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DOCUMENT TITLE	Field Operations Report UXO ID & Disposal
TOTAL NO OF PAGES	59
SUPPLIERS ORDER NO:	457

SUPPLIERS OWN DOCUMENT NUMBER	SUPPLIERS REVISION	DATE	SUPPLIERS APPROVAL SIGNATURE
UXC-PJ00216-FOR-GWO-IDC-001	1.1	20/12/21	

SUPPLIER DOCUMENT REVIEW	
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<input type="checkbox"/>	2. Revise and resubmit. Work may proceed subject to incorporation of changes indicated.
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PACKAGE DESCRIPTION	Pre-construction Site Survey			
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seaway⁷



SEAWAY 7

SEAGREEN OFFSHORE WINDFARM




PRE-CONSTRUCTION SITE SURVEY

PUXO IDENTIFICATION AND DISPOSAL

OPERATIONS AND RESULTS

DOC NO: UXO-PJ00216-FOR-GWO-IDC-001

ISSUE DATE: 20-12-2021

Rev. No: 1.1	UXOcontrol Ltd			Client
	Custodian	Verified By	Approved By	Authority
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Signature				





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Seagreen Offshore Windfarm
PUXO Identification and Disposal
Operations and Results

Rev No. 1.1
Issue Date: 20-12-2021



RISK MITIGATION | SURVEY | EXPLOSIVE ENGINEERING

REVISION RECORD SHEET

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Revision	Issue Date:	Revision Description	Reason for Revision
0.x	n/a	Internal drafts	Internal review
1.0	20-10-2021	First issue	To Client
1.1	20-12-2021	Second Issue	To Client



SEAWAY 7

Seagreen Offshore Windfarm
PUXO Identification and Disposal
Operations and Results

Rev No. 1.1
Issue Date: 20-12-2021

EXECUTIVE SUMMARY

Project objectives
<ul style="list-style-type: none">Identification of all possible UXO targets (Identification phase) provided via the <i>Master Target List</i> document, positively identifying each target as either non-UXO item, suspected sUXO, (suspected), or cUXO object (confirmed) in order to provide sufficient information for the "As Low As Reasonably Practicable" ALARP certificate for the OWFRemoval or relocation as required of non-UXO itemsDisposed confirmed UXO as required

Operations Summary – Glomar Worker

Operations	Start	End
Mobilisation	17-05-2021	28-05-2021
Operations	29-05-2021	12-10-2021
Demobilisation	13-10-2021	13-10-2021

Key Equipment– Glomar Worker

Equipment	Item
Surface positioning	CNAV 3050 with SF2 corrections
Underwater positioning	iXBlue ROVINS including DVL
Detection system (EM)	TSS440
Video cameras	Seaspy camera and Teledyne Bowtech HD camera
Dredge pump	Piranha 6-inch Dredging system
EOD	Low Yield Solution – HYDRA EODS
PAM System	Wildlife Acoustic SM4M Automatic Recording Unit (ARU)

pUXO Identification Results Summary

Target investigation	UXO status			Inspection outcome							Cumulative
	Confirmed UXO	UXO Related	Non-UXO	Relocated	Recovered to deck	Nothing Observed	Nothing detected	Remained in situ	Relocated UXO	UXO disposed	
Investigation Master Target List (iMTL)	4	10	1028	400	0	46	392	200	1	3	1042



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DEFINITIONS AND ABBREVIATIONS

Throughout this report the following terminology is used:

SWEL	Seagreen Wind Energy Ltd (End Client)
Seaway 7	Seaway 7 (Client)
UXOcontrol	UXOcontrol Ltd. (Contractor)
6 Alpha	6 Alpha Associates Ltd. (Client UXO consultant)
Seiche	Seiche Ltd (Marine Mammal Observer sub-contractor)

AF	As Found	OAS	Obstacle Avoidance Sonar
AG	As Given	OCR	Offshore Client Representative
AL	As Left	OSP	Offshore Substation Platform
ALARP	As Low As Reasonably Practicable	OWF	Offshore Wind Farm
ARU	Automatic Recording Unit	PAM	Passive Acoustic Monitoring
BGC	Background Compensation	PEP	Project Execution Plan
CET	Central European Time (UTC+1)	PPS	Pulse Per Second
cUXO	confirmed Unexploded Ordnance	pUXO	potential Unexploded Ordnance
DGNSS	Differential Global Navigation Satellite System	QC	Quality Control
DP	Dynamic Positioning	RF	Radio Frequency
DPR	Daily Progress Report	RPL	Route Position List
DVR	Digital Video Recorder	SHEQ	Safety, Health, Environment and Quality
EM	Electromagnetic	sMTL	Survey Master Target List
EOD	Explosive Ordnance Disposal	SOOO	Senior Opsporen Ontplofbare Oorlogsresten (senior detection of explosives war remains)
EVT	Equipment Verification Test	sUXO	Suspected Unexploded Ordnance
FRC	Fast Rescue Craft	SVP	Sound Velocity Profile
GIS	Geographic Information System	TIR	Target Investigation Report
GRS	Geodetic Reference System	TMS	Tether Management System
IAC	Inner Array Cable	USBL	Ultra-Short Baseline
iMTL	Investigation Master Target List	UTC	Coordinated Universal Time (UTC+0)
INS	Inertial Navigation Sensor	UTM	Universal Transverse Mercator
ITRF	International Terrestrial Reference Frame	UXO	Unexploded Ordnance
LAT	Lowest Astronomical Tide	VORF	Vertical Offshore Reference Frame
LARS	Launch And Recovery System	VTL	Vessel Target List
MMO	Marine Mammal Observer	WGS84	World Geodetic System (19)84
MOC	Management Of Change	WROV	Work class Remotely Operated Vehicle
MTL	Master Target List		
NPED	Non-Primary Explosive Detonators		

1 INTRODUCTION

Seaway 7 (hereafter called Client) contracted UXOcontrol to complete a pre-construction geophysical and unexploded ordnance (UXO) site survey in relation to the installation of the Seagreen Offshore Windfarm project. The project consists of the development of an offshore windfarm, including the Offshore Substation Platform (OSP), 114 (+8 spares) Wind Turbine Generators (WTG) and Inter Array Cables (IAC) within the Offshore Wind Farm (OWF). The Seagreen OWF is located in the North Sea, approximately 27 km from the Angus coastline to the north-east of Dundee.

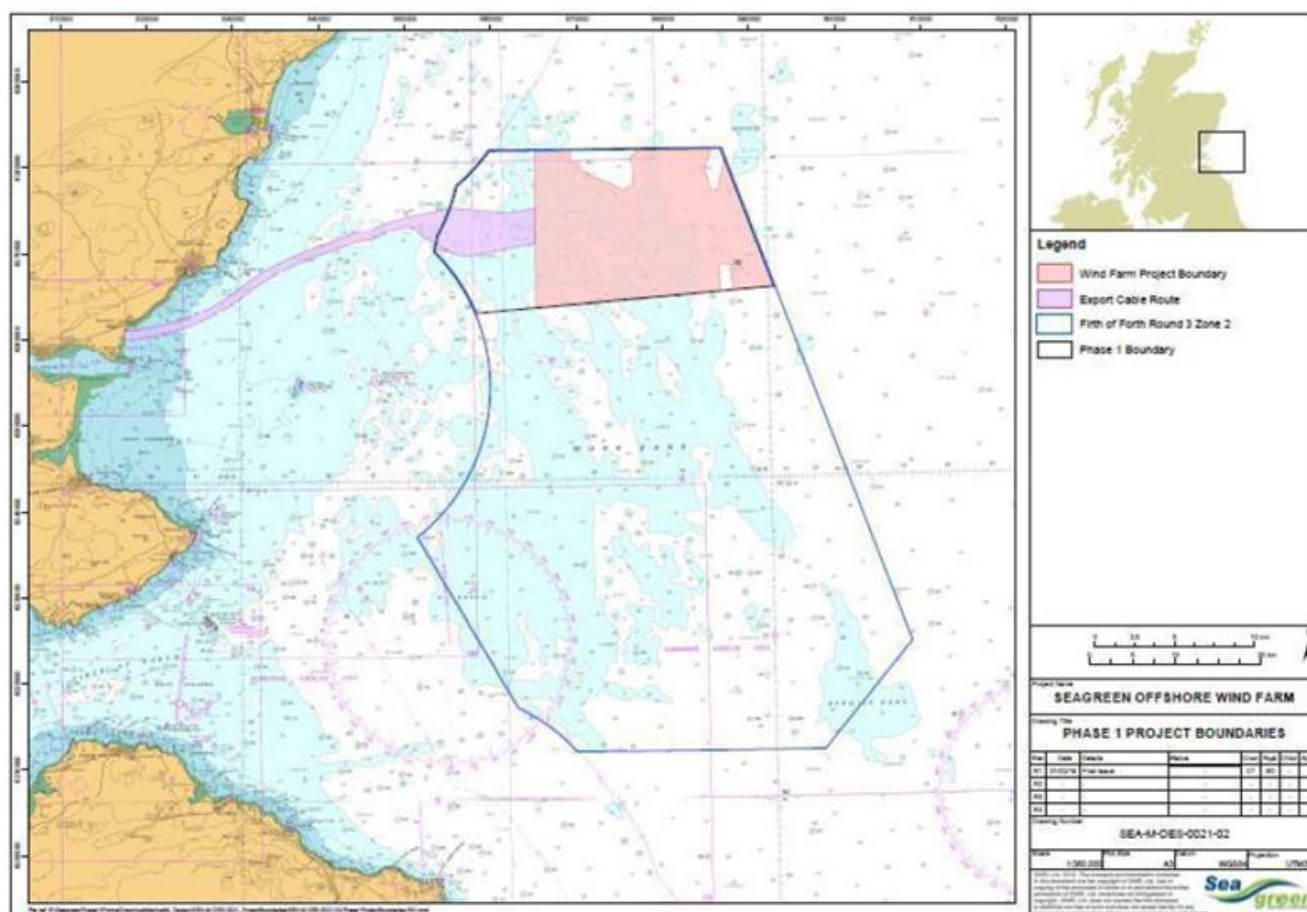


Figure 1-1 Seagreen offshore windfarm

1.1 SCOPE OF DOCUMENT

To undertake the pUXO identification and cUXO disposal work, UXOcontrol utilised the *Glomar Worker* (GWO). This document describes all operational activities associated with that vessel between 17 May and 13 October 2021, to complete the pUXO identification as well as the resulting cUXO disposal operations at the Seagreen Offshore Windfarm. A full *Mobilisation and Calibration Report* was issued on 07 July 2021 [Ref. 6], whilst individual *Target Investigation Reports* (TIR) were issued for each pUXO location investigated [Ref. 9].

1.2 REFERENCE DOCUMENTS

The following documents were relevant to the operations and completion of the identification phase of this project. The list is not exhaustive to the project as a whole, as those are outlined in the *Master Document Register* [Ref. 2].



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1.2.1 UXOcontrol

Table 1-1: UXOcontrol reference documents

#	Document Number / filename	Title
1	UXO-PJ00216-PEP-OPS-SUR-000	Project Execution Plan
2	UXO-PJ00216-MDR-001	Master Document Register
3	UXC-PJ00216-CPG-SHEQ-SUR-001	COVID Policy Guidance
4	UXC-PJ00216-PSP-OPS-IDC-001	Project Specific Procedure – UXO Identification
5	UXC-PJ00216-PSP-OPS-IDC-002	Project Specific Procedure-UXO Disposal
6	UXO-PJ00216-MCR-GWO-IDC-001	Mobilisation and Calibrations Report
7	UXO-PJ00216-EVT-GWO-IDC-001	Equipment Verification Test
8	UXO-PJ00216-FOR-GWO-IDC-001	Field Operation Report (<i>this document</i>)
9	UXO- PJ00216-TIR-GWO-IDC-[Target name as per iMTL]	Target Investigation Report
10	UXC-PJ00216-iMTL-DC-IDC-01_[Rev Nb]_[Date]]	Identification Master Target List
11	UXC-PJ00216-SHE-001	Health, Safety & Environmental Plan
12	UXO-PJ00216-DT-OPS-SUR	UXO Threat Assessment
13	UXO-PJ00216-RA-OPS-SUR	UXO Risk Assessment
14	BMS-OP-0520-PR-005	pUXO Identification ROV

1.2.2 Client

Table 1-2: Client reference documents

#	Document Number / filename	Title
15	ET2361-SCM-000127	Scope of Work for pre-construction site survey
16	LF000009-ENG-OF-MAP-0026	InterArrayCableLayout114
17	LF000009-CST-MA-MAN-0001	GIS Data Standards and Conventions
18	LF000009-ENG-OF-LYT-0001	UXO and Boulder Clearance Areas Detail
19	Seagreen Field Layout Working WG_SWEL_RevR7_Detailed Route Engineering_080321_UXO Control Use.dwg	Field Layout

1.2.3 Third Party

Table 1-3: Third party reference documents

#	Document Number / filename	Title
20	Glomar Worker 2018	Common Marine Inspection Document
21	Glomar Worker Gyro and MRU Calibration, DGNSS Verification and Offset Survey Report	OP0058 - Glomar Worker FINAL Report_13 May2021
22	N/A	Marine Mammal Observer and Passive Acoustic Monitoring Handbook



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1.2.4 Management of Changes

Table 1-4: Management of changes

#	Document Number / filename	Title
23	UXC-PJ00216-MOC-OPS-ID-001	Initial search Grid size change
24	UXC-PJ00216-MOC-OPS-ID-002	SVP and Dredging operations
25	UXC-PJ00216-MOC-OPS-ID-003	Obstacle Identification at P28
26	UXC-PJ00216-MOC-OPS-IDC-001	UXO Related Debris Recovery As-left size
27	UXC-PJ00216-MOC-OPS-IDC-002	Change of Noise Monitoring Locations



2 SCOPE OF WORK

As part of the pre-construction survey of the locations where the WTG and OSP Support Structures are to be installed, Client required Potential UXO (pUXO) identification phase to be conducted to attain the UXO As Low As Reasonably Practicable" ALARP Sign-Off certificate for relevant target locations.

Targets identified as confirmed UXO (cUXO) were disposed, following the identification campaign.

2.1 PUXO IDENTIFICATION

The data from the previously conducted survey phase had been used by UXOcontrol and Seaway 7 to evaluate geophysical targets, select locations for subsequent inspection of surficial or buried (ferrous) objects and preparation of UXO risk signoff documentation or removal/disposal operations. Targets to be identified, as well as newfound targets, were added to the Vessel Target List (VTL), to be incorporated in the iMTL by UXOcontrol.

Until the 01 July 2021, UXOcontrol was responsible for the ALARP, and therefore provided the pUXO listing to Client. From 01 July, the ALARP certification responsibility was transferred to Client UXO consultant 6 Alpha, who was therefore responsible of providing pUXO lists to Client. Based on engineering requirements, Client filtered those lists and provided lists of pUXO locations that could not be avoided and would therefore require identification and UXO clearance, based on ALARP principle.

Since the pUXO identification phase took place simultaneously to the survey phase. The investigation listing was regularly reviewed, based on survey block completed.

An overview of the iMTL revisions during the project is provided in Table 2-1.

Table 2-1: iMTL revision history

iMTL Revision	Date	Description of changes
0.10	20/05/2021	Initial issue, 195 targets to investigate
0.20	21/05/2021	Addition 11 targets from 6 Alpha
0.30	25/05/2021	Added target G-Q-00038 to iMTL
0.40	25/05/2021	Removed G-Q-00038 from iMTL (A total 206 targets to investigate)
0.50	28/05/2021	Removed 4 Targets (6A_G-00077, 6A_G-00194, 6A_G-00223, 6A_G-00224)
0.60	04/06/2021	Removed 5 targets (G-L-00393, G-L-00394, G-L-00396, G-L-00397, G-S-00211) Added 1 target (G-Q-00154)
0.61	08/06/2021	3 Targets added to iMTL: G-Q-127, G-Q-130 & G-Q-134
0.70	09/06/2021	553 Targets added to iMTL (A total of 754 Targets to investigate)
0.71	15/06/2021	Added 66 targets (820 targets to investigate in total)
0.72	23/06/2021	Added 9 targets to iMTL
0.73	25/06/2021	Removed 335 targets from iMTL following Client requests
0.74	01/07/2021	Removed 119 targets from iMTL
0.75	02/07/2021	Added 4 targets (G-IN-01058 / G-IN-01060 / G-IN-01064 / G-IN-01067)
0.76	05/07/2021	Added 50 targets from RWG1-4 within 90m JUB areas and IAC's
0.77	07/07/2021	Added 71 targets from RWG5 within the 90m JUB areas and IACs
0.78	13/07/2021	Removed 1 target (6A_G-00779) from iMTL
0.79	15/07/2021	Added 45 targets to iMTL
0.80	23/07/2021	Added 106 targets to iMTL
0.81	24/07/2021	Removed 12 targets from iMTL as per client request



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iMTL Revision	Date	Description of changes
0.82	28/07/2021	Added 171 targets to iMTL
0.83	19/08/2021	6 targets removed (6A G-00161 A, 6A G-00161 B, 6A G-00161 C, 6A G-00161 A, 6A_G-00162_A, 6A_G-00162_B, 6A_G-00162_C) from iMTL
0.84	03/09/2021	Added 27 targets to iMTL
0.85	04/09/2021	Added 31 targets to iMTL
0.87	09/09/2021	Added 106 targets to iMTL
0.88	18/09/2021	Added 10 targets to iMTL
0.89	22/09/2021	Added 16 targets to iMTL
0.90	30/09/2021	Added 24 targets to iMTL
1.0	18/10/2021	Issue to Client following project completion

2.2 PROJECT SPECIFIC PARAMETERS

All the target investigation followed the criteria mentioned in the *Project Specific Procedure Report* [Ref. 4] as listed below in the Table 2-2.

Table 2-2: Target investigation parameters

Parameters	Criteria
Target Threshold (search task)	50 μV ¹
Maximum dredging depth (m):	2 m ²
Initial survey grid (m):	5 mx5 m
Extended survey grid (m):	10 mx10 m
Debris	Relocated outside as found initial / extended grid to allow for as left survey
Treat UXO related debris as:	Regular debris

2.3 CUXO DISPOSAL PHASE

Any cUXO identified during the ID phase was to be disposed with all efforts on minimising the impact on the environment and marine mammals. UXO clearance works was carried out following standard EOD guidelines and industry practices to always ensure safety for the crew and involved vessels. All detonations took place in daylight.

UXOcontrol assured all necessary procedures and all required approvals / permits for the clearance works were available on time prior the start of the works.

Mammal mitigation measures were put in place by means of using acoustic mitigation devices (AMD). A MMO was on duty during the disposal activities and monitor any marine mammal activity within the area.

The post clearance/detonation as left survey operations, after the successful completion of UXO disposal activities, included a video and Electromagnetic (EM) survey of the surrounding area around the cleared UXO.

¹ Smallest threshold for a single hit seen within a search area, where a larger target was seen and subsequent smaller ones (>50mv) not all targets required inspection, client representative was consulted to determine if further inspections was required at the specific target area.

² Where a significant object was identified before 2.0 m, or where ground conditions dictated, excavation was limited and the depth of 2.0 m did not need to be reached as target location could be considered free of UXO and could be signed off.



3 SURVEY PARAMETERS

3.1 PROJECT GEODETIC REFERENCE SYSTEM

All offshore coordinates are referenced to World Geodetic System 1984 (WGS84) as presented in Table 3-1. All grid coordinates are presented on the Universal Transverse Mercator projection Zone 30 North (UTM 30N). The parameters for the project reference frame and projection are presented in Table 3-1. Note that the alongside calibrations in the Netherlands were performed in UTM Zone 31N.

Table 3-1: Projection parameters

Datum	
Name	World Geodetic System 1984 (WGS84)
Spheroid	WGS84
Semi-major axis (a)	6 378 137 m
Inverse flattening (1/f)	298.257223563
EPSG Code	4326
UTM Projection	
Zone	30 N
Central meridian (CM)	3° West
Latitude of origin	0°
False easting	500 000 m
False northing	0 m
Scale factor at central meridian	0.9996
Projection units	International metres
EPSG code	32630

3.1.1 GNSS Geodetic Reference Frame

The Global Navigational Satellite System (GNSS) positioning solution uses raw data observed on board combined with corrections to compute surface position. The GNSS corrections are provided by two independent suppliers to provide redundancy. The correction data from each supplier is referenced to the global International Terrestrial Reference Frame 2014 (ITRF2014).

The primary positioning system, C-NAV 3050, using C-Nav- and the secondary services the SF2Trimble SPS855 using Marinestar, are based around precise point positioning (PPP) broadcast through communication satellites. Both sets of correction data are referenced to ITRF2014, requiring no geodetic transformation.

Table 3-2: Positioning system correction service datum

Positioning Receiver	GNSS correction service	Datum
C-NAV 3050	C-NAV SF2	WGS84 (ITRF2014)
Trimble SPS855	Marinestar	WGS84 (ITRF2014)

3.1.2 Vertical Control

All height measurements are referenced to Lowest Astronomical Tide (LAT) using VORF model for the WGS84 – LAT separation in the project area supplied by the United Kingdom Hydrographic Office in blocks with a size of 10 km x 10 km. The project area covered 8 complete blocks and 8 partial blocks.

3.2 STANDARD NOMENCLATURE & UNITS

Throughout this report the following nomenclature and units apply unless otherwise stated:

- Linear units are expressed in international meters [m]
- Angular units are expressed in degrees (°)
- Frequency units are expressed in hertz (Hz)
- Electromagnetic measurements (μV)

3.3 TIME KEEPING

Data time-tagging and synchronisation are in Universal Time Coordinated (UTC). All data recorded in the online navigation software are time stamped, where appropriate, using the time string and the pulse-per-second (PPS) from the primary Differential Global Navigation Satellite System (DGNSS).

All times referred to within this document and time used for record keeping during the project are in local time unless otherwise stated. Alongside mobilisation and calibrations took place in the Netherlands, where the local time was UTC + 2 hours, also known as Central European Summer Time (CEST). Offshore calibrations and verifications and operations took place in UK waters where the local time was UTC + 1 hour also known as British summer time.

3.4 OFFSET AND ROTATION SIGN CONVENTIONS

Unless otherwise specified, all offsets and rotations are as per QINSy axis and rotation sign conventions, shown in Table 3-3. The axis sign conventions are illustrated in Figure 3-1.

Table 3-3: Offset and rotation sign conventions

Offset sign convention	
The X axis runs laterally from port to starboard	
The Y axis runs longitudinally, from stern to bow	
The Z axis runs vertically upwards	

Rotation sign convention	
Pitch, bow up (P)	+ (positive)
Roll, starboard down (R)	+ (positive)
Yaw, heading starboard (H)	+ (positive)
Heave, up (Hve)	+ (positive)

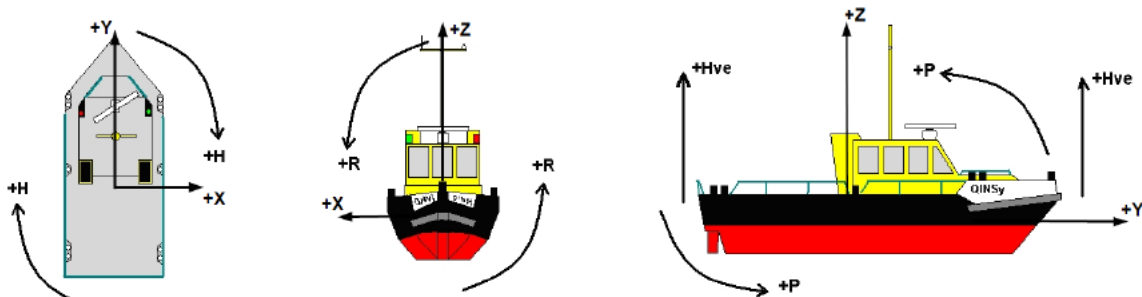


Figure 3-1: Angular and axis sign conventions (source: QINSy documentation)

4 PERSONNEL

4.1 PROJECT COMPANY HIERARCHY

The companies involved in the project are summarised in Figure 4-1:



Figure 4-1: Project company hierarchy

4.2 ONSHORE PROJECT TEAM

The onshore personnel involved in the project are listed in Table 4-1 and represented by an organogram in Figure 4-2. UXOcontrol appointed a dedicated Project Manager for the project. The Project Manager was the primary point of contact and responsible for all aspects of the project.

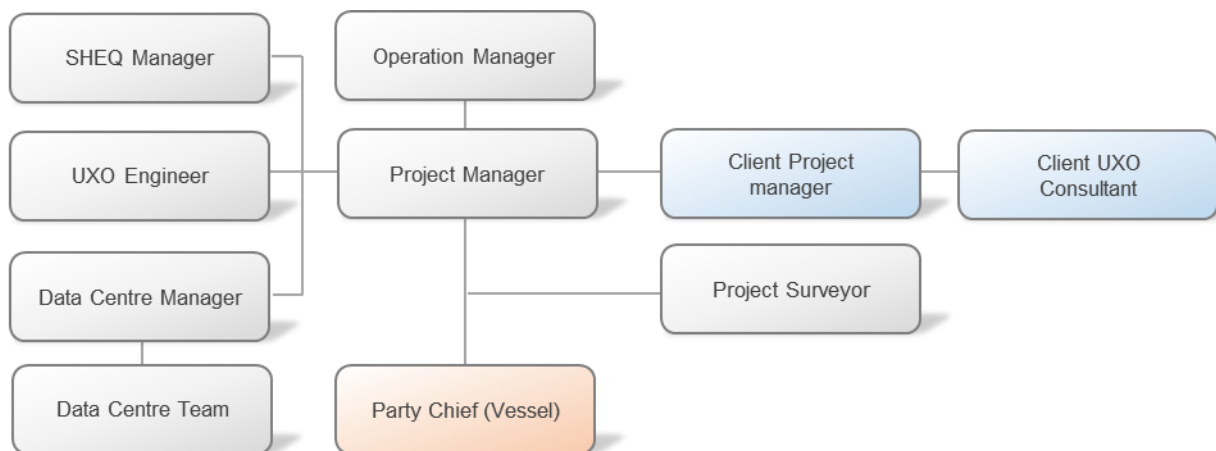


Figure 4-2: UXOcontrol onshore project team organogram



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Table 4-1: UXOcontrol onshore project personnel

Position	Name
Operations Manager	Peter Cherneski
Project Manager	Gerwin Peeters / Dale McDonald
Client Project Manager	Alexandru Lepadatu
Project Engineer	Bram Dröge
SHEQ Manager	Siobhan Galbraith
Data Centre Manager	Hein Filius
EOD Superintendent	Adrian Dann

4.3 OFFSHORE PROJECT TEAM

The personnel positions for the offshore operations are illustrated in the organogram in Figure 4-3 and listed in Table 4-2. Operations continued 24 hours per day with two 12-hour shifts.

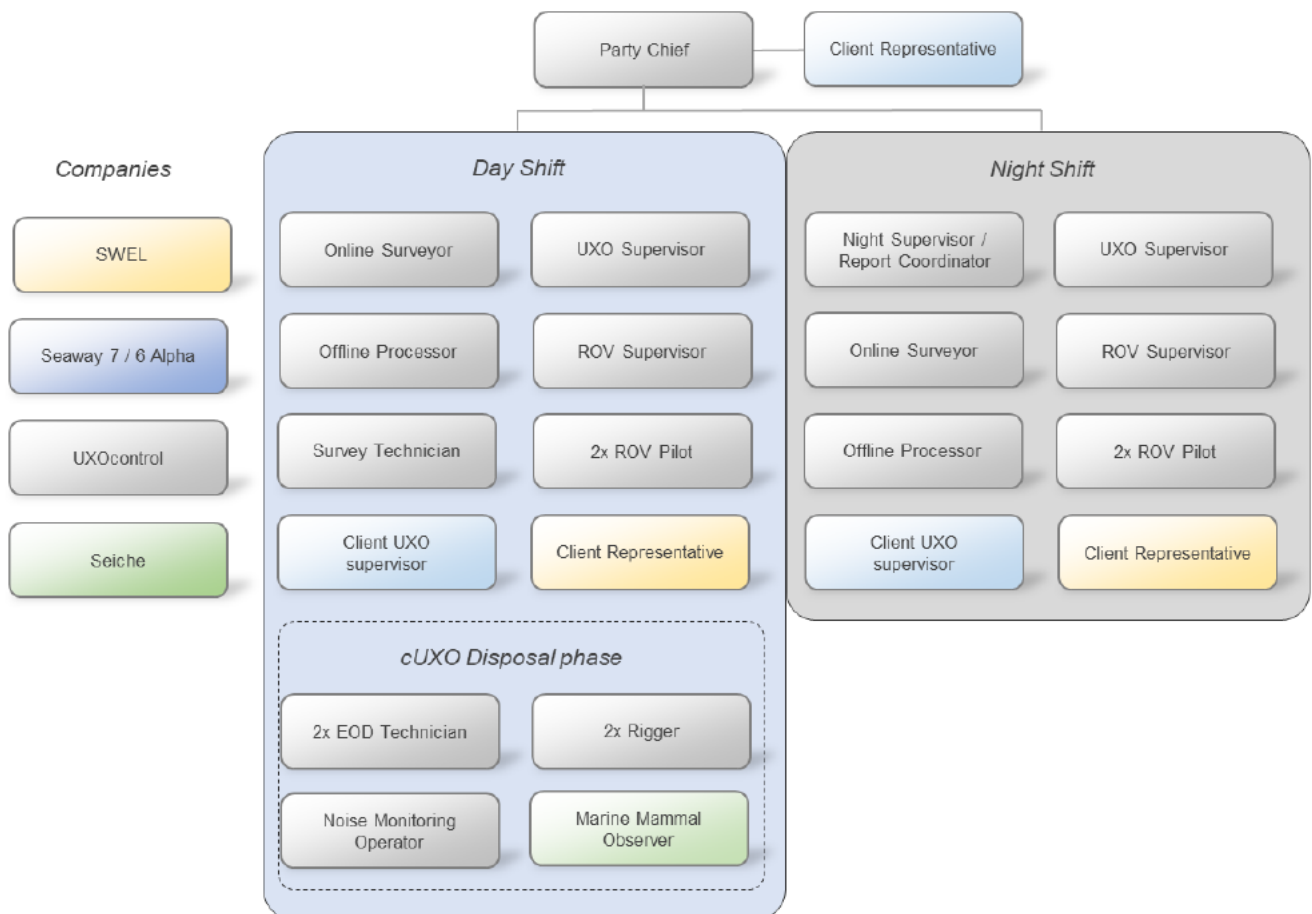


Figure 4-3: Offshore personnel organogram



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Table 4-2: Offshore project personnel

Name	Position	Company	Date on	Date off
Nicholsa Giubarelli	Client Representative	S7	14/07/2021	11/08/2021
Andrew Pearce	Client Representative	S7	20/05/2021	20/05/2021
Robert Lothian	Client Representative	S7	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 01/10/2021
Jason Hogg	Client Representative	S7	20/05/2021 14/07/2021	16/06/2021 11/08/2021
Philip Sullivan	Client Representative	S7	20/05/2021	16/06/2021
Stuart Russell	Client Representative	S7	14/07/2021	11/08/2021
David Bateman	Client Representative	S7	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 01/10/2021
David McKenna	Client Representative	S7	16/06/2021	14/07/2021
Christopher Gray	Client Representative	S7	11/08/2021 31/08/2021	13/08/2021 01/10/2021
Thomas Isaac	Client Representative	S7	02/10/2021	12/10/2021
Andrew Owen	Client Representative	S7	02/10/2021	12/10/2021
Dean Simpson	Client Representative	S7	02/10/2021	12/10/2021
Michael Archer	SWEL client representative	SWEL	20/05/2021 14/07/2021	16/06/2021 11/08/2021
Paul Kennedy	SWEL client representative	SWEL	20/05/2021 14/07/2021	16/06/2021 11/08/2021
Tony Bean	SWEL client representative	SWEL	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 11/10/2021
Graham Turnbull	SWEL client representative	SWEL	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 11/10/2021
Edwin Theis	EOD	N-Sea	20/05/2021 14/07/2021	16/06/2021 11/08/2021
Neil Christie	EOD	N-Sea	20/05/2021	14/07/2021
Paul Jackson	EOD	N-Sea	14/07/2021	11/08/2021
Ian Higgins	EOD	N-Sea	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 20/09/2021
Marcus Dickson	EOD	N-Sea	11/08/2021 31/08/2021	13/08/2021 20/09/2021
Simon van der Kolk	EOD	N-Sea	20/09/2021	12/10/2021
Joseph Weaver	EOD	N-Sea	20/09/2021	12/10/2021
Andrew Hornsby	EOD	N-Sea	20/09/2021	12/10/2021
Matthew Whiting	EOD	N-Sea	20/09/2021	12/10/2021
Iain MacLeod	MMO	Seiche	20/09/2021	12/10/2021
Daniel Graham	Party Chief	N-Sea	18/05/2021	16/06/2021
Barry Jesso	Party Chief	N-Sea	16/06/2021	14/07/2021



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Name	Position	Company	Date on	Date off
Barry Sinclair	Party Chief	N-Sea	14/07/2021	11/08/2021
Neil Landsborough	Party Chief	N-Sea	11/08/2021 31/08/2021	14/08/2021 12/10/2021
Bede Bin Jafri	Online Surveyor	N-Sea	18/05/2021	14/07/2021
Aleksandr Shulev	Online Surveyor	N-Sea	18/05/2021	16/06/2021
Nigel Aird	Online Surveyor	N-Sea	16/06/2021 11/08/2021	14/07/2021 13/08/2021
Opeyemi Oyewole	Online Surveyor	N-Sea	14/07/2021	11/08/2021
Nicholas Gough	Online Surveyor	N-Sea	14/07/2021	11/08/2021
Siarhei Skrytski	Online Surveyor	N-Sea	11/08/2021	24/08/2021
Maksim Zaulichny	Online Surveyor	N-Sea	31/08/2021	02/10/2021
Oleg Klepikov	Online Surveyor	N-Sea	31/08/2021	12/10/2021
Maksim Khanin	Online Surveyor	N-Sea	02/10/2021	13/10/2021
Alice Bamkin	Report Coordinator	N-Sea	21/05/2021 14/07/2021	16/06/2021 11/08/2021
Carol Stern	Report Coordinator	N-Sea	16/06/2021	14/07/2021
Sebastiaan Hartog	Report Coordinator	N-Sea	11/08/2021 31/08/2021	13/08/2021 02/10/2021
Alexander Kazantsev	Report Coordinator	N-Sea	02/10/2021	13/10/2021
Tai Phaik See	Processor	N-Sea	17/05/2021	16/06/2021
Megan Rimmer	Processor	N-Sea	20/05/2021	16/06/2021
Andrey Timoshin	Processor	N-Sea	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 12/10/2021
Vladimir Gubarev	Processor	N-Sea	16/06/2021	14/07/2021
Ivan Sokolov	Processor	N-Sea	14/07/2021	13/08/2021
Daria Pavlova	Processor	N-Sea	14/07/2021	11/08/2021
Anton Povarukhin	Processor	N-Sea	31/08/2021	12/10/2021
David Campbell	Survey Engineer	N-Sea	17/05/2021 11/08/2021	14/07/2021 13/08/2021
Bin Khairuddin	Survey Engineer	N-Sea	14/07/2021	06/08/2021
Alexander Anderson	Survey Technician	N-Sea	17/05/2021	20/05/2021
Niall Pirrie	Survey Technician	Seatronix	18/05/2021	20/05/2021
Stephen Stuart	ROV Supervisor	N-Sea	18/05/2021 14/07/2021 31/08/2021	17/06/2021 11/08/2021 02/10/2021
Gavin Glezer	ROV Supervisor	N-Sea	19/05/2021 11/08/2021	14/07/2021 13/08/2021
Robert Humphries	ROV Supervisor	N-Sea	14/07/2021	11/08/2021
Stephen Stuart	ROV Supervisor	N-Sea	14/07/2021	11/08/2021
George Duncan	ROV Supervisor	N-Sea	14/07/2021 02/10/2021	11/08/2021
Will Nipper	ROV Supervisor	N-Sea	14/07/2021 31/08/2021	11/08/2021 02/10/2021



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Name	Position	Company	Date on	Date off
Richard Postlethwaite	ROV Supervisor	N-Sea	02/10/2021	13/10/2021
Robert Stewart	ROV Supervisor	N-Sea	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 01/10/2021
James McMillan	ROV Pilot	N-Sea	19/05/2021	16/06/2021
Lambertus Wielen	ROV Pilot	N-Sea	17/05/2021	17/06/2021
Mark Whittaker	ROV Pilot	N-Sea	16/06/2021 11/08/2021	14/07/2021 13/08/2021
Iain Wallace	ROV Pilot	N-Sea	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 13/10/2021
Gordon Middler	ROV Pilot	N-Sea	16/06/2021	14/07/2021
Chinedu Wobo	ROV Pilot	N-Sea	11/08/2021	01/10/2021
Michael Mckinnon	ROV Pilot	N-Sea	14/07/2021	11/08/2021
Howard Barnes	ROV Pilot	N-Sea	02/10/2021	12/10/2021
Sam Jones	ROV Pilot	N-Sea	02/10/2021	12/10/2021
Ian Bratton	ROV Pilot	N-Sea	18/05/2021	16/06/2021
Angus Stewart	ROV Pilot	N-Sea	18/05/2021	16/06/2021
Martin Wannop	ROV Pilot	N-Sea	16/06/2021 11/08/2021 31/08/2021	14/07/2021 13/08/2021 13/10/2021
Alan Yackiminie	ROV Pilot	N-Sea	14/07/2021	11/08/2021
Vitalij Sycoiv	Rigger	N-Sea	20/09/2021	12/10/2021
Dmittijs Grebenuks	Rigger	N-Sea	20/09/2021	12/10/2021
Chris Pierpoint	Noise Monitoring operator	N-Sea	20/09/2021	12/10/2021

5 SURVEY EQUIPMENT

5.1 VESSEL

Glomar Worker (Figure 5-1) is a 60 m multipurpose offshore vessel. Completed in 2008 (rebuilt in 2020) and equipped with a grade 2 dynamic positioning system (DP2), a diesel electric drive system, Dual USBL subsea positioning and a 24t heave compensated offshore crane. A survey/ROV spread is permanently mobilised on board.

The *Glomar Worker* has accommodation for 44 persons, together with dedicated office and recreation spaces for marine and charterer's personnel. The vessel has an economical speed of 10 knots and a service speed of 13 knots.



Figure 5-1: Glomar Worker

5.1.1 Vessel Equipment

For the scope of work, the systems listed in Table 5-1 were mobilised.

Table 5-1: Vessel survey equipment

Item	Model
DGNSS receiver (primary)	CNAV 3050 with SF2 corrections
DGNSS receiver (secondary)	Trimble SP855 with Marinestar PPP corrections
Surface motion and heading	iXBlue Octans
USBL Transponders	Sonardyne Lodestar GyroUSBL
Sound velocity profiler	Valeport MIDAS
ROV LARS & Winch System	Purpose LARS 20' Skid

5.2 VESSEL SOFTWARE

The *Glomar Worker* has been equipped with a number of survey software packages to acquire, control and post-process the data. These software packages are listed in Table 5-2.

Table 5-2: Software list

Vessel survey software	Supplier / version
Online/offline navigation and survey acquisition	QPS B.V. / QINSy 9
Geographic information system (GIS)	Open Source (www.qgis.org) / QGIS 3.10.8-A
Tidal reduction	QPS / QINSy 9

5.3 WROV

A Perry Slingsby Triton XLX 150 HP work-class remotely operated vehicle (WROV) (Figure 5-2) was mobilised on the *Glomar Worker*. The system offers a comprehensive combination of thrust, payload, through frame lift and sensor interface. The vehicle has a combined thruster output of 150 HP, a subsea payload capacity of 250 kg for transporting or recovering materials, has a through frame lift capacity of 3000 kg and can operate up to 3050 m of water depth and/or current speeds up to 1.6 kn. The vehicle has an in-air weight of 4800 kg and is equipped with a top hat tether management system (TMS) and launch and recovery system (LARS).

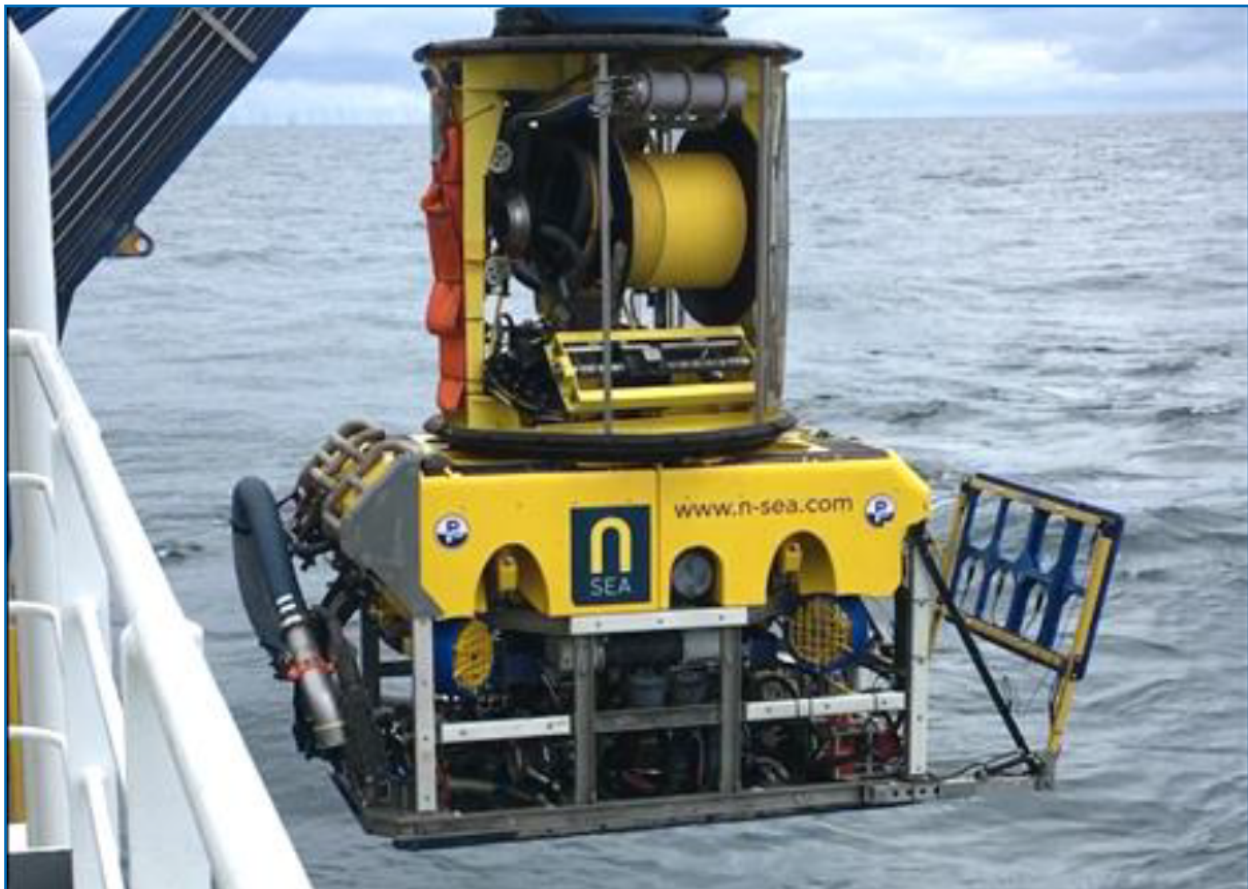


Figure 5-2: Triton XLX WROV with TSS440 and dredge pump



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5.3.1 WROV Equipment

The WROV was fitted with the equipment listed in Table 5-3.

Table 5-3: WROV equipment

Item	Model
Altimeter	Impact Subsea ISA500-L
Depth sensor	Impact Subsea ISA500-L
Obstacle avoidance sonar	Oculus M-Series + Aris 3000
Pipe Tracker	TSS440
Inertial navigation system / DVL	iXBlue ROVINS including DVL
Transponders	Sonardyne WSM 8370 Sonardyne WSM 8190
Sound velocity profiler	Valeport Mini SVS2
Main video cameras	Seaspy camera and Teledyne Bowtech HD camera
Subsea multiplexer	Gen5 MUX
Manipulators	Schilling 5-function Rigmaster and the 7-function Conan
Dredge pump	Piranha 6-inch Dredging system

5.4 EOD EQUIPMENT

5.4.1 Primary solution: Low yield solution (HYDRA EODS)

The HYDRA-Jet Disruptor can guarantee a low yield result when prosecuting the target candidate UXO. The HYDRA technique uses a high-pressure water jet instead of a high temperature plasma jet to achieve the penetration and disruption. The avoidance of an unwanted high order can therefore be guaranteed since no heat is introduced.

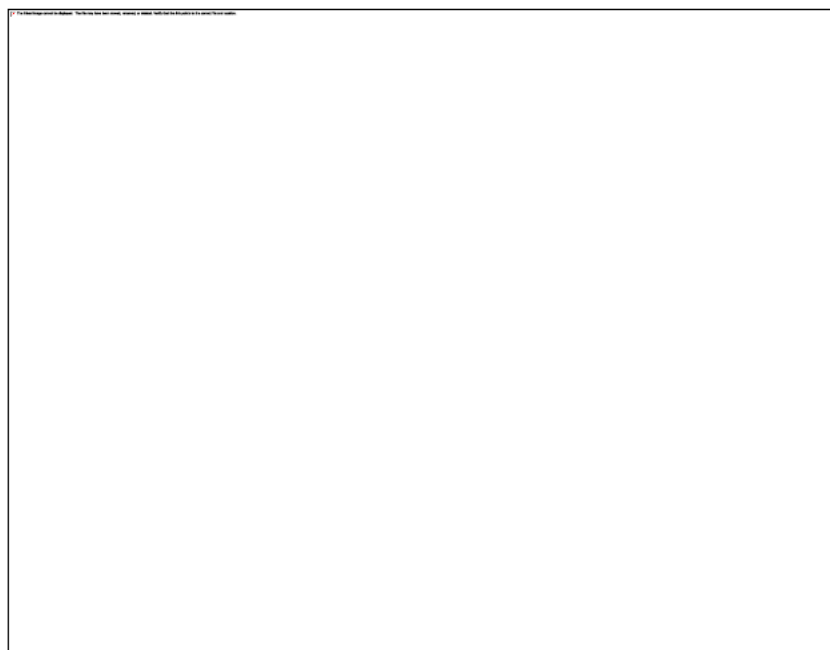


Figure 5-3: Two HYDRA EODS deployed on moored mine



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Each Hydra disruptor is filled with primary energetic, explosive contents. The disruptors are delivered by the ROV and are initiated connecting the shot line float to the Surface Initiation Float and leading in the charge with the transmittance of a secured radio frequency signal.

5.4.2 Secondary solution: Barracuda EODS

The Barracuda Bomb & Mine Disposal System is a Self-Fill Disruptor which can be configured as a shaped charge (for low order, 80 grams of plastic explosives) or a blast fragmentation charge as determined by the EOD Superintendent (3.5 kg of plastic explosives). It uses NONEL firing system with “Twin” NONEL Shot-Lines (Primary and Secondary) fitted Non-Primary Explosive Detonators (NPED’s). Barracuda is initiated on demand, on command using a coded remote initiation system which can be fired remotely from the EOD FRC at ranges up to 3 km line of sight. A manual firing system can be used as back up if required. The manual firing system is used in the unlikely event of a misfire using the remote initiation system. The secondary NONEL shot-line is connected to the manual firing system which initiates kinetic energy into the NONEL shot line. During this campaign, the Barracuda EOD was available as a backup and eventually not used for the disposal activities.

The Barracuda EODS was only inserted in the procedures a contingency. As per the license requirements it was only to be used if the low yield attempts failed.

5.4.3 EOD Fast Rescue Craft (FRC)

Noreq – FRB 650 (Figure 5-4) was used during this ID and Disposal campaign. This EOD FRC was mobilised permanently on the *Glomar Worker*. It was equipped with Inboard Marine Diesel Waterjet as the main engine and has 30 knots speed.



Figure 5-4: Noreq - FRB 650

5.5 MAMMAL, MARINE LIFE AND ENVIRONMENT PROTECTION EQUIPMENT

5.5.1 Passive Acoustic Monitoring (PAM)

PAM was used to monitor for marine mammals in order to ensure no marine mammals were in vicinity of the UXO during disposal operations. Methodology undertaken was in accordance with project requirements and/or the *Marine Mammal Observer and Passive Acoustic Monitoring Handbook* [Ref. 22], which addresses MMO and PAM standards across all marine industries worldwide. The handheld PAM was deployed from the EOD Fast Rescue Craft (FRC). The PAM system used during this campaign was Automatic Recording Unit as depicted in Figure 5-5.

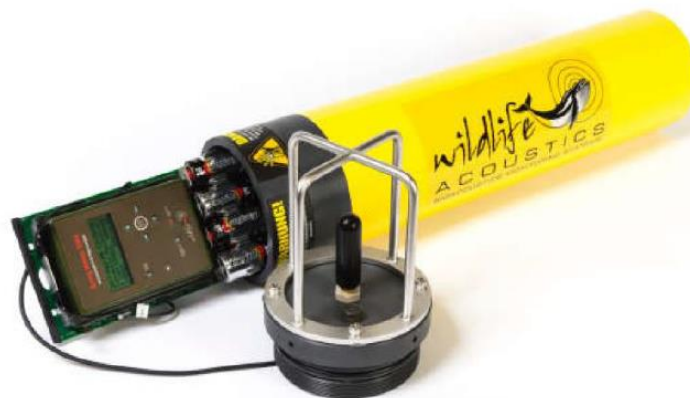


Figure 5-5: Wildlife Acoustic SM4M Submersible ARU

5.5.2 Acoustic Deterrent Device / seal scarer

The Seal Scarer is an acoustic seal repellent system (acoustic deterrent device). The sound produced by the Seal Scarer has been proven effective in keeping seal at a good distance from the detonation point. The system consists of a control unit and a transducer (sound head). The control unit contains a pulse generator and an amplifier and transmits random bursts of audio frequency signals to the transducer, where they are converted into intense sound. The emitted sound has a frequency which is extremely unpleasant for seals and harbour porpoises.

5.5.3 Marine Mammal Observer

Prior to detonation a mammal observer performed a 360 degrees observation on possible surface sea life. One Marine mammal observer (MMO) was stationed on surface support vessel and another one stationed in the FRC to check for the presence of marine mammals and diving seabirds (such as sea-ducks and auks) Detonation was delayed if they were observed in the area. To aid in mammal identification, clearance activities were conducted during daylight hours. If mammals, bird flocks and fish shoals were observed, detonation was delayed.



6 METHOD STATEMENT

6.1 MOBILISATION, CALIBRATIONS AND VERIFICATIONS

The *Glomar Worker* mobilised and carried out alongside verifications alongside quay Cruisekade, at the port of IJmuiden. The vessel commenced mobilisation on 17 May 2021. Alongside verifications were completed on 22 May 2021. The vessel began transit to site to commence offshore trials on 28 May. The offshore trials were completed that same day and consisted out of a USBL spin check, USBL sail away, ROV USBL position verification, EVT and TSS440 noise profile. A dedicated *EVT Report* [Ref. 7] and *Mobilisation and Calibration Report* [Ref. 6] were completed and issued.

6.2 DIGITAL VIDEO RECORDING

During all operations with the WROV, four video channels were recorded to provide an auditable trail. On occasional targets the channel two camera was swapped for black and white camera to show a different camera angle. Feeds for the As Found, As Left surveys and target identification operations were recorded as per Table 6-1.

Table 6-1: DVR channel configuration

Channel	Data
Channel 1	TSS440 pipe tracker display overlayed onto colour camera showing TSS440.
Channel 2	WROV vehicle colour camera
Channel 3	Oculus M-Series forward looking sonar
Channel 4	WROV vehicle HD colour camera

6.3 SOUND VELOCITY PROFILES

A Sound Velocity Profile (SVP) was recorded at an interval of twelve hours, or when location and or operating water depth significantly changed. The resulting profiles were then entered into the vessel's USBL system and into the online navigation system for use during the next 12-hour period.

6.4 BACKGROUND COMPENSATIONS

The TSS440 pipe tracker required compensating account for background magnetic variation. After approximately 15-20 minutes warm up time, the WROV was positioned at least 20 m away from any metallic/conductive material and background compensation measurements were recorded. The background compensation was done for 10 to 15 cycles (3 to 4 minutes). Visual and software QC made sure these measurements did not vary more than 50 μ V, and that an individual coil did not exceed 7500 μ V or a standard Coil did not exceed 1000 μ V and did not deviate by more than 20 μ V. These measurements were then used as the baseline or zero level to which all other measurements were compared.

A TSS440 Background Compensation (BGC) was conducted at least once every 3 hours, as per *Project Specific Procedure* [Ref. 4]. As well as this, background compensation checks were conducted after any significant transit.

Background compensations times were recorded by the surveyor in the online log. The TSS440 display was interfaced to the digital video recording system and screenshots of the results were taken after each BGC.

6.5 MASTER TARGET LIST

Results of the geophysical survey phase were analysed and evaluated by Client UXO consultant and resulted in a list of pUXO targets. Following Client's assessment, those pUXO that could not be avoided were selected for



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investigation. The main scope of work consisted of identification of these pUXO targets. Prior to and during the project, the survey MTL (sMTL) were converted into an iMTL (APPENDIX E) by UXOcontrol Data Centre and released to the vessel as *Vessel Target List* (VTL). Targets were investigated in the most economical way, based on location, local weather, environmental conditions, SIMOPS and OCR's preferences. The VTL was updated on completion of each task and sent daily to UXOcontrol Data Centre onshore for Quality Control (QC). The iMTL was in custodian and maintained by UXOcontrol Data Centre. As the geophysical phase of the survey had not been completed at the time of beginning pUXO survey the master targets list was updated throughout project execution. Table 2-1 details the revision history of the iMTL during the project.

6.6 TARGET INVESTIGATION REPORT

On completion of each target investigation an individual Target Investigation Report (TIR) was compiled and issued, showing as-given (AG), As Found (AF) and As Left (AL) details and results. Each TIR was issued to the OCR, documenting the findings from each individual target identification.

6.7 TARGET INVESTIGATION

The online surveyor verified in the navigation package that background data and all targets from the iMTL were clearly marked in the navigation display. The general procedure followed for all provided pUXO targets on the iMTL that had to be inspected with the WROV was as follows (Figure 6-4). All identification, classification, excavation, and relocation operations were conducted under direct supervision of the OCR.

6.7.1 Vessel Setup

Prior to commencing a target inspection, the vessel was positioned using DP at 30 m; a pre-determined safe stand-off distance from the target, as per procedure [Ref. 4]. If the target was determined to be suspected UXO or confirmed UXO (cUXO), the vessel relocated to a safe stand-off position from the AF position of the target. The stand-off distance was determined by OCR on board the vessel, but minimal 70 m away from the AF location. Identification operations then continued as directed by the OCR. A typical vessel setup is depicted in Figure 6-1.

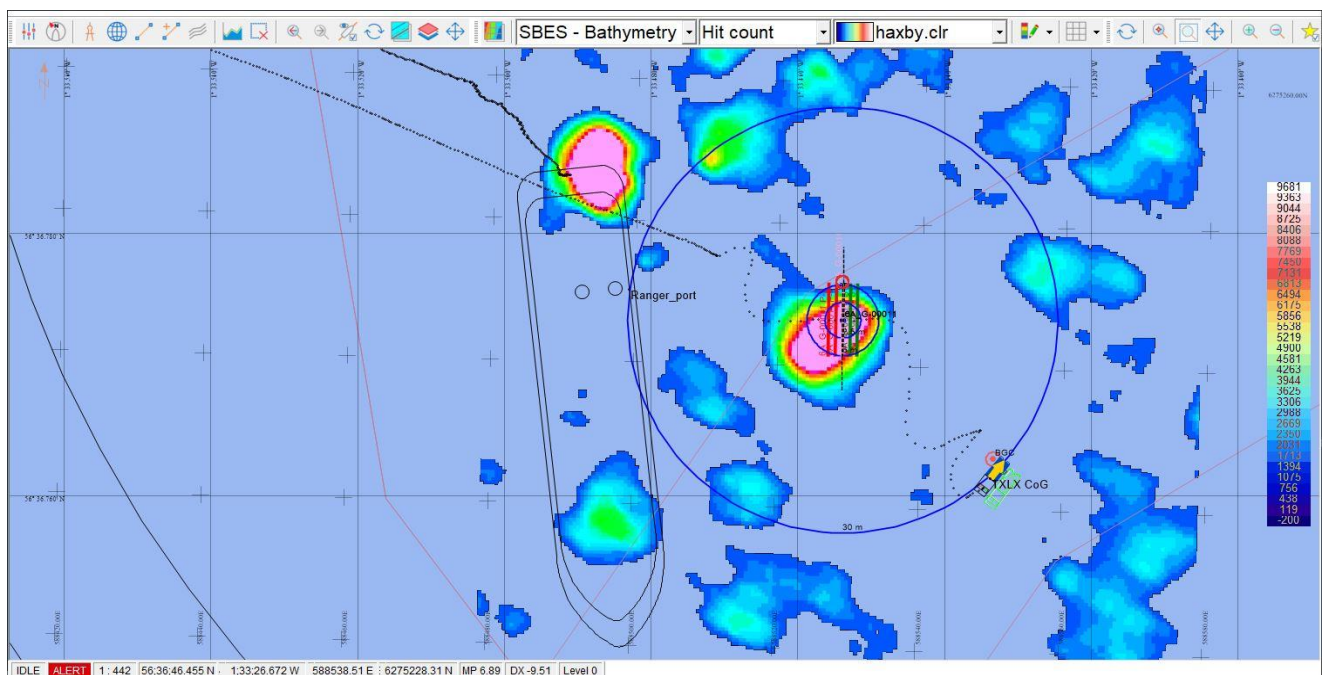


Figure 6-1: Typical vessel setup for target inspections, ROV at BGC location

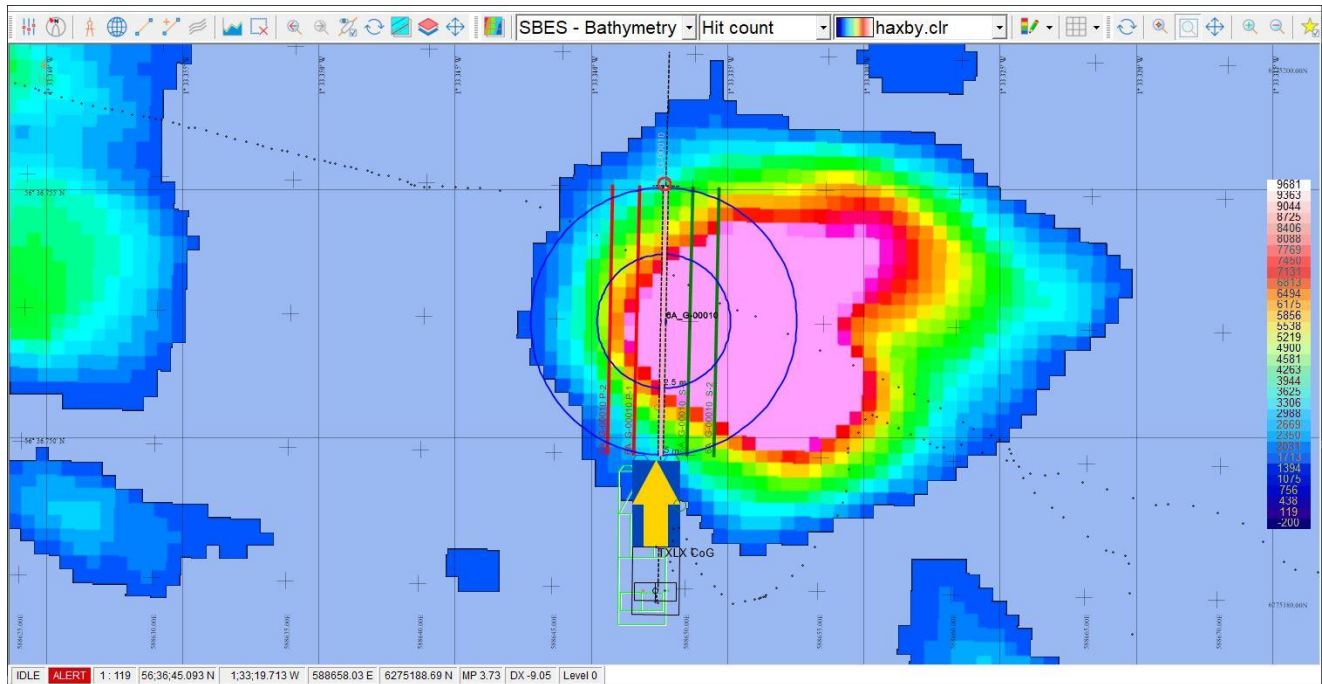


Figure 6-2: ROV before beginning of 5m x 10m grid

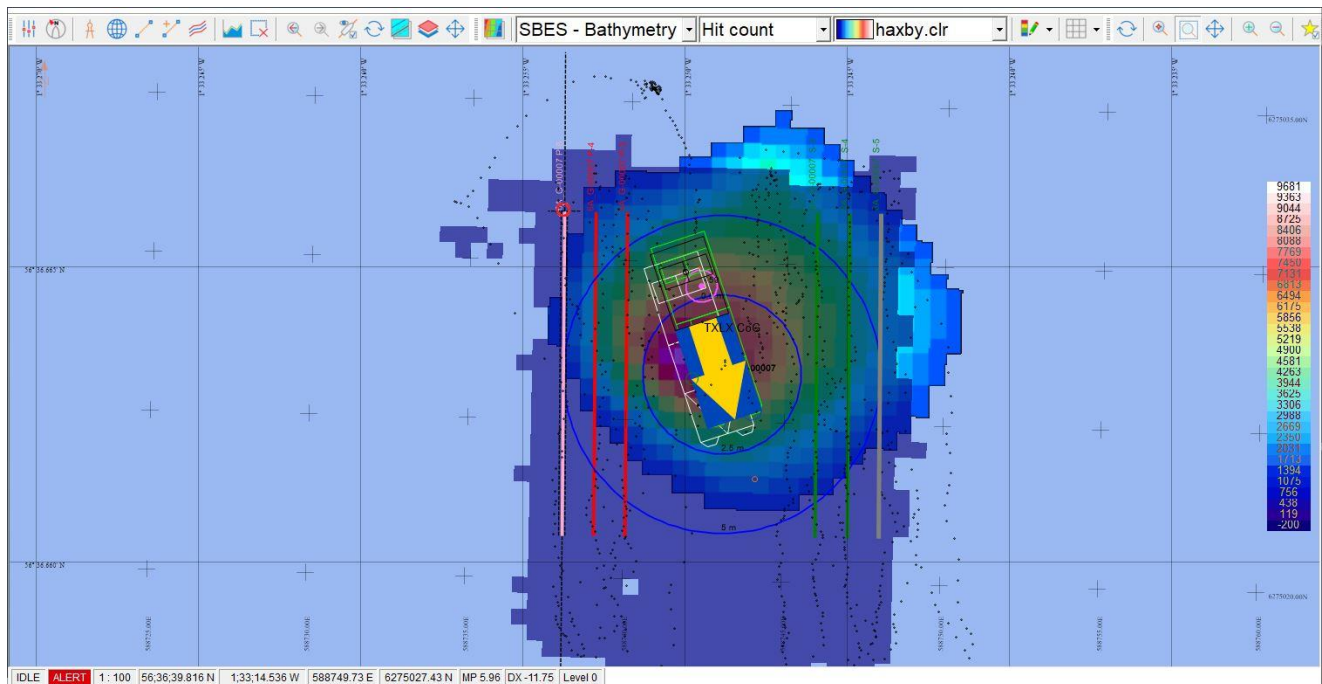


Figure 6-3: ROV before beginning of extended 10m x 10m grid



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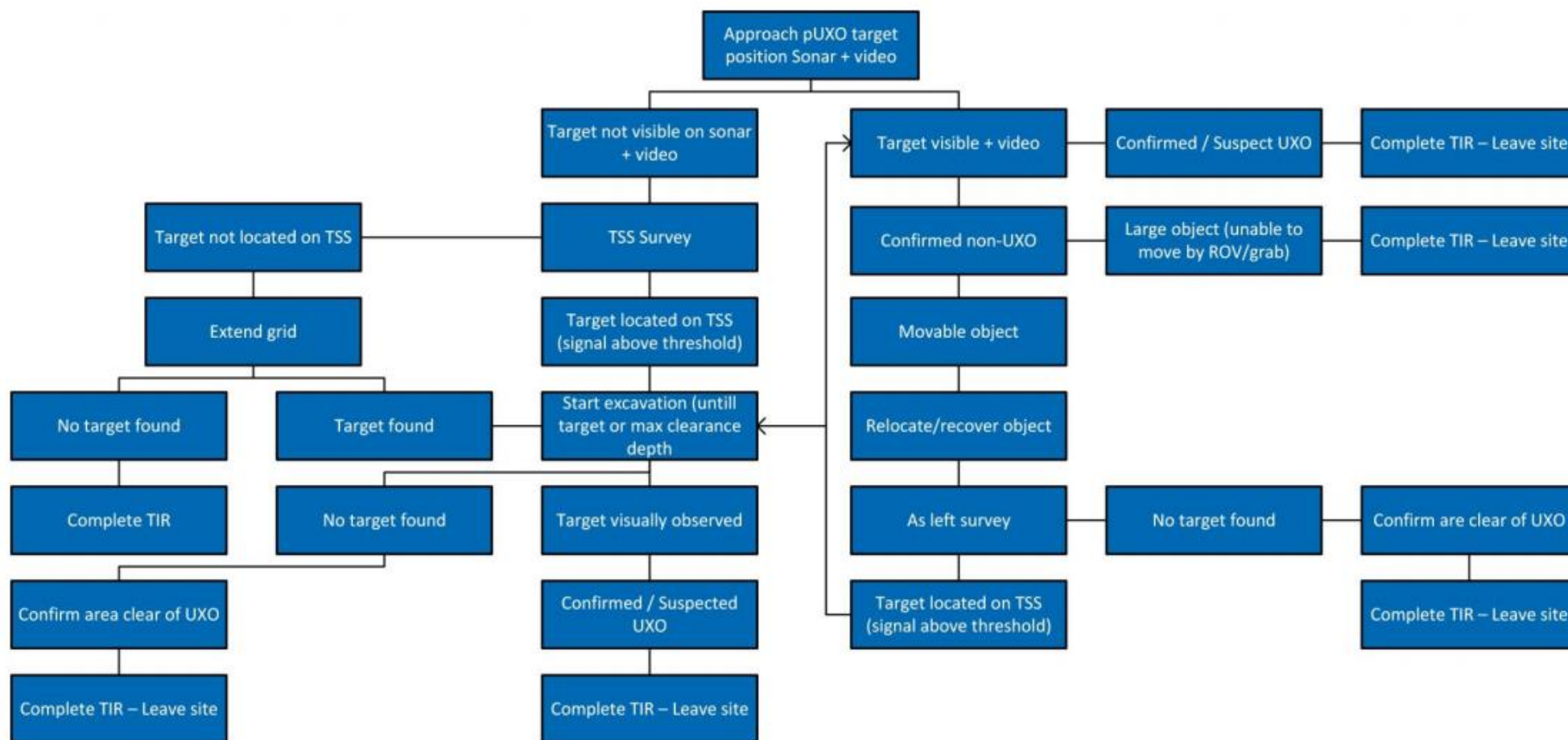


Figure 6-4: Schematic workflow of target investigation



6.7.2 As Found Survey

The WROV was deployed, and a screen grab of the oculus sonar taken 5 m from the target. A 10m x 5m grid of 5 lines with 1 m spacing was then ran with flying height (distance from coils to seabed) not exceeding 0.5 m and ROV speed being as low as reasonably possible. A 5 m x 10 m was run instead of 5 m x 5 m for improved efficiency in case of nothing being detected and a 10 m x 10 m grid being required. During the as found survey the video, sonar footage and TSS440 coil values were observed and the TSS440 coils recorded. The TSS440 coil data was then processed to within the 5 m x 5 m square and a maximum value was obtained and plotted on QINSy.

If no readings above 50 μ V were found, then the grid was extended to 10 m x 10 m.

When anomalies were detected, the online surveyor plotted any position(s) of distinct significant reading(s) in the online navigation system for the WROV to commence identification operations. The discretion, however, always remained with the UXO supervisor and OCR as to which TSS440 pipe tracker distinct significant reading(s) were to be investigated.

6.7.3 Visual Identification and Relocation

To assist in the identification and classification of the targets, it was generally required to excavate and partially or fully expose the target. The WROV was fitted with a subsea dredge pump with 6-inch nozzle. When the target was found during investigation and/or excavation operations, the WROV provided clear images using the colour camera and/or sonar to allow the UXO Supervisor to assess the object and classify it accordingly.

Non-UXO

The WROV was to remove or relocate any object identified as non-UXO from the 5 m x 10 m grids. The relocation of non-UXO items was performed by the WROV. As such it was limited to the weight of objects that could be relocated. In the event that an object was too heavy to relocate with use of the WROV manipulator (items above 100kg), it was left in situ. Small boulders were also left in situ.

Confirmed UXO

Items which were classified by the UXO Supervisor as being either suspected UXO or cUXO were left in situ and no AL survey was conducted. The OCR informed the relevant authorities with the results of the findings.

“Nothing Detected” and/or “Nothing Observed”

In line with the ALARP principle, search activities were completed when the grid had been dredged and searched to the satisfaction of the UXO Supervisor and Client UXO Consultant.

Additional Targets

Additional targets would exist in occasions where AF data resulted in more than one distinct anomaly in the search grid and at client representative discretion. The main target was considered the target with the highest AF reading. The second highest AF reading was named [Target ID] _A, the third highest AF reading named [Target ID] _B, and so on.

Additional targets were added to the VTL and thus to the iMTL. Additional targets were reported within dedicated TIRs.



6.7.4 As Left Survey

Once a non-UXO item had been relocated, an AL survey was performed with the WROV. The AL survey consisted of a minimum of a 10 m x 10 m grid centred over the AF position. Only the outer lines needed to be ran due to the AF grid being 5 x 10m. TSS440 data was acquired to demonstrate that no further magnetic anomalies were present AF search grid. Once the AL survey had been completed the results were processed by the offline processor. When primary target was below 50 μ V and at UXO Supervisor and Client UXO Consultant discretion, the target location was cleared of UXO.

6.7.5 Sound monitoring

Prior to conducting the explosive ordnance disposal operations, three sound monitoring stations were deployed at 500 m, 1000 m and 5000 m from the target in order to monitor the sound levels during the disposals.

6.7.6 Marine mammal mitigations and scaring procedures

To safely conduct EOD operations while reducing disturbances to all marine life in the area the following systems and personnel were utilised:

1. Passive acoustic monitoring: PAM was used to monitor for marine mammals in order to make sure no marine mammals were in the vicinity of the UXO to be disposed.
2. Seal scarer: The Seal scarer is an acoustic seal repellent system (acoustic deterrent device). The sound produced by the Seal scarer has been proved effective in keeping seals at a good distance from the detonation point.
3. Marine mammal observer: Prior to detonation a mammal observer performed a 360 degrees observation on possible surface sea life. One Marine mammal observer (MMO) was stationed on the surface support vessel and one MMO was stationed in the FRC to check for the presence of marine mammals and diving seabirds.

6.8 UXO DISPOSAL

Confirmed UXO identified during the ID phase and listed for disposal were disposed of during this phase.

6.8.1 Disposal phase

The UXO's were disposed of with by the Hydra Low Yields EODS.

Once the charge had been prepared, it was fitted together with a clump and float to the ROV. The ROV was then launched and placed the Hydra system next to the UXO. This was repeated depending on the number of disruptors required. Then, the ROV was recovered back to deck and the Shot line float was released.

Next, the FRC (Fast Recovery Craft) was deployed with the EOD team while the *Glomar Worker* with the Marine mammal observer on board moved 900 m away from the target. At the meantime, the FRC deployed the PAM and the Seal scarer systems. Subsequently the Shot line float was connected to the Surface initiation float.

The operation continued by recovering the seal scarer and the PAM, after which the FRC repositioned itself approximately 100 m to lee side from the *Glomar Worker*.

At agreed firing time, The EOD team on the FRC initiated a RF transmitter signal to the RF receiver on surface initiation float which initiated the primary detonator and fired the main charge.



6.8.2 As Left survey post-detonation

Following the disposal of an UXO, a post-detonation survey was completed to confirm that no further magnetic anomalies were present in the vicinity of the removed/disposed item and to make sure potential primers, booster tubes and detonators were destroyed.

According to the MOC [Ref. 26] issued on 20 September 2021, the As-Left survey following a successful HYDRA Low yield attempt was increased from 5 m x 5 m to a 20 m x 20 m (both visual and EM using the TSS440).

When no significant magnetic evidence or booster tubes were found in this area, the result of the detection was confirmed as “location cleared and free from explosives”. In case a booster tube was found a clearing shot was to be performed required. During the operations no clearing shots were required. All locations were declared free from explosives.

During the as-left, the potential crater following the disposal operations was measured. The crater width and length were measured using the multibeam sonar system mobilised on the ROV. The online surveyor measured the width and length used the digital edge screen grab tool. The crater depth was measured using the dredge hose. Prior to the as-left survey, the dredge hose was marked at predetermined intervals to allow for an “on-screen” measurement.

Upon completion of the disposal operations debris was recovered to deck. The method of recovering the debris was subject to the size of debris following the disintegration of the target.

Table 6-2: Summary of recovery debris options

Debris within WROV recovery capabilities	Debris contains explosive residue	Method of Recovery	Method of on deck storage
Yes	Yes	Subsea ROV basket	Wet stored on board in watertight water skip.
Yes	No	Subsea ROV basket	Store on board debris skip
No	Yes	5t Orange peel grab	Wet stored on board in watertight water skip.
No	No	5t Orange peel grab	Store on board debris skip

Once the debris recovered to deck, it was inspected a final time by the EOD superintendent. In case of explosive residue presented on the UXO related, the debris was to be wet stored on deck. If no explosive residue was present, the debris was marked. For each separate piece of debris, an explosive free certificate was drafted.



7 SUMMARY OF OPERATIONS

Mobilisation of the Glomar Worker started on 17 May 2021 alongside port of IJmuiden in the Netherlands and was completed, together with the alongside verifications, on 22 May 2021. On this day, the vessel cast off IJmuiden and sailed to Seagreen work site. The following day offshore trials were commenced and completed in the late evening of 28 May 2021.

Target investigation started on 29 May in area SN-S11 (Yellow). In the evening of 31 May, a possible archaeological target was found (target ID G-S-00013). On 15 June 2021, a Sea mine casing was found (target ID G-L-01079). Target investigation continued until Wednesday 16 June 2021, on which the vessel sailed to port of Aberdeen for a crew change.

On both 11 July and 12 July 2021, a British buoyant mine was found (targets 6A_G-00167 and 6A_G-00024).

On 14 July 2021, the vessel sailed to port of Montrose, Scotland, for a crew change. After the crew change the vessel sailed back to Seagreen work site where they started on target 6A_G-00114, just after midnight the following day.

On 11 August 2021, after finishing target 6A_G-00315, the vessel sailed to port of Montrose for crew change, during transit the vessel had some issues with one of the azimuth thrusters. In port, a diver did a visual inspection on the thruster, however nothing was found. From then, the project was on vessel breakdown; the project crew was sent home on 13 August 2021 and the vessel went into dry dock for repairs. On 31 August, the project crew returned to the vessel and in the early evening, at 19:33, the vessel sailed to Seagreen work site.

Once the vessel arrived and completed the DP-trials the vessel went down on weather until 2 September 2021. On this day, operations started with identification of target 6A_G-00318. On 6 September 2021, a confirmed UXO was found, a projectile, target 6A_G-00961. Target Identification continued until the evening of 7 September 2021, at 20:00, during dredging operations a side plate on the Conan Manipulator got broken. No spare parts were on board. The vessel sailed to port of Aberdeen to collect a spare part and during transit the ROV was made operational again. Once the vessel arrived at the Seagreen worksite in the morning of 8 September 2021, operations continued until the morning of 10 September 2021. At around 07:00 the Glomar Worker had to do some checks on the main engines oil pump and relief valves. Once this was conducted the vessel deployed a USBL beacon on a tripod and a SIT-item, so the survey vessel *Kommandor Iona* could do their infield calibrations. After the deployment the vessel continued with Target ID on target 6A_G-01011.

On the early morning of 12 September 2021, wind and sea state were increasing and the vessel went down on weather until the evening of the same day when target ID operations restarted at 21:16.

At the start of Monday 20 September 2021, the vessel sailed to Aberdeen, Scotland, for the to mobilise the UXO disposal equipment. Once the necessary crew and equipment were installed on board, the vessel set sail, just after midnight, on 21 September 2021, to the Seagreen worksite. Once at location, the vessel went down on weather until 13:00 on 23 September 2021. The ROV conducted relocation assessment on confirmed UXO-target 6A_G-00961. Once UXO was declared safe for transport and the two possible wet-store locations were confirmed to be clear of pUXO, the operation was cancelled due to upcoming weather.

In the morning of 25 September, at around 03:00, the vessel started with the deployment of the Sound monitoring stations. This was followed up by a *dry run*. This was required prior to the first execution and only a NPED was detonated to sever the shot lines. After the *dry run*, the ROV was deployed to check the first disposal target 6A_G-00577. During the night operations continued with Target ID.



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The following day on 26 September, target 6A_G-00577 was disposed of by using the Hydra system. A visual inspection after disposal was conducted, however due to incoming weather the As Left survey was not completed. The following days the vessel was waiting on weather.

Following issues with the primary positioning system, it was decided to switch to the secondary Trimble DGNSS system. Once setup, a position check was done on the 28 September in a sheltered area.

The vessel then sailed back to Seagreen worksite to check on a Sound monitoring system on request of the Sound monitoring operator. The vessel then headed for area SN-M1 to do an infill survey. Once on site, the weather came up and operations were down on weather again.

Target ID operations resumed on 29 September 2021, until the next day when the weather came in. The vessel sailed to port of Aberdeen on the 01 October because of the deteriorating weather and the coming crew change on 02 October 2021.

The vessel left the haven late evening, on 03 October 2021, to monitor the weather conditions at the working site. In the afternoon of 04 October, the vessel was able to commence the subsea operation. The cUXO target 6A_G-00167 was dredged and prepared for the disposal. The Sounding monitoring system was recovered to deck to be placed closer to the current UXO objects. While the sound monitoring operator was preparing the system, the vessel switched to the target ID operations and conducted four targets before the 02:00 on 05 October, when the vessel returned to disposal operations. The Sounding monitoring system was redeployed during the morning, but the disposal operation was cancelled due the weather forecast. The weather window was too short and did not allow to finish the disposal phase safely. The *Glomar Worker* moved back to the south part of area to resume target ID operations. One target was completed before the weather came up and the vessel sailed away to shelter at 08:00 on the 05 October.

The next short weather window on 06 October was dedicated to target ID operations. The vessel arrived to the North side of the field. Four targets were completed before the weather conditions exceeded the limits again on the same day.

Operations was resumed on the 08 October. The cUXO target 6A_G-00170 was initially investigated on 30 July and additional cleaning was also demanded before the disposal. The weather forecasts showed that cUXO targets could be detonated after the dawn, and the crew focused on the preparation. Once the cUXO targets had been uncovered and cleaned, the vessel conducted a 3 km transit to the disposed UXO target 6A_G_00577 to remove post-detonation debris items, but the sea state did not allow for the ROV basket deployment. In the morning on 08 October, vessel arrived to cUXO target 6A_G_00167. The target was disposed at 10:00 and the next 10 hours were dedicated to post-detonation search and scrap removal. The target was considered clear of UXO by Client's UXO supervisor after mid-night and the vessel moved back to target 6A_G_00577 to resume debris cleaning. At 08:50 on 09 October, the ROV was recovered to deck and preparations for target 6A_G_00170 disposal was started.

The target 6A_G_00170 was disposed at 12:15 on 09 October. The target was cleared by Client's UXO supervisor at 17:30, after the post-detonation surveys and the EOD related debris recovery. Later at the same evening, the vessel resumed the operations on target 6A_G_00577. Once the crater was cleaned the ROV basket was deployed close to the temporary wet store location to recover the UXO related debris. The lifting operations were completed before mid-night and the vessel transited to the cUXO 6A_G-00961 target for the projectile relocation. The projectile was successfully relocated to the wet store by the EOD clamp on 10 October at 03:05.

As all disposal operations were completed, the vessel began to recover the acoustic monitoring systems on board. Two systems were recovered before the weather exceeded the limit for the crane operations. the vessel



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switched to target ID tasks. The last acoustic monitoring system was recovered next morning, and the *Glomar Worker* moved to the North side of area to complete the last 23 target investigations.

The target ID operations were completed at 00:32 on 12 October 2021, and the vessel sailed to Aberdeen for demobilisation.

Throughout the project, *Glomar Worker* was prepared to assist HM Coastguard on EOD operations, at OCR request to UXOcontrol. Assistance was provided variously as per DPRs / Summary of Survey activities below.

A summary of the principal survey activities is given in Table 7-1. A detailed description of the daily activities was presented as a Daily Progress Report (DPR) during operations, copies of which were submitted to all parties concerned. DPRs are provided with this report as APPENDIX A.

Table 7-1: Summary of survey activities

Day	Date	Activity
1	17-05-2021	Mobilisation
2	18-05-2021	Vessel alongside Trawlerkade, Ijmuiden
3	19-05-2021	Vessel alongside Trawlerkade, Ijmuiden
4	20-05-2021	Dimension control survey team arrived onboard
5	21-05-2021	Project induction Muster and fire drill
6	22-05-2021	Vessel transit to Seagreen work site – continue onboard mobilisation
7	23-05-2021	Continued transit to Seagreen site
8	24-05-2021	DP trial Issued permit to enter worksite
9	25-05-2021	Beacon tested Completed compass deviation record
10	26-05-2021	Vessel departed site to Montrose
11	27-05-2021	Beacon tested USBL verification
12	28-05-2021	Offshore verification checks
13	29-05-2021	Start target ID
14	30-05-2021	Continued ID operation
15	31-05-2021	Possible archaeological target found (G_S-00013)
16	01-06-2021	Continue target ID
17	02-06-2021	Continued ID operation (GC-00092 and GS-00097)
18	03-06-2021	Continued ID operation (6A G-00073, GS-00099, GS-00101, GS-00100, GS-00102, GS-00093)
19	04-06-2021	Continued ID operation (GS-00178, GS-00179, GS-00182, 6A G-00055, GS-00180, GS-000188)
20	05-06-2021	Continue target ID
21	06-06-2021	Continue target ID
22	07-06-2021	Continue target ID



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Day	Date	Activity
23	08-06-2021	Continue target ID
24	09-06-2021	Continue target ID
25	10-06-2021	Continued ID operation
26	11-06-2021	Continued ID operation Vessel alongside Aberdeen port waited for ROV equipment
27	12-06-2021	Alongside Aberdeen port Connected new umbilical to TMS Entered worksite
28	13-06-2021	Continued ID operation
29	14-06-2021	Continued ID operation
30	15-06-2021	Sea mine casing found (G_L-01079)
31	16-06-2021	Crew change
32	17-06-2021	Transit to Aberdeen for system check and new crew induction Entered to worksite
33	18-06-2021	DP trials Continue ID operation (G-YE-01064, G-YE-01042, G-YE-01040, G-YE-01041, 6A G-00589, G-YE-01044, G-YE-01045)
34	19-06-2021	Continued ID operation (G-YE-01050, G-YE-01056, G-YE-01057, G-Q-00004, G-YE-01072) Installed new license for Qinsy
35	20-06-2021	Alongside Montrose port Identified vessel faulty of solenoid connector Commenced transit to location
36	21-06-2021	Continued ID operation
37	22-06-2021	Continued ID operation
38	23-06-2021	Continued ID operation
39	24-06-2021	Continued ID operation (6A_G-00659, G-BL-00015, G-BL-00010, G-BL-00009, G-BL-00001) Waiting on weather
40	25-06-2021	Waiting on weather
41	26-06-2021	Waiting on weather Continue ID operation (6A_G-0052 (OSP))
42	27-06-2021	Continue ID operation
43	28-06-2021	Continue ID operation
44	29-06-2021	Continue ID operation
45	30-06-2021	Continue ID operation Waiting on weather
46	01-07-2021	Waiting on weather Continue ID operation
47	02-07-2021	Continue ID operation (G-IN-01072, G-IN-01079, G-Q-00600, G-Q-00602, G-Q-00640, G-Q-00658, G-Q-00654, G-IN-01085, G-IN-01135, G-IN-01126, G-N-00277, G-M-00077)



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Day	Date	Activity
48	03-07-2021	Continue ID operation (G-M-00084, G-M-00080, 6A G-00503, 6A G-00473, 6A G-00501, G-M-00033)
49	04-07-2021	Continue ID operation
50	05-07-2021	Continue ID operation
51	06-07-2021	Continue ID operation
52	07-07-2021	Continue ID operation (6A G-00538, 6A G-00540, 6A G-00539, 6A G-00218) Vessel breakdown: ROV split TMS system Alongside Montrose port Proceed the target ID
53	08-07-2021	Continue target ID
54	09-07-2021	Continue target ID
55	10-07-2021	Continue target ID
56	11-07-2021	British buoyant mine found (6A_G-00167)
57	12-07-2021	British buoyant mine found (6A_G-00024)
58	13-07-2021	Continue target ID Relocated to USBL deployment position
59	14-07-2021	Crew change
60	15-07-2021	Continue target ID
61	16-07-2021	ROV breakdown – changed hydraulic valve Continue target ID
62	17-07-2021	Continue target ID
63	18-07-2021	Continue target ID
64	19-07-2021	Continue target ID
65	20-07-2021	Continue target ID
66	21-07-2021	Continue target ID
67	22-07-2021	Continue target ID
68	23-07-2021	Continue target ID
69	24-07-2021	Continue target ID
70	25-07-2021	Continue target ID
71	26-07-2021	Continue target ID
72	27-07-2021	Continue target ID
73	28-07-2021	Continue target ID
74	29-07-2021	Continue target ID
75	30-07-2021	Continue target ID
76	31-07-2021	Continue target ID DP tests Transit to Montrose port
77	01-08-2021	Waiting on weather Alongside Montrose
78	02-08-2021	Waiting on weather Vessel breakdown: engine issue
79	03-08-2021	Transit to worksite Continue target ID
80	04-08-2021	Continue target ID



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Day	Date	Activity
81	05-08-2021	Continue target ID
82	06-08-2021	Waiting on weather
83	07-08-2021	Waiting on weather Commenced to Seagreen OWF
84	08-08-2021	Continue target ID
85	09-08-2021	Continue target ID
86	10-08-2021	Continue target ID
87	11-08-2021	Crew change Vessel checking on Azimuth thruster
88	12-08-2021	Vessel continuing solving Azimuth thruster issue
89	13-08-2021	Project crew sent back to home – Project continue on vessel break down
90	14-08-2021	Vessel breakdown
91	15-08-2021	Vessel breakdown
92	16-08-2021	Vessel breakdown
93	17-08-2021	Vessel breakdown
94	18-08-2021	Vessel breakdown
95	19-08-2021	Vessel breakdown
96	20-08-2021	Vessel breakdown
97	21-08-2021	Vessel breakdown
98	22-08-2021	Vessel breakdown
99	23-08-2021	Vessel breakdown
100	24-08-2021	Vessel breakdown
101	25-08-2021	Vessel breakdown
102	26-08-2021	Vessel breakdown
103	27-08-2021	Vessel breakdown
104	28-08-2021	Vessel breakdown
105	29-08-2021	Vessel breakdown
106	30-08-2021	Vessel breakdown
107	31-08-2021	Project crew returned to vessel – Vessel sail to Seagreen work site
108	01-09-2021	After arrival at target location and finishing the DP trials the vessel standby on weather. Start with target ID 6A G-00318 in area SN-L16 - Spare
109	02-09-2021	Start with target ID 6A_G-00318 in area SN-L16 - Spare
110	03-09-2021	Continue target ID
111	04-09-2021	Continue target ID
112	05-09-2021	Continue target ID
113	06-09-2021	UXO found (projectile) 6A G-00961 – continue target ID
114	07-09-2021	Quick port call Aberdeen to collect spare part of broken Conan manipulator on the ROV



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Day	Date	Activity
115	08-09-2021	Continue target ID
116	09-09-2021	Continue target ID
117	10-09-2021	Vessel engine checks, calibration items deployment for the vessel Iona and continue Target ID
118	11-09-2021	Continue target ID
119	12-09-2021	Waiting on weather from the early morning until the evening
120	13-09-2021	Continue target ID
121	14-09-2021	Continue target ID
122	15-09-2021	Continue target ID
123	16-09-2021	Continue target ID
124	17-09-2021	Waiting on weather from 04:10 – 20:14
125	18-09-2021	Continue target ID
126	19-09-2021	Waiting in weather from 06:00 – 24:00
127	20-09-2021	Vessel transit to port of Aberdeen for UXO-disposal phase mobilization
128	21-09-2021	Vessel transit to Seagreen worksite to target 6A_G-00961 for relocation assessment. – Waiting on weather.
129	22-09-2021	Waiting on weather.
130	23-09-2021	Relocation assessment on UXO target 6A_G-00961 - Waiting on weather
131	24-09-2021	Continue target ID
132	25-09-2021	Deployment of Sound monitoring stations – Disposal dry run – Visual inspection of disposal UXO target 6A_G-00577 – Target ID
133	26-09-2021	Continue target ID – Disposal of UXO target 6A_G-00577 – Waiting on weather
134	27-09-2021	Continue waiting on weather
135	28-09-2021	Trimble test run with ROV in sheltered waters – Check on Sound monitoring buoys – Waiting on weather
136	29-09-2021	Waiting on weather – Target ID
137	30-09-2021	Continue target ID – Waiting on weather
138	01-10-2021	Waiting on weather – transit to port of Aberdeen
139	02-10-2021	Crew change - Waiting on weather
140	03-10-2021	Waiting on weather - Transit to Seagreen work site
141	04-10-2021	Waiting on weather – Preparation for the disposal operations on the target 6A_G-00167 – Recover Sound monitoring station - Target ID
142	05-10-2021	Target ID – Sound monitoring station deployment - Waiting on weather



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Day	Date	Activity
143	06-10-2021	Waiting on weather - Target ID - Waiting on weather
144	07-10-2021	Waiting on weather
145	08-10-2021	Waiting on weather - Disposal of UXO target 6A_G-00167 - post-detonation search & scrap removal
146	09-10-2021	Disposal of UXO target 6A_G-00170 - post-detonation search & scrap removal on 6A_G-00170&6A_G-00577
147	10-10-2021	Projectile relocation on target 6A G-00961 - Recover Sound monitoring stations – Target ID
148	11-10-2021	Target ID - Recover Sound monitoring station - Target ID
149	12-10-2021	Target ID – Transit to Aberdeen for demobilisation
150	13-10-2021	Demobilisation



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8 SUMMARY OF RESULTS

A total of 1042 pUXO targets were identified. The findings were added to the VTL and thus the iMTL. Each of those 1042 targets was accompanied with an individual TIR. For more comprehensive details please refer to the iMTL and/or the individual TIR provided as APPENDIX E and APPENDIX D respectively.

8.1 TARGET INVESTIGATION RESULTS

A summary of the investigation results is presented in Table 8-1 and Table 8-2 below.

Table 8-1: Cumulative target investigation results

Targets Investigation Results	Cumulative
Nothing detected and/or nothing observed	437
Unidentified	1
Archaeology	7
Boulder	170
Cobbles / Pebbles	5
Cable / Pipeline	3
Fishing Gear	31
Metallic Debris	304
Non-Metallic Debris	0
Steel Wire Rope	68
Wreck	1
UXO Related	10
Confirmed UXO	4
Other	1
Total	1042

Table 8-2: Cumulative target investigation status

Targets Investigation Results	Cumulative
Nothing detected and/or nothing observed	438
Recovered to deck	0
Relocated	400
Remained in situ	200
UXO Relocated*	1
UXO disposed	3
Total	1042

*6A_G-00961 was regarded as 'Relocated' not as 'UXO Relocated' in the investigation outcome of *Investigation Master Target List* and *Target Investigation Report*. This distinction is presented solely in this report.



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8.2 CONFIRMED UXO

8.2.1 Relocation of target 6A_G-00961

During identification operations, a 12-inch naval projectile had been identified on the seabed. Additional identification was required to confirm the exact type of UXO and if the UXO could be safely relocated outside the IAC corridor. Positive ID on the type of the projectile was established and it was determined the UXO was safe to relocate, as it was identified as a solid shot naval projectile.

The relocation was conducted on 10 October 2021. The EOD clamp was installed around the projectile and constricted by ROV. Then the EOD clamp was hooked to the vessel crane wire, lifted about one meter above the seabed and moved 35 m away to a UXO cleared wet store location at 567924.5 mE, 6264665.2 mN

Upon relocation, an as left survey was conducted to confirm that the location was successfully cleared.

8.2.2 UXO Disposed

There were three confirmed UXOs disposed during this campaign. Prior disposal operations were commenced; the acoustic monitoring units were deployed on the seabed.

Each gear was deployed at a different distance from the cUXO. Approximate distance ranges of 500m, 1500m and 5000m were set as required. The system initially placed 500m from the first exploded target 6A_G-00577 was relocated closer to the targets 6A_G-00167 and 6A_G-00170 prior the farther disposal. The coordinates of the acoustic monitoring units for the 6A_G-00577 disposal are shown below in Table 8-3.

Table 8-3 Acoustic monitoring unit locations for the 6A_G-00577 disposal

Range (m)	Easting (m)	Northing (m)
500	589294.13	6270534.54
1500	589012.89	6271576.63
5000	584833.54	6268594.77

The coordinates of the acoustic monitoring units for the 6A_G-00167 and 6A_G-00170 disposal are shown below in Table 8-4.

Table 8-4 Acoustic monitoring unit locations for the 6A_G-00167 & 6A_G-00170 disposal

Range (m)	Easting (m)	Northing (m)
500	588244.15	6272311.43
1500	589012.89	6271576.63
5000	584833.54	6268594.77

Disposal of target 6A_G-00577

The cUXO target 6A_G-00577 was initially investigated on 29 July 2021 and identified as bottom plate and part of sea mine's main charge. The acoustic monitoring systems deployment was done on 25 September. The HYDRA dry run trials were implemented prior the disposal.

The disposal operations on the 6A_G-00577 was started early in the morning on 26 September. The toolbox talk was conducted prior the EOD equipment installation. The HYDRA system was placed towards the target and shot-line float was released at 07:23 am. PAM and seal scan were conducted before the detonation.

During the first attempt to explode the target at 08:15, a misfire occurred. Half an hour, later a second attempt successfully demolished the mine.



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The crater of 1.6 m x 1 m x 0.3 m was caused by detonation. The concrete and metallic parts of HYDRA placement unit coiled mooring wire and mooring plate were found visually in the crater and were temporary relocated to the wet store: 589677.4 mE 6270248.4 mN.

On 09 of October, a visual and TSS440 post detonation survey was completed over an area of 20 x 20 m as per MOC [Ref. 26]. A TSS440 reading of 918 μ V was recorded in the crater. The dredging was conducted by ROV, but no significant targets were found. A second TSS440 as left survey showed that maximum reading was reduced to 70 μ V after two hours of dredging, and target was considered clear by EOD client.

The ROV basket was used to recover all the UXO related debris to deck as seen in Table 8-1.



Figure 8-1: Related debris target 6A_G-00577 loaded to basket

Disposal of target 6A_G-00167

A British buoyant mine MK 17 on the location 6A_G-00167 was discovered on 11 July 2021. The target was buried 0.3 m below seabed and only the top 0.5 m of the mine was exposed after the dredging.

The preparation for the 6A_G-00167 demolition commenced early in the morning on 08 October. The first radio broadcast warning was sent at 6:15, and the MMO watch started at 6:25. The HYDRA charge installation took one hour, and the shot line float was released at 09:05. The target was disposed at 10:15.

A 20 minutes post-detonation MMO watch was conducted.

The crater of 2.18 m x 1.7 m x 0.5 m was induced by detonation. A visual and TSS440 post detonation survey was completed over an area of 20 x 20 m as per MOC [Ref. 26]. No UXO related objects were observed on the surface. A piece of shot line, concrete and metallic parts of HYDRA placement unit as well as the mine top cover plate were found in the crater as seen in Figure 8-2.



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Figure 8-2: Piece of shot line and top cover plate as part of target 6A_G-00167 debris

All UXO related debris were recovered to deck by subsea ROV Basket. An TSS440 reading of 983 μV was observed during the as left survey. After 10 hours of dredging Client UXO supervisor cleared the target location, as no significant objects had been found.

Disposal of target 6A_G-00170

The cUXO target 6A_G-00170 was discovered and identified as probably British MK XVII sea mine on 30 July 2021. Detonation took place on 09 October 2021.

The pre-detonation toolbox talk took place in the morning of on 09 October. All the MMO watch activities were conducted as required prior the detonation. At 10:10 the charge was prepared and ROV was deployed to install the HYDRA system. Once the ROV had a visual contact with the object, the vessel relocated outside the 70 m safety zone. At 11:04 the HYDRA was placed towards the mine and shot line float was released. The FRC approached the shot line float at 11:42 am prior the vessel moved to the 900 m safety zone. At 12:14 the final radio broadcast warning was given and one minute later the 6A_G-00170 was successfully disposed.

The 20 minutes post-detonation MMO watch was conducted. A crater of 2.28 m x 1.6 m x 0.5 m was caused by detonation. The mines mooring plate was found visually in the crater. As per MOC [Ref. 26], a visual and TSS440 post detonation survey was completed over an area of 20 x 20 m. A TSS440 reading of 1978 μV was recorded in the crater and a second debris was recovered after an hour of dredging. The 5m x 5m as left survey over the crater was conducted after all UXO related objects were recovered to deck. The maximum TSS440 reading recorded during the second survey was 31 μV .



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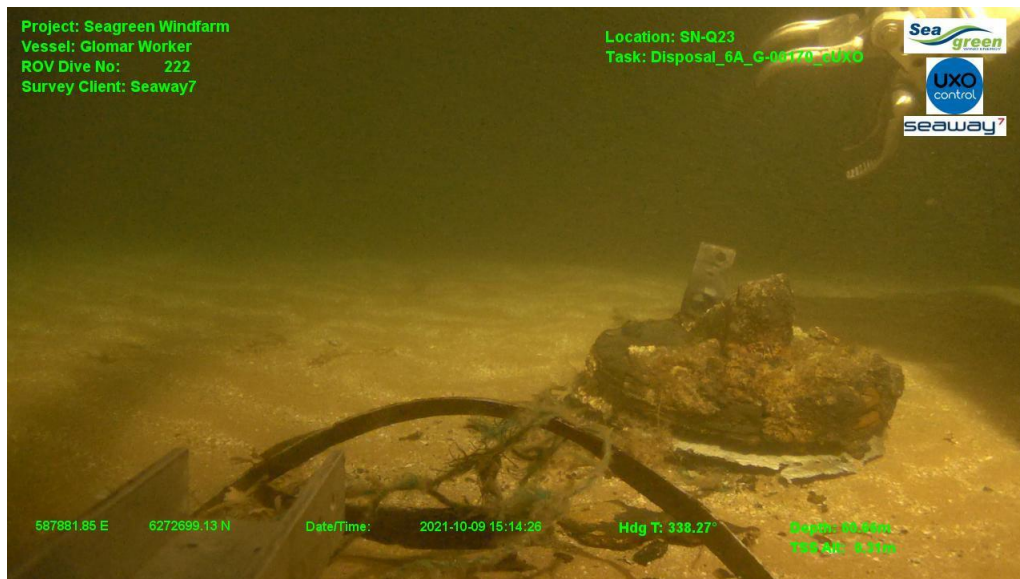


Figure 8-3: Debris recovered from crater of disposed target 6A_G-00170

8.3 MARINE MAMMAL OBSERVERS REPORT

Please refer to APPENDIX F for the MMO report which details the following information per disposal:

- All confirmed UXO identified, including estimated size, type, location and water depth.
- The approach taken for each confirmed UXO, including the dates, times, disposal method attempted, size, type and number of donor charge(s) used.
- Vessel presence, location and activity during UXO clearance operations
- The outcome of each UXO disposal, including evidence of high-order detonation, any clearing charges required and method of debris and residue recovery
- The outcome of each UXO disposal, including evidence of high-order detonation, any clearing charges required and method of debris and residue recovery
- All marine mammal sightings and completed marine mammal recording forms
- Any problems encountered and instances of non-compliance with the JNCC guidelines, MMMP and variations from agreed procedures.

8.4 SOUND MONITORING REPORT

At time of writing this report UXOcontrol's subcontractor Seiche is performing the analysis of the sound monitoring data and preparing the sound monitoring report. This report will be submitted separately as APPENDIX G.



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9 PROJECT STATISTICS

9.1 BREAKDOWN OF HOURS

The project commenced on 17 May 2021 following verifications alongside Sluisplein Quay, IJmuiden, Netherlands. Alongside verifications were completed on 22 May when the vessel departed for infield calibrations and EVT, which were commenced on 28 May 2021 and completed on the same day. Following successful completion of the EVT, project operations commenced on 29 May 2021. The last day of operations was the 12 October 2021 when the vessel completed the last target identification. Subsequently, the project was fully completed on 13 October at 14:00 when the vessel was demobilised alongside Aberdeen.

A full breakdown of project hours is provided below in Table 9-1 and graphically displayed in Figure 9-1.

Table 9-1: Project timings overview

Activity	Codes	Cumulative	Percentage
Mobilisation	L-MOB	266:15	7.8
Disposal phase Mobilisation	DL-MOB	20:45	0.6
De-Mobilisation	L-DEMOB	29:56	0.9
Calibrations - Verifications	L-CAL	17:55	0.5
Transit	L-TRANS	60:36	1.8
Disposal phase Transit	DL-TRANS	06:05	0.2
Infield Transit	L-ITRANS	259:52	7.6
Disposal phase Infield Transit	DL-ITRANS	09:38	0.3
Grid survey	L-OPS	1494:45	44.0
ROV Breakdown	RBD	45:49	1.3
Port Call	L-CC	29:25	0.9
Survey Breakdown	DL-CC	97:30	2.9
Vessel Breakdown	SBD	359:19	10.6
Waiting on Current	VBD	10:47	0.3
Waiting on Weather	L-CUR	542:57	16.0
Additional Work instructed by Client	L-WOW	44:23	1.3
EOD Ops	L-EOD	62:17	1.8
Deployment & Recovery Acoustic Recording Units	L-ARU	32:56	1.0
cUXO Relocation	D-REL	05:56	0.2
Other	OTHER	00:50	0.0
Total		3398:00	100

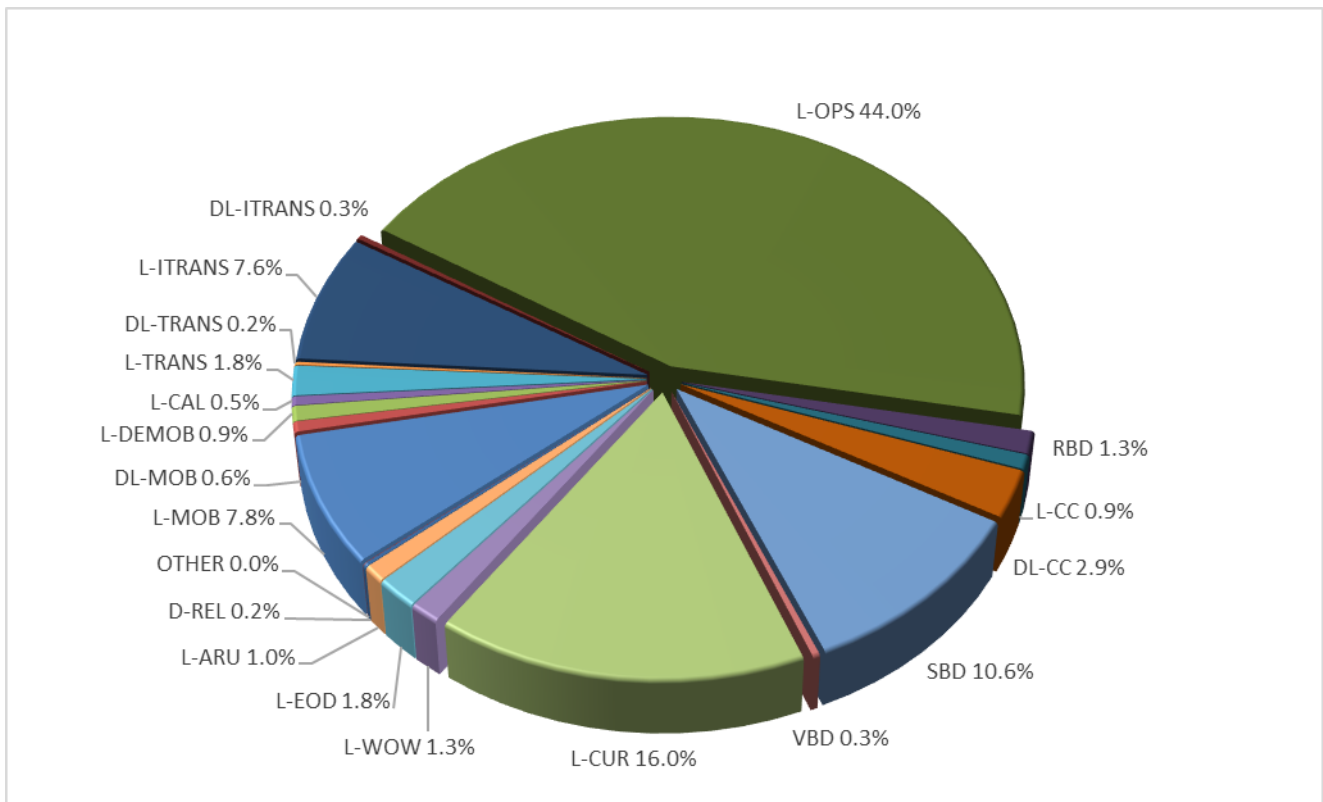


Figure 9-1: Project time analysis pie-chart

9.2 WEATHER

Weather forecasts were received four times a day at 05:00, 11:00, 17:00, and 23:00

Since weather statistics were not included in the DPRs, the weather conditions summarised in this section are based either on forecast from the minutes of daily meetings or from the observed weather as recorded by the survey vessel in the same area (*Geo Ranger / Kommandor Iona*).

Daily wind speed throughout the duration of the offshore operations is shown in Figure 9-2. Wave heights are shown in Figure 9-3. A wind direction frequency is displayed in rose diagram as seen in Figure 9-4.

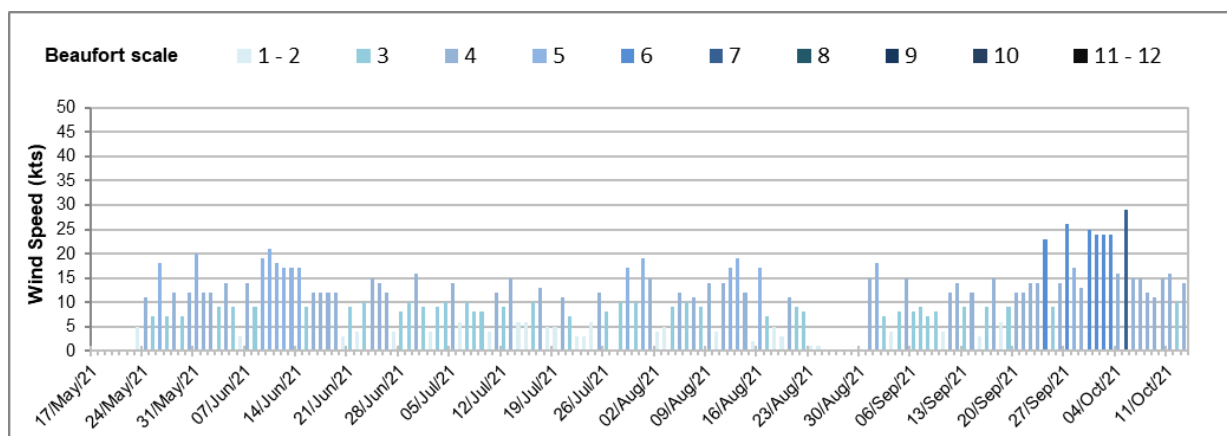


Figure 9-2: Wind speed



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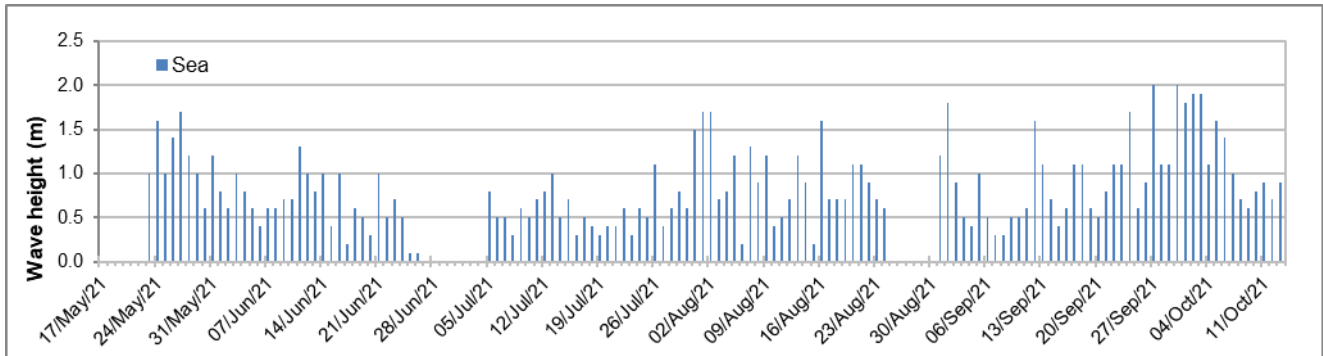


Figure 9-3: Wave height

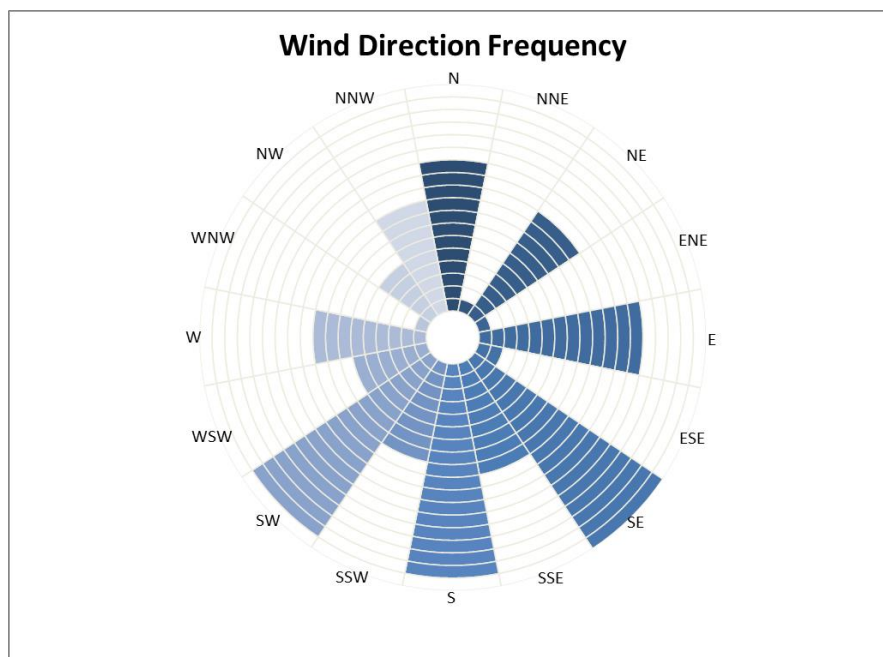


Figure 9-4: Wind direction



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10 SAFETY, HEALTH, ENVIRONMENT AND QUALITY

10.1 SHEQ SUMMARY

Safety is of key importance during all UXOcontrol operations and safety issues were discussed formally on a daily basis during offshore operations. A summary of the project statistics is shown below in Table 10-1.

Table 10-1: Project SHEQ statistics

Subject	Number	Comment
Daily Meetings (including safety)	114	Daily meetings were held each day, except during crew changes, at 08:00
Toolbox Talks	271	Toolbox talks were conducted at shift changes and prior to new or out of the ordinary activities
Safety Observations	71	Safety Observation Cards were raised throughout the project and addressed at the earliest opportunity.
Risk Assessments (not covered in HIRA)	1	Risk assessments were conducted for activities not covered in the HIRA or when deemed necessary
Vessel Drills	10	Muster drills were completed following each crew changes. Several vessel crew drills were also completed.
Worksite Inspections	17	Worksite inspections were carried out on a weekly basis and varying areas of the vessel were visited.
Near Misses	0	
Accidents / Incidents	2	Loss of function starboard azimuth. Loss of function starboard thruster
First Aid Treatment	0	
MOC	5	UXC-PJ00216-MOC-OPS-ID-001 UXC-PJ00216-MOC-OPS-ID-002 UXC-PJ00216-MOC-OPS-ID-003 UXC-PJ00216-MOC-OPS-IDC-001 UXC-PJ00216-MOC-OPS-IDC-002
Non-Conformities	0	
Kick-off Meetings / Project Briefings	20	Project briefing were conducted with all joining personnel.

10.2 VESSEL FAMILIARISATION

All personnel joining the vessel completed the vessel induction program before commencing any activities on-board, unless they have undertaken the induction within the last six months.

Once personal and next of kin details were registered a tour of the vessel was organised and duties and responsibilities clearly set with regards to vessel alarms, emergency announcements and procedures. Personnel were made aware of the operation and location of life saving equipment.

10.3 TOOLBOX TALKS

UXOcontrol policy was to conduct a toolbox talk before any new or non-standard operation. Due to the nature of the project, with its various inspection disciplines toolbox talks were conducted prior to each change in activity or location, and at shift changes.



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10.4 COVID-19 MITIGATION MEASURES

All personnel joining the vessel adhered to the company coronavirus guidance and project specific mitigation measures as stipulated in the COVID Policy Guidance [Ref. 3].

10.5 MANAGEMENT OF CHANGE

During the project, deviations from the scope of work were formally documented using UXOcontrol Management of Change (MOC) process, with a MOC memorandum issued to all parties. A total of five MOC documents were raised during the project.

- UXC-PJ00216-MOC-OPS-ID-001 - Initial search Grid size change
- UXC-PJ00216-MOC-OPS-ID-002 UXO - SVP and Dredging operations
- UXC-PJ00216-MOC-OPS-ID-003 – Obstacle identification at P28
- UXC-PJ00216-MOC-OPS-IDC-001 - UXO Related Debris Recovery As-left size
- UXC-PJ00216-MOC-OPS-IDC-002 - Change of Noise Monitoring Locations



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APPENDIX A. DAILY PROGRESS REPORT

The *Daily Progress Reports* are supplied with this document as separate files in PDF format:

DPR no.	Date	File name
1	17-05-2021	UXO-PJ00216-DPR-GWO-IDC-001
2	18-05-2021	UXO-PJ00216-DPR-GWO-IDC-002
3	19-05-2021	UXO-PJ00216-DPR-GWO-IDC-003
4	20-05-2021	UXO-PJ00216-DPR-GWO-IDC-004
5	21-05-2021	UXO-PJ00216-DPR-GWO-IDC-005
6	22-05-2021	UXO-PJ00216-DPR-GWO-IDC-006
7	23-05-2021	UXO-PJ00216-DPR-GWO-IDC-007
8	24-05-2021	UXO-PJ00216-DPR-GWO-IDC-008
9	25-05-2021	UXO-PJ00216-DPR-GWO-IDC-009
10	26-05-2021	UXO-PJ00216-DPR-GWO-IDC-010
11	27-05-2021	UXO-PJ00216-DPR-GWO-IDC-011
12	28-05-2021	UXO-PJ00216-DPR-GWO-IDC-012
13	29-05-2021	UXO-PJ00216-DPR-GWO-IDC-013
14	30-05-2021	UXO-PJ00216-DPR-GWO-IDC-014
15	31-05-2021	UXO-PJ00216-DPR-GWO-IDC-015
16	01-06-2021	UXO-PJ00216-DPR-GWO-IDC-016
17	02-06-2021	UXO-PJ00216-DPR-GWO-IDC-017
18	03-06-2021	UXO-PJ00216-DPR-GWO-IDC-018
19	04-06-2021	UXO-PJ00216-DPR-GWO-IDC-019
20	05-06-2021	UXO-PJ00216-DPR-GWO-IDC-020
21	06-06-2021	UXO-PJ00216-DPR-GWO-IDC-021
22	07-06-2021	UXO-PJ00216-DPR-GWO-IDC-022
23	08-06-2021	UXO-PJ00216-DPR-GWO-IDC-023
24	09-06-2021	UXO-PJ00216-DPR-GWO-IDC-024
25	10-06-2021	UXO-PJ00216-DPR-GWO-IDC-025
26	11-06-2021	UXO-PJ00216-DPR-GWO-IDC-026
27	12-06-2021	UXO-PJ00216-DPR-GWO-IDC-027
28	13-06-2021	UXO-PJ00216-DPR-GWO-IDC-028
29	14-06-2021	UXO-PJ00216-DPR-GWO-IDC-029
30	15-06-2021	UXO-PJ00216-DPR-GWO-IDC-030
31	16-06-2021	UXO-PJ00216-DPR-GWO-IDC-031
32	17-06-2021	UXO-PJ00216-DPR-GWO-IDC-032
33	18-06-2021	UXO-PJ00216-DPR-GWO-IDC-033
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35	20-06-2021	UXO-PJ00216-DPR-GWO-IDC-035
36	21-06-2021	UXO-PJ00216-DPR-GWO-IDC-036
37	22-06-2021	UXO-PJ00216-DPR-GWO-IDC-037
38	23-06-2021	UXO-PJ00216-DPR-GWO-IDC-038
39	24-06-2021	UXO-PJ00216-DPR-GWO-IDC-039
40	25-06-2021	UXO-PJ00216-DPR-GWO-IDC-040
41	26-06-2021	UXO-PJ00216-DPR-GWO-IDC-041
42	27-06-2021	UXO-PJ00216-DPR-GWO-IDC-042
43	28-06-2021	UXO-PJ00216-DPR-GWO-IDC-043
44	29-06-2021	UXO-PJ00216-DPR-GWO-IDC-044
45	30-06-2021	UXO-PJ00216-DPR-GWO-IDC-045
46	01-07-2021	UXO-PJ00216-DPR-GWO-IDC-046



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DPR no.	Date	File name
47	02-07-2021	UXO-PJ00216-DPR-GWO-IDC-047
48	03-07-2021	UXO-PJ00216-DPR-GWO-IDC-048
49	04-07-2021	UXO-PJ00216-DPR-GWO-IDC-049
50	05-07-2021	UXO-PJ00216-DPR-GWO-IDC-050
51	06-07-2021	UXO-PJ00216-DPR-GWO-IDC-051
52	07-07-2021	UXO-PJ00216-DPR-GWO-IDC-052
53	08-07-2021	UXO-PJ00216-DPR-GWO-IDC-053
54	09-07-2021	UXO-PJ00216-DPR-GWO-IDC-054
55	10-07-2021	UXO-PJ00216-DPR-GWO-IDC-055
56	11-07-2021	UXO-PJ00216-DPR-GWO-IDC-056
57	12-07-2021	UXO-PJ00216-DPR-GWO-IDC-057
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67	22-07-2021	UXO-PJ00216-DPR-GWO-IDC-067
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88	12-08-2021	UXO-PJ00216-DPR-GWO-IDC-088
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94	18-08-2021	UXO-PJ00216-DPR-GWO-IDC-094
95	19-08-2021	UXO-PJ00216-DPR-GWO-IDC-095



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97	21-08-2021	UXO-PJ00216-DPR-GWO-IDC-097
98	22-08-2021	UXO-PJ00216-DPR-GWO-IDC-098
99	23-08-2021	UXO-PJ00216-DPR-GWO-IDC-099
100	24-08-2021	UXO-PJ00216-DPR-GWO-IDC-100
101	25-08-2021	UXO-PJ00216-DPR-GWO-IDC-101
102	26-08-2021	UXO-PJ00216-DPR-GWO-IDC-102
103	27-08-2021	UXO-PJ00216-DPR-GWO-IDC-103
104	28-08-2021	UXO-PJ00216-DPR-GWO-IDC-104
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107	31-08-2021	UXO-PJ00216-DPR-GWO-IDC-107
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138	01-10-2021	UXO-PJ00216-DPR-GWO-IDC-138
139	02-10-2021	UXO-PJ00216-DPR-GWO-IDC-139
140	03-10-2021	UXO-PJ00216-DPR-GWO-IDC-140
141	04-10-2021	UXO-PJ00216-DPR-GWO-IDC-141
142	05-10-2021	UXO-PJ00216-DPR-GWO-IDC-142
143	06-10-2021	UXO-PJ00216-DPR-GWO-IDC-143
144	07-10-2021	UXO-PJ00216-DPR-GWO-IDC-144



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146	09-10-2021	UXO-PJ00216-DPR-GWO-IDC-146
147	10-10-2021	UXO-PJ00216-DPR-GWO-IDC-147
148	11-10-2021	UXO-PJ00216-DPR-GWO-IDC-148
149	12-10-2021	UXO-PJ00216-DPR-GWO-IDC-149
150	13-10-2021	UXO-PJ00216-DPR-GWO-IDC-150



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APPENDIX B. MOBILISATION AND CALIBRATIONS REPORT

The *Mobilisation and Calibrations Report* for *Glomar Worker* is supplied with this document as a separate file in PDF format.



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APPENDIX C. EQUIPMENT VERIFICATION TEST

The *Equipment Verification Test Report* for *Glomar Worker* is supplied with this document as a separate file in PDF format.



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APPENDIX D. TARGET INVESTIGATION REPORT

All of the target investigation reports (TIRs) issued during the Seagreen Offshore Windfarm pUXO identification works along with each target's detail status, description, approximate position, time of inspection, etc are supplied with this document as a separate file in PDF format with the Target ID in each TIR name.



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APPENDIX E. IDENTIFICATION MASTER TARGET LIST

The iMTL issued with this report is the final version and supplied as a separate document file in excel format.



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APPENDIX F. MARINE MAMMAL OBSERVERS REPORT

The *Marine Mammal Observers Report* is supplied as a separate document file in PDF format.

F- 1. MMO LOG SHEET

The *Marine Mammal Observers* sheet issued with this report is supplied as a separate document file in excel format.



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APPENDIX G. SOUND MONITORING REPORT

The *Sound Monitoring Report* is supplied as a separate document file in PDF format.