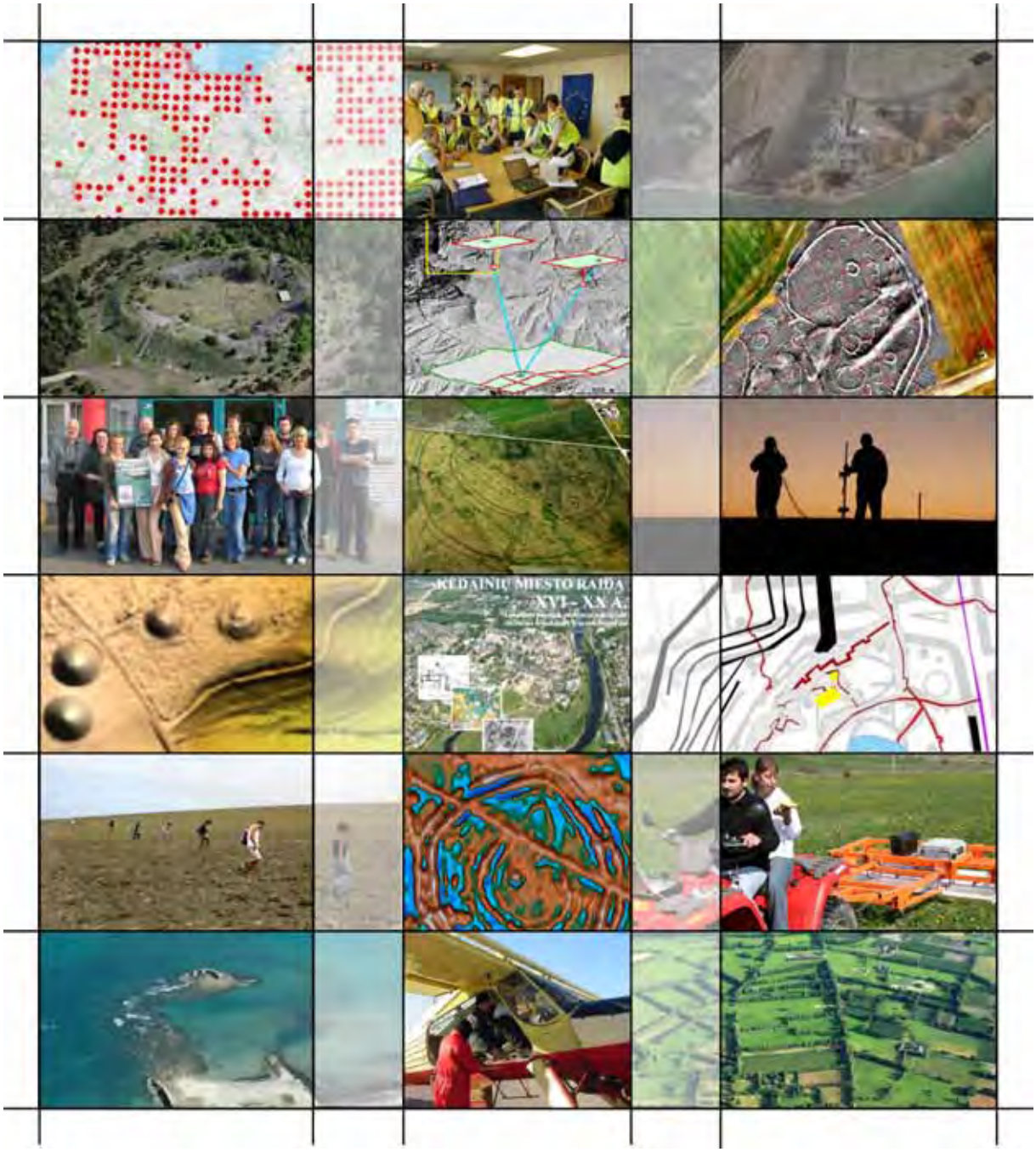
EUROPEAN LANDSCAPES

past, present and future

Culture 2000 Project Ref. No. CH-A2-UK-2077

FINAL REPORT

1 October 2004 – 31 October 2007



Through satellite imagery, airborne survey, fieldwork, geophysics and excavation, the aim of the project is to promote the exploration, public appreciation and conservation of heritage sites and landscapes across Europe.

Education and Culture

Culture 2000

ENGLISH HERITAGE

CONTENTS AND PROJECT PARTICIPANTS

Reports by co-organisers* and co-partners

The complete Final Report or individual reports from partners can be downloaded from:

e-landscapes.com **or**

http://www.muzarp.poznan.pl/EuLandscapes/EuLandscapes/index.htm

Copyright

LATE HALLSTATT PRINCELY FORTS AND THEIR LANDSCAPES

Aerial survey, lidar imagery, geophysical prospection and ground observation

Dr. Jörg Bofinger, Dr. Dirk L Krausse, Dr. Jörg Biel. Regierungspräsidium Stuttgart, Landesamt für Denkmalpflege (LAD), Baden-Württemberg, South Germany

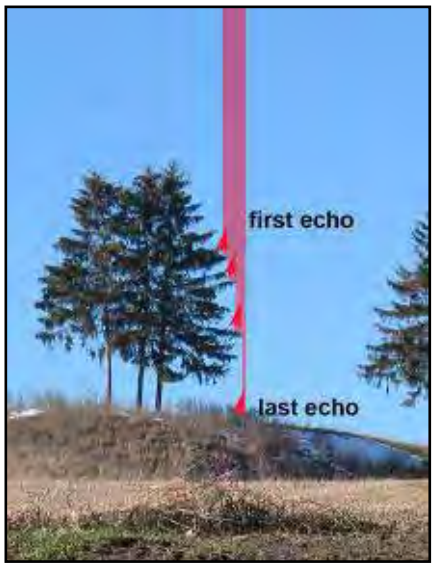
Background and objectives

The contribution of the LAD Baden-Württemberg was focused on the archaeological micro-landscapes around Late Hallstatt princely hillforts in south-west Germany, in close cooperation with French colleagues doing similar work outside the Culture 2000 project.

The micro-landscapes round the hillforts are being mapped systematically by air photography and lidar imagery, a new technique using an airborne laser scanner which can create digital surface models even in dense woodland, revealing parts of the landscape which would otherwise remain hidden or invisible. The air-photo and lidar work have been complemented by ground-based survey and geophysical prospection carried out by the LAD's own experts and by a specialized company. The recent development of the landscape and its impact on site preservation has formed the main objective in this part of the agenda. Knowledge gained about the state of preservation of the hillforts and their surrounding landscapes, where archaeological traces have often been virtually levelled by the plough, will make it possible to provide more adequate protection in the future.

In addition to consultation and co-operation with colleagues in France and elsewhere the programme of work within the Culture 2000 project included the following:

- New aerial survey to increase understanding of the micro-landscapes surrounding the hillforts, plus the purchase and analysis of lidar imagery for the same areas.
- Verification and where possible dating of the sites through ground-observation, geophysical prospection and sample excavation.
- Documentation of excavated structures by 3D laser scanning and integration with the data obtained from lidar survey.
- Enhancement of international networks, education and training of scientific staff, participation in conferences and workshops, publication work for specialists and the general public, and contributions to the Culture 2000 website and final exhibition in Prague.



Left: The Heuneburg, photographed by Dr Otto Braasch. Right: First and last echoes in lidar survey.

Comparison of Google Earth air photograph (left) and last-echo lidar imagery of a wooded area NW of the Heuneburg. The processed lidar data reveals previously hidden mounds and a rectangular enclosure.

Aerial and ground-based work on and around the princely hillforts

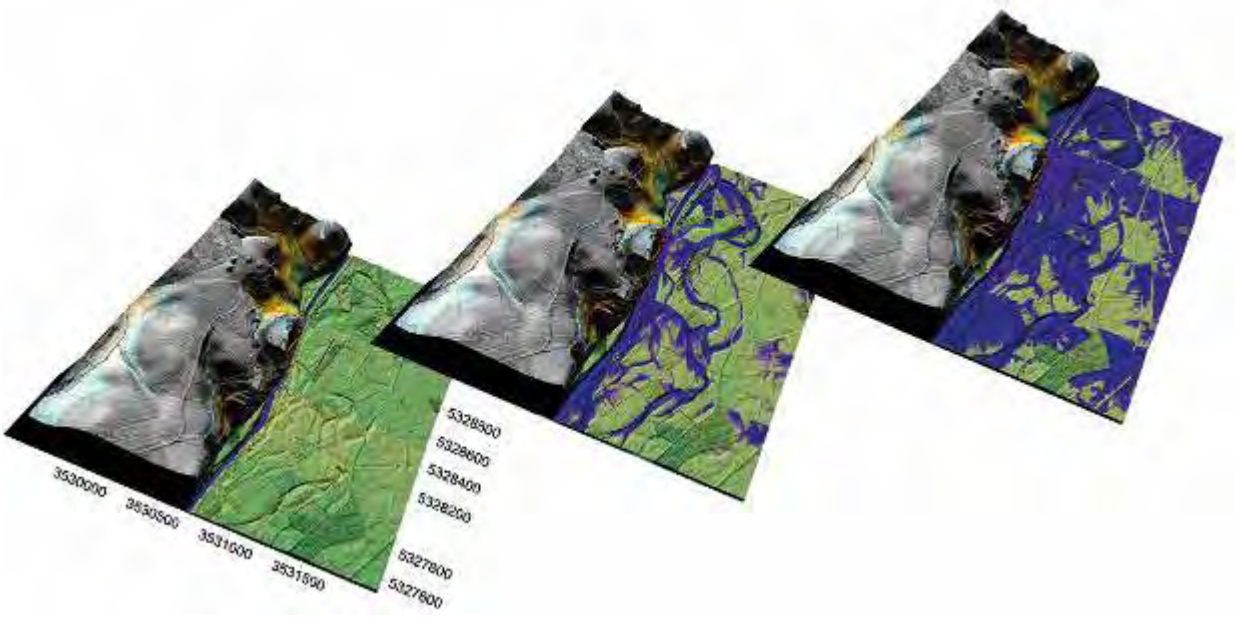
Aerial survey was continued and enhanced around the princely hillforts throughout the course of the project. New and existing aerial photography was compared with lidar data in the Heuneburg and the Hohenasperg survey areas to detect and verify archaeological settlement structures. Additional non-destructive geophysical survey was undertaken in the Ipf, Heuneburg and Hohenasperg study areas. Exemplar excavations at the Heuneburg and Ipf forts showed that features detected by aerial photography and lidar survey could be identified as important archaeological settlement features (town gate, moat, main road of the Heuneburg, farmsteads near the Ipf etc). The large archives of existing air photography in Baden-Württemberg (principally the heritage archive which contains about 400,000 photographs) were revisited to collect data for comparison with the ground survey and lidar material.

An important contribution of the Culture 2000 project was the opportunity to compare lidar data processed by the Landesvermessungsamt Baden-Württemberg with more expensive imagery generated by Toposys Ltd of Biberach. As a result it became clear that the much cheaper data distributed by the Landesvermessungsamt offers a sufficient resolution to reveal a variety of archaeological structures – a major benefit for the economy of future lidar work.

Research on and around the Heuneburg

Lidar imagery for a 20 sq km area round the Heuneburg was studied in detail. The imagery shows the surface topography in great detail, including ancient fluvial features in the Danube Valley, documented in every detail and hence mappable in three dimensions to an accuracy of 2cm. The digital terrain model constructed from the lidar data, when combined with a flood-water simulation for the Danube Valley has given new insights into the possible cultivation of the landscape in Early Medieval times and in prehistory. Significantly larger areas free of flood water, especially towards the centre of the valley, can now be regarded as potential locations for settlement or burial, as impressively illustrated by the Hallstatt settlement alongside the Bettelbühl necropolis, on a gravel ridge largely free of high water in the middle of the Valley.

The work so far has shown that the high-resolution lidar data provide an additional means of documenting both topography and archaeological features, though the effects of ploughing and other human activity can result in a heavily biased information source. Future work, after the end of the Culture 2000 project, will aim to show how much these sources of bias can mislead interpretation and whether the impact of modern interventions can be offset in the search for archaeological understanding. That said, the landscape changes visible through the lidar data in



Computer simulation, using topographical data from lidar imagery, of increasing flood-water levels in the Danube Valley adjacent to the Heuneburg. The right-hand image shows areas of higher land, free of even the most extreme flood-water, that were long favoured for settlement, burial and communication routes.

the meandering riverbed of the Upper Danube constitute valuable information in their own right. Using these new data a research group will try to reconstruct the fluvial history of the Danube so as to identify potential settlement areas or wharves in the valley.

In addition to lidar survey the plateau of the Heuneburg was explored by geophysical prospection, revealing many new structures on the unexcavated parts of the plateau. During archaeological fieldwork in the area of the Heuneburg precinct a spectacular discovery was made: a stone gate forming part of the early Iron Age fortification system. This impressive gate (12 x 8 m), constructed from large limestone blocks, was scanned by 3D laser-survey (Arctron Ltd.), providing the opportunity to integrate the resulting data with the digital terrain model obtained through airborne laser scanning.

Air photography and geophysical prospection at the Hohenasperg

Geophysical survey around the Hohenasperg started in the final months of 2005. Here, the study of the air photo and ground-based data helped in assessing the potential contribution of lidar survey in the understanding and conservation of landscape and archaeological features in a densely populated region heavily affected by recent and earlier construction work.

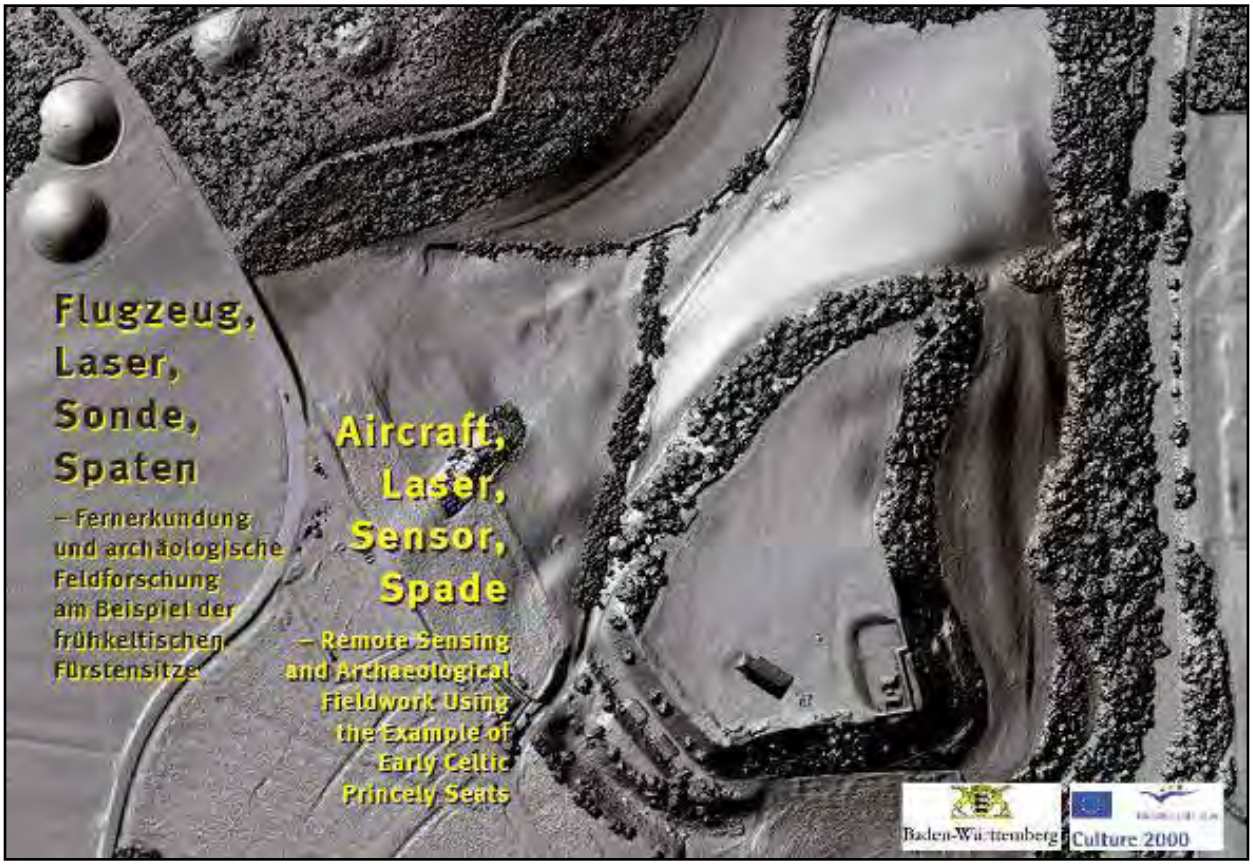
Professional networks, education and publication

Professional collaboration across Europe was maintained and developed throughout the project. Association with the DFG priority-programme 1171 led to good contacts with international workgroups, for example the Mont Lassois research team. At a Workshop in November 2004 in Esslingen workgroups from Germany, France, Switzerland and Austria presented and discussed the first results of their archaeological field survey, traditional geodesy, lidar imagery and geophysics. The varying research perspectives of different national traditions, along with the exchange of knowledge and methods and the study of differing heritage recording systems, has given a new impetus to the current work and will serve to promote continuing trans-national co-operation after completion of the Culture 2000 project.

Participation in the Aerial Archaeology Training School at Foggia, Italy, in May 2007 gave a member of the LAD's staff the opportunity for training in methodological and practical aspects of aerial archaeology, both on the grounds and in the air.

The first results of the ongoing work were presented at the conference on *Computer Applications in Archaeology*, at Tomar, Portugal, in March 2005. An article in the conference proceedings is in print. At the *2nd International Conference on Remote Sensing in Archaeology* (Rome, December 2006) the results of the lidar work in Baden-Württemberg were presented, and were published in the conference proceedings. An article in the 'Nachrichtenblatt der Landesdenkmalpflege Baden-Württemberg' (August 2007) summarised the results of the lidar work and field activities. A further opportunity was provided by the Culture 2000 workshop *Bringing Air and Water Together* at Schwerin, North Germany, in January 2007.

A notable achievement, assisted by Culture 2000 funding, was the publication in hard copy and and on the Internet of a 48-page German-and-English booklet on the princely forts and their surrounding landscapes. This will be particularly useful in informing the general public about the character and value of archaeological work carried out through both new and traditional investigative methods. Copies of the booklet were made available for the opening of the project's final exhibition in Prague and images and related text were used in the exhibition itself.



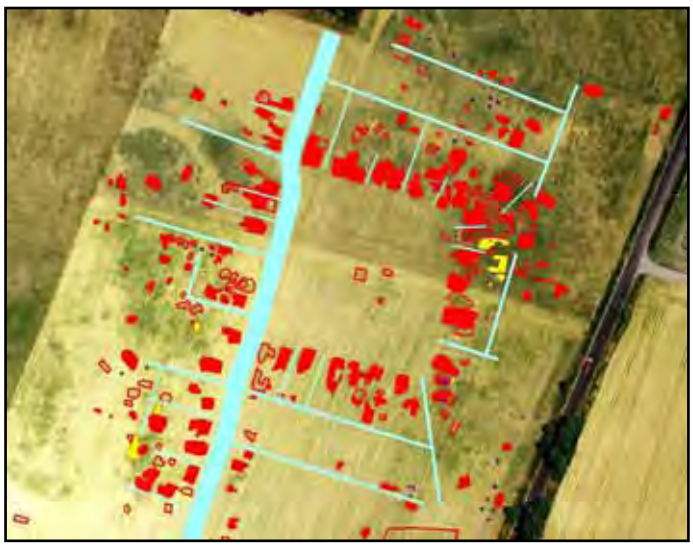
First-echo lidar image of the Heuneburg and nearby burial mounds, as seen on the cover of the 48-page bilingual booklet prepared as part of the Culture 2000 project

General assessment of the project

The Culture 2000 project gave the LAD the opportunity to supplement its on-going work on the princely fortresses and their surrounding in highly productive ways, especially in the testing and use of lidar data and air-photographic evidence, along with the publication (on-line and in hard copy) of a booklet aimed primarily at the general public. Culture 2000 funding also enabled the LAD to expand its international contacts and to take part in a number of important meetings, along with the final exhibition in Prague.

Education and Culture
Culture 2000

EUROPEAN LANDSCAPES: past, present and future



HIGHLIGHTS 2004-2007

Belgium *Air photographs uncover the battlefields of Ypres*

Czech Republic *Air survey, excavation and a grand exhibition*

English Heritage *Air photo training schools at home and abroad*

Estonia *Estonian archaeologists take to the air*

Germany (Mecklenburg-Vorpommern) *Seeing beneath the waves*

Germany (Baden-Würtemberg) *Iron Age fortresses in their landscape setting*

Germany (Freiburg) *Airborne laser scanning to 'see through the trees'*

Hungary *Combining techniques to explore the Neolithic*

Italy (Puglia) *Uncovering and mapping the past through aerial survey*

Italy (Salento) *Modern techniques and a Roman harbour*

Italy (Tuscany) *Air survey, laser scanning and geophysics*

Lithuania *Raising awareness through aerial archaeology*

Poland *New discoveries and new systems for heritage conservation*

Slovakia *Stone Age monuments from the air and on the ground*

A LOST TOWN RE-FOUND

Szamotuły, in Poland is a medieval town, its originally open market square now filled with later buildings (top). Until recently historians believed that the town always occupied its present site. This view changed dramatically in July 2006 when spectacular air photographs, taken as part of the Culture 2000 project, revealed its original location at Mutowo, 2.5km away, where it had stood before a disastrous fire in the 14th century. One of the photographs is shown here (centre), rectified to fit the present-day map. In the bottom image the town's large open square, outlined by the dark marks of cellars beneath its surrounding buildings, has been plotted on the rectified photograph, along with the presumed lines of the linking streets.