

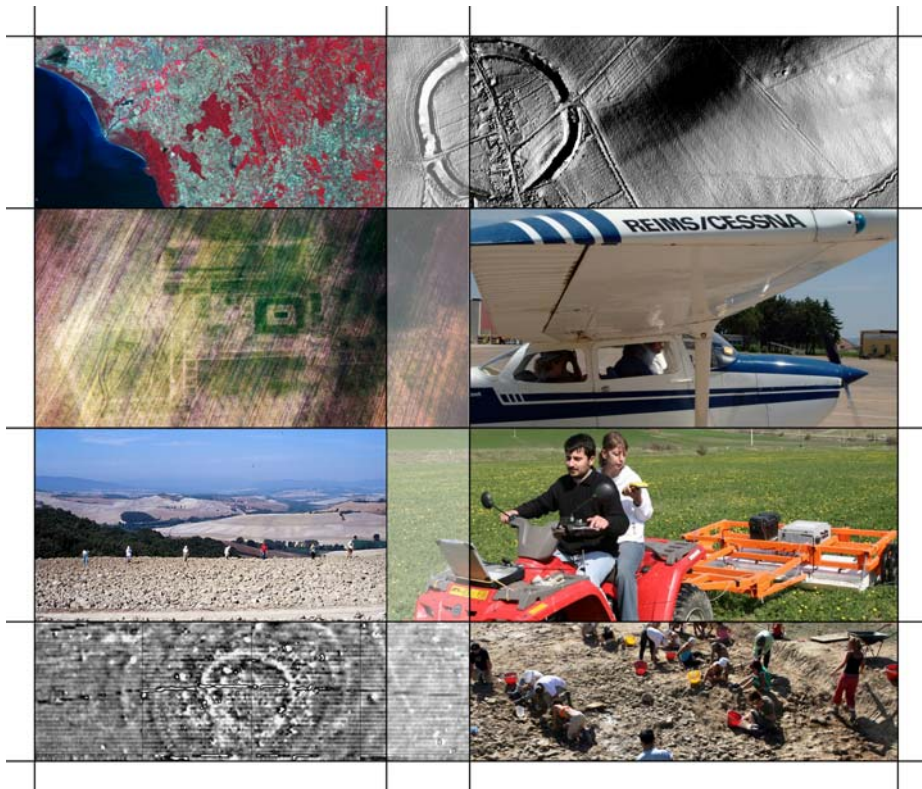
EUROPEAN LANDSCAPES

past, present and future

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

INTERIM REPORT

September 2004–February 2006



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



EUROPEAN LANDSCAPES past, present and future

Co-organisers

English Heritage, Project Sponsor

University of Ghent

Landesdenkmalamt Baden-Württemberg

*Archaeological State Museum
of Mecklenburg-Vorpommern*

Museums of Baranya County, Pécs

University of Foggia

University of Siena

Co-partners

University of West Bohemia

National Heritage Board of Estonia

University of Helsinki

*Agenzia per il Patrimonio Culturale
Euromediterraneo and University of Lecce*

Department of Lithuanian Heritage Protection

Adam Mickiewicz University, Poznań

Poznań Archaeological Museum

Polish Academy of Sciences

Institute for Cultural Memory, Romania

Slovak Academy of Sciences

EUROPEAN LANDSCAPES

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Background

Several co-partners in the present initiative also worked on a Culture 2000 project in 2001 (*Conservation through Aerial Archaeology – CAA*). This built on earlier training schools and exchanges organised by the Aerial Archaeology Research Group (AARG), a UK-founded body which was then expanding into Europe. By 2004 the Group provided an international network of contacts which was crucial in the conception and framing of the present project.

The project is an ambitious one, involving 7 co-organisers in the UK, Belgium, Germany, Hungary and Italy, along with co-partners in 7 other countries. The focus is on aerial archaeology, heritage conservation and public awareness of the cultural heritage. The emphasis is on the broader landscape and on the spread of 'aerial' techniques, especially in the Baltic, around the Mediterranean rim and in the former Soviet states.

Objectives

The aim of the project is to increase awareness and conservation of cultural heritage within European archaeological landscapes, especially through the non-destructive techniques of investigation such as aerial reconnaissance, air-photo mapping, field survey and the innovative use of satellite and airborne remote sensing. There are nine inter-linked Actions.

- Action 1 The promotion of training schools, workshops and seminars
- Action 2 Aerial and ground-based surveys of threatened landscapes
- Action 3 Air-photo interpretation and mapping of cultural landscapes
- Action 4 Innovative surveys using air-photos, lasers (lidar) and satellite imagery
- Action 5 The search for under-exploited air photo sources from World War II
- Action 6 Networking and the exchange of skills across Europe
- Action 7 The Creation of a *European Centre for Aerial Survey and Conservation*
- Action 8 Public outreach through websites, TV/radio, films and exhibitions
- Action 9 Centrally-funded activities, student exchanges, support for meetings etc

Progress, September 2004–February 2006

The planned activities, with inevitable modifications to meet local situations, have been successfully started by sixteen of the seventeen participating organisations (practical problems over the start at Lecce in Southern Italy have now been resolved; see page 25).

Good progress has been made in almost all of the intended Actions. The highlights have been several productive training schools, conferences and seminars, focusing activity on individual countries or helping to spread expertise across Europe. Despite poor weather in some parts of the Continent there have also been successful programmes of aerial survey, along with exploratory work on the use of laser-scanning technology (lidar) in landscape and archaeological recording. The project's central website has been established and work is in hand on teaching packs and exhibitions, both real and 'virtual'. World War II photo-sources (Action 5) have so far proved elusive, except in Poland, but work will continue throughout the rest of the project. Discussions are currently in hand for the eventual creation of the planned *European Centre for Aerial Survey and Conservation* (Action 7).

Progress on individual Actions

Accounts of the work undertaken by each co-partner are set out in the later part of the Report. The following paragraphs summarise progress on the nine corporate Actions.

Action 1 Promotion of Training Schools, Workshops and Seminars

Successful Training Schools, with in-air experience for the students, have been held at Grosseto in Italy and at Barth in North Germany. There will be similar events in Germany and the United Kingdom in 2006 and at Barth in Germany and Foggia in Southern Italy in 2007. Ground-based workshops and/or seminars have been held in Finland, Lithuania and Romania (twice – the first such events in this country). Assistance of one kind or another was given for meetings in Munich, Rome, Grosseto (Italy) and Leuven (Belgium).

Action 2 Aerial and ground-based surveys of threatened landscapes

Substantial programmes of aerial reconnaissance, mainly concentrating on plough-threatened landscapes, were undertaken in Italy (Foggia and Siena). Exploratory flights focussed on specific aspects of the landscape were undertaken in Belgium, the Czech Republic, Estonia, Germany, Hungary, Lithuania, Poland and Slovakia. In all of these countries important archaeological discoveries were made and photographs were taken of heritage landscapes, townscapes and buildings for the benefit of future conservation.

Action 3 Air-photo interpretation and mapping of cultural landscapes

Photo-interpretation and mapping work has been undertaken by many of the co-partners, in particular for 'new' sites or groups of sites discovered from the air during exploratory flights in 2005. More intensive 'landscape' mapping will be undertaken in S Italy in 2006 and 2007.

Action 4 Innovative surveys using air-photo, laser-scanning and satellite imagery

The use and testing of lidar and other remote-sensing methods has been initiated in Germany and Italy. Co-partners here and in the Czech Republic, Hungary and Slovakia have been experimenting with the integration of these techniques with more established ground-based methods such as geophysical prospection, field survey and sample excavation.

Action 5 Under-exploited air photo sources from World War II

The search for further WWII photo-maps in Poland has not yet borne fruit though some important war-time air-photographs have been identified; the search will continue. In Belgium the project is revealing the importance of 'historical' and modern air photographs in the understanding and conservation of Great War landscapes and military remains.

Action 6 Networking and the exchange of skills across Europe

The European network of specialists taking or using air photography and other forms of remote sensing continues to grow, mainly through the attendance at the events listed under Action 1. Particular advances have been made in Scandinavia and the Baltic area.

Action 7 European Centre for Aerial Survey and Conservation

Discussions are in train with the University of Siena to establish the proposed centre within a wider *Centre of Excellence in Landscape Archaeology and Remote Sensing*, at Grosseto in Tuscany. The search will now begin for funds to support the centre in the longer term.

Action 8 Public outreach: websites, TV/radio, films and exhibitions

The project's central website went on-line in November 2005 and is being progressively enhanced and updated. Several partners have added Culture 2000 pages to their own websites. Discussions are in hand with film/TV companies and the collection of material for real and/or 'virtual' exhibitions has been started by most of the project's participants.

Action 9 Centrally-funded activities, student exchanges, support for meetings etc

Funds for cross-partner activities have been used for the TV/website activities and to assist in arrangements for or attendance at training school, workshops, seminars and meetings of other kinds. Student exchanges have been funded and more are planned, for example to spread expertise in the use of the new laser-scanning technique known as 'lidar'.

'Spin-off' activities from the Culture 2000 project

Through the prestige of the Culture 2000 project co-partners have been able to initiate or assist externally-funded meetings relevant to the Culture 2000 objectives, for example:

- An Aerial Archaeology Workshop in Rome, November 2005 (funded by the Aerial Archaeology Research Group, ACE and the British Academy).
- A conference on *GPS and Laser Scanning in Archaeology* at Grosseto, Italy, June 2005 (sponsored by Leica Geosystems).
- The first aerial archaeology training school in Denmark is now being planned for June 2007 (funds to be raised in Denmark).
- First suggestions have been made for exploratory air survey in Syria (see page 22).
- An extra half-day session will be added to the next two annual conferences of the Aerial Archaeology Research Group, to discuss the Culture 2000 project and its outcome.

General Assessment: current progress and future prospects

The co-organisers and co-partners are content with progress so far, both on specific projects of aerial survey or landscape investigation, and on raising awareness of the role of aerial archaeology and related techniques in the co-partner countries and beyond. The participants are keenly aware that much still needs to be done in the coming 18 months, for example:

- Intensive work on outreach projects – website content, TV and film output.
- Design and mounting of actual and virtual exhibitions.
- Sustaining initiatives in the Baltic and Scandinavian states.
- Making first moves in Spain and Portugal, where aerial archaeology is virtually unknown.
- Communicating with heritage and planning agencies throughout Europe so as to secure better archaeological and landscape conservation in the future.
- Continued efforts to secure funding and other resources for similar work after the end of the *European Landscapes* project in August 2007.

Forthcoming events and activities

There will be aerial archaeology training schools in 2006 and 2007, along with smaller workshops and meetings of various kinds. Aerial survey and its co-ordination with ground-based survey and other remote-sensing techniques will continue in several countries. There will be further experiments in the use of laser-scanning (lidar) imagery. Teaching packs will be produced and on-line instruction in aerial archaeology introduced. Students from various countries will receive specialist training from other members of the Culture 2000 team. The European network of contacts in aerial archaeology and landscape studies will be further enhanced. Strenuous efforts will be made to create the nucleus of a European Centre for Aerial Archaeology and Landscape Studies. Members of the Culture 2000 project will continue to support related activities and event through advice, participation and small-scale financial help to students. A 'book of the project' and final exhibitions, both real and virtual, will be produced. Final workshops and conferences will be held.

General and financial Management

General and financial management has been co-ordinated on a day-to-day basis by English Heritage under the monitoring of a Management Group representing the seven co-organisers. The Management Group met at the start of the project in September 2004, and again twelve months later at the beginning of Year 2. On both occasions the co-organisers and co-partners also met to discuss the objectives and to review the progress of the project. A 'half-way' meeting of the Management Group will take place in Prague in May 2006, with further meetings in September 2006 (also with co-partners) and in the spring or early summer of 2007. There will be an open-to-all final conference and a Management Group meeting in late summer 2007. The project will conclude on 31 August 2007.

Dr Robert Bewley and Chris Musson, English Heritage, 28 February 2006

Below: *The landscape of Southern Tuscany, with the concentric ditches of an otherwise vanished Medieval castle at lower left. See also page 28.*



HIGHLIGHTS, 2004- 2005

Belgium *Air photos uncover the battlefields of Ypres, page 7*

Czech Republic *New ideas on settlement in Bohemia, page 9*

United Kingdom *Training school returns to the UK, page 11*

Estonia *Archaeologists take to the air, page 13*

North Germany *Recording under-water wrecks in the Baltic, page 17*

South Germany *Laser scanning and Iron Age fortresses, page 19*

Hungary *Linking air and ground in landscape survey, page 21*

Southern Italy *Mapping the past through air photography, page 23*

Central Italy *Students record the Roman landscape, page 27*

Lithuania *Raising awareness through teaching aids, page 29*

Poland *Designing systems for heritage conservation, page 31*

Slovakia *Stone Age sites revealed from the air, page 35*

COMING IN 2006 AND 2007

Schools, workshops, seminars

'Landscapes of war' conference

Integrated landscape survey, experiments with laser modelling

Air photo interpretation, mapping for research and conservation

Specialist training, emphasis on conservation

Websites and exhibitions

REPORTS BY CO-ORGANISERS* AND CO-PARTNERS

7	BELGIUM*	University of Ghent
9	CZECH REPUBLIC	University of West Bohemia
11	UNITED KINGDOM*	English Heritage
13	ESTONIA	National Heritage Board of Estonia
15	FINLAND	University of Helsinki
17	GERMANY*	Archaeological State Museum of Mecklenburg-Vorpommern
19	GERMANY*	Landesdenkmalamt Baden-Württemberg
21	HUNGARY*	Museums of Baranya County, Pécs
23	ITALY*	University of Foggia
25	ITALY	Agenzia per il Patrimonio Culturale Euromediterraneo and the University of Lecce
27	ITALY*	University of Siena
29	LITHUANIA	Department of Lithuanian Heritage Protection
31	POLAND	Adam Mickiewicz University Poznań Archaeological Museum Polish Academy of Sciences
33	ROMANIA	Institute for Cultural Memory
35	SLOVAKIA	Slovak Academy of Sciences
37	ACROSS EUROPE	Associated events and networking

AERIAL PHOTOGRAPHS AND FIRST WORLD WAR LANDSCAPES IN FLANDERS

Inventory, digitisation, survey and mapping

Birger Stichelbaut & Professor Jean Bourgeois, for the University of Ghent, Belgium

Background and objectives

The Belgian elements of the project have been organised by the Department of Archaeology and Ancient History of Europe at the University of Ghent, which has 25 years of experience in the field of aerial photography and 3 years of involvement in the study of recent military remains. The University's contribution to the project is focused on the study and use of air-photo and related ground-evidence for the remains of WWI in Flanders. The specific aims are as follows.

- To look for and use previously un-exploited archives containing military aerial photographs in the recording and mapping of WWI features and their subsequent examination on the ground.
- To undertake new exploratory flights so as to compare the traces recoverable through new photography with those visible on the historical images.
- To organise a workshop on *Military Aerial Photography and Archaeology* towards the end of the project, with 'conservation' as one of its linking themes.

Progress to the end of 2005

Good progress has been made with all three objectives, despite poor weather for new aerial photography during 2005. The date and venue of the planned workshop has now been set at 19-21 October 2006 at the In Flanders Fields Museum at Ypres.

Work on WWI military air photographs

Within the Culture 2000 project numerous visits have been made to the archives of the Royal Army Museum in Brussels. The collection there contains approximately 25,000 WW1 aerial photographs, mostly taken by the *Aviation Militaire Belge*. For the most part they relate to the Belgian-German frontline between Nieuwport and the north side of Ypres. A carefully-made selection of 950 air photographs have been scanned at 400dpi and incorporated into a database. So far, some 90% have been located on the map and geo-rectified. Ninety years after the events it has proved possible to gain additional information on the topography of military features and the surrounding terrain and to discover emplacements that would otherwise have remained hidden. Nine digital stereoscopic views (anaglyphs) have been created from overlapping archive photographs, using specialist software. The geo-referenced pictures have been used to create a detailed inventory of all visible military and other archaeological traces in the study area. Approximately 3000 separate features have been identified and documented in an area of 49 km². The majority relate to the trench systems of the German second line, which has been traced over a distance of more than 10 km. In addition, 93 certain and 41 possible Medieval moated sites have been recorded, along with 5 as yet unclassified sites seen on the photographs as a result of temporary flooding.

The work undertaken so far has created a sound basis for further study, both of the aerial evidence and of surviving traces on the ground. Work during the rest of the project will aim to establish both a better understanding of the remains and a strategy for selective conservation of the features which still survive above-ground today or which might be expected to retain valuable below-ground evidence.

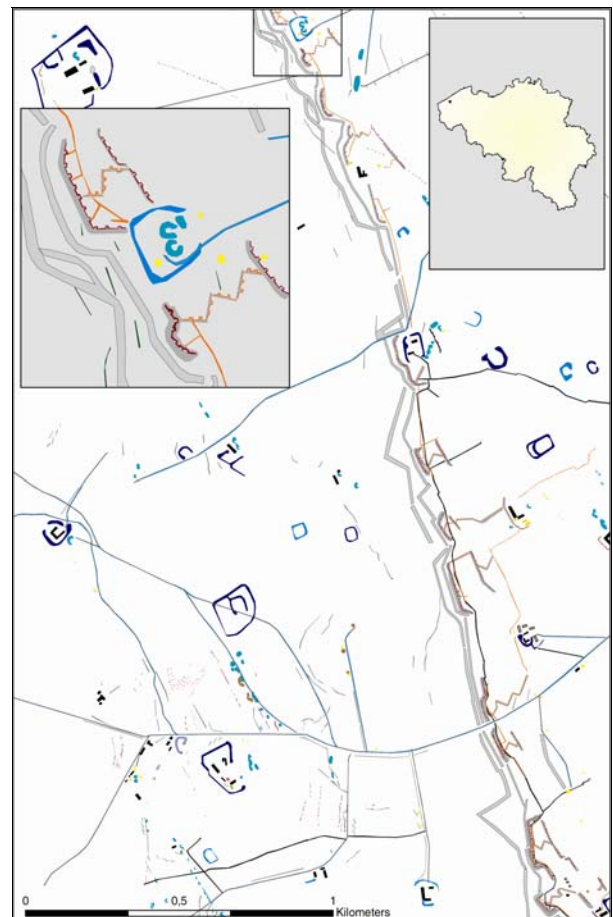
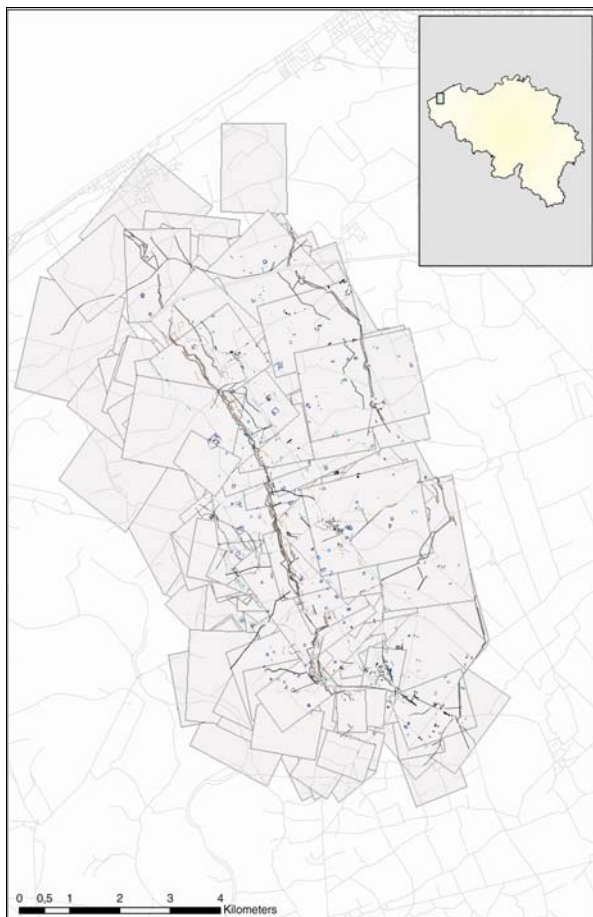
New aerial photography

The second part of the project involves new flights to take oblique aerial pictures of the front area. Flights have been undertaken from the airfields of Wevelgem and Ursel. The basic goal

is to look for traces of WWI and other features that can be seen both today and on the historical air photographs. Unfortunately bad weather in the spring and summer of 2005 proved unhelpful in the recording of both military and other archaeological features. Further flights, however, will be undertaken in the second and third years of the project.

Workshop on *Military Aerial Photography and Archaeology*

The planned workshop, to be organised in collaboration with the In Flanders Fields Museum, will be held at Ypres from 19-21 October 2006. The workshop will have two main themes. The first (*Archives, inventories and the history of military aerial photographs*) will focus on presentation of the main collections of World War I and World War II aerial photographs across Europe, with contributions from a variety of institutions involved with military air photography during both wars. The main questions will be 'where are the archives', 'what do they contain', 'which areas are involved' and 'what are the potentialities for historical and archaeological research, and for selective conservation in the future?' The second theme (*Processing military aerial photographs*) will concentrate on present-day processing of historical aerial archives and their applications for archaeology, whether relating to battlefields or not. Aspects considered in this part of the meeting will include the results of detailed surveys, the processing of the images, the use of stereoscopy and digital analysis, and (most importantly for the Culture 2000 project) the application of the resulting inventories and GIS systems in management and conservation of the archaeological heritage.



Left: *Overview of the selected aerial photographs and of the mapped WWI remains.*
Right: *Detail of the mapped remains of the German 2nd position.*

LANDSCAPE SURVEY AND PRESENTATION IN THE CZECH REPUBLIC

Dr Martin Gojda, Mr L Šmejda, University of West Bohemia

Background and objectives

The objectives of the University of West Bohemia's contribution to the project are to encourage the use of aerial photography and other forms of remote sensing in landscape exploration and conservation are as follows.

- Through research, involving the combined use of new and innovative techniques, including new aerial reconnaissance and the investigation of existing 'historical' air photographs of the Czech Republic.
- Through education, involving the preparation of a centrally-funded film/video and an on-line *Encyclopaedia of Aerial Archaeology and Remote Sensing*.
- Through public presentation, involving the preparation (with others) of a major travelling exhibition on the role of aerial survey and related techniques in landscape exploration, analysis and conservation.

Progress to the end of 2005

The period from September 2004 to December 2005 saw significant progress with the first two objectives. The third, to be carried out in partnership with the Institute of Archaeology and the National Museum in Prague, will be addressed mainly in Year 3, though the first steps have been taken through consultation between the Archaeology Departments at the University and National Museum regarding the overall pattern of the exhibition and the space needed for its arrangement and display.

Research

The main **study area** selected for aerial and other forms of investigation is a tract of landscape in central Bohemia, north of Prague, including the solitary mountain of Říp, where field-walking, test excavations and geophysical survey will be carried out in the second and third years of the project. The intention is to explore the dynamics of past settlement processes in the vicinity of this 'sacred' mountain, with its legendary connections with the beginnings of Czech history in the early Middle Ages.

In June and July 2005, **aerial survey** was carried out both in this study area and in other parts of central and western Bohemia. The sites recorded, some of them not previously known, included Bronze Age enclosures, prehistoric open settlements and Post-Medieval to Early Modern field monuments.

The evaluation and interpretation of recent and historical air photographs began with the analysis of a collection of recent orthophotos of the chosen study area. This revealed a number of previously-unknown cropmark enclosures, some of which will be selected for field-walking and geophysical survey later in the project. The study of earlier 'historical' air photographs, which have often been under-exploited in archaeological research and conservation, will be undertaken during 2006.

Sample excavations and geophysical survey were carried out on a key site at Ledčice, distr. Mělník, within of the Říp study area. The site, first discovered from the air in 2000 by the Institute of Archaeology of the Czech Academy of Sciences, consisted of conjoined rectangular and sub-rectangular enclosures. The aim of the excavations was primarily to find artefacts and other material that would date the site, initially suspected to be of late prehistoric origin, perhaps similar to the Hallstatt-period moated sites well known from central European countries such as Bavaria.



Conjoined enclosure discovered from the air (on the left) and under excavation in 2005 (on the right). The dating of the enclosure to the Medieval period, rather than to prehistory as expected, has major implications for interpretation of heritage landscapes in the Czech Republic.

The excavations, however, showed the site to be of Medieval origin. In the context of Czech archaeology this is in fact the first site of its kind – a representative of the earliest country feudal seat – whose plan is completely preserved, in this case in the form of ‘aerial’ evidence. Pottery from the lower layers of five ditch-sections dated the rectangular enclosure to about 1150-1250 AD, the earliest stage of the High Medieval period in Bohemia. The rectangular enclosure probably represents the ‘bailey’, with the sub-rectangular enclosure serving as the central, residential, part of the site, as indicated by a solitary sunken feature (perhaps a tower house) at its centre.

Educational work

The **aerial survey** already mentioned, along with reconnaissance during the winter of 2004/05, recorded selected monuments and landscapes in various parts of Bohemia for the planned documentary film on the history of aerial archaeology and the past landscapes of Bohemia.

Following discussions with English Heritage (as sponsors of the project) a second educational contribution will be the preparation of an on-line **Encyclopaedia of Aerial Archaeology and Remote Sensing**. The basic technological support and necessary programming have been created in the past year, with a provisional address for system-testing at <http://athena.zcu.cz/airdb>. The encyclopaedia will consist of individual entries and a related database system. The aim is to provide easily accessible information, including images, on aerial archaeology and remote sensing in all their aspects to students, teachers and the general public, the only pre-condition for free access being an internet connection.

A third educational contribution came through the involvement of students from the University in various aspects of the project, including aerial reconnaissance, sample excavations and geophysical work.

Caesium magnetometer

A significant advance during the year was the purchase by the University of a sophisticated caesium magnetometer, capable of greatly enhancing the information recoverable from sites initially identified through aerial survey or related fieldwork. This will make a special contribution both to the Culture 2000 project and to continuing landscape survey after its completion. Because of established financial practices within the University permission was given by the European Commission for the whole of the project’s contribution towards depreciation (14% of the initial cost) to be debited to Year 1, with consequent re-allocation of costs in Years 2 and 3.

UNDERSTANDING ANCIENT LANDSCAPES IN EUROPE

Training and access

Dr Robert Bewley, English Heritage

Background and objective

Aerial archaeology and landscape studies have a long history in the United Kingdom. English Heritage is a leading institution in the fields of archaeological air survey, landscape recording, air photo-interpretation and mapping, archive-management and public presentation. The organisation's role is as project leader, providing administrative and financial support for the project as a whole. It also provides skilled tutors for training events, workshops and conferences within or associated with the project. The specific responsibilities of English Heritage as project-leader are as follows.

- To provide administrative and financial support in the receipt and expenditure of funds and in reporting to the Culture 2000 office in Brussels.
- To administer the project's 'central' funds so as to support meetings, exchange visits and TV/video/website activities.
- To share expertise by arranging speakers and tutors for training events, workshops and conferences organised by Culture 2000 co-partners.
- To organise an aerial survey Training School in England and to act as co-organiser of a GIS Workshop in Italy, the latter in partnership with the University of Siena.
- To promote TV and video presentations so as to publicise aerial archaeology, landscape studies and the contribution made to them by the Culture 2000 project.
- To create and oversee a central website and 'virtual exhibition' for the project.
- To organise a final workshop and 'book of the project'.

Progress to the end of 2005

Good progress has been achieved with all of these objectives, though the TV/video and website work has taken longer than expected. The project's Management Committee have been held and the Interim Report has been prepared and submitted to Brussels.

Administrative and financial support the use of 'central' funds

The financial management of the project, involving seventeen co-partner organisations, has been greatly assisted by the standard Culture 2000 invoice spreadsheet. Significant difficulties have been encountered in only one case (Italy, Lecce) where bureaucratic problems (now hopefully resolved) prevented any progress in 2005. 'Central' funds have helped students and tutors to attend events in Finland, Germany, Italy, Lithuania and Romania, and have supported work on the project's central website.

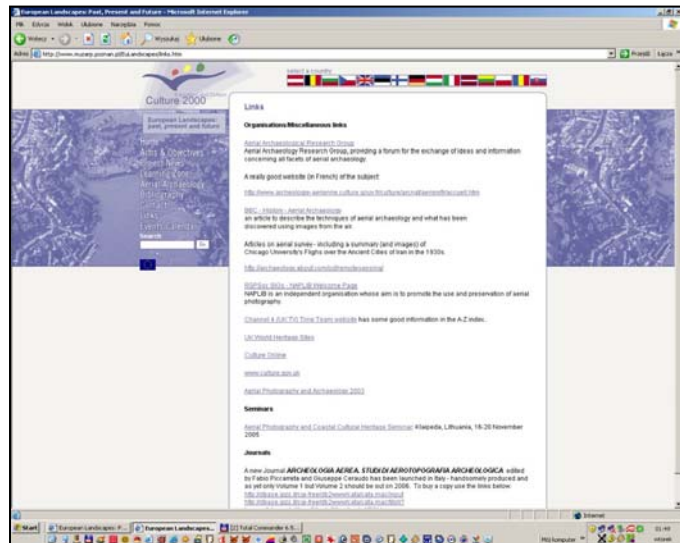
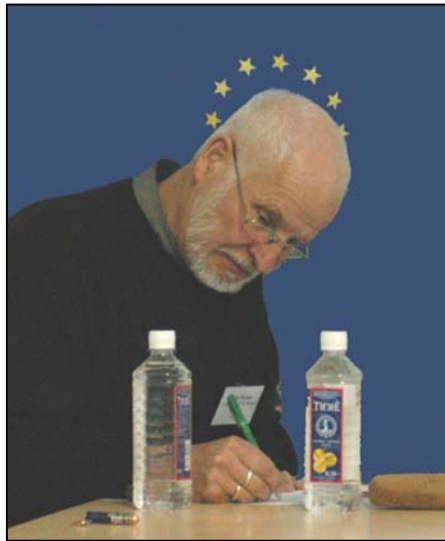
Sharing expertise

English Heritage has arranged for or provided speakers, tutors and pilot-instructors for eight events or actions in five different countries between September 2004 and the end of 2005. Similar support will continue throughout the project.

Aerial Archaeology Training Schools and GIS Workshop

Following discussions with co-partners in Italy the sequence of Training Schools was re-arranged. The school at Grosseto in Tuscany took place in May-June 2005, with the UK school moving to July 2006 and the second Italian school, at Foggia, to May 2007. There is thus a major school in each year of the project. The GIS Workshop, to be organised in partnership with the University of Siena, is now programmed for the final year of the project. In the meantime English Heritage and the Culture 2000 project will contribute to the Siena University's XVth International Summer School, to be held at Grosseto, S Tuscany, in July

2006. The subject, *Geophysics for Landscape Archaeology*, is so close to the Culture 2000 objectives that it was felt better to support the School in a small way and to postpone the GIS workshop until 2007.



Left: *Subtle advertising for the European Union and Culture 2000 at Klaiapeda in Lithuania.*

Right: *Advertising of a different kind – a page from the project's central website.*

TV, video, website and 'virtual exhibition'

The production of TV and video packages has been explored with two TV companies in the UK. One is now developing a proposal for circulation through European broadcasting networks on the concept of *European Landscapes* as TV programmes, CDs and web-based teaching facilities.

The project's central website proved more difficult to arrange than originally anticipated but its format has now been established and it was launched in a development form in November 2005 (at www.muzarp.poznan.pl/EuLandscapes) with links to and from a number of related websites. The plan is for the site to be populated and material loaded up in the first three months of 2006. All co-partners will develop their own 'national' or 'institutional' pages while text and illustrations on the more generic subjects (aerial survey, the background to the project, links, news etc) will be organised by English Heritage staff and volunteers from within the project. The website was created by a UK company called 'nu-breed' and is now being managed and maintained by the Poznań Archaeological Museum in Poland. All co-partners are collecting material for the 'virtual exhibition' which will be assembled in its final form towards the end of the project.

Meetings

Staff from English Heritage attended Culture 2000 meetings at Munich in September 2004, Helsinki and Rome in October and November 2004, Romania in May 2005, Grosseto (Italy) in May-June 2005 and Leuven (Belgium) in September 2005.

Final workshop and 'book of the project'

The British Academy has agreed (in principle) to host and assist in the organisation of the final workshop, if the project's Management Committee decide that London is the most appropriate venue. The Academy has also expressed an interest in publishing the results of the workshop and the project's results.

HERITAGE SURVEY IN ESTONIA

Aerial and ground-based evidence in partnership

Armin Rudi, Project Co-ordinator, for the National Heritage Board of Estonia

Background and objectives

Traditional field survey techniques are well developed in Estonia but less use has been made in the past of geophysical prospection and virtually none of aerial survey, whether for exploration or for conservation. The Culture 2000 project has allowed the National Heritage Board of Estonia to take the first steps in training Estonian archaeologists in the techniques and uses of exploratory air survey, air-photo interpretation and mapping, including the establishment during the project of a limited programme of active aerial survey. Throughout the project the aerial work will be linked closely to ground-based observation and geophysical prospection in a complementary application of techniques not previously attempted in Estonia. Selective fieldwork and aerial observation are being carried out on carefully chosen sites, mostly in the north and north-eastern coastal areas where forest cover is less dense and wrecks and other features may be recordable in shallow water.

Progress to the end of 2005

A four-member team has been established for the project – Mr Ants Kraut, the Board's Chief Inspector of Archaeological Monuments, who has wide experience in the field, Ms Riin Alatalu, Head of the Board's Division of Supervision, administering the finances, Mr Endel Grensmann, managing the photography and technical support, and Armin Rudi as in the role of overall coordinator. Dr Valter Lang, Professor of Archaeology at Tartu University and Dr Marika Mägi, Head of the Department of Archaeology of the Estonian Institute of History, have also been involved as consultants.

So far, the main activities have been the testing of various methods of aerial archaeology in the particular environmental circumstances of Estonia, including the discovery of new sites from the air and the inspection of already-known sites (both archaeological and architectural) for the more precise definition of their boundaries and states of preservation. The aerial work has been matched by extensive ground-inspection of the sites and areas under study. To the end of 2005 approximately 6 hours of aerial reconnaissance have produced about 130 photographs of 32 sites and locations, many of them not previously recorded from the air. Ground-based visits have been made to approximately 65 individual sites as well as to large tracts of landscape of potential heritage significance.



Aerial inspection in the project's chosen study-area in N Estonia has been impeded by the prevalence of extensive tracts of forest and mire (aerial observation normally works best in 'open' landscape). Nevertheless, large bogs are not without interest, aerial inspection within the project having helped to reveal the courses of ancient sledge routes, as in Saarte bog (left). The study of historical maps will also



make an invaluable contribution to the identification of historical communication routes. To achieve the best results, reconnaissance flights will continue in the autumn and winter as well as at other times of year.

During the first season of aerial exploration several complex aggregations of archaeological features have been photographed, notably the ruins of a medieval feudal stronghold overlying a Viking Age settlement site at Angerja, northern Rapla County (above left). Further experience is needed to achieve success in some aspects of the project, especially in areas where the natural conditions are unfavourable. For example, attempts to use aerial survey to establish the precise location of buildings on archaeological sites have so far had limited success, though patches of darker soil indicating intensive human activity have been detected on numerous occasions. In the majority cases the reconnaissance flights have been preceded by on-ground inspection, and all seemingly positive results need to be cross-checked through follow-up visits on the ground.

For the project team a particular interest has focused on manorial estates, as at Hagudi (above right). At such estates the air photography has provided good overviews of the often extensive complexes and of the exact relationship of individual buildings to one another. Aerial views are even more valuable in establishing the condition of the parkland belonging to the manorial estates. Photographs have been used as illustrations in several publications, notably the overviews of the local cultural heritage published by rural municipalities.

Aerial and ground-bases survey in 2006

2006 will see the continuation of new and repeat-flights over the areas of greatest archaeological interest. The study area will also be broadened and related ground-observation will continue, along with mapping of archaeological features detected on the aerial photographs. Further use will be made of the photographs in publications, both for specialists and for the general public. A wholly new technical solution will also be tried for the first time, the utilisation of a stable, cable-operated, helium balloon for photographing particular archaeological features such as ancient field systems.

Aerial Archaeology Workshop

A key event in the Estonian part of the project will be an international seminar and workshop on ***Aerial archaeology and maritime landscapes*** on 26–29 October 2006 at Tallinn and Saaremaa. This will explore the potential of aerial photography for research into maritime landscapes, and will enable discussion of research methods with colleagues from other institutions in the Baltic countries.

Network contacts and meetings

Project members will continue to take part in meetings in partner-countries to broaden their experience through discussion with photographers and landscape archaeologists from other parts of Europe (as at meetings in Munich and Leuven in September 2004 and 2005).

HELSINKI SYMPOSIUM ON AERIAL ARCHAEOLOGY

4-9 October, 2004, Helsinki, Finland

Nina Heiska, for the University of Helsinki

Background and objectives

Aerial survey and air photography have as yet hardly been used for archaeological or landscape studies in Finland, and their application in the other Scandinavian and Nordic states has been sporadic. The aim of the Helsinki event was to promote the use of aerial archaeology in the Nordic and Baltic countries. The Symposium was organised by the University of Helsinki, the Helsinki University of Technology and the National Board of Antiquities as the first major event in the Culture 2000 project *European Landscapes: past, present and future*. Assistance was also given by the Finnish Ministry for Education, Sito oy and the Aerial Archaeology Research Group.

Progress to the end of 2005

The Symposium was a well-attended and lively event, introducing a relatively new archaeological technique to the region. A sub-group was formed to encourage further cooperation between the Baltic and Nordic states in the fields of culture and aerial archaeology, through Ars Baltica and the Aerial Archaeology Research Group.

HESAA 2004

The Symposium

During the first two days of the meeting a public Seminar was held in the auditorium of the National Museum of Finland. A total of 83 professionals and students from varied fields, ranging from land surveying to archaeology and architecture, took part in the presentations and discussions, which were led by experts from Culture 2000 co-partners in Austria, Germany, Lithuania, Poland and the UK as well as speakers from Denmark, Finland, Iceland, Latvia and Slovenia.

The presentations and discussions covered a wide range of subjects: the principles, practice and potential of aerial survey in landscape and archaeological studies; varying kinds of remote sensing, from traditional aerial reconnaissance to satellite imaging; the uses of aerial archaeology in various countries of Europe; and aerial work in the Baltic and Nordic states. A final discussion looked to the future and resolved to form a regional grouping of interested specialists to promote the advance of aerial archaeology and landscape studies in the Baltic and Scandinavian states.

The Workshop

The Seminar was followed by a four-day Workshop, held in a classroom and a well-equipped computer laboratory at the Aleksandria Learning Centre in the University of Helsinki. Altogether 28 professionals and graduate students, all of whom had attended the introductory Seminar, stayed on for more intensive study and practical exercises at the Workshop. The participants came from Iceland, Norway, Denmark, Poland, Russia, Estonia, Latvia, Lithuania and Finland. They were instructed and encouraged by six tutors from Slovenia and Culture 2000 co-partners in Austria and the UK.

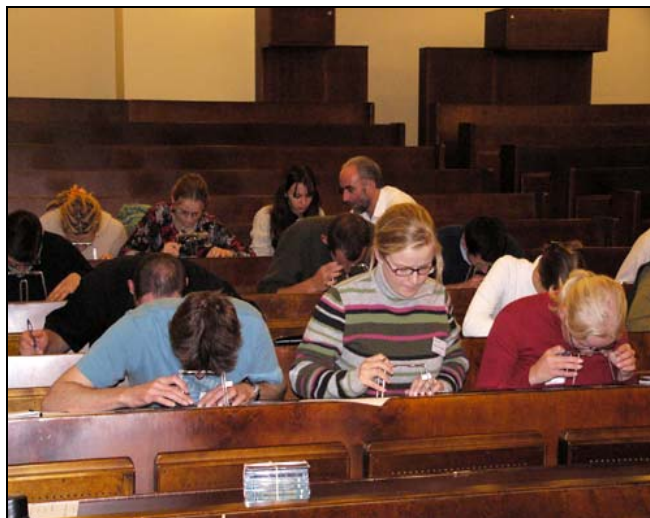
During the Workshop, the participants studied aerial photographs and maps from their own countries. Through descriptions of basic principles and practical exercises they were taught how to read information from the photographs, how to relate it to the maps, how to interpret the data in archaeological terms and how to transcribe the information onto the map-base. There was a lively final discussion of the content and output of the meeting, which was felt by all to have been a success, in particular in the way that a wide variety of archaeological and

landscape information had been treated by the participants according to the needs and circumstances of their own countries.

The future

The organisers were satisfied with the events during the Symposium. In particular, the formal and informal contacts that were created during the week will serve as the basis of a valuable contact network in the future. As the Symposium was organised with minimal funds, the organising committee expressed their special thanks to the HESAA volunteer whose tireless work had made the event possible and to the Aerial Archaeology Research Group and Culture 2000 co-partners who provided most of the lecturers and tutors through their growing network of specialists across Europe.

After the Seminar there has been a growing awareness of the value of aerial archaeology and its methods in Finland and in the neighbouring countries. For instance, a Finnish-Russian team took aerial photographs of an archaeological site at Lake Valg, Estonia, in the summer of 2005. In 2006, too, a Finnish engineering student who participated the HESAA workshop will complete his thesis on the Lake Valg project at the EVTEK University of Applied Sciences. Furthermore in Estonia, the National Heritage Board is planning to expand the use of aerial images in archaeological research. In Denmark, too, archaeologists who attended the Helsinki event are beginning to plan their own aerial archaeology Training School in 2007.



Students and visiting tutors at the Helsinki workshop.

BRINGING AIR AND WATER TOGETHER

Innovative landscape survey in the coastal zone of NE Germany

Dr Susanne Gerhard, Archaeological State Museum of Mecklenburg-Vorpommern

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

Dr Dirk L Krausse, Dr Jörg Biel, Landesdenkmalamt Baden-Württemberg, S Germany

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.

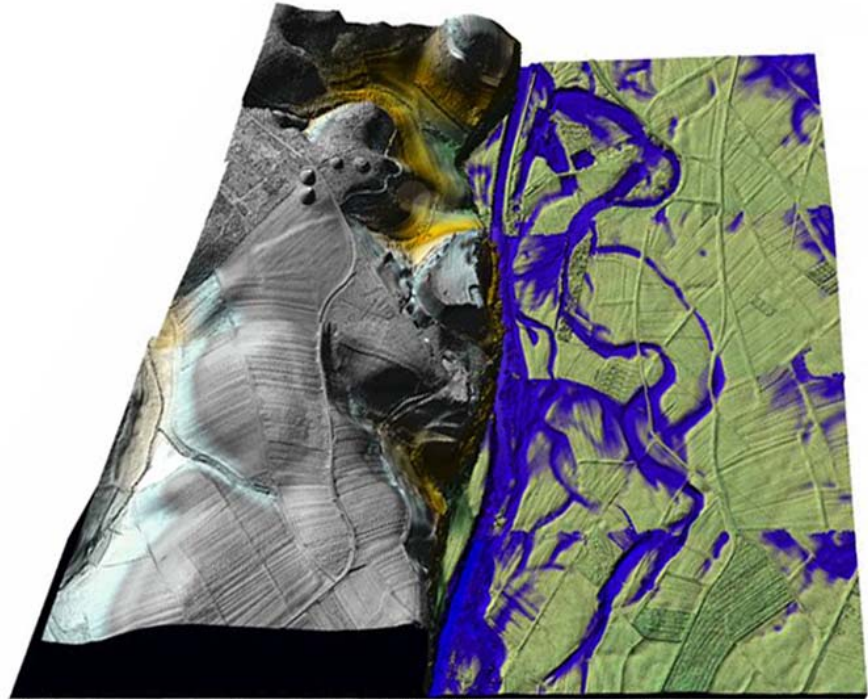
Methodological issues concerning lidar

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.

LANDSCAPE SURVEY, PRESENTATION AND PROTECTION IN BARANYA COUNTY, HUNGARY

Gabor Bertok, for the Directorate of the Museums of Baranya County, Pécs, Hungary

Background and objectives

Aerial photography and other modern methods such as GIS and computer-based research databases have not yet found a regular place in archaeological research and museum work in Hungary, despite recognition of their importance by Hungarian archaeologists. As a result, the aerial image and its interpretation in explaining and presenting the landscape and archaeological heritage of Hungary has been little used in museums or other institutions.

Through the Culture 2000 project the Directorate of the Museums of Baranya County, based at Pécs in SW Hungary, aims to demonstrate the use and importance of aerial photography and non-destructive archaeological methods such as geophysical survey for the presentation and protection of the national heritage. By doing so the Museum will improve the quality of its own work, both in research and in the presentation of the landscape and archaeological heritage to schoolchildren and the general public. The Museum is pursuing these objectives in four main ways.

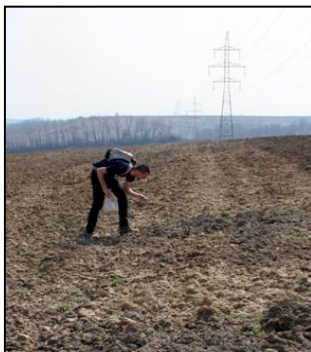
- Through a 3-year **landscape survey project** in Central Baranya County, involving aerial and field survey and archaeological landscape mapping. Use is being made of heritage information from the County and National Museums as well as air photographs from the University of Pécs, with whom the Museum is working on many aspects of the project.
- By setting up a **GIS-based database** for publication on the Internet, making the results of the project immediately available to young people, the general public and researchers.
- By creating a **travelling exhibition** on the importance of aerial survey and other non-destructive methods in the interpretation and understanding of the landscape heritage.
- By taking part in **meetings and exchanges** with Culture 2000 partners and (in Year 3) by organising a workshop to summarise the results of the Museum's Culture 2000 work.

Finally the better availability of the Museum's research results, along with the demonstrated economy and effectiveness of aerial survey, will encourage the long-term use of air survey in Hungary for archaeological and landscape research, presentation and conservation.

Progress to the end of 2005

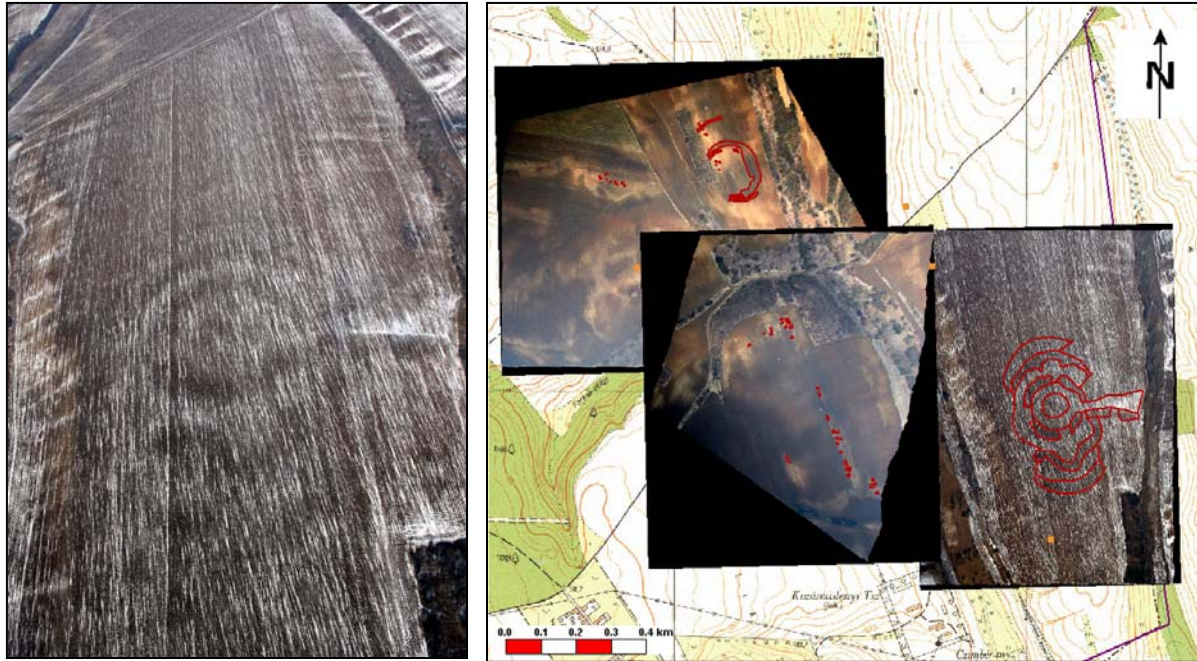
Work has begun in the chosen study area, using both aerial photography and ground-based methods. The GIS database has been initiated and revised after testing. Preliminary work has been done for exhibition work and advice has been obtained from Culture 2000 partners.

September 2004 Participation in first meeting of the Culture 2000 co-partners and annual meeting of the Aerial Archaeology Research Group, both in Munich. Discussions then and later with air photographers, photo-interpreters and landscape archaeologists from elsewhere in Europe to strengthen the basic structure of the project in Hungary.



October 2004–January 2005 Work in the County Museum and the National Heritage Protection Bureau to identify, study and transcribe archival data on the study area. Purchase by the Museum of laptop, PDA with GPS, and Geomedia GIS package. Framing contract with the local flying club. Acquisition of permits for aerial and field survey.

February–March 2005 Setting up of the GIS database for the archaeological heritage of the study area. Two exploratory flights to record archaeological sites in snow or as soilmarks. Field-walking of some of the sites recorded from the air (left).



Left: *Air photograph of a large multiple ring-ditch, possibly a Neolithic henge monument.*
 Right: *Rectified air photographs, with mapped archaeological features marked in red.*

April-May 2005 Creation of a small air-photo exhibition for a larger display in Vienna on the World Heritage Site of Pécs, candidate as Cultural Capital of Europe in 2010 (useful experience for creation of the travelling exhibition in Baranya County later in the project). Refinement of GIS database. Further field-walking, photo rectification and transcription, site mapping and insertion of the resulting information into the GIS.

June 2005 Three aerial survey flights during the cropmark season, bringing the total number of photographs to c600, mostly of sub-surface archaeological features but also of urban and industrial heritage sites and characteristic natural features. Aerial monitoring of major construction sites within the study area. Three sites were subsequently selected for detailed non-destructive survey, including boring and soil-sampling, geophysical survey and the creation of detailed elevation maps and site reconstructions.

July-August 2005 Further mapping of air photo sites. Arrangements for an exhibition in late 2006-early 2007 in the largest shopping mall in the centre of Pécs. Interview on the project with the local branch of the national radio station. A further air-photo flight at the end of August to explore the possibility of cropmark evidence in the late summer period.

September–October 2005 Project co-ordinator involved in field survey in Syria. Culture 2000 experience allowed the first approaches to be made for possible future air survey there.

October–December 2005 Continued work on transcribing the 2005 aerial photographs (105 potential archaeological phenomena and landscape features). Pottery from field-walking identified and inventoried. Report for 2005 activities submitted to the Cultural Heritage Protection Bureau. Arrangements for the 2006 permit for archaeological research. Agreement with a boring and soil sampling company for sampling on two selected sites in summer 2006. First steps to transfer the GIS database to the web server of the Museums of Baranya County.

Future plans

The Museum is considering the organisation of a Workshop with Culture 2000 co-partners, including colleagues from Hungary and neighbouring countries, in 2006 or 2007 to compare the results achieved within the Culture 2000 project and to discuss future possibilities.

HIDDEN LANDSCAPES IN THE TAVOLIERE DELLE PUGLIE

Apulia, Foggia, Southern Italy

Prof Giuliano Volpe, Dr A V Romano and Dr R Goffredo, for the University of Foggia

Background and objectives

The Department of Human Sciences at the University of Foggia, and its archaeological section in particular, is a relatively new institution. The Department has already started a wide range of archaeological and landscape research, employing the integrated use of a variety of survey methods and instruments in partnership with other universities and research institutes. To develop its expertise in the field of exploratory aerial survey the Department promoted in May 2003 a training school in aerial survey, photo-interpretation and mapping. Flights made during the school showed the enormous potential of the Tavoliere for recording partially understood ancient landscapes only visible through aerial survey for a few weeks in early summer and autumn each year. The project has given the University the opportunity to enhance its capacity in these fields in four important and potentially long-lasting ways.

- By putting in place a structured and long-term programme of archaeological air survey.
- By developing the use of satellite and laser imagery for archaeological purposes.
- By achieving a closer integration between systematic ground survey, aerial exploration, remote sensing and investigative techniques in the study of the ancient landscape.
- By organising a training school, attending meetings and arranging student exchanges to promote the use of aerial survey, remote sensing and landscape studies in Italy.

The University is in process of establishing a laboratory of landscape archaeology to specialise in aerial survey, air photography and remote sensing, and to promote intensive aerial survey over the Tavoliere in the coming years. A special focus will be provided by the organisation of a second Training School, where students from Italy and elsewhere Europe will study both traditional and new techniques in aerial archaeology and landscape studies.

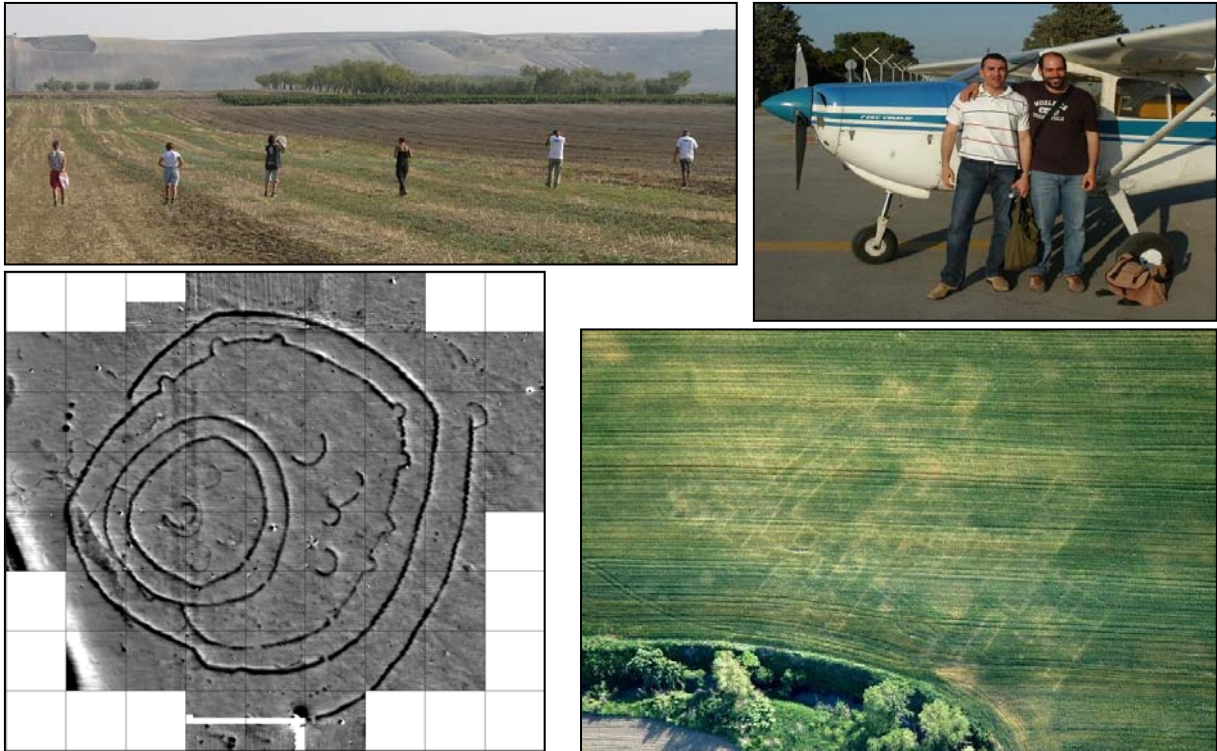
Progress to the end of 2005

Activity to the end of 2005 has been relatively restrained, so as to conserve resources and funding for the Training School later in the project (now planned for May 2007). But a very successful programme of aerial exploration was undertaken in the early summer of 2005 and steps were made towards gaining access to lidar data. Work was also done on combined aerial and ground-based survey in two areas already under intensive study by the University.

Aerial survey and air photo mapping

An intensified programme of aerial survey over the Tavoliere in 2005 saw the recovery of information on literally hundreds of archaeological sites, many of them new to the record. They ranged in date from prehistory to the Roman period, the Middle Ages and later. Conditions for the recovery of evidence in the ripening grain and parched grassland were the best for several years. Previously unrecorded Roman villas appeared in striking numbers, along with substantial 'new' areas of Roman land division. Altogether, 45 hours of aerial reconnaissance were undertaken, 30 by Dr Otto Braasch from Germany and 13 by Dr Valentino Romano and Luigi Fruggiero, a pilot colleague from the Aero Club di Foggia. The latter were the first independent flights made by the University without 'foreign' assistance.

Approximately 6000 digital images were added to the University's growing air-photo archive in 2005. Improvements were made to the database system for archiving and analysing the photographs. Un-costed work by two PhD students saw the rectification and mapping of a significant number of low-level oblique air photographs, especially for partially-known and previously unrecorded sites in the Celone and Ofanto Valleys. Mapping and interpretation work of this kind will be intensified through a student contract in 2006 and 2007.



Clockwise from top left: *Field-walking survey in the Celone Valley. Archaeologist and pilot after a Culture 2000 flight in 2005. Air photograph of Roman villa in the Celone Valley study area. Multi-ditched Neolithic settlement, depicted by geophysical survey undertaken in 2005.*

Laser imagery and related aerial photography

In May 2005 the Universities of Foggia and Lecce learned through Culture 2000 contacts that lidar and other airborne imagery of the ancient city of Arpi, near Foggia, was being taken for the University of Durham, CNR Potenza and the UK Natural Environment Research Council. In response, intensive oblique air-photography of the city was undertaken by Dr Braasch for the University of Foggia, to enable comparison of the results from the two remote-sensing techniques. Plans are in hand for the training of research students from Foggia in the treatment and interpretation of lidar data during 2006 at the University of Durham in the UK.

Integration of aerial and ground-based research

As part of on-going PhD research funded by the University field-checking of archaeological sites first recorded from the air was undertaken at a number of locations, notably in the University's special study areas of the Celone Valley, west of Foggia, and the Ofanto Valley in the vicinity of Canosa. This kind of work will continue as part of the project in future years.

Improvement were made during 2005 to the GIS system to assist future integration between aerial evidence and field survey data, using orthophoto coverage for the Province of Foggia as well as national (IGM) map-coverage at a variety of scales. Models were also created for the interpretation of poorly-defined air-photo features, both by checking air-photo sites on the ground and by taking air photographs of sites initially identified through ground-based survey.

Training School, meetings and student exchanges

The Training School originally planned for 2005 will now be held in May 2007. Research students from the University took part in the Culture 2000 co-ordination meetings at Munich and Leuven in September 2004 and 2005, the annual meeting of the Aerial Archaeology Research Group in 2005, the Rome Seminar associated with the Culture 2000 project in November 2004 and the aerial archaeology Training School at Grosseto in May-June 2005.

AERIAL SURVEY AND MEDIEVAL LANDSCAPES IN SOUTHERN APULIA

Combining modern and traditional technology

*Mrs E Achiardi, Agenzia per il Patrimonio Culturale Euromediterraneo
Prof Giuseppe Ceraudo, Prof Paul Arthur, University of Lecce*

Background and objectives

The institutions involved in this part of the project are described at the foot of the next page. The contribution by the Agenzia and the University of Lecce to the Culture 2000 project will lie in the development and combination of new and traditional techniques for understanding the towns, settlements and landscapes of Southern Apulia (Salento). This is an area of aggressive agricultural development, in which archaeological sites and landscapes are at constant risk of damage or total destruction by heavy ploughing and erosion. A combination of new aerial survey, analysis of existing air photo and satellite imagery along with ground-based survey will serve to demonstrate the losses and aid future protection of key elements of the archaeological and landscape heritage. By enhancing the range of techniques deployed by one of the country's most respected universities the project will also help to promote the active use of exploratory air survey throughout Italy.



Left. Traditional photogrammetric equipment in the laboratory of the University of Lecce. This kind of equipment still has an important role to play in the analysis and mapping of archaeological information recorded from the air. Right. An example of the heavy ploughing which is devastating the archaeological sites and landscapes of Southern and many other parts of Italy.

Progress to the end of 2005

Administrative and staffing problems have prevented active progress in 2005 but the work-schedule has been revised (below) and the co-partners (including the main sponsor, English Heritage) are confident that the original objectives can be achieved in the remaining lifetime of the project. The work and finances will be supervised by academic and administrative staff in the University of Lecce but reporting to the EC will be through the Agenzia. The whole of the original funding will still be available for use.

Plans for 2006/2007

The principal aspects of the project in Salento will be as follows.

- The creation of specific procedures for archaeological and landscape exploration, including – for the first time in this part of Italy – active aerial survey from light aircraft.

- The combined use of traditional methods of ground-based survey alongside air photo analysis of the kind already taken to a high level by the University.
- The innovative study of infra-red and satellite imagery for its capacity to detecting and locate archaeological sites within the landscapes of antiquity and of the present day.
- The creation of a database and GIS environment for the dynamic management of the data to aid efficient landscape planning and conservation of the historic environment.
- The training of two students (potential research workers or conservation archaeologists in the future) in the combined use of aerial survey, field survey and satellite data.

Given the limited resources available emphasis will be placed on aerial and ground-based examination and on the positioning of Mediaeval settlements through the use of GPS technology and satellite imagery. An important aspect of traditional survey will be the study of a representative transect of ancient and modern landscape extending from the modern town of Lecce to its ancient port at San Cataldo.

Public presentation

This kind of work attracts wide public interest in Italy and there will be opportunities to raise outside funds for the public presentation and publication of the Culture 2000 work. Contributions will also be made to the project's central web-site and 'virtual exhibition'.

Revised budget	Year 1	Year 2	Year 3	Totals
Travel/subsist, workshops/C2000 meetings	-	1000	1000	2000
Fieldwork/photo analysis (2 students)	-	9000	9000	18000
Travel costs during fieldwork	-	1100	1100	2200
Participation in Foggia air survey school (3)	-	2700	-	2700
Aerial survey programme (c15hrs per year)	-	2900	2900	5800
Purchase of air photo, satellite imagery etc	-	6300	-	6300
Travel/subsistence for landscape survey	-	1500	1000	2500
Website etc	-	500	500	1000
TOTALS	-	25000	15500	40500
Contribution to University by Agenzia	7500	7500	7500	22500
Culture 2000 funds, via Agenzia	9210	790	8000	18000

The University of Lecce

Within the University of Lecce the Laboratories of Ancient Topography and Photogrammetry and of Medieval Archaeology have worked closely together for many years in the field of the cultural heritage management, notably through field survey and the study of ancient landscapes. This work has produced a substantial quantity of archive material, now incorporated within the University's database management system. The University has the equipment for creating specific cartography and photo interpretation. Its air photo archives, GIS software and technical staff will provide essential support for the Culture 2000 project. The University will make un-costed contributions in the form of office space, maps, computer equipment and programs etc along with academic supervision, general administration and financial management.

The Agenzia per il Patrimonio Culturale Euromediterraneo aims to promote integration between the different areas of the Mediterranean countries and the European Union, through the analysis, study and promotion of interaction between the different cultural, juridical, and socio-economic systems. It also concerns itself with the interaction and integration of scientific and professional competencies, in the matter of the preservation and valorisation of cultural heritage, which do not have a homogeneous distribution in the Euro Mediterranean Area. At present the Agenzia, a non-profit-making public body, is formed by the Municipality of Lecce, the Universities of Lecce, Foggia and Patras, UNIMED-Union of the Mediterranean Universities and CUM-Community of the Mediterranean Universities. The Agenzia will provide the Italian financial contribution to the project and pass to the University and account for Culture 2000 funds received from the principal beneficiary, English Heritage.

LANDSCAPE EXPLORATION, INTERPRETATION AND CONSERVATION IN TUSCANY, CENTRAL ITALY

Dr S Campana, Prof R Francovich, Dept of Medieval Archaeology, University of Siena

Background and objectives

The Department of Medieval Archaeology at the University of Siena, a pioneer of aerial archaeology and remote sensing in Italy, is contributing to the project in four main ways.

- A structured and long-term programme of archaeological air survey in Tuscany, especially within two carefully chosen study areas, Val d'Orcia and Parco dell'Uccellina.
- The purchase, evaluation and application of satellite and laser imagery for heritage uses.
- The integration of aerial, satellite, geophysical and field-walking survey in landscape studies, each supporting the others in the exploration of heritage landscapes in Tuscany.
- The organisation of Workshops, a Training School and student exchanges to promote the application of aerial survey, remote sensing and landscape studies in Italy.

Through its recently-founded Laboratory for Landscape Archaeology and Remote Sensing at Grosseto (LAP&T) the University is presenting the project results in ways which will raise public and official awareness of the heritage landscapes of Italy and of the need for their presentation and conservation as part of the common cultural heritage of Europe.

Progress to the end of 2005

Aerial survey has continued and been intensified throughout the reporting period. Laser imagery has been acquired for four sample areas. The integration of aerial, geophysical and other forms of landscape survey has been further developed. The planned Training School in aerial archaeology was held in late May/early June 2005, a year earlier than intended. Contributions were also made to a specialist Workshop and to Culture 2000 meetings. An Italian-language book on archaeological air survey, begun during an earlier Culture 2000 project, was brought to completion in May 2005.

Aerial survey

120 hours of aerial survey were undertaken between September 2004 and the end of 2005, mostly recording landscapes and archaeological sites in southern Tuscany but also including excavations in progress and about 45 previously unknown sites, most of them at risk of damage or destruction by ploughing or other modern developments. The University's air-photo archive now contains over 27,000 traditional and digital images. To assist their analysis and public presentation two postgraduate students were trained during the year in air-photo mapping and interpretation. Photographs from previous years are already available on an interactive website and more recent images will be added as part of the Culture 2000 project (<http://shaq.archeo.unisi.it/oblique/>).

Laser-scanned landscape data

Through Culture 2000 contacts the University in May 2005 acquired lidar imagery for four sample areas. The technique will have a particular importance in the heavily wooded landscape of Tuscany, being capable of 'seeing through' trees to create a digital terrain model of the underlying surface, including otherwise-hidden landscapes and archaeological features. The imagery was collected for the UK Natural Environment Research Council through contacts with Dr R Bewley of English Heritage. In 2006 training in the use of the data will take place at the University of Durham in the UK.

Integration of aerial, geophysical and field-walking survey

The first year of the project saw the testing and evaluation of geophysical equipment for large-scale data acquisition – very important in Tuscany because of the nature and use of

the region's soils. Without the integrated use of multi-sensor approaches it would rarely be possible to achieve a real impact on Cultural Resource Management or on the search for a better understanding of the region's developing settlement pattern through time. Hence the recent tests on the GSSI TerraVision system (14 radar antenna and 12 cm resolution) and the Foerster MultiCAT system (4 fluxgate gradiometer). Both systems gave very interesting results and the University is now working on plans to add to its own existing equipment.

Training School, Workshops and student exchange

The main event during 2005 was a 10-day international Summer School in Archaeology at Grosseto on *Aerial Survey: digital photography and GIS based interpretation*. More than 100 students applied for the 21 places available. From 30 May to 8 June post-graduate and PhD students from various fields of research and heritage conservation received a combination of instruction and practical experience, on the ground and in the air. Several new teaching methods were introduced. Each student flew for an average of 8 hours during 110 hours of aerial exploration. Over 15,000 photographs were taken over central and southern Tuscany. Important innovations were the first-time presence of participants from Spain and the training of pilots from the Aero Club of Florence to assist in future air-survey work.



Two previously-unknown sites discovered during the Summer School at Grosseto in June 2005. Left: Roman villa near the ancient city of Cosa, Southern Tuscany. Right: Cropmarks of a multi-ditched circular enclosure, shown by later ground-based survey to belong to the Medieval period.

A successful specialist Workshop, initiated through the Culture 2000 project but funded mainly by LEICA GEOSYSTEMS, was held at Grosseto in June 2005, on *GPS and Laser Scanning in Archaeological Research*. More than 150 students and research workers took part and a publication is planned (without cost to the Culture 2000 project). A further workshop on *Archaeological Landscapes and Digital Technologies*, again largely funded outside the Culture 2000 project, is under preparation for July 2006. A postgraduate student from Siena spent two weeks in the Department of Prehistory at the University of Vienna, attending lessons and working in the Aerial Survey Laboratory of Dr Michael Doneus.

Traditional and Internet publications

2005 saw the publication of a pioneering manual on the theory, practice and uses of aerial archaeology, the first to deal in Italian with exploratory air survey of the kind promoted through the Culture 2000 project. The book, *In volo nel Passato*, arose out of a Culture 2000 scheme which helped to fund the first Italian aerial archaeology school at Siena in 2001. The book was launched during the Grosseto School in May 2005 by two of Italy's distinguished researchers in aerial archaeology, Prof Fabio Piccarreta and Prof Giuseppe Ceraudo. Throughout 2005 the University regularly posted information about Culture 2000 activities on its websites, notably www.lapetlab.it. During 2006 there will be further enhancements of this and other websites in both Italian and English.

LITHUANIAN HERITAGE FROM THE AIR

Through recording and collection to education

Dr Romas Jarockis, for the Department of Lithuanian Heritage Protection

Background and objectives

Over the last 50 years the territory of Lithuania has been photographed from the air five times. The resulting vertical air photographs and digital ortho-photographs, cared for in the archives of the Aero-geodesy Institute in Kaunas and the GIS centre in Vilnius, are open to the public and copies of the photographs can be acquired at reasonable prices. In 1996 the Department of Lithuanian Heritage Protection began a limited programme of aerial photography for purposes of heritage protection. At the present time the Department's archives hold over 2000 oblique air-photo images, representing more than 300 sites and structures of the Lithuanian cultural heritage.

The Culture 2000 project is enhancing these first steps in four main ways.

- By developing a digital database of air photographs of the Lithuanian heritage.
- By fully exploiting the new and existing air photograph as a tool in teaching local history.
- By supplementing the small but valuable programme of regular aerial photography undertaken by the Department in recent years.
- By joining the Europe-wide network of contacts provided by the Culture 2000 project and by organising an International Workshop in Lithuania.

Progress to the end of 2005

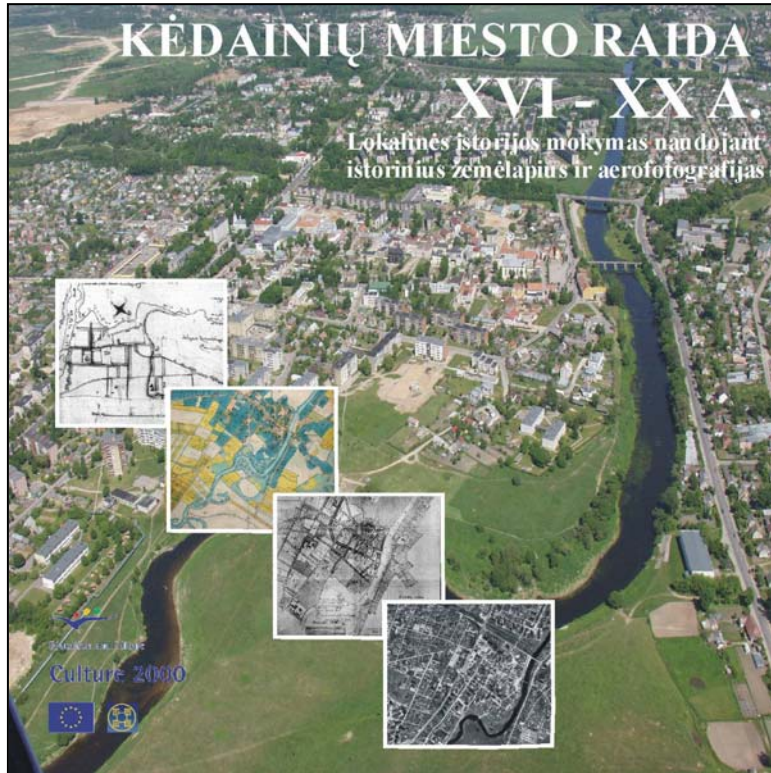
Good progress has been made on all four fronts. Because of time-clashes with other Culture 2000 events the International Workshop was held a year later than intended, in November 2006 at the University of Klaipėda, western Lithuania.

Digital database of air photographs and related data

The basic model for the digital database has been created. Vertical photographs covering 110 sites have been selected from the historical archives and have been digitised. The digital database is being developed on the basis of 'data packages', ie: collections of aerial photographs taken over a range of years, with attached texts containing information on individual heritage sites (such as a castle, town, hillfort or prehistoric enclosure). The packages will contain aerial photographs (black-and-white vertical photographs, ortho-photographs and oblique colour views) taken over a period of years. They will be constantly added to as new photographs are acquired. In implementing the project, interpretation and scientific investigation are being undertaken for sites and monuments detected in both the modern and the archival air photographs.

Education packs

Some 20 towns and townships with origins going back to prehistoric times have been chosen for the preparation of educational packs. The archaeological and historical information for seven of these has been selected and detailed preparation of the packs is in progress, four of them are already completed. The dating evidence lies in prehistoric features both within the towns/townships and in their immediate surroundings – Iron Age hillforts, burial mounds and settlement sites, for example. A castle, a church or an estate attached to the market place are the main components from which the towns and townships developed in the Middle Ages and post-Medieval period. The packs each contain historical and recent aerial photographs, supported by other archaeological data, historical information, cartographic material, ancient paintings and ground-based photographs. The information is being specially adapted for schoolchildren so as to show features of the local cultural heritage and to emphasise their importance for society, both historically and in the present day.



The title page from one of the education packs created as part of the Culture 2000 project, plus the Old Town of Klaipėda seen from the air, and snow-bound participants in the Klaipėda Seminar of November 2005.

Aerial photography

Between September 2004 and the end of 2005 fifteen hours of aerial survey were undertaken, producing about 850 images of approximately 250 cultural heritage sites, of which some ten archaeological sites were new to the record. Two days of field survey were organised to examine the previously unrecorded sites and to compile information for the national archive.

International Workshop/Seminar

The planned International Workshop on aerial archaeology and landscape studies took place at the new University of Klaipėda, on the western coast of Lithuania, on 16–20 November 2005. A total of up to 30 participants from Lithuania, Denmark, Finland, Latvia, Norway, Poland, Russia and the UK considered a range of topics of particular significance to the Baltic region. They also discussed the possibility of future co-operation in the promotion of aerial archaeology, culture and landscape studies. The meeting attracted coverage on radio, television and in the local press. A publication of the proceedings is under consideration, using 50% financial support from Klaipėda University and 50% from Culture 2000 funds.

Culture 2000 contacts

Academic staff and students from Lithuania took part in a number of meetings organised or assisted by the project, including the Culture 2000 and Aerial Archaeology Research Group meetings at Munich and Leuven in September 2004 and 2005, the Helsinki symposium in October 2004 and the aerial archaeology Training School at Barth, Germany, in June 2005.

PHOTO-MAPS AND AIR PHOTOGRAPHS IN POLAND

Old and new resources for Poland's landscape heritage

*Dr hab Włodek Rączkowski, Institute of Prehistory, Adam Mickiewicz University, Poznań;
Dr Andrzej Prinke, Poznań Archaeological Museum; Mr Dariusz Krasnodębski,
Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw.*

Background and objectives

Poland and most of Europe possesses a largely un-recognised landscape resource in a virtually complete coverage of 1:25.000-scale **photo-maps** made for German military and intelligence purposes in the 1930s and 1940s, showing the landscape as it was before the radical changes of the post-war years. Their full historical potential has yet to be assessed.

Up till now little money has been allocated in Poland to **exploratory air photography**. The technique has had to compete for funds with Poland's long-standing programme of ground survey, artefact collection and recording (the Polish Archaeological Record or AZP). This now covers the greater part of Poland through over 500,000 entries. The AZP provides an unrivalled opportunity for Polish aerial survey to be even more effective than in other countries, adding 'shape' to sites known only from surface scatters of artefacts and revealing archaeological and landscape features where no evidence at all is visible at ground level.

The Polish contribution to the Culture 2000 project has three main aims.

- To identify the location, number and quality of the German photo-maps across Europe and to test ways of making them more widely available, for instance as scanned images.
- To carry out air photography in five heavily-ploughed areas, along with mapping of the results and the creation of a database for both field-walking (AZP) and aerial evidence.
- To take part in the Europe-wide network of contacts, meetings and discussions about aerial and landscape archaeology and to publicise the project through the Internet.

The project will demonstrate the value of aerial survey in Poland and will hopefully assist in securing at least modest funding for the technique in the longer term. Adding the results to the AZP will help the conservation of the sites and landscapes revealed from the air. For the general public the photographs will provide striking evidence of the nature and value of these half-hidden traces of the cultural heritage which Poland shares with Europe as a whole.

Progress to the end of 2005

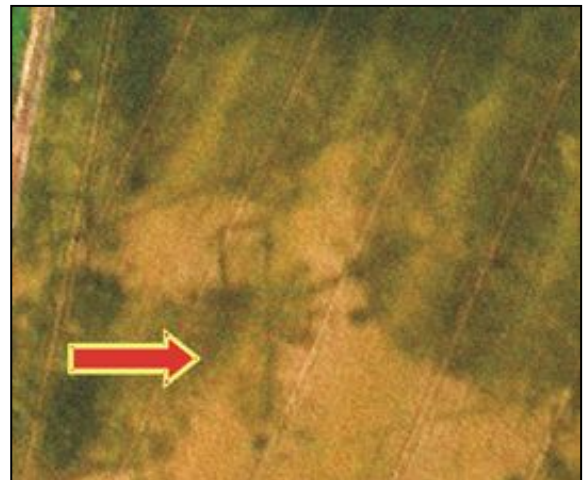
Work on the photo-maps and 'historical' air photographs has been in progress since the start of the project. Air photography in 2005 was hampered by poor weather but significant results were achieved in several areas. Project members took part in a number of meetings through the Culture 2000 network and Poland is now hosting the project's central website.

German photo-maps

The search for photo-maps revealed none in the National Archive in Poznań but the National Museum in Szczecin holds an as yet un-catalogued collection of aerial photographs taken before and during WWII. The material in the Central Military Archive in Warsaw was shown to be still un-catalogued. Work on a database for the photo-maps and mosaics in Poznań and Słupsk in Poland and at Keele University in the UK is well under way, the resulting information being made available in instalments through the project's central website.

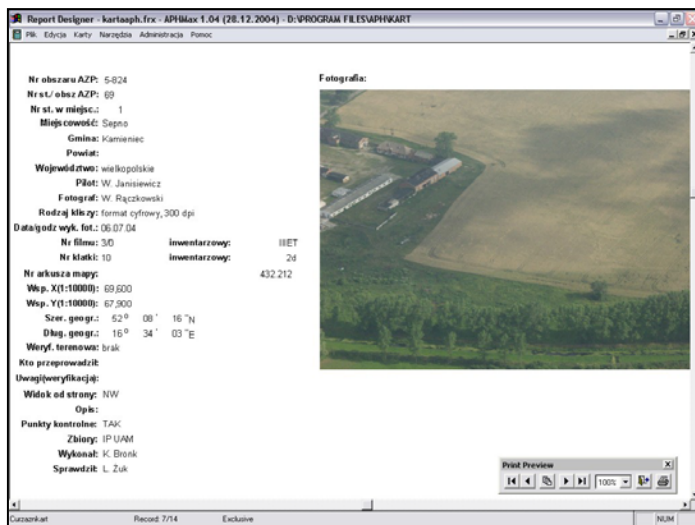
Aerial survey, mapping and interpretation

Despite unfavourable weather conditions useful aerial records were made during two flights in July 2005 over the Vistula, Bug and Narew valleys in N and NE Poland. Sites recorded included a Medieval hillfort and a multi-phase Roman-to-Medieval settlement, along with traditional villages and their surroundings, characteristic landscapes and a prehistoric graveyard under excavation.



Left: *Flight-in 2005 (coloured lines)*. Right: *Trapezoid Neolithic house found from the air in 2005*.

In spite of the poor weather 20 hours of flying in Wielkopolska, Kujawy, Lubusz Land and western Pomerania in June and July 2005 allowed numerous archaeological sites to be photographed as variations in colour or height in the ripening crops. Many were previously unknown and a site-type (the so-called 'pit-alignment' known elsewhere in Europe) was recorded for the first time in Poland. There were also spectacular traces of trapezoidal buildings from the Early Neolithic period. Other settlements were represented by groups of pits. Aerial records were also made of villages, Medieval towns, granges, manor houses, monasteries and churches, as well as more recent industrial and military features.



Database development

A major development was the design and testing of a database application (*APh_Max*) for storage and analysis of the air-photo archives in various institutions. This is being used initially for mass data entry of the 3000 photographs of the Wielkopolska region held at the Adam Mickiewicz University. This is the third module of a heritage management system under development now for several years at the Poznań Archaeological Museum. It will enhance the management of air photo collections

through the creation of unique files for each photograph, that can then be compared with other data-sets such as text descriptions of individual sites, GIS data etc. A typical data screen is illustrated above. The database will shortly be linked to those of the AZP to assist the protection and management of monuments, whether known from ground-survey or from aerial evidence.

Culture 2000 network, meetings and website

Students and members of the project team took part in meetings of the Culture 2000 co-ordination group and of AARG in Munich and Leuven (Sept 2004 and 2005) and in other Culture 2000 meetings at Helsinki, Rome and Klaipeda in Lithuania. The Archaeological Museum at Poznań is now acting as host to the project's central website, to which all of the co-partners are contributing (www.muzarp.poznan.pl/EuLandscapes).

ROMANIA: A FUTURE FOR THE PAST

Aerial information in landscape recording and conservation

Irina Oberländer-Târnoveanu, for the Institute for Cultural Memory

Introduction and objectives

Aerial survey is as yet virtually unused in Romania for archaeology or landscape study. Through the Culture 2000 project the Institute for Cultural Memory (CIMEC) is promoting its introduction through the examination of 'historical' air photo sources and if possible through the initiation of a small programme of exploratory air survey towards the end of the project.

The geographical focus of the work lies in part of the Lower Danube Valley, archaeologically one of the most rich areas in Romania from early prehistory to modern times. Many ancient sites there have been destroyed or are now at risk of damage or destruction by modern development and intensive arable cultivation. Many more await discovery through the aerial techniques which have proved so fruitful elsewhere in Europe. By drawing these sites to the attention of officials and cultural resource managers, the project will contribute to their long-term conservation and future enjoyment by schoolchildren, young adults and public at large.

- The aims of the Institute's contribution, as refined during Year 1 of the project, are as follow
- To enrich the National Archaeological Record by identifying the exact location of known sites and by discovering and documenting 'new' ones through the examination of aerial photographs, archive sources, digital photography and digital cartography.
- To use the resulting information to compile maps of archaeological sites, monuments and landscapes and of protection zones around them.
- To collect previously unrecorded archaeological data of all periods from a pilot area and to make the material available to the public, cultural resource managers and researchers.
- To place individual settlements and ritual or military sites in context with one another, and to demonstrate their relationship with the physical and ecological landscape around them.
- To identify the changes in the landscape which have taken place in recent decades by comparing older and more recent aerial photographs.
- To promote information exchange and development in the use of GIS, the Internet and other forms of digital communication, and to facilitate the digitising and dissemination of air-photo information on the ancient landscape and its significance in modern times.
- To organise workshops and seminars to introduce students, archaeologists and cultural resource managers to the practice and uses of archaeological air survey, photo-interpretation, mapping and record creation in exploration, presentation and conservation.
- To co-operate with co-partners in the design of an Internet exhibition and of education packs and other means of raising public and official awareness of 'aerial' techniques in the identification, presentation and conservation of heritage landscapes across Europe.
- If possible, to initiate a small programme of active aerial survey in Romania.

Progress to the end of 2005

Work in the first phase of the project has had two main goals: gathering information for the pilot area to be surveyed, and training archaeologists in the uses of air photographs and GIS.

Work in the chosen study area

The first task was to identify and assemble bibliographic, cartographic, photographic and GISdata for the chosen study area, the Mostiștea Valley and its environs in the Lower Danube area. It was decided to focus on a pilot study of the Malu Roșu site at Sultana, alongside Mostiștea Lake, analysing landscape change on air-photos taken between 1972 and 2003. The fortified settlement is near Sultana village, on a high terrace above the lake, eroded to the extent that only an area about 30 x 35m across still survives. In the 1920s this



Participants in the second Romanian training course approaching the promontory above Lake Mostiștea where once stood the ancient settlement of Malu Roșu

became the first prehistoric site attributed to the Gumelnița culture to benefit from scientific research. More extensive excavation took place in 1975.

Unfortunately no report was published, the archaeologists died and their excavation diaries and other documents were lost. Today, archaeologists from two major museums are re-excavating the site to establish its basic stratigraphy. The little information available shows that the occupation deposits were about 4m thick, covering three evolutionary phases of the Gumelnița civilization. Remarkable finds in various museums show the site to have been of special significance during the Romanian Calcolithic (Copper) Age.

During 2005 aerial photographs from 1972, 1986 and 2003 were purchased from the National Institute for Cadastre. The evolution of the archaeological excavations over this thirty year period and the progressive erosion of the lake shore have subsequently been plotted as a digital map. This has already proved of great value to the archaeologists working on reconstruction of the earlier research and conservation of the site remains.

Training courses and attendance at meetings

A week-long training course in aerial archaeology and the uses of GIS in heritage work was organised at Bușteni from 9–15 May 2005 through Culture 2000 and the EPOCH Network of Excellence. There were 34 participants from six countries, including six from CIMEC itself.

In September 2005, during a week-long course in Bucharest, five Romanian archaeologists received intensive training by Rog Palmer from the UK in the interpretation of aerial photographs. One day was also spent on targeted field-walking in the Mostiștea Valley.

The Culture 2000 project also helped Romanian representatives to attend the Culture 2000 and Aerial Archaeology Research Group meetings at Leuven in September 2005.



Participants in the first Romanian training course, at Bușteni in May 2005, including (left, front row) the Director and Deputy Director of CIMEC, organisers of the Romanian part of the project.

PUBLIC PRESENTATION OF A STONE AGE PHENOMENON IN SLOVAKIA

Dr Ivan Kuzma, for the Archeological Institute of the Slovak Academy of Sciences

Background and objectives

The great stone circle at Stonehenge, in southern England, is one of the most famous prehistoric monuments in the world. But thousands of years earlier, around 6800 years ago, prehistoric societies all over Central Europe started to create large timber circles enclosed by monumental circular ditch systems. These oldest known monumental structures in Europe have been revealed through aerial archaeology in Austria, the Czech Republic, Germany, Hungary, Poland and Slovakia. Today these uniquely monumental sites, on löess or sandy soils, are under massive threat of destruction, dramatically accelerated by the intensive agricultural use and industrial transformation of the modern landscape.

The Slovak part of the project, promoted by the Archeological Institute of the Slovak Academy of Sciences, takes as its focus these so-called circular enclosure systems in the south-western part of Slovakia, mainly in the region of Nitra, which is particularly rich in archaeological sites. Before aerial survey only two circular enclosures were known in Slovakia. Nowadays more than 50 are known, 25 of them in the region of Nitra.

The main objectives of the work are as follows.

- To use aerial survey and related methods of remote sensing, along with ground-based survey, to illustrate the known sites and to discover previously unrecognised examples.
- To present the monuments and their interpretation to the general public, using new technologies made possible by the Culture 2000 funding.
- To engage in discussion with Culture 2000 co-partners about the interpretation of the Slovakian evidence and the wider European phenomenon.
- To train young archaeologists in aerial survey and thereby contribute to the preservation of these remarkable features of the shared European cultural heritage.

Progress to the end of 2005

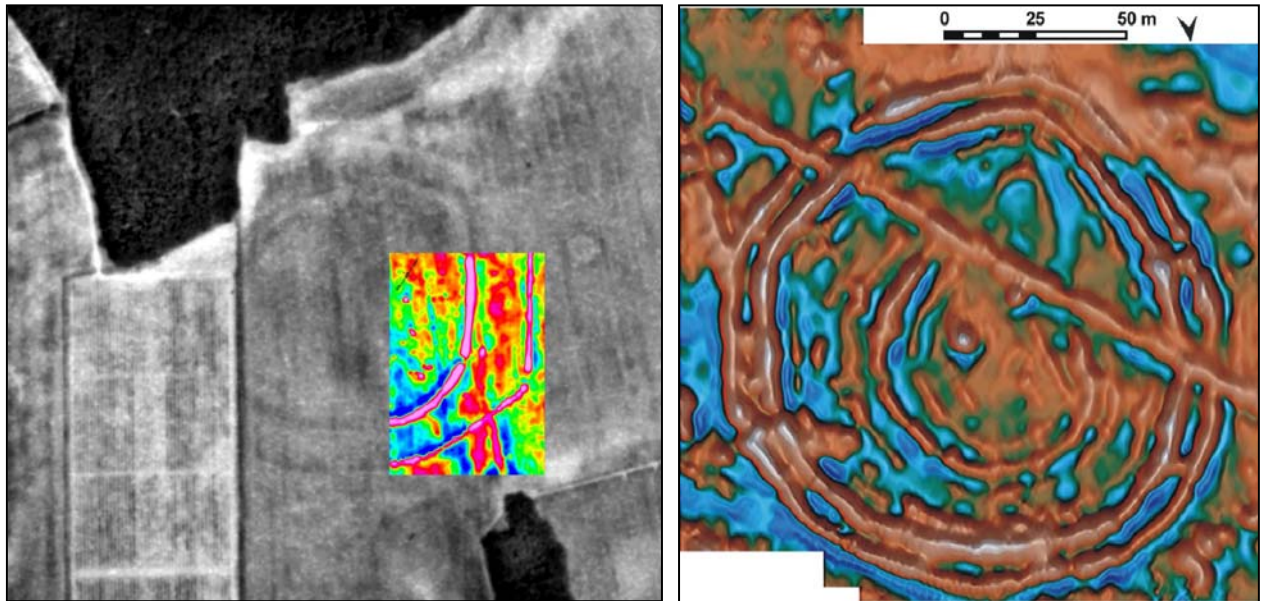
Aerial exploration in 2005 has revealed many new archaeological sites and the resulting data are being prepared for analysis and public presentation. Discussions have been held with specialists throughout Europe. Slovakian students and young research workers have taken part in various aspects of the project, including active aerial photography.

Aerial survey and related work

Aerial survey is one of the most effective methods of archaeological investigation. When combined with innovative technologies such as digital aerial photogrammetry and high-resolution magnetic prospection the technique becomes even more effective. During 2005 systematic aerial survey was undertaken in six flights over western Slovakia. Many known archaeological sites were photographed, along with 50 entirely new features, including four new circular enclosures. Fieldwalking and geophysical prospection on six circular enclosures, using a caesium magnetometer, produced excellent results in most cases. Cataloguing, indexing and archiving of the aerial photographs (taken in digital format in 2005) has been completed. Preparation of the air-photo database is in hand, along with the archaeological interpretation and mapping of selected sites.

In 2006 and 2007 the data from aerial reconnaissance, terrestrial survey and geophysical prospection, along with topographical and land registry information, will be entered into the Institute's GIS to facilitate the standardised mapping and interpretation of the various sources of information. The local environment of the circular monuments will then be examined

through the thematic layers of the GIS, focusing on the intra-site analysis of water supply, site characteristics, inter-visibility, settlement patterns, sustainability and agricultural potential.



Left: *Host'ovce*. Vertical air photograph of two circular enclosures, 300m and 60m across, the larger with a plot of residual magnetic anomalies. The geophysical data adds detail not visible from the air. Right: *Žitavce*. Geophysical measurement of one of the more complex of the circular enclosures.

Public presentation

The work just described will be used to develop functional interpretation models, of which trial examples have already been created. Based on prospection and excavation data, standardised datasets will be used to create virtual reality models of selected sites. These will be produced at differing degrees of detail for use in virtual simulations and presentations to research workers, schoolchildren, young adults and the general public.

In 2006 it is planned to place on the Internet a home page for scientific and public access, including a virtual exhibition. The results will also be presented through the pan-European website of the Culture 2000 project as a whole. Broadcasting companies have been invited to document and popularise the project and to explain the place of these fascinating Stone Age monuments, both in Slovakia and in the broader European context.

During 2005 the Culture 2000 project leader, Dr Ivan Kuzma, contributed discussions of the circular enclosures and their interpretation, both regionally and as part of a pan-European phenomenon, to local and specialist journals in Slovakia, Poland and Germany. With Dr Jan Tirpák he also wrote on the subject of 'New Neolithic circular enclosures' in a special issue of *Contributions to Geophysics and Geodesy*, published in Bratislava, Slovakia, during 2005.

Meetings and specialist discussion

The function of the circular enclosures in Central Europe has been under discussion for over 20 years, as has their relationship with the later phenomenon of timber circles, henges and palisaded enclosures in Britain. Discussions have been held with specialists at various meetings associated with the Culture 2000 project, including the coordination meeting and Aerial Archaeology Research Group (AARG) conference at Munich in September 2004 and the Archaeological Prospection conference at Rome in September 2005. Attendance at the Culture 2000 and AARG meeting later the same month was prevented by travel problems.

ACROSS EUROPE: ASSOCIATED EVENTS AND NETWORKING

Associated events

In several cases members of the Culture 2000 team have acted as instigators and facilitators for events funded mainly or wholly from outside the Culture 2000 project. In addition to advice and experience the project has been able to offer small grants to students for attendance at such meetings. An example was an aerial archaeology workshop at the British School at Rome in November 2004, mainly funded by AARG, ACE and the British Academy. Students from the former Soviet states have been helped to attend Culture 2000 events in Helsinki, Germany and Lithuania. Through Culture 2000 contacts student grants have also been made available by the Aerial Archaeology Research Group (AARG).

Airborne laser scanning (lidar)

In addition to experiments by Culture 2000 co-partners in Germany and Italy the Culture 2000 project has been able, through small travel-grants to Dr Benoit Sittler of the University of Freiburg, to keep members in touch with wider development in the use of this revolutionary technique. Lidar allows precise three-dimensional models of the ground surface to be made for individual sites or wider heritage landscapes. The technique can even 'see through' trees to reveal otherwise hidden archaeological and historical features beneath.

Developments in the Baltic and Scandinavian States

The Culture 2000 Symposium at Helsinki in October 2004 prompted the formation of a regional sub-group of AARG (with *Ars Baltica* imprimature) to assist the development of aerial archaeology and landscape conservation around the Baltic Sea. In Finland aerial archaeology is now being considered for post-graduate studies and contacts have been made with pilots in aero clubs and in the space lab of the Helsinki University of Technology.

Aerial Archaeology Training School in Denmark

In recent decades air photography has been little used in Denmark, though its use showed great promise in the past. Through Culture 2000 events and with the help of Culture 2000 members, archaeologists in Denmark are now planning a self-financed training school in June or July 2007. Tutors from the Culture 2000 team will of course contribute to the event.

First contacts in the USA and Syria

Following contacts with AARG and the Culture 2000 team in 2004 and 2005 an archaeologist from the USA, already experimenting with aerial observation in America, will probably join the UK training school in July 2006. A Hungarian team-member made approaches to introduce the idea of archaeological air photography in Syria while on fieldwork there in Sept 2005.

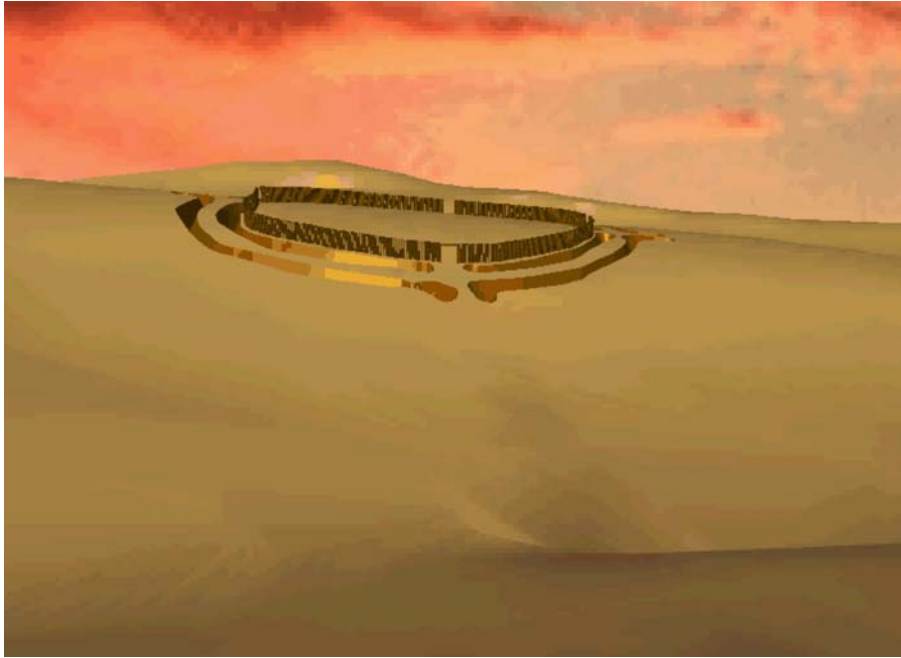
Expanding the European network

Culture 2000 events have helped to boost membership of the Aerial Archaeology Research Group (AARG) from about 160 in 2003 to well over 200 at the end of 2005. The Group's meetings and twice-yearly newsletter *AARGnews* keep members of the 'European network' in touch with one another, and with latest developments in heritage-based 'aerial' studies.



The Culture 2000 project could not have been conceived or carried out without the unstinting assistance of the Aerial Archaeology Research Group and its members across Europe. By enhancing the Group's membership the Culture 2000 project will make a long-term contribution to skill-sharing in heritage studies and landscape conservation throughout Europe.

EUROPEAN LANDSCAPES: past present and future



Speculative reconstruction of one of the circular monuments discovered in recent years through aerial survey in Slovakia. Their impact on the people and landscapes of Europe nearly 7000 years ago, before the construction of Stonehenge in Britain, must have been immense (pages 35-36).