Collecting Hydrographic Data with USVs

GUARDIAN GEOMATICS

Example of the Force Multiplier Effect

Contents

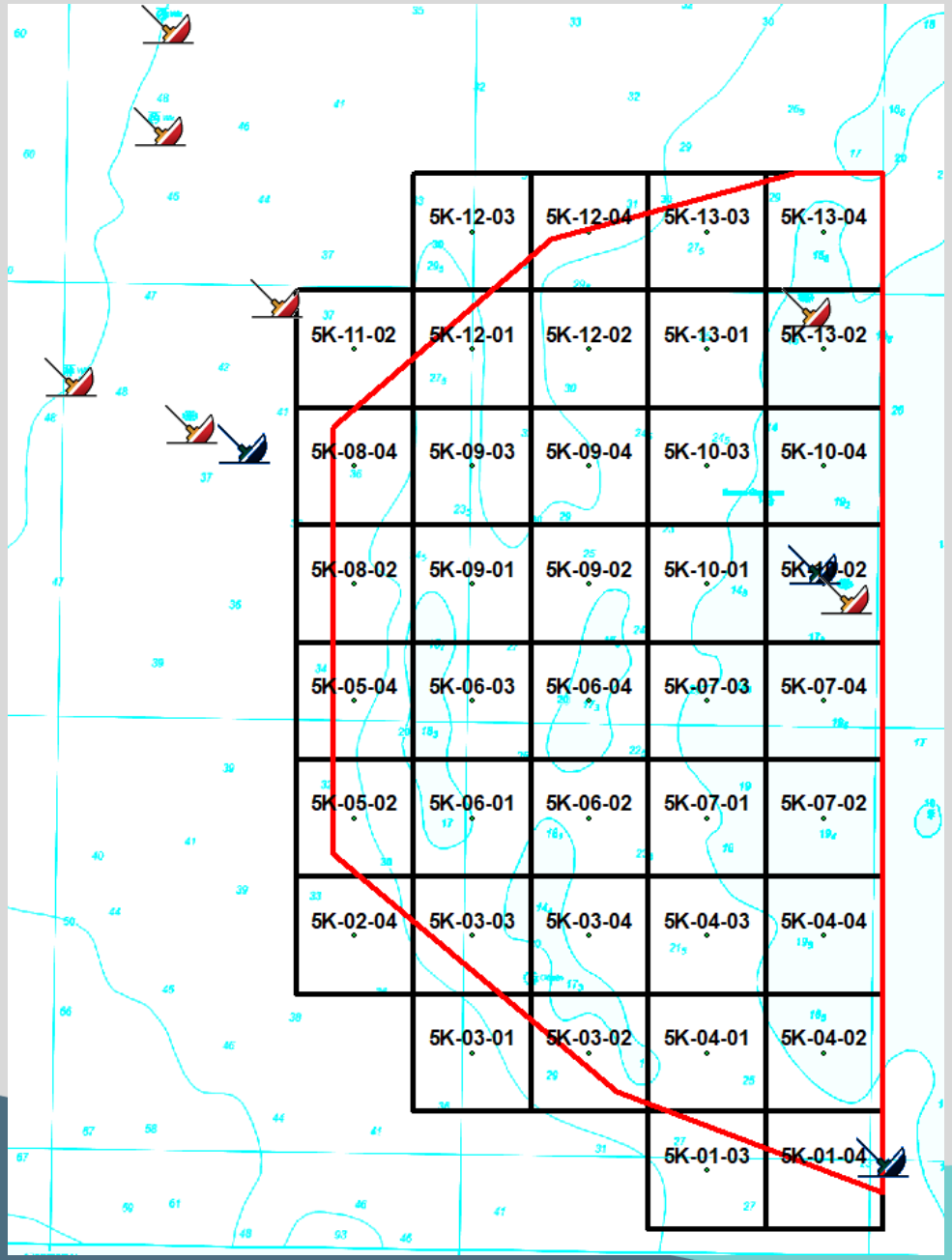
- Scope of Work and Outcomes
- MASS Operations
- Lessons Learned

Original Scope of Work

The survey scope of work undertaken from the vessel includes the following;

- Mobilisation of the Seabed Constructor's over the side pole
- Mobilisation of three MASS units
- Sea acceptance trails for Seabed Constructor and three MASS units
- Deployment of four bottom mounted tide gauges
- Bathymetric survey of area to IHO S-44 requirements
  I. Order 1a for water depths greater than 10m
  II. 100% acoustic coverage shall be achieved for the entire are of operations – full seafloor search
- Contour delineation out to the 40m contour
- Box-in surveys for features identified by the Client
- Recovery of four bottom mounted tide gauges
- Demobilisation
- Final Reporting & Processing

Work area overview – 800km2



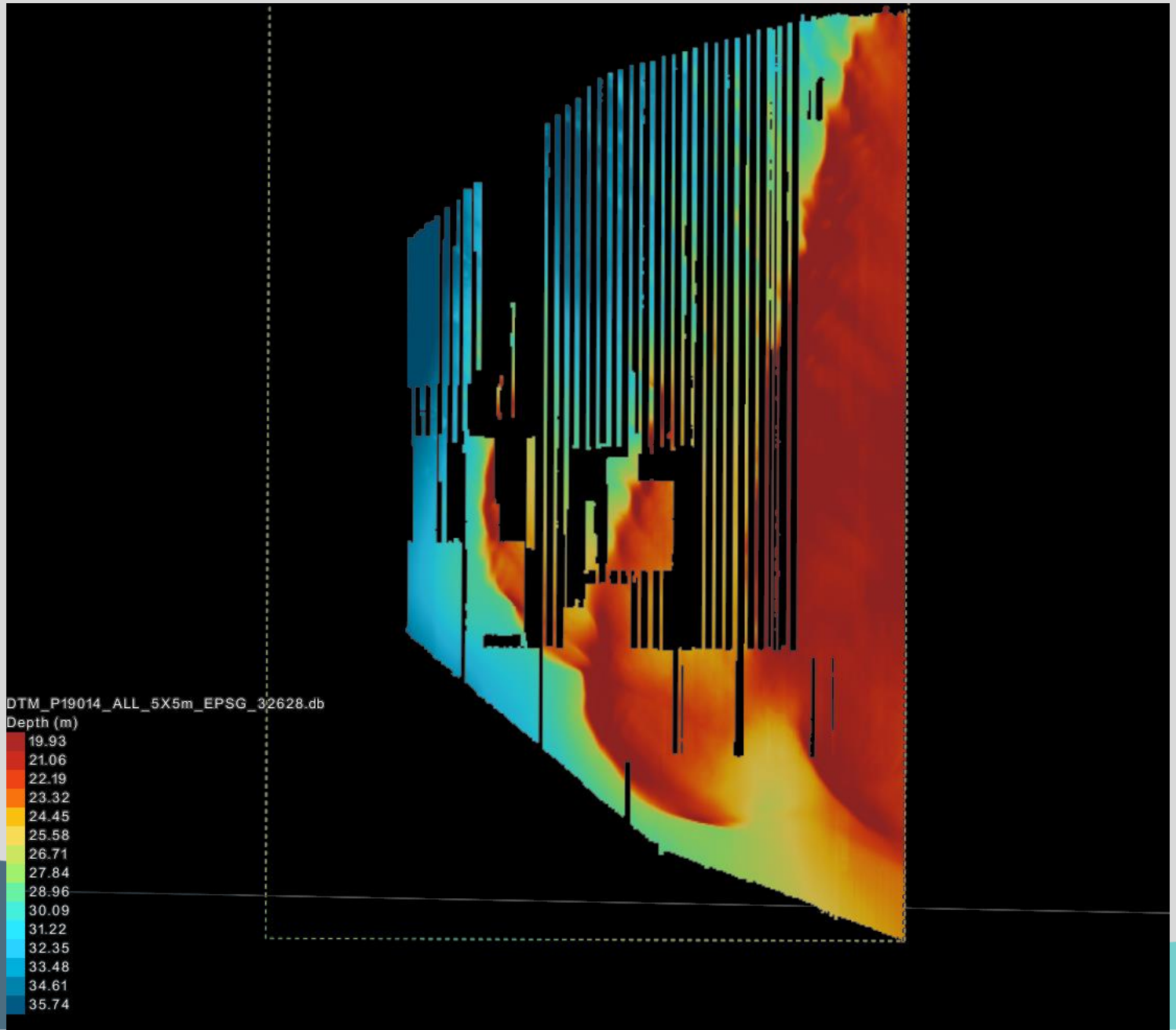
Scope of Work – Outcomes

- **Successfully** mobilised three MASS units
- **Passed** the Sea acceptance trails for Seabed three MASS units
- **Successfully** deployed four bottom mounted tide gauges
- **61.8 % completion (to date)** of the Bathymetric survey
  I. Order 1a
  II. 100% acoustic coverage
- Contour delineation out to the 45m contour
- 12 x Box-in surveys - Completed
- Recovered two bottom mounted tide gauges
- Identified 13 unknown wrecks
- Identified 94 additional features (below impact threshold)

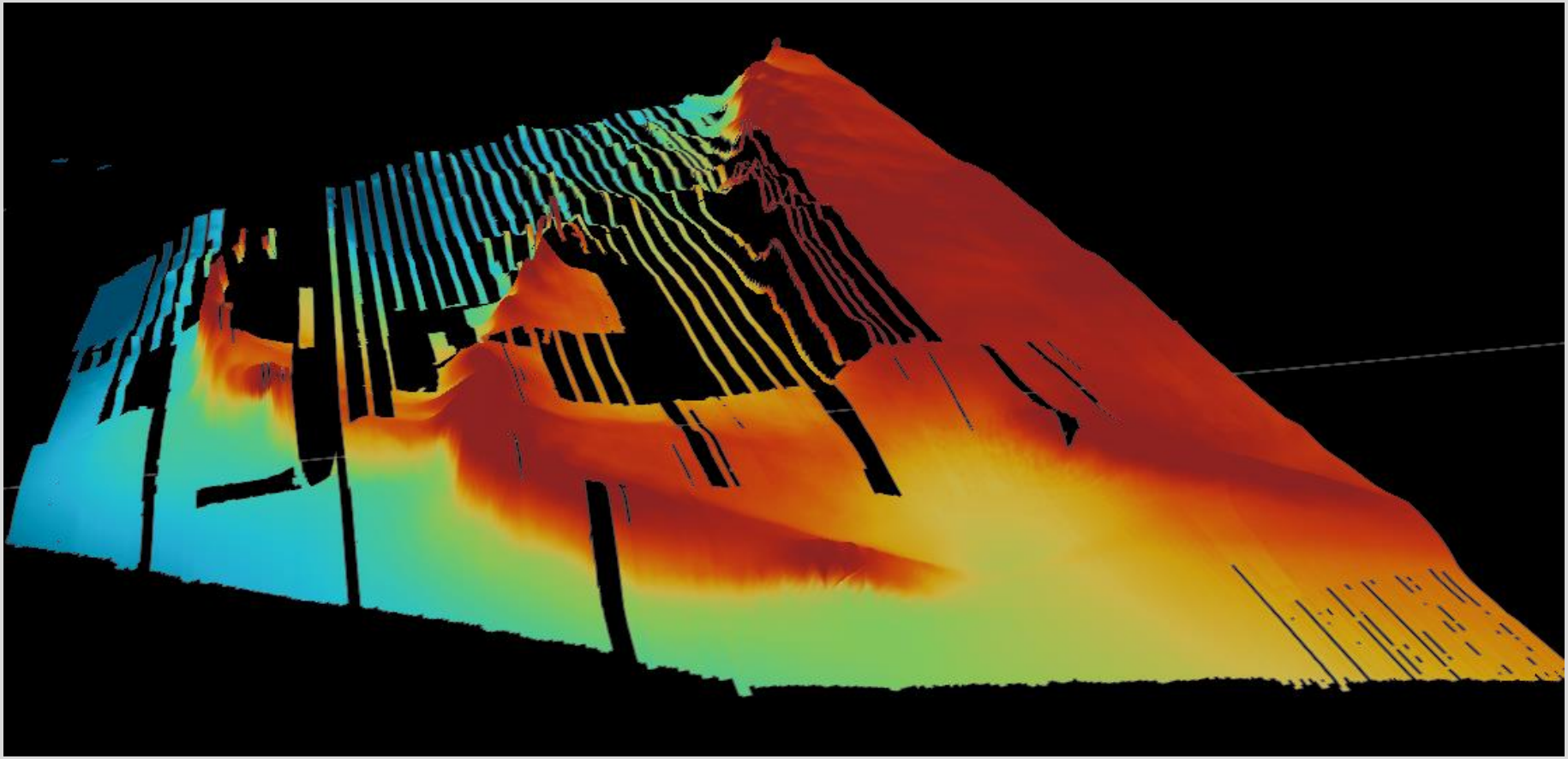
- **Completed 7460 line km in 20 days (to 1 July)**
  - **373 km per day avg. (best day 630 km)**

- **Phase 2 - has just completed**

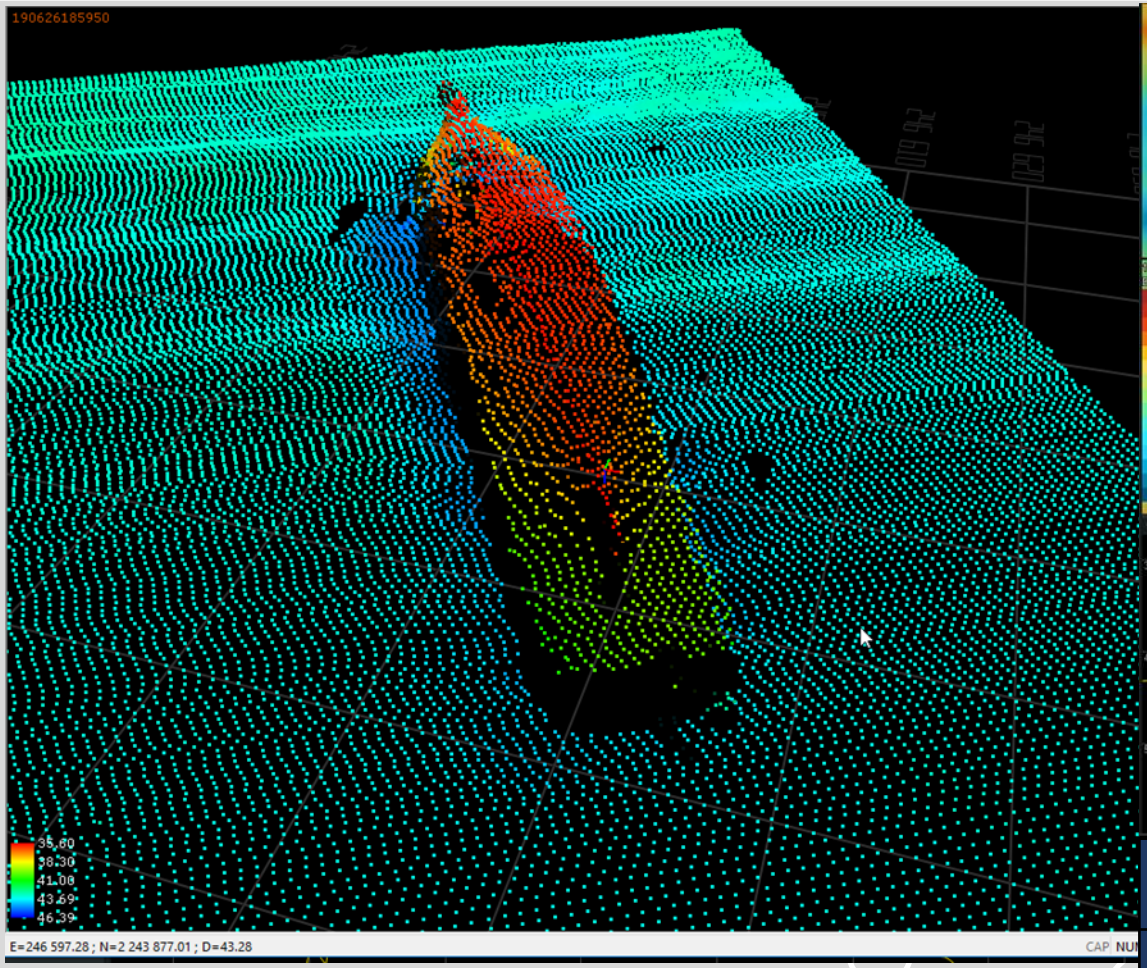
Area Coverage DTM

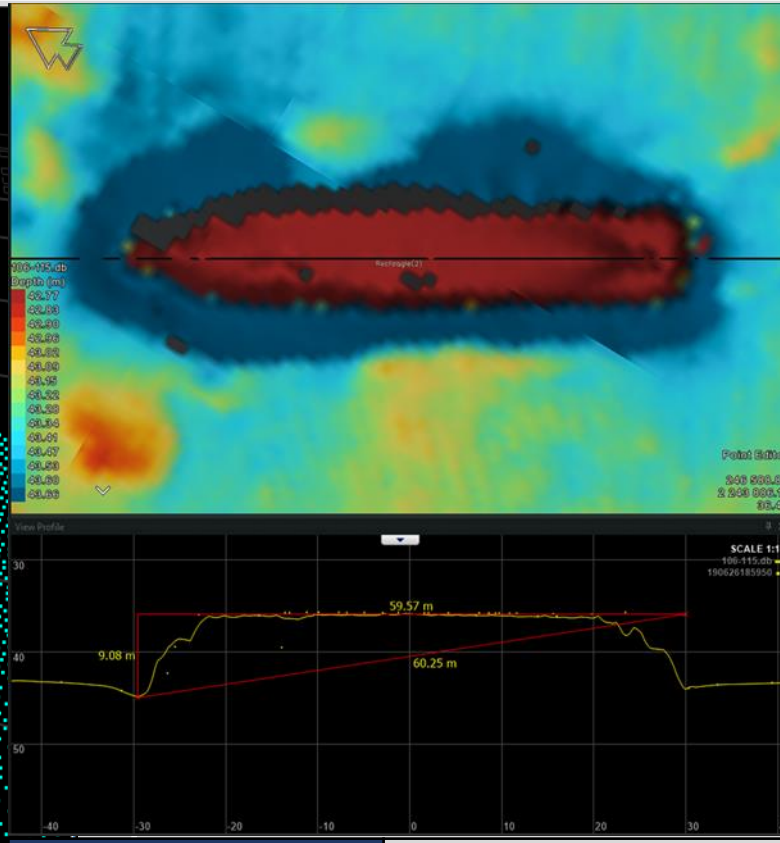


3D View



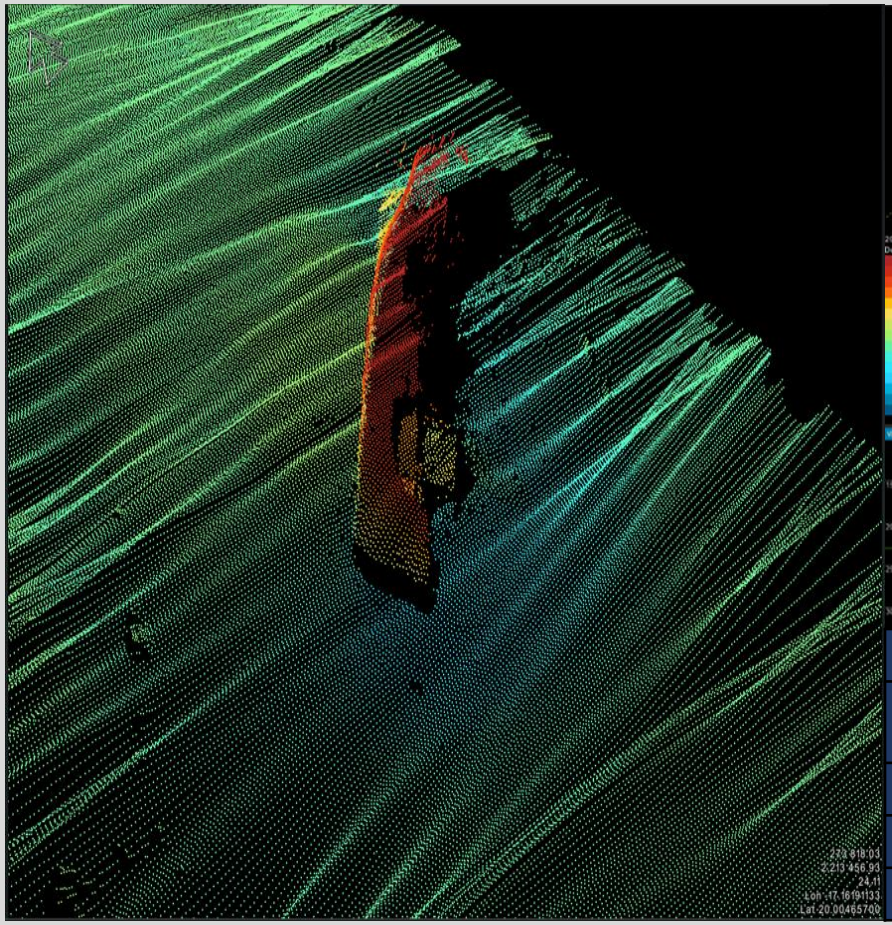
Unchartered Wreck 1

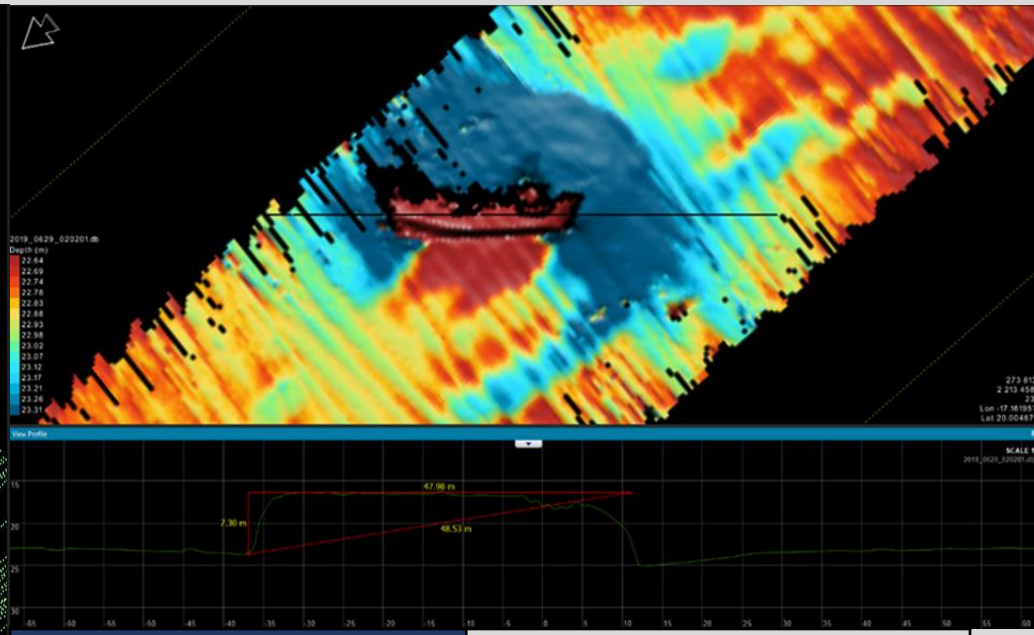




Minimum Depth	36.43m
Mean Seabed Depth	43.30m
Length	59.57m
Width	15.26m
Height	9.08m

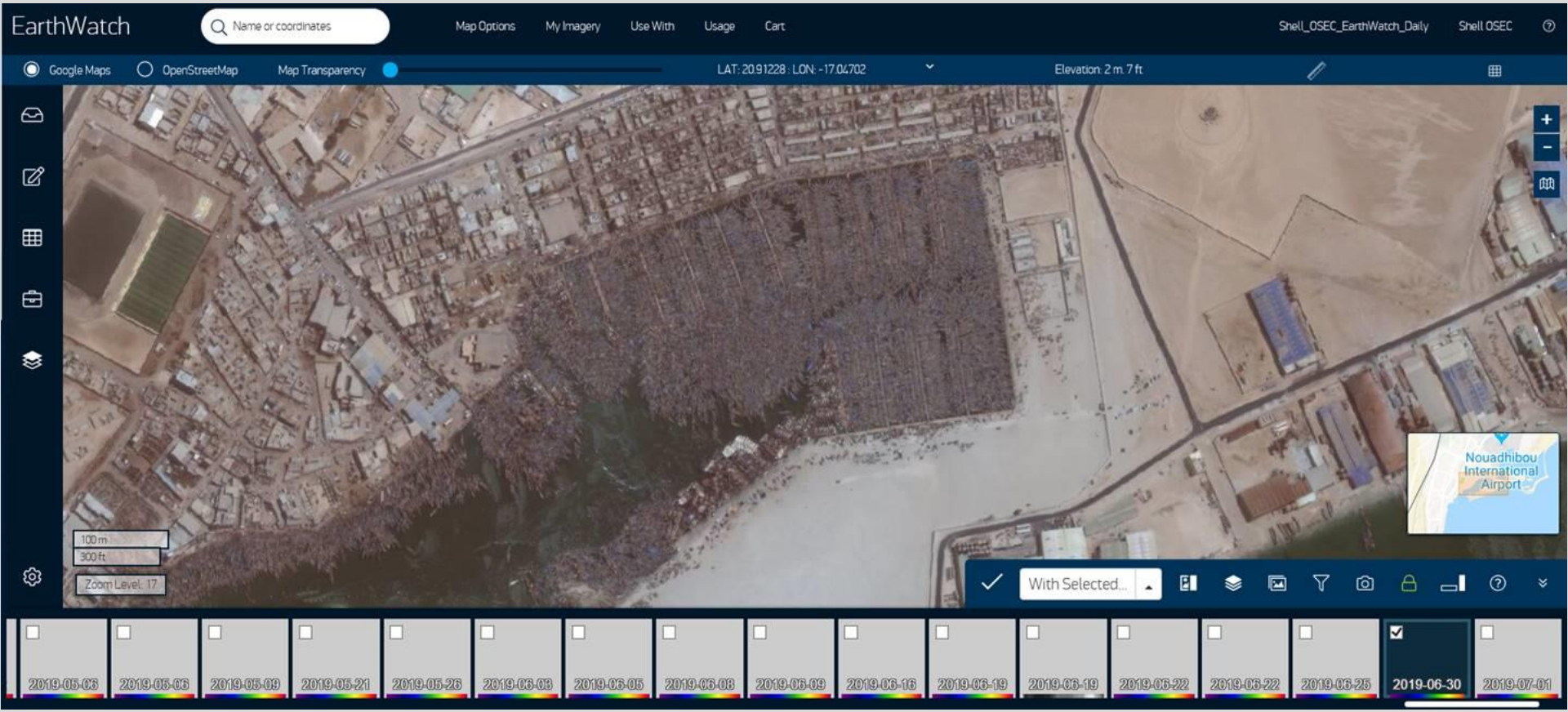
UNCHARTERED WRECK 2



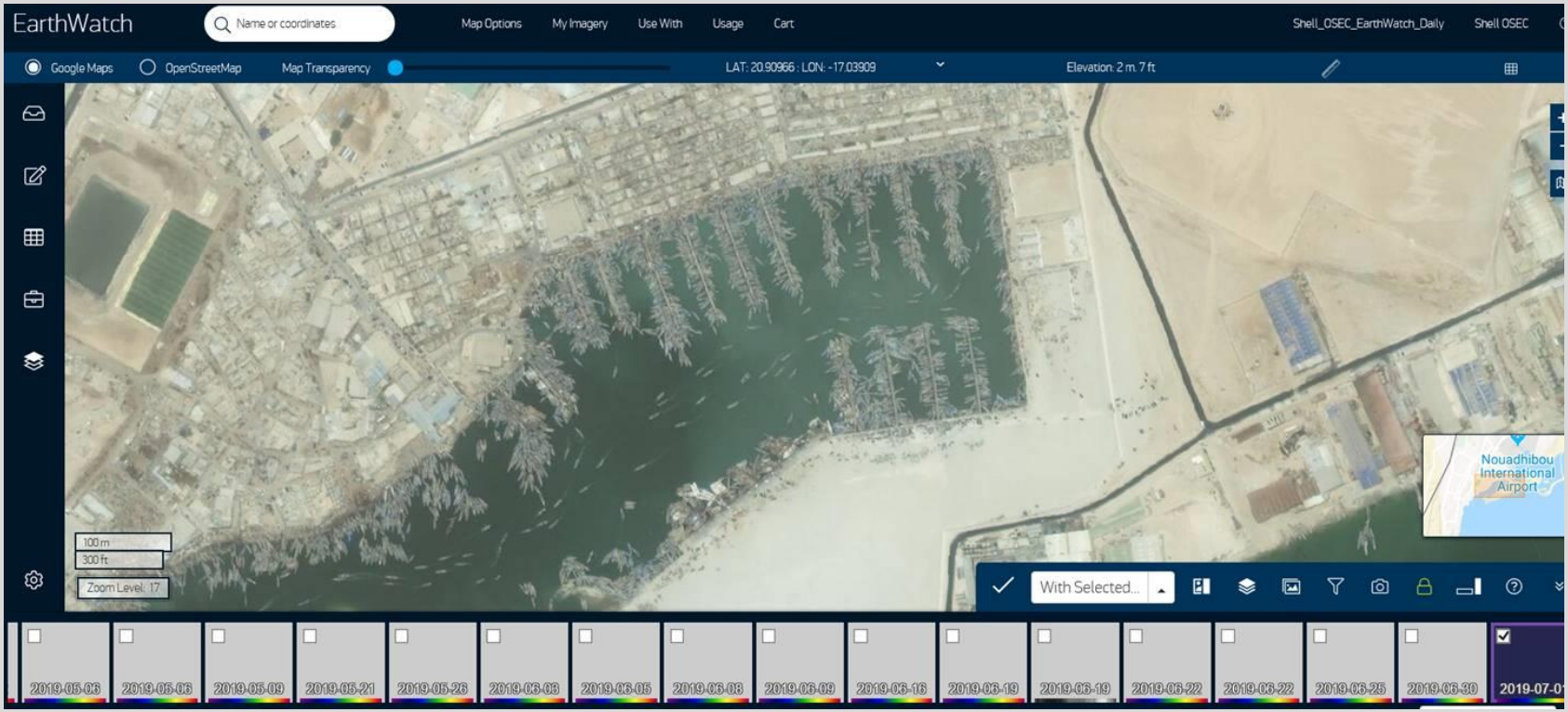


Minimum Depth	**16.30m**
Mean Seabed Depth	**23.00m**
Length	**48.00m**
Width	**11.60m**
Height	**7.30m**

30th June 2019 - Nouadhibou Port

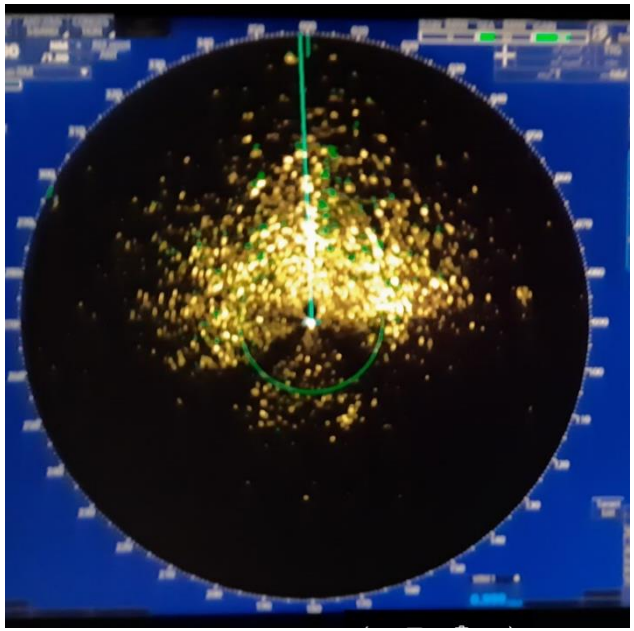


1st July 2019 - Nouadhibou Port



Fishing!

SURROUNDED!

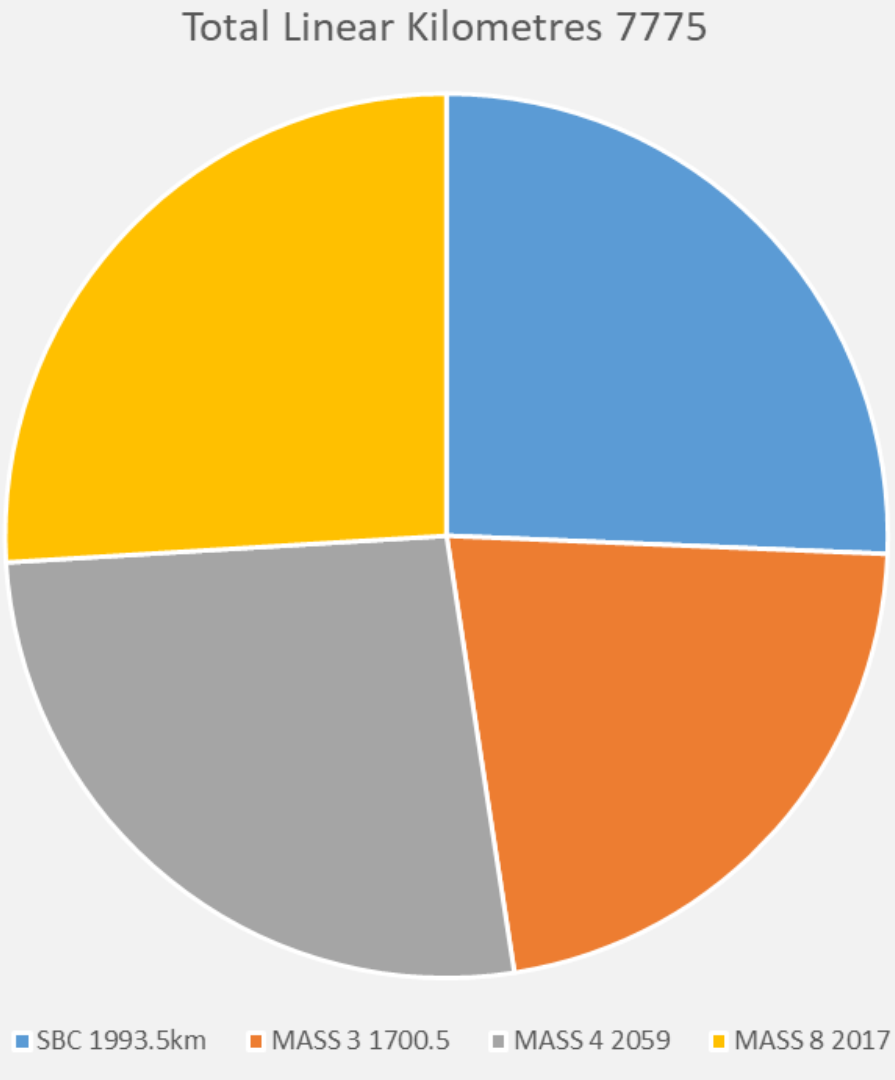


Summary of the MASS Operations

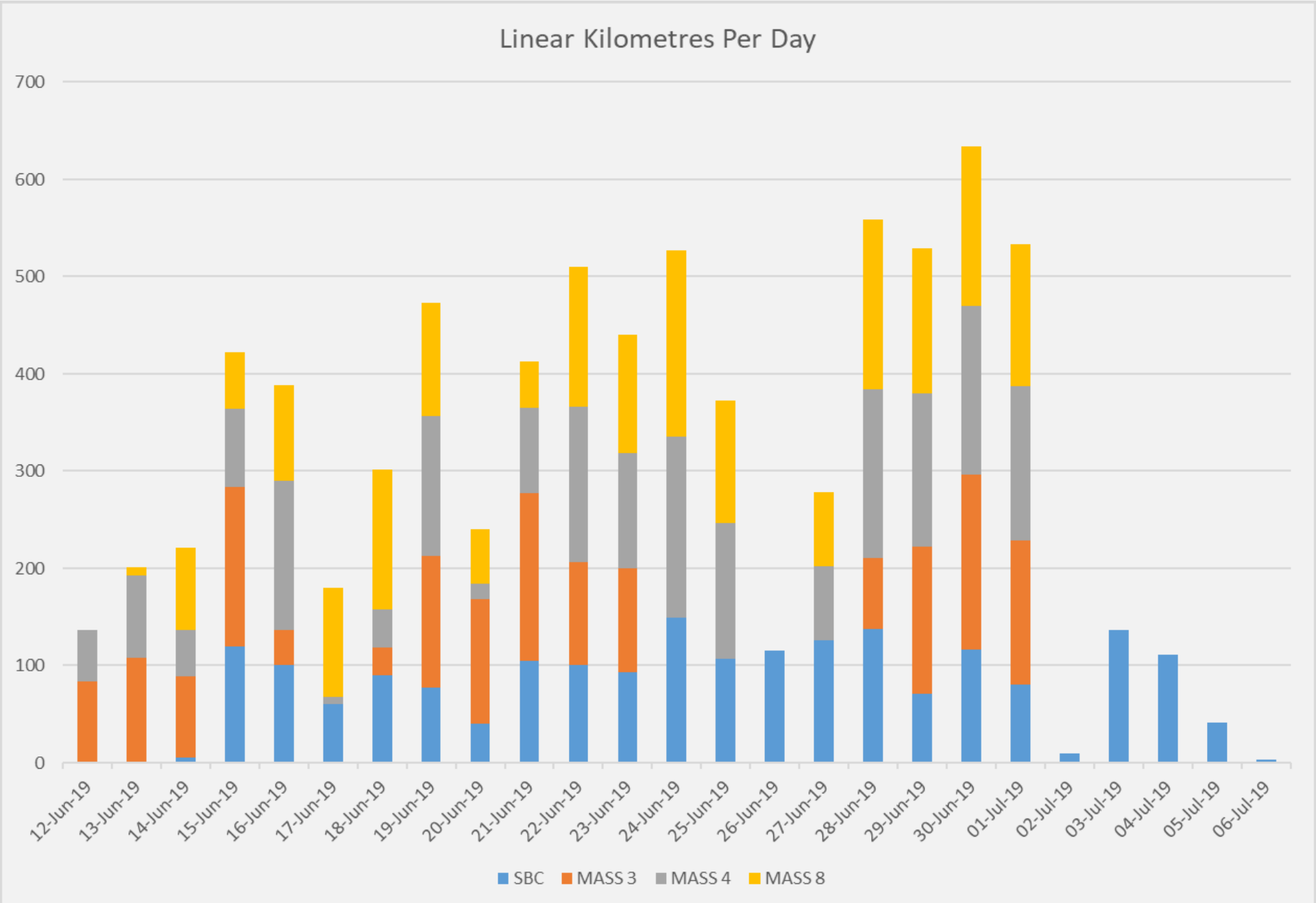
3 x MASS Units:

- ASV 3, 4 and 8 successfully mobilised with a new payload.
- 7.7m vessel built by ASV Global – draft .99m
- Twin Yanmar motors, 1,000 L onboard
- AIS, 3 Cameras,
- Moonpool for payload equipment

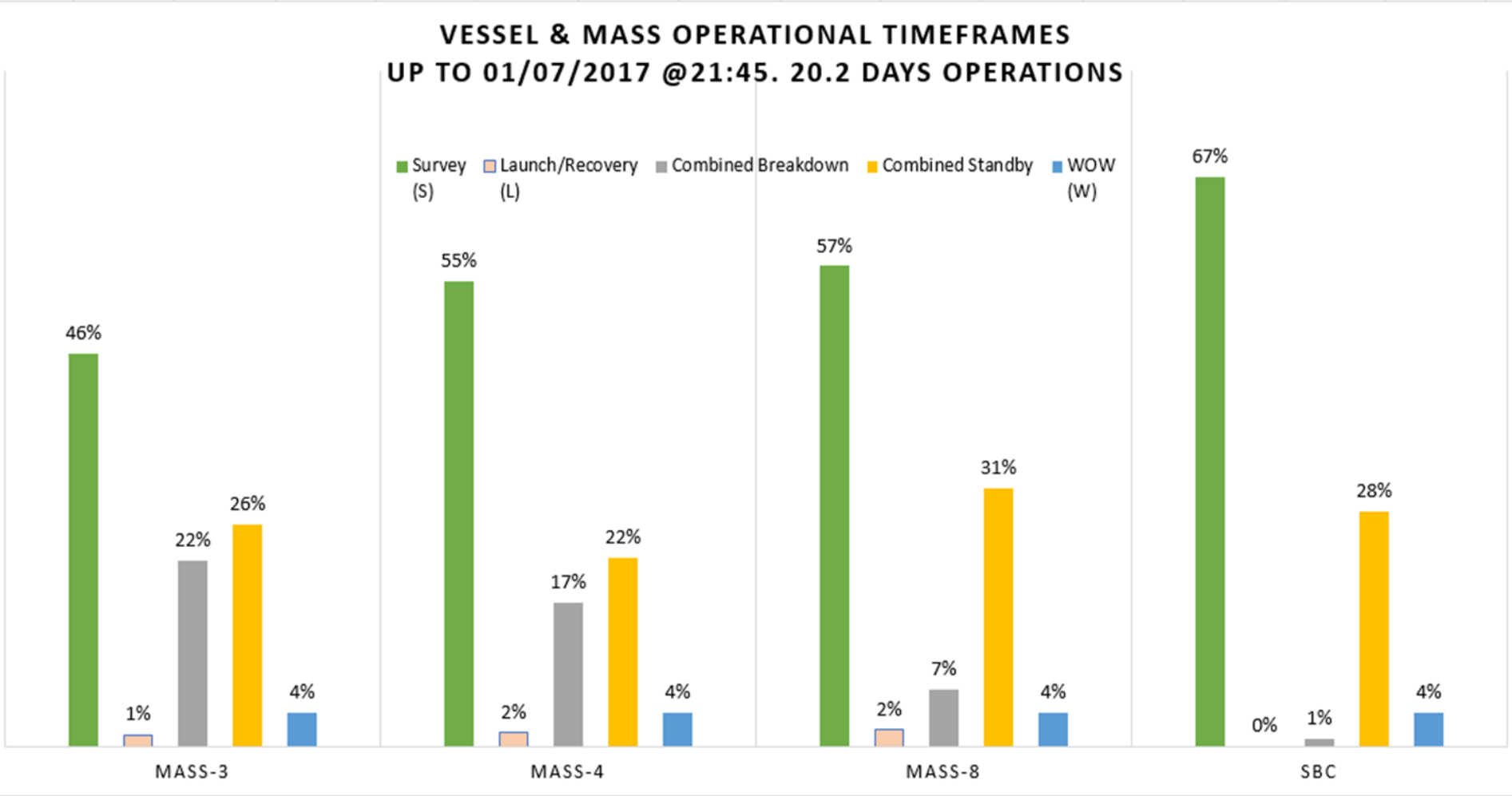
TOTAL LINEAR KILOMETRES

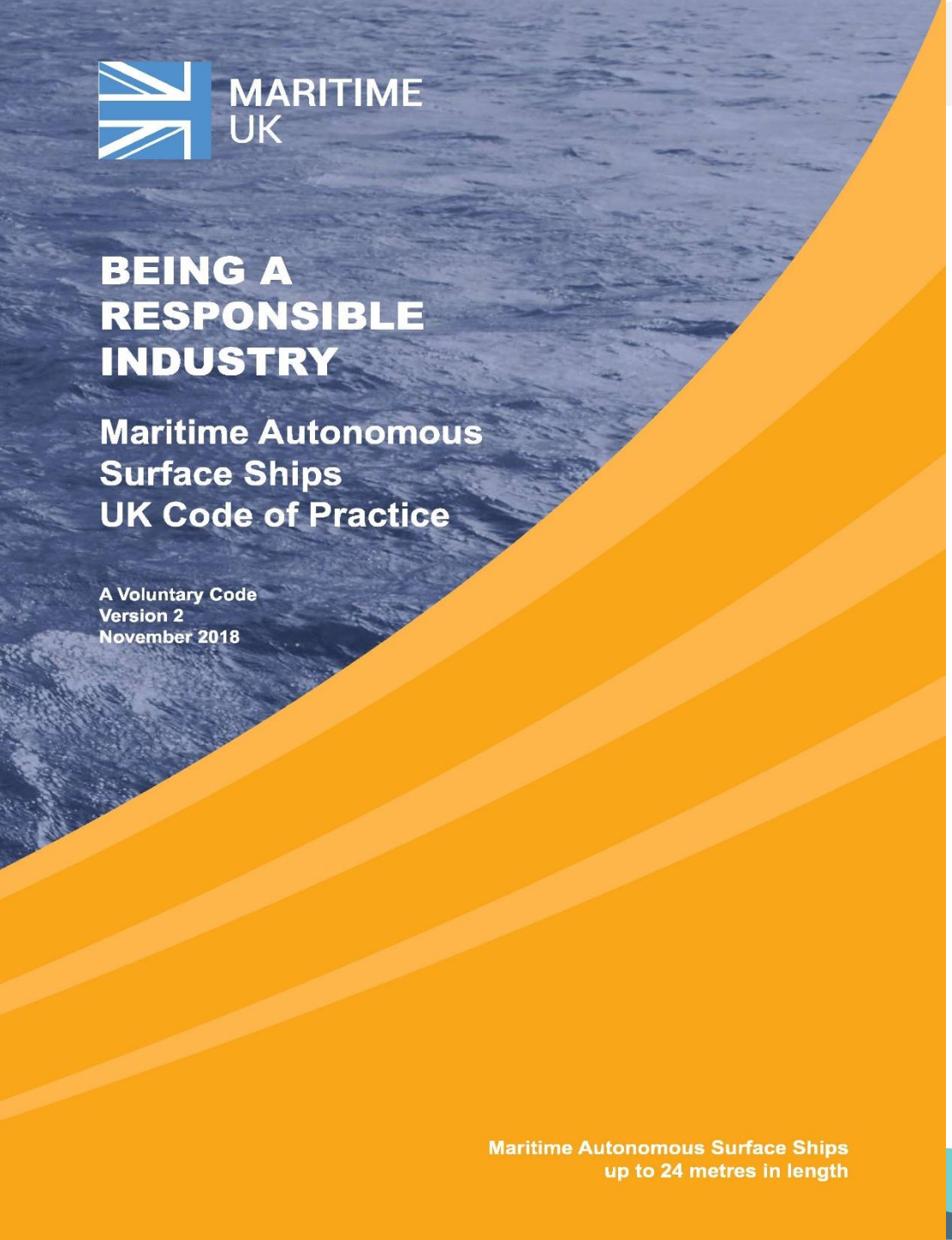


Line KM per Day per Platorm



Vessel & MASS Operational Timeframes





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Overarching document was the UK Code of Practice.

Captain had overall responsibility.

We operated MASS units on the basis of ‘ships equipment’

We had 10 experienced operators – only 4 deemed competent.
- No RYA license
- No ASV Certificate

Once suitable trust obtained - we could allow operators to work under supervision of a competent operator

Control of Operations

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MOPO - MATRIX OF PERMITTED OPERATIONS – SEABED CONSTRUCTOR

WEATHER AND VISIBILITY CONSTRAINTS

G	Acceptable
Y	To be assessed
R	Not acceptable

		Wind speed < 13 knots	Wind speed > 13 < 20 knots	Wind speed > 20 knots	Wave height < 1.5 m	Wave height > 1.5 m < 3.0 m	Wave height > 3.0 m	Currents < 2 knots	Currents > 2 knots	Visibility > 2000 m	Visibility < 2000 m	< Two hours before darkness	Hours of darkness	Severe Weather Forecast
Over-The-Side-Pole (Starboard Bulkhead)		G	G	Y	G	G	Y	G	Y	G	Y	G	G	R
MASS USV ASV	Bunkering at sea[1]	R	R	R	R	R	R	R	R	R	R	R	R	R
	Bunkering in support cradle / frame	G	Y	R	G	Y	R	G	Y	G	G	Y	Y	R
	Launch / Recovery[1]	Y	R	R	G	Y	R	G	G	G	Y	Y	Y	R
	Maintenance in support cradle / frame	G	Y	R	G	Y	R	G	Y	G	G	Y	Y	R
	Survey Operations	G	Y	R	G	Y	R	G	Y	G	Y	Y	Y	R
SEABED CONSTRUCTOR	Bunkering at sea[1]	G	Y	R	Y	Y	R	G	Y	G	Y	Y	Y	R
	Support vessel Alongside[1]	G	Y	R	Y	Y	R	G	Y	G	Y	Y	Y	R
	Helicopter operations[2]	G	Y	R	G	Y	R	G	G	G	Y	Y	R	R
	Crane Operations	Y	Y	R	G	Y	Y	G	G	G	G	G	Y	Y
	Close approach (Inside 500 m Zone)[3]	G	Y	R	G	G	Y	Y	Y	G	Y	Y	Y	R
	FRC, MOB & WB (Launch / Recovery)[1]	Y	R	R	G	Y	R	G	G	G	Y	Y	Y	R
	FRC, MOB & WB in sea (maintenance)	Y	R	R	G	Y	R	G	Y	Y	R	Y	Y	R
	FRC, MOB & WB (Personnel / Equipment transfer)[1]	Y	R	R	G	Y	R	G	G	G	Y	Y	Y	R
ROV	ROV Deployment / Recovery	G	Y	Y	G	Y	R	G	Y	G	Y	G	Y	R
	ROV Operations	G	G	Y	G	Y	R	G	Y	G	G	G	G	R

[1] Lee side.
[2] Ref. helicopter operation regulations/limits.
[3] Ref. clearance with OIM at field.

Launch and Recovery (LARS)

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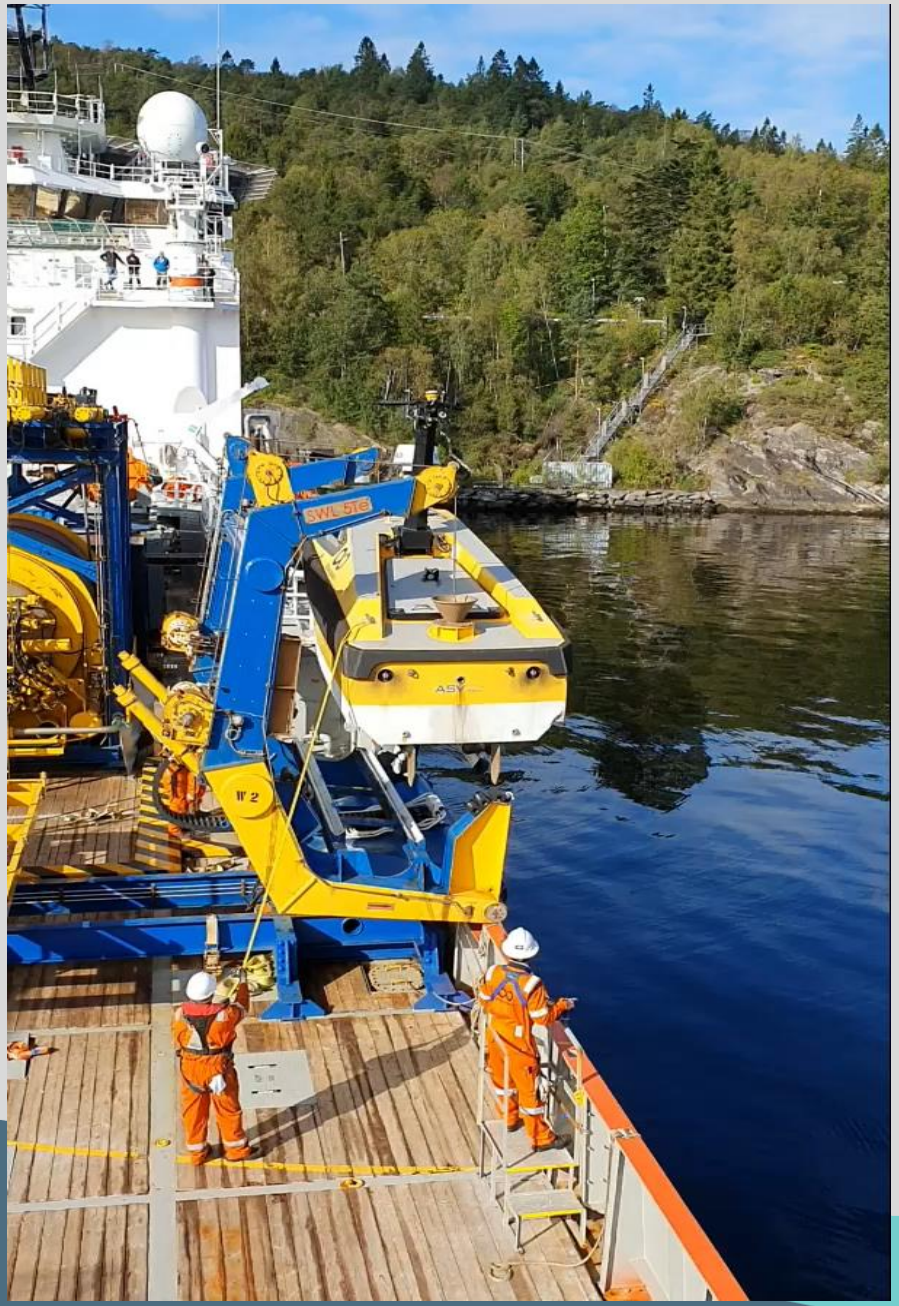
Launch and Recovery (LARS)



Major Lessons Learnt

MASS Unit Survey Operations
More effort required around treating them as autonomous units v unmanned survey vessels. Need to reduce human intervention in survey activity.

MASS Unit Operations
Took some time to get operational at efficient levels. Major issues being:
- Trust in the systems
- Trust in the people / operators
- Setting suitable data acquisition methodology

Data Transfer
Accessing Data onboard is important to determine acceptable coverage. We have implemented an independent wi-fi system for data downloads instead of unit recovery.

USV's a Force Multiplier

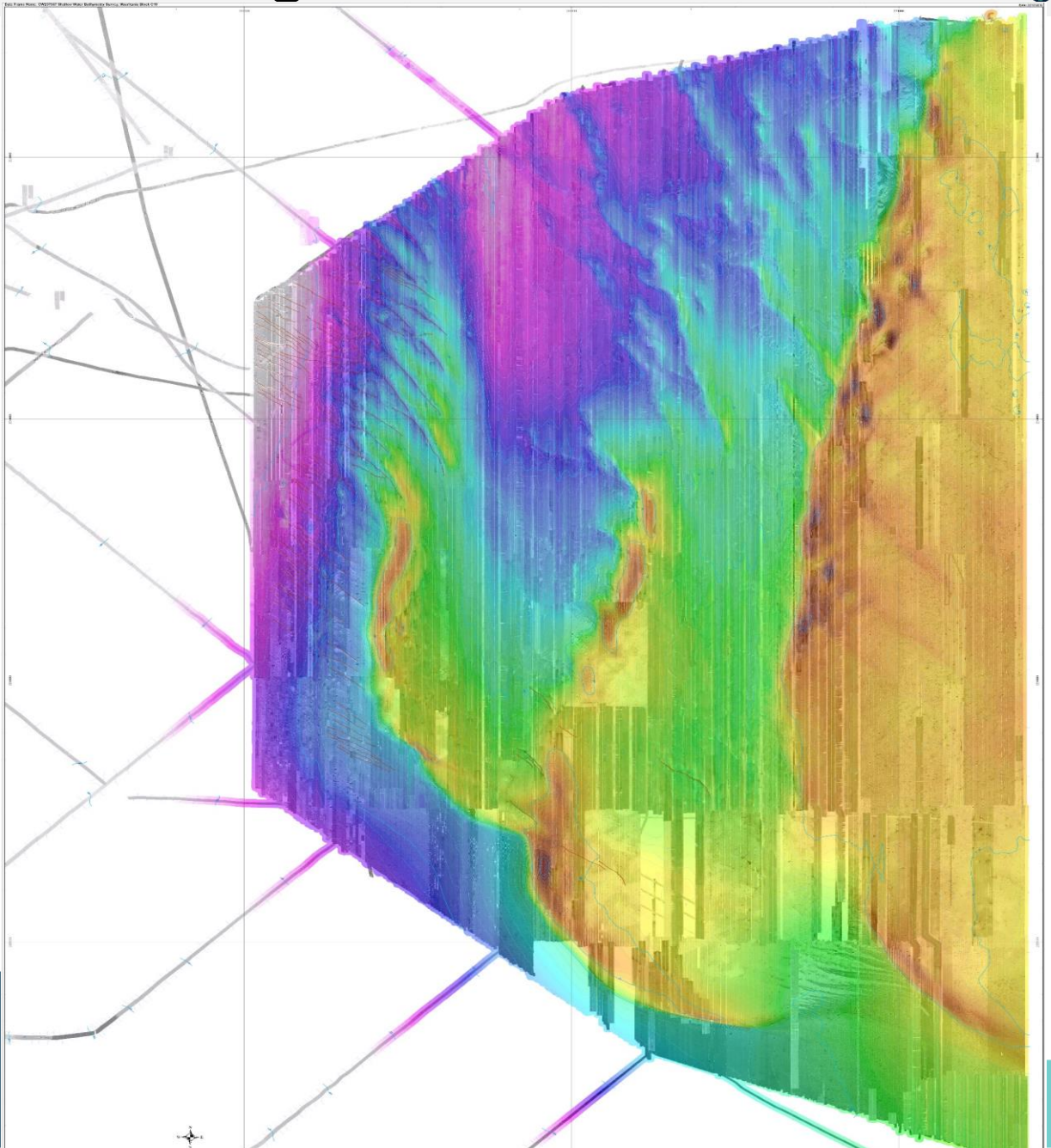
Unmanned Survey Vessel's:-

- Dramatically increase the rate of effort achieved per day
- Significant reduction in fuel usage
- Minimal increase in headcount
- Reduce the risk of shallow water work.

However:-

- Require some different approaches to single vessel acquisition
- Gains diminish with increasing units

Final Data Coverage



Thank You

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