



XOCEAN

Ocean data, **delivered.**

Enabling USVs to use the same
equipment as a traditional
survey vessel

Duncan Mallace - XOCEAN



Highly differentiated value proposition

XOCEAN

TRADITIONAL METHOD

- > **Safety:** Large crew offshore
- > **Emissions:** Significant emissions
- > **Business Model:** High day rates

Hornsea: World's largest offshore wind farm supplying 2.5M homes

Ørsted

XOCEAN SOLUTION: USV

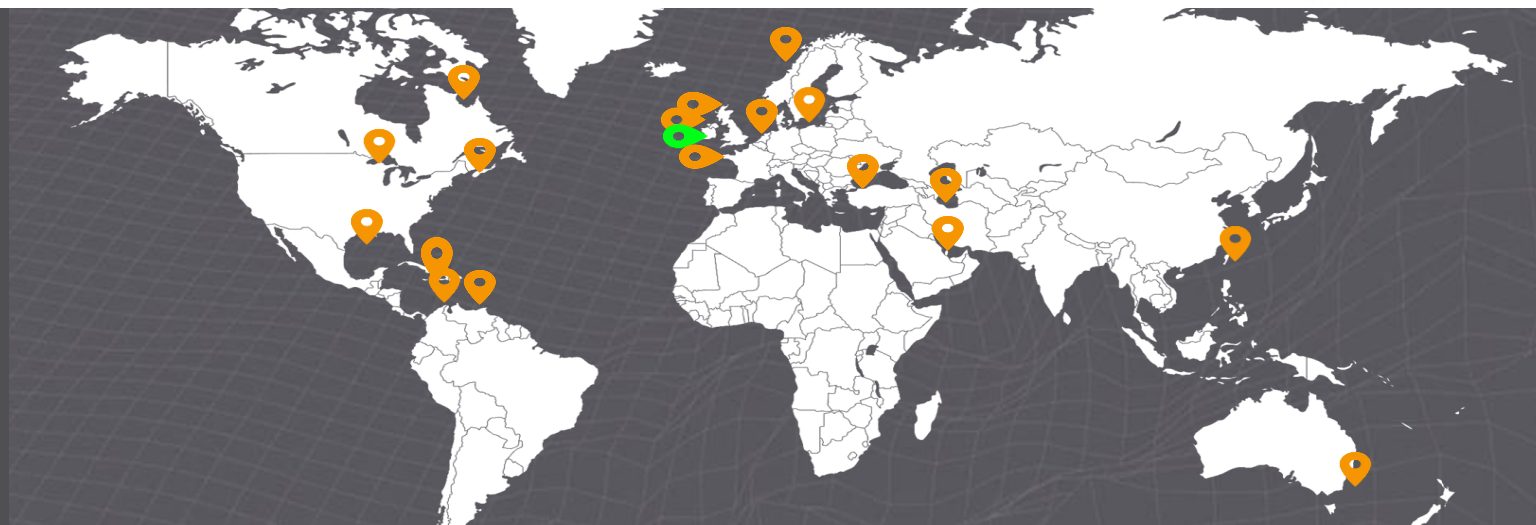
- > **Safety:** No personnel offshore
- > **Emissions:** 1,000x lower
- > **Business Model:** Data as a Service

World class customers, with offices and deployments across 21 markets

XOCEAN

Over **800 missions** across **21 jurisdictions** internationally.

International offices in Ireland, US, Canada, UK, Norway and Australia.

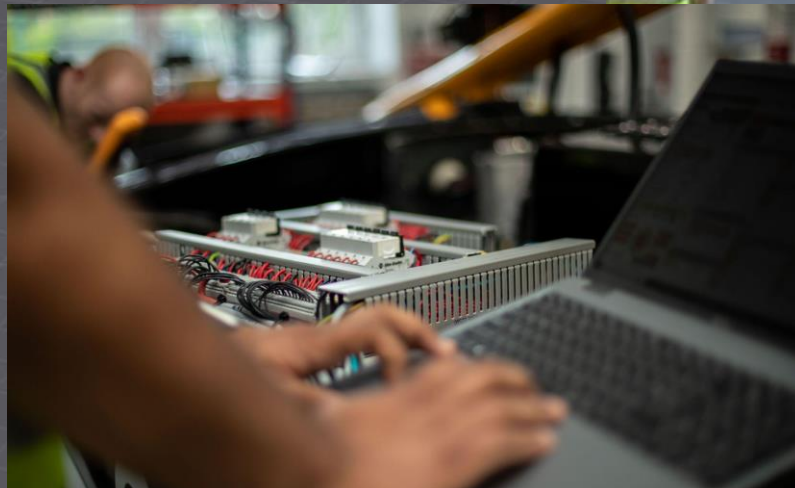


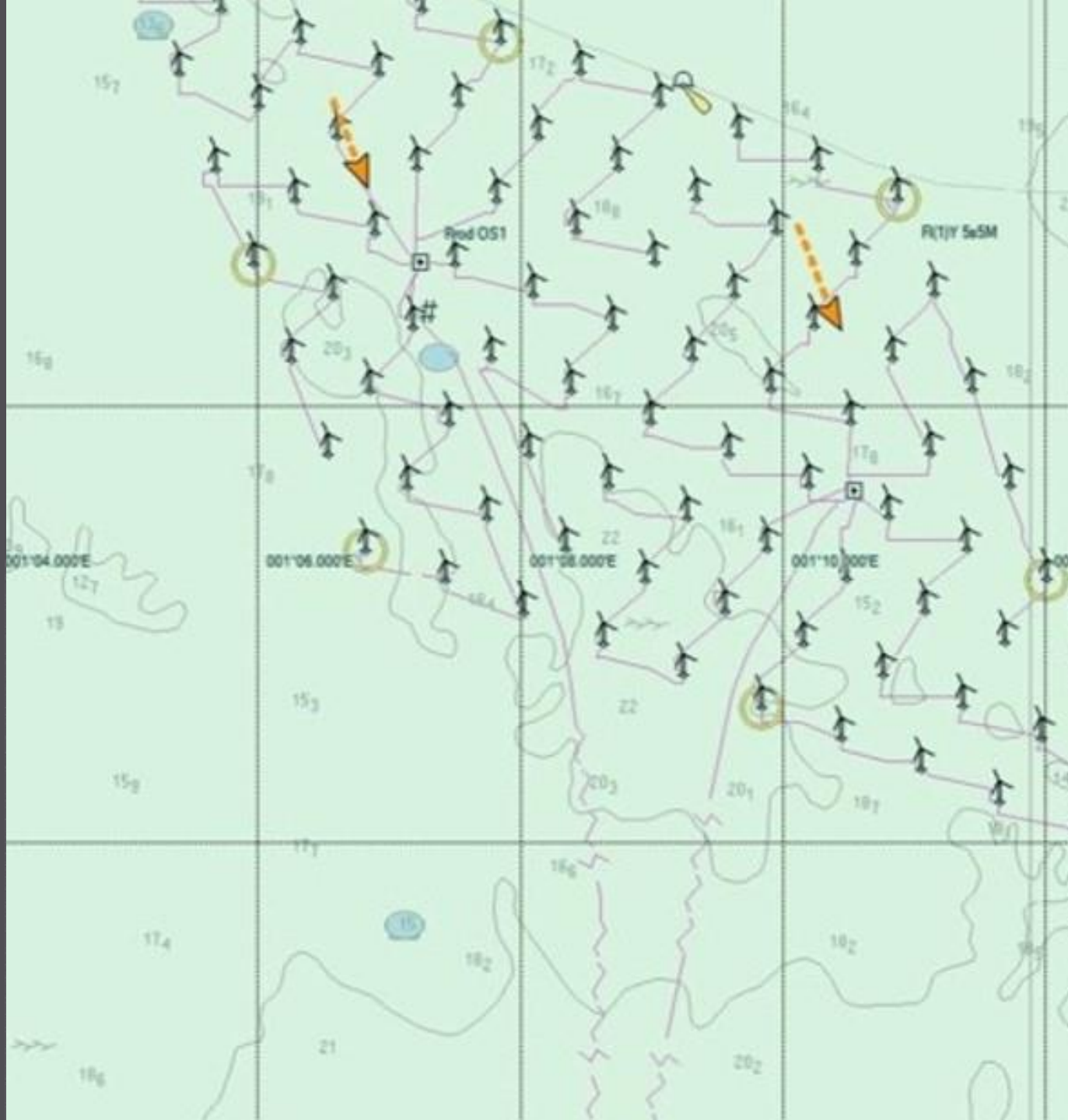
Fisheries and Oceans
Canada
Pêches et Océans
Canada

We operate the **largest fleet** of **survey class USVs**

XOCEAN

- > **FLEET:** XOCEAN operates the world's largest fleet of survey class USVs; X-30 in production
- > **PROVEN:** Over 100,000 hours of system operation from Arctic to equatorial regions.





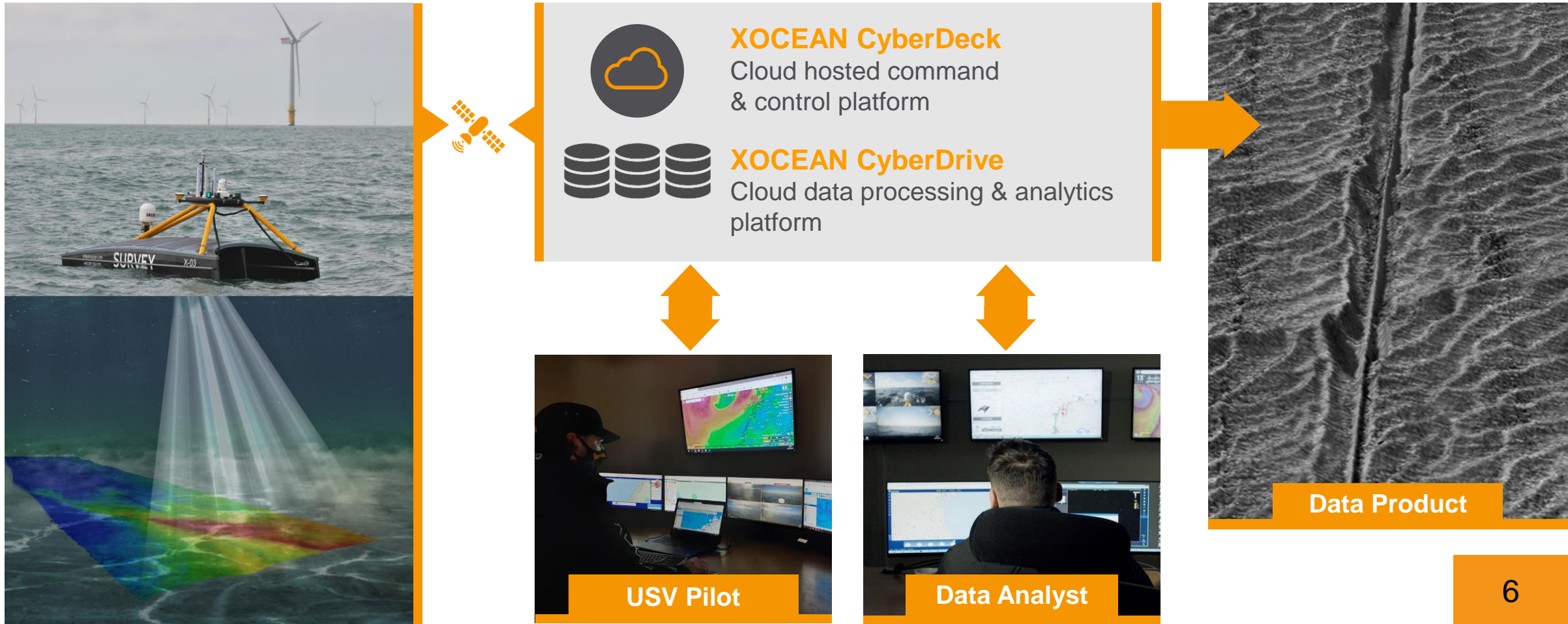
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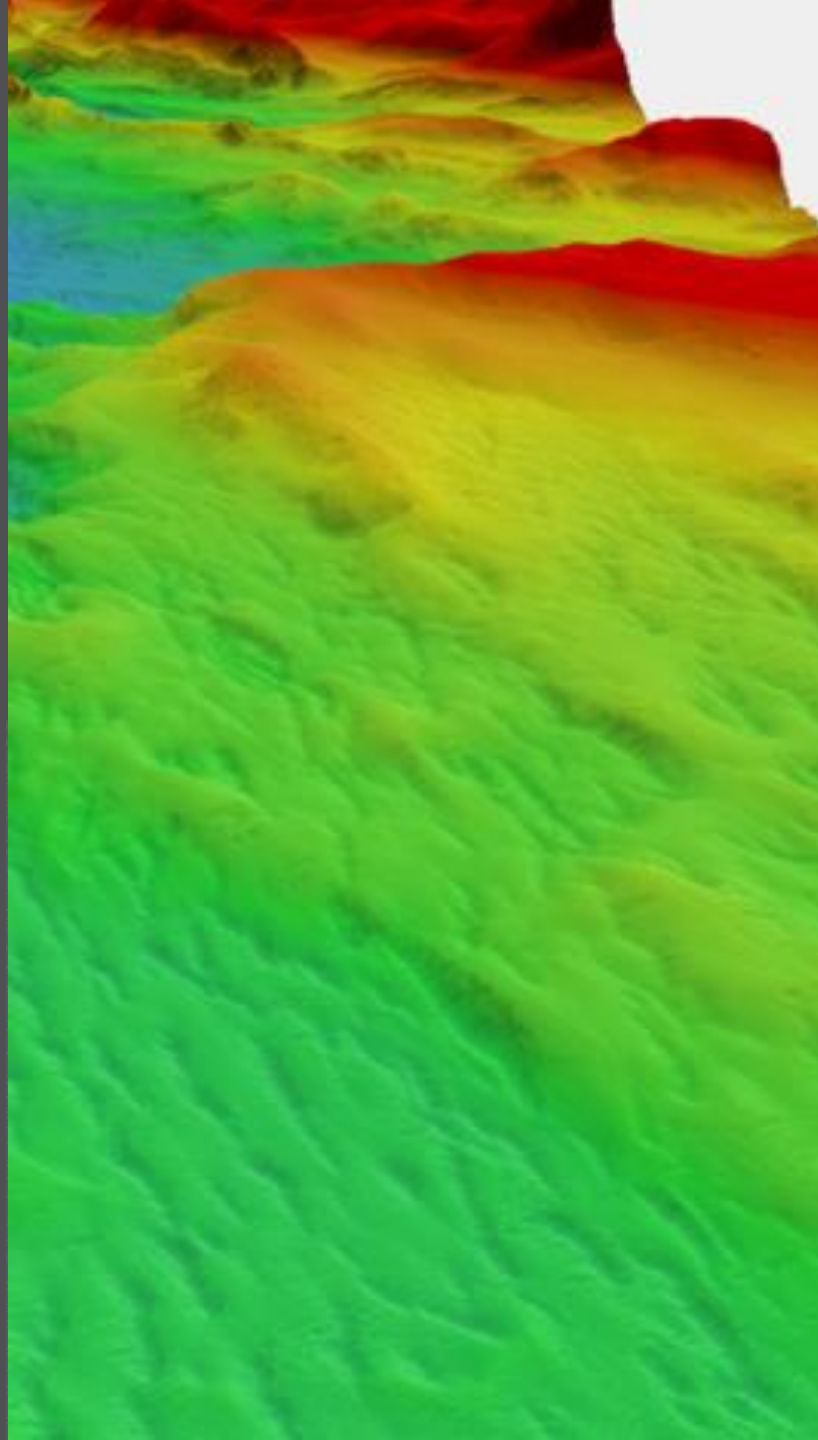
TECHNOLOGY DEVELOPMENT

Vertically integrated **acquisition** and **data analytics** platform

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WORKFLOW





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Multibeam

Bathymetry, Backscatter, Water
Column

Multibeam Echosounder

Nautical Charting: Large area surveys, different workflows required.

Asset Inspection: Offshore Wind (monopile & cable) & O&G (pipeline) inspection. Very high resolution.

Landfall: Drone Flights with Photogrammetric terrain mapping for seamless landfall data set

- Pitch stabilised MBES required for backscatter.
- Survey software runs autopilot



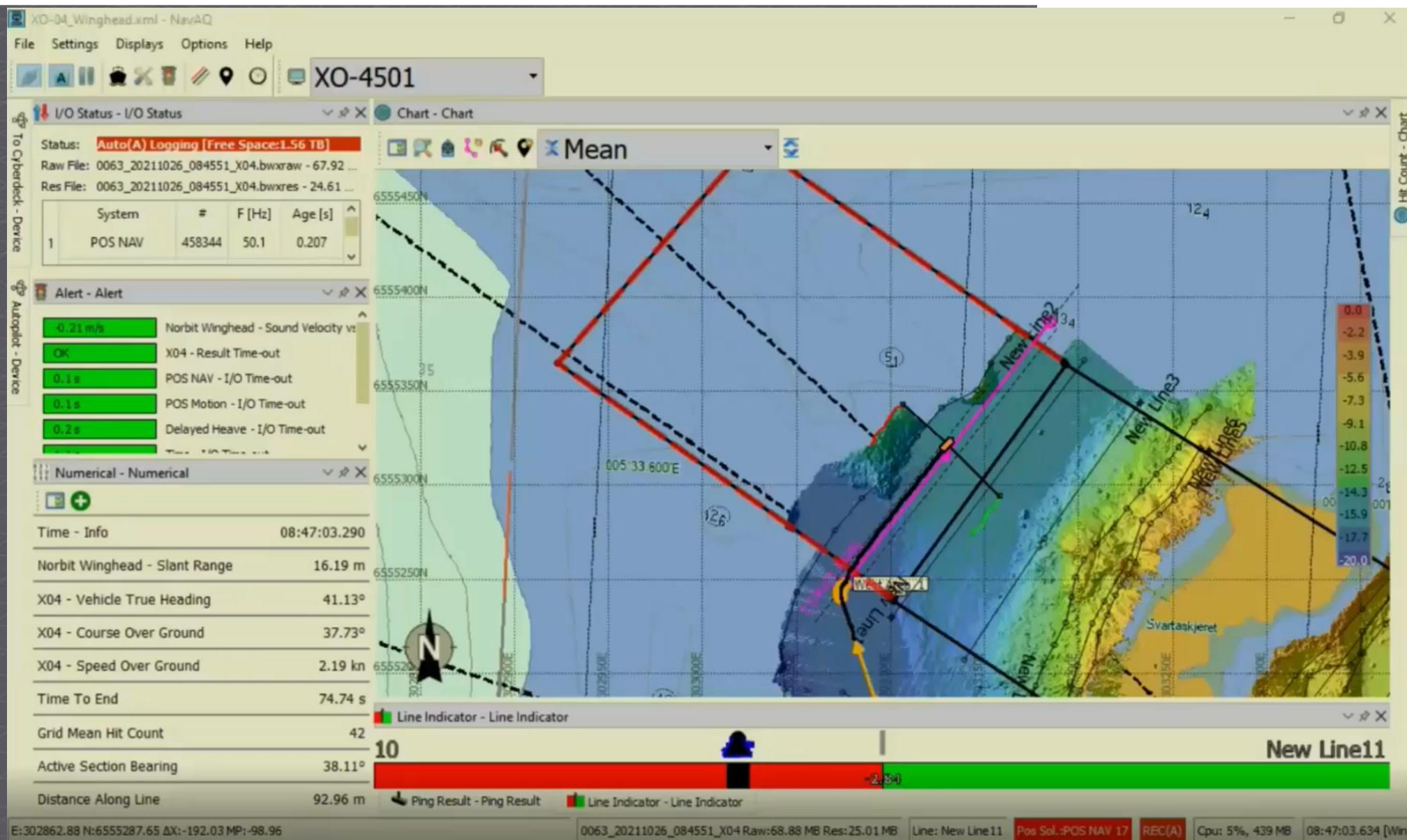
Multibeam Echosounder

MBES Installed

- Norbit iWMBS
- R2Sonic 2024
- Dual R2Sonic 2024
- Kongsberg EM2040P
- Norbit Winghead

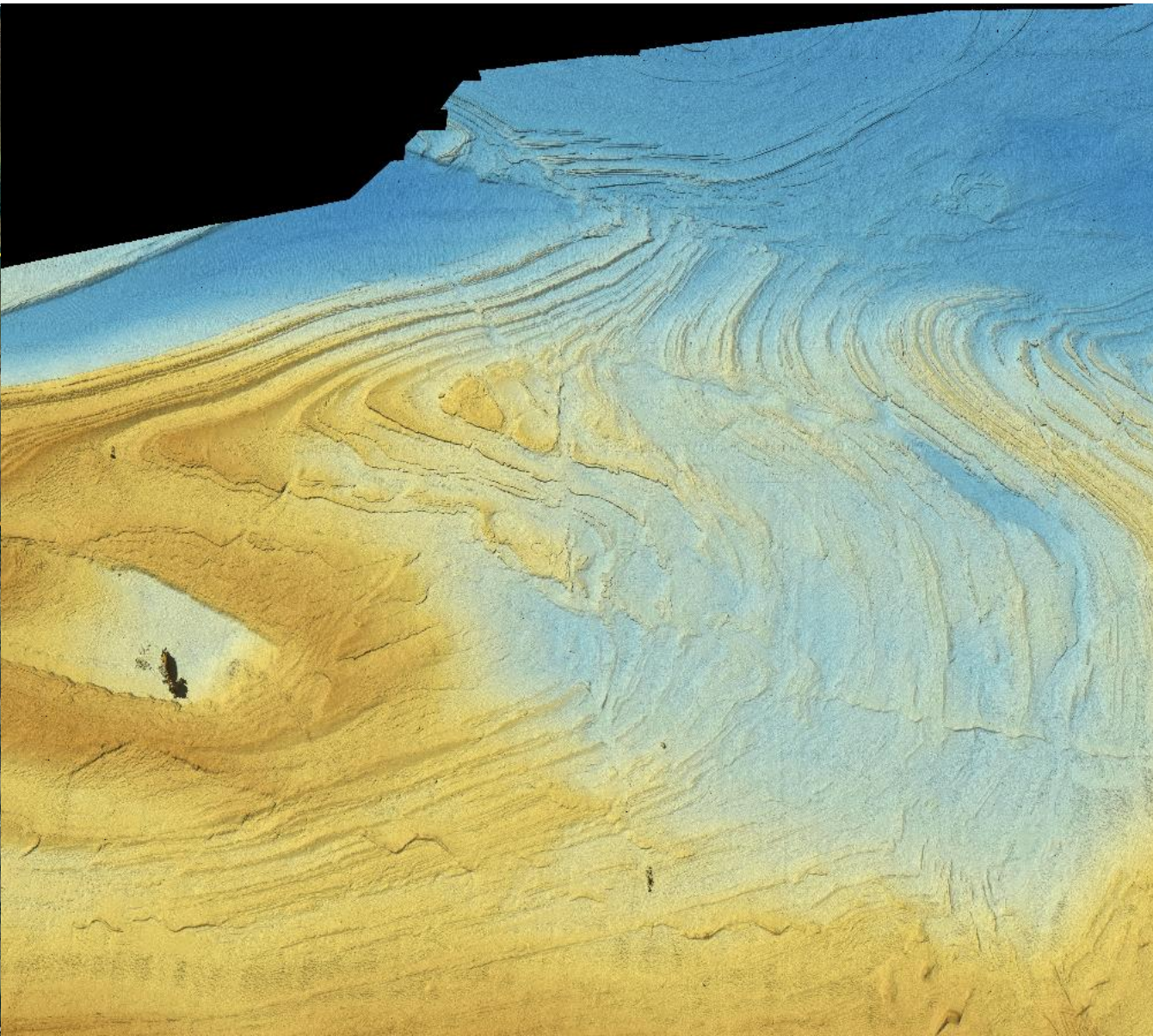
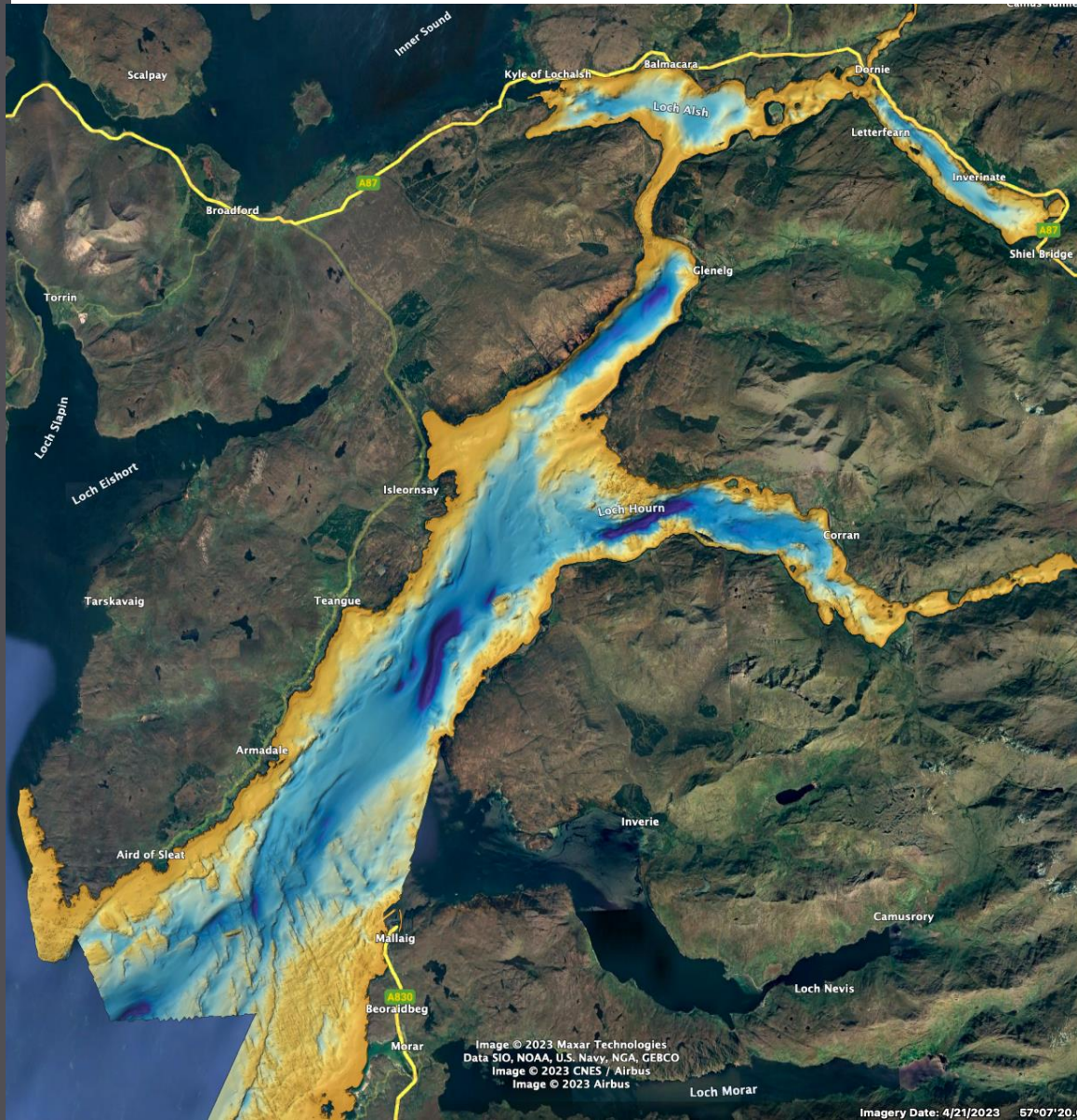


Automating Acquisition

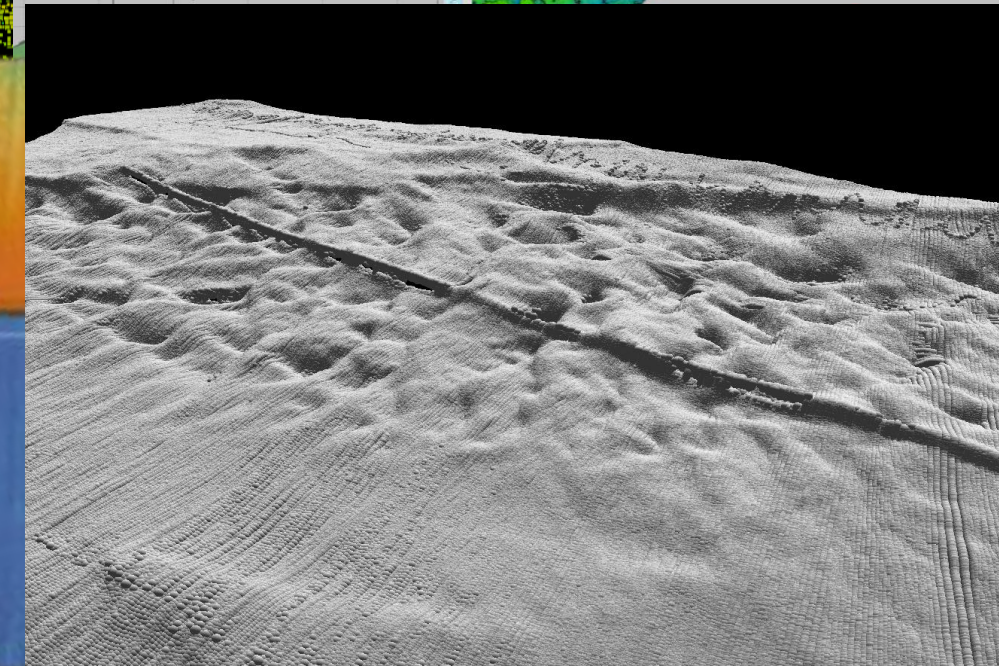
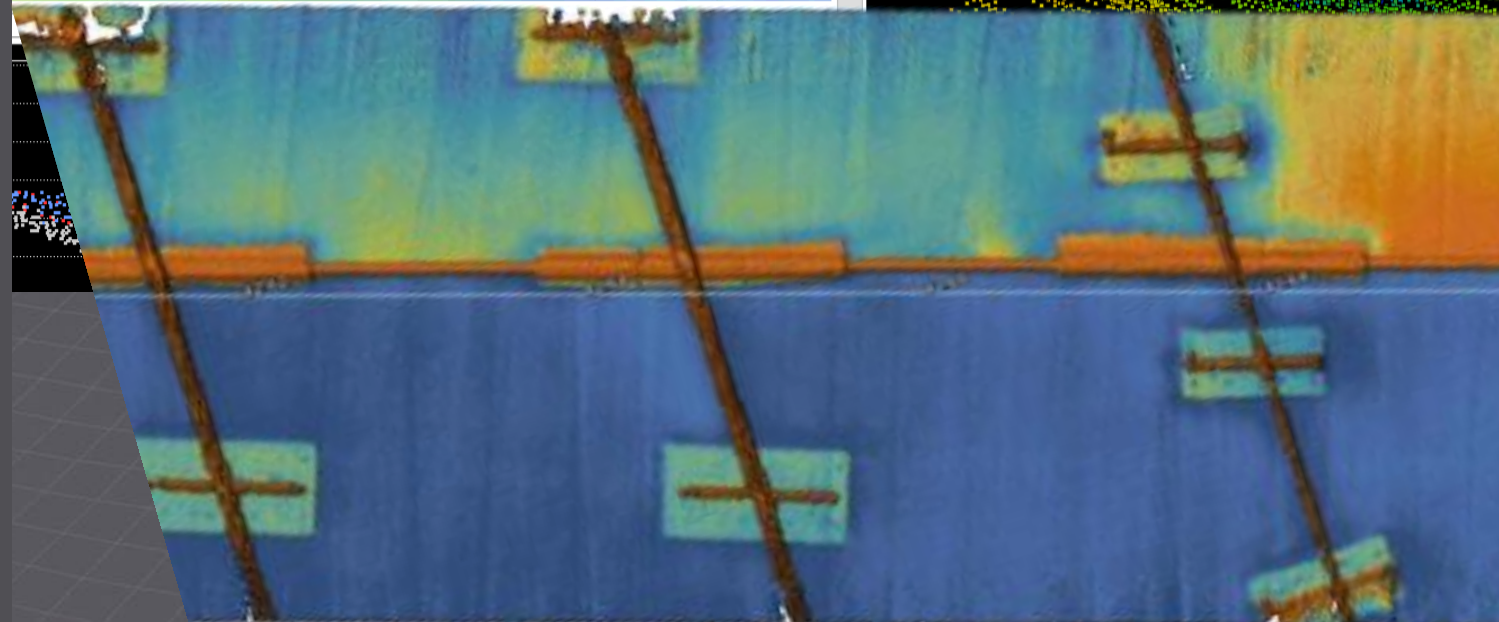
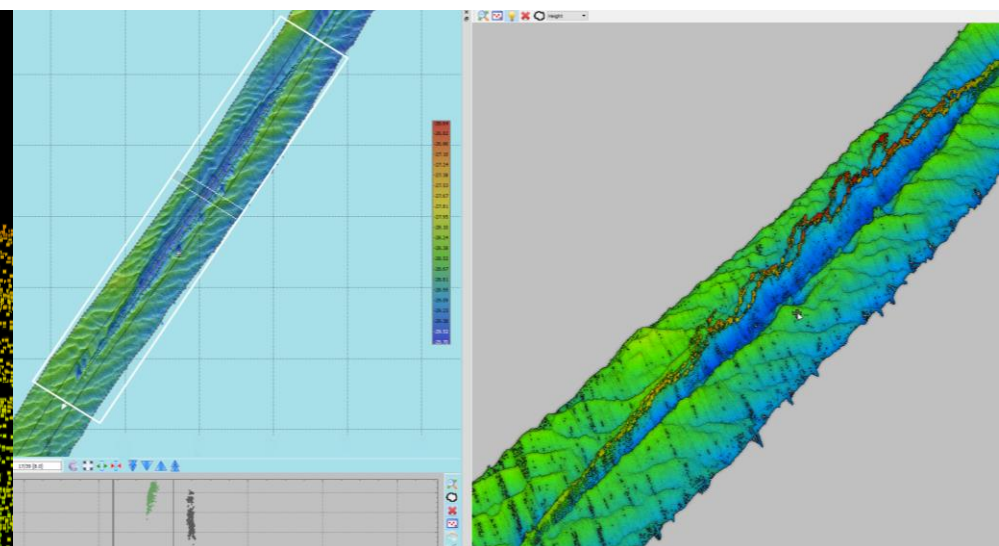
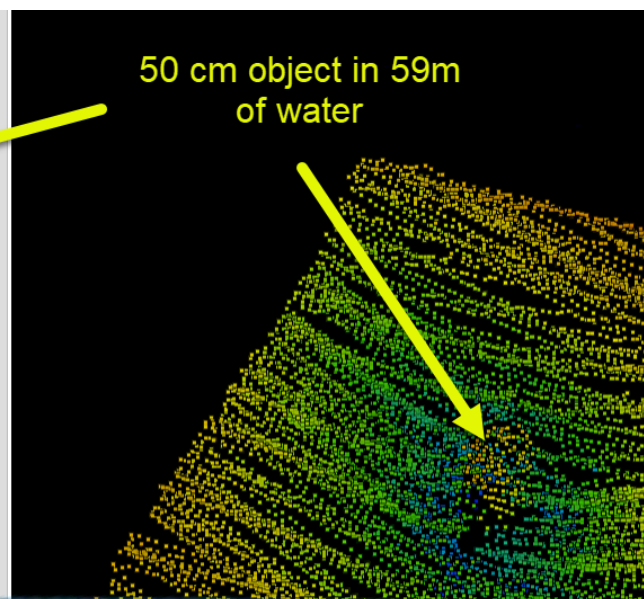
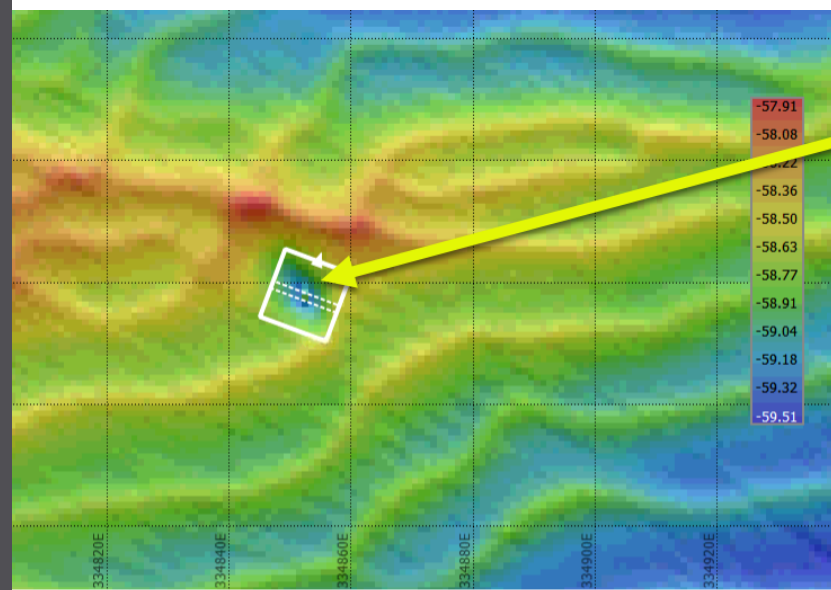




Multibeam Project results



Multibeam Project results





Fisheries

Water Column



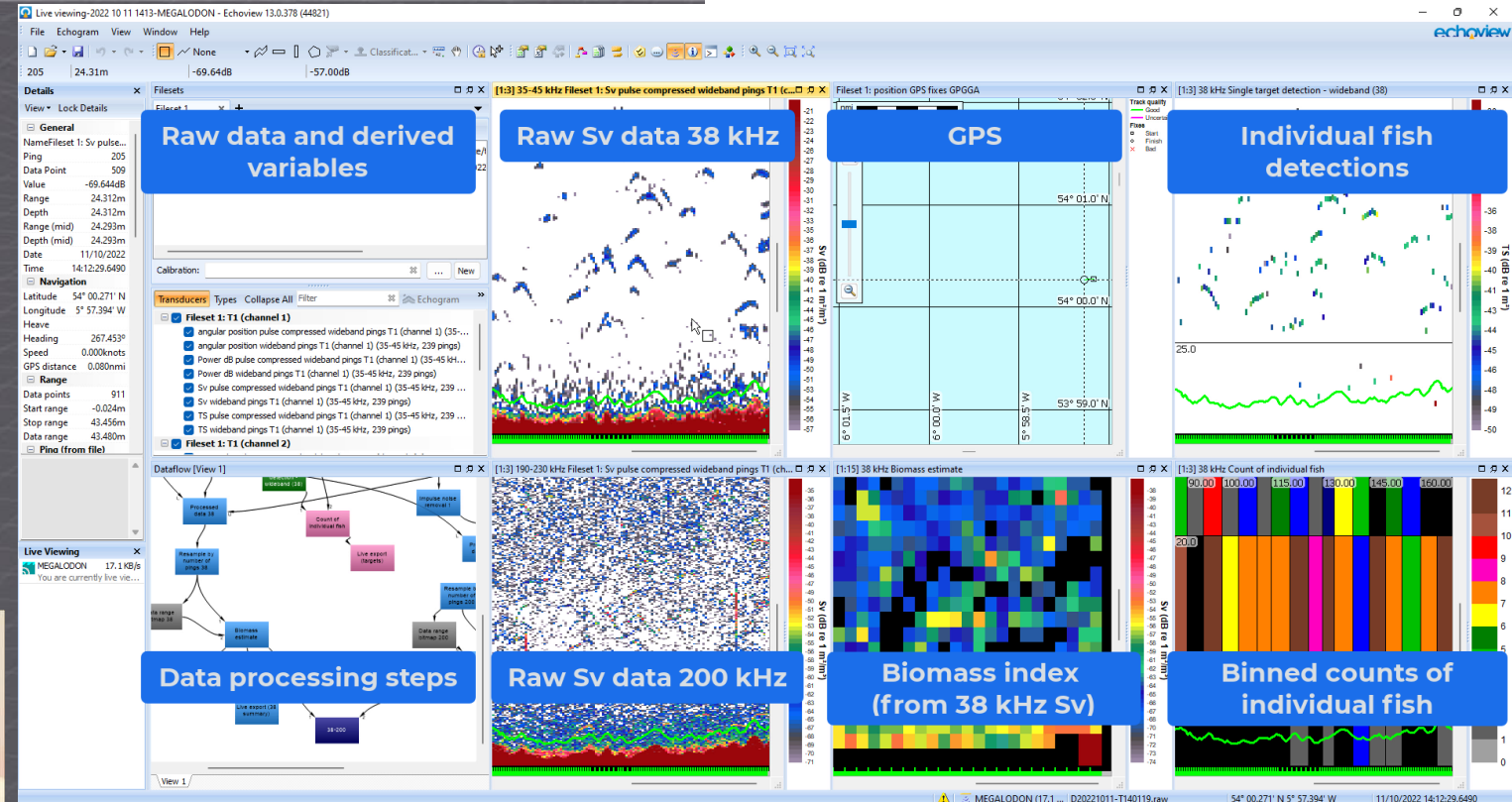
Fisheries Echosounder

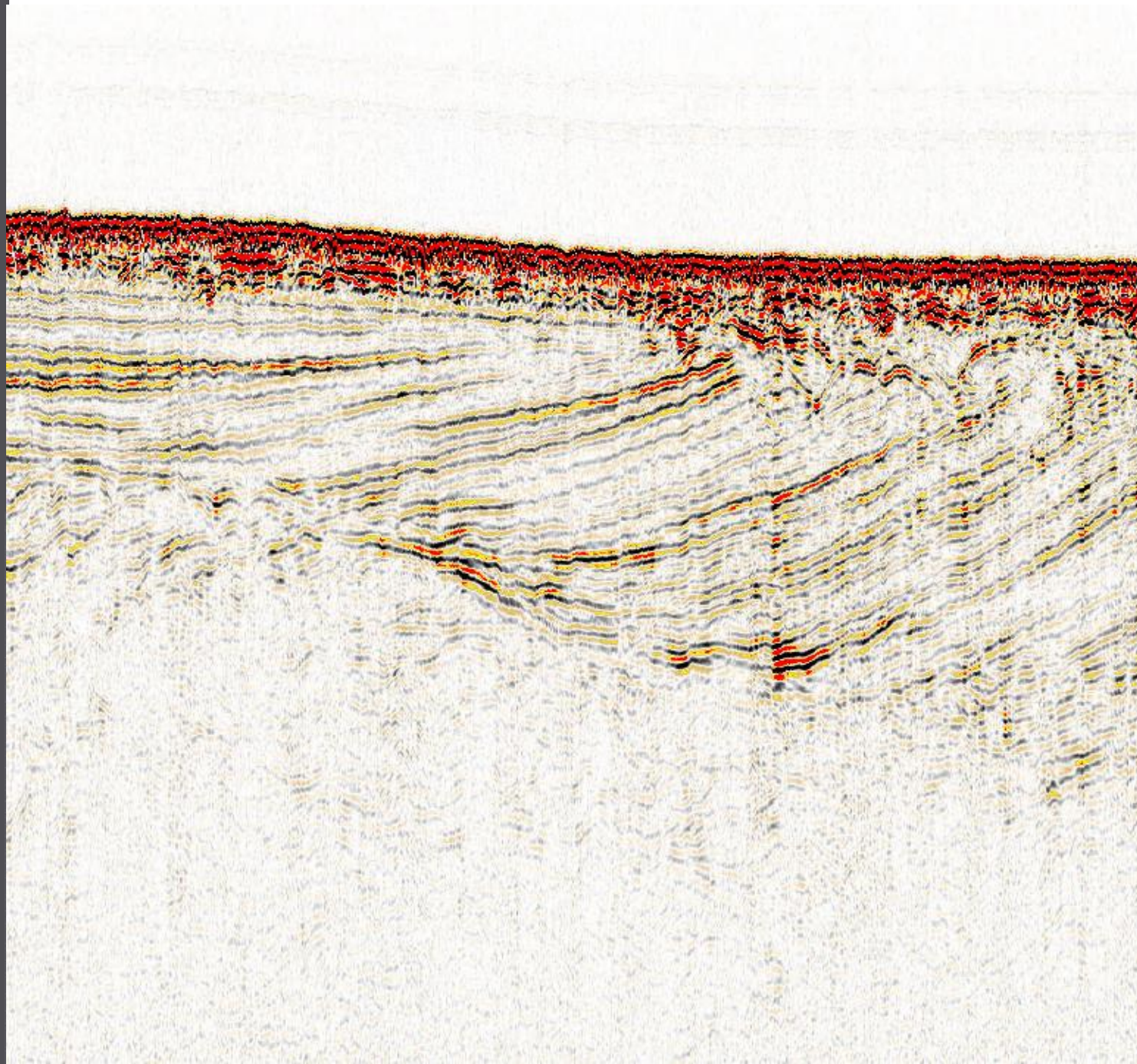
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Stock Assessment Surveys:

Large area surveys.

- USV “sees” 15% more fish than a large research vessel due to dispersal as vessel approaches
- USV also detects more fish due to them swimming closer to the surface to feed on plankton





Sub-bottom Profiler

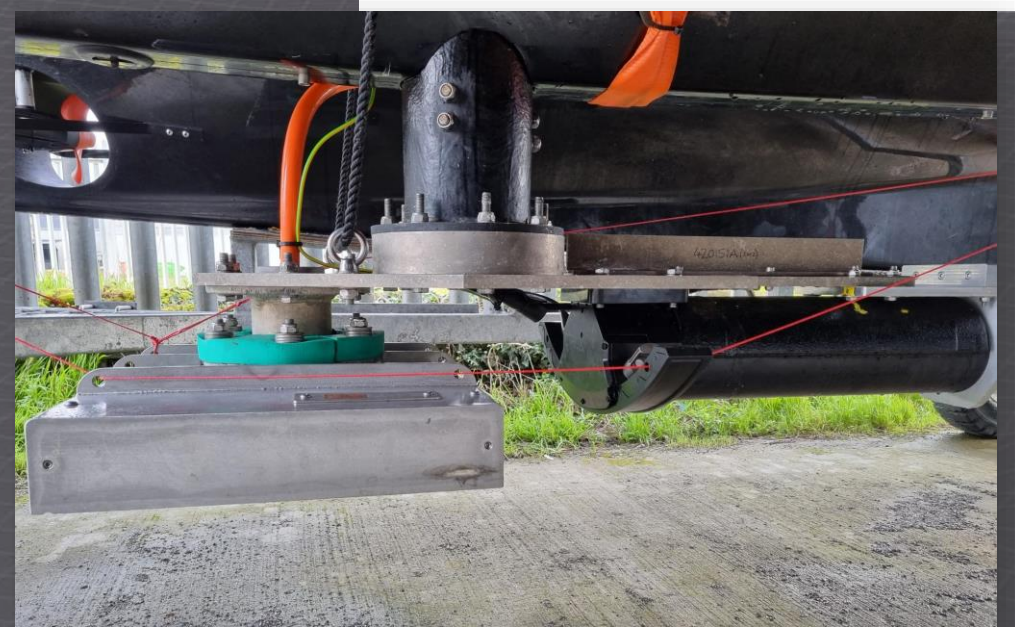
Sub-Bottom Profiler

Cable/Pipeline Depth of Burial: Started with Innomar Smart and Standard. Inter-array cables and pipelines.

Route Surveys: Sub-seabed investigation to de-risk cable trenching.

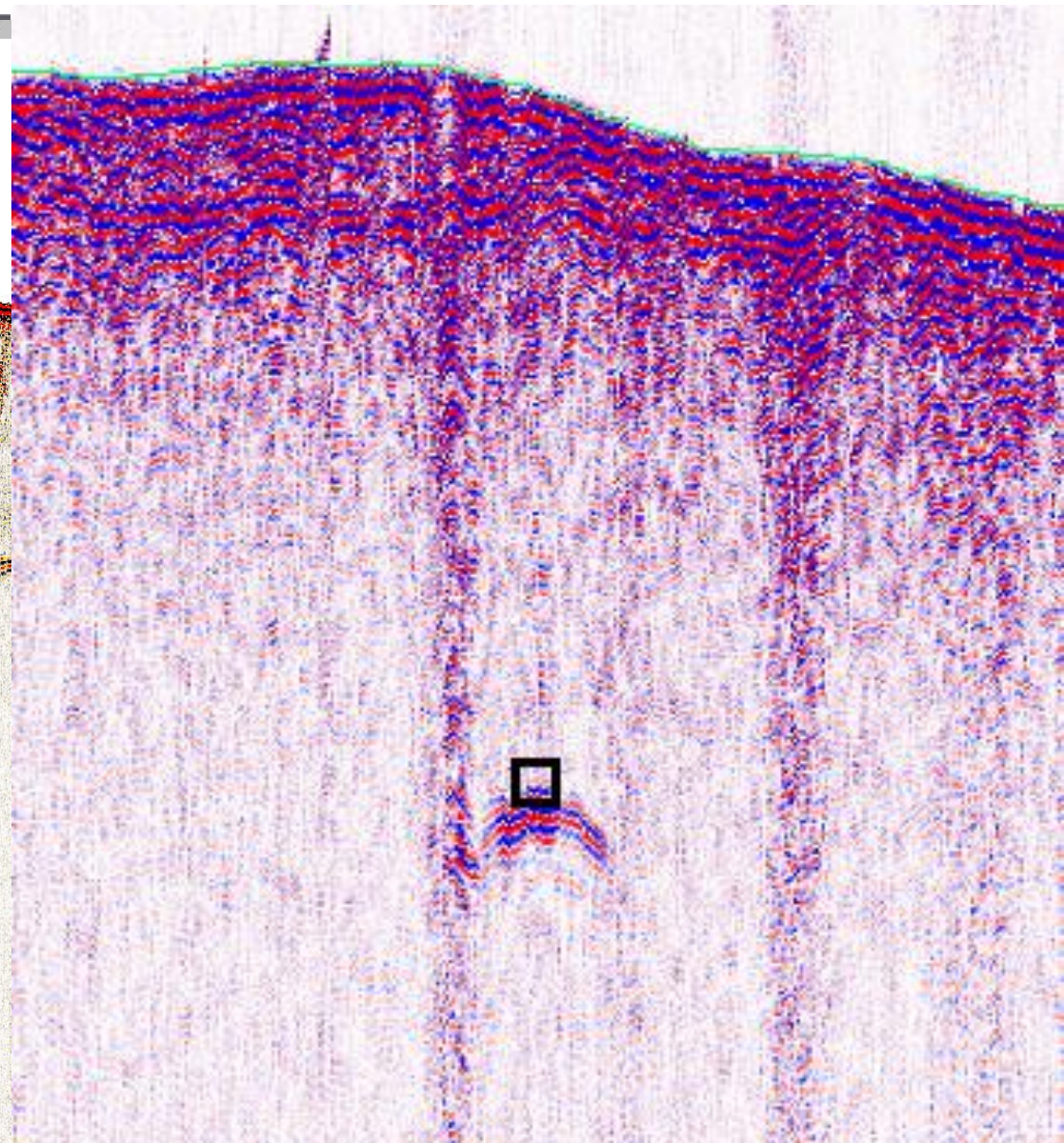
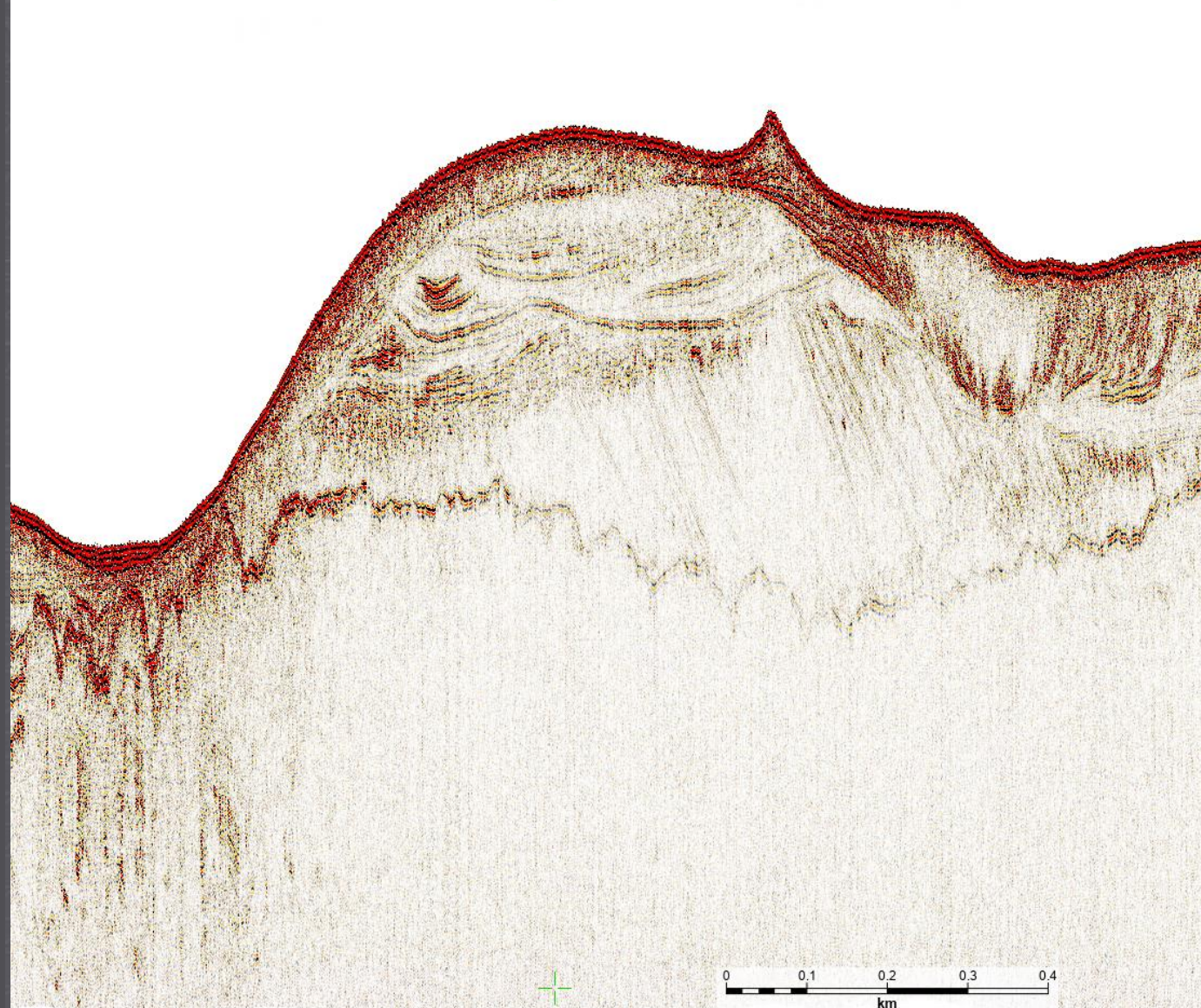
Site Surveys & CCS: Innomar Medium-usv for better penetration and high resolution in the upper 20m of the seabed.

- Sync SBP from MBES
- Need to select destructive interference freq in MBES

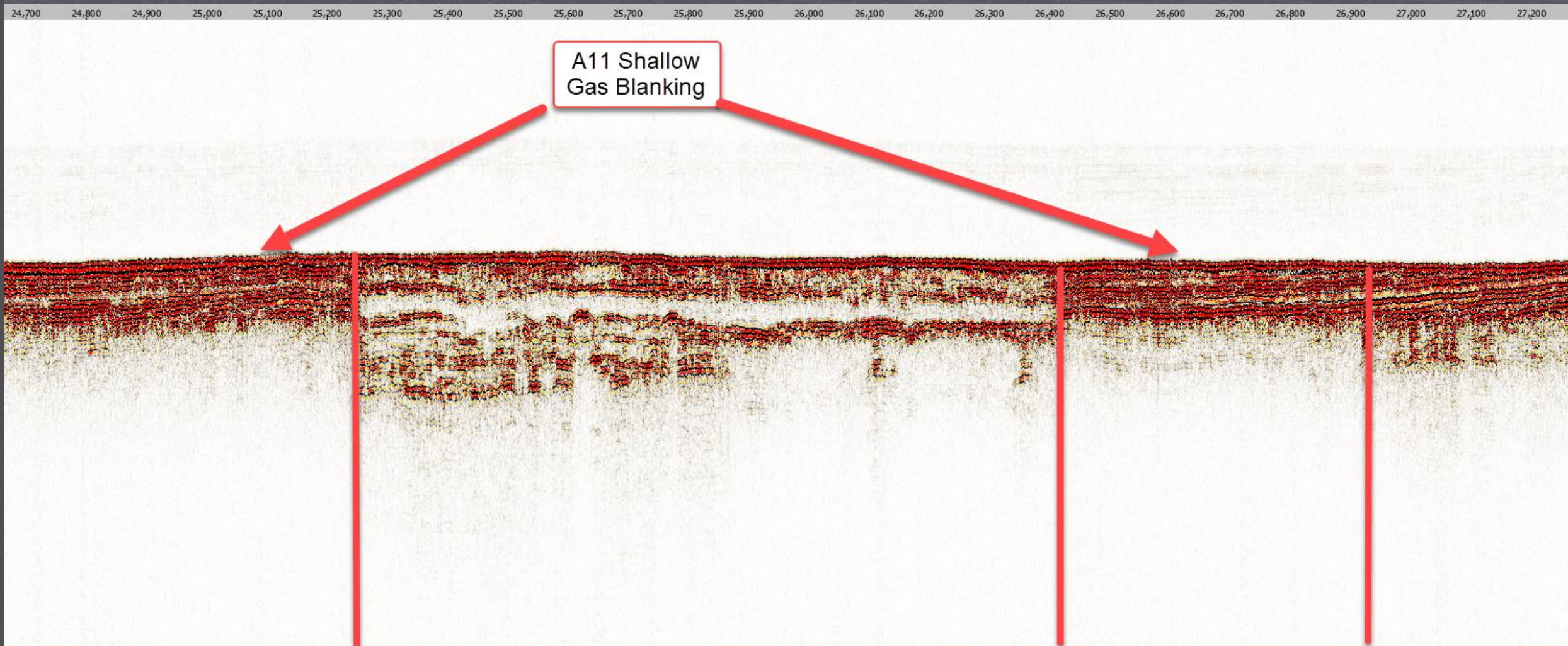


SBP Project results

000 1,500 2,000 2,500 3,000 3,500 4,000 4,459 5,000 5,500 6,000 6,500 7,000 7,500 8,000 8,500



SBP Project results





Side Scan Sonar

Side Scan Sonar – 1.0

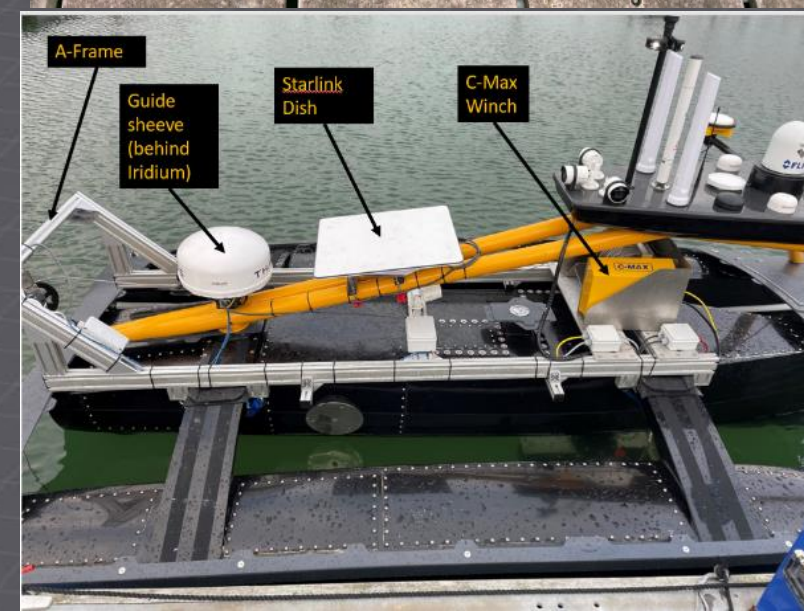
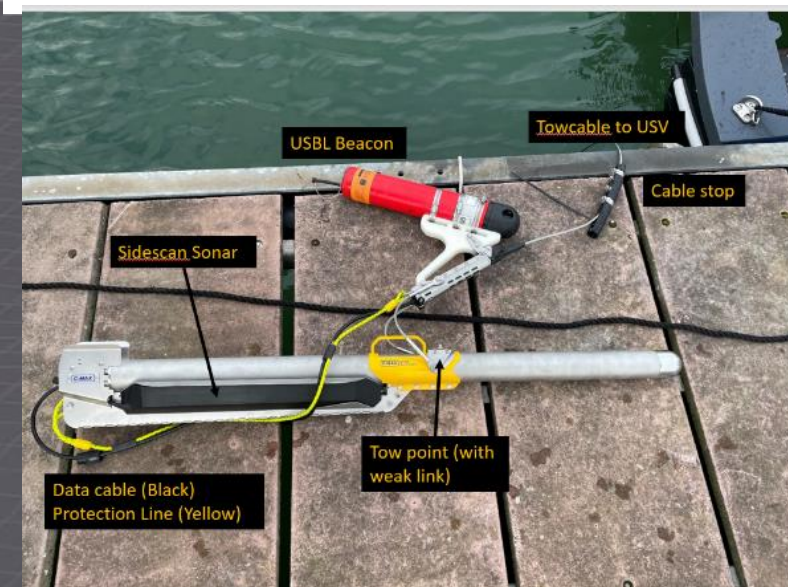
Side Scan Sonars:

- CMAX CM2 780 kHz

Boulder Detection: De-risks monopile offshore windfarm installation & cable trenching.

Archaeological: Regulatory approval and high-resolution mapping in deeper water.

UXO: In combination with magnetometer for pre-geotechnical surveys

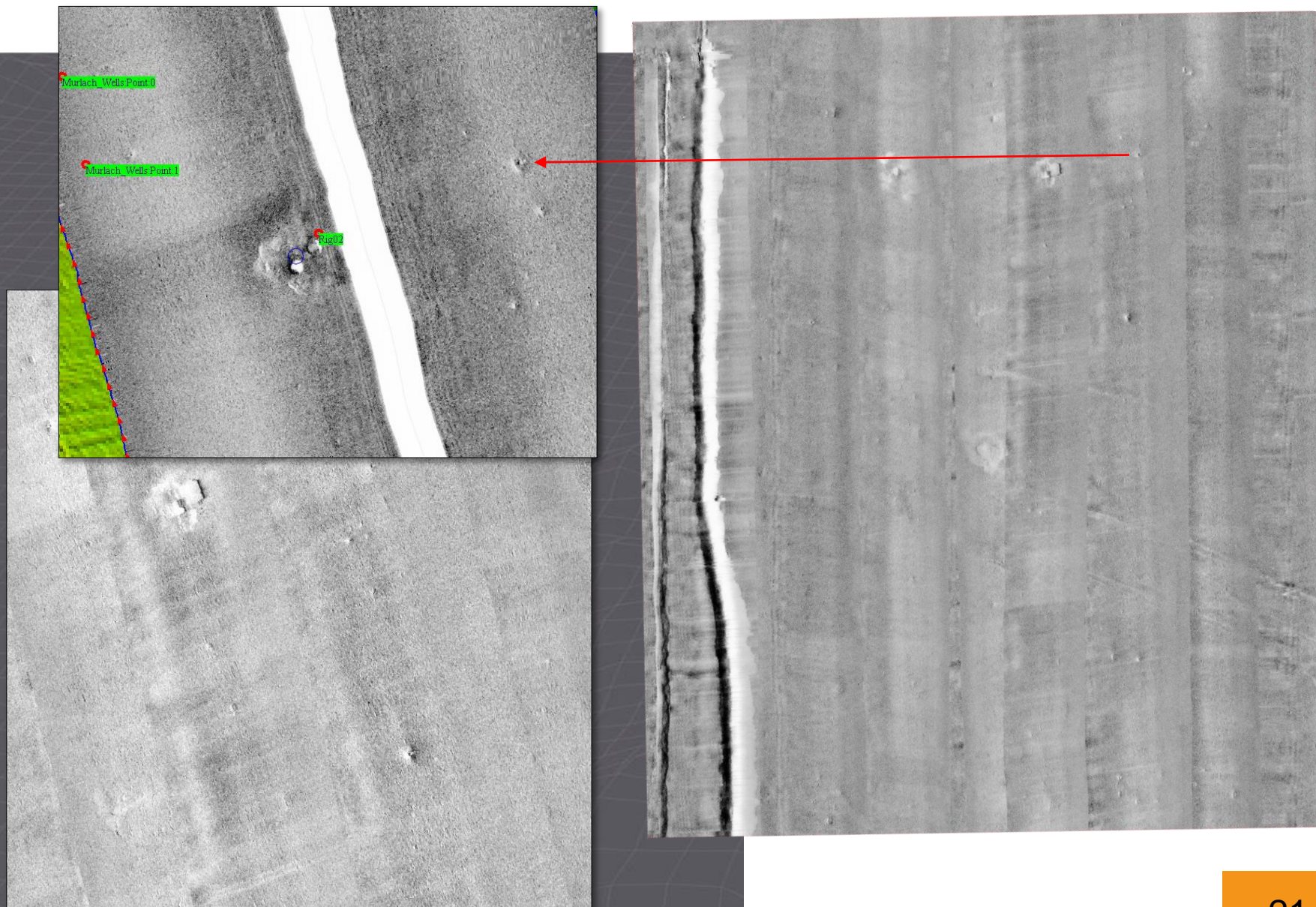


Side Scan Project results

High quality SSS data

Clear definition of small targets with no distortion. (zoomed image)

Overall mosaic accurately maps the pipelines, targets and seabed scars seen running from ESE-WNW.

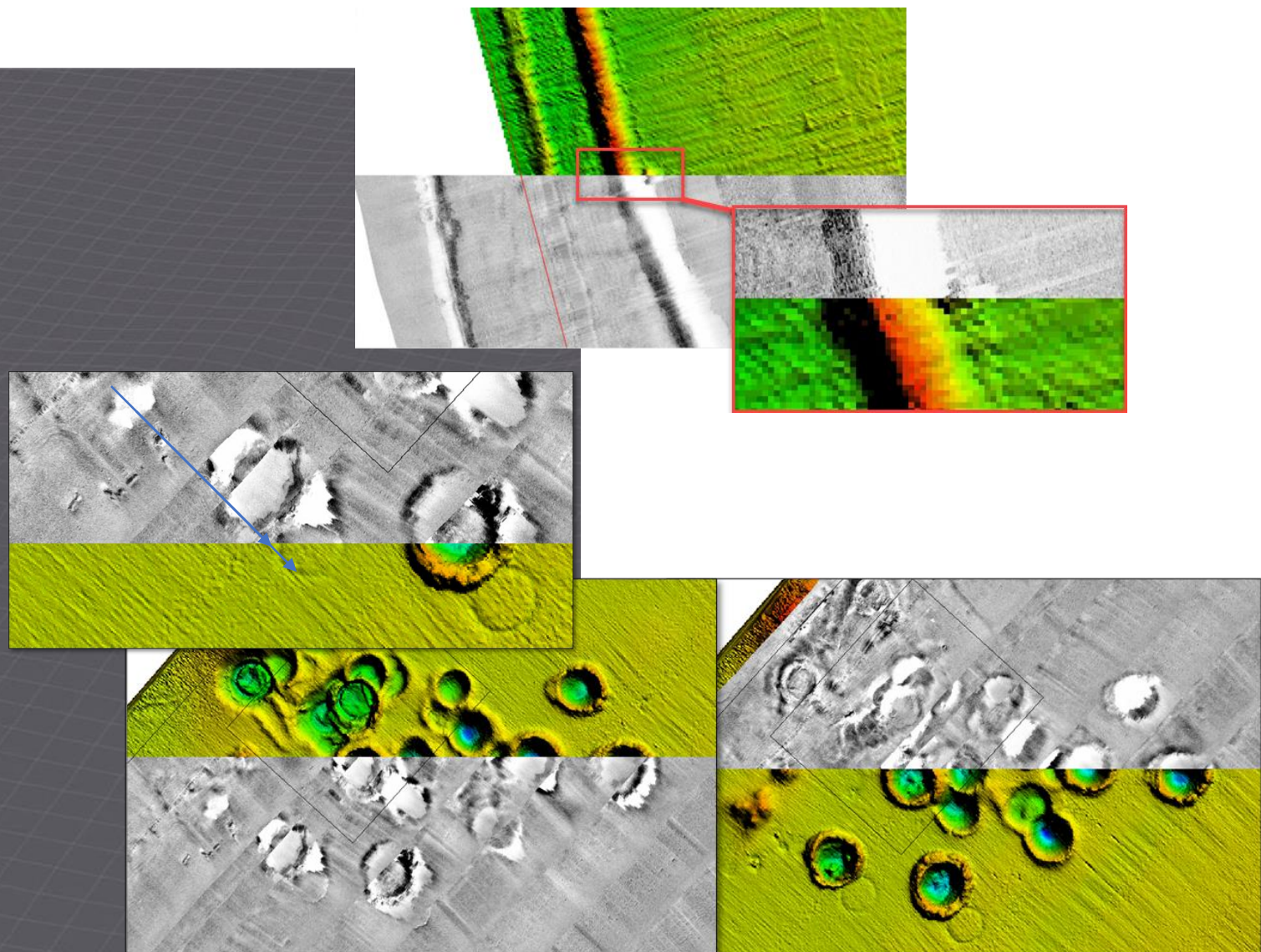


SSS Data Positioning

In-house scripts in order to accurately post-process the USBL data.

An interesting target adjacent to the pipeline matches well with the preliminary MBES dataset.

The datasets show excellent positioning between each sensor and each SSS file. This is shown by the image of a spud can depression imaged by the MBES and multiple SSS lines.



Side Scan Sonar – 2.0

Side Scan Sonars:

- Klein 4K SVY 300/600 kHz

Boulder Detection: De-risks monopile offshore windfarm installation & cable trenching.

Archaeological: Regulatory approval and high-resolution mapping in deeper water.

UXO: In combination with magnetometer for pre-geotechnical surveys





Automated Winch Control

Lidan Winch

ON External Winch Enable

ON Klein Sonar | Sonardyne

Winch Camera Viewer

Off

Manual

Auto

Stop

Home to Sensor

Off - No Motion

Edit values here....

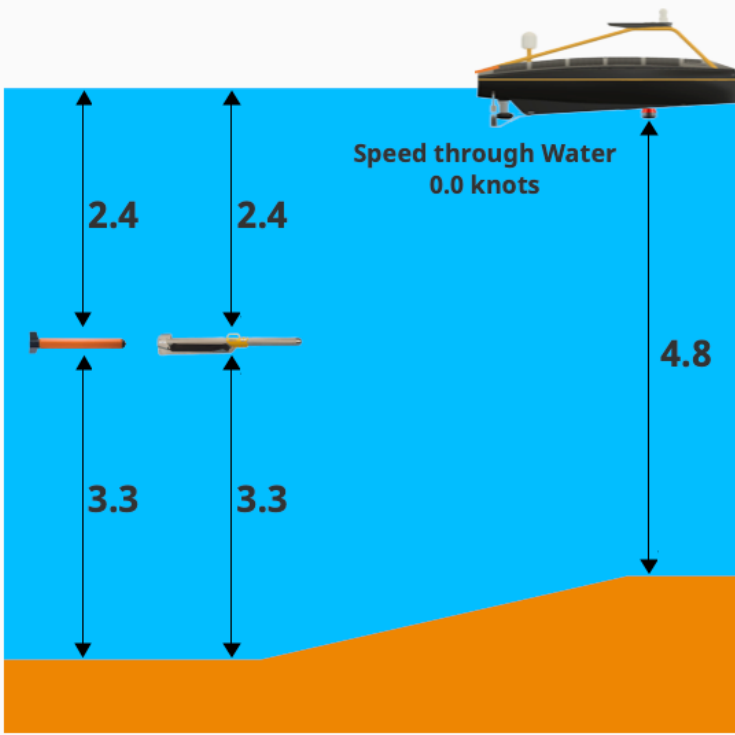
Setpoints	metres
Target Altitude	3
Target Altitude Tolerance	0.5
Delta Depth Threshold	1
Safety Depth	1.8
Winch Line Length	236

OFF Allow Line Disconnection

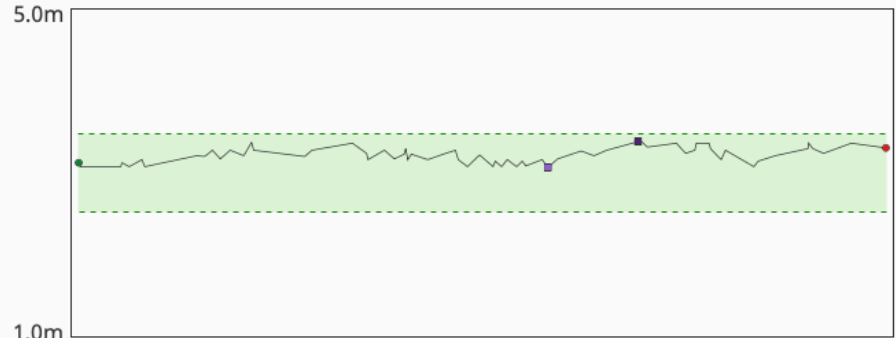
Line Out : -0.09 m
Winch Current : 1.0 A

Power Fuse Healthy

Lidan Winch Info



Side Scan Altitude (last 2mins) ☒ Tight

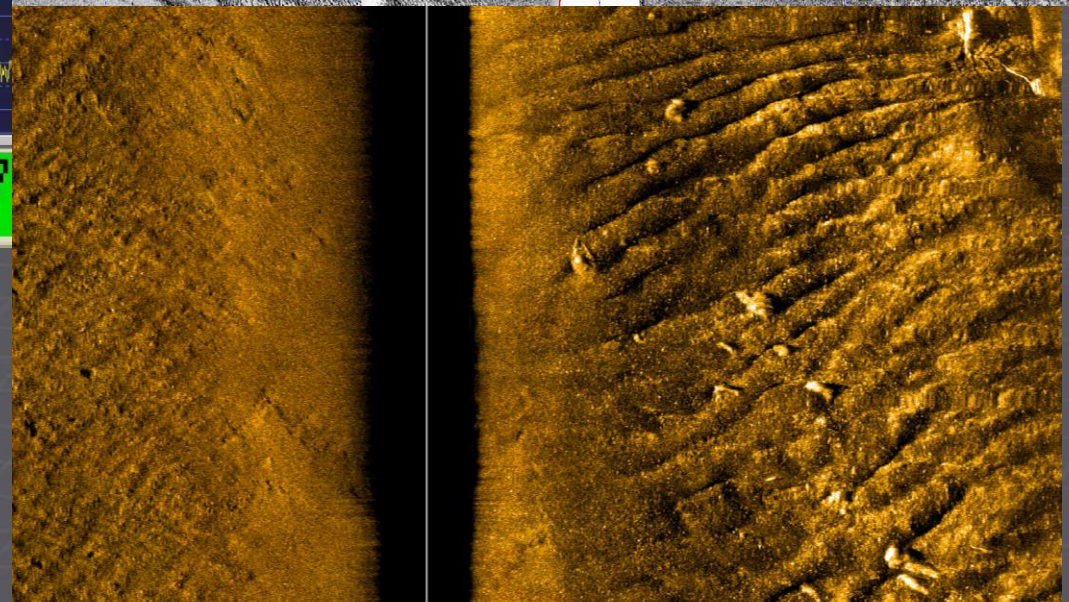
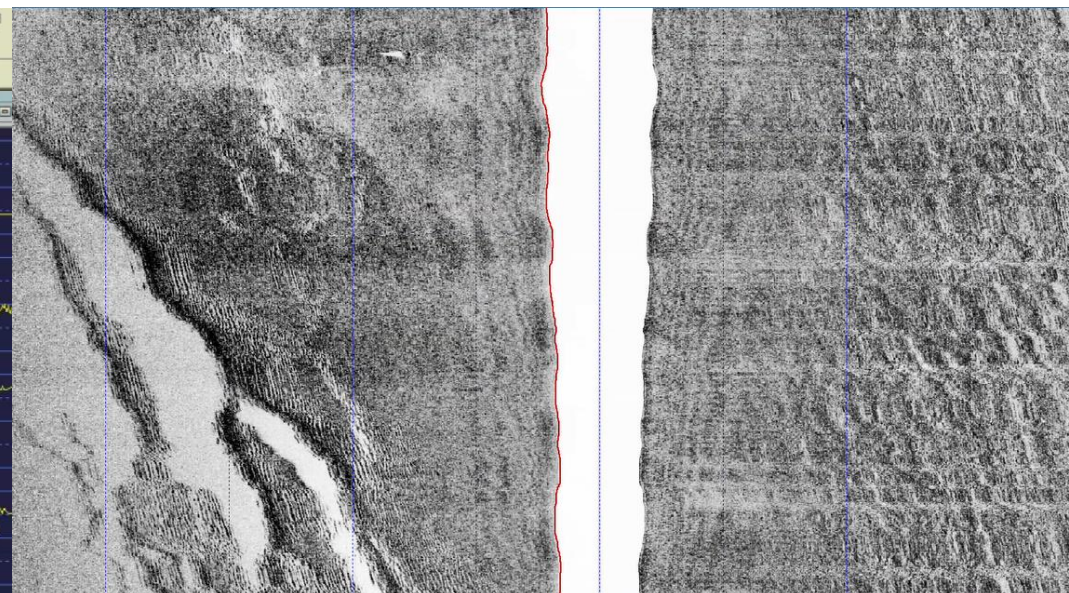
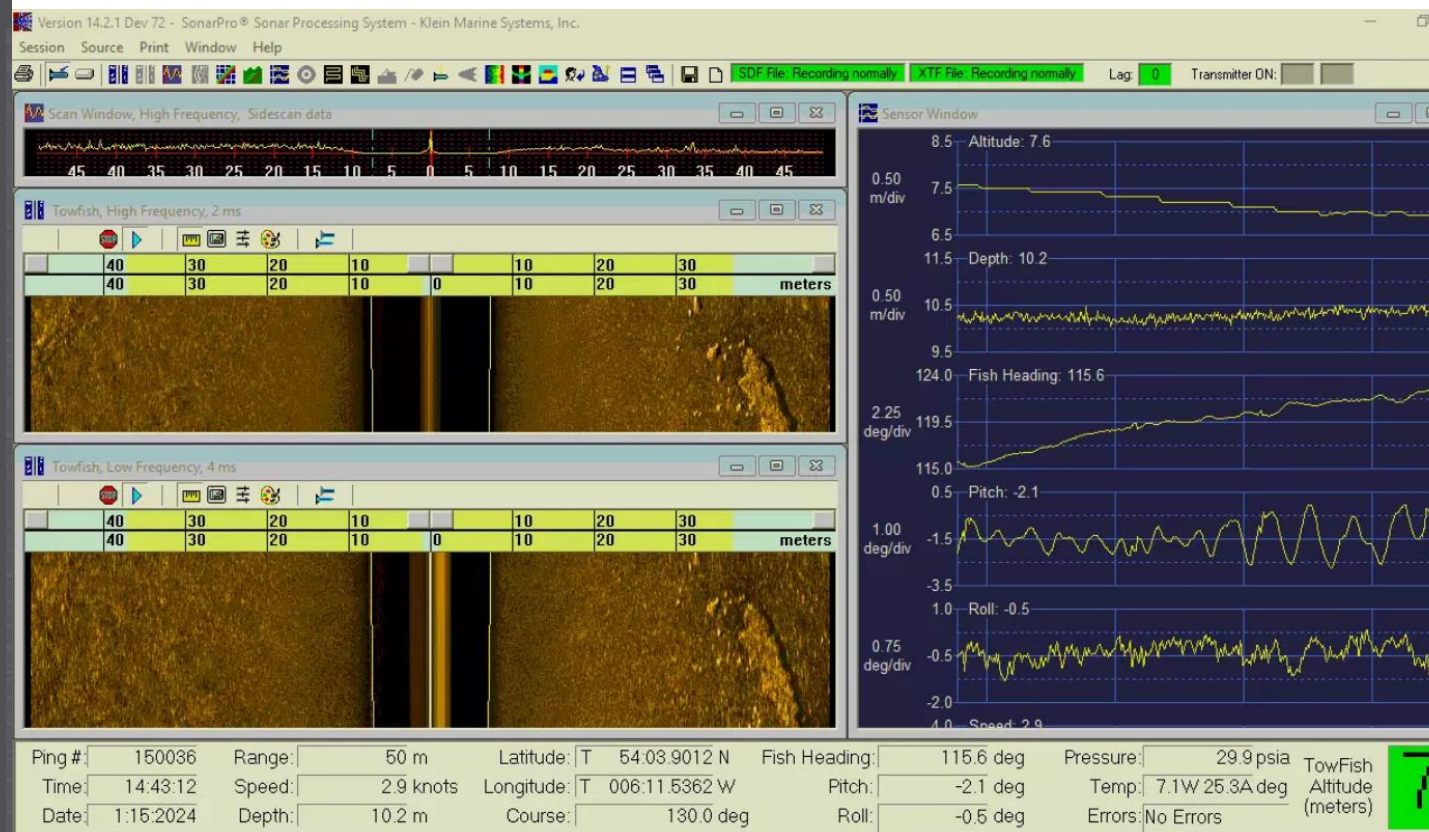


Sonar Depth (last 2mins)

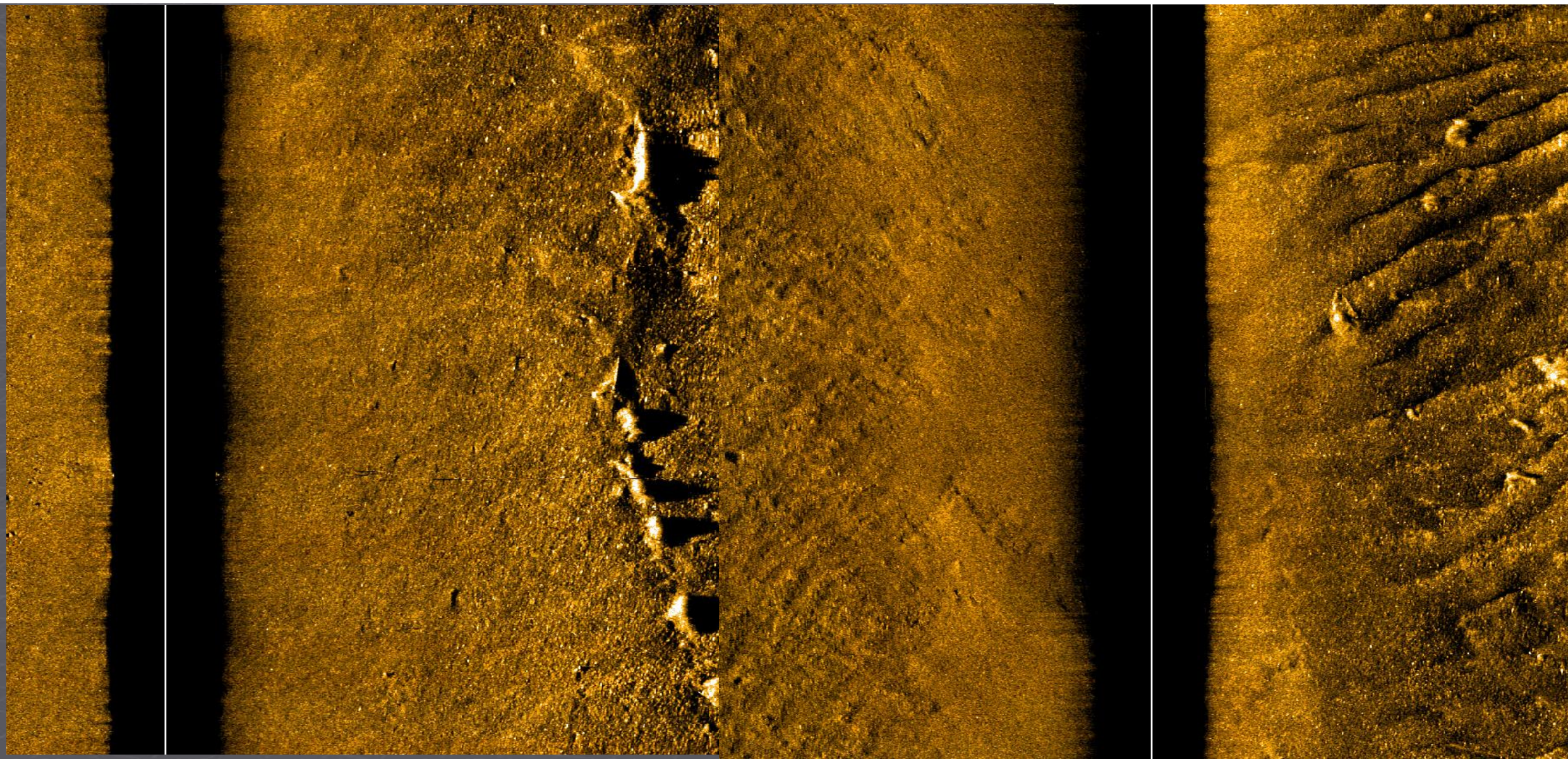


For indication only, not to scale.

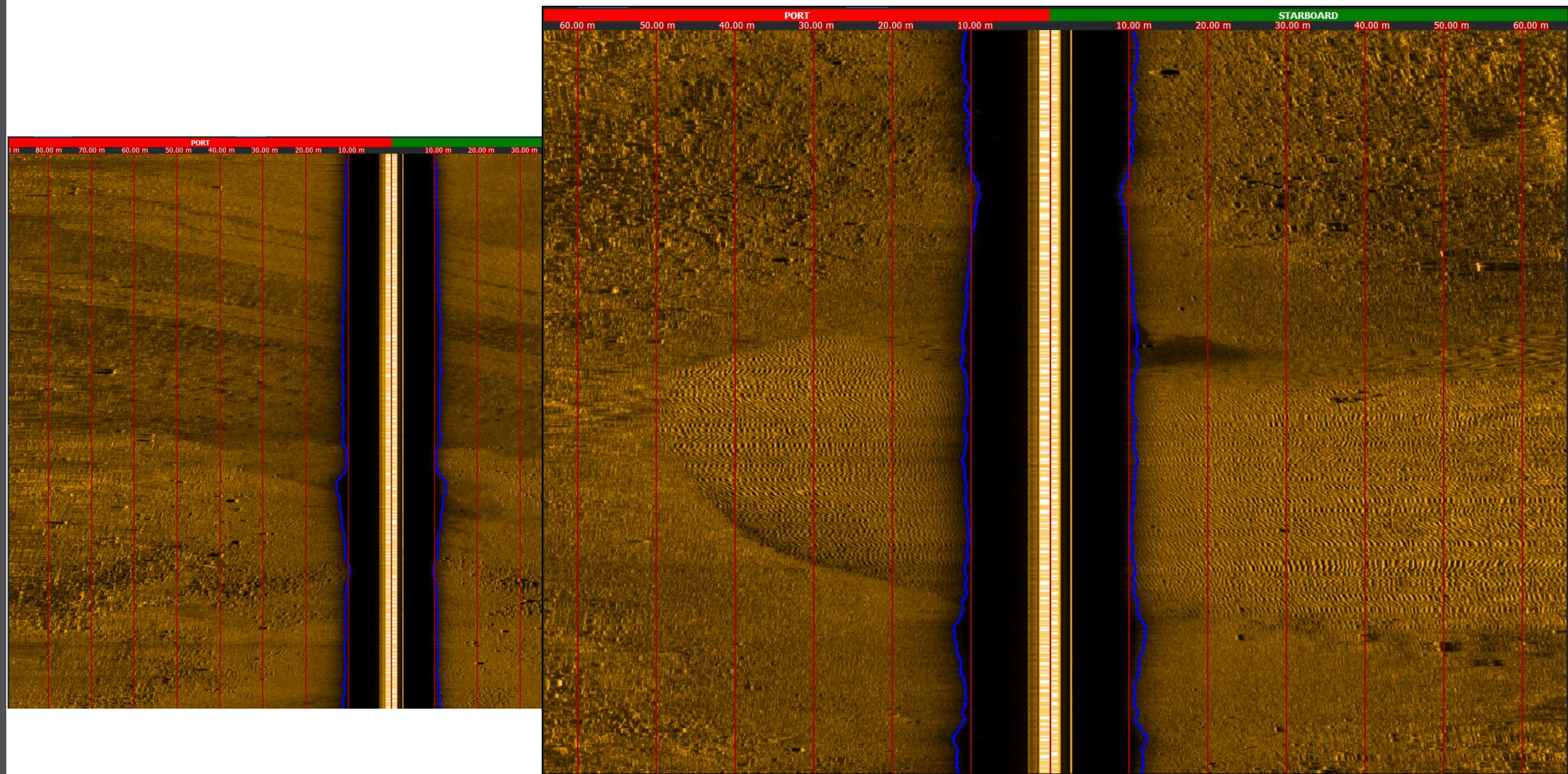
Side Scan – 2.0 Project results



Side Scan – 2.0 Project results



Side Scan – 2.0 Project results





Magnetometer

Magnetometer

Magnetometers:

- Marine Magnetics Synapse
- Marine Magnetics Explorer auv

Site Surveys: Used to detect cables/pipelines, wrecks, general magnetic signature.

UXO: Pre- Geotechnical surveys & before and trenching and piling operations

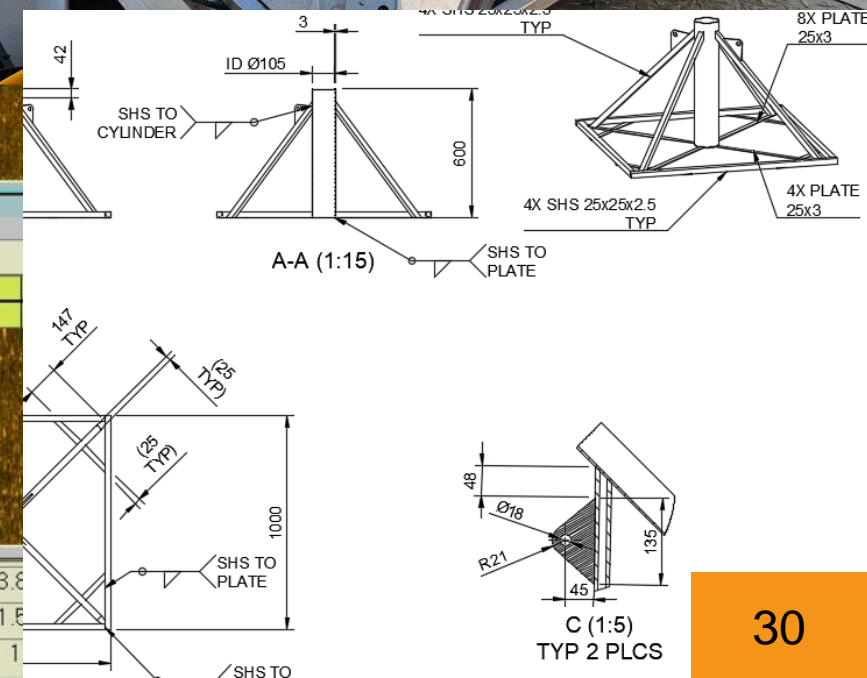
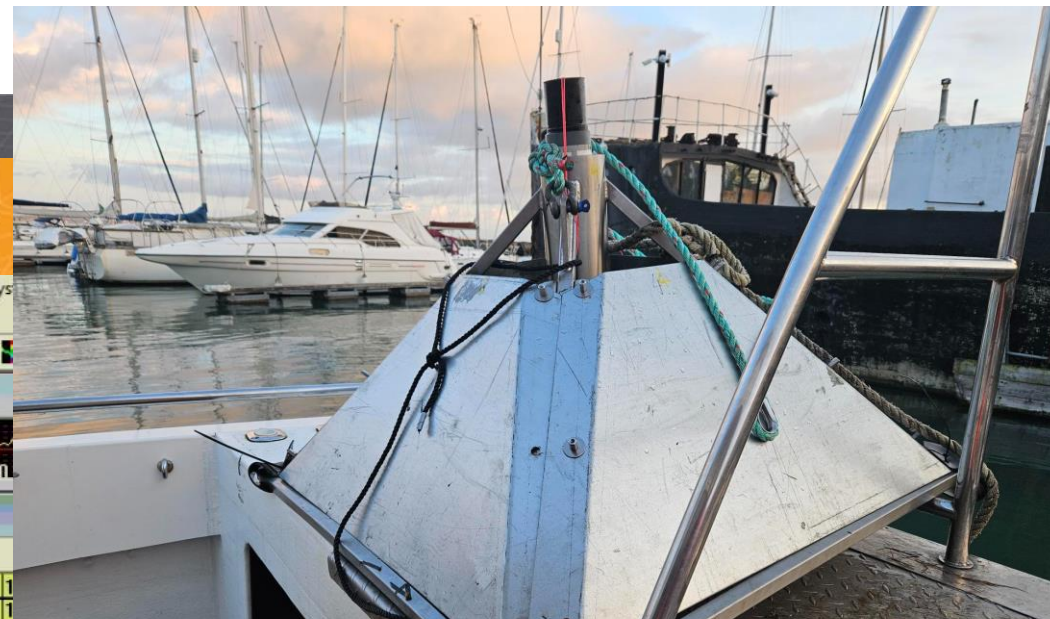
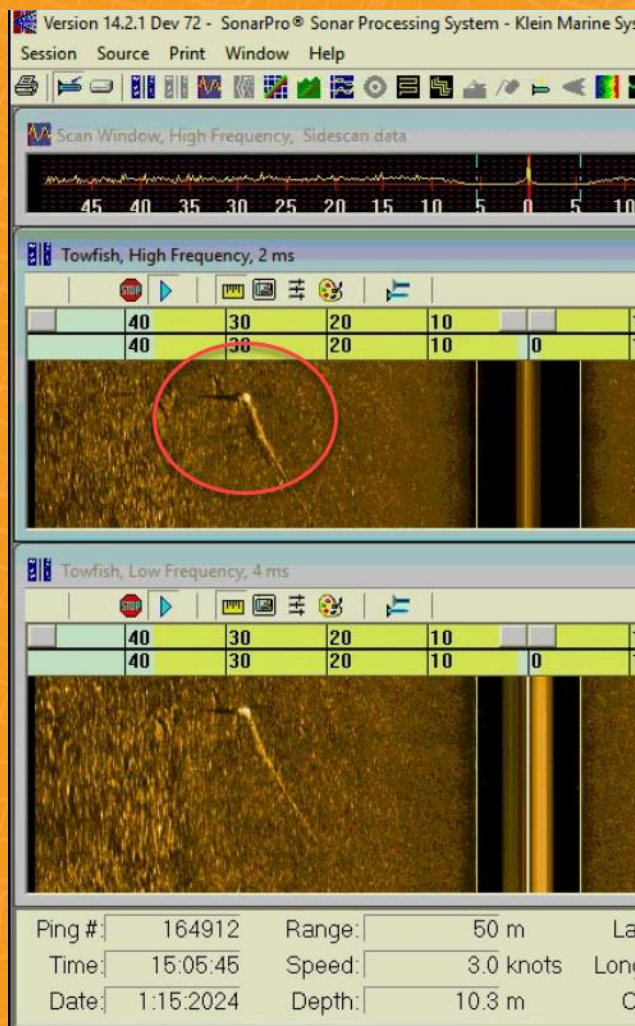
Decommissioning: To ensure that the site is clear of all debris

- Maximum altitude from the seabed is normally 4 metres
- Requires neutrally buoyant magnetometer for easier deployment and recovery



SVT

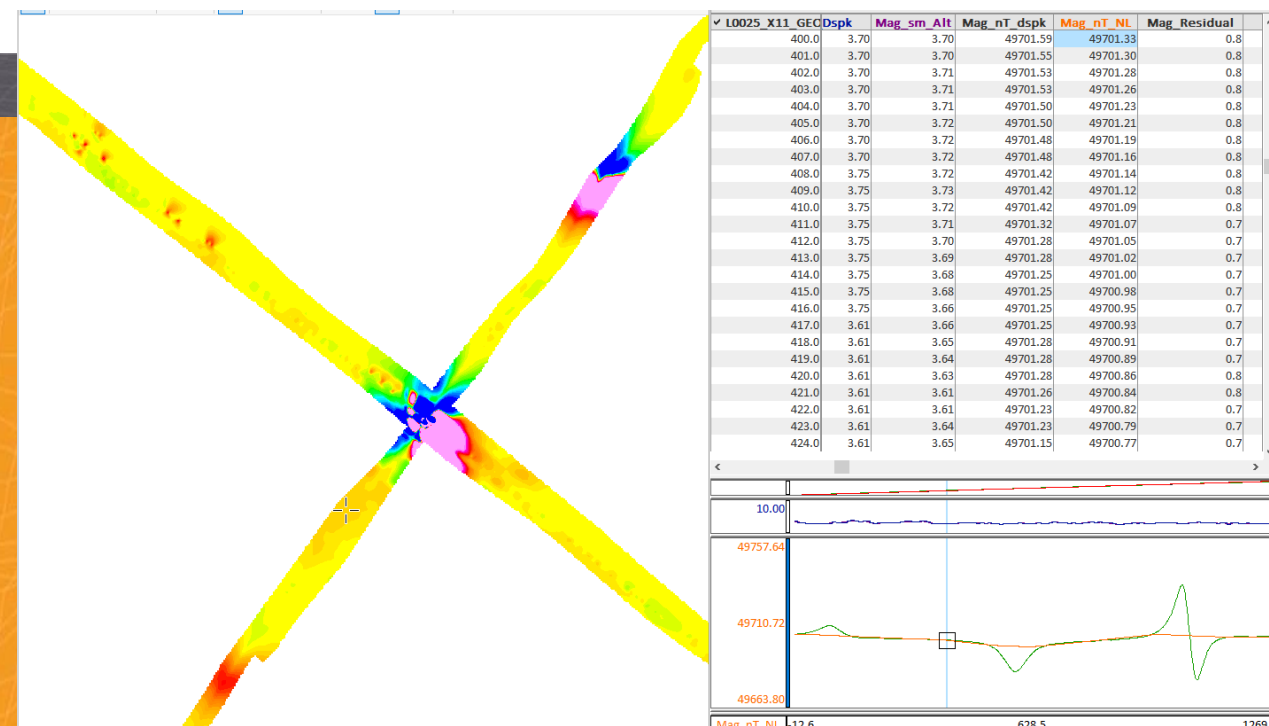
- To prove the **system** performs as expected against a known target size.
- Separate SVT for Explorer and Synapse systems and per USV
- Determines flying height/burial detection/dynamic coverage for pUXO surveys



SVT and EVT Requirements

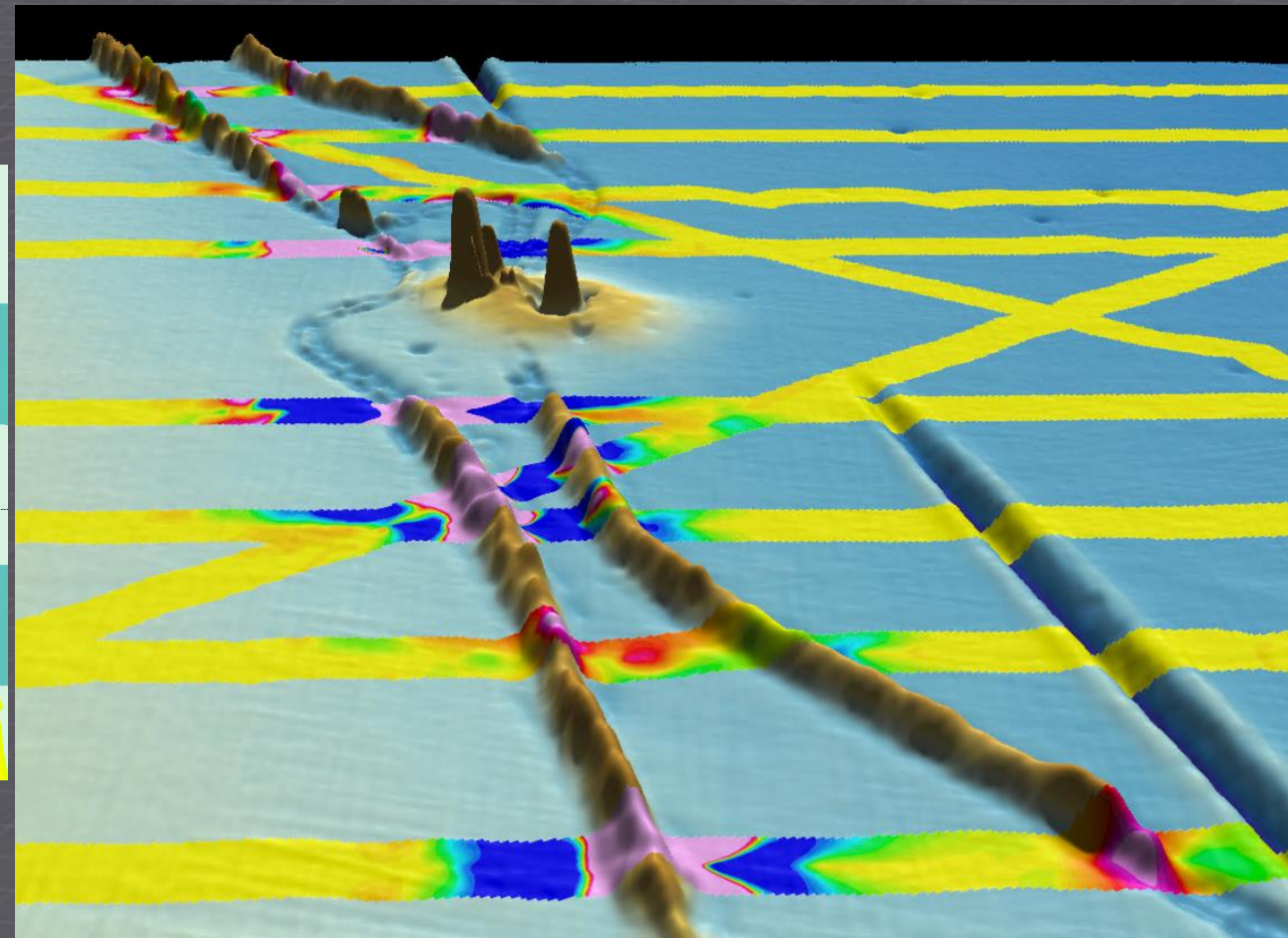
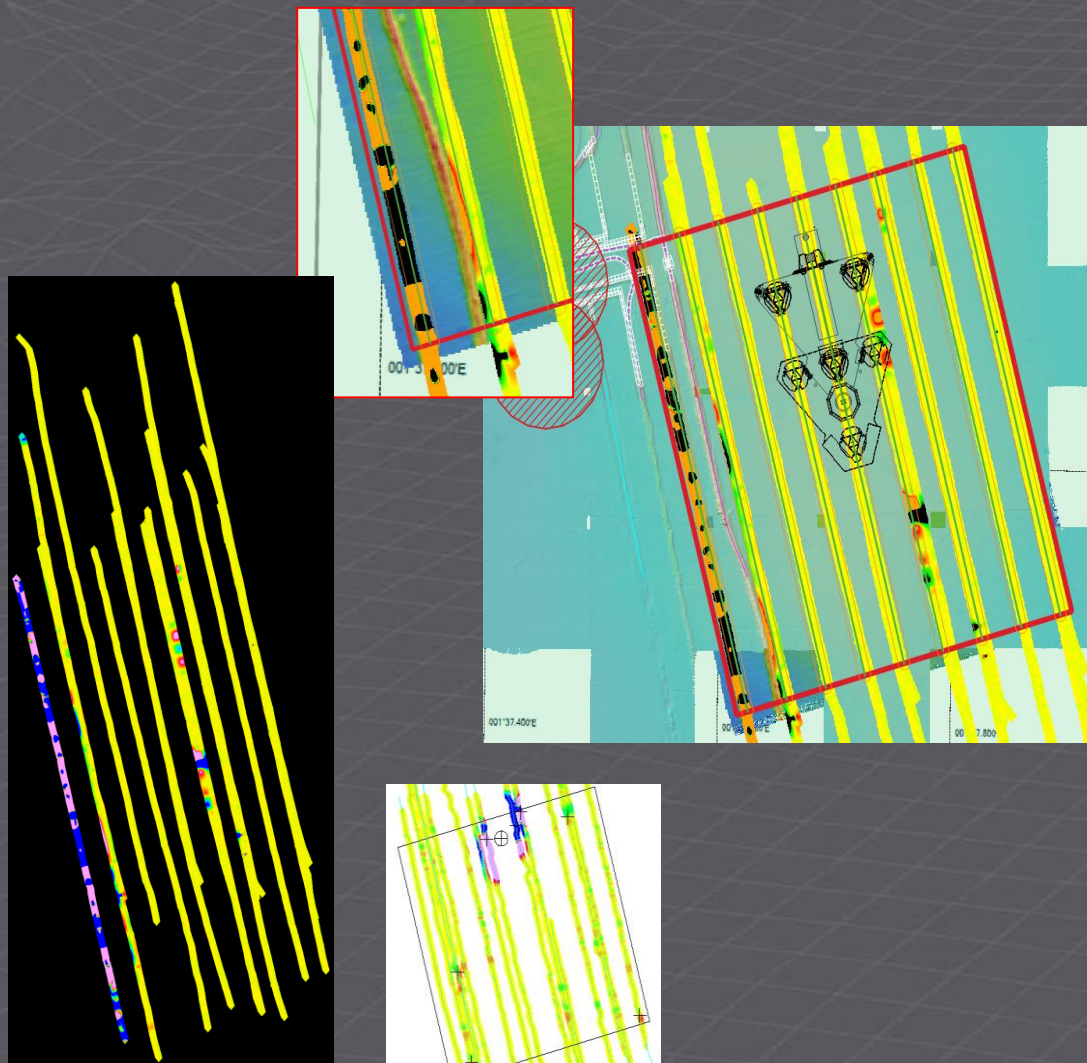
SVT

- 150m x 35m Pre-survey required to ensure area is free of Magnetic material
- SVT Procedure is a minimum of **16** lines once deployed
- Lines in a cross pattern in all directions, repeated at different altitudes - 3m, 5m & 7m (or until not seen)
- Additional Lines after to position with the SSS



	Mean Residual Amplitude (nT)	Maximum Residual Amplitude (nT)	Easting (m)	Northing (m)	Easting C-O (m)	Northing C-O (m)	Used Line Names
MBES Position			683913	5994614			
3m Altitude Grid	25.9	35.2	683914.26	5994613.1	1.255	-0.861	L004, L006, L009, L0010
5m Altitude Grid	5.1	9.1	683913.86	5994613.5	-0.397	0.337	L007, L008, L0011, L0012
7m Altitude Grid	2.6	2.6	683913.48	5994613.8	-0.38	0.289	L0013, L0014, L0015, L0016
	Mean Position				0.1593333	-0.078333	
	Standard Deviation				0.7747844	0.5537757	

Magnetometer Project results



USV XO-08 Towing





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Ocean data, **delivered.**

