STRATASCAN

Geophysical Survey Report

Oakham Castle, Rutland

For

ULAS

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LIST OF FIGURES

1 SUMMARY OF RESULTS

Two possible rectilinear structures have been identified to the east of the present hall. Further possible areas of structural remains or debris can be identified within the southeast corner of the castle earthworks. To the north of the castle, in the north side of survey Area 2, linear anomalies may indicate possible cut features of archaeological origin, some of which may be associated with the bailey earthwork.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by ULAS to undertake a geophysical survey of Oakham Castle. This survey forms part of an archaeological investigation being undertaken by ULAS.

2.2 Site location

The site is located at Oakham Castle in Oakham, Rutland at OS ref. SK 862 089.

2.3 Description of site

The survey area is approximately 2 ha in size, consisting of two survey areas. Area 1 consists of the area inside the present earthworks of the castle. Area 2 covers a recreation area north of the castle, surveying over the associated bailey. Areas of hard standing and steep earthworks were unable to be surveyed by the techniques used. The underlying geology is Middle Lias (British Geological Survey South Sheet, Forth Edition Solid, 1997). The overlying soils are known as Banbury soils which are ferritic brown earths. These consist of well-drained brashy fine and coarse loamy ferruginous soils over ironstone (Soil Survey of England and Wales, Sheet 3 Midland and Western England).

Standing in the centre of survey Area 1 looking northeast

Standing in the centre of survey Area 2 looking northwest

2.4 Site history and archaeological potential

The client has supplied all documentary evidence, with main reference to Clough, T: 1999. *Oakham Castle, a guide and history*. Rutland County Council and Pevsner, N: 1960, 1984. *Leicestershire and Rutland*. Yale University Press. London

It is thought that a castle on this site had existed in Saxon times. William the Conqueror acquired the parish in 1075, when a reference is made to a hall (Clough 1999). In 1086 further reference is made to the presence of a timber hall (Pevsner 1984).

During the 13-14th Century the castle was rebuilt and renovated. In the 13th Century, a stone rampart might have been added or replaced the earlier palisades and the hall rebuilt (Clough 1999). A document of 1340 mentions 'a castle, well walled, with a drawbridge and with an inner bailey, within which was a hall, four rooms, a chapel, kitchen, gaol, stables and a barn for hay' (Pevsner 1984). During 1375 there is documentary evidence for repair and additions to the castle (Clough 1999).

In 1521 the castle is described as 'an old castle, all ruinous …the hall is in the best state of repair, and old fashioned' (Clough 1999). Clough mentions a levelling of the site around the 17th Century and attributes this to George Villiers, who later added a gate and pediment at the town end of the castle.

From the late 1600s onwards the castle is illustrated and described as containing a hall with a surrounding curtain wall. Restoration of the hall was undertaken in 1911, and archaeological work in the 1950's identified the line of the perimeter ditch south of the castle.

2.5 Survey objectives

The objective of the survey is to form part of an archaeological investigation to aid in the production of a conservation plan to enable the forward maintenance and mitigation of archaeologically sensitive areas and elements. To produce a better interpretation of the site, with a view to recommending appropriate mitigation strategies and to produce a development plan to direct future development of the site.

2.6 Survey methods

Detailed magnetometry and resistivity surveys were carried out across the site in order to assess the area with complementary techniques. More information regarding these techniques is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 8 days from 11.04.05-15.04.05 and from 17.05.05-19.05.05 when the weather was variable but mostly fair.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information.

3.3 Description of techniques and equipment configurations

3.3.1 Magnetometer

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using dual FM256 Fluxgate Gradiometers, manufactured by Geoscan Research. The gradiometers are suspended on a frame CF6. One gradiometer acts as a master trigger that controls the second slave gradiometer.

The instruments each consist of two fluxgates mounted 0.5m vertically apart, and very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.

3.3.2 Resistance Meter

This method relies on the relative inability of soils (and objects within the soil) to conduct an electrical current, which is passed through them. As resistivity is linked to moisture content, and therefore porosity, hard dense features such as rock will give a relatively high resistivity response, while features such as a ditch which retains moisture give a relatively low response.

The resistance meter used was an RM15 manufactured by Geoscan Research incorporating a mobile Twin Probe Array. The Twin Probes are separated by 0.5m and the associated remote probes were positioned approximately 15m outside the grid. The instrument uses an automatic data logger, which permits the data to be recorded as the survey progresses for later downloading to a computer for processing and presentation.

Though the values being logged are actually resistances in ohms they are directly proportional to resistivity (ohm-metres) as the same probe configuration was used through-out.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Magnetometer
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid. All traverses were surveyed in a “zigzag” mode.

Resistivity
Readings were taken at 1.0m centres along traverses 1.0m apart. This equates to 900 sampling points in a full 30m x 30m grid. All traverses were surveyed in a “zigzag” mode.

3.4.2 Depth of scan and resolution

Magnetometer
The FM256 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.5m centres provides an appropriate methodology balancing cost and time with resolution.

Resistivity
The 0.5m probe spacing of a twin probe array has a typical depth of penetration of 0.5m to 1.0m The collection of data at 1m centres with a 0.5m probe spacing provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

Magnetometer
The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

Resistivity
The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Magnetometer
Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed magnetometer data used in this report:

Zero mean grid	*Threshold = 0.25 std. dev.*
Zero mean traverse	*Last mean square fit = off*
Despike	*X radius = 1 Y radius = 1*
	Threshold = 3 std. dev.
	Spike replacement = mean

Resistivity
The processing was carried out using specialist software known as *Geoplot 3* and involved the 'despiking' of high contact resistance readings and the passing of the data though a high pass filter. This has the effect of removing the larger variations in the data often associated with geological features. The nett effect is aimed at enhancing the archaeological or man-made anomalies contained in the data.

The following schedule shows the processing carried out on the processed resistance plots.

Despike	*X radius = 1*
	Y radius = 1
	Spike replacement
High pass filter	*X radius = 10*
	Y radius = 10
	Weighting = Gaussian

3.5.2 Presentation of results and interpretation

Magnetometer
The presentation of the data for the survey involves a print-out of the raw data both as grey scale (Figure 3) and trace plots (Figure 4 and 5), together with a grey scale plot of the processed data (Figure 6). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 9).

Resistivity
The presentation of the data for the site involves a print-out of the raw data as a grey scale plot (Figure 7), together with a grey scale plot of the processed data (Figure 8). Anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing (Figure 10).

4 RESULTS

4.1 Magnetometry (Figures 3-6, 9)
A wide range of anomalies has been identified across both survey areas and can be divided into the following categories:

- Positive linear anomalies – possible cut features of archaeological origin
- Positive area anomalies – possible cut features of archaeological origin
- Negative linear anomalies – possible remains of earthworks or embankments
- Negative area anomalies – areas of possible landscaping or archaeological activity
- Descrete low magnitude positive responses – possible pits of archaeological origin
- Areas of magnetic disturbances
- Strong discrete positive anomalies with negative returns – ferrous objects

Positive linear anomalies
A large number of positive linear anomalies have been identified across both survey areas. Area 1 appears to have a higher concentration of linear anomalies towards the eastern half of the survey area, although weak anomalies may also be present to the west but have been obscured by the presence of large areas of magnetic debris. Within Area 2, the positive linear anomalies are mainly situated to the corners of the survey area with the presence of substantial linear anomalies towards the northwest.

Towards the northwest corner of Area 1 is a set of two pairs of parallel positive linear anomalies (**g**). These may represent cut features of archaeological origin.

Within the east of survey Area 1 is a large spread of somewhat disjointed linear anomalies (**h**, **i**). These anomalies may represent cut features of archaeological origin, possibly associated with evidence for previous structures, possible robbing activity, anomalies associated with the present earthworks and possible modern activity.

Towards the northwest corner of Area 2 are a number of strong positive linear anomalies (**a**-**c**). These anomalies may represent cut features, possibly ditches, of archaeological origin, anomalies **a** and **c** may be associated with the bailey earthwork.

In the southeastern corner of survey Area 2 is a series of faint positive linear anomalies (**d**). These may represent cut features of archaeological origin. Towards the northeast of the survey area is a set of linear anomalies with approximate northeast to southwest alignment (**e1**-**2**). These anomalies may represent cut features of archaeological origin; there alignment shows no association with the present earthwork of the bailey, possibly suggesting an earlier date for these anomalies or associated with modern activity.

Positive area anomalies
A number of positive area anomalies have been identified to the east of Area 1 (**h**), these may represent possible depressions or cut features of archaeological origin but may also be caused by modern activity or landscaping.

Towards the western edge of Area 1 is a linear area anomaly running approximately parallel with the present earthworks (**f**). This feature may represent a cut feature, possibly a ditch, of archaeological origin.

Negative linear anomalies
Four negative linear anomalies have been identified towards the north of Area 1 (**l**), although no structural pattern can be recognised, these anomalies may represent structural remains or indicate an area of archaeological activity.

In the south of survey Area 1 are a further three negative linear anomalies can be identified (**k**). These may indicate a further area of archaeological activity. One linear possibly indicating a continuation of the small earthen embankment to the north and the others representing possible structural remains.

Negative area anomaly
An area of feint negative response has been identified towards the northern half of Area 1 (**j**). This anomaly may be caused by landscaping or archaeological activity.

Discrete low magnitude positive responses
A number of discrete low magnitude positive responses have been identified within the central section of survey Area 1. These anomalies may indicate possible pits of archaeological origin.

Areas of magnetic disturbance
Large areas of magnetic disturbances have been identified across both survey areas. These are likely to have been caused by the presence of modern magnetic debris and nearby structures.

Strong discrete positive anomalies with negative returns
These strong discrete positive anomalies with negative returns are likely to be caused by near surface ferrous objects of modern origin. Area 2 appears to contain a higher level of ferrous objects and an overall noisy disturbance from modern debris with a marked decrease when surveying over the present earthwork.

4.2 Resistivity (Figures 7-8, 10)
The resistivity data proved to be the most interesting of the two survey techniques. A number of well defined high and low resistance anomalies have been identified that may indicate the presence of structural remains along with a number of targeted areas of archaeological activity. The identified anomalies have been categorised into the following:

- High resistance linear and area anomalies – possible structural remains
- Low resistance linear – cut features of possible archaeological origin
- Low resistance areas anomalies – cut features of possible archaeological origin
- Low resistance area anomalies – areas of archaeological activity or landscaping
- Present earthworks associated with the castle

High resistance linear and area anomalies
A concentration of high resistance linear and well-defined area anomalies can be identified to the southeast corner of survey Area 1. Linear anomaly **5b** appears to show a continuation of the present earthworks with the castle grounds. Linear anomaly **7** suggests the presence of structural remains that are of a similar shape to the present earthworks.

High resistance linear anomalies **4b**, **6a** and **9b** may all represent possible structural remains of archaeological origin. Area anomaly **8** may represent a rectilinear structure within an area of archaeological debris, possibly surrounded by a linear structure to the north (**7**). Area anomaly **6** may represent an area of archaeological debris.

Area anomaly **4a** may represent a possible rectilinear structure to the east of the present hall. Although the existence of this anomaly appears to be faint within the raw data (Figure 7), the processed data (Figure 8) has exaggerated the surrounding lower resistance readings, this has emphasised the presence of an anomaly that may be of archaeological origin.

To the north of Area 1 is a high resistance rectilinear anomaly (**14**). This anomaly may indicate structural remains of archaeological origin. In the southeast corner of Area 2, four faint high resistance linear anomalies have been identified (**15**). These anomalies may represent structural remains of archaeological origin.

Low resistance linear anomalies
Two linear low resistance anomalies can be identified in the east of Area 1 (**5a** and **9a**). Linear **5a** appears to suggest a cut feature of archaeological origin, associated with the continuation of a present earthwork (**5b**). Anomaly **9a** suggests the presence of a cut feature, possibly a ditch, in a northwest and southeast alignment.

High resistance area anomalies indicating possible areas of structural debris
A number of high area anomalies can be identified within both survey areas, with a higher concentration across the centre and eastern side of survey Area 1. These areas of high resistance may represent areas of structural debris of possible archaeological origin. Anomaly **10** may represent an area of compacted ground or a linear structure, indicating a pathway across the centre of the castle.

Low resistance area anomalies of possible archaeological origin
Situated along the northern edge of Area 2 are a number of low resistance wide linear anomalies (**1**-**3**), many of which correspond with the positive linear anomalies identified within the magnetometer survey (**a**-**c** and **e1**). These features may represent cut features of archaeological origin. The area anomalies towards the northwest corner of Area 2 may be associated with the bailey (**1**). There appears to be a sudden discontinuation of these anomalies approximately 15m south from the northern limit of the survey. Modern landscaping or levelling of the area could have caused these anomalies to 'disappear'.

Low resistance area anomalies possibly indicating areas of archaeological activity or landscaping
Approximately five areas of low resistance anomalies have been identified within survey Area 1. The anomalies situated to the east of the survey area are likely to be associated with the high resistance area anomalies **6** and **8** and could indicate areas of archaeological activity.

Anomaly **11** (a weak low resistance anomaly) situated to the north of the present hall may indicate an area of landscaping or levelling. Two low resistance area anomalies situated to the west of the hall (**12**) may indicate areas of archaeological activity, or be associated with robbing activities or landscaping.

Present earthworks associated with the castle
Areas of high and low resistance anomalies have been identified in the northeast corner of Area 1 and across Area 2 (**13a** and **13b**). These anomalies represent present earthworks associated with the castle.

5 CONCLUSION

Both survey techniques have provided interesting results with a number of anomalies of possible archaeological origin identified within both techniques. The resistivity has produced possible evidence for structural remains immediately to the east of the present hall in the form of two rectilinear structures. Further areas of possible structural remains have been identified within the southeast corner of Area 1.

The magnetometry data within Area 1 suggests the presence of many positive linear anomalies, although no immediate structures can be identified. These anomalies may represent a concentration of archaeological activity with the southeastern corner of the castle. These results are supported by the resistivity data, as areas of possible archaeological activity and structural remains which appear to be confined to the southwest corner of survey Area 1.

Survey Areas 2 has recognized two areas of possible archaeological interest (identified within both data sets). Running across the northern edge of the survey area, a number of linear responses have been identified with a north to south alignment. These may indicate cut features of archaeological origin; a number of these may be associated with the present earthwork of the bailey. These features abruptly disappear as they progress southwards across the survey area, this may be caused by modern landscaping or the levelling of the site, reportedly to have been carried during the 17th century (Clough 1999).

In the southeast corner of survey Area 2, a number of linear anomalies have been identified with both survey techniques. No immediate structural plans can be identified, possibly suggesting a general area of archaeological activity or possible modern disturbances.