

BRINGING AIR AND WATER TOGETHER

Innovative landscape survey in the coastal zone of NE Germany

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Background and objectives

Through the Culture 2000 project the Archaeological State Museum of Mecklenburg-Vorpommern is enlarging its knowledge of dated and undated sites and finds in the offshore region of the Baltic Sea, as well as the nature of drowned landscapes along the coastline. Better understanding will enable the Museum to push forward its efforts in conservation of threatened underwater and coastal sites. The enhanced knowledge will be used to improve public appreciation and concern for the cultural heritage. The project's aims are being pursued through the following activities.

- Exploratory air photography, for combination with ground-based and underwater survey by both traditional and new methods.
- The use of GIS systems to help in the mapping, analysis and visualisation of information from the different data sources.
- Annual five-day Training Schools in aerial archaeology and a three-day Workshop to present the results to specialists and the general public.
- The creation of teaching aids for local schoolchildren and young adults.
- The creation of a 'virtual exhibition' with other members of the Culture 2000 network.

Progress to the end of 2005

Exploratory air survey has been undertaken, photographs have been rectified and maps and diagrams created. Work on the database and GIS aspects has continued throughout the reporting period. The first training school was held in June 2005. Plans are in hand for a workshop and for further schools in 2006 and 2007. Good progress has been made on educational aspects of the project.

Aerial survey

Aerial survey was undertaken during the year, over both land and sea, though poor weather in the summer and autumn did not favour on-land recording. During the Training School in May some 40 known coastal and underwater sites were extensively documented, adding new information to that collected in earlier years.

GIS system and mapping work

Throughout the reporting period the Culture 2000 project has allowed an intensification of database work within the Museum's GIS system with regard to sites and features discovered through aerial reconnaissance along the coast and in the sea: where are they, of what date, what kind of sites they represent, and so on. Through the skills of a land surveyor and AutoCAD specialist a number of aerial photographs have been rectified. The first maps and diagrams have been created. This type of work will allow recent and earlier air photography to be more closely integrated with other data sources so as to improve both understanding and conservation of heritage features in the landscape and adjacent coastal waters.

Training Schools and Workshop

The first of the planned Training Schools in Aerial Archaeology was held at Barth, Western Pomerania, from 13-17 June 2005, thanks to the energetic help of Dr Otto Braasch and his Cessna 172 aircraft from southern Germany. Tutors Dave MacLeod from England and Lidka Zuk from Poland were provided by Culture 2000 partners. Ten participants made the journey from Italy, Lithuania, Ireland, the Czech Republic and various parts of Germany.



In addition to lectures on the prehistory of the region, instruction covered the theory of aerial archaeology, the interpretation of air photographs, exercises in rectifying aerial images, the principles of GIS program packages and general aspects of landscape archaeology. Practical experience in the air was provided under the direction of Dr Braasch (left) the average flying time for each student being 4.5 hours. More than 3.5GB of data were produced during the week, in the form of 2056 digital images and their related metadata. An exciting and unexpected discovery, close to the airfield, was a spectacular double-ditched circular enclosure, previously unknown despite 12 years of aerial reconnaissance in the locality. Cataloguing of the photographs has continued during the rest of 2005 so that the images and related meta-data can be incorporated into the institution's photo archive and GIS system.

Both tutors and participants felt that the School was a great success. Reports have been submitted to the Ministry of Education, Sciences and Culture for Mecklenburg-West Pomerania, to the Mecklenburg-Vorpommern's representative at the EC and to a number of publications in Germany, the first being already printed in the 2005 *Yearbook of the State Agency for the Protection of Archaeological Monuments*. The results, and the aims and achievements of the Culture 2000 project as a whole, will also be presented through the Museum of Underwater Archaeology at Sassnitz, Ruegen, at the moment undergoing refurbishment. Plans are already in hand for the next Training School, from 1-5 May 2006, and for a 3-day Workshop early in 2007.

Educational aspects

Progress has been made in the preparation of a brochure on aerial archaeology for young adults, focusing on aerial reconnaissance in the coastal regions of Mecklenburg-Western Pomerania. The text will be published in conventional written form as well as on the Internet sites of the Museum and the Culture 2000 project, with a revised version for use in schools. Advice and testing of initial versions will be provided by a local grammar-school teacher who has for many years been fostering a relationship between pupils and the State Agency for the Protection of Archaeological Monuments. Contributions have also been made to the Culture 2000 project's overall website.



Impressions from the 2005 Training School. Left: The newly discovered circular enclosure near Barth. Right: Intense discussions between a group of Irish, Lithuanian and German students at the school.

LATE HALLSTATT PRINCELY FORTS AND THEIR LANDSCAPES

Aerial survey, lidar imagery and ground observation

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Background and objectives

The contribution of the LDA Baden-Württemberg is focused on the archaeological micro-landscapes around Late Hallstatt princely hillforts in south-west Germany, in close contact with French colleagues doing similar work outside the Culture 2000 project. The varying research perspectives of different national traditions, along with the exchange of knowledge and methods and the study of differing heritage recording systems, is giving a new impetus to the current work and will serve to enhance trans-national co-operation in the future.

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 and under water, revealing parts of the landscape which would otherwise remain hidden or invisible. The air-photo and lidar work are being complemented by ground-based survey and geophysical prospection carried out by the LDA's own experts. The recent development of the landscape and its impact on site-preservation forms 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 are often virtually levelled by the plough, will make it possible to provide more adequate protection in the future.

The programme of work within the Culture 2000 project is as follows.

- 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 if possible dating of the sites through ground-observation, geophysical prospection and sample excavation.
- Consultation and co-operation with colleagues in France and elsewhere. Organisation of at least one Workshop. Contributions to the project's website and 'virtual exhibition'.

Progress to the end of 2005

Landscape survey on the princely hillforts and their surrounding landscapes

New and existing aerial photography has been compared to lidar-data in the Heuneburg and the Hohenasperg survey areas, to detect and verify archaeological settlement structures. Additional non-destructive geophysical survey has been undertaken in the Ipf, Heuneburg and Hohenasperg study areas. Exemplar excavations at the Heuneburg and Ipf forts has shown 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) have been revisited to collect data for comparison with the ground survey and lidar material.

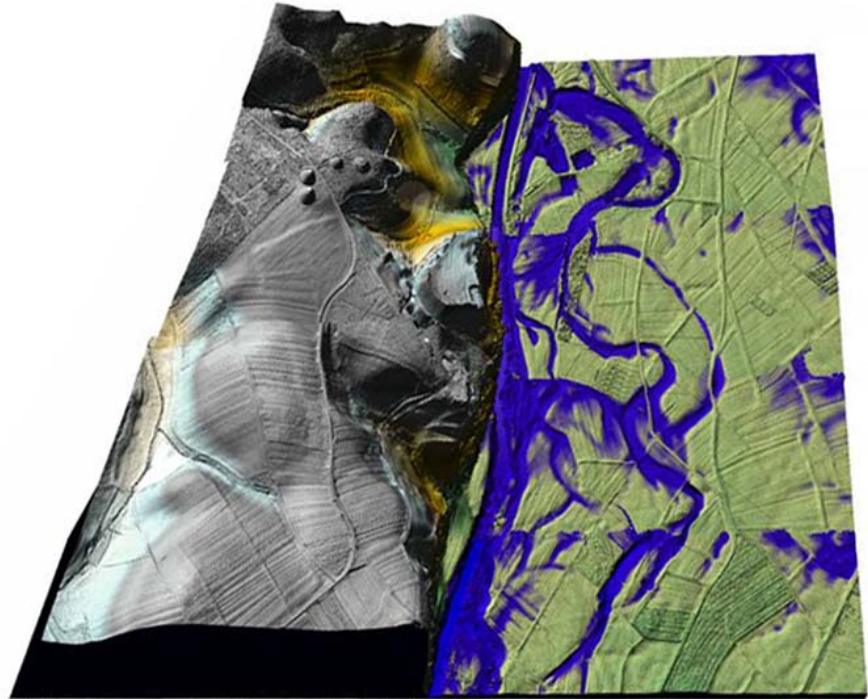
Methodological issues concerning lidar

The data processed by the Landesvermessungsamt Baden-Württemberg was compared to lidar data generated by Toposys Ltd of Ravensburg. As result it became clear that the much cheaper data distributed by the Landesvermessungsamt offers a sufficient resolution to reveal archaeological structures – a major benefit for the economy of future lidar work.

Enhancing professional networks in Europe

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 already in print. Association with the DFG priority-programme 1171 has also

High-water simulation of the Danube Valley. The image is based on lidar data, with the Heuneburg fortress overlooking the valley from just left of centre. The image shows four mounds at top left, two of which are concealed in heavy woodland when seen in conventional aerial photographs. Note the Roman road running north through the valley on a raised bank, free of flooding.



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. LDA Baden-Württemberg is now planning a Workshop as part of the Culture 2000 project towards the end of 2006, at which the existing co-operation with our French partners will be further enhanced through a special focus on the border-region of eastern France and south-western Germany.

Research on the Heuneburg

The LiDAR imagery for a 20 sqkm area round the Heuneburg was studied in detail. The lidar data 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 high-water simulation for the Danube Valley (above), has already given new insights into the possible cultivation of the landscape in Early Medieval times and in Prehistory. Significantly larger areas free of high 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 Danube 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 activities can result in a heavily biased source of information. Future work will aim to show how much these sources of bias can mislead interpretation and whether the impact of these modern interventions can be offset in the search for archaeological understanding. That said, the landscape changes visible through the lidar data in the meandering riverbed of the Upper Danube are 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.

Air photography and geophysical prospection at the Hohenasperg

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