Discuss the Development of Hethel Airfield During the Second World War.

A wall mural of Liberators crossing the sky at Hethel airfield.

Contents

Figures

Introduction

Development

Evolution

Legacy

INTRODUCTION

On 11 December 1941, Germany declared war on America.[1] In retaliation, over a million American servicemen were deployed to England for *Operation Bolero*. As various units of the United States Army Air Force amassed in East Anglia requiring bases from which to launch their campaigns, the pressure to construct airfields heightened. When Hethel airfield became operational in 1943, the local community found themselves living next to a modern and industrious microcosm. Efficiency, technology and a modern infrastructure were just a few fields away and after months of surveying, planning and construction, the landscape of Hethel changed forever. Miles of hedgerows, and areas of woodland were ripped out to make room for signature features such as runways, hard stands and bomb dumps. Elements were modernised and developed throughout the war with an ever increasing need for efficiency, austerity and a need alleviate the over reliance on various manufacturing processes. As these changes were implemented, the design of the airfield changed with them.

Although much is written on the archaeology of airfields in this period, there is very little focus on their impact. This project will study how Hethel airfield was impacted by these chronological developments during its wartime occupation 1943 to 1945.

HISTORICAL CONTEXT

With the collapse of the Geneva disarmament conference in 1933 and the bombing of Guernica in 1937, the power of the German air force was all too realised as was the need for a defence strategy.[2] With the growing threat of war in Europe, Britain implemented an expansion period of aircraft, airfields and personnel. In 1940 the bombing of Pearl Harbour brought America and her military power into the war. The process of airfield expansion

[1] Clarke, B. *The Archaeology of Airfields* (Stroud:2009), p.125.
[2] Holland, M. A. *Sweatin' Out The Mission: 8th Air Force Ground Support In World War Two* (Stroud:2010), p.8.

intensified in preparation of *Operation Bolero* and the proliferation of thousands of Americans who arrived over 1942 and 1943.[3] When they arrived, most of the USAAF bomber forces were concentrated in East Anglia, with a particular concentration in Norfolk and Suffolk.[4] The airfield expansion was such that in 1939 Britain had approximately one hundred and fifty airfields.[5] The peak of construction occurred in 1942 when, on average, one airfield was delivered every three days. By the end of the war in 1945 the total amount of airfields totalled over 700. Of these, the USAAF occupied 150.[6]

The protrusion of East Anglia into the North Sea meant it had a geographical advantage to the rest of Britain. Its location allowed heavy bombers to penetrate further into enemy territory. The fewer miles Liberators had to travel was beneficial, particularly when carrying tonnes of bombs, aviation fuel, ammunition and a crew of ten men. Hethel is positioned in Liberator country in south Norfolk. Its advantageous position meant it was one of the earliest heavy bomber airfields built in Norfolk for USAAF assignment.

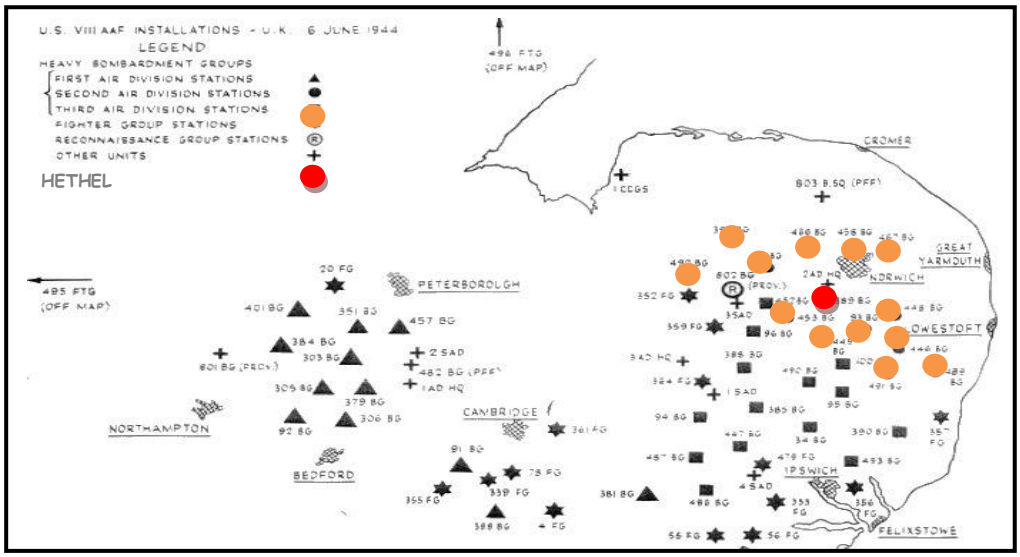

Figure 1: map of USAAF installations across East Anglia. Second Air Division airfields are picked out in orange and Hethel in red.

[3] Clarke. *Archaeology of Airfields*, p.140.
[4] Bodle, P. & Wilson, P. *The 389th Bomb Group in Norfolk: A pictorial history of the USAAF's 389th Bombardment Group at Hethel, during WWII* (Stoke Ferry: no date), p.61.
[5] Dobinson, C.S.. 'Airfield defences in WWII' Twentieth Century fortifications in England Vol.X (Newark:2000), pp.2-6.
[6] Holland, *Sweatin' Out The Mission,* p.25.

After months of surveying, planning and construction, Hethel airfield was ready to accept the 389th Bomb Group, nicknamed the 'Sky Scorpions'. They arrived June 1943[7] and it was this point that Hethel became an integral and active participant in the war against Germany. However, as the war progressed, the demand on each airfield grew and bomb groups flew with other crews from satellite airfields to help alleviate the pressure. The 389th bomb squadrons at Hethel flew campaigns with fellow Liberator crew from nearby airfields at Tibenham and Old Buckenham.[8]

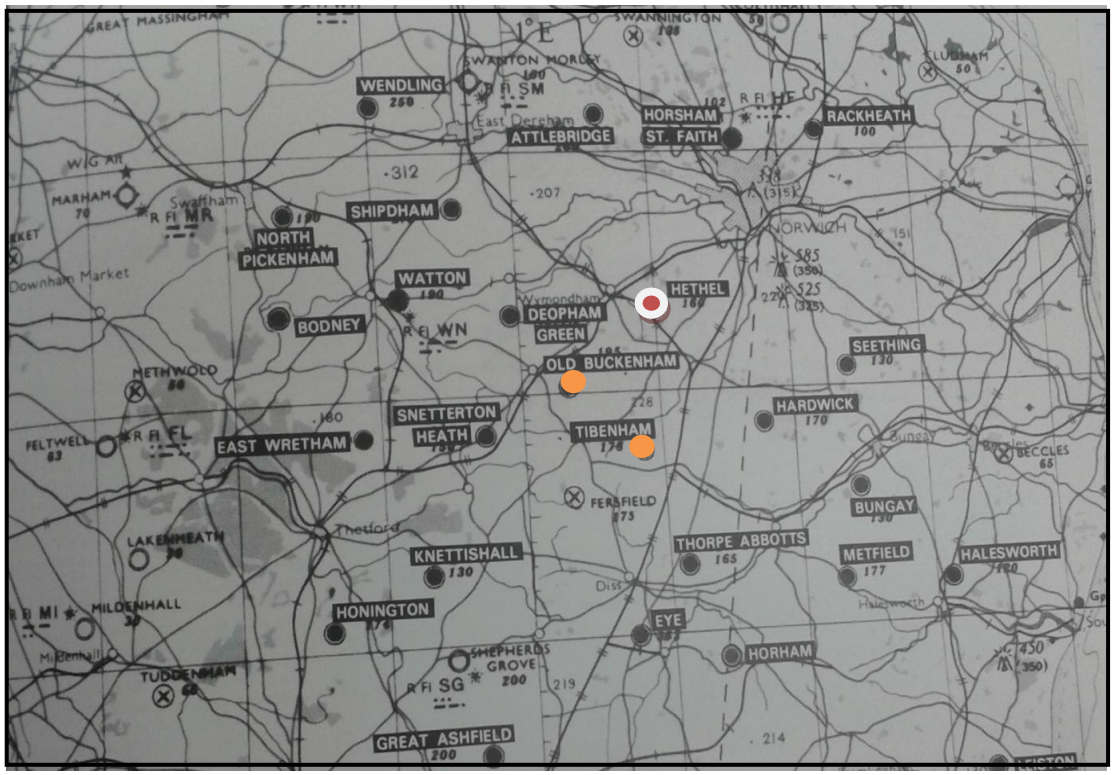

Figure 2: Map showing locations of Hethel, Tibenham and Old Buckenham airfields.

Dobinson's report states that both Hethel and Tibenham predate Old Buckenham and maps from all three airfields will be studied to assess if this is reflected in their layout. Although much has been written on Hethel, there has not been a study of the chronological impact of the Second World War upon the landscape. Conducting this study meant

[7] Bowman, M. *Airfield Focus 53: Hethel* (Peterborough:2002), p.124.
[8] Dobinson, C.S. 'Airfield Themes', *Twentieth Century Fortificationsns in England*, Vol IX 2, (Newark:2000), p.287.

drawing upon contemporary maps, plans and aerial photographs, secondary literature and empirical research 'in the field', this study of Hethel has been an interdisciplinary process and the above materials will feed into it.

DEVELOPMENT

Hethel is isolated, wooded and rural. Its flat terrain and position along a belt of landscape characterised by its 'poor soil and relatively high relief'[9] meant it had all the components required by a heavy bomber airfield. Essentially, Hethel's close proximity to important transport links enabled the movement of essential supplies from the capital and beyond via the main London road or by train from Wymondham. The site was earmarked and a large area of farmland was requisitioned in 1941. By the time it was handed over to the 389th bomb in 1943, the airfield site had been surveyed, planned and designed. What ensued was an intense period of construction in accordance with guidelines set by the Air Ministry.

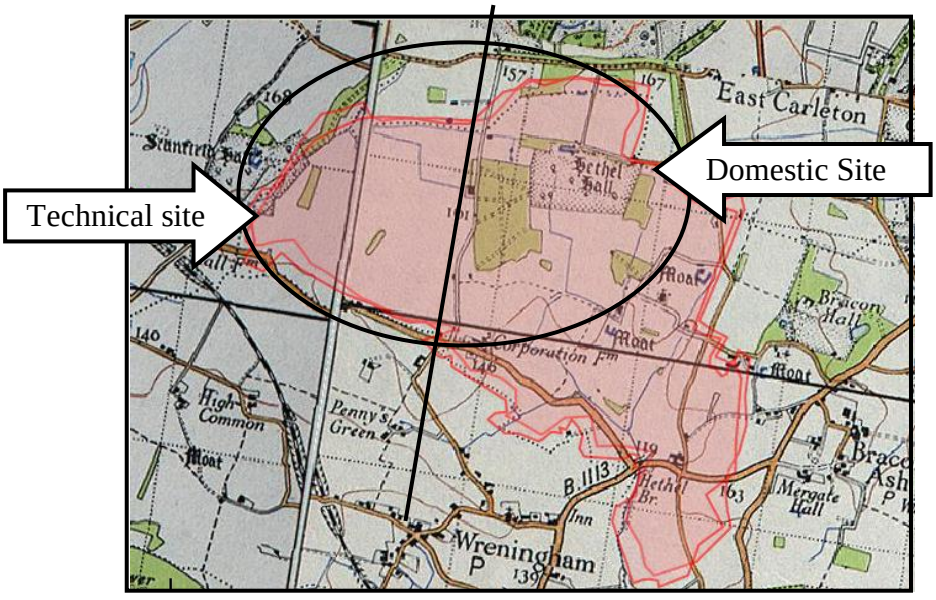

Figure 3: Map of Hethel parish showing characteristics essential for airfield construction. It is rural and isolated with a sparse population. The site of the airfield is circled and crudely divided to indicate the areas designated for the technical site to the west and domestic site to the east.

[9] Liddiard, R. *The Norfolk Deer Parks Project: Report for the Norfolk Biodiversity Partnership*, (2010), p.6.

HEDGEROWS

One of the first transformations to impact the Hethel landscape was the removal of hedgerows to accommodate the runways. The design of airfields evolved as the war demanded different things from it and from the landscape it sat within. Therefore, the introduction of heavy bombers and concrete runways meant that swathes of land were cleared to make way for them and the network of subsidiary buildings that maintained and supported them.

First edition OS map: 1879-1886[10] 1940s map[11]

Figure 4: Hethel where '... almost every hedge, wood, heath and fen ... on the Ordnance Survey ... maps of 1870 is still there on the air photographs of 1940.'[12] It also highlights the binary characteristics of the Hethel site. The hedgerows and part of the nut grove to the west were removed to make way for the runways. Hethel Wood and the hedgerows to the east were essential for camouflaging the domestic sites.

To gauge the mileage of hedgerows lost, the Norfolk County Council's Historic Map Explorer website was invaluable. It provides a facility to overlay various maps and compare them simultaneously which made the task comparatively simple. By overlaying the 1946 aerial photograph of the airfield over the OS map from the late nineteenth century, it was possible to track any discrepancies. By analysing changes to landscape so closely, the binary characteristics of the technical and domestic sites were highlighted.

[10] Norfolk County Council, Available at: http://www.historic-maps.norfolk.gov.uk/mapexplorer/ (accessed 1 November 2015).
[11] Edina, 'Ancient Roam'. Available at: http://digimap.edina.ac.uk/roam/historic, (accessed 1 November 2015)
[12] Rackham, O. *The History of the Countryside: The classic history of Britain's landscape, flora and fauna*, (London: 1986), p.26.

This interpretation could be furthered by dividing them into rural and urban spheres, although this could be too simplistic. The two are certainly interconnected. The positioning of hard stands and the layout of the barracks were both governed by field boundaries that preceded them by decades.

The tool used to gauge the amount of hedgerows removed was a little crude. However, inaccuracies withstanding, I calculated that 11.93 miles (19.2km) of hedgerow was extracted in preparation for the airfield technical site. It must be noted that some crop marks were undistinguishable from old hedgerows, so the calculations are only a rough guide.

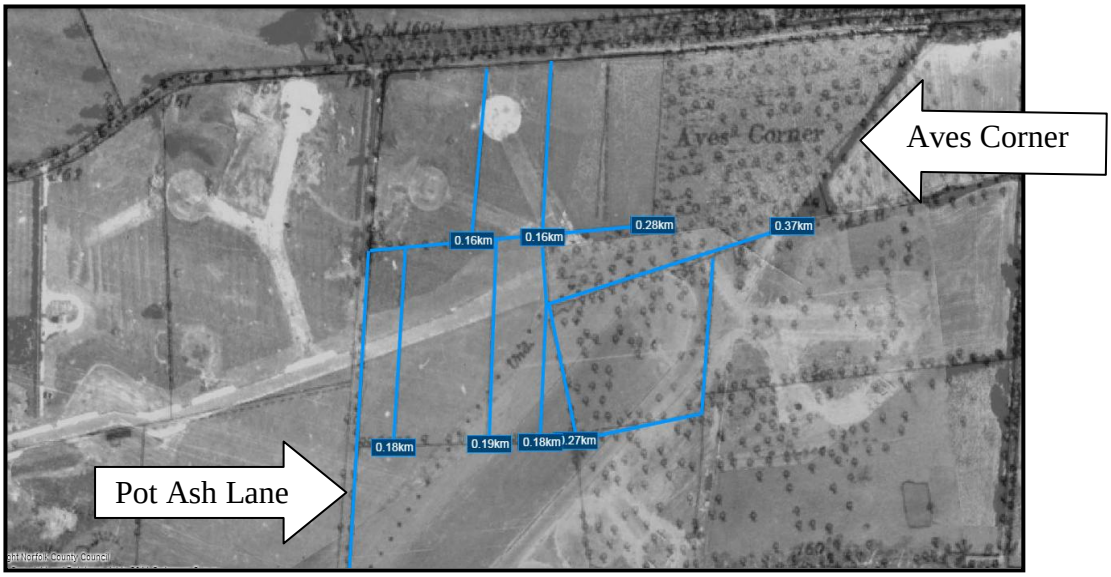

Figure 5: By laying the 1946 aerial photograph over the nineteenth century OS map, it was possible to calculate (roughly) the mileage of hedgerows lost to make way for the airfield at Hethel. This image is from the north of the site near St Thomas' Lane.

Close analysis of the lost hedgerows at Hethel shows that care was taken not to disrupt the landscape beyond that deemed necessary. The perimeter track cut through the 'Nut Grove' to the west making it two thirds its original size, although the field beyond it appears untouched and Pot Ash Lane was re-routed across to Aves Corner. It is also interesting to see that some vegetation around the perimeter tracks remains intact and may have offered cover for gun pits and other defence structures.

What became apparent was that elements of the technical site, such as the hard stands, were carefully planned to fit within field boundaries so that in some instances, only partial hedgerows were removed. With restricted time and resources, it would not make sense to waste time paying labourers to remove anything unnecessarily.

Figure 6: Early plan showing the south-west area of the Hethel airfield. The frying pan hard stands are designed to fit within the existing field boundaries.[13]

DRAINAGE

On average, fifty miles of drainage piping was laid per bomber airfield.[14] Having dug up a significant volume of hedgerow and woodland, it seems likely that sections of the existing drainage system were damaged in the process. However, sufficient drainage survived to be incorporated into the new system as seen in plans for the north of the Hethel site. The proposal shows a complex arrangement of new tile drainage with the existing tile drainage and ditches incorporated within it (see figures 7 and 7a).[15]

[13] Norfolk Record Office, Ref No: ACC 2010/285 Box 3
[14] Clarke, *Archaeology of Airfields*, p.104.
[15] Norfolk Record Office, Ref No: ACC 2010/285 Box 3

Hethel's compact subsoil means that after heavy rainfall, particularly during the winter, the subsoil becomes waterlogged.[16] With the vast quantities of concrete and tarmac used on the site, efficient drainage was essential to combat the volume of runoff that would be created because of it. It was imperative to keep the airfield operative throughout the year which meant that the runways and hard stands had to be kept free from mud and excess water as much as possible. The plan shows the proposed drainage radiating, like fletching, between the runways and hard stands (see figure 7). The enormous and arduous task of installing modern drainage for the entire airfield gives some indication to the serious problems that adverse weather could pose. The provision of proper drainage probably benefitted the Wimpey & Co Ltd contractors too.[17] Certainly, labourers had to work in all conditions, with heavy machinery and tonnes of cement which would have only worsened in wet conditions.

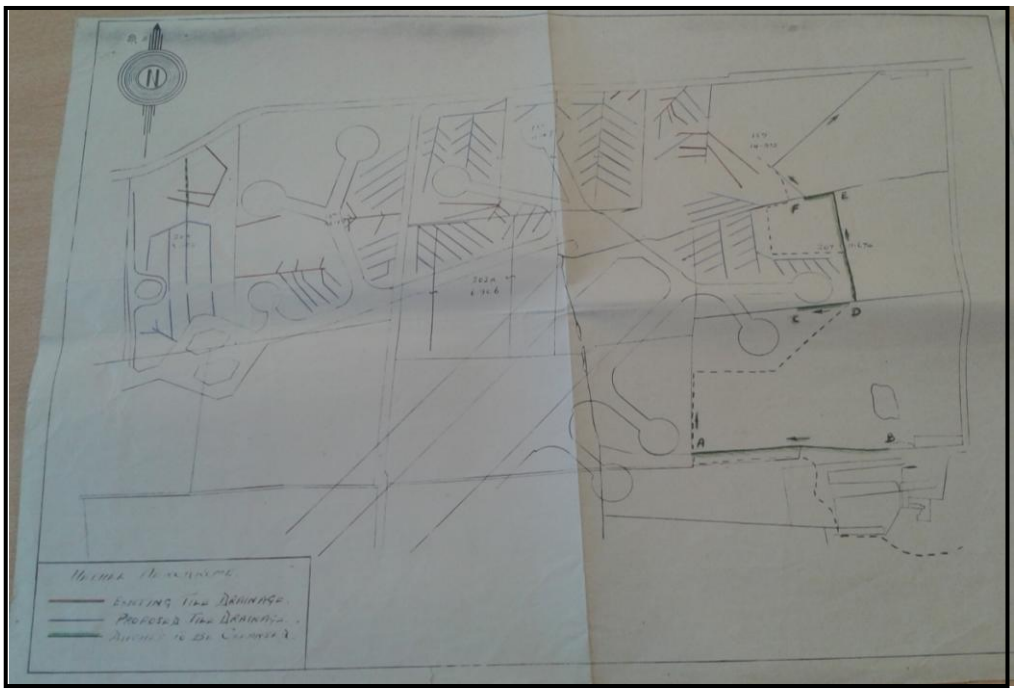

Figure 7: Planning for drainage to the north-west of the airfield using existing systems. Drains were arranged around the runways to ensure they were operational throughout the year. For the key, (see figure 7a).

[16] Cranfield University 'Soilscales Map'. Available at: http://www.landis.org.uk/soilscapes (accessed 19 November 2015).
[17] Bowman, *Airfield Focus*,, p.123.

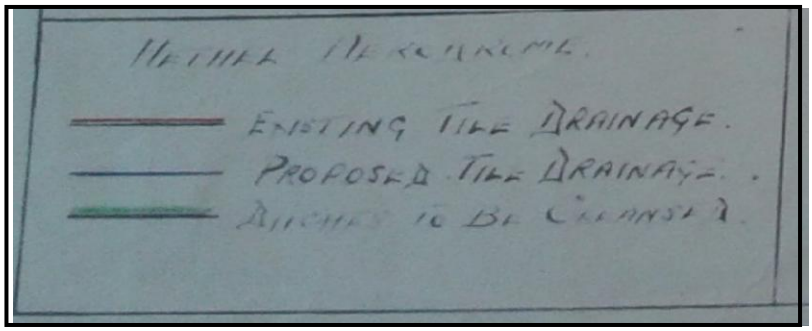

Figure 7a: The key for the drainage plan (see figure 7).

SEWERAGE

To all intense purposes, Hethel airfield was brand new, self sufficient town in the midst of rural countryside. With three thousand inhabitants, Station 114 needed an infrastructure to support the requirements its population demanded. A sewerage system, for instance, was mandatory. The plan below (figure 8) shows the anterior sewerage system that linked the farms around the periphery of the proposed airfield site. The system continues to the east, incorporating a cluster of households.[18] The positioning of the existing sewerage system, means that it was the obvious place to locate the barracks by continuing the sewerage system to the east of the runway.

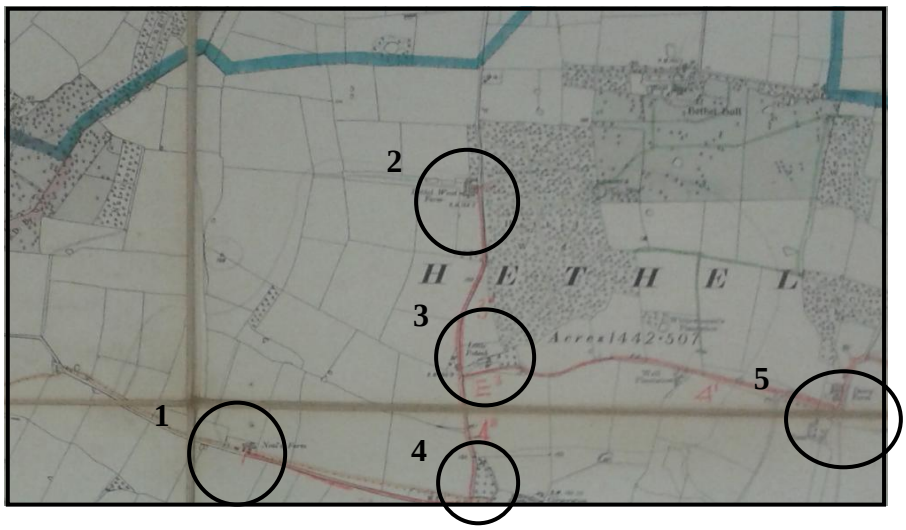

Figure 8: Plan showing the sewerage system servicing Neals's Farm (1), Hethel Wood Farm (2), Potash Farm (3), Corporation Farm (4) and the households to the east of Hethel Wood (5).

[18] Norfolk Record Office, Ref No: MC 3084/4 1034 Y2.

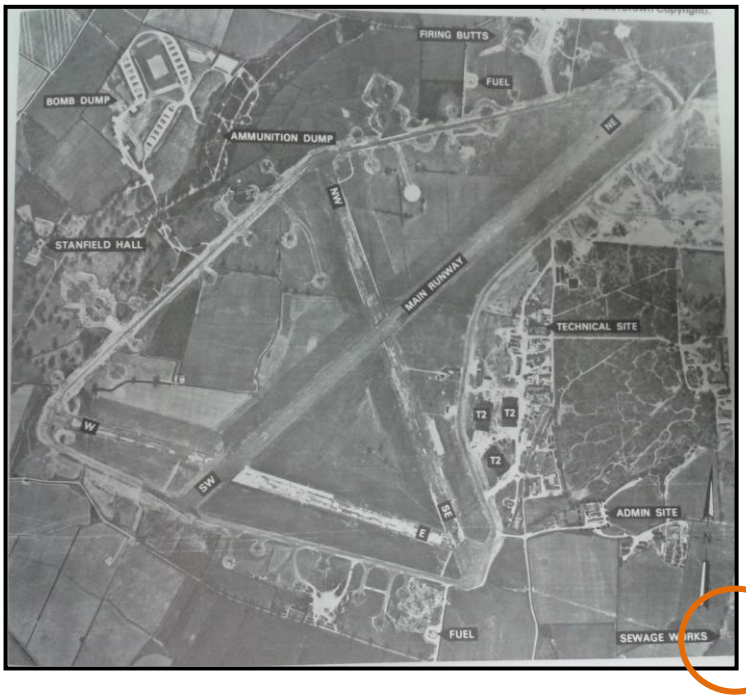

Figure 9: Aerial photo of Hethel airfield showing location of the sewerage works closely aligned to the existing system (see figure 8).

The extensive sewerage system at Hethel is mapped out in detail on the site plan. Drains and pipes radiate from the sewerage depot to the south and incorporate every latrine, ablution block and picket post as far to the west as the sick quarters, as far north as Hethel Hall and as far east as site 4. With man-hole covers at regular intervals, the feat of installing the sewerage system was meticulous and thorough. As Bob Clarke points out, airfield construction was at its most productive in 1942. With a new station being handed over, on average, every three days, it is hardly surprising that airfield contractors became adept at such installations.[19]

[19] Clarke, *The Archaeology of Airfields*, p.133.

EVOLUTION

IMPACT ON POPULATION

After many days travelling from America, arriving at Wymondham station and being ferried to Hethel airfield three miles away must have been a culture shock for the squadrons of the 389th Bomb Group.[20] Their arrival certainly had an impact on Hethel and its population. This is worth a mention.

The figures shown on the graph below reflect the relative stability of Hethel's population over two hundred years using statistics provided by Norfolk Insight[21] and the University of Portsmouth.[22] There was no census conducted during the war, so the 1943 figure is estimated. This was reached by adding the 395 officers and 2,679 American servicemen and women[23] stationed at Hethel to the 1931 population of Hethel.

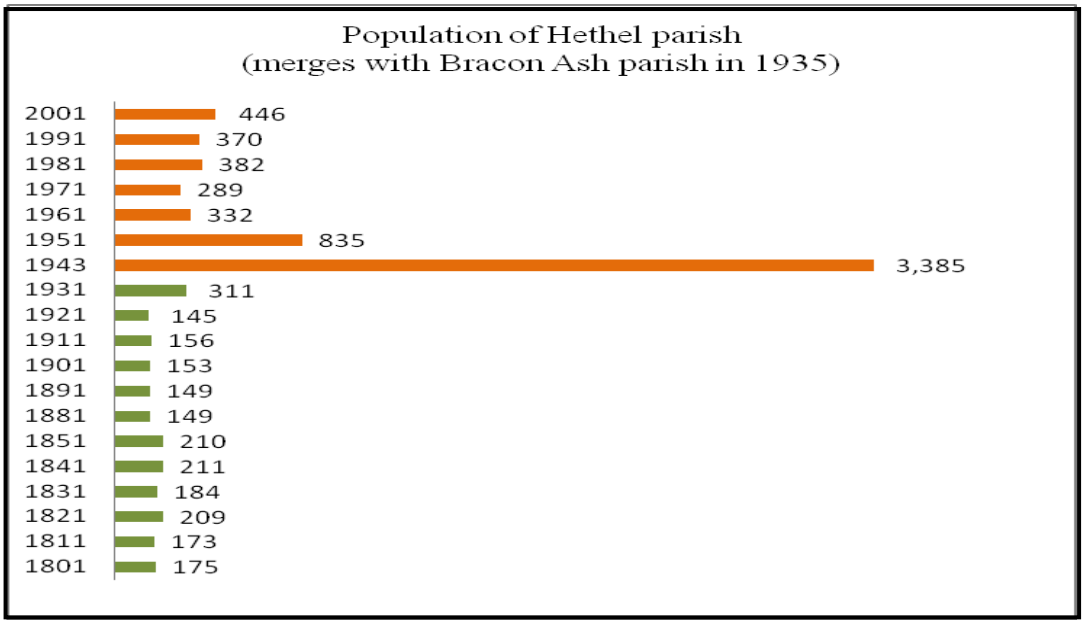

Figure 10: Graph showing the impact on Hethel's population at the arrival of the USAAF and the 389th Bombardment Group (Hethel was incorporated into Bracon Ash Parish in 1935).

[20] 2nd Air Division Memorial Library, Ref No: B0418.
[21] Norfolk Insight, Demographic Department, Norfolk County Council, 2004.
[22] University of Portsmouth, 'Hethel AP/CP', *A Vision of Britain Through Time*, (2009-2014). Available at : http://www.visionofbritain.org.uk/unit/10098865/cube/TOT_POP (accessed 01 December 2015).
[23] Bowman, M. *Airfield Focus 53: Hethel* (Peterborough:2002), p.1.

CONTEXT

During the Expansion Period, the RAF designed airfields in a compact layout to make operations easier. The realisation that this made an airfield vulnerable to concentrated bombing meant that a new layout of dispersal was developed to minimise the risk in an aerial attack. Technical buildings were located near the airfield perimeter and other components were dispersed about the local countryside. Accommodation huts generally hugged, or at least followed, hedge lines for camouflage and individual sites were distanced from each other so they were less susceptible to an aerial offensive.[24] This design indicates Hethel's wartime, rather than expansion period, construction.

By the time Hethel was completed in late 1942, the construction of new airfields had been cancelled. This meant existing airfields took on an increasing volume of aircraft and personnel and airfields such as Hethel struggled to cope. A multitude of contemporary reports complain about housing problems. In August 1944 a monthly report warned that Hethel's strength was approximately double the amount it was designed for.[25] Constant transfers, promotions, new crew and fatalities meant that the station was never stagnant. Managing and accommodating an expanding workforce had to be done on a budget and without relying on any one material, manufacturer or manufacturing process.

Despite its formulaic design, the topography of each airfield made it individual. Although all domestic sites were carefully positioned along field boundaries and camouflaged under woodland, their spatial arrangement was predetermined according to where the field boundaries and woods were located. This also applies to the placement of the hard standings which seem to have been slotted in around field boundaries so as not to disturb agrarian productivity (see figure 6). This means that by looking at site plans, different

[24] Lowry, B. et all, *20th Century Defences In Britain: An Introductory Guide* (York:1995), p.114.
[25] 2AD Memorial Library, Ref No: B0418.

airfields can be distinguished from each other by studying factors such as the runway alignment, design of the hard stands and details of the domestic sites.

Although dispersed, it is also worth noting that no one area of the airfield was completely isolated. Each area was somehow interconnected with the next or had an impact upon it. In August 1944, for instance, extra troops were brought in just to help maintain the perimeter track and the runways. This impacted the domestic sites. Housing was a recurrent problem and finding appropriate shelter for a fluctuating workforce often involved re-jigging huts from different areas to accommodate them.[26]

THE RUNWAY

Hethel airfield's concrete runway helps place it stage of development during the war. Grassed runways had proved ineffectual under heavy usage and as aircraft got heavier, grassed runways became counterproductive, particularly in wet weather. To keep an airfield operational all year round, concrete runways at bomber stations were introduced. By the end of 1940 their construction was standard policy and in July the following year, the RAF specification of three intersecting runways came into effect, along with a perimeter track that connected them.[27] Further developments saw a gradual increase of runway length. The new dimensions recommended 2,000 yards for the principle runway and 1,400 yards for the two subsidiary runways, although these were not rigorously implemented until the end of 1942.[28] The prominent runway was built with the prevailing wind whilst the two supporting runways crossed it at a sixty degree angle which meant that runways created the classic 'A' shape airfield.[29] Hethel airfield's construction started before these recommendations were fully implemented, but the three runways seen on the

[26] 2AD Memorial Library, Ref No: B0418.
[27] Lowry, *Century Defences In Britai*n, p.114.
[28] Clarke, *Archaeology of Airfields*, p.102.
[29] Ibid., p.113.

aerial photographs show it was built to conform to the standardised Class ‘A’ design. Its three runways were also built with the extended dimensions and were ideally aligned with the prevailing wind. Its satellite station at Tibenham also follows the ideal specifications but Hethel’s second satellite station has a main runway aligned further clockwise, albeit slight. Topography did not always allow the perfect layout.

HARD STANDS

Hard stands went through an evolutionary process as the design for a better airfield was constantly being reinvented or improved. Hethel has two different designs, which provide a clue to its early construction and continued wartime activity. Its frying pan hard stands are typical of those designed by the RAF in the beginning of the war when the lighter bomber aircraft could turn easier on a stand that was circular in design. However, as larger heavy bombers were introduced, such as the American Liberator and Flying Fortress, the Air Ministry introduced a new design in September 1942, a month before Hethel was completed.

The new additions were of a new design and seemed to be so rapid that they seem to have been incorporated with the original hard standings. Named ‘spectacle’ or ‘loop’ hard stands, these new designs were developed to meet the ever increasing demands for efficiency. This rapid development is clearly seen in the layout of different airfields. The type of hardstand can differentiate airfields that were constructed just a few months apart. Those of an earlier design may have ‘pan’ stands only or pans incorporating the ‘spectacle’ or even both. Airfields built later will sometimes have ‘spectacle’ only dispersals. The ‘spectacle’ hard stands were advantageous as they allowed better access for more aircraft. Their presence is indicative of the increased aircraft the airfields were dealing with and the increased workforce to flew and maintain them.

Initially, Hethel airfield had thirty six pan hard stands, staggered around the perimeter track to ensure they were dispersed. By the time of completion in late 1942, Hethel was equipped with another fourteen spectacle hard stands so it was able to accommodate 389th bomb group's Liberator bombers.[30] Therefore, by having both designs, the airfields at Hethel and Tibenham are perfect examples of this transitional period. Equally, the airfield at Old Buckenham, designated a heavy bomb group airfield later in June 1944[31], illustrates the latter design. All three airfields demonstrate the hard stand evolution and the staggered construction is clearly seen in the figures 11, 12 and 13 below. Hethel and Tibenham have both 'frying pan' and 'spectacle' hard stands and Old Buckenham has just the 'spectacle' type.

Figure 11: Hethel - Station114

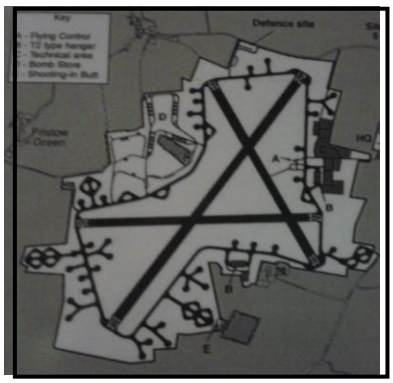

Figure 12: Tibenham - Station 124[32]

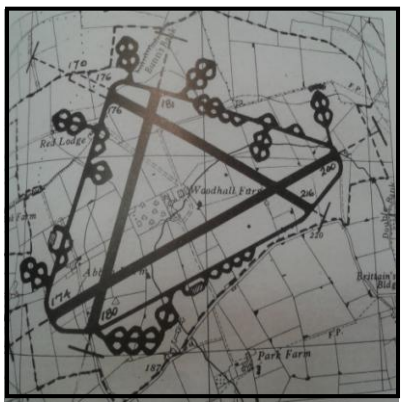

Figure 13: Old Buckenham - Station 144

[30] Freeman, R. Airfields of the Eighth Then and Now, (London:1978), pp.123/4.
[31] Dobinson, Twentieth Century Fortifications 2, p.273.
[32] Kibble-White, D. *Airfield Focus 57: Tibenham* (Peterborough:2003), back cover.

Developments in airfield design were so rapid that both Hethel and Tibenham airfields were updated during their construction. This is illustrated below.

TIBENHAM HARD STANDS

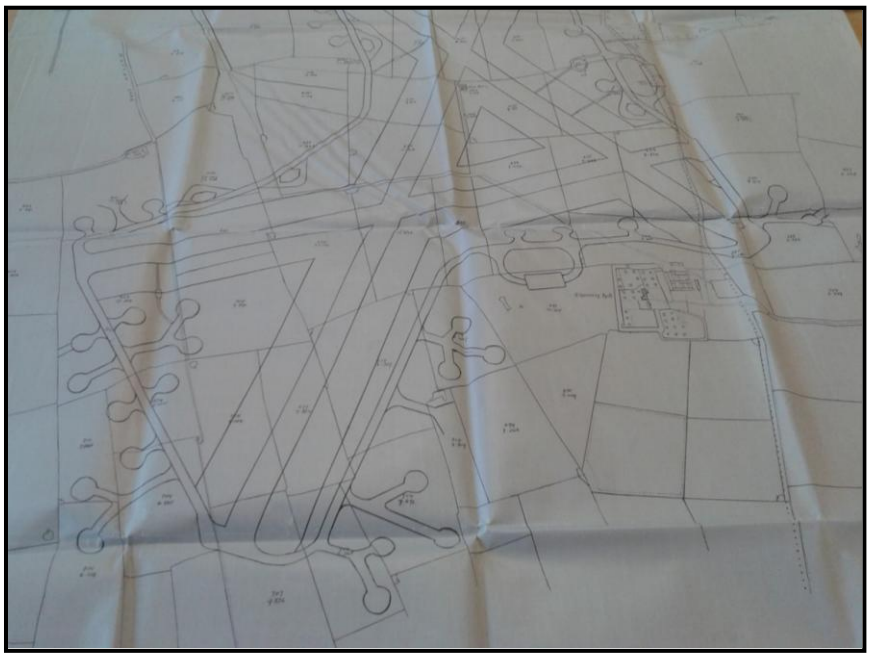

Figure 14: Early plan showing the placement of frying pan hard stands at Tibenham.[33]

Figure 15: The evolution of hard stands at Tibenham. The new spectacle design has been incorporated into the original 'frying pan'.[34]

[33] NRO, Ref No: ACC 2010/285 Box 7.
[34] NRO, Ref No: ACC 2010/285 Box 7.

HETHEL HARD STANDS

Plans at the Norfolk Record Office show that the new standardised spectacle hardstand at Hethel was incorporated into its existing plans. Unfortunately, none of these maps were dated so it is impossible to be any more specific than the applicable year; 1942.

Figure 16: Plans showing the redesign of Hethel at the north-east end of the main runway. The original frying pan has been extended into a spectacle.[35]

Figure 17: Spectacle stands were introduced after the 'pan' stands to make the airfields more effective as the demands of war increased.

[35] NRO, Ref No: ACC 2010/285 Box 3.

BOMB DUMP

Hethel's bomb and ammunition dumps are located to the north-west of the airfield and away from the domestic site to the east. The need for dispersal meant that alternative locations were limited and its proximity to Stanfield may not be perfect but it seems there was no other choice if practicality and convenience was to be maintained. Indeed, an appropriate location was carefully thought out with space calculated around the dump and allotted according to predicted and estimated crater size in the event of an accidental explosion.[36]

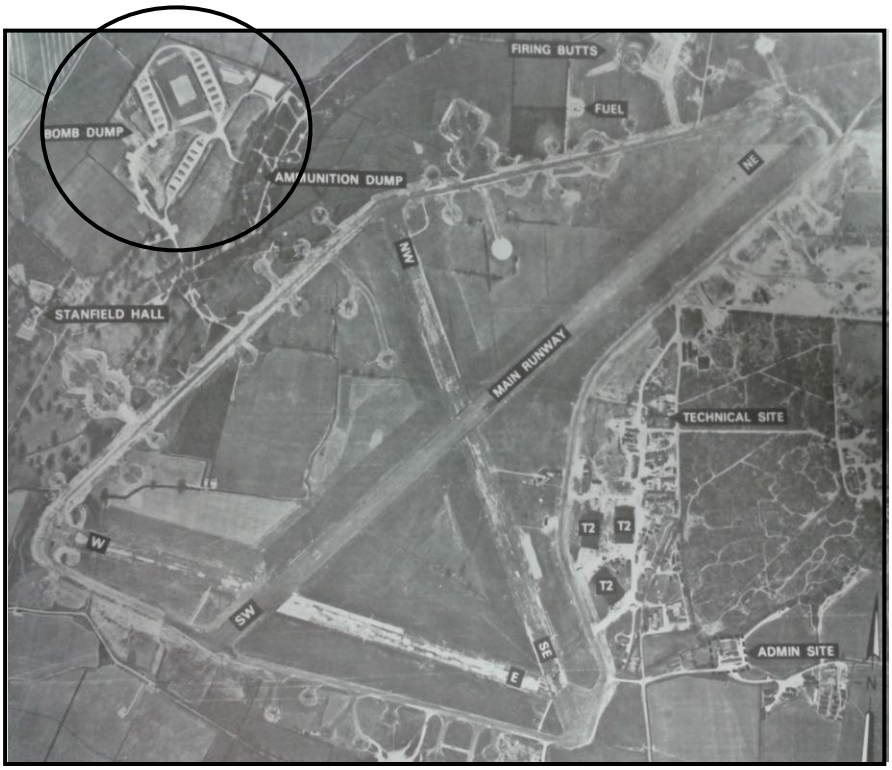

Figure 18: The dispersed layout of Hethel showing the bomb dump to the north-west.

A report from May 1944 lists the bombs dropped that month.[37] This indicates the kind of threat an accidental bomb explosion could pose:

[36] Francis, P. *British Military Airfield Architecture: From Airships to the Jet Age* (Sparkford:1996), p.42.
[37] 2AD Memorial Library, Ref No: B0418.

Quantity	Weight (lbs)	Type
862	1,000	Demolition bombs
2,058	500	Demolition bombs
82	500	RDX bombs
288	500	Semi Armour Piercing Bombs
416	300	Demolition bombs
2,308	100	Demolition bombs
3,064	n/a	M-47 incendiary bombs

Figure 19: Table showing a month's bomb usage at Hethel airfield (May 1944).

As the overall airfield evolved, the smaller elements had to develop with it to ensure that practicality and functionality continued as much as possible. When the standardised dispersal was implemented, the bomb storage area became isolated from the rest of the airfield and a call for greater efficiency inspired redesign. Paul Francis places these redesigns into three phases; the Expansion Period and early and late wartime periods.

The bomb stores at Hethel airfield are typical of those built in the latter part of the war and thereby are indicative of its later construction. The double system of roads along the bump dumps allowed trucks to unload deliveries on one side whilst loading up high explosives and incendiary bombs on trolleys the other side. Efficiencies were furthered by the compartments which were designed with a slight slope so gravity aided the loading.[38]

[38] Clarke, *Archaeology of Airfields*, p.100.

THE DOMESTIC SITE: AESTHETICS

In July 1943 the 567th bomb squadron arrived at Hethel. One of the crew commented how deserted, 'raw and new' it looked, despite having been occupied previously. He commented that the whole job of building the site into a convenient operational base was up to the men of the new group. With no planes to work on, the crew worked on seeding grass and cleaning their own squadron areas. They built fences and grumbled about having to beautify England and working on 'unlovely Nissen huts' that looked 'much more liveable in the end.'[39] Similar circumstances occurred when the air echelon were engaged in combat duty overseas, such as the missions in Africa in 1943. With no maintenance to keep them busy, the ground echelon were kept on an intensive drive to keep the squadron areas spruced by cutting back bushes and seeding grass.[40] Several men mention trying to keep areas grassed, presumably to keep the area as camouflaged as much as possible. The impact on the contemporary landscape was, to a certain extent, dependant on what missions the airbase was engaged in at any one time.

THE DOMESTIC: UTILITY AND AUSTERITY

The site map of Hethel clearly shows the six varieties of hut used. New types were constantly developed throughout the war to economise on materials and skilled labour. They were introduced at different stages throughout the war which help clarify the chronology of Hethel's evolution.[41] These examples of construction through utility and austerity included, in alphabetical order, the Laing, Nissen, Nissen Brick, Orlit, Seco and Thorn huts. Their transitory nature is in stark contrast to the RAF buildings constructed in the interwar years. The ordered, classical architecture and permanence reflected the British

[39] 2AD Memorial Library, Ref No: B0418.
[40] 2AD Memorial Library, Ref No: B0418.
[41] Lowry, *20th Century Defences In Britain*, p.114

imperial sense of authority and stability before war broke out in 1939. Conversely, the expediency of construction and the shortages of materials available meant that American airfields, such as Hethel, were scattered, utilitarian and ephemeral. The domestic site, the squadron areas within it and the huts within them were deliberately disordered to look less like a traditional military camp. To take advantage of the hedgerows, accommodation blocks were meant to hug the edges of them to remain hidden. Some squadron sites appear to sprawl away from the boundaries and on occasions and seem to get very close to the adjoining site which defies the rule of dispersal.

Initially domestic accommodation was situated 800 yards behind the technical site and 800 yards from one another. The distances between the various sites resulted in a loss of administrative and operational efficiency and so the dispersal of an airfield site developed once again. The new minimum distance was reduced to 200 yards. Using Norfolk Heritage Explorer again, it was possible to calculate the distances between the sites at Hethel. All comply with the 200 yards regulation, except for sites 2 and 3 (see figure 20 below). See figure 21 for the distances converted into yards.

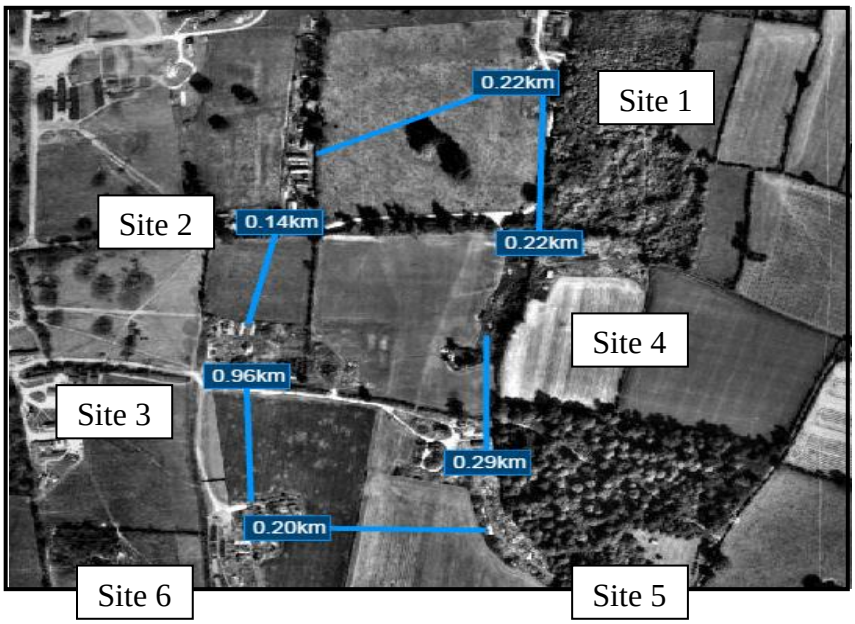

Figure 20: 1946 aerial photograph of Hethel's domestic sites and the distances between them.

The extent to which each site could expand into the surrounding fields is equivocal. Certainly the land near site 4 continued to be used for agrarian productivity which would limit site expansion. A complaint from May 1944 states that personnel using the field adjacent to the 564th bomb squadron were leaving the gate open which allowed livestock to escape. Use of the playing field would not be permitted if the gate was left open again.[42]

Distances between domestic sites (using Norfolk Heritage Explorer)		
Sites	Distance in km	Converted into yards
Site 1 to Site 4	.22	240.595
Site 4 to Site 5	.29	317.1479
Site 5 to Site 6	.20	218.723
Site 6 to Site 3	.96	1049.869
Site 3 to Site 2	.14	153.1059
Site 2 to Site 1	.22	240.595

Figure 21: Table showing the distances between the sites on Hethel airfield in km and yards. Sites 2 and 3 fall below the minimum 200 yard distance required between them..

The variety of accommodation provided reflects the ways in which the Ministry of Supply attempted to avoid the over reliance on one manufacturing process, supplier or resource material.[43] As Dobinson points out, the dispersal of the site and the huts were reflected in the dispersed nature of the manufacturers across the country to counter any periodic shortages of any one material such as asbestos, timber or iron.[44]

[42] 2AD Memorial Library, Ref No: B0418.
[43] Dobinson, C.S. 'Airfield Themes', *Twentieth Century Fortifications in England*, Vol IX 1, (Newark:2000), p.201.
[44] Dobinson, *Twentieth Century Fortifications*, Vol IX 1, p.202.

The shortage of materials and need for austerity, meant that the ever evolving site at Hethel and the quality of accommodation provided generally deteriorated over the war. By 1940 timber was so scarce that hutting was designed to use little or no wood and huts such as the Seco used laminated plywood for the framework.[45] The Laing and the Thorn are earlier designs using light timber frames. The Seco, Orlit, and the revived Nissen followed later.[46] The Orlit hut is the only type that did not contain timber. (see figure 22 below).

Huts at Hethel	Usage	Dimensions	Materials
Laing	1940	18x60	* Light timber frame * Covered felted with plasterboard & corrugated asbestos sheets * Concrete floor
Nissen	from Mar '41	16x36	* Timber purlins * Covered with corrugated steel sheeting * Concrete floor.
Nissen Brick			
Orlit	Aug '42 - Jun'43	18.5 x60	* Reinforced concrete framing. * Pre-cast concrete slab walls * Pre-cast concrete roof covered felt. * Concrete floor.
Seco	from Aug '42	19ft span x multiples of 12ft lengths	* Hollow plywood columns /beams. * Asbestos cement & wood wool, * Cement & timber composite wall & roof panels, roof felted. * Concrete floor.
Thorn(e)	1940		* Timber frame

Figure 22: Details of temporary huts found at Hethel ordered alphabetically.[47]

[45] Lowry, *20th Century Defences In Britain*, p.25.
[46] Smith, *Britain's Military Airfields*, p.86.
[47] Smith, D. J. *Britain's Military Airfields 1939 – 45* (Wellingborough:1989), pp.87-90.

The various form of hut help, to a limited extent, follow the evolution of Hethel airfield. There is more information on the obligatory Nissen hut, but less for the unfamiliar types such as the Thorn and Orlit.

There are more Laing huts at Hethel than any other (see figure 23). This would have been agreeable, particularly to the 567th Bomb Squadron which arrived at Hethel in July 1943. The men were 'pleased greatly' to find they were assigned a 'Lang' rather than a Nissen.[48] This gives some insight into the basic conditions the personnel faced on arrival and that the temporary accommodation provided was not homogenous. The type of hut assigned to the personnel was valued.

Most of the huts at Hethel had concrete flooring. Many still remain hidden in the undergrowth at Hethel. This gives them an aspect of permanence, despite the emphemeral purpose that was intended for them.

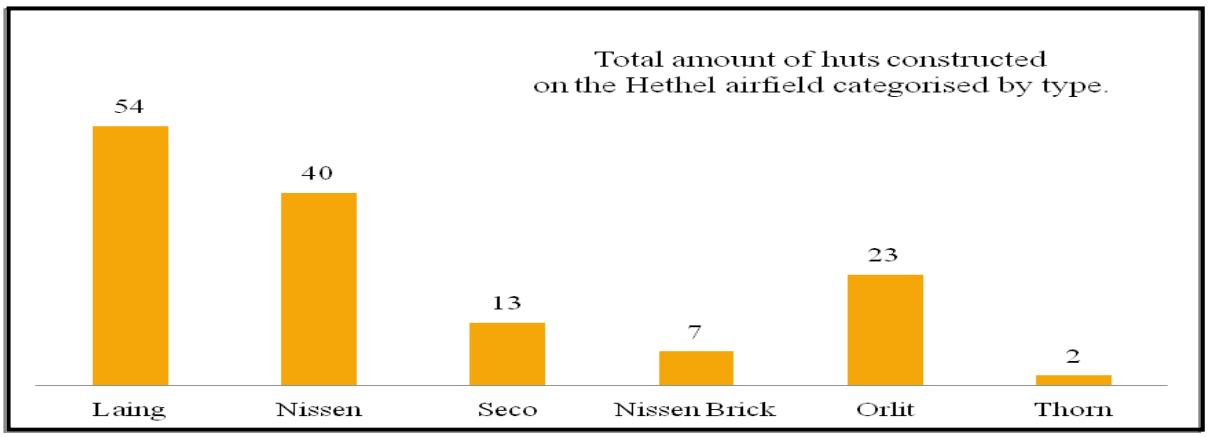

Figure 23: Total of six hut designs shown on the Hethel site map and quantity of each at Hethel airfield.

[48] 2AD Memorial Library, Ref No: B0418.

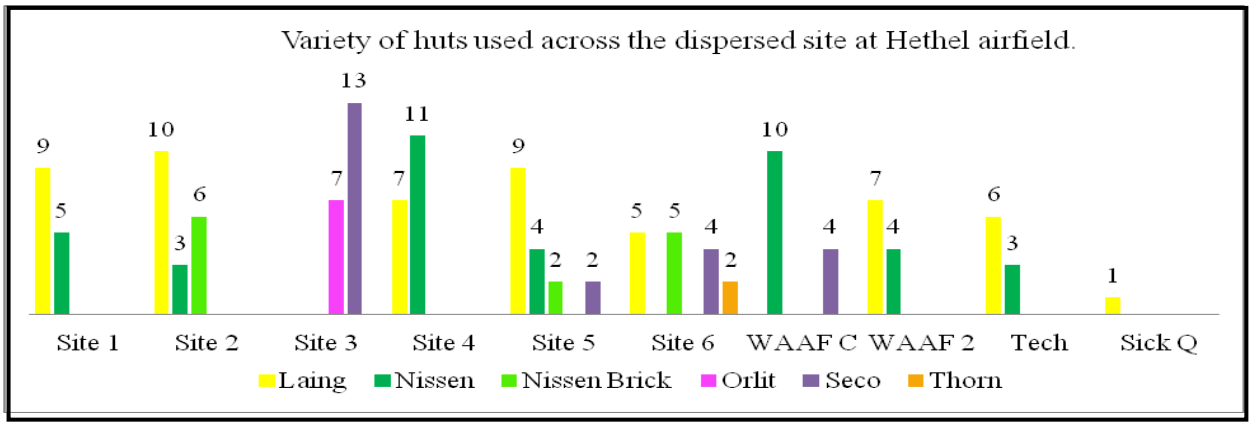

Figure 24: Distribution of temporary hutting on the domestic site, Hethel airfield.

DEFENCE

There had not been much thought given to defence of air fields until the Munich Crisis of 1938. Reassessment of security saw the introduction of passive defence measures such as the dispersal of aircraft around the perimeter of airfields. German territorial ambitions were realised on 9 April 1940 when they invaded Norway and managed to take it by air and by sea in what was 'the world's first airborne operation'.[49] In just a few hours, several thousand German paratroopers landed and overpowered ground. It appeared that British defence strategy was underprepared. The threat of an aerial invasion meant that security was focused on the 'core' rather than the periphery. In this sense, the airfield became monastic in design with the industrious epicentre became the focal point and the dispersal of subsidiary buildings radiating from it. This did not mean to say that the sites furthest from the 'core' were not protected. The site plan shows that every domestic site, with the exception of Site 3, had its own picket post (see figure 25). These were connected with each other and controlled the flow of traffic and personnel across the airfield site. Stanton shelters and blast shelters were provided (see figure 25).

[49] Dobinson, Airfield Defences in WWII, p.8.

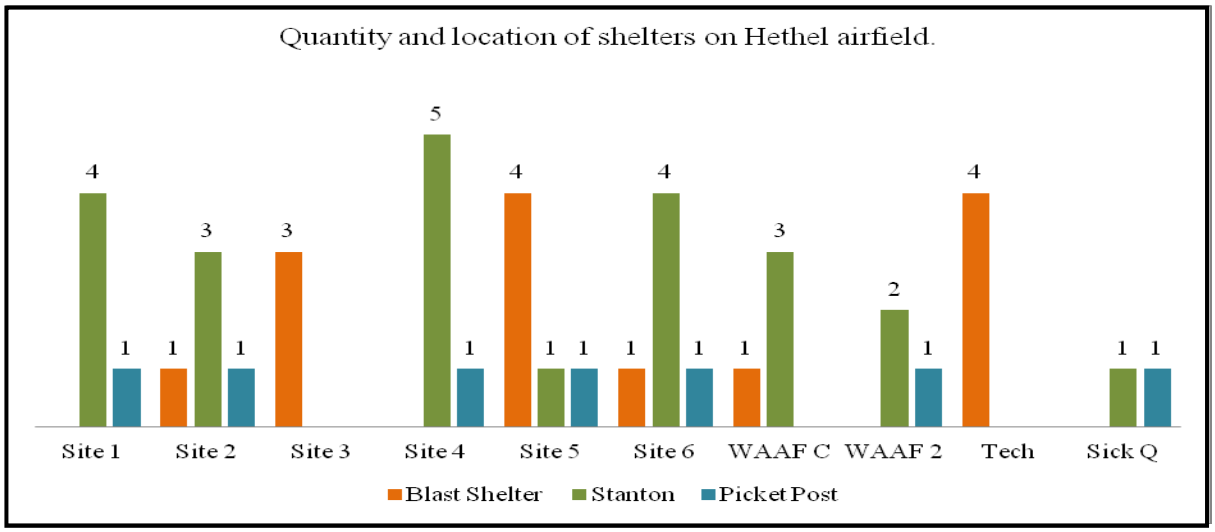

Figure 25: Internal security at Hethel airfield showing shelters and picket posts.

Security around the periphery appears less rigorous. A contemporary map shows plans to install a fence around part of the technical site but on closer inspection of aerial photographs, there is no fence where they appear on the plan. The only barrier between the airfield and the landscape beyond it are field boundaries and hedges. Certainly if constructed, the fence would appear on photographs as it would have been approximately six miles long with 1,760 x 18 ft posts and 2,640 x 12 ft posts and 14 gates (see figure 26).

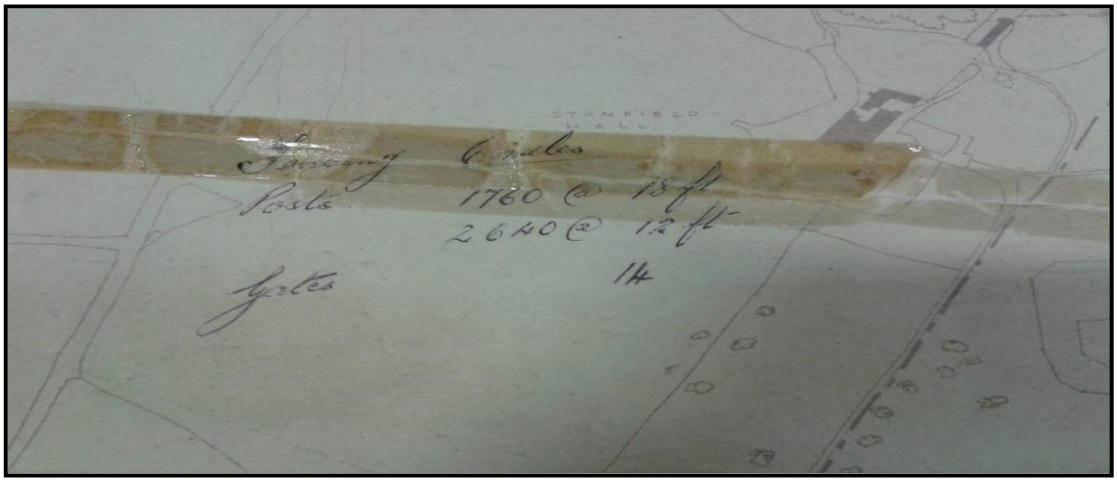

Figure 26: Plan for fencing at the technical site and bomb dump at Hethel airfield.[50]

[50] NRO, Ref No: ACC 2010/285 BOX 3

Reasons for not implementing the plans are various. The dispersed nature of the airfield may have posed a complication particularly when resources and time were scarce. It is also worth considering the evolutionary aspect of the site which meant that having to update the perimeter fencing as the site expanded, may have proved too problematic.

It is also worth noting that the USAAF undertook daytime raids so most maintenance and servicing was done at night, deterring, to some extent, nocturnal crime.[51] With internal security linking picket posts by telephone and sentries on the access roads to the sites, fencing may not have been as important.

CONTEMPORARY IMPACT

It is worth mentioning that the impact of Hethel airfield also involved less obvious changes within the landscape. They may not be gleaned from aerial photographs or rapid surveys but from contemporary sources including bulletins, diaries and reports. When first commissioned by the RAF, Hethel airfield, was not designated for heavy bomber use. Therefore, with the arrival of the USAAF Liberator aircraft, Hethel's fuel storage had to be increased 144,000 gallons to 200,000 gallons.[52] The demand steadily increased over the war and got to crisis point in June 1944, when Hethel had more aircraft than it could handle, so much so that two hundred extra plane guards were enlisted. This also had an impact on the pre-invasion demand for fuel. The refuelling operators had to go to the nearest British fuel depot and get extra supplies. In July 1944, the extension and installation of the refuelling station meant that tractors and trailers, used to refuel in the field, were no longer needed. However, trucks were still required to bring in water after it was restricted due to the hot summer of 1944.[53]

[51] Holland, *Sweatin' Out The Mission,* p.41.
[52] Bowman, *Airfield Focus*, p.124.
[53] 2AD Memorial Library, Ref No: B0418.

The extra personnel on the base meant that the amenities had to expand too. The hospital got a new emergency lighting system which was installed in May 1944. This then impacted the generator which stepped up from 110 volts to 230 volts.[54] There were also various station garden sites on which the Agricultural Office ensured personnel were kept busy planting 'radishes and onions' and planning to get crops planted in the ground at the appropriate time.

LEGACY

TECHNOLOGY

Technological advances mean that websites, such as Google Earth, enable casual enthusiasts to scour the countryside for tell tale signs of bygone airfields. In particularly dry summers, the ground can also produce detailed crop marks that reveal secrets from the past. Vegetation and crops marks still give away clues to the wartime past. An aerial photograph from 2006 reveals crop mark imprints of the old bomb dump site to the north west and a couple of 'pan' standings and the ghost of a 'spectacle' hard standing close by (see figure 27).

Well worn routes are still indelibly printed upon the landscape but the ancient hedgerows and trees that were cleared for airfield construction are gone forever.

[54] 2AD Memorial Library, Ref No: B0418.

Figure 27: Aerial photograph of the Hethel airfield taken in 2006. Crop marks reveal the ghostly outlines of the bomb dump to the north west and spectacle hard stand to the north. Frying pan hard stands are also visible.

The following figures help demonstrate the ways in which some elements of the old airfield have impacted, and continue to impact, the landscape. Spectacle hard stands are easily identifiable and although some crop marks can still reveal the ghost of their shape, there is one hard stand at Hethel where two spots of vegetation are all that remain. A photograph taken in 1988 displays this perfectly.

Figures 28: The impact of a spectacle hardstand near Stanfield Hall. The initial OS map before the war and the 1946 aerial photograph to show a contemporary view.

Figures 28a: The impact of a spectacle hardstand near Stanfield Hall. The 1946 aerial overlaid with the 1988 aerial photograph and finally, the 1988 photograph shows the remnants of the hardstand in a faint crop mark and two clumps of vegetation where the gaps used to be.

DESTRUCTION AND CONSERVATION

Some urban airfields have survived due to the technological advances of international travel but Hethel's longevity is due, in part, to its isolation. This was beneficial for an airfield and made it a suitable site for Lotus Cars. The legacy of other airfields, despite their transitory purpose during the war, lives on in various guises. For some, the land reverted to the plough but their class A' shape is still visible in the field patterns (see figure 29).

Figure 29: The Deopham Green airfield is still visible in the field patterns.

Other airfields continued as flying clubs or developed into bigger airports, such as Stanstead or Heathrow. The partial survival of Hethel's runway is attributable to Lotus

Cars who bought the land in 1964. The original technical site and T2 hangars were developed to house the Lotus factory and although they are now supplemented by other buildings, they still survive as testimony to their wartime past.[55]

Less obvious elements of Hethel airfield's still exist, hidden on private property and reclaimed by undergrowth. With permission from the landholder, it was possible to investigate site four in the summer of 2015. A rapid survey helped find, to a point, which 'temporary' structures still exist and continue the evolution of impact.

The huts on site 4 comprised of Laing and Nissen only (see figure 20). Both huts had concrete floors which mean they still survive, nestled in undergrowth in various states of repair. Although the undergrowth hindered the search, it was possible to locate some of the bases, some of the pathways and remnants of the sewerage and drainage systems (see figures 27 and 28).

Figure 30: Path at site 4

Figure 31: Man hole at site 4

[55] Bowman, *Airfield Focu*, p.124.

Figure 32: Concrete rubble at site 4
Possibly Laing or Nissen hut bases.

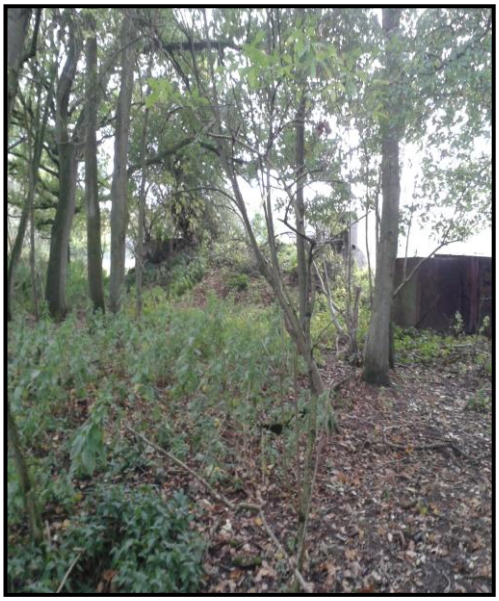

Figure 33: Stanton shelter on site 4

The position of the huts did not match the site map exactly but as established earlier, the airfield's accommodation was never static and huts were moved and adapted over the course of the war. The four Stanton shelters also remain on site.

CONCLUSION

The assessment of the impact at Hethel involved interdisciplinary analyses of various sources including archaeological, photographic and primary. Together, they demonstrate how the base was constantly maturing to meet the demands made upon it. However, it was a site of two halves. Whist having to remain industrious, efficient and productive, it also had to provide a home for the three thousand personnel stationed there. Its grocery store, barber, gym and cinema[56] attempted to make Hethel airfield a home from home, despite its alien location in a rural pocket of Norfolk.

[56] All notable on the site map

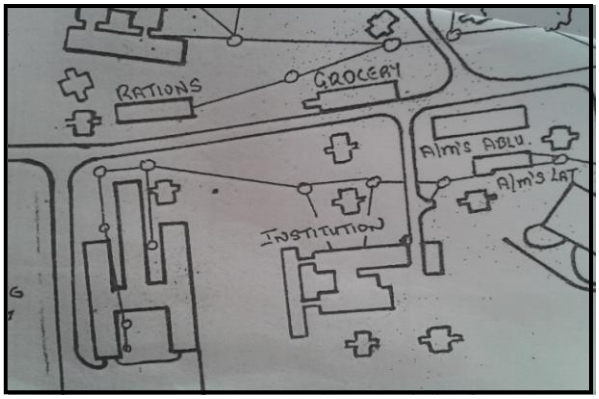

Figure 34: Grocery store at the Hethel site (taken from site map)

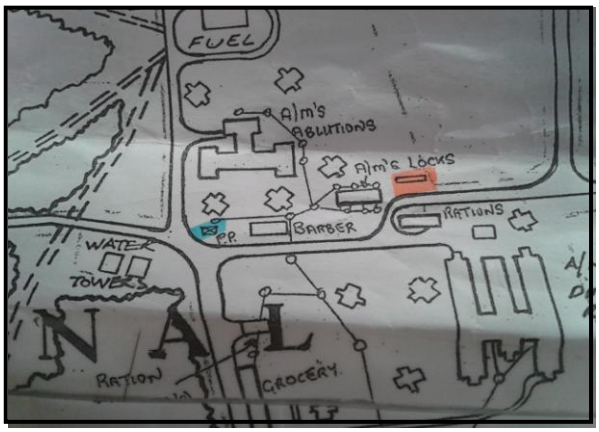

Figure 35: Barbers provided for personnel at Hethel site (taken from site map)

Hethel airfield continues to impact the landscape today. Lotus Cars use part of the runways to test their sports cars, whilst the concrete bases of site 4's Laing and Nissen huts remain camouflaged within overgrown hedgerows nearby.[57] Memorials at the church at East Carleton and Hethel All Saints churches and annual remembrance services keep the memories of the American servicemen and women alive. Indeed, as recently as 7 November 2015, a Remembrance Service was held at Hethel airfield for the 588 members of the 389th Bomb Group who died on bombing campaigns during the Second World War. Their descendants continue to make the journey across the Atlantic to honour them.[58]

Word count: 6,592

[57] Bowman, M. *Airfield Focus 53: Hethel* (Peterborough:2002), p.2.
[58] Royal, K. 'Service in Hethel dedicates new standard to crews of the 389th Bombardment Group' (2015) EDP. Available at: http://www.wymondhamandattleboroughmercury.co.uk/news/service_in_hethel_dedicates_new_standard_to_crews_of_the_389th_bombardment_group_1_4302119 (accessed 18 November 2015).

Bibliography

2nd Air Division Memorial Library, Ref No: B0418.

Bodle, P. & Wilson, P. *The 389th Bomb Group in Norfolk: A pictorial history of the USAAF's 389th Bombardment Group at Hethel, during WWII* (Stoke Ferry: no date).

Bowman, M. *Airfield Focus 53: Hethel* (Peterborough:2002).

Brown, I. et all, *20th Century Defences in Britain: An Introductory Guide*, (York: 1995).

Clarke, B. *The Archaeology of Airfields* (Stroud:2009).

Cranfield University, 'Soilscales Map'. Available at: http://www.landis.org.uk/soilscapes (accessed 19 November 2015).

Dobinson, C.S. 'Airfield Themes', *Twentieth Century Fortificationsns in England*, Vol IX 1, (Newark:2000).

Dobinson, C.S.. 'Airfield Defences in WWII' *Twentieth Century fortifications in England*, Vol.X (Newark:2000).

Dobinson, C.S. 'Airfield Themes', *Twentieth Century Fortificationsns in England*, Vol IX 2, (Newark:2000).

Edina, 'Ancient Roam'. Available at: http://digimap.edina.ac.uk/roam/historic, (accessed 1 November 2015).

Francis, P. *British Military Airfield Architecture: From Airships to the Jet Age* (Sparkford:1996).

Freeman, R. *Airfields of the Eighth Then and Now* (London:1978).

Google Earth,

Holland, M. A. *Sweatin' Out The Mission: 8th Air Force Ground Support In World War Two* (Stroud:2010).

Kibble-White, D. *Airfield Focus 57: Tibenham* (Peterborough:2003).

Liddiard, R. *The Norfolk Deer Parks Project: Report for the Norfolk Biodiversity Partnership*, (2010).

Lowry, B. et all, *20th Century Defences In Britain: An Introductory Guide* (York:1995).

Norfolk County Council, 'Heritage Map Explorer'.Available at: http://www.historic-maps.norfolk.gov.uk/mapexplorer/ (accessed 1 November 2015).

Norfolk Insight, Demographic Department, Norfolk County Council, (2004).

NRO, Ref No: ACC 2010/285 Box 1.

NRO, Ref No: ACC 2010/285 Box 3.

NRO, Ref No: ACC 2010/285 Box 7.

NRO, Ref No: MC 3084/4 1034 Y2.

Rackham, O. *The History of the Countryside: The classic history of Britain's landscape, flora and fauna*, (London: 1986).

Royal, K. 'Service in Hethel dedicates new standard to crews of the 389th Bombardment Group' (2015) EDP. Available at: http://www.wymondhamandattleboroughmercury.co.uk/news/service_in_hethel_dedicates_new_standard_to_crews_of_the_389th_bombardment_group_1_4302119 (accessed 18 November 2015).

Site map available at 2nd Air Division Memorial Library, Norwich.

Smith, D. J. *Britain's Military Airfields 1939 – 45* (Wellingborough:1989).

University of Portsmouth, 'Hethel AP/CP', *A Vision of Britain Through Time*, (2009-2014). Available at : http://www.visionofbritain.org.uk/unit/10098865/cube/TOT_POP (accessed 01 December 2015).