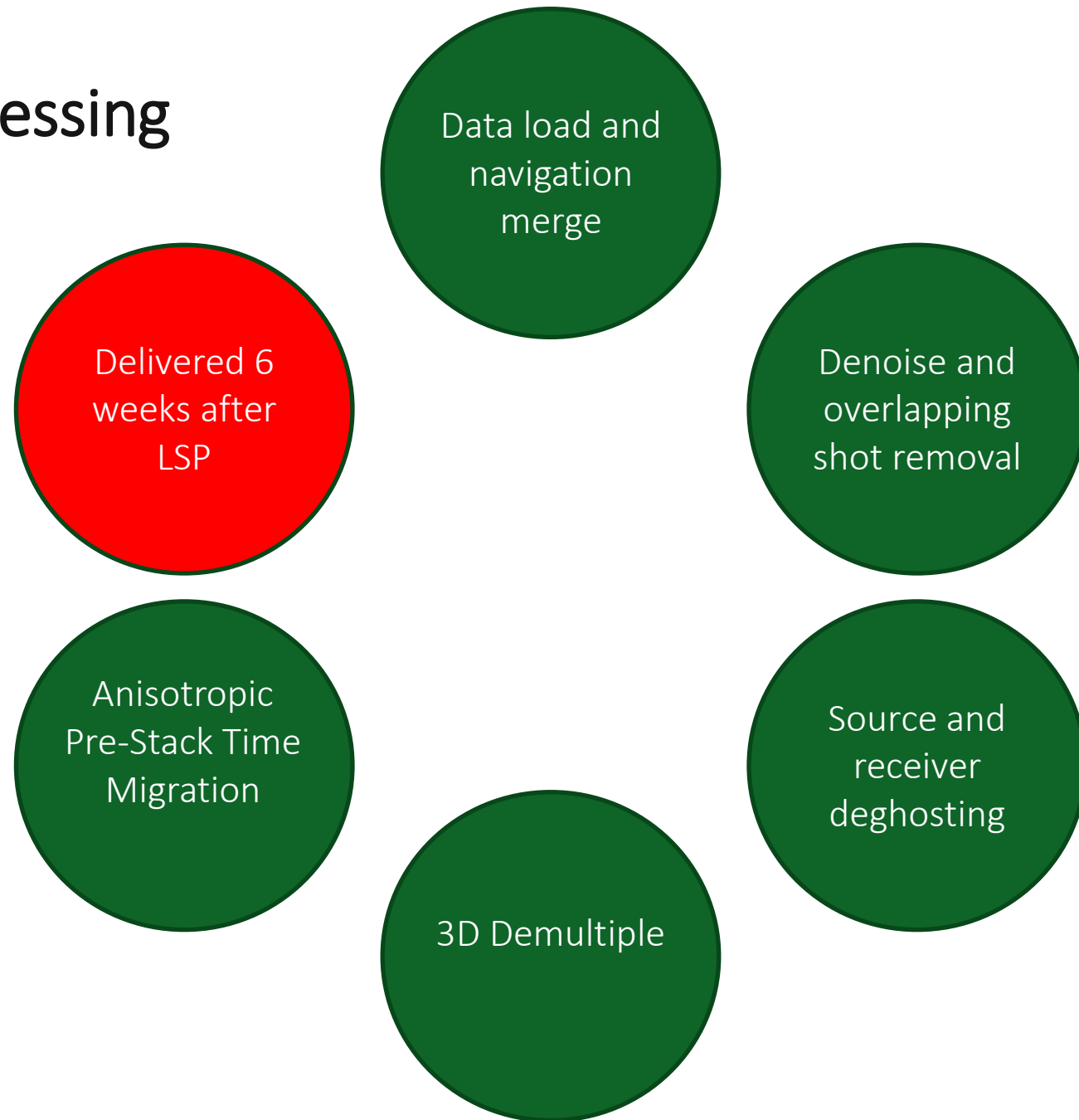
- Survey divided into 4 stages:
- Main area 6x112.5mx6km, 12m streamer depth, 5m source depth
- Saleh area 6x112.5mx4km, 12m streamer depth, 5m source depth
- Shallows area 6x112.5mx4km, **8m streamer depth**, 5m source depth
- Anchorage area 6x112.5mx4km, 8m streamer depth, 5m source depth
- Steer on preplot, shoot racetrack

Shooting Strategy - Actual



- Main area 6x112.5mx6km, 12m streamer depth, 5m source depth
- Shallows area 6x112.5mx6km, **8m streamer depth**, 5m source depth
- Saleh area 6x112.5mx**4km**, 8m streamer depth, 5m source depth
- Anchorage area 6x112.5mx4km, 8m streamer depth, 5m source depth
- Completed thirty-five close pass operations in seven days
- Steer on coverage, select available lines

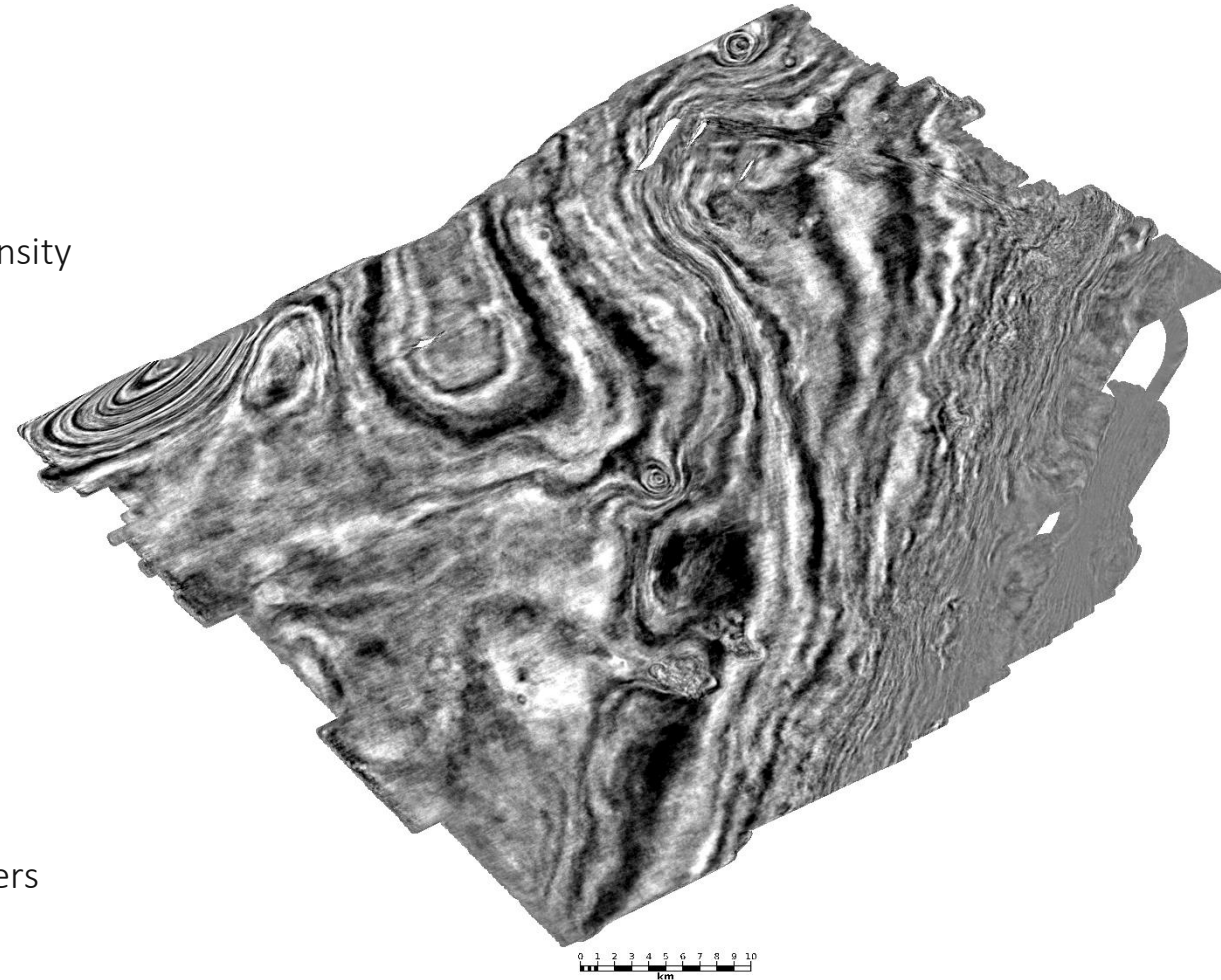
Onboard Processing



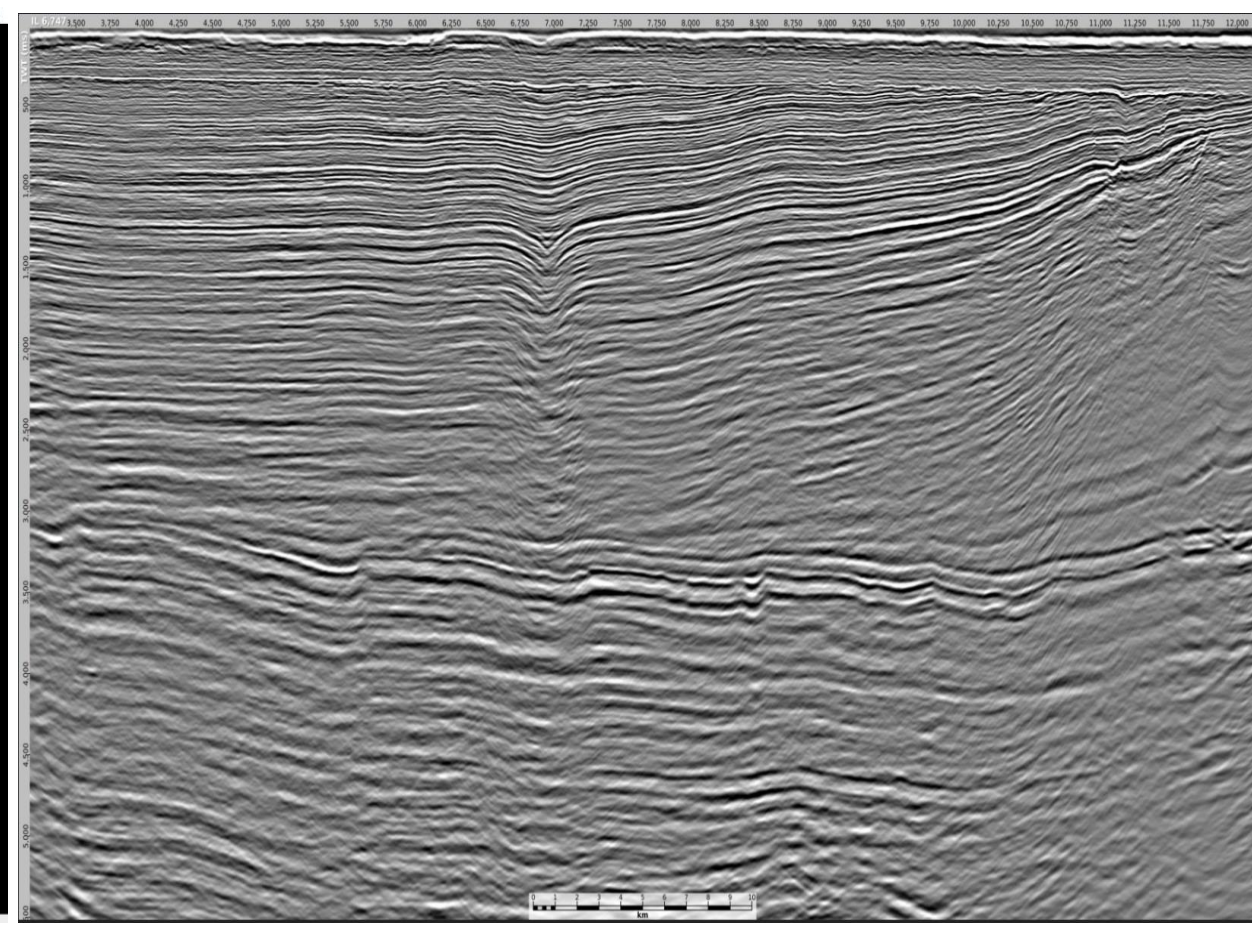
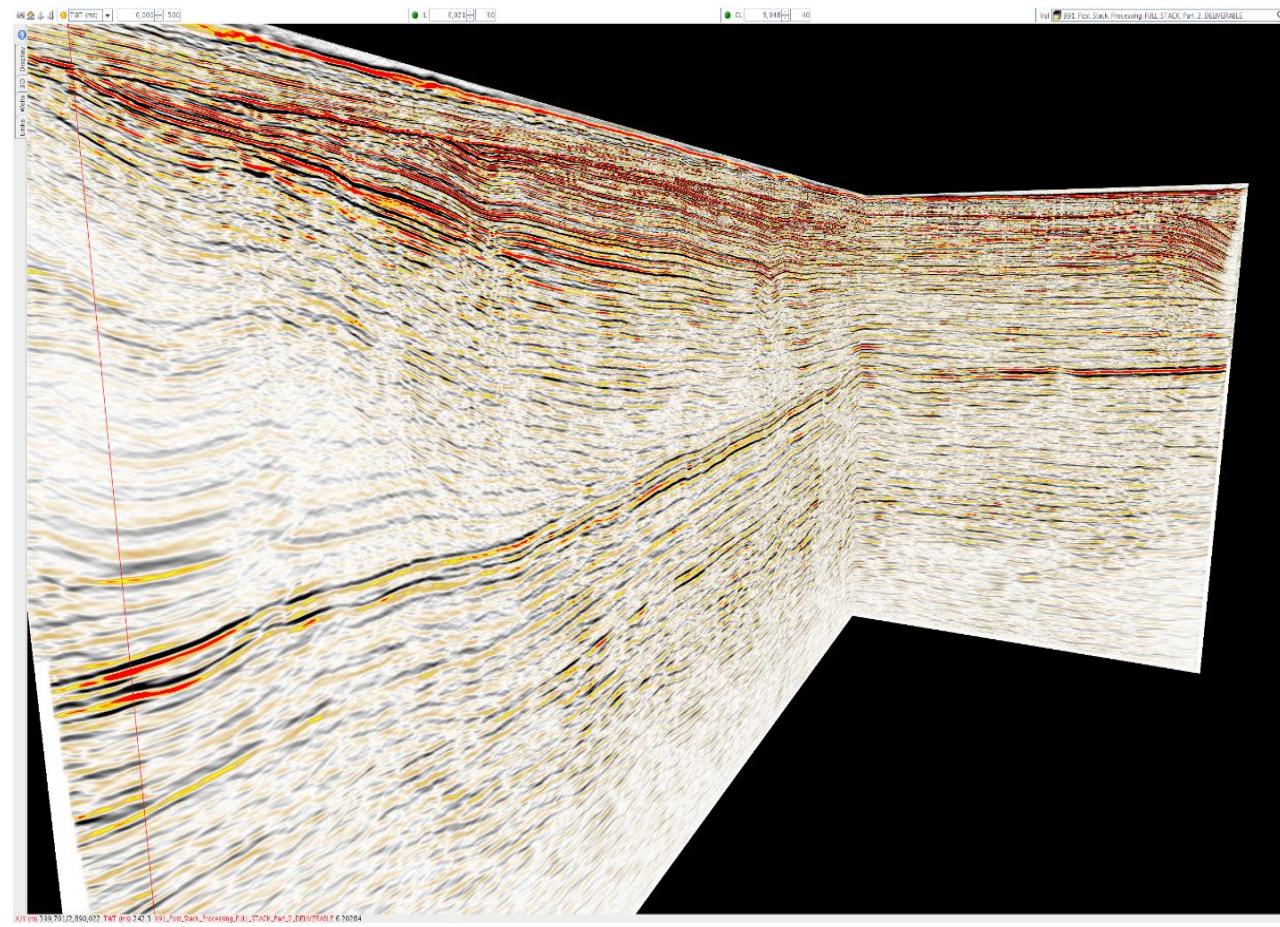
Onboard Processing

Highlights :

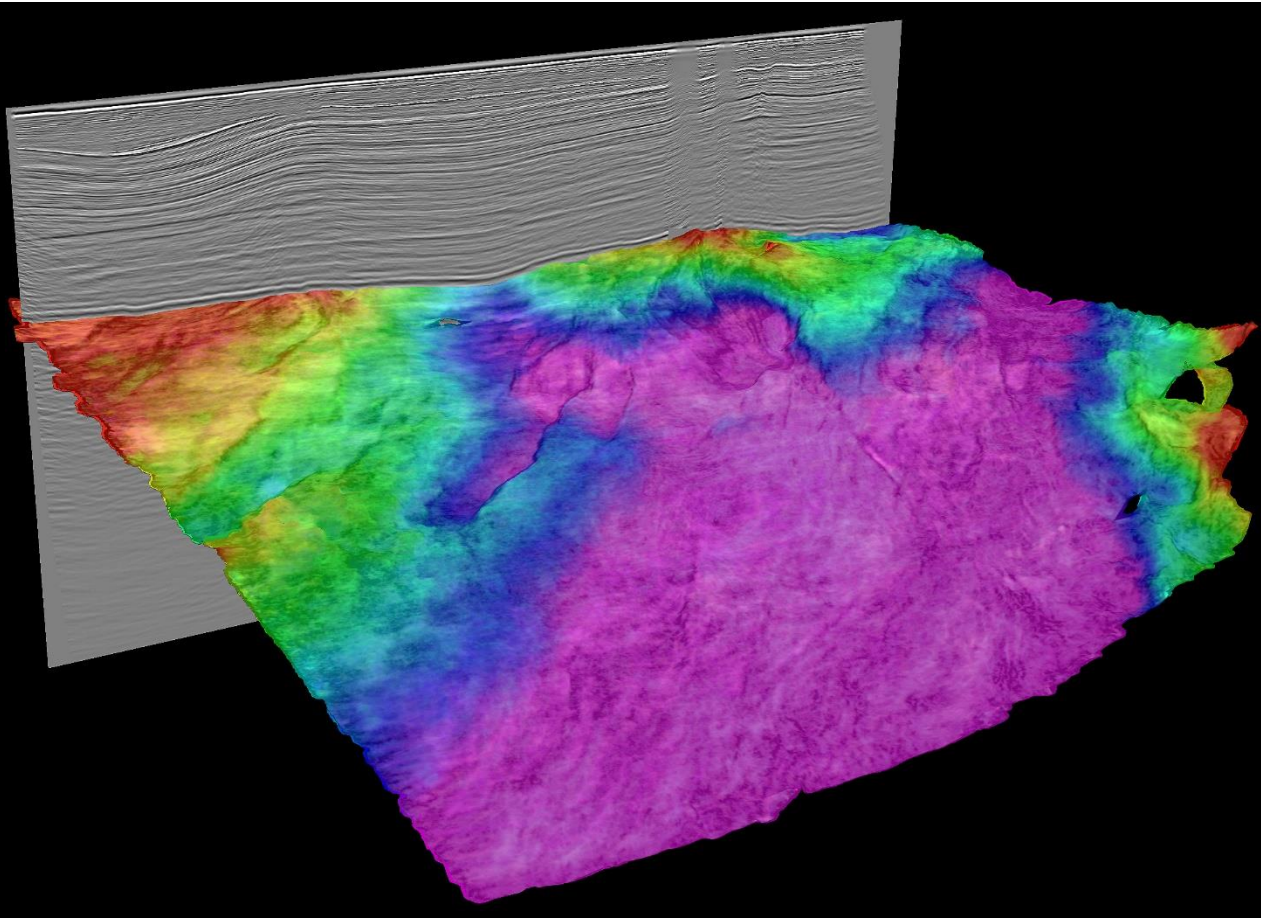
- Challenging but successful attenuation of ship noise
- High quality image because of blended acquisition and high trace density
- Deterministic source and receiver deghosting for broadband dataset
- High-quality demultiple using a suite of workflows
- Offshore 3D pre-stack anisotropic time migration
- DUG hardware and software performed extremely well
- Good coordination with DUG London, RAK Gas and interpreters
- Satellite exchange of data through the cloud with the onshore partners



Onboard Processing – Final Volume



Conclusion and What's Next



Lyme Bay Consulting's Detailed Reconnaissance Study (DRS)

A high-quality dataset was delivered that images the very complex geological setting

No incidents harming people or the environment.

Maximized coverage around the installations and in the shallow water zone.

Project completed within the allocated time frame and budget.

Onboard processing delivered for the 2018 license round (now being viewed in RAK Gas data rooms).

Towed streamer successfully used where ocean bottom seismic is a popular choice.

Full onshore PreSTM will be delivered in July 2018 from our processing partners DownUnder GeoSolutions, London UK.

Acknowledgments

A wide-angle photograph of a sunset over a calm body of water. The sun is low on the horizon, casting a warm, golden glow across the sky and reflecting on the water's surface. In the background, a range of dark, silhouetted mountains stretches across the horizon. On the right side of the water, a small, dark boat is visible in the distance. The overall atmosphere is serene and peaceful.

I would like to thank RAK Gas, RAK Ports and the crews of the Polarcus Alima, Maria G, Zarkher Fugro, Miclyn Orion, Horizon Surveyor and Horizon Echo for their hard work and diligence throughout this project.

Photographs were taken by the crew of the Polarcus Alima.

