

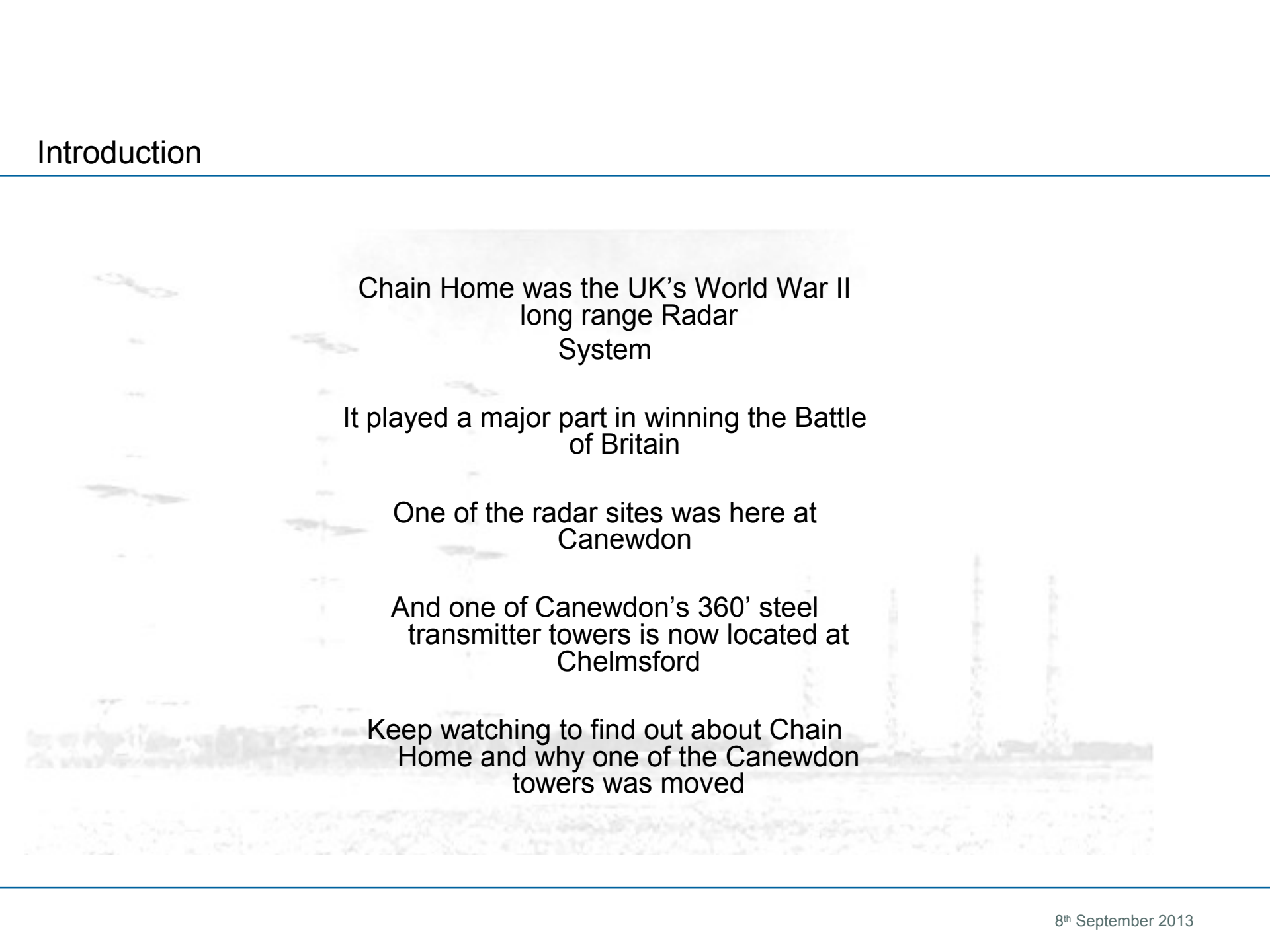


# The History of Canewdon Chain Hone



# Introduction

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Chain Home was the UK's World War II  
long range Radar  
System

It played a major part in winning the Battle  
of Britain

One of the radar sites was here at  
Canewdon

And one of Canewdon's 360' steel  
transmitter towers is now located at  
Chelmsford

Keep watching to find out about Chain  
Home and why one of the Canewdon  
towers was moved

## Introduction

- In 1932 Stanley Baldwin gives a speech to Parliament in which he states

**“The Bomber Will Always Get Through”**

- He was not wrong, aircraft technology was improving and for the first time bomber aircraft were faster than fighters



## Introduction

On the 2<sup>nd</sup> August 1934 Hitler becomes Germany's head of state.

He makes no secret that he wants to expand Germany's borders.

He starts to build up Germany's armed forces which is expressly forbidden under the terms of the treaty of Versailles.

No European country is able or prepared to stop Germany.

Some UK politicians think war is inevitable.

## The UK's Air Defense Strategy – 1930 to 1935

- Early 1930's
- UK's Air Defence Strategy
  - Mainstay was Royal Observer Corps formed in 1928
  - Who used Optical, Infrared and Acoustic detectors to warn of approaching aircraft
  - Unfortunately they all suffered from:
    - Poor sensitivity
    - Limited range and were weather dependant



Acoustic Detector

## The UK's Air Defense Strategy – 1930 to 1935

- Acoustic Detectors - Sound Mirrors
  - The Sound Mirror was at the pinnacle of Acoustic Detection, the high tech Radar of its day
  - Made from concrete with sensitive Microphones placed at the focal point that could hear the engine noise of an approaching aircraft

200' Long wall (Dungeness)



## The UK's Air Defense Strategy – 1930 to 1935

- Acoustic Detectors - Sound Mirrors

They gave about a 4 minute warning of an aircraft approaching at 300 MPH

30' Acoustic Detector dish (Dungeness)



## The UK's Air Defense Strategy – 1930 to 1935

- 1934 RAF Air Exercises
  - A planned full scale attack on London
  - The Observer Corps pre-warned of targets
  - 50% of enemy aircraft reached their targets
  - All London targets completely destroyed

**A Radical Rethink of The UK's Air Defense Was Necessary**



## The UK's Air Defense Strategy – 1930 to 1935

- In 1934 the Committee For Scientific Survey of Air Defence was set up by the government to look at new detection technologies.
- Two members, Wimperis and Rowe had previously located 53 papers on Air defence.

None Contained  
*"ideas which were especially suitable for the establishment"*

# The Death Ray

- Intelligence from Germany indicated the Germans were working on some sort of Death Ray Weapon
- It was thought that such a weapon would be based on high power Radio Frequencies (RF)
- Air Ministry had a Prize of £1,000 for anyone who could demonstrate a Death Ray that could kill a sheep at 200 yards, no questions asked !



## The Death Ray

- Robert Watson-Watt who was superintendent of the Radio Research Laboratory (now NPL) was asked by the Committee For The Scientific Survey of Air Defense if a Death Ray was possible
- He asked a colleague Arnold Wilkins to do some calculations
- Wilkins calculations showed that a huge power would be required for such a weapon. However, he said “It might be possible to detect the reflected radiation from an aircraft”
- Watson-Watt reports back to the committee and Requests £12,000 to begin research
  - He is given just £2,000 for a demonstration to prove that it would work



*Watson-Watt*



*Wilkins*

## The Daventry Experiment

- On the 26<sup>th</sup> February 1935 one of the 20th Centuries most important experiments was performed in a frosty field near Daventry
- A sensitive receiver and a Cathode Ray Oscilloscope was set up in a field at Weedon
- A Heyford bomber was flown between the receiver site and the Daventry shortwave transmitter
- The spot on a Cathode Ray Oscilloscope moved up and down as the bomber passed by and continued to do so until the bomber was 8 miles away
- The experiment proved without doubt that aircraft could be detected by radio waves

## The Birth of Radar

# Top Secret

- A team lead by Watson-Watt was hastily put together to start work on what was now a Top Secret project
- Orfordness in Suffolk was chosen to house the new research establishment because of its remoteness
- Within weeks aircraft were detected at ranges of 27km and then with increased transmitter power 100km
- Watson-Watt and Wilkins were already considering a chain of stations along the east coast
- The project was called RDF because it didn't give away its purpose



*Orfordness*

## The Birth of Radar

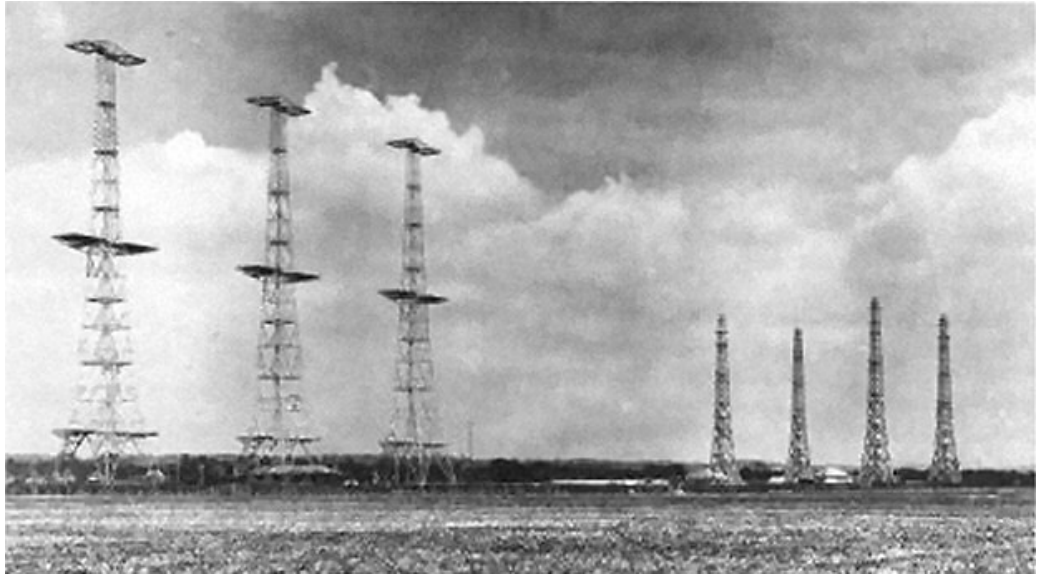
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- **Bawdsey Manor**
  - Soon the team outgrew the Orfordness establishment
  - Bawdsey Manor was purchased in early 1936 for £23,000; the owner was only too pleased to sell !!
  - Bawdsey Manor became RAF Bawdsey the site of the first Chain Home station
  - Although all the parts for Chain Home were made by well known UK manufactures they were all based on the designs produced at Bawdsey Manor



## Chain Home

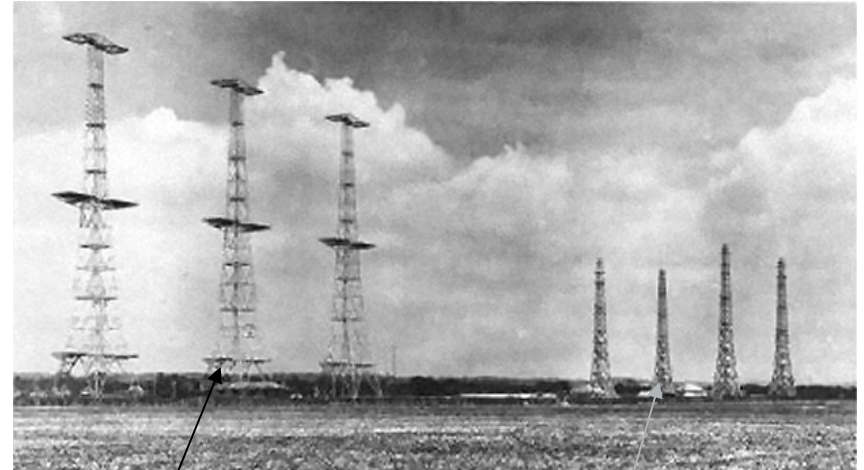
- Chain Home (AMES Type 1) Specification
  - 4 Frequencies between 20MHz and 55Mhz
    - later just 2 between 20MHz and 30MHz
  - Horizontal Polarisation
  - Peak Power 350KW
    - Later 750KW and even later 1MW
  - PRF 25 and 12.5Hz locked to national grid
  - Pulse length 20 $\mu$ S
  - Long interpulse period 40mS to mask long range scatter
  - Accuracy was sufficient to place a fighter aircraft within 1 mile of a single bomber target
  - Measured distance to target and target height
  - Range 200km



*A Typical Chain Home Station  
(this is what RAF Canewdon looked like)*

## Chain Home

- Each station had 3 or 4 huge 360' transmitter towers made by Dorman Long on Teesside
- Each tower cost £2,400
- The Marconi company of Chelmsford supplied and installed the curtain arrays which were slung between the cantilevered platforms which give the towers their distinctive shape
- Beneath the towers was the concrete transmitter bunker with a thick steel door and blast wall to protect it
- A short distance away was the buried reserve transmitter in case the main transmitter was put out of action



*Transmitter  
site and  
Antennas*

*Receiver  
site and  
Antennas*



## Chain Home

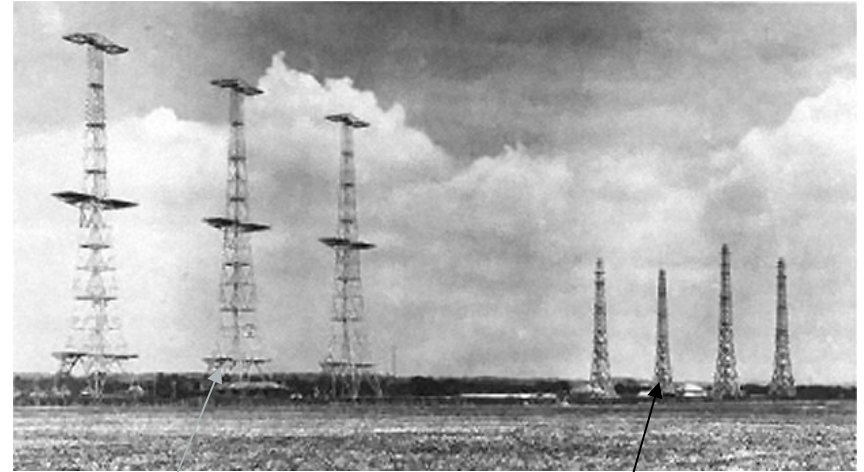
- Transmitter
  - Made by Metropolitan-Vickers and designated T3026
  - Output power 750KW peak later 1MW peak
  - Output and driver stages, continuously evacuated demountable tetrodes, type 43
  - As a countermeasure against deliberate jamming the stations operating frequency could be changed in 15 seconds



*Fig. 9. East Coast CH transmitter room*

## Chain Home

- A short distance away from the transmitter towers and slightly in front were the receiver towers
- The Village Hall we are in is built on Canewdon's receiver site
- The towers were made of wood so not to influence the received signals
- They were 240' high
- Beneath the towers was the receiver in its bunker and once again a short distance away was a buried reserve
- Unlike a modern Radar there were no moving parts !!



*Transmitter  
site and  
Antennas*

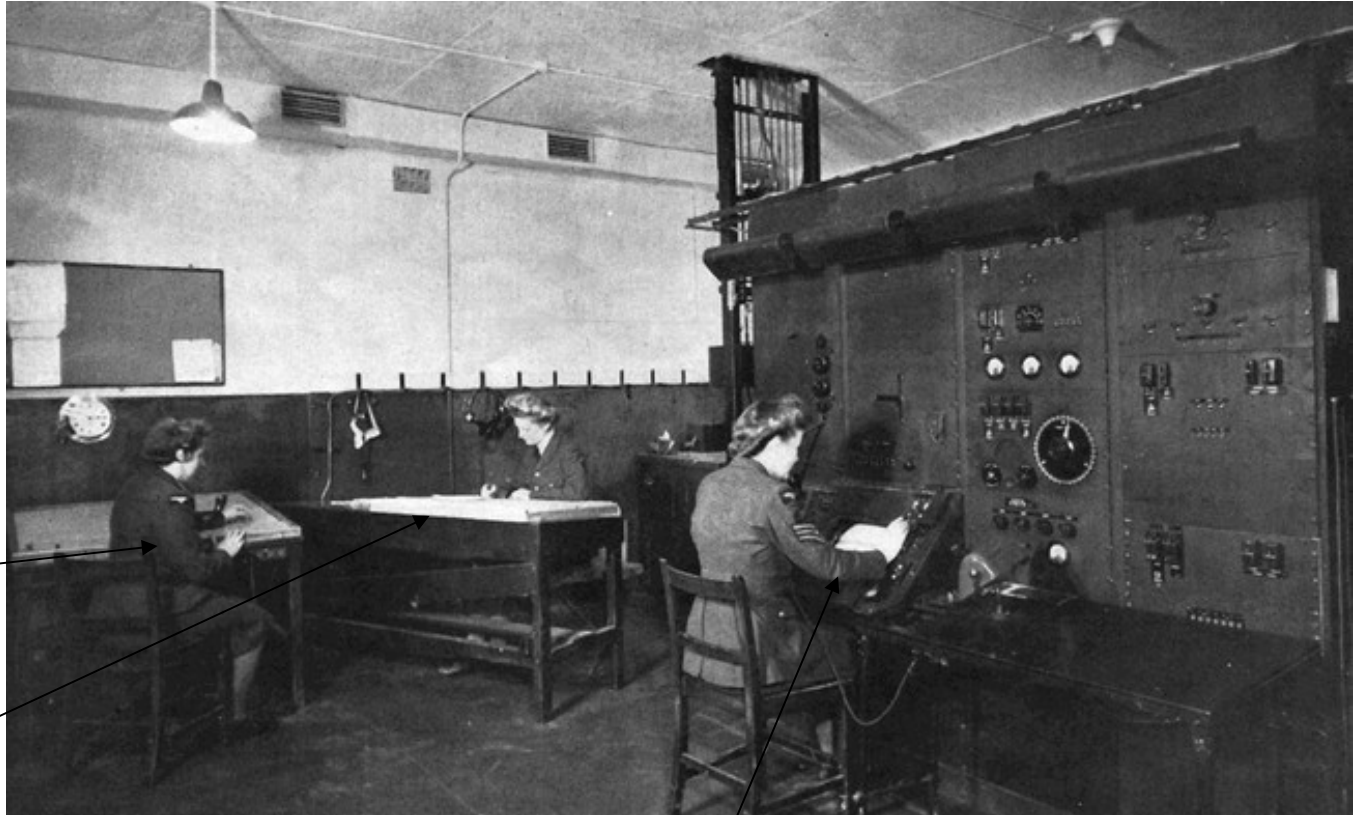
*Receiver  
site and  
Antennas*

## Chain Home

- The Receiver and display were all in one unit
- Made by A C Cossor Ltd

*Track Teller*

*Plotter*



*Operator and Radar Display*

## Chain Home

- In order to accurately measure the target height an early form of computer was used, known as the Calculator (or fruit machine)
- The program was “hard wired” into the Calculator by tracking an aircraft or Autogyro on a series of known courses or tracks
  - Inputs
    - Target range
    - Target bearing
    - Target height
    - Earth's Curvature
  - Output
    - Corrected Target Height
- Each Station had to be regularly calibrated



*Fig. 15. CH electro-mechanical calculator*

## Chain Home

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- The first 5 Stations were built to test operating principle, known as the Thames Chain, they were:
  - RAF Bawdesy Manor (1936)
  - RAF Gt Bromley (1937)
  - RAF Canewdon (1936)
  - RAF Dunkirk (1937)
  - RAF Dover (1936)
- Air Exercises were held in late 1937 and early 1938 known collectively as the Biggin hill experiment
- Demonstrated the difficulty of guiding fighters onto a target

## Chain Home

- The Biggin hill experiment gave birth to the Command and Control system that sat behind Chain Home
- Filter rooms filtered out the tracks and picked the most accurate track from several Chain Home stations
- The Sector control room with its situation map plotted the targets by coloured counters moved around by girls from the Woman's Auxiliary Air Force
- And Ground Controlled Intercept (GCI) guided the fighters to their targets
- All were connected together by high quality telephone lines
- Without the Command and Control system Chain Home was almost useless, with it it couldn't be beaten



*The Situation Map*

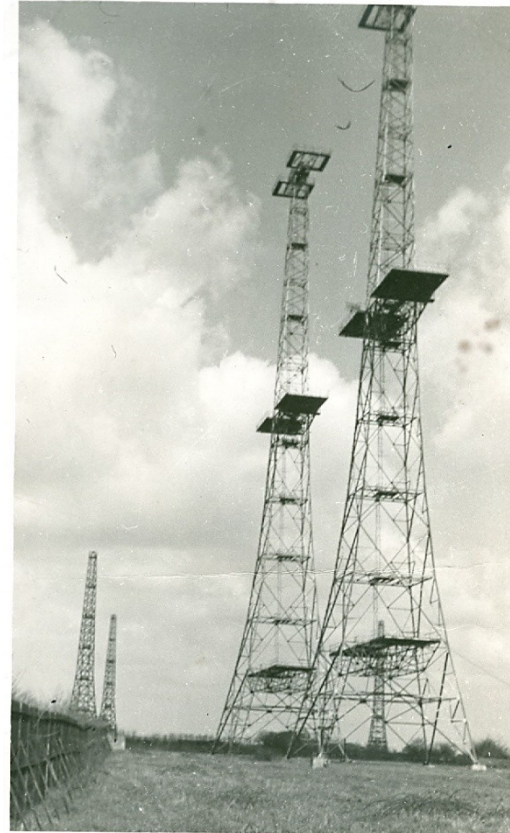
## Chain Home

- At the end of the Biggin hill experiment £10m was released to complete the chain (about £1b in today's money)
  - On Good Friday 1939 all 20 completed Chain Home stations go on 24/7 watch
- Without Chain Home we would almost certainly have lost the Battle of Britain
  - Existence of RDF (Chain Home) disclosed to the public in 1942
  - The term Radar was coined in 1940 by the United States Navy as an acronym for **RA**dio **D**etection **A**nd **R**anging



## A New Lease of Life

- By the end of WW2 Chain Home was obsolete, new microwave Radars were smaller, more powerful and more accurate
- Half the Chain Home sites were dismantled
- The other half kept a daylight watch
- By 1950 RAF Canewdon had ceased to be an operational Radar site and the site was taken over by the RAF Aerial Erector School for practical climbing assessments





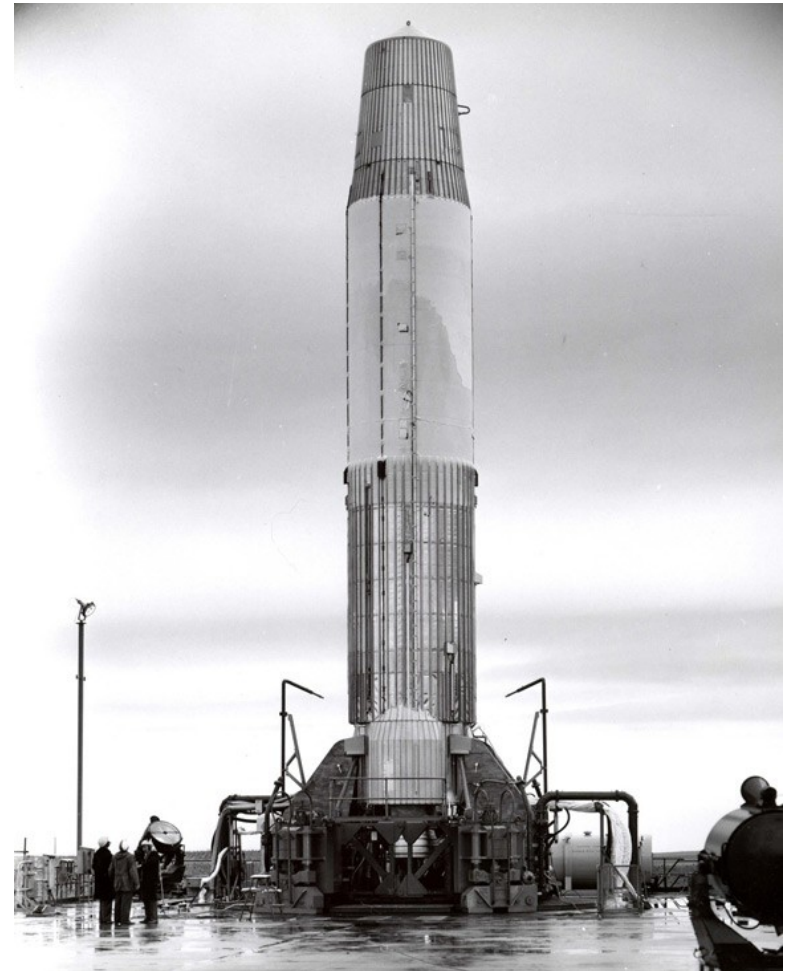
## A New Lease of Life



- The school was set up in RAF Chigwell
- The climbing assessments and training was done at RAF Canewdon an hours drive from RAF Chigwell
- There were few facilities at RAF Canewdon
- Rations had to be brought each day and the key to the gate had to be collected from the guard room at RAF Chigwell
- In 1956 the school moved to RAF Norton and RAF Canewdon closed

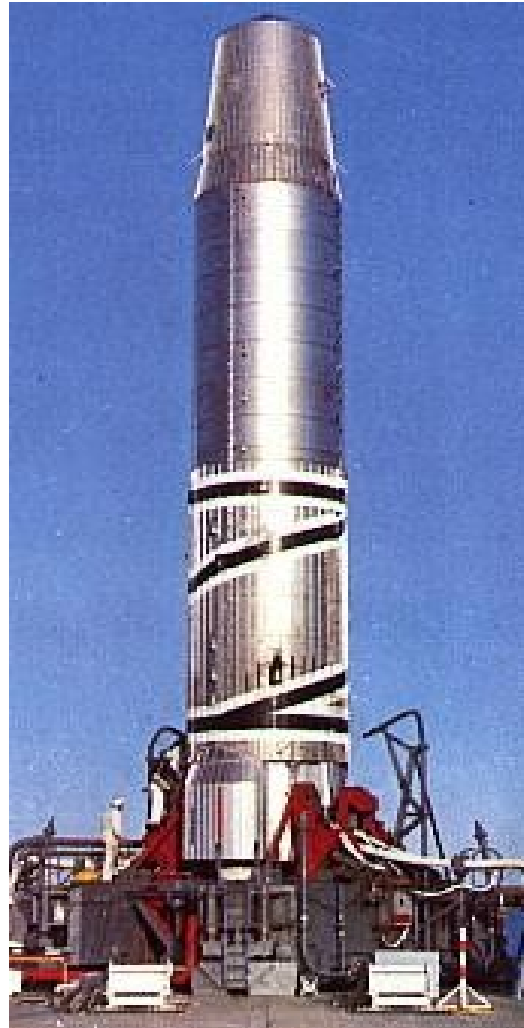
## Blue Streak

- Blue Streak was the UK's Medium Range intercontinental Ballistic Missile
- It was designed to carry the UK's nuclear deterrent
- In 1955 the Marconi Company wins an MoD order to design and build the Microwave Guidance for Blue Streak
- Marconi require a high structure to do some of this work
- One of RAF Canewdons three transmitter towers is dismantled and in 1956 re-built at the Marconi Research Laboratories at Gt Baddow on the outskirts of Chelmsford



## Blue Streak

The contract was cancelled  
in favour of Inertial Guidance

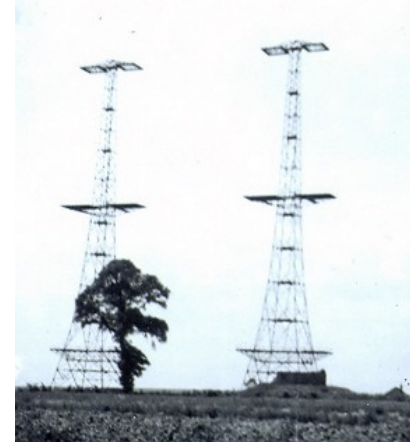


And finally the Blue Streak  
contract was cancelled in  
1960 in favour of Polaris

**What happened to the other towers?**



***Do you Know?***



## The End

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- During the next 15 years the remaining wooden receiver towers may have been used by GCHQ
- And in June 1970 Canewdon was the base of a powerful jamming transmitter to jam the pirate radio station Radio North Sea International who were trying to change the outcome of the General Election
- Finally the last wooden transmitter tower was dropped to the ground



## The Gt Baddow Tower

- **Since 1956 the Gt Baddow tower has been used for a number of projects, here just a few**
  - Early work on radio wave Propagation was done for the BBC and ITV prior to the launch of the 625 line UHF television service in the 1960's
  - A High Speed Radar Data Link using microwaves was developed to transmit real time Radar pictures to the sector control rooms
  - National One, a precursor to the mobile telephone system we all rely on today was developed
  - 805SW Tracker Antenna for SWMLU has been tested on a low reflection test range which has used the hut on the left-hand platform since the 1970's



# The Future



**Gt Bromley**



**Dover**

**Out of at least 60 transmitter towers built there are only 5 left. The tower at Gt Baddow which came from Canewdon is the most complete, It's future, who knows.....**



**Gt Baddow**



**Stenigot**



**Stoke Holy Cross**

## And Finally

- Thank-you for watching this presentation
- If you have any memories or things to add about RAF Canewdon please let us know
- I would like to thank BAE SYSTEMS for the loan of the model tower, the Ex RAF Aerial Erectors Association and many other Web sites in producing this presentation



### **Chain Home**

*A tribute to the men and women dedicated to the development and operation of the first radar network. Without their skill and commitment, the outcome of the "Battle of Britain" would certainly been different.  
From the original Painting by Chris French G.Av.A.*

**BAE SYSTEMS**

