

Tests to determine the suitability of AgiSoft StereoScan for archaeological recording

A Meerstone Archaeological Consultancy White Paper: July 2010

Product website <http://www.agisoft.ru/products/stereoscan/>

Overview

As part of our development of Meerstone Archaeological Consultancy and the services that we offer we are writing a series of white papers to share our experiences of testing new approaches and techniques. As part of our commitment to ethical archaeology and making high quality archaeology accessible to all we are particularly interested in open source and freeware solutions. This is our first white paper which reviews our tests of AgiSoft StereoScan.

"AgiSoft StereoScan is an easy to use 3D modeling tool for automatic generation of textured 3D models from individual stereo pairs. The stereo pairs are not required to be calibrated or aligned, and can be captured by hand from any generic positions. Based on the close-range photogrammetry methods, StereoScan automatically calibrates the images, including camera positions and lens distortions. Both image alignment and 3D model reconstruction is fully automated.

Besides the image-based 3d modeling, StereoScan can be used for alignment of anaglyphs and side-by-side stereo pairs. The processing of stereo shots from FujiFilm Real 3D W1 stereo camera is also supported.

Supported input formats: JPEG, TIFF, PNG, JPS, JPEG Multi-Picture Format (MPO).

Supported output formats: Wavefront OBJ, 3DS Max, PLY, VRML, COLLADA, Universal 3D, PDF."

Taken from the AgiSoft website July 2010.

This software takes two digital photographs and automatically creates a 3d model. The name suggests that these need to be a stereo pair but as long as they represent a view from two different points roughly representing a view from left and right, then it will work. The software takes the images and then automatically identifies common points. It then creates a TIN network (triangulated irregular network) which it then decimates to thin the data. The photograph is then wrapped over the TIN although you can also display the model as a wire frame or as a solid or shaded model. The model can be rotated and zoomed in the program or exported in a number of different formats.

AgiSoft StereoScan has been tested using three different types of image. Firstly aerial views captured using kite aerial photography (KAP). Secondly photographs of architectural details taken using a hand held camera. Thirdly small artifacts were photographed to test its ability to model small finds.

Next to the sample images below are links to a pdf version of each model. The latest version of Adobe Reader (version 9) allows the reader to zoom and rotate the images in just the same way as within StereoScan. By right clicking over the image in Adobe Reader you can access various viewing options under the Model Render Mode option. We would suggest that you try the solid and the wireframe options.

KAP images

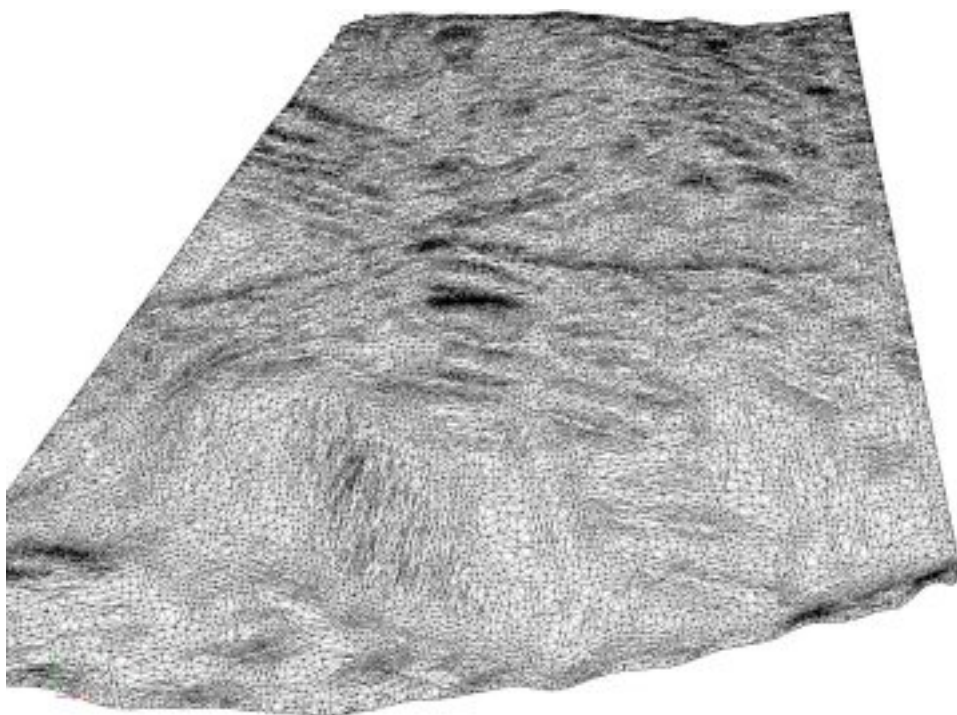
The KAP images were chosen with care to represent overlapping images. These included photographs taken over a three year period and with two different cameras. The earlier images with an Olympus u790SW, 7mp camera, the later images by a Canon DIGITAL IXUS 860 IS 8mp camera. The latter produces a better quality image.

Processing time is very quick using the medium quality setting, less than a minute, and generally produced agreeable results. Initially some of the images looked ok but on rotation were found to have holes in the data. A more careful selection of images did sort this out but it was found that strongly oblique images, approaching a vertical view worked best. The images that were less successful were ones with partial building remains which the software had problems interpolating. Images that had a higher percentage of things at a similar height worked much better.

The images below are screenshots of test subjects as solid models and as wireframes. These

have received no further processing.

Example 1 Lead dressing floor Bolton Gill. Camera: Canon DIGITAL IXUS 860 IS

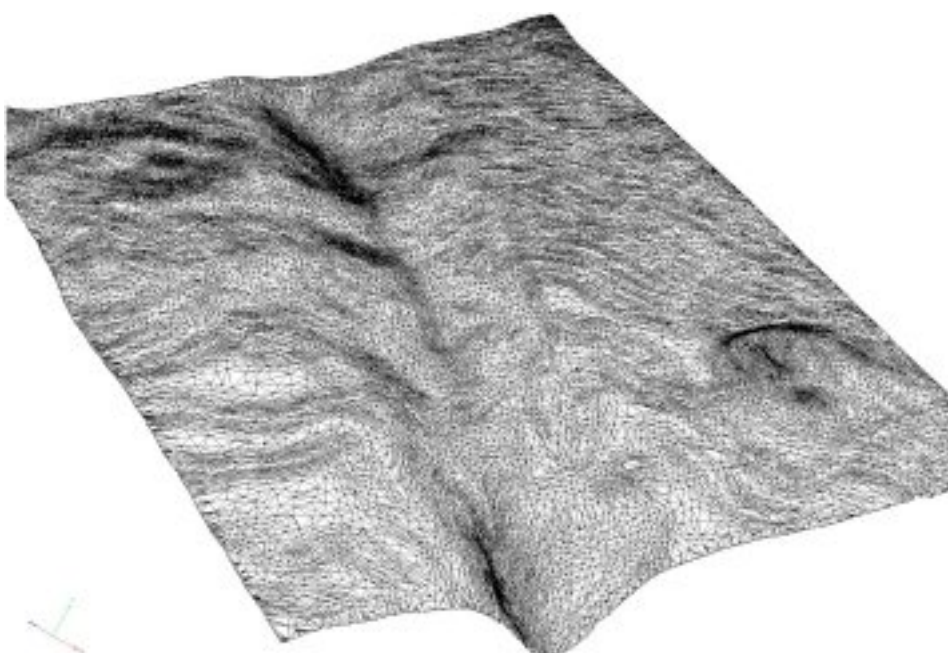


[view full model](#)

*If you are using the Google Chrome web browser this PDF file may not display correctly. To solve this problem open Acrobat Reader and in edit>preferences>internet, uncheck the **Display PDF in browser** option.*

This model provides reasonable record of the geometry of the site and would be ideal for monitoring erosion. The wireframe version adds no noticeable additional data.

Example 2 Opencut trench Castaway vein, Grassington Moor. Camera: Canon DIGITAL IXUS 860 IS

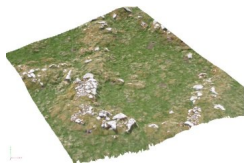


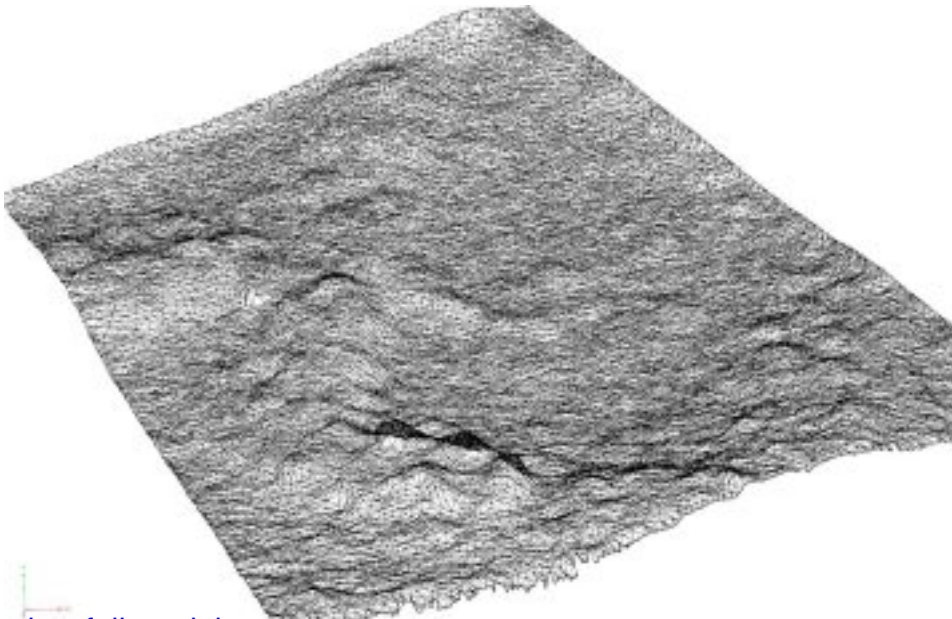
[view full model](#)

*If you are using the Google Chrome web browser this PDF file may not display correctly. To solve this problem open ☐ Acrobat Reader and in edit>preferences>internet, uncheck the ☐ **Display PDF in browser** option.*

This model picks up detail of the opencut and the morphology of associated tips and the remains of a 17 century miners coe (a small building). The wireframe version demonstrated that this technique is picking up quite small details such as a shaft covered with a stone beehive, seen as a dimple in the top left.

Example 3 Romano British walls Lea Green, Grassington. Camera: Olympus u790SW





3D Modelling with AgiSoft StereoScan

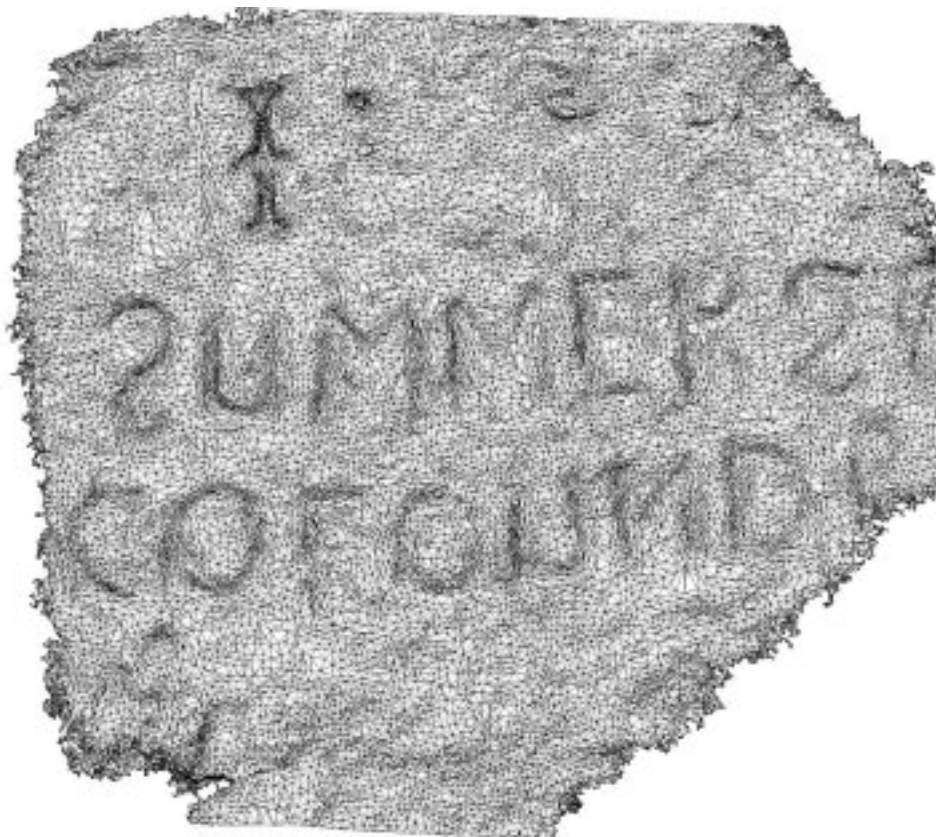
Architectural detail

The ground level photographs of architectural detail included ornate carvings, incised text and monumental inscriptions on grave stones. The photographs were taken hand held to test the claim that the software is able to handle images that were not truly stereo. The chosen objects were photographed from left and right at angles between 60 and 45 degrees to the surface. Most of the photographs relied on natural light but for some of the gravestones flash was used to observe the effect that this would have on the image. The distance to the objects was around 1m. All the photographs were taken with a Canon DIGITAL IXUS 860 IS 8mp camera.

Processing was again very quick but the results varied and the low and high quality setting were tried to improve the results. In the case of more ornate carving the low setting proved to be most reliable but it was observed that the depth of the carving was much reduced in these cases. The two examples below show the best results.

Example 4 Inscribed Meerstone, Grassington Moor. Camera: Canon DIGITAL IXUS 860 IS



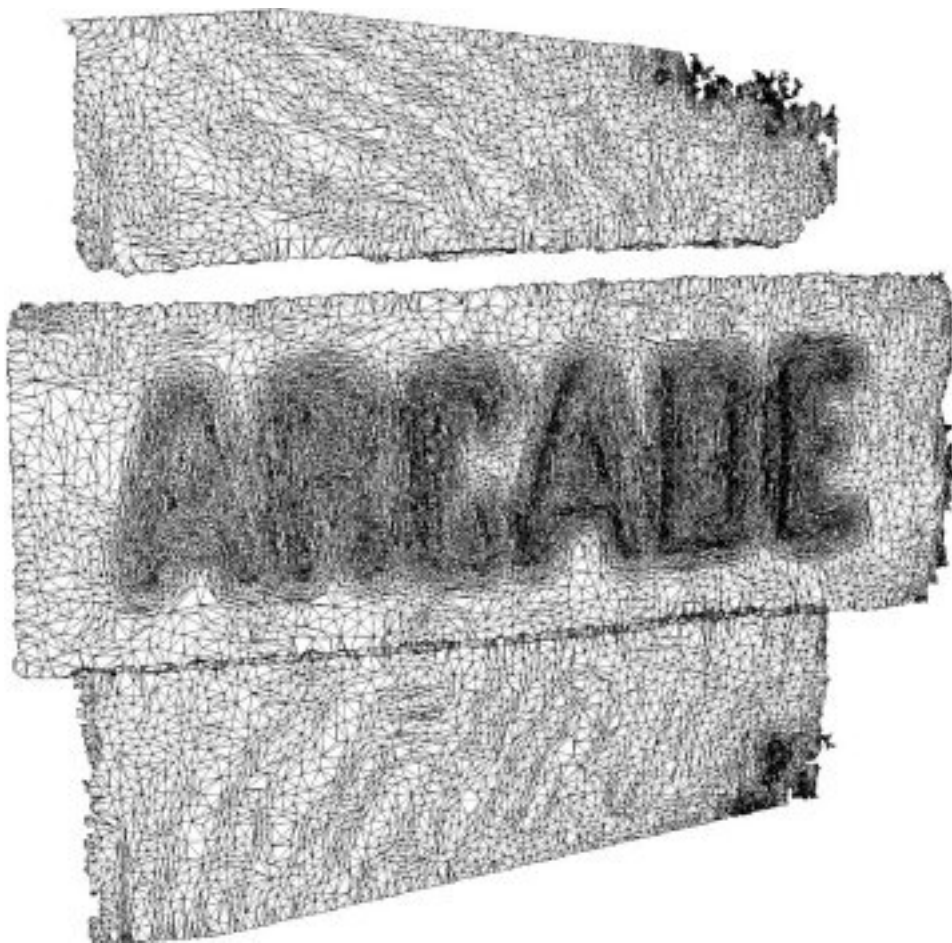


[view full model](#)

*If you are using the Google Chrome web browser this PDF file may not display correctly. To solve this problem open ☐ Acrobat Reader and in edit>preferences>internet, uncheck the ☐ **Display PDF in browser** option.*

Although the software did not fully model the stone, a problem that could be solved by taking more care with the photographs, it has captured the lettering very well in low contrast lighting. The wireframe has done an excellent job of enhancing the visible lettering, although there appears to be a missing letter to the right of the "I" at the top of the stone.

Example 5 Carved stonework Halifax Market – with this image the software has clearly not been able to see the flat surfaces above and below the text. It has also failed to recognise the return side of the block to the left of the letter A. It has however nicely captured the depth of the lettering.



[view full model](#)

*If you are using the Google Chrome web browser this PDF file may not display correctly. To solve this problem open Acrobat Reader and in edit>preferences>internet, uncheck the **Display PDF in browser** option.*

Small artefacts

A range of small artefacts were photographed to test the software's ability to model small finds. These were taken against a white background in a variety of natural and artificial lighting conditions. For this technique to work successfully it would need to work with a range of materials and objects and so test objects chosen included examples ferrous and wooden artefacts with both simple and complex shapes. None of the results were satisfactory. This may have been a result of the lighting or the camera settings.

Comments

As a piece of free software this is a useful tool that demonstrates the value of 3d modelling from photographs. The results were sufficiently encouraging to consider trying more sophisticated software that can handle more photographs to build more detailed models. As it stands the software coupled with kite aerial photography is a capable tool able to produce models suitable for site monitoring, for publications, or for museum virtual displays. The ability to rotate the image and the added 3d feel adds a considerable level of usefulness to aerial photographs. The next obvious step is to try and use the models to map sites. This would be a big step forward but as the software provides no way of calibrating the images, a feature available in more expensive software solutions, a work around will have to be developed involving other software packages.

Using the software for recording architectural detail, carving and graffiti partly depends on how the photographs are taken, but it does look like hand held photography will work. Further tests are needed using different lighting options. This is an application that will benefit considerably from using software able to use more than two images.

Sadly it looks like close up photography of artefacts was a task that the software was unable to easily do. Perhaps with a little more thought about the staging of the shots and lighting better results can be achieved.

In its favour the software is easily to install and simple to use and appears robust. The ability to export in a range of recognised file types including pdf is very useful and allows the model to be either distributed as is or to be fine tuned in other modelling packages.

Written by Martin Roe © July 2010

