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The contribution of aerial photography to medieval and post-medieval studies

by Glenn Foard and Alison Deegan

Introduction

Northamptonshire lay at the heart of the region comprising almost solely nucleated villages and open field in the medieval period. Although a significant number of townships saw early enclosure by agreement in the late medieval and post-medieval, over 50% of the land area remained as open field until enclosed by the Parliamentary Enclosure Act in the 18th and 19th centuries, the highest proportion of any county in England (Tate 1949). While most of the land was under open field, it also included two large tracts of woodland: the royal forests of Rockingham and Whittlewood/Salcey. The archaeology of the period has been extensively investigated, including ground survey of most of the earthwork sites by the RCHME in the 1970s and early 1980s (RCHME 1975, 1979, 1981, 1982, 1985), ground survey of the open field systems of the whole county by Hall (Hall 1995), and intensive investigation of settlement and landscape in small sample groups of townships in both the Raunds Area Project (Foard and Pearson 1985; Parry 2006) and the Whittlewood Project (Page and Jones 2003). The general landscape history of Northamptonshire between the 11th and 18th centuries has recently been reviewed (Foard 2004; Hall 2004).

This NMP project has mapped a wide range of aerial archaeology evidence relating to the medieval and post-medieval landscape of the county. The vast majority of the evidence is in the form of earthworks because, as a result of the progressive ancient and then parliamentary enclosure largely for conversion of arable to pasture, until the late 1940s land use in the county was largely pastoral. Many of the earthwork remains are well recorded on the RAF vertical photographs of the late 1940s, while intensive photography, in many cases exploiting exceptional light and ground conditions, by CUCAP and then from the mid-1970s by NCC, produced a detailed aerial archaeology record of the earthwork sites, many of which are now levelled. This campaign of photography in the 1970s onwards also recorded a small but increasing amount of soilmark and cropmark evidence for these sites, as they were levelled, as well as limited, but very detailed, complementary evidence from surviving earthwork sites in the form of parchmarks in grass.

If one excludes the unique problems posed by the extensive landscapes of ridge and furrow, 3,761 individual 'sites' that date to the medieval or post-medieval have been mapped by the project.

Impressive though this figure is, it actually reveals very little about the contribution the NMP data have to make to the study of the medieval and post-medieval Northamptonshire. Working from cartographic, documentary and archaeological sources, more than 500 settlements of probable medieval date have been identified in the county, comprising approximately 11 towns, 430 nucleated villages and hamlets and the remainder being isolated farms, lodges, castles and so forth (Foard 2004b).

Aerial archaeology provides a poor record of the medieval towns, because of a high level of settlement continuity and expansion. In contrast, approximately 200 of the other nucleated medieval settlements are represented in the NMP data, although in some cases the actual features recorded may prove to be later or, occasionally, earlier. This evidence ranges from a few banks, ditches and house platforms surviving in and around living settlements to the extensive remains of now wholly-deserted or extensively-shrunken or shifted villages, occasionally covering more than

10ha or 15ha, mainly in the form of earthworks. Other site types include a small number of the 100 or so known dispersed settlements, such as isolated farms, deer park lodges, moated sites and castles, and a wide range of other non-settlement remains, including fishponds, deer parks, post-medieval gardens and landscape parks, and the remains of industrial or craft activity. Many of these lesser monuments have never been subject to earthwork survey, and so the aerial data currently represent the only substantial record of these monuments.

A good example is the site of Biggin near Oundle. This is the site of Peterborough Abbey, the largest monastic grange, with its associated deer park (Fig 8.1).

In addition the county had in the 1940s one of the best preserved of all medieval open field landscapes in England. Since that date it has, however, been subject to rapid destruction (Hall 1993). The earthworks were, to a varying level of clarity, recorded on the RAF verticals in the late 1940s, but unfortunately these remains were not subject to the same intensive recording by CUCAP and NCC as were the individual monuments. Only in the later stages of the rapid destruction of this resource did the significance of this failure become apparent, when it was realised the contribution that intensive aerial survey might have made as a complement to the countywide mapping of the resource by Hall's ground survey.

Overall the medieval and post-medieval landscape raises a number of distinct problems for the NMP programme. A simple mapping exercise from the aerial archaeology data is justified, to provide a basic record of the presence of features and their general form. However, it is not realistic to expect the specialised level of interpretation of the evidence that is required to enable the mapping itself to be in any way definitive. One is dealing with specialised aspects of the landscape, where there is substantial other data available: documentary (in both written and historic map form) and archaeological (earthwork ground survey and, where now ploughed, potentially field-walking) for many if not most of the remains being recorded. If the aerial data are to be fully exploited, and the significance of much of the detail understood, then it is essential for a specialist in that period or theme to undertake the detailed mapping and analysis, combining all the relevant datasets. The assessment of the approach taken and of the datasets it produced in the Northamptonshire NMP for the medieval and post-medieval needs to take this into consideration, as well as the implications of the remit and strategy of the NMP generally and of the Northamptonshire project in particular.

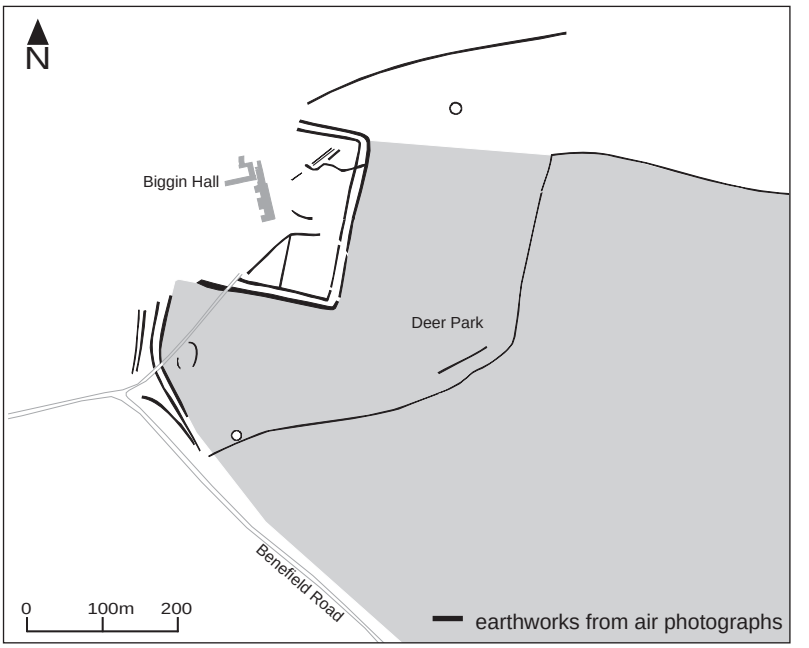

Fig 8.1
Extending from beneath the 18th century Biggin Hall are the irregular earthworks remains of Biggin monastic grange, covering a rectangular area encompassed by the pale of the associated deer park, which can be seen running south west from the grange and then south eastward alongside the modern road.

Earthworks

There is a small number of prehistoric and Roman monuments in the county that still survive or are recorded on earlier aerial photographs as earthworks, including a handful of round barrows, four hillforts, and a few areas of fields with associated settlement enclosures, the latter all within woodland or in former woodland areas. The remainder, the vast majority of earthwork sites mapped by the project, as in much of lowland England, are from the medieval and post-medieval, with a handful of even later date. The RCHME inventories of Northamptonshire include ground survey plans of many of these earthwork sites that survived into the 1970s or beyond, surveyed at a large scale and published at a variety of scales from 1:7 500 to 1:1 500 (RCHME 1979, 1981, 1982, 1984, 1985). In addition, others have surveyed sites not dealt with by the RCHME and in a few cases have conducted more intensive re-survey of individual sites already dealt with by RCHME (for example Brown 1991); a small number of paced surveys have also been undertaken (for example Hall and Nickerson 1969).

Air photographs, particularly the RAF verticals from the 1940s, have long been exploited as a record of medieval and later earthworks, particularly for those that were levelled or destroyed before ground survey could be undertaken. At Daventry, for example, Brown mapped medieval settlement remains associated with the village of Drayton, which was engulfed by development in the 1970s: the southern area was recorded by field survey, but the northern part was mapped from aerial photographs (Brown 1991, 38). The NMP has recorded the same areas, but has mapped more extensive detail on the northern area and varies in detail on the southern area. In the absence of any record as to which aerial photographs were used by Brown, the discrepancies may merely reflect NMP's access to additional photography. Aerial photographs were also used in the RCHME inventory to assist in the production of plans of levelled medieval and later sites, but, like their mapping of prehistoric and Roman cropmarks and soilmarks, these were sketch plans with a low level of positional accuracy and limited detail. Hence, as at Daventry, the NMP data provide a supplement to the RCHME work, but there is substantial opportunity for further analysis of such aerial data.

Such photography has also been extensively used by Hall, as an important complement to ground survey, in his mapping of the open field systems of the county, particularly to provide complementary detail where ridge and furrow is now levelled, but also to provide the primary evidence in areas subsequently quarried or developed before ground survey was completed (Hall 1995; Foard *et al* 2004b). As a result of such work, the majority of medieval and post-medieval earthworks recorded on aerial photographs had been registered in the SMR before the NMP project began, and thus the level of 'resource discovery' achieved by the project has been relatively low.

Ground survey versus aerial data

A significant, though rarely-documented principle of the NMP is that higher-level survey, where available, should be incorporated into the NMP maps in preference to the presumed lower-level of information that might be gleaned from air photographs. This approach is still advised for current NMP projects (Y Boutwood pers comm). With regard to earthwork survey, the NMP policy was adhered to in the Northamptonshire project until 1998, with existing earthwork surveys being used in preference to independent mapping from the air photos.

With hindsight, it was a significant mistake to have integrated earthwork ground survey data directly into the NMP dataset, especially as it was then already known that substantial additional data for many sites was available from the aerial photographs. Thus for many sites mapped in NMP prior to 1999 there is additional information to be retrieved from the air photographs than is present on the NMP data taken from the RCHME plans, while on some other sites there is a hybrid dataset combining information from both ground survey and air photo, but not distinguishing the two.

The review of the project undertaken in 1999 led to a modification of this policy and for the data generated thereafter, which fortunately encompasses the area of the county with the highest density of earthwork sites, an independent vector dataset was created, drawn purely from the air photographs. In addition the earthwork plans themselves were all geo-referenced, to enable them to be viewed beneath the earthwork transcription from the air photographs and other aerial data in the GIS. Based on the Northamptonshire experience we would argue that this represents the most effective solution to the complex problems posed for NMP when dealing with extensive earthwork remains of the last millennium.

Use of hachures

A second problem relates to the way in which earthworks have been represented in GIS in the project. Rendering of multi-layered, three-dimensional earthwork data into a two-dimensional map poses particularly problems for all NMP projects, and these have yet to be adequately resolved nationally. Until recent advances in digital survey, the use of hachures to depict the direction and, by varying their length and width, the length and relative steepness of slopes, was the method almost always used in ground survey to record earthworks (for example Taylor 1974, 36–52). It is by far the most effective, simple way to represent the fine detail of information that

exists in many earthwork remains, and is thus still the most common form of representation of earthworks. For the same reasons hachures also have value for the recording of earthworks from aerial archaeological sources.

In contrast, the other conventions of recording earthworks applied in NMP, most notably the same bank and ditch conventions employed for cropmarks and soilmarks, are difficult for the user to interpret, as they do not effectively convey the direction and intensity of slope; and problems can also arise, as the direction of slope may not always be apparent from the aerial data. Hachures also provide for rapid recognition, as they are sufficiently distinct from crop- and soilmark representation, something that is important in a digital environment where separate layers of data from soilmark, cropmark, parchmark and earthwork sources may need to be superimposed, often in conjunction with other datasets.

Several pre-cursors to the NMP, such as surveys in the Hertfordshire, Thames Valley, Kent and Yorkshire Wolds, were limited to the recording of cropmark or soilmark archaeology, and this bias has perhaps had an unconscious influence on the way earthwork mapping is tackled in the NMP nationally. This bias was apparent in the early models of morphological classification published in *Antiquity* in 1989 (Edis *et al* 1989). The Yorkshire Dales, also a pre-cursor to the NMP, and other early NMP projects such as those for the National Forest and Lincolnshire, recorded earthwork sites with simple T-hachures, or, for narrower features, the same bank and ditch conventions employed for cropmarks and soilmarks. These projects preceded the digitisation of the NMP, in which mapping, usually sketch-plotting, was hand-drawn onto acetate sheets with pen. In this manner the creation of a T-hachure plan did not require a significantly greater input of time compared to levelled features of similar complexity.

The Northamptonshire project, being the first comprehensively digital NMP project was the first to encounter the problems of adequately recording complex earthworks in a digital environment. Given the number of earthwork sites in the county, many of them large and complex, this represented a major challenge. Although we believe that the correct decision was taken in deciding to represent earthworks using hachures, with hindsight it is clear that far more wide-ranging experiment should have been conducted at the outset to establish a more efficient and cost-effective method to produce digital hachuring. This was only finally achieved in the light of the experience of the earlier work when a review of the project was undertaken in 1999, resulting in a simple but effective method.

A distinctive line convention was used, placed along the top of the earthwork slope with equal sized hachures pointing down slope. Although the sophistication of varying length and width of hachure was thus abandoned, this was a reasonable compromise to rapidly achieve clear digital representations. Moreover, such a convention is appropriate given the often limited information available from basic rectification of single oblique air photos regarding the scale and character of slopes concerned, although this practice can of course be substantially enhanced where viewing of stereo pairs is possible. This approach does cause problems when transferred to some software, such as the Autodesk drafting package preferred by English Heritage. Autodesk cannot easily replicate the MapInfo line convention, but all leading GIS packages should be able produce similar output.

The value of aerial data for earthwork sites

Comparison of the earthwork ground surveys to the aerial data produced from 1999 onwards shows that significant differences exist between the NMP mapping and the RCHME ground survey plans. Some of the variation between the air photographic data and ground surveys may reflect limitations inherent in the aerial view: distinguishing the top of a slope can be a far more subjective task from an air photograph than it is on the ground, and at times even distinguishing the direction of slope can pose a problem. However, in other cases the NMP mapping is significantly at odds with the ground survey in detail and/or extent. Although usually this mapping was the simple continuation of linear elements, in some cases significant archaeological features lay beyond the extent of the ground survey and were not described in the text, as at Lamport, Clopton and Welford. In other cases there was omission of significant features, as for example at Barby and Winwick.

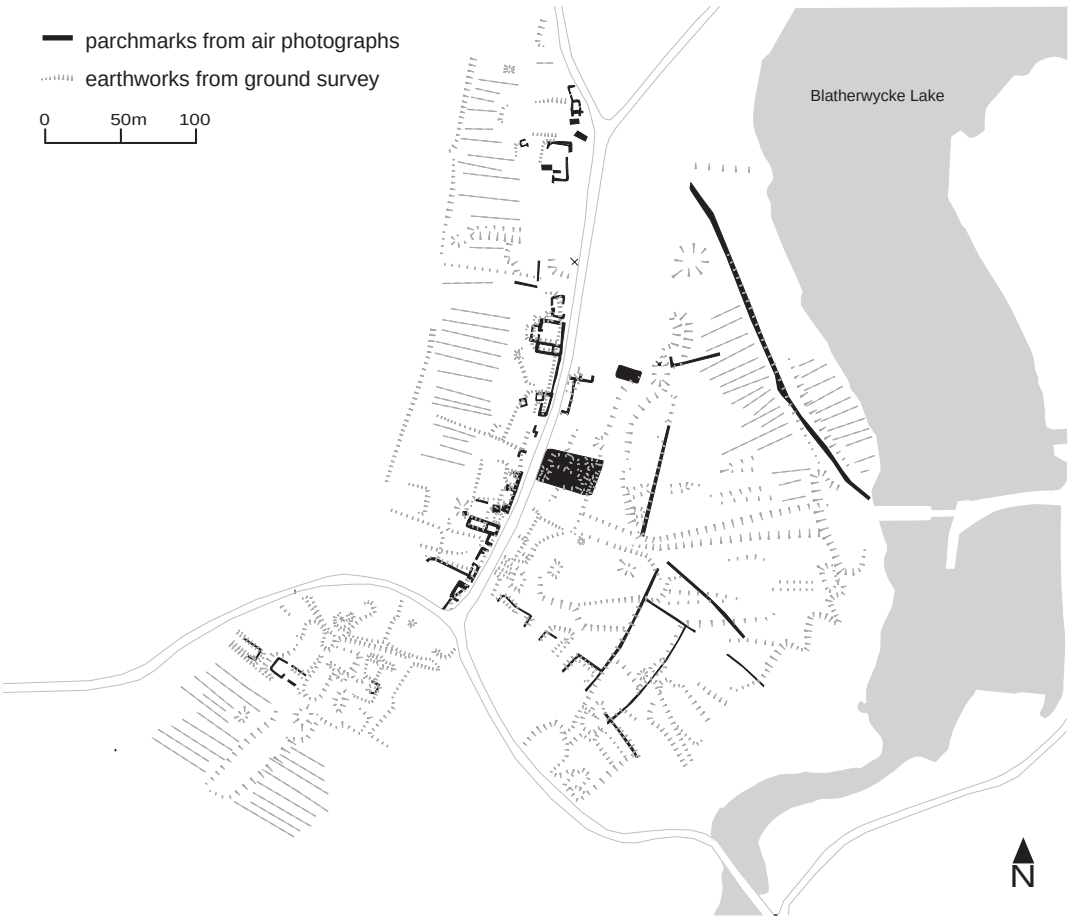

Fig 8.2
English Heritage ground survey plan of earthworks at Blatherwycke, superimposed with the parchmarks mapped from air photographs by the NMP (after unpublished plan NMR Event UID 1208535, Monument UID 347630)

However, this comparison is not a straightforward one of the potential contribution of aerial and ground survey, because the RCHME plans were produced as a rapid survey intended to deal with all major earthworks in the county in a reasonable timescale. It was carried out as a rapid survey, between the early 1970s and early 1980s, by two investigators, requiring limitations to be set in the amount of detail that could be recorded. It thus did not claim to be a definitive survey of each site or to provide comprehensive coverage of all surviving earthwork sites. The RCHME plans typically provide the broad extent and character of the site, but in many cases far more fine detail can be seen on ground inspection where the earthworks still survive.

Where sites have been re-surveyed on the ground since the RCHME surveys were done, far more detail has often been revealed. At West Cotton, Catesby and Blatherwycke subsequent earthworks surveys are both of a higher standard of accuracy and represent a more comprehensive record, particularly of the finer details (Windell *et al* 1990; Giggins and Laughton 2003; *NMR Event UID 1208535*). Most of the earthwork sites that were not surveyed, being only briefly mentioned in the inventory text, were small sites, such as isolated fishpond and windmills, or limited areas of settlement remains on the peripheries of villages. However, a few cases of large areas of settlement that had not been mapped have been identified, for example at Pilton (Brown 1996–7, 211). For these reasons the RCHME survey is not a valid yardstick against which to judge the value of aerial, as opposed to ground survey, data for earthwork sites, and recourse must be made to subsequent more detailed surveys.

At West Cotton the western half of the deserted medieval hamlet was omitted from the RCHME survey. However, the ground survey by Foard and Windell in the 1980s shows the whole site, and the air photographic earthwork evidence adds nothing new (Windell *et al* 1990). Also, for Blatherwycke the new ground survey by English Heritage in 1999 (unpublished plan in NMR), the RCHME plan is seen to omit

the northern half of the settlement earthworks (*compare* Figs 8.2 and 8.3). Figure 8.2 also provides a more accurate spatial representation of features, which correlate closely with the position of features independently mapped from the aerial earthwork data, as well as providing finer detail. Significantly, at the southern end of the site the RCHME plan does communicate more of the form of the earthwork than the computer-generated modern survey, because the hachures on the latter do not provide a coherent form to key features (Fig 8.3). The limitations of the graphic representation in the modern ground survey, in part, is perhaps merely because the plan was never prepared for final publication, but also perhaps resulting from the lack of direct, on-site interpretation contributing to the earthwork plan, which means that the earthwork air photography adds clarity to the understanding to the monument that it would not normally provide (Fig 8.2). Where the aerial data contribute dramatically to the interpretation is in the evidence provided by the parchmarks. They reveal a range of new features, most of which are buildings, some simple single-cell structures, but others apparently arranged around a courtyard. There are also various boundary walls and a later metalled road, probably associated with emparking. Many of these structures correlate closely with, but substantially enhance the ground survey earthwork features and, since none of structure appears on the Tithe map of the 1840s, it is likely that they are the result of late medieval population decline in the 18th century or earlier imparking.

At Catesby the new ground survey by Foard and Giggins confirms the accuracy of position of most features on the RCHME survey, but, as at Blatherwycke, it demonstrates that significant and finer detail is missing from the latter. For example specific buildings are not recorded, as well as a few substantial, important features, such as the probable mill building and tail race. When the new ground survey is compared to the earthwork aerial photography it is found that the only significant details added by the latter are the tree pits from the avenues and a little more clarity or extent to several faint features visible on the ground (Giggins and Laughton 2003).

In contrast, when the parchmark data are added, a broad range of new features, mainly buildings and boundary walls, are revealed, which complement the earthwork evidence (Figs 8.4 and 8.5).

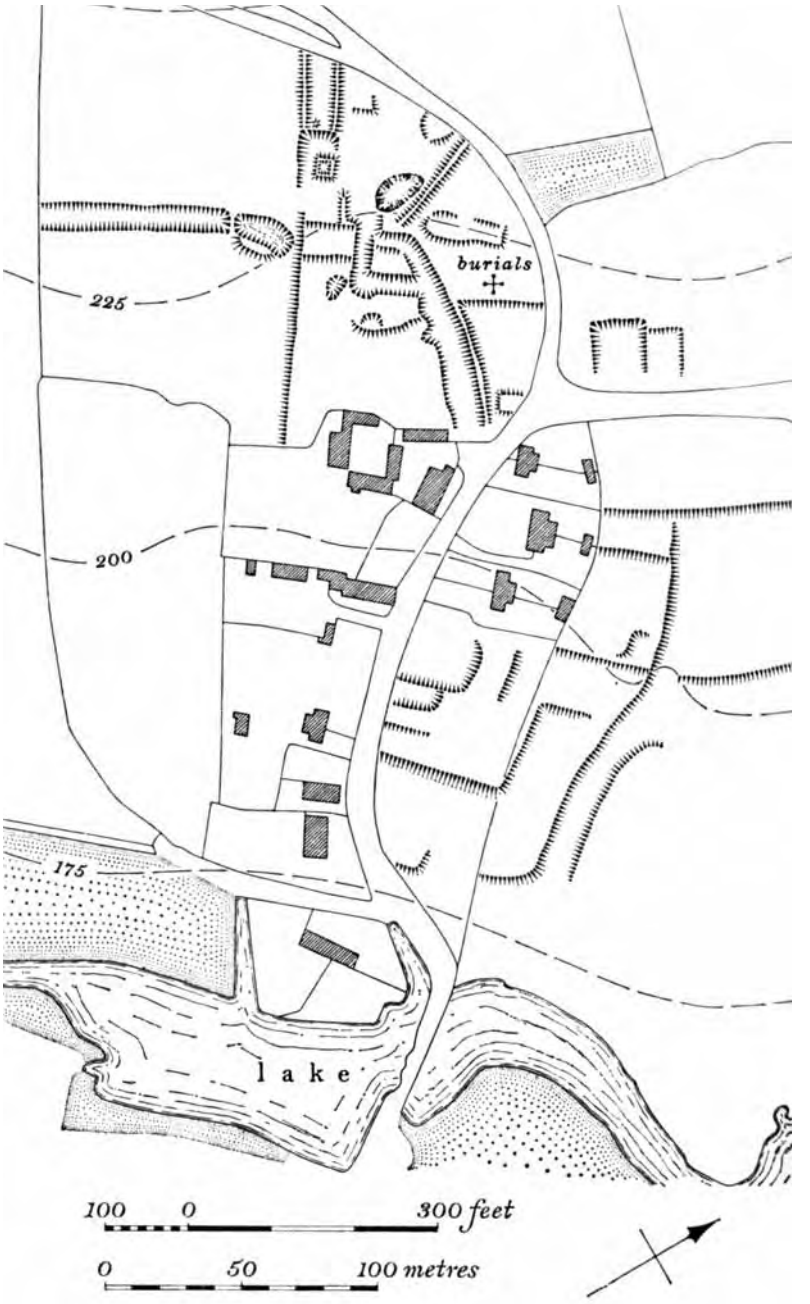

Fig 8.3
RCHME survey plan of earthworks at Blatherwycke (RCHME 1975, fig 31).

The rectification of actual photographic images from 1999 onwards, and the registration of the RCHME plans in GIS, have made it possible to overlay vectorised and raster data in various combinations to enable rapid assessment to be done across the rest of the county. This assessment provide a similar picture to that provided by the case studies, suggesting that where intensive ground survey is conducted, and carefully prepared interpretive hachured

Fig 8.4
Parchmarks of buildings within the medieval market village of Lower Catesby, mainly along the hollow way on the left, the foundations of the buildings of the monastery and the post dissolution country house to the right, and the mill leat to the centre bottom. (NCC photograph SP5159/060 July 1996 NCC copyright)

Fig 8.5
Earthworks emphasis different aspects of Lower Catesby. The avenues of the formal gardens of the post dissolution house are very clearly seen between the two sets of surviving buildings (NCC photograph SP5159/047 4th March 1988 NCC copyright).

plans produced, the aerial earthwork data rarely add significant evidence, even when the latter have been taken in the very best light and ground conditions.

The overall assessment has, however, shown that high-quality aerial photography can enable valuable independent validation upon the level of accuracy and completeness of existing ground surveys, in addition to providing a far more immediate and intelligible representation of the sites than do ground surveys, particularly for the layman.

Parchmarks

On earthwork settlement sites, as mentioned above for Blatherwycke and Catesby, it is with parchmark evidence that aerial archaeology has potential to make a major contribution to the understanding of earthwork sites that have already been subject to detailed ground survey. At some 33 locations the NMP mapping shows stone buildings, structures and walls. Unfortunately, following national practice, parchmarks have been recorded alongside cropmarks in NMP, without separate classification. Given their unique character and the rarity of their appearance, but also the important and distinctive nature of the evidence they tend to reveal when they do appear, it would have facilitated easier analysis if all parchmarks could have been distinguished from all other cropmarks.

Examples of complex building and boundary evidence are seen at the deserted village of Glassthorpe (Fig 8.6). One of the most striking examples is at Pilton, where parchmarks complement the earthwork evidence of buildings along an abandoned street running parallel to the present High Street. Although this area is described in the RCHME inventory as '…covered with low banks, mounds and scarps, forming no coherent pattern…' (RCHME 1975), the value of the aerial data must be considered in the light of a detailed earthwork survey by Brown, which revealed a regular pattern of tenements lining both sides of a road (Brown 1996–7, fig 1). The aerial data complement the latter, providing detail of stone buildings in association with some platforms, but showing far more detail of layout. It also reveals for part of the site a far more coherent, clearer rectilinear plan to the occupation. While in some places the lack of close correlation between the

Fig 8.6
Parchmarks revealing fine detail of a number of medieval farms within the deserted village of Glassthorpe (NCC photograph SP6661/062 July 1994 NCC).

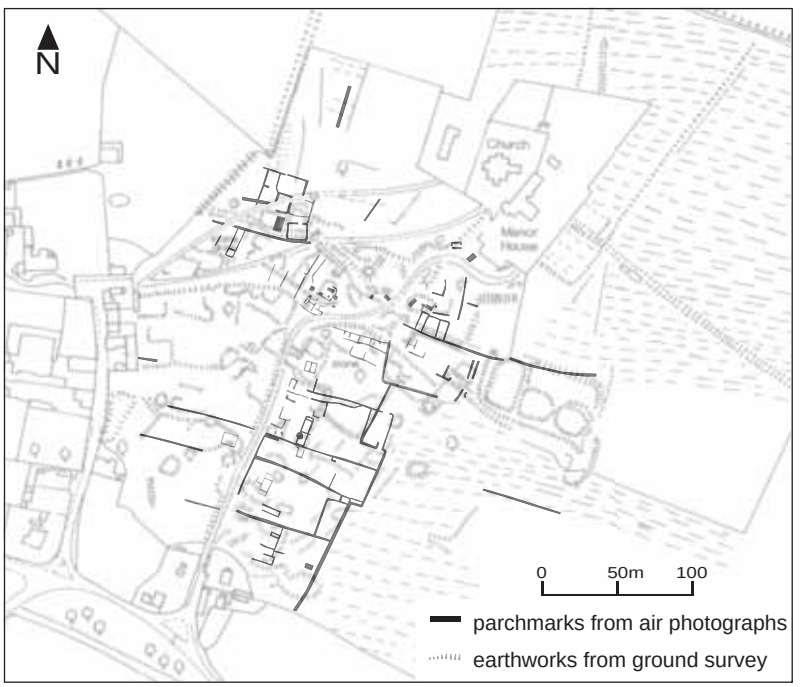

Fig 8.7
Earthwork plan by Brown (1996–7, fig 1) superimposed with the parchmarks mapped by the NMP).

two datasets may reflect minor inaccuracies in one or other of the surveys, it must be remembered that some of the earthworks may reflect a different phase in the development of the settlement to that shown by the stone walls revealed by the parchmarks, which are only recording stone structures that lie sufficiently close to the surface to affect grass growth (Fig 8.7).

While such data can represent a major enhancement of our understanding of earthwork sites, during more than two decades of intensive reconnaissance substantial parchmark evidence was only revealed on a handful of occasions following intense dry periods, and in almost every case only once on any individual site. The results were achieved by specially targeted reconnaissance of known earthwork sites when exceptional conditions occurred, and it is likely that such an approach would continue to be a cost-effective strategy. The one caveat is that those conditions are so rare and it is so unpredictable as to which earthwork site will respond with the production of good parchmarks, that in general it may be far more productive and cost-effective to recover comparable data through geophysical survey. However, in the absence of extensive resistivity survey of any of the good parchmark sites in Northamptonshire one cannot determine whether the aerial data provides any detail that geophysical survey cannot recover, or vice versa. In support of aerial survey, what can be stated with certainty is that images of good parchmark evidence have a far higher potential for the general communication of the character of medieval settlements and other monuments, for it is so much more immediate and intelligible to layman and professional alike, and as such may more than justify the costs of reconnaissance.

Soilmarks and cropmarks

Where earthwork sites have been levelled, air photography has occasionally revealed extensive new data in the form of soilmarks or cropmarks. While earthworks are a diminishing resource, at the same time, at least in the short to medium term, the soil and cropmark data increase. Soilmark evidence does generally decay in quality over time and finally disappears in the long term, as soils are homogenised by ploughing. In contrast, cropmarks may tend to improve over time, as confusing stratified deposits are destroyed, enabling cut features to stand out more distinctly. But of course the potential of stone structures, which may occasionally produce cropmarks, will also be destroyed in the same process, as the stone scatters on a handful of settlement sites bear witness.

However, crop and soilmark data for medieval and post-medieval sites represent an even smaller percentage of the data mapped in the NMP project than earthworks.

In one particular case aerial survey has contributed significantly to the understanding of the archaeology of medieval and post-medieval Northamptonshire, as a result of intensive targeted reconnaissance as part of a wider programme of research into the medieval landscape. This is the soilmark evidence of the medieval charcoal industry. The evidence, in the form of roughly circular patches of intensely black soil of some 10–20m in diameter, is concentrated solely in the former woodland areas, in Whittlewood, Salcey, but most clearly in Rockingham Forest (Fig 8.8).

The significance of the black patches were recognised initially only as a result of ongoing ground survey by various individuals (Foster 1988), and then were targeted by intensive aerial survey in the late 1970s and 1980s (Foard 2001a). The absence of charcoal hearth evidence on any non-NCC archaeological aerial photography, other than some visible on the RAF verticals of the 1940s, demonstrates the importance of targeted aerial reconnaissance based on a detailed knowledge of the medieval landscape of an area, which enables recognition of potentially significant evidence. However, comparison of the small-scale published plan of the distribution of charcoal hearths (Foard 2001a) with the mapping of the soil marks in NMP records a substantial number of additional soilmarks that are unlikely to represent charcoal hearths, but does not distinguish one from the other. A similar problem, of the lack of recognition of the importance of a particular type of evidence in particular locations, is seen in the failure in NMP to adequately map the many stone quarries in the Collyweston / Easton on the Hill area from earthwork, cropmark and soilmark data. These quarries represent the main evidence for a regionally-important stone slate industry of the medieval and post-medieval periods. The potential of the aerial data were only recognised in 1999 when the

Fig 8.8
Soilmarks of charcoal burning hearths at Brigstock (NCC photograph SP9283/036 24th September 1987 NCC copyright).

Fig 8.9
This hollow way lined with the earthwork remains of peasant houses lies in the southern part of the deserted medieval hamlet of Kirby, near Corby. Within the pasture field the stone walls clearly define the stone buildings, which include at least one courtyard farm. In the arable immediately to the left other buildings a represented by stone scatters. This street had been deserted long before the first map of Kirby was draw in the 1580s, for Kirby had by then already seen extensive enclosure for sheep farming (NCC photograph SP9292/027).

subject was briefly assessed for the first time (Hall 2004). When detailed study is undertaken of the industry, aerial photographic data will undoubtedly complement that from past and new ground survey and documentary sources (for example the Ordnance Surveyor's Drawings of the 1810s and the Enclosure maps and Awards for Collyweston and Easton). In the meantime, however, the available NMP mapping does not provide an adequate record of the evidence available on aerial photographs.

The same is true of ironworking evidence. As a result field-walking and trial excavation on various sites, it is now possible very occasionally to recognise the faint traces of iron furnaces as slight soilmarks and earthworks on aerial photographs, features that were, understandably, not recognised in the NMP mapping. Examples are the soilmarks and earthworks of furnaces immediately north of, and a large slag heap immediately south of, Fineshade Castle, of which only the latter was recorded by this project (Bellamy *et al* 2001).

Unfortunately, with regard to medieval settlement, the potential of neither soil mark nor cropmark data can be adequately assessed in comparison to earthwork data because of the lack of consistency and completeness in the NMP mapping of such datasets for medieval sites. For example, at the deserted hamlets of Newbold and of Barton Thorpe much of the earthwork, soilmark and cropmark aerial data have not been mapped. There are, however, only about a dozen cases each of significant soil and cropmarks on medieval nucleated settlements, and this in part accounts for the severe limitations in the NMP handling of this type of data.

The significance of some small sites has undoubtedly been missed altogether, and will only be recognised when detailed documentary work is undertaken. A good example if this is the site of the medieval hermitage to the north of Rockingham, where the significance of the cropmark evidence was only revealed during detailed research on the history of the nearby medieval village (Foard 2001c). Other isolated sites are sometimes more obvious and easy to identify, as with the ring ditches of windmill mounds where the cross tree is visible, for example at Ringstead; but more often, as at Tansor, they may be confused with Bronze Age ring ditches, with which in the latter case it was associated.

Where soilmark data have been mapped, as at Hale – a hamlet whose plan form is known primarily from soilmark aerial data – the failure of NMP data to clearly distinguish stone scatter from dark soil areas is a problem, as it means that evidence for probable stone structures cannot be clearly distinguished. The same is seen with several farms on the periphery of Kirby in Deene, although such problems are not restricted to soilmarks of medieval sites (Fig 8.9). It also occurs with the occasional soilmarks of Roman stone structures, as at Easton Maudit and at Sewardsley.

cropmark data, excluding parch marks, appear somewhat more difficult to interpret in terms of the plan of settlements than many earthwork datasets. Generally, compared to earthwork evidence, it would

appear that cropmarks can produce good evidence for the systems of ditched enclosures, and of tenement boundaries and closes, but tends to poorly represent the structures within those enclosures. Wythemail, a deserted hamlet whose plan is known in part from cropmark data, is a good example. Only rarely have cropmarks revealed stone structures on medieval sites. One of the few exceptions is in the double-moated site at Grendon, this site is not in the project data because it was photographed after NMP mapping of that area had been completed.

The data clearly need to be reviewed, and in some cases remapping undertaken, but this needs to be undertaken as a single task, integrating all types of archaeological and also any relevant historic map data in a single study. It is hoped that this will be achieved within the AHRC Northamptonshire landscape project (*see below*), which would then enable an effective assessment of the contribution of aerial data to the understanding of medieval settlement in the county.

Ridge and furrow

A decision was taken when the Northamptonshire project was developed, unlike in later NMP projects in other counties, to exclude the detailed recording of ridge and furrow, whether recorded as earthworks, soilmarks or cropmarks. In common with certain other Midlands counties, Northamptonshire had, until the 1950s, very extensive areas of medieval ridge and furrow representing vast swathes of near-continuous archaeological evidence for medieval landscapes (Hall 2001a). In addition, ground survey of the county's open field systems, by Hall, was already well advanced by the 1990s. In consultation with Hall it was concluded that the mapping of the resource to the NMP standard (an outline extent of visible remains with an arrow to indicate the direction of ploughing) could not significantly contribute to this theme (Figs 8.10 and 8.11).

This is a conclusion supported by various other specialists, who consider that it would have been a very weak record, unworthy of the effort required to produce it (S Wrathmell and R Palmer pers comm). The detail of mapping required to enable a valuable contribution would have required a far higher level of resourcing and specialist expertise than could reasonably be expected within NMP. NCC also recognised that such a programme of recording ideally needed application across the Midlands, and thus a wider involvement with its planning (Northamptonshire Heritage 1994, section 4.3). Initial ideas for recording had been outlined in 1993 (Hall 1993), but when a regional study was undertaken it only dealt with issues of survival and management of the resource, and the report still identified the need for a recording strategy to be defined and implemented (Hall 2001a).

Thus, it was always conceived that more expansive work on medieval field systems would be undertaken in parallel with this NMP project, drawing upon Hall's ground survey. Such a strategy for recording was finally developed and implemented through the Rockingham Forest Project, developed in collaboration with the Rockingham Forest Trust, with Heritage Lottery Fund, English Heritage and NCC funding. This project mapped the medieval and post-medieval landscape of 577 km^2 of the former Rockingham Forest, representing about 25% of the county (Foard *et al* 2004a, 2004b). This is being enhanced and extended to the whole historic county in an Arts and Humanities Research Council funded project at the University of East Anglia. For this a methodology has been developed to enable the integration of information from aerial archaeology with the more comprehensive dataset from ground survey, supplemented where appropriate with documentary evidence. Only when this project is completed in 2009 will be possible to effectively assess the contribution of aerial data to the mapping and understanding of the open field systems of the Midlands.

Conclusions

While the greatest strength of NMP is in the mapping of the Iron Age and Roman landscape, where large amounts of cropmark data dominate, its greatest weakness is in the mapping of the medieval and post-medieval, where earthworks dominate, but where there are also extensive comp-lementary data of various types, both archaeological and documentary.

Given the intensive amateur and professional field survey carried out in the county since the early 1960s, together with intensive aerial survey by NCC, CUCAP and others, and with detailed SMR

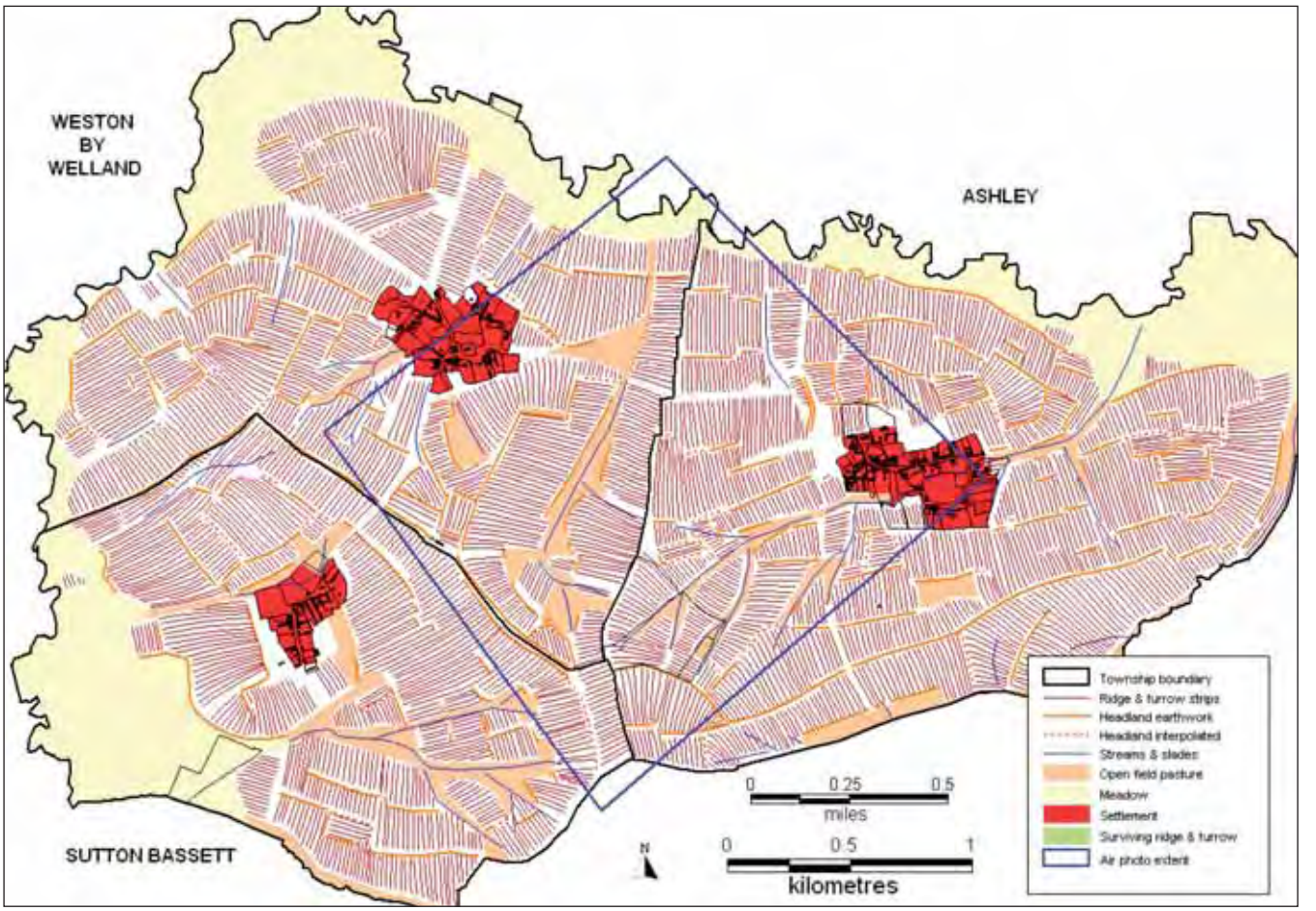

Fig 8.10
The open field furlong pattern of part of Weston by Welland and Ashley, mapped by Hall from ground survey of remnant headlands and surviving ridge and furrow, compared with the earthwork evidence of ridge and furrow recorded on the vertical air photos of the 1940s (Reproduced from Foard et al 1994b, fig 26).

enhancement since 1974 from all the sources, it is not surprising that the NMP mapping in Northamptonshire has revealed almost no major new medieval or post-medieval sites. Almost the only potential for this was in the systematic searching of the RAF vertical aerial photography, which had already been extensively consulted for the RCHME inventories. In very specific ways aerial survey has, however, yielded important evidence that complements that from ground survey and documentary research.

In some cases this has been earthwork evidence for sites subsequently levelled or destroyed; in some cases it has been the result of intensive, targeted reconnaissance work, as with the soilmark evidence for the medieval charcoal industry; in other cases it has been through the recovery of parchmark evidence, again as a result of carefully targeted reconnaissance during exceptional dry conditions. As a result, the NMP mapping has provided important initial, and in some cases the sole graphical, interpretation of earthwork sites that were not included in the RCHME inventories. However, because one is dealing with a millennium where a vast documentary record is available, and where other archaeological techniques can yield evidence on an intensive and on a landscape scale, it must be recognised that NMP has a limited role, primarily of providing a basic graphic index to what aerial data exist. Only when that data are analysed in more detail by medieval specialists, drawing upon the full range of available evidence, can the full potential of the aerial data in some cases be realised, whether this be for medieval and post-medieval settlement, land use or industry.

In view of the policy, before 1999, of working from existing earthwork plans, it is likely that re-examination of some earthwork aerial photography for sites that were surveyed by RCHME may yield more data than are currently available within the NMP mapping. It may also be that other monuments scattered through the wider landscape, such as windmill mounds and water mill sites, may occasionally have been missed because there was no systematic

Fig 8.11
1940s RAF vertical air photograph showing earthwork ridge and furrow (English Heritage (NMR) RAF photography CPE UK 1925/1179 copyright MOD)

mapping of the ridge and furrow. However such omissions are likely to be corrected in the AHRC project.

The upstanding medieval and post-medieval remains of lowland Britain pose a significant, but rarely acknowledged, problem for the NMP. A consistent solution to the problems of how to render these complex multi-layered, three-dimensional landscapes within a two-dimensional digital drawing has not been established. The Northamptonshire NMP Project tested a variety of options and finally settled upon a cost-effective method that we believe provides a sensible role for the NMP: that is, to provide an initial guide to the extent and character of the earthworks evidence. What is clear is that NMP cannot attempt the sort of intensive analysis and mapping that can only be effectively implemented through the integration, by medieval specialists, of aerial data with that from various types of ground survey and documentary research. One of the two author's wider experience of the NMP is that such issues have not been adequately addressed, either for current projects or for those in planning.

9
Studying modern military remains

by Graham Cadman

The Northamptonshire NMP Project was designed in 1994 at the time when Britain's 20th century military remains, defined for the purposes of this report as monuments up to the end of the Cold War in 1989, were only just beginning to be accepted as an archaeological resource worthy of study and selective preservation (Dobinson 2000). Only after the start of the Defence of Britain Project (DoB) in 1995 was detailed guidance available on the recording of such remains, and only then did significant evidence begin to be systematically collected by the SMR in Northamptonshire (Dobinson 1996, 2000; Dobinson *et al* 1997; English Heritage 1998, 2000). In 1994 such data were not routinely sought, and only a handful of entries for modern military sites existed in the SMR, compared with more than 600 records by 2002.

Twentieth century sites had not been specifically targeted by the intensive NCC aerial reconnaissance programme that ran from the mid-1970s to the mid-1990s, so there were few specialist oblique photographs of known sites (*see* chapter 2). Although in 1994 the archaeological scope of the NMP did encompass military remains up to 1945, the remit of the North-amptonshire project was only to record airfield and other defence sites that were not already on Ordnance Survey maps (Northamptonshire Heritage 1994, 10). Buildings, including those with military functions, either by design or appropriation were not normally to be mapped at all, although there was provision for significant structures such as pillboxes to be noted and reported to the SMR (North-amptonshire Heritage 1994, 10). In practice this meant that the majority of the military sites of the last century were beyond the scope of the mapping project. As a result, while the NMP mapping has contributed some useful new data to the understanding of the resource, its contribution is more limited than it might have been had the reconnaissance programme and the project been initiated later.

A total of 106 sites in 34 groups were identified by the project as 20th-century military features. Few of these were previously unknown, although the project has added important detail in some cases.

The majority of records for 20th-century military remains now in the SMR originate from DoB recording, carried out by volunteers, whom NCC helped to coordinate; work by the author on the aerial photographs; and supplemented from the national documentary assessments undertaken by Colin Dobinson on behalf of the CBA for MPP. Aerial photography as utilised by NMP has contributed relatively few new sites.

The 20th-century military resource in Northamptonshire

There is an enormous range of 20th-century military remains across Britain, including civil defence and related works, all of which reflect the changing nature of threats to national security and the new and varied counter-measures built in response to them. Although less vulnerable than many parts of the country, there was a significant military impact on Northamptonshire. The county had only small numbers of many of the main categories of 20th-century military sites, as defined by the MPP (English Heritage 2000), and some types, such as the 'stop line' static defence anti-tank ditches of early World War II, were entirely absent (Table 9.1). Many of the sites known in the county presently lay outside the MPP classes at the time of writing, mainly those of a Civil Defence and quasi-military nature, including Prisoner of War (POW) camps, hospitals, training camps, barracks and drill halls, stores, and facilities for agriculture and evacuees.

While military exercises held before World War I may have left some archaeological traces, the principal remains of this era are those of barracks and drill halls, including the large, nationally-important Royal Ordnance Depot at

Table 9.1 Northamptonshire twentieth century military sites with comparative national data.

category/type	*UK estimated total*	*Northamptonshire estimated total*	*observations and references (Northamptonshire references are to SMR and other NCC records unless specified)*
inland or 'defence in depth':			
pillboxes	20,000 minimum	38	national total from Dobinson (2000, vol. II). Northamptonshire total includes all recorded pillboxes including those built for airfield defence
road blocks	unknown	75	no national estimate traced
Spigot mortars	*c*28,000	1 minimum	national total from Dobinson (1996, vol II). Estimated total issued to Home Forces
anti-tank ditches	752km (467miles)	0	total national length is that planned in July 1940. Dobinson (1996, vol II). None were constructed in Northamptonshire
airfields and airfield defences:			
WW1 military airfields (1918)	301	3	National total from Dobinson (2000, vol IX.1). Northamptonshire total includes emergency landing ground at Clipston
military airfields (1936)	*c*150	2	National total from English Heritage (2000a)
WW2 military airfields (1945)	740	7	National total from Dobinson (2000, vol IX.1)
military airfields (2000)	not available	3	
bombing ranges	108	3	National total for WW2 inland ranges from Smith (1989)
Thor missile sites	20	2	National total from from Cocroft (2001)
anti-aircraft defences:			
WW1 AA	376	?2	National total from Dobinson (1996, vol I.1)
WW2 AA	2270	44	National total from Dobinson (1996, vol I.1). Comprising 981 HAA, 1238 LAA and 51 minimum Z batteries. Northants 5 HAA, 39 LAA.
WW2 searchlights	1000s	79	
WW2 bombing decoys	797	11	National total from Dobinson (2000); 797 locations with *c*1100 'decoy functions'. Northants 10 sites with 11 decoys (Cadman 1998-9)
U/G ROC Posts	985	20	National total from Dobinson (2000, vol XI.1). Northamptonshire total included information from Subterranea Britannica
infrastructure:			
PoW camps WW1	unknown	15	Northamptonshire WW1 and 2 sites range from parent camps to local PoW hostels
PoW camps WW2	1500	20	National total from English Heritage (2002). Northamptonshire WW2 sites range from parent camps to local PoW hostels
air aid shelters (domestic)	3.5 million	33	Estimated numbers of Anderson and Morrison shelters from Dobinson (2000 Vol VIII). Northamptonshire figure is for all SMR recorded civil and domestic shelters
miscellaneous:			
aircraft crash sites	11,000 min	550	National figure is for UK in WW2 only from Holyoak (2002). Northamptonshire figure us for military aircraft destroyed 1917 to 1964 from Gibson (1982)

Fig 9.1
The Royal Ordnance Depot at Weedon on the 13th April 1947. A superb vertical view of the stores, magazines, barracks and hospital at what was clearly a busy period shortly after the end of WW2. Rows of Romney and other temporary 20th century hutting, since demolished with little if any recording, are clearly evident together with what appear to be overflow stores lined up alongside the A45. Such photographs provide a rare opportunity to witness the working site with practices that may not be wholly recoverable from the documentary record. The Depot was constructed in the early 19th century and continued in military use until the latter part of the 20th century (extract from English Heritage (NMR) RAF photography CPE/UK/1994 1268).

Weedon (Fig 9.1) ((Menuge and Williams 1999). During World War I the main military impact in the county was represented by military camps and training areas, POW camps, wartime production – most notably of munitions at Warkworth and Northampton – plus the building of two military airfields. During the interwar period the concept of offensive deterrence was adopted and guided the siting and layout of RAF stations until World War II. Offensive bomber bases originated in East Anglia and Oxfordshire, although only during World War II did a rapid airfield building programme extend into Northamptonshire. Government re-armament from the early/mid-1930s included establishment of some anti-aircraft (AA) and searchlight provision, along with Civil Defence arrangements (English Heritage 1998, 2000b).

In World War II Northamptonshire was far enough away from important centres of population and heavy industry to avoid concentrated bombing, but it did have offensive RAF and US bomber stations, which played an important role in the training of air crews, and had other training and storage facilities. Munitions and other wartime materials were also produced, and POW camps established.

During the Cold War Northamptonshire moved into the front line with the deployment, albeit short lived, in the late 1950s of nuclear missiles. It also had a 'V' bomber base, nuclear bomb stores, communications facilities along with part of the national network of Royal Observer Corps posts and civilian buffer stores, some continuing in use to the end of the Cold War.

Aerial photography and modern military archaeology

Lowry has noted that 'although the use of aerial photographs to identify archaeological sites is well established, few people have used such photographs to locate former military sites. This is a little surprising, given that aerial photographic reconnaissance was devised for this very purpose' (Lowry 1996, 9). The MPP has used air photographs to check for survival and completeness of select classes of site after they had had their primary sources assessed (English Heritage 1998, 2000a), and they were used in the evaluation of Cold War, AA and radar sites (English Heritage 1998; Anderton 2000). Air photographs also assist in understanding and assessing very select World War II civil defence sites for preservation, although only where full location lists from primary sources exist to enable evaluation in a targeted programme. Most other civil defence sites currently lack the assessment of primary sources, and along with other classes of site – such as

searchlights and town defence plans – require a different, more reactive approach.

As part of the research undertaken in preparing this paper, a limited sample of documented and/or fieldwork confirmed World War II AA sites was identified and a check made to establish which of these are identifiable on historic and/or contemporary air photographs. This confirmed the presence of some military remains on air photographs that had not previously been recognised.

Table 9.2 demonstrates that the number of sites so recognised exceeded that identified by either NMP or MPP. In the case of heavy anti-aircraft gun sites, all documented sites have been identified on both historic and modern aerial photographs, but none by NMP. To reinforce this point, two heavy AA gun sites, forming part of the Banbury Gun Defended Area, not previously documented as both being in the county have been discovered to survive at least partly *in situ* since completion of NMP. It is also now clear that both are discernable on 1940s and modern aerial photographs. Further examples of military sites in Northamptonshire that are identifiable on air photographs are provided in the supplementary web-based resources for the NMP project available through the ADS (http://ads.ahds.ac.uk/).

Targeted use of aerial photography in Essex was identified as being 'one of the most effective methods of recording change in modern industrial plants', as applied to an explosives factory of the 1890s to 1919 (Strachan 1998), as well as to World War II defensive features around Harwich (Strachan and Ingle 1998). Also in Essex, the importance of contemporary aerial photographs as a source for studying World War II remains has been recognised as in many instances 'the only surviving record' (Strachan 1998, 86). As experience in Northamptonshire now confirms, the RAF vertical photography of the 1940s provides the best aerial dataset for locating sites at or soon after the time of use, as many features have subsequently been destroyed, while modern vertical colour photography of the whole county in 2000 provides a useful source for rapid assessments of present-day survival of sites.

The Northamptonshire NMP thus presented an opportunity to identify new and existing sites during its systematic trawls through this photographic record, although unfortunately this was not fully pursued. Indeed, until recently air photographs had been but little used in Northamptonshire for the identification of 20th-century monuments, apart from the identification of a handful of cropmarks of the sites of anti-aircraft (in reality searchlight) batteries by RCHME prior to 1981. While the RAF verticals for the county held in the NMR were examined for the project, there was no systematic examination of these for modern military features, as this lay outside the remit of the project.

The failure of the project to identify or correctly interpret some 20th-century military sites, even when they did exist as earthwork, soilmark or cropmark features was compounded by the lack of specialist recognition training of NMP staff and an absence of comparative material to aid recognition, at least in the early years of the programme. Moreover, many sites, especially civil defence/anti invasion monuments, are extremely small, as well as being constructed with a view to concealment – for example, hedgerow-located pillboxes, spigot mortars, and road- and rail-blocks – while some types were located in woodland. Other more ephemeral types can be very difficult to identify even to the trained eye, such as some temporary

Table 9.2 WW2 heavy and light anti-aircraft, decoy, Z battery and searchlight sites in Northamptonshire

type	*total currently recorded*	*identified on air photographs by the author*	*identified on air photographs by NMP*	*identified on air photographs by MPP*
Heavy AA	5	5	0	1
Light AA	39	9	1	0
Decoy	11	5	0	4
Z Batteries	?2	N/A	0	0
Searchlight	79	24	15	N/A

fieldworks. In future it might be appropriate to carry out pilot work on locations where such defences are well planned in order to establish what evidence may be recovered on aerial photography, as a guide to identification elsewhere.

Many features will therefore be visible on the air photographs that were not consulted by this project. In addition, there are other sources that were not available at the time that may contain useful information, such as the military obliques held by the NMR and the wartime German air photographs now held in the USA.

Other sources and resources

The air photographs are just one element of a wide range of resources that pertain to this subject. Information can be retrieved from contemporary and post-war ordnance survey maps. Site plans for RAF airfields and non-flying stations are available from the RAF Museum (London), and copies are held in the SMR. The Northamptonshire Record Office and the Public Record Office at Kew both contain useful information, and local information from farmers, landowners and residents is also invaluable. Much of this information, together with the results of fieldwork, has been collated and contributed to the SMR either via the DoB project, reports by NCC staff (including this author) and reports by local volunteers, notably by Mr Adrian Armishaw (now Sywell Aviation Museum). There are also reports on work at on such sites arising from planning process, either among the grey literature or published in local journals and newsletters such as *Northamptonshire Archaeology*, alongside notes and articles from special interest groups, such as the Pillbox Study Group, the Fortress Study Group and the Society for the Protection of Ancient Buildings. There are reference works such as the reports compiled for the CBA by Dobinson (1996, 2000) and the online resources of *Subterranea Britannica*.

On a county and national level the state of knowledge varies considerably between the different monuments types and groups (*see* Schofield 2004) and it is clear that information on some civil defence sites is still very sparse.

Conclusions

NMP was largely successful in identifying 20th-century military remains that appeared as 'conventional' cropmarks, soilmarks and earthworks in rural areas, even if the interpretations were sometimes awry as a result of insufficient training and an absence of comparative evidence. This is largely because the primary purpose of the mapping and analysis was to distinguish modern features that may otherwise have been mistaken for earlier archaeology. In this it follows the approach used in the RCHME county inventories. The most numerous type of military site recorded by the project is therefore the searchlight battery, yet even for this type the number mapped is small in comparison with overall population estimated from DoB (Fig 9.2). This is not surprising given the mobility of some of these batteries, which would have left little physical trace even at the time of

Fig 9.2
Earthworks of the WW2 'Potters Clay' cluster searchlight site, Yardley Hastings. Note the distinctive clover-leaf pattern fieldwork which accommodated what were often a single 150cm and two 90cm projectors. The separate ring ditch emplacement may have been the location for the battery's sound locator or alternatively have been the site of an earlier single searchlight emplacement (NCC photograph SP8555/018 11/12/82).

use, and the fact that other sites have been subject to rapid deterioration and loss through agriculture.

Thus, NMP has identified only a very small proportion of the modern military sites in the county in comparison with those recorded from other sources. The project identified no new major classes of 20th-century military monument, while, in contrast, volunteer recorded fieldwork and documentary research utilising aerial photographs – conducted by the writer as an adjunct to the DoB and NMP projects – and directly targeted to the topic, has resulted in various new additions. The results of this additional research are published in the supplementary web-based resources for the NMP project, which are available through the ADS (http://ads.ahds.ac.uk/).

It is to be hoped that the evidence from this assessment is sufficient to demonstrate the potentially wider value of the air photographic record in helping identify and understand modern military remains in Northamptonshire.

Air photographs have a valuable role in confirming the exact location of sites and permitting verification or amendment of transcribed military grid references, as well as providing information on the extent, general condition and development of military sites at a particular point in time, including variations from the documented. In addition, contemporary wartime/immediate post-war vertical air photographs can also be used to identify new sites not yet traced through documents. More recent oblique photographs can contribute to understanding current survival, and inform longer-term management of individual sites. Such recording should extend to built structures as well as to earthwork and cropmark monuments.

In summary, a strong case exists for a systematic search of historic vertical air photographs to identify all military activity, urban and rural, and to encourage photography of modern military features when encountered by aerial photographic flyers.