

Archaeological Field Survey Report

ANTI-AIRCRAFT BATTERIES BOWATERS FARM, EAST TILBURY, ESSEX

by Alastair Oswald



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1. INTRODUCTION

In May 1994, the Royal Commission on the Historical Monuments of England, in consultation with Essex County Council, carried out a survey of the Second World War anti-aircraft batteries at Bowaters Farm, near East Tilbury, Essex (NGR TQ 678 771).

The site comprises a fenced military compound, containing two groups of concrete emplacements: four 4.5-inch guns, deployed from the end of 1939 until late 1944, and four 5.25-inch guns which superseded them in 1944 and remained in position until the 1950's, together with a number of ancilliary buildings.

The batteries are located at 8m above OD, slightly below the crest of a south facing escarpment, commanding broad views over Tilbury Docks and the Gravesend Reach of the Thames.

The compound was scheduled in 1991 (SAM Essex 12709), and is now used as a rough paddock, becoming densely overgrown in places with hawthorn scrub. The emplacements themselves are extremely well-preserved. Existing written descriptions and sketch plans of the site (Godwin 1982; 1987) were drawn on in the production of this report.

2. HISTORY OF THE SITE

During the Second World War, the site was known officially as Buckland or N13, the 'N' standing for Thames and Medway North. The land, which had previously been pasture, was requisitioned in 1939. According to the war diaries of the 37th Anti-Aircraft brigade (PRO WO166/2269-70; WO 166/394; WO166/11211; WO166/14651), the anti-aircraft guns were frequently in action and the units which manned them were rotated at irregular intervals. Two 3-inch guns were moved to the site from Harwich on the 27th September 1939 and on the 30th September the 265th battery of the 37th Anti-Aircraft brigade replaced the 75th battery of the 28th regiment. On 2nd December, the 3-inch guns were transferred to Newhaven and half of the 156th battery of the 82nd regiment together with two 3.7-inch mobile guns and ammunition moved to the site. This unit was replaced by half of the 265th battery of the 59th regiment on 10th January 1940. The 3.7-inch guns remained the responsibility of the 171st battery of the 61st regiment and on 11th May, a third mobile 3.7-inch gun was moved from an anti-parachutist regiment at Biggin Hill.

Between the 15th and the 19th three 4.5-inch guns were added, implying that the emplacements had been built by this stage at least. In August and September 1940, the guns were in action almost daily during a number of bombing raids on Tilbury docks. On 19th September, the 265th battery were moved to Clayhall in the Inner Artillery Zone; the War Diary suggests that four guns were also moved, but this seems not to be the case, since the fourth 4.5-inch gun was not delivered until 7th February 1941. On 26th May 1941, the 306th battery moved to the site and on 26th July this unit was replaced by the 233rd battery of the 75th regiment; the 306th battery returned to relieve the 433rd battery of the 127th regiment on 14th November 1941. On the 8th January 1942 1st battery of the 2nd brigade of the Royal Canadian Artillery arrived. On 1st May 1943, the 641st battery of the 179th regiment (the first mixed-sex unit to operate the guns) was replaced by the 389th battery of the 111th regiment. From the 19th to the 29th May the 411th battery of the 127th regiment manned the site.

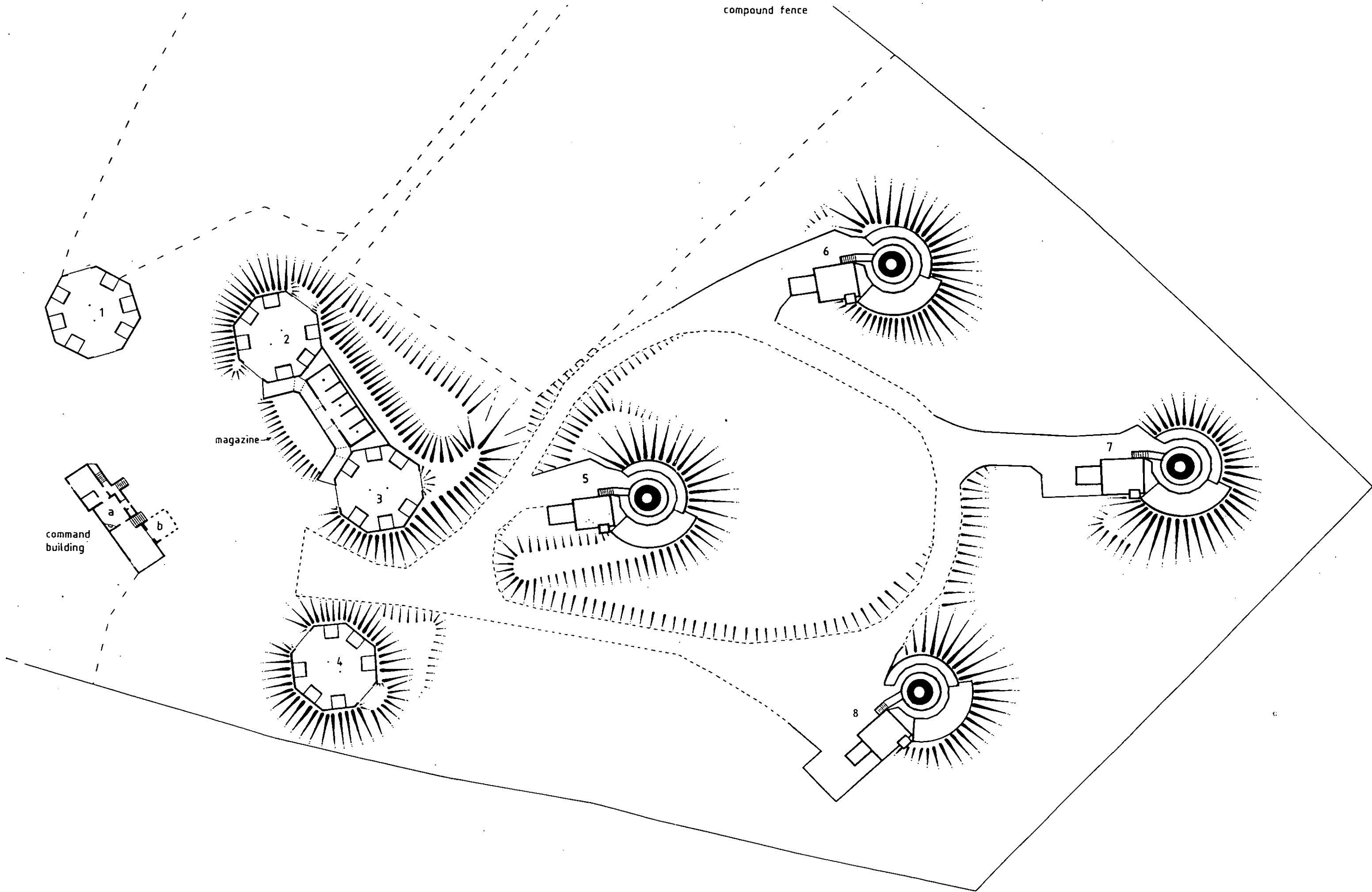
After mid-1944, most of the action was against the V1 revenge weapons. On 19th September 1944, the 574th and 590th batteries of the 137th regiment arrived. On 12th December the 551st battery of the 157th regiment joined them and were replaced on 28th December by the 627th battery of the 184th regiment, who departed on the 2nd February 1945 to disband.

The war diaries, however, provide only anecdotal evidence for the physical development of the site. The emplacements and gun store had certainly been built by the end of September 1940 (RAF aerial photograph 26H/3/1 frame 1800), and a searchlight battery was located a short distance to the north. The magazine was added c. 1942 and the circular radar net which guided the guns is first visible on a photograph of 1944 (RAF HLA/686 frame 3031).

The subsequent history of the site is less well-known, though it is probable that more intensive research would reveal further information. Bowaters Farm was one of only a few sites in Essex converted to the 5.25-inch gun, possibly because experimentation with the 4.5-inch guns had already proved the feasibility of a coastal defence role. Other factors considered were whether the existing gun site could continue to function while work on the new emplacements went ahead, whether the existing accommodation and facilities were suitable for mixed-sex crews and whether the ground was sufficiently dry, since the 5.25-inch emplacements needed much deeper foundations; Bowaters Farm met all these criteria. A memo of 27th June 1943 (WO 166/11154) indicates that work had already begun to convert a number of sites in the area and that others were ear-marked for later deployment. The work on the emplacements at Bowaters Farm was carried out late 1944 and a photograph of May 1946 indicates continuing use by construction traffic (RAF 106G/UK/1447, frames 1080-3).

The new battery, along with two other sites, was given the designation 'Igloo 2' (the name derived from the shape of the emplacement). The system was the most sophisticated of the day and cost more than a quarter of a million pounds to install. Gun-laying was effectively computerised and relied on increased accuracy to counteract the increasing speed of aircraft. The data was at first transferred to dials on the guns themselves, which then had to be adjusted manually, but from the beginning of the 'Rotor' period in the 1950's, this too was automatic, so that the sole task of the gun crew was to keep the gun supplied with ammunition. The network linking the remote powerhouse, the predictor and the emplacements, and the surviving perimeter fence, can be seen soon after construction on an aerial photograph of 1951 (RAF 58/720 part 4, frame 5046). Three more structures adjacent to the predictor building had been added by 1953 (RAF 82/713, frame 0668). This was the last major phase of building; the site went out of use in 1956-7 and the guns were declared obsolete in 1959 (Hogg 1978, 113).

compound fence



3. SITE DESCRIPTION

See site plan at 1:500 and building plans at 1:100 (Figures 1-3).

The 4.5-inch emplacements

The half-battery of four emplacements (1-4), probably constructed in mid-1940, is arranged in a north-east facing arc around a partially sunken command building, which was partly demolished and re-designed during the war (see below). Between the central pair of emplacements lies a sunken rectangular magazine. The area between the emplacements and the command building, which seems not to have been properly surfaced, was approached from the west by a gravel track, which continued in a loop around the four emplacements. No trace of this loop track now survives, but its former course is depicted on the Ordnance Survey 1:2500 map (surveyed 1960, published 1961). This arrangement is standard for 3.7-inch and 4.5-inch anti-aircraft emplacements; a closely comparable site survives at Northwick, on Canvey Island (NGR TQ 761 840), some 13kms to the east and an almost identical site, also facing north-east, at Belmont Castle, west of Grays (NGR TQ 608 795), some 7kms to the west.

The concrete emplacements are identical in plan, comprising a simple octagonal wall, 12.7m in diameter and 1.6m high, with gateways 3.5m wide on two opposing sides, one of which is oriented towards the command building in each case. The gun mountings, of which two large steel sockets and eight smaller bolt fittings survive in each case, are located centrally on this axis, probably set into the top of a low plinth, now obscured. The hangings of heavy steel inward-opening double doors survive on either side of each gateway. The opposing doorways allowed the gun transporter to drive straight through the emplacement, lowering the gun directly onto its mounting. Subsequently, only the entrance nearer the command post was used and the other was partially blocked. Six concrete ammunition lockers, 2.0m long by 1.8m wide, project into the centre of the emplacement from the outer wall; these are walled on the inner side, but accessible at both ends through steel doors, the frames and hangings of which survive. The walls of the central locker on each side of the emplacement are thickened by the later addition of an internal casing of brick, into which are set ceramic vents on either side of each door; there are occasional remnants of a rubber seal around the door frame. This possibly indicates that these lockers were intended for the storage of high-altitude shells, which were more susceptible to humidity. The absence of external lockers, a latrine and rest room, which are always associated with 3.7-inch guns, indicate that the emplacements were designed to take 4.5-inch guns.

Emplacements 2-4 are surrounded by earthen embankments, which vary slightly in plan, but generally extend from 3m to 6m from the octagonal wall and rise almost to its top. Emplacement 1 appears never to have been protected in this way, although a short section on the south-eastern side is shown on the Ordnance Survey 1:2500 map (surveyed 1960, published 1961).

The walls of emplacement 1 are marked with compass bearings every ten degrees around the interior (for all surviving signs, see appendix), and there is some evidence that all the emplacements were originally marked in this way; this is also typical. Tables on the south-western, western and north-eastern walls list cardinal directions and indicate bearings towards Gravesend, Tilbury and possibly Stanford-le-Hope respectively. This may refer to bearing restrictions which were placed on the guns on 22nd June 1944 (PRO WO166/14651). Traces of camouflage paint also survive on emplacement 1, but there are no surviving fittings on any of the emplacements for camouflage netting.

Emplacement 3 has a table on its northern wall, which indicates that the emplacements were called 'Red', 'Blue', 'Green' and (?) 'Yellow', and possibly gives gun numbers and specifications for each. A date at the bottom of the table may be 'May 1 1939', although the War Diaries record that the guns arrived one year later (PRO WO166/2269).

The guns themselves no longer survive; they were either the 4.5-inch Mark 2, which fired a 54lb high explosive shell and was the standard heavy anti-aircraft gun until 1944-5, or the variant Mark 1A, which had semi-armour-piercing shells and allowed greater depression for firing against shipping. The orientation of the four emplacements, with a restricted view seaward, together with the letters 'HE' (high explosive) on the north-western wall of emplacement 1, suggest that they were probably originally intended for the former purpose. However, the letters 'SAP' on the same wall may refer to the semi-armour-piercing shells, implying that the function of the site adapted to a dual role. The word 'PRE-SET' refers to the fuses. Both types of gun were protected by an open-backed mild steel shield and could traverse through 360 degrees. They were elevated and traversed manually, but loaded electrically after 1940, allowing a firing rate of eight rounds per minute (Hogg 1978, 112-3). Each gun had a crew of ten.

The magazine

This rectangular concrete building is located symmetrically between emplacements 2 and 3, but was not constructed until some time after the emplacements (RAF aerial photograph 26H/3/1, frame 1800). It measures 12.3m long by 4.5m wide, and is partially sunken to a depth of 1.2m. A single door, located centrally in the south-

western side, is accessible by ramps which extend to either end of the building. On the other three sides, the building is protected to roof level by a curtain wall with an external earthen embankment up to 1.3m high. The wall alongside the access ramps is similarly embanked. The interior of the building is divided into five equal rooms, which open onto a corridor along the south-western side. These rooms are lit by two windows located symmetrically either side of the door and ventilated by three small circular apertures in the roof.

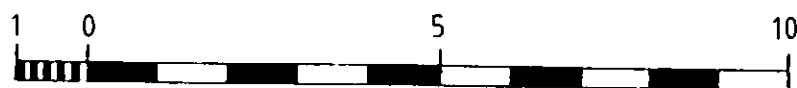
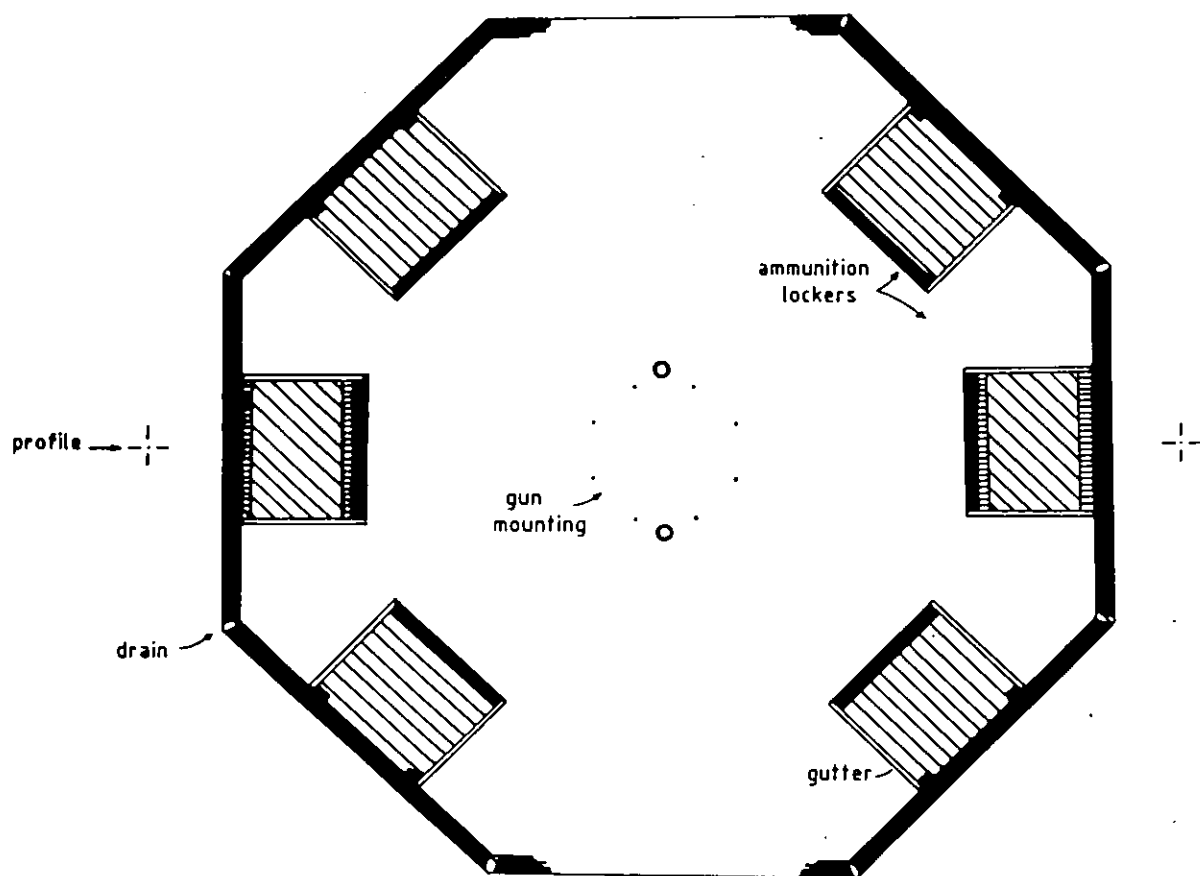
The command building

The original command post for the 4.5-inch guns comprised two half-sunken concrete structures (a and b), both 5.0m long by 4.0m wide, separated from each other by a broad staircase. These two buildings housed the communications room and plotting room; there may also have been a rest room which no longer survives. The buildings are located in the typical position at the rear of the arc of 4.5-inch emplacements, separated from them by approximately 25m. The surviving building a is windowless, with a door on its north-eastern side, approached by a passage and staircase. Only the south-western wall of building b survives, with a broad central window; the rest of the structure is visible as a parch-mark.

Two larger brick rooms were added and building b was partially demolished c. 1943, possibly when the guns acquired a dual role. The surviving wall of building b was incorporated into the exterior of a single room 7.5m long by 4.5m wide. This extension also abuts the south-eastern side of building a. Another room, 6.5m long by 3.5m wide, was added to the north-east wall of building a and doors were broken through the concrete walls to give access to the new rooms. The north-eastern room was later subdivided by the construction of a brick partition wall to form a room 2.0m square, which was probably a rest room. Access to each part of the command building was gained by a separate door and staircase, and each room had a single small window, possibly for emergency escape, in its south-western side.

Building a has a small brick fire-place in its southern corner and the word 'SILENCE' painted onto the rear wall; which suggests that it may have been the plotting room. Two instrument pits, located approximately 25m to the north and south of the command building, are visible on an aerial photograph of September 1940 (RAF 26H/3/1, frames 1799-1802). The command post as a whole would have been operated by a crew of ten.

4.5-inch anti-aircraft gun emplacement number 4



metres

- concrete
- brick
- concrete roof

The 5.25-inch emplacements

The four emplacements (5-8), constructed in 1945-6, are arranged in a diamond pattern around a concrete loop-road extending eastwards from the 4.5-inch battery. Emplacements 5-7 face almost south, while emplacement 8 faces south-eastwards. The concrete structures are identical in plan, comprising the emplacement itself, which has a total diameter of 13.2m, and an adjoining rectangular power house, with vehicular access onto the loop road.

Each emplacement comprises a circular pit 5.8m in diameter and 1.6m deep, within which the gun was mounted on a circular pedestal, 3.5m in diameter and 0.9m high. The gun was fixed by thirty large bolts to a circular steel holdfast 0.4m wide on the top of this block. An underground passage links the power house both to the pit, via a shaft opening onto a door in its side, and to the gun mounting, via a central circular well, 1.6m in diameter and 2.6m deep. The central well has some surviving fixings for machinery and a triangular niche cut into the wall opposite the doorway of the underground passage. Access to the pit from the exterior was possible by an unenclosed staircase and passage adjacent to the power house. A circular groove around the outer edge of the pit guided a support for the undercarriage of the steel shield. A level walkway 1.2m wide separates the edge of the pit from the interior of the surrounding parapet. A second circular groove around the exterior of the walkway drained the area. The interior of the revetment is polygonal, corresponding to the doors of fourteen rectangular lockers set under the parapet. The ammunition lockers are 1.4m long by 1.0m wide and alternate between 0.8m and 0.7m deep, with wooden shutters closing their open sides, of which only the frames survive. The lockers are linked in pairs by vents. Over an arc of 110 degrees the parapet is only 1.1m high so as to allow greater depression of the gun towards the Thames and extends in an apron 3.4m wide; the remainder is 1.5m wide and 1.3m high. All the emplacements are surrounded by earthen embankments, which vary slightly in plan, but generally extend from 4m to 8m from the edge of the parapet and rise almost to its top.

The power house

This rectangular half-sunken room housed a diesel-powered generator and hydraulic machinery which powered the traverse, elevation and firing mechanisms of the 5.25-inch gun. The room measures 5.0m long by 4.3m wide and 2.9m high internally; there are some surviving fittings, including pipework, wall brackets and two rectangular concrete beds; the larger of these supported the hydraulic pump and the diesel generator and the smaller an air compressor for the recoil system of the gun. A large wooden panel, painted red, which survives on the wall above the latter in three of the emplacements, would originally have held four junction boxes, through which data on

the range, angle, bearing and fuse setting were relayed from the command post (Godwin 1984). At first, this data was indicated on a dial on the gun, which then had to be adjusted manually, but in the 1950's the aiming became fully automatic, and the power was supplied from a building some 150m away (see below). The gun crew were only required to supply the loading tray with shells.

The power house was located to one side of the circular emplacement, connected to the gun pit and turret by an underground passage, which could be closed off at the power house end by a steel door. The low passage contained the pipes which transmitted the hydraulic power to the gun turret and allowed access for maintenance. Some of the fittings survive, but the pipes themselves have been removed.

The main steel double doors into the power house were located in the opposite wall, away from the emplacement, opening onto an unroofed sunken loading bay, measuring 3.6m long by 2.2m wide and 2.1m deep. The edges of the loading bay were protected by a railing and the adjacent driveway could be reached by fixed steel ladder. In other 5.25-inch emplacements, a davit fixed onto the end wall was used to lower fuel etc. into the loading bay (Godwin 1984), but no trace of this survives at Bowaters Farm.

A square ventilation shaft, 1.2m across, adjoins the side of the power house, with an opening into the side of the room at its base, closed off by a steel shutter. The top of the shaft is roofed and projects 0.5m above the roof of the power house. There are slits, 0.2m high and 0.6m wide on all four sides, which are protected by steel grills.

The compound

The present fence around the compound was added in the second half of 1951 (RAF aerial photograph 58/720 part 4, frame 5046). It is constructed of standard concrete posts with out-turned tops supporting three strands of barbed wire. It may have replaced a fence supported by steel rods, a large number of which litter the site.

Ancillary buildings

Three concrete buildings, one of which is contemporary with the 4.5-inch emplacements, are located on the southern side of the access track, towards the western end of the compound. Immediately inside the compound gate lies the gun store, which stored spare parts for the guns. This is a rectangular building, some 9m long by 7m wide and 3m high, with steel double doors at its western end, and four windows with heavy steel shutters in its southern wall. At the western end of the building, a concrete latrine faces the compound gate. This building can be seen on an aerial photograph of 1940 (RAF 26H/3/1).

The same photograph shows an instrument pit some 25m west of emplacement 4 and a second some 50m north-west of emplacement 4. A large building evidently connected with the emplacements was located some 120m north-east of the command post and a group of probably four searchlight emplacements some 140m to the north-west. By 1944, this area was occupied by the circular radar net, centred at TQ 6775 7718 (RAF aerial photograph HLA/686, frame 3031).

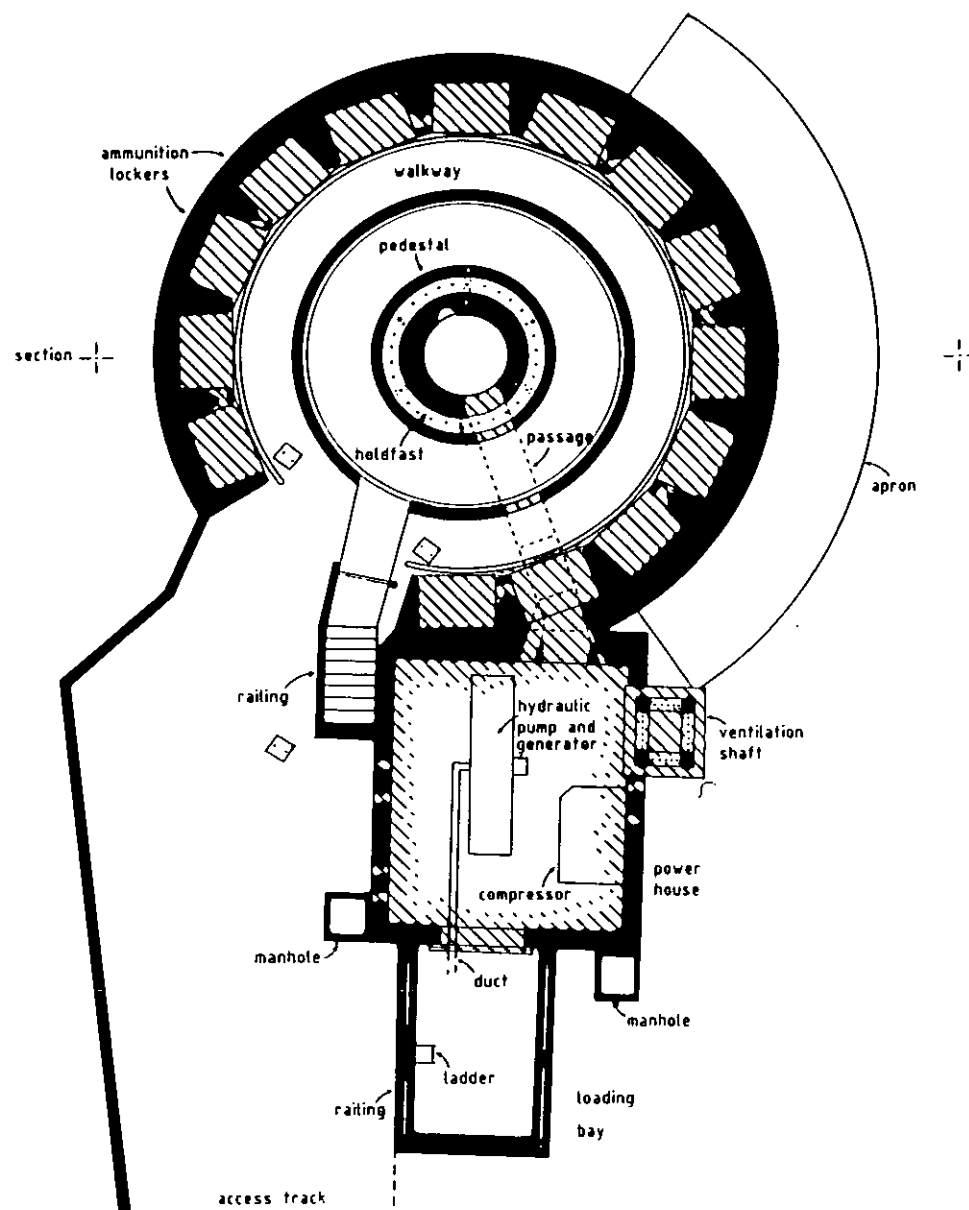
Some 20m east of the gun store lies a windowless building, some 3m long by 2m wide and 2.5m high, with a single door facing onto the access track. The purpose of this building is unknown; it was probably added c.1950.

Some 15m further east lies a range of rooms comprising, from west to east, a generator room, a possible accommodation block and two store rooms. The generator room, some 7m square and 3m high, has a double doorway facing onto the track and is lit by a series of small apertures beneath the roof on all four sides. It held the remote generator and hydraulic pump, which replaced the power houses adjacent to the emplacements when the guns became fully automatic in the 1950's. The adjoining accommodation block contains three rectangular rooms with overall dimensions of some 14m long by 4m wide. All are well lit, by a total of eight large square windows with heavy steel shutters, and each has a door facing onto the access track; the two rooms to the east also have a connecting door. Each of the adjoining store rooms is 2.5m wide by 4m long, with a door facing onto the track. Each has a number of small vents beneath the roof and there is a single window in the western end of the range, with a heavy steel shutter.

A roughly paved path approaching the northern side of the track immediately to the east of the gun store indicates the position of a structure which existed in 1940 (RAF aerial photograph 26H/3/1) and was re-designed later in the war and again in the 1950's.

The command post for the 5.25-inch guns was located 1.0kms to the north-west of the emplacements, and was not investigated by the RCHME. It is a semi-sunken building, shielded on the south-east by a curtain wall and earthen revetment. This, together with the distance from the guns, protected the delicate machinery of the computerised predictor, which automatically aimed the 5.25-inch guns towards the target.

Other ancilliary buildings including barracks and vehicle stores stood outside the fenced compound, and can be seen on aerial photographs from 1940 onwards; although a number of these still survive, permission was not given for investigation by the RCHME. Approximate construction dates and probable interpretations of the more distinctive structures are indicated on the aerial photographic plot (Figure 4).




**ROYAL
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OF ENGLAND**

10 5 0 50
 metres

5.25 INCH ANTI-AIRCRAFT GUN EMPLACEMENT
 AT BUCKLAND, ESSEX

4. APPENDIX: PAINTED SIGNS

4.5-inch emplacement 1

The emplacements were probably all marked with compass bearings every ten degrees around the interior. There are also occasional traces of olive drab and black camouflage paint on emplacements 1 and 4.

North-east wall

20	30	40
		NORTH
		SOUTH
		E(ast)
		W(est)
		S ?LE ?? (?Stanford-le-Hope)

East wall

70	80	(90)
----	----	------

South-east wall

(110)	120	(130)
-------	-----	-------

South-west wall

200	210	220
NORTH		
SOUTH		
EAST		
WEST 246(?)		
GRAVESEND		

West wall

(250)	(260)	270
?		
?		
?		
?		
TILBURY		

North-west wall

290	(300)	310
		HE
		SAP
		PRE-SET

4.5-inch emplacement 3

North wall

RED	BLUE	GREEN	(?yellow)
BG 257 BG 26?			
F 164	F 11	F11	F1?
F 18?	QE 16	QE 16	Q(e 16)
MAY 1 ?939		QE	

South-west wall

210

4.5-inch emplacement 4

North-east wall

50

South wall

A
B

South-west wall

210

(220)

230

Miscellaneous

Although there are some traces of painted signs on the walls of the power houses of the 5.25-inch emplacements, none is legible.

The word 'SILENCE' is painted white on a red background on the rear wall of building a. There are traces of signs on the walls of both brick extensions, but none is legible.

On the northern wall of the accomodation block, a sign reads '(for use in ca)SE OF FIRE ON(ly)'.

5. SURVEY AND RESEARCH METHODOLOGIES

The survey was carried out by Alastair Oswald and Jane Kenney of the RCHME. Control points and some of the structures were surveyed using a Wild TC1610 Electronic Theodolite with integral EDM. Data was captured on a Wild GRM 10 Rec Module and plotted via computer on a Calcomp 3024 plotter. The details of the plans were supplied at 1:1000 scale with Fibron tapes using normal graphical methods. The report was researched and written by Alastair Oswald and edited by Paul Pattison. Ground photography was carried out by Steve Cole.

The site archive has been deposited in the National Monuments Record in Swindon (TQ 67 NE 52).

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Aerial Photographs	1940	RAF 26H/3/1 frames 1799-1802 23-SEP-40
	1944	RAF HLA/686 frames 3031-2 02-MAR-44
	1944	USAF 14/PH/GP/LOC326 frame 4018 03-MAY-44
	1946	RAF 106G/UK/1447 FRAMES 1080-3 01-MAY-46
	1951	RAF 58/720 part 4 frames 5046-7 06-JUN-51
	1953	RAF 82/713 frames 667-9 06-FEB-53
Godwin D	Mar 1982	'Essex HAA' <u>Embrasure</u> (Newsletter of the Medway Military Research Group) 17, 10-12
	Jan 1984	'Visit to a Cornish Gun Site' in <u>Embrasure</u> 17, 9-13
	Dec 1987	Untitled report <u>ALDIS</u> (Newsletter of the United Kingdom Fortification Club) 39, 16-20
Hogg IV	1978	<u>British and American Artillery of World War 2</u> London Lionel Leventhal
Ordnance Survey	1961	1:2500 map sheets TQ 6776 and 6777
Public Record Office	1939	War Diaries of 37th Anti-Aircraft Brigade
	-45	WO 166/2269-70
		WO 166/394
		WO 166/11211
		WO 166/14651
	1943	Memo on HAA - 5.25 Guns WO 166/11154

