

THE MIRA SYSTEM MALÅ IMAGING RADAR ARRAY



SUBSURFACE SURVEYING FOR THE **21ST CENTURY**



Introduction

Using revolutionary new technology, the MIRA (Malå Imaging Radar Array) system delivers accurate 3D Ground Penetrating Radar (GPR) acquisition, interpretation and reporting of subsurface infrastructure an impressive 50 times faster than any normal GPR method. Designed and engineered by Malå Geoscience, the global leader in the design and manufacture of Ground Penetrating Radar, the MIRA system is set to change the UK's approach to GPR surveys for good!

The MIRA system is the first commercially available, true 3D, multi channel GPR system in operation in the UK and can be purchased or hired through the exclusive UK distributor, Lord Technical Utilities Ltd (LTU).

Unlike other commonly marketed

multi-channel systems which could be regarded as parallel, single channel systems, the MIRA system enables fast and true 3D data acquisition. From a user perspective this means that large areas can be mapped without loss of information and this method is suitable for almost any kind of shallow, subsurface investigation.

The MIRA track record is firmly established by use in service location projects overseas. Four units are solely employed for service location in Japan and a further two units are employed for service location and various types of archaeological investigation in Sweden. The vast majority of surveys are on private land where client confidentiality restricts the publication of data. Under

such circumstances many case studies are unavailable, however, data from an archaeological investigation in Sweden has been made available from Mala Geoscience.

The archaeological investigation at Birka, Sweden highlights the MIRA ability to cover differing terrain. Please see Appendix 1 - ISAPNews16_MIRA.pdf.



Wakefield FC Case Study

The LTU MIRA System was used to analyse the layout & position of the drainage below Wakefield FC pitch. This site has been built up over a number of years and therefore ground conditions were likely to be challenging for conventional GPR.

The extremities of the pitch along with features such as goals & dug-outs were surveyed directly into the MIRA

Software package using a Leica TCP 1205 Total Station. The MIRA was then used to survey the pitch, linked to the Leica Total Station via a radio link mounted on the Tractor unit to enable accurate positioning of the radar data. (A RTK Differential GPS System could be used where conditions permit).

The line of each run up & down the pitch was marked using biodegradable paint, triggered by the marking system either side of the antennas. This allowed the operator to see where he had

surveyed and overlap the adjacent run to ensure the entire site had been surveyed. (see interpretation of results on page 5, each position is indicated by a yellow dot).

Approximately 9000 square metres were surveyed in about 1 hour 45 minutes and the results were processed in 1.5 hours and can be seen in this document. It would be impossible to create the same data using a traditional GPR system and the collection of this level of data would take weeks instead of hours.



Example data: Wakefield Football Club



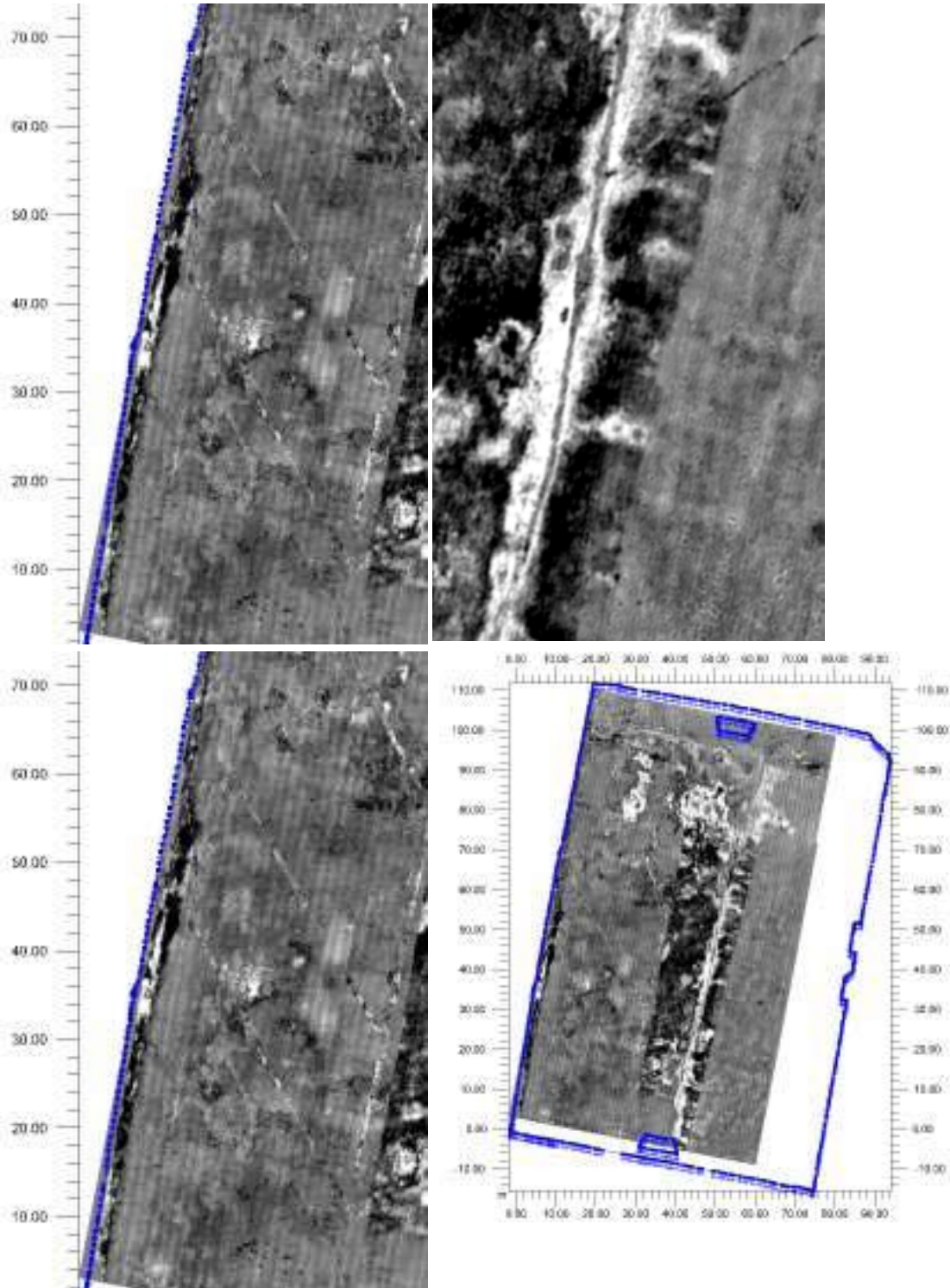
Wakefield Football Club: aerial image



Wakefield football club with GPR data overlay and herringbone drainage system example



The Wakefield football club GPR data shows a classic Herringbone drainage system. This level of detail & accuracy is not achievable with traditional GPR units.





GPR Errors and Accuracies

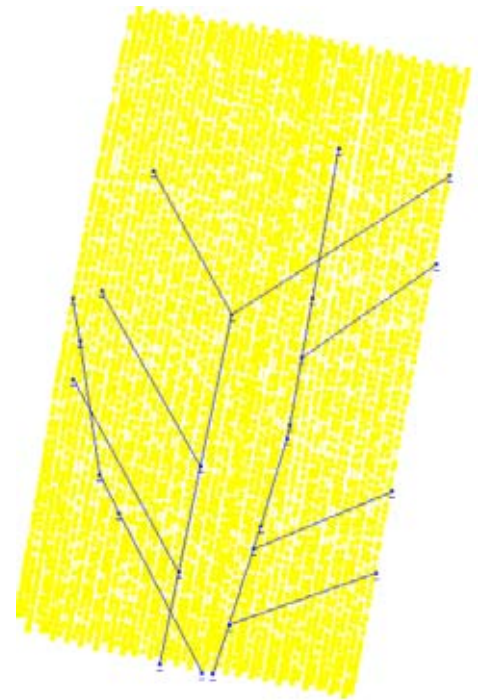
Traditional single antenna GPR systems such as the MALA Easy Locator have a stated depth accuracy of +/-20% of the depth of the target. The 2D plan position of a utility is, therefore, as accurate as the method of collection – a surveyor will mark findings with paint and position the paint mark using a total station or chains and offset, GPS etc. Using this methodology, traditional GPR positioning of data inevitably adds human error.

The MIRA system is able to capture large volumes of 3D data vastly more accurately than traditional GPR techniques. The data set is positioned using a total station then post processed using MALA's software, this means that the depth of a target will be known along the entire route rather than relying on where a surveyor would

choose to mark the depth, this ensures that changes in depth of buried utilities can not be missed using the MIRA system.

It also becomes possible to model the diameter of a target – previously very difficult (and quite inaccurate) with single channel GPR systems.

Depth accuracy of GPR can be as poor as +/-20% of the measurement because the velocity of ground varies with different ground conditions. Older systems operate using an average ground velocity. When on site, the MIRA system will still utilise the same average velocity as an Easy Locator, however, while the data is being post-processed it is possible to deduce the velocity of the ground from known targets using MALA software. This means that in areas that there are sufficient targets to calibrate the software from; the depth accuracy (in that localised area) will be at worst +/-5% of the measurement. While some ground conditions can still have an effect on the quality of the data



being produced by the MIRA, the sheer volume of data being collected means that results will still be possible in areas where traditional GPR units are unable to capture any useful data.