



German Radar

The Germans, along with the British entered W.W.II with a good understanding of the principles of radar.

Only the Americans were left behind, but by the end of the war they led the world in the development of radar detection.

The most common German radar installation in Normandy was the Wurzburg, which came in many formats.

The Wurzburg was designed and manufactured by Telefunken and the Zeppelin company.

It was used for both air raid warnings and for fighter guidance.

It could also be used to aid anti aircraft guns reach their targets more accurately.

They came in various sizes and were even used to lock searchlights onto their targets so that anti aircraft guns that were not linked by direct radar could be more effective.

This is the only German radar that has the appearance of a modern radar, with a parabolic reflector, all the others had square elements.

The second radar used by the German's was the Freya.

This radar was designed and made by GEMA, and many companies were subcontracted in its manufacture.

The Freya was used for the detection of enemy aircraft over a range of 200 km.

Whilst the Freya had a good range its downfall was that it could only detect range and bearing, but not height.

Another radar found in great numbers was the Wassermann.

This huge radar installation was impossible to hide, over 50 meters high. It was mounted on a turntable to enable it to sweep the sky.

Variations of this type of radar were equally large, the Mammut and Ceasar radar's were almost as high but over 100 meters in length.

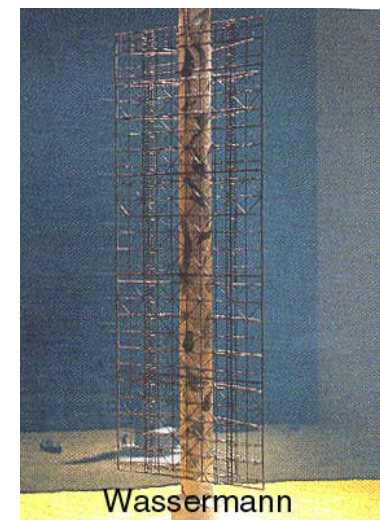
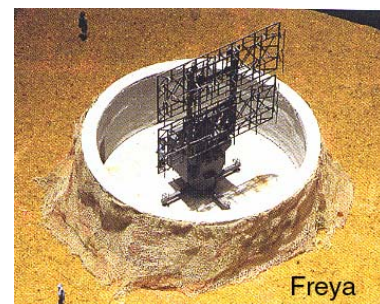
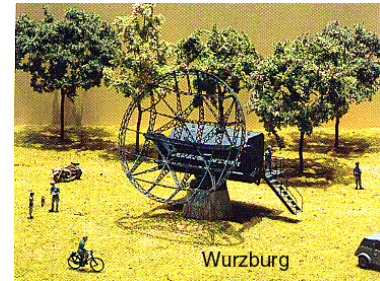
Most of the radar installations had specially built bunkers where the signals were received and the results coordinated.

Because the signals from the aerial array was weak the bunkers could not be situated very far from the antenna.

An average installation such as a Mammut would require around thirty six trained staff to operate it each shift.

Because of their vulnerability most radar stations had a defense system of anti aircraft guns around the perimeter of the radar site.

During the British air attacks over Germany and France the RAF found the most effective way of jamming the German radar was to drop aluminum foil, cut to the same or half length of the radar's operating frequency. This silver foil was called windows.



During the early days all the X-Gerat beams came from Mount Couple near Calais, but later when the Y-Gerat system was introduced the intercepting beams came from three different transmitters. Below are listed the Y-Gerat stations, and the beams use.

German Radio Guidance cont 2

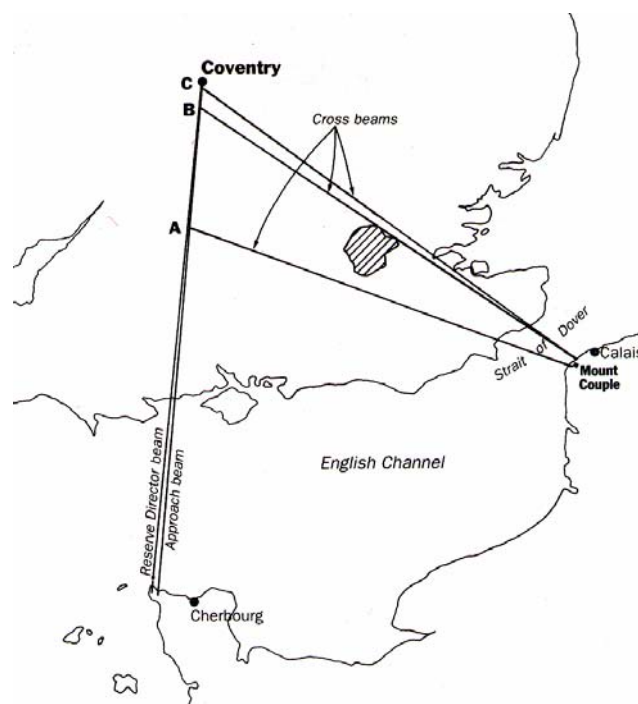


The first of these cross beams (A) called Rhein, which was transmitted from Cleve in Germany, told the aircraft that they were 50 kms (30 miles) from their target.

On crossing the second beam (B) called Oder transmitted from Julianadorp in the Netherlands, told the aircraft observer presses the button to start the bombing clock.

The distance to the target is now 15 kms (9 miles)

When the aircraft intercepts beam (C) called Elbe, this beam originated from Bredstedt in Northern Germany. On hearing the beam the aircraft observer stops the bombing clock, it is now 5 kms (3 miles) to the target. The second hand continues to sweep and when it is aligned to the other hand, an electrical contact is switched and the bombs are released.



The next system to be used was the Y-Gerat and was an improved X-Gerat.

This system was used by Heinkel 111 H-4 III/KG flying out of Poix in eastern France.

The stations built for this system, which used an antenna mounted on top of the bunker were

at:	Y1	Berta	Cassel	Pas de Calais
	Y2	Gustav	Boursin	Pas de Calais
	Y3	Cicero	St Martin aux Bruneaux	Haute Normandy
	Y4	Dora	Paluel	Haute Normandy
	Y5	Anton	Joburg	Basse Normandy
	Y6	Emil	Morlaix	Brittany

The only station on the Cotentin Peninsular was at Joburg, and is now buried under the French Coast Guard station.

German Radio Guidance cont 3

There was a system called Bernard FuSan 724/725 and only one station was built at La Pernelle, this was quickly bombed by the British.



Another variation was Electra.

Three stations were built at:

E3	Bayeux	Normandy
E4	Morlaix	Brittany
E5	Quimper	Brittany

The final radio guidance system developed by the Germans was Erika, and two stations were built.

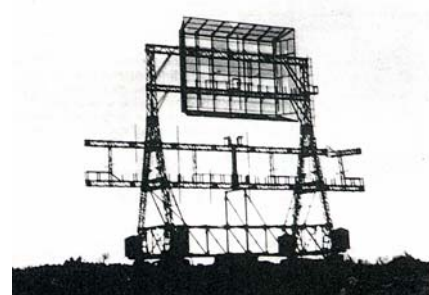
Erika 1	Equihen	Pas de Calais
Erika 2	St Pierre Eglise	Basse Normandy



The problem with all the German systems was that they all required large antenna, and in the case of the one at La Pernelle the antenna was mounted on a railway track.

By the time the Germans had perfected the system of radio guidance the Germans had lost the battle for air superiority and were flying very few bombing raids over England.

By late 1943 most of these stations had been converted to house radar sets of various types. Because the radio guidance stations were among the first bunkers constructed by the Germans in France, they were of a much higher standard than many of the later fortifications constructed along the Atlantik Wall.





Searchlights

After the end of the first world war and the Treaty of Versailles, the German Luftwaffe was greatly restricted in what it could do. It was not allowed to develop its airforce so it turned to the defence of the Fatherland. Much of the equipment that was designed to protect Germany could also be used as an offensive weapon.

By the time the war came the Germans had 75,000 men assigned to Flak Batteries. These batteries included around 3,000 searchlights.



Radar as a means of detecting enemy aircraft was in its infancy and searchlights proved a reliable means of detecting incoming aircraft at close range.

Acoustic amplifiers were also used, these were like large trumpets and amplified the sound of aircraft engines.

The German night fighters which were few in number at the start of the war, relied on these searchlights to illuminate the position of Allied bombers attacking German Cities.

Later in the conflict the searchlights were directly linked to radar and could react quicker to incoming aircraft.

On the Atlantic Wall in Normandy there are bunkers still remaining, built to house searchlights with a diameter between 60 cm and 150 cm.

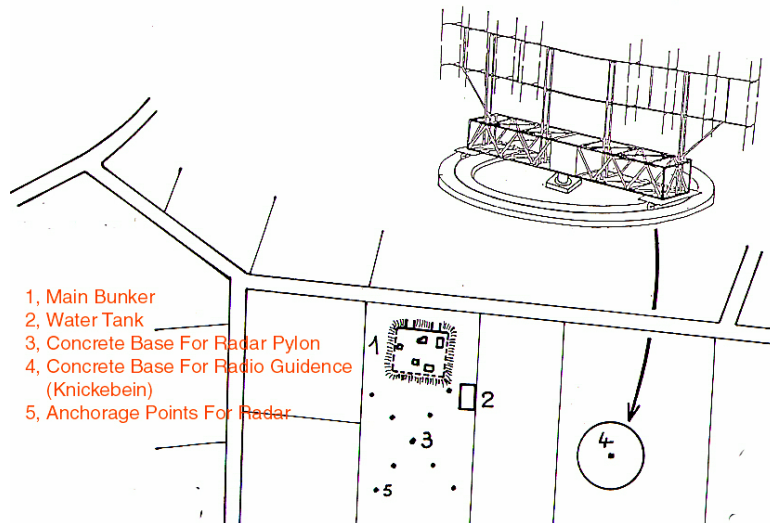
They were built mostly at the waters edge to enable them to spot incoming aircraft at the greatest possible range to enable the FlaK crews to react.

Many of the bunkers have a generator room built into them, either alongside or under the searchlight position.

In some cases the searchlight was kept in a bunker by day and hauled onto the top of the bunker by means of an inclined ramp for night time operations.



Fort Allemand cont. 3



One cannot be certain as to the evolving use of the bunker during the war.

The main entrance would have been through the right hand door under the Eagle.

A chicane would have restricted the entrance width.

Room 1) This would have been the living accommodation for the troops stationed here, opposite the officers room..

They were billeted in the village, but would spend long periods on duty here, mostly at night.

A toilet and shower were provided (Room 2).

The shower was a standard feature of most German bunkers as they feared a gas attack.

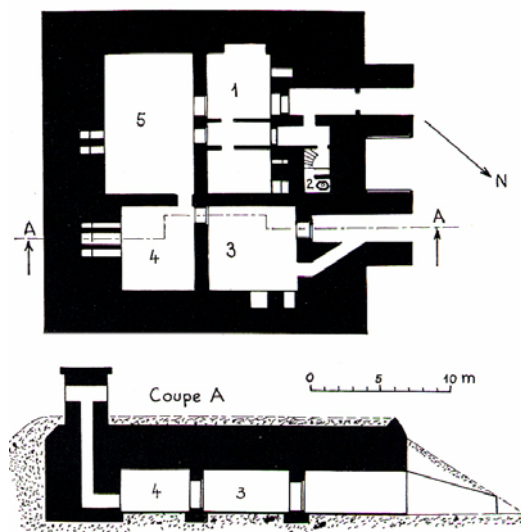
Room 5) This room has evidence of housing three diesel generators The heat generated by the diesel motors necessitated the use of an air cooling system, which can be seen in the roof space.

The water tank (2 on upper plan) would have been used to supply the radiators of the generators.

Room 4) There would have been large quantities of batteries, needed to give a stable voltage to the radio guidance and radar equipment. The room was tiled so that any acid spillage would not enter the concrete and give off poisonous fumes.

Room 3) Here would have been housed all the transmission equipment to set up the navigation beam, and the later radar.

The transmitters would have also been installed in this room, and again because of the heat of the valves, forced air would have been needed to keep temperatures down.



Operation Moonlight Sonata



There had been several raids on the city of Coventry during the previous months. Nothing had prepared the city for Operation Moonlight Sonata.

On the night of November 14th 1940 over 500 bombers were brought together, their target ... Coventry.

As the sun sank down and the night closed in bombers of Kampfgeschwader 100 left their airfield in France. These were the 'pathfinder' squadron which carried crude onboard 'computers' and followed set radio beams, known as the X-Gerat system, to their target. Each aircraft followed a continuous beam which broke down if they strayed from its line. As they got nearer the target a second beam cut across the first - this initiated the crude 'computer's' bombing sequence.

As these pathfinder bombers approached the centre of Coventry a third radio beam told the 'computer' to begin its final dropping sequence measured to fall over the city centre.

At 19:00 the air raid sirens began to wail and at 19:20 the ack-ack and Bofurs burst into life as the planes droned overhead in the bright moonlit night.

First fell parachute flares which hung over the city like great iridescent white chandeliers. These were followed by incendiaries, not normal ones, but phosphorus, exploding incendiaries.

These were dropped to start fires to mark the target for the ordinary bombers of General Field Marshalls Kesselring and Sperrle which followed.

At 19:30 this second wave of planes arrived and the first of 500 tons of high explosives began to shake the city centre.

Incendiaries, both exploding and non-exploding, continued to fall amid the bombs as a continuous stream of droning bombers passed over the city.

Some were aimed at industrial targets around the city but many others concentrated on bombing the centre of the city to create a firestorm.

Early on in the evening the Cathedral of St Michael was hit. By only 7.40, despite valiant efforts, its defenders had succumbed to the incendiary barrage and the roof began to burn.

At 7.59 every available fire appliance in the city was in use as fire-fighters battled the ever increasing flames amid ear-bursting explosions.

At the end of this night 26 of them lay dead, 34 were seriously injured and 200 suffered cuts and bruises.

The populace hid themselves in cellars, crypts and air raid shelters as the heart of the city was ripped apart above them. Others stayed in their homes, thousands of which were destroyed or damaged.



Practically all gas and water pipes were smashed and people were advised to boil emergency supplies of water.



Operation Moonlight Sonata cont.3

Some bodies were however never identified.



Douvres



All German radar stations came under the jurisdiction of the Luftwaffe, and all coastal gun batteries came under the jurisdiction of the Navy, which caused many delays in getting information to the guns defending the coast.

The station here was manned by over 200 officers and enlisted men.

The power for the radar and associated equipment came from diesel generators housed in underground bunkers.

The earliest radar installed here was the Freya, which was completed in the autumn of 1940 and could only give a two dimensional picture: ie just the distance of ships or aircraft.

In the case of shipping this was all that was needed, but for aircraft, one also needed to also know the altitude to be able to intercept.

This development took some time and was available in late summer of 1941 and was called Wurzburg, and in its final form came in two sizes, the standard and the giant.

The Chimney (Wassermann 3) was a later development of the Freya, but had the advantage of being able to give a three dimensional image.

By D-day there were one Chimney, two Freyas and two Giant Wurzburg

One of the latter is preserved here.

All the radar's installed here were bombed before D-day, and were jammed during the Allied Landings.

Apart from these radar stations, the Germans installed various radio guidance stations in Normandy, the Knickenbein and the later x- & y- beam based on the Cotentin Peninsula.

On D-day the task of taking the radar station fell to the Canadians, but the station was very well defended and the decision was made to leave it and push on into France.

The station held out until June 17th then the garrison finally surrendered.

During the intervening days the station had passed much valuable information to the high command.

After the war, the station was dismantled, and much of the equipment went to universities for research work including the making of the first radio telescope.

Today the station is a museum dedicated to the development of radar.





Douvres cont.2

One of the main features of the radar station at Douvres is the bunker built here for the guidance of fighters directly linked to the radar. This system was called “Anton” by the Germans.

A special bunker was built type L479 which was one of only five built in Normandy. The L 479 is a very large bunker, built on two stories and hidden as much as possible underground.

The height of the bunker is 8.5 meters and its width is 18 meters and the length is 23 meters. Over 2,600 square meters of concrete was used in its making.

Nearly twenty rooms are found here, but the most impressive feature is the Seeburg plotting room, based on two floors.

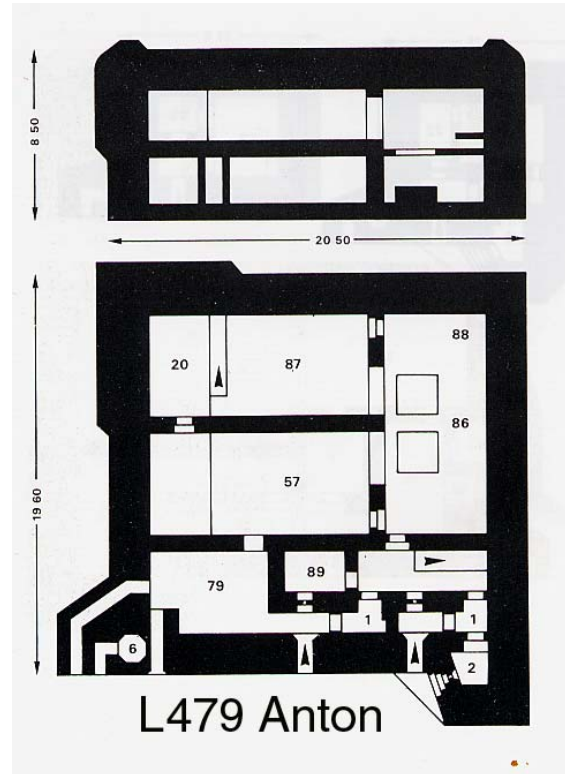
The main feature was a large glass table on which was a grid superimposed on a map of the area.

Two operators linked by phone to the two Wurzburg radar's, and standing below the table, shone torches onto the underside of the table giving the positions of both friendly and enemy aircraft.

A blue light was used to denote enemy aircraft and a red beam was used to denote friendly planes.

The lights were moved as information was updated, the information be relayed to the German fighter pilots giving them another pair of eyes.

The system worked well but could be easily overwhelmed when large raids were in progress.





Digulleville

Near the Hameau des Asselins lies the most interesting of German bunkers.

This is a rare Mammut radar installation (named Gouesneraie), used not only for detecting shipping, but it also gave the range for the guns to either side of it.

The bunker is quite a rare V143 type of which only four were built during the war.

The Mammut radar was called hoarding by the British, because of its size and shape.

It sat on three huge concrete pillars sitting on top of the bunker.

It was a long range radar having an effective range of 300 kilometers, and it gave an incredible accuracy in its findings.

The cables that linked the antenna to the electronics below in the bunker can still be seen.

There were two entrances to the control centre, both protected by machine gun posts.

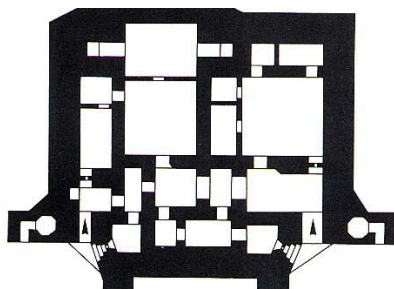
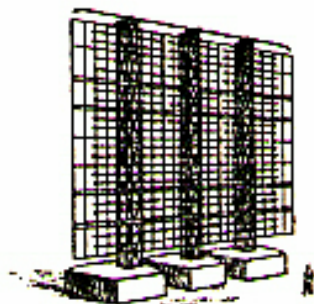
Inside the condition of the bunker is good and none of the heavy metal doors have been taken for scrap.

None of the equipment remains as all radar and electronic equipment was taken for further use by the liberating Americans.

The floor of many of the internal rooms show just how much thought went into its construction.

Cable ducts and special walkways were formed into the concrete, much as you would have found in a computer during the 1960's.

You can see evidence of the taking of the radar station by the Americans on the left hand entrance.



La Pernelle



The village of La Pernelle was well favoured by the Germans.

Not only did they build two gun emplacements near the village, they also installed one of the largest

“Coast Watcher” radar installations in the village.

The choice was a simple one, the village sits high on hills just to the north of Quettehou, overlooking the eastern approaches of the Bay of the Seine.

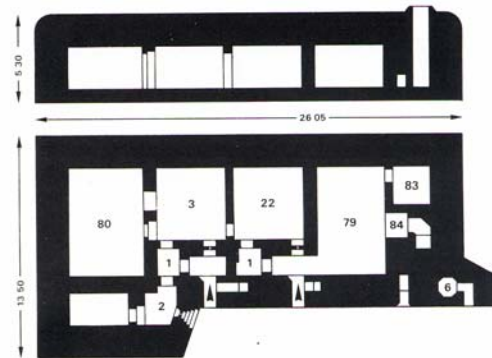
This installation was well placed to find any incoming ships or aircraft attacking the fortified port of Cherbourg.

The radar bunker still lies hidden on the outskirts of the village in a wood and is a type L486, nearby the concrete base for the antenna still stands.

The antenna was so large that four railway cars were used to rotate it.

These sat on a circular railway track, to enable the radar to be moved..

One strange feature of the site is that an observation turret (cupola) still sits in front of the church looking out over the bay. Most of these cupolars were taken for scrap after the war.



St Pierre Eglise



Erika was a late development in radio guidance, and came too late to have much effect on the German's war effort.

They had started with Knickebein, then progressed to X-Gerat and Y-Gerat, all of which were far superior to anything the Allies had at that time.

The only problem with this system was the large number of bunkers needed which allowed the planes of the RAF to spot the installations.

Erika was a long distance navigation system. The transmitting station sent out two tones and equipment on the bomber gave the position to the air crew to within an accuracy of 400 meters.

Unfortunately by the time the system was operational the Germans had little or no air force remaining.

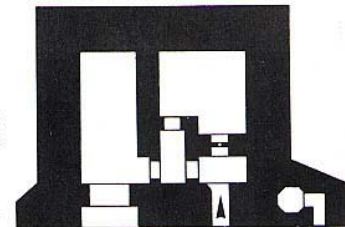
At St Pierre Eglise there are six installations each with a radio bunker and two generator bunkers.

At the heart of the centre was a fortified control room which supervised the transmitting of the signals.

Emergency Exit



A large, concrete bunker structure on a beach, identified as the bunker at Omaha Beach. The bunker has a semi-circular front and a steep, sloping roof. It is situated on a sandy beach with some low-lying vegetation in the foreground. The sky is blue with scattered white clouds.



On the outskirts of the town at the edge of the camping site is a radio guidance bunker. The bunker is 130 meters above the sea. The system used here was the second generation of radio guidance called Y-Gerat. For an explanation of this system consult the pages on Fort Allemande. The aerial was mounted on the roof of the bunker and was rotated to its position on a rail, the supports of this rail can still be seen on the roof of the bunker. The reason for mounting antenna on the roofs of bunkers was because the shorter the cable from the transmitter to the guidance equipment meant less loss of signal due to the resistance of the cable. This made for a better signal strength but also meant that the large antenna gave away the position of the bunker to Allied photo reconnaissance aircraft. The system could guide bombers to within 3 kms of their targets over a range of 400 kms. The bunker is sealed so it is difficult to imagine the layout in the relatively small workspace. The electrical supply was almost certainly piped in as there is no sign of exhaust outlets needed when generators were installed.





La Pointe de la Percée

To the west of Omaha beach the German's installed a radar station.

The Pointe at Raz de la Percée is better known as the point where the American Rangers landed wrongly on the morning of D-day when taking the Point du Hoc.

The Kriegsmarine station code named "Imme" housed two Giant Wurzburg Riese, and one Freya radar.

The razor wire placed here by the Germans has long since disappeared, but blackberry vines and gorse bushes are possibly more effective at keeping people at bay.

The coastal footpath is closed because of rock falls and access is very difficult.

The Tobruks are still in place as is the tower for the Freya radar

The garage type of construction at the seaward edge of the site I first thought was a gun garage, but it has railway lines built into the roof, possibly as mountings.

Some earlier plans show a Seetakt radar installed at this point.

The most interesting find was the communications centre.

This is of light construction, half buried and hidden in undergrowth, and the interior filled in, and almost impossible to photograph.

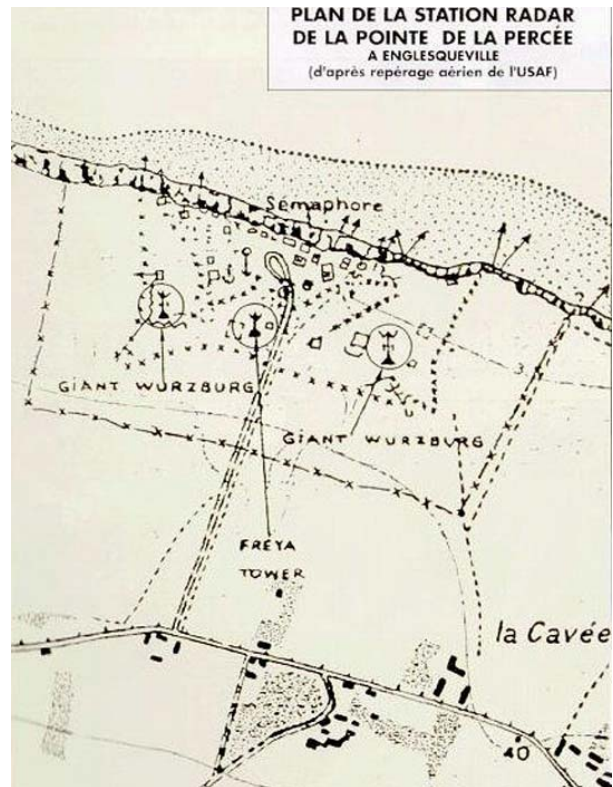
Most Allied accounts tell of the bombing of this radar station.

Putting it out of action on D-day.

The concrete remaining shows no sign of damage, and with the communications bunker only twenty meters away from the Freya radar, showing no signs of damage, the bombing must have been very accurate.

None of the four 20 mm anti aircraft positions could be found.

On the flat fields behind the radar site, the Americans on June 17th 1944 set up an advanced landing strip code named A1 and this airfield was used until the end of August. A monument commemorates the events and also the 834th Air Engineers who built and maintained the site.



La Pointe de la Percée cont 2



< Western Tobrouk



^ Hidden Communication Building



< Seetakt Radar ?



^ Eastern Tobrouk

< Freya Radar Base





Arromanches

The site high on the cliffs to the east of the town is no thought of as being the viewing platform to see the remains of the Mulberry Harbour.

The site was known to the Germans as Stp 42 and housed three Oerlikon 20 mm Flak 28 anti aircraft guns.

There were also three Tobrouks housing machine guns, together with large areas of anti tank and anti personnel mines.

The cliffs were dominated by the array of radar antennae's that included a Seetakt FuMO 2 which was known to the Allies as "coastwatcher" and a See Riese FuMO 214.

As this was a Kriegsmarine site its primary purpose was to watch for Allied shipping and as such was high on the Allies list of priorities for destruction by D-day.

The radar was only normally used at night or in times of bad weather, when visual contact could not be used.

Just to the east are two H612 casemates that housed 75 MM guns to protect the eastern end of Gold Beach.

This position was known as Wn39.

