

Tekna Seabed Mapping and Inspection

USV geophysical survey – results and feedback from a full towed sensor campaign

Project Highlight



Failing Upward To Success

- Takes time to innovate, implement, become reliable, become consistent and efficient.
- Then it takes more time to gain market acceptance and customer **TRUST** in product.
- We see this in other markets, ours is no different.



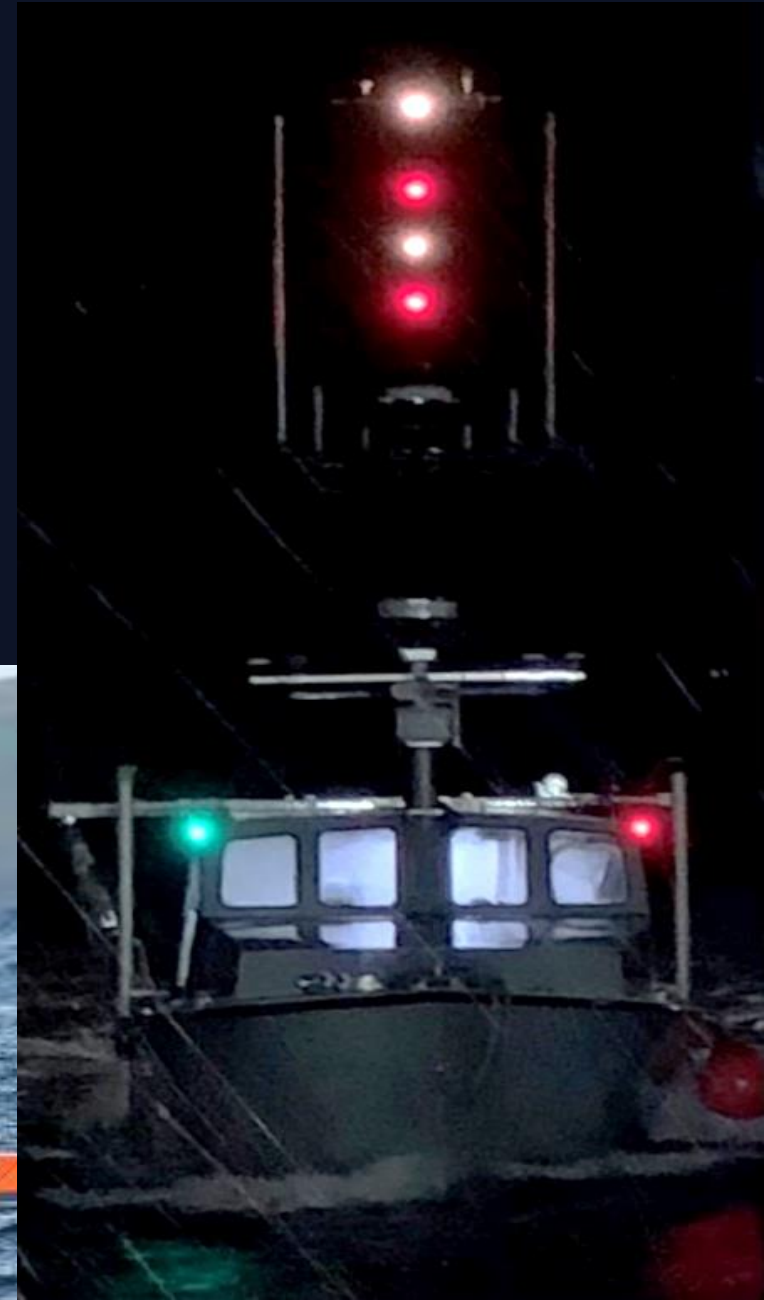
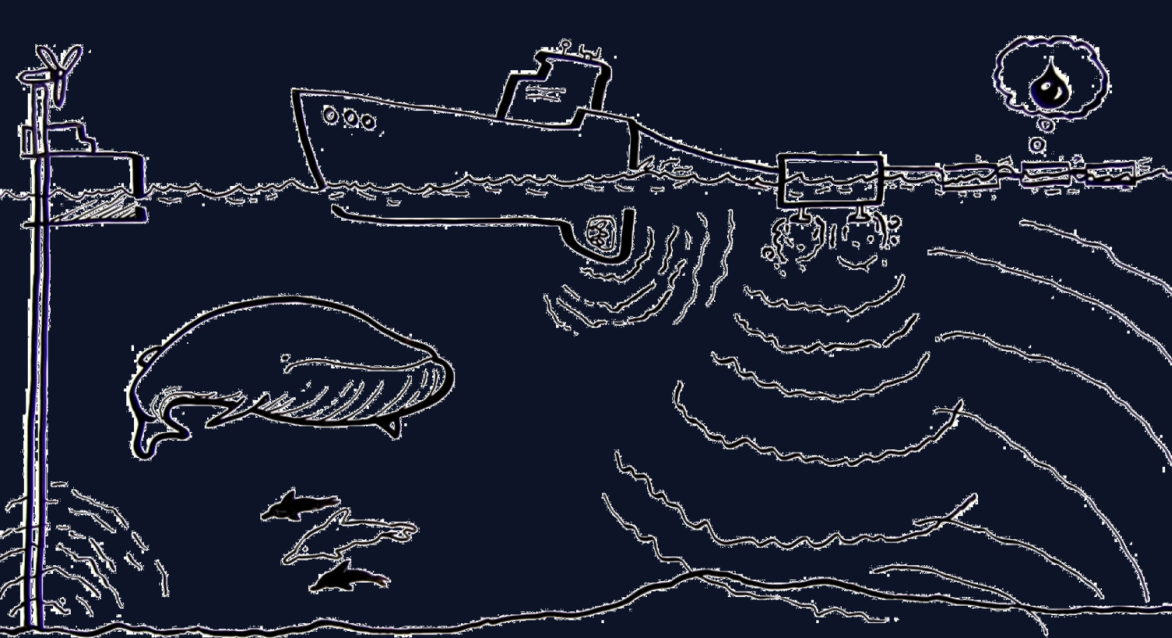
The Challenges

- Unseen / undetected hazards
- Operating logistics
- Weather / sea states
- Safety Regulations and Permitting
- Data Storage
- Self monitoring sensors
- Broken / failed equipment
- Communication
- Data states and QA/QC (processing / raw)
- Multi-sensor mitigations



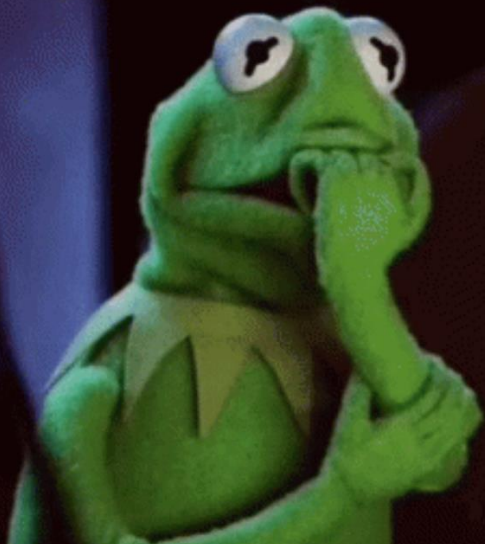
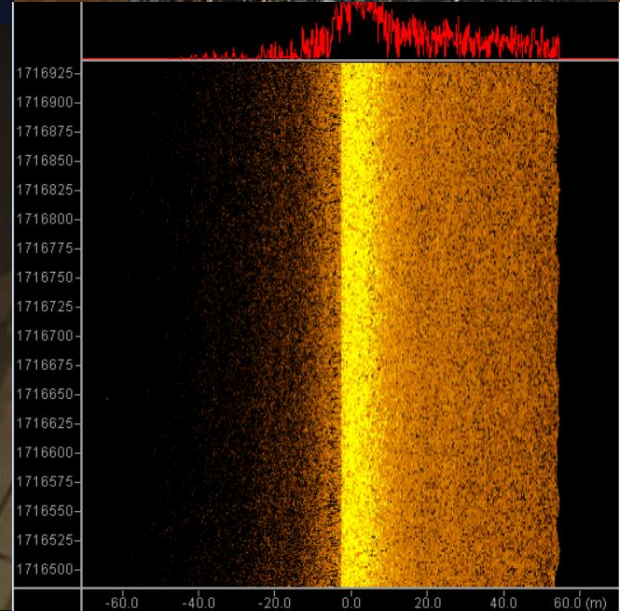
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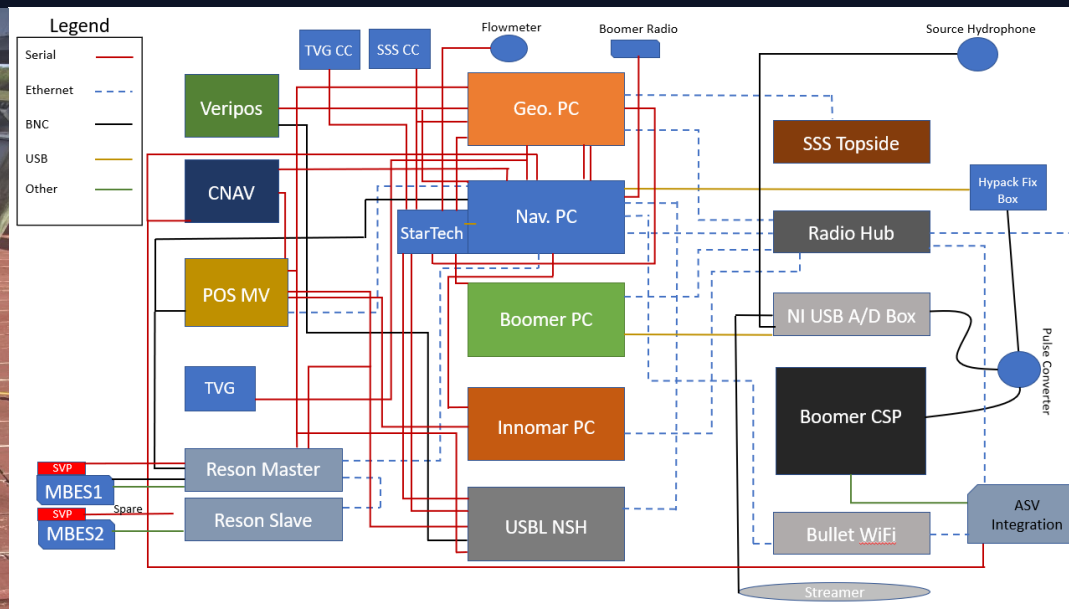
OH NO...

**SOOO
MUCH
DATA!!!**



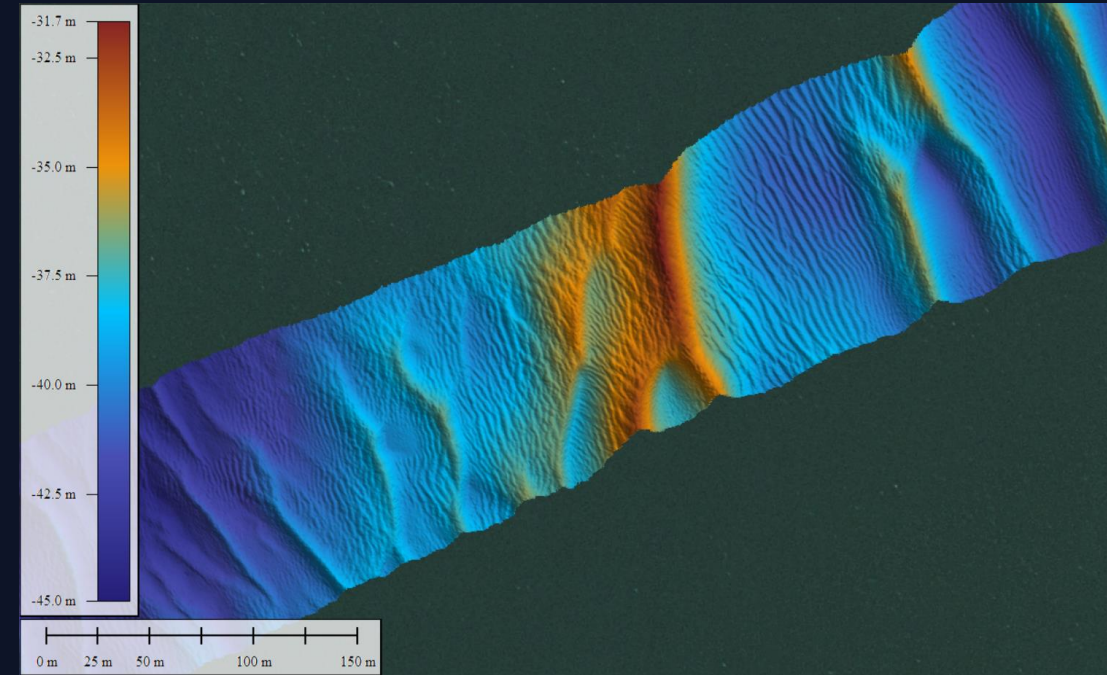
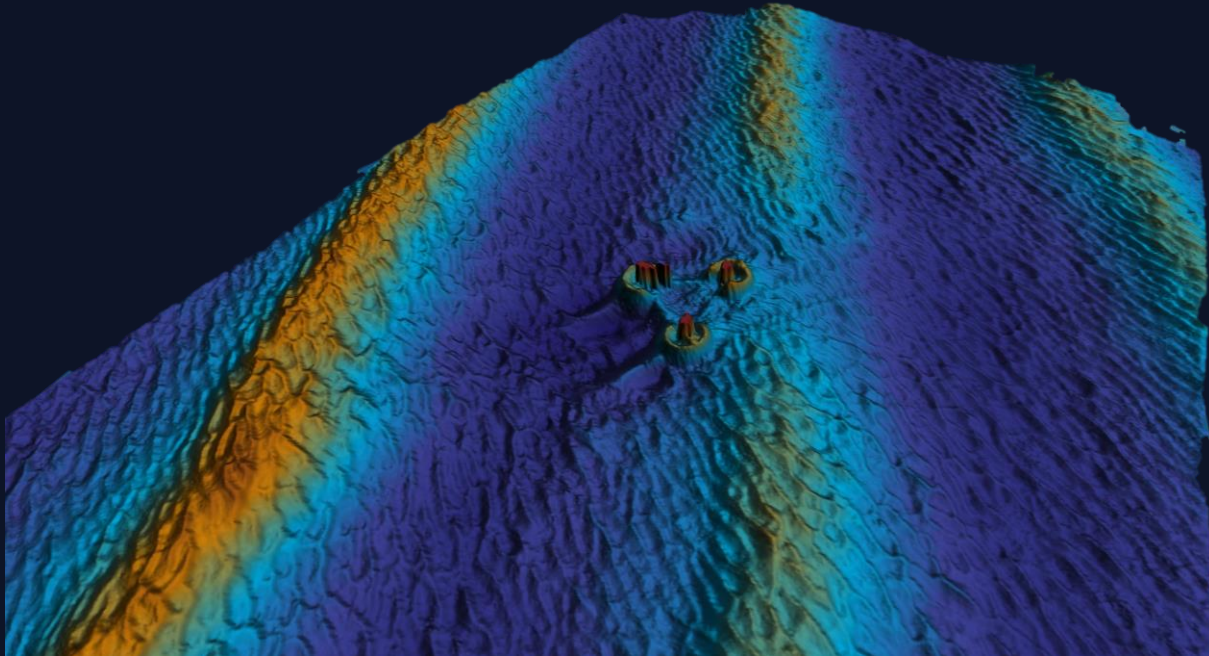
The Challenges

- Unseen / undetected hazards
- Home operating platform logistics
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- Broken / failed equipment
- Communication (thank you eccentric billionaire)
- Data states and QA/QC (processing / raw)
- Multi-sensor integrations



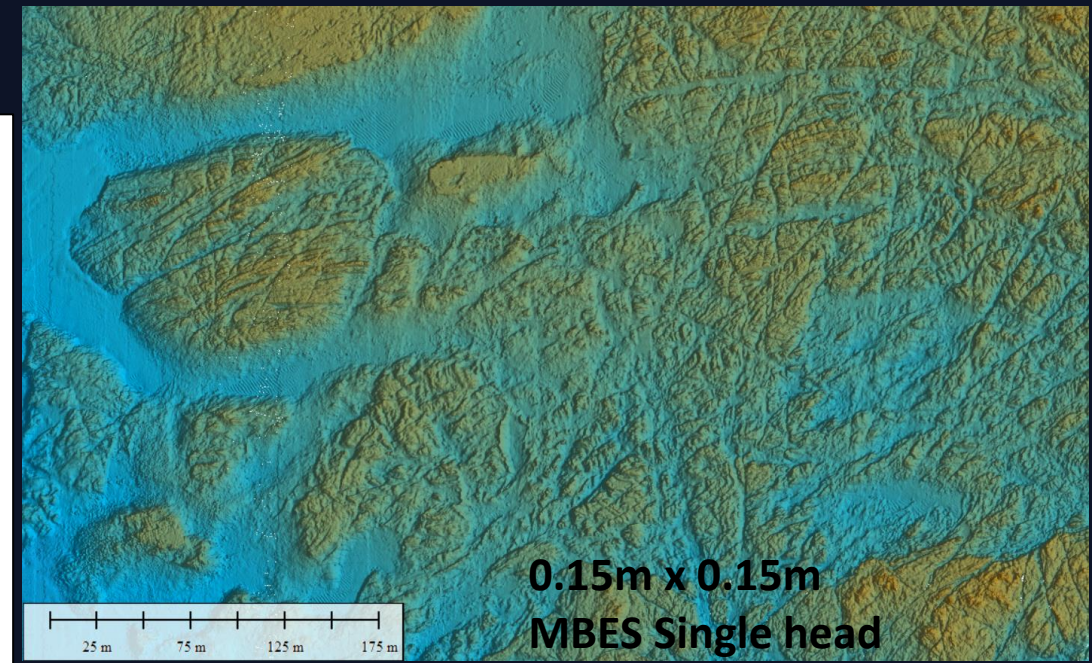
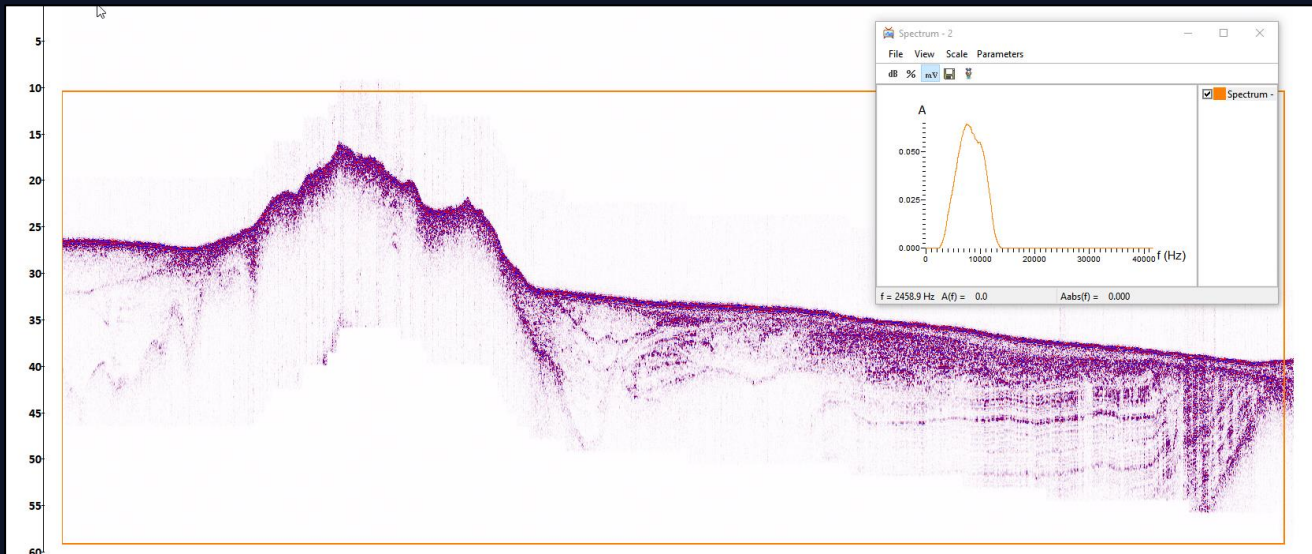
Our baby step approach

- Get acceptance at each step.
 - Started simple with XOCEAN and Drix Vehicles using just MBES



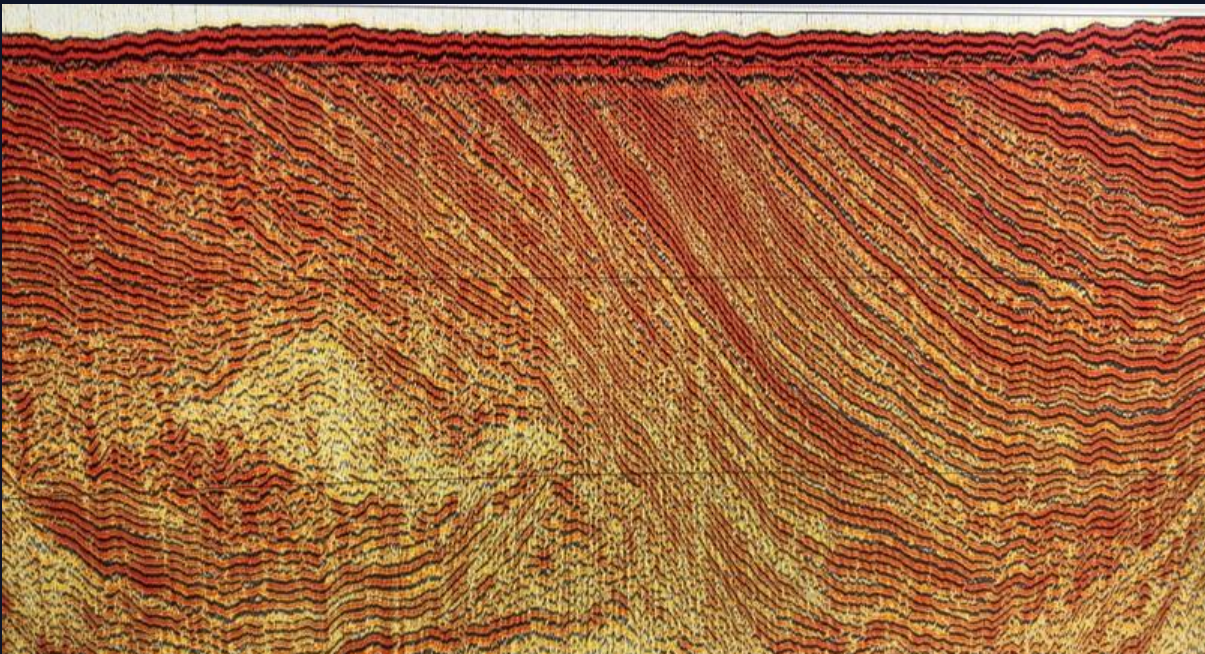
Our baby step approach

- Added SBP's with the MBES. Parametric systems were chosen due to their want in the industry, small beam width, and BOEM ruling in the US that they do not need PSO mitigation.



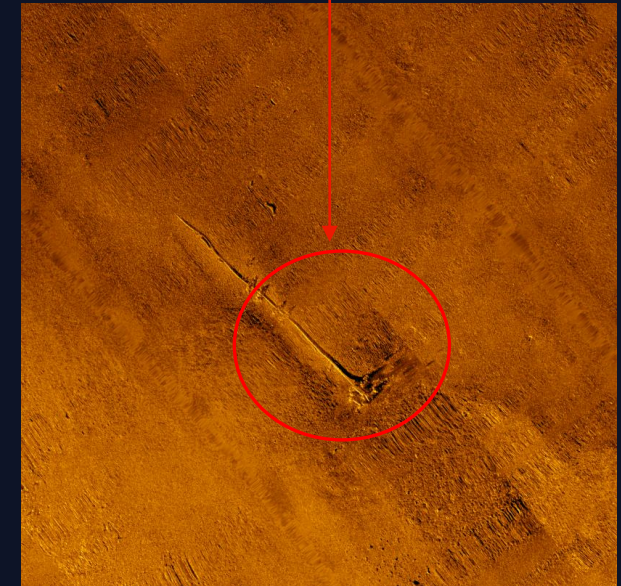
Our baby step approach

- We then added WAMV vehicles to support ultra shallow surveys.
- Propagated our knowledge of MBES/SBP integration from the other vehicles. No loss time in integration. Also realized there was no need for triggering!!



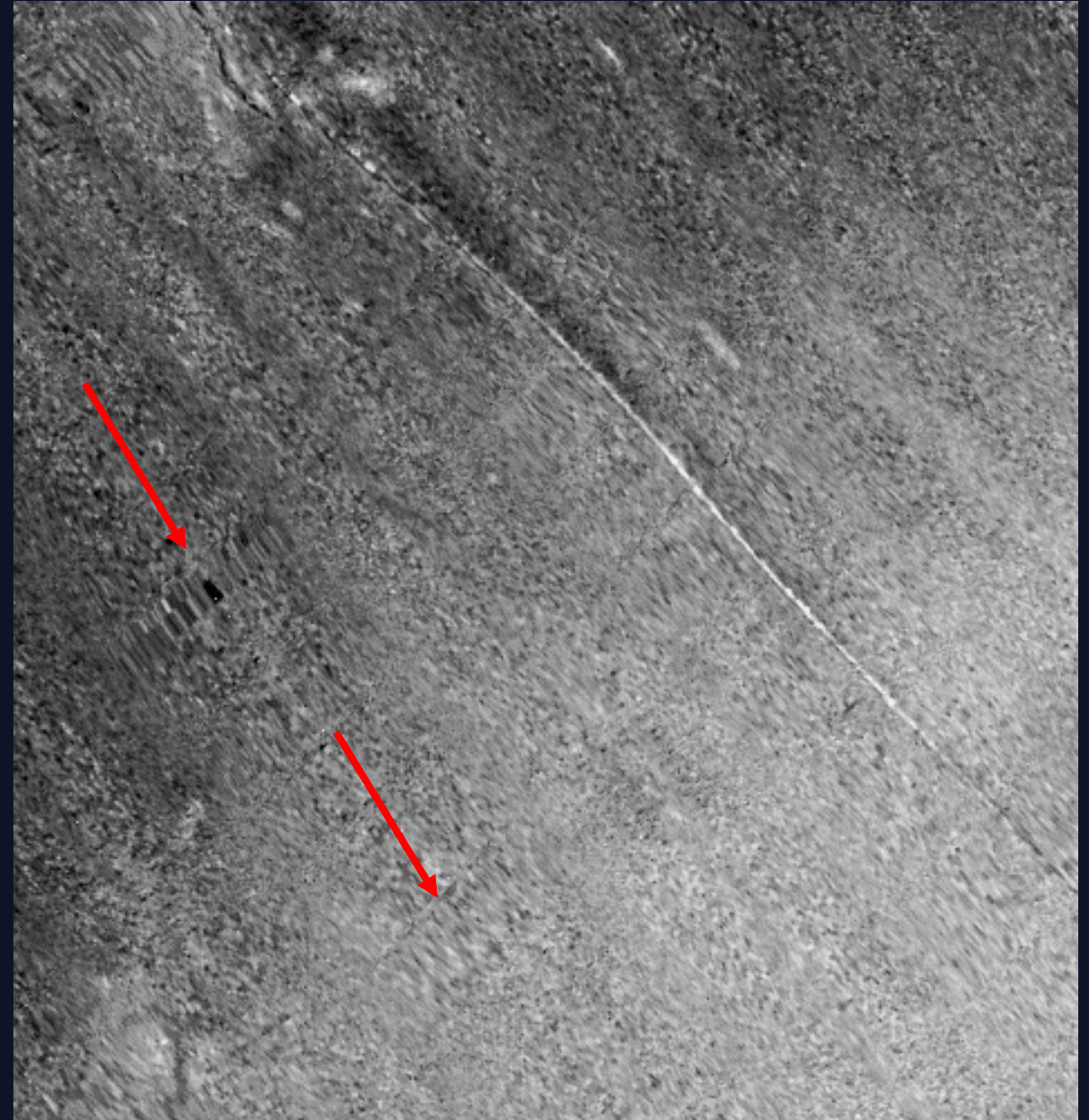
Our baby step approach

- We then started towing a SSS for shallow water pipeline work.
- We kept the MBES and SBP on as well.

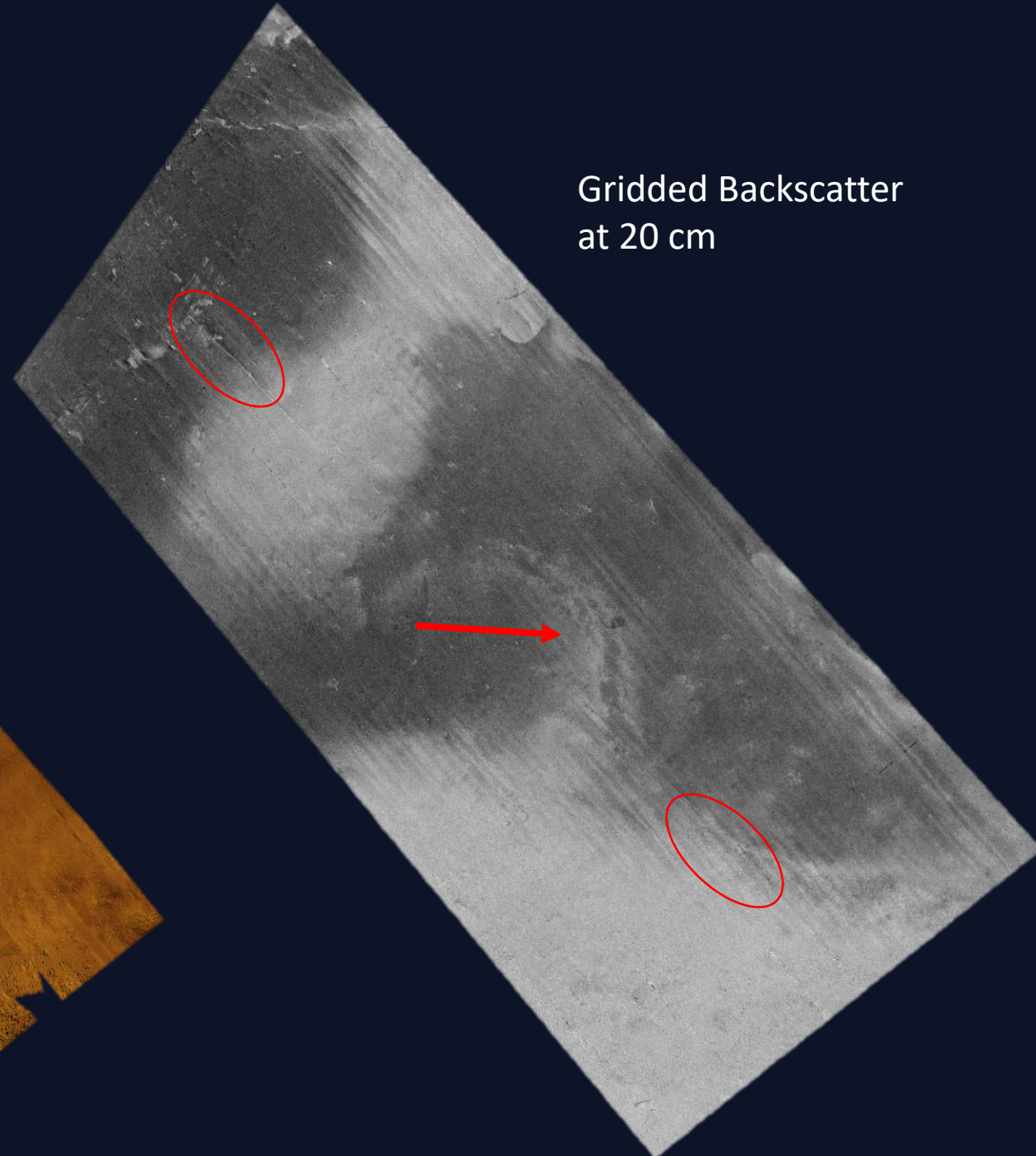


Issues Realized

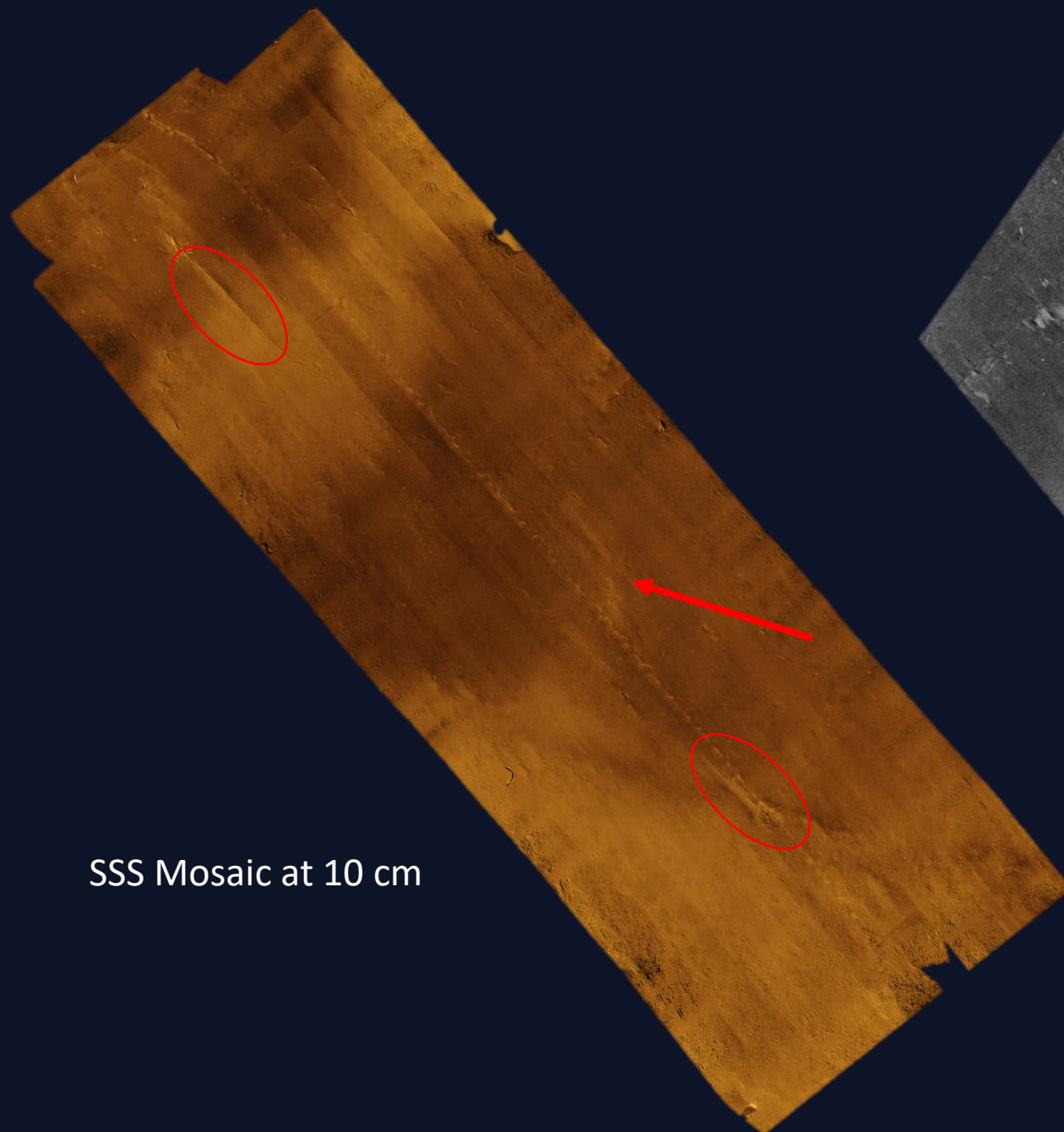
- SSS was towed from actuated pole on a short tow to avoid engines.
- Due to the short cable length, sharp heading errors propagated into the data.
- Wasn't seen in testing because testing was done in a bay environment vs the surface zone on a open ocean.



Gridded Backscatter
at 20 cm

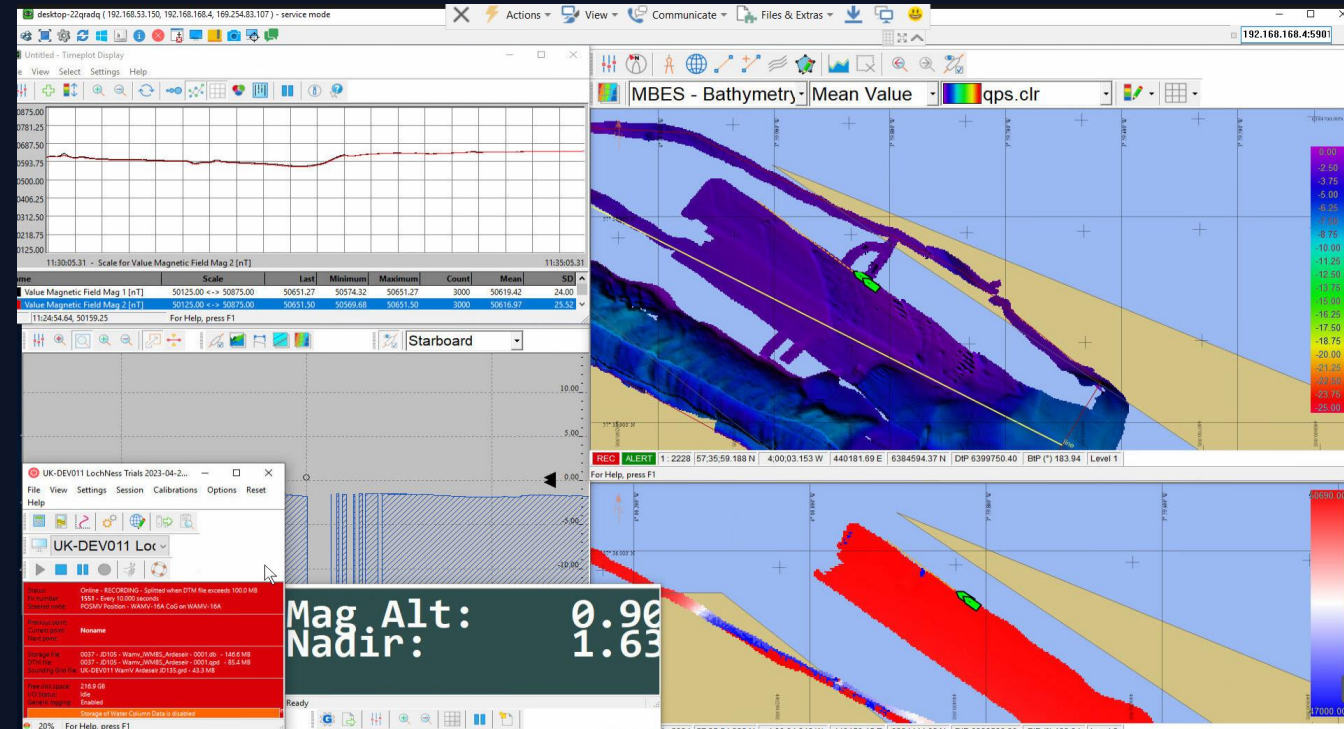


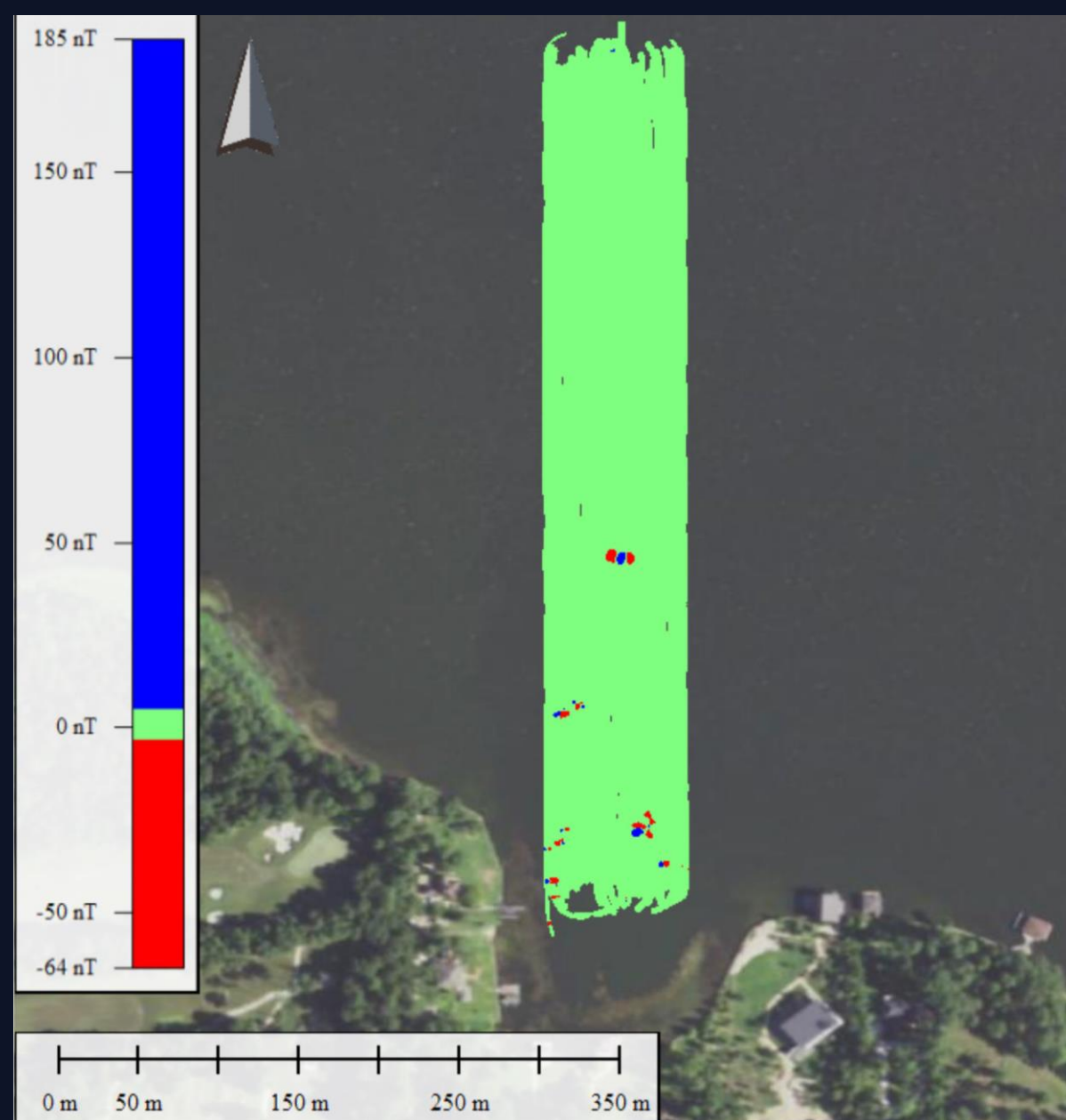
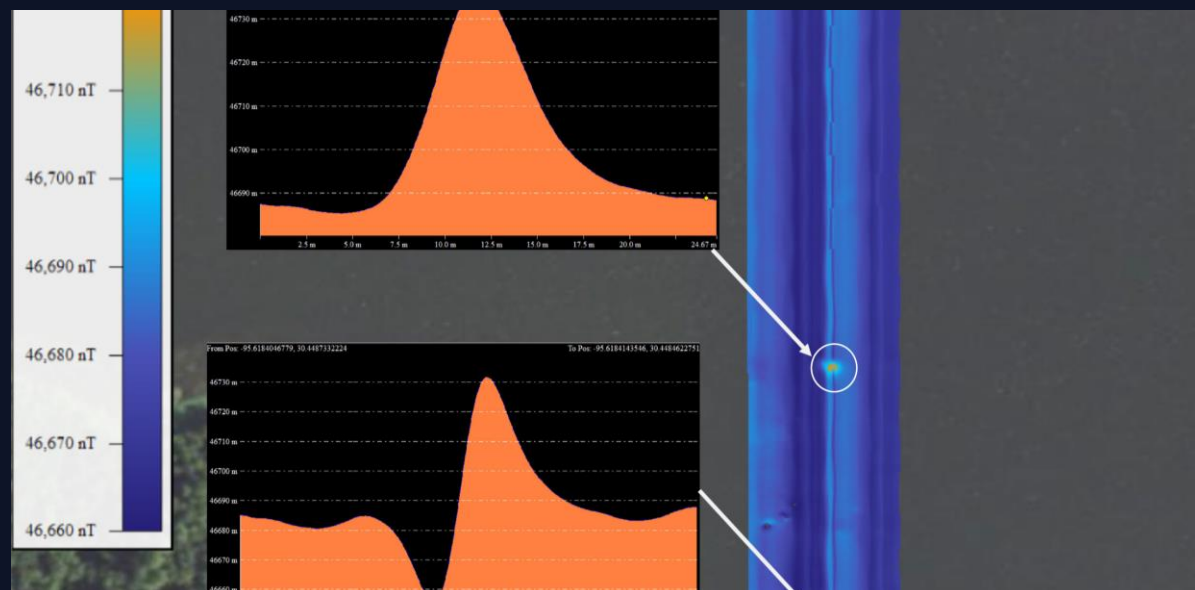
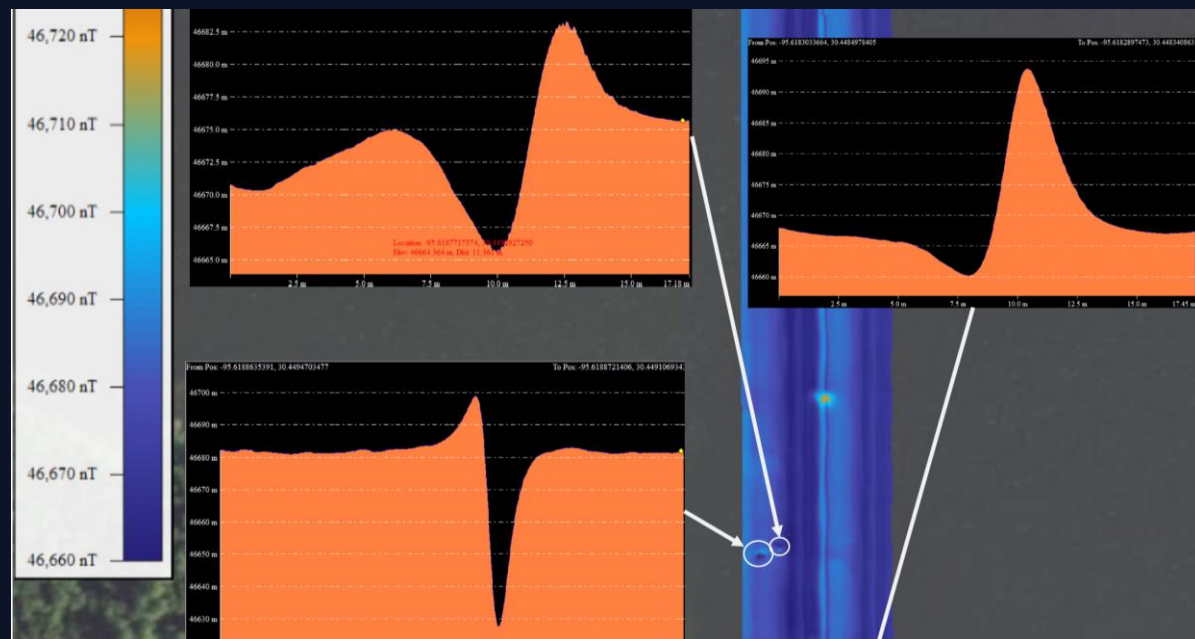
SSS Mosaic at 10 cm

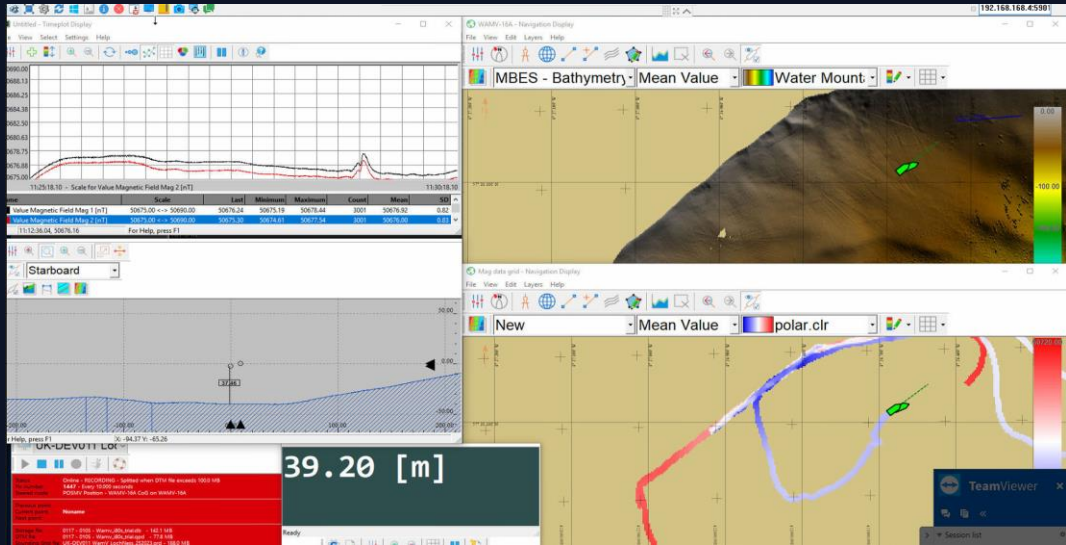
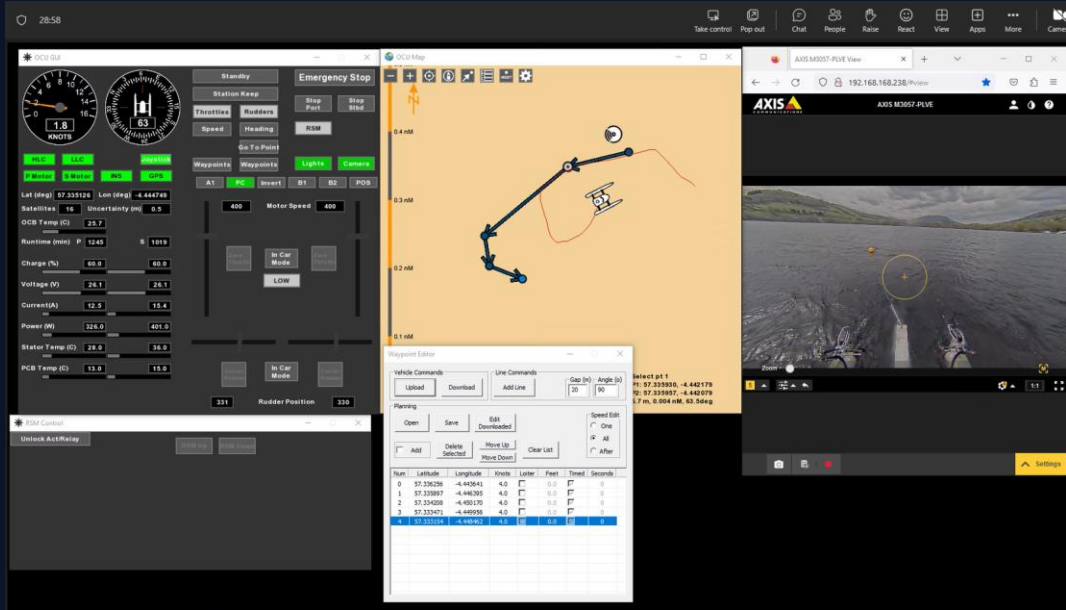
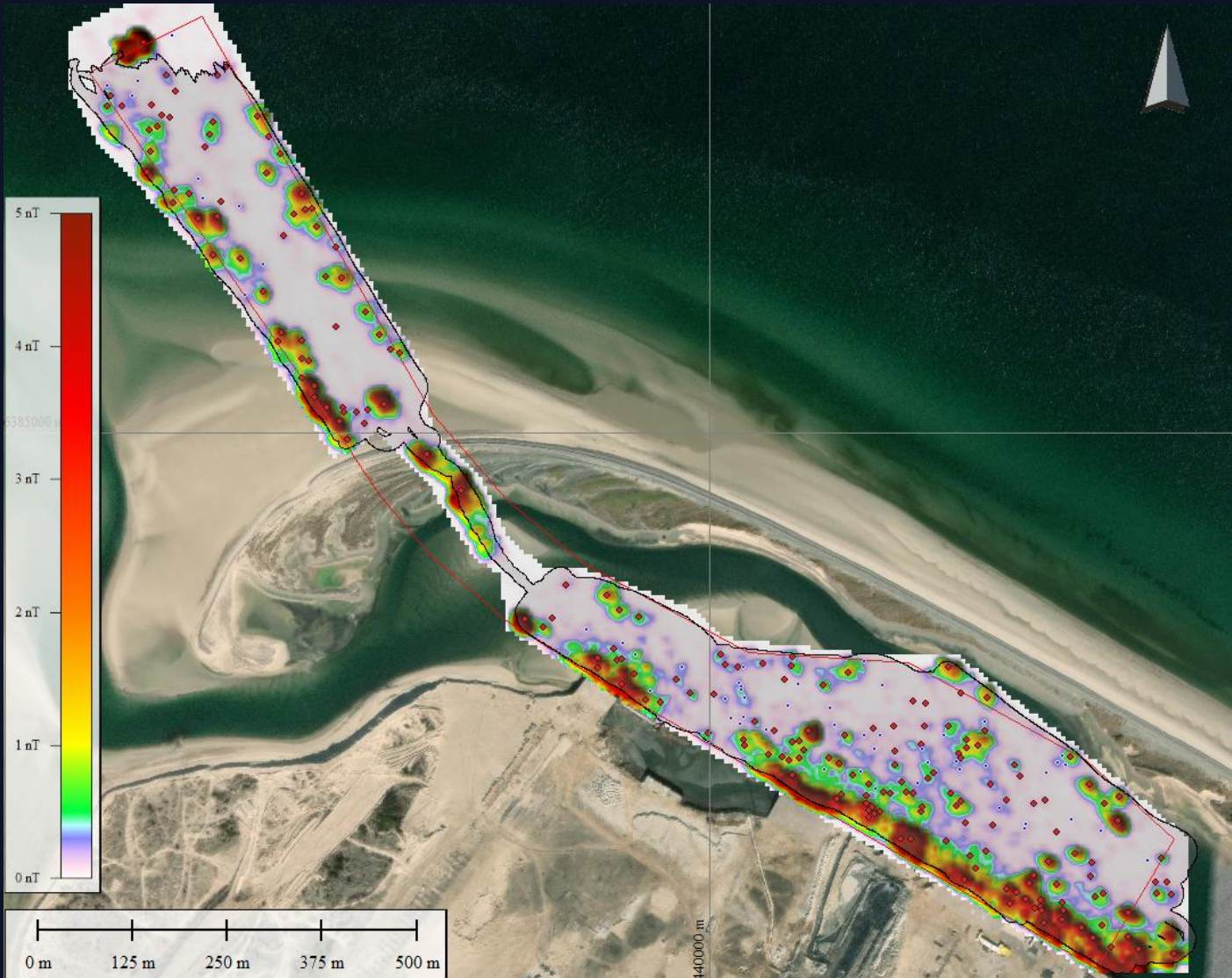


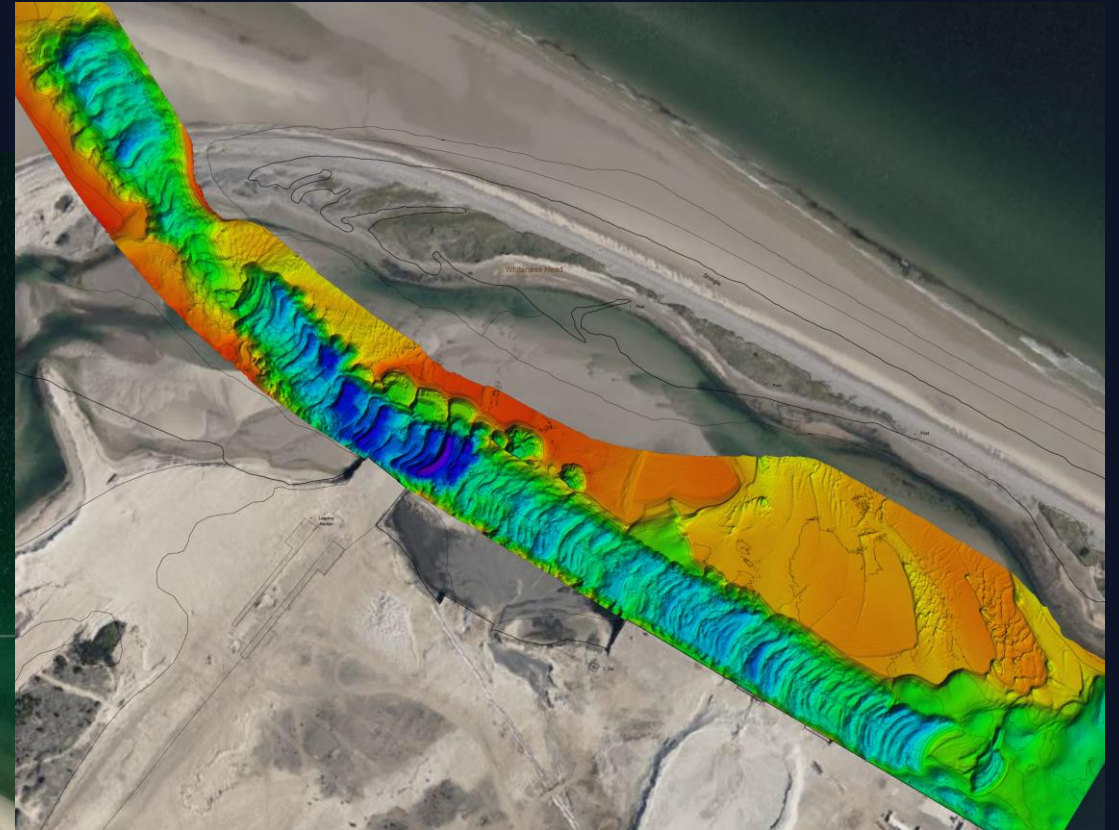
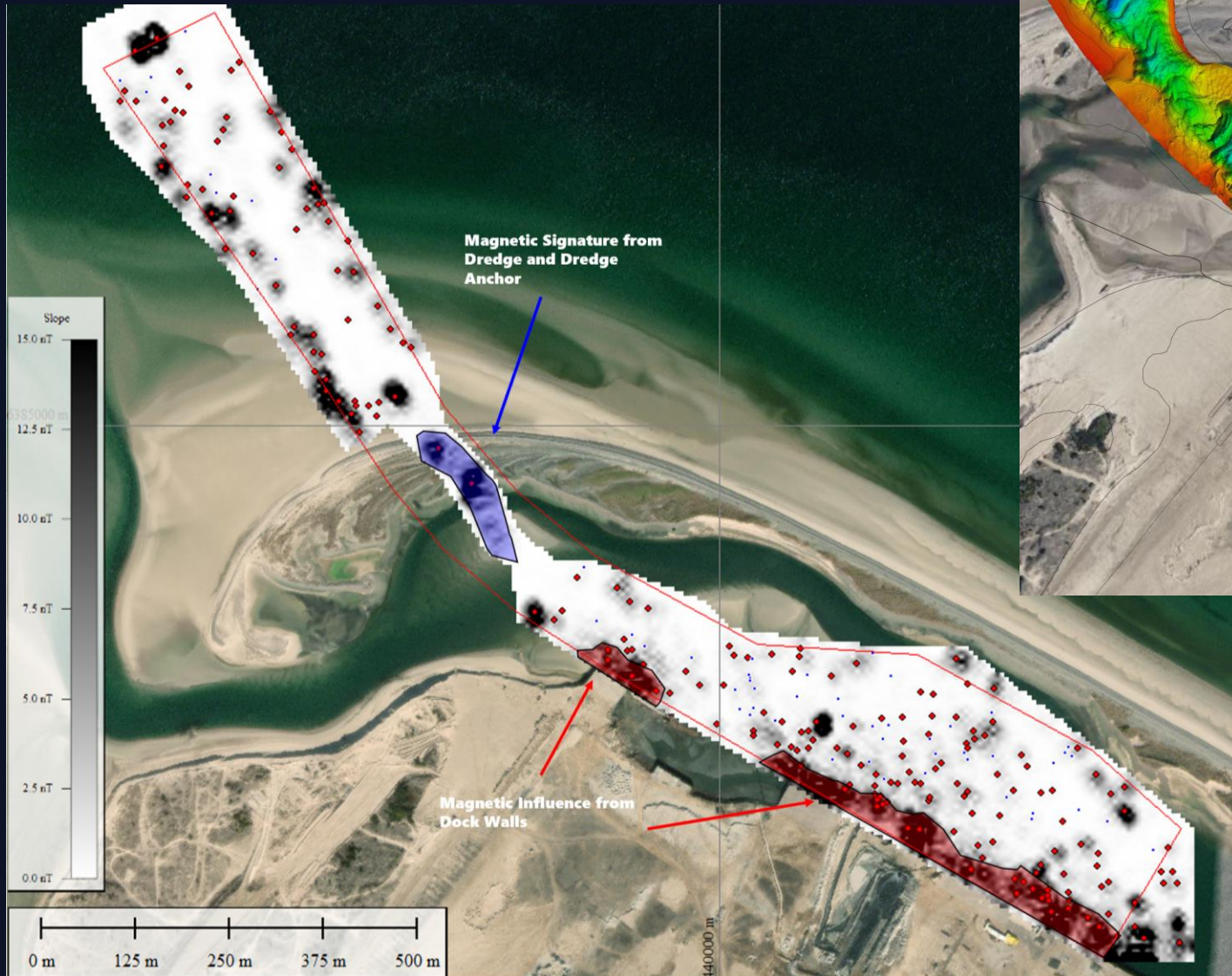
Our Approach

- We then started towing a TVG for shallow water UXO work.
- We kept the MBES but took off the SBP and SSS.









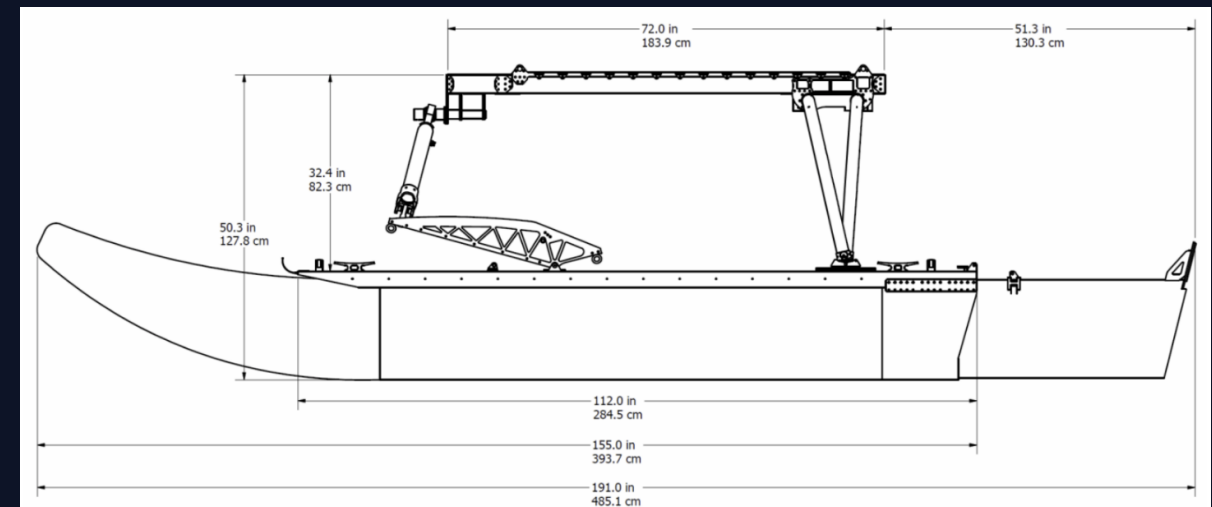
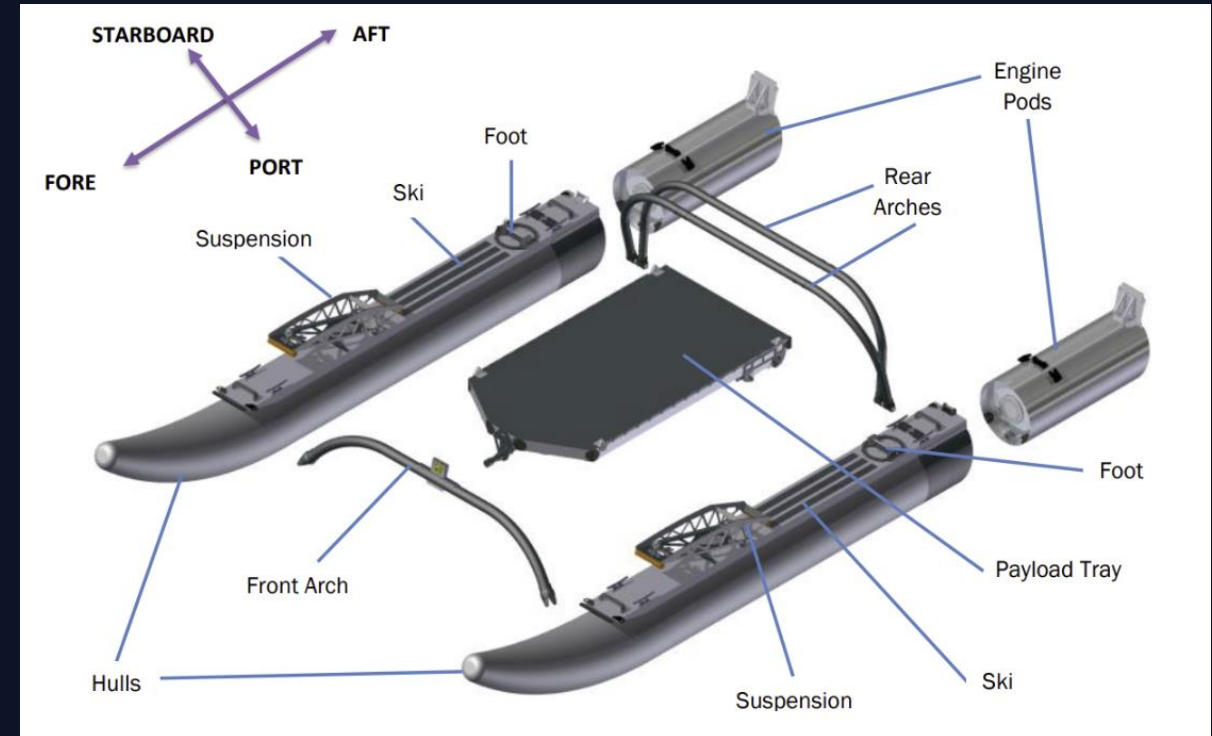


Project Highlight: Carbon Sequestration Project GOM



Vehicle

- Can be broken down and transported in the back of a pickup truck.
- Suspension on each pontoons.
- Gimbled platform with attached sensor payload.
- Tow davit extended from gimbled platform out past the engines.
- Two electric motors power by 4-8 battery bank.
- 120kw inverter used for survey kit and Starlink communication. Radio and 4G communications run off DC.

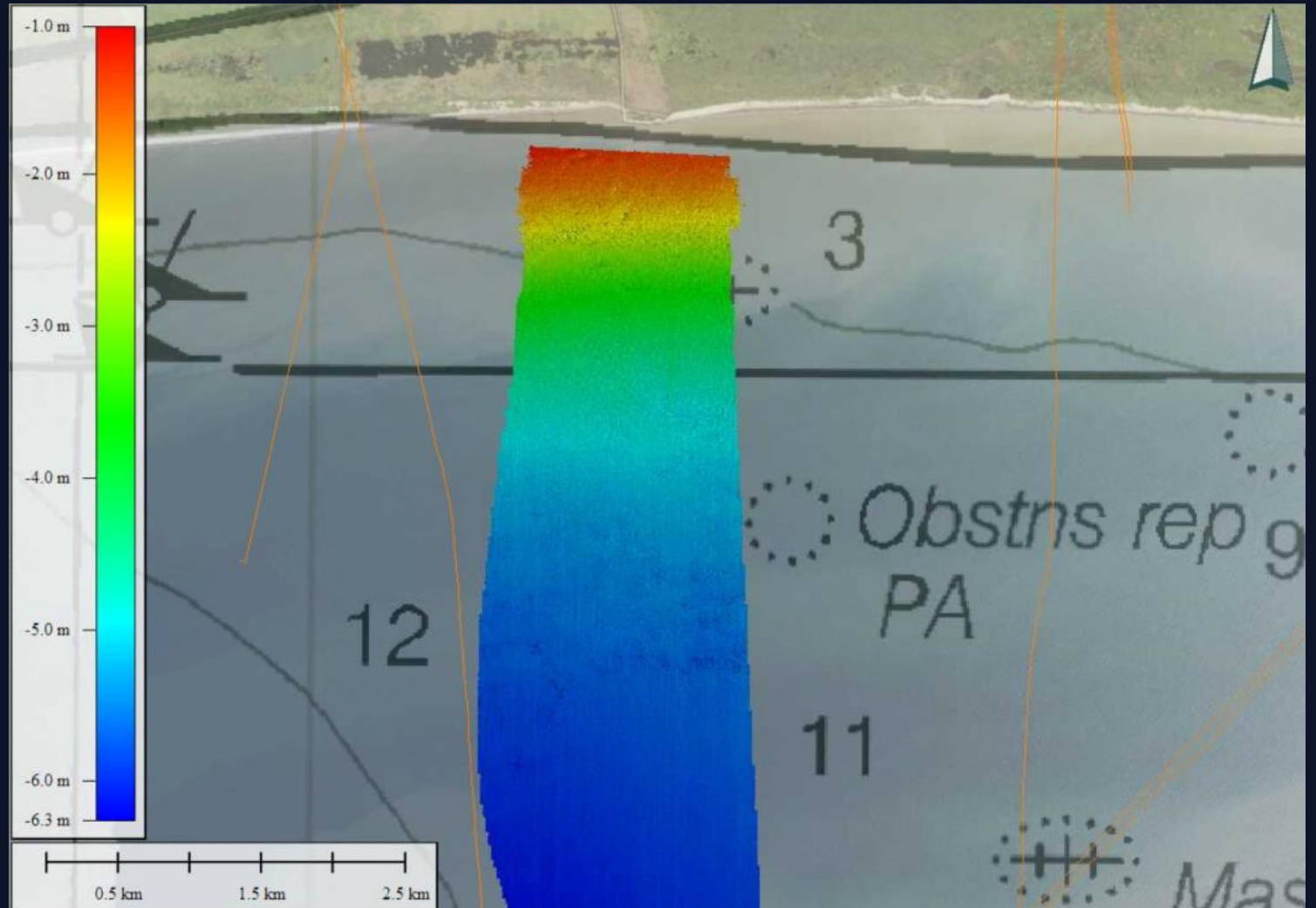


Vehicle



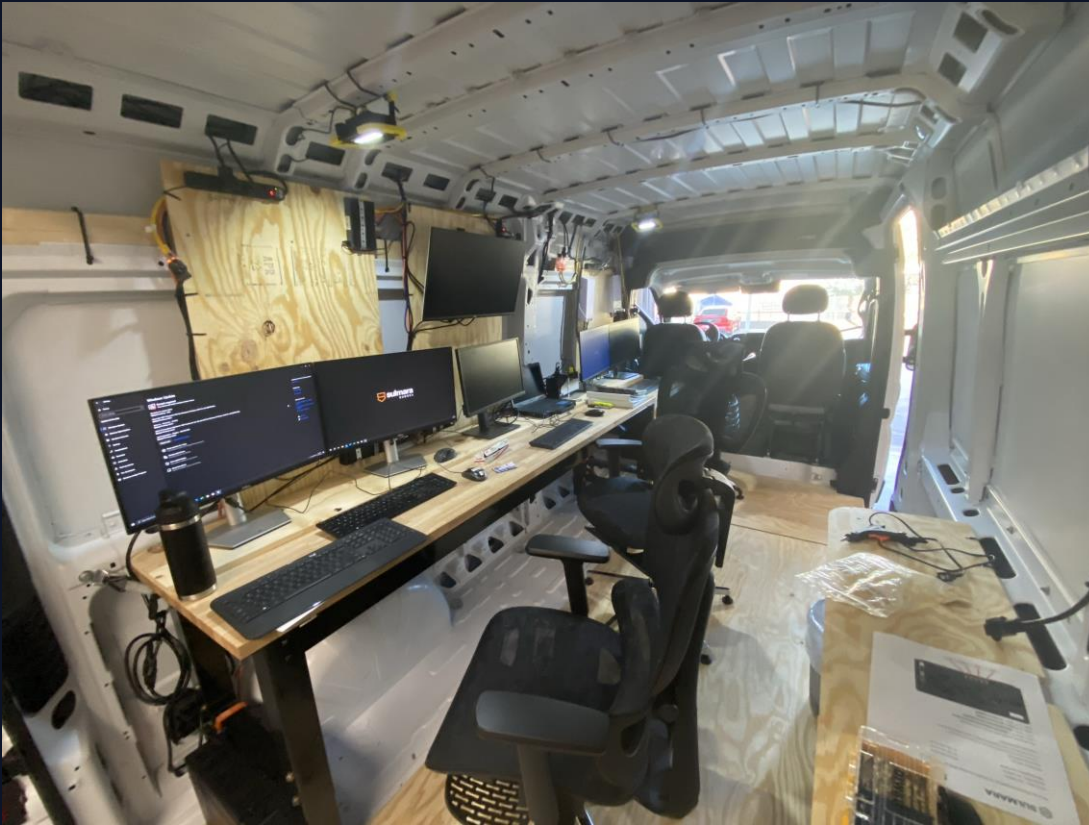
Project

- Survey split between 32' manned vessel (RV Yeti) and 16' uncrewed vessel (WAMV 16).
- Survey area split between both. USV ran the gray area in the shallows and the manned vessel did the offshore region.
- Water depths ranged from 0.3m to 8m.
- 1100 survey kms for WAMV and 1500 kms for the RV Yeti.



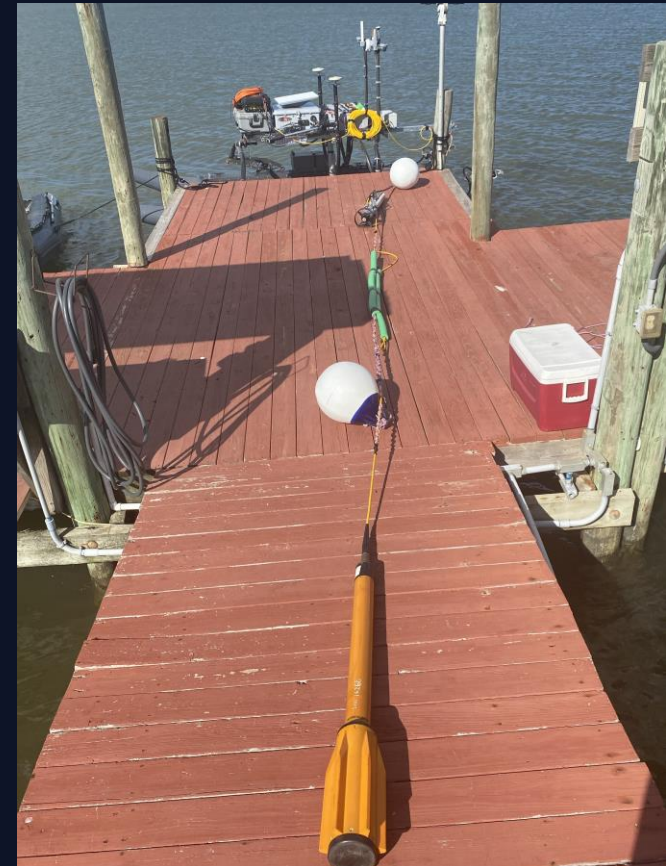
Baby Steps

- Mobilized to be onsite instead of being in ROC to ease client into operations.



Mobilization

- Project house with a dock on the bay was chosen for ease of mobilization and calibrations.
- Buoys were used to aid in shallow water towing operations.



Mobilization



Operations



Operations



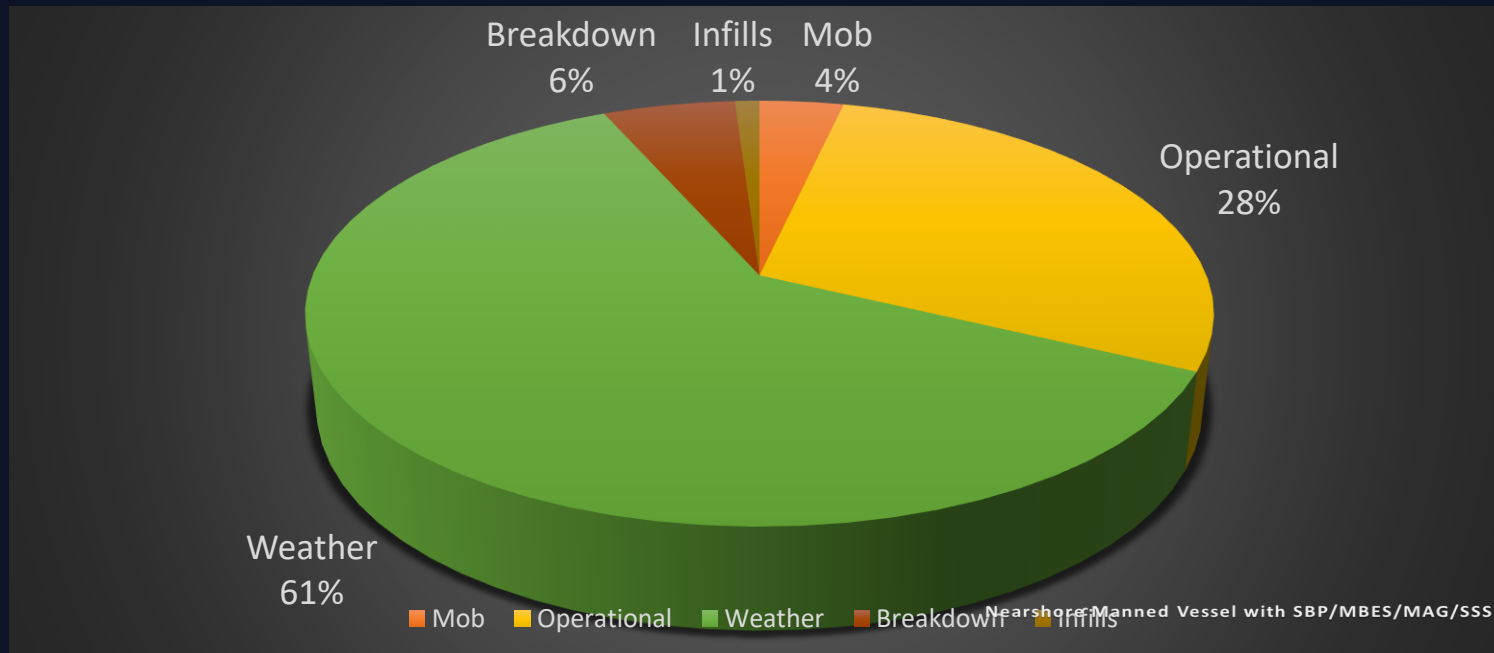
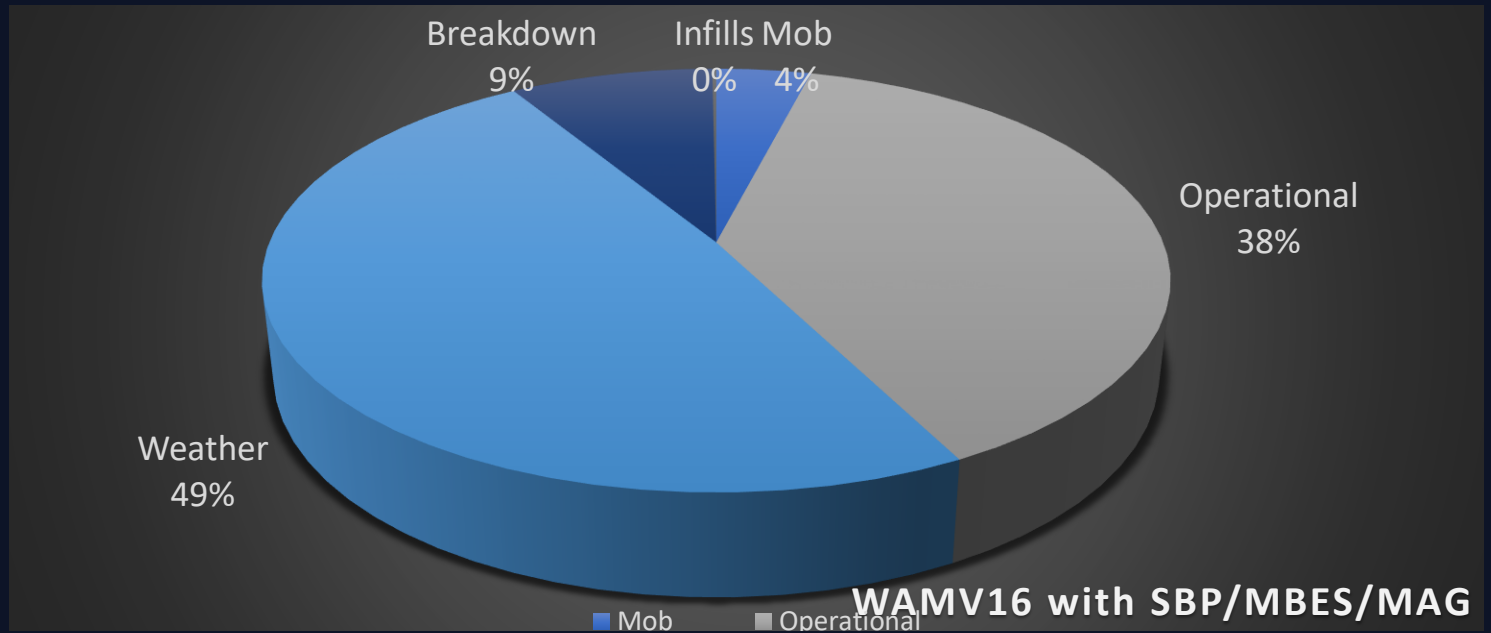
Operations

- Original survey plan: summer survey, beach launch, ~33 kms per day on average with weather.
- Actual Survey: October start, winter beach, so tow out (4 hour total), ~28 kms per day on average with weather improving to ~41 kms per day with weather improvement in Feb.
- Weather limits: vehicle never experience data loss due to weather able to work in 1-2 sec wave period at 1m, tow in/out dictated weather and stopped at 1.5 m or 25 knot winds.
- Vessel speeds between ~4 knots, battery life lasts the full survey day.
- Starlink, 4G, and radio communication for command and control and separate remote survey connection.



Performance

WAMV 16 Uncrewed Vehicle

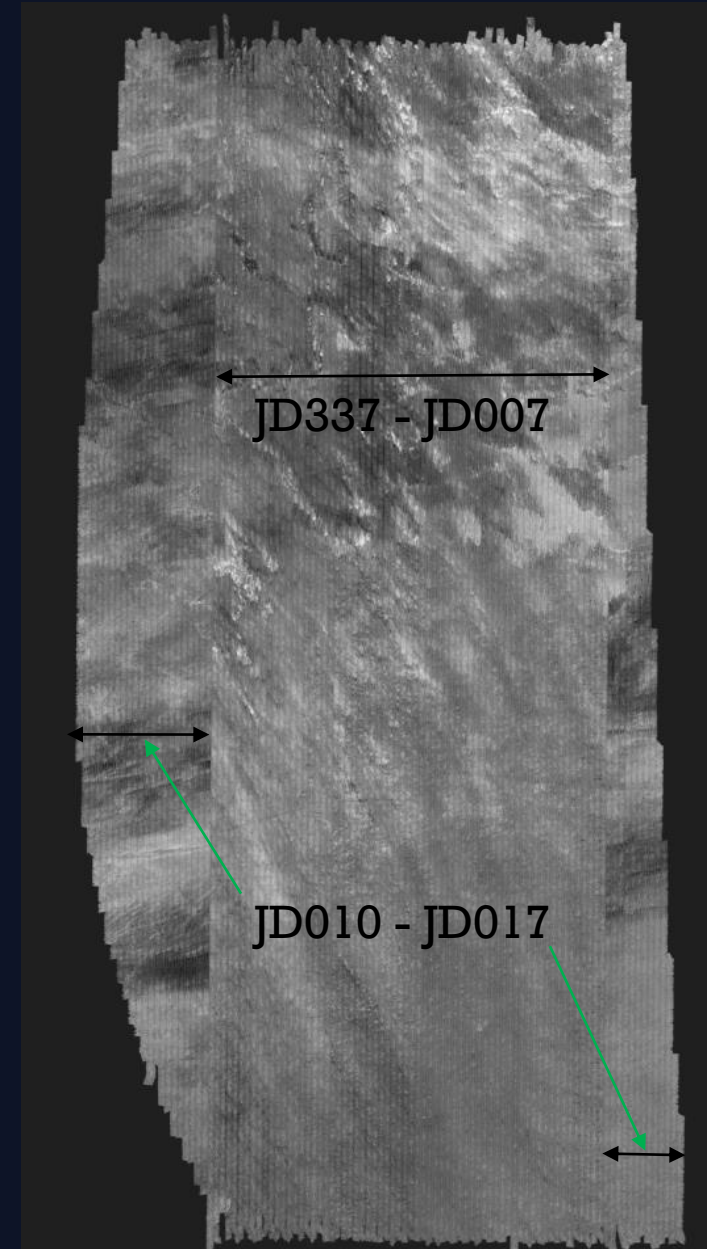


RV Yeti Manned Vessel



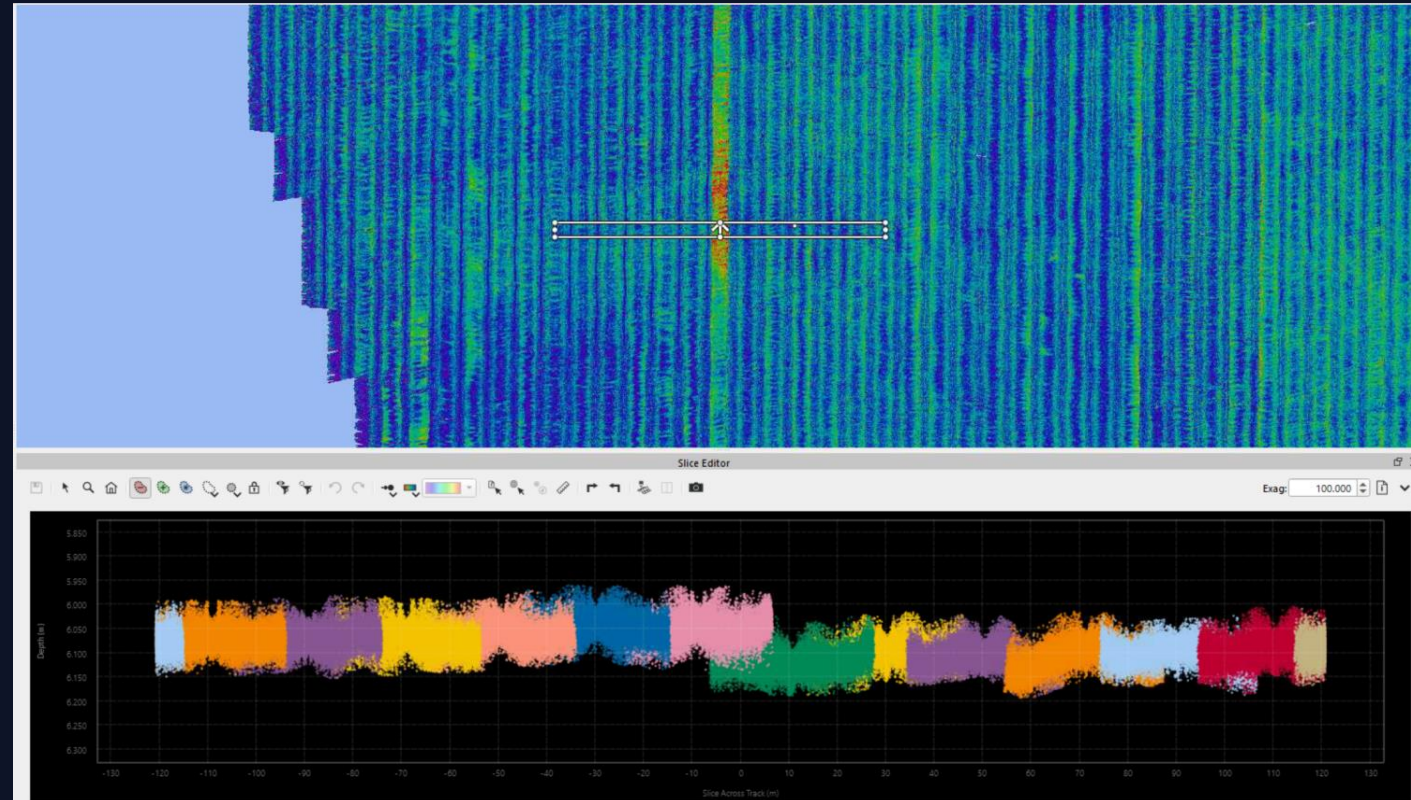
WAM-V Mid-shore Backscatter

- Acquisition of the Mid-shore zone started on JD337 part way along the area working eastwards.
- After JD007 there is a clear change in the backscatter.
- This is also observed when surveying comes back to finish the westernmost lines.
- Discontinuities are also seen in the MBES grid which match the backscatter anomalies.
- This can be explained by poor weather on JD008 and JD009 causing sediment transfer.

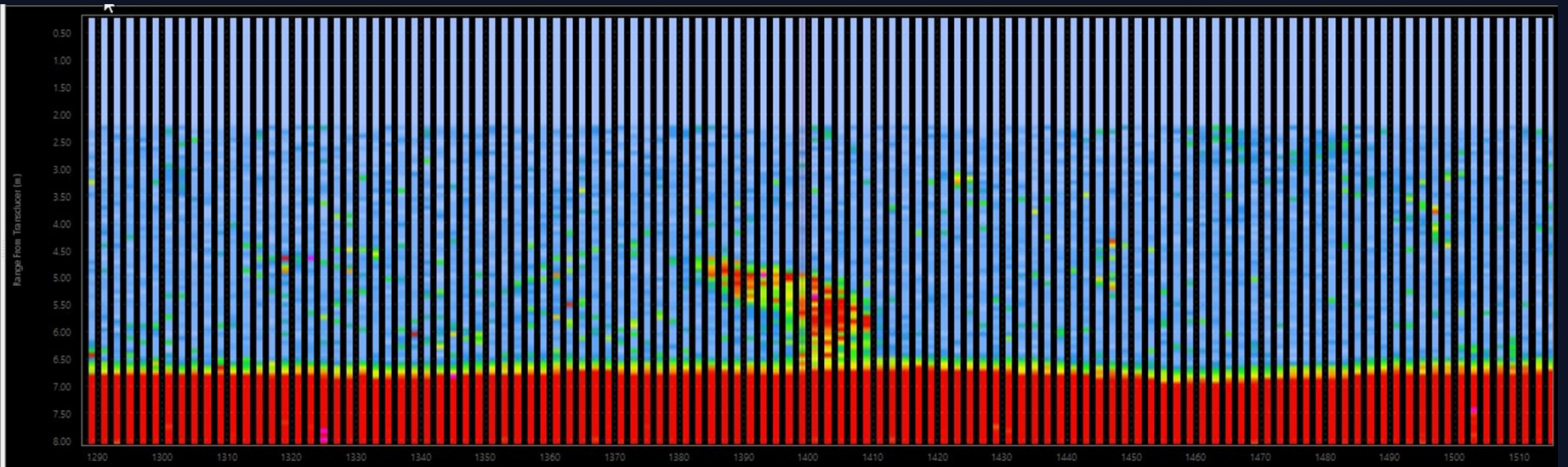
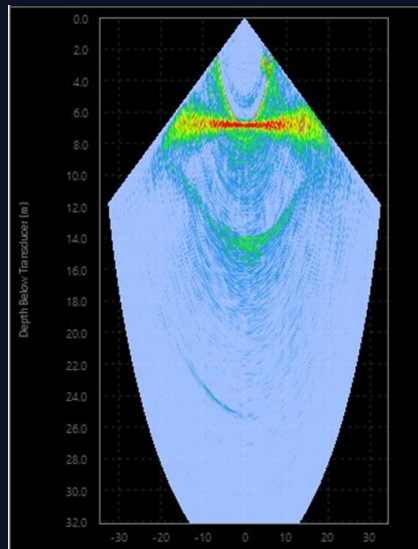
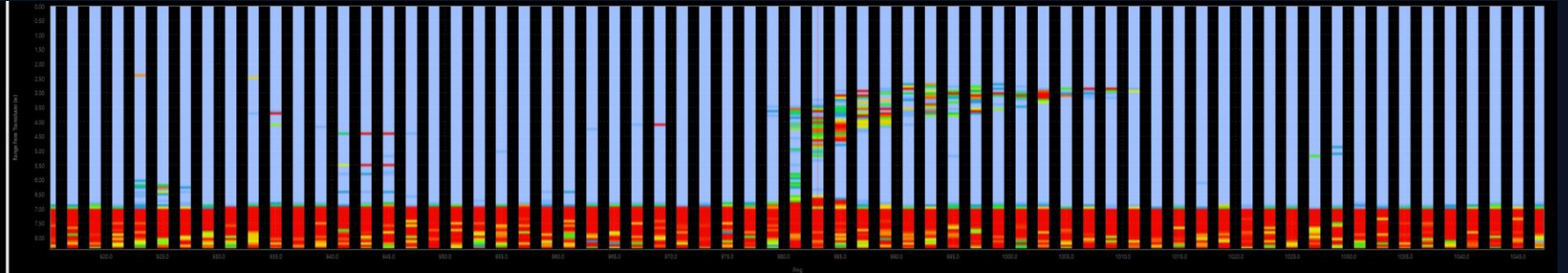
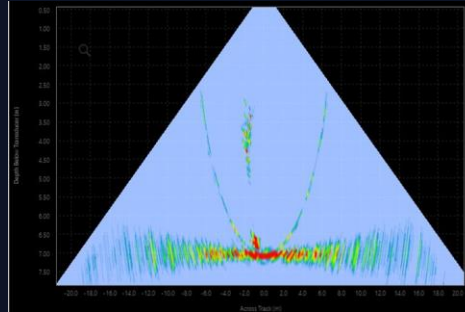


Sediment Mobility

- Correlation of bathymetry that shows significant sediment movement from storm event.
- Benefit in disguise, pictures aren't as pretty but we get a lot of information on the geologic and environmental processes in the area
- Also seen in the RV Yeti data offshore

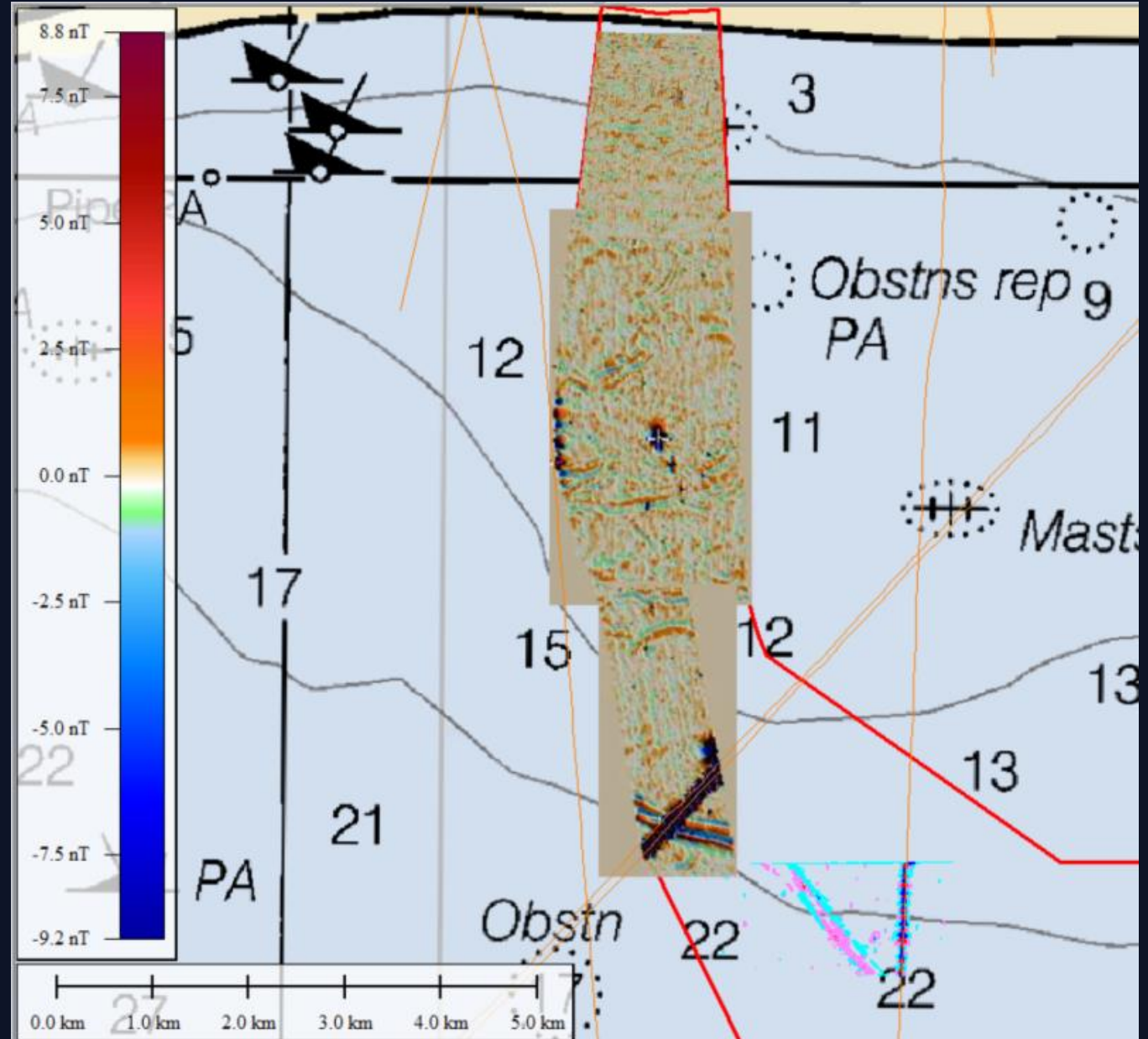


MBES Water Column Data



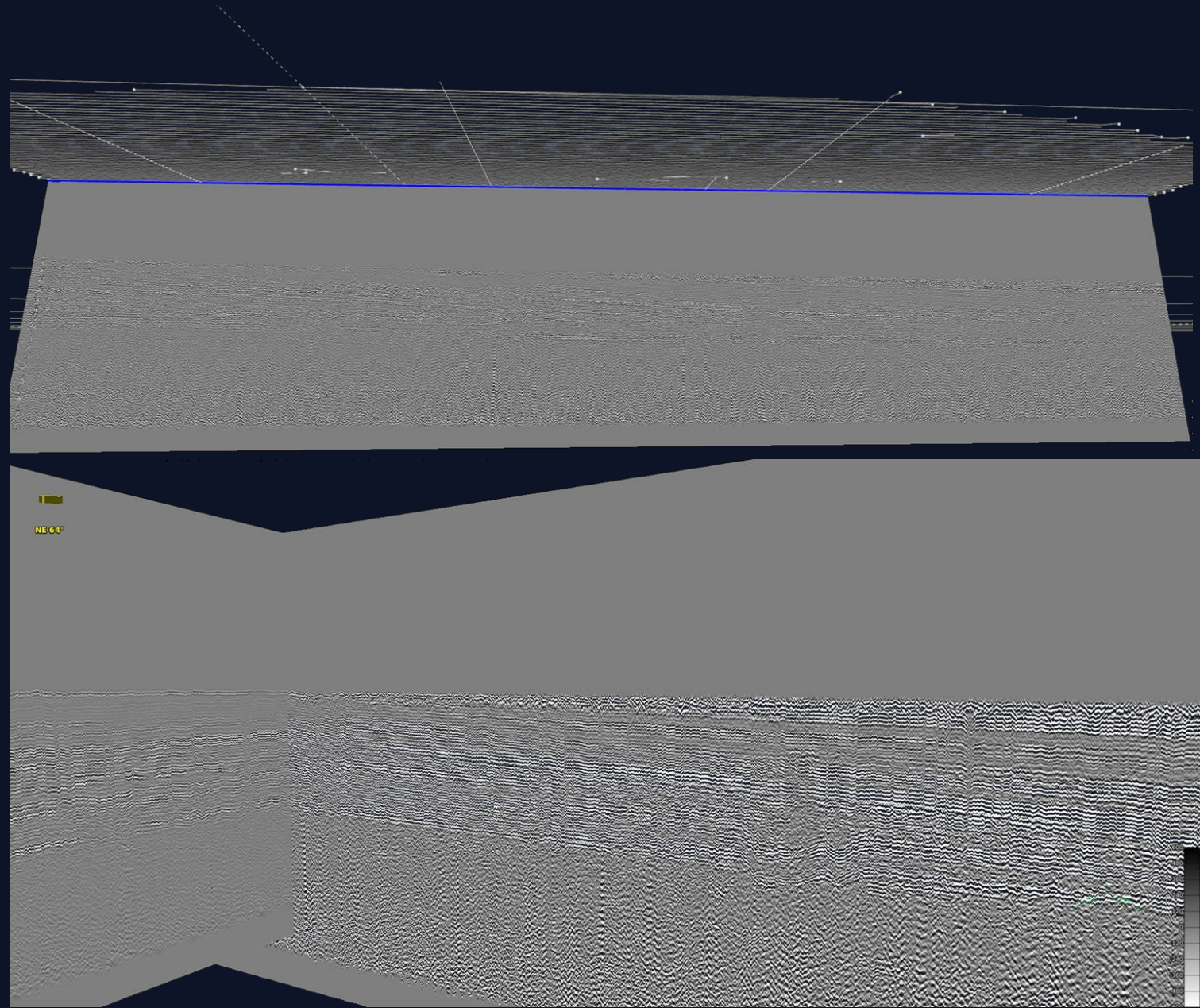
Magnetics

- Well heads and pipelines are easily seen.
- Charted shipwreck also found (150m from charted location).
- Very low noise in data allowed for low amplitude relic features to be seen. Relic channel cutting through clay layer seen in the magnetic data in both vessels data. Channel unable to be seen in SBP due to shallow gas.
- Faults seen on the site (and from previous seismic survey) also correlate to derivative magnetic grids.



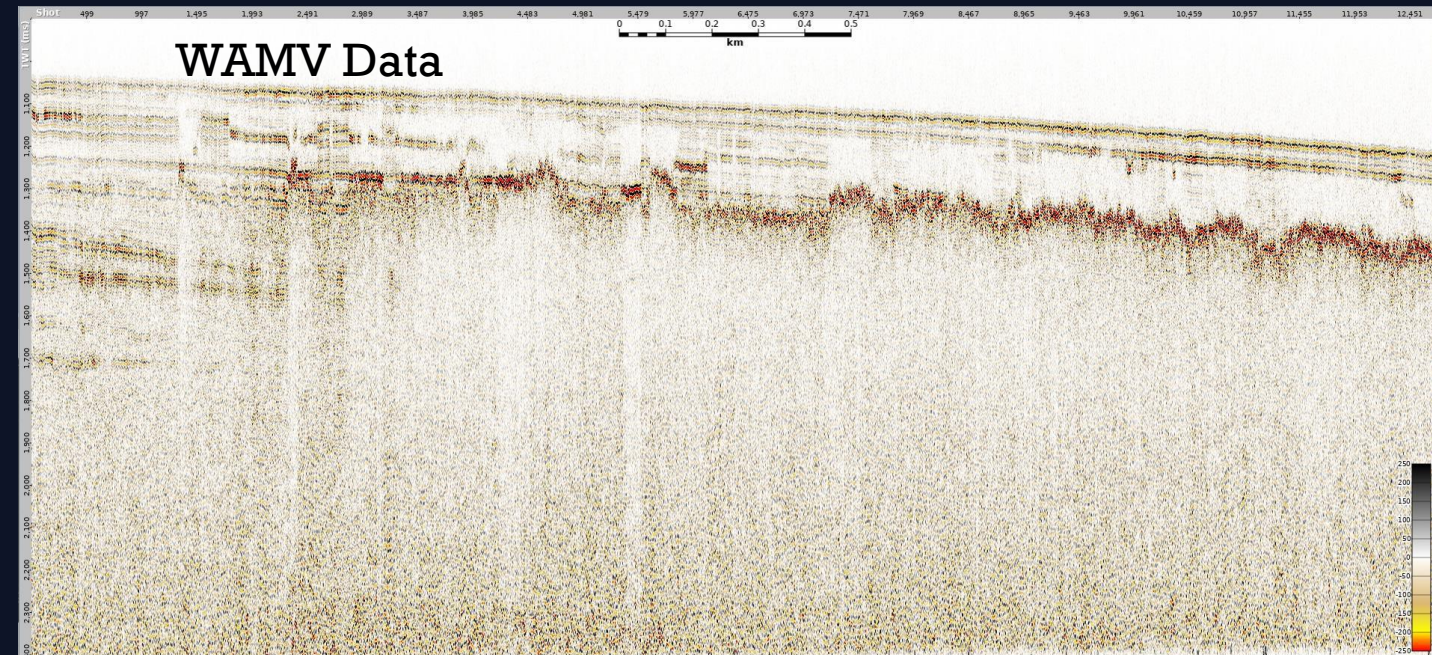
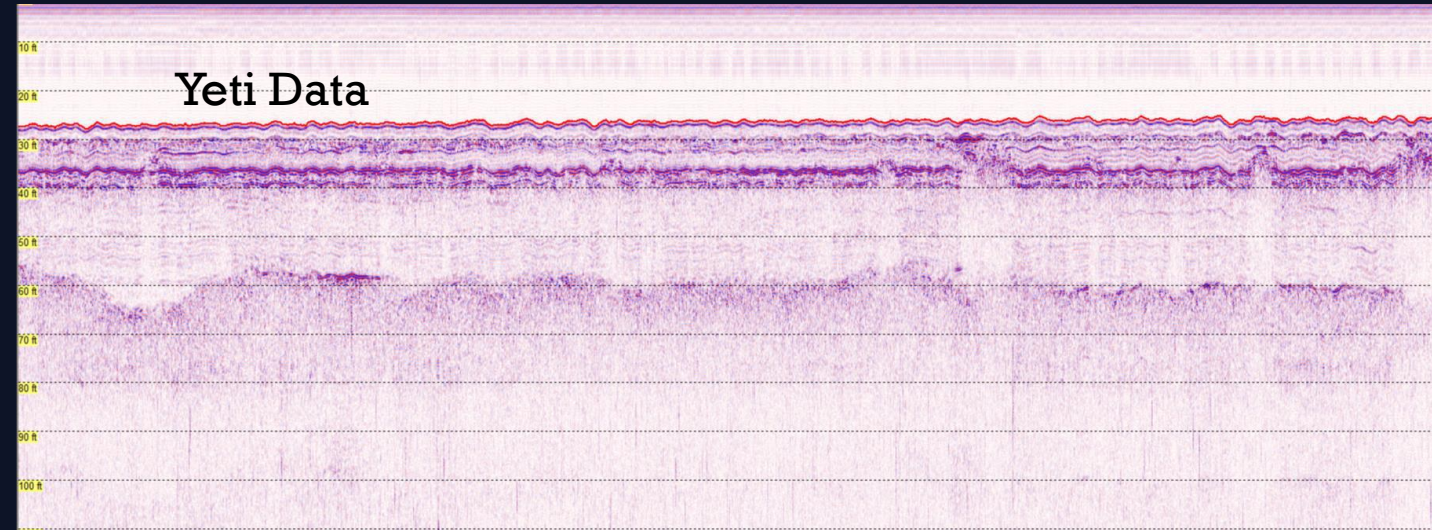
SBP

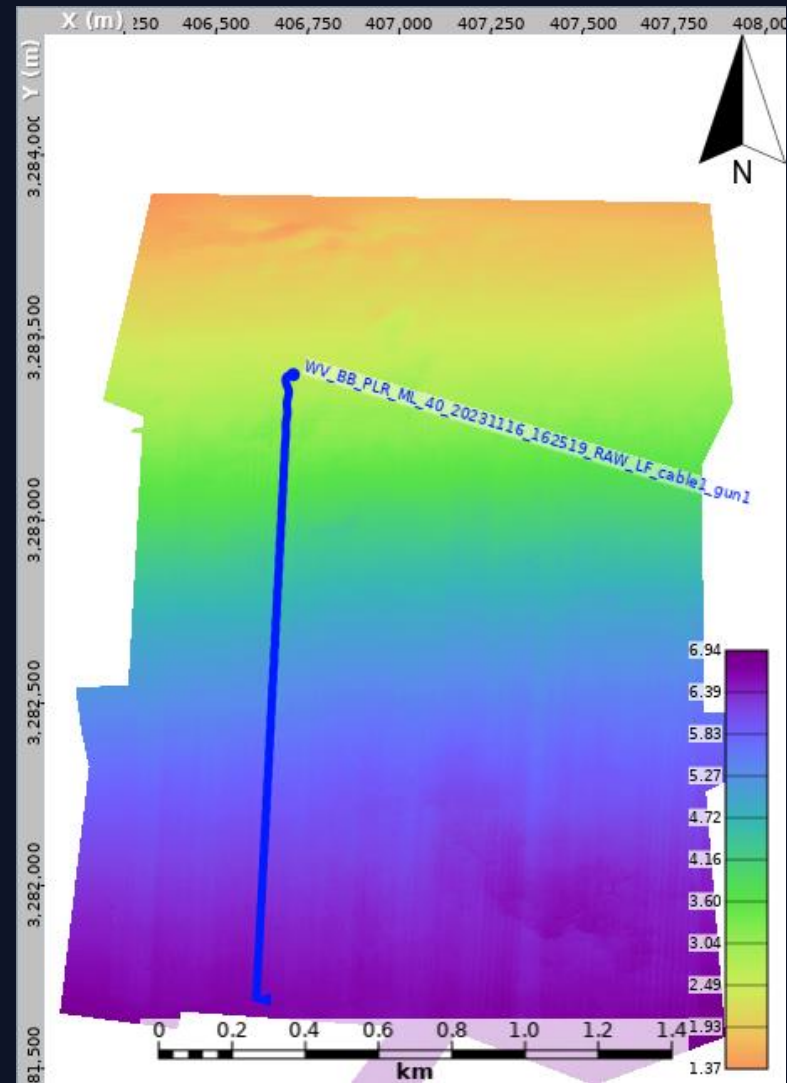
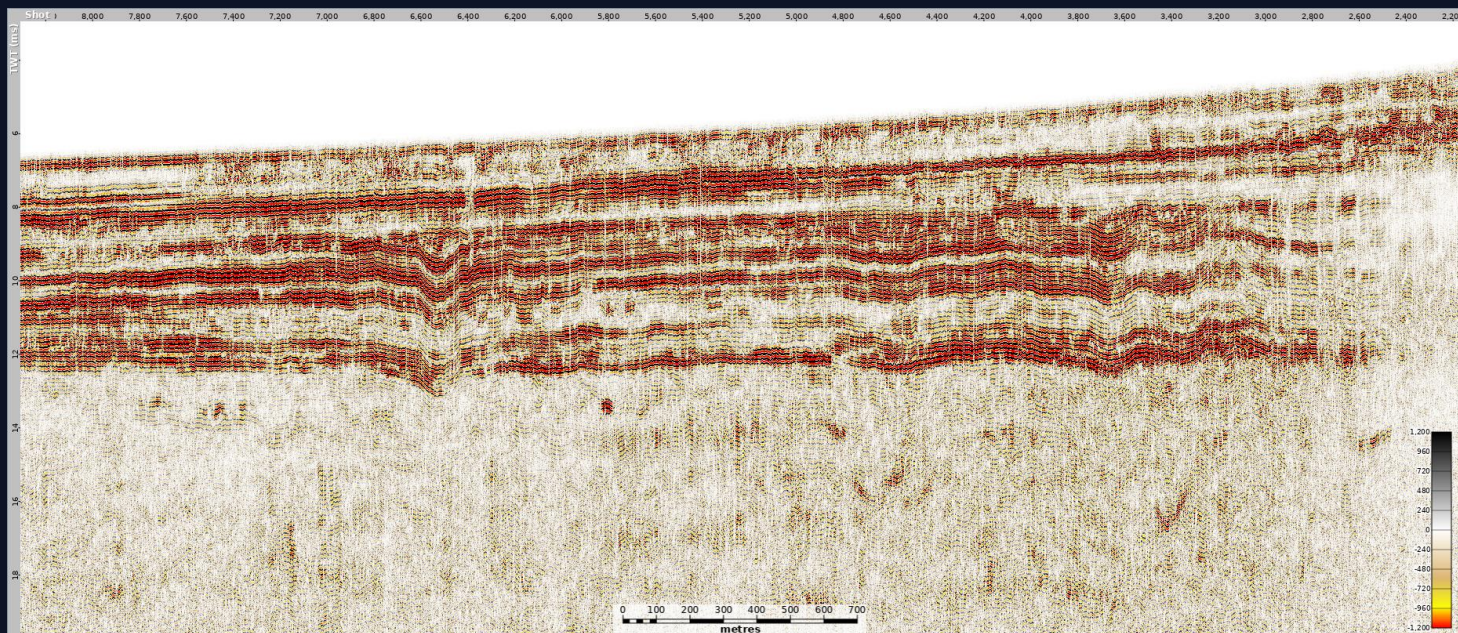
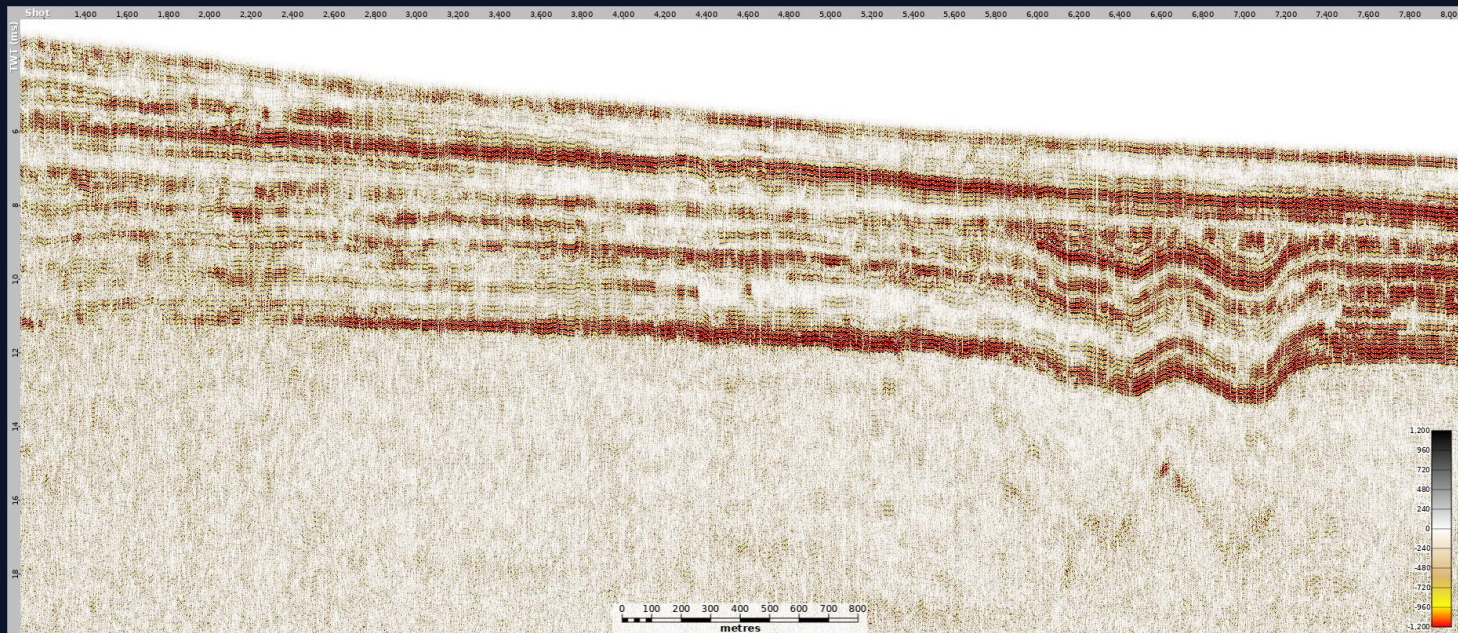
- 2-5 cm vertical resolution with very low noise.
- Good penetration even in 0.5m of water underneath SBP in a sandy environment.
- Innomar Compact used on WAMV and a EdgeTech 3400 used on Yeti. Both pole mounted.
- MBES WC anomalies are compared to SBP to try and correlate flow pathways.



SBP

- Shallow gas front is extensive across the site, but so far does appear to be contained by a boundary layer.
- The same reference grid was ran by both vessels to ensure correlation was possible between the two SBP responses.
- Shallow gas is seen in higher and higher quantities as we move further offshore.





Thanks to the crew and processors that made the project a success!



