

# **Geophysical Survey Report MSTL33**

of

Land at Moreton Hall,

Bury St. Edmunds, Suffolk

For

**Cotswold Archaeology** 

**On Behalf Of** 

# Jaynic Suffolk Park Limited

Magnitude Surveys Ref: MSTL33 HER parish code: RGH 094 HER event number: ESF24699 September 2016





# magnitude surveys

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## Abstract

Magnitude Surveys was commissioned to assess the archaeological potential of a *c*. 46 ha area of land at Moreton Hall, Bury St. Edmunds. A fluxgate gradiometer survey was successfully completed. The geophysical results primarily reflect the remains of a former Royal Air Force Station, agricultural activity, modern structures and geological deposits. Besides the anomalies pertaining to the former airfield, no other anomalies of a potential archaeological origin have been detected.

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## 1. Introduction

- **1.1**. Magnitude Surveys Ltd (MS) was commissioned by Cotswold Archaeology (CA) on behalf of Jaynic Suffolk Park Limited to undertake a geophysical survey on a *c*. 46 ha area of land at Moreton Hall, Bury St. Edmunds, Suffolk ([TL 885 637).
- 1.2. The geophysical survey comprised hand pulled, cart-mounted fluxgate gradiometer survey.
- 1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David et al., 2008), the Chartered Institute of Field Archaeologists (ClfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).
- 1.4. The survey was conducted in line with a risk assessment and methods statement submitted to Suffolk County Council. The project's HER parish code is RGH 094. The project's event number is ESF24699. The completed OASIS form is appended to the end of this report.
- **1.5.** The survey commenced on 4 August 2016 and took six days to complete.

## 2. Quality Assurance

- 2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIFA, 2014; David et al., 2008, Schmidt et al., 2015).
- 2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).
- **2.3.** Director Graeme Attwood is a Member of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group.
- 2.4. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group.
- **2.5.** All MS managers have postgraduate qualifications in archaeological geophysics. All MS field staff have relevant archaeology degrees and at least three years field experience.

# 3. Objectives

- 3.1. The geophysical survey aimed to assess the potential archaeological landscape of the survey area.
- **3.2.** The survey forms part of the archaeological mitigation required by Suffolk County Council and shall be used to inform the location of any trenches, should they be required.

## 4. Geographic Background

- 4.1. The underlying geology comprises chalk formations, with superficial deposits of sand and gravel (BGS, 2016). Archaeological excavations in the field immediately north of the survey area record pits being carved into natural geology, as shallow as 0.2 m from the ground surface (Beverton, 2012).
- 4.2. The soils consist of freely draining slightly acid but base-rich soils (Soilscapes, 2016).
- **4.3**. Survey was undertaken over two large, flat fields, which had recently been cultivated. The fields were divided by an access road. The survey area's southern edge was bounded by the A14 and the western edge by Lady Miriam Way. The northern edge is bounded by a road currently under construction.

# 5. Archaeological Background

- 5.1. The following forms a summary of significant heritage assets derived from Heritage Gateway using a 1 km search radius from the survey area's centre.
- **5.2.** The survey area encompasses the site of the former Royal Air Force Bury St Edmunds Airfield, or Rougham Airfield, which was operational in World War II. The airfield fell out of military service in 1948, after which the runways were broken up and removed (Suffolk HER RGH 046). A crop mark within the survey area, recorded as a possible ring ditch, could also relate to Rougham Airfield, possibly a searchlight emplacement or an AA gun emplacement, due to its proximity to the end of a former runway (Suffolk HER RGH 065). Excavation immediately north of the survey area, in the same field, revealed material and soil disturbances related to the former airfield. A number of pits were uncovered that averaged 1 m in diameter to a depth of up to 0.2 m. The origin of these pits is uncertain in many cases, but some pits suggest a potential fog-lifter origin. Fog-lifter pits were typically filled with petrol and burnt to disperse fog around the runways. However, a couple pits similar in nature to the potential fog lifter pits were discovered within the runways, suggesting a different origin (Beverton, 2012).
- 5.3. Prehistoric activity has been uncovered immediately north of the survey area in the form of a late prehistoric pit and a ditch containing middle Iron Age pottery (Suffolk HER RGH 066). 700m SW of the survey area, a large flint scattering, mainly dating to the Middle Bronze Age has been recorded (HER Suffolk RGH 048). A further scatter of mainly Middle Bronze Age worked flints has also been recorded approximately 1000m SW of the survey area (Suffolk HER RGH 043). Approximately 900m NW of the survey area, a number of ditches, pits and posthole features linked with prehistoric pottery have been recorded (Suffolk HER RGH 030).
- **5.4.** Roman remains have been recorded approximately 600m NW of the survey area in the form of pits containing pottery remains (Suffolk HER RGH 031).

# 6. Methodology

## 6.1.Data Collection

- **6.1.1**. Geophysical prospection comprised the magnetic method as described in the following table.
- 6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1 m	200 Hz reprojected to 0.125 m

- 6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system.
  - 6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna is accurate to 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm in the vertical.
  - 6.1.3.2. Magnetic and GPS data were logged on a USB flash drive housed in MS' bespoke data-logger and transferred to a laptop computer for processing.
  - 6.1.3.3. A series of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, to ensure that the data was efficiently collected and processed.

### 6.2. Data Processing

**6.2.1**. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps were limited to:

<u>Sensor Calibration</u> – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

<u>Zero Median Traverse</u> – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

<u>Projection to a Regular Grid</u> – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

<u>Interpolation to Square Pixels</u> – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

## 6.3.Data Visualisation and Interpretation

- **6.3.1**. This report presents geophysical results as greyscale images. Multiple greyscales images have been used for data interpretation; these were at different plotting ranges and show different components of the vector magnetic field. This report presents the gradient of the sensors' total field data. Greyscale images should be viewed alongside the XY trace plots, found on the archive disk. XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.
- **6.3.2**. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street mapping, satellite imagery, historic mapping and LiDAR data.

## 7. Results

## 7.1.Qualification

7.1.1. Geophysical techniques are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.

## 7.2.Survey Considerations

ſ	Survey	No.	Surveyed	Ground	Further notes:
	Area	Survey	Y/N	Conditions	
		Blocks			
	1	2	Y	Largest	A line of trees extending from the eastern field edge
				field <mark>, flat,</mark>	has precluded survey in this area.
				stu <mark>bble</mark>	A footpath extends eastwards from the track, which
					bisects the two areas.
					Low slung powerlines ran along the north of the
					survey area.
		1			As a portion of this field was outside the survey area
					this left a small section to be surveyed independent
		1			of the rest of the field.
	2	2	Y	Smaller	Crater like indentations present, roughly 15m <sup>2</sup> .
				western	The southeast portion of this field was done as a
				field, flat,	separate survey block to run in line with the crop.
	W.			stubble	A section to the South West Corner was
				1	unsurveyable due to tall vegetation.

## 7.3.Discussion

- **7.3.1**. The geophysical results, both greyscale images and XY traces, were interpreted in consideration with satellite imagery (Bing, 2016; Figure 5) and historic mapping (Ordnance Survey, 6" 2<sup>nd</sup> edition *c*.1882-1913; Figure 6).
- **7.3.2**. The magnetic survey has responded well to the survey area's environment. The edges of the former runways of Rougham Airfield are mainly detected as lines of high-contrast ferrous spread. No other anomalies of a potential archaeological origin have been identified. The geophysical results also detect former field boundaries and anomalies relating to agricultural activity. A swathe of variable strength amorphous responses in the eastern half of the site correlates with a band of sand and gravel superficial deposits marked on British Geological Survey mapping (2016); these have been classified as Natural in origin.

## 7.4. Interpretation

#### 7.4.1. General Statements

- 7.4.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually. Specific anomalies discussed within the text have been assigned numbers, which are emboldened within square parenthesis e.g. [1].
- 7.4.1.2. **Undetermined** Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes--although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.
- 7.4.1.1. Ferrous (Discrete/Spread) Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated scattering of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

#### 7.4.2. Magnetic Results - Specific Anomalies

- 7.4.2.1 Former Runways (Archaeology Probable) Only the edges of the former runways have been detected as the runway itself was broken up and removed following closure of the airfield. The edges of the former runways are primarily detected as a defined, linear mixed spread of ferrous and other highly magnetic material. A series of discrete linear anomalies run along the southwest and northern edges of the former runway; these linear anomalies do not have the typical mixed material spread responses as seen along the other runway edges. Although the type of response is different to that of the ferrous spread, these discrete linear anomalies undoubtedly relate solely to the runway and do not represent archaeology of an earlier date.
- **7.4.2.2 Former Runways (Ferrous Spread)** The northern edge of the runway aligned NE-SW is not as clearly defined as the other edges. However, amorphous areas of ferrous spread within the runway's area likely reflect activity relating to the removal of the runway's material.
- 7.4.2.3 Agricultural Linear and curvilinear anomalies running along current field boundaries have been identified in both areas and represent agricultural activity. The stronger, ditch-like responses of the anomalies following the edges of the access road can be caused by repeated turning with modern ploughing.

- **7.4.2.4 Agricultural** Former boundaries located in Area 2 (Figure 9) have been detected as weak linear responses. These boundaries are denoted on historic mapping (Figure 6).
- 7.4.2.5 Ferrous Spread The N-S linear ferrous spread detected west of the runways in Area 1 (Figure 7) correlates with the location of a former line of trees, visible in satellite imagery (Figure 5). This location also correlates with a former field boundary denoted on historic mapping (Figure 6).
- 7.4.2.6 Ferrous Spread The access road that separates Area 1 and 2 previously extended through to the eastern edge of Area 1. A linear band of ferrous spread in Area 1 (Figure 10) correlates with the remains of a former access road.
- 7.4.2.7 Natural Near surface geology and soil variation have produced a dappling effect of mixed weak and strong amorphous anomalies running NW-SE through Area 1 (Figure 8). This alignment coincides with topography noted on the historic mapping (Figure 6) and a band of superficial sand and gravel drift in British Geological Survey mapping (BGS, 2016).
- **7.4.2.8 Undetermined** A number of strong, pit-like anomalies occur across the survey area and may be due to a number of causes. Excavations immediately north of the survey area uncovered a number of pit features, both inside and outside the former runways. Many of these pit features were ambiguous in origin and some pits indicated imported soil and modern disturbance. Ten of the pits were initially interpreted as potential fog-lifter pits, but not with complete confidence as only four of the pits displayed clear evidence for in-situ burning (Beverton, 2012). Given the history, modern usage and geology of the site, there are many anthropogenic and natural processes that could give rise to these pit-like anomalies in the geophysical results. Those identified within the runway are less likely to be of archaeological origin as the construction and subsequent demolition of the runway would most likely have obscured or destroyed any archaeological remains.

## 8. Conclusions

- 8.1. The geophysical survey has responded well to the survey area's environment. The edges of the former runways associated with Rougham Airfield have been clearly detected in the magnetic results. These edges are represented by discrete linear anomalies and defined alignments of mixed material spread. No other anomalies of a probable or possible archaeological have been identified.
- **8.2.** Agricultural features have been identified by linear anomalies correlating with former field boundaries and curvilinear anomalies relating to modern ploughing activity.
- **8.3.** Modern activity is represented by strong, ferrous anomalies. These are associated with the former access road, fencing, scattered debris and the power cables, which traverse E-W across the survey area's northern end.

## 9. Archiving

- **9.1.** MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This archive stores unprocessed and processed data.
- **9.2.** MS contributes all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.
- **9.3.** Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

# 10. Copyright

10.1. Copyright and the intellectual property pertaining to all reports, figures, and datasets produced by Magnitude Services Ltd. is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

## 11. References

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MSTL33 - Land at Moreton Hall, Bury St. Edmunds Figure 10 - Magnetic Greyscale 1 : 1500 @ A3 Copyright Magnitude Surveys Ltd 2016 Contains Ordnance Survey data © Crown copyright and database right 2016 OS (100056946)	-2 nT 3	0 25



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#### **Printable version**

#### OASIS ID: magnitud1-262469

#### **Project details**

Project name	Geophysical Survey of Land at Moreton Hall, Bury St Edmunds, Suffolk
Short description of the project	Magnitude Surveys was commissioned to assess the archaeological potential of a c. 46 ha area of land at Moreton Hall, Bury St. Edmunds. A fluxgate gradiometer survey was successfully completed. The geophysical results primarily reflect the remains of a former Royal Air Force Station, agricultural activity, modern structures and geological deposits. Besides the anomalies pertaining to the former airfield, no other anomalies of a potential archaeological origin have been detected.
Project dates	Start: 04-08-2016 End: 12-08-2016
Previous/future work	Not known / Not known
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 2 - Operations to a depth less than 0.25m
Monument type	RUNWAY Modern
Significant Finds	RUNWAY Modern
Methods & techniques	"'Geophysical Survey'"
Development type	Not recorded
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology	CHALK (INCLUDING RED CHALK)
Drift geology	SAND AND GRAVEL OF UNCERTAIN AGE OR ORIGIN
Techniques	Magnetometry

#### **Project location**

Country	England
Site location	SUFFOLK ST EDMUNDSBURY BURY ST EDMUNDS Moreton Hall
Postcode	IP32 7YB
Study area	46 Hectares
Site coordinates	TL 885 637 52.238695232135 0.761034627059 52 14 19 N 000 45 39 E Point

#### **Project creators**

Name of Magnitude Surveys Ltd Organisation

Project brief originator	Cotswold Archaeology
Project design originator	Magnitude Surveys Ltd
Project director/manager	Chys Harris

Project supervisor Graeme Attwood

#### **Project archives**

Physical Archive Exists?	No
Digital Archive recipient	Magnitude Surveys
Digital Archive ID	MSTL33
Digital Contents	"Survey"
Digital Media available	"GIS", "Geophysics", "Images raster / digital photography", "Images vector"
Paper Archive recipient	Cotswold Archaeology
Paper Archive ID	MSTL33
Paper Contents	"Survey"
Paper Media available	"Map","Report"

#### Project bibliography 1

	Grey literature (unpublished document/manuscript)
Publication type	
Title	Geophysical Survey Report MSTL33 of Land at Moreton Hall, Bury St. Edmunds, Suffolk
Author(s)/Editor(s)	Swinbank, L., Harris, C.
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Entered on	13 September 2016

