

UK HYDRO 2025

Low frequency SAS imaging and bathymetry with correlative multibeam soundings for seafloor and sub-seabed mapping

Author & Presenter

Kevin Rychert – *Principal Acoustic Scientist*



Outline

- Systems overview
- Case 1: Imagery from multi-physics survey approach for UXO
- Case 2: Cable Depth of Burial (DOB) Surveys
 - Bottom detection from 3D SAS, motivation and method
 - Comparison imagery
 - New application



System Overview

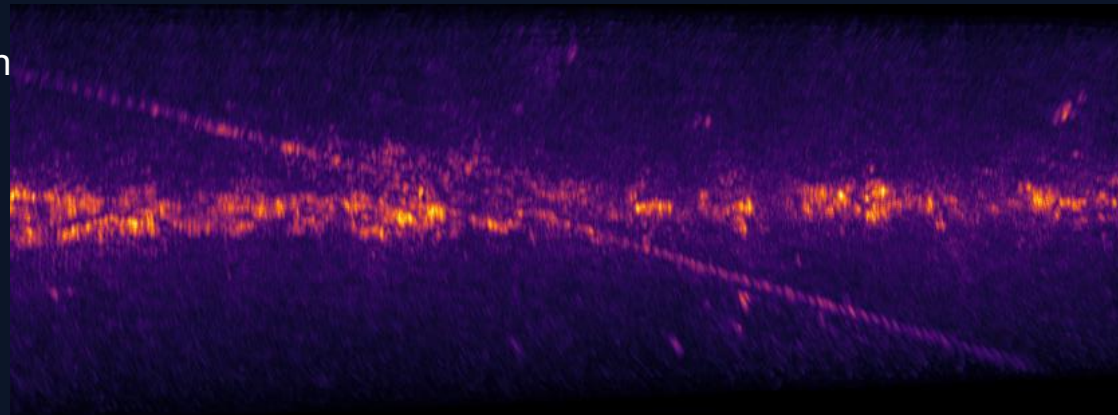
Integrating technologies, hardware, and software from Sulmara, EdgeTech, Sonardyne, Geometrics & EIVA yields a single system capability called Discover.

Advanced sub-bottom imaging capability, combined with magnetometry, and a variety of other survey sensors.

High-resolution 3D acoustic data in real-time with penetration down to 15m+ below seabed and swath widths of ~4x WD

Benefits include:

- High-speed large area survey
- Real-time SAS processing and visualization
- Multi-platform capability
- Co-location with conventional sensors
- Lightweight, small footprint sensors



Deployment platforms

As a SAS-based system, Discover requires stability but is platform agnostic and currently operates on several vehicles.

Optimum flying height is 5m above seabed for maximum resolution



WAM-V16/22 USV



WROV



ROTV



AUV
(2026)



Example deployment suite, single pass survey

- Shipboard
 - MBES: high resolution seafloor mapping
 - Innomar medium parametric SBP
- Towed
 - EIVA Scanfish ROTV with Sulmara Discover
 - eBOSS: Subottom SAS imagery
 - Geometrics Magnetometers (MFAMS or G882)
 - Coupled Sonardyne DVL INS + USBL
 - EdgeTech Sidescan

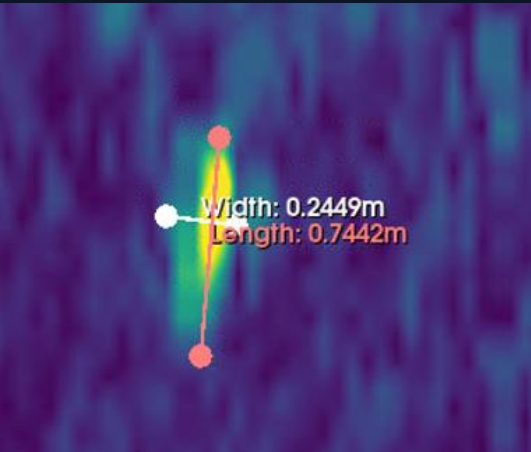
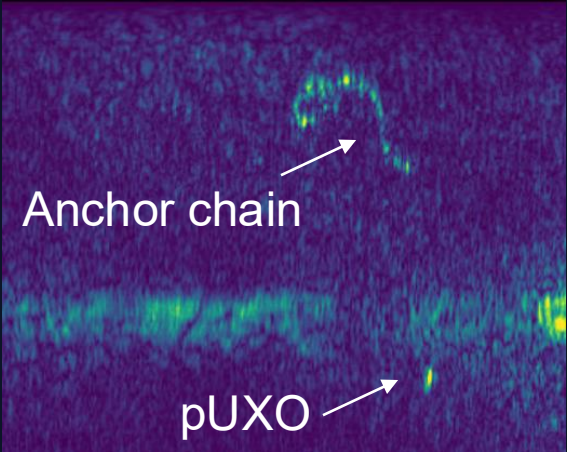
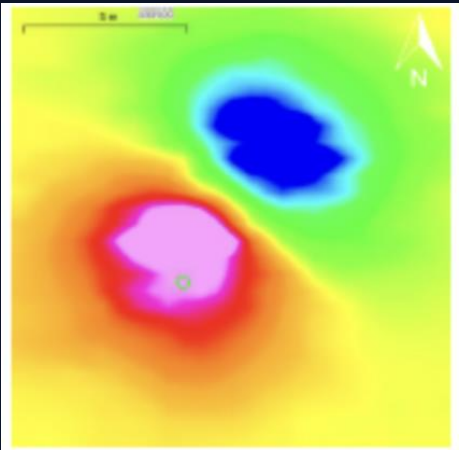
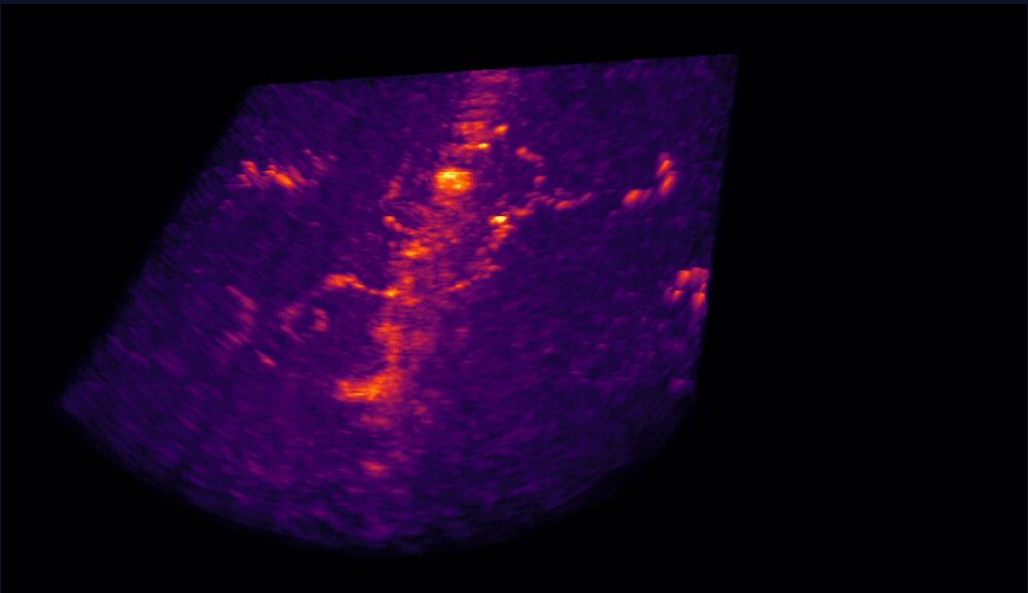


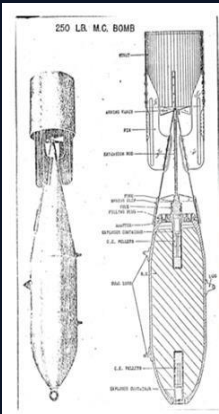
Ferrous UXO target discrimination

Buried objects Identified from co-located magnetometers, resolved acoustically at high resolution and speed, with an efficiently wide swath at the same time

Resolution and penetration allows for discrimination of target types and shapes

Wide swath allows capturing multiple targets in a single pass (20m wide in examples)

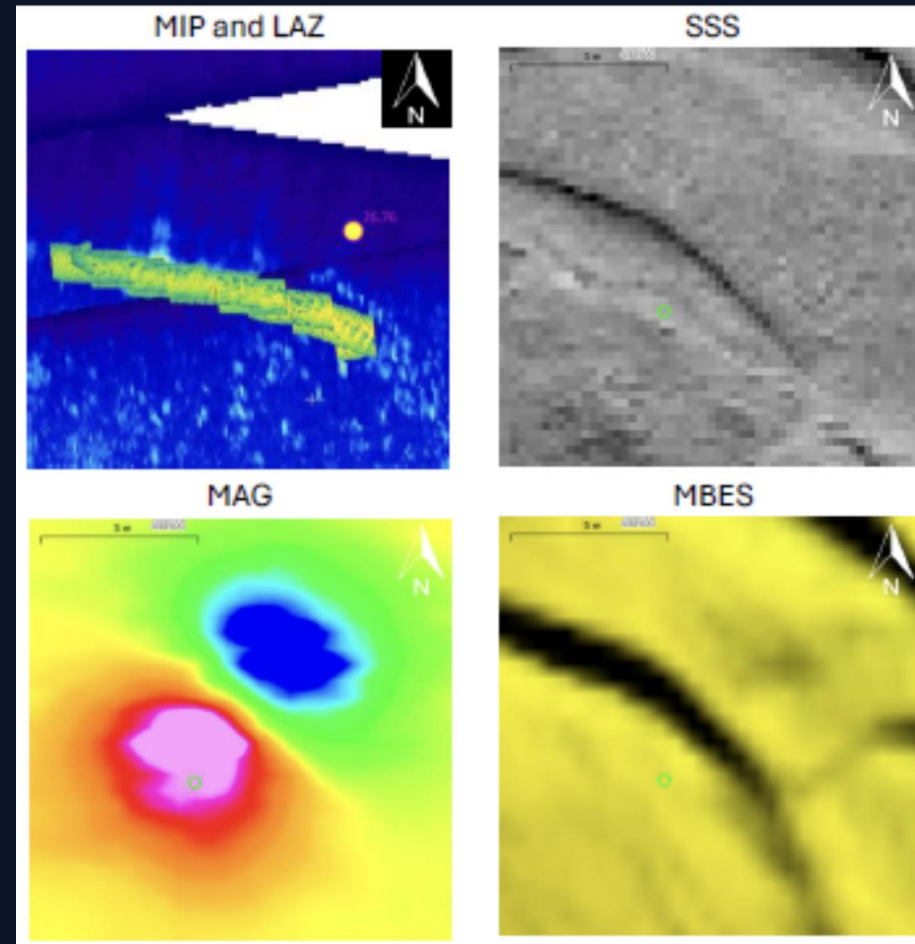
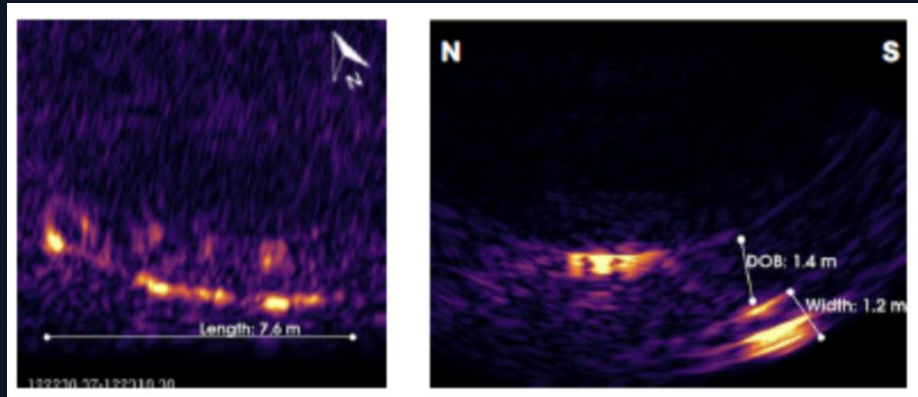


	Description
	Parallel sides with Ogive nose and slight rear taper, similar to US GP bomb. Single suspension lug on Mk 1 + 2 on Mk2
	Technical
	Type: Medium Capacity Bomb Weight: 102Kg Explosive Weight: 50Kg Explosive Fill: Amatol Fuze Type: Impact type Pistol Bomb Dimensions: 687.5 x 250mm Body Diameter: 250mm 1 x suspension lug Mk 1 (2 Mk 2) Pistol fitted to rear and possibly nose.



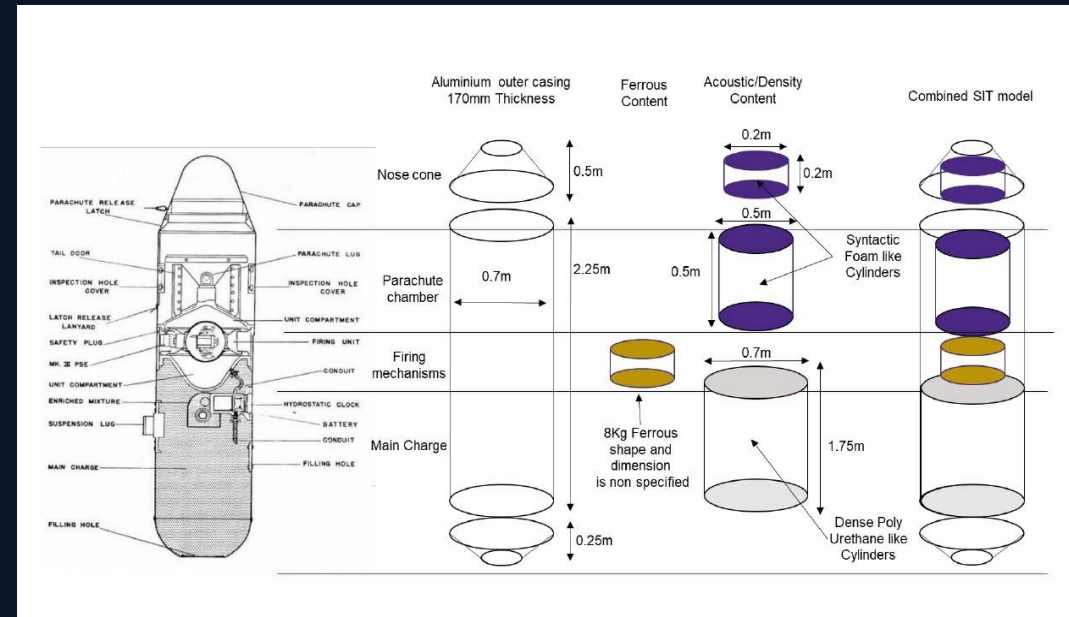
Multi-physics for target discrimination

- Linear chain debris target buried 1.4m below seabed
- Mag anomaly
- Not visible in sidescan or MBES
- Segmentation overlayed eBOSS MIP



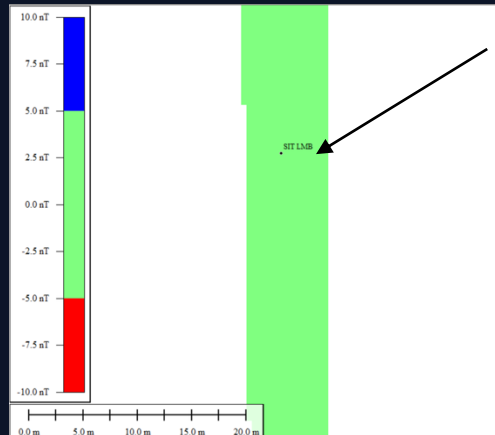
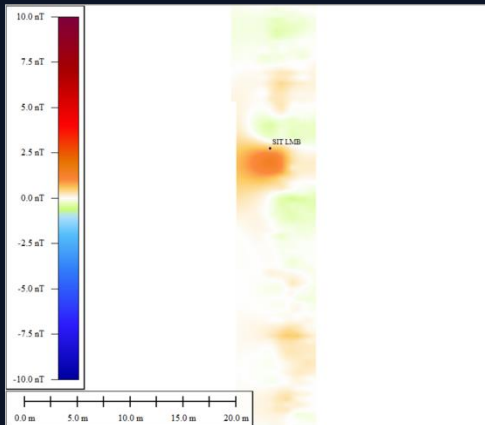
Non-ferrous, UXO Survey: Surrogate Item Target (SIT)

- Luftmine B (LMB)
- Aluminium shell (non-ferrous)
- 8kg steel core (ferrous)
- Syntactic foam cylinders
- Low magnetic signature

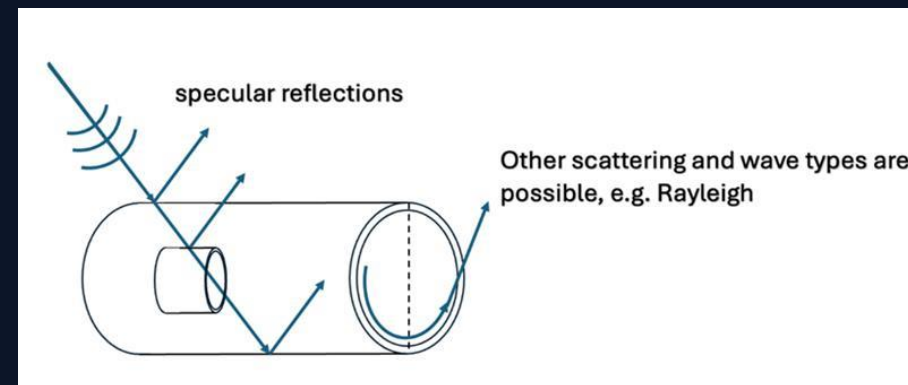
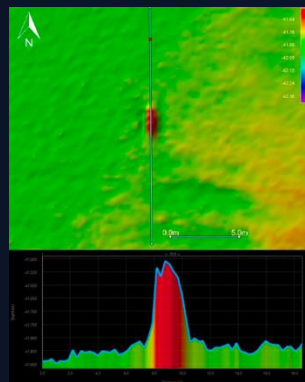
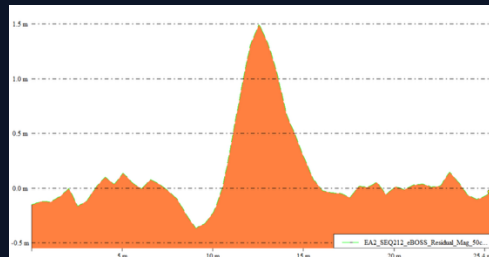
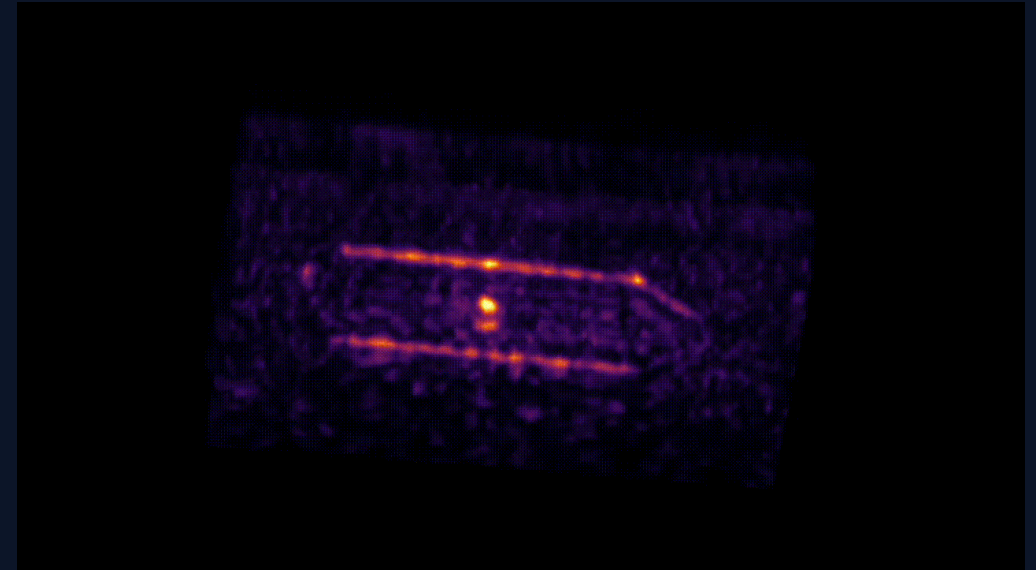


Application, UXO Survey, SIT

- $<2\text{nT}$ signal, barely over background
- Observed in MBES and eBOSS
- Multiphysics approach mitigates risk for ALARP survey

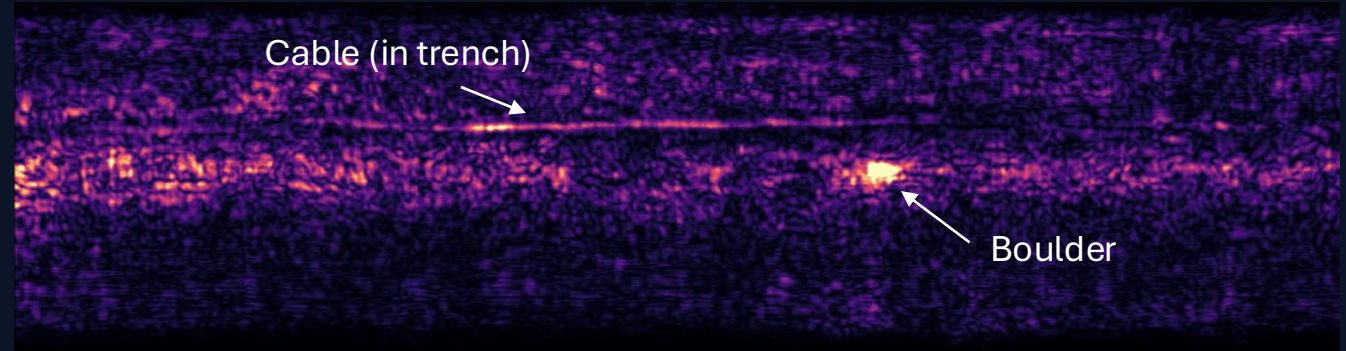


clears typical
5nT screening

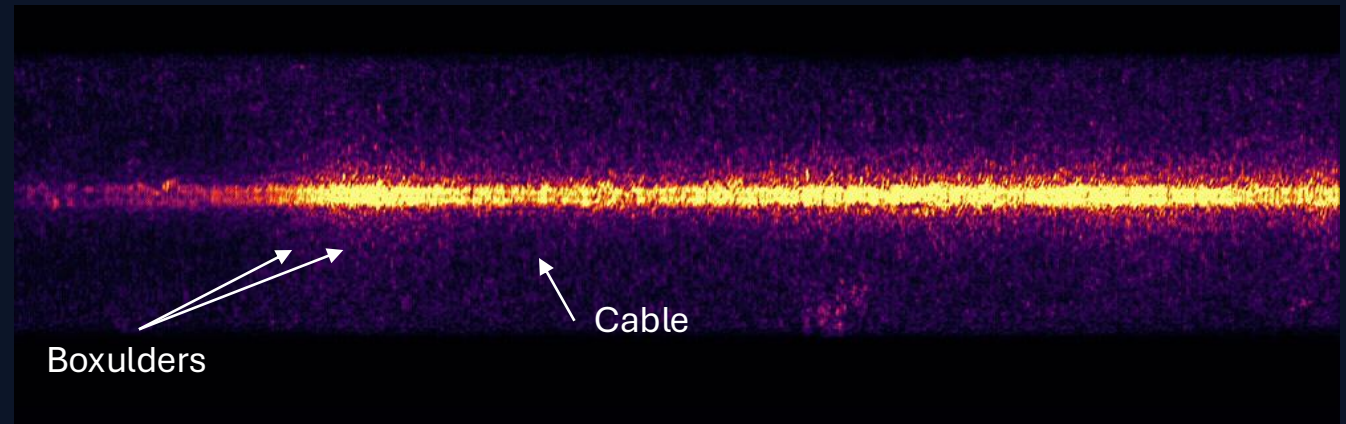


DOB Survey: multi-platform

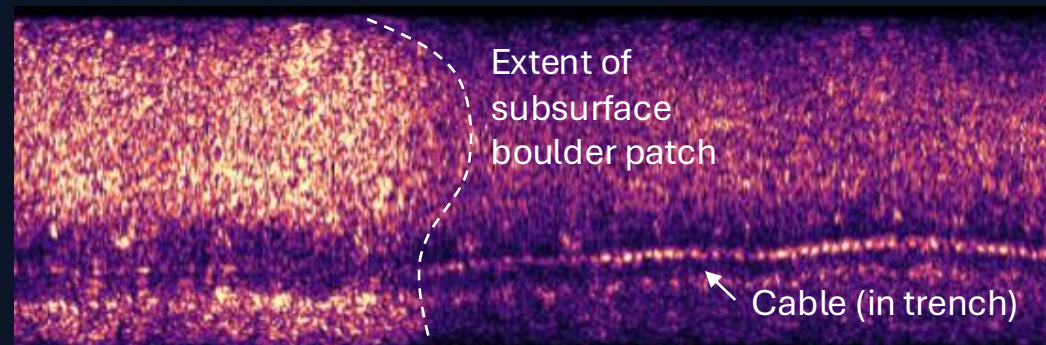
USV: 16cm fluid-filled umbilical, 1-8mWD



ROTV: 15cm inter-array cable amidst boulders

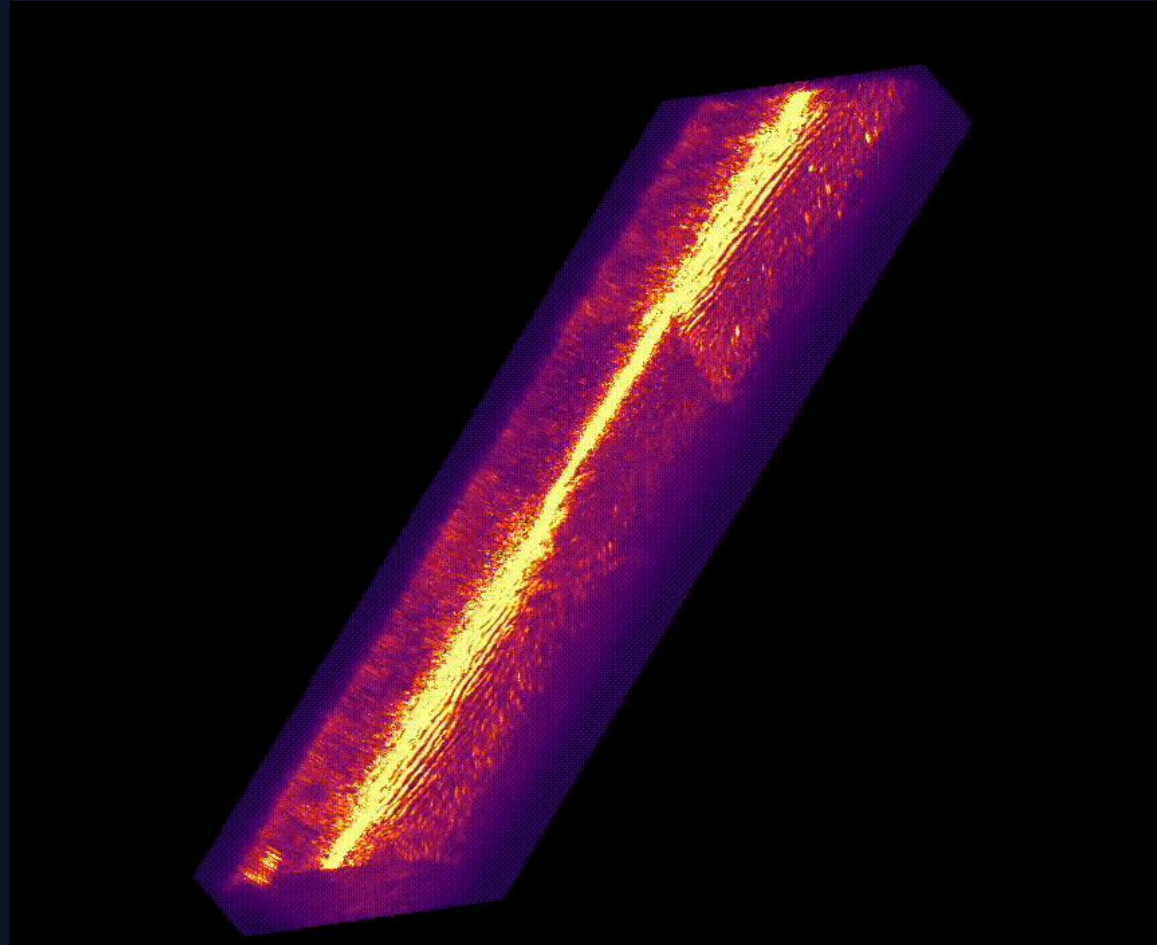


WROV: 20cm triple core export cable trenched through boulder fields



New cable scope, 0.1m bathymetry and DOB of cable

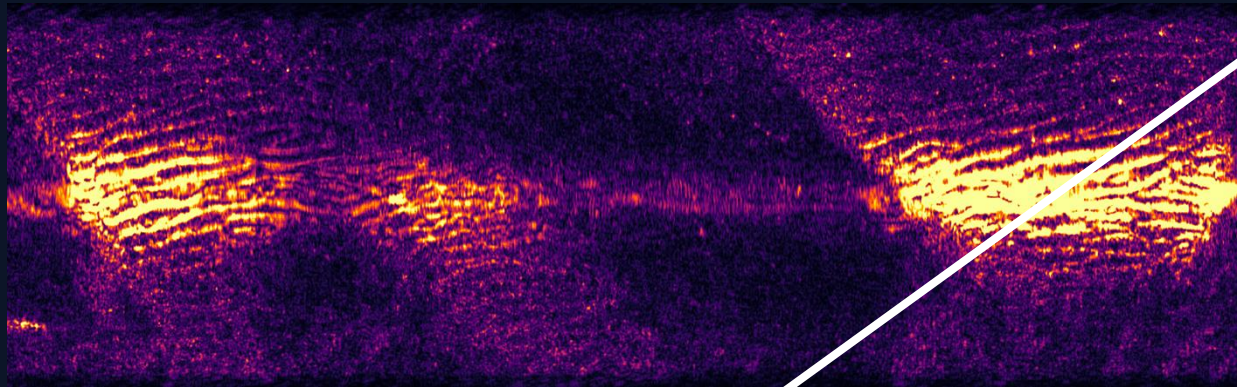
- Client requirements drive us to run MBES on ROTV and Discover derive high density/resolution MBES not achievable from the surface as well as DOB.



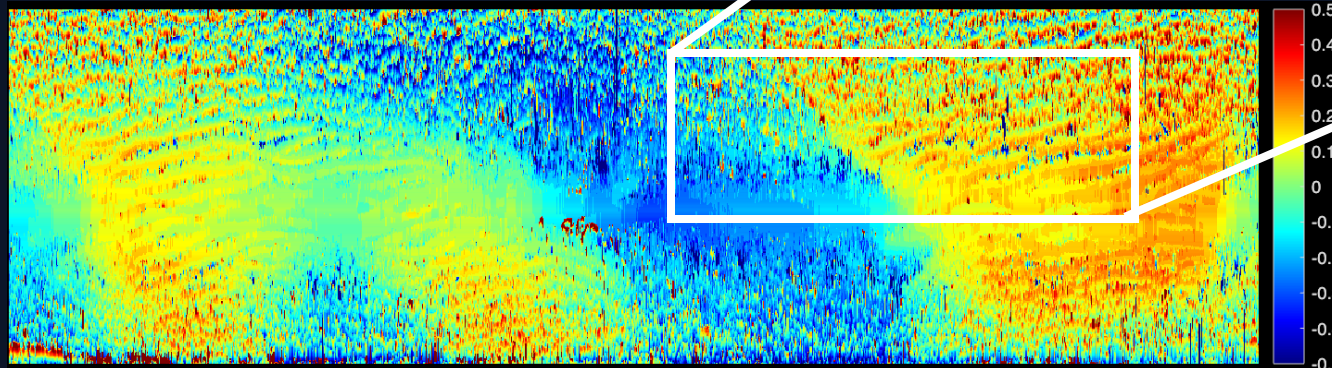
Initial bottom detection tests

- MBES typically used for high resolution surface detections for
- While full surface bottom mapping may not be possible from LF-SAS for charting purposes
- LF-SAS can provide high resolution data for target detection/clearance and cable depth of cover
- Accomplish ROV scope with ROTV

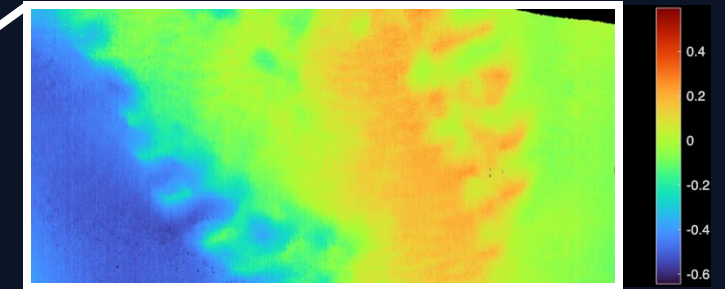
Intensity image of
depth at seabed
surface



LF-SAS derived
bottom detection
algorithm for
bathymetry



MBES



Summary

- Sensor suite and multiphysics approach increases operation efficiency
- Provides higher confidence in to remote sensing interpretation
- Application dependent deployment allows tuning for the most suitable method
- Typical DOB scopes were WROV surveys
- New application employing ROTV suggests this can complete scope at 10x higher speed and lower costs
- Continue to optimize algorithm and survey characteristics

