

The

# *Spirit* of **North Weald**

The North Weald Airfield History Series | Booklet 5



**World War 2 –  
the ground trades at North Weald**

WAAF and Norwegian parachute packer Olsen at North Weald



# The challenge of RAF operations

Many trades and sections provided the range of services required...

During its time as an operational RFC and RAF Station North Weald only had a comparatively small number of pilots on its strength – a mixture of sergeants and officers. But it also had many hundreds of airmen and airwomen working to support their flying activities. The ratio on the operational squadrons was around 9:1. Many more were on the Station's roll.

A vast logistics chain kept the Airfield supplied with fuel and ammunition from 64 MU at Ruislip, part of 42 Group. Fuel was kept in special underground facilities – one next to the current Gymnasium, with pipes coming out of the ground for filling bowsers, another was on the site of the current Hangar 39. The ammunition and bombs were stored in four shielded buildings behind Hangar 4A.

Everything else required for the Airfield's daily activities from food and drink to coal, uniforms, toilet paper, furniture, engines and aircraft spares came from 40 Group's Universal Equipment Depots. Much of it arrived by rail at North Weald

Riksarkivet Norway

Changing a Merlin engine in Hangar 3



LNER Station, and was then transferred to the Stores Section. Groundcrew – fitters, riggers, armourers plus radio and instrument specialists – attached to the various Squadron Servicing Echelons maintained their aircraft on a daily basis, refuelling and rearming them as required for training or combat missions. Most of the work was carried out in the open at the dispersals and revetments or in the eight adjacent temporary blister hangars. Major servicing was done in the original Type A Hangar 3, now the site of AMG.

The Station armourers were responsible for the flares and pyrotechnics used by the Watch Office (and later the new Flying Control Tower), Runway Control Caravan and Station Flight aircraft. They serviced the aircraft cannon, rifles and other small arms held by the Airfield or personally owned



Armourer cleaning a 20mm canon barrel



Fire crew training

by the officers. The gun butts used for harmonising aircraft guns were next to where Hangar 5A is today.

Another of their responsibilities was bird control. Geoff Monahan, who served as a Station Armourer as well as with 72 and 601 Squadrons, remembers the Deputy Armaments Officer ordering large quantities of mothballs, which were supposedly effective in deterring birds. This proved to be an old wives' tale and caused much merriment!

Then as now, rabbits were also a big problem. Myxomatosis was introduced to curtail their numbers. A Land Rover made daily patrols to pick up the carcasses. Groundcrew from 111 Squadron also recall illicitly poaching hares around the Airfield with a crossbow.

The Service Police manned the Guardroom at the Main Gate. They also periodically kept an eye on a hole in the fence further along the Epping Road, which several generations of airmen recall as handy for getting back onto the Airfield after hours. The unlucky ones ending up in a cell for the rest of the night. Each squadron also had its own Disciplinary NCO for handling minor misdemeanours.

With several hundred acres of grass to keep cut, there was a range of vehicles and tractors maintained by the Motor Transport Section workshops. As well as mowers, the tractors towed fuel bowser trailers and could also be used as aircraft tugs.

There were also staff cars, a variety of light utility vehicles for transporting supplies, mobile cranes and dedicated bowsers, including the larger 6-wheel Matadors used later for fuelling the larger capacity jet fighters with Avtur.

The Fire Section used a range of vehicles as well. During World War 2 this was based in what is now Booker's car park with an Emergency Water Supply tank nearby (and still in use). The 240 Building next to the Control Tower was built in the 1950s as the new Fire Station, and continues in that role today. The Sick Bay, Gas Decontamination Section and Ambulance Garage was adjacent to Hangar 1 where the Bassett Business Park is situated. A larger Sick Bay was later dispersed to Thornwood. A Standby Set generator was also available for providing power in an emergency. Parachutes were routinely carried by aircrew, and had their own Section for airing, servicing and repacking. This was in a building now covered by Booker's car park. WAAFs were frequently used as packers. It was customary to tip a packer 10 shillings after a successful bale out!

The engine workshops and test shed were next door, where Hangar 5A now stands, and could prepare new engines or service ones not requiring a return to the manufacturer. There was a separate Blacksmith's shop nearby.

The Station Commander's office was in the house which is now the Airfield Museum next to the old Main Gate. The Intelligence and Photographic Sections along with the Wing Commander's office and briefing room were based at what is now Hangar 4A. Each squadron also had offices adjacent to their flight dispersals with their own Adjutants and Intelligence Officers. The Station Flight consisted mostly of liaison aircraft and was based in Hangar 1. In the 1950s it included an Airspeed Oxford, Tiger Moth, Meteor F8 and a Vampire T11, XE856, which can be seen at the Bournemouth Aviation Museum.

Everyone also had to be fed, and the cookhouse and main messes were next to the Parade Ground and H-Blocks for accommodation. NAAFI wagons went around the dispersals with tea and sandwiches during the day. These were also run by voluntary organisations such as the YMCA and the Church Army. The Officers' Mess was across the Epping Road, and is currently the *Norway House* hostel. The *Drury Lane* theatre/cinema was on the south eastern side of the site.

After a direct hit during the Battle of Britain the Sector Control Room was relocated to Blake Hall along with its direction finding organisation. It was later moved to the ROTOR bunker at Kelvedon Hatch. (*See Issues 17 and 21 for specific articles.*) There were also RAF Regiment Anti-aircraft and Ground Defence Squadrons (*Issue 22*), along with a Bomb Disposal Flight (*Issue 20*) based here too. The Station really was an extremely diverse community. ■

# Differing priorities to resist attacks

## The need for airfield defence led to a bitter battle over resources...

During the 1930s budgetary constraints, inter-service rivalry and a lack of awareness of the seriousness of the potential threat, meant that provision for the defence of RAF airfields and installations against air or ground attack was seriously lacking. As the Nazi threat intensified, all the armed forces were expanded, putting a strain on the allocation of resources and suitably trained personnel.

In theory, the Army was responsible for defending airfields, but this often proved to be impossible in practice because manpower and weapons were not available. Generals were more concerned with using scarce light anti-aircraft guns to protect their own field formations from enemy air attack.

The RAF realised that ultimately it had to rely on its own protection, and 100 airmen on each station were trained as ground gunners. These were formed into flights and squadrons for anti-aircraft and ground defence duties.

Around 70% of the weapons available were obsolete World War 1 Mark VII Lewis guns supplemented by more modern Vickers K machine guns. Neither were equipped with suitable ground mountings. Even the RAF's Lee Enfield rifles had been taken back by the Army in 1937.

The RAF's 0.303-inch ammunition was supplied in boxes belted for re-arming aircraft, and extra time was needed to fill the drum magazines of these ground-based guns.

The *blitzkrieg*, which resulted in the fall of France, showed just how vulnerable aircraft on the ground were to bombing and strafing attacks. Paratroops were also used extensively in the conquest of Holland and Belgium, seizing bridges, other key points and airfields, to which more troops were then flown by Junkers Ju 52/3m transports or landed by glider.

Small numbers of 20mm Hispano cannon were belatedly released for anti-aircraft use, but were issued with ball ammunition rather than explosive shells. Rough and ready conversions of lorries with crude armour provided basic protection and mobility for the airfield local defence flights.

The most numerous version was called the *Armadillo*, which consisted of a double skinned wooden box structure with the six-inch gap between the layers filled with gravel to protect the occupants. This was mounted on the flatbed of a lorry, with mild steel armour forming the cab! The Mark III version

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was based on the Bedford 3-ton truck and was fitted with a 37mm Coventry Ordnance Works cannon, the COW gun.

Other extemporised vehicles used concrete six inches thick reinforced with three sheets of expanded metal to stop small arms fire. These concrete lorries were generically known as *Bisons*. Many were made by Concrete Limited in Leeds.

Another light armoured vehicle in use on airfields was the Standard *Beaverette*, adapted from a motor car chassis. The 11 mm of steel was reinforced with a 3-inch backing of oak planks. Some were armed with surplus quadruple machine gun turrets from Defiant fighters.

Young Soldier battalions allocated by the Army to airfields often consisted of recruits who had never fired a rifle, and were therefore not allowed to carry live ammunition on guard duty. At North Weald, nine such teenagers from C Company,

3-inch 20 cwt anti-aircraft guns like this were used to defend North Weald in 1940



Bison concrete armoured lorry



Beaverette with a Defiant turret



7th (Home Defence) Battalion of the Essex Regiment were killed by a direct hit on a shelter on 24 August 1940. They are commemorated by a plaque in Hampden Close.

By way of a contrast, in 1939 the *Luftwaffe* had around two-thirds of its 1.5 million personnel fully trained as anti-aircraft gunners, support troops or parachutists.

In May 1940, North Weald had just four old 3-inch 20 cwt anti-aircraft guns, including one purloined from the Whippis Cross Drill Hall! These were in a battery position known as A3 to the east of the Airfield at Chase Farm with four octagonal emplacements and a control room for range finders and predictors. They were manned by 285th Anti-Aircraft Battery of the 90th AA Regiment, Royal Artillery. By November 1941 they were redeployed elsewhere and the position left vacant. A mixture of shrapnel and high explosive shells were used.

In August 1940 the anti-aircraft defences were augmented, and now included twelve machine guns along with three 40mm Bofors guns. By October two additional Bofors guns had been deployed. Eventually, the Lewis guns would be replaced by Brownings. In 1941, three Pickett-Hamilton Forts – a form of disappearing pillbox – were also installed at a cost of £200 each, plus additional fixed pillboxes.

Other desperate measures which were adopted included the Rocket Parachute and Cable device (PAC). This consisted of a rocket which fired a thick steel cable 400 feet into the air with a parachute on the end, which would tangle with the wing of an aircraft and bring it down. These were arranged in batteries on the main approaches to an airfield and were fired remotely by an electric switch in barrages of 25 rockets. Development flying for the weapon was carried out by the famous Canadian pilot Johnny Kent while he commanded the Defence Department Flight at the RAE Farnborough.

In June 1940 PACs were deployed at eleven airfields and nine factories. These were used until 1942, and actually brought down only one aircraft, with another damaged. This German pilot describes being attacked by PACs at RAF Kenley: "Suddenly red-glowing balls rose up from the ground in front of me. Each one trailed a line of smoke about one metre thick behind it, with intervals of 10 to 15 metres between each. I had experienced machine gun and flak fire often enough, but this was something entirely new." By the end of 1941 PAC batteries were in place at 59 airfields, along with eleven at aircraft factories and other vital installations.

Machine guns using a variety of different mountings and the various types of cannon formed the main defence. RAF gunners succeeded in bringing down 15 aircraft during the Battle of Britain, with another six damaged.

Lessons learned from the German airborne assault on Crete led to the allocation of three Vickers Mark VI light tanks in June 1941 to strengthen the mobile defences. Twin Browning machine guns were also introduced.

The RAF Regiment was finally founded in 1942 from the various station defence squadrons and anti-aircraft flights, to provide a more cohesive defensive capability. It was made up of light anti-aircraft (LAA), rifle and armoured car squadrons.

As part of the reorganisation, 2779 (Anti-Aircraft) Squadron arrived at North Weald from Netheravon, converting to the Bofors 40mm LAA guns in 1943 before it moved down to Cornwall. 2830 Squadron came to the Airfield from Southend, swapping places with 2779 Squadron to carry out training from November 1942 until February 1943. This unit ended the war at Gardermoen and Bardufoss in Norway.

2715 (Anti-Aircraft) Squadron moved to North Weald from Bolt Head, Devon, in early June 1943 after converting to the LAA role from ground defence, and had a detachment based at Hunsdon. LAC John Hall from this Squadron was killed at North Weald on 3 September. The unit went to Manston in December, and later served in Europe with the 2nd Tactical Air Force (2 TAF).

2729 was a Defence Squadron, which came to North Weald from Waddington in 1942 and moved on to Tangmere in April 1943. It was one of the squadrons which went to the continent with 2 TAF, securing and defending airfields as the Allies advanced. It helped to capture the Focke Wulf design team including Professor Kurt Tank at Bad Eilsen in April 1945, and disbanded at Gatow in Berlin during 1946.

2819 Squadron arrived in October 1943 from Gravesend. After spending the winter training, it went to Swanton Morley in February 1944. This squadron was armed with Hispano 20mm cannon.

Another Defence Squadron – 2777 – arrived from Eshott in March 1943 and departed for 130 Airfield during May 1944 in the lead-up to the invasion. This designation was for the airfield which would operate the Mustang Mark Is of 2, 4 and 268 Squadrons after they departed from North Weald to join 35 (Reconnaissance) Wing, 2 TAF. Initially this was

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Odiham, then Gatwick. The HQ of 130 Airfield was also based here from mid-November 1943 to February 1944.

Other LAA squadrons based on the Airfield included 2840, which was also at Bradwell Bay, 2704 and 2723. The last two were both here during 1945, the latter for disbandment at the end of the war.

The RAF Regiment suffered constant and fierce opposition from the Army for the allocation of men, vehicles and weapons, including the more effective 40mm Bofors guns, which were made up of squadrons of twelve guns. Its establishment strength was subsequently cut back several times and trained personnel transferred to Army battalions and anti-aircraft batteries against their will at the behest of Winston Churchill, Epping's MP. ■

## Targets for the guns

### The anti-aircraft co-operation squadrons at North Weald...

The extensive anti-aircraft defences around London and the numerous airfields in the region required the calibration of radars as well as the use of aircraft to represent simulated targets and tow drogues for live firing exercises. Mobile radar Ground Controlled Interception (GCI) personnel were also being trained at nearby RAF Chigwell ready to support the operations of the 2nd Tactical Air Force in Europe after D-Day. Aircraft from several squadrons were at North Weald on detachment from 1944 onwards to perform these tasks.

Anti-aircraft calibration flights were carried out by 116 Squadron during the summer of 1944, while London was being threatened by massed attacks of the V-1 Flying Bombs. Many of these were shot down by radar-controlled anti-aircraft guns using the new VT proximity fuses.

No. 17 Armament Practice Camp was temporarily based at North Weald during August to train pilots in the use of the recently-introduced gyro gunsight. This was the new

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designation of the former 1488 (Fighter) Gunnery Flight, which used Dengie Flats near Bradwell Bay as a range.

Anti-aircraft co-operation flights and target towing were carried out by a detachment from 285 Squadron during 1944 and 1945, 287 Squadron (for the Armament Practice Camp in August 1944) and 288 Squadron (August to November 1944). Serving at North Weald during 1945 was 1494 (Target Towing) Flight. 695 Squadron was at the Airfield in 1946 and 1947.

These units operated a variety of aircraft including Tiger Moths, Airspeed Oxfords, Hurricanes, Spitfires, Miles Masters and Bristol Beaufighters to represent different sized targets travelling at varying speeds. Miles Martinets, Lysanders, Vultee Vengeances and Hawker Tempests were used to tow target drogues for live firing exercises. ■

# Solid defences

## The surviving legacy from the threat of invasion...

Some of North Weald's pillbox defences still remain. Most of them are sited on the eastern side of the Airfield. The majority are the common hexagonal Type FW3/22, made of brick and concrete with loopholes on five sides and a doorway. Some were subsequently strengthened with a further external layer of concrete to the walls.

Other types included the circular FC Mushroom cantilever pillbox with a central brick support, which allowed a 360-degree arc of fire. One survives on Church Lane and there is another at the southern end of the Airfield in the hedgerow of the golf course. Another more substantial but unstrengthened brick and concrete Type 27 pillbox is on the hedge line near the Rayley Lane / Merlin Way roundabout.

There are also three retractable Pickett-Hamilton Forts, one of which is visible at The Squadron in the raised position. This was originally positioned on the other side of the Airfield. The second is in a small enclosure on the eastern runway safety fence and the third is in the grass next to the Hangar 2 Apron.

Other defences included a Battle Headquarters linked to a pillbox by a tunnel, which were just to the south of the runway, and a trench line defending an anti-aircraft position adjacent to where Hangar 2 now stands. These are now gone.

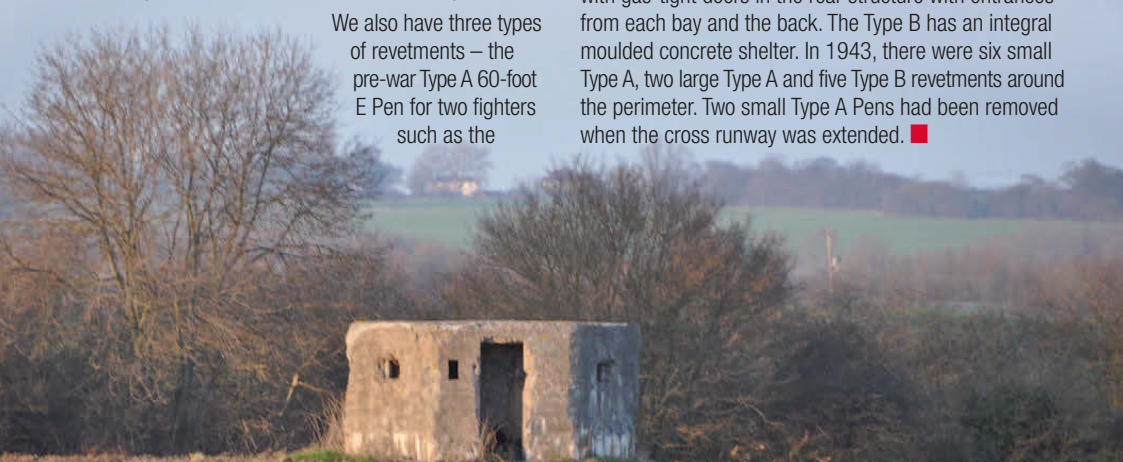
There would also have been other sandbagged anti-aircraft guns around the Airfield. One 3-inch anti-aircraft gun site was south of Vicarage Lane at Chase Farm. This comprised four large, octagonal emplacements and a command post with predictors and range finders on the roof, and was about 400 yards east of the old Airfield boundary.

We also have three types of revetments – the pre-war Type A 60-foot E Pen for two fighters such as the



Hurricane, the larger Type A 78-foot E Pen designed to hold Blenheims and the later curved Type B, one of which incorporates the Little Norway Memorial and is accessible from The Squadron. The E Pen beyond The Squadron is the large version, the two adjacent to Hangar 4A are the smaller ones and are now missing their central dividing blast walls.

The Type A Pens feature a corrugated iron air raid shelter with gas-tight doors in the rear structure with entrances from each bay and the back. The Type B has an integral moulded concrete shelter. In 1943, there were six small Type A, two large Type A and five Type B revetments around the perimeter. Two small Type A Pens had been removed when the cross runway was extended. ■





Chain Home plotter position



East Coast Chain Home control room



Chain Home radar transmitter masts

## Early warning!

### The Chain Home radar station at Canewdon protected North Weald

The single Chain Home radar station in the North Weald Sector was at Canewdon, near Southend. It was built between 1936 and 1938 to provide early warning of enemy aircraft approaching the Thames Estuary, and was one of the first five to be constructed.

RAF Canewdon provided early warning of raids on London during the Battle of Britain. The station had transmitter and receiver blocks, four 240 foot timber receiver aerial towers and four 350 foot steel transmitter aerial towers that stood on concrete pads. Other buildings included dispersed accommodation huts, guard huts and standby set houses.

This early form of radar had a range of around 120 miles using a wavelength of 12 metres (20-30MHz). Each station had a main and standby frequency, with a pair of masts allocated to each. The transmitters were made by Metropolitan Vickers, and the aerial array was in the form of a curtain slung between the pairs of towers.

The wooden receiver towers had three sets of aerials mounted on them at differing levels. Height finding was done by comparing the ratio of signal strengths from these levels. A simple calculator known as the *Fruit Machine* was

then used to calculate the height based on the signal ratio and range. The plot was then passed back to the Fighter Command Filter Room at Bentley Priory for assessment before being relayed on to the relevant Control Rooms at Group and Sector.

From 1940 defensive measures were installed at radar stations, including Light Anti-Aircraft gun emplacements, pill boxes, road blocks and air raid shelters. The Canewdon station was split into two halves, the receiver site north of Lambourne Hall Road and the transmitter site south of Gardeners Lane.

As a designated Vulnerable Point during the Battle of Britain it was defended by a platoon of the 7th (Home Defence) Battalion, the Essex Regiment, and had a 6,000 yard defensive perimeter and sixteen pillboxes. Once the danger of invasion had passed this was reduced to 4,000 yards and seven pillboxes, partly manned by the Home Guard.

From 1950 onwards, the station was used for practical training and height tests for airmen from the Aerial Erectors School at RAF Chigwell, itself a former barrage balloon centre. In all, 28 courses were held, and 560 aerial erectors were successfully trained until the School finally closed in 1956.

One of the transmitter aerials was subsequently relocated to the Marconi site (now BAE Systems Advanced Technology Centre) at Great Baddow near Chelmsford, and is the only complete Chain Home mast still in existence. Four other incomplete masts also survive elsewhere. ■



# Electronic warfare

## Trimley Heath was the North Weald Sector Ground Control Interception radar station near Felixstowe

The original Chain Home and Chain Home Low radar stations were based on the coast facing out to sea, with no coverage inland. The Observer Corps (later Royal Observer Corps) were responsible for overland reporting, which was not effective in bad weather or at night.

The Ground Control Interception (GCI) radar was designed to fill this gap, providing inland coverage to Filter Rooms, Sector Operations Rooms and Gun Operations Rooms, in addition to the local control of fighters combating enemy aircraft by day and night. The original GCIs were mobile to provide maximum flexibility from the equipment, and were the first phase of a three part programme: Mobile, Intermediate (Mobile or Transportable) and then Final.

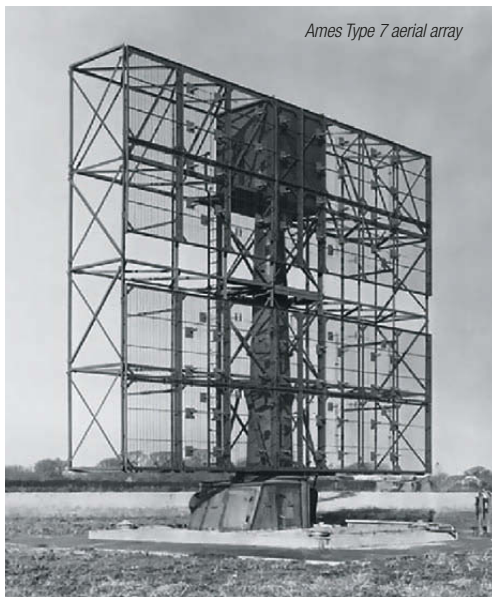
Trimley Heath, near Felixstowe was the North Weald Sector GCI station, codename *Frogspawn*. It initially functioned as an Intermediate Transportable station, which comprised a single aerial array mounted on a gantry and a non-metallic operations hut. Additional on-site buildings included a small power house, temporary offices, and a guard hut for the site entrance.

By January 1943 the site had been developed into a Final station. Final GCI or AMES (Air Ministry Experimental Station) Type 7 units comprised a single rotating aerial array with transmitter equipment stored beneath in an underground well, plus an operations block (known as the *Happidrome*), a standby set house for reserve power, and a guard post.

Joyce Deane was a WAAF who was posted to GCI duties, first of all with a Mobile station. "We worked in a small trailer in the middle of a field. Working conditions were very cramped, the consoles holding the two cathode ray tubes being very large. The "plan position indicator" at last gave us instant plots although the blips would often fade and the controller had to guess where the bomber had gone and rely on dead reckoning. The second tube gave height and range but was very difficult to read and work out on a chart. Two airmen underneath in a shed bicycling on a fixed frame rotated the aerials through 360 degrees manually – it seems incredible now!"

She later became an officer. "Now having learnt the admin side of being an officer, the technical side was to begin and I was posted to North Weald (11 Group) and its GCI at Trimley Heath just inland from Felixstowe.

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Ames Type 7 aerial array

"By this time, GCIs had proved to be effective in accomplishing controlled interceptions and had developed from the original small trailer into a fixed building – a blockhouse with no windows. Inside were two interception cabins, a chief controller's cabin, a cabin controlling aircraft from base to coast, an army cabin (guns and searchlight control) and rooms for mechanics, teleprinter, telephones and restrooms. The rooms were on different levels with three cabins looking down on the general plotting table. Everywhere was spotlighted creating a very dramatic and theatrical effect. There was no noise, except for orders being given in a tense atmosphere.

"The aerials were now powered by electricity and the size of the watch had grown from 10 to about 30 with most of the jobs being interchangeable between RAF and WAAF personnel. I was a supervisor. We were told in advance of our bomber movements and where they would be crossing the coast and also the position of convoys. The coastline guns were allowed to fire at anything unidentified flying lower than 8,000 feet and our balloon barrage was a hazard to be avoided too. We lived in civvy billets and cycled to work."

Trimley Heath controllers set up many successful interceptions of German intruders. After the war the site was reduced to care and maintenance until 1948 when it was upgraded and developed, housing some 300 personnel. It was due to be part of the RAF's *Rotor* early warning network, but the operations block was destroyed by fire in 1951, which effectively sealed the station's fate. It closed in 1955. A few of the buildings remain. ■

# UXB

## How the RAF made safe German and Allied unexploded bombs ...

Prior to the outbreak of war in 1939, the RAF was aware that not all the bombs dropped from the air would explode. Consequently, the responsibility for the disposal of these unexploded bombs (UXBs) was laid upon the shoulders of the Senior Non-Commissioned Armourers. It was assumed that when war came the disposal of enemy UXBs would be part of their duties as well.

After the first bombing raids on Britain, the RAF was made responsible for all unexploded bombs and ordnance, including Allied ordnance, and all ordnance of whatever nationality found on or near to crashed aircraft.

At the start of 1940, 80 RAF Demolition Sections existed to carry out duties on the more important airfields around the country, which were designated as 'X' (for explosive) Stations. The equipment available was primitive and minimal training was given in addition to that normally provided for Armourers. By September 1940 these had been supplemented by additional mobile squads.

The first re-organisation of the RAF's Demolition Sections then took place to tackle the increased workload caused by the *Luftwaffe's* air raids. 29 Flights were formed from the amalgamation of Sections and mobile squads, and North Weald was designated as a Bomb Disposal Flight Headquarters. The Flights became operational in October.

A further re-organisation of combining the 29 Flights into six Squadrons took place in April 1943. 6220 Bomb Disposal Flight based at North Weald became part of the newly-formed 5133 Squadron. It was later replaced by 6210 Bomb Disposal Flight, transferred in from 5132 Squadron.

On 16 June 1944 the USAAF base at Boreham reported that an 'unusual missile' had come down nearby. A squad of men from 6210 Bomb Disposal Flight investigated and collected pieces of debris, which were taken to Boreham for closer examination by intelligence officers. It was one of the first V-1 Flying Bombs, just three days after their campaign against the UK had begun!

This Flight was then superseded by 6207 Bomb Disposal Flight, which came from 5131 Squadron. All three of these Flights subsequently served in Europe. 6220 went ashore on D-Day +2. The others followed later. They were

North Weald Airfield Museum



Bomb craters south of the Epping Road in 1940

mainly concerned with making safe captured German ordnance, including many warheads from V-1 Flying Bombs and V-2 rockets across Belgium and Holland.

The work was dangerous as many had been sabotaged and the explosives left open to the elements, making them unstable. Inevitably there were casualties. One of these from 6220 Bomb Disposal Flight was Leading Aircraftman Gordon Collier, who was fatally injured when clearing a *Luftwaffe* bomb dump at Welshap Airfield near Eindhoven in Holland on 28 March 1945.

The Flights were very efficient in dealing with unexploded ordnance and their equipment enabled them to excavate to almost any depth. Many of their tools were non-magnetic or non-ferrous for added safety, and even included x-ray machines to disable fuses. They could disarm German and Allied bombs of all known types at the time.

RAF Bomb Disposal qualifying courses began in March 1940 at the School of Technical Training at Melksham in Wiltshire, where selected personnel were sent to undergo training. They were taught procedures enabling them to deal with all types of munitions. The course lasted six weeks. If the trainee passed with a mark of 65% or more, he was promoted to Corporal Armourer/Bomb Disposal.

In the first two years of the war RAF Bomb Disposal (RAF BD) made 1,512 enemy bombs safe and the specialist Officers had to deal with a further 114. All these bombs were actually dropped from aircraft. During World War 2, the largest number of UXBs disarmed by RAF BD were of British or American origin. The fuses in these bombs were just as dangerous as those in enemy bombs and sometimes more so.

When war ended in 1945, about 84,000 bombs had been dealt with in the UK and some 92,000 on mainland Europe. Many of these were British and Allied weapons jettisoned in an emergency or recovered from crash sites.

Around 8,000 airmen served with RAF BD, and 800 of these were specialist armourers. Ten lost their lives when the bomb they were working on exploded. ■

# Rolls Royce Merlin

## A war-winning engine

The Rolls Royce Merlin is arguably the most iconic aircraft engine in the world. It was a development of the earlier series of engines named after birds of prey. It was a 12-cylinder liquid-cooled Vee engine. Its immediate predecessor was the very successful Kestrel, which in its developed form had an output of 695 horsepower from a capacity of 21 litres.

The Merlin began life as the PV-12 in 1933, with the first production versions running in 1936. These were used to power the prototypes of the Hawker Hurricane and Supermarine Spitfire fighters, which were designed around this larger engine.

It had a capacity of 27 litres and produced 1,030 horsepower in the Merlin II. The fully-developed Merlin 130 produced 2,060 horsepower and was used specifically to power the de Havilland Hornet twin-engine fighter.

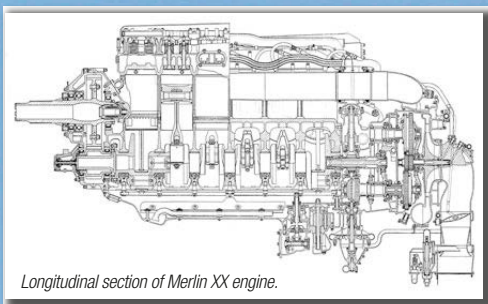
The octane ratings of fuels increased, which helped to improve performance. Even the design of the exhausts produced additional thrust, increasing the speed by around 10 mph!

In total, nearly 150,000 Merlins were produced up to 1950 in the UK and a further 37,000 by Packard in the USA. It was used in 43 aircraft types, even Messerschmitt 109s and Heinkel 111s in post-war Spain.

The first versions had a single stage supercharger, but from the Merlin XX, a two stage supercharger was introduced with an intercooler for better performance at altitude. This generated an additional 300 horsepower at 30,000 feet,



The Merlin 70 installation in the Hangar 11 Collection's Spitfire PRX1



Longitudinal section of Merlin XX engine.

and gave a Spitfire Mark IX a 70 mph speed advantage over the Mark V at the same height.

It was this combination which allowed the North American P-51 Mustang to become one of the best fighters of World War 2.

Originally fitted with an Allison engine, its performance dropped off dramatically with altitude. Rolls Royce fitted a Merlin engine to the airframe experimentally. This transformed it into a high altitude escort fighter, capable of escorting the bombers of the USAAF 8th Air Force to Berlin and back, with a performance superior to the enemy fighters it faced in combat.

The most numerous use of the Merlin was in Lancaster bombers and Mosquitoes.



A non-supercharged version was also produced to power tanks, and there was a navalised single stage engine for motor

torpedo boats and air-sea rescue launches. These were called the Rolls Royce Meteor. ■

# Other aero engines used at the Airfield

Ranging from 120 hp to 3,040 hp

## Napier Sabre

The Sabre was an H format 24-cylinder, liquid-cooled, sleeve valve, piston engine, designed by Major Frank Halford. In its developed form it produced 2,850 hp at 3,800 rpm and 3,040 hp on emergency power at 4,999 rpm. It was one of the most powerful engines of World War 2, with a capacity of 2,240 cubic inches.

The H-block provides a compact layout, consisting of two horizontally opposed engines, lying one on top of the other. Because the motion in one cylinder was balanced by the motion of the opposing one, vibration was minimised.

However the Sabre suffered from development problems and poor build quality, which led to many engine failures. It was first used in the Hawker Typhoon, which also suffered structural failures to the tail section, so the combination was understandably unpopular with squadron pilots!

Napier was subsequently taken over by English Electric and the production difficulties solved, but the engine only received widespread use in the Typhoon and later Tempest V. It was really effective up to 20,000 feet after which the performance dropped off. Typhoons were flown by 486 (New Zealand) Squadron briefly at North Weald in 1942, while 287 Squadron operated Tempest target tugs here during 1944 and 1945.

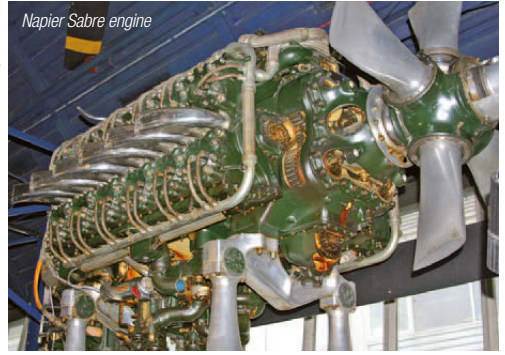
## De Havilland Gipsy Major

The Gipsy Major is a four-cylinder, air-cooled, inline engine, which is designed to run inverted, and was a development of the earlier upright Gipsy III engine. This allowed the propeller shaft to be kept high without having the cylinders blocking the pilot's forward view. It produces 122 hp from a capacity of 373.7 cubic inches. By 1945 the Gipsy Major had been cleared for a then world record of 1,500 hours Time Between Overhaul (TBO)

The engine was used on many light aircraft types from the 1930s to 1950s, including the de Havilland Tiger Moth and Chipmunk trainers used by the RAF, the Dragon Rapide and various Miles aircraft. Over 14,600 were built.

## Armstrong Siddeley Cheetah

The Cheetah Cheetah was a seven-cylinder air-cooled radial engine of 834 cubic inches capacity, and produced 345 hp at 2,425 rpm at 7,875 feet. The engine was first introduced



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in 1935 and continued in production until 1948. It powered several civil aircraft, and its main RAF use was with the ubiquitous Avro Anson and Airspeed Oxford trainers.

The Cheetah was developed from the earlier Lynx using the increased bore cylinders from the Armstrong Siddeley Panther. In all 37,200 examples were manufactured. Superchargers were available for the later variants as well as propeller reduction gear of various ratios.

## Pratt & Whitney Double Wasp R-2800

The Double Wasp R-2800 was the United States' first



Station Flight Tiger Moth

18-cylinder radial engine design and first ran in 1937. Its twin row of cylinders produce up to 2,400 hp from a displacement of 2,800 cubic inches.

To improve cooling on the twin-row design, thinner and closer-pitched cooling fins were machined from the solid metal of the head forging, rather than being cast as was the previous practice. A total of 125,334 R-2800 engines were produced between 1939 and 1960, and they are still in regular use today.

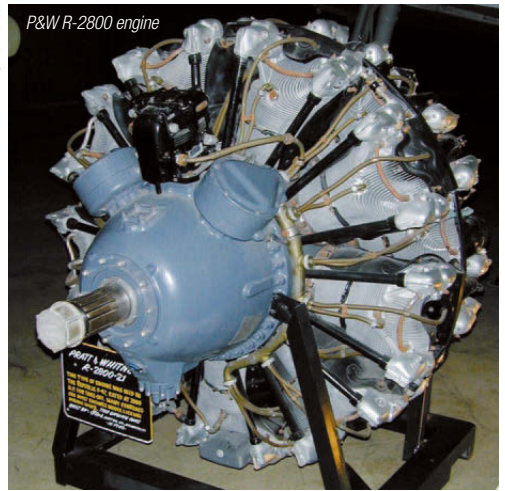
The engine was used on many famous US fighters including the P-47 Thunderbolt, Vought Corsair and Grumman Hellcat, Bearcat and Tigercat. It powered the Lockheed Ventura and Martin B-26 Marauder bombers and the Vickers Warwick transports (operated by the Polish 301 and 304 Squadrons at North Weald) along with the Douglas DC-6 and Lockheed Constellation airliners.

### Pratt & Whitney Wasp R-1340

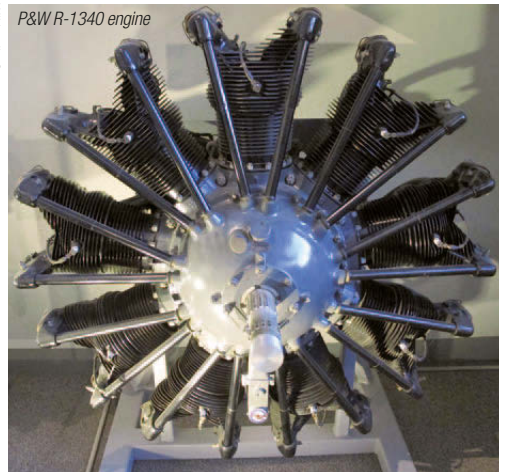
The Wasp R-1340 is a single-row, nine-cylinder, air-cooled, radial engine, which displaced 1,344 cubic inches and produced 600 hp and 2,250 rpm.

It was the Pratt & Whitney's first engine design and dated from the 1920s. A total of 34,966 R-1340s were produced. It was used to power numerous aircraft types, most notably the North American T-6 Texan / Harvard

*T-6 Harvard KF709 was used by 604 (County of Middlesex) Squadron at North Weald as a trainer and wears the yellow wartime training scheme, roundels and tail flash*



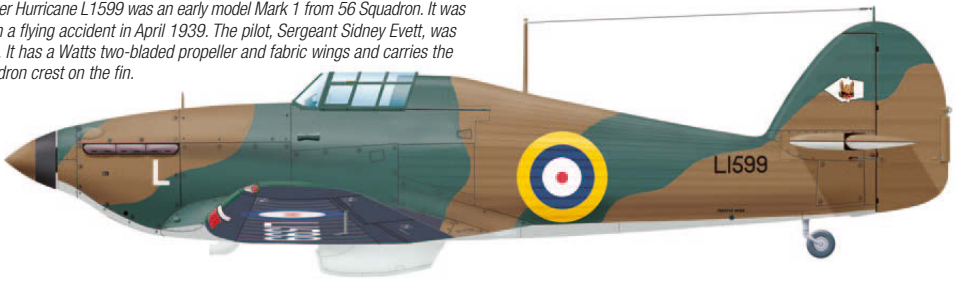
P&amp;W R-2800 engine



P&amp;W R-1340 engine

trainers. 601 and 604 Squadrons flew these at North Weald while equipped with Spitfire XVI's. The engines were also fitted to several helicopters including early versions of the Westland Whirlwind. ■

Hawker Hurricane L1599 was an early model Mark 1 from 56 Squadron. It was lost in a flying accident in April 1939. The pilot, Sergeant Sidney Evett, was killed. It has a Watts two-bladed propeller and fabric wings and carries the Squadron crest on the fin.



# Aircraft types operated from North Weald

From fighters to transports...

## The Hawker Hurricane

The Hawker Hurricane was the RAF's first new generation monoplane fighter which flew in 1936, powered by the Rolls Royce V-12 Merlin engine, giving it a top speed of around 320 mph. The original Mark 1s were fitted with fabric covered wings. These were subsequently upgraded with all-metal ones.

The early Hurricanes also had fixed pitch two-bladed Watts propellers. Again, these were replaced at first by two-pitch three-bladed propellers and then constant speed units to improve performance.

The Mark 1 was armed with a battery of eight Browning machine guns, with sufficient ammunition for 14 seconds firing. It proved to be a very stable gun platform. The guns were laid out in close proximity to each other, which provided a good concentration of fire in action, and meant that they were also easy to rearm.

56 Squadron was the first unit at North Weald to receive the new type in May 1938, which was the most numerous fighter used during the Battle of Britain. The first two cannon-armed Hurricane prototypes were also tested at North Weald by 151 Squadron at this time.

## The Bristol Blenheim IF

The Bristol Blenheim started life as a fast, light bomber powered by two Bristol Mercury engines. During the RAF's frantic expansion in the late 1930s it was also converted into a long range fighter by bolting a four gun pack into the bomb bay. At the start of World War 2 it carried out convoy patrols.

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© IWM (HU 104652)



During the Battle of Britain it was used as a night fighter as it did not have sufficient performance to survive against the *Luftwaffe* Messerschmitts and also bore a passing resemblance to the Junkers 88, which made it vulnerable to attack from RAF fighters as well! The type was later fitted with an early form of airborne radar.

The Blenheim was flown by 25 and 604 Squadrons from North Weald during 1939 and 1940. John Cunningham was one of 604's pilots and later became one of the top scoring nightfighter aces and the Squadron's CO.

## The Supermarine Spitfire

The Supermarine Spitfire gradually superseded the Hurricane as Fighter Command's primary fighter. In August 1941, 71 (Eagle) Squadron swapped its Hurricanes for Spitfire Mark IIs. The type was constantly developed and the Mark V and Mark IX were both flown from North Weald, especially by the Norwegian fighter squadrons – 331 and 332.

Supermarine Spitfire LFXVI RW382 of 604 (County of Middlesex) Squadron in the post-war silver scheme. This Spitfire survives and operates from Biggin Hill in a high back configuration



## Hawker Typhoon

The Typhoon was designed as the replacement for the Hurricane and first flew in 1940. Its more powerful Napier Sabre engine had many developmental problems and the aircraft also suffered from structural failures of the rear fuselage which delayed its entry into service.

The aircraft had a good performance at low altitudes, but was lacking higher up so came to be used in the ground attack and anti-shipping roles where it excelled. When armed with unguided rockets it became a formidable tank-buster, well-known from the Normandy campaign. No 1 Squadron and 486 (New Zealand) Squadron both flew the type briefly from North Weald.



## North American P-51 Mustang

The Mustang was based on a British fighter specification and first flew in just 102 days in October 1940, entering RAF service in 1942. It was initially powered by an Allison engine, which lacked performance at higher altitudes. Because of its long range the Mustang was used in RAF service as a tactical reconnaissance and ground attack aircraft and was the first Allied single-seater to fly over Germany since 1940. Fitted with a Rolls Royce Merlin it became a superb long-range escort fighter. Six squadrons operated the type from North Weald, mainly in the TacR role, later moving south to join the 2nd Tactical Air Force.



## Vickers Warwick

The Warwick was a twin engine heavy bomber developed in parallel with the smaller Wellington. While the Wellington went on to a successful operational career as a bomber, anti submarine patrol aircraft and trainer, the Warwick languished due to a lack of suitable engines. It eventually used Pratt & Whitney R2800 Double Wasp engines.

Only 235 were built, with many entering storage. It did see limited service as an air sea rescue aircraft carrying an airborne lifeboat, but most were converted to the transport role. Two Polish squadrons – 301 and 304 – operated the type from North Weald in 1945. ■

The Mark IX Spitfire Merlins were fitted with a two-stage supercharger, which was recognisable by a longer engine cowling and six exhaust stubs per side rather than three. This was difficult to make out in combat, which gave them a tactical advantage when the type was first introduced.

The only Griffon-engined Spitfires to operate from the Airfield were Mark XIVs flown by 130 Squadron, which was based here briefly to re-equip in May 1945.

Low back Mark XVI's were the last of the type to operate from North Weald when 601 and 604 Squadrons of the Royal Auxiliary Air Force moved in from Hendon in 1949.

# Hangar space

## The later types at North Weald...

### Type A Aeroplane Shed

The Type A aeroplane shed was built on permanent RAF airfields from 1925 until 1940 and the first of the permanent end-opening hangars of the interwar period. It was superseded by the much larger Type C in the mid-1930s, which was designed to house bomber aircraft.

The basic structure was a steel shell, with stanchions supporting steel-framed roof girders forming a ridge-and-valley roof. Walls were usually infilled with concrete with a glazed strip high up. The gable ends were made of brick and supported on RSJs.

The doors were steel and formed of four leaves and had an armoured cladding on the lower portion. They could be opened to the full width. Single storey workshops and flight offices were usually built along the side walls. Typically, they had a length of 249 feet, a span of 122 feet 5 inches, and a clear door height of 30 feet.

Two Type A Hangars were built at North Weald, and only one survives. The shrapnel damage from the bombing raids of 1940 is still visible on the armoured doors.

### Type T2 Transportable Hangar

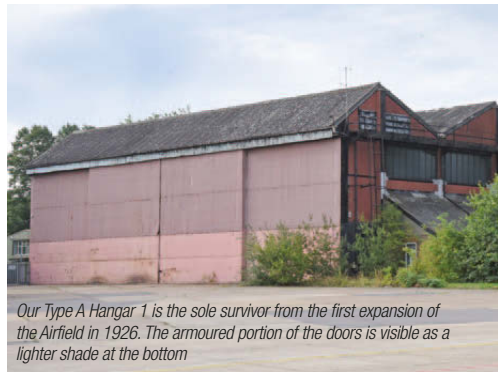
The Type T2 transportable hangar (often just called the 'T2') were designed to be easy to manufacture, erect and move to a new location. The first was erected in 1940, with 906 manufactured for RAF stations in the UK and abroad. They could accommodate the largest aircraft of the time.

As with other Type T hangars, the T2 was jointly developed by the Air Ministry and Teeside Bridge & Engineering Works. Construction was in steel covered in galvanised corrugated iron, with a span of 113 feet 6 inches, clear height of 25 feet and a length of 135 feet 5 inches or 239 feet 7 inches.

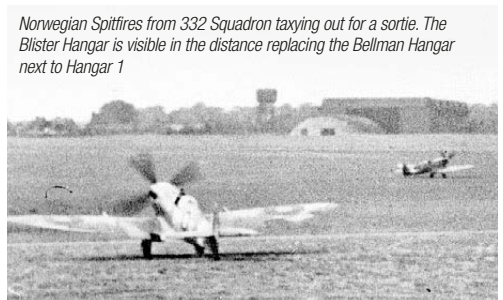
North Weald's T2s (Hangar 2 and Hangar 4) were moved here in the 1950s to accommodate the two Royal Auxiliary Air Force squadrons, which came here from Hendon.

### Blister Hangar

Blister Hangars were open ended curved structures 45 feet long, 70 feet clear opening and 20 feet high. They were designed by notable British airport architect Graham Dawbarn and patented by Miskins and Sons in 1939. Originally made of wooden ribs clad with profiled steel sheets, steel lattice ribs and corrugated steel sheet cladding were later used instead. They did not require a foundation



*Our Type A Hangar 1 is the sole survivor from the first expansion of the Airfield in 1926. The armoured portion of the doors is visible as a lighter shade at the bottom*



*Norwegian Spitfires from 332 Squadron taxiing out for a sortie. The Blister Hangar is visible in the distance replacing the Bellman Hangar next to Hangar 1*

slab and could be anchored to the ground with iron stakes. North Weald had twelve blister hangars dotted around the various dispersals, where aircraft could be maintained under cover and supplies stored.

### Bellman Hangar

The Bellman Hangar was designed in 1936 as a light transportable shed for use in war by N Bellman, who was an Air Ministry Directorate of Works structural engineer. The brief stated that it had to be capable of mass production and have interchangeable parts to permit rapid erection and dismantling.

Its general dimensions were 175 feet long, 95 feet wide (87 feet 9 inches clear width) and 25 feet clear height. The hangar was constructed in 14 bays at 12 feet 6-inch centres using a unit system of rolled steel sections. Both walls and roof used the same standard units joined at the junction of wall and roof by a standard corner unit.

From 1938 to 1940 some 400 Bellman hangars were built. There was just one at North Weald, which was situated between the two Type A Hangars. It seems to have been destroyed in an air raid in 1940 as subsequent wartime and post-war pictures show a blister hangar in this location. The site is now occupied by Hangar 5, which came from the Glosters aircraft factory at Brockworth. ■