

NEWSLETTER June 2025

Hello Everyone, I hope you all coped with the "heatwave". Honestly, I think the media blow things out of proportion, it is summer ! Likewise in winter it can be cold. Maybe they have not anything else they think is worth reporting on. Anyway, moving on .

This year seems to be flying, and it won't be long till the AGM, so you know what is coming next!. We have limped through the last year; we still do not have a secretary and the Committee has reduced in number. There are a few of us that keep the show on the road, but there will come a time when there won't be enough Committee members to do everything without more people volunteering to help. Help could mean joining the Committee, it could be someone who wants to help at the Hungate Centre, i.e. set the screen and projector up, or look after the tea bar. Think about it.

I am organising a visit to *The Land of Iron Museum* at Skinningrove in September. The tour is about an hour long and there is a Pub next door! The museum also offers *Skinningrove Heritage Walks* around the village that last about 2 hours, which I would like. Wives and partners are welcome to join us, and as soon as I have more details, I will pass them on and ask for numbers. Please have a look at their website (see below) and see if it appeals to you. If you have a suggestion for a visit, why not have a go at organising it? I can broadcast emails on your behalf so that will help you with the "admin".

This month's *Bring and Brag* at the Hungate Centre will hopefully be interesting, but it depends entirely on you joining in. For those of you who are fed up with biscuits, we will be offering a variety of sandwiches and snacks to make it a little different. It's a juggling act to get the balance right between chatting in groups, and chatting about what you brought. Have you any questions to ask ? I am pretty sure someone will have the answer.

We enjoyed a jolly good night at *Namaste Bengal*, an Indian restaurant in Pickering to raise a glass or two to David and Pam and to wish them good health and happiness in their new home. Plenty of PEEMS members and partners turned up to wave David goodbye ~ see photos on page 23.

I don't like repeating myself, but I must say that David's time as Chairman, and Secretary kept PEEMS running smoothly, and set an example of "how to do it". Thanks David.

The cutter grinder is making good progress. We will need an inverter to run the 3-phase motor, it's 0.5 HP and before we purchase a new one, has anyone got a redundant one we could buy? (Not one that is a bit intermittent!). Alternatively any 0.5 HP single-phase motor that might fit? Thats about all for now, Glastonbury on TV time.

Jonathan.

□ Forthcoming Events.

- **Wednesday July 2nd** **Summer '*Bring and Brag*' and Social.**
- **Tuesday July 15th** **Workshop Morning.**
- **Wednesday August 6th** **The History and Operation Of The *Blacker* Power Hammer.
A Talk by Chris Bramley.**
- **Tuesday August 19th** **Workshop Morning.**
- **Wednesday September 3rd** ***My Milling Machine*. A Talk By Peter Bramley.**
- **Tuesday September 9th** **Visit To Skinningrove '*Land Of Iron*'. <https://landofiron.org.uk> click on link**
- **Tuesday September 16th** **Workshop Morning.**

Club Evening Wednesday 4th June 2025 ~ World War 2 Radar at Ravenscar. A Talk By Brian Mulvana.

Jonathan welcomed everyone to the meeting. There was a good turnout and a number of guests.

Jonathan welcomed Brian, the speaker for the evening. Brian had returned to speak to the Club, having given a very interesting talk about 'Scarborough Trams' in August 2024, which has been written up in that month's newsletter.

There were no announcements.

• Second World War Radars at Ravenscar, a talk by Brian Mulvana.



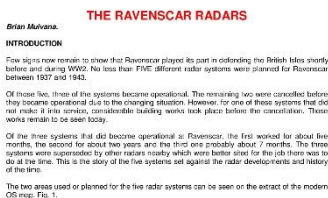
○ Introduction.

Brian started off by saying he was going to talk about the radars that were schemed for Ravenscar, that many people may not have known existed. The only reason Brian found out about the radars was due to his daughter who wanted to go to Eden Camp about 30 years ago. Eden Camp have a display about radar, with a big wall map showing the radar sites during World War 2. There was Staxton Wold and Danby Beacon, and one at Ravenscar. There was none shown at Bempton, or at some other places that Brian had known had been radar sites.

Eden Camp were not much help, so Brian decided that this would be a good project for some research.

This resulted in Brian preparing a paper for the *Defence Electronics History Society* in April 2015:

○ World War 2 Radar, a Brief History.



This is just the introduction to the paper he wrote. Brian said that he couldn't talk about Ravenscar radar without talking generally about the history of radar throughout World War 2, so we can put into context how Ravenscar played its part locally.

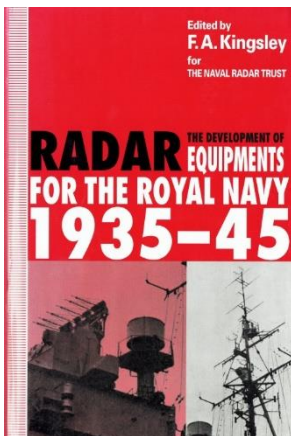
■ Primary Information Sources.

There weren't many primary sources, there was, however:

- Kew National Records:** With a big thanks to Squadron Leader Mike Dean. He dug out the Ravenscar details from the mass of files stored there. Kew was the main archive where Brian eventually found the drawings for what was going to be installed on the site. Brian also managed to find a couple of people who worked on the systems at Ravenscar.
- Defence Electronics History Society:** Articles and letters from people who were directly involved with radar in World War 2.

■ Secondary Information Sources.

If anyone wants to find out about radar during World War 2, these are good sources.



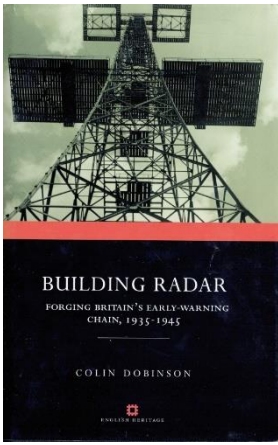
Naval Radar. Development Of Radar Equipments For The Royal Navy. F.A. Kingsley.

Brian said that you may wonder what the Navy had to do with these systems. In fact, they had a lot to do with them.

Question: Which service do you think was responsible for protecting the country from invasion. The RAF, or the Navy?

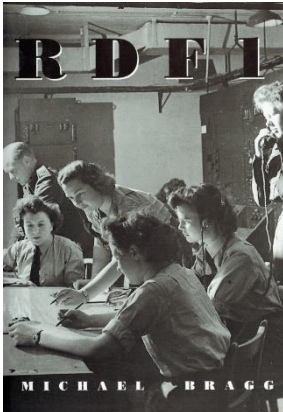
In fact, historically it was the Army.

If you can find this book for less than £70, you are doing well.



Building Radar ~ Forging Britain's Early Warning Chain 1935-1945. Colin Dobinson.

Again, if you can find this book for less than £70 second hand, you are doing well. This book gives all the dates for when the systems went in, and it will tell you a lot about what you don't know,



RDF1. Michael Bragg.

You can acquire this book cheaper at about £20 - £25 second-hand. It's a very good read. The episodes are very convoluted, but they explain how the different services worked together to eventually reach solutions that worked.

○ Your Local Radar Knowledge?

- **Fylingdales.** You probably know that Fylingdales has a radar. There have actually been two systems in Fylingdales since the 1960s. First were the "Golf Balls" and now there is the "Pyramid". It has only had two systems in the last sixty years. It's very likely the 'Pyramid' has had lots of upgrades over the years.
- **Staxton Wold.** You might know that there is a radar on the hill at Staxton. That has had only three and a half generations of radar since 1939. The RAF are very secretive about the radar up there. The wind farms in the North Sea can play havoc with the radar systems.
- **Bempton.** People visiting *RSPB Bempton* will be aware of the disused radar station behind. There is an underground bunker there. That wasn't there during World War 2, and the actual Bempton radar site during the War was further back from the cliff edge.
- **Goldsborough.** Not many people know of the Goldsborough radar site. Goldsborough and Bempton had two different radar systems.
- **Danby Beacon.** Danby Beacon only ever had one type of radar.

But did you know that the first working radar in Yorkshire was at Ravenscar?

And that FIVE different radar systems were planned for Ravenscar between 1937 and 1942. Three of those entered service and the fourth nearly did.



Key:

CD ~ Coastal Defence (Army).

RDF ~ Range and Direction Finding.

ACH ~ Advanced Chain Home

CH ~ Chain Home.

CHL ~ Chain Home Low.

CHEL ~ Chain Home Extra Low.

The first working radar in Yorkshire was at Ravenscar.

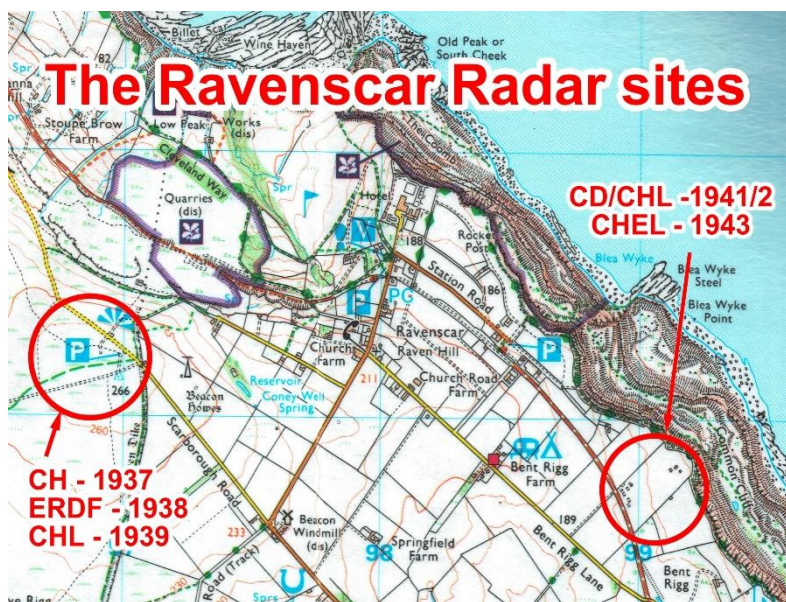
Brian said that he wanted to talk about the five systems that were planned for Ravenscar. Three of them worked, one nearly did and one was a system that didn't last long.

As can be seen on the previous map, the two Chain Home (CH) stations between Flamborough and Goldsborough were at Staxton Wold and Danby Beacon.

The first Chain Home Low (CHL) was at Flamborough Head next to the lighthouse. It turned out to be an absolutely appalling site for a radar, and after a few months, it moved up the coast to Bempton. It wasn't on the cliff edge; it was half a mile back from the cliff. The road from Bempton rises up the hill towards the coast and drops for the last quarter of a mile. The radar was just before the top of the hill, so it could just see over the top. That was a Chain Home Low (CHL).

Goldsborough was a Coastal Defence (CD) radar and was installed by the Army. Staxton Wold and Danby Beacon were Chain Home (CH) radars installed by the RAF.

○ The Two Ravenscar Radar Sites



The lower road is the road from Scarborough which goes up to the windmill at the junction and then down to the Raven Hall Hotel. The Station Road car park is shown.

The first site of interest is at the top of the hill on the Scarborough Road. The road is now a dead end, but in the past the road continued on to Whitby. Brian has been told that you went down to the beach at Stoupe Beck, and climbed up again at Robin Hood's Bay.

When Brian was young, the last hill to the beach was signposted 1 in 2. It's cobbled, but now overgrown and only wide enough for one person to walk down. When Brian was a teenager, you could get Land Rovers down it.

The second radar site is at the cliff edge south of Ravenscar, between the old disused railway and the cliff edge.

○ It's 1935 and Radar Development Starts.



In 1935 there is the Daventry experiment and Watson-Watt is told to build some radars. Radar development starts at Orfordness and then moves to Bawdsey.

In 1937, the first five "estuary" stations of the "Home Chain" were built around the Thames estuary.

In 1937 only Bawdsey was working properly, and the others were still being put together. The blue area on the map is the cover they were providing at that stage.

The stations were very close together so coverage overlapped, but when they were first put in, the technicians didn't think they were going to get the range that they did actually achieve in 1937.

When the system was finally set up, they had only just sorted out direction finding, and in that month while they still didn't know how to determine the height of the target, the Government said "it's working and we have to extend the chain!"

The intention was not to extend the chain along the south coast, as Germany hadn't yet occupied France, but to put in some stations further north.



○ It's 1937 And The Home Chain Is Extending.

In 1937, Ravenscar is chosen as one of the sites for "Chain Home". Three months later, the technicians had figured out how to determine the height of a target, and as Ravenscar was 900 feet above sea level, with a cliff in front of it, it would have been hopeless for height finding. So it got cancelled, and another site is sought.

Danby Beacon is the new choice, but they couldn't get these sites installed and working quickly.



○ September 1938 ~ The Munich Crisis.

In September 1938, there is the Munich Crisis and war is confidently expected in the next few days.

This means there was a big rush to get some sort of coverage and three emergency RDF stations were planned to give that coverage. Ravenscar was one of the sites, Drone Hill was another and West Beckham was the third. Because it was so low down, Beckham couldn't do much with the emergency equipment.

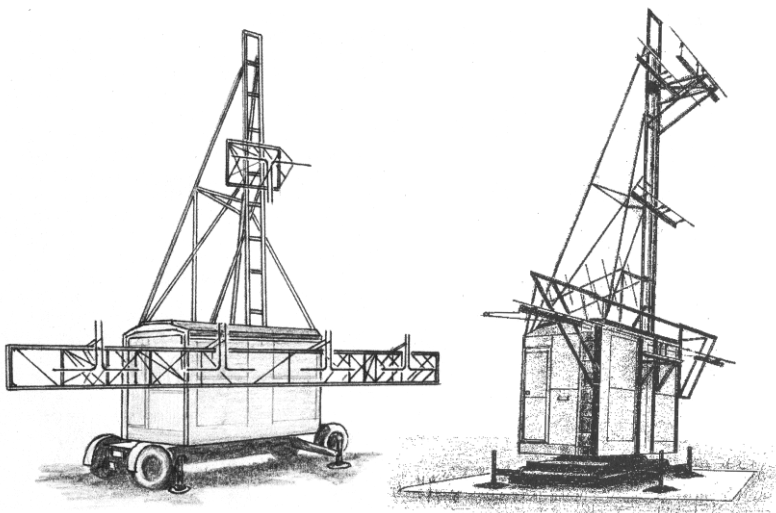
Ravenscar was good because it was covering the Tees and Tyne, but couldn't quite manage Hull. Drone Hill was covering Edinburgh and The Firth of Forth. Those areas needed to be covered extremely quickly.

The three stations were built within weeks. But why only three sites? That is because they only had bits that they could scrape together for three.

Ravenscar was a "star turn". It's 900 feet high and that's why it had longer range (80 miles) than the others.

○ The Army and Anti-Aircraft Radar.

Where did these emergency systems come from? They were normally put in by the RAF. At Bawdsey, alongside Watson-Watt, there was an Army "cell" working to develop a shorter range radar to warn anti-aircraft guns that something was coming. They had a range of about 30 miles and were called GL1 (Gun Laying 1).



They were developed from early Chain Home technology and had separate transmitter and receiver trailers.

Once the system had height finding they were called GL2 (Gun Laying 2).

On the left is the transmitter (TX) and on the right the receiver (RX).

The cabin on the transmitter was mounted on a turntable, so it can turn and point at the target. Obviously, the transmitter and receiver have to point in the same direction.

At this stage of radar development, a lot of benefit came from bicycles. There was a bicycle inside the transmitter cabin which operated the turntable. There were no motors, it was all operated by human beings



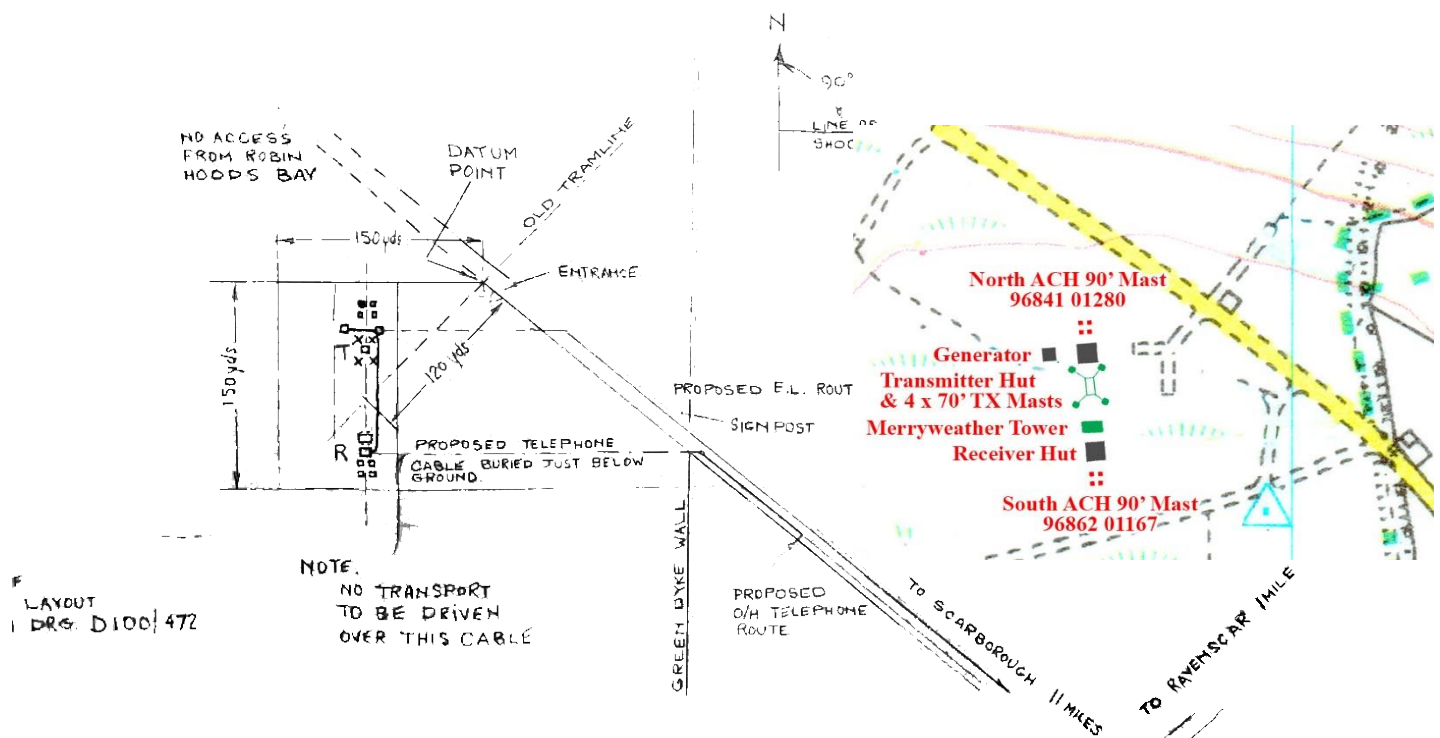
The RAF realised that if the enemy came and bombed one of their Chain Home systems, they needed something mobile to plug in quickly.

For this reason, the RAF took the transmitter/receiver electronics from the Army, and developed it in to something more appropriate for their applications.

It was prototypes of this system that would have been available for the three sites.

The photograph shows what would have been seen at the Ravenscar site, or something similar. There are two towers, a transmitter on one and a receiver on the other. However, as mentioned previously, there were only parts for three sites.

○ The Ravenscar Site 'At The Top Of The Hill'.



This is the drawing that Brian found in Kew National Records. The main road, is the road from Scarborough to the windmill at the junction of the road to Ravenscar.

The radar site was beyond the junction, on the original road to Stoupe Brow. The datum point shown on the drawing is at the intersection of the road and the old tram line which ran over the moors. This tram line ran from the old *ganister* mine near the Whitby Road, to the now disused Scarborough to Whitby railway line. From Whitby, the *ganister* was transported to Middlesborough blast furnaces. *Ganister* is a lining material for blast furnaces. The entrance to the radar site was also at the datum point.

When the radar was set up, the tramway was out of use, but the rails were still there. In fact, they were used later in the war. The drawing proved to Brian that he had everything in the right place, based on the other sources.

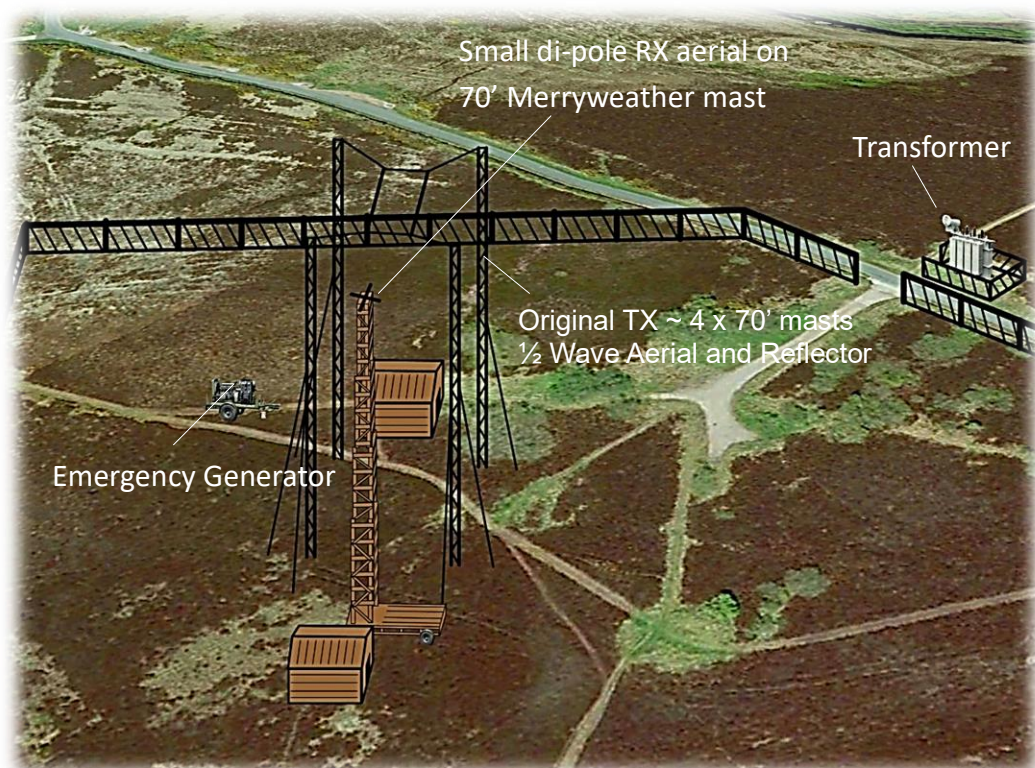
The other picture shows the installations, imposed on an Ordnance Survey map. The installation is at the place where the *Lyke Wake Walk* intersects the Scarborough Road. There used to be a pub there, on the left going down to Ravenscar village, which was closer than the Raven Hall Hotel. It was one of the first buildings that side, but is just an ordinary house today. After a 40 mile *Lyke Wake Walk* it was a welcome break, rather than continuing the extra ¼ mile to the Raven Hall Hotel !

Today, the hard standings at the site for car parking were put in for the wartime radar equipment.

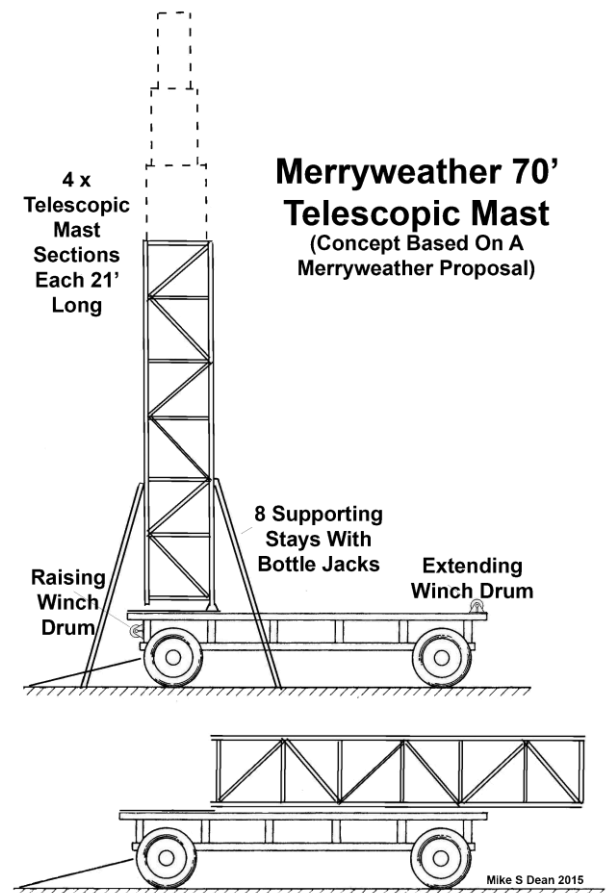
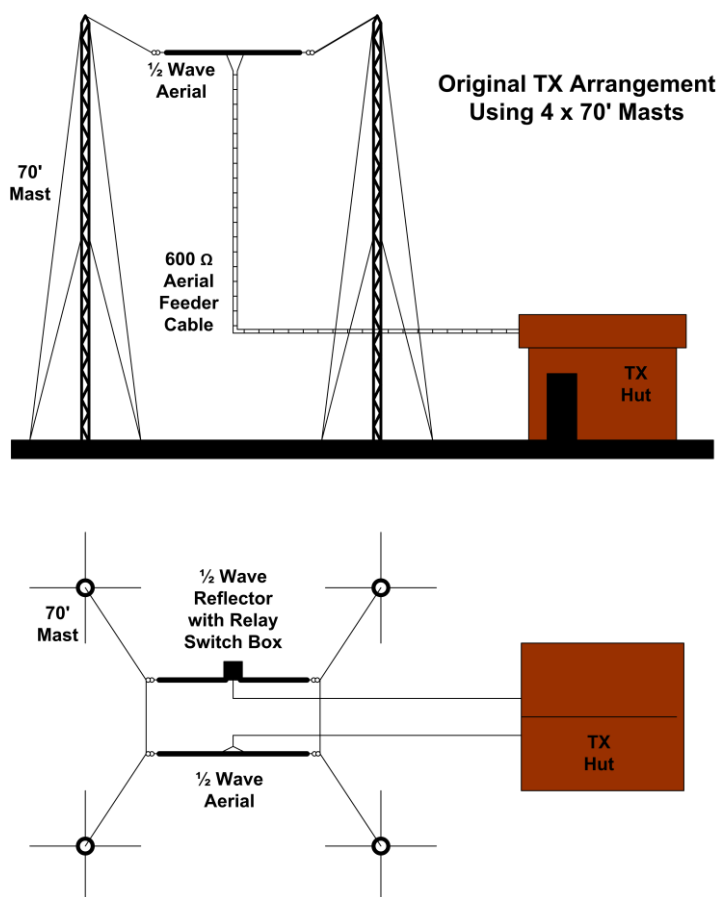


Within days of the decision to use the site, they put in a tower. This schematic shows metal parts in black, and wooden parts in brown. The four black metal towers supported the transmitter, and a single brown wooden tower supported the receiver. Wooden huts are also shown. Next to the northern most hut, sat an emergency generator.. The drawing of the site shows where the fence was to go around it, and the fence was put in exactly as specified on the drawing. This meant that the public right-of-way (now the *Lyke Wake Walk*) had to be diverted around it for the duration of the war.

Another reason for choosing Ravenscar for the site, was because there was an 11,000 Volt supply nearby. The transformer was positioned across the Scarborough Road from the site entrance. You can still see the concrete base for the transformer today.



The First Set Of Transmitter (TX) Masts And Receiver (RX) Telescopic Mast.



The first set of transmitter masts were 70 feet high, and the plan and side views are above.

i) TX Mast

The TX was a one half wave di-pole. Spaced from it at a quarter wave length was another piece of metal with a break in the middle. In the middle was a relay which could connect the two halves, creating a continuous piece of metal, or disconnecting to create two pieces of metal.

For the continuous piece of metal, most of the energy of the radar goes towards the target with the rest going in the opposite direction. When it is two pieces of metal, the relay contact is open and it is 50:50 energy going in both directions. That was the feature they used to determine if the target was in front or behind the system.

ii) RX Telescopic Mast.

The receiver mast was manufactured by a company called *Merryweather* who were associated with fire engines. However, unlike the Spitfire and the Lancaster, the Merryweather telescopic tower was not a success. It didn't last very long.

The First Few Days.

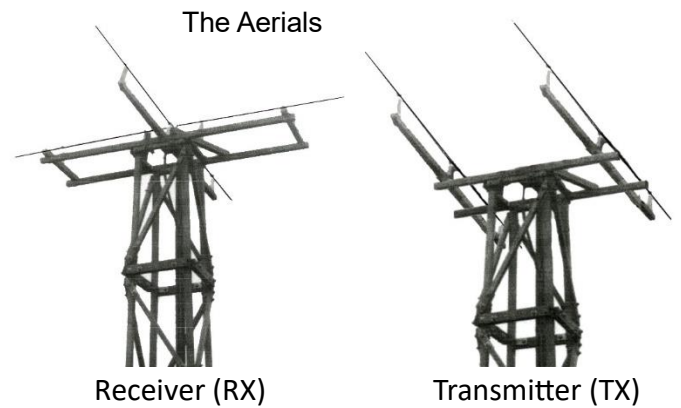
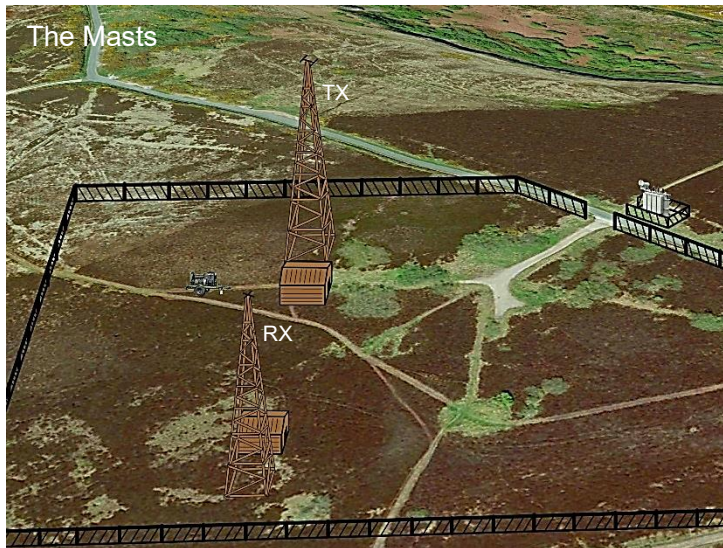
The radar system was installed on site by 27th September 1938, and lasted a week. When the first gale came on the 4th October, some bits of the transmitter tower and rigging were damaged. However, those could be repaired.

The Merryweather receiver tower was seriously damaged and couldn't be repaired on site. It was taken away in bits. It's not clear if it ever worked again.

The system probably did not work again until the 'proper' 90-foot masts arrived.

The 90-foot Mast System.

The next system set up with two wooden towers, operated from November 1938 to April 1939. This was the first radar in Yorkshire, protecting the UK, it first reported to Catterick and then to the filter rooms in Bawdsey and then to Stanmore. The emergency generator shown on the next picture was probably put in a shed for protection. After April 1939, the TX and RX were sent to Netherburton and the 90-foot masts and huts were left in place.

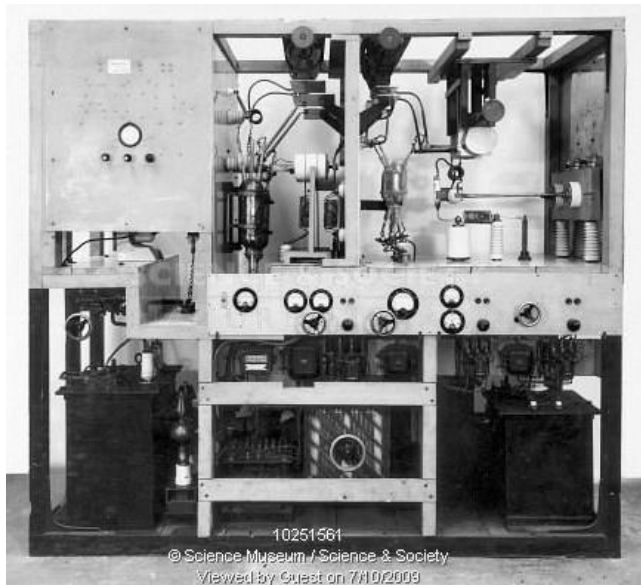


Receiver ~ Two Crossed Di-Poles

Transmitter ~ One Di-Pole With A Reflector Behind It.

The aerials were made from copper, and if you wanted to build this sort of radar today, you would go to the B&Q plumbing section, go to copper pipes, and choose the 22mm pipe they use for bath taps, and that would be the right fit for what was used on these aerials.

○ What Does the Transmitter Electronics Look Like?



Here the sides have been taken off. The photograph is courtesy of *The Science Museum/Science and Society*.

This was called TM1 and was built at Bawdsey.

No photo exists of the actual TM1, but it was similar to this *Science Museum* photo.

- 25 or 50 pulses/second.
- Pulse Width 5-35 μ s.
- Pulse Power 80KW.

The transformers and heavy items were placed at the bottom, and the switches and adjustments are in the centre.

The three valves are positioned at the top.

The small valve is on the right and the two larger valves are on the left.

These days, computer chips are based on silicon, and there have been silicon transistors since the 1960s, but in the 1930s silica was used.

Silica Valves.



Made at the Navy "Signal School". The only place these valves could be obtained was from the Royal Navy, who were there right at the beginning of radar.

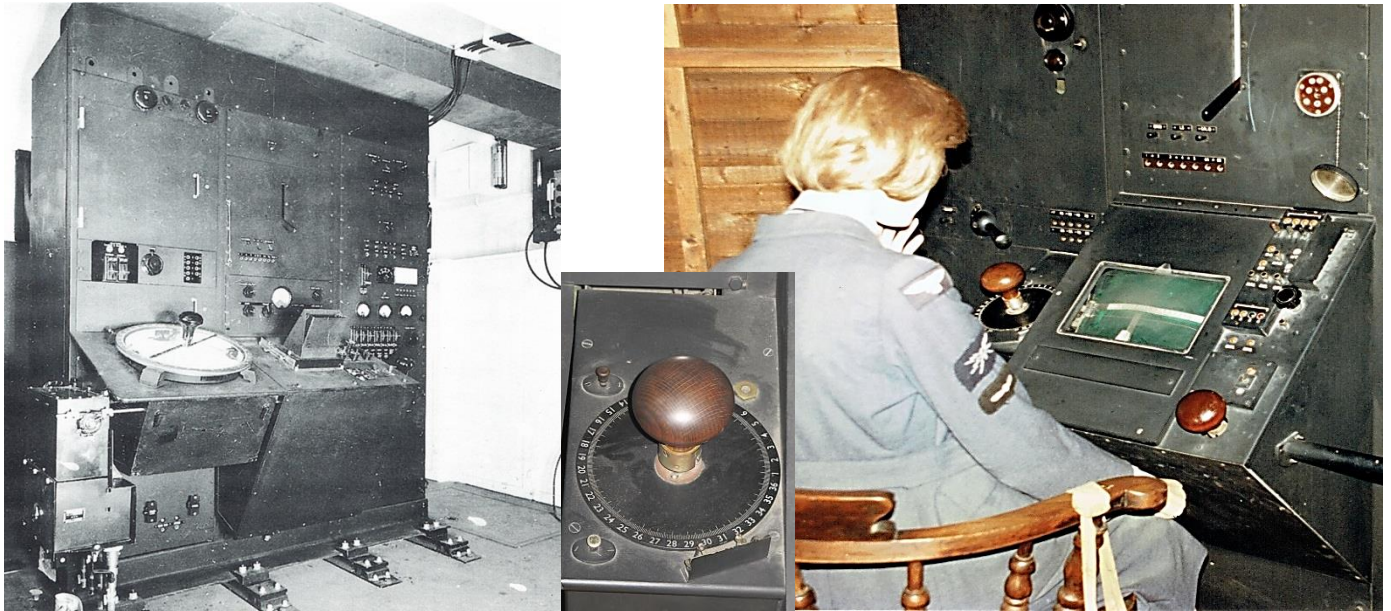
Originally for naval ship transmitters, these powerful valves allowed communications over very long distances, and were developed in the inter-war period.

Note the long glass necks on all the electrodes. The long necks were to keep the seals, between electrodes and silica, away from the hotter source at the centre

The Silica envelope allows the IR radiation out. Silica is pure glass (silicon dioxide) with no impurities in it. The reason for using Silica in the valves is because it allows the heat out. This means that the valves can run cooler to last longer, or they can be worked harder.

The Silica was quite difficult to work, which is why only the Navy could manage it. With regards to the electrodes, these will expand or contract depending on temperature. Pure Silica doesn't expand with temperature. There are seals at the junctions of the electrodes and Silica surrounds at the end of the necks. Unless the Silica expands at the same rate as the electrode, the seal will crack. To get over this problem, rings of different varieties of glass were welded together to get a glass that had the same thermal expansion as the electrodes.

○ What Does The Receiver Equipment Look Like?



No photo of the actual installation at Ravenscar exists, the photo on the left is thought to be the nearest to what was there.

Note the big protractor dial on the left of the console, which determined the direction of the target, and the hooded CRT or monitor to the right of it. The display wasn't very bright to start with, so they needed the hood to exclude light.

The photo on the right shows a later Chain Home receiver. Note the female** operator. The big knob on the left-hand side is also a protractor, which has angles on it, but no pointer. Later in the war, they didn't take the readings from the protractor at all. When the position of the target was determined on the monitor, another button was pushed, and that reading was automatically transferred to the filter room. That was quicker, and there was less chance of mistakes. The bottom right-hand knob moved a cursor across the screen until it located on the target 'blip'.

** Watson-Watt had been campaigning since 1937 for women to be brought into the service, because of manpower shortages. He also believed that they would be better operators than men.

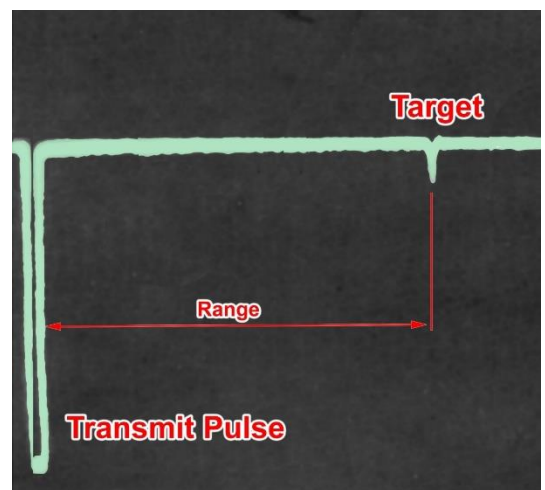


THE THREE SECRETARIES at BRS. Miss H. Brooker (left), Miss N. Boyce (centre) and Miss M. Girdlestone (right) whose expertise in plotting at the Dover CH station in February 1939 after a few weeks' training supported Watson Watt's view that women would be superior to men in plotting and observing. It led to the introduction of the WAAF into operational areas that hitherto had been the exclusive preserve of the RAF. (DWM EIMORS 1426, 1427)

At the end of 1938 he got permission from the Ministry to do this, except the policy was that women couldn't be allowed into the secret about radar.

However, there were three secretaries at Bawdsey. One day in 1938, Watson-Watt approached these three secretaries and offered them a holiday in Dover for a week or so. They all said yes, and got sent to the Dover Chain Home Station and got trained on how to use the system. After five days they were as good as the men, and got better in the days before they were due to return home. From then on, women were in the system.

○ Chain Home Receiver Operation ~ How You Take And Send The Readings.



The control on the left of the console is called a *goniometer* (*gonia* ~ Greek for “angle”) and it measures the angle to the target. On the screen is a massive transmitter pulse on the left. The *goniometer* knob is turned and as it gets close to the angle of the target, a ‘blip’ will start rising out of the trace. When the ‘blip’ is at a maximum, the radar is “pointing” at the target. The angle on the *goniometer* gives the angle to the target, and the range is the distance from the transmit pulse to the ‘blip’.

The operator had a cursor which would have been moved over the target ‘blip’. When everything was set up, a button was pushed and the reading went to another machine (called a ‘fruit machine’) which converted the readings into coordinates. This system made it less easy for the operator to make a mistake.

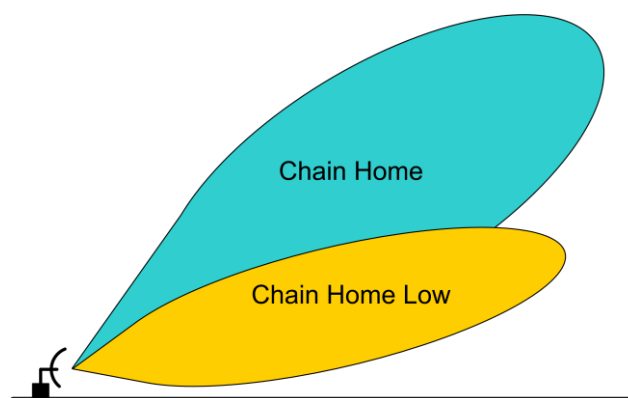
○ Chain Home Radar Coverage April 1939.

Ranges are at a height of 10,000 feet. But there are serious weaknesses in the system.



Staxton Wold and Danby Beacon had just come on-line in April 1939. The coverage wasn’t bad, but Chain Home had a serious weakness in that it couldn’t register any target below an angle of about 2°, depending on the site. An enemy bomber coming in low wouldn’t be seen, and this was a problem in the Thames estuary where mine laying aircraft wouldn’t be detected at all. The British realised this right at the start in 1935.

The Germans took longer to ‘catch on’, in fact in mid-1940. The interim solution was to use radar at a higher frequency, and this was Chain Home Low (CHL)



○ Where Did Chain Home Low (CHL) Come From?

It was another Army system.

After Chain Home, the RAF’s next priority was to get a radar to fit in a fighter. They developed a working “Airborne Intercept” (AI) working at 200 MHz. Edward Bowen was a key figure in this development. and he came up with the 200 MHz system and got it working.

The Army was responsible for coastal defence. The Army was at Bawdsey and saw this 200 MHz system and as they were responsible for defending the country against invasion, what better than a radar that could see ships coming. They took parts of the AI set. and from it developed a Coastal Defence (CD) radar. These systems were beginning to appear in late 1939.

Because it didn’t have to fit in a plane, it could be more powerful and with much bigger aerials, making it more efficient.

○ The Army Coastal Defence (CD) Radar.

The radar could spot ships at 24 miles.

The Army called it “CD No.1 Mk1”.

It was also good at spotting low flying planes, which got the RAF very interested!

Because of their higher priority, the RAF took over all the early Army’s CD’s coming from the factories, and installed them to back up Chain Home. They didn’t even leave one for the scientists and technicians to use!

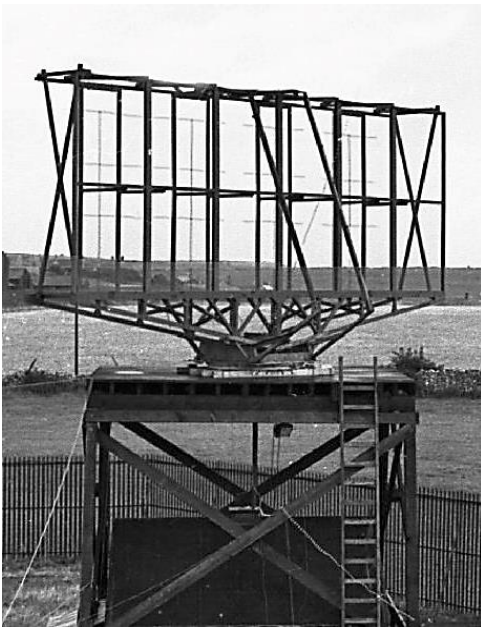
The RAF (rather cheekily!) renamed the CD system as “Chain Home Low” (CHL), and later “Type 2”.

The first CHL commissions on the south coast in November 1939, a couple of months after the war started.

The first CHL in Yorkshire commissions at Flamborough in February 1940. It was sited right next to the lighthouse. The first systems had separate TX and RX buildings, 75 yards apart. The bases can still be seen in the field next to the lighthouse on *Google Earth*.

The site was poor and the radar was moved to Bempton soon after.

○ **The Chain Home Low (CHL) Systems.**



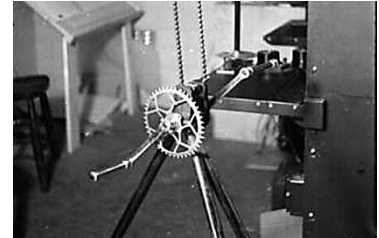
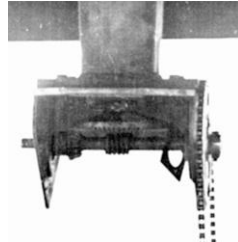
This is what the first CHL radars would have looked like. There would have been two of these, 75 yards apart.

The early systems had separate transmitter and receiver gantries and aerials.

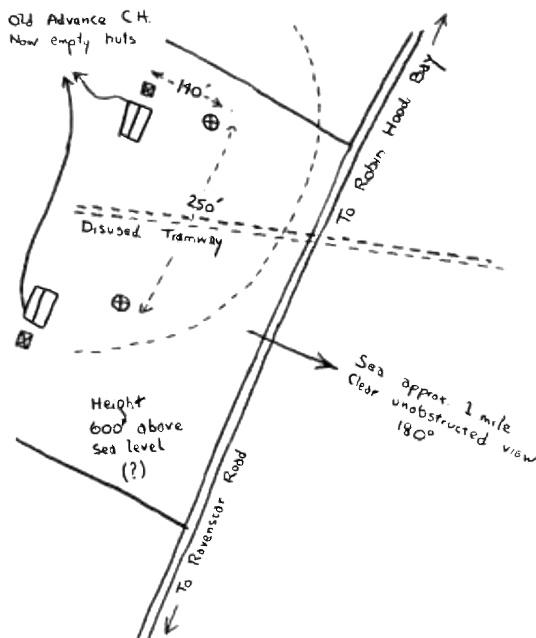
Flamborough had two of these from February 1940, and the bases of these can still be seen in the field next to the lighthouse.

There is a box in the middle with bits of string hanging down from it. This allowed the radar to be turned by hand using bits of bicycle.

Up until 1942, the CHL aerials were hand turned. The first systems were very basic



○ **It's The Next Panic ~ War Breaks Out In September 1939.**



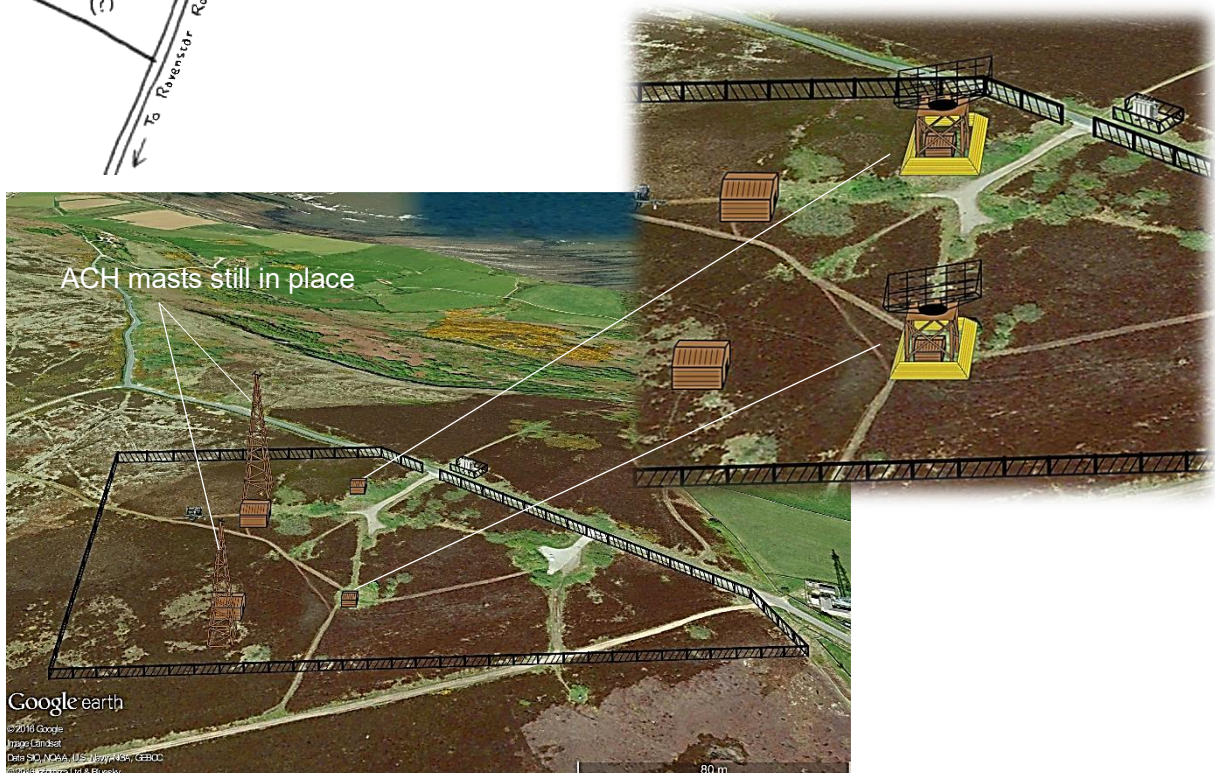
Suddenly a lot more radar stations are planned.

Ravenscar is planned for a CHL and they nearly get it in.

It's at the top of a hill again, and the ACH masts are still there at this time.

This is the sketch done by the surveyor, and it was the first sketch that Brian got from Kew. It is confusing for those who know the site. The road isn't parallel to the site, it's at an angle, and it's 900 feet above sea level, not 600 feet as indicated. The disused tram line is on the sketch.

Below is a schematic for the proposed CHLs at Ravenscar.



To give extra protection against fighters strafing them, sand bags were placed around them.

It got as far as the CHL aerials, and all the hardware being installed. The power was there too. All they were waiting for was for the transmitter and receiver equipment.

- **Over The Next Few Months The Following CHLs Commission.**

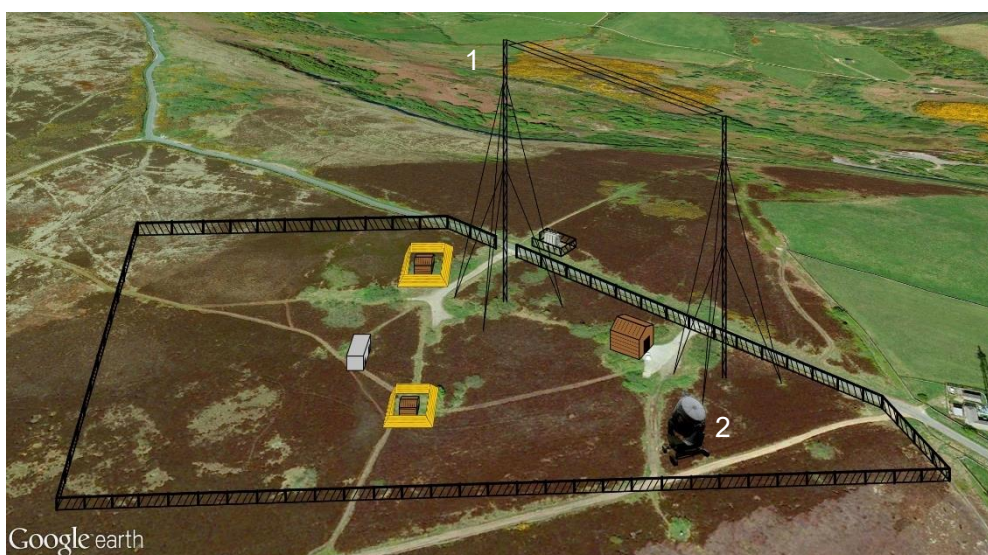
Flamborough commissions in February 1940 covering the Humber area. It then moved to Bempton in July 1940.

Shotton on the Durham coast commissions shortly afterwards covering the Tees and Tyne.

Although there was a CHL gap between Shotton and Bempton, **Ravenscar never gets any transmitter and receiver equipment. It was never commissioned.** The TX and RX equipment must have been urgently needed elsewhere

The gantries and huts remained in place for about a year, then one hut and gantry were recovered to Worth Matravers for continued research. Brian knows this fact because he has seen the letters in Kew. The other was recovered some time afterwards.

- **Not Part Of The World War 2 Ravenscar “At The Top Of The Hill” Radar Story, But There Were Other RAF Systems Up There Later.**

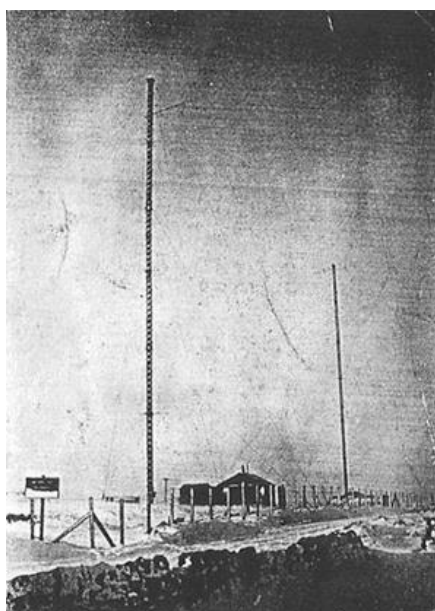


As far as the Ravenscar “at the top of the hill” radar story, this is the end. The RAF were still interested in the site.

The big mast (1) was a beacon used in the late war-time to guide bombers returning from Germany. The beacon put out a signal, and the bombers could home in on it.

The searchlight (2) had a specific purpose as described below.

Brian managed to talk to someone who worked on the site.



This is an “unofficial” photo of the beacon at Ravenscar.

There was also a “*Darkie Watch*”. A returning bomber would start orbiting Ravenscar, and it would transmit a code down to the ground and someone with a transmitter on the ground would give them a direction to fly to the nearest runway.

Also, the searchlight was normally turned off and pointing up. When the returning bomber was close, it would switch on and slowly tilt to the horizon in the direction of the airfield. Further on, another search light would do the same. That was the “*Darkie Watch*” used to get the bombers back.

The other system up there was a “*Radio Track Guide*” or “*J-Beam*”. There is very little in the history books about this system, but in 1942, 43 and 44 the German air defence radar could only track two bombers in one ‘box’ at a time. Any more than two and the radar system couldn’t cope. Part of the tactics of the RAF was to put the bombers in a stream to fly through the ‘boxes’. Two bombers might get attacked, but the others could get through.

“*Track Guide*” put a radio beam in the sky, dots to one side on the radio, dashes at the other and a continuous tone in the middle.

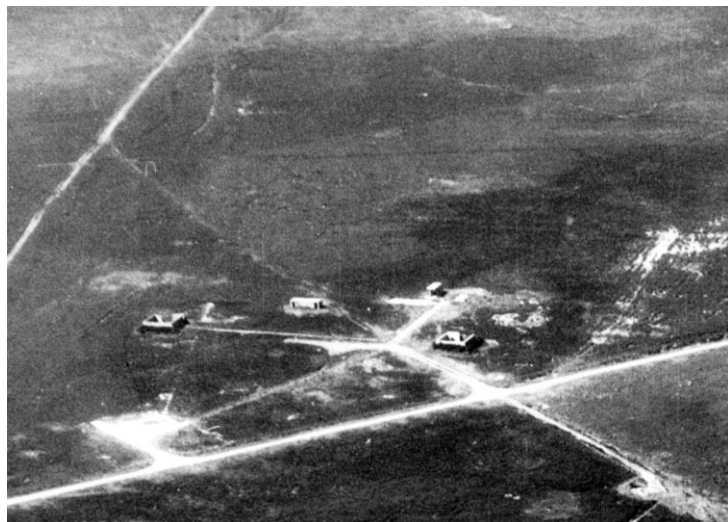
It was actually a copy of the German *Knickbein* system. *Knickbein* was a bombing system which used narrower beams.

Brian was told that the *Track Guide* system was mounted on the ganister tram line rails so it could be pushed out beyond the fence, away from any metal work, which could have affected where the beam went. The *Track Guide* had a cabin arrangement similar to the GL1 radar.

The last two photos are aerial views of the Ravenscar 'top of the hill' site. You can see how the public right of way has been diverted around the fence. You can also see the CHL systems and there's patches where the ACH system was.



RAF Aerial Photo 23rd September 1943



Alan Green Photo AG 6944 held at the Whitby Museum

The whole site has now just collapsed into mounds. Only the base and brackets for the southern 90-foot mast are there. The northern mast brackets are in the shrub. The CHL raised base can be seen.



Base of southern ACH 90-foot mast.



Raised base of northern CHL

○ **Nothing Much Happens With Radar At Ravenscar Until 1942.**

- i) The RAF complete their CHL chain and equipment starts to become available for the original function ~ Coastal Defence (CD) by the Army.
- ii) The Army installs two local CD radar systems:
 - a) Goldsborough, right on the cliff top.
 - b) Ravenscar, also right on the cliff top.

There aren't any accurate dates for installation in the National Archive. The Army records have never been found., because they were probably destroyed, but Brian thinks it was most likely in early 1942.

○ The Ravenscar Site 'At The Top Of The Cliff'.



The Coast Guard station right on the cliff edge is seen in both photos although it has nothing to do with the radar site.

The photo above was taken in 1946, when the site was being demolished. The buildings adjacent to the railway would have been 'Nissen' huts, and as no shadows are being cast, they would have already been demolished. The buildings close to the cliff edge are still standing as they are casting shadows.



This is a better view of the Coast Guard station and the buildings closer to the cliff edge.



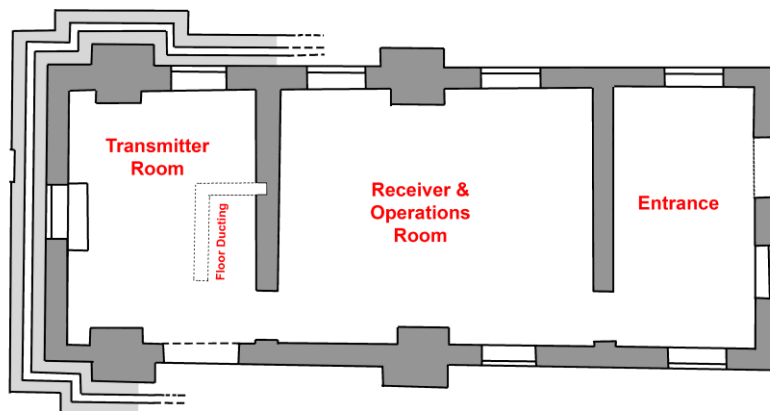
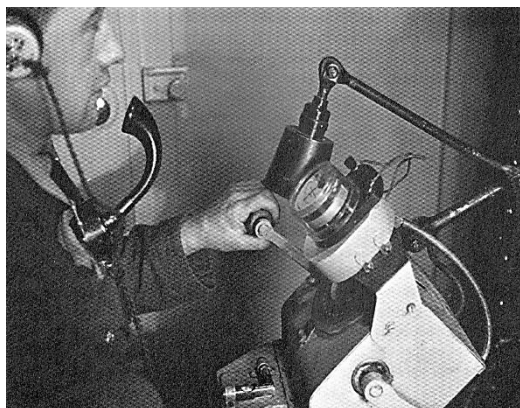
This schematic gives an idea of how the original Army CD radar would have looked like on the building. There was one aerial with the transmitter positioned above the receiver.

The Tizard Mission to America took the Magnetron over there. They also took the 200MHz radar too.

The Americans really liked the 200 MHz radar. One of the ideas that came back from the Tizard Mission was how to make one aerial do the job of transmitter (TX) and receiver (RX).

The problem is that the power of the transmitter will vaporise the receiver circuits if nothing is done about it. Something special had to be done. It wasn't difficult once they knew what they were doing.

In late 1941, Britain started using the same aerials for TX and RX. The aerials were once again rotated using bicycle parts, in this case by hand, similar to the photo below..



Inside the building, the transmitter sat by itself in its own room. The Receiver and Operations room is the main area. The buttresses in the wall are the strengthening required to support the aerial on top of the building.



Here is a photo of the transmitter, which has a 150KW output pulse which is good.

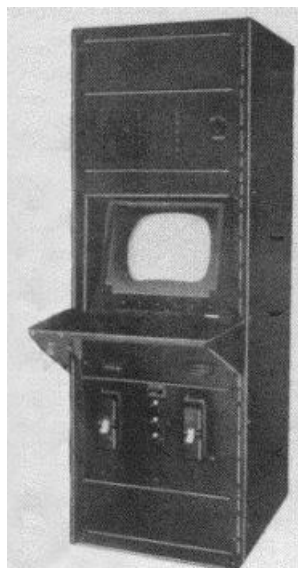
Details: 150 KW Output Pulse.
 3 μ s Pulse Width
 400 Pulses/sec.

On the left-hand side of the console is a cathode ray tube so that the waveform can be seen. The transmitter basically runs itself. The systems were becoming fairly reliable at this time, and they were just left to transmit all the time.



This is a photo taken later in the war of a typical Receiver and Operations room. It is a 'posed shot'. There really wouldn't have been as many people in there at once. The early systems only had one screen, not two as seen here.

They did keep a local plot of what they were seeing, so that they could come back to see if the target was still there.



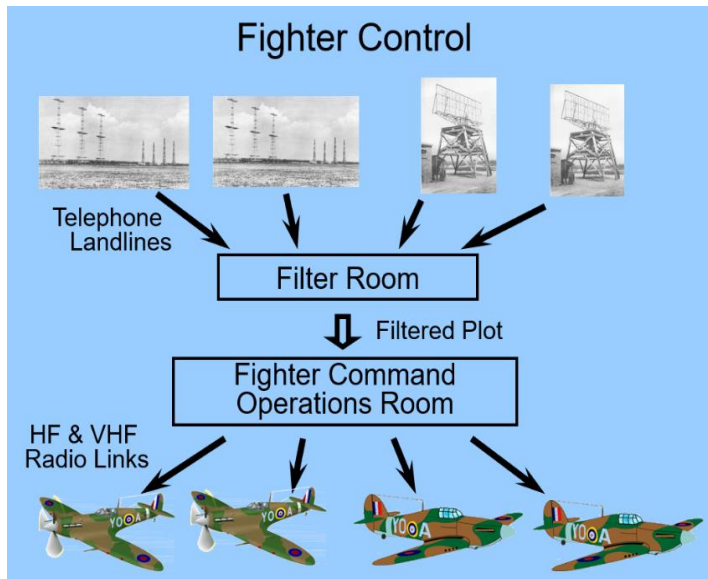
The CHL receiving console was not much different to the Chain Home console.

○ The Radar Control System.

As well as the British, Japan invented radar as did the Americans, Russians, Italians, and Germans. In fact, in the early war years, the German radar was technically better than the British radar.

The British, however, were using the information a lot better than anyone else. They were using the information better in 1940 than the Americans were at the end of 1941 and the Germans at the end of 1945. American radar detected the approaching Japanese aircraft at Pearl Harbour (December 7th 1941), but they didn't have a system that dealt with the information properly.

Here is a diagram of the Control System:



This diagram shows a couple of Chain Home (CH) and a couple of Chain Home Low (CHL) stations.

They all send information to a filter room by telephone.

These four radar stations could be seeing the same target, or four different targets. It was the job of the filter room to decide if they were seeing the same target, or different targets.

The CHs were good on range, but not that accurate on direction (they could be 5°- 10° out) but they could determine target height.

The CHLs were good on range and very good on direction, but couldn't determine target height. If a target appeared on a CHL but not a CH, the target was low level.

The information was then sent to the Fighter Command operations room which then sent the information to the fighter aircraft. Information was also received from the Observer Corps. As well as the fighter aircraft, information was also being sent to the air raid sirens and the anti-aircraft guns. No other country had anything like this system at that time. The system was the main reason the Battle of Britain was won.

○ Supporting Buildings At Ravenscar Cliff Top.

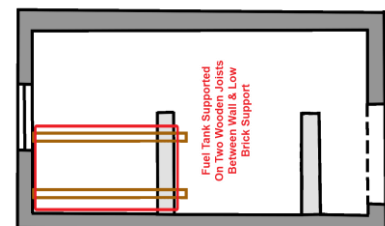


The radar building at Ravenscar had a couple of support buildings. The main one was the generator room. It was a funny shape. It has 'wings' at one end. There is a solid door at that end, and the 'opening' had gratings in it. This allowed massive amounts of air to freely flow in, go around the generator and then out the chimney. This kept everything cool. If you go to the site, the openings are wide enough for you to enter.

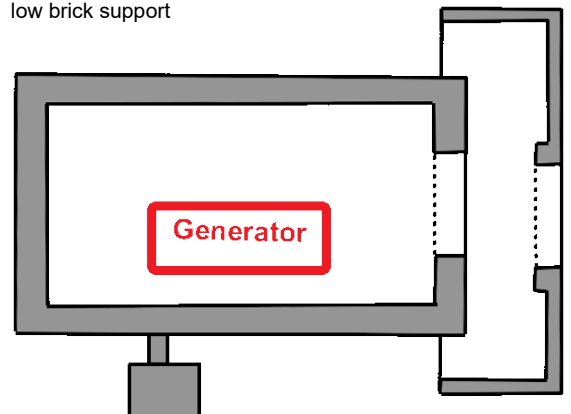
The other building is a fuel store, kept nearby but separate. All the main buildings are concrete. In addition, there was a "Nissen" hut and two to three wooden buildings for storage and meals. The latter are no longer on site.

○ Ravenscar and Goldsborough Coastal Defence Radar Commission In Early 1942.

The RAF took a big interest in Goldsborough. They weren't interested in Ravenscar. They took over Goldsborough from the Army immediately, 'pulling rank' again!



Fuel Tank supported on two wooden joists between wall and low brick support



They take in over in March 1942, They rapidly improve it with extra power, and with power turning of the aerial. It also has a "Plan Position Indicator" PPI.

It now reports on both ships and planes.

The RAF are not interested in Ravenscar, they get all the coverage they need from Goldsbrough.

If you look at low level cover, they had Shotton and they had Bempton, but with a gap between, and Goldsbrough couldn't have been a better site to fill that gap.

Plus, Goldsbrough is closer to Danby Beacon, so it could be administered from there.



Probably late in 1942, Ravenscar was upgraded to a single TX/RX aerial, higher power, and for the first time at Ravenscar, a continuously turning aerial under a proper power drive, (like a light house).

It would have looked like the schematic in the picture on the left.



The original receiver console stayed, as it's still better for range and direction. Towards the end of the war, when there was no chance of invasion, but there were still allied convoys going up and down the coast, there was a need to direct them away from minefields. This was the main reason for these radars later in the war.

A new console was added with a "Plan Position Indicator" (PPI).

Bicycle parts were removed and power turning controls were added as seen in the small unit on the left with switches and buttons.

○ There Was Still A Weakness In The Chain At Very Low Levels.

Chain Home Low still leaves a gap at very low level. Enemy aircraft could still fly in at 50 feet.

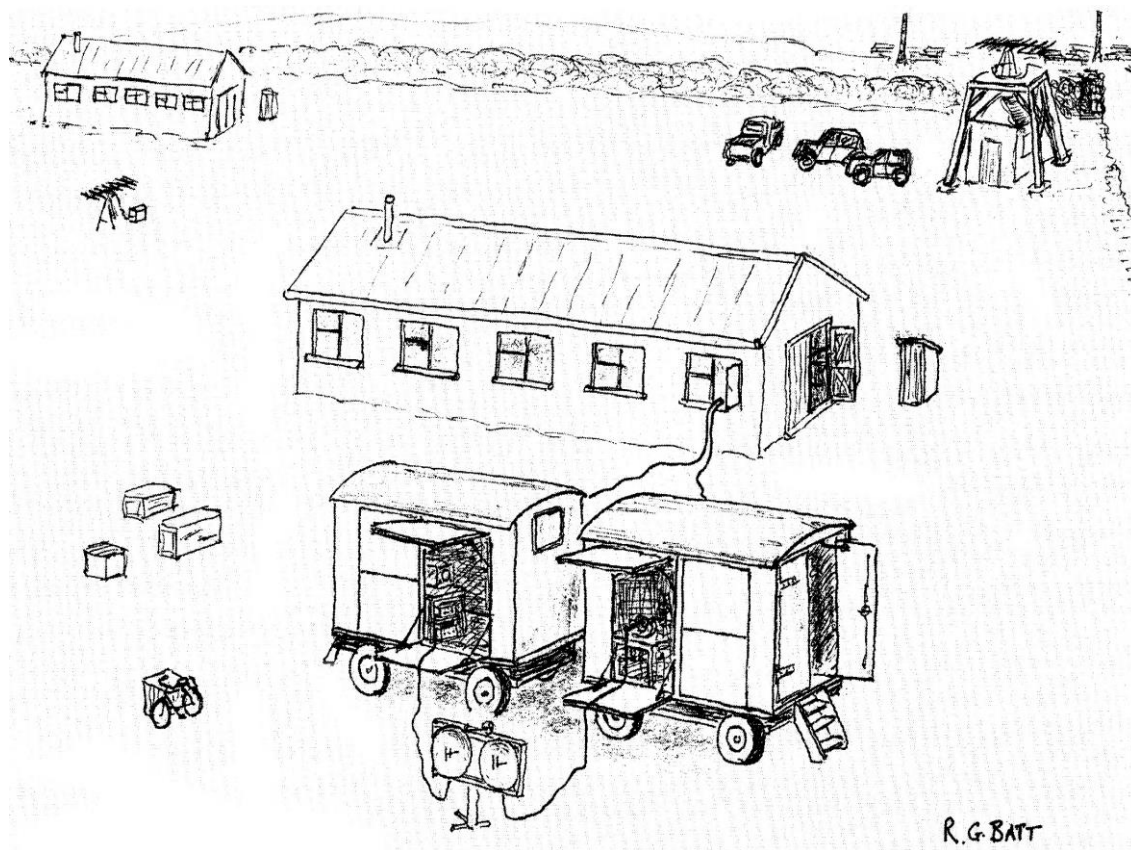
A solution is a radar with much higher frequencies.

In February 1940, the "Cavity Magnetron" prototype first operates at Birmingham University.

Frequency is 3 GHz (10cm wavelength).

By July 1940, the first prototype microwave radar exists at Watson-Watts' organisation at Worth Matravers. He wasn't very quick to get this into production, but the Navy really "pushed it". Even after the War, the RAF were using the Navy's equipment.

There isn't a photograph of the microwave system, but there is a sketch:



This is a sketch by Reginald Batt, and this is the very first microwave radar. There is a parabolic aerial for transmitting and another for receiving. These are just mounted on a post and can be twisted sideways.

There are transmitter electronics in one van and receiver electronics in the other. The vans are getting their power from the generator in the building behind. There are two masts in the background (could this be Ravenscar???)

There is a bike shown. The first target ever detected by microwave radar was Reginald Batt cycling along the cliff edge carrying an aluminium sheet.

Once this microwave system was working at the cliff edge, they were detecting ships, and even picked up a submarine periscope. When they showed this to the Navy, they got very excited.

○ Along Come The Navy.

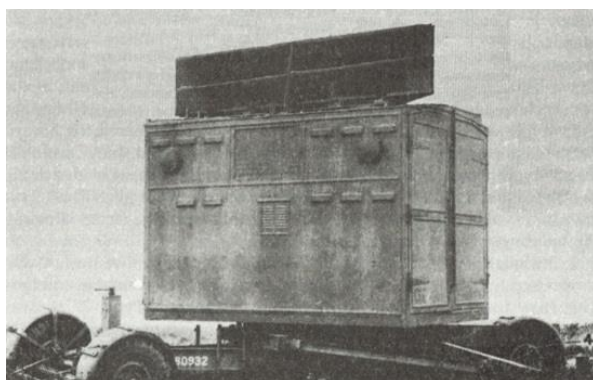
The Navy sees the performance of the prototype microwave radar on ships.

They realise it's just what they want for detecting surfaced submarines near convoys.

They send a team to Worth Matravers and develop their own prototype, this time on only one trailer.

It's ready by December 1940,

No real photos exist, but it would have looked something like the photo below.



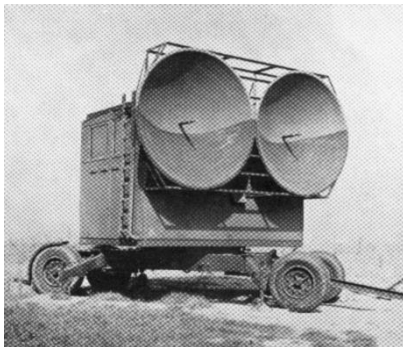
This radar is on a turntable to give it direction. It has two aerials, one on top of the other. It's called a 'cheese aerial' and has a very narrow beam, but vertically it's quite wide. The beam is narrow horizontally for good direction, and wide vertically so that ship rolling won't affect the performance much,

The Navy develop their own version of the 'cheese aerial' at Portsmouth, and that's the one that's installed on a ship. The Navy development on ships ends up being called 'Type 271' and the aerial looks like this: This aerial helped win 'The Battle Of The Atlantic', because they were able to detect surfaced submarines.



To get more operational experience with microwave radar, the Navy put the electronics in a van with two parabolic TX and RX aerials attached.

They build six "temporary" trailer systems of this type, to be sited at shore bases.



One went in near Dover. It proved so good, that the Admiral at Dover wouldn't let it be taken away. It even saw ship movements on the French coast.

○ Now The Army Takes Over.

The Army take the Navy trailer with all the Navy electronics in it, and develop it into three different types of Coastal Defence (CD) radars. As mentioned before, coastal defence is their responsibility.



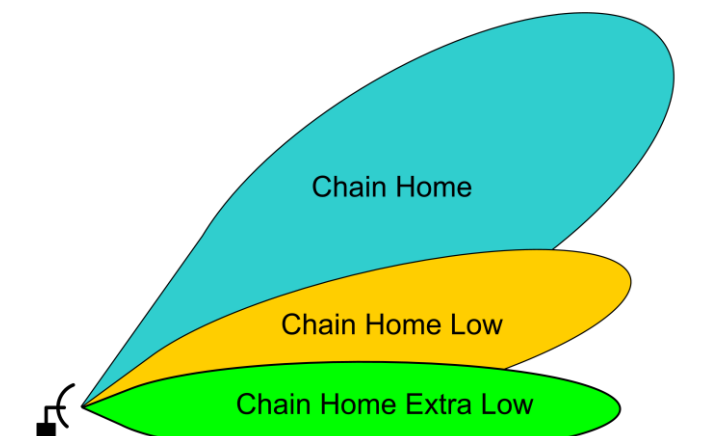
They make fifty CD No.1 MK4 mobiles, and when they took over a site, that system was the first in there. Eventually they would move in the other two versions:

- i) CD No.1 MK5 transportable "Gibson Box", and
- ii) CD No.1 MK6 fixed site.

They all have the same electronics, initially 5KW Output, 0.5 μ s Pulse Width, and 500 pulses/sec.

○ Chain Home Extra Low (CHEL)

However, when the Army develop a radar, the RAF have to take it over, and they take over all the early Army production. Chain Home Extra Low (CHEL) is now filling the gap down to sea level.



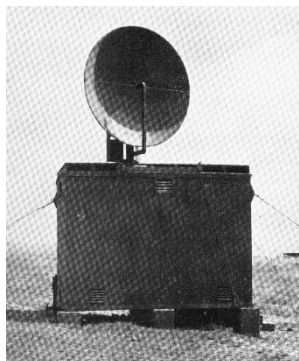
Locally, one went in at Bempton as part of the CHEL chain (called a "Type 31" by the RAF). Bempton then gets an upgrade to a higher power, ("Type 54") before Ravenscar.

At the beginning, the Magnetron was producing 5KW, but after a couple of months it was producing 70 KW. This was the "Type 41".

A couple of months after that, the Magnetron was producing 500 KW which was the "Type 52", and if it was on a short tower like at Bempton, the "Type 54".

Eventually, supplies of the microwaves go to the Army. Reading the history, it appears that Ravenscar was at the bottom of the list for the whole country, when it came to microwave radar, and it was the last for it to be installed. No firm date can be found for the installation, but it was probably January 1943.

The CD No.1 MK5 (Gibson Box).



This was the CHEL that was planned for Ravenscar. It had a single dish, because it had been figured out how to use a single parabolic TX/RX aerial by that time.

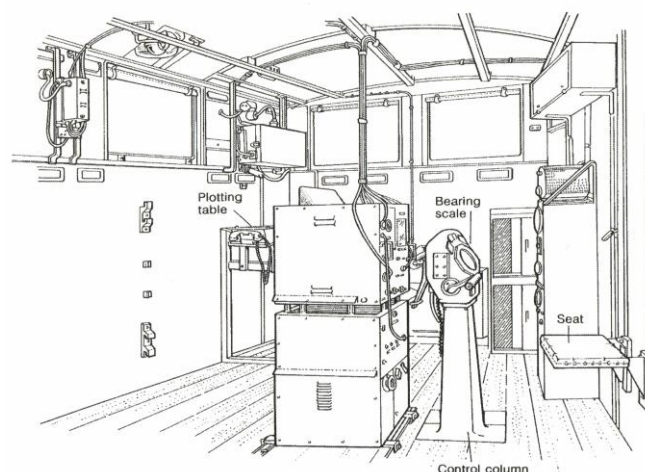
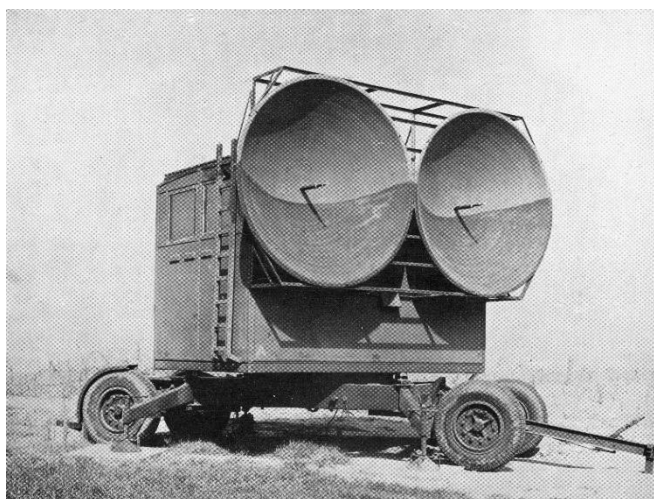
The electronics were contained in a railway furniture transport container.

The door was 7 feet high, so the aerial could sit inside when transported.

The radar came as a kit. It was placed on a flat base and tied down. The container was wood, so it didn't last long, and the aerial was rotated manually using bicycle parts.

There is no firm evidence that one was actually installed at Ravenscar.

The CD No.1 MK4 (Mobile).



The CD No.1 MK4 trailer type did however, make it to Ravenscar. It's an earlier version, with two parabolic aerials. We know this operated at Ravenscar because there are notes by someone who went there when it developed a fault. Inside, there was a seat, bicycle parts for cabin and antenna rotation, and a screen. Someone would be on the telephone in the corner sending information off.

○ "Nissen" Hut At Ravenscar.



There is also a "Nissen" Hut still standing at Ravenscar. It's not technically a "Nissen" hut because those have corrugated iron roofs. This one has a roof of corrugated asbestos sheeting, and is called a "curved asbestos building". It has these small alcoves inside. Because of the asbestos, it has now got a fence around it.

Some people thought that that was where the microwave radar was put, but it wasn't. For one thing, it has no engineered holes in the roof for the aerial to come through.

- **Autumn 1943 – The RAF Take Over The Site Again.**



About a year after taking over Goldsborough, the RAF take over the Army's Ravenscar CD/CHL and also CHEL.

This was done to lower maintenance and running costs, by putting all the radars under one organisation.

There was no risk of invasion in 1943, but the radars monitored allied convoys, to keep them from straying into minefields.

- **1944- Manpower Shortages.**

There is no risk of invasion, and Bempton and Goldsborough can cover the convoys.

There is insufficient manpower to keep the operational stations running AND make staff available to go to the continent.

So Ravenscar closes on 21st August 1944 releasing staff to go to the continent.

The radar equipment would have been rapidly removed, but dates are not known.

Aerial photos show the smaller buildings and these were demolished during 1946.

The CD/CHL, Generator Building and "Nissen" still survive, looked after by *English Heritage*.

Questions and Answers.

Q: Where did the people who worked on the radars stay?

Brian: They stayed on site. There were a number of Nissen huts in the corner of the site near the railway.

Q: How many staff would have been billeted on site?

Brian: I don't know, but there were a lot of "Nissen" huts there. The Army probably put a lot more men there than the RAF did. I have not found any Army records that would tell us.

Q: How did they get all the equipment on site. Was it by rail?

Brian: No there was access by road. The Scarborough-Stoupe Brow road was not far away and Bent Rigg Lane provided access too. The access from the road, crossed over the railway just north of the site



Map Copyright ~ Ordnance Survey

That's All Folks!
Thank You For Listening



PEEMS thanks Brian for a very interesting and informative talk. Thanks also to Brian for proof reading this article and suggesting improvements.

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David and Pam's 'Leaving Do' 26th June 2025 ~ *Namaste Bengal*, Pickering.



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