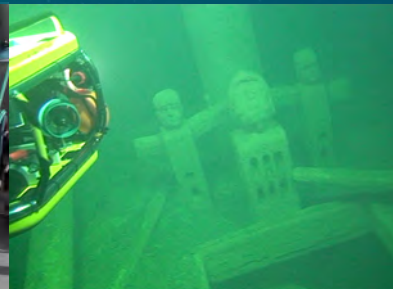
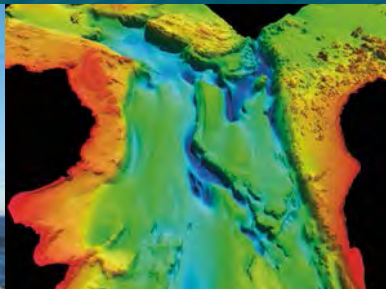
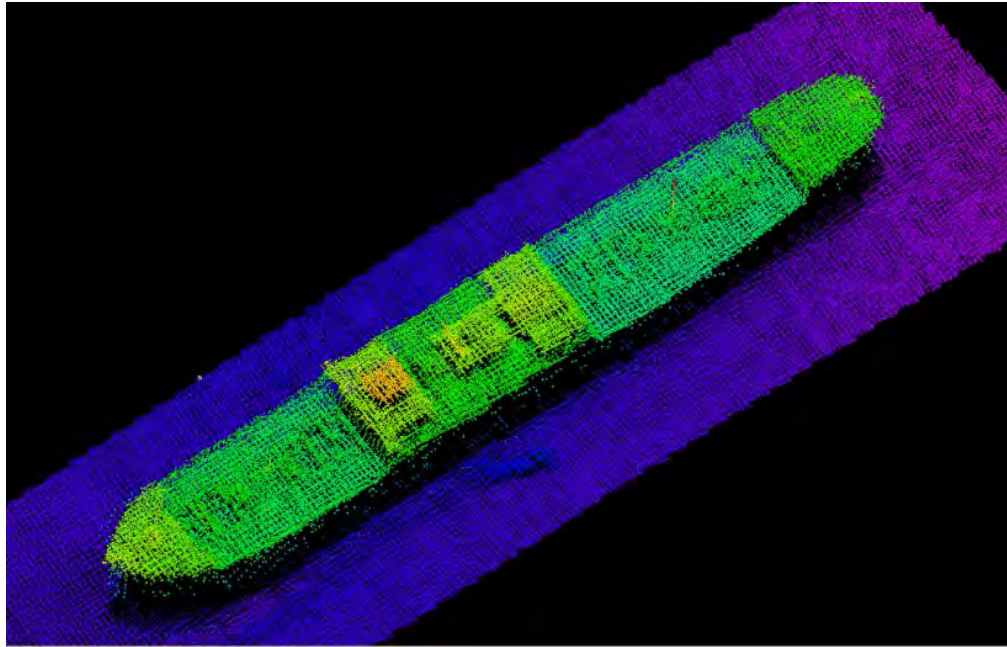




MMT | EM2040 experience



MMT | MBES Experience



Wreck in the Baltic with EM2040D in 400 kHz mode
Water depth: 75 meter Length: 102 meter

Acknowledgements



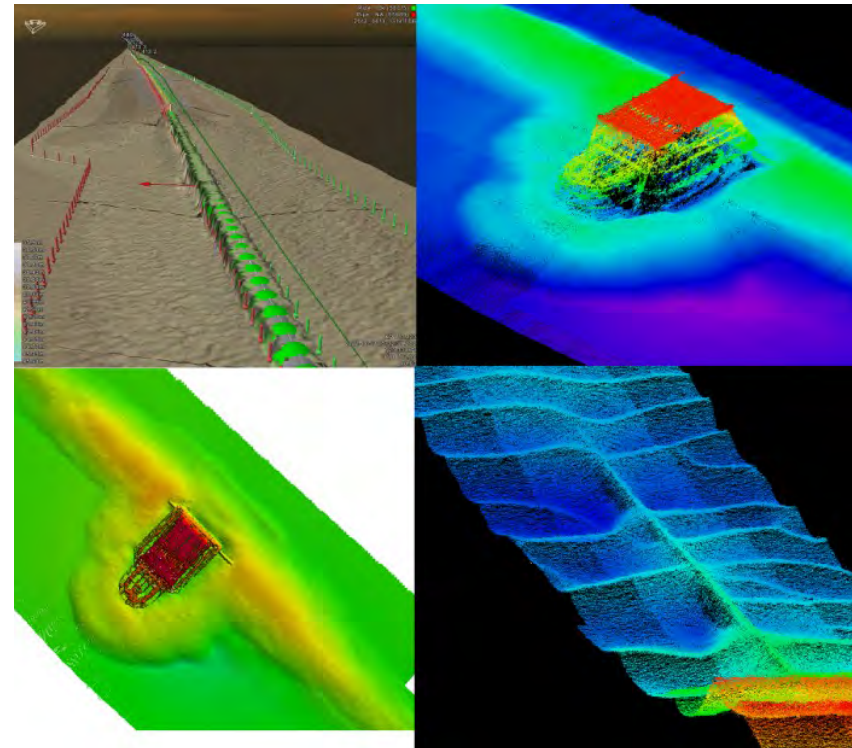
Martin Wikmar
Operation & Technical Director
Martin.Wikmar@mmt.se



MMT | MBES Experience

Contents:

- System
- Setup
- Types
 - Hydrographical Mapping
 - Pipeline Inspection
 - Object Detection
- Support
- Conclusion



EM2040D in 400 kHz mode



Company Profile

- High Resolution Seabed Mapping, Pipeline, Geophysical and Geotechnical Surveying
- MMT Sweden founded in 1976
- MMT UK (NetSurvey) founded in 2002
- Offices in Gothenburg, Sweden & Banbury, UK
- Privately owned
- 200 specialists
- 8 vessels
- 4 ROVs
- 2 ROTV

MMT | MBES Experience

14 MBES systems:

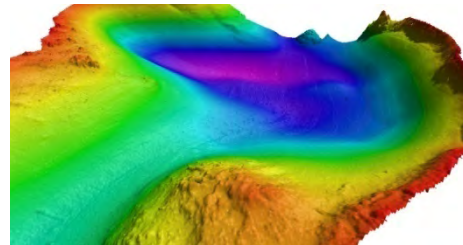
- 3 - EM2040 Dual Head
- 1 - EM710
- 4 - EM3002 Dual Head
- 1 - EM1002
- 3 - 7125 Dual Head
- 2 - 2024 Dual Head



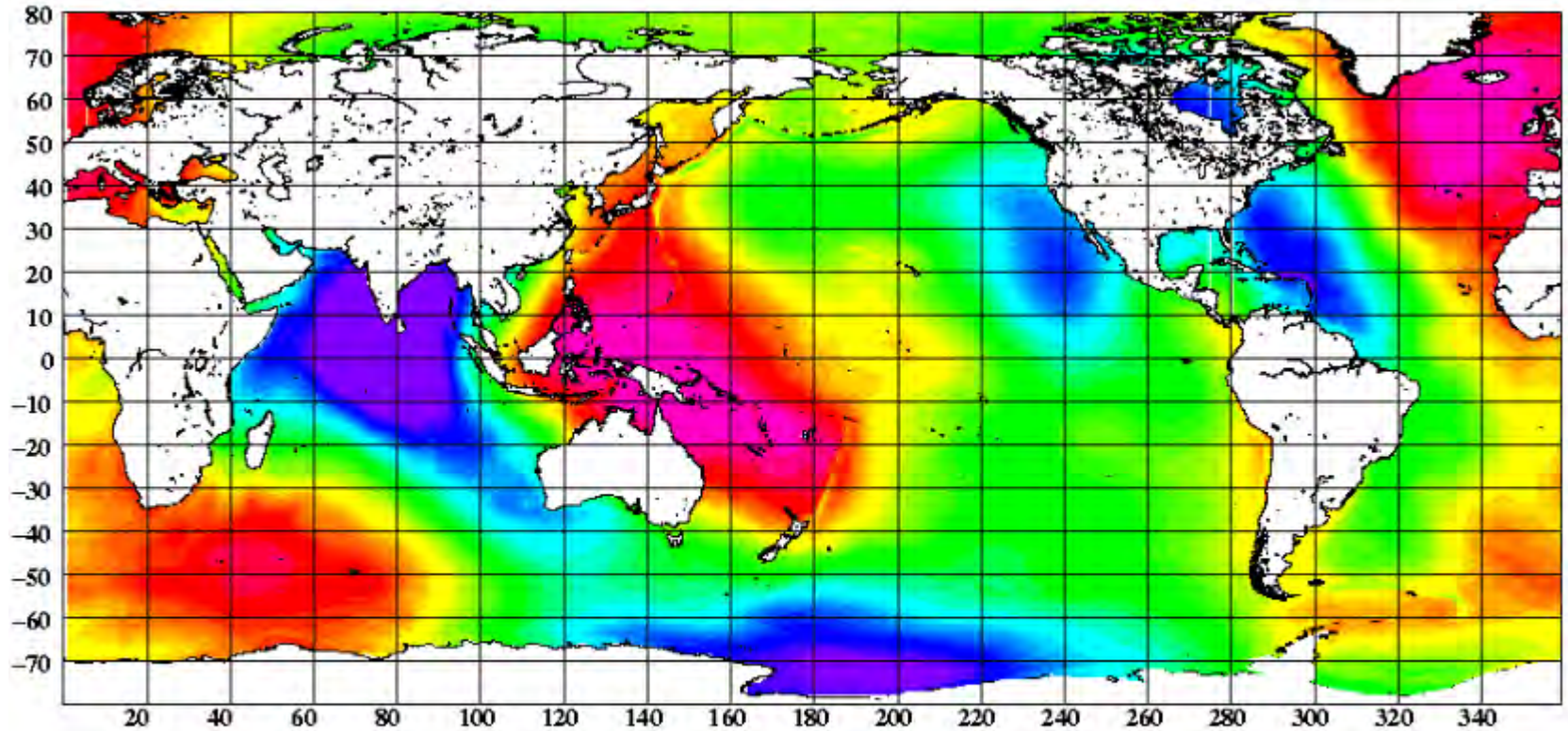
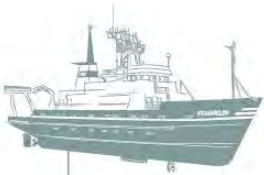
MMT | MBES Experience

Misc Equipment:

- Applanix POSMV 320 Positioning & INS
- CNAV corrections (10 cm RMS)
- Valeport
 - Tidegauges
 - Sound Velocity Probes
- Trimble for leveling and GNSS checks
- CARIS & Fledermaus
- Applanix PosPac



MMT | DTU 10 Model



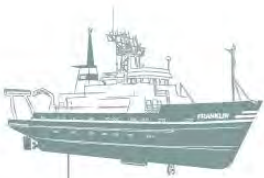
-60.0



60.0 m



MMT | MBES Experience



Liikennevirasto

Finnish
Transport
Agency



Large Scale Mapping



MMT | EM2040D Performance

Figure 7 Different bottom types, Cold ocean water, $\alpha = 44.3$ dB/km, Dual RX

@100 Depth(m)

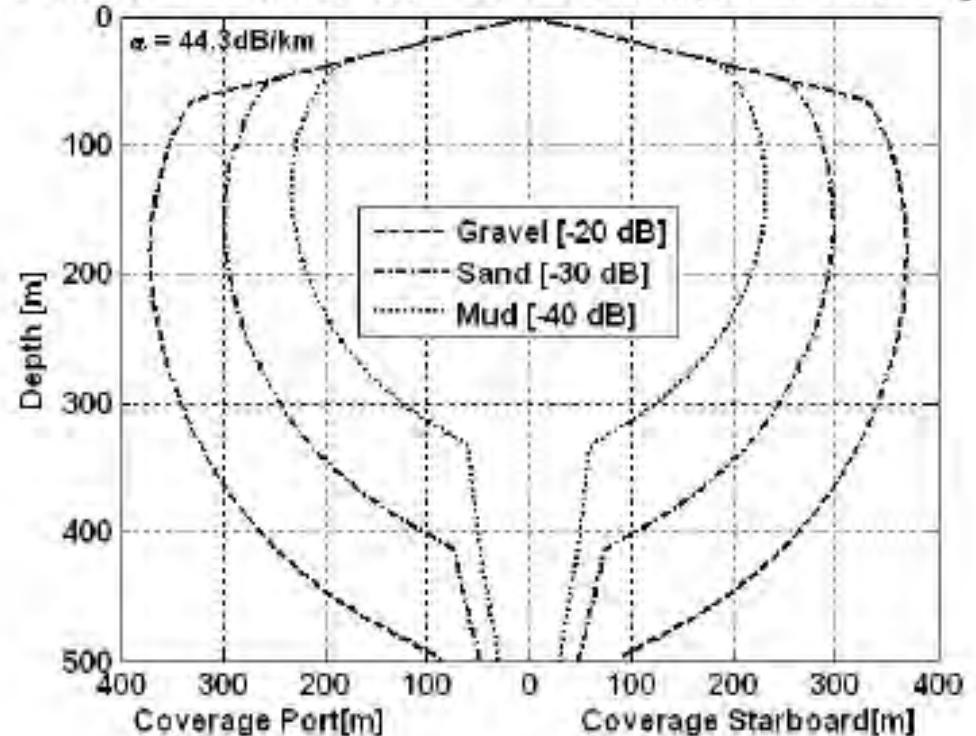
Gravel

700 meter coverage

Mud

450 meter coverage

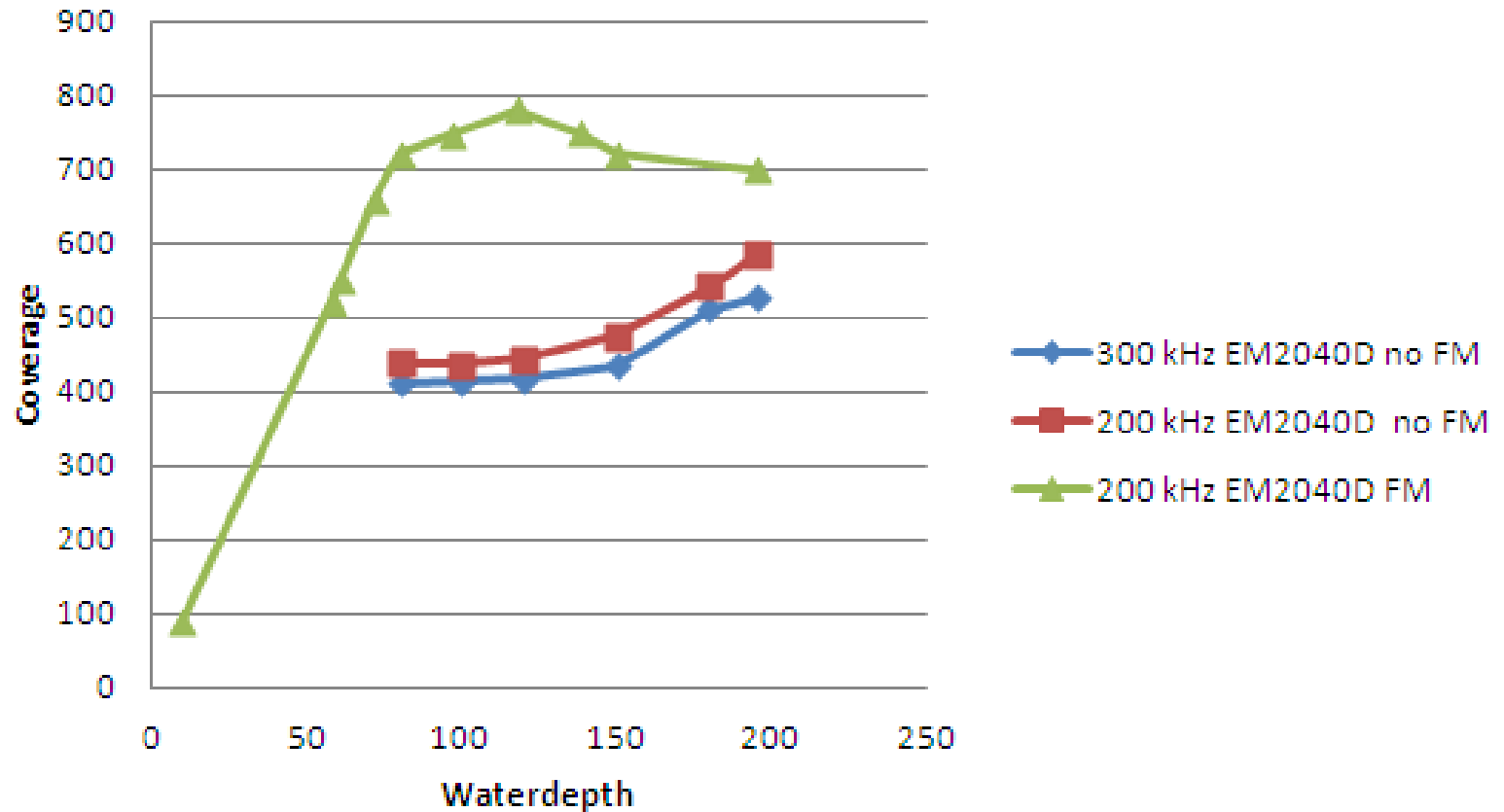
EM 2040, 200 kHz, Cold ocean water, NL=50 dB, Dual RX 0.5°/1 degree



MMT | EM2040D Performance



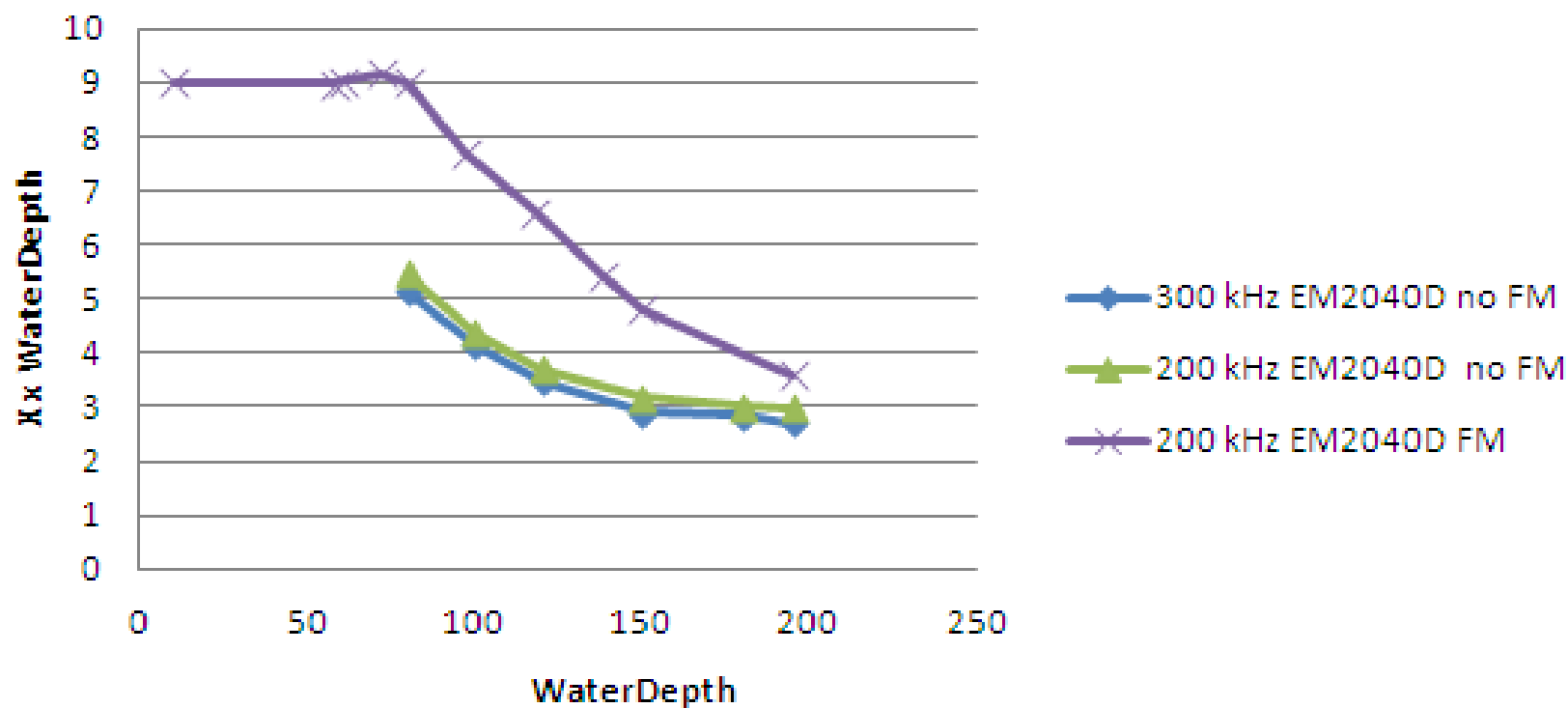
EM2040D





MMT | EM2040D Performance

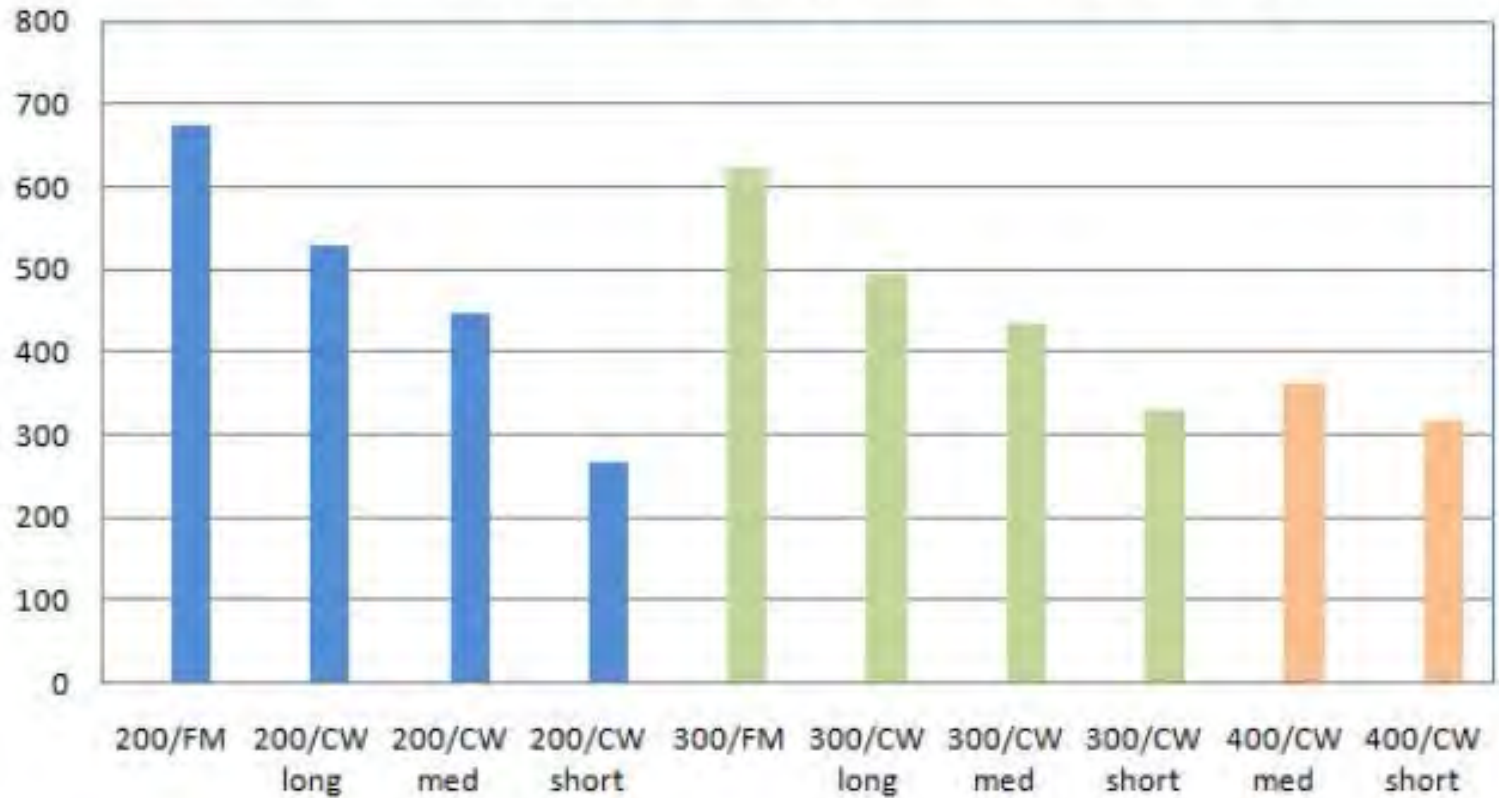
EM2040D



MMT | EM2040D performance



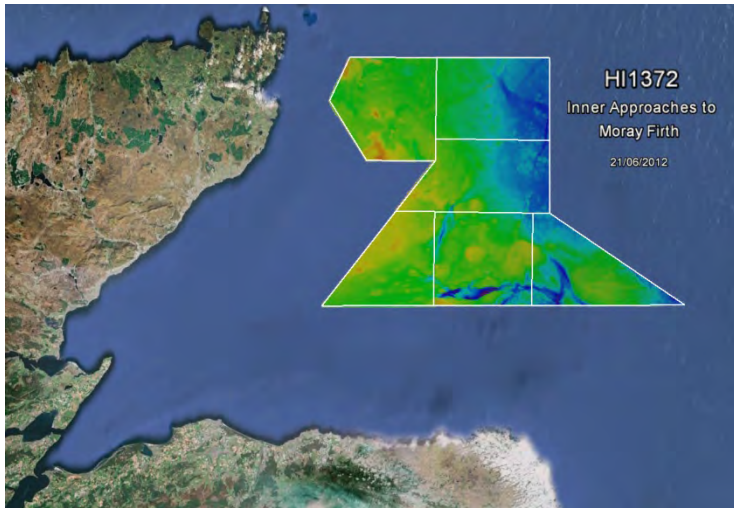
Swath Width, 76 degrees, 112 m water depth



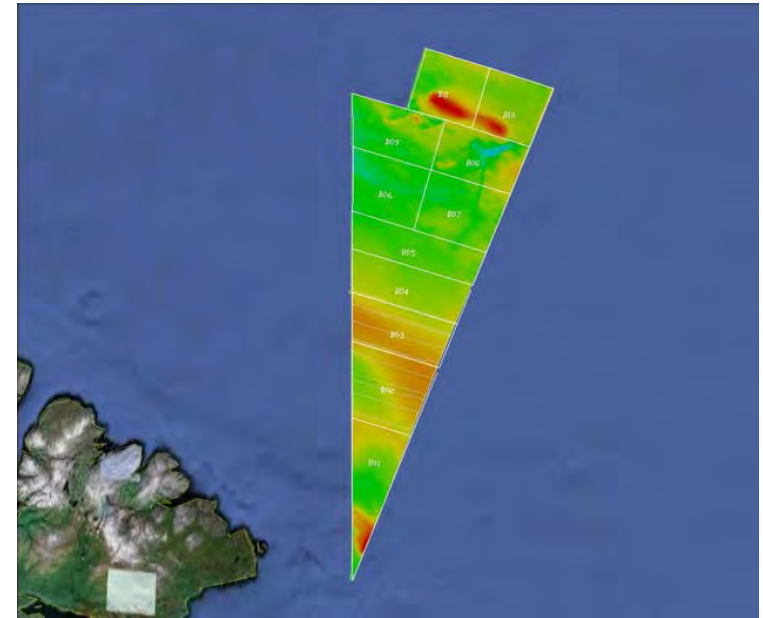
MMT | Large Scale Mapping

Two types of SoW:

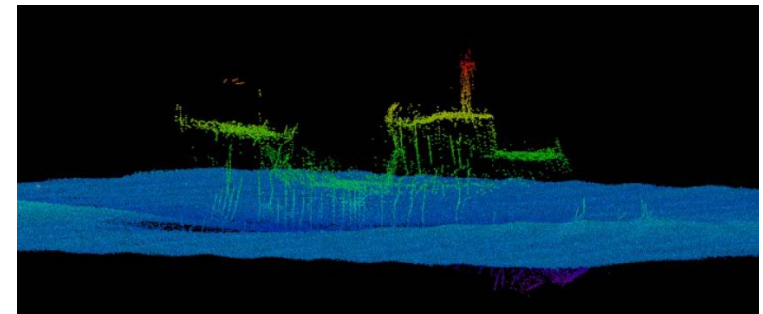
- Fixed angle
 - ± 65 degrees from Nadir
 - Number of soundings(5)
- Varying angle
 - IHO Order 1
 - Number of soundings(9)



NorthSea (3700 km²)



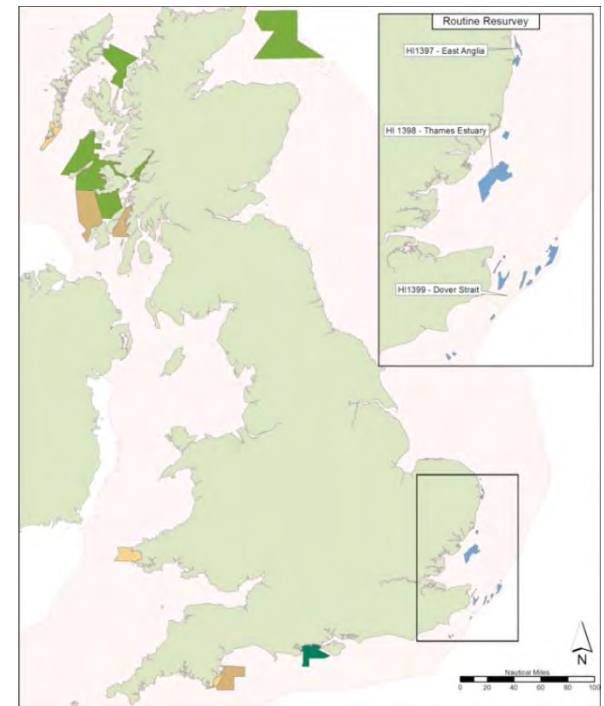
BarentSea (8056 km²)



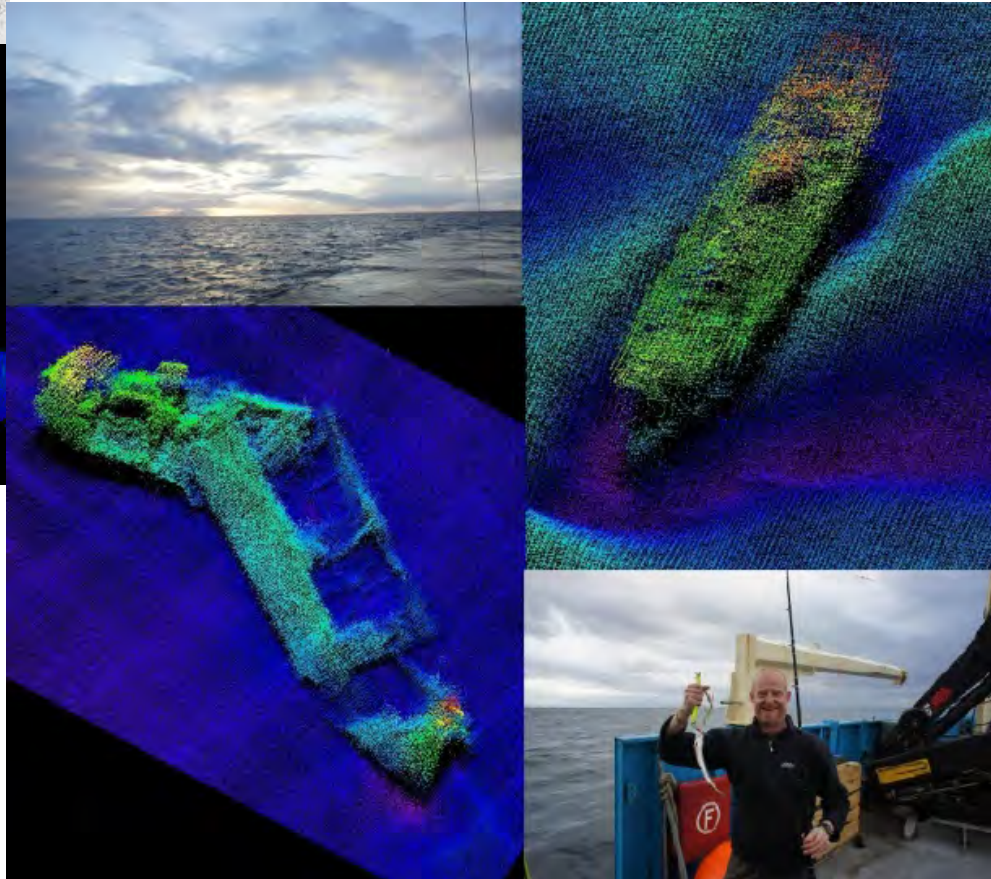
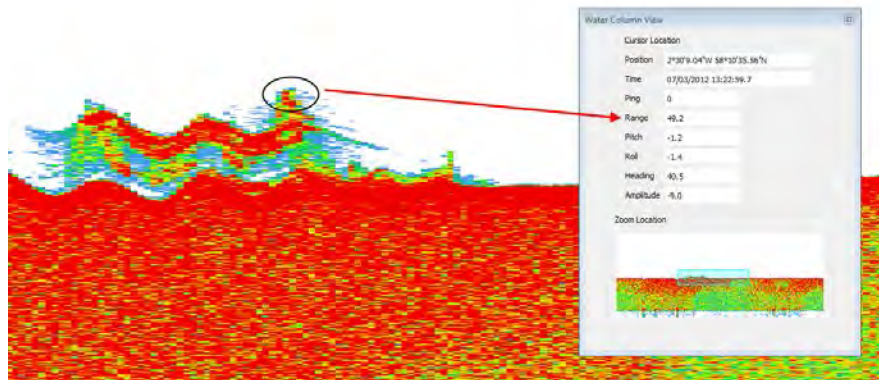
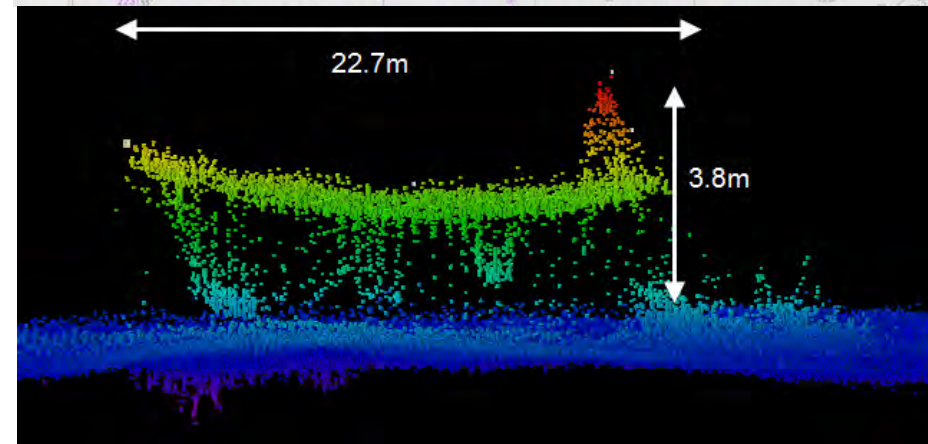
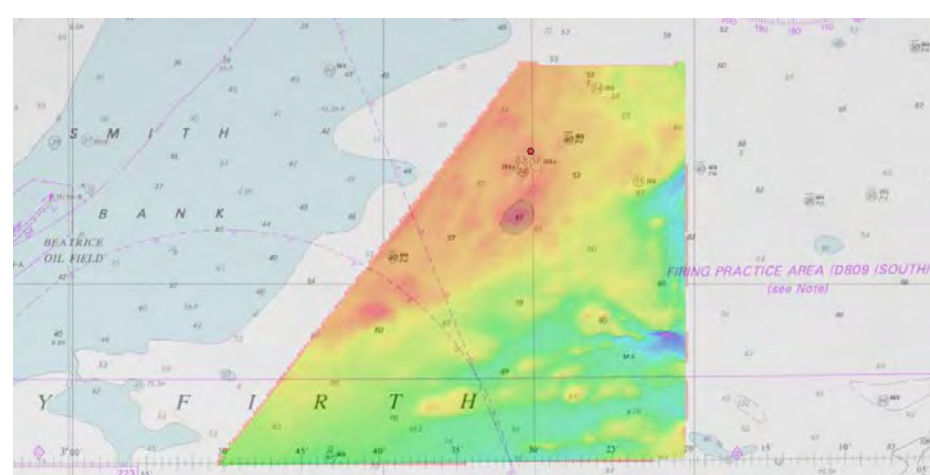
MCA UK Lot 2 2005 -

- ~20 000 km² of seabed surveyed with EM2040D from 2011
- 20 TBs of raw data collected

*Fishing trawl scour off Humber
or P for Perfect Survey?*



One of the Uncharted wrecks and ahmm.. Dinner?





Example Chart Discrepancy

MV Seabeam



MMT - Large Scale Mapping



EM3002D

- Max utilisation 2-25 m.
- Max Depth 250 m
- Max Coverage 250 m

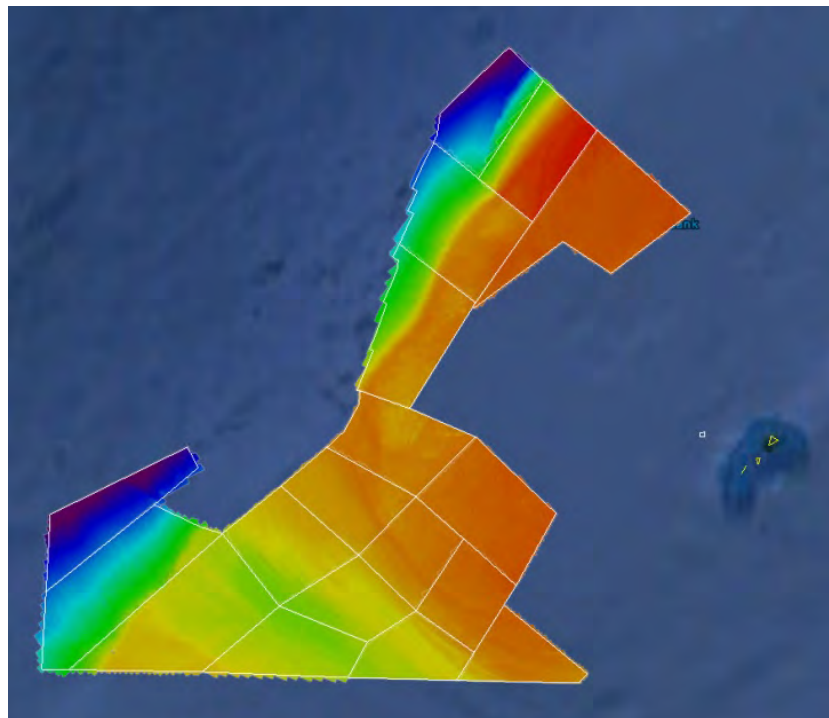
EM2040D

- Max utilisation 2-170 m.
- Max Depth 650(Cold Ocean) m
- Max Coverage 700(Cold Ocean) m



EM710

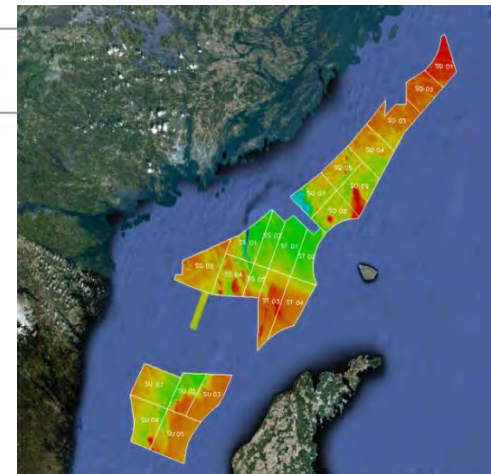
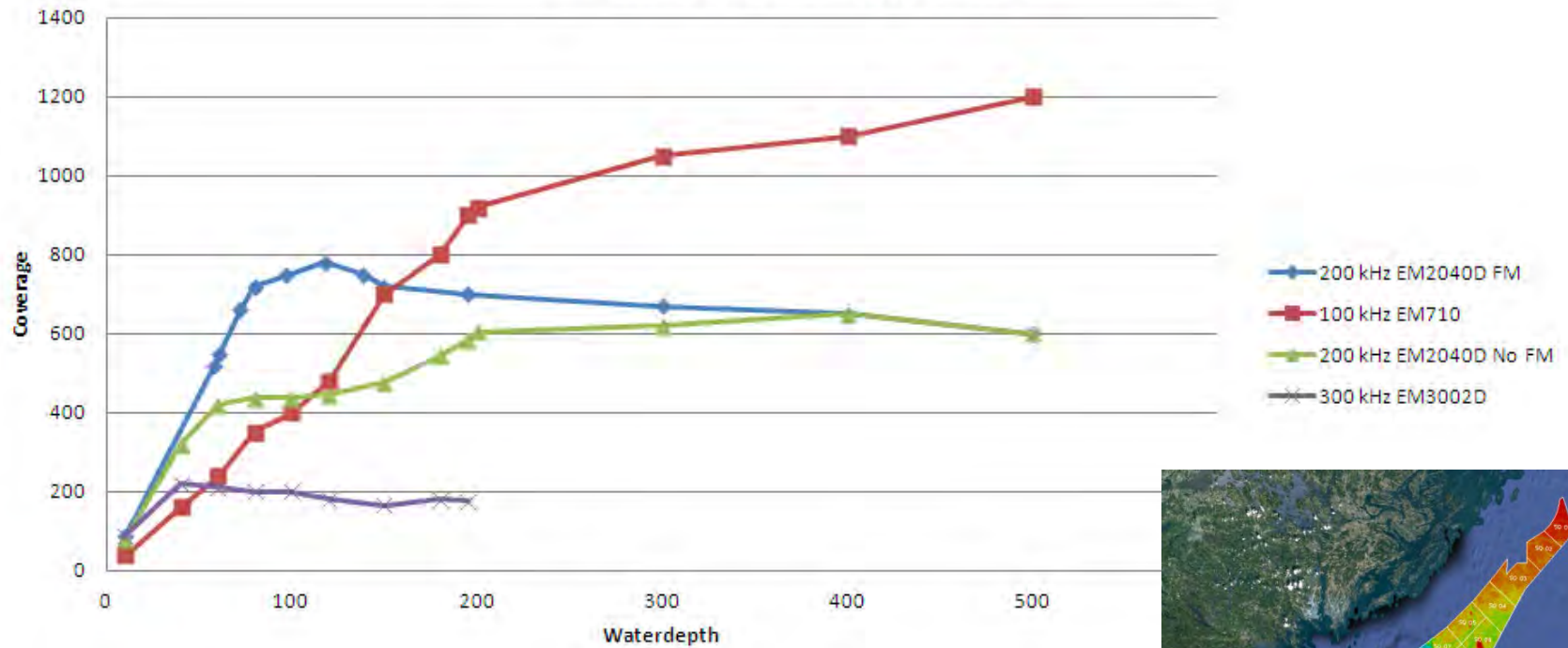
- Max utilisation 170-1200 m.
- Max Depth 2000 (Cold Ocean) m
- Max Coverage 2000(Cold Ocean) m



Nordland VI (9000 km²)

Conclusion- Large Scale Mapping

EM710 - EM2040 - EM3002D



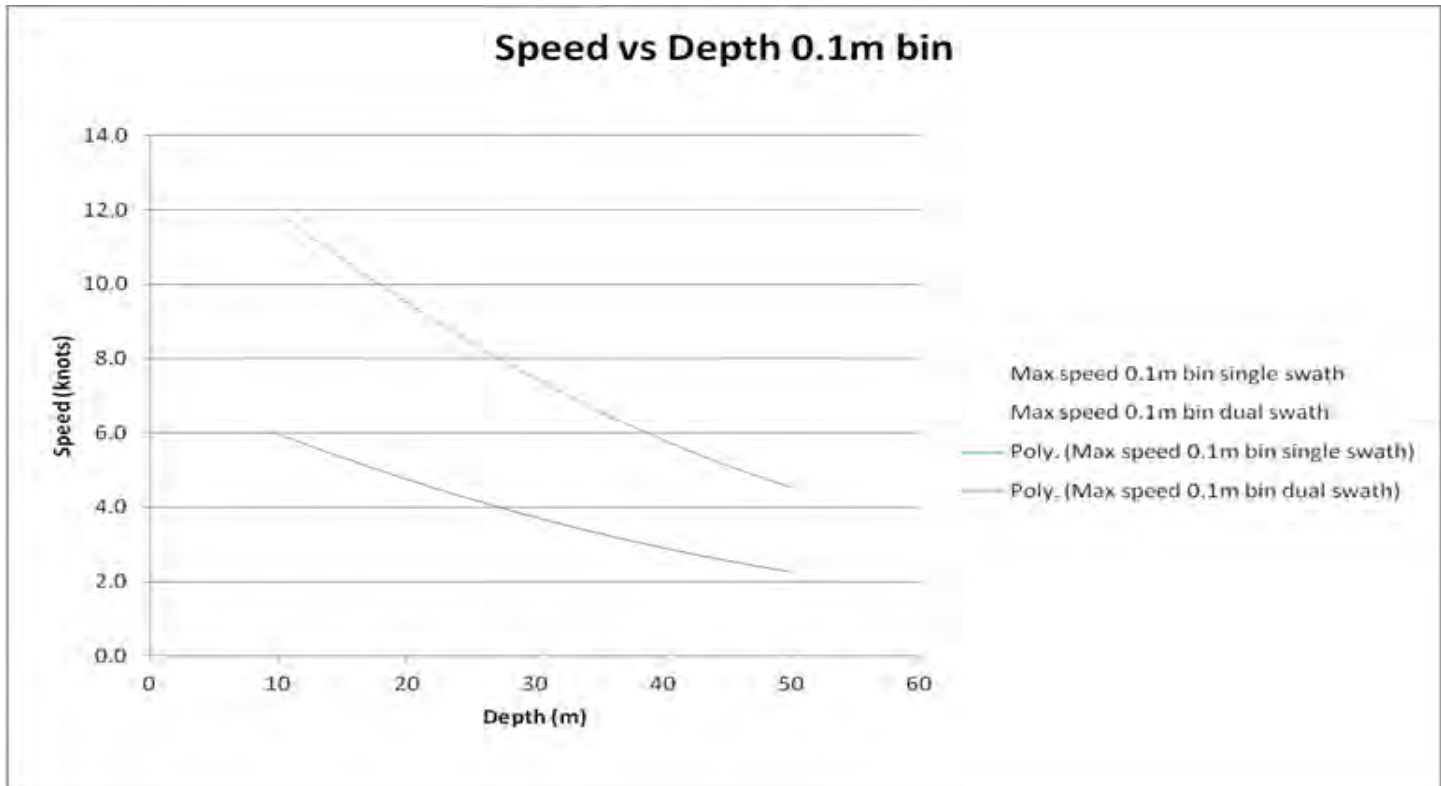
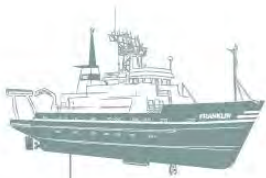
Baltics (8000 km²)

MMT | MBES Experience

Pipeline Inspection

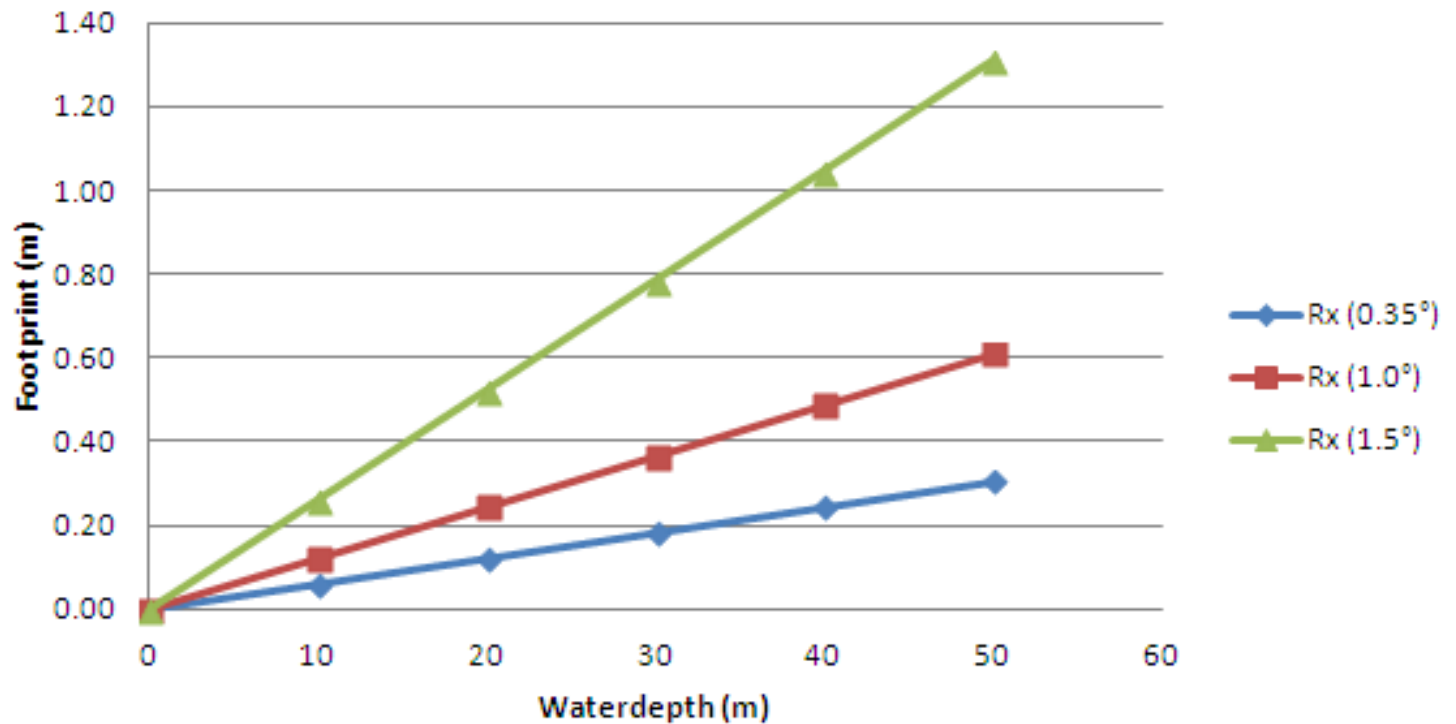


Pipeline Inspection | Resolution 10 cm bin



Pipeline Inspection | Footprint

EM2040D - EM3002D



2012 tests

Hull mounted multibeam echo sounder



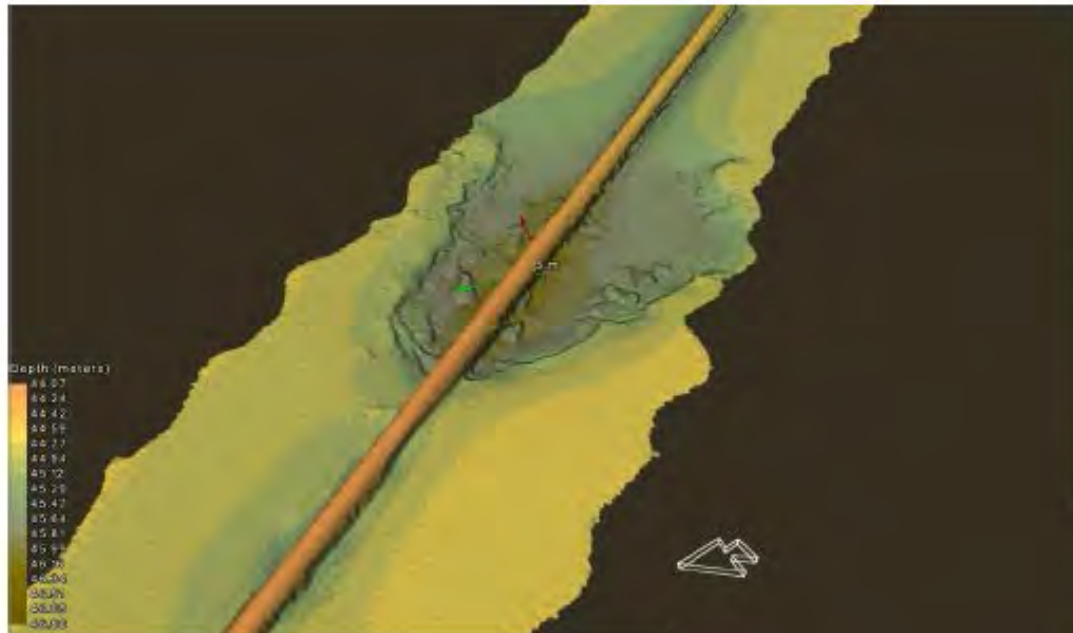
Hull mounted Kongsberg EM2040 dual head
Sub bottom profiler
Vessel IceBeam 40 m 17 crew

Europipe 1
Europipe 2
Zeepipe 1
Franpipe

Surveys performed

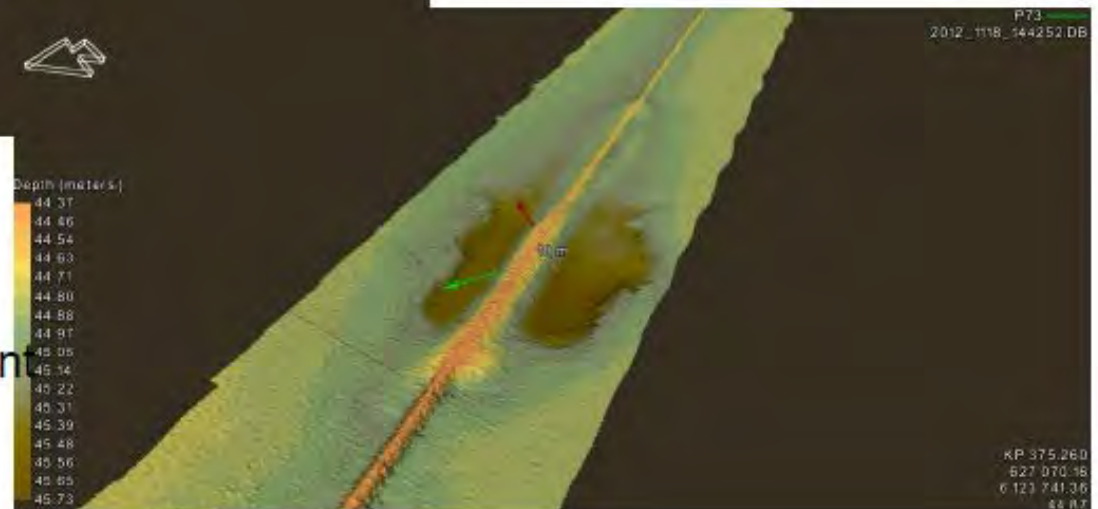
Ref no.	Doc no.	Title	Survey Date	Section	Author
1	D035-S0-P70-F-RA-002	Europipe 1 P71, P72 and P73 Annual Inspection Report 2011	2011-07	KP359.8-380.8	Subsea 7
2	D052-S0-P100-F-RA-003	Europipe 2 P105, P103 and P102 Kårstø Annual Inspection Report	2011-07	KP510-538.1	Subsea 7
3	D035-D0-P70-F-RA-009	Europipe 1 P70 Annual survey report 2012	2012-04	Shipping Lanes	Deep Ocean
4	D052-D0-P100-F-RA-010	Europipe 2 P100 Annual Survey Report 2012	2012-03 to 05	Shipping Lanes	Deep Ocean
5	D035-MM-P70-F-RA-001	Europipe 1 Shallow Water acoustic Pipeline Survey North Sea	2012-06	Shipping Lanes & KP359.8-380.8	MMT
6	D052-MM-P100-F-RA-001	Europipe 2 Shallow Water acoustic Pipeline Survey North Sea	2012-06	Shipping Lanes & KP510-531.8	MMT

Results

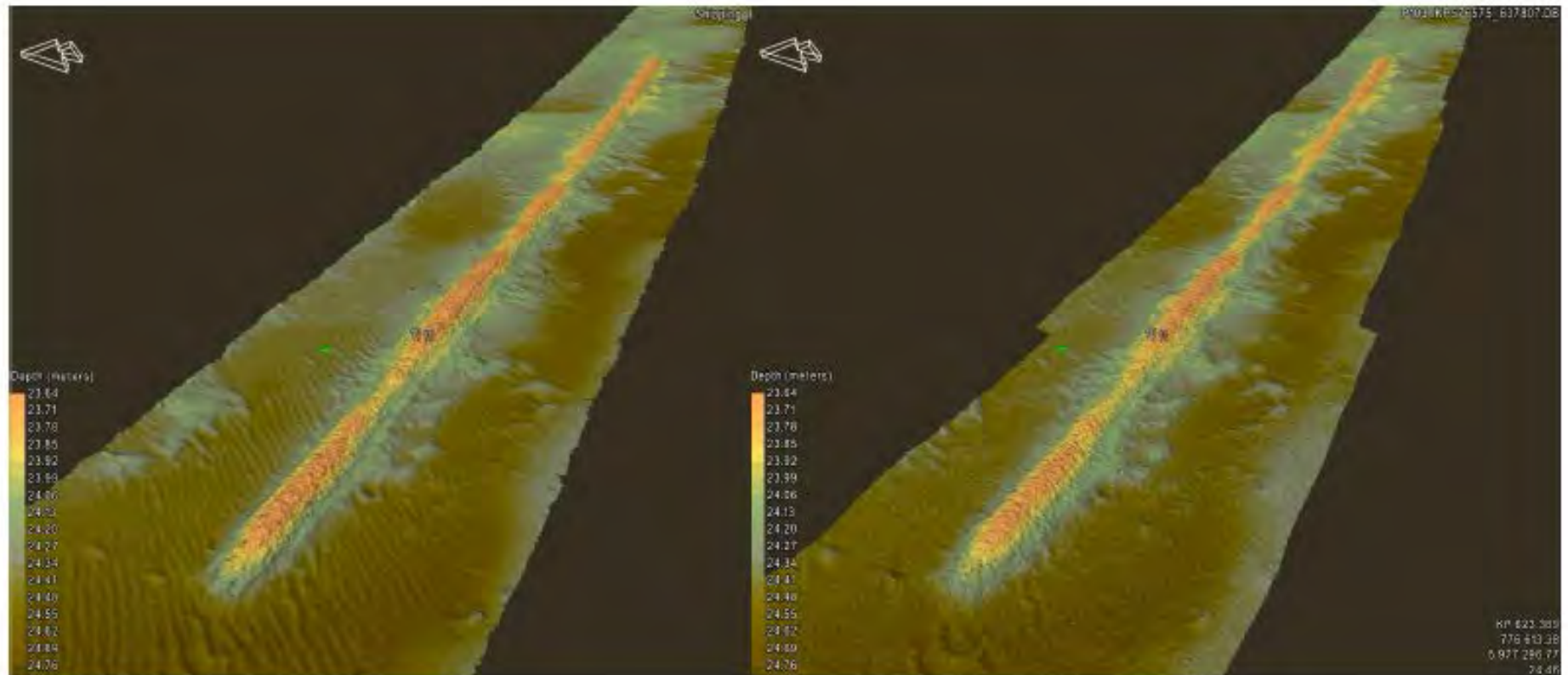


ROV

Hull mount



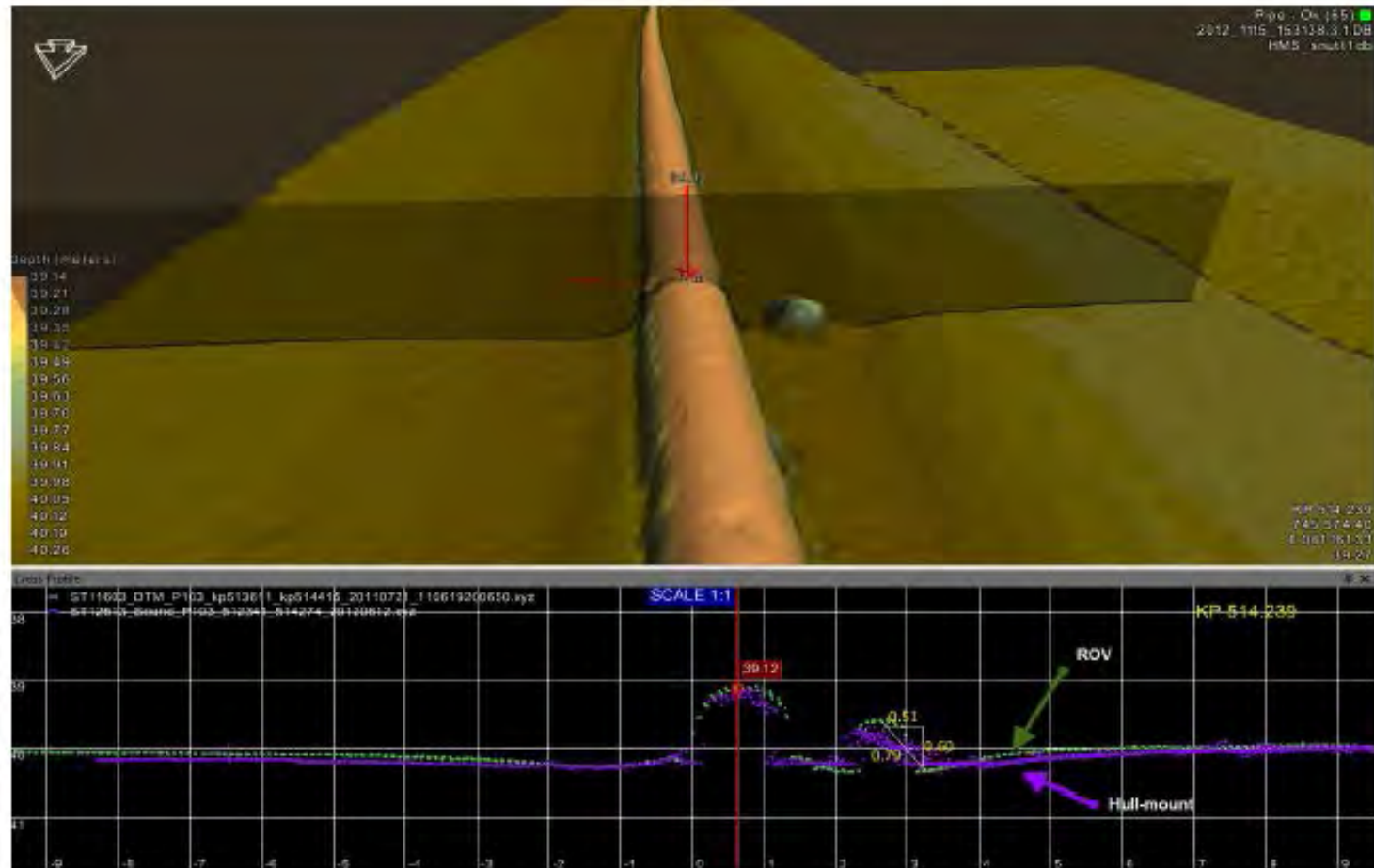
Intervention area



ROV

Hull mount

Seabed Features

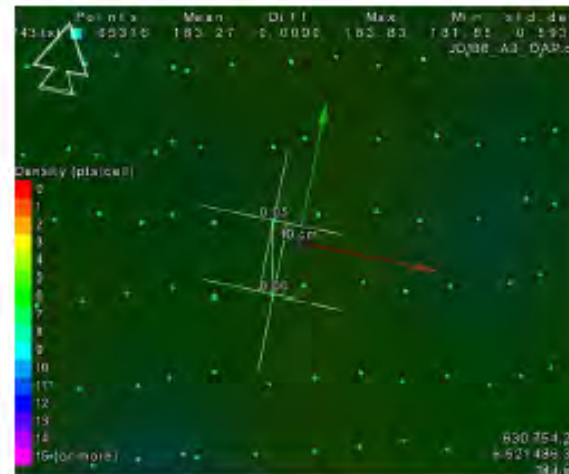
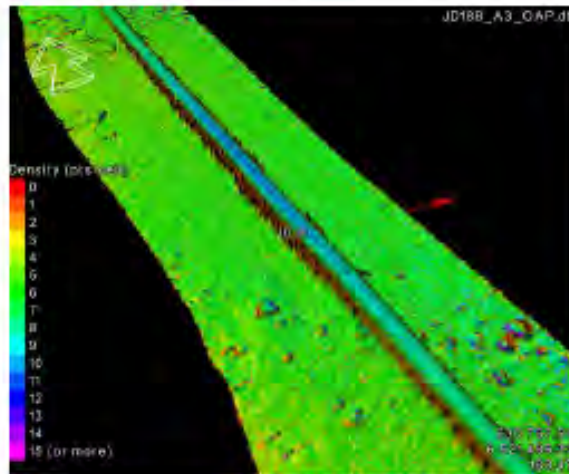


AUV trials july 2012



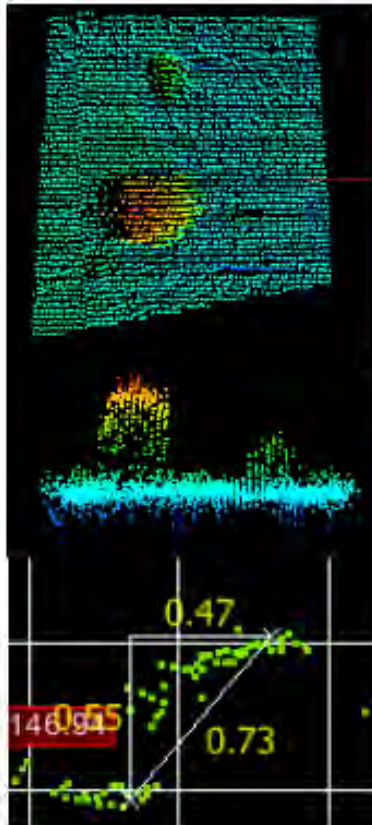
Data density

Altitude (m)	Dist. (cm)	Density (m ²)	Density (m ²)
	Across / Along Track 2040	2040 Nadir	2040 outer
3.0 m (3.3 knts)	3 / 5	500-520	480-500
4.5 m (3.3 knts)	5 / 4	470-490	430-450
5.5 m (3.5 knts)	5 / 5	320-330	270-290
7 m (3.5 knts)	7 / 6	300-320	190-230
4.5 m (5.5 knts)	4 / 8	260-280	240-260

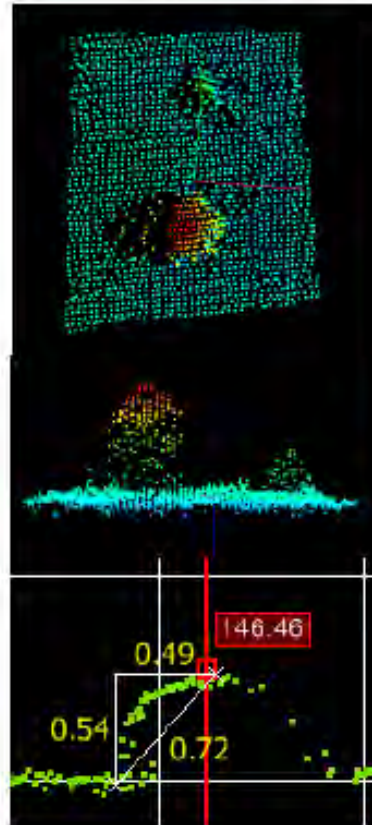


Target detection

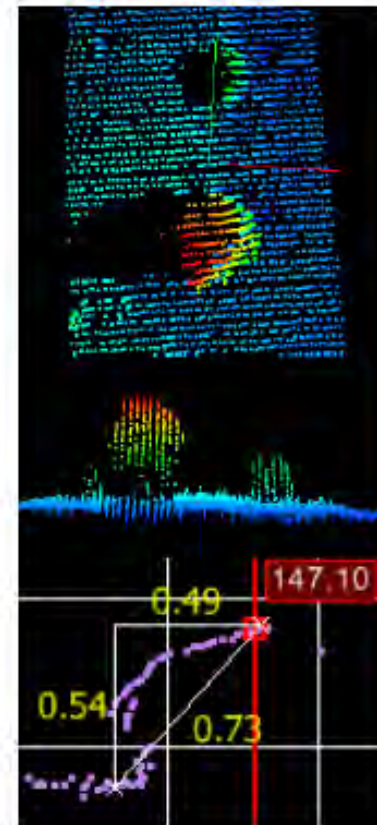
AUV 3m



AUV 7 m



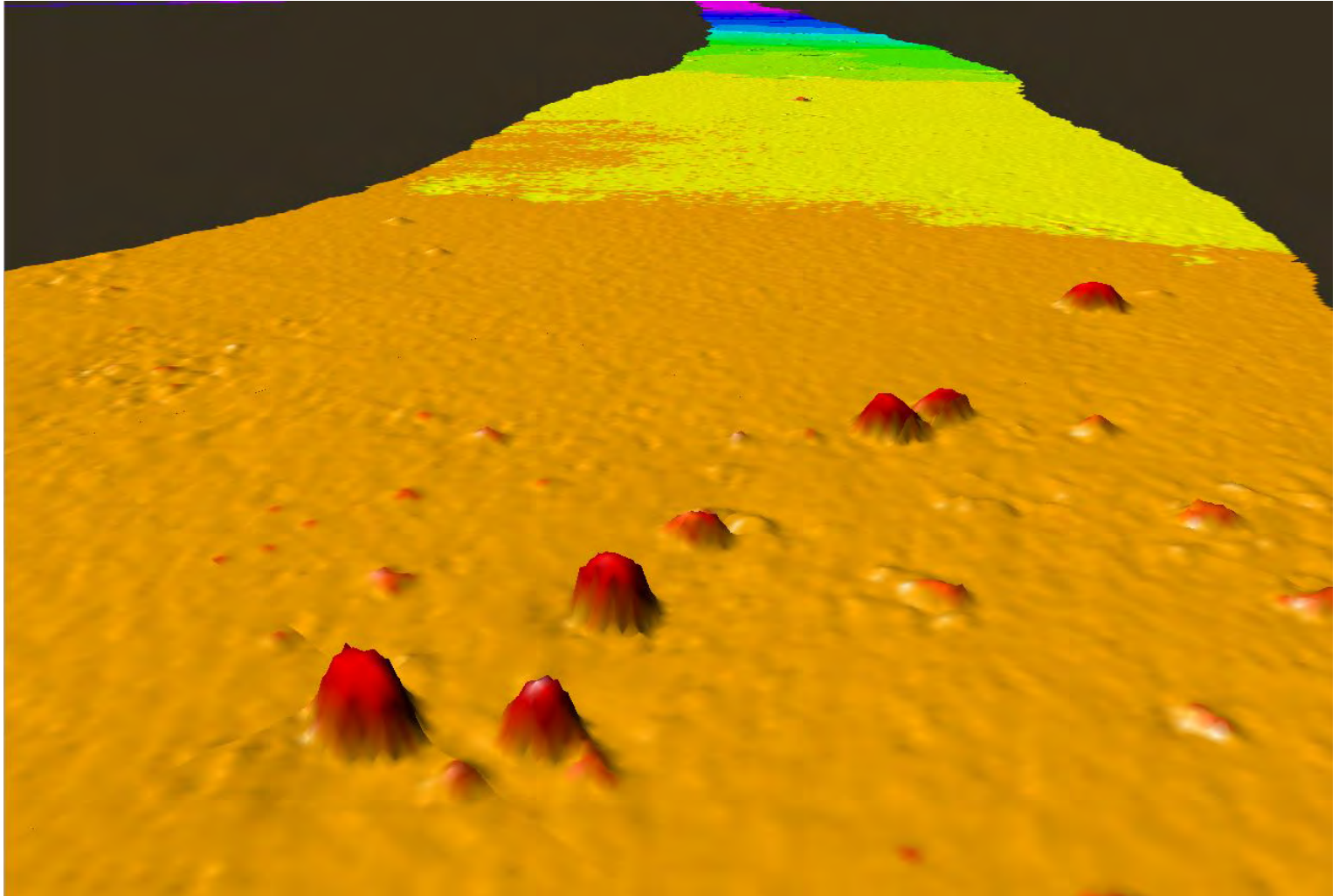
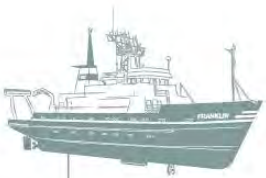
ROV



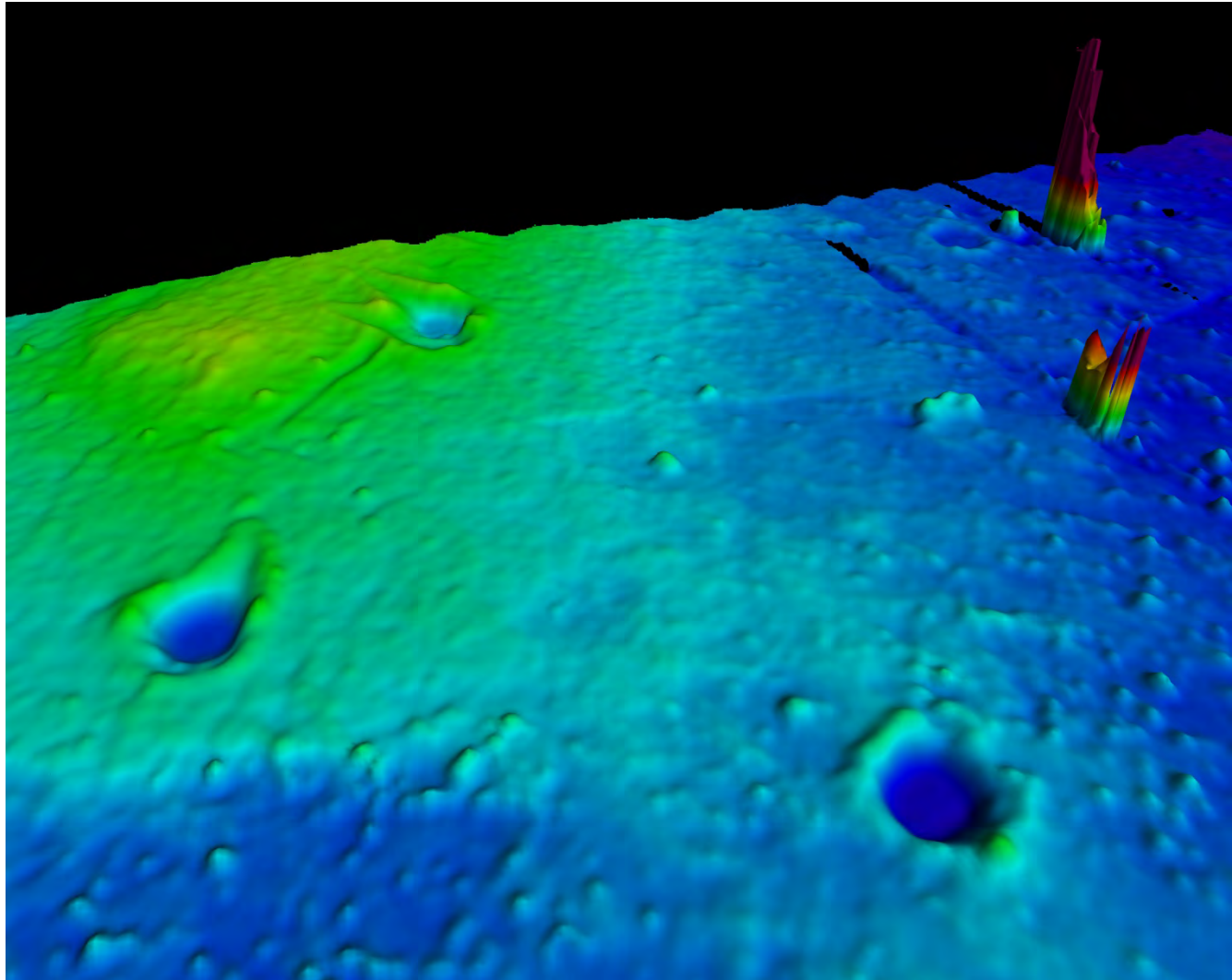
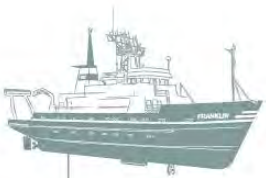
Object detection



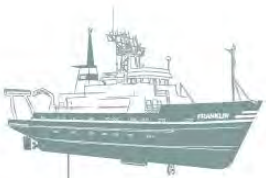
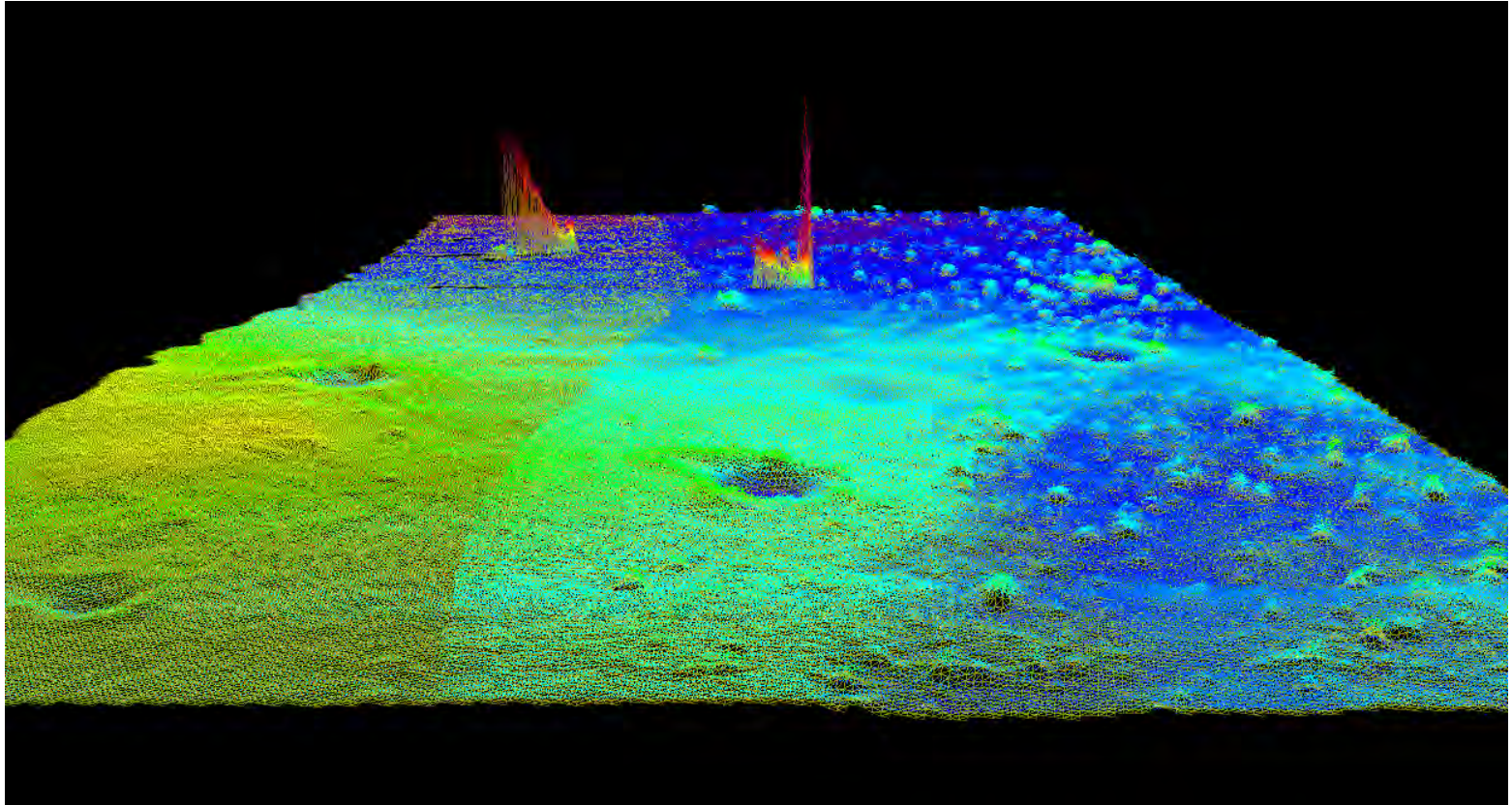
MMT | Experience in Object Detection



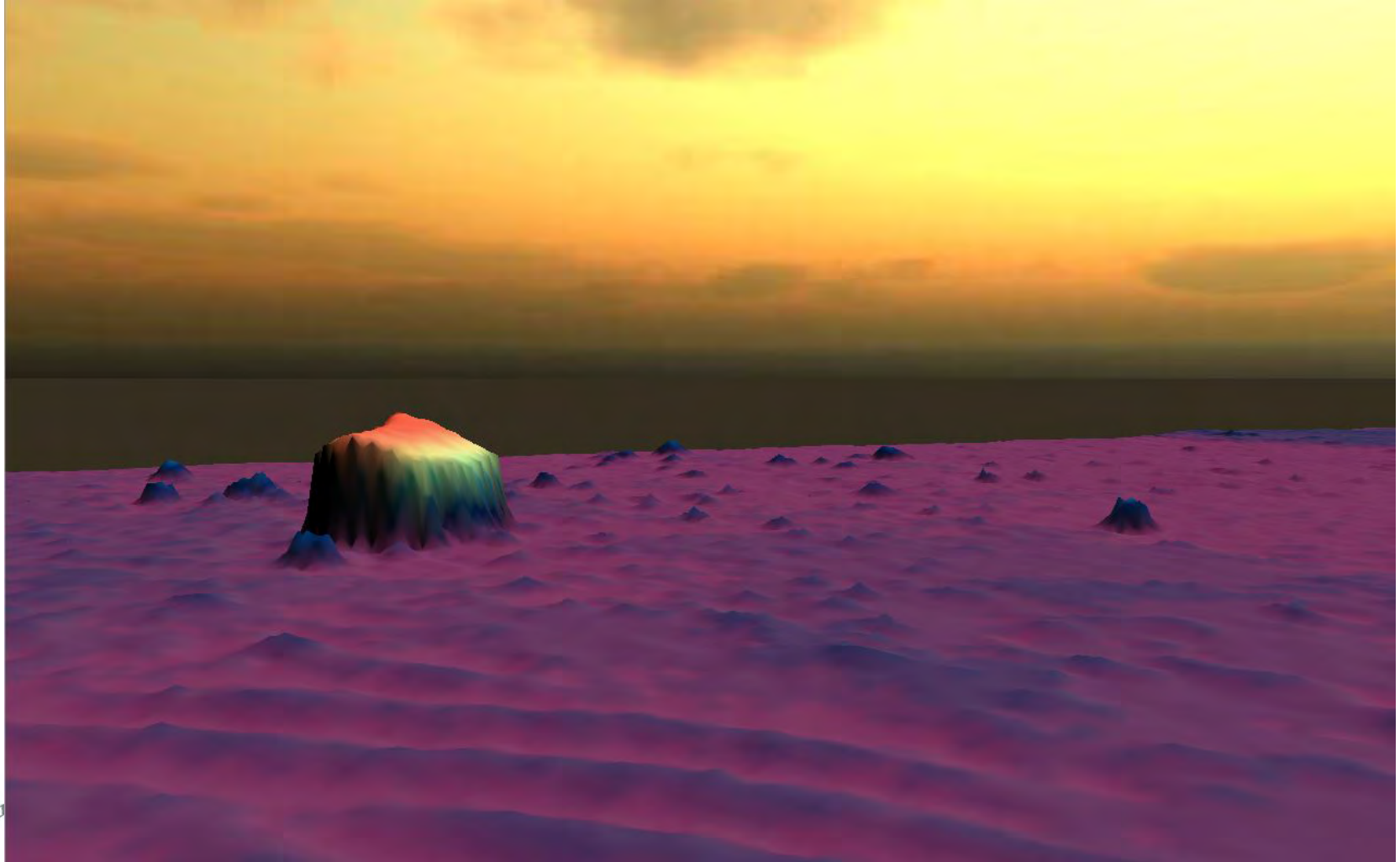
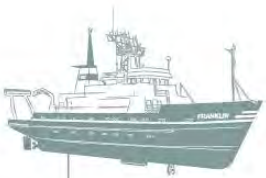
MMT | Experience in Object Detection



MMT | Experience in Object Detection



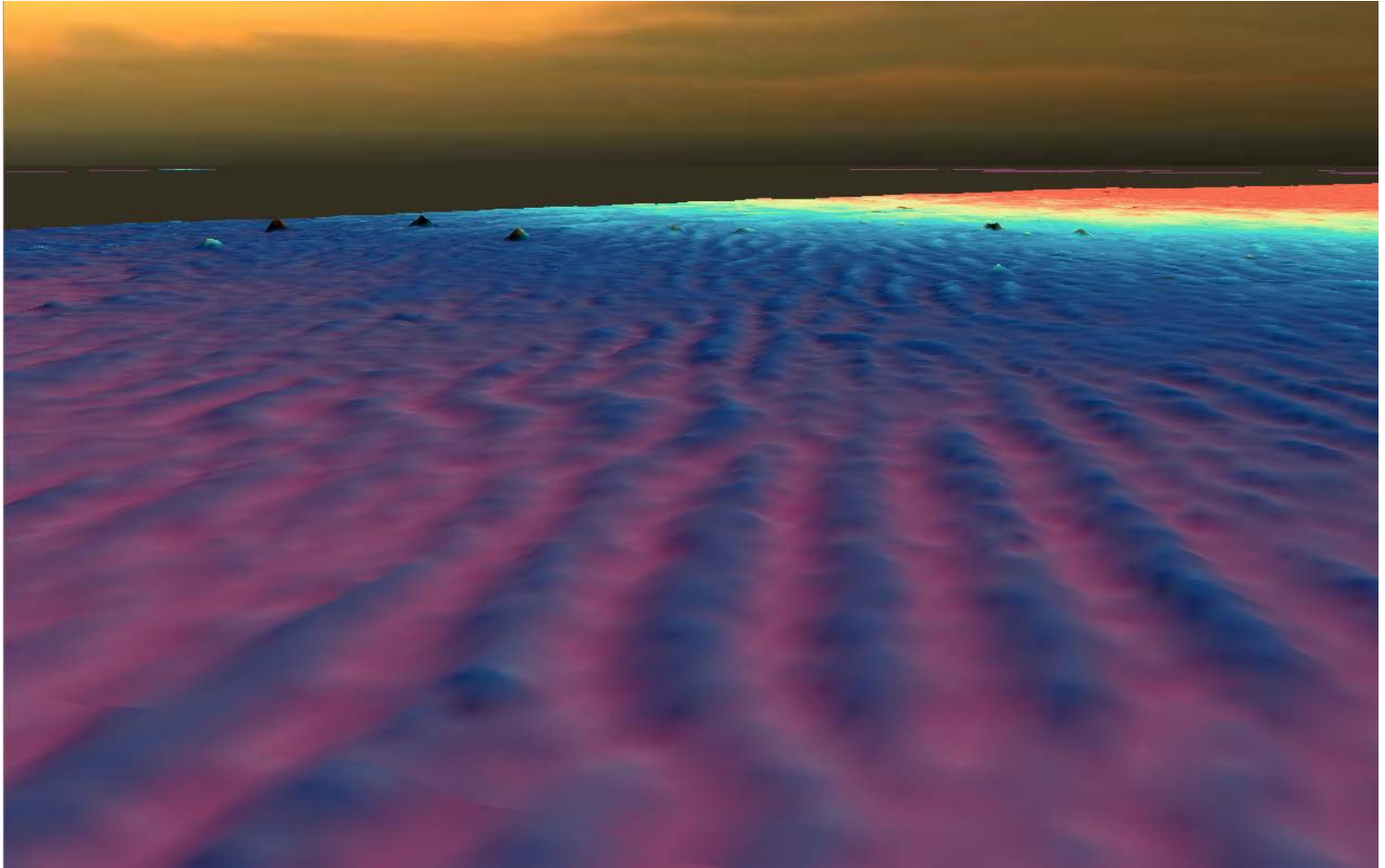
MMT | Experience in Object Detection



MMT | Experience in Object Detection



MMT | Experience in Object Detection



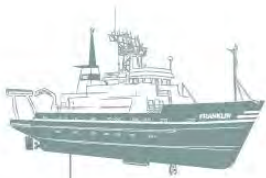
MMT | MBES Experience



Support



MMT | Development of EM2040D



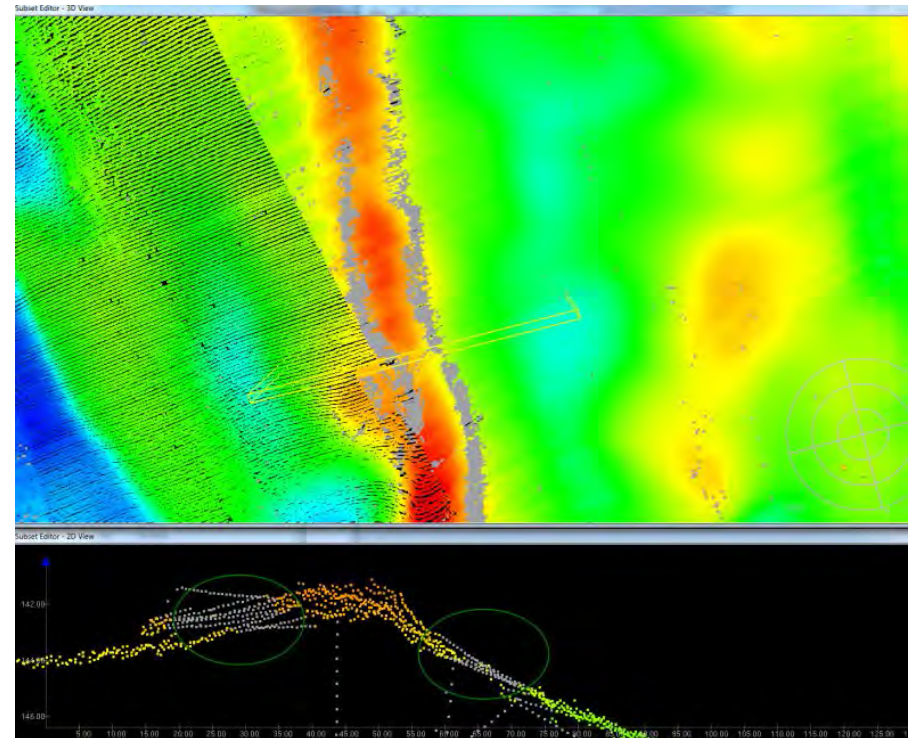
Beams disabled in SIS

Bottom detection fail on both sides of ridges frequently.

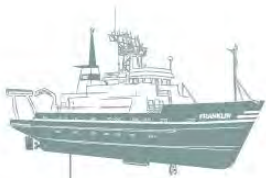
Can't see similar issues on EM3002 and EM710.

Affects infills hence speed

In progress



MMT | Development of EM2040D

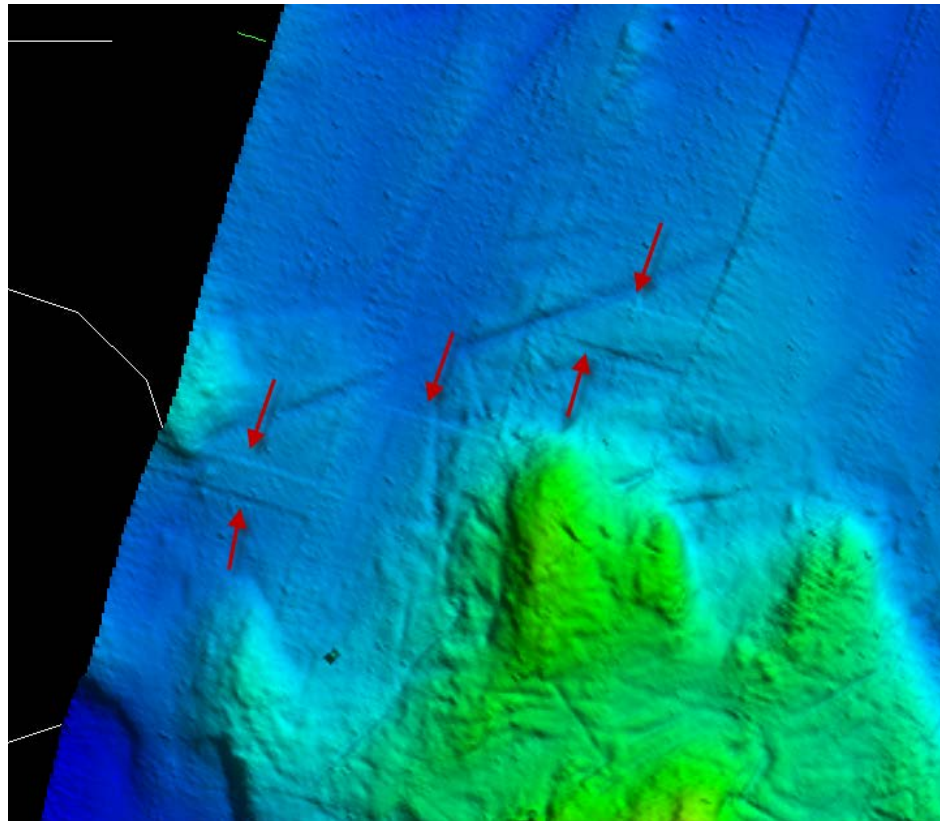


Vertical jumps in data, when using FM pulse

Filter introduced in SIS 3.8.4 turned off manually and after that the issue hasn't reappeared.

Affected infills

Solved

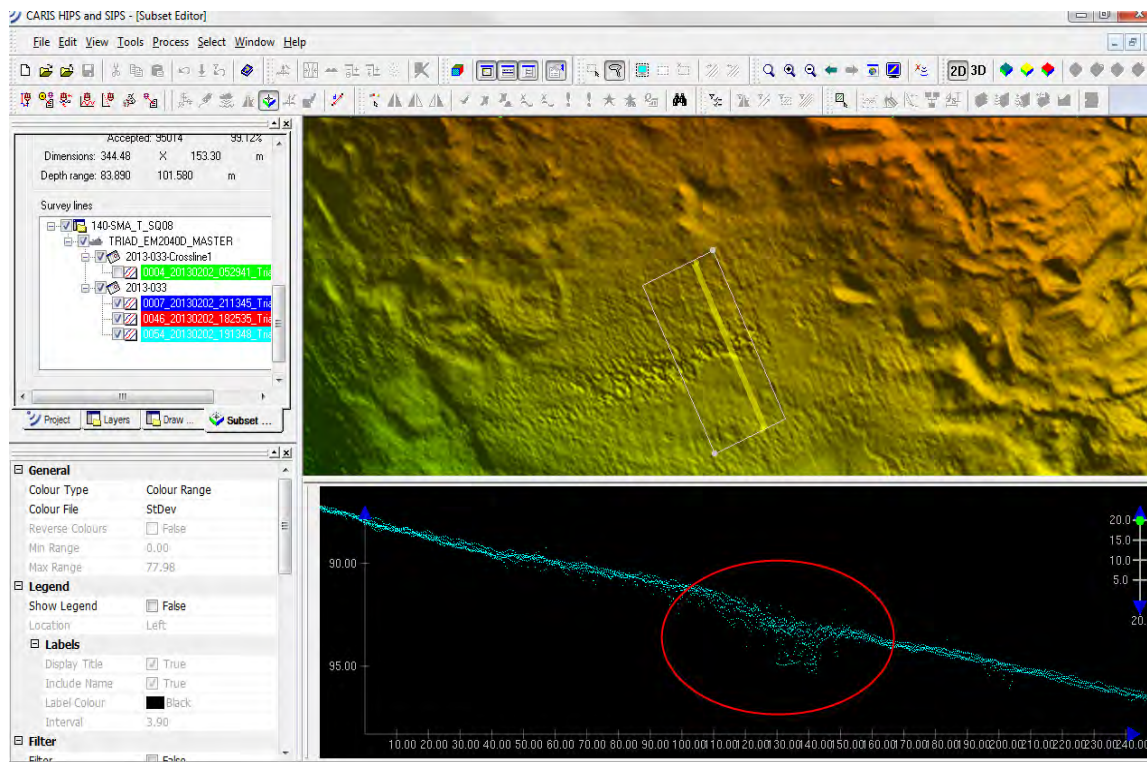




MMT | Development of EM2040D

Penetration issues in the Baltics(200 kHz & 300 kHz mode)

Data sent to Kongsberg, development department evaluating using penetration experience from EM1002 & EM710. Last update 20 Mars.



MMT | Development of EM2040D



Ping rate - > Increased resolution or Speed with up to 20 %

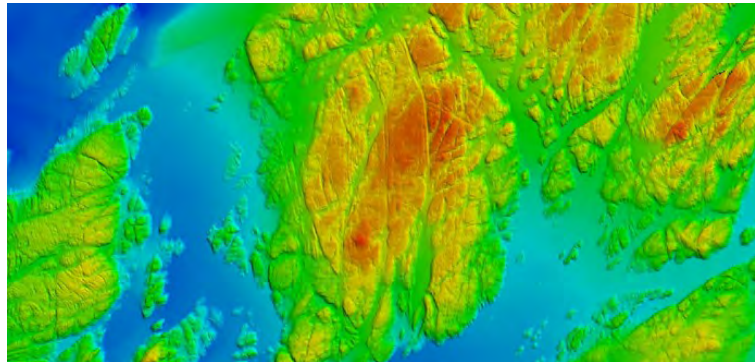
MMT suggestion is to look into possibility to set a very tight range under the sea floor which has a big tolerance upwards in order to increase ping rate but not remove objects.

Kongsberg is working on a solution until then this will be done manually.



MMT | MBES Experience

Conclusion





MMT | EM2040D Experience

Conclusion:

- EM2040D is a robust system for 24/7 operations 365 days a year
- High resolution system with greater coverage than previous systems.
- More clean data than earlier systems
- Higher pingrate than earlier systems
- Can be used for Acoustic pipeline inspection to reduce cost and environmental impact
- There are several tools operative now
 - AUV
 - ROTV
 - Hull mounted
- Optimization of the system will make it even more effective tool in the future

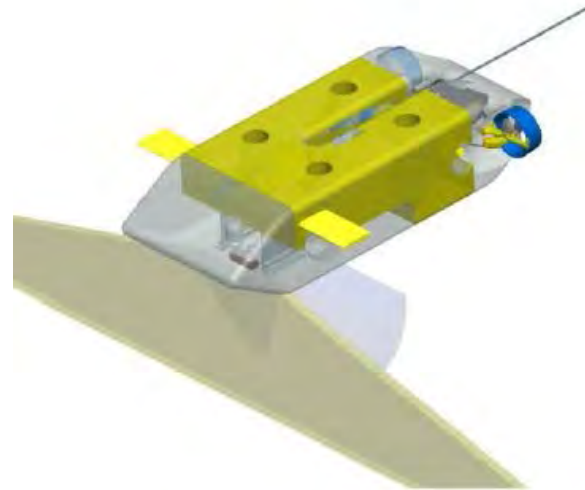


MMT | EM2040D Future



To Kongsberg development team to make the system even more competitive:

- Binsize 0.1 meter resolution as deep as possible with a coverage of 30-40 meter. Today 50-70 meter. Future 250 meter?
- Maximum coverage as deep as possible with 9 soundings in a 10% of waterdepth binsize. @800 meter -> 80 meter binsize with 9 soundings.



A need for speed





Martin Wikmar
Operation & Technical Director
Martin.Wikmar@mmt.se

