



Project Summary

Organization:
ArchHeritage

Location:
Wiltshire, U.K.

Project Objective:

- Examine detailed laser scan data of Stonehenge World Heritage Site

Products used:
Bentley Pointools

Discovery of Extraordinary Bronze Age Art at the UK's Stonehenge World Heritage Site

Bentley Pointools® Facilitates the Visualisation and Analysis of 850 Gigabytes of 0.5 Millimetre-resolution Survey Data

Laser-scan and Visualization Tools Help Reveal Prehistoric Carvings

While the mysteries of Stonehenge, constructed in England between 3000 BC and 2000 BC, may never be truly revealed or understood, a recent examination of the historic monument using cutting-edge visualisation tools has unearthed some fascinating carvings that date to the Bronze Age. It is not yet known what questions about Stonehenge these carvings will answer, but the project did uncover the potential for using laser-scan and visualisation technology on the world's antiquities.

The plan to more closely examine the stone structure began in November 2011 when English Heritage, the U.K. government's statutory adviser on the historic environment, commissioned the most detailed laser scan survey of Stonehenge ever undertaken. During the project, each stone was recorded in unparalleled detail with point spacing of 0.5 millimetres by the Greenhatch Group survey company. This huge data resource, comprising more than 850 gigabytes, would lead to new discoveries about the monument.

The enormous task of examining the data was awarded to ArchHeritage, part of the York Archaeological Trust, in April 2012, whose Geomatics and Visualisation team examined the laser scan survey. One challenge was to visualise a large amount of information and identify and isolate very subtle features. Preliminary examination of meshed models showed promising signs of useful information in the data

set. For example, individual tool marks more than 5,000 years old could be seen and identified, but there were also tantalising hints that the data contained prehistoric artwork carved onto the surfaces of the stones.

Enables Detailed Examination of Data

Examining the meshes alone was not sufficient to draw out these ancient carvings from the data and a different method needed to be employed. The team decided to visualise the original point-cloud data and created a workflow using Bentley Pointools, which enabled large datasets to be loaded, which facilitated the examination of the full 0.5 millimetre resolution data. In addition, the shading functions in Bentley Pointools proved instrumental in visualising the most subtle features.

Bentley Pointools' Plane Shading function was used to create a greyscale band 7.5 centimetres wide, which was moved at 1 millimetre intervals through the data to make a high-quality rendering of the plane shaded image. The process was repeated 75 times to complete a full colour change for every point in the data. Depending on the position in relation to a preset camera plane, each point would be assigned a greyscale value, which creates the potential to see very subtle features hidden in the data. The team combined all 75 images into an animation, which proved astounding; as the greyscale band was moved through the data, prehistoric carvings could be seen fading in and out of view.

Fast Facts

- English Heritage commissioned the most detailed laser scan survey of Stonehenge ever undertaken.
- The 850 gigabytes of laser scan data was visualised and analysed by ArchHeritage using Bentley Pointools.
- 72 previously unknown prehistoric carvings were discovered thanks to the visualisation capabilities of Bentley Pointools.



Range shade example.

“Bentley Pointools is capable of loading both 3D mesh data and point-cloud data; furthermore Bentley Pointools has a full suite of measuring tools and unique visualisation tools.”

– Marcus Abbott, Member of The ArcHeritage Geomatics and Visualisation team

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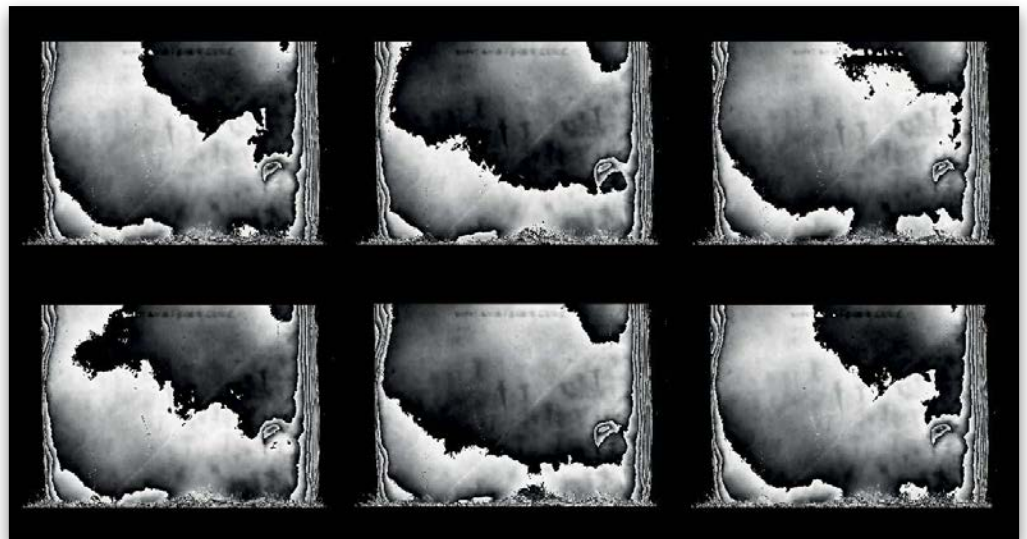
Thanks to the team’s innovative use of Bentley Pointools’ visualisation capabilities, this eroded prehistoric artwork could be seen for the first time in possibly thousands of years. Once the team identified the extent of the carvings, they used Bentley Pointools’ measuring and point-location tools to accurately plot the carvings to the Ordnance Survey grid.

Technology Enables Major Discoveries

When the examination was completed, it was clear the team had made some major discoveries. For a start, 72 previously unknown prehistoric carvings had been uncovered – almost double the number of known carvings at Stonehenge. The carvings of Bronze Age axes are estimated to be made from 1750 BC to 1500 BC, roughly a thousand years after Stonehenge was constructed. It is hoped the carvings will help archaeologists understand the type of civilisation that existed there more than three thousand years ago.

Moreover, these discoveries, exciting in their own right, illustrate how project teams can use laser scan data to make ground-breaking discoveries on the world’s ancient wonders. In addition, using laser scan visualisation techniques on other sites has the potential to greatly impact how archaeologists perceive and utilise technology on future heritage projects.

Marcus Abbott, a member of the ArcHeritage Geomatics and Visualisation team that worked on this project said, “English Heritage presented us with over 800 gigabytes of data; we needed a software solution that would handle and visualise vast quantities of survey data. Bentley Pointools is capable of loading both 3D mesh data and point-cloud data; furthermore Bentley Pointools has a full suite of measuring tools and unique visualisation tools. This functionality was crucial to the success of the Stonehenge project, and the discovery of unrecorded prehistoric rock art on the stones was first realised in Bentley Pointools.”



Range sequence image.