Collecting Hydrographic Data with USVs

Example of the Force Multiplier Effect
Contents

• Scope of Work and Outcomes
• MASS Operations
• Lessons Learned
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 area 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
Unchartered Wreck 1

<table>
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<tr>
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<th>Value</th>
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<tr>
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<td><strong>Minimum Depth</strong></td>
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<td><strong>Length</strong></td>
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<td><strong>Width</strong></td>
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<td><strong>Height</strong></td>
<td>7.30m</td>
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30th June 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

Total Linear Kilometres 7775

- SBC 1993.5km
- MASS 3 1700.5
- MASS 4 2059
- MASS 8 2017
Line KM per Day per Platform

Linear Kilometres Per Day

SBC, MASS 3, MASS 4, MASS 8
Vessel & MASS Operational Timeframes

VEssel & MASS Operational Timeframes
Up to 01/07/2017 @21:45. 20.2 Days Operations

MASS-3
- Survey (S): 46%
- Launch/Recovery (L): 1%
- Combined Breakdown: 22%
- Combined Standby: 4%
- WOW (W): 26%

MASS-4
- Survey (S): 55%
- Launch/Recovery (L): 2%
- Combined Breakdown: 17%
- Combined Standby: 4%
- WOW (W): 22%

MASS-8
- Survey (S): 57%
- Launch/Recovery (L): 2%
- Combined Breakdown: 7%
- Combined Standby: 4%
- WOW (W): 31%

SBC
- Survey (S): 67%
- Launch/Recovery (L): 0%
- Combined Breakdown: 1%
- Combined Standby: 4%
- WOW (W): 28%
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

## MOPO - Matrix of Permitted Operations - Seabed Constructor

### Weather and Visibility Constraints

| G | Acceptable |
| Y | To be assessed |
| R | Not acceptable |

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

1. Ref. helicopter operation regulations/limits.
2. Ref. clearance with OIM at field.
3. Ref. clearance with OIM at field.
Launch and Recovery (LARS)
Launch and Recovery (LARS)
Major Lessons Learnt

MASS Unit Survey Operations
More effort required around treating them as autonomous units vs 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