Galloper Offshore Wind Farm

Heritage Method Statement: Addendum (AB_OSP_Mag_145: Aircraft Material)

Review of Archaeological Material identified during Unexploded Ordnance Survey (Offshore Wind Farm)

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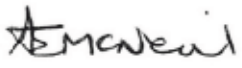
v01	E	*Andrea Hamel*	*AEM*		19/09/2016
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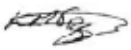
v02	E	*Andrea Hamel*	*Louise Tizzard*		30/09/2016
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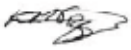
v03	E	*Andrea Hamel*	*Louise Tizzard*		11/01/2016
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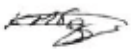
v06	E	*Andrea Hamel*	*Louise Tizzard*		08/12/2016
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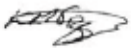
v07	E	*Andrea Hamel*	*Louise Tizzard*		12/12/2016
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* I = Internal Draft; E = External Draft; F = Final

Galloper Offshore Wind Farm

Heritage Method Statement: Addendum (AB_OSP_Mag_0145: Aircraft Material)

Review of Archaeological Material identified during Unexploded Ordnance Survey (Offshore Wind Farm)

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology has been commissioned by Galloper Wind Farm Limited (GWFL) to undertake a review of archaeological material identified during Unexploded Ordnance Survey of the Offshore Wind Farm (OWF) (Wessex Archaeology 2016a) to be undertaken as part of the Galloper Offshore Wind Farm (GWF) project (Figure 1).

1.1.2 As part of ongoing works all ROV data collected for the UXO Clearance and Disposal survey are subject to archaeological assessment (Wessex Archaeology 2016a). This approach enables a representative sample of archaeological anomalies identified as part of the archaeological assessment of geophysical survey data to be subject to ground-truthing exercises. The aim of this assessment was to contribute towards a greater understanding of the nature, character and extent of the marine archaeological environment and to inform upon appropriate mitigation strategies adopted for the scheme. This assessment is currently ongoing.

1.1.3 Wessex Archaeology's assessment of ROV survey data attained as part of the UXO Clearance and Disposal operations, interpreted debris comprising a concentration of aluminium sheets, other aluminium material, wires, metal debris, possible canvas fabric and lightweight fabric which suggested a possible parachute as likely aircraft material. The debris was related to four targets (AB_OSP_Mag_0145, AB_OSP_Mag_0145_A, AB_OSP_Mag_0145_B and AB_OSP_Mag_0145_C) (Figure 2). These anomalies are referred to collectively as AB_OSP_Mag_0145: aircraft material (or the Site) and are bounded by the red line in Figure 2. Further definition of the Site boundary is provided in Section 2.3. The magnetometer contact 70161 was previously identified by Wessex Archaeology at this location (Wessex Archaeology 2015), and was also identified in the 2016 geophysical dataset.

1.1.4 Based on the assessment that the material likely related to an aircraft crash site, images of the site were forwarded to Ewen Cameron, Curator Royal Air Force Museum Stafford, for confirmation. Ewen Cameron agreed that the lightweight fabric was likely parachute fabric and that the other debris in the area was also aircraft-related.

1.1.5 When it was initially discovered, the Site was recommended for a temporary Archaeological Exclusion Zone (AEZ), which was developed to inform discussions with the Client, Historic England, and the MoD Agency, the Joint Casualty and Compassionate Centre (JCCC). However, the location of the Site, approximately 20 m to the east of the Offshore Substation Foundation (Figure 1) where Array Cables C, D, E, F, G and H join the Offshore Substation,

is considered to be within an area of impact as a result of construction activities. Therefore, following consultations with Historic England, the temporary AEZ has been removed, and further discussions regarding mitigation for the Site are in progress.

1.2 Aim

1.2.1 The aim of this document is to describe the location and archaeological nature of the targets which may be subject to impact as a result of the development.

2 THE SITE

2.1 Geology

2.1.1 The geology of the site has been assessed through existing sources: British Geological Survey (BGS) charts (BGS 1991, 1992), the *Outer Thames Estuary Regional Environmental Characterisation* (REC) (Emu Ltd. 2009), and the *Galloper Wind Farm Project Environmental Statement – Chapter 9: Physical Environment* (Royal Haskoning 2011).

2.1.2 The base of the geological sequence across the OWF site is the Eocene London Clay Formation (Emu Ltd. 2009, p.15; Royal Haskoning 2011, p.10). The Formation comprises firm to stiff silty clay and clayey and sandy silt with subordinate sand (Royal Haskoning 2011, p.10). The London Clay is considered an immobile geological unit (Royal Haskoning 2011, p.11). In places, the London Clay is exposed on the seabed, although in other places it is overlain with a thin veneer of sands and gravels, not exceeding 1 m in thickness (BGS 1991, 1992; Emu 2011, p.15; Royal Haskoning 2011, p.11, p.23). Where present, the sands and gravels comprise coarse to medium relatively well sorted gravelly sand and slightly gravelly sand (BGS 1991). The potential for sediment transport in the gravelly areas is lower than the potential on the nearby sandbanks (Royal Haskoning 2011, p.28), and in general, the combined wave and tide bed shear stresses have little influence on transport processes at the sites with depths around 30 m (*ibid*).

2.1.3 On the Site, the ROV video indicates the seabed comprises a gravelly sand seabed. During the ROV investigations, limited excavations were undertaken with the dredge pump attached to the ROV. This dredging was used to remove loose sediment around targets, and this revealed buried material, and also small quantities of silt under the gravelly surface. However, generally the visibility around the site was quite good, suggesting that there is not much loose silt exposed on the seabed or present in the water column.

2.2 ROV Target Anomalies

Methodology

2.2.1 As part of the UXO Survey, initial investigations were undertaken by N-Sea (contracted by GWFL to undertake the UXO ROV survey) using an ROV. The UXO ROV survey identified four targets of metal debris (AB_OSP_Mag_0145, AB_OSP_Mag_0145_A, AB_OSP_Mag_0145_B and AB_OSP_Mag_0145_C). The extents of these investigations areas are shown in Figure 2.

2.2.2 The archaeological review of the UXO Survey data began with an assessment of the N-Sea Target Identification Sheets. From this review, a Data Sheet was created, comprising information about the location of the Site, a brief description of the material visible on the Site, and images from the Target Investigation Report. When the initial archaeological assessment suggested that the material was potentially aircraft related material, the ROV video was requested for a more detailed assessment.

2.2.3 The initial ROV survey covered a linear grid roughly 16 m NEE/SSW, with 13 lines covering an area 11 m across (Figure 2a). Following the initial survey, target investigations were carried out by the ROV on the targets identified above (Figure 2b). The positions illustrated in Figure 2b are for the ROV central reference point at 1 second intervals. The exact location of the camera on the ROV was not recorded during the survey, as there are different cameras mounted on the ROV, all of which are moveable and rotatable, however the distance from the front of the ROV to the central reference point is only approximately 0.4 m, and this slight discrepancy is not considered to greatly affect the results of the archaeological assessment. The video data for the initial ROV survey and for the target investigation surveys were archaeologically reviewed. During the archaeological assessment, a number of stills were taken from the target analysis videos for further assessment. Stills from the video have been used to further illustrate the Data Sheets (see Appendix 1).

2.2.4 During the archaeological assessment, the different material within each target, as illustrated by the video stills, was given an individual anomaly number. The anomalies were labelled based on the 'parent identifier' as supplied by the UXO Survey, and with additional numerals to indicate additional material/locations. For example, material associated with anomaly AB_OSP_Mag_0145_A would become AB_OSP_Mag_0145_A_1 (see Figure 2). In some cases, material is illustrated by a single video still, whereas for other material numerous video stills are provided.

2.2.5 Table 1 below provides a list of the anomalies and the associated ROV video and video still file names.

2.2.6 Selected stills were forwarded to Ewen Cameron, Curator of the Royal Air Force Museum Stafford for further analysis.

2.2.7 Positional information for each anomaly encountered during the UXO ROV Survey operation was obtained from the working ROV (WROV) coordinates as displayed in the ROV video monitor screen assessed for each target. The WROV position is the reference point on the ROV which is based on an offset from the centre coil, relative to that position and is considered to be the most accurate position with respect to mapping targets inspected by ROV, and when the ROV is positioned immediately adjacent to the material, the position is likely to be accurate to within 1-2m. However, the ROV was not always immediately adjacent to the material being recorded, and therefore in these cases, the position only provides an estimate of the location and is not conclusive.

Results

2.2.8 The results of the archaeological analysis of the ROV video provide details of the anomalies present on the seabed and have been used to inform the following account. Twenty contacts were identified within an area approximately 13 m N/S x 6.5 m E/W and these are summarised in Table 1, below, and the locations are shown on Figure 3. The Data Sheets in Appendix 1 provide further details.

2.2.9 Further details regarding their archaeological nature, and images of the features, can be found in the Data Sheets, Appendix 1.

Table 1: Archaeological Anomalies

UXO Target ID	Description	UTM31N Easting	UTM 31N Northing	Data assessed
AB_OSP_Mag_0145	Metal debris	432692.01	5756145.94	Target Investigation Report 0238

UXO Target ID	Description	UTM31N Easting	UTM 31N Northing	Data assessed
AB_OSP_Mag_0145_1	Metal debris and wire	432695.10	5756147.85	ROV Video: Dive 212 16-05-26 15.11.52_C4 Video Still: Dive 212 16-05-26 15.11.52_C4_00003
AB_OSP_Mag_0145_2	Fabric and metal debris	432690.91	5756147.11	ROV Video: Dive 212 16-05-26 15.11.52_C4 Dive 212 16-05-26 15.11.52_C4_00011
AB_OSP_Mag_0145_A	Metal debris	432697.21	5756145.11	Target Investigation Report 0239
AB_OSP_Mag_0145_A_1	Possible netting or other debris covering metal debris	432695.93[1]	5756144.96	ROV Video: Dive 212 16-05-26 15.25.45_C4 Video Still: Dive 212 16-05-26 15.25.45_C4_00017
AB_OSP_Mag_0145_A_2	Aluminium material	432695.38	5756145.59	ROV Video: Dive 212 16-05-26 15.25.45_C4 Video Still: Dive 212 16-05-26 15.25.45_C4_00026
AB_OSP_Mag_0145_A_3	Wire	432695.80	5756144.71	ROV Video: Dive 212 16-05-26 15.25.45_C4 Video Still: Dive 212 16-05-26 15.25.45_C4_00009
AB_OSP_Mag_0145_A_4	Fabric straps	432695.46	5756144.62	ROV Video: Dive 212 16-05-26 15.25.45_C4 Video Still: Dive 212 16-05-26 15.25.45_C4_00001
AB_OSP_Mag_0145_B	Metal debris	432693.65	5756154.91	Target Investigation Report 0240
AB_OSP_Mag_0145_B_1	Shell chasing	432694.89	5756152.34	ROV Video: Dive 212 16-05-26 15.43.55_C4 Video Still: Dive 212 16-05-26 15.43.55_C4_00002
AB_OSP_Mag_0145_B_2	Metal debris	432694.62	5756152.75	ROV Video: Dive 212 16-05-26 15.43.55_C4 Video Still: Dive 212 16-05-26 15.43.55_C4_00013
AB_OSP_Mag_0145_B_3	Metal debris	432694.93	5756152.59	ROV Video: Dive 212 16-05-26 15.43.55_C4 Video Still: Dive 212 16-05-26 15.43.55_C4_00010
AB_OSP_Mag_0145_B_3	Metal debris	432694.92	5756153.12	ROV Video: Dive 212 16-05-26 15.43.55_C4 Video Still: Dive 212 16-05-26 15.43.55_C4_00021

[1] Note: Positional details for AB_OSP_Mag_0145_A_1 and AB_OSP_Mag_0145_A_2 are vague as the ROV was stationary at the time but the camera zoomed in on material.

UXO Target ID	Description	UTM31N Easting	UTM 31N Northing	Data assessed
AB_OSP_Mag_0145_B_4	Metal debris – wing or spar fitting	432694.45	5756153.41	ROV Video: Dive 212 16-05-26 15.43.55_C4 Video Still: Dive 212 16-05-26 15.43.55_C4_00026
AB_OSP_Mag_0145_B_5	Fabric with black coating	432695.03	5756153.42	ROV Video: Dive 212 16-05-26 15.43.55_C4 Video Still: Dive 212 16-05-26 15.43.55_C4_00034
AB_OSP_Mag_0145_B_6	Metal object	432694.32	5756153.42	ROV Video: Dive 212 16-05-26 15.43.55_C4 Dive 212 16-05-26 15.43.55_C4_00035
AB_OSP_Mag_0145_C	Metal debris	432697.47	5756143.08	Target Investigation Report 0241
AB_OSP_Mag_0145_C_1	Metal sheet	432697.41	5756146.48	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Dive 212 16-05-26 16.05.03_C4_00005
AB_OSP_Mag_0145_C_2	Metal debris	432697.87	5756142.55	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Dive 212 16-05-26 16.05.03_C4_00017
AB_OSP_Mag_0145_C_3	Metal debris	432697.34	5756143.20	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Dive 212 16-05-26 16.05.03_C4_00021
AB_OSP_Mag_0145_C_4	Probable parachute material (close up)	432697.28	5756142.80	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Dive 212 16-05-26 16.05.03_C4_00028
AB_OSP_Mag_0145_C_5	Probable parachute material	432697.43	5756142.94	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Dive 212 16-05-26 16.05.03_C4_00030
AB_OSP_Mag_0145_C_6	Metal debris	432697.49	5756142.92	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Dive 212 16-05-26 16.05.03_C4_00034
AB_OSP_Mag_0145_C_7	Probable parachute material associated with a concentrated accumulation of debris slightly raised off the seabed	432696.76	5756143.74	ROV Video: Dive 212 16-05-26 16.05.03_C4 Video Still: Target Investigation Sheet, Dive 212 16-05-26 16.05.03_C4_00041

2.3 Site boundary

2.3.1 Based on the assessment of ROV survey data, a 'Site boundary' was developed (Figure 2, 3 and 5). The Site boundary is based on the known locations of the material that is visible in the ROV video data, buffered by 2 m to take into account basic assumptions about possible positioning errors. Possible errors derive from the following unknowns: ROV positioning error; error regarding the estimated size of the material on the seabed; approximate position of camera mount; and error in depth of field, (in particular AB_OSP_Mag_0145_A_1 and AB_OSP_Mag_0145_A_2). Taken together, the various errors could amount to 2 m, and a buffer of this size around known debris has therefore been included.

2.4 Geophysical Anomalies

Associated with AB_OSP_Mag_0145

2.4.1 An archaeological assessment of geophysical survey data (Wessex Archaeology 2015) identified a magnetic anomaly (70161), situated 37 m from the proposed Offshore Substation Platform area. The magnetic anomaly measured 99 nT. The anomaly was present over a number of survey lines without an associated sidescan sonar or bathymetry contact and was considered to possibly represent a significant piece of buried ferrous debris. Without further information this was classified as an A2 anomaly (Uncertain origin of possible archaeological interest).

2.4.2 Following the archaeological assessment of ROV video data, the 2016 geophysical data were assessed at this location. As the geophysical data acquisition and ROV investigations were undertaken concurrently over this area, geophysics data acquired pre-ROV survey and post-ROV survey were available for review. The pre-ROV sidescan sonar data were assessed to determine whether any upstanding material was present in the area and the magnetometer data were reviewed to assess whether there were any further anomalies in the wider area. The extents of the high resolution 2016 geophysical survey data covering the Site are illustrated in Figure 4a and b.

2.4.3 An area of bright reflectors was observed on the 2016 pre-ROV survey data and the magnetometer data indicated an anomaly of 313 nT. The area of bright reflectors was coincident with the concentrated accumulation of debris within the Site (as shown by the purple line in Figures 2 and 3). The concentrated accumulation of debris is directly associated with magnetic anomaly 70161, which lies on its boundary, and with the ROV survey targets AB_OSP_Mag_0145_A and AB_OS_Mag_015_C. The concentrated accumulation of debris slightly raised off the seabed and measures approximately 6 m N/S by 3.9 m E/W. The material is associated with the locations of AB_OSP_Mag_0145_A and AB_OSP_Mag_0145_C. The closest part of the boundary of the feature is situated approximately 22.9 m from the proposed Offshore Substation Platform Area.

2.4.4 The post-ROV survey sidescan sonar data indicated an area of seabed disturbance comprising a discrete elliptical area of irregular dark and bright reflectors, (the dashed purple line on Figure 2). The area measures approximately 13 x 5 x 0.2 m, at the widest diameter. This area surrounds the debris previously identified in the pre-ROV sidescan sonar data, and extends approximately 6.5 m to the south. There is no visible indication of structure in the data, and it is possible that the disturbance visible in the geophysical data relates to changes to the seabed made by dredging from the ROV and the exposure of previously buried material. Where there is coverage by the ROV survey data and target investigation ROV video, there does not appear be any anomalies visible on the seabed, indicating that there is no surface material in this area of seabed disturbance.

2.4.5 Based on the assessment of the ROV and 2016 geophysical data anomaly 70161 was re-classified to A1 (Anthropogenic origin of archaeological interest) and a temporary Archaeological Exclusion Zone (AEZ) of 15 m around the boundary of Site 70161 was initially recommended, in order to inform discussions with Historic England, the Client and the MoD Agency, the JCCC.

In the wider area

2.4.6 In order to assess the potential for further, possibly related, material in the wider area, geophysical anomalies within 200 m of 70161 were reviewed. This revealed 13 A2 anomalies.

2.4.7 Two of the anomalies correspond with ROV targets. These comprise two magnetic anomalies. The closest ROV target (72885 / AB_OSP_Mag_0153) is 67 m to the north of AB_OSP_Mag_0145_B, and the 2016 geophysical data indicated a magnetic anomaly of 91 nT. The next nearest ROV target (72869 / M_Mag_0114) lies approximately 120 m to the south of AB_OSP_Mag_0145_C and the 2016 geophysical data indicated a magnetic signature of 13 nT . The potential connection between these sites has been commented on in Section 2.5.

2.4.8 There are four further magnetic anomalies, without surface expression (71376, 72878, 72889 and 72894). The 2016 geophysical data indicated magnetic anomalies equal to or greater than 50 nT (67 nT for 71376 and 50 nT for 72878), and therefore they are considered to be of archaeological potential. Anomalies 72889 and 72894 have magnetic values below 50 nT (both 16 nT) and therefore are considered to be of relatively low potential (Wessex Archaeology forthcoming).

2.4.9 The remaining seven anomalies all had surface expression without an associated magnetic anomaly, and all were characterised as dark reflectors (72886, 72887, 72888, 72890, 72891, 72892 and 72893) (Wessex Archaeology forthcoming). Due to their small size (less than 3 m), all are considered to be of low archaeological potential. Two of these anomalies (72891 and 72892) are approximately 15 m to the south of 70161 and they are discussed below.

2.5 Discussion

Assessment of the Site

2.5.1 The archaeological assessment reviewed the ROV video footage taken during the initial assessment of target AB_OSP_Mag_0145, and the subsequent target investigation survey of the four UXO targets (AB_OSP_Mag_0145_main, AB_OSP_Mag_0145_A, AB_OSP_Mag_0145_B and AB_OSP_Mag_0145_C).

2.5.2 The ROV surveys revealed scattered metal debris, comprising aluminium sheets, aluminium debris, other metal debris, wires, possible canvas fabric, lightweight fabric which is likely a parachute, and two small items of ordnance of relatively small calibre. The material covers an area approximately 13 m N/S by 7 m E/W. The nearest piece of debris to the Offshore Substation Foundation is AB_OSP_Mag_0145_2 lies 21 m to the NW.

2.5.3 The magnetic anomaly 70161 is associated with the Site, and as 70161 comprises the magnetic response of 99 nT in the 2015 data and 313 nT in the 2016 data (the differences due to towfish proximity to the ferrous material rather than a change in ferrous content), it is considered to be consistent with the wires and fragmentary metal debris visible on the Site.

2.5.4 At AB_OSP_Mag_0145_C_7, there is a concentrated accumulation of debris that is slightly raised off the seabed (images Dive 212 16-05-26 16.05.03_C4_00041, Dive 212 16-05-26 16.05.03_C4_00047). It is situated 22.9 m from the proposed Offshore Substation Foundation (Figure 3) The debris includes probable parachute material, wires and other metal debris. The archaeological assessment of side scan sonar data indicates that this area of debris measures 6 m N/S by 3.9 m E/W, and its extents are illustrated by the purple line in Figure 3. From the review of video data, it is apparent that the seabed in the immediate vicinity of this accumulation of debris is slightly silty. In general, the presence of silt promotes preservation of organic and non-organic materials (Bournemouth University 2007), and it is possible that additional, probably fragmentary, non-ferrous material could be shallowly covered by silty sediment in the area immediately surrounding the accumulation of debris. It is also possible, that the accumulation of debris itself conceals further fragmentary, material.

2.5.5 To the north of the main area of debris, there are fragmentary pieces of aluminium, canvas fabric and other metallic debris (AB_OSP_Mag_0145_B), all of which lay flat on the seabed, or in some instances were covered by a shallow layer of sediment, and revealed through the ROV dredging loose sediment around the target.

2.5.6 Although the majority of material is fragmentary, the concentration of aluminium material, small pieces of metal debris, and wires is consistent with material from an aircraft, based on professional experience. Ewen Cameron, Curator of the Royal Air Force Museum Stafford, concurs that the material is likely to have derived from an aircraft, and he has identified AB_OSP_Mag_0145_B_4 as likely to be an aircraft wing or spar fitting. In addition, he has identified the lightweight material as probable parachute material, based on the stitching visible in video still Dive 212 16-05-26 16.05.03_C4_00028. Parachutes had a wide range of uses, and Ewen Cameron commented that the parachute was likely, based on his professional opinion, to have been for an air-dropped sonobuoy, flare or other ordnance item, although being material from a personnel parachute could not be ruled out. The concentration of debris surrounding the probable parachute suggests that it was still retained within an aircraft when it entered the water.

2.5.7 The two pieces of ammunition comprise a spent shell casing identified on the seabed (AB_OSP_Mag_0145_B_1) and a live small arms round that was discovered lodged in the ROV's dredging hose, and likely came from one of the four targets investigated. The small arms round has been identified by Wessex Archaeology Coastal and Marine staff Toby Gane and Alistair Byford-Bates, based on its size and shape, as likely to be a .50 calibre Allied bullet, as used by British, Commonwealth and American aircraft during the Second World War. However, as the base of the bullet is not visible in the image, and no markings were recorded following its recovery, it is not possible to be more specific. This type of bullet was widely used on a large range of Second World War aircraft. The presence of the small arms ammunition has a number of possible interpretations, for example it could indicate that the aircraft material derives from either a bomber or fighter aircraft, or that the arms were being carried as cargo. Although unlikely, the fact that the spent shell casing was discovered lying on the seabed suggests the possibility that it could be derived material that initially came from another site and has been transported across the seabed by natural or man-made forces, or could have arrived on the seabed through a separate incident. However, the fact that the live bullet was discovered in the ROV dredge hose suggests that it originated from buried sediment, and therefore increases the likelihood that the ammunition is related to the Site.

2.5.8 The aircraft material is more likely to be associated with the Second World War than the First. During the First World War there was less action in the air, and the aircraft used were

lightly built, wooden frames with canvas, and were therefore less likely to survive impact with the water. The presence of parachute material likely also indicates a Second World War date, as although parachutes began to be used by German pilots during the First World War, they did not become standard for Allied crews until the Second World War, when airplane cockpits became large enough to accommodate pilot and parachute. Further evidence to support a Second World War date includes the fact that the .50 calibre bullet did not enter military service until 1921, and sonobuoys, which used parachutes, first appeared in 1942.

2.5.9 During the Second World War, the airspace above this area witnessed considerable action, and numerous aircraft were lost. *Aircraft Crash Sites at Sea: A scoping study: Archaeological Desk-based Assessment* (Wessex Archaeology 2008) indicates that although the National Monument Record (Now the National Record for the Historic Environment) and the local Historic Environment Records for Essex and Suffolk contain a limited number of known aircraft crash sites and records of loss (Wessex Archaeology 2008, Figure 2), the distribution of Second World War British Air/Sea Rescue Operations (Wessex Archaeology 2008: Figure 3) indicates a significant concentration off this coast. This suggests that there are a considerable number of Second World War aircraft crash sites in the wider area, many of which have not yet been discovered.

2.5.10 No human remains have been identified. The scattered nature of the Site, and the absence of large ferrous items associated with a coherent cockpit, undercarriage, or engine(s) associated with this material, suggests a catastrophic breakup and dispersal of crash material. It is therefore unlikely that articulated human remains will be present. The nature of the aircraft loss, potential for explosion, crew bail-out, breakup on contact with sea surface or seafloor give rise to numerous opportunities for human remains to come separated and widely distributed from a wreck site. However, there is insufficient evidence to entirely rule out the probably unlikely potential for disarticulated or fragmentary remains.

2.5.11 Based on the information available, the material at the Site is likely to be from a probably Allied, Second World War military aircraft that crash landed and had largely disintegrated before arriving at the location on the seabed and being lightly covered by seabed sediment. What is not known is the nationality of the aircraft, the type of aircraft, whether fragmentary human remains could be present or further information about the nature, character and level of preservation at the Site.

2.5.12 The sidescan sonar, magnetometer and ROV surveys undertaken so far have not shown any indication of large pieces of ferrous debris present at the Site or in the wider area – which rules out the possibility that there are substantial pieces of aircraft present in the areas surveyed, either on the seabed or buried. Much of the aircraft material, such as the engine(s), wheels, and cockpit, would likely have sufficient ferrous composition to be revealed through magnetometer survey.

2.5.13 In addition, the depth of the site and the seabed composition must be considered. The Site is at 30 m, and it is unlikely that aircraft material, having fallen 30 m through the water column, would have had the momentum to penetrate deeply into the stiff London Clay deposits. Therefore, any material relating to the aircraft is likely to be limited to the shallow layer of gravelly sand that overlies the bedrock, and would likely be fragmentary and limited in size, as demonstrated by the material already uncovered during ROV dredging. However, there is potential for some, small pieces of material to be relatively well preserved, as evidenced by the small areas of silt, such as in the immediate vicinity of the concentrated accumulation of debris, which would promote the preservation of organic and non-organic material.

Other sites in the wider area

AB_OSP_Mag_0153

2.5.14 Approximately 67 m to the NNW of the Site is AB_OSP_Mag_0153, an area of metal debris covering an area approximately 15 m x 15 m.

2.5.15 The N-Sea Target Identification Report identified the metal debris as significant quantities of live small arms ammunition, together with numerous corroded ammunition boxes and associated debris.

2.5.16 The Ordtek assessment indicates that the site comprises hundreds of small arms ammunition (SAA) and possible ammunition containers amongst other items of metallic debris. Small calibre High Explosive filled cannon shells may also be present although there is no direct evidence for such items.

2.5.17 Based on these assessments and the archaeological assessment of video stills and the target investigation video, the site was initially interpreted as an ammunition dump, however it is also possible that this site could be related to AB_OSP_Mag_0145. The possible association is strengthened by the fact that Wessex Archaeology's Alistair Byford-Bates has indicated that the ammunition appears to be consistent with .50 calibre bullets, although it is not possible to confirm due to the lack of scale during the ROV survey, and as any detail that could be present on the base of the cartridges are not visible in the images or on the video.

2.5.18 Wessex Archaeology suggested that the anomaly could comprise an ammunition dump of First or Second World War material, however, it is also possible that this anomaly could be related to AB_OSP_Mag_0145. Therefore, the ROV video for AB_OSP_Mag_0153 was requested and has been archaeologically reviewed, however it has not been possible to confirm whether or not the two sites are connected.

2.5.19 Based on the material that has been assessed, there are two possibilities for association. The first possibility is that this anomaly is directly related to AB_OSP_Mag_0145, and that it comprises additional material from the same aircraft crash site. Many military aircraft, such as the large bombers, carried large stores of ammunition. This would support the interpretation of a very broken up and scattered site, particularly as there are no large magnetic anomalies in the vicinity to indicate further material. A second possibility is that the anomalies are not related, but that munitions from AB_OSP_Mag_0153 have been transported, either by natural or man-made forces to AB_OSP_Mag_0145. A third possibility is that the position of the targets is simply co-incidental and that they are not, in fact, related. There is insufficient evidence to conclusively determine whether there is any relation between the two sites. Due to the classification of AB_OSP_Mag_0153 as Suspected UXO by Ordtek, the target has been recommended for avoidance. Avoidance of AB_OSP_Mag_0153 is possible due to its location.

M_Mag_0114 and M_Mag_0114_A

2.5.20 Approximately 120 m to the SSE of the Site lay M_Mag_0114 and M_Mag_0114_A, two pieces of metal debris. M_Mag_0114 has been identified as a metal switching board with three switches and a circular window or gauge and M_Mag_0114_A is a metal pipe. Although it is possible that the switching board could be aircraft related, it is also possible that it comes from a vessel, or it could have been a piece of broken material cast overboard. Therefore, it is not possible to conclusively determine whether the M_Mag_0114 is related to AB_OSP_Mag_0145.

Geophysical survey anomalies without a corresponding ROV target

2.5.21 There are two geophysical survey anomalies without a corresponding ROV target approximately 15 m to the south of 70161, between String H and String J. These comprise two dark reflectors (72891 and 72892) that are not associated with a magnetic anomaly. Based on the 2016 geophysical data, 72891 measures 1.0 x 0.3 x 0.1 m and 72982 measures 0.4 x 0.2 x 0.1 m. They have been interpreted as of low archaeological potential due to their small size and characteristics (Wessex Archaeology forthcoming).

2.5.22 The nature of these anomalies is not known, and although they could comprise non-ferrous debris associated with the Site, it is also possible that they could be natural in origin.

2.6 Archaeological Value

2.6.1 In order for the impacts of any given development to be explored, archaeological sites and finds (i.e. receptors) are assigned a sensitivity, typically assessed via four factors: adaptability, tolerance, recoverability and value. Since archaeological receptors cannot adapt, tolerate or recover from impacts caused by a proposed development, the sensitivity of archaeological receptors can be quantified only by their value. This section discusses the archaeological value of AB_OSP_Mag_0145: aircraft material.

2.6.2 Based on the information available, the Site, AB_OSP_Mag_0145 aircraft material, is of medium value and therefore sensitivity. The nationality of the potential aircraft material has not been identified although the likelihood is that it relates to the Second World War, a major international conflict, and therefore although it may be British, it may instead have an international connection. However, the remains visible on the seabed are fragmentary, and may only have moderate potential to contribute to knowledge and understanding.

2.6.3 Beyond the 12 nm limit, British aircraft that crashed while in military service are automatically protected under the Protection of Military Remains Act 1986 and their unlicensed disturbance is prohibited. Therefore, on a precautionary basis, advice is being sought on the application of the Act to the Site from the Ministry of Defence (MoD). If it is determined that the site does not, in fact, represent material from an aircraft crash site then the Act would not apply.

2.7 Vulnerability

2.7.1 The area in which AB_OSP_Mag_0145: aircraft material, is located is considered to be vulnerable to the development. Three Array Cables (D, E and F) cross locations where aircraft material has been identified on the seabed (Figure 2), and therefore material is likely to be impacted by the cable or installation activity. Three further Array Cables (C, G and H) cross within 4 - 10 m of the material identified through the ROV survey, and may also potentially impact the material.

2.7.2 Material from the Site is exposed on the seabed and therefore has likely been vulnerable to natural forces (such as wave and tide regimes) and man-made forces (such as trawling or fishing). Although no direct evidence of disturbance was visible on the site in the ROV video, the fragmentary nature of the site could have resulted from disturbance, if it was not caused during the wrecking process itself. Therefore, it is likely that some degree of disturbance has already taken place at the Site.

2.8 Conclusion

2.8.1 The Site is interpreted as likely to be material from a probably Allied, Second World War military aircraft. This is the interpretation most consistent with the available data. Based on the precautionary principle and the potential for this aircraft to be British, and therefore

automatically protected under the Protection of Military Remains Act 1986, a temporary Archaeological Exclusion Zone (AEZ) was initially recommended, in order to inform discussions with Historic England, the Client and the MoD. However, as the proposed locations of the Array Cables will impact the Site, the AEZ will not be applicable, and the site will be dealt with based on discussions between Historic England, the Client and the MoD.

2.8.2 The Site boundary is based on a 2 m buffer around the known locations of the material encountered on the seabed during the ROV survey. The 2 m buffer accounts for potential positioning errors in the current dataset. However, as material from the site appears fragmentary and distributed across a wide area, there remains some potential for additional, previously undiscovered, probably fragmentary, non-ferrous aircraft material to be present, either within the area already assessed, covered by a thin layer of sediment, or beyond the areas covered by the ROV surveys (Figure 2), either on the seabed or covered by a thin layer of sediment.

2.8.3 The Site appears to be relatively stable, but many of the pieces of metal debris exhibit evidence of corrosion or other deterioration or damage. This, along with the limited seabed movement of the area, suggests that parts of the site have been exposed for some time, rather than recently exposed. However, the material that was shallowly buried and uncovered by the ROV is also fragmentary in nature and corroded, suggesting that the deterioration of the material is not solely due to natural processes, but likely also reflects the wrecking event, subsequent depositional processes and relatively poor preservation in sand and gravel.

2.8.4 Apart from the accumulation of debris that was slightly raised off the seabed (AB_OSP_Mag_0145_C_7), the majority of the remaining material encountered during the ROV survey was either relatively flat on the seabed or covered by a thin layer of sediment.

2.8.5 The magnetometer, side scan sonar and ROV surveys have ruled out the presence of substantial, ferrous remains in the area, suggesting that any material in the Site that has not already been located would be non-ferrous and fragmentary.

2.8.6 The geology of the Site consists of a shallow sandy gravel seabed veneer (less than a meter) over London clay bedrock. The clay bedrock is very stiff, and it is unlikely that aircraft material, after falling 30 m through the water column, penetrated deeply into bedrock. Therefore, if any further material is present, it is likely to be limited to non-ferrous, fragmentary material either lying flat on the seabed beyond the ROV coverage, or within the shallow layer of sands and gravels, and the size of the material will be limited by the available sediment depth. In addition, sand and gravel are not as conducive for the preservation of archaeological material as silt, and therefore material buried in this layer, or exposed on the seabed, will likely exhibit signs of deterioration. However, limited ROV dredging revealed localised areas of slightly silty sediment, which would promote preservation of archaeological material, and it is possible that small pieces of fragmentary, non-ferrous material could be present in the area, and relatively well-preserved.

2.8.7 The Protection of Military Remains Act 1986 applies to the fabric and contents of the aircraft – including cargo and crew. Given the identification of the Site as likely Second World War military aircraft material, the Ministry of Defence (MoD) has been consulted. Intentional disturbance of the Site without a licence or permission would be in breach of the Act.

3 REFERENCES

Bournemouth University 2007 *Enhancing our Understanding of the Marine Historic Environment: National Hazards Project*.

British Geological Survey 1991 *Ostend* Sheet 51°N - 02°E. Seabed Sediments and Holocene Geology.

British Geological Survey 1992 *Ostend* Sheet 51°N - 02°E. Quaternary Geology

Emu Ltd. 2009 *Outer Thames Estuary Regional Environmental Characterisation*. Published by Marine Aggregate Levy Sustainability Fund.

Royal Haskoning 2011 *Galloper Wind Farm Project Environment Statement – Chapter 9: Physical Environment*, Final Report, Document Ref. 5.2.9.

Wessex Archaeology 2008 *Aircraft Crash Sites at Sea: A Scoping Study: Archaeological Desk-based Assessment*. Unpubl report ref: 66641.02

Wessex Archaeology 2015 *Archaeological Assessment of Geophysical Data and Stage 1 Geoarchaeological Assessment of Geotechnical Logs* Unpubl report ref: 106221.01

Wessex Archaeology 2016a *Galloper Offshore Wind Farm: Review of Archaeological Material during Unexploded Ordnance Survey (Offshore Wind Farm): Advisory Note to Client*. Unpubl report ref: 106221.06

4 APPENDIX 1: DATA SHEETS

Galloper Offshore Wind Farm UXO Survey Archaeological Assessment	**Area: AC**	**UXO Target ID: AB_OSP_Mag_0145**	**WA ID: 70161**
Assessor	Wessex Archaeology	**Survey Date**	May 2016
Assessment Date	July 2016	**Survey Company**	N-Sea
As Found Position (UTM31N): AB_OSP_Mag_0145	432692.01		5756145.94
As Found Position (UTM31N): AB_OSP_Mag_0145_A	432697.21		5756145.11
As Found Position (UTM31N): AB_OSP_Mag_0145_B	432693.65		5756154.91
As Found Position (UTM31N): AB_OSP_Mag_0145_C	432697.47		5756143.08
Description	**AB_OSP_Mag_0145**: Metal debris, in close proximity to **AB_OSP_Mag_0145_A**, **AB_OSP_Mag_0145_B** and **AB_OSP_Mag_0145_C**. This debris comprises a number of pieces of broken aluminium, a piece of very thin aluminium sheet, and fabric – possibly some kind of canvas. There are numerous additional pieces of aluminium on the seabed in the wider area. **AB_OSP_Mag_0145_A**: Metal debris, in close proximity to **AB_OSP_Mag_0145**, **AB_OSP_Mag_0145_B** and **AB_OSP_Mag_0145_C**. The metal plate measures approximately 1.0 m in length and width. On one side of the plate, there is an area of small pieces of wire immediately adjacent to the plate, on the other side of the plate, a short distance away, there is an area of rope – possibly fishing debris, covering additional aluminium material. In the wider area, there is a small pile of fabric straps. **AB_OSP_Mag_0145_B**: Metal debris, in close proximity to **AB_OSP_Mag_0145**, **AB_OSP_Mag_0145_A** and **AB_OSP_Mag_145_C**. This debris is an extensive area of metal, mainly consisting of aluminium, thin, broken pieces of aluminium sheeting, and wire, as well as live or spent small arms ammunition. Excavation also revealed a section of blackened fabric, with a tan edge. Ewen Cameron, Curator of the Royal Air Force Museum Stafford, has indicated that one bent piece (image AB_OSP_Mag_0145_B_4 / Dive 212 16-05-26 15.43.55_C4_00026) appears to be a wing or spar fitting. **AB_OSP_Mag_0145_C**: Metal debris, in close proximity to **AB_OSP_Mag_0145**, **AB_OSP_Mag_0145_A** and **AB_OSP_Mag_0145_B**. The debris covers an extensive area, and the majority of the material appears to be aluminium,		

	wire and fabric. In one area, there is a long sheet of aluminium. Other areas are notable for wires poking out above the seabed. There are pieces of fragmented, degraded aluminium attached to wires. The largest area comprises a considerable quantity of lightweight, light coloured fabric, possibly very fine silk or polyester, along with pieces of aluminium and wires. Images of the site were shown to Ewen Cameron, Curator of the Royal Air Force Museum Stafford, and he indicated the stitching visible on the lightweight fabric is very much like what would be expected at the base of a parachute. However, it was not possible to determine whether the parachute was for a person, part of an air dropped sonobuoy or part of an ordnance item like a parachute flare. In any case, he suggests that the debris around the parachute suggests that it was still attached to an aircraft when it entered the water. The fabric was buried, and excavation revealed that it had been buried in a silty seabed, which would encourage preservation. The fabric appears to be part of a mound, which may cover additional material and debris. It is very possible that additional, non-metallic debris could be buried in the area. One live round of small arms ammunition was recovered from one of the four contacts in this anomaly. It is likely a .50 calibre bullet, although it is not possible to confirm as the base of the cartridge is not visible in the photographs, and no markings were recorded when it was recovered. **Overview of Site** The quantity of aluminium sheets, other aluminium pieces, wires, and parachute fabric, indicates that this is likely to be an aircraft crash site.				
Category	Archaeological interest	**Archaeological Value**	Medium	**Confidence Rating**	High
Action	Recommended for AEZ, however, due to the location of the site and the nature of the development, it may not be possible to avoid this site, and therefore, it is recommended that discussions be undertaken with RWE Innogy UK Ltd and the Ministry of Defence to discuss further mitigation options, such as further archaeological investigation, excavation and recovery.				
Assessment Method	Archaeological Review of N-Sea Target Investigation Report, including video footage and stills from ROV video. Review of archaeological assessment of geophysical data. Images forwarded to Ewen Cameron, Curator of the Royal Air Force Museum Stafford, for further assessment.				
References	NSL-10019267-REP-0238_01 - Target Investigation Report 0238 - ICA_AB_OSP_Mag_0145				
	NSL-10019267-REP-0239_01 - Target Investigation Report 0239 - ICA_AB_OSP_Mag_0145_A				
	NSL-10019267-REP-0240_01 - Target Investigation Report 0240 - ICA_AB_OSP_Mag_0145_B				
	NSL-10019267-REP-0241_01 - Target Investigation Report 0241 - ICA_AB_OSP_Mag_0145_C				
	Target Investigation ROV Videos: Dive 212 16-05-26 15.11.52, Dive 212 16-05-26 15.25.45, Dive 212 16-05-26 15.43.55 and Dive 212 16-05-26 16.05.03				
	Initial Survey ROV Videos: Dive 212 16-05-26 14.30.20, Dive 212 16-05-26 15.01.50				

Images: AB_OSP_Mag_0145

Dive 212 16-05-26 15.11.52_C4_00001

AB_OSP_Mag_0145_1 / Dive 212 16-05-26 15.11.52_C4_00003

Dive 212 16-05-26 15.11.52_C4_00005

Dive 212 16-05-26 15.11.52_C4_00006

AB_OSP_Mag_0145_2 / Dive 212 16-05-26 15.11.52_C4_00011

Dive 212 16-05-26 15.11.52_C4_00014

Dive 212 16-05-26 15.11.52_C4_00015

Dive 212 16-05-26 15.11.52_C4_00016

Dive 212 16-05-26 15.11.52_C4_00018

Dive 212 16-05-26 15.11.52_C4_00019

Dive 212 16-05-26 15.11.52_C4_00020

Dive 212 16-05-26 15.11.52_C4_00021

Dive 212 16-05-26 15.11.52_C4_00025

Dive 212 16-05-26 15.11.52_C4_00027

Dive 212 16-05-26 15.11.52_C4_00028

Dive 212 16-05-26 15.11.52_C4_00033

Target Investigation Sheet

Dive 212 16-05-26 15.11.52_C4_00026

Dive 212 16-05-26 15.11.52_C4_00031

Images: AB_OSP_Mag_0145_A

Dive 212 16-05-26 15.25.45_C4_00019

Dive 212 16-05-26 15.25.45_C4_00020

Target Investigation Sheet

Dive 212 16-05-26 15.25.45_C4_00028

AB_OSP_Mag_0145_A_1 / Dive 212 16-05-26 15.25.45_C4_00017

AB_OSP_Mag_0145_A_2 / Dive 212 16-05-26 15.25.45_C4_00026

Dive 212 16-05-26 15.25.45_C4_00006

AB_OSP_Mag_0145_A_3 / Dive 212 16-05-26 15.25.45_C4_00009

AB_OSP_Mag_0145_A_4 / Dive 212 16-05-26 15.25.45_C4_00001

Images: AB_OSP_Mag_0145_B

AB_OSP_Mag_0145_B_1 / Dive 212 16-05-26 15.43.55_C4_00002

Target Investigation Sheet

Dive 212 16-05-26 15.43.55_C4_00007

AB_OSP_Mag_0145_B_2 / Dive 212 16-05-26 15.43.55_C4_00013

AB_OSP_Mag_0145_B_3 / Dive 212 16-05-26 15.43.55_C4_00010

Dive 212 16-05-26 15.43.55_C4_00014

Dive 212 16-05-26 15.43.55_C4_00018

AB_OSP_Mag_0145_B_3 / Dive 212 16-05-26 15.43.55_C4_00021

AB_OSP_Mag_0145_B_4 / Dive 212 16-05-26 15.43.55_C4_00026

Dive 212 16-05-26 15.43.55_C4_00032

Target Investigation Sheet

AB_OSP_Mag_0145_B_5 / Dive 212 16-05-26 15.43.55_C4_00034

Dive 212 16-05-26 15.43.55_C4_00036	AB_OSP_Mag_0145_B_6 / Dive 212 16-05-26 15.43.55_C4_00035
	

Images: AB_OSP_Mag_0145_C

AB_OSP_Mag_0145_C_1 / Dive 212 16-05-26 16.05.03_C4_00005

AB_OSP_Mag_0145_C_2 / Dive 212 16-05-26 16.05.03_C4_00017

AB_OSP_Mag_0145_C_3 / Dive 212 16-05-26 16.05.03_C4_00021

AB_OSP_Mag_0145_C_4 / Dive 212 16-05-26 16.05.03_C4_00028

AB_OSP_Mag_0145_C_5 / Dive 212 16-05-26 16.05.03_C4_00030

AB_OSP_Mag_0145_C_6 / Dive 212 16-05-26 16.05.03_C4_00034

Dive 212 16-05-26 16.05.03_C4_00036

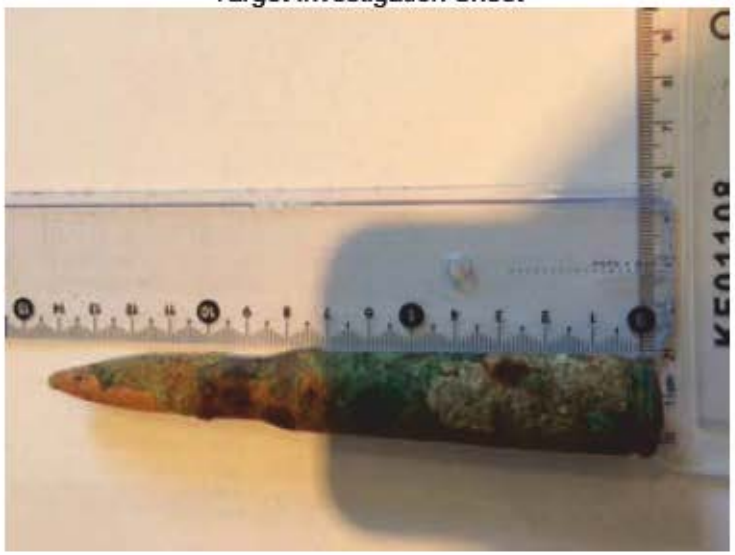
Dive 212 16-05-26 16.05.03_C4_00041

Target Investigation Sheet

AB_OSP_Mag_0145_C_7: Target Investigation Sheet

Dive 212 16-05-26 16.05.03_C4_00047

Target Investigation Sheet



Galloper Offshore Wind Farm UXO Survey Archaeological Assessment		**Area: AC**	**UXO Target ID: AB_OSP_Mag_0153**		**WA ID: 72885**
Assessor	Wessex Archaeology		**Survey Date**		June 2016
Assessment Date	July 2016		**Survey Company**		N-Sea
As Found Position (UTM31N)		432712.23		5756219.59	
Description	Metal debris. The debris are strewn across a 15 m x 15 m area. The ROV video data from this area has been identified by Ordtek as comprising hundreds of items of small arms ammunition (SAA) and possible ammunition containers amongst other items of metallic debris. Small calibre High Explosive-filled cannon shells may also be present although there is no direct evidence for such items. The site appears to be a First or Second World War ammunition dump, however the ammunition has been interpreted as possibly .50 calibre, which would suggest a Second World War date. The interpretation cannot be confirmed as no scale is visible in the images, and any detail that might be present on the base of the cartridges is not visible. Another possible interpretation for the site, as it is situated approximately 67 m to the NNE of AB_OSP_Mag_0145, an area of probably Second World War aircraft material, is that the sites may be related.				
Category	Archaeological interest	**Archaeological Value**	Medium	**Confidence Rating**	High
Action	UXO requirements take precedence. No further action is required.				
Assessment Method	Archaeological Review of N-Sea Target Investigation Report, including stills from ROV video and ROV video footage, and Review of Ordtek Geophysical Target Confirmatory Report – Confirmed UXO				
References	NSL-10019267-REP-0283_01 - Target Investigation Report 0283 - ICA_AB_OSP_Mag_0153				
	JM5242_GWF_UXO_Confirmatory_Report_ICA_AB_OSP_Mag_0153_V1.0				
	ROV Videos: Dive 249 16-06-08 02.29.46, Dive 249 16-06-08 02.59.48, Dive 249 16-06-08 08.07.07, Dive 249 16-06-08 08.54.57, Dive 249 16-06-08 09.06.05, Dive 249 16-06-08 08.17.38, Dive 249 16-06-08 07.20.46, Dive 249 16-06-08 07.50.48, Dive 249 16-06-08 08.03.19 and Dive 249 16-06-08 08.44.44				

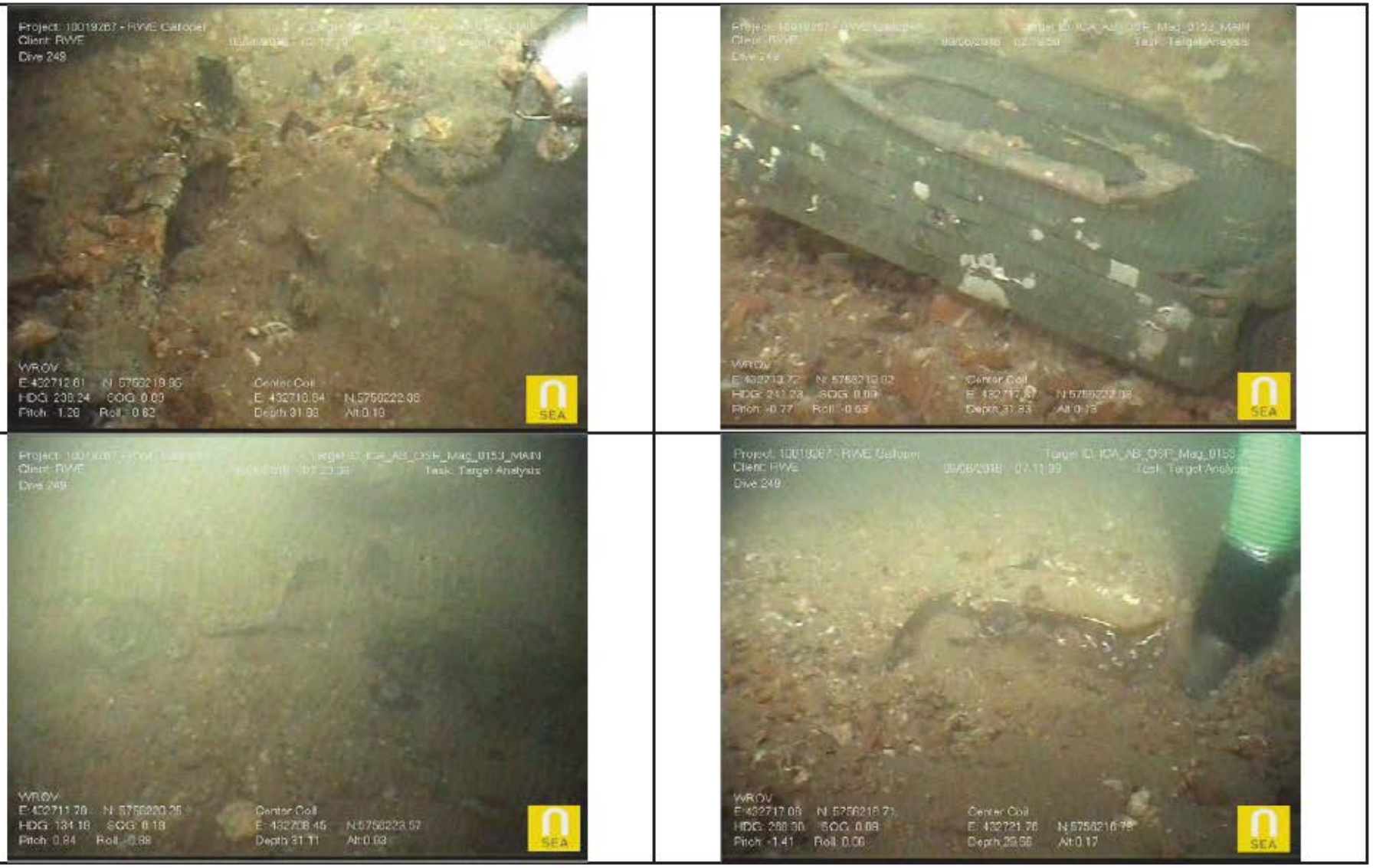
Images


Project: 10019267 - RWE Galoper
Client: RWE
Dive 249
WROV
Center Coil
SEA


Project: 10019267 - RWE Galoper
Client: RWE
Dive 249
WROV
Center Coil
SEA


WROV
Center Coil
SEA


Project: 10019267 - RWE Galoper
Client: RWE
Dive 249
WROV
Center Coil
SEA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Client: RWE
Dive 249
WROV
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Center Coil
E 432710.84 N 5758222.98
Depth 31.93 Alt 0.10
SEA
Project: 10019267 - RWE Gallopin
Client: RWE
Dive 249
WROV
E 432713.72 N 5758219.82
HDG 241.23 SOG 0.09
Pitch -0.77 Roll -0.93
Center Coil
E 432717.87 N 5758222.98
Depth 31.83 Alt 0.13
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Project: 10019267 - RWE Gallopin
Client: RWE
Dive 249
Task: Target Analysis
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HDG 134.18 SOG 0.18
Pitch 0.84 Roll -0.89
Center Coil
E 432708.45 N 5758223.57
Depth 31.71 Alt 0.03
SEA
Project: 10019267 - RWE Gallopin
Client: RWE
Dive 249
WROV
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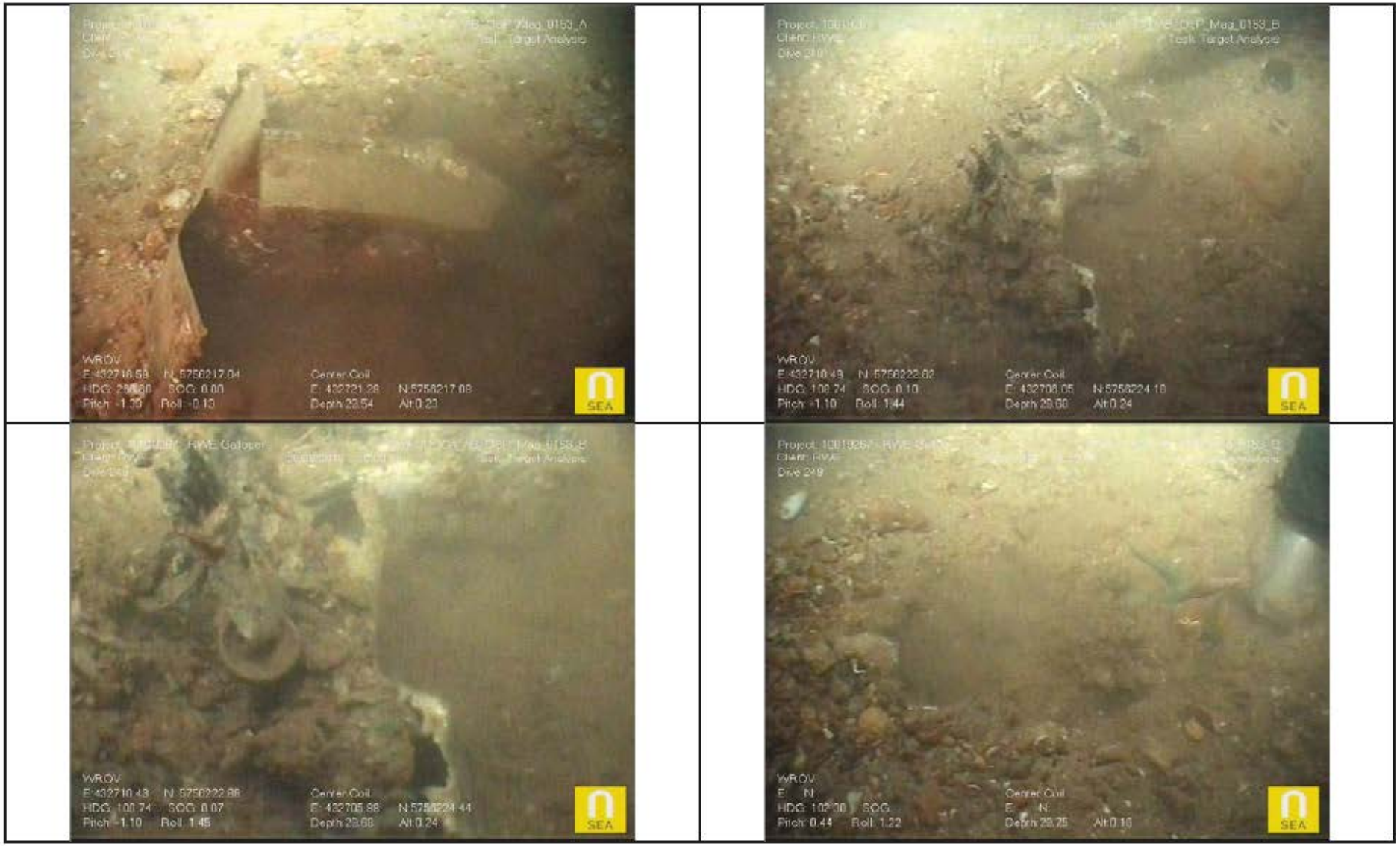
SEA


WROV
Center Coil
SEA
WROV
Center Coil
SEA
WROV
Center Coil
SEA
WROV
Center Coil
SEA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SOG: 0.03
oll: 1.21
Center Coil
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Depth:29.23
Alt:0.17
SEA


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SOG: 0.11
oll: 0.91
Center Coil
E: 432703.99
N: 5756222.11
Depth:29.65
Alt:0.19
SEA


Dive 249
WROV
Center Coil
Depth:29.47
Alt:0.21
SEA


Dive 249
WROV
Center Coil
Depth:29.51
Alt:0.19
SEA


Project: 10019267 - RWE Gelloper
Client: RWE
Dive 249
WROV
E 432717.75 N 5756224.17
HDG 257.26 SOG 0.19
Pitch -0.44 Roll -0.77
Center Coil
E 432722.05 N 5756225.15
Depth 29.48 Alt 0.21
SEA


Project: 10019267 - RWE Gelloper
Client: RWE
Dive 249
WROV
E 432710.71 N 5756209.06
HDG 204.80 SOG 0.07
Pitch -1.36 Roll 0.03
Center Coil
E 432712.74 N 5756212.33
Depth 29.68 Alt 0.17
SEA


Dive 249
WROV
E 432710.57 N 5756206.02
HDG 204.81 SOG 0.06
Pitch -1.36 Roll 0.04
Center Coil
E 432712.60 N 5756212.27
Depth 29.68 Alt 0.17
SEA


Dive 249
WROV
E 432711.37 N 5756208.44
HDG 206.46 SOG 0.07
Pitch -1.03 Roll -0.80
Center Coil
E 432713.51 N 5756213.68
Depth 29.67 Alt 0.18
SEA

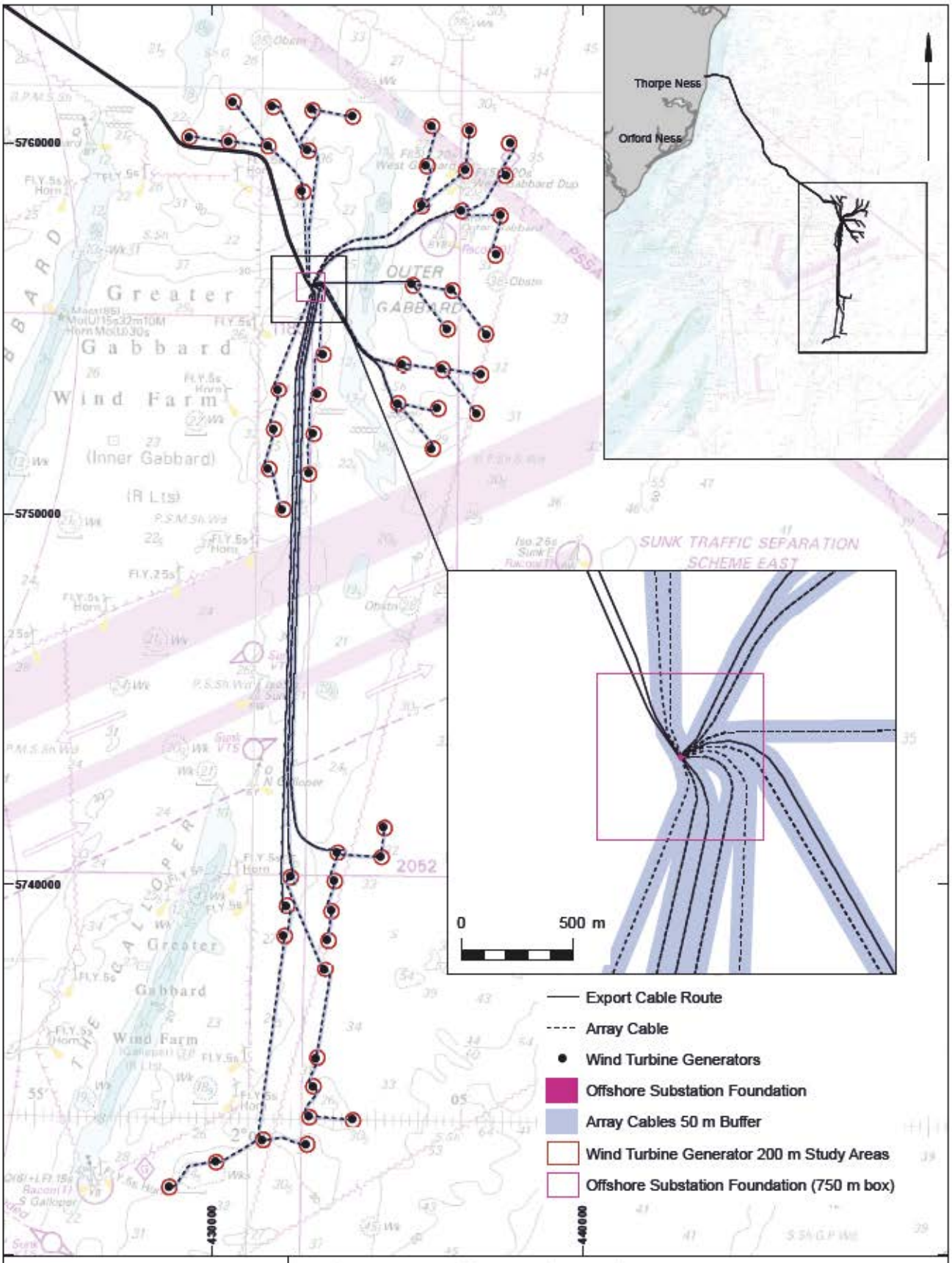

Target ID: IOA_AB_OSP_Mag_0153_E
Task: Target Analysis
WROV
Center Coil
SEA


Target ID: IOA_AB_OSP_Mag_0153_E
08:40:28
Task: Target Analysis
WROV
Center Coil
SEA


WROV
Center Coil
SEA

Galloper Offshore Wind Farm UXO Survey Archaeological Assessment		**Area: AC**	**UXO Target ID: M_Mag_0114**		**WA ID: 72869**
Assessor	Wessex Archaeology		**Survey Date**		June 2016
Assessment Date	July 2016		**Survey Company**		N-Sea
As Found Position (UTM31N): M_Mag_0114	432725.20		5756024.80		
As Found Position (UTM31N): M_Mag_0114_A	432728.72		5756019.18		
Description	**M_Mag_0114**: Metal debris, in close proximity to **M_Mag_0114_A**. This debris measures approximately 0.1 m in length and width and 0.04 m in height. This object is a switching board with three switches and a circular window or gauge. The switching board is located 120 m to the SSE of AB_OSP_Mag_0145, an area of probably Second World War aircraft material, and it is possible that the two sites could be related. **M_Mag_0114_A**: Metal debris, in close proximity to **M_Mag_0114**. This debris measures approximately 1.0 m in length and 0.1 m in diameter. This object is a metal pipe which is heavily corroded in places.				
Category	Possible archaeological interest	**Archaeological Value**	Low	**Confidence Rating**	Medium
Action	Review if reinvestigated or recovered.				
Assessment Method	Archaeological Review of N-Sea Target Investigation Report, including stills from ROV video				
References	NSL-10019267-REP-2046_01 - Target Investigation Report 2046 - ICA_M_Mag_0114				
	NSL-10019267-REP-2047_01 - Target Investigation Report 2047 - ICA_M_Mag_0114_A				

Images: M_Mag_0114	
	
Images: M_Mag_0114_A	
	



0 5 km

Date:	02/11/2016	Revision Number:	2
Scale:	1:150,000 & 1:25,000 at A4	Illustrator:	KJF
Path:	W:\Projects\106223\GIS\FigsMXD\Aircraft\2016_11_02		

AB_OSP_Mag_0145: Aircraft - Site Location: Substation

Figure 1

A. UXO ROV survey initial coverage

B. UXO ROV survey target investigation coverage

C
D
E
F
G
H
J

AB_OSP_Mag_0145_B
AB_OSP_Mag_0145
AB_OSP_Mag_0145_A
AB_OSP_Mag_0145_C
70161
72892
72891

0 10 m

Site boundary
Offshore Substation Foundation

Anomalies of archaeological potential

Anthropogenic origin of archaeological interest
Uncertain origin of possible archaeological interest

UXO ROV anomalies
AB_OSP_Mag_0145 boundary from pre-ROV survey geophysical data
AB_OSP_Mag_0145 boundary from geophysical data following ROV survey
UXO ROV survey initial coverage

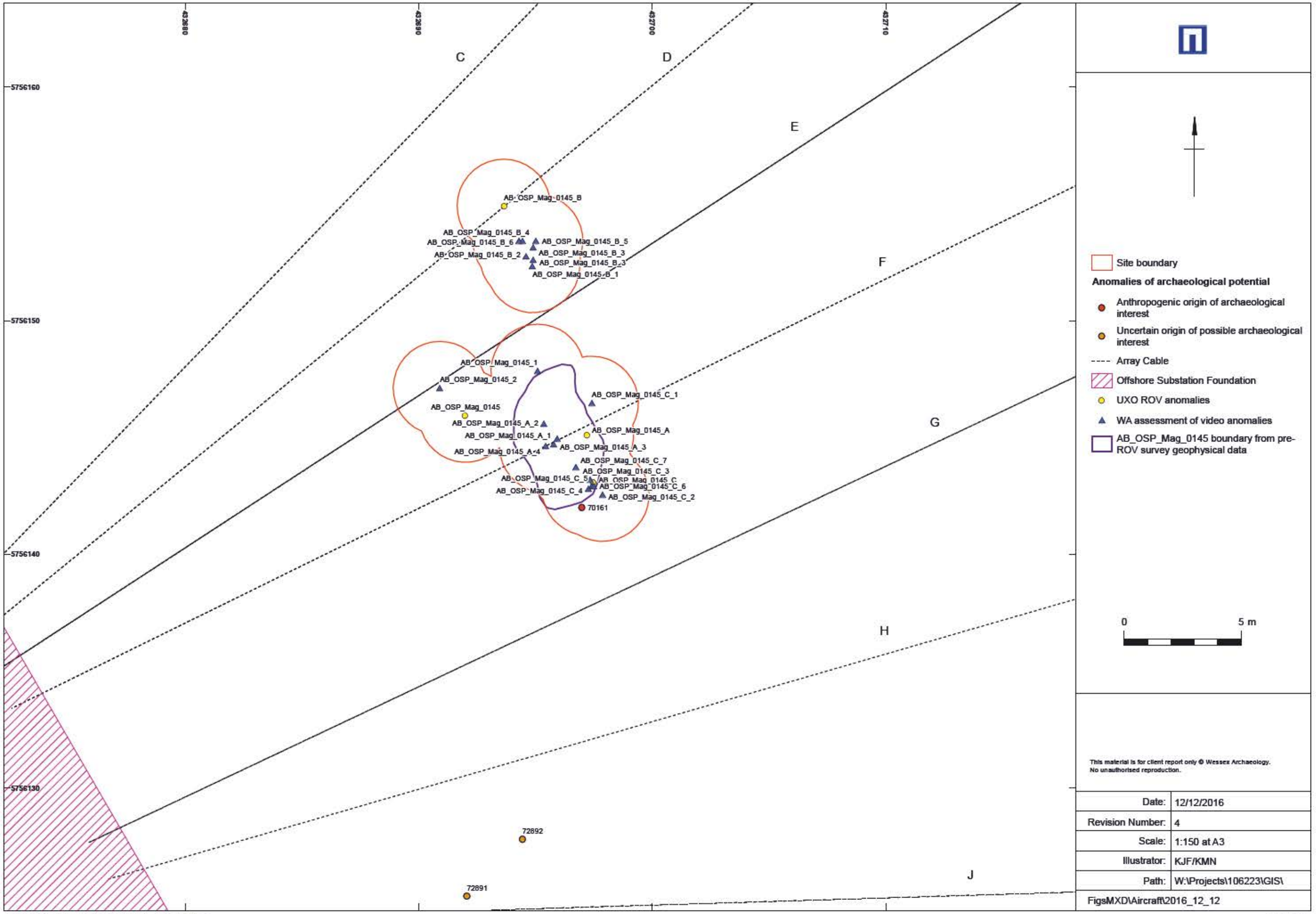
AB_OSP_Mag_0145_Main ROV coverage
AB_OSP_Mag_0145_A ROV coverage
AB_OSP_Mag_0145_B ROV coverage
AB_OSP_Mag_0145_C ROV coverage
Array Cable

ROV central reference point, within approximately 0.4 m of camera position.

Date:	12/12/2016	Revision Number:	3
Scale:	1:10,000 at A3	Illustrator:	KJF/KMN
Path:	W:\Projects\106223\GIS\FigsMXD\Aircraft\2016/12/12		

UXO ROV survey coverage

Figure 2



Date:	12/12/2016
Revision Number:	4
Scale:	1:150 at A3
Illustrator:	KJF/KMN
Path:	W:\Projects\106223\GIS\
FigsMXD\Aircraft\2016_12_12	

AB_OSP_Mag_0145: Aircraft - Anomalies

Figure 3

A. Side Scan Sonar Survey Areas

B. Magnetometer Survey Areas

AB_OSP_Mag_0016
AB_OSP_Mag_0060
AB_OSP_Mag_0111
AB_OSP_Mag_0065
AB_OSP_Mag_0153
AB_OSP_Mag_0145_B
AB_OSP_Mag_0145
AB_OSP_Mag_0145_A
AB_OSP_Mag_0145_C
M_Mag_0114
M_Mag_0114_A
M_Mag_0110
M_Mag_0108

5757000
5756000
5755000
432000
433000

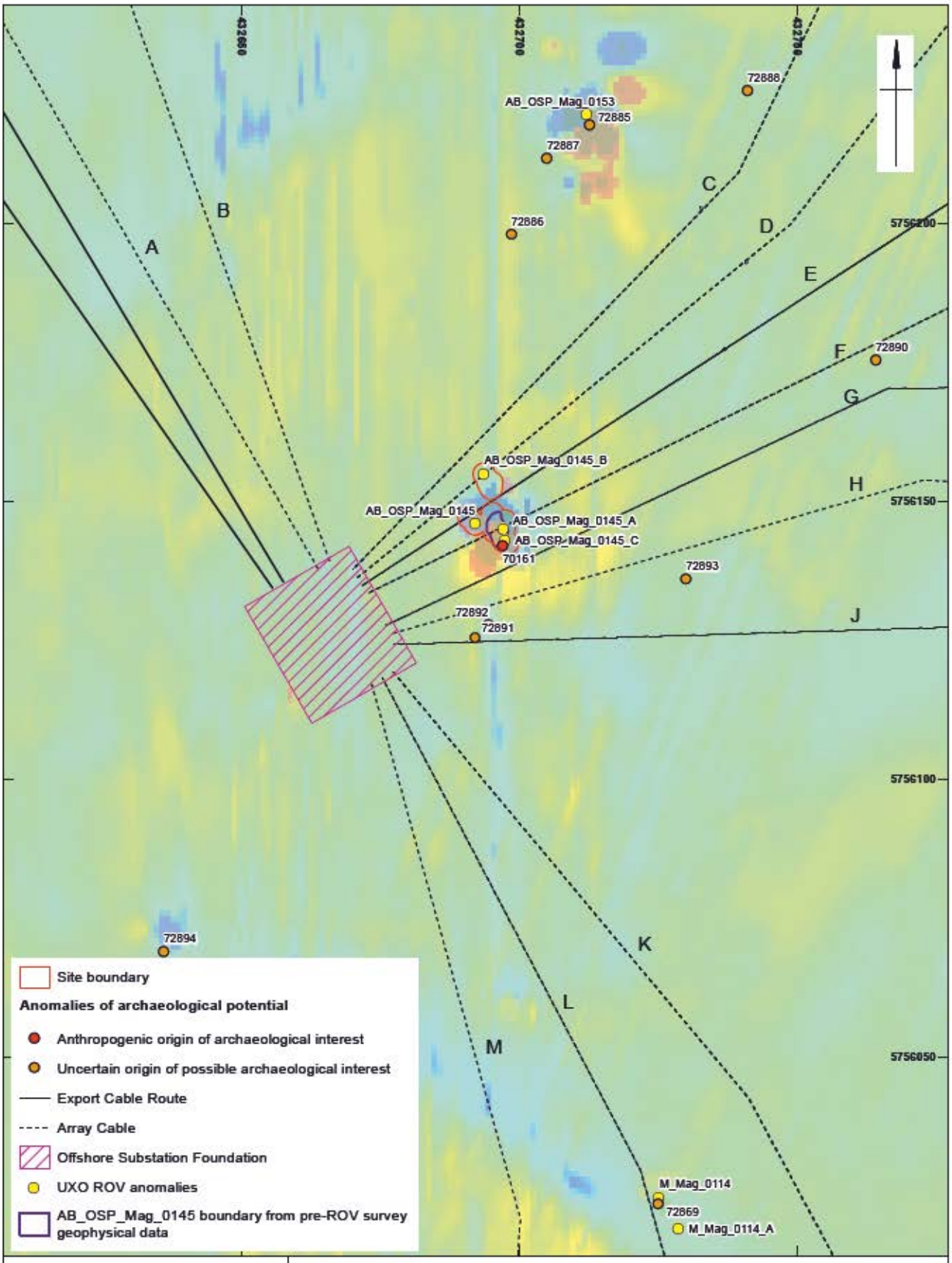
Export Cable Route
Array Cable
Wind Turbine Generators
Offshore Substation Foundation
Array Cables 50 m Buffer
Offshore Substation Foundation (750 m box)
UXO ROV anomalies
Side Scan Sonar Survey Areas
Magnetometer Survey Areas

0 500 m

Date:	02/11/2016	Revision Number:	2
Scale:	1:10,000 at A3	Illustrator:	KJF
Path:	W:\Projects\106223\GIS\FigsMXD\Aircraft\2016_11_02		

Side Scan Sonar and Magnetometer Survey Areas

Figure 4



Date:	12/12/2016	Revision Number:	6
Scale:	1:1000 at A4	Illustrator:	KJF/KMN
Path:	W:\Projects\106223\GIS\FigsMXD\Aircraft\2016_12_12		

AB_OSP_Mag_0145: Aircraft Site with magnetometer data

Figure 5