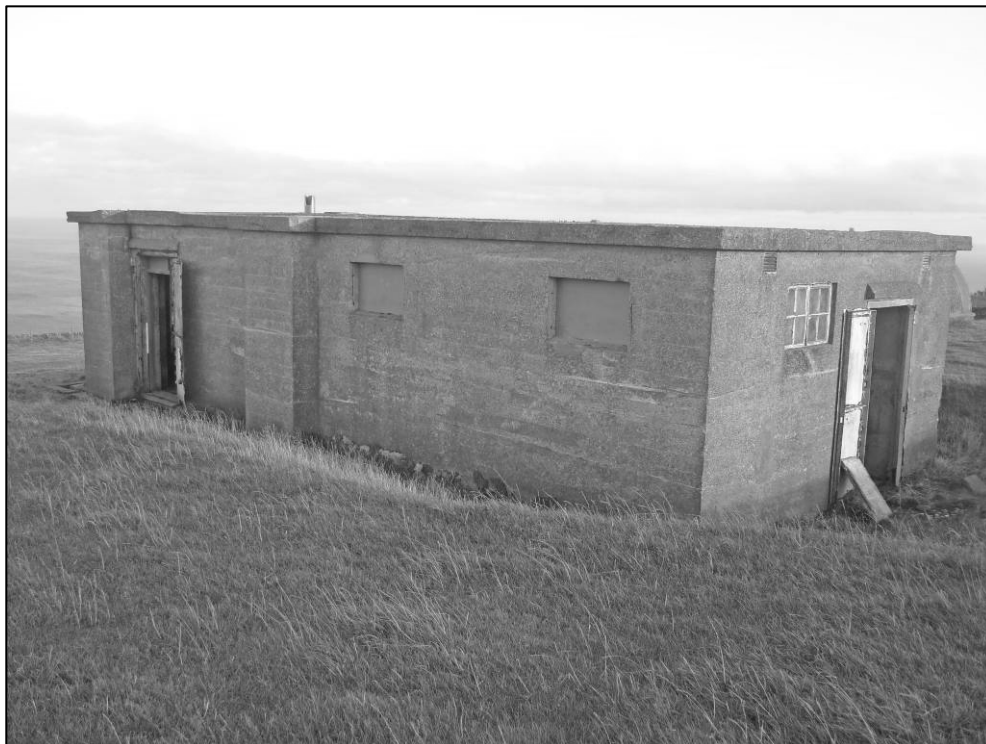


BENT RIGG RADAR STATION,  
SOUTH-EAST OF RAVENSCAR, STAINTON DALE,  
NORTH YORKSHIRE

ARCHAEOLOGICAL SURVEY



Ed Dennison Archaeological Services Ltd  
18 Springdale Way  
Beverley  
East Yorkshire  
HU17 8NU

BENT RIGG RADAR STATION,  
SOUTH-EAST OF RAVENSCAR, STANTON DALE,  
NORTH YORKSHIRE

ARCHAEOLOGICAL SURVEY

Report no: 2011/410.R01  
Version: Final  
Date: September 2014  
Author: Ed Dennison & Shaun Richardson

Ed Dennison Archaeological Services Ltd  
18 Springdale Way  
Beverley  
East Yorkshire  
HU17 8NU

On behalf of

Mr P Cother  
Colcroft Farm  
Fylingdales  
North Yorkshire  
YO22 4QQ

**ARCHAEOLOGICAL SURVEY,  
BENT RIGG RADAR STATION, SOUTH-EAST OF RAVENSCAR,  
STANTON DALE, NORTH YORKSHIRE**

**CONTENTS**

EXECUTIVE SUMMARY

1	INTRODUCTION.....	1
2	HISTORICAL BACKGROUND.....	7
3	DESCRIPTION OF THE SURVEY AREA .....	13
4	DISCUSSION AND CONCLUSIONS.....	39
5	STATEMENT OF SIGNIFICANCE.....	45
6	BIBLIOGRAPHY.....	46
7	ACKNOWLEDGEMENTS.....	48

Appendices

1	Previous Survey of Bent Rigg Buildings
2	Photographic Record
3	Natural England Project Brief
4	EDAS Project Design

## LIST OF FIGURES

- 1 General location
- 2 Survey area
- 3 Type 52 Nissen Hut reconstruction
- 4 Tx/Rx building reconstruction
- 5 Contemporary paintings
- 6 1946 aerial photograph
- 7 General site survey
- 8 Section through site
- 9 Radar buildings
- 10 Building R4 plans
- 11 Building R4 window detail
- 12 Accommodation Buildings

## LIST OF PLATES

- 1 General view towards radar group of buildings, looking NE.
- 2 View from accommodation group (Buildings A8 to A11) towards radar buildings, looking E.
- 3 Building R1, east external elevation, looking SW (photo 2/954).
- 4 Interior of Building R1 after clearance, showing brick supports for fuel tank, looking SW (photo 4/566).
- 5 Building R2, south and east external elevations, looking NW (photo 4/575).
- 6 Building R2, north external elevation and porch, looking SE (photo 1/850).
- 7 Building R2, detail of north vent in west elevation, looking NE (photo 1/851).
- 8 Building R2, 'internal' door in east elevation, looking SW.
- 9 Building R2, remains of engine bed after clearance, looking SW (photo 4/573).
- 10 Building R3, looking NW (NT photo 100/9, February 1998).
- 11 Building R3, looking NW (photo 2/008).
- 12 Building R3, looking SE (NT photo 100/8, February 1998).
- 13 Building R3, looking SE (photo 2/002).
- 14 Building R3, interior looking NW (photo 2/012).
- 15 Building R3, interior showing construction, looking SW (photo 2/023).
- 16 Building R4, south elevation, looking N.
- 17 Building R4, west elevation, looking NE showing earthworks.
- 18 Building R4, north elevation, looking SE (photo 2/971).
- 19 Building R4, east elevation showing former ladder position, looking SE (photo 2/967).
- 20 Building R4, external drain around NE corner, looking SW (photo 2/964).
- 21 Roof of Building R4, looking E (photo 5/376).
- 22 Roof of Building R4, showing base of radar array and lip over doorway D1, looking NE (photo 5/385).
- 23 Roof of Building R4, north-west base of radar array, looking NW (photo 5/384).
- 24 Roof of Building R4, pad of radar turning mechanism and pipe, looking E (photo 5/379).
- 25 Building R4, internal south elevation of east room showing decoration, blast doors to window and triangular wooden blocks, looking S (photo 2/978).
- 26 Building R4, internal north elevation of west room, showing blast shutters and folding wooden shutters, looking N (photo 3/282).
- 27 Building R4, east internal elevation of east room, detail of covered vent, looking NE (photo 2/981).
- 28 Building R4, west internal elevation of east room, showing bakerlite clips, looking SW (photo 3/292).
- 29 Building R4, east internal elevation of central room, showing decoration, fittings for sliding door, T-shaped opening and roof bolts, looking NE (photo 2/982).

- 30 Building R4, floor of east room after clearance showing cable ducts and battens in concrete floor, looking E (photo 4/587).
- 31 Building R5, looking E (photo 2/949).
- 32 Coastguard station, looking NW.
- 33 Building A3 with Building A4 in background, looking SW (photo 2/918).
- 34 Building A5 with tank to rear, looking NE (photo 2/913).
- 35 Building A7, looking W (photo 2/926).
- 36 Building A8 with Building A7 to rear, looking NW (photo 2/931).
- 37 Building A11, looking NW (photo 2/935).
- 38 North end of southern part of Building A11 after clearance (photo 4/561).
- 39 Building A11, remains of asbestos wall on east side, looking N (photo 2/941).
- 40 Building A11, detail of asbestos wall on east side (photo 2/940).

## EXECUTIVE SUMMARY

*In November 2011, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by Mr P Cother to produce a management plan for the Bent Rigg radar station, south-east of Ravenscar, Stainton Dale, North Yorkshire (NGR NZ 9893 0072 centred). The work comprised archaeological and wildlife surveys, an architectural condition report and proposals for conservation, repairs and alterations, to inform a proposed scheme of consolidation and interpretation. The management plan was funded by Natural England.*

*This stand-alone report details the archaeological survey which involved the production of metrically accurate hachured plans of the structures and earthworks within the survey area, together with written and photographic recording. The wildlife survey, architectural condition survey and proposals for conservation, repairs and alterations are submitted as separate stand alone reports.*

*A broad visible sweep of the horizon, an elevated position and a north-east coastal location made Ravenscar an attractive location for the siting of long range detection devices for some time before the Bent Rigg radar station was constructed. For example, a horizontal acoustic listening disc was built in 1932 on the high ground to the west of the village near Beacon Howes, and on nearby Brow Moor a Short Wave Aerial/Broadcast (SWAB) Station was built in 1941. Other World War Two air to ground communication stations in the area included a 'Darky' station, forming part of an overall distress chain, and a Radio Track Guide Station which laid down beams for RAF aircraft to follow. Raven Hall (now the Raven Hall Hotel) was also requisitioned and used as a headquarters for the battalions engaged in the coastal defence of the Scarborough to Whitby area.*

*The first station at Bent Rigg was probably built by the Army after March 1941, and it was initially equipped with a static Type 2 radar. By February 1942, and perhaps as early as October 1941, it had a 1.5m wavelength radar and formed part of the Army's Coastal Defence/Chain Home Low (CD/CHL) chain; it was designated as Station M47. At some point around March 1942, the radar was replaced by a centimetric Type 52 set and it became part of the RAF's Chain Home Extra Low (CHEL) system; it was designated station K47 by July 1942. It is assumed that the station was decommissioned after September 1944. The, admittedly limited, published accounts of the history of the Bent Rigg site are sometimes contradictory, and it has not been possible to resolve the issue of whether there were two different Transmitting and Receiving (Tx/Rx) blocks, or whether a single example was equipped with two different versions of the Type 52 radar over its lifetime. For example, Building R3 is a Turners curved asbestos hut, a type of structure which was only manufactured from May 1942 onwards, and so it could not have been present when Bent Rigg is first known to be active.*

*The surviving Tx/Rx block, standby set house and other structures are very similar to those recorded at other CD/CHL chain sites, such as that at Craster in Northumberland. However, the Tx/Rx block at Bent Rigg appears to be unusually well preserved, retaining both fixtures and fittings and evidence for their former positioning. The Bent Rigg site also differs markedly from Craster in that the current survey uncovered virtually no evidence for defensive positions around the station.*

*A national survey of Second World War radar stations has identified some 242 sites at 200 separate locations. Thirty-six of these are CHEL sites, of which only six are complete or near complete; Bent Rigg is one of the best preserved of these six examples and is one of only two which have been the subject of any detailed archaeological survey.*

# 1 INTRODUCTION

## Reasons and Circumstances for the Project

- 1.1 In November 2011, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by Mr P Cother to produce a management plan for the Bent Rigg radar station, south-east of Ravenscar, Stainton Dale, North Yorkshire (NGR NZ 9893 0072 centred). The work comprised an archaeological survey, together with a wildlife survey, an architectural condition report and proposals for conservation, repairs and alterations, to inform a proposed scheme of consolidation and interpretation. The project was undertaken jointly by EDAS, Peter Gaze Pace Architects and Ecological Information Network Consultants (EINC), and it was funded by Natural England via Mr P Cother.
- 1.2 This stand-alone report details the archaeological survey which involved the production of metrically accurate hachured plans of the structures and earthworks within the survey area, together with written and photographic recording. The scope of the project was defined by a brief prepared by Natural England and a subsequent EDAS project design (see Appendices 3 and 4).

## Site Location, Ownership and Designations

- 1.3 The Bent Rigg Chain Home Low Radar station lies in the north-east half of a rectangular-shaped pasture field adjoining the Cleveland Way footpath, on a high cliff top c.1km south of Ravenscar (NGR NZ 9893 0072 centred) (see figure 1); the long axis of the field, which slopes gently down to the cliff, is aligned north-east/south-west and has been bisected by the now disused Whitby to Scarborough railway line. All the remains of the radar station complex lie on the east side of the railway line, occupying an area of 300m by 160m (maximum) (see figure 2).
- 1.4 The site is owned by the National Trust, and the field is tenanted to Mr Cother of Colcroft Farm. It has been subject to a Higher Level Stewardship scheme since February 2010. The site also lies within the North York Moors National Park, and the North Yorkshire and Cleveland Heritage Coast Project has erected a notice board on the Cleveland Way adjacent to the site, outlining the history and development of the complex, as well as a smaller board at a Coastguard lookout. A permission footpath also passes through the site.
- 1.5 The radar buildings and the remains of the associated barrack complex were protected as a Scheduled Monument on 7th March 2002 (SM 34842 & National Heritage List for England entry 1020544). The complex is also listed in the English Heritage Archives (sites NZ 90 SE 85 & NZ 90 SE 143), the National Trust's Sites and Monuments Record (NT SMR 31160/1-4 and 31161), and the North York Moors Sites and Monuments Record (site 4669). None of the structures within the site are Listed as being of Special Architectural or Historic Interest.

## Summary Description

- 1.6 The radar station was constructed in 1941, as a Type M station, and it formed part of the national coastal defence known as the CD/CHL (Coastal Defence/Chain Home Low) system. It was later converted to house more powerful equipment as part of the Chain Home Extra Low (CHEL) system. This system had two functions, to monitor coastal shipping and low flying aircraft, the latter being only poorly identified by the strategic Chain Home system. Originally manned by the Army, the coastal sites were ultimately handed to the RAF. After the war, the Bent Rigg site

was superseded by the Fylingdales listening station, lying only a few miles inland. It seems that most of the domestic/barracks structures were demolished when the station was decommissioned, although the presence of some remains of sheeting superstructures may suggest that one or more were retained for agricultural use. There were proposals for complete demolition, but this was avoided and both the radar buildings and the remains of the barrack complex are now a Scheduled Monument.

- 1.7 The radar site consists of two clusters of buildings, which for the purposes of this report are prefixed 'R' for the radar group and 'A' for the accommodation group. The radar part of the site, forming the technical and support buildings, comprises four structures located towards the north-east end of the field, within 50m of the cliff edge; these buildings have been identified as a fuel store, engine house, the Transmitting and Receiving block (Tx/Rx) and a communications hut - the aerial array for the radar would have been mounted on a metal gantry set on the roof of the Tx/Rx building. These flat-roofed buildings are all of reinforced-concrete and brick construction, although the communications building is a Turners curved asbestos hut. All the buildings were open, and contained a certain amount of sheep debris to the extent that the floor surfaces were largely obscured, at the time of the EDAS survey. A fifth building, built in 1935 as a Coastguard lookout post and subsequently reused as part of the radar complex, lies on the north-east edge of the field, adjacent to the Cleveland Way long-distance footpath which runs along the cliff top here.
- 1.8 The second cluster of buildings lies c.200m to the west, in the angle of the field adjacent to the former railway line. Here are the remains of at least eleven rectangular buildings, measuring c.12m by c.5m and represented by concrete footings, steps and hardstandings, various brick structures and low ruined wall lines. This complex is believed to have provided accommodation and administration space for the crew of the radar station. Some c.40m to the north-east of these are the remains of two other buildings representing latrines.

### **Aims and Objectives**

- 1.9 The National Trust wish to incorporate the radar station site into an existing educational access project. As part of this, they hope to allow controlled access to the interiors of the buildings. This access may include some limited reconstruction and interpretation of the interiors of the key buildings.
- 1.10 The key aims and objectives of the proposed project were characterised as:
- Bring the remains into a condition (and under a management regime) commensurate with their designation as a Scheduled Monument;
  - Make them much more accessible to the public, both through planned events and when passing or visiting the buildings;
  - Meet broader National Trust and Natural England objectives with regard to the above;
  - Consolidate and manage the remains to ensure their long term survival.



## Summary of Previous Research and Investigation

- 1.11 The Bent Rigg radar station was first visited by National Trust archaeologists in the 1990s. Subsequent monitoring visits were augmented in 1997-98 when a volunteer, Katie Kenyon, carried out a survey of the structures and produced 1:50 scale plans and elevations of all the standing buildings, and 1:200 scale plans of the two main complexes. Further detailed recording of internal and external fittings and fixtures was carried out in June 2000, together with a photographic record. The results of both phases of recording were published in September 2000 as a National Trust archive report (Newman & Kenyon 2000).
- 1.12 The complex was also recorded by 'The Defence of Britain' project, run by the Council for British Archaeology between 1995 and 2001; the precise date of the site visit to the Bent Rigg site is not known. The results for the Whitby area were subsequently published by the North Yorkshire and Cleveland 20th Century Defence Study Group (NYCDSG) (Harwood & McMillan 2008). As part of these works, extensive research was undertaken at the National Archives in London, where little or no primary documentation relating to the Bent Rigg site was found to survive (John Harwood, *pers. comm.*).
- 1.13 The radar complex was also briefly recorded by a National Trust coastal survey (Schofield 2007), and it was included in English Heritage's Rapid Coastal Zone Assessment project (Buglass & Brigham 2008 & 2011).

## Survey Methodologies

- 1.14 As noted above (para 1.2), the scope of the archaeological survey work was defined by a Natural England brief and an EDAS project design (see Appendices 3 and 4).

### *Documentary Research*

- 1.15 A limited amount of historical documentary research was carried out for the project, from readily available primary and secondary sources. The above National Trust survey report (Newman & Kenyon 2000) was used extensively, and material held by the Defence of Britain Project and other data sets was consulted. Other relevant publications considered by the survey included Dobinson's and Bragg's research on acoustics and radar stations (Dobinson 2000a & 2000b; Bragg 2002) and work on comparable radar sites (e.g. Hunt & Ainsworth 2006). Other relevant material on the internet was also consulted, for example the 'Airfield Information Exchange' ([www.airfieldinformationexchange.org](http://www.airfieldinformationexchange.org)), the 'Radar Pages' ([www.radarpages.co.uk](http://www.radarpages.co.uk)) and Subterranea Britannica ([www.subbrit.org.uk](http://www.subbrit.org.uk)), as well as other websites which provide photographs and descriptions of similar radar complexes. Finally, consultations were carried out with other interested parties, including the Staintondale and Ravenscar Local History Group and staff at the National Trust estate office at Peakside, Ravenscar.
- 1.16 There are no contemporary aerial photographs of the site, those that do exist were taken at a high altitude and no specific detail can be seen (John Harwood, *pers. comm.*). However, contemporary vertical aerial photographs taken in 1941 and 1946 were obtained from English Heritage Archives (EHA) - one, dated to 27th August 1946 is printed at c.1:10,000 scale and some details can be identified (see Chapter 2 below).

### *Site Clearance*

The Natural England project brief (see Appendix 3) noted that before any archaeological recording could take place, the hardstandings and footings of the buildings within the accommodation/administrative part of the complex would need some cleaning and vegetation clearance to ensure their detail could be fully recorded. However, in the event, the site clearance work was limited to the removal of fallen asbestos and the cleaning out of buildings in the radar group, and this did not take place until late January 2012, by which time the field survey had been completed. However, EDAS did return on 4th February 2012 to record the clearance work and amend/enhance the survey records as necessary. A further visit for additional recording was made on 4th December 2012, following the clearance of the interior of the Tx/Rx building.

### *Archaeological Field Survey*

- 1.17 A Level 2 archaeological survey of the site was required by the Natural England brief, comprising drawn and photographic records; a Level 2 survey is a descriptive record (English Heritage 2007, 23). Subsequent discussions established that a new plan of the site was also required at 1:500 scale, together with new 1:200 scale plans of the two building complexes.

#### (a) Drawn survey

- 1.18 A new overall plan of the survey area was produced at a scale of 1:500, using EDM total station equipment and in accordance with current English Heritage guidelines (English Heritage 2011). Sufficient information was gathered to allow the survey area to be readily located through the use of surviving structures, fences, walls, water courses, trackways and other topographical features. The survey recorded the ground level footprint of all structures, areas of hardstanding and concrete etc, wall remnants and revetments, earthworks, water courses, paths, stone and rubble scatters, ironwork, fences and other boundary features, and any other features considered to be of archaeological or historic interest. The site survey was integrated into the Ordnance Survey national grid by resection to points of known co-ordinates. Heights AOD were obtained by reference to the nearest OS benchmark; contours were also plotted across the survey area. Control points were observed through trigonometric intersection from survey stations on a traverse around and through the survey area, and the locations, descriptions and values of the Bench Marks and control points are stated in the final survey data. On completion of the EDM survey, the field data was plotted and re-checked on site in a separate operation. The EDM survey work was undertaken in early December 2011 and the field checking and enhancement on 11th January 2012.
- 1.19 In addition to the above, the EDM survey data was used to produce new 1:200 scale survey plans of the two distinct groups of buildings, including the coastguard tower. These new plans included details of associated features and earthworks around the structures in greater detail than could be depicted on the 1:500 plan. It should be noted that the project brief required no detailed drawn recording of the structures themselves, and so Kenyon's existing records were commented on. A set of her internal elevations of the Tx/Rx building within the radar complex have been marked up for inclusion in the project archive with features that were not recorded during the previous survey work. However, it should be noted that this has been done in sketch form, and the new information was added to scale on scaled versions of Kenyon's drawings. These drawings were supplemented by a

new ground floor plan, at a scale of 1:50, made in December 2012 following the clearance of the interior of the Tx/Rx building. At the same time, the opportunity was also taken to produce a roof plan of the Tx/Rx building at the same scale, and to examine it for evidence of former fixtures and fittings.

- 1.20 A 1:5 scale drawn record was also made of one of the windows within the Tx/Rx building. As no individual window retained a complete set of original furniture, and some furniture previously described was removed during the late 2000 conservation works, a composite record was created using the best preserved examples of the different furniture from different windows, in addition to drawing on the information previously recorded in 2000. The blast shutters from window W4 were recorded, the wooden shutters from window W7 and the external metal frame from window W4.
- 1.21 The resulting site surveys were produced at a scale of 1:500 and 1:200, and presented as an interpretative hachure plan using conventions analogous to those used by English Heritage (1999; 2002, 14; 2007, 31-35). The 1:5 scale drawn record also conforms to English Heritage guidelines (English Heritage 2006).

#### (b) Photographic recording

- 1.22 A new photographic record was made of the buildings making up the radar complex (both radar and accommodation concentrations), to show both general views and detailed elevations of each building, as well as all original internal and external fixtures and fittings. Photographs were also taken of the overall appearance of the rooms and circulation areas, and any detail (structural or decorative) which might be relevant to the building's design, development or use and which did not show adequately on general photographs. Other photographs were taken of any inscriptions or date stones, signage or graffiti etc which contributed to an understanding of the building(s), and any contents or ephemera which had a significant bearing on the building's history.
- 1.23 The photographs were taken in colour, using a digital camera with 10 mega pixel resolution. English Heritage photographic guidelines were followed (English Heritage 2006, 14) and each photograph was provided with a scale, where practicable. All photographs were clearly numbered and labelled with the subject, orientation, date taken and photographer's name, and have been cross referenced to digital files and a photographic catalogue (see Appendix 2). A total of 183 photographs were taken, on 5th and 13th December 2011, and 11th January 2012. A further 47 photographs were taken on 4th February 2012 after the clearance work had been completed. Finally, an additional 30 photographs were taken on the 4th December 2012 on the roof of the Tx/Rx building.

#### (c) Reporting

- 1.24 Individual descriptions were produced for each identified element within the radar complex, for example specific buildings (whether extant or sites), hut bases, earthworks etc. This description included an account of each element's overall form (e.g. structure, materials, layout, evidence for any attached demolished structures etc), function, date and sequence of development and use, together with the evidence supporting this analysis and interpretation. Particular attention was made to compare previous descriptions with the remains as they currently exist, so as to provide an indication of any deterioration etc. Any fabric likely to be affected by future repair was analysed and commented on. As noted above (para 1.19), these site records were amended or enhanced as necessary following the clearance work.

## **Report and Archive**

- 1.25 This report forms a detailed written record of the radar complex, prepared from the sources of information set out above, cross-referenced to the drawn and photographic record, and wildlife survey. It describes the surviving structures, and analyses their form, function, history, and sequence of development, as far as is possible using the previously gathered information. The radar complex is also placed within its historical and technological context (where possible), using the available documentary and secondary evidence. A draft of the survey report was produced for comment in February 2012.
- 1.26 The project archive, comprising paper, magnetic and plastic media, has been ordered and indexed according to the standards set by the National Archaeological Record (EDAS site code BRR 11). It was deposited with the National Trust (Yorkshire Region) on completion of the project.

## 2 HISTORICAL BACKGROUND

### Introduction

- 2.1 A broad visible sweep of the horizon, an elevated position and a north-east coastal location made Ravenscar an attractive location for the siting of long range detection devices. For example, a horizontal acoustic listening disc was built in 1932 on the high ground to the west of the village near Beacon Howes, and on nearby Brow Moor a Short Wave Aerial/Broadcast (SWAB) Station was built in 1941, on the south side of Scarborough Road (Harwood & McMillan 2008, 177-178 & 182-183). The latter site comprised a powerful short wave transmitter coupled to an aerial which was strung between two 150ft high lattice masts placed 200ft apart; the main role of the station was to maintain communications between all RAF aircraft and ground controls). Other World War Two air to ground communication stations in this area included a 'Darky' station, forming part of an overall distress chain, and a Radio Track Guide Station which laid down beams for RAF aircraft to follow (Harwood & McMillan 2008, 180-181). Raven Hall (now the Raven Hall Hotel) was also requisitioned and used as a headquarters for battalions engaged in the coastal defence of the Scarborough to Whitby area (Harwood & McMillan 2008, 190).
- 2.2 While this continuity of use of the local landscape for such activities is important in assessing the significance of Bent Rigg, a detailed consideration lies outside the scope of this report. The following section therefore concentrates on those aspects of the development and use of radar during the Second World War which are relevant to the Bent Rigg station.

### The Development of Coastal Radar

- 2.3 In their report on the radar station complex at Craster in Northumberland, Hunt and Ainsworth (2006, 7-9) provide a useful summary of the development of coastal radar, itself drawing upon other sources which dealt with the technical and operational details in depth (e.g. Brown 1996; Dobinson 2000a & 2000b; Bragg 2002). This has been used, together with original source material and information from other relevant detailed accounts, for example, the work of Michael Pearson (1991, 93-106) and Dobinson's recently published account of the development of wartime radar (2010), to provide the following text.
- 2.4 In 1935, research experiments had begun to replace acoustic detection by using the re-radiation of radar signals to detect the position of an aircraft. The potential of this to provide effective defence from airborne enemy attack (in the form of launching a rapid counter-attack) was recognised and development continued apace. This method was initially known as RDF, an amalgamation of 'Radio Detection' and 'Direction Finding', although Pearson (1991, 93) states that the meaning was actually 'range and direction finding', 'radio direction finding' being a deliberate attempt to mislead as to its true purpose. It was not until 1943 that the acronym 'RDF' was superseded by the more familiar 'Radar' (Radio Aid for Detection and Ranging) (Bragg 2002, 299).
- 2.5 The principle of a chain of RDF stations situated at strategic points around the coast was seen as a solution to the airborne threat, which had been recognised during World War One, and by 1939 this chain was in place, although not completed (Bragg 2002, 1). This was known as the 'Chain Home' (CH) system. In the early stages of World War Two, work to improve and extend the chain was ongoing, and efforts were increased to enhance the detection system, particularly

for aircraft flying at low altitude - the weak point of the existing CH system. This resulted in the introduction of Chain Home Low (CH equipment against Low flying aircraft - CHL) stations, which were beginning to be installed by the start of December 1939. They were originally designed by Army scientists for use in plotting shipping for coastal batteries, but were then dedicated to locate low-flying aircraft (Lowry 1995, 45). At this date, a typical CHL station consisted of two principal buildings, a transmitter and a receiver, located c.75 yards (68.5m) apart and each with a wooden gantry supporting the aerial assembly (Bragg 2002, 167). The aerial was turned manually via a device constructed from a bicycle frame and chain, although this was modified in mid-1940 when an arrangement using a car steering wheel and gearbox was introduced (Bragg 2002, 204). Early guidelines for the positioning of radar stations recommended a site not more than 0.5 miles (0.8km) from the coastline, on cliffs or high ground overlooking the sea (Bragg 2002, 78). Some CHL stations were operated by the Army and formed part of the Coastal Defence (CD) chain (CD/CHL), used to provide radar plotting of both shipping and aircraft movements (Dobinson 2000b, 167; Lowry 1995, 45). One RDF station was established on Brow Moor above Ravenscar in September 1938 but it was abandoned in mid 1939, to be replaced by the much larger Danby station (Harwood & McMillan 2008, 184-185).

- 2.6 By 1941, a final version of the CHL station had been developed. The main difference between this and earlier stations was that the transmitter, receiver and operation rooms were now housed in a single building (the Tx/Rx block), measuring 50 feet (15m) by 18 feet (5.5m), upon which the aerial (now continuously power-turned) was mounted (Bragg 2002, 261-2). During the latter part of 1941, an advance in technology resulted in the development of a radar with a 10cm wavelength (centimetric radar), as opposed to the original 1.5m band, which gave much improved sea-level coverage and particularly provided reliable plots of shipping (Dobinson 2000a, 128); the Chain Home Extra Low (CHEL) is a blanket term for sets operating on a wavelength of 10cm or less (Lowry 1995, 45-47). The new centimetric equipment was rolled-out to the CHL and CD/CHL stations from the start of 1942 (Dobinson 2000a, 130). By the end of 1942, there were nearly 200 radar stations in the UK - these included 62 CH stations, 62 CHL stations and 19 Army CD/CHL stations (Bragg 2002, 292).
- 2.7 As well as permanent stations, a mobile device known as a 'Gibson Box' (officially known as a Radar CD No 1 Mk V) was also developed, which comprised a large van containing all the essential equipment of a centimetric set (including the aerial) and spares. Once in position, the aerial was mounted on the top of the vehicle, and the interior became the plotting room. However, at sites with a pre-existing plotting room, the Gibson Box could be a smaller fixed structure which supported the aerial (Radar CD No 1 Mk VI -Type 33) (Dobinson 2000a, 130).
- 2.8 The operational buildings of a CHL station would also have included a Standby Set House, which housed a generator to provide an emergency, back-up power supply for the Tx/Rx block. In order to function, the radar station would have required its own infrastructure, incorporating a connection to both the mains power supply and the telephone system as well as access to a source of water. In addition to the operational structures, there would have been a need for accommodation to house the operating staff and storage buildings for fuel and provisions.
- 2.9 Any radar station complex would have been closely guarded due to the top-secret nature of the technology contained in the operational buildings, and keeping the location of the sites secret was paramount. A typical complex would have been contained within a secure compound, usually defined by a perimeter of barbed

wire, which was sometimes camouflaged by incorporating existing features such as hedges, fences and field walls (Bragg 2002, 230). Attempts were also made to camouflage the structures and elements of the infrastructure in order to avoid detection by aerial reconnaissance. In 1940, Mr A P Rowe, Superintendent of the Bawdsey Research Station, wrote “we have talked a lot about encasing the whole of the CHL station in a hut so that camouflage will be easy and wind effects will not arise” (Bragg 2002, 231).

- 2.10 The sites would have been manned by military personnel and, as well as being defended on the ground by physical barriers such as a barbed wire perimeter, there would have been other defensive positions. In the case of CH stations, the latter included emplacements for light anti-aircraft guns (usually four 40mm Bofors guns) and standard infantry defences (such as weapons pits, for light machine guns, and pill boxes). Similar defences, with some variations, were established at CHL stations (Dobinson 2000a, 63).
- 2.11 The information collected via the radar would have been plotted using equipment within the Tx/Rx block. These plots, in the form of horizontal and vertical co-ordinates, would then have been telephoned to the operations room of the adjacent Sector and Group for filtering and onward transmission to the Group Headquarters (Bragg 2002, 79). Originally, the central Fighter Command headquarters were based at Stanmore in Middlesex, but in 1941 each RAF fighter group was provided with a separate plotting centre (Dobinson 2000a, 113).
- 2.12 A decision was taken in September 1944 to discontinue the use of the radar chain, although by this date, a number of stations had already been closed (Bragg 2002, 310). As a result of this decision, many of the stations were gradually either dismantled or mothballed, with the potential to return to operational status if necessary. However, after the end of the war, many sites were simply stripped of their equipment and abandoned.

### **Bent Rigg Station**

- 2.13 The earliest surviving structure within the survey area, the coastguard lookout or watch tower, predates the establishment of the radar station. The tower is believed to have been built in around 1935 (information from a plaque on the building) and in 1937 it was designated as a Peace Time Auxiliary Watch. Following the outbreak of war, it became a War Watch Station, manned by four coastguards. The first floor look-out surmounted a brick and concrete bunker used as a minewatch facility, and the building was connected by telephone to the radar buildings to the west (Harwood & McMillan 2008, 191; information from plaque on building). It was designated a Coast War Watch Station IV in 1961 and is believed to have continued in use by the Coastguard until 1972 (Harwood & McMillan 2008, 191; information from a plaque on the building).
- 2.14 In 1938, at Stoupe Brow, two miles north-west of Ravenscar, an Advanced Chain Home RDF station was erected. However, the first station to be built at Bent Rigg was probably an Army site, suggested to date to 1941 and to have been equipped with a Type 2 static radar (Harwood & McMillan 2008, 186); an aerial photograph taken in March 1941 shows only the coastguard station, with no evidence for any other activity or buildings within the site (EHA RAF/4J/BR 184). In the early part of 1941, and then again in the summer of the same year, there had been moves to create a ‘Triple-Service chain’, rationalising and co-ordinating radar stations built or operated independently by different branches of the armed services. The general idea was to get all of the stations equipped and linked up by early autumn, when

they would be manned by joint-service crews. However, by August 1941, the test results from centimetric radar were so impressive that planning for a second-generation joint service chain began. At the same time, the War Office pressed ahead with its 'independent' chain of radar stations. It is not always easy to establish an exact chronology as to when some of the Army's independent 1.5m CD/CHL chain came into being. A figure published by Dobinson (2010, 424 & figure 41) shows the Army chain in its final form, as it existed in late Spring 1942. Ravenscar is marked, and it is noted by Dobinson that the station at Goldsborough (the next station in the chain to the north of Ravenscar) was active in October 1941 (Dobinson 2010, 421-424).

- 2.15 It is believed that the first station at Bent Rigg was a Type 'M' permanent station forming part of the CD/CHL system (Newman & Kenyon 2000, 2), the 'M' denoting that it was equipped with a 1.5m wavelength radar set (as opposed to a later 'K' station using the 10cm wavelength centimetric set) (Pearson 1991, 96); Ravenscar was designated as Station M47 by February 1942 (Dobinson 2000b, 167). It is not clear exactly what is meant by the 'Type 2 static radar' referred to above. One internet source defines a Type 2 radar as comprising one common transmit and receive aerial that was made up of a 5-bay, four stacked dipole rotating array mounted in front of a reflecting screen (<http://www.radarpages.co.uk/mob/chl/chl1.htm>). When on a 200ft high tower or on 200ft high cliffs, the range on the target at 500ft was 110 miles (<http://www.radarpages.co.uk/mob/types/types1.htm>).
- 2.16 Pearson (1991, 97-98) gives a description of a typical CD/CHL Mark II 1.5m wavelength 'M' station set. The transmitters were manufactured by the Metropolitan Vickers Electric Company and the receivers by Pye Radio. The standard set was installed in a permanent concrete operations building, measuring about 40ft long by 20ft wide and 10ft high. On top of this building was a tower, constructed of steel sections in the form of a truncated square pyramid, also about 10 feet high and carrying a turntable for the rotating aerial system. The aerial turntable was driven by a DC electric motor. The display arrangements were built into two separate consoles for range and bearing, one of these incorporating the receiver, with the aerial control box mounted between them. Data transmission was by telephone only. The difference between a Mark II set, as opposed to a Mark I, was that there was a single transmitting and receiving aerial rather than separate aerials for each function. Dobinson also notes that the permanent CD/CHL site at Grimston (East Yorkshire - M53) also contained a Nissen hut and the usual standby set house (Dobinson 2000a, 126).
- 2.17 It has been suggested that Bent Rigg subsequently had a Type 52 radar, accommodated within and on top of a Turners curved asbestos hut (Building R3 and the earliest Tx/Rx block; see Chapter 3 below). A reconstruction drawing (Harwood & McMillan 2008, 187) (see figure 3) shows the array as comprising a dish-type aerial mounted on a wooden gantry taking the form of a truncated square pyramid, 20ft (6m) high, supported on four legs which themselves rest on blocks either side of the hut. The gantry appears to incorporate a walkway at a lower level, with a tube rising up through the roof of the hut which is assumed to have transmitted power to the aerial turntable. The gantry was reached by an external ladder. This reconstruction drawing, which has been adapted from a more generic reconstruction drawing of a Type 52 array positioned over a Nissen-type hut (Lowry 1995, 44) (see figure 3), is also reproduced from a slightly different angle on the interpretive notice board adjacent to the site. A contemporary painting of a Nissen and gantry structure by Rawlinson suggests that the reconstruction is broadly accurate (see figure 5). The Type 52 was a centimetric set (i.e. a 'K' Station) which



began to be installed from early 1942, and so it must have replaced the original 1.5m wavelength ('M') set; Ravenscar was a 'K' Station (K47) by July 1942 (Dobinson 2000b, 171). The NYMNP information panels on the Cleveland Way adjacent to the site carry a similar reconstruction of the asbestos hut and radar, but describe it as 'the first radar transmitting equipment' on the site; this is incorrect, as one internet source states quite clearly (<http://www.airfieldinformationexchange.org/community/showthread.php?4523-Ravenscar-Bent-Rigg-Farm-CD-CHL>). However, the evidence for there actually being a Type 52 array over the asbestos hut at Bent Rigg is sketchy (see Chapter 4 below), and it is interesting that neither the Scheduled Monument description, the National Archaeological Record nor the National Trust material note the presence of this device.

- 2.18 The Army-operated radar stations were handed over to the RAF as part of the Triple-Service scheme; the Bent Rigg station became RAF Ravenscar. Following this, the 'K' Stations in RAF hands were re-designated as CHEL (Chain Home Extra Low) (Pearson 1991, 96). Dobinson (2010, 425) notes that the handover took place at Goldsborough in March 1942, and so it is possible, if the handover was organised geographically, that Bent Rigg was transferred at about the same date or soon after. The station was under the command of 73 Wing RAF, based at Easthorpe Hall in Malton, North Yorkshire (Harwood & McMillan 2008, 186). In 1943-44, local oral evidence suggests that the site was guarded by the Northumberland Fusiliers (Roberts transcript).
- 2.19 It has been suggested that Bent Rigg was "probably converted to the common Tx and Rx aerial configuration" in the summer of 1942 and that "in 1944 the Type 52 would have been installed [and] this explains the presence of two Rx/Tx structures" (i.e. Buildings R3 and R4) (Harwood & McMillan 2008, 186). However, and most confusingly, an accompanying reconstruction showing the site in operation in 1942 depicts both Tx/Rx blocks, the earlier Nissen hut Tx/Rx block having lost its gantry while the later Tx/Rx block is shown with a Type 52 aerial array in place. But the accompanying information puts a date of 1940 for the concrete Tx/Rx block, and a date of 1944 for the Nissen hut array, in direct contradiction to another illustration (Harwood & McMillan 2008, 188). There is also a further reconstruction of the later Tx/Rx block (Building R4) showing the metal Type 52 aerial array on the roof, supported by four piers (Harwood & McMillan 2008, 188); one example of a Tx/Rx block with its gantry survives at Swansea Bay ([www.subbrit.org.uk/sb-sites/sites/m/margam/index.shtml](http://www.subbrit.org.uk/sb-sites/sites/m/margam/index.shtml)) (see figure 4). Once again, a Rawlinson contemporary painting depicts the array on top of a Tx/Rx block, with a separate receiver (see figure 5).
- 2.20 This confusion with the above dates suggests that the precise date of installation and the construction of the concrete Tx/Rx block lies between 1942 and 1944. For example, it might be that the earlier Type 52 array on top of the curved asbestos hut was relatively short-lived, probably being erected in early 1942 but then replaced by the concrete Tx/Rx building and array by the summer of 1942. Alternatively, the curved asbestos hut array could have continued in use until 1944 before being replaced. By comparison, the very similar concrete Tx/Rx block at Craster in Northumberland is thought most likely to date to towards the end of 1941, and to have initially have been provided with a 1.5m radar which was replaced by a centimetric set after December 1942 (Hunt & Ainsworth 2006, 34-35). Whichever option is chosen, the Type 52 configuration was a standard station for both air and sea watching by the end of the war (Lowry 1995, 47).

- 2.21 The electricity power supply for Bent Rigg would have been provided by Scarborough Council Electricity Department, although the site was also provided with a stand-by set house and fuel store (Harwood & McMillan 2008, 186). Local oral tradition suggests that farmers were paid to graze their sheep near the radar buildings in order to make them appear more rural from the air, although this seems unlikely to have been effective (Newman & Kenyon 2000, 24-25).
- 2.22 The National Trust estate office at Ravenscar holds photocopies of two photographs which are thought to have been taken at Bent Rigg in wartime. The first is entitled 'Radio Huts and Aerials' and shows two masts set some distance apart, with two buildings between them. In the foreground, there is a drystone wall, a track and then a barbed wire fence supported on angle-iron posts. If the feature in the foreground is the railway line, rather than a trackway, then the view might possibly be taken from the very north-west corner of the survey area, looking towards Buildings A5 and A4 of the accommodation group. However, there is little other convincing evidence to support this interpretation, and the photograph is almost certainly of the SWAB Station on Brow Moor (see para 2.1 above). The second photograph is titled 'LAC S Young on Duty' and shows a young male (radio operator?) sitting in a chair in front of two large banks of dials. In the background, furniture, wall boards and cabling are visible. Again, it is impossible to know if this photograph was taken at Bent Rigg, and it is more likely to be the inside of the Tx/Rx block at the SWAB station.
- 2.23 Many of the CD/CHL stations in Wales, Scotland and Northern Ireland were made redundant by mid 1944, but the English stations remained operational to support Operation Overlord and other campaigns. It is not known precisely when Bent Rigg fell out of use, but this is assumed to have taken place after September 1944. An aerial photograph taken in August 1946 shows that the barracks and accommodation buildings had already been demolished, and this part of the site perhaps returned to bracken rather than grassland, although one structure (part of Building 11) and the radar building remained (EHA RAF 106G/UK/1700 frame 2452; see figure 6). The same is shown on another aerial photograph dated slightly later, in December 1946 (EHA RAF/4J/BR 1882). Unfortunately, neither of the aerial photographs appear to show any other structures or defences at the site, and indeed, it is even difficult to see how the site was accessed (see para 3.6 below). The Scarborough to Whitby railway line, which passes along the west side of the radar site, opened in 1885 and closed in March 1965 (Hoole 1978, 86-88). It was therefore working during the time that the radar station was operating. It may have been used to bring supplies, equipment and personnel, although no platform or siding was specifically constructed.
- 2.24 By the late 1980s the National Trust were proposing to demolish the remaining buildings, but they were persuaded not to do so by, amongst others, the Staintondale Local History Society. A programme of repairs and restoration was undertaken by the National Trust in late 2000 which included removing damaged roof sections, removing window frames and bricking up the openings in the Communications Hut, removing and/or replacing broken glazing and repairing the doors in the Tx/Rx building, and generally cleaning out the buildings (National Trust 2000). The remains were protected as a Scheduled Monument in March 2002.

### 3 DESCRIPTION OF THE SURVEY AREA

#### Introduction

- 3.1 The survey area is formed by a single pasture field, lying to the east of the now disused Whitby to Scarborough railway line. It has maximum dimensions of 300m east-west by 160m north-south, and slopes downwards towards the cliff edge; within the survey area, the ground surface falls from 176m AOD to 157m AOD from west to east. The survey area is bounded by a modern post and wire fence to the west, and by drystone walls to the north, east and south. The drystone wall to the east end has a post and wire fence placed just inside it.
- 3.2 The survey area contains two distinct groups of structures, forming part of a single, larger, wartime complex (see plates 1 and 2). These two groups are described below, together with any associated smaller features and earthworks, and also the earthworks which occur more generally across the survey area; to avoid confusion, the buildings within the radar group are prefixed with 'R' while those in the accommodation group are prefixed with 'A'. Given that parts of the complex have already been subject to quite detailed recording (see Appendix 1), and that the project brief was specific that any new survey should build on and not duplicate previous recording, the following descriptions only catalogue any changes or additional information noted during the current survey.
- 3.3 Reference should be made to the survey drawings (see figures 7 to 12), and the photographic record which appears as Appendix 2; photographs are referenced in the following text in italic type with square brackets, the numbers before the stroke representing the film number and the number after indicating the frame e.g. [1/32]. Finally, for ease of description, the following text assumes that the long axis of the site is aligned east-west.

#### Setting, Approach and Organisation

- 3.4 The topographic setting of Bent Rigg provided a superb location for a radar station, amply fulfilling the ideal criteria set out in 1938: "*The greater the station height the greater the range at which approaching aircraft can be detected and roughly located. The smoother the fall of the land over the radius of a few miles in front of, and to the flanks of the site, the more accurate the height finding and direction finding.*" (Bragg 2002, 90). Standing on the roof of the Tx/Rx building provides an even better demonstration than at ground level as to just what a superb position the radar station occupies [5/394-5/401].
- 3.5 The ground surface falls over 19m from the accommodation group in the west to the coastguard tower in the east, forming a series of very shallow and gradual south-east facing terraces (see figure 8). Little evidence has been uncovered by the current survey that allows the boundaries of the station compound to be definitively defined, but it is assumed that they were approximately the same as those of the survey area itself. The only part where traces of an original perimeter might survive is along the eastern edge of the survey area, adjacent to the coastal footpath. The sinuous drystone wall has a post-and-wire fence set just within it for much of its length, the latter supported in part by angle-iron posts, and there are also several redundant examples leaning against the drystone wall; there are 20 in total, some of which still have barbed wire attached (see figure 7). Each post is c.0.95m in height and 0.04m wide along both outer sides from the angle, each side being 3mm thick. The posts all have at least six holes cut into one of the sides, placed at 0.06m centres, with corresponding semi-circular 'nicks' at the outer end

of that side and of the opposite side. The uppermost hole and associated 'nicks' are slightly larger than those below [3/289]. The posts are of a form used during the Second World War, and their siting alongside a pre-existing boundary reflects contemporary official guidance, as they were then less likely to be visible to enemy aerial reconnaissance (Hunt & Ainsworth 2006, 17). It is not known if there were any attempts to further camouflage the station at Bent Rigg, as the site must also have been clearly visible from the adjacent railway line [4/556].

- 3.6 It is not clear where the original main point of access to the station compound was, but it would be logical to have been somewhere near the accommodation group. It would also have been logical for the compound to have been approached from the north-west from Ravenscar, along the track from Ravenscar Square which now serves Blea Wyke Lodge. Modern Ordnance Survey maps also show a track leaving the north side of Bent Rigg Lane and heading north-east directly towards the accommodation group; this could have provided both pedestrian and vehicular access, although there would obviously have had to be an at-grade crossing over the railway line. Alternatively, or perhaps in addition, there was access from the south-east close to the railway bridge on Bent Rigg Lane; there is a track running along a level terrace from just north from the bridge along the east side of the railway lane towards an overgrown gate in the southern corner of the site. Whichever route was the main access, it is likely that there would have been a guard hut or other similar structure close to the entrance to the site. Unfortunately, the 1946 aerial photographs do not depict any obvious access or guardhouse structures (see figure 6).
- 3.7 There is little evidence within the station compound for any formal internal communication routes between the two groups of buildings, which are placed over 180m apart. This is considerably further than at the radar station at Craster in Northumberland, for example, where the remains of upright stones forming the edging of paths were recorded running between the Tx/Rx block and the accommodation grouping; it was argued that these would have been essential to delineate routes between the structures for operators moving around the site at night during a blackout (Hunt & Ainsworth 2006, 26). The reconstruction drawings of the Goldsborough CD/CHL station also show roads or tracks linking the radar buildings with the accommodation areas (Harwood & McMillan 2008, 159-160).
- 3.8 Although the earthworks of two possible internal routeways were identified at Bent Rigg, nothing structural survives. To the south-east of Buildings A1 and A2 of the accommodation group, there is an east facing scarp, set c.6m to the east of and running parallel to a more prominent scarp defining one edge of the group. Together, the two may define a raised curving track or road ('a' on figure 7) used for vehicular access within the compound; this may reflect an entrance in the southern corner of the site and it may be connected with another possible track running north-east ('b' - see below, para 3.75). There is also a linear depression, measuring 2m wide by 0.50m deep, running north for c.80m from the southern corner of the survey area ('c'). This depression runs parallel to the track bed of the former railway line, becoming shallower as it moves north and eventually fading to a north-east facing scarp. Approximately two-thirds of the way along its length, a broken cast-iron object projects from the ground surface. This object rises a maximum of 0.23m above the existing ground surface, and clearly once rose higher, the upper part having sheared off. It is a rather squat cruciform in section, measuring a maximum of 0.09m long by 0.07m wide. The sides taper inwards slightly as it rises, although it maintains the same sectional form [3/300]. It's function is unknown, although the depression itself may represent part of the western boundary of the complex.

- 3.9 It is possible that the curving track noted above ('a') links with an isolated 45m long section of a similar earthwork further to the north-east long ('d' on figure 7). This may have provided a route to the radar buildings, although the earthwork does appear to turn to the north at its north-east end. Another broad but shallow linear depression ('e') runs parallel to the drystone wall forming the south side of the survey area. The depression appears to originate close to a gateway towards the south-west end of the wall and it is initially very faint, although it becomes more prominent as it moves north-east, eventually being 5.0m wide and 0.4m deep. The depression has a flat bottom, and by the time it passes an isolated brick structure (see below), it has the appearance of a former vehicle trackway. This may have been associated with the internal organisation of the compound, but is equally likely to have been created wholly by post-war farming activity.
- 3.10 The mains power supply into the compound may be represented by a narrow shallow depression, c.1m wide but only 0.2m deep, running c.35m north and parallel to the south side of the survey area ('f' on figure 7). It can be traced from the west side of the survey area almost as far as Building R3 of the radar group. A small brick structure adjacent to the same drystone wall might also have been associated with the mains power supply (see Building R5 below).
- 3.11 Perhaps the most surprising result of the current survey work is the lack of evidence for any defensive positions at the station, and none can clearly be seen on the 1946 aerial photographs (see figure 6); several small white and black circular features can be seen, particularly around the accommodation block, but the evidence is not convincing. This is in stark contrast to Craster, where evidence for a double-barbed wire perimeter and numerous weapons pits was recorded, forming a well-organised system of defence (Hunt & Ainsworth 2006, 14-16). In addition to well-preserved defensive earthworks, recording work undertaken at a searchlight battery at Cracoe in North Yorkshire (Richardson & Dennison 2011, 8) has demonstrated that even the remains of probable Light Anti Aircraft (LAA) machine gun positions that were largely of sandbagged construction can be discerned through careful detailed measured survey. There is also no surviving evidence for any shelters or slit trenches, in which to take cover from aerial attack, although of course these could have been infilled once the station was abandoned and the land returned to agricultural use. A reconstruction drawing of the now destroyed CD/CHL site at Goldsborough shows four gun pits, at least one representing a 'Motley Mount' pit which would have contained a twin Vickers 'K' machine gun (Harwood & McMillan 2008, 160-161).
- 3.12 Within the Bent Rigg survey area, there is a series of at least four sub-oval depressions immediately adjacent to the north drystone boundary wall. The largest of these measures 4.5m long, at least 1.5m wide and 0.5m deep. They all appear to be partly or wholly bisected by the drystone wall, their other halves lying outside of the survey area, and so are unlikely to be gun pits. There is at least one very similar feature towards the east end of the drystone wall forming the southern boundary of the survey area. However, there is a one sub-circular depression near the north-west corner of the site, measuring c.2m across and up to 0.40m deep, and perhaps open to the south-east ('g' on figure 7) [2/910]. It is surrounded by a low bank, most prominent to the south-west, up to 0.30m in height. However, none of these earthworks strongly resemble weapon pits or any other form of Second World War defensive site.

## The Radar Group of Buildings

- 3.13 As has already been noted, the survey area contains two distinct groups of structures forming part of a single, larger complex. The first, and smaller, group lies in the north-east part of the survey area, and is represented by four upstanding buildings, with limited associated earthworks and structures (see figure 9 and plate 1). The numbering scheme adopted in the earlier survey report (Newman & Kenyon 2000) is retained for ease of description, although now the identifiers are prefixed with 'R'.
- 3.14 As a whole, the group covers an area measuring a maximum of 35m north-west/south-east by 46m north-east/south-west. Within this area, the ground surface slopes downwards (from south-west to north-east) from c.166.60m AOD to 162.50m AOD. The 1946 aerial photographs (see figure 6) show the five buildings all extant, and there also appears to be some small concrete bases immediately to the north and south of the Tx/Rx building (R4) and another to the north-west of the Communications Hut (R3). None of these features survive on the ground (although they may be buried) and it is difficult to interpret them; it is possible that those features around the Tx/Rx building might be ground anchors associated either with the earlier static Type 2 radar array that was on the site or to help secure the Type 52 array on top of the building, as was probably the case at Craster (Hunt & Ainsworth 2006, 20).
- 3.15 Although the buildings are set on either north-east/south-west (R1, R2 and R4) or north-west/south-east (R3) alignments, again following the precedent set by the earlier report, for descriptive purposes they are considered to be aligned either east-west or north-south.

### *Building R1 - the fuel store (NTSMR 31160/1)*

- 3.16 In June 2000, this building was described by Newman and Kenyon (2000, 4-6) (see Appendix 1). For ease of description, the long axis of the building is considered to be aligned east-west.

### External elevations

- 3.17 This building has maximum external dimensions of 4.95m east-west by 3.00m north-south. The bricks used in its construction are machine-moulded and light red/orange in colour (average dimensions 220mm x 110mm x 70mm) and set with a cement mortar. The external east wall [1/845; 2/954] is largely as recorded by Kenyon in August/September 1997, the frame to the left (south) jamb having been replaced during the late 2000 conservation works; the door which it is assumed was fitted here at the same time has been broken off and thrown into the interior (see plate 3). The patches of repaired render and a crack above the top right corner of the door still remain. The external north wall [1/846] is as recorded in August/September 1997, as is the west wall [1/847], with the exception of the window, which had an inner frame fitted with safety glass inserted into the earlier frame during the late 2000 conservation works - the outer frame has lost its paint and the bottom is now rotted; the whole is now painted a greyish-blue, rather than the dark brown noted in June 2000. Patches of repaired render are visible (as in 1997) as well as a small area of fallen render. The external south wall is as recorded in 1997 [1/848, 1/849], although only five of the eight square holes referred to in 2000 were visible at the time of the EDAS survey; Kenyon shows five such features on her 1997 survey drawing. A narrow strip of concrete runs along the base of the east external elevation, returning along the south wall for a short

distance; there is a larger area of concrete adjacent to the south-east corner of the building [3/297].

#### Interior

- 3.18 The internal west wall [1/866] is as recorded by Kenyon in August/September 1997; one of the bricks to the sill of the window is frogged. There are three sub-section wooden pegs or dowels projecting from the east end of the south wall [1/869] which do not appear on the 1997 drawings and are not referred to in the subsequent report. The pegs are placed 1.46m above the existing internal floor level and project 0.05m from the wall face; they are set into the mortar between two courses of brickwork. The internal east wall [1/868] is as recorded in 1997; the render on the doorway lintel was largely renewed as part of the late 2000 conservation works (although the north side has since fallen), and the dark green paint referred to in June 2000 has been overpainted greyish-blue. The internal south wall is as recorded in 1997. The brick supports for the fuel tank [1/867] rise to a maximum height of 0.55m above the existing floor level. The majority of the seven courses of bricks used to build the supports are very similar to those in the main walls of the building; however, they also incorporate a small number of darker red examples (average dimensions 225mm x 105mm x 75mm) with shallow frogs; they may have been re-used from elsewhere. The clearance of the floor of this building in late January 2012 revealed the concrete floor and the full extent of the fuel tank supports [4/565, 4/566] (see plate 4), but nothing further of interest; the wooden door previously inside the building was now placed outside [4/568].

#### *Building R2 - Engine House/Standby Set House (NYSMR 31160/2)*

- 3.19 In June 2000, this building was described by Newman and Kenton (2000, 6-8) (see Appendix 1). For ease of description, the long axis of the building is considered to be aligned east-west.

#### External elevations

- 3.20 This building has maximum external dimensions of 6.95m east-west by 5.10m north-south. The external east wall [1/856, 1/857; 2/952; 4/569, 4/574, 4/575] of the screen/porch is as recorded by Kenyon in October 1997 (see plate 5), although the edges of the concrete roof are worn. The doorway to the 'external' east wall of the main part of the building retains the frame noted in June 2000 but it has since been overpainted a greyish-blue and the etched 'ENGINE HOUSE' lettering on the lintel is no longer visible; a painted wooden panel has been added above the lintel, presumably as part of the late 2000 conservation works (see plate 8). The opening was fitted with new double doors during the conservation works but only one (north) leaf now remains *in situ*, the other having been thrown into the interior. There are two more small square recesses or holes in the north external wall [1/850] than were recorded in 1997, placed at the very west end of the wall (see plate 6). The external west wall [1/852] is as recorded in 1997, with the northern of the two vent openings [1/851] retaining probably the most complete set of fittings described in 2000 (see plate 7). The external south wall [1/853] is as recorded in 1997. Each of the vents has a streak of discoloration below it, running down to the ground surface, but it is not clear what the source is, perhaps staining from the former metal grills; similar, but fainter, streaks can be seen below vents in the external north wall. The concrete drain cover [1/855], with its central ring, at the base of the south wall is still present, while a narrow strip of concrete runs parallel to the base of the east external wall.

## Internal

- 3.21 The internal east [1/861], north [1/864, 1/865], south [1/862, 1/863] and west [1/858] walls are generally as recorded by Kenyon in October 1997. Although it was noted in June 2000 that the bakelite clamps recorded in 1997 were no longer present, a single clamp or cable holder does still survive on the east internal wall, with the faint impressions left by other, removed, examples still just visible in oblique torchlight. In addition to the features noted by Kenyon, in the east internal wall to the north of the doorway, 1.19m above the internal floor level, two threaded bolts project from the wall face, flanking a circular recess 0.06m in diameter and 0.04m in depth. Directly above them, close to the ceiling, two screws may mark the former position of a bakelite clamp. To the south of the doorway, just above the neutral strip, there may be further evidence for removed fittings.
- 3.22 Using an oblique torch light, it appears that all four internal walls of the engine house once bore pencil marks at regular intervals, set just above the neutral strip, although these markings only remained clearly visible on the north and west walls. On the west wall, there are vertical pencil strokes at centres of between 0.25m to 0.27m; three of the vertical strokes towards the middle of the wall have '1/4' faintly pencilled above them [1/860]. On the north wall, the vertical pencil marks are at 0.33m to 0.38m centres. Several have fractions very faintly pencilled above them, but only '1 5/16' and '1 7/16' can be made out with any certainty [3/298, 3/299]. The fractions may increase in size from west to east.
- 3.23 The clearance of the floor of this building in late January 2012 revealed a concrete floor together with the outline of the former machine bed which would have supported the generator (see plate 9). This outline measured 2.87m by 0.83m and it was aligned with the south wall although 0.64m to the north of it, and 0.57m from the west wall; a corroded metal strip ran north-west from near its north-west corner towards the west end of the north wall [4/571-4/573]. The bed had clearly been dismantled as far as possible, leaving a pock-marked surface, and no markings or bolts to secure the generator remain. The position of the former machine bed corresponds exactly with that seen in the Standby Set House at Craster (Hunt & Ainsworth 2006, 23-24). The south leaf of the wooden door had also been refixed but other material found during clearance, including a telephone cable mount, remained outside [4/570].

### *Building R3 - The "Communications Hut" (NTSMR 31160/3)*

- 3.24 In 2000, this building was described by Newman and Kenyon (2000, 8-15) (see Appendix 1). For ease of description, the long axis of the building is considered to be aligned north-south.

## External elevations

- 3.25 This building is a Turners curved asbestos hut rather than a Nissen hut; these were manufactured by Turners Asbestos Company Limited of Trafford Park in Manchester from May 1942 onwards (Francis 1996, 213). This type of hut required no frame, with 'Everite Six' curved asbestos cement corrugated sheets being bolted together to form an arch fixed to a concrete curb above the floor to a radius of 9ft [2/006]. A number of internal wooden purlins supported a lining of flexible asbestos sheets. The partly ruinous state of the roof of the building and interior allows this form of construction to be seen [4/579] (see plate 15). The end walls were usually timber framed with plasterboard inside and felted plasterboard outside, although cement rendered temporary brick was used. Typically, the



internal span was 17ft 4ins, the internal length was a multiple of 6ft (usually 36ft) and the internal height was 9ft 2ins.

- 3.26 The long axis of the building is set at right-angles to the other brick and concrete structures in the radar complex, and it has maximum external dimensions of 7.40m (24.2ft) east-west by 5.70m (18.6ft) north-south. The external elevations [2/002, 2/004, 2/008-2/010] remain largely as surveyed in November-December 1997 and described in June 2000, although there has been a significant change to the external appearance of the building since then due to the blocking of the windows in the north elevation (see plates 12 and 13), and the blocking of the doors and windows in the south elevation (see plates 10 and 11) [2/003, 2/007]; all were blocked with brick and the frames taken out during the late 2000 conservation works, and the ventilation opening over the doors were bricked with honey-comb brickwork. The telephone cable mounting referred to on the north elevation in 1997 and 2000 has also been removed since late 2000. The section of broken/missing asbestos roofing at the north end of the building noted in 1997 is still missing, despite some repairs seemingly undertaken in late 2000 [4/576, 4/584].
- 3.27 The adjacent concrete slab noted in June 2000 remains [2/005], but it has been moved from its former position propped against the south external elevation (see plate 10), and is now laid flat at the north end of the west external elevation (see plate 13). In addition, it was noted by the current survey that there is a very slightly raised bank, 0.80m wide, running parallel to the west external wall of the building, in line with the slab. The firmness of the bank suggests that it may comprise turf-covered brickwork. The bank curves around the south-west corner of the building and then stops. However, a similar bank is visible curving around the south-east corner of the building, and then continues along the base of the east external elevation as a 0.30m high north-east facing scarp. There may also be a very slight platform to the immediate north-east of the building, again aligned roughly parallel to the building, measuring 1.1m in length by 5m in width.

#### Interior

- 3.28 At the time of the current survey, the interior of the building was in poor condition, with missing asbestos to the north and south ends of the roof. There were significant quantities of broken asbestos sheeting on the floor, a wooden former with asbestos sheeting laid on it and a plastic bin in one corner, together with a broken wooden door frame [2/011, 2/012, 2/022, 2/023, 2/025; 4/581]; it is assumed that these were left over from the late 2000 conservation works.
- 3.29 The floor areas of the small east and west rooms at the north end of the building [2/013, 2/014, 2/017, 2/018] were covered with broken asbestos sheeting, although the various fixtures described in June 2000 remain *in situ* [2/015, 2/019], as do most of those in the main room [2/024] (see plate 14). However, some of the previously described fixtures within the main room of the building have either deteriorated and fallen of, or have been removed. Fewer of the ceramic cable mountings to the immediate north of the circular timber mounting located towards the east side of the ceiling arc [2/021] survive than is shown in 2000. The heads of the retaining bolts and associated piece of timber described on the north wall of the small west room are no longer visible, and neither are the fragments of unwired glass placed on the concrete shelf. All of the surviving elements of door frames and the cable holders in the entrance passage noted in 2000 are now missing.

- 3.30 The clearance of the floor of this building in late January 2012 revealed the concrete floor and the full extent of the internal concrete side walls which measure 0.26m high [4/578, 4/580, 4/583]. No other features of interest were noted. The remains of the internal doors and other metal window frames had been gathered together and placed outside the building [4/577, 4/585, 4/601].

*Building R4 - Transmitter/Receiver (Tx/Rx) Block (NTSMR 31160/4)*

- 3.31 In 2000, this building was described by Newman and Kenyon (2000, 5-22) (see Appendix 1). The building is set on a north-east/south-west alignment with maximum external dimensions of 13.20m east-west by 6.20m north-south; for ease of description, the long axis of the building is considered to be aligned east-west.
- 3.32 The building is set within a U-shaped hollow, open to the east, which has been created by excavating into the natural east facing slope here (see plate 17). The hollow has steeply scarped sides, facing inwards towards the building, and rising to a maximum height of 1.40m. Some of the excavated material was spread out to the east of the hollow, so as to create a level platform on which to place the building. The west end of the hollow is accessed via a flight of five concrete steps [2/956], which lead to the doorway in the west elevation.
- 3.33 To the north-east of the platform on which the east end of the building stands, there is a second, smaller, platform, scarped to the east side and standing to a maximum height of 0.50m. On the platform, there is a concrete pad with a squat L-shaped plan form, measuring a maximum of 2.95m north-south by 2.70m east-west [3/287, 3/288]. This pad formerly supported a brickwork wall or base around the outer edges, with evidence for an internal sub-division on the west side and a possible access opening on the east side. A pre-1992 photograph (National Trust VBS2) taken prior to the conservation works shows that the concrete pad was once covered by a spread of angular stone rubble.

External elevations

- 3.34 The external elevations of the building are largely as recorded by Kenyon in January 1998, the main changes having resulted from the conservation works undertaken in late 2000. Commencing with the south external elevation [2/960-2/963] (see plate 16), all of the four windows were reglazed during the conservation works and painted with silver 'Hammerite' paint, and none of the glass with hexagonal wire reinforcement survives, although fragments can still be found lying on the ground around the building. The external frame of window W3 on the south elevation has been removed and replaced with a wooden ply panel. The timber shutters have also been removed, but the internal blast doors are as described in June 2000; four pots of paint were placed behind them within the window at the time of the EDAS survey. The timber shutter remains have been removed from window W4 and the top right-hand pane of the west leaf, replaced during the conservation works, is now broken. There are areas of more recent concrete render over windows W1 and W2 in this elevation.
- 3.35 On the east external elevation [2/966-2/968], the external metal frame of window W5 was removed during the late 2000 conservation works and replaced with a wooden ply panel. The metal ladder, giving access to the roof, is missing, but the rusting metal brackets for the top of the ladder and brick base still survive (see plate 19); the 2000 conservation works required it to be taken down, painted and stored in the building. On the north external elevation [2/970-2/972], the remains of the external metal frame to windows W6 and W7 have been removed and

replaced with wooden ply panels, while the door (D1), reconditioned in late 2000, is now rusting and the right hand leaf is detached and lying inside the building (see plate 18). On the west external elevation [2/955, 2/958] (see plate 17), the window (W8) was reglazed during the late 2000 conservation works and painted with silver metal paint; the bottom left-hand pane of both leaves of the external metal frame are now broken. The door (D2) was also made operational, primed and painted silver but it is now rusting [2/959].

- 3.36 The external concrete drain remains clearly visible around the base of the east external elevation [2/965] and around the eastern halves of the north and south external elevations [2/964, 2/969] (see plate 20). The drain channel has a broadly square cross-section, and measures on average 0.13m wide by 0.15m deep. It is shallower to the base of the east elevation, suggesting that water may have drained towards the north-east corner of the building. An iron plate, set flush with the top of the channel's sides, is laid across the drain in line with the doorway at the east end of the north elevation. A rectangular brick-lined chamber [2/957] at the south-west corner of the building may also be associated with drainage.

### Roof

- 3.37 In December 2012, access was gained to the roof of the building, and a plan and photographs made of it, adding to what can be seen on a National Trust photograph (100/15 dated February 1998) of the late 1990s (see figure 10). The roof is formed by a reinforced concrete slab, 0.19m thick and projecting beyond or overhanging all the external wall faces below by 0.13m [5/375-5/377] (see plate 21); the projection has a drip channel to the underside. Over the external doorways in the north (D1) [5/402] and west (D2) [5/403, 5/404] walls, a shallow concrete lip (0.03m high) is present to the edge of the slab, presumably to try to prevent water blowing or running off the roof directly above the doorways [5/385]. The lip over the north doorway appears to be integral to the slab, whereas that over the west doorway is a subsequent addition (see plate 22).
- 3.38 The main surviving features on the roof are the bases which secured the four legs or piers of a metal Type 52 aerial array to the roof. Each array base is placed in line with (although not always exactly central to) one of the external concrete piers of the building; the area covered by the bases measures 5.80m square. Each base comprises a sub-pentagonal concrete pad (essentially formed by a 0.79m square with the internal corner replaced by an angle), slightly raised above the surface of the slab by up to 0.06m [5/386]. The pads were apparently created by cutting out a shallow surface recess of the same shape into the surface of the slab and then adding additional concrete into this recess, so that resulting pad was raised above the slab. Within each pad, there is the shallow impression left by a pair of rectangular metal plates to which the legs or piers of the aerial array were fixed. Metal bolts (6mm in diameter) project up to 11mm from within the impressions left by the plates. The bolts do not appear to have been threaded, although this may be the result of weathering and decay. The arrangement of the bolts is not the same for all of the bases; the western two bases have four bolts to each plate [5/384], whereas the eastern bases have only three [5/387-5/389] (see plate 23). In the internal angle of the plate impressions to each base, there is a slight right-angled depression with a shallow internal groove to each side. The only exception to the description given above is the south-west pad; here, the plate footprints are slightly raised rather than recessed, and there is also a 0.06m diameter circular hole filled with lead to the internal angle [5/390, 5/391].

- 3.39 Slightly off-centre to the east of the square formed by the four bases, the remains of the housing which held part of the aerial array's turning mechanism are visible [5/392, 5/393] (see plate 24). The housing is formed by a concrete pad, c.0.50m square, and raised 0.05m above the surface of the slab; again, as with the bases, it is an addition to the slab. The corners of the pad are slightly rounded and all four sides of the upper surface slightly rounded. In the centre of the pad, there is a circular moulded fitting, 0.26m in diameter, formed from a single thin sheet of metal. Although now rusted and decayed, the fitting once had a raised vertical lip around the outer edge, which projected slightly above the surface of the pad. The base was flattened around the edge (and set below the surface of the pad) but then rose in a convex profile towards the central 0.04m diameter opening. There are two small dabs of cement render to the north-east and south-east of the circular metal fitting, probably added to adjust the level of whatever rested on the pad's surface [5/379-5/381]. A much larger spread of cement render to the immediate south-west of the pad may have served a similar purpose, or perhaps more likely represents a repair to the slab's surface when another fixture/fitting had been removed [5/383].
- 3.40 Some 0.95m east of the pad, a 0.27m diameter ceramic pipe rises 0.32m above the surface of the slab [5/382]; this presumably represents a cable duct from the radar array into the building. It is noticeable that a section of the slab's surface, angled between the pad/pipe and the north-east base, is very slightly raised above the rest, and is also smoother [5/378]. It is not certain if this represents a historic repair or differential weathering caused by the former presence of the aerial array, or relates to an alteration to the array. Conversely, a very faint gridded pattern to the surface of the north-western part of the slab is almost certainly no more than a reflection of differential weathering and internal reinforcement; there is no convincing evidence here, or indeed across the rest of the roof as a whole, for any major change in the layout or form of the structures once secured to the slab.

#### Interior

- 3.41 At the time of the EDAS survey, the interior of the building was in poor condition, although the internal walls preserve a significant amount of information relating to its former function. The interior of the building is divided into three rooms or cells, a larger central room and smaller but unequal east and west rooms. The floor of the east room had been used to dump some debris, including the external metal window frames described in June 2000 but removed during the conservation works.
- 3.42 The interior of the building is floored throughout with concrete; softwood battens, on a longitudinal east-west alignment, have been set into the concrete at 0.35m centres, so that their upper surfaces projected slightly above the surface of the concrete (see plate 30). The whole appears to have been covered in a black paint/bitumen-like substance, which now survives only patchily, and it is likely that floorboards were once laid over the battens. In the south-west corner of the east room, there is a shallow channel set into the floor. This channel is 0.20m wide and was probably also once provided with a board cover, as the tops of the sides are recessed slightly below floor level. To judge by adjacent wall-mounted fixtures (see below), the channel once formed a duct to house electrical cabling. The channel projects for a length of at least 0.60m into the east room; the west end of the channel passes beneath the west wall into the central room. In the central room, the channel is 0.16m wide and runs parallel to the south wall. At least four shallower, narrower, channels leave the south side of the main channel in this room, at right angles to run towards the south wall. A channel of similar

dimensions to the main channel leaves its north side at a right angle to run parallel to the east room of the wall, on a line c.0.65m away from it. To the west, two narrower channels also leave the north side at a right angle, and they can be traced north for 1.75m. All three north-running channels pass through breaks in the softwood battens of the concrete floor. The main channel does not appear to have continued west into the west room (but see para 3.55 below).

- 3.43 The EDAS survey noted a number of features not shown on the internal drawings made by Kenyon in January 1998, as well as providing further information on the features that were recorded. In the east room, the concrete block in the centre of the east wall (Elevation A) [2/976] appears to have been used as a step for an observer to stand on, so that they could look out through the window (W5) directly above. At the north end of this east wall, there are the remains of five shelves, set within the recess formed by the wall and the adjacent pier of the north wall [2/973, 2/974]. The fourth shelf up is supported on two plain timber brackets, each 0.330m long, 0.020m wide and 0.025m deep, and fixed to the wall using two screws. A pair of cross timbers run between the brackets, screwed onto their upper surfaces at either end. A rectangular piece of asbestos sheet rests loosely on top of the north cross timber but against the south cross timber; the latter has a piece of blue twine tied around it. The asbestos sheet has two 0.06m diameter circular holes cut out of it [3/290].
- 3.44 To the south of the concrete block noted above, there are five (rather than the four shown in 1998) small rectangular pieces of wood let into the wall, each measuring 0.045m long by 0.020m deep, plus an additional nail which may once have formed part of the same group. At the top of the wall, there are paired vent openings. These do not open straight out to the exterior but pass into the thickness of the wall where they meet an internal channel running parallel to the wall. On the external side of this channel, there are the vents noted externally; in each group, the external vent is placed slightly off centre between the paired internal vents. As in Building R2 (the engine house), the vent openings and channel are lined with what appears to be plywood. The majority of the internal vent openings have lost their original treatment, although the very few surviving examples allow the original form to be reconstructed. Pieces of timber, 0.03m deep, were fixed to the top and bottom of the vent opening over the lining [3/280]. A piece of zinc mesh was then placed over the opening, held in place by a beaded wooden frame with mitred joints; each side of the frame is 0.025m wide. Finally, what looks like either a thick felt-like material or decayed cardboard was nailed to the beaded frame over the mesh [2/981; 3/278] (see plate 27). Similar paired vents are visible in the central and west rooms.
- 3.45 The west face of the pier to the south wall of the east room (Elevation B) [2/978] and the west face of the corresponding pier to the north wall (Elevation D) [2/973] may preserve evidence for the former presence of fixtures, but the form is not wholly clear. A wall-mounted switch was placed just above the neutral painted strip to the west of the doorway in the north wall (Elevation D); the (wooden?) base on which the switch was mounted was c.0.07m square with rounded corners, and was held in place by two screws. The 'triangular wooden blocks' to the north and south walls noted in June 2000 still survive (see plate 25), as do the other examples to the north and south walls of the central and west rooms. With one exception, these features are all of similar form. They occur only on the north and south walls of each room. The base of each is set 2.50m above the existing internal floor level, and they are all 0.27m high, meeting but not passing through the ceiling. The side facing into the room slopes out from the wall as it rises, so that the features are 0.14m wide where they meet the ceiling. They all appear to

be of hollow construction, the three sides formed by pieces of softwood nailed together; it is unclear how they are attached to the wall or ceiling, although the pattern of nails to the sloping side suggests that they may conceal wall-mounted timbers [3/274, 3/275]. The exception to this general form is the example at the east end of the north wall of the east room (Elevation D). This has two additional pieces of timber nailed to the wall to either side and to the underside of the sloping face; in addition, the top does not quite meet the ceiling, there being a narrow gap between the two [3/276, 3/277].

- 3.46 On the west wall of the east room (Elevation E) [2/980], two rows of cable holders were shown by Kenyon in January 1998, mounted on the wall directly above the floor channel previously described. At the time of the EDAS survey, only the lower row survived. This comprises three two-part Bakelite cable holders [2/984; 3/291, 3/292], of which only the lower parts still survived (see plate 28). Two of the cable holders measure 0.06m long and stand 0.025m proud of the wall, but the third is slightly smaller at 0.05m in length; all three are secured to the wall using a single central mounting screw. There are two screws or nails in the wall to the south of the cable holders, in addition to those shown by Kenyon, and also three dowels set flush with the wall in a triangular arrangement above the neutral paint strip. There are more small holes around the high-level T-shaped opening in the wall than were marked in 1998, forming a rectangular arrangement that perhaps once secured some kind of cover. There is a narrow strip of staining on the wall in line with the base of the opening.
- 3.47 The ceiling of the east room also preserves a number of fittings relating to the former operation of the radar. Principal amongst these are two north-south lines of three bolts which project down from the ceiling, each of the six bolts retaining a square nut. They are placed over the west side of the room, just to the south of the T-shaped opening in the west wall [2/983]. To their north, but not placed centrally in relation to the two bolt lines, there is a 0.15m diameter ceramic pipe which passes through the full thickness of the roof slab, and projects above it, as described above [2/975]. The pipe is however placed centrally to the T-shaped opening, although 0.65m to the east of it. To the immediate east of the east bolt line, there is a small diameter circular recess in the ceiling, and to the north the shadow of small fitting held in place by two screws, most likely a former ceiling light. Within the T-shaped opening itself, there is a second ceramic pipe placed centrally above and again passing through the roof; it is fitted with the metal housing visible from the roof and described above. The base of the pipe is surrounded by a sub-square area of smoothed concrete with a projecting bolt at each corner.
- 3.48 The east and central rooms of the building were once separated by a sliding door fitted across the west side of the opening between them. The door itself has been removed, but the fittings which once secured the upper runner or track can still be seen over the doorway in the east wall of the central room (Elevation F) [2/982] (see plate 29). The door came to rest against a trapezoidal wooden block mounted on the north wall [3/284].
- 3.49 In addition to the features recorded by Kenyon in 1998, the EDAS survey noted a square arrangement of screws or nails to the immediate north of the high-level T-shaped opening, and two further examples to the immediate south. Towards the south end of the wall, above the neutral paint strip, there is a rectangular shadow left by a removed fitting, measuring 0.60m in height by 0.43m in width [3/294]. Below the neutral strip, at 0.92m above the existing internal floor level, there is a thin line of blue-grey paint at the approximate height one might expect for a desk or

table; this runs the full length of the wall beyond the doorway. Of the two rows of Bakelite cable holders marked by Kenyon at the south end of the wall over the floor channel, only a single example from the upper row survives [3/293].

- 3.50 The aforementioned line of blue-grey paint is visible at the same height on the north wall (Elevation D) of the central room, running as far as the west side of the central pier [2/991, 2/992]. There may once have been further fittings attached to the east and west faces of the pier, and there were once wall-mounted switches, of the same form as that described above, to the extreme east and west ends of the wall. That to the east has the faint impression of a cable run rising vertically above it, while that to the west has a single surviving two-part Bakelite cable holder over it [3/295, 3/296]. On the south wall of the central room (Elevation B) [2/985, 2/986], the impression left by another wall-mounted switch can be seen on the north face of the central pier, with the former positions of two cable holders visible above. To the east, at a low level, four screws in a sub-square arrangement mark the position of a former fitting. On the west wall (Elevation G) [2/989, 2/990], at the west end just above the neutral paint strip, a piece of softwood with chamfered edges, measuring 0.455m in length by 0.12m in depth, is fixed to the wall using two screws [3/285]. There are a row of ten small holes to the upper part of the face, one of which retains a small curved hook upon which to hang a key/keys. The two southernmost hook positions have very small and faint pencil marks over them, and there are pencilled arrows to both the top and bottom of the wood. However, only the fifth hook position from the north end has anything clearly decipherable associated with it; beneath, the upper case letters 'GATF' are written in blue pencil with two pencilled arrows pointing upwards. There are four dowels set flush with the wall beneath the former key rack, while a rectangular arrangement of four screws at a low level denotes the position of a former fixture.
- 3.51 As over the east room, the ceiling of the central room also preserves a number of fittings relating to the former operation of the radar. Approximately 1.10m to the west of the T-shaped opening in the east wall, and directly in line with the opening, there is a rectangular arrangement of four bolts projecting from the ceiling [2/987, 2/988] (see plate 29).
- 3.52 As with the east and central rooms, the central and west rooms were once separated by a sliding door fitted across the west side of the opening between them. The door itself has been removed, but the fittings which once secured the upper runner or track can still be seen over the opening in the east wall of the west room (Elevation H) [2/997, 2/998], while the lower metal runner also remains *in situ* [2/999, 2/001]. The door came to rest against a trapezoidal wooden block mounted on the north wall. Towards the south end of the wall, a piece of softwood, measuring 0.30m in length by 0.125m in depth, is fixed to the wall using two screws [3/286]. There may be three or four circular marks on the face, arranged to form a square, but they are very faint and this is not certain. There are four dowels set flush with the wall to the north of the piece of wood, very similar to those visible beneath the key rack in the central room. Below the neutral paint strip, there are two pieces of wood, 0.025m square, set one above the other and slightly recessed into the wall face; each contains a small circular central hole.
- 3.53 On the north wall of the west room (Elevation D) [2/993], in addition to the features recorded by Kenyon in 1998, there are two small vertically aligned holes below the latch for the east blast shutter leaf. On the south wall (Elevation B) [2/996], four small holes are placed at the corners of the shadow of a former fitting placed below the neutral paint strip. On the west wall (Elevation C) [2/994, 2/995], to the north of the doorway, there are four screws set in a rectangular arrangement, of a similar

size and at a similar height to the arrangement near the base of Elevation G in the central room. To the south of the doorway (D2), in addition to the four projecting threaded bolts above the neutral paint strip, there is evidence for a rectangular fitting placed at a low level close to the floor.

- 3.54 As noted above (para 1.21), a composite drawing was created using the best preserved examples of the different furniture from different windows, in addition to drawing on the information previously recorded in 2000. The blast shutters from window W4 on the south side of the east room were recorded, the wooden shutters from window W7 on the north side of the west room, and the external metal frame from window W4 (see figure 11). Typical blast shutters and wooden shutters are also illustrated in plates 25 and 26. The overall form of the windows is designed both to provide blast protection but also to allow ventilation without light leakage during blackout through the use of plywood covers nailed to the folding shutters [2/977, 2/979; 3/281, 3/282].
- 3.55 The clearance of this building in late January 2012 revealed the full extent of the channels or, more properly, cable ducts in the floor, allowing the description given prior to clearance (see para 3.42 above) to be amended (see figure 10). As previously described, there is an east-west aligned channel running almost the full length of the building close to the south wall, measuring between 0.15m-0.30m wide and 0.12m deep. This channel exits under the west wall of the building [4/596], and also passes under the two internal dividing walls. In places (for example, in the west room), this channel was rather crudely cut, although some of this may result from the post-abandonment stripping out of fixtures and fittings [4/595]. Within the central room, the channel was evidently constructed to a slightly greater width originally. The opening where the channel ran under the west dividing wall had a shallow arched top [4/587, 4/592] (see plate 30) whereas the opening under the east dividing wall was square [4/594]; this channel appears to link with an inspection chamber located off the south-west corner of the building, which might in turn provide a cable run to Building R5 (see below). There were a total of four further channels running north at right angles from the north side of the main channel for up to 2.60m, one in the east room and three in the centre room; in the latter, two channels lay towards the west end and one towards the east end [4/591, 4/598]. These channels were generally better constructed, and measured 0.100m wide and 0.125m deep with a concrete base (see plate 30); the eastern channel in the central room was slightly wider, 0.15m wide, and had a shallow scar leaving the north end to run as far as the north wall of the room. The channel within the east room widened slightly at its north end. Again, as noted above, the east-west aligned softwood battens, which were present in all three rooms and set very slightly proud of the concrete floor, stopped just short of these channels, indicating that they were presumably formerly covered with a board which could be lifted for maintenance and access [4/589, 4/590]. In addition, within the central room, at least one narrower channel left the south side of the main east-west channel to run as far as the south wall, just to the east of the wall pier. There were a further two shallow scars (one to the east and one to the west) on the south side of the main east-west channel; the battens break to allow the west scar through, while the east scar runs only as far as the southernmost batten. Finally, in the central room, there were two scars running north-south across the full width of the room, in line with the edges of the piers [4/593], and the full extent of the *in situ* runner for the sliding door between the central and west rooms was revealed [4/597]. The same system of cable ducts as described above, although slightly different in design, was noted in the Tx/Rx building at Craster (Hunt & Ainsworth 2006, 18).



- 3.56 As with the other cleared out buildings, wooden doors (presumably not from this building) and other metal ephemera had been collected and placed outside the building. Included in this material was another iron plate which presumably covered the drain at the west door, which implies that concrete drain runs around the full extent of the building [4/586, 4/600].

#### *Building R5*

- 3.57 A small brick structure adjacent to the south-east drystone wall forming the southern boundary of the complex might have been associated with the mains power supply. Surprisingly, this building was not recorded by the previous surveys (Newman & Kenyon 2000).
- 3.58 This structure is c.1.66m square [2/949] and is built of light red machine-moulded bricks (average dimensions 0.225m by 0.10m by 0.07m) laid in stretcher bond and set with a lime mortar (see plate 31). The flat roof of the structure is formed by a concrete slab, 0.07m thick, which projects slightly beyond the wall face below on the south side. The external walls are largely featureless. There is a small vent at the top of the west wall, retaining the remains of a metal grille, and a second such feature at the top of the east wall. An 0.82m wide opening in the south-west wall [2/950] was formerly fitted with a timber lintel and jambs, almost certainly supporting a door. The interior of the structure [2/951] was choked with rubble and pieces of timber at the time of the survey. The walls are of bare brickwork, with four screws to the west wall formerly holding a rectangular fitting in place. A 0.08m diameter ceramic pipe rises vertically from the north-east side of the earth floor. This pipe appears to contain a cable, wrapped in cloth, that has been cut off and sealed shortly after it emerges from the pipe. Although two of the buildings within the radar group (Building R3 and the coastguard tower) either preserve or did preserve evidence for telephone connections, the current survey has not been able to identify how the compound was connected to the wider telephone network.

#### **The Coastguard Tower**

- 3.59 The coastguard tower lies some 30m north-east of the radar group, at an elevation of 157m AOD, very close to the cliff edge. It has a sub-rectangular plan form, with maximum external dimensions (including attached structures) of 3.70m north-south by 4.10m east-west (see plate 32). It is of two storeys, although the ground floor spaces are rather limited in extent. The concrete roof appears flat from a distance, but is in fact very shallowly pitched; the pitch is uneven, the north slope being slightly wider than the south slope. The roof projects slightly over all sides of the building, slightly more so to the east than in the other directions, and has a drip channel to the underside. A short structure emerges from the roof ridge, which relates to features surviving internally (see below).
- 3.60 Circulation through the building is based around a flight of internal steps rising from the north-west corner of the ground floor. The watchtower has load-bearing external walls built primarily of machine-moulded light red/orange bricks (average dimensions 220mm by 105mm by 70mm) laid in stretcher bond externally and Flemish bond internally, and set with a cement mortar. Extensive internal use of concrete is made to the steps and floors, with some timber also to the first floor. A plaque on the north side of the building notes that the structure was renovated in 1999 by the North Yorkshire and Cleveland Heritage Coast Project.

### *External Elevations*

- 3.61 The principal elevation of the building, as might be expected, faces east out to sea [1/838]. The lower part of the east elevation is largely blank, the brickwork interrupted only by a small vent fitted with a ceramic grille towards the base. Above, the first floor viewing opening has a slightly projecting concrete sill, again provided with a drip channel to the underside [e.g. 1/833]. The viewing opening itself is now infilled with a timber and plywood construction, incorporating a slot through which a wide expanse of sea is visible [1/824]. The timber and plywood construction is not all original and appears to date partly from renovations undertaken in 1999. A photograph taken prior to the 1999 works (Harwood & McMillan 2008, 191) shows only the outer part of the existing timber frame to be present, together with the timber posts at the north-east and south-east corners, which have metal sheathing to their exteriors. The east and south viewing openings appear to have been further sub-divided into two halves of equal size by a narrow upright timber, and the whole covered by a wire mesh which appears to be of post WW2 vintage.
- 3.62 The south elevation [1/837] is divided into two parts. The lower half of the larger, eastern, part is again largely blank, the brickwork interrupted only by a small vent fitted with a ceramic grille towards the base. The viewing opening is of the same form as described above for the east elevation. The narrower, western, part of the south elevation [1/841] is recessed from the eastern part, and the brickwork is rendered. A flight of three concrete steps, flanked by low rendered brick walls, leads down to a recess at the base of the western part of the south elevation. At the base of the steps, there is a circular iron drain cover set into a sub-square area of concrete [1/843]; the surface of this concrete is lower than both the bottom step and the concrete floor of the recess. The recess itself [1/842] is rectangular in plan, measuring a maximum of 1.61m north-south by 0.88m east-west, but rather low, barely 1.20m in height. At the south-east corner of the concrete floor, there is a small rectangular cut-out to house the base of a vertical timber, and therefore it appears that the recess was provided with a door.
- 3.63 The west elevation [1/840] is wholly rendered and also largely blank, although there is a square vent fitted with a ceramic grille towards south bottom corner, serving the small recess described above. At the top of the elevation, a telephone cable mount has survived, and it is assumed that this was once connected with the similar mount that formerly existed on Building R3. The north end of the elevation is butted by the screen wall for the internal steps. This screen wall is L-shaped in plan, and is carried across the west end of the north elevation.
- 3.64 Like the south elevation, the north elevation is divided into two parts [1/836]. The recessed west part contains the opening to the internal steps, and the east part the viewing opening, which is constructed in the same manner as those in the east and south elevations. Beneath the viewing opening, there is a second, much smaller opening, which provides the only access to the low, enclosed ground floor space to the east of the internal steps. The opening retains a frame, partly restored during the 1999 works. The older part of the frame, which comprises jambs and lintel only, is recessed 0.07m from the external wall face. The jambs run parallel for 0.07m and then have rounded profiles to the inside edges. The internal rebate preserves evidence for a pair of small doors, each leaf hung on two hinges, and possibly closed with a fastening on the west side. The inside edges of the frame retain traces of dark green and drab green paint. Beyond the frame, the top, bottom and sides of the opening are rendered.

## *Interior*

- 3.65 At the time of the EDAS survey, the only access to the low, enclosed ground floor space (described as a minewatch facility (Harwood & McMillan 2008, 191)) to the east of the internal steps was through the small window-like opening in the north elevation. The space was filled with beer cans, old blankets and other debris associated with rough sleeping, and so for Health and Safety reasons it was not inspected in detail. All interior walls are of bare brickwork. The north wall has three vertically aligned scars to the west of the opening, where a fixture has been pulled off the wall, and a short copper strip positioned to the east. The east wall has a set of three vertically aligned scars to the upper half, while in the south wall, a small vent has a metal cover and a rather large concrete still beneath [1/839]. This seems far too large for the vent, and might once have acted as either the lintel or sill of a larger opening, subsequently blocked but for which no real evidence remains. There appears to be another piece of concrete at the upper west end of the south wall, which is otherwise blank.
- 3.66 Access to the first floor was via the internal steps on the north side of the building. The opening in the north elevation leading to the steps was protected by the L-shaped screen wall here, which bears a metal plaque giving a brief account of the building's history and the 1999 conservation works [1/834, 1/835]. The steps are of concrete construction throughout, with five steps rising to a small landing. Those ascending the steps then turned through 90 degrees to the east, where a single step leads up to the doorway to the first floor. The side walls of the step passage are of whitewashed brickwork [1/832]. At the base of the passage, there are small horizontal pieces of timber set into the east and west walls at 0.48m, 1.35m and 2.02m above the top of the lowest step. At approximately the same height as the uppermost timber, there is a triangular 'nick' out of the whitewash to either side. Taken together, these features suggest that the base of the passage was once fitted with a door frame and door, rising to c.2m above the level of the top of the lower step. Above this, any remaining gap to the ceiling of the passage was presumably infilled with a timber panel. At the head of the passage, over the landing, two threaded bolts project from the south wall at a high level.
- 3.67 The first floor of the building is 2.14m square in plan, with a floor to ceiling height of 2.21m; an inserted plywood floor conceals what is assumed to be an original concrete floor. The doorway in the west wall retains its framing [1/828]. The frame is recessed 0.23m from the east wall face of the step passage. However, at 0.21m back from the same point, a slightly raised render strip rises up the brickwork of either side of the doorway opening. On the south side, between 0.75m to 0.92m above floor level, there is a gap in the render where a fixture has been removed, and some minor damage to the adjacent brickwork. The door frame is 0.095m deep by 0.075m thick, rounded to the passage and rebated to the building's first floor. The door opened inwards and was hung on two hinges on the north side. There are lets, measuring 0.09m by 0.035m, placed at centres of 0.20m and 1.6m above the internal floor level; these housed hinge plates held in place by three screws. The inner face of the frame is recessed 0.02m from the west wall face of the first floor, and has a metal housing for a mortice/latch attached to the south side secured by two screws. A second frame, comprising jambs and lintel, is nailed to the inner face of the door frame. The frame is made from timber measuring 0.025m wide by 0.02m thick, with a single nail projecting from the north side approximately halfway up the jamb. The doorway has a concrete lintel; at the north end of the inner face, there is a single nail and a small diameter wooden dowel set into it.

- 3.68 Both the door frame and the second frame retain traces of several different paint schemes. The most recent is white, possibly the same whitewash seen on the internal walls of the first floor and the sides of the step passage. On the passage side of the door frame, beneath the white paint, there is a dark green paint which has flaked off to reveal a drab green. The same drab green can be seen to the inner face of the door frame and the second frame, but in the narrow gap between the second frame and the doorway sides, there is a drab bluish-green to the brickwork. In the same gap, around the top of the second frame, a short section of cable remains *in situ*. It comprises two wires, twisted together, possibly with a cloth covering.
- 3.69 Turning to the first floor room itself, on the west wall to the south of the doorway, there are three vertically aligned nails set 0.07m in from the corner of the room, placed at 0.45m, 1.64m and 2.01m above the internal floor level. To the north of the doorway, there are two small pieces of timber set into the joints between the brickwork, one horizontal and one vertical, forming an approximate right-angle centred at 1.45m above the internal floor level. Above these, there is a single nail, and at 1.80m above internal floor level, a second horizontal timber set into the brickwork. There is a vertical line in the whitewash of the brickwork between these two features, and a possible horizontal line at 1.92m above floor level. Together, these features may define a former rectangular fixture, measuring 0.60m long by 0.42m high [1/829, 1/830]. Between this and the corner of the room, there are three vertically aligned nails set 0.50m in from the corner, placed at 0.10m, 0.80m and 1.32m above the floor level. Approximately 0.10m in from the corner, there is a vertical timber with two nails set into a joint in the brickwork, centred at 1.45m above floor level.
- 3.70 In the north wall [1/825], to the west of the concrete-framed viewing opening, there are two nails, set 1.48m above floor level and 0.045m apart. At the base of the brickwork course below these two nails, there are two small holes set 0.15m apart, and there is also some staining to the brickwork above the nails, some of which is caused by the remains of further nails set into the wall. At 0.38m in from the corner, there are two decayed bolts projecting from the wall, set within cement and placed at 0.30m and 0.33m above the floor level. The west side of the concrete frame of the viewing opening is chamfered, while the top of the concrete sill is set at 0.94m above floor level. Within the sill, there is a recess set slightly to the east of centre. The base of the recess is placed at 0.54m above floor level; it is 0.40m wide, 0.42m high and 0.14m deep. The outer edges of the jambs are rounded, as is the top of the rear side. A nail projects from the brickwork of the wall below the recess. There is a very similar recess towards the south end of the east wall [1/826]. At the base of the concrete sill of the viewing opening in the east wall, there are several small circular holes, unevenly spaced and some bearing traces of rust/iron staining. In the south wall [1/827], the viewing opening is structured as in the north wall, with a recess in the same place. To the west of the opening, there are groups of nails placed at 1m, 1.25m and 2.07m above floor level. The lower group includes some nails with pyramidal heads, rather than the more common flat circular heads.
- 3.71 In the centre of the ceiling over the first floor, there is 0.18m square vent or opening [1/831]. The opening was surrounded or covered by a 0.39m square fixture, with wooden dowels placed towards the outer corners. The opening rises vertically for 0.33m and is then blocked, but was presumably once continuous with the squat structure visible externally rising from the roof ridge. There is also a 0.13m band around the north, south and east edges of the ceiling which is set slightly lower than the main body of the ceiling itself. The band corresponds to the

concrete-framed viewing openings in the north, east and south walls, and presumably relates to whatever filled this prior to the insertion of the existing modern wooden structures.

### **The 'Accommodation' Group of Buildings**

- 3.72 The second, and largest, group of buildings lies in the north-west corner of the survey area. The group is represented by a series of concrete and brick platforms, building foundations and associated structures, together with limited associated earthworks, some of which may be contemporary with the platforms and building foundations. The August 1946 aerial photograph shows that all the buildings had been demolished by this date, with the exception of one (the southern half of Building A11) (see figure 6).
- 3.73 The group of buildings occupies an L-shaped area of ground, the western 'arm' measuring a maximum of 70m long (north-west/south-east) by 20m wide (north-east/south-west), and running parallel to the raised track bed of the former railway line to the immediate south-west (see figure 12). The northern 'arm' measures a maximum of 95m north-east/south-west by 30m north-west/south-east, although part of the central area, including previously recorded structures, is now obscured by a thick spread of gorse. Within the western arm, the ground surface slopes down from south-west to north-east from c.178m AOD to 176.40m AOD; within the northern arm, in the same direction, the slope is from c.178m AOD to 173m AOD. The buildings within the western 'arm' (Buildings A1 to A5) have a north-north-west/south-south-east alignment, whereas those in the northern arm (Buildings A6 to A13) are aligned north-west/south-east. However, for descriptive purposes only, all buildings are considered to be aligned either north-south or east-west.

### *Earthworks*

- 3.74 The surviving earthworks suggest that some levelling activity was undertaken to create shallow artificial terraces on which to place the buildings of both arms of the group, and that there were defined boundaries around the buildings. Of these, perhaps the most prominent is the intermittent scarp which defines the east (downslope) side of both arms of the group. This scarp first becomes visible some 7m to the north-east of Building A13, as a spread, north-east facing earthwork, 4m wide and 0.40m high, aligned north-west/south-east. It runs 13m south-east from the drystone wall that defines the north boundary of the survey area, and then angles sharply to the south-west, where it pursues a straight course for c.32m, becoming narrower but steeper as it does so ('h' on figure 7). It eventually fades out altogether, but becomes visible again 12m to the north-east of Building A11, initially as a rather spread feature. However, to the immediate north-east of the building, the scarp becomes better defined, measuring 1.0m wide and standing up to 0.50m high. It passes very close to the eastern corner of Building A11 before turning almost through a right angle to continue south-west for 35m. As before, it pursues a very straight course, parallel to the narrower end walls of the buildings to the north-west, averaging 2m wide and 0.50m high. At its south-west end, it again becomes more spread and begins to fade, almost certainly as the result of the movement of either stock or vehicles, as to the immediate east there is a slightly raised curvilinear mound in line with a funnel-shaped hollow leading to an existing gateway. The main scarp was almost certainly once continuous with a very similar feature on the south-east side of the break caused by subsequent stock or vehicle movement. This latter scarp, averaging 2m wide by 0.50m high, follows a north-south line parallel to Buildings A2 and A3 for over 38m ('i' on figure 7). It then

begins to curve gently towards the south-west just beyond Building A2, and can be traced for a further 25m beyond the south-west end of Building A1.

- 3.75 There are two further scarps/banks on the south-east sides of Buildings A1 to A4; these have the same general alignment as the buildings themselves, diverging slightly from the route followed by the former railway track bed. The first, a spread bank, is first visible off the south-west corner of Building A5. This bank has a total width of 2.50m; the north-east facing scarp stands up to 0.30m in height, but the south-west scarp is very faint, less than 0.20m in height. The north-east scarp, reaching a maximum width of 2.0m and a height of 0.40m, begins to fade out close to the spread of gorse between Buildings A1 and A2, although it appears to run towards the north-west corner of Building A1. It has a poorly-defined sub-rectangular platform on its north-east side, measuring c.4.50m long by 2.50m wide, but barely 0.30m high. The second linear earthwork, a spread, north-east facing scarp, runs parallel to the bank described above but on a line 10m further to the west. It has a maximum width of 3.0m and a maximum height of 0.30m. Between them, these banks create a slight terrace c.15m wide ('b' on figure 7), already referred to as a possible road or track.
- 3.76 To the north-west of Building A5, there is a cluster of minor earthworks, all set to the west of a north-east facing scarp created by the movement of stock/vehicles through the adjacent gateway in the fence forming the northern boundary of the survey area. A rectangular, concrete rendered brick trough with metal supply pipe [2/909] is set within a shallow sub-oval depression; the age of the trough is uncertain, but it might have provided an outdoor washing area for the accommodation group of buildings; the NYCDSG suggest it is water tank (Harwood & McMillan 2008, 189). There is a second sub-square depression to the west ('g' on figure 7), which is surrounded by a low bank, most prominent to the south-west, up to 0.30m in height. There is also a low mound to the immediate north, and to the west, a low bank c.19m in length, running parallel to the former track bed of the railway line.
- 3.77 Finally, the area between Buildings A5 and A8 ('j' on figure 7) appears to have been slightly terraced and flattened, perhaps to create a storage or vehicle parking area.

#### *Buildings A1 to A3*

- 3.78 In 2000, these buildings were described by Newman and Kenyon (2000, 22-23) (see Appendix 1).
- 3.79 The southernmost building (Building A1) of the three measures a maximum of 11.05m long by 4.95m wide externally; the extent of the visible remains is broadly the same as shown by Kenyon in May 1998. The foundations of the building are of concrete and stand to a maximum height of 0.68m at the south-east corner [2/923, 2/924]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. The foundations have an average width of 0.25m. On the south side of the foundations, four threaded bolts once projected from the upper surface of the concrete, set at c.1.50m centres, but they have subsequently been bent over; the bolts measure 0.08m in length and 5mm in diameter. The same type of threaded bolts are visible to the east side of the structure, but set at c.2.00m centres, and it likely that the bolts were also once present to the west and north sides. Adjacent to the centre of the south wall, there is a flight of three concrete steps, cast as a single block, and butting the wall itself [2/921]. The interior of the building is grassed, and slightly

raised above the level of the top surface of the concrete foundations. Within the interior, there are two low sub-rectangular spreads of angular sandstone rubble, now largely grassed over. These are likely to have been dumped here after the upper part of the building had been demolished, rather than resulting from the demolition of the building itself or being indicative of any former internal structures.

3.80 The central building (Building A2) measures a maximum of 12.80m long (including the structures at either end) by 5.0m wide externally. The extent of the visible remains is less than that shown by Kenyon in May 1998; most of the south-west corner is now obscured by a spread of gorse and some grass, while the west side is also less well defined than in 1998. The foundations of the building are of concrete and stand to a maximum height of 0.70m at the south-east corner [2/920]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. There is a substantial crack in the concrete near the south-east corner. The foundations have an average width of 0.23m, and retain the same pattern of threaded bolts as described above for Building A1. Adjacent to the centre of the south wall, there is a flight of three concrete steps, cast as a single block, and butting the wall itself. On the outside of centre of the north wall, there is a partially visible, sub-rectangular concrete slab. The interior of the building is grassed, and slightly raised above the level of the top surface of the concrete foundations. Within the interior, there are four linear sub-rectangular spreads of angular sandstone rubble, now largely grassed over, running roughly parallel to the walls of the building. This material is likely to have been dumped here after the upper part of the building had been demolished, rather than resulting from the demolition of the building itself or being indicative of any former internal structures.

3.81 Building A3 measures a maximum of 12.80m long (including the structures at either end) by 4.80m wide externally. The foundations are of concrete and stand to a maximum height of 0.60m at the south-east corner [2/918]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface (see plate 33). The foundations have an average width of 0.23m, and retain the same pattern of threaded bolts as already noted at Buildings A1 and A2. Adjacent to the centre of the south wall, there is a flight of three concrete steps, cast as a single block, and butting the wall itself [2/919]. On the outside of the centre of the north wall, there is a partially visible, sub-rectangular concrete slab. The interior of the building is grassed, and slightly raised above the level of the top surface of the concrete foundations.

#### *Building A4*

3.82 In 2000, this building was described by Newman and Kenyon (2000, 23) (see Appendix 1).

3.83 The building measures at least 11.05m long (including the structure at the south end) by a maximum of 5m wide externally. The extent of the visible remains is less than that shown by Kenyon in May 1998; the north end of the west side can no longer be seen, nor can the whole of the north side as shown in 1998. The foundations of the building are of concrete and stand to a maximum height of 0.45m at the south-east corner [2/916]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. The foundations have an average width of 0.23m, and retain the same pattern of threaded bolts as already noted for Buildings A1 to A3.

- 3.84 Adjacent to the centre of the south wall, there is a flight of steps [2/917], of differing construction and form to those surviving at Buildings A1 to A3. Rather than rising directly towards the building as in the latter structures, a pair of concrete steps cast as a single block rise parallel to the wall. Those ascending the steps then reached a small level area, measuring 1.22m by 1.04m, where they would have turned to the left through 90 degrees to enter a doorway. The level area is formed by a single 0.12m deep concrete slab, with small sub-square cut-outs at the north-west, north-east and south-west corners. The slab itself lies on a solid brickwork foundation, comprising four visible courses of machine-moulded orange bricks (average dimensions 0.23m by 0.115m by 0.07m) set with a lime mortar. The sides of the steps and level area butt the south wall of the building.
- 3.85 The interior of the building is grassed, and slightly raised above the level of the top surface of the concrete foundations. Within the interior, there is a slight, angular north facing scarp, set to the south of the north end of the building as shown in 1998. This probably results from post-demolition disturbance. The concrete paving at the north-west end of the building, running between it and Building A5 to the north-west is still visible, but rather overgrown [2/914]. It may originally have comprised at least four slabs, but with a larger area of broken concrete to the south-west.

#### *Building A5*

- 3.86 In 2000, this building was described by Newman and Kenyon (2000, 23) (see Appendix 1).
- 3.87 The long axis of this building is set at right angles to Building A4 to the south, and measures at least 9.80m long by a maximum of 3.30m wide. The extent of the visible remains of the building is the same as shown by Kenyon in May 1998, but the surrounding concrete paving is less; in addition, the remains of the stone wall running to the north noted in 1998 are no longer visible.
- 3.88 The foundations of the building are of concrete and stand to a maximum height of 0.30m at the east end [2/913] (see plate 34); unlike Buildings A1 to A4, where the foundations are slightly terraced into the sloping ground surface, those of Building A5 stand proud of the ground surface. The foundations have an average width of 0.15m, and retain a few threaded bolts, of slightly larger dimensions than those present in Buildings A1 to A4; the upper surface of the foundations is much more damaged than in Buildings A1 to A4, suggesting that the superstructure of the building was attached in a different way, causing a greater degree of damage when it was removed. An c.1.80m wide gap in the centre of the south wall may represent an original opening, as it is placed roughly opposite the former north wall of Building A4 to the south, although there is also another, narrower, gap at the south-east corner. The interior [2/911] of the building is grassed, and set slightly below the level of the top surface of the concrete foundations. The internal concrete surfaces referred to in 1998 are no longer clearly visible. The juxtaposition of Building A5 with Building A4 is interesting, and it may have been a wash house or ablutions block.

#### *Building A6*

- 3.89 In 2000, this building was described by Newman and Kenyon (2000, 23) (see Appendix 1).



- 3.90 Externally, the building measures 5.35m long by 4.97m wide. The extent of the visible remains is slightly less than that shown by Kenyon in May 1998, the square piece of concrete paving no longer being visible. The foundations comprise concrete walls, standing to a maximum height of 0.50m at the south-east corner [2/930]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. The foundations have an average width of 0.23m and retain the same pattern of threaded bolts as noted in Buildings A1 to A4. There appears to be a narrow step running the full length of the base of the east side. The interior of the building is grassed, and slightly raised above the level of the top surface of the concrete foundations.

*Building A7*

- 3.91 In 2000, this building was described by Newman and Kenyon (2000, 23) (see Appendix 1).
- 3.92 The building measures 5.70m long by 5.10m wide externally. The extent of the visible remains is slightly less than that shown by Kenyon in May 1998, principally as a result of a conical heap of rubble [2/925], 3.50m in diameter and 1m high, having been dumped over the north-west part. The heap largely comprises angular sandstone rubble, some pieces being over 0.50m across, but also includes cement powder which has set solid inside a bag and then been tipped out.
- 3.93 The foundations of this building are in two distinct parts. The lower part comprises concrete walls, standing to a maximum height of 0.30m at the south-east corner [2/926]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. At the south-east corner, the top surface of the concrete wall incorporates a small rectangular socket or recess, measuring 0.10m by 0.05m [2/929]. The upper part of the foundation comprises a 0.15m thick concrete slab, broken into several pieces (see plate 35). In the approximate centre of the east side, there is a shallow inset, perhaps just the result of decay, although it could mark a former doorway. There are also threaded bolts at either end of the east side, set into cement-filled recesses in the upper surface of the slab, with the faint impression of a 0.15m wide base visible running between them [2/927]. The majority of the south side of the slab is recessed 0.11m from the face of the concrete wall below, with the upper edge of this recessed area perhaps being very slightly chamfered. No interior features were visible at the time of the survey.
- 3.94 In 1998, Kenyon marked a "Hole covered by two concrete slabs" and a "Brick lined and rubble filled hole" to the south of Building A7. The latter can still be located, but the former is no longer clearly visible.

*Building A8*

- 3.95 In 2000, this building was described by Newman and Kenyon (2000, 23) (see Appendix 1).
- 3.96 The building measures at least 6.30m long by a maximum of 2.80m wide externally. The extent of the visible remains is broadly the same as that shown by Kenyon in May 1998. The foundations are of concrete and stand to a maximum height of 0.40m at the south-east corner [2/931]; unlike Buildings A1 to A4, where the foundations are slightly terraced into the sloping ground surface, those of Building A8 (like Building A5) stand proud of the ground surface (see plate 36). The foundations have an average width of 0.15m. On the south and east sides of

the foundations, there are a small number of threaded bolts, again, like those of Building A5, slightly larger than those noted at the other building foundations within the complex. The small square hole and clay pipe described in 1998 at the north end are no longer clearly visible, although the position of the former is marked by a grassed sub-square depression. The interior of the building is grassed, and set slightly below the level of the top surface of the concrete foundations.

#### *Building A9*

- 3.97 In 2000, this building was briefly described by Newman and Kenyon (2000, 23) (see Appendix 1).
- 3.98 The building is set on the same alignment as those adjacent, and the extent of the visible remains is the same as that shown by Kenyon in May 1998 - her survey drawing is labelled "remains of two limestone walls". The western length of walling measures externally at least 4.00m long by c.0.40m wide [2/932]. It appears to be built wholly of angular sandstone rubble. The eastern length of walling measures at least 3.40m long by 0.40m wide, the east side taking the form of a low grassed scarp. It appears to be built wholly of concrete. The two are separated by a 0.50m deep linear depression, running between them.

#### *Building A10*

- 3.99 In 2000, Building A10 was described briefly by Newman and Kenyon (2000, 23) (see Appendix 1).
- 3.100 Externally, the building measures a maximum of 12.40m long (including the structure at the south end) by a maximum of 4.80m wide. The extent of the visible remains is the same as that shown by Kenyon in May 1998. The foundations are of concrete and stand to a maximum height of 0.75m at the south-east corner [2/933]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. The foundations have an average width of 0.24m. Threaded bolts survive to the east side only. Adjacent to the centre of the south wall, there is a flight of steps [2/934], most likely once of similar construction to those surviving at Building A4. Rather than rising directly towards the building, a pair of concrete steps cast as a single block rise parallel to the wall. Those ascending the steps would then have reached a small level area, capped by a concrete slab such as survives at Building A4, where they would have turned to the left to enter a doorway; the level area has been removed. The interior of the building is grassed, and slightly raised above the level of the top surface of the concrete foundations. Within the interior, there is a slight, sub-oval mound toward the south end; this probably results from post-demolition disturbance and dumping.

#### *Building A11*

- 3.101 In 2000, Building 11 was described by Newman and Kenyon (2000, 23-24) (see Appendix 1).
- 3.102 The building measures a total of 14.60m long (including the structure at the south-east end) by a maximum of 6.20m wide. The extent of the visible remains is slightly less than that shown by Kenyon in May 1998, particularly at the north-west corner.

- 3.103 The smaller northern part (the smaller room as described in 2000) measures externally a maximum of 4.60m long by 4.0m wide. The foundations are of concrete and stand to a maximum height of 0.45m at the south-east corner; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. The foundations have an average width of 0.20m. There is a 1.0m wide doorway set to the south of centre in the east wall. To the immediate north, the possible drains covered by concrete slabs are still visible, although the visible part has been reduced since 1998 due to vegetation growth. The interior of the building is grassed, and slightly raised above the level of the top surface of the concrete foundations.
- 3.104 The larger southern part (the larger room as described in 2000) measures externally a maximum of 8.00m long by 5.80m wide. The foundations are of varying construction, and stand to a maximum height of 0.90m at the north-east corner [2/943]; the greater height here is accounted for by the building being slightly terraced into the shallow natural slope of the ground surface. The north wall is solely of concrete construction, and rises vertically to a slight projecting lip, above which it rises vertically again before assuming a sloping profile [2/942]. The slope rises to meet the remnants of a line of jagged corrugated asbestos which runs along the east and west walls (see plates 39 and 40). This material shows that the building was originally a Turners curved asbestos hut, similar to Building R3 in the radar complex [2/939-2/941]; a pre-1992 photograph (National Trust VBS8) shows a pile of broken corrugated asbestos on this part of the building, which has since been removed. Along the east wall, behind the asbestos (i.e. towards the interior of the building) there is a narrow slot, after which the wall top slopes down to meet the internal face of the wall; the external and internal slopes to the wall top are not equal, the former being approximately twice the width of the latter and somewhat steeper.
- 3.105 The concrete of the east wall returns around the southern corner of the building to form the lower part of the south wall (see plate 37). However, the upper part is built of a maximum height of five courses of machine-moulded orange bricks (average dimensions 0.23m by 0.115m by 0.07m) set with a lime mortar. The lowest course is formed only of headers, but all those surviving above are stretcher courses [2/935, 2/936, 2/938]; this is precisely the same arrangement as that which survives on the south side of Building R3, suggesting that this also had a brickwork elevation with windows either side of the central door. A pair of concrete steps cast as a single block butt the centre of the wall face; they rose to a doorway, marked by a break in the foundation wall [2/937]. The hexagonal block of concrete noted in 1998 is still present [4/557]. The west wall of the building is of the same construction as that described for the east wall above but is in poorer condition. At its northern end, the east wall returns to the west for a short distance, incorporating a chamfered offset, to form the north wall (but see below). The wall line is continued in plan only by brickwork, perhaps marking another doorway into the building. A piece of concrete to the immediate west may also follow the former north wall line, although it does appear at least partly *ex situ*. The interior of the building is largely grassed, and slightly raised above the level of the top surface of the concrete foundations; the remnants of a concrete floor can be seen at the south end.
- 3.106 The space between the two parts of the building is floored with concrete paving, supported on a low brickwork wall to the east side. This wall is four courses in height and built of similar brickwork to that described above. A drain marked at the base of the wall in 1998 remains visible, although it is now rather overgrown.

- 3.107 Some 12m north of Building A11, in a gap between two areas of gorse, there is a possible rectangular brick-lined drain opening [2/944] not noted in previous descriptions. Some 7m to the west, what may be the end of a low, sub-rectangular platform projects from beneath the edge of a spread of gorse. The platform measures at least 4m north-south by 7m west-east, and appears to contain a high proportion of stone rubble. To the west, there is a much smaller sub-rectangular depression, possibly marking the former position of another drain or brick-lined pit.
- 3.108 In late January 2012, clearance work was undertaken over the southern half of the building [4/558]. Nothing was evident in the main part of the floor area, but the lower course of the north brick wall was revealed in its entirety; this had a central 1m wide gap, presumably a doorway, with side walls running to the north to create a passage [4/559-4/561] (see plate 38); the west side of the passage had lost its brickwork, and it may be that this was the entrance into the building, an arrangement also evident in Building R3. A few brick fragments, presumably gathered from the clearance work, lay together close to the south-east corner of Building A10 [4/562], and an iron fragment, possibly the hinged cover from an oven, lay on its east wall [4/563, 4/564].

#### *Buildings A12 and A13*

- 3.109 In 2000, these buildings were described by Newman and Kenyon (2000, 24) (see Appendix 1).
- 3.110 At the time of the EDAS survey, Building A12 was no longer visible, having disappeared beneath a thick spread of gorse.
- 3.111 Building A13 is set on a north-east/south-west alignment, measuring externally a maximum of 7.20m long by 6.20m wide. The extent of the visible remains is approximately the same as that shown by Kenyon in May 1998, although the internal arrangement is slightly different. The foundations are of concrete and stand to a maximum height of 0.20m; they have an average width of 0.17m. The building is essentially divided into two parts. The eastern part was shown as having an inset to the north-east corner in 1998, but there appears to be an opening here, with the wall to the north returning at its eastern end to form a small internal partition or cubicle [2/946]. The east wall has a shallow 0.10m wide inset to the external face, once housing a small timber upright at its north end and with a narrow gap through the width of the foundation at the south end. The inset continues around the south wall for a short distance, and once housed a second small timber upright here. There is then a gap, a small sub-square inset, the shallow impression of a wall base and finally another gap before the main inset recommences; a third recess for a timber upright survives at the west end of this section. The west part of the building [2/947] is set at a slightly higher level than the east part, and might be butted by it. The interiors of both parts of the buildings are grassed.
- 3.112 The brick-lined drain holes to the east [2/948] and south [2/945] of Building A13 remain visible, although neither retains the concrete slab covering noted in 1998 and both have had rubble inserted into them. Both have a concrete slab set to the immediate south-west of the drain opening; the drain hole to the south is the larger of the pair. To the immediate east of Building A13, there is an L-shaped spread of angular sandstone rubble, measuring c.4m north-east/south-west by 4.80m north-west/south-east. This may result from modern clearance work.

## 4 DISCUSSION AND CONCLUSIONS

### Chronology

- 4.1 It has only been possible to establish a broad chronology for the development of the Bent Rigg radar station. Aerial photographic evidence demonstrates that, with the exception of the coastguard station, the site was undeveloped in March 1941. The first station was probably built by the Army soon after this date, and perhaps in September/October 1941 if it became active at the same date as the station to the north at Goldsborough (Dobinson 2010, 421-424). There is a suggestion that the station was initially equipped with a 'Type 2 static radar' (Harwood & McMillan 2008, 191), but the current survey has found no evidence to support this. By February 1942, Bent Rigg had a 1.5m wavelength radar and formed part of the Army's Coastal Defence/Chain Home Low (CD/CHL) chain; it was designated Station M47. As will be argued below, it is highly likely that the radar's aerial array was mounted on the roof of the existing Tx/Rx concrete block (R4) building, and that this was the only Tx/Rx building that was ever present at Bent Rigg. At some point perhaps around March 1942, and by July 1942, the radar was replaced by a centimetric Type 52 set and it became part of the RAF's Chain Home Extra Low (CHEL) system; it was designated Station K47. It is assumed that the station was decommissioned after September 1944, and an aerial photograph shows that the accommodation buildings were demolished by August 1946 (apart from the south end of Building A11), leaving the concrete bases and foundations which remain today.
- 4.2 As has been stated in Chapter 3 above, it is surprising that no evidence for any defence structures, in the form of a defensive perimeter, light anti-aircraft gun pits or shelters/slit trenches, have been identified. Other similar sites did have light anti-aircraft protection, and it is possible that any such features at Bent Rigg were removed or infilled once the station was decommissioned and the land returned to agriculture. It is also possible that some defensive elements lay outside the survey area, although nothing is immediately obvious on the 1946 aerial photographs. The sites of two 'Diver' AA guns have been noted at Ravenscar at Raven Hall Hotel and at Blea Wyke Point (Harwood & McMillan 2008, 190), but these date to late 1944 and were a defence against V1 rockets, and so are likely to post-date the operation of the radar station. There were some anti-aircraft guns at Whitby and Scarborough (Foster 2004, 157), but they may have been too far away to provide effective cover. The fact that some potential threat was considered at the site is shown by the survival of the blast shutters over the windows of the Tx/Rx building, which itself was built of reinforced concrete and brick.
- 4.3 Despite extensive research, apart from Craster in Northumberland (Hunt & Ainsworth 2006), it appears that very few CD/CHL or CHEL stations have been subject to any detailed archaeological survey, and so comparison with the detail of other sites is difficult.

### Two Tx/Rx Buildings?

- 4.4 The precise operational details for the station are unclear and, as has been set out in Chapter 2 above, the information provided in rather sketchy published accounts is sometimes contradictory and inconsistent. The principal issue revolves around whether there were two different Transmitting and Receiving (Tx/Rx) blocks, or whether a single block was equipped with two different Type 52 radars over its lifetime. It has been stated elsewhere (Harwood & McMillan 2008, 186 & 188) that the curved asbestos Tx/Rx hut (Building R3) was earlier than the concrete Tx/Rx

block (Building R4), although the evidence on which this assertion is based is not clear and in some cases demonstrably incorrect. Several points can be made.

- 4.5 Firstly, Harwood and McMillan (2008, 187) say that “there is evidence of the gantry arrangement“ at the earliest Nissen Tx/Rx building. However, this evidence appears to be limited to the concrete block with the smooth upper surface set against the west elevation and the pipe emerging from the roof. On the reconstruction drawing, the concrete block is shown as forming the base for one of the gantry legs (Harwood & McMillan 2008, 187) and it currently occupies this position in relation to the building. However, it has only been placed here since 2000, at which date it was propped against the north elevation. It is therefore *ex situ* and there appears to be no definite evidence to link it with the building. In addition, as the June 2000 survey work noted (see Appendix 1), there is another example located a considerable distance away, leaning against one of the buildings (Building A11) within the accommodation group. Although the blocks are of an unusual form, and might once have housed something set into the smooth side, they would be unsuitable to secure a radar gantry as there is no evidence that they were ever bolted into a concrete base; the other reconstruction drawing of a Nissen and gantry arrangement (Lowry 1995, 44) shows the concrete blocks to be far more substantial. Surely it cannot be a coincidence that each of the two blocks was originally located next to one of the two curved asbestos huts (Buildings A11 and R3), and so must be related to their construction or function rather than being associated with a radar gantry. Furthermore, the pipe emerging from the roof of the asbestos hut is shown on the reconstruction drawing (Harwood & McMillan 2008, 187) (see figure 3) as transmitting power to the aerial turntable of a centimetric set. This was described as a ‘chimney’ by the June 2000 survey work and, although similar pipes can be seen in the roof of the other Tx/Rx building (Building R4), these have associated bolts and other fittings to support the continuously power-turned mechanism that the centimetric set required; there is no evidence that these were ever present in Building R3.
- 4.6 Secondly, the two reconstruction drawings show a Type 52 Nissen and Gantry arrangement (Harwood & McMillan 2008, 187; Lowry 1995, 44). However, Building R3 is not a Nissen hut of corrugated iron built over a frame of steel T-shaped ribs but a Turners curved asbestos hut, a self supporting structure built of corrugated asbestos sheets (Francis 1996, 210-211 & 213). Thirdly, Building R3 seems rather small when compared to the dimensions given for the final version of the CHL station Tx/Rx block which had developed by 1941 (Bragg 2002, 261-2).
- 4.7 Finally, it is known that Bent Rigg was definitely active as Station M47, forming part of the Army’s CD/CHL chain, by February 1942 at the latest. As has already been noted, Building R3 is a Turners curved asbestos hut, a type of structure which was only manufactured from May 1942 onwards. It therefore cannot have been present during the period when Bent Rigg is first known to be active. Furthermore, the existing Tx/Rx block (Building R4) is of a form and size that was being built during 1941 and certainly by early 1942, and which could also have accommodated the most likely development of radar on the site (see below). It is acknowledged that the current survey has uncovered evidence for possible buried wall lines flanking Building R3, which might have supported a gantry or indeed form the remains of a larger structure replaced by the current building, that Building R3 probably once had a telephone connection to the coastguard tower, and that Building R3 might have been entirely re-modelled during wartime, removing any evidence for an earlier function, perhaps the operation of a 1.5m radar set. However, unless further evidence is produced to the contrary, it is proposed that Building R3 was never used as a Tx/Rx block and that in fact there is simply no need for anything

other than the single existing Tx/Rx block (Building R4) within what is known about the site's development.

- 4.8 The alternative, and more likely, scenario is that Building R4 is the original (and indeed the only) Tx/Rx block at Bent Rigg, and that it was built by the Army late in 1941 with the other two concrete structures (Buildings R1 and R2) as part of a CD/CHL station. A 1.5m radar would originally have been mounted on the roof of the Tx/Rx block but this would have been replaced at sometime after early 1942 by a centimetric set. The arrangement of features recorded on the roof of the block would have been well suited to securing the truncated square pyramid supporting the rotating aerial system of a typical Mark II 1.5m wavelength 'M' station set (Pearson 1991, 97-98). There is no evidence for any radical alterations to the roof of the block, and so the arrangement must also have been suitable, with little alteration, to accommodate the Type 52 set that would have been installed from early 1942 onwards. During the same period, operation of the site would have been handed over from the Army to the RAF; a similar development scenario is proposed for the station at Craster in Northumberland (Hunt & Ainsworth 2006). Instead of a Tx/Rx block, the asbestos Building R3 might therefore have been used for communications, as a wash-house/toilet block and/or radar workshop. It is likely that there would have been such facilities near the station, to prevent difficult walks back to the accommodation group of buildings during blackouts.

#### **Tx/Rx Block (Building R4)**

- 4.9 Bent Rigg bears other direct comparisons with the site at Craster. The Tx/Rx block (Building R4) is of a very similar design to that recorded at Craster (Hunt & Ainsworth 2006, 17-22). The example at Craster is set within a slight hollow, and with a slight platform to the east end; the greater depth of the surrounding hollow at Bent Rigg may be explained by the building being terraced into a steeper natural slope, although if the top of the hollow were to be sandbagged, then it would have afforded some blast protection. The projecting concrete pier on the north and south external elevations at Bent Rigg are the same as at Craster, and they acted as gantry supports for the aerial array on the roof, as the NYCDSG reconstruction shows (Harwood & McMillan 2008, 188) (see figure 3). Craster does not appear to have had the same external drainage system as at Bent Rigg; the provision of such at Bent Rigg for only the Tx/Rx block presumably reflects concerns about the effect of flooding on the electrical equipment housed within. It may also reflect the location of the block within a hollow.
- 4.10 Turning to the interior of the Tx/Rx block, by comparison with Craster, the east room at Bent Rigg may have housed the CHL transmitter, with the concrete step against the east wall and window above acting as an observation point, through which nearby planes or ships detected by the radar could be confirmed visually. The arrangement of pipes in the ceiling is exactly the same as that recorded at Craster, with one pipe housing the cabling running between the power source and the turning mechanism, and the other housing the turning mechanism itself (Hunt & Ainsworth 2006, 19). At Bent Rigg, the ceiling bolts located to the east and west of the T-shaped opening in the west wall of the room are also likely to be associated with the turning mechanism.
- 4.11 The central room acted as the plotting room, receiving the information from the radar aerial, and would have housed equipment such as the plotting table, the Plan Position Indicator (PPI) and range consoles (Hunt & Ainsworth 2006, 20-21). The layout of the cable ducting in the floor at Bent Rigg is again similar to that at Craster, although slightly less extensive, perhaps due to the fact that at Bent Rigg

parts have become infilled. It is also noticeable that some of the vertical cable positions recorded at Craster are very similar to those at Bent Rigg. Dobinson (2010, 431) reproduces a photograph of a CHL receiver room, showing the plotting board to be a freestanding, moveable structure at the centre of the room, with the PPI and range consoles set against the wall. Based on the distribution of the cable ducts and other features, it is suggested that the PPI and range consoles were located against the south wall of the plotting room at Bent Rigg, with desks, tables or cupboards (denoted by the line of blue paint at 0.92m above floor level) against the east and north walls. There were wall-mounted switches at the east and west ends of the north wall, and also on the pier at the centre of the south wall, as well as traces of other former fittings which would require further research to ascertain their function. The west room at Bent Rigg may well have been the telephone room and office, where the plots (in the form of horizontal and vertical co-ordinates) would have been telephoned to the operations room of the adjacent Sector and Group for filtering and transmission to the Group Headquarters (Hunt & Ainsworth 2006, 21).

- 4.12 As at Craster, all three rooms in the Bent Rigg building were separated by doorways fitted with sliding doors, and were also provided with wall vents of the same form. As many of the pieces of equipment within the Tx/Rx block were valve-operated, a considerable amount of heat would have been generated in the interior of the building, requiring vents for both ventilation and to allow the heat to escape (Hunt & Ainsworth 2006, 19 & 22), although it is likely that the differential heights between the internal and external openings would have also reduced any light leakage during blackout. The system of channels in the floor for cabling, as revealed by the recent clearance work, is also similar to Craster.
- 4.13 However, there are some differences between the Tx/Rx blocks at Bent Rigg and Craster. In terms of survival, when it was surveyed in 2006, Craster did not retain any blast shutters to the windows and its internal blast doors were incomplete. In contrast to the tripartite paint scheme employed at Bent Rigg, that at Craster was of two parts, the upper cream paint used on top of a layer of fine cork chippings, apparently to reduce noise and to absorb radio waves (Hunt & Ainsworth 2006, 21). Finally, Craster does not appear to have had any of the angled wooden features placed at a high-level on the north and south walls of all three rooms at Bent Rigg. The purpose of these remains unclear. It was initially thought that they might conceal the end of bolts or ties passing through the ceiling which were used to stabilise the radar aerial above, but this function appears to have been performed solely by the concrete piers of the building.
- 4.14 The standby set house at Bent Rigg (Building R2) is again very similar to the example recorded at Craster, and was designed to provide an emergency power supply to the radar should the mains electricity fail. The Craster example retained the base of a large water-cooled generator; the standard models used were a Nunn three-phase generator and a Lister 15kVA unit, running on diesel (Hunt & Ainsworth 2006, 22; Pearson 1991, 97), and a similar but denuded base survives at Bent Rigg. It had the same form of vents in the long walls; the differing levels of the exterior and interior apertures were ascribed to blast protection although they would also have been essential to ventilate the building (Hunt & Ainsworth 2006, 22). In addition, the differing levels of apertures would have prevented light leakage from the building, which would obviously have been important in blackout conditions.



## Accommodation Complex

- 4.15 The accommodation group at Bent Rigg was both slightly larger and more complex than at Craster, and indeed more complex than those recorded at other small Second World War military sites, such as searchlight batteries (Richardson & Dennison 2011, 7-8). However, it is comparable to the CD/CHL site at Goldsborough (now destroyed), as depicted in a reconstruction drawing (Harwood & McMillan 2008, 159). As well as accommodation, the group would have contained buildings for administration, a mess/kitchen, storage and latrines. It is difficult to estimate the size of the workforce at Bent Rigg; the interpretative notice board suggests there were up to 30 staff present, including women, which seems reasonable. Based on their plan form, three different types of huts/buildings can be identified, although with the exception of the Turners curved asbestos hut (the southern part of Building A11), which cannot have been in place before May 1942, it is difficult to construct any kind of relative chronology between them. Clearly, it is likely that some accommodation would have been present from when the first station was constructed (i.e. from as early as late 1941 onwards), and this would probably have been modified and expanded during the life of the station.
- 4.16 It is suggested that the main accommodation area is represented by the four buildings aligned north-north-west/south-south-east (Buildings A1 to A4) at the west end of the site. Their bases are all of a similar size (11.05m long by 4.85m wide - 36ft by 16ft) and they have a similar construction, a thin concrete wall with bolts spaced at c.2m (6ft) centres along the long sides and c.1.5m centres along the short sides; there was presumably a slightly recessed concrete base internally. All have steps at their south ends, although Building A4 has a right-angled entrance compared to the others that are entered straight on. These foundations are similar to those of structures N3 to N6 at Craster, which also retained threaded bolts or holdfasts (Hunt & Ainsworth 2006, 26). It is likely that these buildings were Nissen huts, built with a semicircular frame of steel T-ribs spaced at 6ft centres over which were secured corrugated steel sheets internally and corrugated iron sheeting externally; the end walls of timber-framing or rendered brick contained two windows and a door frame (Francis 1996, 210-211). The 16ft span meant that there were no dormer windows in the long sides and the 36ft length suggests six bays in total. The number of internal divisions depended on the rank of the occupants - a Type A senior officers' quarters consisted of four rooms including one for servants (two rooms for a commanding officer, one room for a junior officer), a Type B sergeants' quarters was a single room for eight sergeants, and an airman's barracks block was a single room for 12 airmen (Francis 1996, 211). If female operators were present (as was common), then they would have required segregated accommodation and also a separate wash house.
- 4.17 The narrower building (Building A5) set at right angles to those in the main accommodation area may well be a detached ablutions/wash house block. This building is only 3.30m (c.11ft) wide, and its foundations stand proud of the ground surface; the few threaded bolts that survive are different to those seen in Buildings A1 to A4, and the upper surface of the foundation is more damaged, suggesting that there was a different form of superstructure. It is not known what type of structure this represents, it being narrower than most RAF huts, but it was probably of prefabricated concrete construction.
- 4.18 The service buildings are probably those buildings orientated north-east/south-west, located to the east of the accommodation area (Buildings A6 to A11). This complex contains one Nissen hut (Building A10) and a Turners curved asbestos hut (southern part of Building A11); the latter is a maximum of 8.00m long by

5.80m wide and it remained standing when all the other buildings were demolished by August 1946. There is also a narrower 2.8m wide structure (Building A8), of very similar construction to Building A5, and two other potentially almost square structures (Buildings A6 and A7). Most of these buildings have slightly upstanding concrete foundations. It is not possible to assign functions to these buildings without further research, but it might be that the southern half of Building A11 was a kitchen with a store room to the north, Building A10 could be a mess hall, Building A8 could be a wash house, and Building A6 might be a storage building. It must be significant that Building A7 is separate from the rest, so perhaps this could be an administration building or workshop. No possible interpretation can be suggested for Building A9 at this stage. The current survey has found no evidence to contradict previous suggestions that Buildings A12 and A13 formed latrines (Newman & Kenyon 2000, 24), although one might expect there to have also been some facilities in the Nissen huts.

## 5 STATEMENT OF SIGNIFICANCE

- 5.1 The fact that the Bent Rigg complex is designated as a Scheduled Monument means that it has national importance, and this needs to be taken into account when proposing any repair or interpretation strategies. The site also has added significance by virtue of its prominent location, the fact that it lies adjacent to the Cleveland Way long-distance footpath, and that there is public access to all parts of the site.
- 5.2 A national survey of Second World War radar stations has identified some 242 sites at 200 separate locations, some extending over significant areas (Anderton 2000). Thirty-six of these are CHEL sites, some 60% of which survive in some form although only six are complete or near complete. All these complete or near complete examples represent developments of earlier radar stations, involving the adaption of existing fabric. Bent Rigg is one of the best preserved of these six examples. The above ground remains of other CHEL or CD/CHL sites along the Yorkshire coast have either been destroyed (e.g. Goldsborough, North Yorkshire and Easington, East Yorkshire) or are in imminent danger of being destroyed (e.g. Atwick, East Yorkshire; Foot 2006, 177-178). As far as can be determined, only Bent Rigg and Craster (Northumberland) have been the subject of any detailed archaeological survey.
- 5.3 There is a considerable potential for interpretation of the complex, over and above the existing North Yorkshire and Cleveland Heritage Coast notice board which is positioned just outside the eastern edge of the site. Some of the details on this board are incorrect, and there is now a good opportunity to enhance and expand the interpretation of the site. This might extend to formally allowing the public to enter the buildings, to understand and appreciate what they are seeing, although of course there is already public access to the various structures. It is understood that interpretation proposals are being considered and drawn up by others.

## 6 BIBLIOGRAPHY

### Primary Sources

- 1941 Vertical aerial photograph taken 13th March 1941 (RAF/4J/BR 184) (English Heritage Archives)
- 1946 Vertical aerial photograph taken 27th August 1946 (RAF 106G/UK/1700 frame 2452) (English Heritage Archives)
- 1946 Vertical aerial photograph taken 6th December 1946 (RAF/4J/BR 1882) (English Heritage Archives)
- 2000 Roberts transcript: 'Exact transcript of hand-written notes provided by Mr & Mrs F Roberts of Sleights, with some information from Arthur Watson of Sleights, formerly of Grange Farm, Staintondale' (mss held by Staintondale and Ravenscar Local History Group)

### Secondary Sources

Anderton, M J 2000 *Twentieth Century Military Recording Project: World War Two Radar Stations* (unpublished English Heritage mss)

Bragg, M 2002 *RDF1: The Detection of Aircraft by Radio Methods 1935-1945: The Location of Aircraft by Radar Methods 1935-1945*

Brown, J 1996 *Radar: How it all Began*

Buglass, J & Brigham, T 2008 *Rapid Coastal Zone Assessment, North Yorkshire: Whitby to Reighton: English Heritage Project 3729* (unpublished Humber Field Archaeology Report 238)

Buglass, J & Brigham, T 2011 *Rapid Coastal Zone Assessment, North Yorkshire: Whitby to Reighton: English Heritage Project 3729: Phase 2* (unpublished Humber Field Archaeology Report 327)

Dobinson, C S 2000a *Twentieth Century Fortifications in England, Volume VII(1). Acoustics and Radar: England's Early Warning Systems 1915-45* (unpublished mss held at CBA, York)

Dobinson, C S 2000b *Twentieth Century Fortifications in England, Volume VII(2). Acoustics and Radar: England's Early Warning Systems 1915-45 Appendices* (unpublished mss held at CBA, York)

Dobinson, C S 2010 *Building Radar: Forging Britain's early-warning chain 1935-45*

English Heritage 1999 *Recording Archaeological Field Monuments: A Descriptive Specification*

English Heritage 2002 *With Alidade and Tape: Graphical and Plane Table Survey of Archaeological Earthworks*

English Heritage 2006 *Understanding Historic Buildings: A Guide to Good Recording Practice*

English Heritage 2007 *Understanding the Archaeology of Landscapes: A Guide to Good Recording Practice*

English Heritage 2011 *Traversing the Past: The Total Station Theodolite in Archaeological Landscape Survey*

Foot, W 2006 *Beaches, Fields, Streets, and Hills: the Anti-invasion landscapes of England, 1940* (Council for British Archaeology Research Report 114)

Foster, J 2004 *The Guns of the North-East: Coastal Defences from the Tyne to the Humber*

Francis, P 1996 *British Military Airfield Architecture*

Harwood, J M & McMillan, S 2008 *Defence of the UK: North Yorkshire & Cleveland: Whitby vol 2*

Hoole, K 1978 *A Regional History of the Railways of Great Britain: Volume 4 The North East*

Hunt, A & Ainsworth, S 2006 *Craster, Northumberland: An Archaeological Investigation of a World War II Radar Station Complex* (English Heritage Research Department Report 43/2006)

Lowry, B (ed) 1995 *20th Century Defences in Britain: an Introductory Guide* (Council for British Archaeology Practical Handbooks in Archaeology No 12)

National Trust (Yorkshire Region) 2000 *Schedule of Works: Repairs to War-time Buildings, Ravenscar* (mss held in National Trust Estate Office, Ravenscar)

Newman, M & Kenyon, K 2000 *Bent Riggs Radar Station: Standing Buildings Recording* (unpublished National Trust Yorkshire Region archive report MNNTYR95)

Pearson, M 1991 'Coast Defence Radar'. *Fort* vol 19, 93-106

Richardson, S & Dennison, E 2011 *The Searchlight Battery, Fell Lane, Cracoe, North Yorkshire: Archaeological and Historical Survey* (EDAS archive report 2009/358.R01 for Mr J W Stockdale)

Schofield, P 2007 *National Trust Holdings on the North Yorkshire Coast* (unpublished National Trust Yorkshire Region report)

### **Electronic Sources** (all accessed late January 2012)

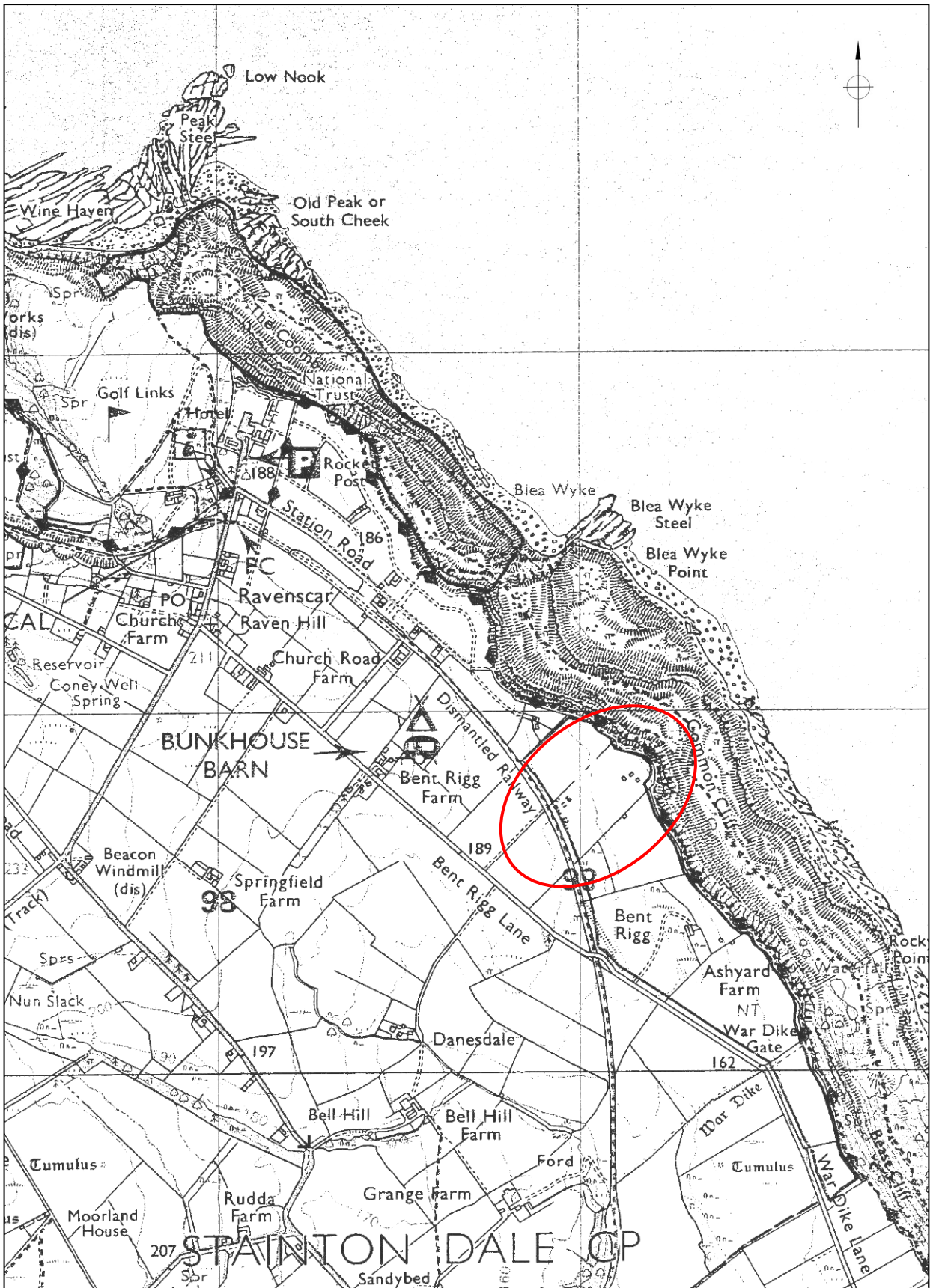
[www.airfieldinformationexchange.org](http://www.airfieldinformationexchange.org) - Airfield Information Exchange Group

[www.radarpages.co.uk](http://www.radarpages.co.uk) - The Radar Pages

[www.subbrit.org.uk](http://www.subbrit.org.uk) - Subterranea Britannica

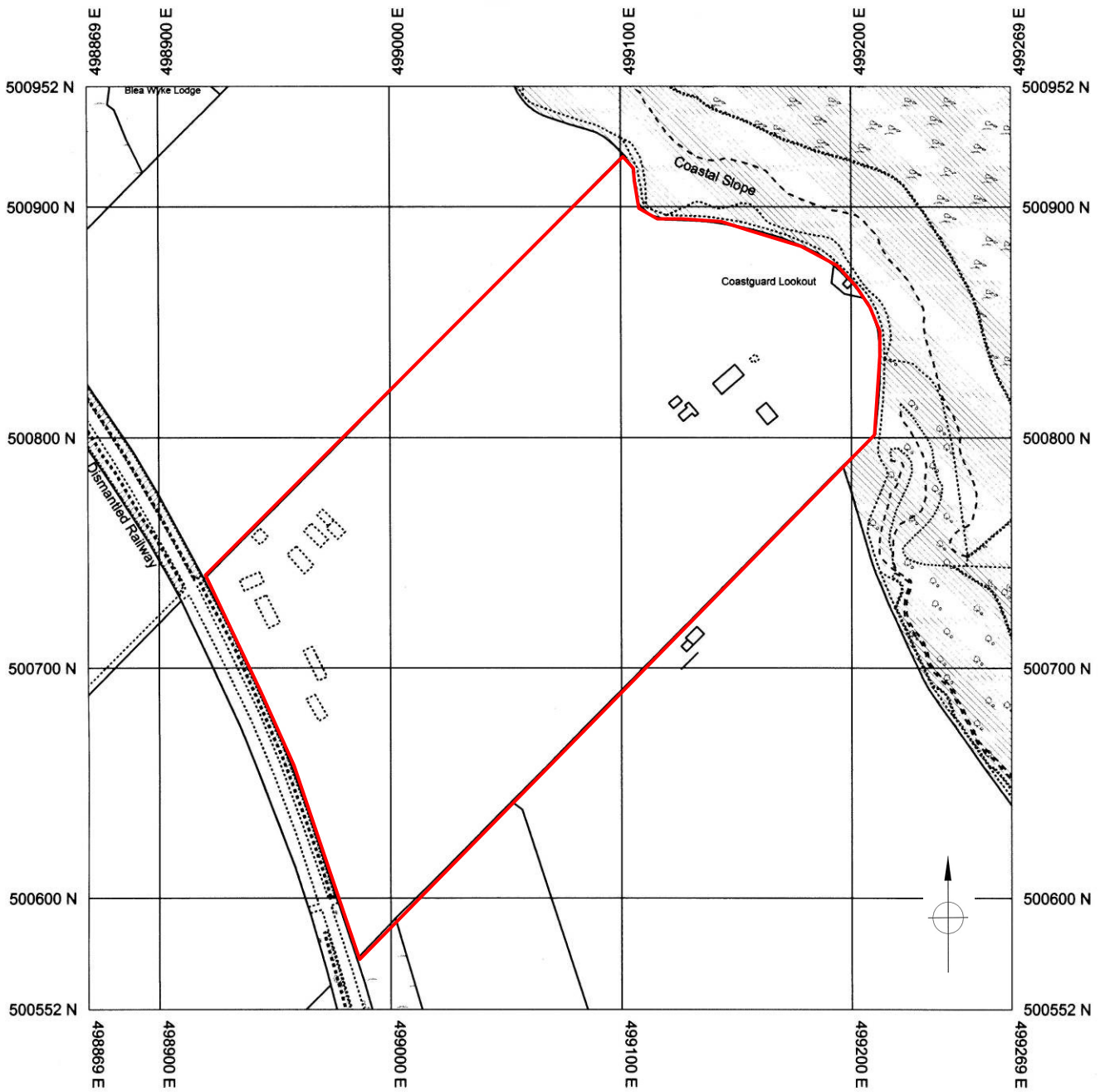
## 7 ACKNOWLEDGEMENTS

- 7.1 The archaeological survey of the Bent Rigg radar station was commissioned by Mr P Cother, through Natural England. EDAS would like to Mr Cother and Margaret Nieke of Natural England for their assistance and co-operation in carrying out the survey work. Additional help and support was provided by Mark Newman, Mark Frain, Mark Bradley and Julian Carlisle of the National Trust. Thanks are also due to John Harwood for supplying some further information on the site.
- 7.2 The topographical earthwork survey was undertaken by Shaun Richardson (EDAS) and Dave Kempley (Benchmark Surveys), with the resulting data being hand-enhanced by Shaun Richardson. Shaun Richardson produced the fieldwork records, photographs and a draft report, and Ed Dennison completed the survey drawings. Mark Newman of the National Trust provided useful comments on the draft document. The final report was produced and edited by Ed Dennison of EDAS, with whom the responsibility for any errors remains.
- 7.3 Copyright of all survey material and this survey report has been assigned to the commissioning bodies, although the originators retain the right to be identified as the authors of all project documentation and reports as specified in the Copyright, Design and Patents Act 1988 (chapter IV, section 79). Any use made of the survey data and/or information contained in the survey report should acknowledge the originators and authors.



© Crown copyright and Database rights  
 Ordnance Survey Licence 100013825 (2014).

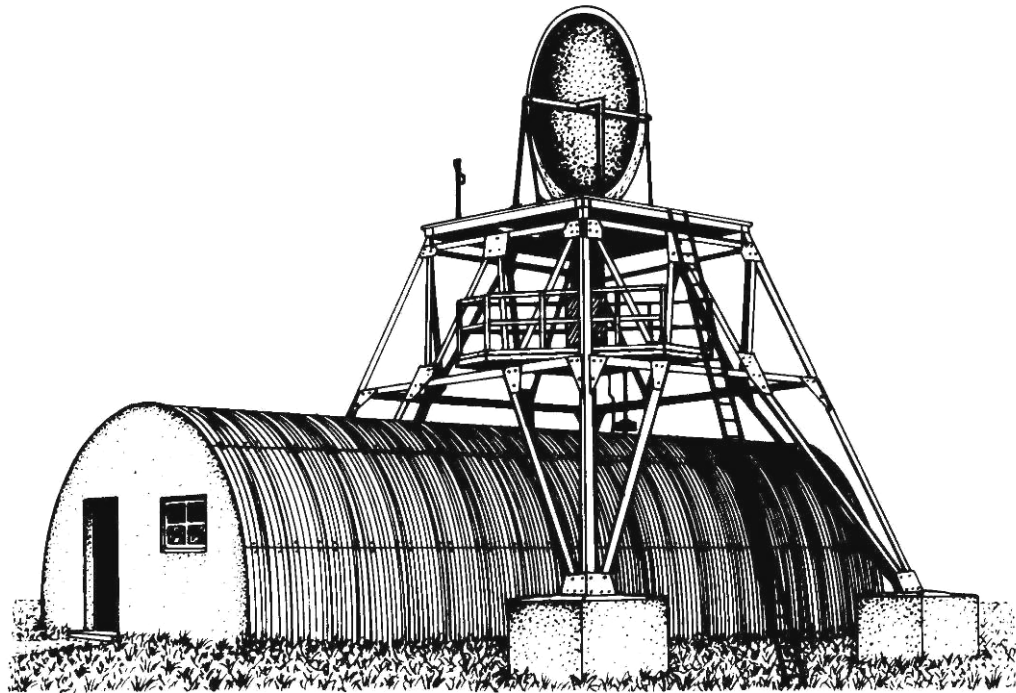
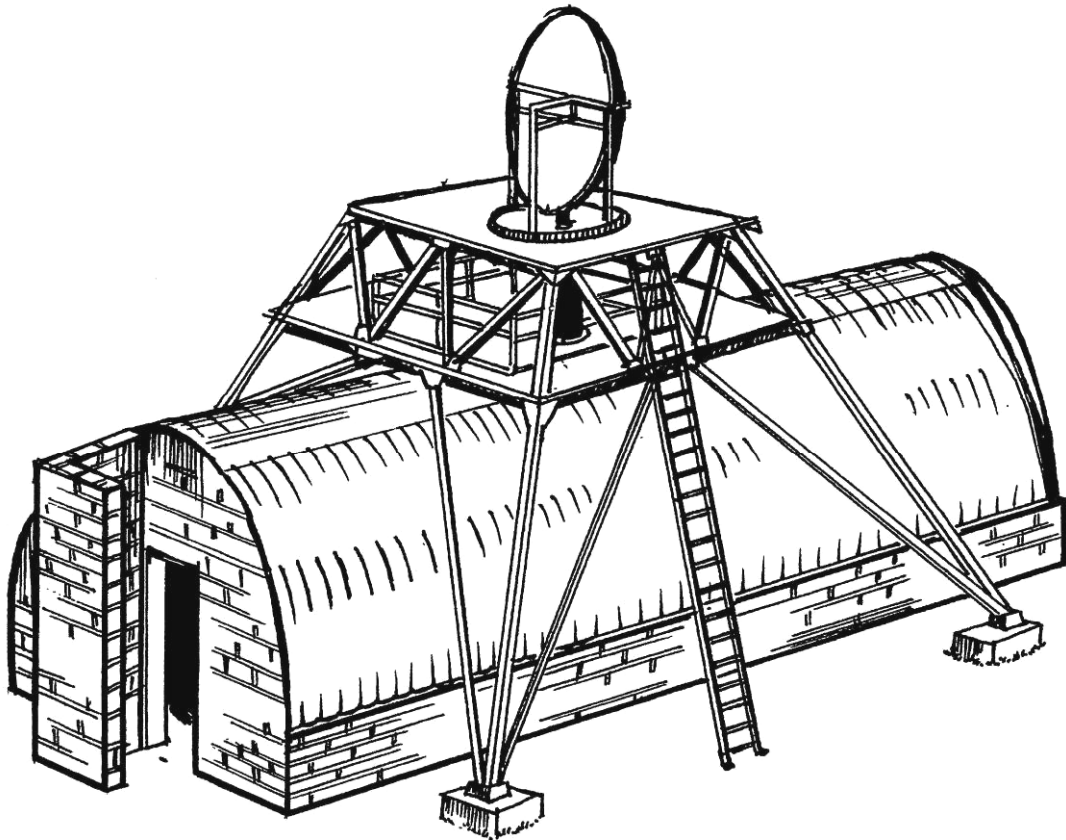
PROJECT		BENT RIGG RADAR STATION	
TITLE		GENERAL LOCATION	
SCALE	NTS	DATE	SEPT 2014
EDAS		FIGURE	1



© Crown copyright and Database rights  
 Ordnance Survey Licence 100013825 (2014).

PROJECT		BENT RIGG RADAR STATION	
TITLE		SURVEY AREA	
SCALE	NTS	DATE	SEPT 2014
EDAS		FIGURE	2

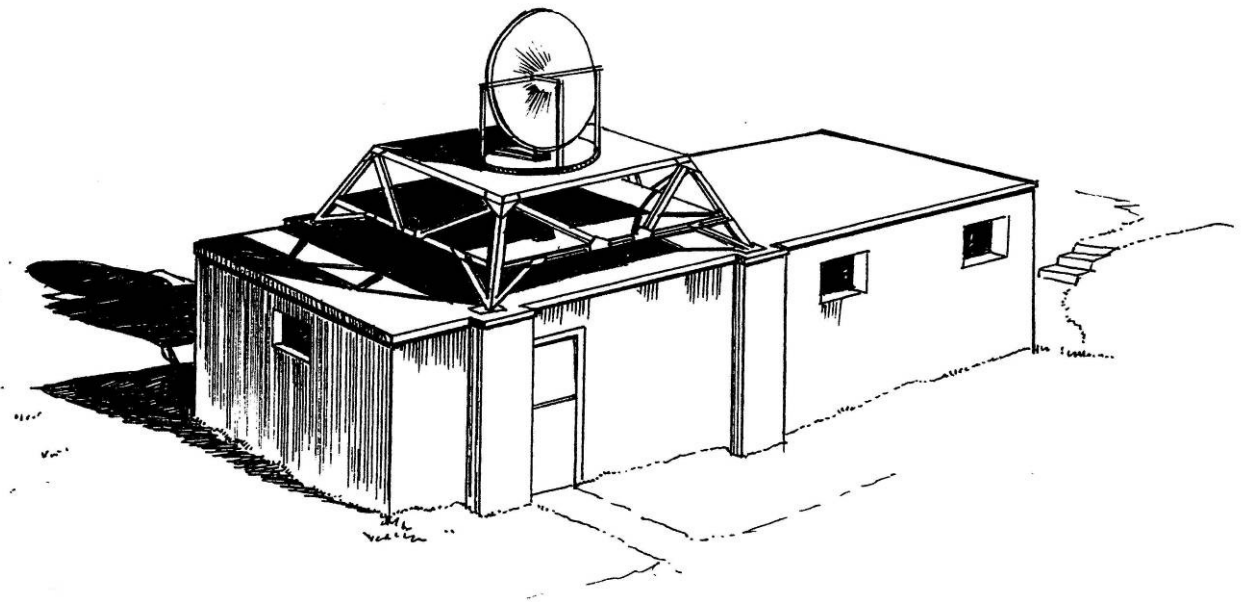




Top: Type 52 Nissen and gantry arrangement at Bent Rigg (Source: Harwood & McMillan 2008, 187).

Bottom: Generic Type 52 Nissen and gantry arrangement (Source: Lowry 1995, 44).

PROJECT		BENT RIGG RADAR STATION	
TITLE		TYPE 52 NISSEN RECONSTRUCTION	
SCALE	NTS	DATE	SEPT 2014
EDAS		FIGURE	3



Top: Tx/Rx block at Bent Rigg (Source: Harwood & McMillan 2008, 188).

Bottom: Remains of Tx/Rx block with array framework, Swansea Bay CHL station (Source: [www.subbrit.org.uk/sb-sites/sites/m/margam/index.shtml](http://www.subbrit.org.uk/sb-sites/sites/m/margam/index.shtml)).

PROJECT		BENT RIGG RADAR STATION	
TITLE		Tx/Rx RECONSTRUCTION	
SCALE	NTS	DATE	SEPT 2014
EDAS		FIGURE	4

This image cannot be shown  
due to Imperial War Museum  
copyright constraints.

This image cannot be shown  
due to Imperial War Museum  
copyright constraints.

Paintings by W T Rawlinson (Imperial War Museum).

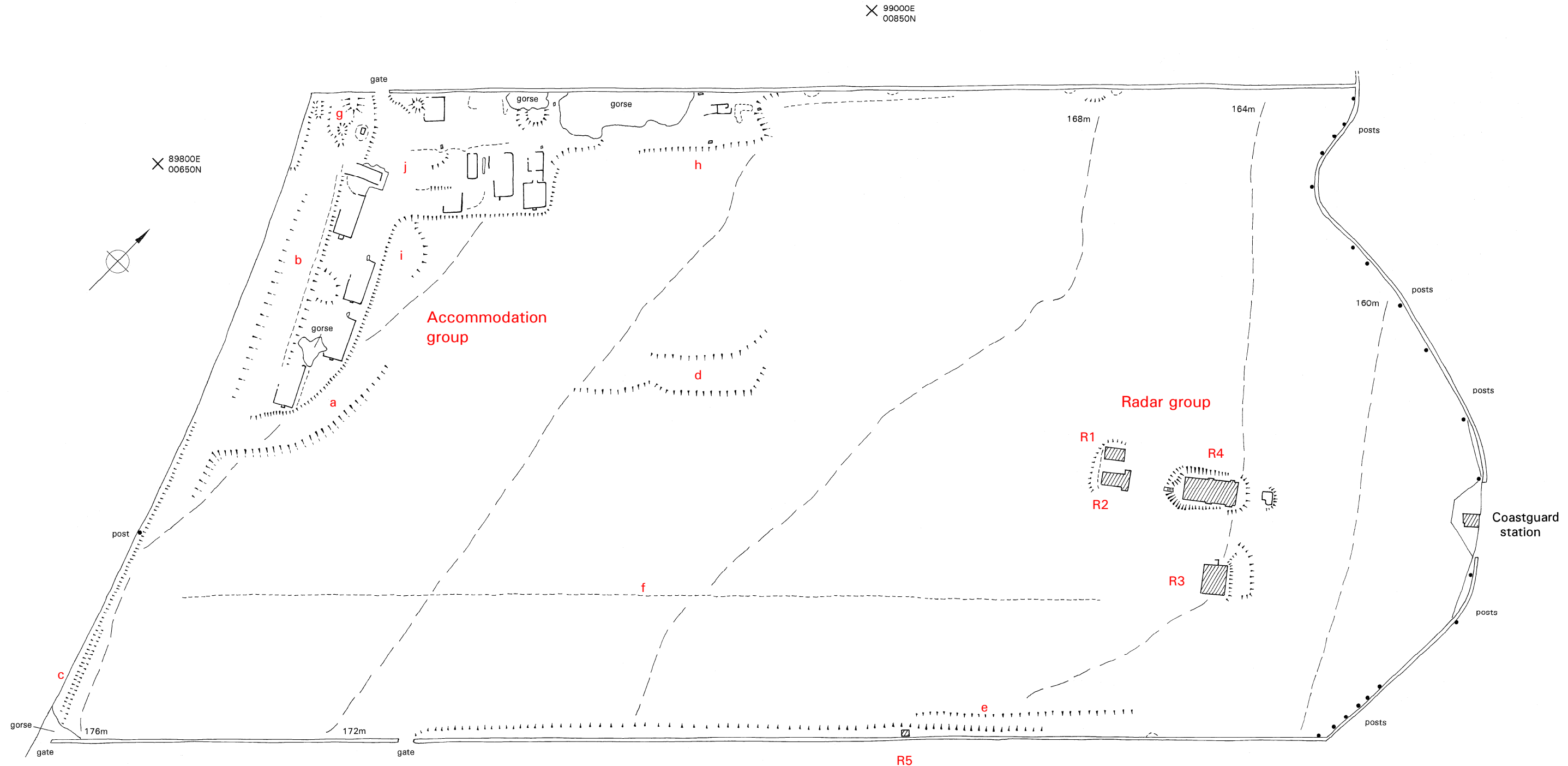
Top: A CHEL Radar Station, 1945  
(Source: ArtIWM ARTLT 5732).  
Bottom: A CHL Radar Station, 1946  
(Source: ArtIWM ARTLD 5734).

PROJECT		BENT RIGG RADAR STATION	
TITLE		CONTEMPORARY PAINTINGS	
SCALE	NTS	DATE	SEPT 2014
EDAS		FIGURE	5



Source: RAF 106G/UK/1700 frame 2452 taken 27th August 1946 (English Heritage Archives).

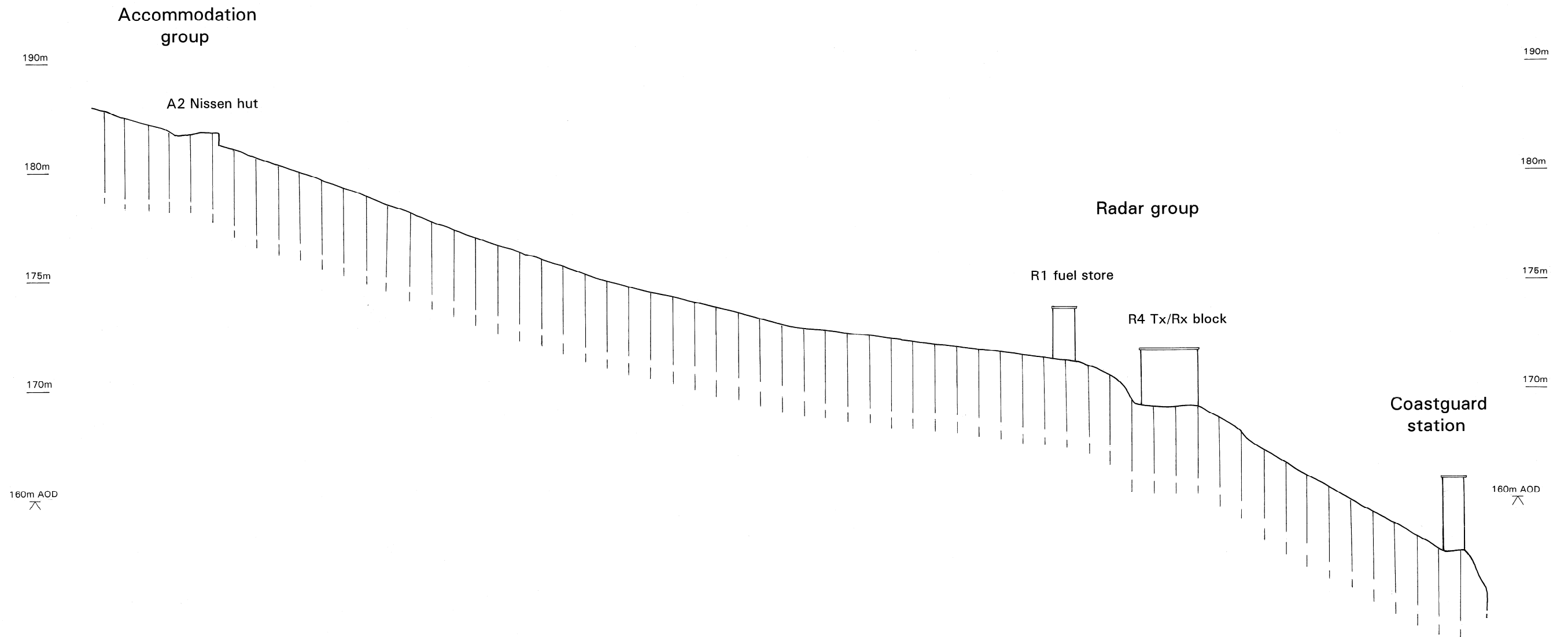
PROJECT		BENT RIGG RADAR STATION	
TITLE		1946 AERIAL PHOTOGRAPH	
SCALE	NTS	DATE	SEPT 2014
EDAS		FIGURE	6



For building identifiers in the Accommodation group, see figure 12.



PROJECT		BENT RIGG RADAR STATION	
TITLE		GENERAL SITE SURVEY	
SCALE	AS SHOWN	DATE	SEPT 2014
EDAS		FIGURE	7

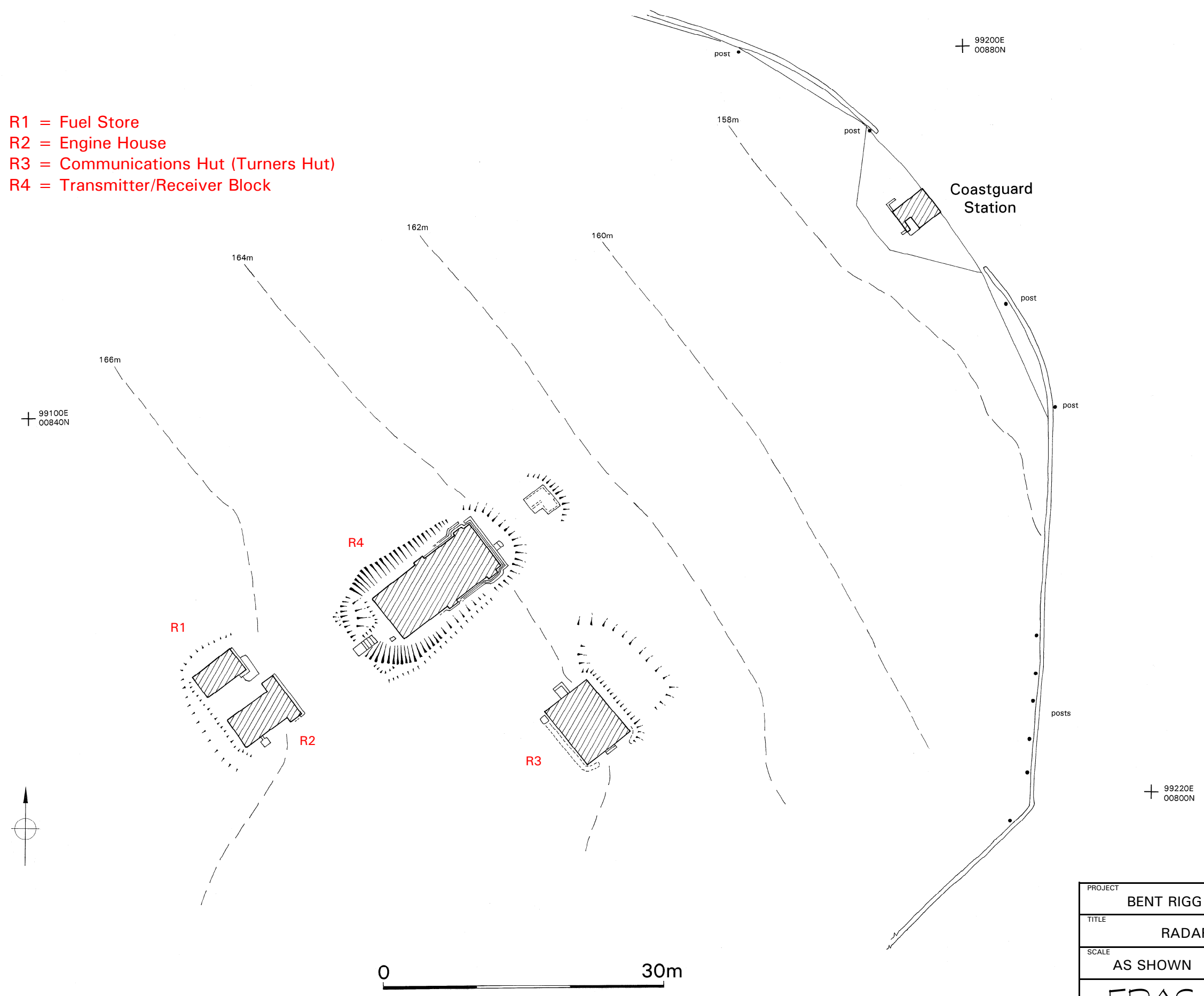


Horizontal scale 0 100m

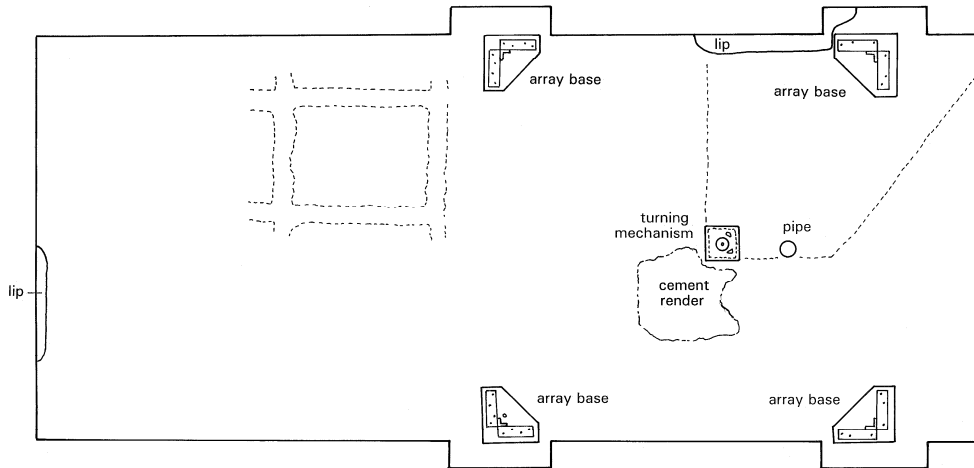
Vertical scale 0 15m

PROJECT		BENT RIGG RADAR STATION	
TITLE		SECTION THROUGH SITE	
SCALE	AS SHOWN	DATE	SEPT 2014
EDAS		FIGURE	8

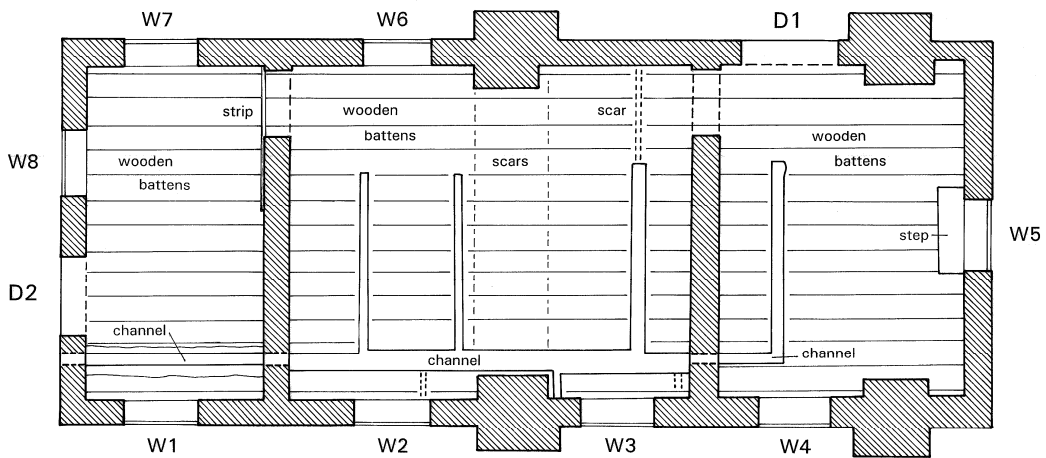
- R1 = Fuel Store
- R2 = Engine House
- R3 = Communications Hut (Turners Hut)
- R4 = Transmitter/Receiver Block



PROJECT		BENT RIGG RADAR STATION	
TITLE		RADAR BUILDINGS	
SCALE	AS SHOWN	DATE	SEPT 2014
EDAS		FIGURE	9



Roof plan

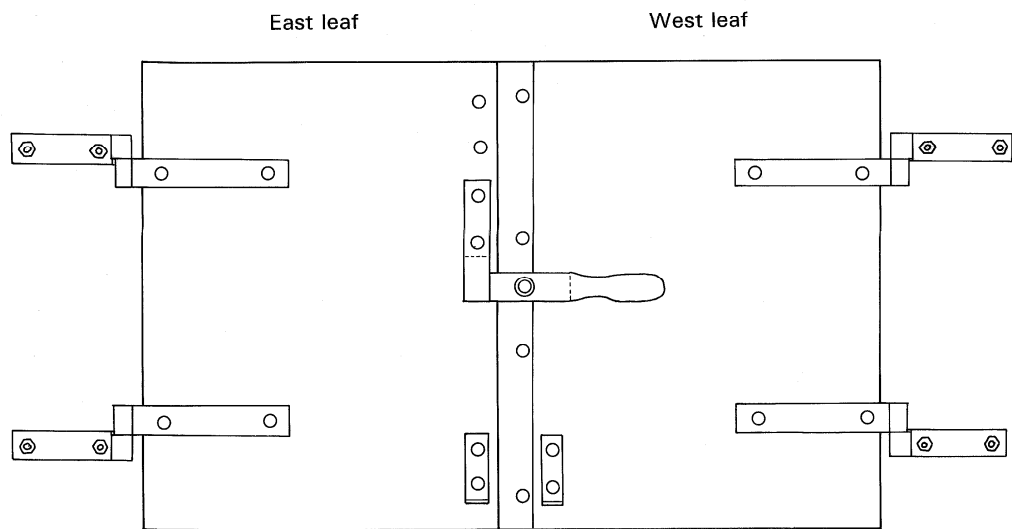


Floor plan showing channels and wooden battens

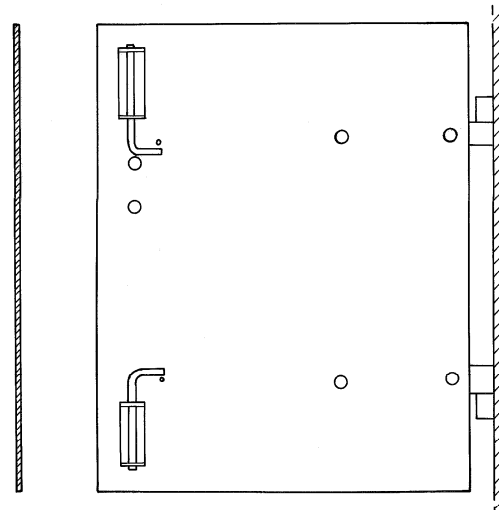


PROJECT		BENT RIGG RADAR STATION	
TITLE		BUILDING R4 PLANS	
SCALE	AS SHOWN	DATE	SEPT 2014
EDAS		FIGURE	10

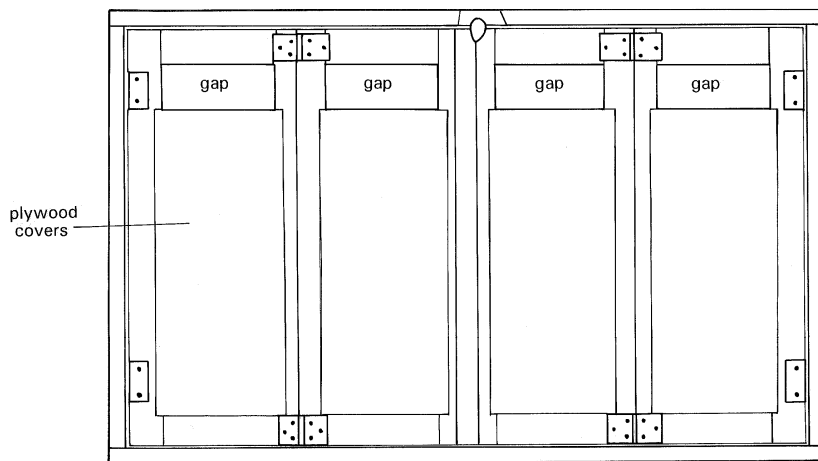




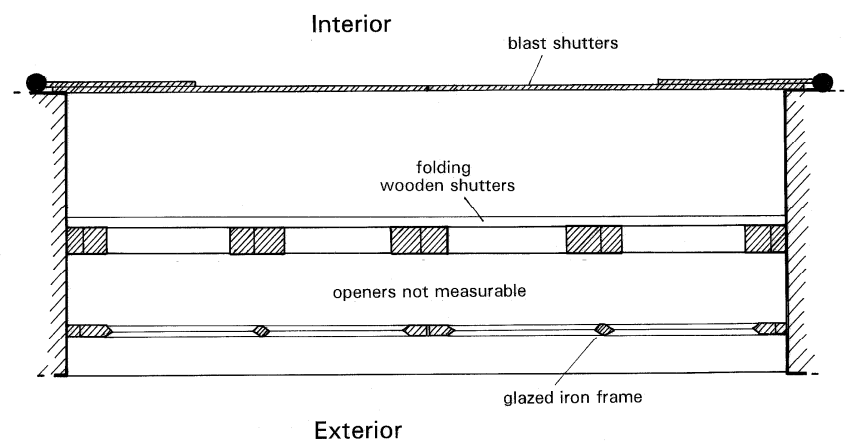
**Internal blast shutters (W4)**  
Shown fully closed, viewed from interior



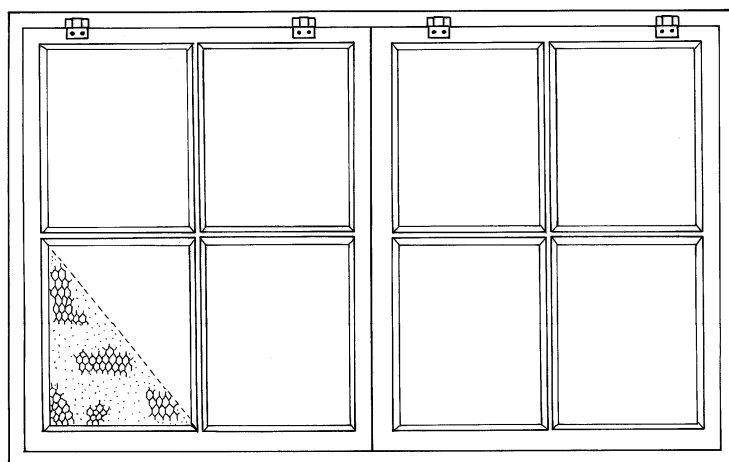
**Internal blast shutters (W4)**  
Rear of east leaf when open



**Internal wooden shutters (W7)**  
Shown fully closed, viewed from interior

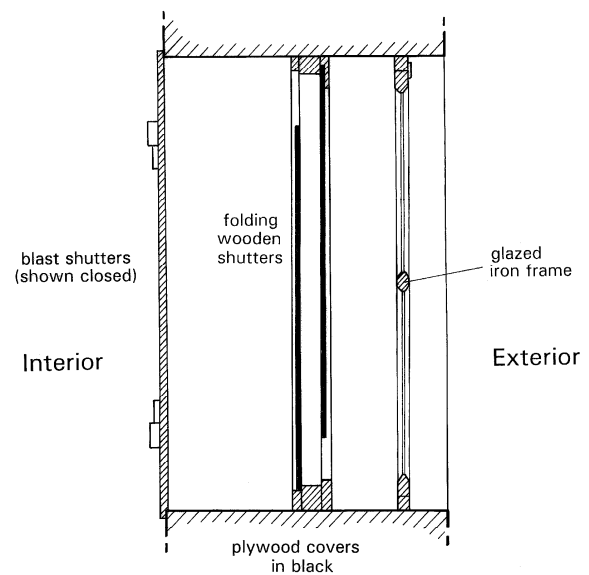


**Simplified composite plan**



wire pattern of original glazing partly shown

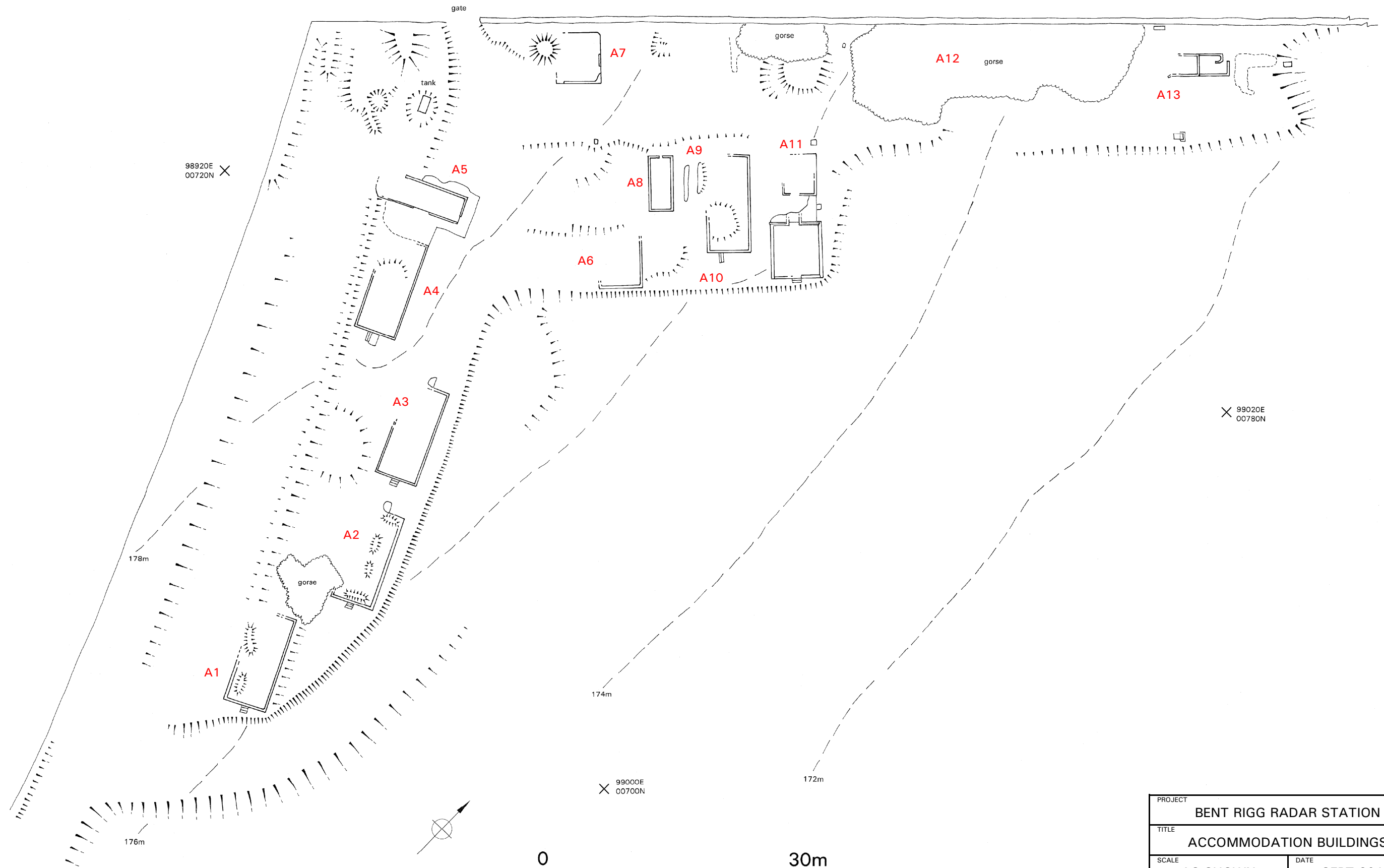
**External iron frame (W4)**  
viewed from exterior



**Typical composite cross section**



PROJECT		BENT RIGG RADAR STATION	
TITLE		BUILDING R4 WINDOW DETAIL	
SCALE	AS SHOWN	DATE	SEPT 2014
EDAS		FIGURE	11



PROJECT		BENT RIGG RADAR STATION	
TITLE		ACCOMMODATION BUILDINGS	
SCALE	DATE	AS SHOWN	SEPT 2014
EDAS	FIGURE		12



Plate 1: General view towards radar group of buildings, looking NE (December 2011).



Plate 2: View from accommodation group (Buildings A8 to A11) towards radar buildings, looking E (December 2011).



Plate 3: Building R1, east external elevation, looking SW (photo 2/954, December 2011).



Plate 4: Interior of Building R1 after clearance, showing brick supports for fuel tank, looking SW (photo 4/566, February 2012).



Plate 5: Building R2, south and east external elevations, looking NW  
(photo 4/575, February 2012).



Plate 6: Building R2, north external elevation and porch, looking SE  
(photo 1/850, December 2011).



Plate 7: Building R2, detail of north vent in west elevation, looking NE (photo 1/851, December 2011).



Plate 8: Building R2, 'internal' door in east elevation, looking SW (December 2011).



Plate 9: Building R2, remains of engine bed after clearance, looking SW (photo 4/573, February 2012).



Plate 10: Building R3, looking NW (NT photo 100/9, February 1998).



Plate 11: Building R3, looking NW (photo 2/008, December 2011).



Plate 12: Building R3, looking SE (NT photo 100/8, February 1998).



Plate 13: Building R3, looking SE (photo 2/002, December 2011).





Plate 14: Building R3, interior looking NW (photo 2/012, December 2011).



Plate 15: Building R3, interior showing construction, looking SW (photo 2/023, December 2011).



Plate 16: Building R4, south elevation, looking N (December 2011).



Plate 17: Building R4, west elevation, looking NE showing earthworks (December 2011).



Plate 18: Building R4, north elevation, looking SE (photo 2/971, December 2011).



Plate 19: Building R4, east elevation showing former ladder position, looking SE (photo 2/967, December 2011).



Plate 20: Building R4, external drain around NE corner, looking SW (photo 2/964, December 2011).



Plate 21: Roof of Building R4, looking E (photo 5/376, December 2012).



Plate 22: Roof of Building R4, showing base of radar array and lip over doorway D1, looking NE (photo 5/385, December 2012).



Plate 23: Roof of Building R4, north-west base of radar array, looking NW (photo 5/384, December 2012).



Plate 24: Roof of Building R4, pad of radar turning mechanism and pipe, looking E (photo 5/379, December 2012).



Plate 25: Building R4, internal south elevation of east room showing decoration, blast doors to window and triangular wooden blocks, looking S (photo 2/978, December 2011).



Plate 26: Building R4, internal north elevation of west room, showing blast shutters and folding wooden shutters, looking N (photo 3/282, January 2012).



Plate 27: Building R4, east internal elevation of east room, detail of covered vent, looking NE (photo 2/981, December 2011).



Plate 28: Building R4, west internal elevation of east room, showing bakelite clips, looking SW (photo 3/292, January 2012).



Plate 29: Building R4, east internal elevation of central room, showing decoration, fittings for sliding door, T-shaped opening and roof bolts, looking NE (photo 2/982, December 2011).



Plate 30: Building R4, floor of east room after clearance showing cable ducts and battens in concrete floor, looking E (photo 4/587, February 2012).





Plate 31: Building R5, looking E (photo 2/949, December 2011).



Plate 32: Coastguard station, looking NW (December 2011).



Plate 33: Building A3 with Building A4 in background, looking SW (photo 2/918, December 2011).



Plate 34: Building A5 with tank to rear, looking NE (photo 2/913, December 2011).



Plate 35: Building A7, looking W (photo 2/926, December 2011).



Plate 36: Building A8 with Building A7 to rear, looking NW (photo 2/931, December 2011).



Plate 37: Building A11, looking NW (photo 2/935, December 2011).



Plate 38: North end of southern part of Building A11 after clearance (photo 4/561, February 2012).



Plate 39: Building A11, remains of asbestos wall on east side, looking N (photo 2/941, December 2011).



Plate 40: Building A11, detail of asbestos wall on east side (photo 2/940, December 2011).

**APPENDIX 1**  
**PREVIOUS SURVEY OF BENT RIGG BUILDINGS**

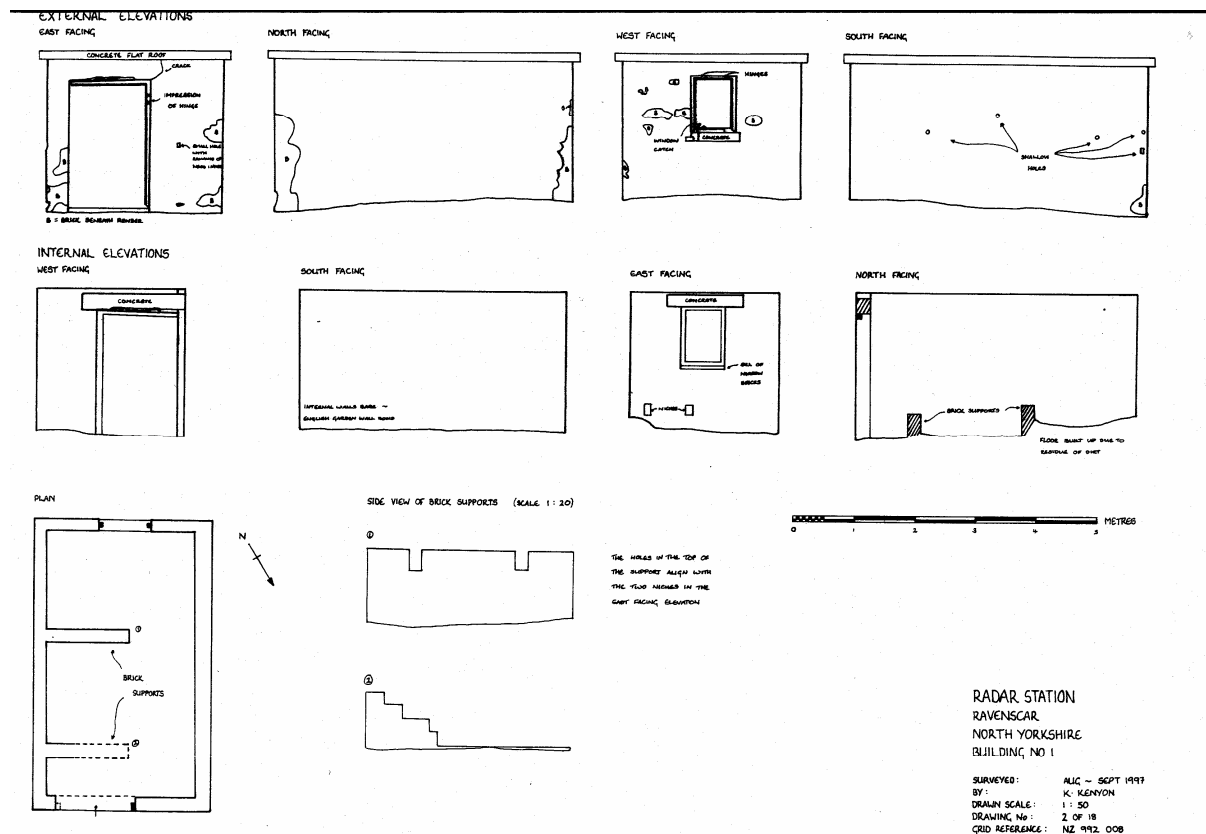
## APPENDIX 1: PREVIOUS SURVEY OF BENT RIGG BUILDINGS

Source: Newman, M & Kenyon, K 2000 Bent Riggs Radar Station: Standing Buildings Recording (unpublished National Trust Yorkshire Region archive report MNNTYR95).

Note: references to photographs omitted.

### Radar Buildings

#### *Building R1 - the fuel store*



In June 2000, this building was described as follows (Newman & Kenyon 2000, 4-6):

A single storey, single cell brick building with cement rendering and a flat concrete roof.

#### *Interior*

The walls inside are bare showing the brick is in English Garden Wall bond (with three stretcher courses). The floor is obscured by mud but appears to be concrete. The ceiling is also concrete. There is one window at the rear with a plain timber frame painted a dark red/brown; no glass remains. Some iron fittings are still in place showing the window was hinged at the top and opened at the bottom. Beneath the window is a sill of narrow stretchers. There is a concrete lintel. Built against the north-facing wall are the remains of two brick supports, five to six courses high. The better preserved of the two has two niches at the top which correspond to two in the rear wall; presumably there were also two in the second support. These niches would have taken two metal rods which in turn would have supported a fuel tank.

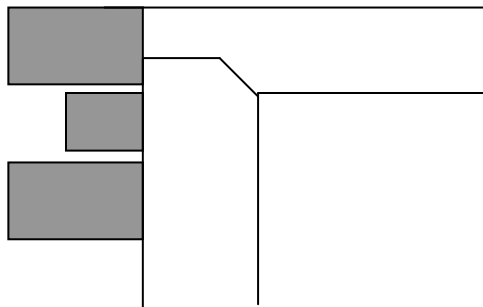
There is a doorway in the east face of the building. No door remains but there is one plain timber jamb and a lintel still in place, with traces of dark green paint. Above this is a concrete lintel. Hinge marks on the jamb indicate the door opened outwards.

### *Exterior*

The building has a flat concrete roof. The walls are cement rendered. The south facing wall has a series of small holes along its length. The window has a concrete sill.

The door in the east wall retains its framing to the north jamb and lintel. This is quite nicely carpentered, with rounded corners. The frame sits flush with the external face of the wall, and is 10cm deep by 7cm thick. There is a recess 2.5cm deep by 1.5cm wide in the outer edge into which the door was seated, opening outwards. The presence of a bolting hole near the centre of the lintel indicates a double leaf; this hole is 55cm from the south jamb and 64cm from the north suggesting that the north door overlapped the south one. The doors were hung on two substantial hinges. Lets measuring 6 x 20cm were centred at 24 and 183cm above floor level, housing hinge plates held in place by four screws.

The jambs meet the lintels with well made, shaped, joints:



The window in the west wall shows the same well-made, robust carpentry as the door, but survives less well – though both sides, sill and lintel are all present. The frame is a total of 11cm deep, with rounded profiles to the inside edges of the frame. Jointed as shown above.

A recess 4.5cm deep is cut into the outer face of the frame for the window. This was top-hung on two large hinges which survive in situ.

In addition to the more formal features of this building there are a series of eight square holes (3-4cm square) in the exterior of the south wall (with one in the west wall). The purpose of these is unclear, but there are similar holes in the north wall of the engine house opposite.

### *Building R2 - Engine House*

In June 2000, this building was described as follows (Newman & Kenton 2000, 6-8):

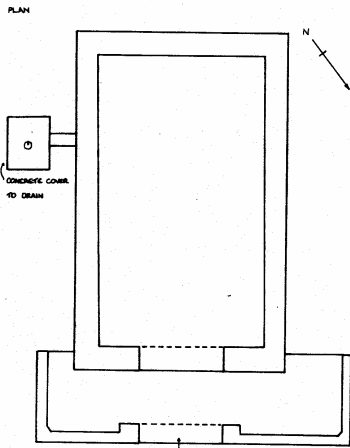
A single storey, single cell building of reinforced concrete with a flat concrete roof. The front of the building has a large screen/porch, again of concrete.

### *Interior*

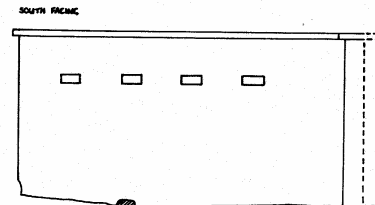
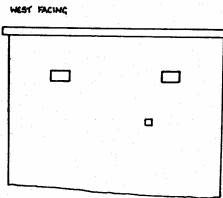
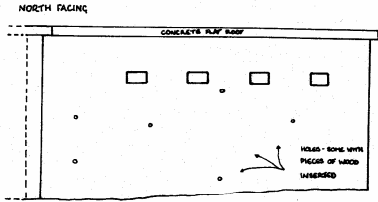
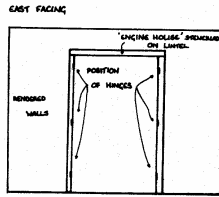
The floor is concrete, as are the walls and ceiling. There are no windows, but there are a series of large rectangular holes (approx. 30cms x 20cms) with narrow timber frames, which are lined with a thick card material. The walls are painted an orange/red at the bottom and pale yellow at the top, divided halfway by a thin strip of neutral colour. This strip has a series of small holes containing wooden pegs indicating something was fixed around the walls at this point. Some Bakelite clamps are still in situ, presumably to hold cables.

There is a doorway in the east face of the building with a timber frame still in situ, with traces of dark red paint. Marks on the jambs indicate that there was a double door which opened outwards. Etched on the lintel the words 'ENGINE HOUSE' are just visible.

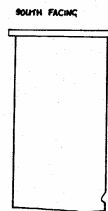
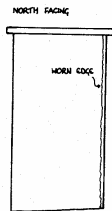
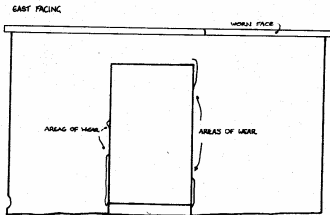




EXTERNAL ELEVATIONS

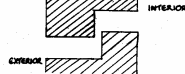


EXTERNAL ELEVATIONS - SCREEN



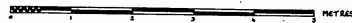
EACH HOLE HAS A SERIES OF SCALARS AROUND IT - SOME WITH THE REMAINS OF SHEET METAL ATTACHED. MOST HAVE SOME METAL MESH COVERING ATTACHED. THEY ARE LINED WITH THIN BOARD.

CROSS SECTION

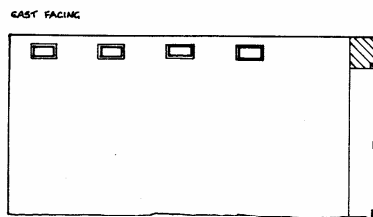
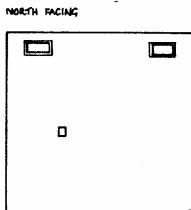
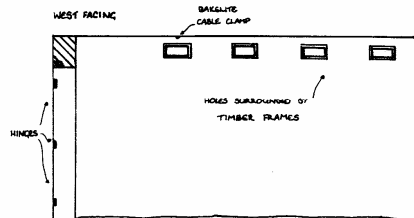
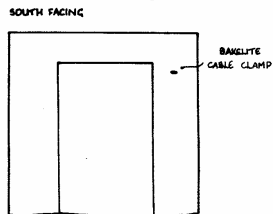


RADAR STATION  
RAVENS CAR  
NORTH YORKSHIRE  
BUILDING NO 2 'ENGINE HOUSE'

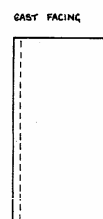
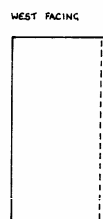
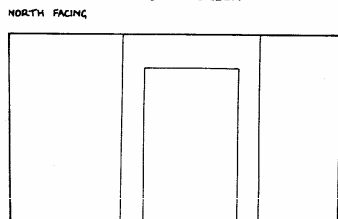
SURVEYED: OCT 1987  
BY: K. KENTON  
DRAWN SCALE: 1 : 50  
DRAWING No: 3 OF 18  
GRID REFERENCE: NZ 492 008



INTERNAL ELEVATIONS



INTERNAL ELEVATIONS - SCREEN



RADAR STATION  
RAVENS CAR  
NORTH YORKSHIRE  
BUILDING NO 2 'ENGINE HOUSE'

SURVEYED: OCT 1987  
BY: K. KENTON  
DRAWN SCALE: 1 : 50  
DRAWING No: 6 OF 18  
GRID REFERENCE: NZ 492 008



### *Exterior*

The building has a flat concrete roof. The rectangular holes visible on the inside also appear on the external walls but are slightly lower. Inside the holes but flush with the surface, are the remains of metal grilles. Around the holes are a series of screws suggesting they were covered over.

At the side of the south facing wall is a brick lined manhole, covered by a large concrete slab with an iron ring in the centre for lifting. A concrete pipe runs between this and the building. Running through the west facing wall is a small square hole. In the north facing wall is a series of small holes. These seem to correspond in position with those seen in the south facing wall of Building 1. Running from roof to floor are also three vertical marks in the wall suggesting something was fixed to the wall here.

Porch: the porch is formed by a concrete wall, of the same height as the main building, which runs across the front and wraps around the sides of the building. There is a doorway in the front and access is also possible through a doorway at either side. The porch and the main building are both covered by the same roof.

This building has only one main opening, its door in the east wall. This has a neatly carpentered frame set flush with the surface finish of the wall exterior and the inward facing sides of the door opening. It too hung double doors, here on three hinges, parts of all of which remain in situ. A central bolthole can be seen in the lintel, set slightly closer to the south jamb.

The other features of note in this structure are the ten ventilators – four in both the north and south walls, with two in the west wall. Each is constructed in the same way, though with varying degrees of preservation. Internally the vents were 30cm wide by 15cm high. However, they did not open straight onto the outside world; instead they passed 28cm into the thickness of the wall, before dropping 48cm. Only here did they exit the building. The vent channels were lined with plywood or even cardboard. At the interior entrance a zinc mesh was placed over the opening (largely vanished – only little fragments remain) held in place by a beaded wooden frame. Presumably the lining and entry treatment were mounted fixed to a wooden subframe.

Externally, the vents (of the same size) were first protected by steel mesh, built into the concrete of the walls (recessed 1.5cm back from its outer face). Small surviving fragments and mounting screws show that this was in turn covered by more zinc mesh.

The “dog-leg” shape would have been effective in preventing light leakage, but this may not have been a major concern as the engine/generator would have operated in the dark. The lining may hint that the design was an attempt to baffle the sound of the motor running.

The Bakelite clamps mentioned by KK were not noted on the recent site visit.

### *Building R3 - The “Communications Hut”*

In 2000, this building was described as follows (Newman & Kenyon 2000, 8-15):

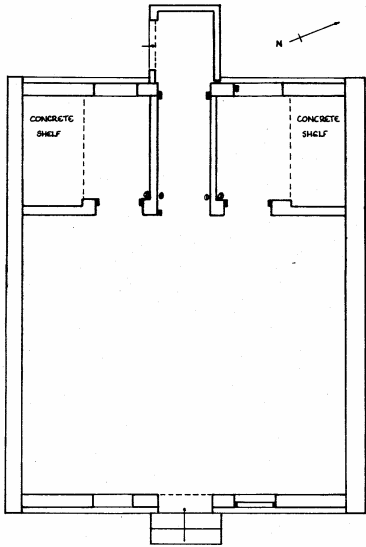
A single storey, three cell brick building with a small brick porch. It has a barrel-shaped corrugated asbestos roof.

### *Interior*

There is one large room and two smaller rooms at the western end which are divided by a short passageway. There is a concrete floor. Short concrete side walls form a supporting base for the roof. The roof is panelled inside with sheets of asbestos. The brick walls are in English Garden Wall bond in some places, Stretcher bond in others. The eastern wall has two windows, one of which has an outer timber frame and inner metal window still in place. The window has four lights of which only the top one opens. No door or frame remains. A single concrete lintel runs across all three openings.

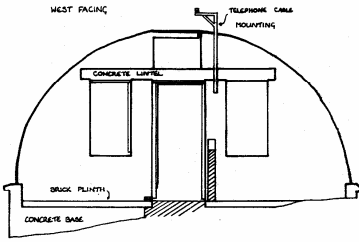
The opposite internal wall has three doorways with a single concrete lintel over. The central one leads to a short passageway and the porch at the western end. The other two lead to two small

PLAN

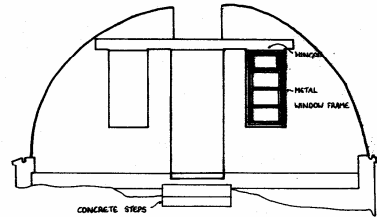


EXTERNAL ELEVATIONS

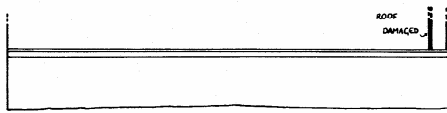
WEST FACING



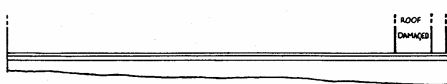
EAST FACING



NORTH FACING

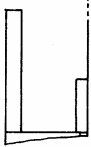


SOUTH FACING



EXTERNAL ELEVATIONS - PORCH

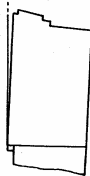
SOUTH FACING



WEST FACING

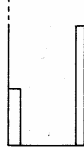


NORTH FACING

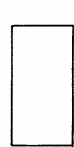


INTERNAL ELEVATIONS - PORCH

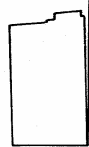
NORTH FACING



EAST FACING



SOUTH FACING



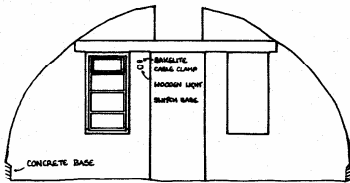
RADAR STATION  
RAVENSCAR  
NORTH YORKSHIRE  
BUILDING NO 3

SURVEYED : NOV - DEC 1997  
BY : K. KEENYON  
DRAWN SCALE : 1 : 50  
DRAWING No : 5 OF 18  
GRID REFERENCE : NZ 992 008

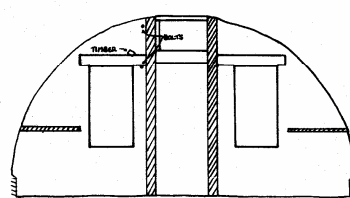


INTERNAL ELEVATIONS

WEST FACING



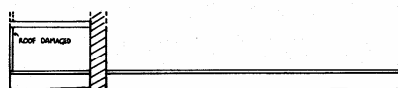
EAST FACING



NORTH FACING

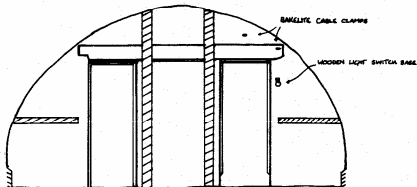


SOUTH FACING

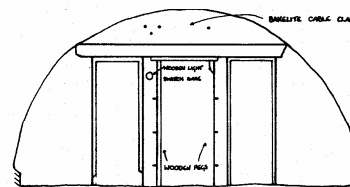


INTERNAL WALL ELEVATIONS

WEST FACING

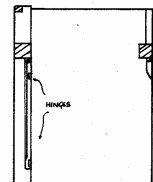


EAST FACING

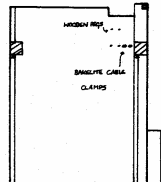


CORRIDOR WALLS ELEVATIONS

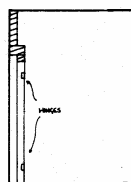
SOUTH FACING @



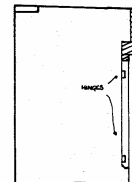
NORTH FACING @



NORTH FACING @



SOUTH FACING @



RADAR STATION  
RAVENSCAR  
NORTH YORKSHIRE  
BUILDING NO 3

SURVEYED : NOV - DEC 1997  
BY : K. KEENYON  
DRAWN SCALE : 1 : 50  
DRAWING No : 6 OF 18  
GRID REFERENCE : NZ 992 008



rooms, one either side of the passageway. Parts of the plain doorframes are still in situ painted a dark blue. Each of the small rooms have a wide concrete shelf against the side walls, and one window. One of these has remains of a plain timber window frame with traces of brown paint. Over the windows and an external doorway at the end of the passageway is, again, a single concrete lintel. This doorway has part of the plain door frame still in situ.

The porch is formed by two narrow brick walls at right angles to each other built on a square concrete base. It was possibly built at a later date than the rest of the building as there is a straight joint between the two.

Various fittings survive inside the building including Bakelite cable clamps and two round wooden light switch bases. There is also a small, short chimney in the main room.

*Exterior*

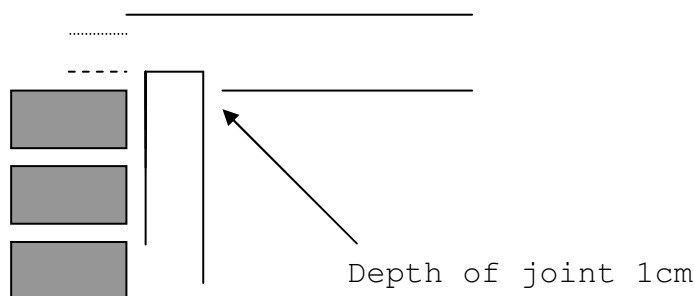
Three concrete steps lead up to the doorway in the east facing elevation. Leaning against this wall is a square slab of concrete with the corners taken off (effectively forming a hexagon). The back of this is flat while the front has a raised lip around it - there are no clues as to its use. The brick walls have a narrow brick plinth and rest on a short concrete base. Above the doorway in the west facing elevation is a metal telephone cable mount.

*South Elevation*

Little fenestration of door furniture remains in situ. In the west window there is little evidence of fenestration, just some mortar on the east side of the sill, and gaps in the brickwork where there were once timber inserts for mounting the window frame. These measure 5 x 6cm and the base and top of the window, with gaps 9cm wide and 1.5cm high at 35 and 88cm above the sill. These are mirrored on both sides of the opening.

The door retains some slight mortaring on the west jamb and lintel. There are holes for timber inserts, as described, in the sides of the opening. There is the impression of a timber measuring 10cm north-south by 7cm east-west in the cement floor, flush with the north face of the wall, 9 x 1.5cm timber slots at 78, 149 and 184cm above floor level, and a 7 x 6cm hole at the top of the opening. This pattern is repeated on both sides of the opening.

The east window has construction details similar to those seen in the west but with timber surviving in the east jamb and lintel. In the west jamb there is a 5 x 6cm hole towards the south edge of the wall at sill level. There are 9 x 1.5cm slots for timbers at 44 and 88 cm above the sill. The east jamb timber is 7cm wide and 3.5cm deep, held in place by framing to the cill and lintel components and by nailing (using two round-headed nails) to the timber inserts in the jamb. In place the timber is recessed 2.5cm from the external face of the wall. Metal staining from an iron window structure marks the outer 2.5cm of the remaining timber. There are screw-holes from mounting the metal structure at 67 and 102cm above sill level. There is a simple joint between the timber jamb and lintel as shown -



The lintel timber is 7cm wide and 3.5cm thick, also mounted 2.5cm inside the exterior face of the opening. The tenon fitted into the jamb brickwork is slightly reduced from the main width of the timber. The uprights are mainly held in place by a single main vertical nail.

There is evidence burning on the external face of the timber.

A small "fanlight" is sited over the door. This has 9 x 1.5cm slots for timber inserts at 10cm and 36cm above sill height, but no other remaining evidence of original furniture.

#### *Interior, main room*

The interior of the main room is lined with sheet of smooth asbestos cement 3mm thick. The standard sheet width is 1.23m, but there are also narrower strips cut for sections adjacent to the end walls. The sheets are mounted on a system of 6cm wide laths, nailed in place with lines of small round-headed nails. The nails were laid out on lines marked in pencil, which remain visible. Additional strips of sheeting 7.5cm wide overlay the upper and lower edges of each sheet, and the lateral margins.

A line of electrical fittings is mounted on the ceiling towards the east side of the arc, at a height of 2.5m above floor level. Five of these fittings are two-part cable holders in a white ceramic material. Each of these measures 5cm by 3cm in plan, and stands 2.5cm proud of the ceiling. There are several slightly different types present. Three fragmentary examples (and nails from a fourth) run between the north wall and a central wooden fitting (see below). They are sited at 4, 76, 149, and 228cm south of the north wall. These were designed to carry three cloth-bound electrical cables (stubs of which remain in the central timber mounting) 3mm in diameter. The cable was held between the two halves of each mounting. The two halves were held in place on the ceiling by two nails or screws, with one cable outside each side of this arrangement, and one between the two nails. South of the timber mounting only two cables emerged; these were held by further ceramic mountings located at 9 and 84 cm south of the central wooden mounting. There may have been further examples on a now missing piece of ceiling nearer the south wall. These southern mountings are only designed to carry two cables, and have just a single central mounting nail.

There is a crude hole in the north wall through which the cable entered the room.

The central timber mounting consists of three wooden components. A base ring 9cm in diameter receives the cables; this seems to have been painted yellow. A second ring 7cm in diameter is screwed onto the top of this with two screws. Within this is a third wooden component, a screw-threaded "peg" with a sort of "wing-nut" flanges on its outer face. On either side of this flange a copper connection plug emerges from the fitting.

Mounted on the south wall, on the pier between the door and the east window, is a double cable ceramic holder and a timber mounting. The timber mounting now only consists of a bevelled disk 8cm in diameter, with holes drilled down from its upper edge for two cables, meeting two horizontal holes emerging through the front of the disk. It is held to the wall by two screws located just below these holes. The centre of the disk lies 1.80m above floor level, the ceramic mounting 9cm above this. These features are perhaps related to the ceiling-mounted series described above, but if so it is notable that they are sited 60cm south of their line.

A circular hole c.18cm in diameter perforates the crown of the arc, centring on 87cm south of the north wall of the room. Probably to let a heating flue exit through the ceiling.

Remains of another row of cable holders (double cable) run along the north wall at 2.50m above floor level. These appear to run from the same cable entry point. They lie at 11, 78, 158, 177 and 207cm west of the entry point. They are mainly only now recorded by their nails, and fragments of the ceramic holders. The last in the sequence lies "under" a line on the west side of the ceiling made up of one remaining double cable holder and a series of marks where equipment like that on the east side was once sited. The western line was set slightly higher off the floor, and 2.63m and may not have continued as far as the south wall, as the east line did. Also only two cables, not three, approached the central timber mounting.

Beneath the north wall series of mountings there are mounting nails for two further ceramic mounting, descending from between the 3<sup>rd</sup> and 4<sup>th</sup> in the series. These are above another wooden disk set high on the pier between the entrance way and the western small room. It is identical to that mounted on the south wall, described above, and is set 1.76m above floor level.

### *North wall*

Door between the main room and the small east room: The frame survives in situ, mounted against the north face of the opening: this matches the arrangement at the entry to the west room but contrasts with that to the central "entrance passage". The frame, unusually, consists of a double skin. A frame of timber measuring 10cm wide and 2cm thick lies closest to the wall, and then a second frame 8cm wide by 1.5cm thick lies inside this. The latter is displaced by 1cm to the south, possibly for draught exclusion. The top of the frame falls 4cm short of the concrete lintel and is held in place by rough blocks of wood; this was obscured by a asbestos cement sheet fascia, which survives towards the south. The door (missing) was hung on two hinges centred on 30 and 175cm above floor level. One rectangular metal hinge remains in place, measuring 3cm wide by 7cm high, secured by three screws set in a straight line. The hinges were on the west jamb. The corresponding catch was mounted in a shallow (2mm) recess in the east jamb, centring on 1.31m above floor level. The recess is 10cm high with a small screw hole just inside its upper and lower margins. The door would have opened northwards. This is painted R.A.F. blue.

### *Small east room*

The roof cladding is continued here as in the main room. 1 nail at the top of the door lintel lies above a triple cable holder and wooden mounting on the east door jamb. This wooden disk only has two cables emerging and is held in place with two screws set towards the left, and below its centre. This would indicate that the wooden mountings were not completely pre-fabricated.

The window in the north wall retains timber in its west jamb and lintel. The timber measures 3.5 x 7cm in profile and is fitted in the same way as that in the south wall. A small fillet 1.5cm square is nailed to the west side of the west jamb, with some fragments of plywood remaining on its lower end. Purpose unclear.

### *Small west room*

The door frame survives in the opening from this room to the main room and is built to exactly the same description (including idiosyncrasies) as that to the east room. The door also opened to the north, and was hung on hinges in the east jamb. A line of double ceramic mounts, two pairs of nails holes and then a triple mounting (with cables remaining) shows the supply route to a timber mounting, with more normally placed mounting screws. This is sited at 1.68m above floor level on the west door jamb.

All fenestration has been removed from the window in the north wall. As in the main room south wall, however, gaps in the brickwork can be seen, where there were formerly timber inserts. These allowed for a frame set against the exterior face of the wall, as in all other cases. 6 x 7cm holes lie at the top and bottom, with 9 x 1.5cm slits at 19 and 96cm above sill level.

Asbestos cement cladding lined the room, as per the main room.

In addition to the window in the north wall there are the heads of two retaining bolts associated with the exterior stansion to be seen in this wall and a piece of timber nailed crudely in place. It is not clear if the latter dates from the WWII period.

Some fragments of 2.5mm thick, unwired, window glass remain on the concrete shelf in this room.

### *"Entrance passage"*

The door from the main room to this passage retains its lintel and west jamb. Both are cut from 5 x 7cm timber and have an un-carpentered junction – simply nailed together at right angles. Unusually, the lintel is built into the brickwork, extending out 10cm on each side of the opening. The door is also unusual in that it is flush with the south face of the north wall, whereas the others are flush with the north face.

Paint remains would suggest an inner frame 2.5cm deep against the south side of the outer frame. The absence of clear signs of hinges on the west jamb suggests that they were on the east one.

The exterior end of the passage also has a surviving door frame. This is more substantial with an outer frame 9.5 x 5cm. This is crudely made and inserted on the same model as the inner door described above. An outer frame formed of a baton of profile 4.5 x 1cm was then added to the north side of the frame. This remains across the lintel and east jamb. Hinges were sited in the east jamb, centred on 34 and 175cm above floor level. Hinge plates were rectangular, measuring 10.5 by 3.5cm. They were held in place by four screws, set zig-zag fashion. The door opened southwards, with a latch/lock plate located in the west jamb at 1.04m above floor level.

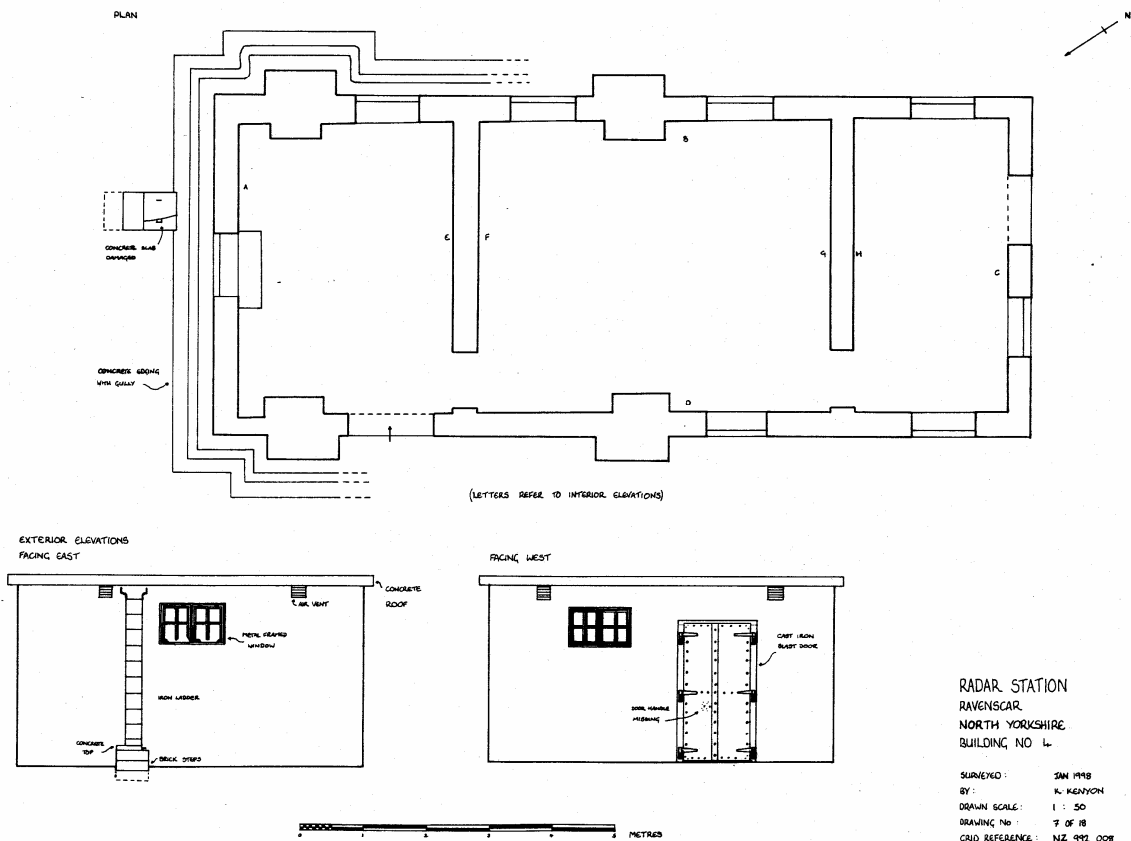
Two double cable holders are sited just above the west door jamb on the west wall of the passage. These are set side by side. Nearby are four timber plugs in the brickwork where some other equipment was once mounted.

One "loose" window frame remains in the building. This is metal (iron) with an external measurement of 60 x 122.5cm (which would suit any of the four windows). Internally it is divided into four lights in a vertical row, each measuring 53 x 27cm. The top light opens, being hung on hinges on the upper side of the frame. These are well made, with brass movement washers and central pivot.

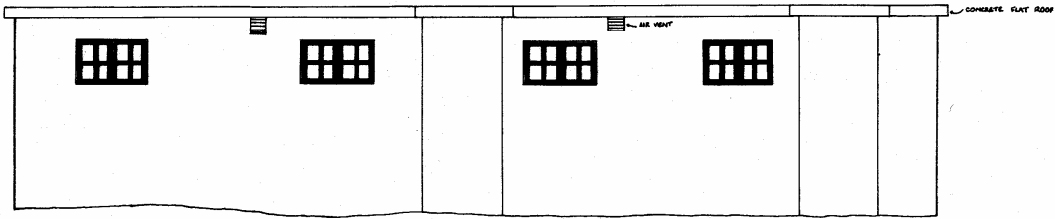
### Building R4 - Transmitter/Receiver (Tx/Rx) Block

In 2000, this building was described as follows (Newman & Kenyon 2000, 15-22):

A single storey, 3 cell building of reinforced concrete with a flat concrete roof. The walls have been strengthened by a series of thicker square columns built into the walls.

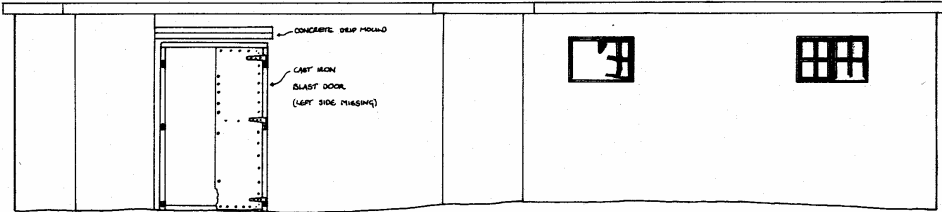


EXTERIOR ELEVATIONS  
FACING SOUTH



ALL WINDOWS ARE METAL FRAMED

FACING NORTH

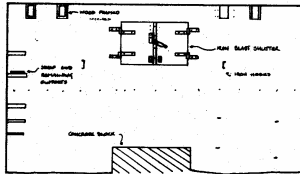


RADAR STATION  
RAVENSCAR  
NORTH YORKSHIRE  
BUILDING NO 4

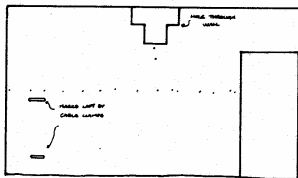
SURVEYED : JAN 1998  
BY : K. KENYON  
DRAWN SCALE : 1 : 50  
DRAWING NO : 9 OF 18  
GRID REFERENCE : NZ 992 008

INTERNAL ELEVATIONS

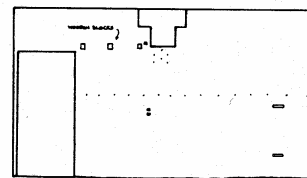
ELEVATION A



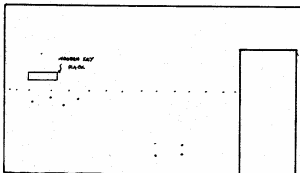
ELEVATION E



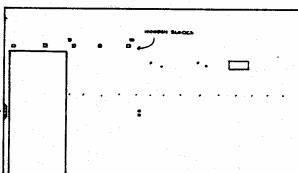
ELEVATION F



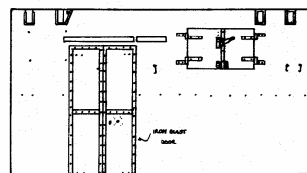
ELEVATION G



ELEVATION H



ELEVATION C



ALL WALLS AND THE FLOOR (UPPER SURFACE) ARE REINFORCED CONCRETE

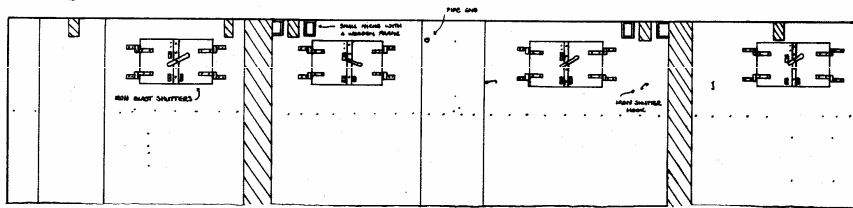


RADAR STATION  
RAVENSCAR  
NORTH YORKSHIRE  
BUILDING NO 4

SURVEYED : JAN 1998  
BY : K. KENYON  
DRAWN SCALE : 1 : 50  
DRAWING NO : 9 OF 18  
GRID REFERENCE : NZ 992 008



INTERNAL ELEVATIONS  
ELEVATION B

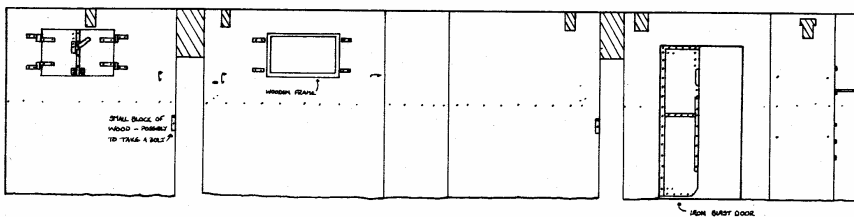


THE SMALL RECTANGULAR HOLES  
AT THE TOP OF THE WALL ARE  
WEDGE SHAPED IN SECTION:



DOES REPRESENT OLD HOLE OR  
NEW HOLE

ELEVATION D



RADAR STATION  
RAVENSCAR  
NORTH YORKSHIRE  
BUILDING NO 4.

SURVEYED : JAN 1978  
BY : K. KENYON  
DRAWN SCALE : 1 : 50  
DRAWING NO : 10 OF 18  
GRID REFERENCE : NZ 942 008

### Interior

The building has a large central room flanked by two smaller rooms. There is a concrete floor throughout. All the internal walls are painted in the same way as seen in Building 2, ie orange/red paint at the base, pale yellow at the top and a thin neutral band through the middle. This also has the same series of wooden pegs in the walls suggesting something was fixed to the walls at this point. All the windows have blast shutters still in situ, which could be opened and fixed to the walls by hooks when required. Between the wall and ceiling on the long walls are a series of small triangular wooden blocks. There are also a series of small rectangular holes in the walls, just below the ceiling, with narrow timber frames. These seem to correspond to a number of ventilation grilles on the external walls. There are two internal doorways, neither of which has any evidence remaining of doors or door frames.

Entrance to the building is through the first room (east end). The doorway has half of a set of blast doors still in situ. This room has a large block of concrete beneath the window in the east facing wall. There was also a narrow set of wooden shelves in a narrow niche formed between the end wall and one of the thicker columns. In the wall between this room and the larger central room is a T-shaped hole above which, in the ceiling, is a round hole through to the roof. There are also a series of bolts in the ceiling. Presumably both of these elements were connected with the fixing of the radar mast to the roof of this building.

The third room (west end) has another doorway, this time with the blast doors intact. All through the building there are various marks on the walls indicating the positions of cables etc.

### Exterior

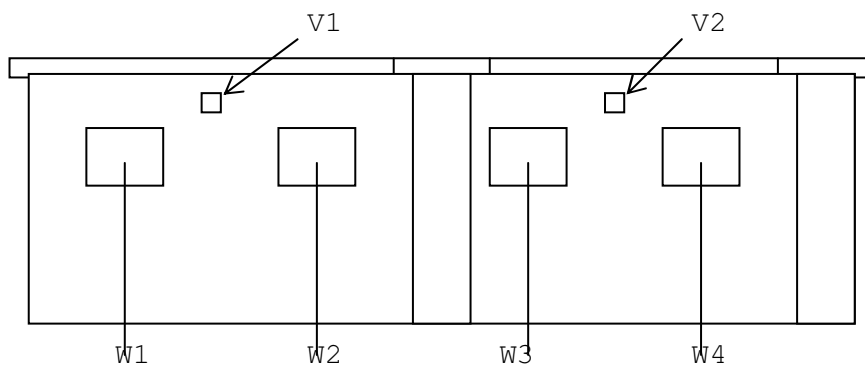
At the east end is an iron ladder, fixed to the roof, which rests on a brick base of three steps, each with a concrete top. On the roof is a series of bolts.

At the base of the building at this end is a wide concrete edging with a gully running through the centre. There is also a square concrete platform in front of this end of the building, slightly further down the slope.

Each window has a metal frame divided into two, each with four lights. The windows are hinged at the top and open from the bottom. Some wired glass is still in situ. There is also, between the outer metal frames and the inner blast shutters, a further timber frame in the windows. Over each of the doorways is a concrete drip mould.

This building is further down the slope than 1 and 2 and the ground has had to be dug out to some extent to provide a level surface. Because of this there is a set of concrete steps leading to the doorway at the west end of the building.

*South side, Exterior*



*Not to scale.*

W1: Window at the western end of the southern side of the building. Double leaf metal framed window, with each half opening on top hung hinges. Each half is divided into four lights. Overall external dimensions are 1.00m x 63cm. Each opening half is 48 x 60cm; each light 20 x 26cm. Main frame and hinges are in iron. The hinge and latch for the opener is in bronze.

The window frame is mounted 5cm behind the external face of the wall and 9cm in front of wooden shuttering (described in detail below). Wooden shuttering is 6cm thick and set 18cm in front of the inside wall face. Total thickness of the wall is 40cm. Heavy iron shutters further protect the inside of the opening. These were hung from pintels mounted on the inside face of the wall. Also double-leafed, the iron (blast) shutters are side hung; the east shutter bolts top and bottom with sliding bolts mounted externally; the west shutter slightly overlaps and is locked in place with a handle-turned latch. The lower pintle on the east side blast shutter is loose.

Little of the timber shutter remains – only the outer frame and fragments of hinges. See below for standard description and measured description of blast doors.

The windows were glazed with 5mm thick wire reinforced glass. This smooth externally and pitted internally. The reinforcement wire forms hexagonal structures. All of the glass panes are broken, with less than 25% remaining in situ. The frames are rusted shut, but in reasonable condition. There is some damage to the west side and the bottom of the frame in the east half. The moveable leaves are largely intact.

V1: A square (23cm a side) ventilation grille is set high in the wall between W1 and W2. It is a cast mounting in (?) zinc-coated iron, consisting of six down-angled slots. Nearby are three nails surviving from some screen arrangement which once overlay this. Flakes of what appears to have been zinc mesh remain adhering to the nails. This was probably to keep insects out.

W2: Another window as described above, and below. Virtually all the glass is missing from its west half; all lights are broken but 50% of the glass remains in the east half. Both halves have rusted shut; there is some erosion to the frame on the underside of the east half.

The western wooden shutter is missing; the east shutter is present but difficult to reach and record. The shutters are each made in two halves; the west half of this one has lost its plywood, while much remains (in a poor condition) in the east half. Blast doors are present and jammed shut.

W3: Another window, as above. Frame: West opening half present, with some damage to the bottom rail; east opening leaf is missing. Some appreciable bending to frame, probably resulting from subsidence of building. c. 30% of glass surviving.

Both leaves of blast shutters are present, though with some concrete cancer effecting the window sill. The lower pintle on the west side shutter is bent out of true.

There is more timber shuttering here than in W1 or W2. Framing of the shutters consists of timber 3 x 4cm, screwing into the window opening. Around this, on the outer face of the timber, is a further frame, 5cm deep and 1.5cm thick. This was, no doubt, to ensure that there was no light leakage. It extends all around the frame.

The inward opening timber shutters were hung from this frame. Each window was closed by two shutters, each side mounted on two hinges sited 13 and 53 cm above sill level. Each shutter was also centrally articulated on two further hinges, mounted at the upper and lower edges of the timber work. This produced four shutter segments in two pairs, each segment measuring 24cm wide by 57cm high. The joint between the paired segments was also cut to exclude light, with one half kneeling into the other.

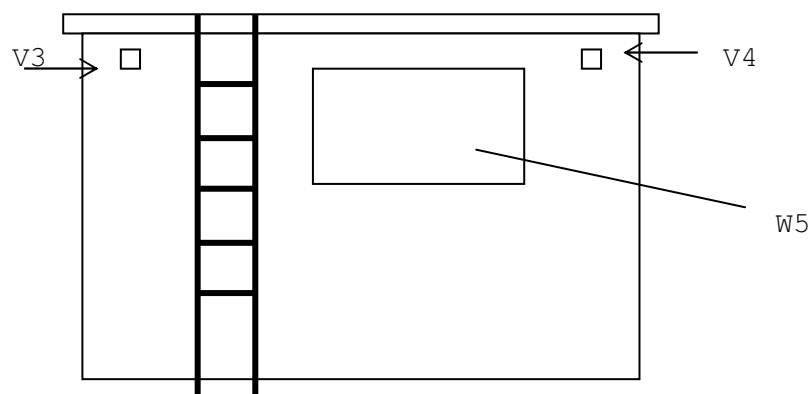
The frame of each segment measures 3.8cm wide by 2.8cm deep. Each frame is rectangular, and onto it was nailed a plywood sheet on each side. However a gap of 7cm was left at the bottom of the external leaf and at the top of the internal side. The purpose of this was presumably to allow ventilation without light leakage.

Only the "outer" (west) half of the west shutter survives here; the east shutter has both halves, but the plywood skin is missing from the "inner" half. The east shutter is also loose on its lower hinge.

V2: Another ventilator in the south wall, to the same description as V1 above. Also has (slightly trapezoidal) arrangement of outlying nails for further screening.

W4: Eastern window of the south wall, much as those described above. The frame is rusted shut but otherwise in good condition. Both leaves are present; all glass is broken but c.40% remains in situ. Only the outer segments of the shutter remain in both the east and west leaves. Both blast doors are present.

### East Wall



V3 & V4: Vents, as described above.

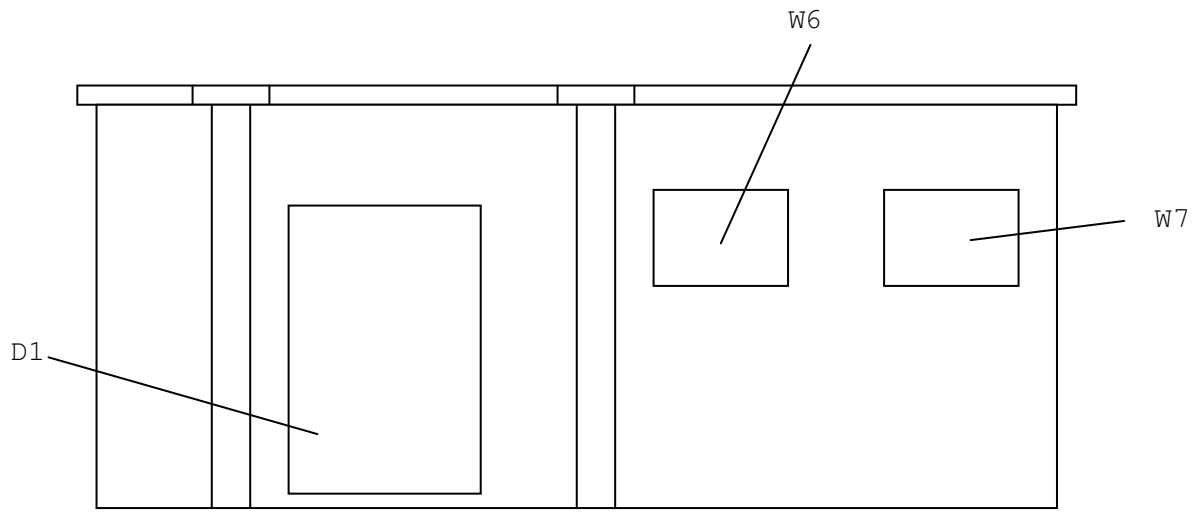
W5: Single window in the east wall of the building, much as described above. The window frame is in poor condition; the outer frame is generally present, though only 40% the left (south) moveable leaf is present and that without glass. The right (north) leaf is damaged, much of the bottom missing, with no glass.

The left (south) half of the shutters is missing; the right has both segments present and in good condition – still articulated.

Both blast doors are present. As with the other examples, the doors are made of steel 5mm thick. The hinge pintles are mounted on iron strips bolted to the inside face of the wall, two pintles to each shutter. One plate bolts in place when closed, using external bolts as described above. The other would then have been locked in place using a “handle” lock. This arrangement was presumably stronger than mounting all the bolts internally. The internal faces of the blast doors are also fitted with loops so that they could be fixed open, using pins attached to the adjacent walls.

The handle lock is actually broken off in W5, with the fragments on the floor nearby.

#### North Wall



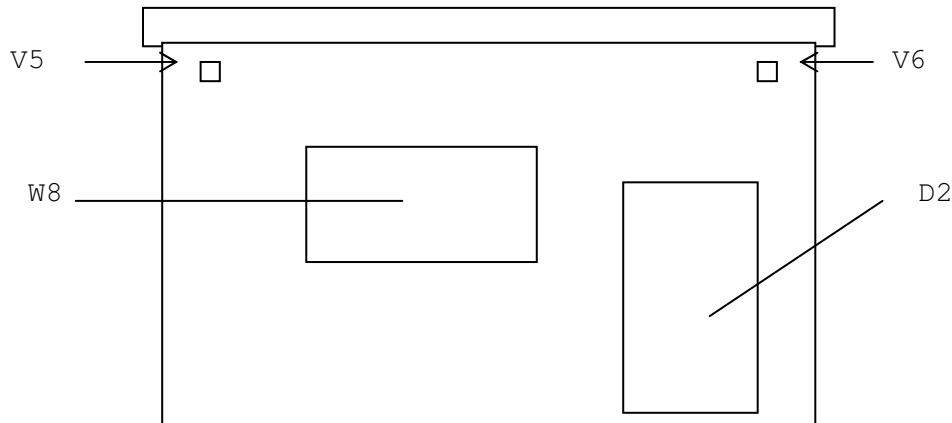
D1: Door opening measuring 1.38m wide by 2.2.6m high. Originally closed by a pair of interlocking steel doors – but only the west leaf now remains. The doors were mounted in a steel frame set into the concrete walls, hung on three hinge pintles. The doors opened outwards, in contrast to the blast shutters. The surviving hinges have brass pintles and turning washers. The handle and locking mechanisms have been stripped off.

W6: Window, originally as those described above. However it is now in very poor condition. The blast shutters are missing; so are the timber shutters with the exception of the external frame. In the window frame, most of the west leaf and half of the east is missing. Little glass remains. The west, base and centre of the of the fixed iron frame is also missing along with half of the east side.

W7: Window in the north wall of the building, as described above. Blast shutters present and rusted in place. Best preserved set of wooden shutters. The west leaf has both segments present with plywood sheets in place; the east leaf has both segments present, although the plywood is missing from the east segment.

The window frame is not so well preserved. Much of the east side of the outer frame is missing. The bottom parts of both leaves are missing or poorly preserved. However, the west leaf is still articulated and moves on its hinges.

## West Wall



W8: Window in the west wall of the building. Blast doors both present. Only the side and top of the outer frame of the wooden shutters remain. The window frame itself is not in bad condition, but with very little glass in place.

D2 is a second double-leafed door, built as is described above for D1. It fills an opening measuring 1.23m wide by 2.23m high. The handle and locking mechanisms have been removed, and the doors have rusted shut. There is some dark coloured paint still adhering to the door surfaces.

V5 & V6 – Vents as described above.

## Accommodation Buildings

### *Buildings A1 to A3*

In 2000, these were described as follows (Newman & Kenyon 2000, 22-23):

Buildings 1 -3: A rectangular structure formed from a narrow concrete wall which has a series of short reinforcing rods. The centre of the structure is now grassed over. A set of concrete steps lead to a doorway in the south facing wall. At the north end of buildings 2 and 3 is a square of concrete paving.

### *Building A4*

In 2000, this building was described as follows (Newman & Kenyon 2000, 23):

Building 4 - As for 1 - 3 except that the steps to the doorway run along the front wall rather than lead up to it. They consist of two concrete steps with the third step formed by a large brick platform covered by a concrete block. At the north end of the building is an area of concrete paving, with some brickwork between, which covers the area between the rear of Building 4 and the side of 5, and then runs around the front of the latter building and up the other side.

### *Building A5*

In 2000, this building was described as follows (Newman & Kenyon 2000, 23):

Building 5 - Built in the same way as the previous buildings, but it is slightly smaller and has narrower walls. There are no steps up to it. Inside are large slabs of concrete, possibly the remains of a floor. Running away from the north side of the building are the remains of a stone wall.

### *Building A6*

Building 6 - A square building formed from narrow concrete walls, as above. There is a slight concrete plinth at the base. There are no steps. At the west end there is a square piece of concrete paving.

### *Building A7*

Building 7 - The same building type as 6, but this structure has a large concrete slab covering the whole.

### *Building A8*

Building 8 - A rectangular building of narrow concrete walls with reinforcing rods. No steps. At the west end is a small square hole bounded by concrete edges - possibly a drain. Inside this building, built into the base of the north facing wall, are the remains of a clay pipe approx. 10cms in diameter.

### *Building A9*

Building 9 - Two short, parallel lengths of stone walling. The extent of them is unclear.

### *Building A10*

Building 10 - Exactly the same structure and layout as Building 4, except there is no concrete paving to the rear.

### *Building A11*

Building 11 - This is in two parts joined by an area of concrete paving. The smaller of the two rooms is a square formed by concrete walls and with a concrete floor. At the west end of the building, at a short distance away, are two possible drains covered by concrete slabs. At the east end is a doorway. The paving between the two rooms is built on a base of bricks, four courses high. To the side of this is a drain.

The larger room seems to be a smaller, square version of Radar Building 3, with short concrete walls supporting a corrugated asbestos roof, no longer in situ but remains of which litter the floor. The two walls at front and rear are of brick on a base of concrete. Two concrete steps lead to the doorway. Again, as at Radar Building 3, there is a hexagonal block of concrete leaning against the front wall.

### *Buildings A12-A13*

Building 12 - 13 - Built at some distance away from the main complex, approx. 40 - 50 metres, are two much smaller buildings, constructed in the same way but with thinner walls. At the edge of 12 is a vertical clay pipe set into the ground. This, and the shape and position of the two buildings suggests they may have been latrines. There are also two brick lined drain holes, covered with concrete slabs, nearby.

**APPENDIX 2**  
**PHOTOGRAPHIC RECORD**

## APPENDIX 2: PHOTOGRAPHIC CATALOGUE

Film 1: Digital colour photographs taken 5th December 2011

Film 2: Digital colour photographs taken 13th December 2011

Film 3: Digital colour photographs taken 11th January 2012

Film 4: Digital colour photographs taken 4th February 2012

Film 5: Colour digital photographs taken 4th December 2012

Film	Frame	Subject	Scale
1	824	Coastguard tower, 1F viewing slot, looking N	-
1	825	Coastguard tower 1F interior, looking N	1m
1	826	Coastguard tower 1F E internal wall, looking NE	1m
1	827	Coastguard tower 1F S internal wall, looking SE	1m
1	828	Coastguard tower 1F W internal wall, looking SW	1m
1	829	Coastguard tower 1F W internal wall, looking SW	1m
1	830	Coastguard tower 1F W internal wall, paint / whitewash pattern around former fittings, looking W	-
1	831	Coastguard tower 1F ceiling vent, looking NE	-
1	832	Coastguard tower, stairs to 1F, looking S	1m
1	833	Coastguard tower, overhanging concrete roof to N side, with drip channel to underside, looking SE	-
1	834	Coastguard tower, stairs to 1F, looking NE	1m
1	835	Coastguard tower, information plaque to stairs	-
1	836	Coastguard tower, N external elevation, looking SE	1m
1	837	Coastguard tower, E & S external elevations, looking NW	1m
1	838	Coastguard tower, E external elevation, looking NW	1m
1	839	Coastguard tower, GF internal E wall, looking NE	-
1	840	Coastguard tower, W external elevation, looking NE	1m
1	841	Coastguard tower, S external elevation, looking NW	1m
1	842	Coastguard tower, alcove at base of S external elevation, looking NE	1m
1	843	Coastguard tower, drain adjacent to alcove at base of S external elevation, looking NW	-
1	844	Buildings R4 and R3, looking E	-
1	845	Building R1, E external elevation, looking SW	1m
1	846	Building R1, N external elevation, looking SE	1m
1	847	Building R1, W external elevation, looking NE	1m
1	848	Building R1, S external elevation, looking N	1m
1	849	Building R1, S external elevation, detail of holes, looking N	1m
1	850	Building R2, N external elevation, looking SE	1m
1	851	Building R2, W external elevation, detail of north vent, looking NE	-
1	852	Building R2, W external elevation, looking NE	1m
1	853	Building R2, S external elevation, looking NW	1m
1	855	Building R2, drain cover adjacent to S external elevation, looking NW	1m
1	856	Building R2, E external elevation, looking SW	1m
1	857	Building R2, lobby at E end, looking SE	1m
1	858	Building R2, W internal wall, looking SW	1m
1	860	Building R2, W internal wall, pencilled numbers and fractions, looking SW	-
1	861	Building R2, E internal wall, looking NE	1m
1	862	Building R2, S internal wall, looking SW	1m
1	863	Building R2, S internal wall, looking SE	1m
1	864	Building R2, N internal wall, looking NE	1m
1	865	Building R2, N internal wall, looking NW	1m
1	866	Building R1, W internal wall, looking SW	1m
1	867	Building R1, S internal wall, looking S	1m
1	868	Building R1, E internal wall, looking NE	1m
1	869	Building R1, S internal wall, pegs at E end, looking E	-
2	001	Building R4, W room Elevation H, track for former sliding door, looking N	1m
2	002	Building R3, looking SE	1m
2	003	Building R3, N external elevation, looking SE	1m
2	004	Building R3, entrance to N external elevation, looking N	1m
2	005	Building R3, concrete slab at base to W elevation	0.50m
2	006	Building R3, looking N	1m



2	007	Building R3, S external elevation, looking NW	1m
2	008	Building R3, looking W	1m
2	009	Building R3, looking SW	1m
2	010	Building R3, N elevation, blocked window, looking SE	1m
2	011	Building R3, entrance passage, looking SE	1m
2	012	Building R3, internal N wall, looking NW	1m
2	013	Building R3, doorway into NW room, looking NW	1m
2	014	Building R3, shelf in NW room, looking W	0.50m
2	015	Building R3, former electrical fitting in NW room, looking SE	-
2	017	Building R3, doorway into NE room, looking N	1m
2	018	Building R3, shelf in NE room, looking N	0.50m
2	019	Building R3, former electrical fitting in NE room, looking SE	-
2	021	Building R3, former electrical fitting over E side of ceiling, looking E	-
2	022	Building R3, S internal wall, looking SE	1m
2	023	Building R3, interior, looking SE	1m
2	024	Building R3, former electrical fitting on S internal wall, looking SE	-
2	025	Building R3, interior, looking NE	1m
2	909	Trough to NW of Building A5, looking NE	1m
2	910	Sub-circular hollow to NW of Building A5, looking W	1m
2	911	Building A5, looking E	1m
2	913	Building A5, looking SW	1m
2	914	Concrete surface between Buildings A4 & A5, looking SW	1m
2	916	Building A4, looking NW	1m
2	917	Building A4, steps, looking E	1m
2	918	Building A3, looking NW	1m
2	919	Building A3, steps, looking NW	1m
2	920	Building A2, looking NW	1m
2	921	Building A2, steps, looking NW	1m
2	923	Building A1, looking NW	1m
2	924	Building A1, looking NW	1m
2	925	Pile of rubble on Building A7, looking SW	1m
2	926	Building A7, looking W	1m
2	927	Building A7, threaded bolt in SE corner	0.50m
2	929	Building A7, shallow recess / socket in NE corner	0.50m
2	930	Building A6, looking W	1m
2	931	Building A8, looking NW	1m
2	932	Building A9, looking NW	1m
2	933	Building A10, looking W	1m
2	934	Building A10, steps, looking N	1m
2	935	Building A11, looking NW	1m
2	936	Building A11, looking NW	1m
2	937	Building A11, looking NW	1m
2	938	Building A11, looking NW	1m
2	939	Building A11, detail of E wall construction, looking SE	1m
2	940	Building A11, detail of E wall construction	0.50m
2	941	Building A11, detail of E wall construction, looking N	0.50m
2	942	Building A11, detail of chamfer to NE corner of S part, looking SW	1m
2	943	Building A11, detail of chamfer to NE corner of S part, looking NW	1m
2	944	Overgrown pit / cistern?, N of Building A11, looking N	0.50m
2	945	Pit / cistern to S of Building A13, looking SW	0.50m
2	946	Building A13, looking SW	1m
2	947	Building A13, looking SW	1m
2	948	Pit / cistern to NE of Building A13, looking N	1m
2	949	Building R5, looking E	1m
2	950	Building R5, looking NE	1m
2	951	Building R5, interior, looking NE	-
2	952	Building R2, E external elevation, looking SW	1m
2	954	Building R1, E external elevation, looking SW	1m
2	955	Building R4, W external elevation, looking NE	1m
2	956	Building R4, steps to SW, looking SW	0.50m
2	957	Building R4, manhole / cistern to SW of W external elevation, looking NE	0.50m
2	958	Building R4, window (W8) to W external elevation, looking NE	0.50m
2	959	Building R4, blast doors (D2) to W external elevation, looking NE	1m
2	960	Building R4, W end of S external elevation, looking NW	1m

2	961	Building R4, S external elevation, looking NE	1m
2	962	Building R4, looking NE	1m
2	963	Building R4, E end of S external elevation, looking NW	1m
2	964	Building R4, external drain at NE corner, looking SW	1m
2	965	Building R4, external drain on E side, looking NW	1m
2	966	Building R4, E external elevation, looking SW	1m
2	967	Building R4, former ladder position on E external elevation, looking SW	1m
2	968	Building R4, former ladder position on E external elevation, looking SW	-
2	969	Building R4, external drain at NW corner, looking SW	1m
2	970	Building R4, E end of N external elevation, looking SE	1m
2	971	Building R4, looking SE	1m
2	972	Building R4, blast doors (D1), E end of N external elevation, looking SE	1m
2	973	Building R4, E room, N wall (Elevation D), looking N	1m
2	974	Building R4, E room, N wall (Elevation D), looking N	1m
2	975	Building R4, ceiling fittings over E room, looking SE	-
2	976	Building R4, E room, E wall (Elevation A), looking NE	1m
2	977	Building R4, blast shutters in E wall of E room (W5; Elevation A), looking NE	0.50m
2	978	Building R4, E room, S wall (Elevation B), looking SE	1m
2	979	Building R4, blast shutter in E room (W4; Elevation B), looking SE	-
2	980	Building R4, E room, W wall (Elevation E), looking SW	1m
2	981	Building R4, E room, E wall (Elevation A), detail of covered vent, looking NE	-
2	982	Building R4, central room, E wall (Elevation F), looking NE	1m
2	983	Building R4, central room, E wall (Elevation F), looking E	1m
2	984	Building R4, central room, E wall (Elevation F), detail of bakelite clips over cable duct, looking NE	0.50m
2	985	Building R4, central room, E part of S wall (Elevation B), looking SE	1m
2	986	Building R4, central room, S wall (Elevation B), looking SE	1m
2	987	Building R4, central room, ceiling fittings over E end, looking NE	-
2	988	Building R4, central room, ceiling fittings over E end, looking NE	-
2	989	Building R4, central room, W wall (Elevation G), looking SW	1m
2	990	Building R4, central room, W wall (Elevation G), looking SW	1m
2	991	Building R4, central room, E end of N wall (Elevation D), looking NW	1m
2	992	Building R4, central room, W end of N wall (Elevation D), looking NW	1m
2	993	Building R4, W room, N wall (Elevation D), looking NW	1m
2	994	Building R4, W room, N end of W wall (Elevation C), looking SW	1m
2	995	Building R4, W room, W wall (Elevation C), looking S	1m
2	996	Building R4, W room, S wall (Elevation B), looking SE	1m
2	997	Building R4, W room, E wall (Elevation H), looking NE	1m
2	998	Building R4, W room, E wall (Elevation H), looking NE	1m
2	999	Building R4, W room, E wall (Elevation H), track for former sliding door, looking NW	1m
3	274	Building R4, E room, E wall (Elevation A), typical wooden ceiling structure	-
3	275	Building R4, E room, E wall (Elevation A), typical wooden ceiling structure	-
3	276	Building R4, E room, N wall (Elevation D), differing wooden ceiling structure	-
3	277	Building R4, E room, N wall (Elevation D), differing wooden ceiling structure	-
3	278	Building R4, E room, E wall (Elevation A), wall vent with cover	-
3	280	Building R4, E room, E wall (Elevation A), wall vent without cover	-
3	281	Building R4, W room, N wall (Elevation D), folding wooden shutters to W7, looking NW	-
3	282	Building R4, W room, N wall (Elevation D), blast shutter & folding wooden shutters to W7, looking NW	-
3	284	Building R4, W room, N wall (Elevation D), stop for sliding door	-
3	285	Building R4, central room, W wall (Elevation G), former key rack	-
3	286	Building R4, W room, E wall (Elevation H), wooden board	-
3	287	Structure to NE of Building R4, looking NE	1m
3	288	Structure to NE of Building R4, looking NW	1m
3	289	Typical angle-iron post in east wall of site, looking NE	1m
3	290	Building R4, E room, N wall (Elevation D), shelves, looking NW	-
3	291	Building R4, E room, W wall (Elevation E), bakelite clips	-
3	292	Building R4, E room, W wall (Elevation E), bakelite clips to E room	-
3	293	Building R4, central room, S wall (Elevation B), former clip positions	-
3	294	Building R4, central room, E wall (Elevation F), former fitting position	-
3	295	Building R4, central room, N wall (Elevation D), former switch position and clip	-

3	296	Building R4, central room, N wall (Elevation D), bakelite clip	-
3	297	Building R1, concrete to SE external corner, looking NW	1m
3	298	Building R2, N internal wall, typical pencilled marks	-
3	299	Building R2, N internal wall, typical pencilled marks	-
3	300	Broken iron stanchion, adjacent to railway line, looking SW	1m
4	556	View along railway line, looking N	-
4	557	Building A11, SE corner showing concrete slab, looking N	1m
4	558	Building A11, clearance of S half, looking S	-
4	559	Building A11, clearance of N end of S half, looking SW	1m
4	560	Building A11, clearance of N end of S half, looking SW	1m
4	561	Building A11, clearance of N end of S half, looking NW	1m
4	562	Building A10, dump of bricks after clearance to Building A11, looking NW	-
4	563	Building A10, iron artefact after clearance to Building A11	-
4	564	Building A10, iron artefact after clearance to Building A11	0.50m
4	565	Building R1, E external elevation, after clearance, looking SW	-
4	566	Building R1, after internal clearance, looking SW	-
4	568	Building R1, wooden door against N external elevation, looking SW	-
4	569	Building R2, E external elevation, after clearance, looking SW	-
4	570	Building R2, cleared fragments outside N elevation	-
4	571	Building R2, after internal clearance, base of machine bed, looking SW	-
4	572	Building R2, after internal clearance, base of machine bed, looking NE	1m
4	573	Building R2, after internal clearance, base of machine bed, looking SW	1m
4	574	Building R2, SE external corner, looking NE	-
4	575	Buildings R1 and R2, looking NW	-
4	576	Building R3, looking SE	-
4	577	Building R3, materials gathered from clearance, looking SE	-
4	578	Building R3, interior after clearance, looking N	-
4	579	Building R3, form of roof construction, looking E	-
4	580	Building R3, entrance passage after clearance, looking SE	-
4	581	Building R3, interior after clearance, looking S	-
4	582	Building R3, hole in roof, looking NW	-
4	583	Building R3, interior after clearance, looking SE	-
4	584	Building R3, NW external corner, looking SE	-
4	585	Building R3, looking NW	-
4	586	Building R4, doors and other items gathered after clearance, looking S	-
4	587	Building R4, E room after clearance, looking S	1m
4	589	Building R4, E room, cable duct in floor after clearance, looking S	0.50m
4	590	Building R4, E room, cable duct in floor after clearance, looking SE	0.50m
4	591	Building R4, central room after clearance, looking S	-
4	592	Building R4, central room after clearance, cable duct passing under W wall, looking S	-
4	593	Building R4, central room after clearance, looking S	1m
4	594	Building R4, central room after clearance, looking SW	-
4	595	Building R4, central room after clearance, looking SE	-
4	596	Building R4, W room after clearance, looking SE	-
4	597	Building R4, W room after clearance, looking N	-
4	598	Building R4, central room after clearance, looking S	-
4	599	Building R4, W room, hinges to doorframe (D2)	-
4	600	Building R4, door and other items gathered after clearance, looking NE	-
4	601	Building R3, materials gathered after clearance, looking SW	-
4	602	Building R4, looking NW	-
5	375	Building R4 roof, looking E	1m
5	376	Building R4 roof, looking E	1m
5	377	Building R4 roof, looking E	1m
5	378	Building R4 roof, looking E	1m
5	379	Building R4 roof, pad of turning mechanism & pipe, looking E	1m
5	380	Building R4 roof, pad of turning mechanism, looking E	1m
5	381	Building R4 roof, pad of turning mechanism, looking W	1m
5	382	Building R4 roof, pad of turning mechanism & pipe, looking W	1m
5	383	Building R4 roof, pad of turning mechanism & pipe, looking W	1m
5	384	Building R4 roof, NW base, looking NW	1m
5	385	Building R4 roof, lip to N doorway (D1), looking NE	1m

5	386	Building R4 roof, NE base, looking W	1m
5	387	Building R4 roof, NE base, looking NE	1m
5	388	Building R4 roof, SE base, looking SE	1m
5	389	Building R4 roof, SE base, looking SW	1m
5	390	Building R4 roof, SW base, looking SW	1m
5	391	Building R4 roof, SW base, looking SE	1m
5	392	Building R4 roof, looking W	1m
5	393	Building R4 roof, looking W	1m
5	394	Building R4 roof, looking W towards coastguard station	-
5	395	Building R4 roof, looking W towards coastguard station	-
5	396	Building R4 roof, looking W towards coastguard station	-
5	397	Building R3, looking SE	-
5	398	Building R3, looking SE	-
5	399	Building R3, looking SE	-
5	400	Buildings R1 & R2, looking SW	-
5	401	Buildings R1 & R2, looking SW	-
5	402	Building R4 roof, lip to N doorway (D1), looking NE	1m
5	403	Building R4 roof, lip to W doorway (D2), looking W	1m
5	404	Building R4 roof, lip to W doorway (D2), looking W	1m



1-824.JPG



1-825.JPG



1-826.JPG



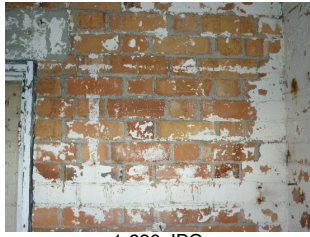
1-827.JPG



1-828.JPG



1-829.JPG



1-830.JPG



1-831.JPG



1-832.JPG



1-833.JPG



1-834.JPG



1-835.JPG



1-836.JPG



1-837.JPG



1-838.JPG



1-839.JPG



1-840.JPG



1-841.JPG



1-842.JPG



1-843.JPG



1-844.JPG



1-845.JPG



1-846.JPG



1-847.JPG



1-848.JPG



1-849.JPG



1-850.JPG



1-851.JPG



1-852.JPG



1-853.JPG



1-855.JPG



1-856.JPG



1-857.JPG



1-858.JPG



1-860.JPG



1-861.JPG



1-862.JPG



1-863.JPG



1-864.JPG



1-865.JPG



1-866.JPG



1-867.JPG



1-868.JPG



1-869.JPG



2-001.JPG



2-002.JPG



2-003.JPG



2-004.JPG



2-005.JPG



2-006.JPG



2-007.JPG



2-008.JPG



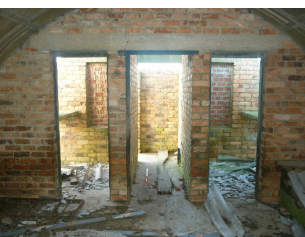
2-009.JPG



2-010.JPG



2-011.JPG



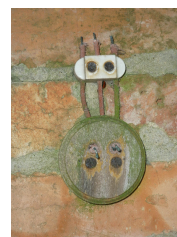
2-012.JPG



2-013.JPG



2-014.JPG



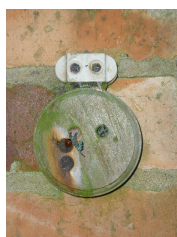
2-015.JPG



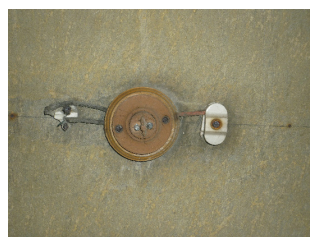
2-017.JPG



2-018.JPG



2-019.JPG



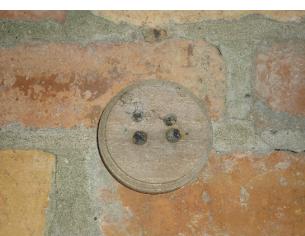
2-021.JPG



2-022.JPG



2-023.JPG



2-024.JPG



2-025.JPG



2-909.JPG



2-910.JPG



2-911.JPG



2-913.JPG



2-914.JPG



2-916.JPG



2-917.JPG



2-918.JPG



2-919.JPG



2-920.JPG



2-921.JPG



2-923.JPG



2-924.JPG



2-925.JPG



2-926.JPG



2-927.JPG



2-929.JPG



2-930.JPG



2-931.JPG



2-932.JPG



2-933.JPG



2-934.JPG



2-935.JPG



2-936.JPG



2-937.JPG



2-938.JPG



2-939.JPG



2-940.JPG



2-941.JPG



2-942.JPG



2-943.JPG



2-944.JPG



2-945.JPG



2-946.JPG



2-947.JPG



2-948.JPG



2-949.JPG



2-950.JPG



2-951.JPG



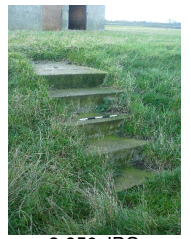
2-952.JPG



2-954.JPG



2-955.JPG



2-956.JPG



2-957.JPG



2-958.JPG



2-959.JPG



2-960.JPG



2-961.JPG



2-962.JPG



2-963.JPG



2-964.JPG



2-965.JPG



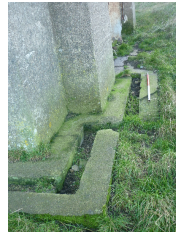
2-966.JPG



2-967.JPG



2-968.JPG



2-969.JPG



2-970.JPG



2-971.JPG



2-972.JPG



2-973.JPG



2-974.JPG



2-975.JPG



2-976.JPG



2-977.JPG



2-978.JPG



2-979.JPG



2-980.JPG



2-981.JPG



2-982.JPG



2-983.JPG



2-984.JPG



2-985.JPG



2-986.JPG





2-987.JPG



2-988.JPG



2-989.JPG



2-990.JPG



2-991.JPG



2-992.JPG



2-993.JPG



2-994.JPG



2-995.JPG



2-996.JPG



2-997.JPG



2-998.JPG



2-999.JPG



3-274.JPG



3-275.JPG



3-276.JPG



3-277.JPG



3-278.JPG



3-280.JPG



3-281.JPG



3-282.JPG



3-284.JPG



3-285.JPG



3-286.JPG



3-287.JPG



3-288.JPG



3-289.JPG



3-290.JPG



3-291.JPG



3-292.JPG



3-293.JPG



3-294.JPG



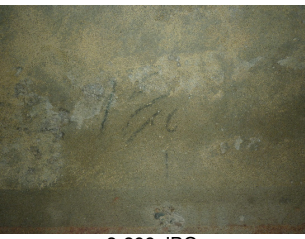
3-295.JPG



3-296.JPG



3-297.JPG



3-298.JPG



3-299.JPG



3-300.JPG



4-556.JPG



4-557.JPG



4-558.JPG



4-559.JPG



4-560.JPG



4-561.JPG



4-562.JPG



4-563.JPG



4-564.JPG



4-565.JPG



4-566.JPG



4-568.JPG



4-569.JPG



4-570.JPG



4-571.JPG



4-572.JPG



4-573.JPG



4-574.JPG



4-575.JPG



4-576.JPG



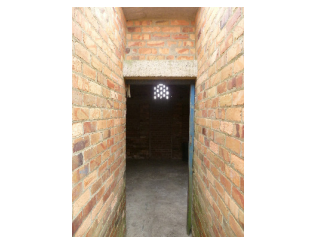
4-577.JPG



4-578.JPG



4-579.JPG



4-580.JPG



4-581.JPG



4-582.JPG



4-583.JPG



4-584.JPG



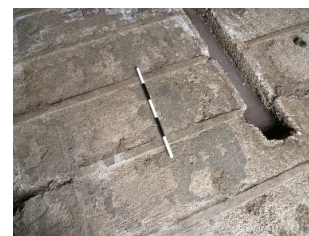
4-585.JPG



4-586.JPG



4-587.JPG



4-589.JPG



4-590.JPG



4-591.JPG



4-592.JPG



4-593.JPG



4-594.JPG



4-595.JPG



4-596.JPG



4-597.JPG



4-598.JPG



4-599.JPG



4-600.JPG



4-601.JPG



4-602.JPG



5-375.JPG



5-376.JPG



5-377.JPG



5-378.JPG



5-379.JPG



5-380.JPG



5-381.JPG



5-382.JPG



5-383.JPG



5-384.JPG



5-385.JPG



5-386.JPG



5-387.JPG



5-388.JPG



5-389.JPG



5-390.JPG



5-391.JPG



5-392.JPG



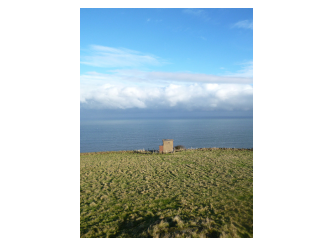
5-393.JPG



5-394.JPG



5-395.JPG



5-396.JPG



5-397.JPG



5-398.JPG



5-399.JPG



5-400.JPG



5-401.JPG



5-402.JPG



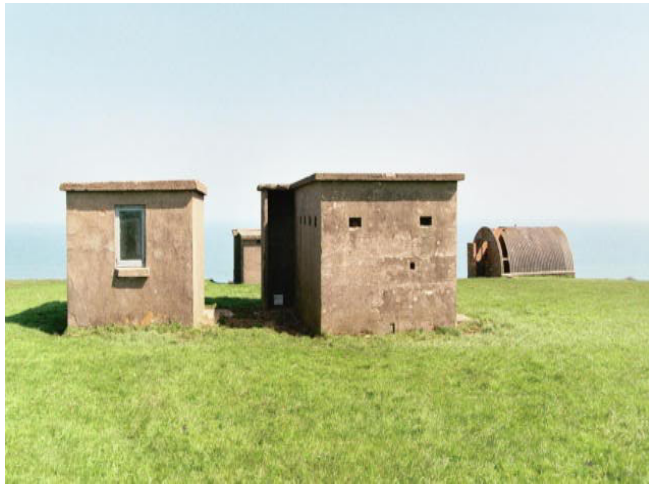
5-403.JPG



5-404.JPG

**APPENDIX 3**  
**NATURAL ENGLAND PROJECT BRIEF**

**Project Brief for archaeological recording and consolidation for an interpretation project, Bent Riggs Radar Station, Staintondale, Yorkshire Coast.**



**Prepared for:**

Mr Cother,  
Colcroft Farm,  
Fylingdales,  
North Yorkshire  
YO22 4QQ

HLS AG 00296652

**By:**

Dr. Margaret Nieke  
Yorkshire and the Humber Historic Environment Lead Adviser (HELA)  
Natural England  
4<sup>th</sup> Floor  
Foss House  
King's Pool  
1-2 Peasholme Green  
York YO1 7PX

June 2011

Tel: 0300-060-1898

Email: [margaret.nieke@naturalengland.org.uk](mailto:margaret.nieke@naturalengland.org.uk)

**National Grid Reference:** NZ991 008

The Bent Riggs Chain Home Low Radar station lies in a pasture field adjoining the Cleveland Way footpath, on a high cliff top just to the south of Ravenscar. Owned by the National Trust (NT), the field is tenanted by Mr. Cother. It has been subject to a Higher Level Stewardship scheme since February 1<sup>st</sup> 2010. It is scheduled (SM34842) in three land parcels.

The station was constructed as part of a coast defence radar system in 1941, and continued in use until after the Second World War. It now consists of

- a group of three reinforced-concrete and brick buildings, with a fourth Nissen Hut, in the centre of the field;
- evidence for both sub-surface services adjoining these buildings, and – possibly – the ploughed out remains of outlying defences such as slit trenches;
- the footings of a complex of about a dozen barrack blocks and other domestic building at the southern end of the field, adjoining the disused (but contemporary) Whitby-Scarborough railway line.

Nearby stand:

- In the field to the east an alleged cement works of C19 date, for processing cement stone from the cliffs below
- To the north, next to the Cleveland Way, a Coastguard lookout

Of these the cement works require no further detailed recording.

The Second World War buildings were long neglected. It seems likely that most of the domestic/barracks structures were demolished when the station was decommissioned, although the presence of some remains of sheeting superstructures may suggest that one or more were retained for agricultural use thereafter. The gaunt radar buildings received considerable negative comment, and proposals for their demolition were seriously considered. Thankfully, their value has been more fully recognised in more recent times, especially as there is unusual survival of fenestration structures in the main Tx/Rx building. Both the radar buildings and the remains of the barrack complex were Scheduled in 2002.

The remains were surveyed by Katie Kenyon and Mark Newman in 2000, prior to previous consolidation works by the National Trust, which have since been partially vandalised.

This proposal for works suitable for HLS funding has been developed following a site visit by National Trust staff (Mark Newman, Mark Bradley, Bill Blake and Zoe Franks), the tenant and Margaret Nieke on September 23<sup>rd</sup> 2009.

Funding is available for these works until January 2013 although it is hoped to complete the bulk of work by March 2012. Any contract for works is with the agreement holder. Works must be paid for in full by the agreement holder and then claimed via the HLS agreement with claims supported by fully receipted invoices. Stage payments may be possible by agreement with the agreement holder and the Natural England HELA.

**Aims: The National Trust wish to include the radar station in an existing educational access project; as part of this they hope to allow controlled access to the interiors of the buildings. This access may include some limited reconstruction and interpretation of the interiors of the key buildings.**

The key aims of the proposed work can be characterised as:

- a) Bring the remains into a condition (and under a management regime) commensurate with their designation as a Scheduled Ancient Monument
- b) Make them much more accessible to the public, both through planned events and when passing or visiting the buildings
- c) Meet broader National Trust and Natural England objectives with regard to the above
- d) Consolidate and manage the remains to ensure their long term survival.

Before any of the structures can be opened up they require detailed recording and proposals for appropriate conservation. Tenders are therefore being sought for this first phase of work.

### **Phase 1 Cleaning and clearance**

Before any recording works can proceed the buildings and footings will need some cleaning and clearance to ensure their detail can be fully recorded. The work required is as follows:-

#### **Barrack block area**

It is proposed that a local contractor be employed to remove superimposed field clearance rubble from the concrete building bases and remove this off site. They would also carefully remove any remaining elements of asbestos sheeting cemented onto/into the concrete bases.

Either a local contractor or NT staff to trim invasive vegetation to reveal the extent and nature of the surviving structures prior to further planning for the presentation of these remains.

There may possibly be a subsequent phase of work to expose hidden elements of footings, under archaeological supervision, once vegetation is cleared.

This work will require securing Scheduled Ancient Monument Consent. The NT would undertake to manage this consent process. The appointed archaeological contractor will need to agree the works required with the NT and oversee works on-site. The NT will provide details of appropriate contractors but the archaeological contractor will need to include costings for the work in their tender for works.



Vulnerable loose original fixtures and fittings (fenestration within the Tx/Rx building and an access ladder) will have been removed from site and placed in secure storage. Access to removed material will be arranged for the agreed contractors.

### **Phase 2a Initial recording requirements:-**

Archaeological contractors will be commissioned to undertake detailed recording of the radar complex, services in its environs and the revealed Barracks complex. This should build on and not duplicate previous recording.

This work will consist of:

#### ***Radar buildings***

Photographic survey of the buildings in their present condition

Additional details survey of the fenestration of the Tx/RX building

Photographic elevation by elevation recording of the buildings

Accurate recording of all original internal and external fixtures and fittings including full interpretation of their original function

Drawn and textual recording of the services around the complex. This will consist of a feature by feature survey, and a plan (at 1:50) of the whole complex showing the location of identified features. Some probing survey may be needed to follow these features.

Conservators report to be prepared on the conservation needs of the surviving fenestration, door furniture and other surviving details (such as electrical fittings). This must be prepared in discussion with the National Trust's conservator.

Identification of areas/features requiring consolidation or repair.

#### ***Barrack complex***

Completion of an accurate plan of the exposed complex at 1:50, or larger scale if greater detail is considered useful. The plan will show the built structures and any other relevant topographic detail.

Interpretation of original function of each individual surviving building.

Feature by feature photographic and textual recording of the exposed building bases.

#### ***Whole landscape***

Documentary research, including Defence of Britain records, local oral history, work on comparable sites (e.g. the EH survey of the CHL station at Craster), aerial photographic evidence.

Targeted geophysical surveys of the field may be appropriate to identify some elements of the former complex – eg the outer defences. Potential costings for such works should be presented as an optional extra.

The potential for elements of the above to be undertaken as Engagement, or Community Archaeology, projects should be fully explored in discussion with the National Trust.

### **Objectives of this Brief & Submission of Quotes**

- This brief should be used by the applicant to obtain three itemised quotes for the preparation and production of the recording and repair proposals outlined above.. Quotations should be based on the requirements set out in each section of this brief and each item of work costed separately.
- The submission should also include:
  - A method statement demonstrating how the work will be undertaken,
  - Identification of who will undertake the work and an outline of their professional expertise in building conservation and buildings of this type.
  - Requirements for CDM cover, input from structural engineers etc should be made clear. Where appropriate providers of these services should be identified and their input clearly costed.
- This brief and the resulting Management Plan should be used to facilitate full liaison with Natural England concerning the technical details of any subsequent application for grant aided work to restore the building.

### **Content of the Management Plan**

#### **1. Summary**

A short concise summary identifying:

- Site Location
- Site Description, including a site plan to an appropriate scale
- The aims of the restoration
- Current condition of the building and the threats and issues it faces

#### **2. Summary of the Historical Development and Statement of Significance**

A brief summary of the historical development of the complex; where appropriate illustrative photographs from key viewpoints should be included and cross-referenced to a scaled plan.

#### **3. Analysis and Recording**

Undertake a site survey of the complex looking at its form, use of materials and methods of construction, past function, style of architecture and changes/adaptations over time and the reasons for the changes. This should be cross-referenced with the information gathered in 2 and 3 above.

A record of the buildings as they presently exists, and analysis of the fabric likely to be affected by repair should be made using appropriately scaled plans, drawings and photographs, equivalent to Level 2 of English Heritage's

*'Understanding Historic Buildings: A Guide to Good Recording Practice'* (available at [www.helm.gov.uk](http://www.helm.gov.uk) under Guidance Library). Level 2 is a visual and descriptive record. A brief to guide the building recording based on the English Heritage guidance is attached (Appendix Two). Depending on the nature and level of necessary repair identified within the management plan, appropriate recording may also be required during repair works and after their completion.

#### **4. Wildlife Survey**

Identify the location of any wildlife species which use the site either seasonally or throughout the year and consider their requirements and mitigation, and the legal obligations under the relevant wildlife legislation, when compiling the plan and scheduling of works. If protected species are found, a licence may be needed before work can take place. Certain species using a building may be protected under the UK Wildlife & Countryside Act (1981) and/or European wildlife legislation. Species lists can be found at:

<http://www.naturalengland.org.uk/conservation/wildlife-management-licensing/habsregs.htm>

or by contacting your local Natural England office.

#### **5. Condition Survey**

Using floor plans and elevations as a baseline, prepare a comprehensive, photographically illustrated condition survey of the complex. Comments should be made on the feasibility of repair, highlighting good points as well as looking at defects and the remedies required. The survey should prioritise work into areas into immediate (1-2 years), necessary (2-5 years) and desirable (10 -20 years).

Further detailed survey of particular problem areas may be required, However all commentary, photographs or additional survey work must be tied into a scaled plan.

Discussion with the Natural England HELA will be essential at this stage to discuss approaches to the consolidation project. These must focus on conservation of the buildings 'as found' but there will be scope for discussion on the most appropriate remedies, and approaches to conservation and future management of the various wall openings, including the main doorways.

#### **6. Building Repairs and Alterations**

Using information from 1 to 5 above, identify the repair work required and prepare a full specification for materials and work methods, together with a schedule of works in order for comparable quotations from building contractors to be obtained. Any repair work identified must only use materials and approaches appropriate for the long-term historic conservation of the structure. This will require prior discussion with the Natural England HELA and the National Trust.

There will be a need to install robust access control ( grilles and gates) to the repaired buildings. Consideration should be given to how to install these without damaging the structures.

**At this stage the consultant should provide a draft copy of the Management Plan to the Natural England HEA which covers the above points of the brief. This will enable Natural England to comment further prior to proceeding with an invitation to building contractors to tender for the building work.**

## **7. Tender and Tender Reporting**

Using the agreed specifications and schedules of work, obtain three competitive quotes from building contractors with demonstrable experience of working on building conservation projects and buildings of this type. Evaluate and make an assessment of the tenders and provide a written and justified recommendation to Natural England and the owner as to which offers the best value. At this stage the consultant should also provide a quote for the costs of managing the project through to completion.

## **8. Reporting Requirements**

Copies of a draft Management Plan should be submitted to the Natural England HEA for comment before final submission. Natural England will require 2 copies of the final Management Plan in a bound A4 printed format. Where appropriate to guide the repair work A3 annotated drawings folded to A4 should be included.

An additional copy should be submitted to the Historic Environment Record at the North Yorkshire Moors National Park Authority for the attention of:

Graham Lee,  
North Yorkshire Moors National park Authority,  
The Old Vicarage,  
Bondgate,  
Helmsley,  
York,  
YO6 5BP

01439-770657

## **Appendix One**

### Higher Level Stewardship: the Repair and Restoration of Historic Buildings Applicants' Guide

A guide to help applicants understand which types of buildings and what restoration works are eligible for grant aid under Higher Level Stewardship (HLS): *available for this project as an e-document from [vivienne.metcalf@btinternet.com](mailto:vivienne.metcalf@btinternet.com)*

## **Appendix Two**

### **Brief for Building Recording**

#### **Introduction**

This brief outlines the necessary level of building recording. It should be used to inform the production of the Management Plan.

#### **Level of Recording**

The building recording should be undertaken to Level 2 of 'Understanding Historic Buildings: A Guide to Good Recording Practice' as referenced in section 4 above. This guidance should be referred to in conjunction with this brief.

Both the exterior and interior of the building will be photographed and a plan made. The examination of the building will produce an analysis of its development and use and the record will include the conclusions reached.

A level 2 record will typically include:

#### **Written Record**

1. The precise location of the building.
2. The date of the record and the name(s) of the recorders.
3. A summary statement describing the buildings type or purpose, materials and possible date(s).
4. A short account of the buildings plan, form, age and development sequence, where known. There should also be a note of building's setting and contribution to the local landscape.

### **Drawn Record**

1. A site plan drawn to an appropriate scale.
2. A floor plan to scale which should show the form and location of any structural features of historical significance (e.g. blocked doorways and windows, former openings, masonry joints, changes in internal levels).
3. Drawings (to scale or fully dimensioned) recording the form and location of other significant structural detail (e.g. timber framing, roof construction, internal features relating to use such as troughs, fittings etc).

### **Photography**

Photography should be undertaken before and after works. Should the situation warrant it (for example a high level of repair to historically significant fabric) then photos should be taken during works. The record should consist of:

1. Views of the exterior of the building, including details of any structural features of historical significance
2. Views of the interior of the building, including details of any structural features of historical significance.

The photographs should be tied in with the block plan.

### **Deposition of Record**

The results of the building recording are to be included within the Management Plan.

One copy of the building recording, as described in Section 9 above, should also be submitted to Historic Environment Record at North Yorkshire County Council.

**APPENDIX 4**  
**EDAS PROJECT DESIGN**

# **MANAGEMENT PLAN WITH ARCHAEOLOGICAL RECORDING AND CONSOLIDATION FOR AN INTERPRETATION PROJECT, BENT RIGGS RADAR STATION, STAINTONDALE, NORTH YORKSHIRE**

## **EDAS PROJECT DESIGN**

### **Introduction**

The project will be undertaken jointly by Ed Dennison Archaeological Services Ltd (EDAS), Peter Gaze Pace Architects and Ecological Information Network Consultants (EINC), in accordance with the brief produced by Natural England (dated June 2011). The lead contractor will be EDAS who will also be responsible for the management of the project. All three consultants have worked together on several similar Natural England projects in the past, as well as on various English Heritage funded projects. The site was visited by EDAS on 28th October 2011.

### **Background Information**

The Bent Riggs Chain Home Low Radar station lies in the north-east half of a rectangular-shaped pasture field adjoining the Cleveland Way long-distance footpath, on a high cliff top c.1km south of Ravenscar (NGR NZ 9893 0072 centred); the long axis of the field, which slopes gently down to the cliff, is aligned north-east/south-west and has been bisected by the now disused Whitby to Scarborough railway line. All the remains of the radar station complex lie on the east side of the railway line, occupying an area of 300m by 160m (maximum). The site is owned by the National Trust, and the field is tenanted to a Mr Cother of Colcroft Farm. It has been subject to a Higher Level Stewardship scheme since February 2010. The North York Moors National Park have erected a notice board on the Cleveland Way adjacent to the site, outlining the history and development of the complex, as well as a smaller board at a Coastguard lookout. A permission footpath also passes through the site.

The radar station was constructed in 1941, as a Type M station, and it formed part of the national coastal defence known as the CD/CHL (Coastal Defence/Chain Home Low) system. It was later converted to house more powerful equipment as part of the Chain Home Extra Low (CHEL) system. This system had two functions, to monitor coastal shipping and low flying aircraft, the latter being only poorly identified by the strategic Chain Home system. Originally manned by the Army, the coastal sites were ultimately handed to the RAF. After the war, the Bent Riggs site was superseded by Fylingdales, lying only a few miles inland. It seems that most of the domestic/barracks structures were demolished when the station was decommissioned, although the presence of some remains of sheeting superstructures may suggest that one or more were retained for agricultural use. There were proposals for complete demolition, but this was avoided and both the radar buildings and the remains of the barrack complex were protected as a Scheduled Monument in March 2002 (SM34842).

The radar site consists of two clusters of buildings. The main part of the site, forming the technical and support buildings, comprises four structures located towards the north-east end of the field, within 50m of the cliff edge; these buildings have been identified as a fuel store, engine house, the Transmitting and Receiving block (TX/RX) and a communications hut - the aerial array for the radar would have been mounted on a metal gantry set on the roof of the TX/RX building. The flat-roofed buildings are all of reinforced-concrete and brick construction, although the communications building is a corrugated asbestos-roofed brick Nissen Hut. All the buildings are open, and contain a certain amount of sheep dung and earth to the extent that the floor surfaces are largely obscured. A fifth building, built in 1935 as a Coastguard lookout post and subsequently reused as part of the radar complex, lies on the north-east edge of the field, adjacent to the Cleveland Way long-distance footpath which runs along the cliff top here.



The second cluster of buildings lies c.200m to the south-west, in the angle of the field adjacent to the former railway line. Here are the remains of at least eleven rectangular buildings, measuring c.12m by c.5m and represented by concrete footings, steps and hardstandings, various brick structures and low ruined wall lines. This complex is believed to have provided accommodation and administration space for the crew of the radar station. Some c.40m to the north-east are the remains of two other buildings representing latrines.

A small isolated brick-built flat-roofed structure also lies against the centre of the south side of the field. The function of this building is unknown, but it may be associated with supplying electrical power to the complex. Adjacent to this, just over the field wall to the south, is an older stone-built structure, perhaps a barn, which appears to have been modified during the 2WW, perhaps to contain a Nissen hut and it also contains concrete-rendered walls and wooden beams with bolts suggesting the need to secure something at a higher level, perhaps a water tank. Neither of these two buildings are required to be surveyed as part of the current project.

The site was first visited by National Trust archaeologists in the 1990s. Subsequent monitoring visits were augmented in 1997-98 when a volunteer, Katie Kenyon, carried out a survey of the structures and produced 1:50 scale plans and elevations of all the buildings, and 1:200 scale plans of the two main complexes. Further detailed recording of internal and external fittings and fixtures was carried out in June 2000, together with a photographic record. The results of both phases of recording were published in September 2000 as a National Trust archive report (Newman & Kenyon 2000).

Kenyon's plans and elevations are an accurate record of the complex as it existed in 1998. However, while all of the structures are still evident, there have been a number of significant changes, especially internally. For example, in the Communications Hut, the door and window openings in the east elevation, and the windows in the west elevation, have been blocked with mortared brick, relatively few of the internal electrical fittings remain, door and window frames are lying on the floor, and parts of the internal plaster and corrugated asbestos roof are broken. There is no remaining evidence of the words "Engine House" over the east door of this building, doors have been damaged with pieces lying inside the structure, and it appears that some replacement woodwork has been inserted. Nevertheless, the TX/RX building is relatively intact, with timber and metal fenestration (including wooden blast shutters) remaining, although again some of the wooden doors have been damaged, and the external ladder giving access to the roof has been removed; previous descriptions have not commented on the presence of former sliding doors between the three cells of the building. All of the buildings are open to sheep, and the quantity of sheep debris is obscuring most of the floors. Kenyon's 1:50 or 1:200 scale plans of the radar buildings do not always depict external features, such as the enclosing bank around the TX/RX building. The hut bases etc within the accommodation/administrative group of buildings survive as planned by Kenyon, although there is some encroachment by gorse and one of the hut bases is currently being used to house a sheep feeder. Some of the hut bases also have small dumps of field clearance material on them and all are grassed over.

The ground between the two main clusters of buildings appears relatively level, although slightly sloping to the north-east, and there seems to be no evidence for any shelters, trenches or other means of protecting the radar staff from attack, or for any defensive installations that might have protected the station as a whole, either from air or land attack. It is possible that some features might have been ploughed out or infilled, but one would have expected some remains to have been visible. The boundaries around the site, particularly that on the north-east side, still retain some 2WW iron posts on which barbed wire would have been secured.

As well as being a Scheduled Monument, the complex is listed on the National Archaeological Record (site NZ 90 SE 143) and the National Trust Sites and Monuments Record (NT SMR 31160/1-4 and 31161). None of the structures within the site are listed as being of Special Architectural or Historic Interest.

## **Aims of the Project**

The National Trust want to include the radar station in an existing educational access project. As part of this, they hope to allow controlled access to the interiors of the buildings. This access may include some limited reconstruction and interpretation of the interiors of the key buildings.

The key aims of the proposed project can be characterised as:

- Bring the remains into a condition (and under a management regime) commensurate with their designation as a Scheduled Ancient Monument;
- Make them much more accessible to the public, both through planned events and when passing or visiting the buildings;
- Meet broader National Trust and Natural England objectives with regard to the above;
- Consolidate and manage the remains to ensure their long term survival.

## **Content of the Management Plan**

### *1. Summary*

A concise summary of the complex will be produced, including details of site location, site description (including a site plan), the aims of the restoration project, and details of the current condition of the buildings and the threats and issues they face.

### *2. Summary of the Historical Development and Statement of Significance*

A summary of the historical development of the complex will be produced, based on observations made during the site survey (see below) and locally-based research. The latter will involve documentary research, using Defence of Britain records, local oral history, work on comparable sites (e.g. the CHL station at Craster, Northumberland; Hunt & Ainsworth 2006) and aerial photographic evidence. Other relevant publications will also be consulted, for example Dobinson's research on acoustics and radar stations (Dobinson 2000a & 2000b), and contact will be made with the Staintondale and Ravenscar Local History Group. The historical development will be linked to appropriate illustrative photographs of the complex from key viewpoints and cross-referenced to a scaled plan. It should be noted that only locally-held data sources will be consulted - although some aerial photographs may be obtained from English Heritage, there is no provision for a visit to the National Archaeological Record in Swindon, or to the wartime archives held at the National Archives in London.

The Statement of Significance will assess the complex from both a local and regional perspective, and comment on the contribution of the complex to the local landscape character, public amenity and biodiversity.

This summary of the historical development and statement of significance will be included in the EDAS survey report (see item 3 below).

### *3. Archaeological Analysis and Recording*

#### **a) Site Clearance**

The Natural England brief notes that before any archaeological recording can take place, the hardstandings and footings of the buildings within the accommodation/administrative part of the complex will need some cleaning and vegetation clearance to ensure their detail can be fully recorded.

An appropriately registered/qualified local contractor (or others) will therefore be employed/directed by Natural England/National Trust to remove superimposed field clearance

rubble from the concrete building bases and remove this from the site. The local contractor will also carefully remove any remaining elements of asbestos sheeting cemented onto/into the concrete bases. Either a local contractor or National Trust staff will then cut invasive vegetation to reveal the extent and nature of the surviving structures prior to their recording and presentation. There may potentially be a subsequent phase of work to expose hidden elements of footings, once vegetation is cleared.

The site clearance work will require Scheduled Monument Consent (SMC), and this process would be initiated and managed by the National Trust. However, EDAS would be available to discuss and agree the extent of the required works with the National Trust as part of the SMC application if required.

All the site clearance work and other ground disturbing activity would be subject to archaeological monitoring by EDAS, to ensure that sufficient material is cleared to fully reveal the structures and/or to ensure that no inadvertent damage is done to the archaeological remains.

## **b) Archaeological Recording**

It is clear from an examination of the existing survey report (Newman & Kenyon 2000) that the majority of the buildings within the radar site have been recorded to an appropriate level. Plans and elevations at 1:50 scale have been produced of all the buildings, 1:200 scale plans have been produced of the two concentrations of buildings (the radar station and barrack block), and there is a detailed photographic record. However, there is no survey of the coastguard lookout on the north-eastern edge of the site or of the two structures on the south side of the site, nor any over-arching plan showing the site as a whole and the relationships between the two concentrations of buildings.

The existing survey report also makes a number of recommendations for further survey work, for example recording the external features around the transmitter complex (especially around the TX/RX building), recording the internal features of the TX/RX building, and recording the remaining features of the domestic complex adjacent to the railway line.

It will be necessary for the National Trust to provide copies of the original 1:50 and 1:200 survey drawings as well as the photographic record, in order to allow EDAS to undertake the required survey work.

### *Overall survey plan*

A new overall plan of the site complex (measuring 300m by 160m maximum) will be produced at a scale of 1:500, using EDM total station equipment. Sufficient information will be gathered to allow the survey area to be readily located through the use of surviving structures, fences, walls, water courses, trackways and other topographical features. The survey will record the ground level position of all structures, areas of hardstanding, concrete etc, wall remnants and revetments, earthworks, water courses, paths, stone and rubble scatters, ironwork, fences and other boundary features, and any other features considered to be of archaeological or historic interest.

The site survey will be integrated into the Ordnance Survey national grid by resection to points of known co-ordinates. Heights AOD will be obtained by reference to the nearest OS benchmark (if available); contours will also be plotted across the site. A temporary bench mark could be established and left on site using a ground marker approved by the National Trust if required. Control points will be observed through trigonometric intersection from survey stations on a traverse around and through the site, and the locations, descriptions and values of the Bench Marks and control points will be stated in the final survey data.

On completion of the EDM survey, the field data will be plotted and re-checked on site in a separate operation. Any amendments or additions will be surveyed by hand measurement, and the results digitised back into the electronic survey data. Some limited probing with surveying arrows etc may be undertaken to trace buried features such as drains etc.

The resulting site survey will be produced at a scale of 1:500 and presented as an interpretative hachure plan using conventions analogous to those used by English Heritage (1999; 2002, 14; 2007, 31-35). It should be noted that the final product arising from the site survey will be a hand-drawn plans, although AutoCad (or equivalent) electronic data could also be provided if required. Larger scale plans, at 1:10,000 and 1:2,500 scale, will be used to put the survey area into context (OS map bases to be provided by the National Trust).

The existing walled boundaries of the survey area will not be inspected or recorded, unless specifically requested.

### *Buildings plans*

Kenyon's existing 1:200 plans of the two concentrations of buildings (radar complex and accommodation complex) will be enhanced and amended to take account of any new information revealed by the site clearance work. The Coastguard lookout will also be added to the plan of the radar buildings. These new plans will also show adjacent relevant features such as the banks surrounding the TX/RX building.

It should be stressed that these surveys will build on the existing 1:200 scale survey plans (which will need to be provided to EDAS before the start of the project), with new information being surveyed by hand (tape and offset) and details added as appropriate. The resulting plan drawings will therefore be largely based on the existing survey data.

### *Detailed records*

In order to provide a detailed record of the fenestration of the TX/RX building, a 1:5 or 1:2 scale survey of a representative example of the windows will be made, to show the arrangement of lights, detail of the double leaf metal frame, hinges and latch, and the internal iron shutters. This survey would be cross referenced to the existing 1:50 elevations of the building. The survey drawings would conform to English Heritage guidelines (English Heritage 2006).

### *Photographic recording*

A new photographic record will be made of the buildings making up the radar complex (both radar and accommodation concentrations), to show both general views and detailed elevations of each building, as well as all original internal and external fixtures and fittings. Photographs will also be taken of the overall appearance of the rooms and circulation areas, and any detail (structural or decorative) which might be relevant to the building's design, development or use and which does not show adequately on general photographs. Other photographs will be taken of any inscriptions or date stones, signage or graffiti etc which contribute to an understanding of the building(s), and any contents or ephemera which have a significant bearing on the building's history.

The photographs will be taken in colour, using a digital camera with 10 megapixel resolution. English Heritage photographic guidelines would be followed (English Heritage 2007, 14) and each photograph will normally be provided with a scale. All photographs would be clearly numbered and labelled with the subject, orientation, date taken and photographer's name, and will be cross referenced to digital files and a photographic catalogue. The existing 1:200 and 1:50 scale survey plans will also be used to provide drawings showing the position and direction of each shot.

## *Reporting*

Individual descriptions will be produced for each identified element within the radar complex, for example specific buildings (whether extant or sites), hut bases, earthworks etc. This description will include an account of each elements' overall form (e.g. structure, materials, layout, evidence for any attached demolished structures etc), function, date and sequence of development and use, together with the evidence supporting this analysis and interpretation. Particular attention will be made to compare previous descriptions with the remains as they currently exist, so as to provide an indication of any deterioration etc. Any fabric likely to be affected by future repair will be analysed and commented on.

The written account will also include a discussion of any published sources relating to the complex and its setting, as well as an account of its history as given in readily-available published sources, cross referenced to a full bibliography and other references. The report will also include an executive summary as well as details setting out the circumstances in which the archaeological record was made, including its objectives, methods, scope and limitations. The report will also be illustrated with photographs and will contain appendices detailing the photographic record, project design, Natural England brief etc.

A stand-alone A4 comb bound EDAS survey report would be produced, together with an electronic (pdf format) document. A draft copy of the report would be made available for discussion and comments from Natural England and the National Trust prior to completing the final document.

## *4. Wildlife Survey*

A desk-top study will be undertaken, to gather and collate information from specialist consultees such as the North and East Yorkshire Ecological Data Centre and the North Yorkshire Bat Group.

All species of bats are fully protected under current legislation and so a systematic daytime inspection for bats roosting in the building will be undertaken. Bats are most active between May and August, and so this is the best time for such an inspection. However, the timescale of the project precludes this, and so the daytime inspection would be carried out as soon as possible in November/December 2011 (i.e. early winter). The early winter survey would search for live bats (hibernating at this time of year) and also for droppings beneath and/or within potential bat roost sites, such as any small holes/crevices within internal and external walls, and any timber support structures.

It is also recommended that the results of the bat survey be available in a full report at least two months prior to the commencement of any restoration work. This is to ensure that, should bats be recorded within the key structures, there is enough time available to apply for, and be granted, a Bat Licence from Natural England before the commencement of any works. The aims would be to ensure that an approved mitigation statement is available for the continued welfare of the existing local bat population and that any unnecessary and costly delays to the possible commencement date(s) of the proposed restoration works are avoided.

Signs of other protected species, such as birds of high nature conservation priority within the buildings or nearby vicinity, would also be recorded.

The resulting report would evaluate the buildings within the site for roosting bats according to their national, regional, district, parish and/or local ecological value. The report would also summarise relevant information from UK and Local Biodiversity Action Plans on priority habitats and species. The report would be written in the format of a Methods Statement, sufficient in detail to submit as part of an application for a Licence from Natural England in Respect of Bats, and also sufficient in detail to satisfy the local authority's requirements regarding these species. It would include sections on the type of surveys undertaken (including a habitat description and an

interpretation/evaluation of the results), an impact assessment (including long-term impacts etc) and a section on mitigation and compensation.

A stand-alone wildlife survey report would be produced by EINC, both as hard copy and an electronic (pdf format) document. A draft copy of the report would be made available for discussion and comments from Natural England and the National Trust prior to completing the final document.

Depending on the findings of the early winter daytime survey, a further nocturnal emergence and/or dawn bat survey may be required. Should bats be identified, extra work may be required for the submission of an application for a licence to Natural England and the administration of the licence conditions in respect of bats. Such extra work would include the production of Documents 1 and 2 Method Statement as well as a 'Reasoned Statement of Application'. It would also involve monitoring documents and site supervisory work as part of the licence conditions.

### *5. Condition Survey*

A comprehensive, photographically illustrated condition survey of the buildings within the radar complex will be produced. The survey will utilise existing plans and elevations (Newman & Kenyon 2000), and other information produced from the archaeological survey (see above), as well as producing any other specific data that might be required. All parts of each building within the complex will be examined (the upper levels subject to safe access) to determine the condition of the walls (e.g. type of mortar, construction of wall, condition of core, any structural weakness etc) using minimum invasive techniques. All commentary, photographs or additional survey work will be tied into a scaled plan.

A conservators report will be prepared on the conservation needs of the surviving fenestration, door furniture and other details (e.g. electrical fittings). Comments will also be made on the feasibility of repair, highlighting good points as well as looking at defects and the remedies required. Where required, additional conservation advice will be brought in to deal with specialist items such as electrical fittings.

Discussion will take place with Natural England and the National Trust over the most appropriate approach to conservation repair techniques. It is expected that the approach to these 20th century buildings will be similar to that for ancient buildings - the SPAB philosophy will be adopted, i.e. saving original materials wherever possible, specifying techniques that are compatible with original materials, and making any new work identifiable but used sympathetically so as to preserve the original character. Research materials from the English Heritage technical handbook (Volumes 1 to 5), together with technical material from the Twentieth Century Society, will also be used. In short, all proposed works will be 'conservation friendly' and will utilise appropriate materials and traditional repair techniques.

A stand-alone Condition Survey report would be produced by Peter Gaze Pace Architects, both as a hard copy and an electronic (pdf format) document. This would prioritise repair works into appropriate categories, e.g. immediate (1-2 years), necessary (2-5 years) and desirable (10-20 years). A draft copy of the report would be made available for discussion and comments from Natural England and the National Trust prior to completing the final document.

### *6. Building Repairs and Alterations*

Using the information gained from the archaeological recording and condition survey, the repair work required will be identified and a full specification for materials and work methods will be prepared by Peter Gaze Pace Architects. This specification will include design proposals for the installation of necessary grilles and gates to the repaired buildings. The specification will include a schedule of works in order for comparable quotations from appropriately qualified building

contractors to be obtained. A stand-alone specification would be produced by Peter Gaze Pace Architects, both as hard copy and an electronic (pdf format) document.

A draft copy of the specification and the supporting reports will be provided to both the National Trust and Natural England, to allow for comments prior to proceeding with an invitation to building contractors to tender for the building work.

Depending on the nature and level of necessary repairs or conservation works, appropriate drawn and photographic records may also be made during and after work. The need for any such work will be identified in the architect's specification.

## *7. Tender and Tender Reporting*

Using the agreed specification and schedules of work, three competitive quotes would be obtained from building contractors with demonstrable experience of working on building conservation projects and buildings of this type; it is expected that the building contractors work and reputation would be known to the project architect. The tenders would be evaluated and assessed, and a written and justified recommendation would be provided to Natural England and the National Trust as to which offers the best value.

## *8. Reporting Requirements*

The reports produced under items 3, 4, 5 and 6 above would be drawn together as a single Management Plan in a bound A4 printed document, with item 1 providing a summary. Both a hard copy and pdf copy would be provided to Natural England and the landowner, and additional copies would be provided to the National Trust and the North York Moors National Park Authority.

## **OASIS Compliance**

EDAS subscribe to English Heritage's OASIS (Online Access to Index of Archaeological Investigations) project, and all EDAS projects are fully OASIS compliant. Prior to the start of any fieldwork, an OASIS online record will be initiated and key fields completed on Details, Location and Creators forms. All parts of the OASIS online form will be subsequently completed for submission to English Heritage and the National Trust SMR, and this will include an uploaded pdf version of the archaeological survey report. It should be noted the final acceptance of the OASIS record will be reliant on validation from the National Trust SMR.

## **Copyright**

Copyright of all survey material and the survey report would pass to Natural England and the National Trust (Yorkshire Region) at the end of the project, although the originators retain the right to be identified as the authors of all project documentation and reports as specified in the Copyright, Design and Patents Act 1988 (chapter IV, section 79). Any use made of the survey data and/or information contained in the survey report by Natural England and the National Trust should acknowledge the originators and authors.

## **Health and Safety, and Insurance**

EDAS would comply with the Health and Safety at Work Act of 1974 while undertaking the project. A full copy of their Health and Safety Policy is available on request. Appropriate provision of first aid, telephone and safety clothing as required by IFA and SCAUM is provided. Ed Dennison will be nominated as the project safety officer.

Necessary precautions will be taken regarding overhead lines and other services. Especial care will be taken when working in close proximity to water bodies and steep slopes. A risk

assessment would be produced prior to any site work. Health and Safety issues will take precedence over archaeological matters.

The site is owned by the National Trust, and EDAS would indemnify the landowner in respect of their legal liability for physical injury to persons or damage to property arising on site in connection with the survey, to the extent of EDAS's Public Liability Insurance Cover (£5,000,000).

## **Staffing and Experience**

The project would be undertaken by EDAS, who are registered as an Archaeological Organisation with the Institute for Archaeologists.

The project would be undertaken by Ed Dennison and Shaun Richardson of EDAS. Both have some 20 years experience in non-intrusive earthwork and topographical survey, and they have undertaken numerous walkover and detailed surveys of specific monuments and of areas of historic landscape throughout Yorkshire. These surveys have included land uses of all types, and in addition to identifying a wide range of archaeological remains, detailed management strategies and recommendations have been proposed. Some of these surveys have included 2WW sites, for example an anti-aircraft searchlight battery at Cracoe, North Yorkshire (Richardson & Dennison 2011), various slit trenches and training facilities in Cawthorn Woods, North Yorkshire (Dennison 2005), the identification of hut bases, shelters, a searchlight battery and a balloon tethering station at Preston, East Yorkshire (Dennison 2009), and 2WW civilian air raid in Hamburg, north Germany (Richardson 2008). Further details of EDAS's activity can be found on their website [www.edarchserv.co.uk](http://www.edarchserv.co.uk).

The topographical survey will be undertaken in conjunction with Benchmark Land Surveys of Leeds, who have worked with EDAS on numerous similar survey projects in the past.

The wildlife surveys will be undertaken by Dr Madeline Holloway, Director of EINC (Ecological Information Network Consultants) based in Bradford. Dr Holloway (BSc, MA, MSc, PhD) is a full Member of the Institute of Ecology and Environmental Management (MIEEM), and she currently holds a bat handler's licence, a great crested newt licence, a white-clawed crayfish licence and a barn owl licence. She has worked with EDAS on numerous archaeological and architectural surveys, including those relating to the consolidation and repair of ancient monuments (e.g. Sheriff Hutton Castle, Harewood Castle, Bolton Percy gatehouse, Wharram Percy farm barns, Colburn Hall).

The Condition Survey, documents relating to Building Repairs and Alterations, and the Tender documentation will be produced by Peter Gaze Pace, an English Heritage approved conservation architect based at Scrayingham near York. EDAS have worked with Peter Pace on numerous similar projects in the past, including Risby folly, Harewood Castle, Sheriff Hutton Castle, Bolton Percy gatehouse and Oakwell Hall, as well as numerous church projects. Peter Pace will be assisted where necessary by Elizabeth Hirst of Hirst Conservation, an internationally renowned company dealing with all matters of architectural conservation (<http://hirst-conservation.com>).

Curriculum vitae can be provided on request.

## **Programming and Resources**

The Natural England project brief notes that the majority of the Management Plan should be completed by March 2012. Assuming a prompt commission, it is to be expected that the Archaeological Analysis and Recording, and the Wildlife Survey, will be undertaken in November/December, with the Condition Survey being undertaken in January 2012. The specification for repair and alteration is then likely to be produced in February 2012, with tenders returned in March 2012. However, the archaeological survey work will depend on the site clearance work being completed very early on in the timescale of the project.



A detailed timescale for the project would be drawn up soon after appointment, and after appropriate discussions with the National Trust and Natural England regarding access and vegetation clearance.

A detailed costed fee proposal is attached to this project design. Various contingencies for additional survey work or meetings etc as yet unforeseen, are also included, together with day rates for the monitoring of the site clearance work.

## **Access**

There is pedestrian access to the site from the area in front of the now abandoned railway station at Ravenscar. However, the railway line is now a bridleway and cycle track, and permission will be sought from the National Trust to allow the survey team vehicular access along the track. From here, access into the radar station site is through a wooden field gate.

## **Monitoring**

It is to be expected that the project as a whole will be monitored at periodic intervals by the project monitors. These are likely to include Margaret Nieke (Natural England), Mark Newman (National Trust) and/or Graham Lee (North York Moors National Park).

The Natural England project brief does not require any site meetings, either prior to the start of work or during the project. Nevertheless, meetings can be arranged if necessary, subject to additional contingencies.

## **Modifications**

The programme of recording work may be modified in accordance with the professional judgement of the staff undertaking the work, insofar as the overall provisions and objectives of this project design would not be changed. Any variations in the project would be discussed and agreed with the project monitors prior to implementation.

## **Bibliography**

Dennison, E 2005 *Archaeological Survey of Cawthorn Woods, East Moor, Cawthorn, North Yorkshire* (EDAS archive report 2003/187.R01 for North York Moors National Park Authority)

Dennison, E 2009 *Proposed Eastern Park and Ride Site, former Hull Airfield, Preston, East Yorkshire* (EDAS archive report 2009/349.R01 for Pell Frischmann Consulting Ltd)

Dobinson, C S 2000a *Twentieth Century Fortifications in England, Volume VII 1. Acoustics and Radar: England's Early Warning Systems 1915-45* (unpublished mss held at CBA, York)

Dobinson, C S 2000b *Twentieth Century Fortifications in England, Volume VII 2. Acoustics and Radar: England's Early Warning Systems 1915-45 Appendices* (unpublished mss held at CBA, York)

English Heritage 1999 *Recording Archaeological Field Monuments: A Descriptive Specification*

English Heritage 2002 *With Alidade and Tape: Graphical and Plane Table Survey of Archaeological Earthworks*

English Heritage 2006 *Understanding Historic Buildings: A Guide to Good Recording Practice*

English Heritage 2007 *Understanding the Archaeology of Landscapes: A Guide to Good Recording Practice*

Hunt, A & Ainsworth, S 2006 *Craster, Northumberland: An Archaeological Investigation of a World War II Radar Station Complex* (English Heritage Research Department Report 43/2006)

Newman, M & Kenyon, K 2000 *Bent Riggs Radar Station: Standing Buildings Recording* (National Trust Yorkshire Region archive report MNNTYR95)

Richardson, S 2008 'Destruction Preserved: Second World War Public Air-Raid Shelters in Hamburg'. In Rakoczy, L (ed) *The Archaeology of Destruction*, 6-28

Richardson, S & Dennison, E 2011 *The Searchlight Battery, Fell Lane, Cracoe, North Yorkshire: Archaeological and Historical Survey* (EDAS archive report 2009/358.R01 for Mr J W Stockdale)

Ed Dennison  
Ed Dennison Archaeological Services Ltd  
October 2011