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CRASTER, NORTHUMBERLAND AN ARCHAEOLOGICAL INVESTIGATION OF A WORLD WAR II RADAR STATION COMPLEX

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Craster radar station with Dunstanburgh Castle in the background

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Summary

In 2003-2005 English Heritage undertook investigations into the World War II Chain Home Low radar station on The Heughs, near Craster. Field survey recorded the two principal buildings of the radar station in detail (the TxRx block and the Standby Set House) and identified the remains of other buildings which would have formed part of the complex, including the bases of Nissen huts forming the accommodation and ablutions blocks. A number of surviving weapons pits sited in strategic locations around the radar station complex were recorded. These formed part of the wider coastal defences of the area. Aerial photography was consulted in conjunction with the field survey. The former revealed the position of some ephemeral features, for example, barbed-wire entanglements which defined the perimeter of the compound. Documentary research demonstrated that the radar station at Craster was built in late 1941 and continued in operation until July 1944. Oral testimony was gathered from local people who had been resident in Craster during the World War II period; this revealed that the radar station buildings and compound had been used as a Prisoner of War camp in the latter stages of World War II.

1. Introduction

In 2003 and 2004, English Heritage undertook an archaeological investigation of Dunstanburgh Castle and its environs, in Northumberland (Oswald *et al* 2006). The castle occupies a remote and dramatic coastal headland roughly 3km east-south-east of the village of Embleton and 2km north of the tiny fishing village of Craster (Figure 1). The entire coastal strip, including the land occupied by the castle, is owned by the National Trust and lies within the Northumberland Coast Area of Outstanding Natural Beauty (AONB). Within this strip, some 650m north-west of Craster at National Grid Reference NU 2546 2040, on top of a prominent escarpment known as 'The Heughs', stand two concrete buildings, remains of a World War II Coast Defence/Chain Home Low (CD/CHL) radar station (Figure 2). The northern of the two is the TxRx (Transmit/Receive) Block and the other the Standby Set House. Close by are a series of earthworks and the remains of a number of other structures. It is known that part of the site was re-used towards the end of World War II, and for a short time afterwards, as a prisoner of war (POW) camp. At the request of The National Trust, an analytical survey of the radar station complex was undertaken to gain an understanding of the nature, survival and extent of the military activity here and to inform conservation and management of the site.

The English Heritage field investigation covered an area of 7.3 hectares (18 acres) and was carried out at Level 3 standard (as defined in RCHME 1999, 3-4). The survey of the complex as a whole was conducted at a scale of 1:1 000 (reproduced in this report as Figure 5) and detailed recording of the CD/CHL radar station operational buildings at 1:50 scale. The

Figure 1
Location map

documentary research undertaken as part of the survey was limited to a review of the secondary sources and readily available primary sources. Additionally, oral testimony was obtained from local residents who lived in or near Craster around the time of World War II.

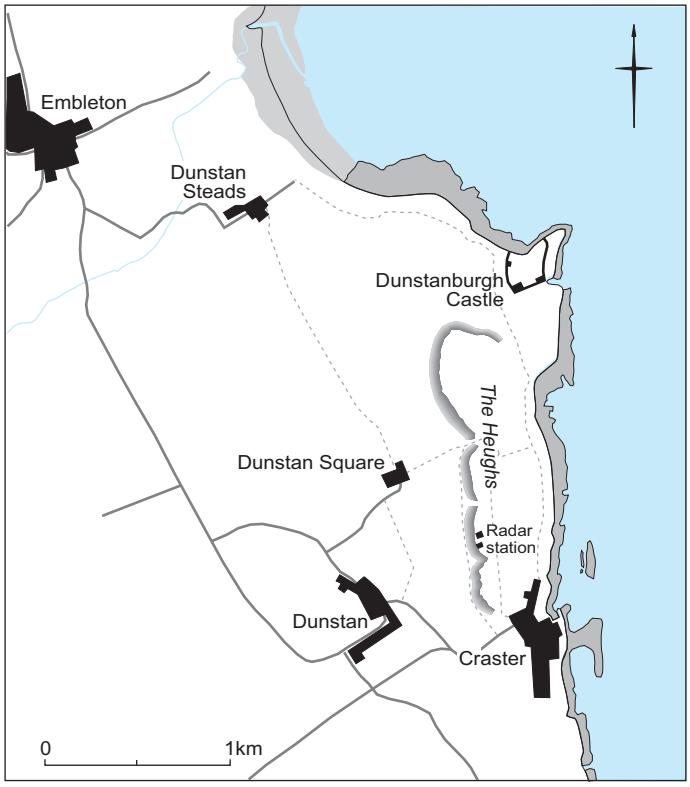


Figure 2
Map of the Craster environs

2. History of Research

Relatively little previous research has been undertaken on the Craster radar station complex. The most significant work is that done by Harry Beamish, Archaeologist responsible for the North-East Region of The National Trust. He surveyed both the TxRx block and the Standby Set House in 1989 and undertook research into the background of the site, including the gathering of oral testimony from local residents (Beamish 1993). Students of the School of Fighter Control at RAF Boulmer visited the Public Records Office (PRO), Kew, in 1990 and made notes on the F540 (Operations Book) of No 73 Wing, which were passed on to Harry Beamish.

A number of studies were commissioned by English Heritage's Monuments Protection Programme in the 1990s to cover major categories of defence works from 1900-1969; the most relevant of these studies to the present investigation are Colin Dobinson's volumes on acoustics and radar (Dobinson 2000a; 2000b). This major study includes references to the radar station at Craster, although these are mostly confined to the dates at which specific types of radar were in place and operational (Dobinson 2000a, 130; 2000b, 167, 171).

Ian Brown, of the Historical Radar Archive, has collated a large amount of material relating to CD/CHL and CHL sites, much of which is unpublished. Detailed sketches of two RAF CHL stations at Cockburnspath (Scotland) and notes on their operation by a former radar station operator are particularly useful in shedding light on the layout of both an early CHL station (with separate Tx and Rx buildings) and the later combined version (with an aerial mounted on a ground-level gantry).

A search of the military archive at the PRO was also carried out by Roger J C Thomas, a military archaeology specialist from English Heritage. However, no further documents were identified which relate directly to the operation of the Craster radar station.

3. Geology, Topography and Land Use

The geology of the area between Dunstanburgh Castle and Craster village consists of outcrops of igneous dolerite protruding through the overlying carboniferous limestone. These form coastal and inland cliffs (such as The Heughs) where differential erosion has worn away the limestone, exposing the hard dolerite, which is particularly resistant to weathering. This phenomenon is part of a much more extensive geological feature known as the Whin Sill, which occurs across the region and runs north to south through the area of survey. Further evidence of exposure of the sill can be seen close to the sea on the coastal side of the site. A thin layer of glacial boulder clay covers this underlying geology on the eastern, seaward side of The Heughs and on the lower ground at the foot of the inland cliff (Geological Survey of England and Wales 1956).

The nature of the underlying geology gives the site a distinctive topographical profile; the exposure of the Whin Sill has created a very steep, west-facing inland cliff with an area of relatively level ground at its foot. The ground between the top of the inland cliff and the coast, to the east, has a much less severe gradient, with the land sloping gently down towards the sea (Figure 3). On this gently sloping ground, the underlying geology has created a number of rocky ridges, which have the appearance of man-made features, thus making the surface archaeology in this area somewhat difficult to interpret.

The operational buildings of the radar station are located at approximately 40m above sea level, close to the crest of The Heughs. This position would have afforded the roof-mounted aerial of the radar station an uninterrupted sweep of the coast from a relatively elevated position. South of the site of the radar station, there is a natural gap in the inland cliff, which is known as 'Big Shaird' (*see* Figure 4). This declivity is occupied by a trackway which delineates the southern edge of the area surveyed for this investigation.

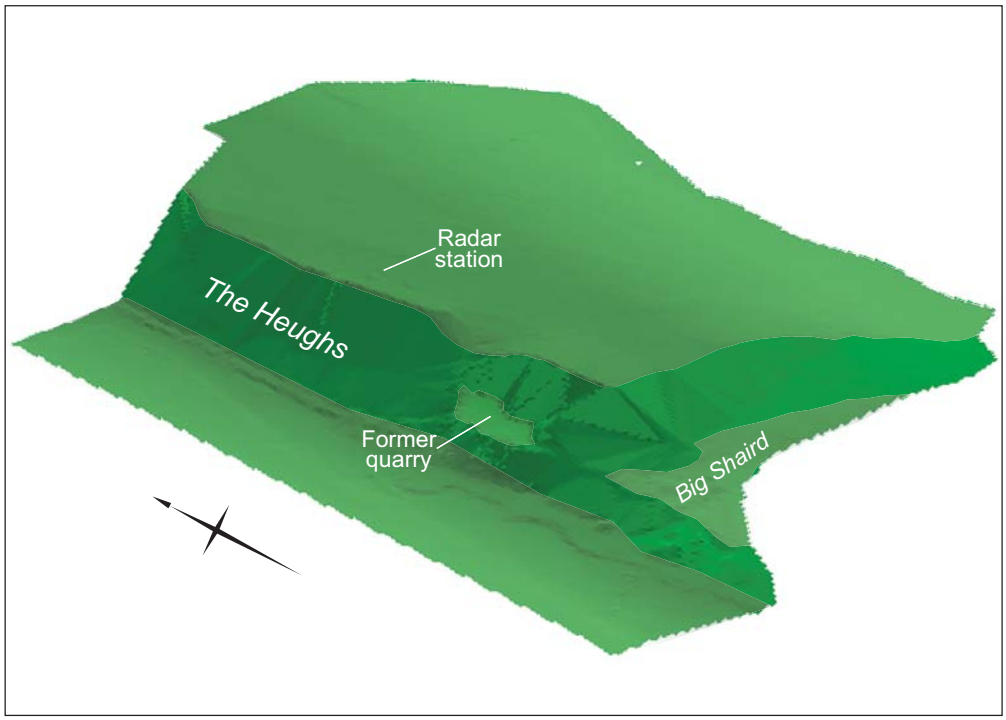


Figure 3
Topographical model of the survey area, created using 3-D data collected during the field survey

The inland cliffs are an accessible source of whinstone and, in places, there is evidence that it was formerly quarried (*see* below). This quarrying necessitated the insertion of access tracks, some of which are still in existence and currently in use as public footpaths. One such footpath runs along the foot of The Heughs from the main road into Craster, opposite the public car park on the western side of the village. On the seaward side of The Heughs are further footpaths, which give access from Craster village to Dunstanburgh Castle (Figure 2). The most heavily-used of these is adjacent to the sea; its popularity has led to an increasing amount of erosion and wear along its route. Although publicly accessible, few visitors ascend the slope to the west of the main footpath to look at the remains of the radar station.

The land within the survey area is currently used for sheep pasture. In spite of the grazing, there is relatively dense gorse cover over much of the site. Aerial photography of the area shows that there has been partial gorse cover on the site for over 60 years (RAF 1941a and b; RAF 1946; Ordnance Survey 1971), although it has been managed to some extent. It is possible that further archaeological remains are obscured by the gorse coverage. The National Trust undertook some clearance to coincide with the field survey, principally the removal of gorse and vegetation on the slope of the inland cliff. The buildings of the radar station are currently used as a shelter by animals grazing the land, hence the floors have a covering of

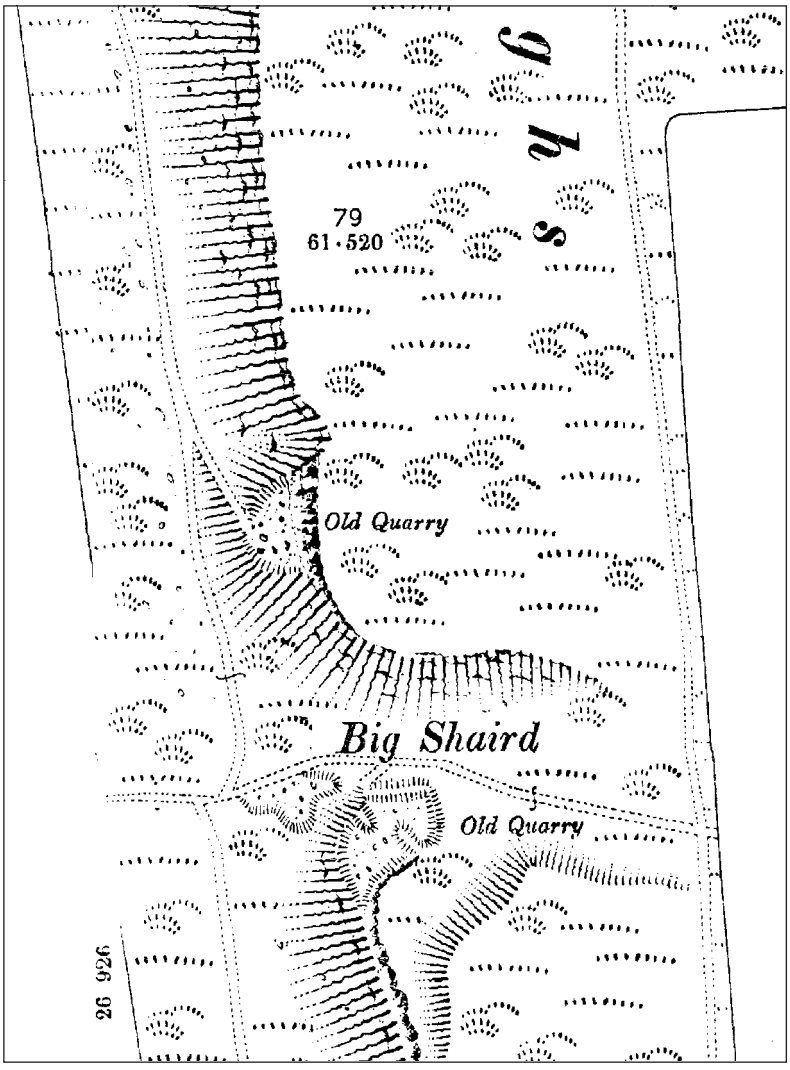


Figure 4
Ordnance Survey Second Edition 25-inch map. Reproduced from the 1897 Ordnance Survey map.

mud and manure. Vandalism and graffiti have been a problem to some degree, but in general, the buildings survive in relatively good condition.

There is evidence of stone extraction along the west-facing cliff of The Heughs prior to World War II. Although there are no quarries explicitly labelled on the Ordnance Survey (OS) First Edition 6-inch map, which was surveyed in 1861, there are areas along The Heughs which appear to have a convention showing quarrying (Ordnance Survey 1866). This interpretation is confirmed on a later edition of the OS 25-inch map which has two areas adjacent to either side of 'Big Shaird' labelled as 'Old Quarry' (Figure 4), suggesting that by this date these quarries were no longer in use (Ordnance Survey 1897). Both maps depict a trackway running north-south along the foot of The Heughs crossed by an east-west track descending through Big Shaird; also shown is a spur from the north-south track leading up to the quarry to the north of Big Shaird. This network of tracks presumably provided access to the quarries during their active periods (*see* Section 5.1.2). To the west of the main north-south track the truncated remains of medieval ridge and furrow survive (*see* Section 5.1.1).

4. Radar: Historical Background

The historical background to the development of World War II radar stations and the technical and operational details have been covered in depth elsewhere (*see* Brown 1996, Dobinson 2000a; 2000b; Bragg 2002). Thus, what follows is no more than a summary of the relevant details.

The development of an effective system to identify and locate enemy aircraft approaching the coast of the British Isles began in the aftermath of World War I. By the late 1920s/ early 1930s, the use of large concrete sound 'mirrors' was being trialled in south-eastern England, but in 1935 experiments had begun using the re-radiation of radio 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'; it was not until 1943 that this acronym was superseded by the more familiar 'Radar' (Radio Aid for Detection And Ranging) (Bragg 2002, 299).

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 I, and by 1939 this chain was in place, although not complete (*ibid*, 1). This was known as the 'Chain Home' (CH). In the early stages of World War II, 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 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. At this date a typical CHL station consisted of two principal buildings, a transmitter and a receiver, located approximately 75 yards (68.5m) apart and each with a wooden gantry supporting the aerial assembly (*ibid*, 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 (*ibid*, 204). Early guidelines for the positioning of radar stations recommended a site not more than 0.5miles (0.8km) from the coastline, on cliffs or high ground overlooking the sea (*ibid*, 78). Some CHL stations were operated by the army and formed part of the Coast Defence (CD) chain; Craster was a CD/CHL station (Dobinson 2000b, 167).

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 operations room were now housed in a single building (the TxRx block), measuring 50ft (15m) by 18ft (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 proved to be particularly useful in providing reliable plots of shipping (Dobinson 2000a, 128). Initially, a 1.5m radar would have been operating at Craster, as indicated by the 'M' prefix of the

station's identification number (Dobinson 2000a, 108). The new centimetric equipment was rolled-out to the CHL and CD/CHL stations, including Craster, from the start of 1942 (*ibid*, 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). As well as permanent stations, a mobile device known as a 'Gibson Box' (officially known as a Radar CD No 1 Mk V) was developed, which comprised of 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 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). Documentary sources show that by December 1942, Craster had been allocated a CD No1 Mk IV or V radar, although it is not confirmed as being in use by this date (Dobinson 2000a, 130).

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 TxRx 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.

The 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 site secret was paramount. The 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' (*ibid* 231).

The site 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 pillboxes). Similar defences, with some variations, were established at CHL stations (Dobinson 2000a, 63).

The information collected via the radar would have been plotted using equipment within the TxRx block. These plots, in the form of horizontal and vertical co-ordinates, would then have been telephoned to the operations rooms of the adjacent Sector and Group for filtering and onward transmission to the Group headquarters (Bragg 2002, 79). Originally, the central Fighter Command headquarters was based at Stanmore, Middlesex, but in 1941 each RAF

fighter group was provided with separate plotting centres (Dobinson 2000a, 113). The radar station at Craster was within the area covered by 60 Group 73 Wing, the headquarters of which were in Malton, North Yorkshire.

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). Following this, many of the stations were gradually either dismantled or mothballed, with the potential to return to operational status if necessary. After the end of the war, many sites were simply stripped of their equipment and abandoned.

5. Description and interpretation of the field remains (Figure 5)

The surviving field remains fall into two broad categories – those pre-dating World War II and those related to the wartime activity and later.

The letters in the text relate to features labelled on Figures 6, 7 and 18.

5.1 Pre-World War II (Figure 6)

The pre-war features relate to agricultural activity in the area (ridge and furrow ploughing and field boundaries) and small-scale industrial activity (post-medieval quarrying and access tracks).

5.1.1 Agricultural activity

Evidence of pre-World War II agricultural activity is evidenced by the remains of various episodes of ridge and furrow ploughing and enclosed fields. The survey area takes in the north-west corner of a field defined by a partially collapsed drystone wall (a), obscured in places by gorse bushes. The First Edition 6-inch OS map shows that this boundary was in existence by 1866 (Ordnance Survey 1866), but its form is typically post-medieval in date. The land to the east of the field boundary shows evidence of ridge and furrow ploughing, with the ridges approximately 8 to 9m wide. Ridges of similar width were recorded to the north of the enclosed area. To the west of the field boundary further remains of ridge and furrow ploughing were recorded, although the ridges were narrower, around 4.5 to 6m wide. However, there are indications of broader ridges, similar to those to the north and east, underlying the narrower ones. This would suggest that the field wall was laid out over the phase of broad ploughing and thus post-dates it. The majority of the narrower ridges are also on a different alignment to the broader ones to the north and east, suggesting that they belong to a separate phase of activity. The field evidence indicates that this phase of narrow ridge and furrow ploughing to the west of the boundary stopped short of the field wall itself. The narrower ploughing would thus appear to have been contemporary with, or to post-date, the field wall. Only a few of the furrows were traceable towards the top of the slope leading up to The Heughs, possibly because the covering of topsoil higher up the slope is minimal. Gaps in the pattern may also have been caused by the difficulty of ploughing over the rocky outcrops.

To the west of The Heughs, further evidence of ridge and furrow ploughing was recorded, extending from the present field boundary (and the western edge of the survey area) towards the foot of The Heughs. All the ridges in this block terminate where the ground drops off into the natural valley which runs along the base of The Heughs. This valley, which in places is still wet, would have formed a natural eastern boundary to the ploughlands and a headland developed along its edge. The ridges are approximately 7 to 9m wide, similar spacing to those east of the field wall (a) on the coastal slope. The field beyond the western edge of the survey area has been intensively ploughed in recent times, thus obliterating any surface traces. Aerial photographs show the ridge and furrow with curving ends as crop-marks

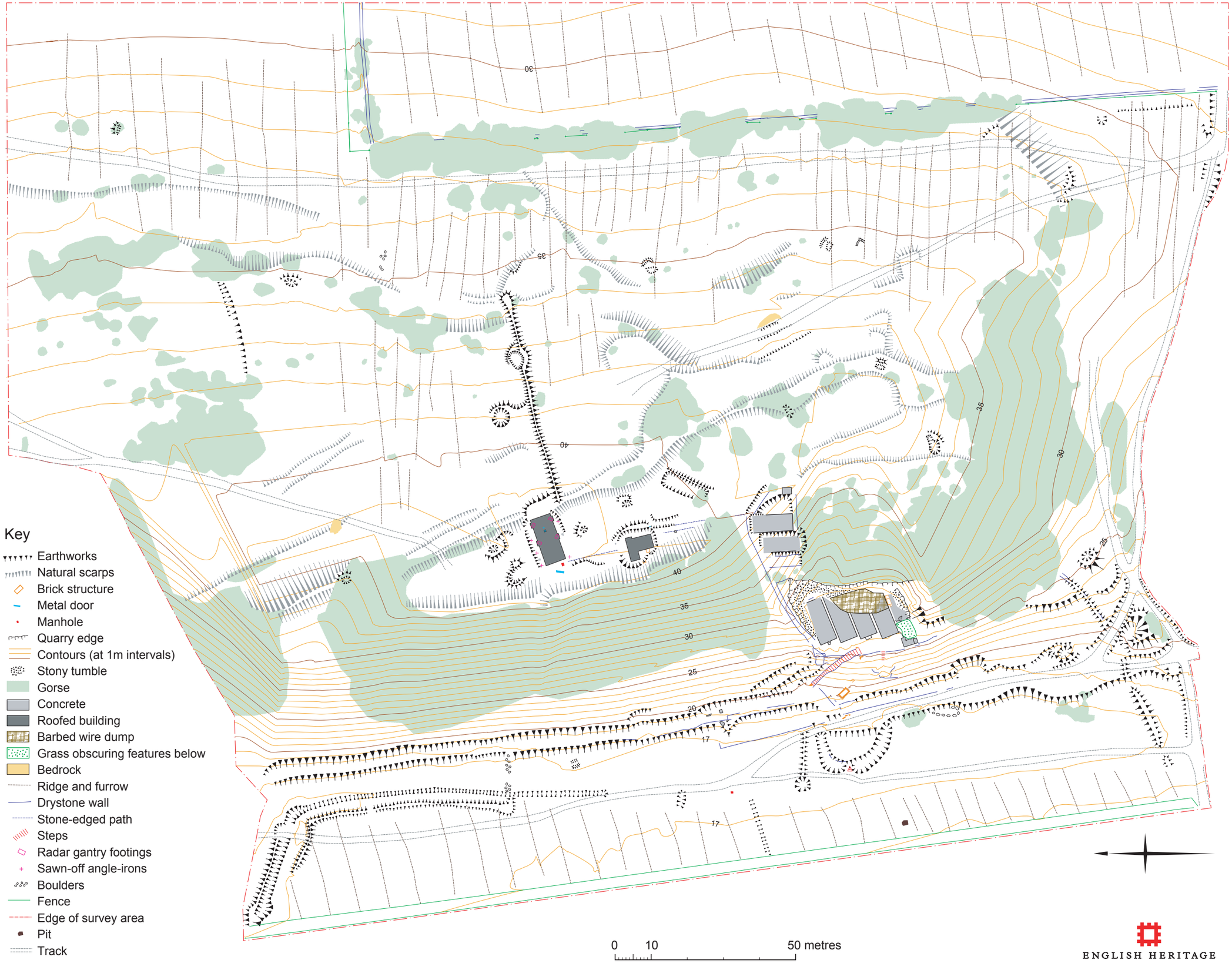


Figure 5
English Heritage earthwork survey plan at 1:1000 scale

continuing further to the west (Ordnance Survey 1971; Ordnance Survey 1972). At the north-east, a length of bank (b), orientated north to south, lies at the fringe of the ploughing. At the north it turns off at an angle to the north-west before fading after 15m; at the south it turns east at a right angle to meet the track at the foot of The Heughs. In this latter section is a break and its content is much stonier. The bank sits on top of the natural headland area noted above and thus must post-date the ploughing. One of the furrows appears to cut into the bank, although this is due to water run-off, as all the others stop short.

In the south-western corner of the survey area is another earth and stone bank (c). It follows a similar alignment to that of the ridges to the north-west. A further small section of the bank is visible crossing under the modern footpath to the east and then re-appearing on the slope

Figure 6
Plan showing features within the survey area dating to the pre-World War II period

defining the northern side of Big Shaird. Along this part of the bank, short sections of stone revetment walling were recorded. Neither of the lengths of bank (b) nor (c) are recorded on existing cartography and are therefore likely to be earlier than the date of the First Edition OS map in 1866. The broad ridges and reversed 'S' terminals (visible on aerial photographs) are typical of medieval ploughing and indicate that this area was probably in use for arable cultivation in that period. There is no direct relationship between bank (c) and the ridge and furrow, although it, like bank (b), probably marks an attempt at the creation of field boundaries during the post-medieval period.

As noted above, the form of the ploughing to the west of The Heughs is typical of the medieval period. The similarity of spacing would suggest it is also of a similar date to the ridge and furrow to the north and east of the field wall (a). The narrower ridges suggest that there was a further, later phase of ploughing superimposed upon the medieval fields. The fact that the narrow ridges respect the field wall suggests that they are post-medieval in date and relate to the land division which occurred in that period.

The only other significant agricultural feature pre-dating World War II activity within the survey area is on the coastal slope to the east of The Heughs. This is a stony bank (d) running roughly on an east-west alignment. It stretches from a point close to the south-east corner of the TxRx block for a distance of approximately 60m downslope, in the direction of the sea. It is cut into by, and therefore pre-dates, a possible circular weapons pit (e), which probably relates to the defence of the radar station (*see* Section 5.2.1). A further possible circular pit was recorded a short distance to the north of the bank (f), with a small slope on its downslope side linking back to the bank; this too appears to be a later feature. At the east, after a gap, a short section of the bank turns to the south-east, running on top of a natural step in the slope. The date of the bank is, like much of the ploughing, difficult to ascertain, as it is isolated from any other features and at no point has any physical relationship to the ridge and furrow. Further north, a degraded length of ditch (g) lies parallel to the bank (d). The alignments of the features are slightly different from that of the traces of ridge and furrow immediately in the vicinity, suggesting that the two were not associated. The angle at which the bank (d) crosses the alignment of the ridge and furrow would suggest that it is likely to be later in date. The eastern terminals of both banks and the ditch lie close to the tops of natural north-south terraces (*see* Figure 5). These boundaries and the natural terraces together create the appearance of 'Celtic fields', which are typically prehistoric or Roman period in date, although the, albeit minimal, field evidence noted above suggests that this is unlikely.

5.1.2 Quarrying

To the west of The Heughs, the majority of the non-World War II field remains, with the exception of the traces of ridge and furrow ploughing described in Section 5.1.1, are connected with post-medieval quarrying. The focus of this activity is a quarry (h) cut into the inland face of The Heughs to the north of Big Shaird, forming a semi-circular gouge into the cliff. During World War II, this quarry was used as the site of accommodation and mess huts (*see* Sections 5.2.2 and 5.2.3) and this later adaptation will have obscured any contemporary

features which may have existed on the quarry floor. Although the quarried area only measures some 30m by 15m, a large volume of stone has been removed. Waste material has been dumped onto the slope below to form a flat surface and slight projecting platform.

Further quarrying was observed adjacent to Big Shaird, just beyond the southern edge of the present survey area (i). A spoil heap, apparently associated with this quarrying, is located at the foot of Big Shaird within a triangle of land enclosed by converging trackways (*see* Figure 6). This quarry and spoil heap are depicted on the OS maps, although, as with the quarry to the north, they are not labelled on the earliest map but are shown as 'Old Quarry' on the First Edition 25-inch map (Ordnance Survey 1866; 1897). The suggestion is thus that the quarries were in contemporary use for a time, but had become redundant by the end of the 19th century.

The access to both quarries appears to have been along the track which ran along the foot of The Heughs. The southern part of the present day footpath follows the course of this earlier quarry track which is, in places, revetted with drystone walling. The robust construction indicates that the track needed to be able to withstand regular use by heavy carts. To the north of the quarry (h), the track is terraced into the lower part of the inland cliff-face and displays further short sections of stone revetment. An inclined spur from this part of the track, also cut back into the cliff-face, gives access to the quarry floor. This short stretch of trackway, along with the north-south track along the foot of The Heughs, is depicted on the earliest OS maps of this area (*ibid* 1866; 1897). The inclined spur is truncated by the north-south track, indicating that alterations were made to the main track after the quarry went out of use, probably during World War II. There is also a short stretch of drystone walling revetting the scarp which cuts across the foot of the inclined spur. It is possible that this and some of the other revetment may also relate to this wartime period. Fragments of concrete slabs alongside the trackway a short distance to the north provide evidence of later alterations, possibly the location of a platform associated with the radar station compound (*see* Section 5.2.2). The route continues beyond the survey area to the north and, although not surveyed, rapid inspection revealed other quarries, field boundary banks and a possible industrial site or farmstead in this direction. Eventually, the route leads to Dunstanburgh Castle. This suggests that it may have much earlier origins, as there was agricultural activity on the land to the north during the medieval period, both pre- and post-dating the construction of the castle (Oswald *et al* 2006), for which access would have been necessary. A path along the base of The Heughs would have offered a sheltered route to the castle from the south.

5.2 World War II and later (Figure 7)

The remains of the World War II activity on the site fall into three broad phases: pre-radar station, radar station and POW camp.

5.2.1 Coastal defence pre-dating the radar station

The surviving field remains of the initial phase of coastal defence within the survey area comprise of a small number of weapons pits; further afield are pillboxes and other defensive positions. These were part of a systematic construction of anti-invasion defences along

much of the British coastline, including barbed wire entanglement with weapons pits and gun emplacements at strategic points to defend the barrier. Embleton Bay, a short distance to the north, and other beaches on this stretch of coastline were identified as being particularly vulnerable to an invasion launched from Scandinavia. The background to the anti-invasion preparations and associated fieldworks is covered in detail elsewhere (Dobinson 1996), including specific details pertaining to the area of Northern Command's implementation along the north-east coast (*ibid*, 109-120). The local World War II coastal defences are discussed in more detail in the English Heritage Research Report on Dunstanburgh Castle (Oswald *et al* 2006). On the stretch of coastline between Dunstanburgh and Craster, it is

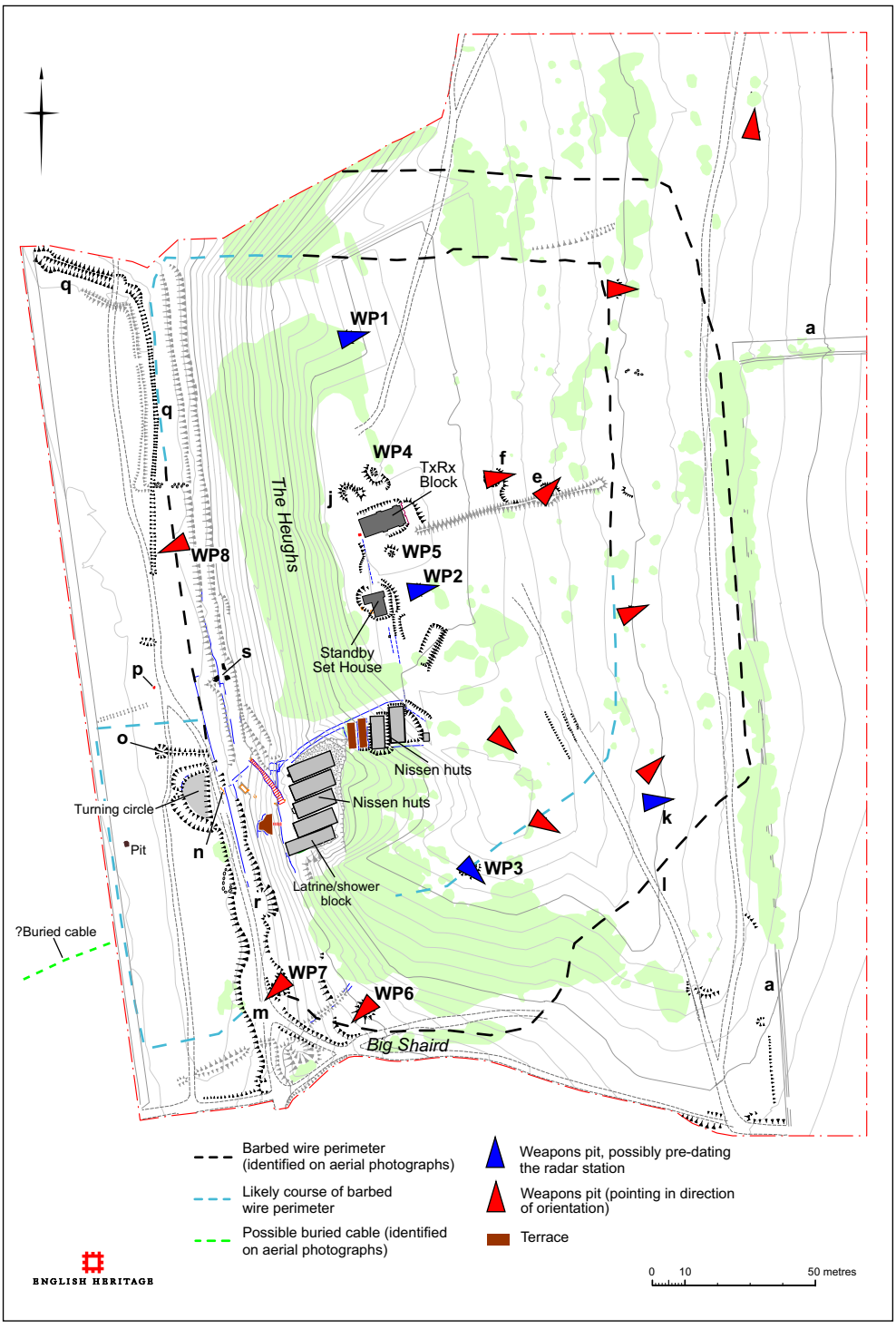


Figure 7
Plan showing features within the survey area dating to the World War II period

unusual to see such a high concentration of weapons pits as there are around the radar station. Comparable numbers occur in conjunction with the minefield to the south-west of Dunstanburgh Castle (Oswald *et al* 2006).

Within the survey area are at least 13 weapons pits/foxholes dug into the ground (*see* Figure 7). The distribution would suggest that some pre-date the establishment of the radar station in 1941, although they may have been re-used when the radar station was established (discussed below, Section 5.2.2). The three earthworks positioned in the immediate vicinity of the TxRx block (WP4, WP5 and 'j') could be interpreted as weapons pits, but their form and orientation suggests that this is unlikely, as their proximity to the structure would not have allowed a broad horizontal range. It is possible that these are in fact the remains of structural elements of the TxRx block (*see* below). The three weapons pits emplaced along the crestline of The Heughs (WP1, WP2 and WP3) may be part of an earlier phase of activity, creating a line of defence along the highest point in this area. They also appear to have been incorporated in the radar station defences. The gorse is particularly thick along the crest and further remains of defensive features may be hidden. One example of a chevron- or v-shaped trench was also recorded on the seaward slope (k); this may pre-date the radar station

5.2.2 CD/CHL Radar Station

The radar station compound at Craster originally occupied an area of approximately 230m by 170m, and comprised of an operational building (TxRx block), a generator block (Standby Set House) and accommodation, all surrounded by a barbed wire perimeter (*see* Figure 7). Two entrances into the compound defined by the barbed wire perimeter have been identified, one at the south-east (l) and one at the south-west (m), the latter being the main entrance. There was a further guarded entrance to the access track some 0.5km to the south. The most prominent remains of the radar station are those of the TxRx block, the larger of the two extant structures on the upper edge of The Heughs, and, some 25m to the south, the smaller Standby Set House.

Figure 8
An example of a metal picket found on the site (not in situ). This would have supported a barbed-wire entanglement.

Evidence from a 1946 aerial photograph (RAF 1946; Figure 18) shows that the whole radar station complex at Craster was originally surrounded by at least two lines of barbed wire entanglements (*see* Figures 7 and 18). No trace of these lines survive on the ground, although examples of angle-irons and pickets, which would have supported the barbed wire, were found scattered across the area to the east of the operational buildings (Figure 8). There are also a number of sawn-off, *in situ* angle-irons around the TxRx block building (Figure 5); these are discussed more fully below. The outer line of barbed wire appears to have run alongside

the field wall to the east of the radar station ('a' on Figures 6 and 7), thus utilising the pre-existing boundary to strengthen and/or disguise the defences on this side. The fact that there are two lines of barbed wire to the north of the site, but only one to the south suggests that parts of it may have been removed by 1946, the date of the aerial photograph. Local residents recalled that the Italian POWs were tasked with removing the barbed wire entanglements (Mr W Archbold, *pers comm*), supporting the idea that the perimeter had been partially dismantled by June 1946. The decaying dump of barbed wire in the quarry results from the final clearance after the closure of the POW camp.

Access to the radar-station compound appears to have been primarily from the south, along the valley to the west of The Heughs, re-using the pre-existing quarry road. A local resident recalled that a road, made of crusher dust, was laid in this area in 1940 (Mr W Archbold, *pers comm*). There was a guard permanently stationed at the southern end of this north-south track where it meets the east-west road into Craster (at NGR NU 2558 1986), controlling this approach to the radar-station compound (Mrs W Hogg, *pers comm*). The 1946 aerial photograph also shows a track approaching from the south-east and crossing the barbed wire perimeter (at 'l' on Figure 7). This may have been an original entrance, in which case there was possibly a gate in the barbed wire at this point, or it may have been created in order to facilitate vehicular access during the dismantling of the radar station after the end of the war. Vehicular access would also have been necessary during the construction of the radar station and to enable equipment to be brought in; the most likely route for this would have been up Big Shaird.

The aerial photographic evidence shows that there was probably not a great deal of gorse clearance around the operational buildings of the radar station during the wartime period (RAF 1946). This may have been a deliberate policy in order to provide some form of camouflage for the compound and to limit its visibility on aerial photography. Enemy aerial reconnaissance would have been more likely to identify activity in the area if there were large tracts of freshly-cleared ground. Official guidance stated that transmission lines should follow natural features and that fences should not form rectilinear patterns and should follow pre-existing boundaries (Bragg 2002, 230). These guidelines seem to have been followed at Craster, as witnessed by the proximity of the barbed wire perimeter to the stone field wall to the east of the radar station and the marked angle in the perimeter at the south-east. There also ought to have been barbed wire along the western side of the compound, as it would not have been left undefended, but this is not clearly visible on the 1946 aerial photograph (RAF 1946), suggesting that it had either been successfully camouflaged, or possibly that it had been removed by the date the photograph was taken.

TxRx Block (Figures 9 and 10)

The TxRx block is orientated on a roughly east-west alignment and is sited on the highest point of The Heughs, with the land in front of it to the east gradually falling away. This would have allowed the radar aerial array a clear sweep of the coastline.

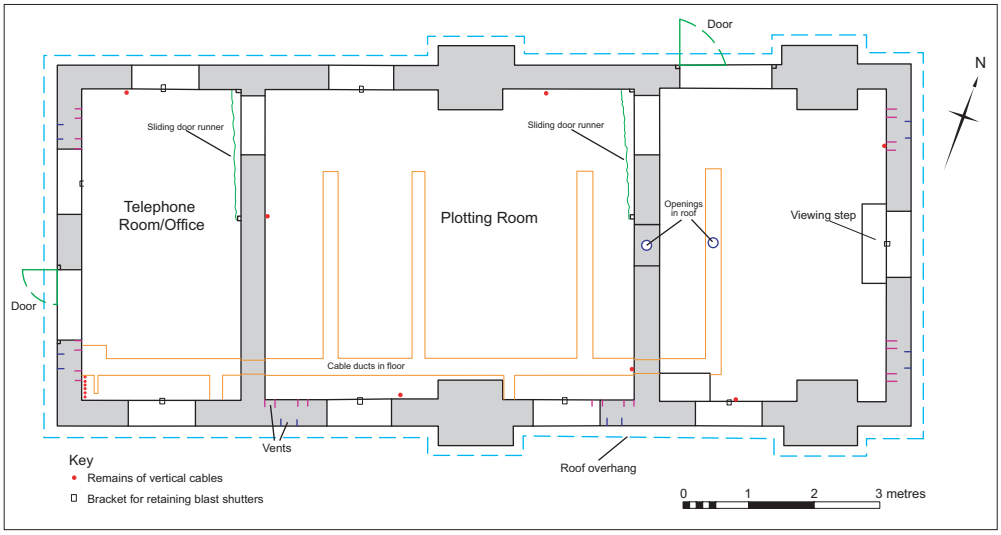


Figure 9
Plan of the TxRx Block, reduced from the original survey scale of 1:50

A '1941' version CHL station would typical have consisted of a continuously power-turned aerial array supported on a 20 foot (6.1 m) wooden gantry at one end of the TxRx block; the latter usually measuring 50 feet (15.2 m) by 18 feet (5.5 m) (Bragg 2002, 261-2). The aerial array itself (for a 1.5m wavelength set) was a large, flat, rectangular wire-mesh screen with a five-tiered arrangement of aerials attached to it.

Exterior

The structure is rectangular in plan, with four projecting concrete piers, acting as gantry supports, at its eastern end. It is of poured concrete construction and the building stands to a height of 3m. The block has four 'window' openings along the south side, one at the east and west ends and two along the north side. There are two doorways, one at the west and one at the north. The windows are all of a standard measurement, and would probably have been protected by, and light-proofed with, metal blast shutters. A CHL radar station at Ravenscar, North Yorkshire has a number of these shutters still *in situ* (Newman and Kenyon 2000, 12-17). Although the actual shutters no longer survive at Craster, the position of their retaining brackets can still be seen inside the building. The window at the east of the building appears to also have functioned as an observation point, as there is a concrete viewing step underneath it.

The exterior doors of the TxRx block were metal and provided blast protection. They were hung in pairs and the metal frames are still *in situ*. At the western end of the building, one of the doors is still *in situ* (Figure 10), while the second lies on the ground a short distance away. Of the doors in the northern wall, there is similarly one of the pair still *in situ*, although it is badly corroded; the location of the missing door is not known.

The roof of the building extends 0.15m beyond the exterior wall line all around the building and the entire roof was originally covered in a bituminous waterproof membrane, fragments of which still survive intact. On the roof are four metal plates, the footings for the roof-mounted, 18-foot (5.5m) timber and steel gantry which supported the aerial array (Figure 11). The metal plates are all rectangular (measuring 0.65m by 1.1m) and still have the bolts attached to which the gantry was fixed. A similar gantry still survives on a standing structure

Figure 10
The TxRx Block viewed from the south-west. Note the surviving metal door at the western end of the building.

at Margam in West Glamorgan (Subterranea Britannica website – http://www.subbrit.org.uk/sb-sites/sites/m/margam/index.shtml). The bituminous membrane appears to have been applied to the roof after the plates were positioned, as it overlies parts of some of the plates. Close to the south-western metal plate are the remains of a severed cable-feed from the room below set into the concrete roof. Also surviving on the roof is a small, square, brick-built chimney-like structure, measuring 0.5m across, coated with concrete render which encases a length of ceramic drainpipe; this would have housed the turning mechanism, allowing the transmission of power from the room below to the aerial array above. A second piece of drainpipe approximately 1m to the east, which is simply cemented into the roof, would have housed the necessary cabling between the power source below and the aerial array above.

Pairs of small rectangular openings, slightly over 0.2m across, are situated just below the roof overhang in each of the east, west and south walls. These would have provided ventilation for the building. A pair of bolts was recorded just to the north of the window in the eastern wall of the building, the fixings for a ladder which would have given access to the roof for

Figure 11
The roof of the TxRx Block, looking east, with the metal footing-plates for the roof-mounted gantry

maintenance purposes. There is a ladder giving access to the roof surviving *in situ* on the eastern wall of the TxRx block at Ravenscar, North Yorkshire (Newman and Kenyon 2000, 12-15).

No obvious route for the delivery of the mains power supply or telephone connections to the TxRx building has been identified. Both were essential components of the infrastructure. Electricity was obviously vital to power the aerial turning mechanism and electrical components in the TxRx block. Equally vital was the need to distribute the details of the radar-gathered information to the network of other control centres in the defence network (Bragg 2002, 79 and 91). It is possible that wires were either carried on poles along the base of The Heughs from Craster or to the TxRx block from the west of the site, or that cables were buried underground. The latter would have been considered desirable due to the potential protection from bomb damage or sabotage. No overhead lines are visible on the 1946 aerial photographs, but there is a linear crop-mark running across the field to the west of the survey area towards a rectilinear feature just inside the fence, which could indicate the location of a buried cable (Figures 7 and 18). This may have been a cable from the mains power supply or may have been a telephone cable. If this was the route for cabling, then the power (or telephone connection) needed to be transferred to the operational buildings on top of The Heughs. How this was acheived up the steep slope has not been identified, as the dense covering of gorse makes investigation impossible. However, an inspection cover at ground level, just over 1m from the western end of the TxRx building, appears to indicate the position at which the mains and back-up power supplies approached the building, suggesting that the cabling was underground. The inspection cover is aligned with the principal east-west cable duct within the building and, in addition, there are the remains of a series of five vertical cable-housings in the internal south-western corner of the building. These would have distributed power from the main source throughout the building.

Set a short distance away from the exterior walls of the TxRx block are a number of sawn-off angle-irons. These may indicate that at some point the block was surrounded by barbed wire or some other form of barrier, possibly relating to the camouflage of the structure. Another possibility is that the barbed wire was erected after the radar station had been abandoned, in order to keep the POWs out of the structure; the fact that the original interior paint survives with little indication of later changes may support this latter interpretation.

Also situated close to the TxRx block are three small earthworks, two of which appear to be weapons pits (WP4 and WP5). The third is a horseshoe-shaped bank (j). It is known that roof-mounted aerial arrays were susceptible to strong winds and the solution was to tether them to the ground or to construct enormous protective screens (Bragg 2002, 261). It is possible that the horseshoe-shaped earthwork close to the TxRx block is the remains of the footings for some similar attempt at wind-proofing the aerial array, although its form makes this interpretation unlikely; its function remains unclear.

Interior

The interior of the building is divided into three unequal-sized rooms, with the two small end rooms flanking a larger central room. The central room would have been the plotting room

where information received through the aerial would have been processed and plotted. Housed in this room would have been large pieces of equipment, such as the plotting table, the PPI (Plan Position Indicator) and Range consoles. It is possible to ascertain the positioning of this equipment, given that cable ducting still survives in the floor and gaps in the paint indicate where equipment was attached to the walls (*see* below).

The small room to the west is likely to have been the telephone room and office, which is where the plots would have been telephoned (in the form of horizontal and vertical co-ordinates) to the operations rooms of the adjacent Sector and Group for filtering and onward transmission to the Group headquarters (Bragg 2002, 79). A doorway links this room and the plotting room. Runners indicate the operation of a sliding door on the inside of the telephone room/office. A similar door arrangement links the plotting room and the room at the east, although here the runners indicate that the door was on the inside of the plotting room. The doors no longer survive, but the stoppers at the end of the runners housing the doors do, although the one on the eastern wall is no longer *in situ*.

The small room at the eastern end of the TxRx block would probably have housed the CHL transmitter (illustrated in Bragg 2002, Plate XXV). Below the window in the eastern wall of this eastern room is a concrete viewing step. This feature was used as an observation point to provide a visual check on approaching aeroplanes or shipping which had been detected by the radar; it may possibly have served as a firing position and 'last ditch' defence in the event of an attack (Beamish 1993), particularly given the location of the site close to good landing beaches. There is also a concrete plinth in the south-west corner of the eastern room, but the function of this is unclear. There is a niche at the top of the wall between the plotting room and the eastern room, situated directly below the western hole in the roof. This would have provided the base for the aerial array turning mechanism.

Although all the original fixtures and fittings have been removed from within the TxRx building, there is still evidence to indicate the location of much of the cabling and the position of equipment attached to the wall (Figures 12a and 12b). The original paint survives in reasonably good condition over most of the interior walls; the lower part of the walls were painted with a brown paint (to a height of 1.24m), while above this and over the ceiling, a cream paint was used on top of a layer of fine cork chippings, giving a textured finish. The purpose of the chippings under the paint was to reduce noise (R J C Thomas, *pers comm*) and possibly to absorb the radio waves.

Figure 12a
The gaps in the paintwork show the position of equipment and wiring within the TxRx Block

Although the floor of the TxRx block is covered by a layer of mud and organic material, the original wooden-lined cable ducting in the floor survives underneath. The concrete floor is spanned by recessed timber battens, indicating that wooden floorboards would have been laid on top. Small fragments of brown 'plain' linoleum found in the building would tend to

Figure 12b
The interior of the eastern room of the TxRx Block, showing further evidence of the positioning of equipment within the building

indicate that polished linoleum was used as a floor surface. Additionally, evidence of vertical cable-housing survives adjacent to the walls, although these had been cut close to ground, presumably when the structure was gutted. In the south-western corner of the building, as mentioned above, are the remains of a series of five vertical cables and the wooden battens with which they were fixed to the wall (Figure 12a). This was the point at which the power entered the building and then was distributed to the electrical equipment in the three rooms.

Many of the pieces of equipment in the TxRx block were valve-operated, and would thus have generated a lot of heat. As well as vents in the exterior walls (described above) there are also similar openings in the interior walls, but the latter are in pairs and are slightly off-set from the exterior vents (*see* Figure 9). These openings would have allowed the heat generated by the equipment to escape, as well as ventilating the building.

Standby Set House (Figures 13 and 14)

The Standby Set House was an essential component of the CD/CHL radar station, as it provided an emergency power supply for the TxRx block. The building would have housed a large, water-cooled generator; the standard models were a Nunn three-phase generator and a Lister 15kVA unit (Dobinson 2000a, 124). The generator would have produced sufficient power to keep the TxRx block operational in the event of a mains electricity supply failure. At Craster, the Standby Set House is located approximately 25m to the south of the TxRx block. It has two parts, the main room, which would have housed the generator, and the annexe across the northern end, part of which may have acted as a fuel store. This is an unusual variant, as it is more usual for the fuel store to have been housed in a separate building (*see* below).

Exterior

The Standby Set House is an irregular T-shape on plan. It is of the same poured concrete construction as the TxRx block, also stands 3m high and the roof similarly extends 0.15m beyond the exterior wall line. A concrete plinth, varying in width from 0.15 to 0.30m, surrounds much of the building, but is absent from the north-western corner, where it has been cut back into the underlying bedrock. Although there are no window openings in this building, there are a number of vents in the walls. The vents are all located in the walls of the generator room, with four in each of the east and west walls and two in the southern wall. The exterior and interior apertures for the vents are not at the same level, in order to afford blast protection, and are not of the same depth (*see* Figure 13). The vents would have been essential to ventilate the room, as the generator would have produced excessive heat and fumes when in operation. The waste water from the water-cooled generator was channelled

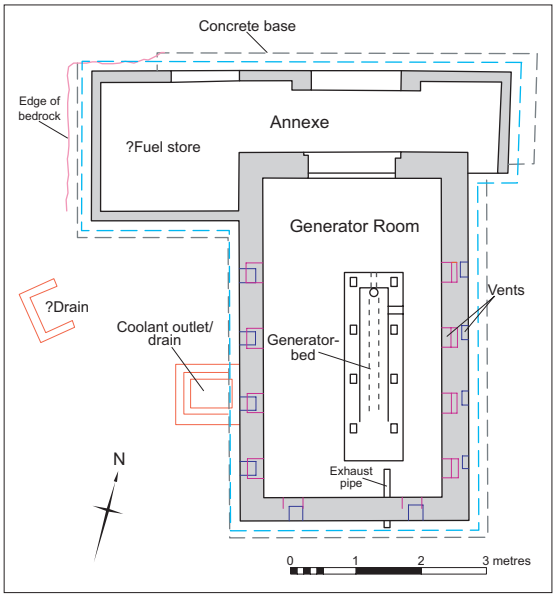


Figure 13
Plan of the Standby Set House, reduced from the original scale of 1:50

away from the building along a pipe which passed through the foot of the western wall, into a rectangular brick and concrete sump. A small, brick-built rectangular structure with an open side to the east, which is located 3.5m west of the Standby Set House, may be the site of a drain, although its precise function is unclear.

Entrance into the building was via one of the two doors in the northern wall. The main door is aligned on the internal door into the generator room and measures approximately 1.3m across. This positioning of the doors would have allowed machinery to be moved in and out of the building with relative ease, facilitated maintenance operations and also allowed light into the generator room. There is a second, narrower door to the west of this, which gave access to the possible fuel store at the western end of the annexe. There is no evidence that this building had any exterior camouflage or barbed wire fencing supported by angle-

Figure 14
The Standby Set House viewed from the south-east

irons. As this building is unlikely to have housed any evidence of secret equipment, this supports the theory that the TxRx block was fenced off at a later period, when the compound was used as a POW camp.

Interior

Inside the generator room is a concrete generator-bed, which stands *in situ* and slightly off-centre (Figure 15). The generator would have been mounted on this and the bolts which held it in place are also *in situ*. There is a hollowed-out, rectilinear sump in the centre of the machine bed, which slopes down towards the door where there is a hole, leading to a pipe encased in the concrete, exiting the bed at its northern end. This would have enabled any waste liquid to be channelled away. There is also a channel cut into the eastern edge of the bed. Built into the southern wall is the sawn-off metal exhaust pipe from the generator; it protrudes 0.1m beyond the exterior of the building (*see* Figure 14).

A doorway gives access between the generator room and the annexe. This would have housed a pair of doors, neither of which survives, although most of the wooden door-frame is still *in situ*. The survival of the wooden frame suggests that the doors themselves were wooden, as the frame could not have supported metal doors of the type used in the TxRx block. The walls of the generator room are thicker than those of the annexe. The eastern part of the annexe is a narrow corridor-like area, whilst the western part is square. There is no evidence of a door separating the two areas.

There are few features of note within the annexe. At the east end of the annexe there is a gap between the east wall and the north-west corner of the generator room. It is too narrow to be an access doorway, but may have been constructed in order to afford some form of blast protection to the generator room and perhaps also to provide an escape route. Although there is no evidence that the western end was divided off from the rest of the annexe, the fact that there is a door in the north wall suggests it functioned as a separate room and therefore was originally partitioned off. There are few clues as to how this area was used, but there are fragments of wooden brackets still attached to the wall, which suggests that there were shelves here. One possibility is that this was used as a fuel store and the shelves would have been used for storing jerry cans and tools. As mentioned above, this would normally be a separate building, as is the case at Ravenscar (Newman and Kenyon 2000, 4-5). However, there are no other buildings in the vicinity of the Craster site which are likely to have fulfilled this function, and therefore this annexe is likely to have been used for this purpose.

Figure 15
The machine bed, which supported the generator in the Standby Set House

Accommodation huts and associated structures

As well as the TxRx block and the Standby Set House, there would have been other associated structures, such as accommodation for the operators, an ablutions block, administration buildings and storage.

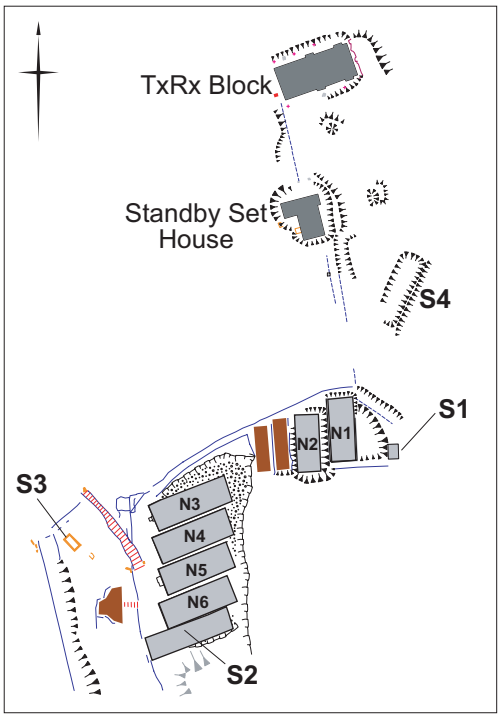


Figure 16
Plan showing the position of the World War II structures and features discussed in the text

The remains of these buildings still survive at Craster in the form of hut bases and ground-level foundations, the positions of which are shown on Figure 16.

The main accommodation blocks and associated structures are located to the south of the Standby Set House in two discrete, but adjacent, groups. The first group is located on top of The Heughs, and consists of a pair of hut bases with concrete retaining kerbs and *in situ* holdfasts (N1 & N2). The holdfasts indicate that the plinths supported superstructures, probably Nissen huts. They measure approximately 11m by 4.4m (36 feet by 14.4 feet) and 10m by 4m (32.8 feet by 13.1 feet) respectively and are orientated north-south. They are constructed on level platforms which have been artificially cut into the natural slope. The concrete edging of the eastern base still survives intact on three sides, to a height of three courses (*c* 0.75m). Only the concrete edging along the western side of the lower hut base survives. It is possible that these huts served as administration buildings, given that they are closer to the operational buildings.

S1 is a small rectilinear concrete plinth, measuring approximately 2.5m by 1.8m. There are a number of holdfasts set into the concrete (Figure 17) and the aerial photograph shows a small building on it (Figure 18). The holdfasts indicate that the plinth held a superstructure, presumably of corrugated iron similar to that of the Nissen huts. As such it would have been no more than a fairly insubstantial structure (not strong enough to mount a radar on) and probably accommodated ancillary equipment, such as a fire bucket or sand for smothering a fire. Given the electricity and quantities of fuel in close

Figure 17
The concrete plinth (S1) with in situ holdfasts

proximity on the site, the risk of fire was high and thus provision needed to be made for this eventuality. It has been queried whether this may have been the position of a fixed Gibson Box (Beamish 1993, 2), but this is unlikely as it is set down below the crest of the high ground, making it an unsuitable situation for a radar. It is much more likely that this was a store. However, it is too small for a fuel store, which would have required a more substantial structure.

Between the TxRx block, Standby Set House and the pair of Nissen huts (N1 & N2) are a number of incomplete lines of stones set into the ground. These are the remains of upright edging stones which would have defined the path between these structures. Bearing in mind that operators would have been moving around the site during the night with a blackout in force, this would have been essential to delineate the routes between the structures. A stone-edged path can be traced from these huts, leading west down the steep slope to the other accommodation block group (*see* below), north to the operational buildings, and east curving towards a small structure (S1). Although now mostly overgrown these paths are still marked by stone kerbs protruding through the turf and are clearly identifiable on the 1946 aerial photograph (Figure 18).

Below the western hut base (N2), and on the same alignment, are two level areas terraced into the steep natural slope. These are discussed below, as they are believed to date to the period when the former accommodation huts of the radar station were re-used for housing POWs.

The second main group of buildings is located in the quarry to the west of the first group. This group consists of the remains of five structures (N3-6 & S2). As will be discussed below these are the remains of the living accommodation and ablutions block of the CD/CHL operating staff (subsequently re-used by the POW inmates). The choice of location is interesting given the steep climb up to the TxRx block, as this would have been potentially hazardous at night with a blackout in effect. As early as 1939 CH stations were placed on 24-hour watch as soon as they were operational (Bragg 2002, 124). Thus, the radar station would have been continuously manned with staff on duty and changing shifts throughout the night. However, the inconvenience of the situation of the huts was obviously considered to be secondary to the benefits of positioning the huts in the former quarry which would have provided ready-made camouflage as well as protection from the coastal winds and bombardment. The structures are set in a staggered line close together. The four northern ones are marked by a concrete retaining kerb. These have *in situ* holdfasts which indicate the fixings for a 16 ft (4.88m) span Nissen hut superstructure. Stony tumble from the quarry face, a dump of barbed wire and scrub growth have all obscured the full extent of the hut bases, but from what remains visible, they appear to have been of similar size, perhaps with the exception of the southernmost hut. They are generally just under 16ft (4.88m) wide and probably extended to around 42ft (12.80m) in length. Standard Nissen huts came in three internal spans, 16 ft (4.88m), 24ft (7.32m) and 30ft (9.15m) and could be any length in multiples of 6ft (1.83m) bays on a concrete base (Lowry (ed) 1995, 116). An imprint along the edge of the concrete path alongside the southern hut (N6) shows the tell-tale sign that the superstructure was made of corrugated iron and is therefore likely to be a Nissen hut,

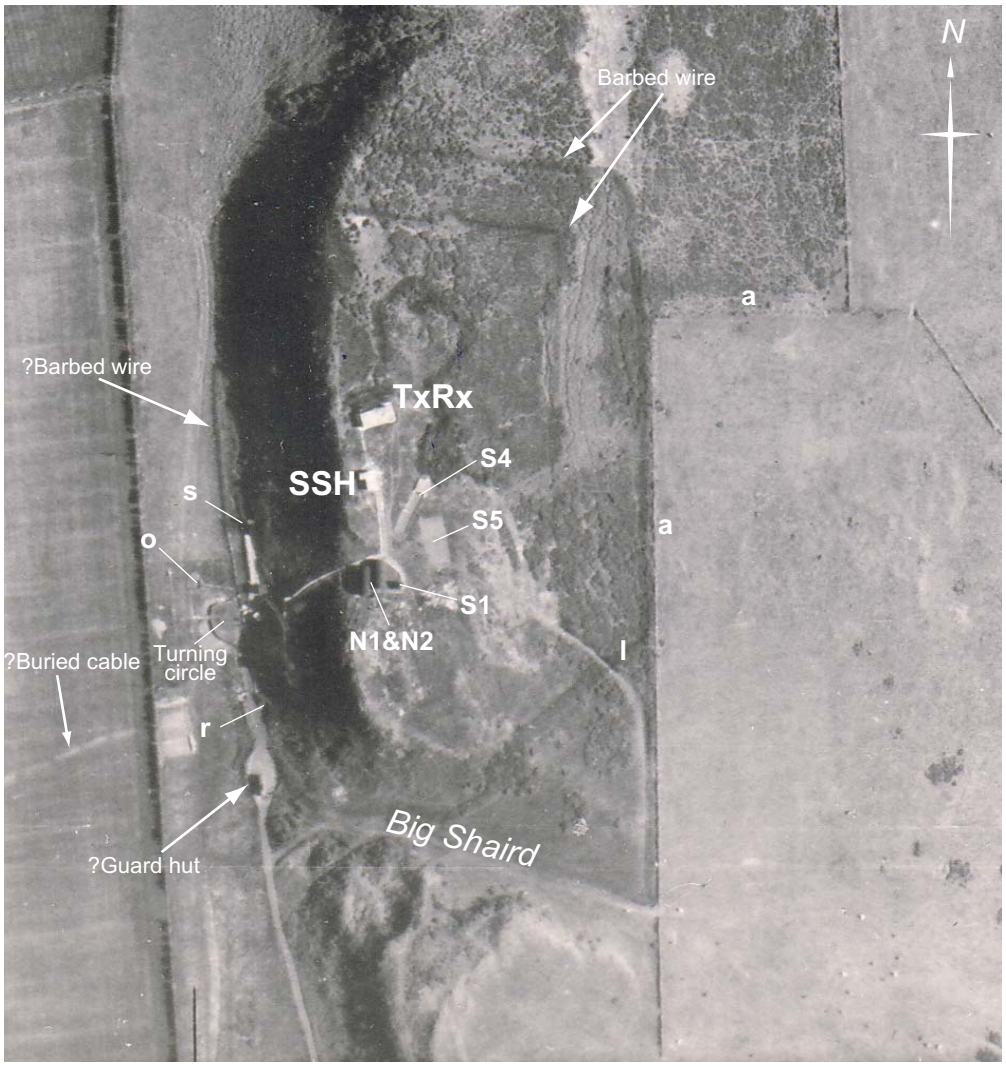


Figure 18 Annotated 1946 aerial photograph of the site. The annotations relate to features mentioned in the text. (© Crown copyright. NMR RAF 106G/SCOT/UK121 Frame 3412 20-Jun-1946)

similar to the two others (N1, N2). This is also confirmed by oral testimony (*see* below).There are few additional surviving details associated with the four huts (N3-N6), with the exception of concrete steps adjacent to the front edges of the northernmost and middle ones, which indicate that the entrances were at the west end.

The southernmost structure (S2) is different in form to the other four and appears to have been the ablutions block serving the huts (*see* below). It measures approximately 15m by 4m and its outline is mostly turf-covered but in places there is concrete flooring exposed and imprints of small sub-divisions, which may indicate toilet or shower cubicles. Small recesses in the edge indicate that this structure was timber-framed and was probably clad in corrugated sheeting. Between this (S2) and the southern of the former Nissen huts (N6) are the remains of a concrete path. At its eastern end and between the two buildings, is a rectangular brick-built structure, which is part of the drainage system; at the time of the survey it contained a slab of non-slip tile which would have been used within the showers (Figure 19). At the west, its remains are collapsing due to erosion on the steep slope. Its location might imply that the southernmost of the Nissen huts acted as a mess or kitchen and shared a common drain with the ablutions block. Prior to the current survey, the remains of brick stands, probably for a water tank were observed south-east of the rear of the

Figure 19
A 'fat trap', part of the drainage system associated with the ablutions block

ablutions block. However, these have subsequently been obscured, and possibly destroyed, by tumbled rocks from the quarry face.

The dump of barbed wire and pickets which covers the eastern end of huts N4-N6 is what remains of the barbed-wire entanglements cleared from the site following the end of World War II. Some sawn-off angle irons are still *in situ* at the west side of the platform supporting the group of huts within the former quarry.

Another brick-built structure (S3) close to the foot of the inland cliff appears to be a sewerage settling tank associated with the ablutions block (Figure 20). This was presumably linked to the ablutions block by an underground drain which would have utilised gravity to draw the waste water down to the tank below. A ceramic drain encased in concrete exits this settling tank and can be traced intermittently down the slope. Some displaced parts lie at the bottom of the slope ('n' on Figure 7) and its *in situ* route can be traced as a grass-covered bank (o) leading to a sump and the connection with an underground drain (*see* below) along the base of the valley at the west. A manhole cover to the north of the sump (p) indicates the underground route of the drain (which would have flowed to the north) in the direction of the section still visible as a narrow surface channel (q). On the cast iron manhole cover are the words 'J Sample – Warkworth', whom it is believed may have constructed the whole complex (Mr S Sample, *pers comm* in Beamish 1993). The shallow channel (q) follows a north-south alignment before turning towards the north-west.

Access between the operational buildings on top of The Heughs and the Nissen huts and other military structures at the foot of the inland cliff was via a path down the steep cliff. This appears to have been created at the time that the military structures were constructed, as there is no path depicted in this location on the pre-World War II OS maps. It has fragmentary drystone walling defining its northern side and the lower half of its southern side, and gives access to the level area in front of the huts, which is also revetted with drystone walling along its western edge. This revetment is also likely to be associated with the construction of the huts, designed to provide a stable platform; it does not appear on

Figure 20
Settling tank forming part of the drainage system from the ablutions block

pre-World War II maps. The route from here to the foot of The Heughs cuts across the natural slope and would formerly have consisted of a flight of stone steps, although only a few of these now survive *in situ*. These too have drystone walling defining both sides. Traces of lime plaster or white paint survive on the eastern wall of the steps, suggesting that the walls were highlighted to make them stand out in torchlight at night. At the top of the steps a brick-built pillar stands *in situ*, probably a gate pier (Figure 21); the remains of another were found tumbled on the slope and there is also a fallen pillar at the foot of the steps.

Some 20m to the south-east of the Standby Set House is a rectilinear platform measuring approximately 12m long by 3.5m wide cut into a slight slope (S4). It seems likely that this area was the base of a structure, or perhaps a level stance for a vehicle or temporary structure, as there are no indications of concrete or other flooring material. The feature can be seen on 1946 aerial photographs of the site and appears to have a small, low structure at its north-eastern end, although there is presently no trace of this. It is possible that the platform was created to provide a level area upon which a mobile 10cm radar (Gibson Box) was located (*see* Section 3). In December 1942, Craster radar station had been allocated a 10cm radar of the types CD No 1 Mk IV and V (Dobinson 2000a, 130), although the latter was not installed until September 1943 (PRO No 73 Wing F540). The Mk V would have been positioned separately from the TxRx block, but would also have needed to be relatively close for operational and power supply reasons. The siting of the platform, on high ground close to the crest of The Heughs, would have been eminently suitable for the positioning of a radar.

Also visible on the 1946 aerial photograph is another rectilinear feature (S5), a short distance to the south-east of S4, but larger and on a different alignment. It appears to be an area cleared in the vegetation and may have been a recreation area for the inmates when the compound was used as a POW camp. The fact that no trace of this now survives on the ground as an earthwork may support this interpretation.

Other World War II features

Although the track along the foot of The Heughs dates to at least the mid-19th century, if not earlier, it appears to have been modified and re-used to enable vehicular access for the

Figure 21
A brick pier at the top of the steps connecting the Nissen huts with the foot of The Heughs

military activity in this area. Oral testimony (as noted above) indicates that the entrance to this track from the road at Craster was continuously guarded during the World War II period (Mrs W Hogg, *pers comm*) and was the main access to the site.

The southern part of the track within the survey area appears to have been broadened, with clear scarps defining each side and loose rocks from the nearby quarry spoil heaps used to revet the downslope side. This was presumably due to the need to support the weight of lorries approaching the compound. Close to the junction with Big Shaird, the track bulges out, a feature which can be seen on a 1946 aerial photograph of the area, possibly with a small hut or a vehicle on it. If it is a hut, then this may be the position of a guard hut, controlling access into the compound from the south (labelled 'm' on Figure 7 and '?Guard hut' on Figure 18). It was usual for a small watch hut to have stood at the entrance to a CHL site (Dobinson 2000a, 72). In addition, a gate or barrier might be expected here to control access into the main compound, through its barbed wire perimeter. A short distance to the north of this, at (r), another scarp defines a level area cut into the natural slope on the eastern side of the track. While this may have been utilised as a parking place for a vehicle, it was probably created as a small quarry scoop to provide ballast for the modifications to the track during the wartime period.

North of this, at (s), are three large concrete fragments, the remains of a platform which would have extended some 25m to the south. Along the western edge of this former platform there is still intermittent, *in situ* drystone revetment surviving. A further line of drystone revetment to the west of the latter indicates that there was a track or level area parallel to it. The platform is visible on the 1946 aerial photograph as a long, white rectangular area, between (s) and a probable turning circle (*see* below and Figure 18). It may have functioned as a loading/unloading platform. It is possible that there was a small structure at (s), but the evidence on the aerial photograph is not conclusive.

Opposite the site of the Nissen huts (N3-N6), in the valley at the foot of The Heughs, is a semi-circular area defined by a ditch with a small, narrow causeway on its west side (labelled 'Turning circle' on Figures 7 and 18). Fragments of stone survive in the inner face of the northern ditch, indicating that it was formerly revetted. The two sections of ditch are separated by a small baulk of earth, which creates a narrow causeway, giving access to the level area enclosed by the ditches. The semi-circular platform has clearly been built up against the base of the slope to make a level area. The material for this may have come from the ditch. There is no ground evidence of any structures having been located on this platform, and none is visible on the 1946 aerial photographs. Its function may have been to provide a turning circle for vehicles, although a slight drop in height from the track (which is still marked by a low scarp) would seem to cause an unnecessary inconvenience. The radar-station complex would have regularly required various supplies, particularly during construction, and later on fuel and food, thus creating a need for a delivery point. The position of the platform would have been convenient for access to the accommodation buildings as well as being close to the foot of the path leading up The Heughs to the operational buildings.

Close to the hedge marking the western boundary of the survey area is a small pit measuring 1.5m by 1.5m (labelled on Figure 7). The pit is cut through the ridge and furrow (and is thus later in date) and corresponds in position with an area which has, on 1946 aerial photographs, apparently been recently cleared or perhaps disturbed (RAF 1946; Figure 18). The rectilinear area visible on the photograph may have been the base for a structure removed by the time the photograph was taken in 1946. The irregular spacing of the plough-furrows in this area suggests that one of the furrows may in fact be the remains of a ditch associated with this disturbed area. The fact that a buried cable approaches this area (*see* Figure 18) may indicate that the pit might be the position of an inspection pit or manhole.

Defensive positions

Security around the CD/CHL station would have been of prime importance during the period of its operation and thus it is unsurprising that there are a number of weapons pits located along The Heughs; the distribution of these within the survey area is shown on Figure 7. The majority take the form of a shallow depression with a bank on at least one side, typical of defensive positions housing rifles and light machine-guns. There are two or three larger features which may have housed light anti-aircraft weapons (WP4 and 'f' on Figure 7). Part of the ground defences for a radar station would have included sentries and lookouts to counter sabotage and landings by parachutists (Bragg 2002, 137) and trenches for infantry defences where necessary (Dobinson 2000a, 72). The weapons pits in key positions include WP1, WP2 and WP3, which would have provided defence against a coastal attack, WP6 and WP7, which would have provided cover for the southern approach, and WP8, which would have guarded against an approach from the west. There are other weapons pits further down the slope to the east of the radar station buildings, some of which would have been close to the barbed-wire perimeter. The pits along the barbed-wire perimeter may have served such a purpose and would have acted as a final line of defence in the instance of a ground attack.

One example of a chevron- or v-shaped trench was also recorded on the seaward slope ('k' on Figure 7). It is possible that some of these small dugouts relate to a period of activity prior to the construction of the CD/CHL station, perhaps part of the general defences of this stretch of coastline (*see* Section 5.2.1).

5.2.3 POW Camp

Following the abandonment of the radar station, the accommodation huts in the former quarry were re-used to house first German and then Italian POWs (Mr W Archbold, *pers comm*). It is not known if the pair of Nissen huts (N1 and N2) and the operational buildings on top of The Heughs were also used for this purpose or not. Although the best evidence for the re-use of the radar station as a POW camp is the oral testimony of local residents (*see* Section 3), there is also field evidence which seems to support this change of use. Close to the eastern pair of former Nissen huts are artificial terraces cut into the slope below (Figure 22) and another in front of the main group of huts in the former quarry. These terraces have drystone revetment on their downhill side and have the appearance of cultivation terraces or gardens, similar to, but on a much smaller scale than, examples which proliferate in

Mediterranean countries. A short flight of steps was found to give access to the terrace in front of the main group of Nissen huts. These terraces can be best explained as attempts by the POWs to create gardens in and around their temporary 'home'. Undertaking the creation and cultivation of these garden terraces would have given the prisoners a constructive occupation, as well as providing a source of food through the growing of vegetables. Oral testimony confirms that the prisoners attempted to grow vegetables, but failed due to the unsuitable nature of the soil (Mrs W Hogg, *pers comm*). The prisoners were mostly 'trustees' who were allowed to move about relatively freely – local residents recall the prisoners working on nearby farms and filling 'jerry cans' of water from Craster, loading them onto a truck taking them back to the camp (Mr W Archbold and Mrs W Hogg, *pers comm*). This may indicate that there was no piped water to the radar station or later POW camp.

Figure 22
Section of drystone walling defining and revetting the western edge of one of the terraces below the pair of Nissen huts (N1 and N2)

6. Discussion

Three broad chronological phases of activity have been firmly identified within the area of the present analytical field investigation, but none of these appears to pre-date the medieval period. However, there is evidence of prehistoric and possible Romano-British activity elsewhere along the Whin Sill. At Dunstanburgh Castle, for example, a scattering of Mesolithic/ Neolithic flints has been found and recent analytical field survey located a round barrow and confirmed the long-suspected existence of a late Iron Age promontory fort with probable Romano-British re-use (Oswald *et al* 2006). Within the survey area itself, the banks and natural terraces on the gently sloping ground (*see* Section 5.1.1) are reminiscent of 'Celtic fields'; the bank labelled (d) on Figure 6 does not appear to fit in with the obvious pattern of post-medieval fields which would be expected to be more regular. There is no unambiguous evidence to ascribe an early date to these boundaries and thus the post-medieval period may be their best context. Nevertheless, possible early exploitation of this slope cannot be ruled out, particularly in view of the other early field remains in the vicinity.

Medieval activity is evidenced by the survival of ridge and furrow cultivation remains within the survey area. The evidence for this is clearest to the west, where the tail-end of broad, curving plough ridges still survive. This medieval ploughing is part of a much wider agricultural landscape of this period, which included the working of the land around Dunstanburgh Castle, possibly from an associated later-medieval farmstead associated with the castle (Oswald *et al* 2006).

Evidence of later land division and cultivation remains from the post-medieval period can still be found on the ground and in the cartographic record. In the south-west of the survey area is an earth and stone bank, formerly a boundary, labelled (c) on Figure 6. The boundary is not shown on the 1861 OS 6-inch map (Ordnance Survey 1866), which suggests that it was redundant by this date and is probably a fragment of an earlier phase of land division, prior to the mid-19th century. It is possible that fragmentary boundaries which create the appearance of 'Celtic fields' (noted above) may in fact be of a later date and perhaps belong to a post-medieval period of land division, in spite of their irregular nature. The stone field-wall, (a) on Figure 6, is shown on the 1861 OS map, as is the hedge which defines the western edge of the survey area and both relate to an implantation of regular field divisions on this landscape. In addition, the remains of narrow ridge and furrow ploughing between the radar station and the field wall (a) appear to date to this same period.

Stone quarrying was also an important activity in this area during the post-medieval period. The village of Craster itself was founded *c*1780 by Shafto Craster to make use the natural topography, which offered a suitable landing place, and to exploit the local fishing resources, primarily herring (Linsley 2005, 93-98). During the 19th and 20th centuries whinstone quarrying along the Whin Sill provided supplementary economic support for the settlement and also utilised the harbour at Craster. There were certainly two quarries opened up in the vicinity of Big Shaird as well as others closer to Craster and along Craster Heugh (south-west of the

village) (Figure 4; Ordnance Survey 1897). A large part of the present public car park in Craster village is situated in a former quarry. The track running along the foot of The Heughs is likely to pre-date the extraction, although it was subsequently modified to give access to the quarry (h). The depiction of a track heading west through Big Shaird on the 1861 OS map shows it to be truncated by the field boundary currently defining the western edge of the survey area (Ordnance Survey 1866). A continuation of the track to the west, leading to Dunstan Square, is fossilised in a present day footpath across the ploughed field. This track and others linking Dunstan Steads, Dunstanburgh Castle and Dunstan Square are all depicted on Greenwood's 1828 Map of Northumberland, demonstrating that they date to at least the first quarter of the 19th century, if not earlier.

Following the abandonment of the quarry (h) within the survey area, the site lay dormant until the outbreak of World War II when the growing need to defend Britain's vulnerable coastline became apparent. As mentioned previously, the radar station was merely one component in the much wider coastal defences in this area. Other features which still survive in the surrounding landscape relating to these defences include a pillbox close to Dunstanburgh Castle and anti-tank cubes by Craster harbour. The Heughs provided the ideal topographic setting for a radar station, with its relative height, isolation and proximity to the coast, allowing the aerial a clear, uncluttered sweep of the horizon. A memo sent out in 1938 by R A Watson Watt (then Superintendent of the Radio Research Department of the National Physical Laboratory, Slough), set out the ideal location for a radar station, criteria all met by the Craster site:

> "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)

The security of radar station sites was of greatest importance. During the early days of World War II, radar was top secret. At Craster, there is evidence of a double barbed-wire perimeter surrounding the complex, which would have been supplemented by a number of defensive fieldworks. Bofors light anti-aircraft guns and Lewis machine guns would have protected the radar stations against attack from the air, while there would also have been sentries and lookouts on the ground (Bragg 2002, 137). Evidence of such fieldworks has been found in the form of weapons pits and fox-holes around the site.

Despite the relatively recent date of the radar station at Craster, there are few surviving documents relating to the military occupation of the site. The precise date of construction is not known, but it is likely that it was towards the end of 1941; the operations buildings conform to the arrangement adopted for the 1941 version CHL station. Additionally, there do not seem to be any buildings in the correct positions on aerial photographs dating from March and August 1941 (RAF 1941a; RAF 1941b). As the station was a CD/CHL station, it would originally have been administered by the army, possibly using personnel from the Royal Artillery; there were coastal batteries at Amble and Spittal and the headquarters of

the Coastal Regiment was at Blyth. Initially, a 1.5m radar would have been operating at Craster, as indicated by the 'M' prefix of the station's identification number (Dobinson 2000a, 108). Documentary sources show that by December 1942, Craster had been allocated a CD No1 Mk IV or V radar (a 10cm set – *see* Section 4), although the equipment is not confirmed as being in use by this date (Dobinson 2000a, 130). By the end of 1942 the Craster radar station, along with the other CD/CHL sites, had been handed over to the RAF and was then utilised for surface watching only. It would have come under the responsibility of 73 Wing, which had its headquarters at Malton, North Yorkshire (Beamish 1993, 3).

While the location was ideal for the radar operation, it was not so well suited in terms of the infrastructure needed to keep the radar station running. Although far from certain, it appears that power was taken from the mains system to the west and transmitted to the site via underground cables. The same was probably true of the telephone connection. The transfer of power within the compound is no longer evident, but may have been via a network of camouflaged cables. The radar-station complex had its own drainage system, but it would have been necessary to have brought water in from elsewhere. During the time that the site was used as a POW camp, the prisoners collected the water from Craster and took it back to the camp. It is likely that the same arrangement had been operated to supply the radar station.

The existence of the radar station at Craster was a closely-guarded secret during World War II and the local residents were not allowed near it. They did not know what went on within the compound, merely being told that it was 'something to do with radios' (Mrs W Hogg, *pers comm*). Other mis-information was used to mask the activities at the radar station. For example, at Craster harbour an aerial ropeway and a distinctive gantry on the end of the harbour wall, which brought whinstone from the quarries to waiting boats, was dismantled by the army in the early stages of World War II. At the time, residents were told that this was to prevent it being used as a navigation aid by the Luftwaffe (Mr W Archbold, *pers comm*). Given that it was relatively small and that the gantry was unlikely to be of much use as a navigation aid, it is more likely that they were dismantled due to potential interference with the radar emissions. As early as 1937 the possible problems of objects close to a radar station were acknowledged, as shown in Watson Watt's guidelines, stating that there should be 'no buildings, tress, or other obstructions within half a mile of the towers' (Bragg 2002, 78).

The Craster radar station ceased to function on 1st July 1944, at which date it was still described as an Army controlled CD station (PRO No 73 Wing F540 – Air Ministry letter s.84229/0.1(b), 30-Jun-1944). Although the radar buildings were redundant by 1945, some of the other buildings on the site were re-used to house POWs, firstly Germans and subsequently Italians. The secrecy surrounding the wartime radar operations meant that the site would already have been well protected and secure and the Nissen huts in the former quarry (h) would have provided suitable accommodation. Little is known about this period of the site's use. The most useful source has been the personal recollections and memories of local people. Local residents recall that around 1945 there were POWs working

on the land at Dunstan Square farm, some 500m to the north-west of the site (Mrs W Hogg, *pers comm*). Mr Archbold recalled that the interior of huts had a plaster-board lining, upon which the prisoners had painted murals, one of these was a scene of a man sitting beside a lake at sunset, perhaps a reminder of the prisoners' homeland. The POWs also made items such as willow baskets and finger rings and sold them locally (Mr W Archbold, *pers comm*). In 1947 the POWs left the camp at Craster and by 1950 the artwork had been removed and the huts dismantled. Even as late as 1949, part of the radar station site was still surrounded by barbed wire (Mr W Archbold, *pers comm*).

Parts of the site have survived in relatively good condition. The TxRx block and Standby Set House structures survive well, in part due to their substantial construction and the lack of pressure from modern development. Despite being gutted after falling out of use, the interiors of the buildings still contain valuable scraps of evidence about their former layout and appearance. This is an unusual survival in buildings of this type. There is a certain amount of graffiti in the buildings which may threaten the survival of some of the interior detail, however, at present it is not a particular problem. The use of the structures as shelters by animals, such as sheep and birds, does not appear to pose a major threat to the fabric of the buildings, and, as is the case of the cable ducts in the floor of the TxRx block, may in fact serve to protect some of the interior detail under layers of animal waste and mud. Gorse is clearly prevalent over much of the site and may be obscuring further archaeological remains in places. Some of the drystone walling on the inland cliff slope is somewhat unstable, in places dislodged by gorse roots and vegetation growth. At the time of the field survey, part of the stone revetment of the level area directly in front of the accommodation huts bases had crumbled away and part of the western end of the ablutions block was collapsing. However, clearance of the vegetation covering the accommodation hut bases has proved successful and has enabled the recording of this previously obscured area.

7. Acknowledgments

The field investigation was requested by Harry Beamish of The National Trust. Detailed information about the operational detail of the radar station was provided by Ian Brown. Roger J C Thomas, a military archaeology specialist from English Heritage, accompanied the team on a site visit and provided further in depth information about the layout and function of the buildings and the wider wartime use of the landscape in this area. Local residents Mr William Archbold and his sister, Mrs Winnie Hogg, very kindly took the time to talk to members of the Archaeological Survey and Investigation team about their recollections and experiences of living in Craster around the time of World War II.

8. Survey Methodology

The field investigation was carried out in February 2004 and September 2005 by Abby Hunt, Stewart Ainsworth, Al Oswald and Trevor Pearson. Trimble 4800 and 5800 dual frequency Global Positioning Satellite (GPS) systems were used to establish a base station on site and to record the majority of the detail. The plot of the site was produced from the GPS data using Key Terra-Firma, Geosite and AutoCAD software and output at a scale of 1:1 000. The plot was checked in the field and further detail added to it by means of conventional graphical techniques using hand-tapes. Sufficient GPS points were surveyed to generate contours on the survey plot at 1m intervals. The TxRx Block and Standby Set House were plotted with conventional graphical techniques, using hand-tapes, at a scale of 1:50.

The report was written by Abby Hunt and Stewart Ainsworth and illustrated by Phillip Sinton and Abby Hunt using AutoCAD and Adobe Illustrator software. The 3-D topographical model (Figure 3) was produced by Stewart Ainsworth, using ArcGIS software. Roger J C Thomas commented on the text and Stewart Ainsworth edited the report.

The site archive has been deposited in English Heritage's National Monuments Record, Great Western Village, Kemble Drive, Swindon SN2 2GZ to where applications for copyright should be made (reference number NU 22 SE 25)

9. Bibliography

Beamish H 1993 '*Chain Home Low' Radar station on Craster Heughs*. Unpublished draft report

Bragg, M 2002 *RDF1.* Paisley: Hawkhead Publishing

Brown, J 1996 *Radar: How it all Began.* London: Janus Publishing

Dobinson, C S 1996 *Twentieth Century Fortifications in England, Volume II Anti-invasion defences of World War II.* York: Council for British Archaeology

Dobinson, C S 2000a *Twentieth Century Fortifications In England, Volume VII 1. Acoustics and Radar: England's early warning systems 1915-45*. *Text*. York: Council for British Archaeology

Dobinson, C S 2000b *Twentieth Century Fortifications In England, Volume VII 2. Acoustics and Radar: England's early warning systems 1915-45*. *Appendices*. York: Council for British Archaeology

Geological Survey of England and Wales 1956 (Re-print) *Sheet 6 Alnwick (Holy Island) 3rd Edition (Drift)* 1:63 360 scale. Ordnance Survey: Southampton

Linsley, S 2005 *Ports and Harbours of Northumberland*. Stroud: Tempus

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

Newman, M and Kenyon, K 2000 *Bent Riggs Radar Station: Standing Buildings Recording.* National Trust Yorkshire Region: Archive Report MNNTY95 (Yorks VBS 1040)

Ordnance Survey 1866 *First Edition 6-inch scale map, sheet Northumberland 27,* surveyed 1861

Ordnance Survey 1897 *First Edition 25-inch scale map, sheet Northumberland 27.12,* surveyed 1896

Ordnance Survey 1971 *OS 71/070 Frame 320 11-Apr-1971*

Ordnance Survey 1972 *OS 72/319 Frame 238 17-Aug-1972*

Oswald, A, Ashbee, J and Porteous, K 2006 *Dunstanburgh Castle, Northumberland.* Research Department Report Series no. 26/2006. York: English Heritage.

Pearson, M nd *REME and Coast Artillery Radar.* REME 50. Unpublished article.

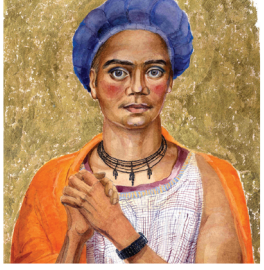
PRO No 73 Wing F540 – notes made by students of the School of Fighter Control at RAF Boulmer from the Operations Book of No 73 Wing on a visit to the PRO in 1990 (supplied by Harry Beamish)

RAF 1941a *RAF NU2520/2 4C/BR51/3 Frame 2446 13-Mar-1941*

RAF 1941b *RAF S419.H1.1416 Frame 92 19-Aug-1941*

RAF 1946 *RAF 106G/SCOT/UK 121 Frame 3412 20-Jun-1946*

RCHME 1999 *Recording Archaeological Field Monuments: A Descriptive Specification.* Swindon: RCHME



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