Education in Aerial Remote Sensing for Archaeology

Edited by Dave Cowley & Rog Palmer

Collected papers and report of the AARG/EAC Working Party on Aerial Archaeology

Occasional Publication of the Aerial Archaeology Research Group No. 1
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The Aerial Archaeology Research Group is an international forum for all involved in aerial photography, space and airborne remote sensing, photo interpretation and mapping, archive research, field archaeology and landscape history.

AARG hosts an annual conference, together with regular workshops, seminars and day schools. Members receive a biannual newsletter and preferential conference rates. Student and young-researcher participation at its meetings is encouraged through a generous bursary scheme.

The primary mission of the Europae Archaeologicae Consilium is to support the management of the archaeological heritage throughout Europe and to serve the needs of national archaeological heritage management agencies by providing a forum for organisations to establish closer and more structured co-operation and exchange of information. The EAC is dedicated to the exchange of information between its members about standards and best practice related to heritage management.

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All internet links in this document were accessible on 31 March 2009
Our title is drawn from section 2.1 of the constitution of the Aerial Archaeology Research Group (AARG), in which an educational role for the group is highlighted. AARG has a long track record in organising training schools and its annual meetings are opportunities for dialogue and learning. Amongst our members there are many ‘formal educators’, based in Universities and other institutions, a robust student membership, and many who work in government and similar agencies, but also have an educational role. This educational focus is also manifest over the last few years in the relationship with the Europae Archaeologiae Consilium (EAC) through a joint Working Group on Aerial Archaeology, one component of which has been a Working Party (WP) on Education, convened by Dr Ioana Oltean of Exeter University. The AARG 2007 conference in Copenhagen saw a major session on Education as part of the process of reporting progress by the WP to our members.

The major output of the WP – its draft report – is reproduced here. This collection of papers is a further output of this process, and together with the draft of the WP report, should be a useful statement of the state of play and potential for the future.

From contributions to this education-themed Occasional Publication it will be clear that an agenda to promote the application of aerial remote sensing for archaeology is being advanced on a number of fronts. Papers by Campana, Doneus, Gerhard, Godja, Halkon, Hanson & Brophy, and Oltean describe various models from across Europe for teaching students the importance of aerial remote sensing. These include introductions to remote sensing prospection techniques in the broad context of landscape archaeology. Such approaches that embed aerial imagery and its uses in integrated packages are surely to be encouraged, equipping students with a broad-based set of transferable skills in archaeological prospection and sources of data. Although unevenly applied across Europe, this is where most undergraduates get some exposure to aerial imagery and its uses. The popularity of this model ensures that many archaeological practitioners will have at least a passing familiarity with the applications of aerial photography and its products. There is also clearly a place for the more specialised in-depth teaching of aerial archaeology, especially at Masters level, if nothing else to equip potential PhD candidates working on aerial derived data with a higher skill-base than an undergraduate degree would do. The integrated approach to prospection techniques at Siena described by Campana is vital in developing the discipline of landscape archaeology, demonstrating the synergies between data sets and exploring (as much as possible) the totality of the archaeological resource. That this approach is embedded into teaching ensures that graduates understand the context of archaeological remote sensing in general.

The provision of generic teaching aids across the internet in the form of simple, downloadable and easily modified resources was recommended by the AARG/EAC Education WP. The general issues surrounding such provision are explored by Beck & Hughes (this volume) and are linked to an example hosted by the Higher Education Academy (HEAcademy) subject centre for
Archaeology. This is an important innovation and can be built on with the support of AARG members to build a resource that will contribute to the more effective teaching of the discipline.

The broader context of non-academic teaching is explored by Boutwood & Winton, highlighting the importance of community audiences, but also of continuous professional development as a means of skilling professionals already in employment. An example of this is summarised by Helles Olesen in her description of what seemed to be a very enjoyable two-day school for archaeology professionals and students that mixed class work with a short flight in which participants could take aerial photographs. Musson & Palmer review the development of the training school, many of them organised under the aegis of AARG, where through both introductory and advanced courses students and professionals have been given instruction in the collection and interpretation of aerial data. A further development from these schools has seen certain contacts maintained and an ongoing process of mentoring that is ensuring the transfer of skills from highly experienced photo interpreters and airborne surveyors to new generations of workers.

These papers highlight the multiplicity of ways in which skills in the interpretation and use of aerial remote sensed data can be gained – embedded in undergraduate courses, through specialist schools and through postgraduate degrees and research. All have a role in providing the skills and experience that will inform the appropriate use of aerial data across a broad constituency and also provide the foundations from which future specialists may develop. There are thus many routes to creating specialists, but ultimately most will emerge from the workplace and ongoing research, where the foundation skills and knowledge gained from university courses, training schools or continuous professional development can be honed.

Despite differing degrees of optimism in the papers, the report of the WP suggests that teaching could be improved at all [or most?] levels. At present, some undergraduate teaching may not extend beyond use of aerial photography to record discoveries despite the number of publications that have applied aerial photographic information to archaeological problems. Within higher degrees much more can be taught and specialist training can develop ways in which a student can use aerial remote sensing data to undertake research about natural and anthropogenic landscapes. But there are limits to what can be achieved by using only one kind of data and integration of teaching into practical contexts, such as landscape projects, international schools and collaborative research are key to promoting the appropriate use of aerial remote sensing for archaeology – and ensuring that the role of the specialist interpreter is appreciated. The importance of ongoing review by peers and mentoring of ‘young’ interpreters by more experienced professionals is difficult to quantify, but we believe that the continued development of such specialist skills rarely progresses without it.
AARG/EAC Working Party on Education in Aerial Remote Sensing for Archaeology
Draft Report

Compiled by Ioana Oltean & Yvonne Boutwood
Edited by Dave Cowley

Summary

Aerial Remote Sensing (ARS) encompasses a long-established and well-proven suite of techniques and approaches, but its application across Europe is variable. This variability is reflected in the emphasis given to ARS in both specialist and general archaeological teaching and training, which is all too frequently superficial. Structured education in ARS is vital to create both specialist practitioners in the discipline and knowledgeable consumers and beneficiaries, so that aerial imagery and its products (e.g. mapping) can be applied in appropriate and robust ways.

This report aims to advance an ARS education agenda around three key strategic principles:

- to identify and promote simple guidelines likely to have general application across Europe
- to highlight areas where maximum impact can be achieved and where existing educational structures can be supported
- to support customized approaches for academic/higher education and for non-academic/lifelong learning


Acknowledgments

This report is the product of collaboration between members of the Working Party (see Appendix 1). Beyond this constituency, the compilation of the report has also benefited from the input from many AARG members, whose contribution is gratefully acknowledged. Our thanks also for the support of Historic Scotland, through the good offices of Dr Noel Fojut, in funding a roundtable meeting in Glasgow during 2007.
Introduction

Context
The AARG/EAC Working Group (WG) on Aerial Archaeology arose from an approach to the Europae Archaeologiae Consilium (EAC) by the Aerial Archaeology Research Group (AARG) and was established in early 2007. The emphasis is on the main areas of common ground in Aerial Archaeology between AARG and EAC, with a clear emphasis on the cultural (as opposed to natural) heritage. The WG has been convened under the overall direction of Dave Cowley (Chair of WG) in collaboration with the EAC sponsor for the WG, Dr Kristín Huld Sigurðardóttir. It was agreed that work would be directed to the development of broad-based strategies and, especially with reference to heritage management, statements of best practice and standards. The initial focus of work has been directed to Education through the foundation of the Working Party (WP). This document is the draft report on Education and is posted on the AARG and EAC websites for a period of consultation to run until the end of July 2009, after which it will be amended as appropriate and reissued. Comments should be sent to Dave Cowley (dave.cowley@rcahms.gov.uk).

Scope
The term ‘Aerial Archaeology’ has traditionally been defined as the collection, interpretation and application of aerial and satellite data for archaeology. This definition reflects current practice in much of Europe in dealing with a much wider suite of data than merely traditional aerial photographic acquisition and analysis. Much wider arrays of above ground remotely sensed data sources (e.g. hyperspectral) are now available, both airborne and satellite-acquired, and technologies capable of providing valuable information have rapidly developed, such as Laser scanning methods. Therefore, the domain of Aerial Archaeology is more appropriately defined nowadays as Aerial/satellite Remote Sensing (ARS), which will be used forthwith. The articulation of ARS and other survey data, such as geophysics and topographic survey, is seen as vital as parts of a suite of techniques that individually enhance aspects of the archaeological record, but should be combined in appropriate contexts where-ever possible to achieve greatest effect.

Education Working Party
The Education Working Party of the AARG/EAC Aerial Archaeology Working Group, was convened in 2007 by Dr Ioana Oltean (see Appendix 1 for membership of WP). From the outset the WP identified the desirability of establishing guidelines, based on a European-wide assessment of the state of ARS education (teaching, research and practice), from which to propose realistic directions for improvement. A preliminary roundtable meeting of the WP was held in Glasgow, 17th-18th July 2007, with sponsorship from Historic Scotland. This meeting established an agenda and directed subsequent debate by AARG members in a dedicated discussion session at the AARG meeting on 25th September 2007 in Copenhagen.

Terms of Reference
The WP structured its work around two principal areas:
- Firstly, in reviewing specialist/academic ARS, in particular the provision of effective teaching in Universities, concerns were identified that all too frequently training and awareness may be superficial.
Secondly, it is clear that the provision of non-specialist/general education, including primary and secondary education and community-based and lifelong learning across Europe is very uneven.

In both areas the role of aerial photographs and interpretation as one of a suite of tools for the landscape historian is stressed, with an awareness of the links to related disciplines, but maintaining a clear focus on the Cultural Built Heritage. The WP believes that there is a real need for structured education in ARS to create both specialist practitioners in the discipline and knowledgeable consumers/beneficiaries, so that aerial imagery and its products (e.g. mapping) can be applied in appropriate and robust ways.

**Strategy**

Despite being a long-established and well-proven suite of techniques and approaches in many parts of Europe, in other parts of the Continent ARS is dismissed as either inefficient, with excavation seen as “the only way of doing archaeological work”, or is still impeded by legal issues. Such variability is also reflected in the emphasis given to ARS in universities. Significant progress has been made in introducing ARS to “new” areas, especially under the Culture 2000 funded programme ‘European Landscapes Past, Present and Future’ ([http://www.muzarp.poznan.pl/EuL Landscapes/assets/pdfs/FINAL REPORT EU LANDS lower_res.pdf](http://www.muzarp.poznan.pl/EuL Landscapes/assets/pdfs/FINAL REPORT EU LANDS lower_res.pdf)), and similar smaller-scale initiatives (Musson & Palmer this volume). Generally, the last decade has witnessed an improving situation across Europe as a whole in regard of the acceptance and knowledge of ARS approaches. This can be seen in conference papers, publications, funded projects and so on, but the situation is still variable, and key to addressing this issue of the WP identifies a clear need for ARS teaching to be promoted to foster better understanding of the value of this approach. In promoting an ARS education agenda the WP defined some key principles in defining its strategy:

- to identify and promote simple guidelines, which are therefore most likely to have general application across Europe and its differing educational and cultural context.

- to highlight those areas where a maximum impact is more likely to be achieved and where existing European educational structures can be supported in their ARS provision.

- customized approaches for academic/higher education and for non-academic/lifelong learning are beneficial.
Academic Education

University-based education has a key role to play in producing ARS consumers and ARS practitioners/specialists (archaeologists with the knowledge and skills to generate ARS products). Undergraduate teaching of ARS is vital to equip the broad base of archaeologists as ARS consumers with a general knowledge of techniques, products and the value of the ARS specialist. Postgraduate programmes and structured continuous professional development are the main means of producing a smaller number of individuals with the deeper knowledge and experience that support their development into ARS specialists. The creation of centres for ARS teaching is also advocated as a possible means of promoting the discipline within Universities and beyond.

1. Undergraduate training

The WP identifies a key issue that the exposure of archaeology students to ARS during higher education across Europe is generally limited. However, as might be expected, the reasons for this vary considerably from country to country.

ARS is currently being taught in varying detail at a number of universities (e.g. Campana; Doneus; Gerhard; Gojda; Halkon; Hanson & Brophy; Oltean – all this volume), but in general most do not include it in their general teaching. In some countries, such as Slovenia, archaeological interpretation is being taught within general aerial photographic interpretation modules (along with geography or civil engineering); there, the multi-disciplinary approach is a bonus in terms of funding attractiveness. A recent general survey of universities teaching archaeology in the UK (Halkon this volume) revealed that teaching staff are well aware of ARS, but that treatment of the topic in courses was highly variable. In many cases coverage is restricted to occasional lectures in general methods courses, with only a few providing dedicated modules. At postgraduate level, the popularity of landscape archaeology in the UK does, at least, ensure that ARS is taught as part of a suite of survey techniques and data sources. It is noteworthy that most UK university archaeology departments do not appear to have ARS specialists on their staff, and this must limit their ability to provide detailed coverage of the subject in undergraduate teaching. Aspects of the UK picture are shared by Germany (Gerhardt this volume), where coverage is very patchy, with little specialist teaching and ARS briefly mentioned in the context of archaeological prospection or tangentially in teaching of prehistoric archaeology. However, it is worth noting that the apparent weakness of formal teaching provision is in contrast to an active aerial archaeological community (e.g. Gerhard this volume and http://www.univie.ac.at/aarg/php/cms/News/treffen-zur-luftbildarchaeologie-in-deutschland).

Overall, the WP identifies a clear need to promote student exposure to ARS at undergraduate level, to improve awareness throughout the archaeological community of the value of these approaches and best practice in their application. The ARS community needs to take steps to encourage the use of aerial data and examples of its interpretation in university courses, not just in relation to prospection methods but also to landscape archaeology/history, as is the case in Vienna, for example, where most teaching of archaeological prospection is undergraduate (Doneus this volume) but covers more or less the range of lectures that Glasgow has in its postgraduate programme. The significant synergies that can be gained from integrated teaching of methods need to be emphasised in general teaching for archaeology students, whereby ARS is identified as part of a battery of tools for prospection
that have strengths and weaknesses. Archaeologists in general need to have a basic appreciation of these techniques, to be aware of their advantages and disadvantages (e.g. understanding the cultural, physical and environmental processes involved) and to appreciate the value that an ARS specialist can bring into to their work. Moreover, such teaching will provide undergraduates with a foundation for post-graduate ARS courses and/or research using ARS data. Reference to ARS derived data and its origins can also be inserted in curricula that are structured around a more traditional culture-historical approach, particularly in countries where landscape archaeology is not well established. The need to develop approaches that are appropriate to particular context is vital and there should be no presumption that a model of teaching and deployment of ARS, from the UK for example, can simply be applied across the rest of Europe.

In terms of basic deliverables for any undergraduate course a primary focus on the detection of archaeological features is desirable, leaving data acquisition and interpretation for post-graduate courses. All undergraduates should understand site formation processes and the relationship between features and soil/landscape etc., for which a landscape-based perspective is most suitable. Issues to be covered should, at the very least, include sensors, platforms, formation processes, landscapes, chronology and applications (e.g. heritage management). Such a structure may take as its starting point ARS in the context of an application rather than simply a method, in the context of a landscape history case-study and this may make an appreciation of how techniques and data sources may be combined and contrasted easier to grasp.

The apparent general lack of ARS specialists within university teaching staff is not easily addressed. Rather, the WP identifies that existing teaching capacity within universities can be supported to include appropriate ARS content in their teaching. For example, the provision of an internet-based resource for teaching would allow lecturers to download content directly into course materials. Such teaching materials would include both packages illustrating what aerial photographs can do and what they cannot, with good pictorial examples and explanatory texts (see Beck & Hughes this volume; and see also Parcak 2009 for a text book with a companion website). This resource could include copyright-free materials (see below under Non Academic and Life-Long Education) and can make use of Google Earth, Grade or Go-Geo existing facilities. It is hoped that such a web-based resource for undergraduate teaching would encourage people over wide areas to stress applicability in their own geographical context, and therefore different case studies from different environmental and cultural areas should be provided. In addition, options within all the issues outlined (i.e. Sensors; Platforms; Formation Processes; Landscapes; Chronology; Applications) could be provided, which would allow a pick-and-mix approach when designing teaching.

Accessibility to this material will need to be quick and easy so that courses can be generated in short order, but also allow for a more in depth case study by picking and choosing other tools. An exemplar of this type of material has been placed on the web with the support of the Higher Education Academy (HEAcademy) subject centre for Archaeology, and is available at: http://www.heacademy.ac.uk/hca/resources/detail/Aerial_archaeology_research_group. It is hoped that this model will stimulate debate about providing such resources and may be built on in future.

AARG membership has a good pool of experienced ARS professionals that could provide these materials, with some quality control to ensure that it meets basic teaching requirements
2. Postgraduate training

The WP identifies that postgraduate training has an important role in producing graduates with a well-developed knowledge of ARS and the experience that equips them to develop into future ARS specialists. Considerable variability across Europe in the exposure of undergraduates to ARS subjects is noted (above) and this has a bearing on the variability in potential scope of postgraduate programmes across the Continent. Alternative routes for producing ARS specialists through workplace experience and continuous professional development are discussed below (see Non Academic and Life-Long Education). At present across Europe as a whole, it appears that many practitioners with an ARS expertise have a knowledge base that is essentially superficial, rather than deep. Consequently, the number of true ARS specialists is in fact very small and this has clear implications for the discipline.

It is the strong view of the WP that proper postgraduate qualifications (Masters) in ARS are required. Such postgraduate teaching will help equip potential PhD students whose research covers ARS topics or derived data with appropriate foundation experience and skills. In the workplace, these courses will also provide the deeper knowledge for future professional archaeologists to better understand the techniques and data, such as aerial photographs that are increasingly routinely being used. The danger of ARS practitioners being perceived as operating at a purely ‘technical’ level must be resisted. Postgraduate qualifications are also important in supporting the development of freelance specialists in the future, as a means of accrediting them in an environment where there is a perception that ‘anyone can do it’. At the date of writing (2009) the Masters ‘Aerial Archaeology’ programme in Glasgow, UK is currently the only taught postgraduate course available (Hanson & Brophy this volume). The course covers techniques, formation processes, photogrammetry, issues of bias and classification and applications based on interpretation. While much of the teaching is largely traditional photo-based, the contribution of other methods (e.g. Lidar; multispectral and hyperspectral imagery) is being enlarged. The programme includes a work placement during which students gain further training through practical experience in areas such as aerial reconnaissance, cataloguing, interpretation, and cover searches.

The expansion in the provision of postgraduate courses in Europe is desirable, though there is no need for numerous universities to provide this facility (and unrealistic to expect it). Realistically, it is those university departments which already have ARS specialism on the staff, which should be encouraged to develop postgraduate courses, though in a ‘chicken and egg’ situation they will probably only do so if there is a ‘demand’ from the market-place (e.g. potential students and potential employers). These universities may wish to support such developments by establishing specialist ‘Centres’ (below).

Shared expertise is important in solving problems of getting specific specialists on courses, while remote delivery is also clearly a way forward, using facilities such as Access Grid to share lectures (e.g. Gaffney 2007). In addition, the Erasmus scheme should be able to continue to help student mobility to Universities which provide specialised training not available in their home Universities and even support work placements (university-to-company, i.e. the former Leonardo da Vinci programme: e.g. Sokolowska 2008). In parallel, Masters programmes on cognate subjects (e.g. landscape archaeology, cultural heritage management, etc.) taught in Universities will be encouraged to provide information for future specialist
users of ARS products through proposed web teaching materials. Less formal, but equally vital, is that university staff who take on postgraduate researchers utilising ARS data ensure that these students have appropriate experience and skills to utilise their source material.

3. ARS Centres

The WP supports the creation of a network of university departments and potentially other affiliated organisations as Centres with a specialism in ARS. This is seen as a means of coordinating many of the issues discussed above: agreeing, sharing and maintaining standards, promoting research and providing a ‘critical mass’ of expertise for teaching. These Centres could/should host web material derived from AARG as discussed above, and may provide some degree of permanence to avoid problems of an infrastructure crumbling when an individual leaves. Such Centres should be established in a University context as Government Agencies do not always have the priorities or the resources for research or extensive academic outreach. Affiliations, or an informal relationship between universities and such agencies, which may employ many ARS specialists is to be encouraged. Proposed centres may operate best on a regional or language basis rather than along national lines. The WP would encourage the creation of a framework of such Centres as a forum to facilitate applications for funding, exchanges of personnel, research collaboration and so on.

Such Centres may provide a formal means of making connections into other organisations, such as the Special Interest Group on Remote Sensing and Archaeology, which has been set up by the Italian National Council for Research through its Institute for Archaeological and Architectural Heritage (Istituto per i beni archeologici e monumentali). This group, who are primarily specialists in Remote Sensing rather than archaeology (sensu stricto), share obvious common ground with ARS and there are evident synergies in collaboration. The University of Glasgow, UK, has now set up the ‘Centre for Aerial Archaeology’ with the stated purpose of providing a centre of excellence for teaching and research in aerial archaeology, to act as a focus for research grant applications, and to encourage links with other institutions (Hanson 2008). In August 2008, an Aerial Archaeology Unit was set up in the Institute of Prehistory, Adam Mickiewicz University in Poznań, Poland (Rączkowski 2009). Its aims emphasise the interdisciplinary use of non-invasive remote sensing techniques (i.e. aerial photography, satellite imagery or laser scanning) in the study, management and protection of the cultural heritage, especially in a landscape context. The exploration of the theoretical basis for the application of remote sensing methods in archaeology is highlighted, and alongside the aim of participating in the development of academic archaeology teaching in European universities, participation in projects preparing educational materials for schools also attaches some importance.

The WP supports such initiatives though it recognises that single initiatives are undoubtedly vulnerable to changes in staffing and University politics. Centres must also be seen to be productive as there is some cynicism amongst funding bodies to organisations that appear to be little more than paper exercises. However, a loosely affiliated network of Centres would provide strength in depth and greater kudos when dealing with senior management or politicians. Moreover, international cooperation is very much at the forefront of academic thinking at senior levels in Universities.
Non Academic and Life-Long Education

This section includes formal, informal and workplace education for all ages from children to adults. It includes professionals, the general public, children in schools and young adults in further education institutions (other than universities). The aims of life-long education are: to improve knowledge, competence and expertise; attain national targets in skills and qualifications; raise teaching/learning standards; and widen participation and access. This overview examines the contexts where aerial photographs and derived data can be used, primarily in its application to studying archaeology, but also in related subjects. It identifies approaches to broadening access to using aerial photographs for these target audiences, each of whom specific needs have. Although, contributions from AARG Education WP members attempted to broaden the perspective beyond the United Kingdom (UK) to Europe, this overview is not comprehensive.

1. Professional Training

The WP has identified an often low knowledge base amongst professional archaeologists about ARS and the application of derived data. The importance of ARS specialists and researchers presenting their work to archaeology and heritage management professionals via conferences, particularly large ones such as EAA with Landscape archaeology papers is stressed. Some European countries, such as Slovenia and Romania, have annual report meetings when archaeologists get together to present recent work, and these too are good opportunities for spreading the word.

However, the wider provision of professional courses for those out with the formal education system is identified as of potential benefit to the profession (Boutwood & Winton this volume). Professionals use continuous professional development (CPD) to improve their knowledge, competence and expertise and to attain new skills and qualifications. This benefits individuals, employers and the archaeological profession. The Institute of Field Archaeologists (IFA), who has members in the UK and Europe recommends at least fifty hours CDP over a two-year period for its members. This includes attending training courses, workshops and conferences, or attaining new skills by on the job training and job shadowing. Any of these may lead to attaining new qualifications and is an effective vehicle for acquiring skills in using aerial photographs and other remote sensing data, such as Lidar.

There are very few courses available, which specifically include training in using aerial photographs. Oxford University Department of Continuing Education (OUDCE) is one of the leading establishments in UK providing professional training in the historic environment. A two-day course in aerial photography includes interpretation and mapping and applications to landscape studies. Participants come from a wide range of backgrounds and it caters for archaeologists and historic environment professionals, both as consumers of ARS mapping data and those trying to interpret aerial photographs themselves. The course counts for the CDP requirement for the IFA. Apart from the OUDCE course at Rewley House, Oxford, there are few other courses in Britain that cater for professionals, as it relies on having expert tutors to deliver the courses. In Europe there appear to be no equivalent institutions and courses of this nature available. TORC (Training on-line Resource Centre for Archaeology http://www.torc.org.uk/), lists archaeology and related courses in the UK and PLOTEUS (Portal on Learning Opportunities throughout the European Space...
http://ec.europa.eu/ploteus/) is a similar European database. We need to ensure that any courses on ARS are listed on these databases.

AARG members have specialist needs in their professional development as they have to keep up to date with developments in ARS work and other remote sensing techniques. The annual AARG conference and more specialised workshops organised by AARG and others provide a forum to share knowledge and expertise (e.g. Campana; Helles Olesen; Musson & Palmer – all this volume). To reach a wider audience, conferences that target archaeologists, for example those organised by the European Association Archaeologists (EAA) and annual meetings in Slovenia and Romania, provide an opportunity to broaden awareness by presenting papers on aerial photography and landscape studies.

Work placements provide an opportunity to train people on the job, working alongside specialists. In the UK workplace learning bursaries in archaeology and heritage management are designed and administered by the IFA. In English Heritage, EPPIC placements (English Heritage Professional Placement in Conservation) train for one-year in architecture, field investigation or aerial survey. The latter is an effective means of acquiring aerial photographic interpretation skills and applying them to a variety of landscapes. These placements are funded by English Heritage, the IFA and the Heritage Lottery Fund (HLF) and improve candidates’ employability status. The work undertaken can be used to attain National Vocational Qualifications (NVQ) in Archaeological Practice.

2. The General Public

The general public includes amateur archaeologists and community groups, who often have an interest in their local history and archaeology. Such groups are flourishing and there is a variety of ways to engage with them. In Britain presentations through media, such as television programmes (e.g. Time Team and Time Flyers) have had a huge impact on stimulating interest in studying local history and archaeology. Displays at heritage sites and museums, conferences and talks to societies, provide an opportunity to use aerial photographs and raise awareness. More specialist needs can be catered for by providing workshops and courses, but the provision of these is dependent on local circumstances, as to whether specialists are available to teach courses. Dedicated Community Archaeologists, supported by the Heritage Lottery Fund, provide free workshops on all aspects archaeological investigation including using aerial photographs.

In many European countries national curricula for school children (ages 5-18) provide guidelines for teachers. They vary in their approach to being prescriptive on certain topics and/ or offering recommendations on aspects of teaching, such as methodological approaches. Influences may be localised, for example in Germany where education is the responsibility of the federal states, or national, in the case of England, or international, where organisations like UNESCO may have an influence on education. In the UK there is some flexibility in teaching in schools and using aerial photographs can be adapted to a wide range of subjects, not just history and geography.

Further education colleges (students over 16 years) are autonomous independent institutions, which cater for vocational training and can set their own curricula. The course content and lecturers may not be validated, but some courses in the UK are accredited by the National Open College Network (NOCN) and these have strict standards and syllabi. Although syllabi
set topics for study, there is some flexibility to introduce case studies, which are a useful resource for teachers. It is in this context that advanced level archaeology and archaeological science is taught. Students need to demonstrate appreciation of all forms of archaeological evidence and survey including aerial photography and other forms of remote sensing.

3. Schools

There are two approaches to consider promoting the use of aerial photographs in schools and colleges. Firstly, there is a need to train teachers and raise awareness of the potential of using aerial photography in a wide range of subjects. The framework for teachers’ professional development exists through In Service Training (INSET) courses in the UK and Europe, but courses in using aerial photography are rarely offered. In the UK organisations who promote archaeology, like the Council for British Archaeology (CBA), strive for the recognition of archaeology in the UK education system. One-off workshops on using aerial photographs have been delivered at the CBA Education Conference, which attracts teachers, outreach officers and museum staff. Secondly, there is a need to improve the availability of suitable teaching resources that include aerial photography. Many standard textbooks may be out of date, but more specialised topic information is becoming more readily available in publications. For example an English Heritage Teachers’ handbook includes resources and aerial photographs, on a CD, which contains case studies linked to the national curriculum. Copyright restrictions have been lifted for use in schools and this is crucial to promote the use of aerial photographs.

Another approach is to widen the range of teaching resources available via the web. Material can be downloaded, without copyright restrictions if used for education purposes and this needs to be extended to aerial photographs. In the UK this has revolutionised the way information is accessed and shared by education professionals, but in some European countries resources are not shared via this medium. In the UK there is an abundance of web sites (e.g. TeacherNet http://www.teachernet.gov.uk/) and some network providers already include aerial photographs (e.g. InfoMapper in association with South West Grid for Learning, has aerial photographs, maps, satellite photography and other resources). In the UK heritage agency web sites already have resources available to teachers and the inclusion of aerial photography is expanding. To encourage other European countries to develop sites with resources, there is a need for web providers to facilitate this. Sites like the Golden Web (http://www.goldenweb.org/), which is a world history internet project that can link material in any language, could potentially facilitate this. However, this can only be effective if teachers, or other professionals in European countries, collate and share resource material and provide case studies that include aerial photographs.

It is also appropriate to consider other contexts, such as museums and social contexts where children and youth groups engage in activities relating to archaeology. In all of these contexts educating the teachers, lecturers, youth leaders and outreach officers is the most effective way of promoting the use of aerial photography. In the UK the Young Archaeologists (YAC) already has good links to professionals that have introduced leaders to using aerial photographs. Similarly, in Poland out of school workshops have the benefit of professionals familiar with aerial photography. Exhibitions and museums displays can be enhanced by using aerial photography. Interactive displays can also be socially inclusive, as seen at an exhibition at the Natural History Museum in London, where aerial photographs were adapted for the blind.
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Appendix 1: Membership of the AARG/EAC Working Party on Education

**Dr Ioana Oltean** (Chair; University of Exeter, UK)
**Dr Cinzia Bacilieri** (UK & Italy)
**Dr Anthony Beck** (University of Leeds, UK)
**Yvonne Boutwood** (English Heritage, UK)
**Dave Cowley** (AARG, RCAHMS & Chair of AARG/EAC Aerial Archaeology WP)
**Dr Michael Doneus** (Institut für Ur-und Frühgeschichte, Vienna, Austria)
**Dr Susanne Gerhard** (State Authority for Culture and Preservation of Monuments, Department of Archaeology, Schwerin, Germany)

**Professor Darja Grosman** (University of Ljubljana, Slovenia)
**Professor W. S. Hanson** (University of Glasgow, UK)
**Chris Musson** (Aber Photo Services, Wales, UK)
**Rog Palmer** (AirPhoto Services, Cambridge, UK)
**Sólborg Una Pálsdóttir** (The Archaeological Heritage Agency of Iceland)

**Professor Włodek Rączkowski** (Adam Mickiewicz University, Poznan, Poland)
Teaching aerial archaeology and remote sensing for landscape archaeology at the University of Siena (Italy)

Stefano Campana

The history of aerial archaeology studies at the Department of Archaeology and History of Arts of the Siena University dates back to the mid-1980s. In 1984, Professor Riccardo Francovich in collaboration with a photo interpreter, Marcello Cosci, started a programme of aerial reconnaissance in Tuscany and Umbria. At about the same time Professor Francovich set up an undergraduate course in aerial archaeology. The approach emphasised the analysis of vertical aerial photographs stored in the archives of the Military Survey (IGM collection dating back to the 1930s, 1950s and 1960s) and of the Tuscan and Umbria Region Survey Bureau. In this manner, they identified a huge number of archaeological sites, especially medieval hillforts and Neolithic and Bronze Age enclosures. A significant development in approach took place in 1999 when Professor Francovich organized an International Summer School on Remote Sensing in Archaeology. After that event, new approaches based on the integration of different prospection methods have been developed by a new Laboratory established by Francovich and the author: The Landscape Archaeology and Remote Sensing LAB (http://www.lapetlab.it/indexE.html).

In 2000, in anticipation of imminent changes in Italian law on aerial photography, the possibility of organizing an aerial survey training course in Siena was discussed with two colleagues from Britain - Chris Musson, from Wales, and Robert Bewley, then Head of Aerial Survey at English Heritage. In the spring of 2000 we carried out preliminary aerial reconnaissance to check at first hand the potential and limitations of oblique aerial photography in the landscape of Tuscany. Then, at the end of May 2001, twenty-one post-graduate students engaged in the areas of research and heritage conservation took part in the first Aerial Archaeology Research School to be held in Italy. In addition to instruction in aerial survey and photo interpretation, a further objective of the school was to start building up an archive of oblique aerial photographs for the recording of the archaeological resource throughout Tuscany. Progressively additional expertise and tools for archaeological prospection have been developed. In February 2001 we began to build up our experience in the use of High Resolution Satellite Imagery. The aim was the evaluation of multispectral data for archaeological research, firstly using Ikonos-2 imagery and then from June 2002 working on QuickBird-2 imagery. In May 2001 we started applying geophysical survey methods to better understand archaeological sites. In 2005, through a Culture 2000 project of the European Union, entitled European Landscapes: past, present and future, the University of Siena took its first steps in LiDAR data acquisition, processing and interpreting for four sample areas in the provinces of Siena and Grosseto. This was made possible through the good services of colleagues in England at the Natural Environment Research Council and the Unit for Landscape Modelling at the University of Cambridge. The results were processed in collaboration with the Department of Geography at Durham University (UK) under the supervision of Professor Daniel Donoghue and Dr Nikolaos Galiatsatos.

We have added geophysical prospection (mainly magnetometry, but also sometimes Ground Penetrating Radar and electrical prospection methods) to our suite of methods for the examination of archaeological sites. Building on this approach we have also started a programme, based on the striking results achieved by Professor D. Powlesland in the Vale of
Pickering (Powlesland 2009), of large scale continuous geophysics aimed at exploring systematically the landscape including traditionally blank areas between traditional sites, highlighting the potential of the off-site record in a landscape-based approach (e.g. see papers in Campana & Piro 2009).

Undergraduate teaching
At present, the University of Siena gives two lecture courses on aerial archaeology and remote sensing, which are repeated annually in modules of 30 hours each, on “Landscape Archaeology” and “Landscape Archaeology and Remote Sensing”. The courses provide a brief introduction to the history of remote sensing in archaeology, focusing on the development of applications to the study archaeological sites and landscapes.

In detail, we address the following issues:
- Satellite archaeology
- Aerial archaeology
• Airborne scanners (hyperspectral scanners, LiDAR)
• Aerial survey and oblique aerial photography
• Geophysical prospection
• Aerial and ground archaeological “visibility” with particular regard to emptiness

**Doctoral research**
The Department Archaeology and History of Arts also has doctoral programmes on landscape archaeology and remote sensing, focusing particularly on data integration aimed at facing methodological issues systematically joined with well defined archaeological and historiographical problems. Recent successful theses have included Emanuele Vaccaro (2007), Cristina Felici (2008) and Federica Boschi (2009).

**International Summer Schools program**
The International Summer School in Archaeology is a well-established interdisciplinary event. Established by Professor Francovich and Professor Daniele Manacorda in 1987, it serves as an interface between experts in archaeology, cultural heritage, art history and those from remote sensing, photogrammetry, CAD, spatial information science, computer graphics, virtual reality, etc. The Schools have an international audience, extended discussion between participants, and direct relationship between teachers and students.

The University of Siena has the leading role in Italy in the organization of the International Summer School. After more than twenty years of meetings the School still presents one of the most important opportunities for fostering and advancing working relationships between archaeology and related disciplines. The Summer Schools have dealt with themes which have created important initiatives and international debate aimed at advancing archaeological work in Italy and beyond. In general the Schools involve teaching concerned with archaeology in practice and with the use of interdisciplinary techniques. The range of issues related to remote sensing and landscape archaeology addressed by the Summer Schools over the years can be seen in this listing:

1991 - Landscape Archaeology
1995 - Information Systems and Geographical Networks in archaeology: GIS-Internet
1999 - Remote Sensing in Archaeology
2001 - Aerial Archaeology Research School (Culture 2000 project)
2005 - Aerial Survey, Digital photography and GIS-based interpretation archaeological (Culture 2000 project)
2006 - Geophysics for Landscape Archaeology
2007 - Exploring Archaeological Landscapes: from Archaeological Record to Virtual Reality
2008 - 3D modelling in Archaeology and Cultural Heritage (in collaboration with ETH-Zurich, BKF Trento, University of California Merced)
2009 - Training education on Geophysics for Archaeology: surveying methods, elaboration and 2D and 3D representation (in collaboration with ITABC-CNR)
2009 - 3D modelling in Archaeology and Cultural Heritage (in collaboration with ETH-Zurich, BKF Trento)
Integrated approaches to archaeological prospection and further developments
The University of Siena has a long history of teaching aerial archaeology and remote sensing, developing an integrated approach to prospection in a landscape context through its Landscape Archaeology and Remote Sensing LAB. This approach is an integral part of its undergraduate and postgraduate programmes, extending also into a leading role in organising international summer schools and international workshops.

The importance and the impact of our experience might be, probably, better followed and understood through our main publications:

- Campana S. & Forte M. (eds) 2006, From Space To Place, Proceedings of the 2nd International Conference Remote Sensing Archaeology, Rome (December 4-7 2006), Archaeopress BAR International Series
- Campana S. & Piro S. (eds) 2009
- Musson C., Palmer R. & Campana S. 2005, In volo nel passato. Aerofotografia e cartografia archeologica, All’Insegna del Giglio

The experience of the Department and of the LAB in teaching, archaeological research and fieldwork (landscape, test-areas, excavations) has prompted us to start a spin-off company ATS (Archaeolandscapes Tech & Survey - www.atsenterprise.com) of the University of Siena aimed firstly to commercial archaeological prospection, which gives our students an opportunity to carry on their skills.

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Powlesland, D. 2009 Why bother? Large scale geomagnetic survey and the quest for "Real Archaeology", in Campana S. & Piro S. (eds) 2009
Vaccaro, E. 2007 Processi di trasformazione insediativa, gestione del territorio e circolazione ceramica nella Maremma costiera tra IV e XIV secolo d.C. Per una definizione dei rapporti politici e socio-economici tra città e campagna tra tardoantichità e medioevo: i casi della bassa valle dell’Ombrone e della valle dell’Osa (GR), PhD Thesis, University of Siena
Students at Rosia (Italy) in 2001 working together on the necessary task of locating on a map the aerial photographs they had taken the day before.
Teaching non-invasive archaeological methods at the University of Vienna

Michael Doneus

In Austria, the importance of prospection using the non-invasive methods of aerial archaeology and remote sensing, airborne laserscanning, and geophysical prospecting is constantly increasing in archaeological work. The development of aerial archaeological prospection in Austria has mainly taken place at the University of Vienna, where in 1992 the Department of Prehistoric and Medieval Archaeology (www.univie.ac.at/urgeschichte) created a full-time job for an aerial archaeologist. In 1994 the Vienna Institute for Archaeological Science (VIAS) was founded, which now also offers part-time jobs in aerial archaeology and archaeological geophysical prospecting. The offices of both are located at the Department of Prehistoric and Medieval Archaeology. This enables us to establish a close cooperation between aerial archaeology and geophysical prospection.

In Vienna, research and education go hand in hand, and lectures on prospection techniques have become a vital part of our student curricula over the last 15 years. Therefore, lectures in aerial archaeology and geophysical prospection are given by specialists of the respective fields. There has always been a consent at the department that teaching archaeological prospection has to start at the undergraduate level. Therefore, the basics of both aerial archaeology and geophysical prospection are already lectured within the introductory module, which is obligatory for every student.

Besides that, the Department of Prehistoric and Medieval Archaeology offers two modules, in which archaeological prospection is lectured in the context of landscape archaeology. The module ‘prospection techniques and landscape archaeology’ is part of the Bachelors curriculum. At the moment, among others it contains lectures on archaeological stratigraphy, GIS, archaeological interpretation of aerial photographs and geophysical prospection techniques. The module ‘landscape archaeology’ is part of the Masters curriculum and imparts e.g. air photo interpretation and landscape archaeology, and theory and practice of geophysical prospection.

Going into more detail, the lectures on aerial archaeology cover:

1. Basics of aerial archaeology. This lecture is part of the Bachelors curriculum and obligatory for all students. It imparts basic information such as the history, application, and limitations of aerial archaeology, formation of sites and visibility marks, production and use of vertical and oblique aerial photography, etc.

2. Archaeological interpretation of aerial photographs. Again, this lecture is part of the Bachelors curriculum. It focuses on the different phases of aerial archaeological interpretation (oblique reconnaissance, photo reading, mapping) giving theoretical information on the principles of remote sensing, perception, hermeneutics, as well as practical information on how to interpret, which instruments to use, etc.

3. Aerial photo interpretation and landscape archaeology. As part of the Masters curriculum, this lecture bridges the gap between aerial archaeology and all kinds of spatial archaeology. After a theoretical introduction students learn how to rectify and map aerial photographs and in that way to systematically collect basic archaeological data for further spatial analysis.
In the near future, there will be an additional lecture on airborne laserscanning. Other modules also contain lectures on surveying, photogrammetry and CAD. All of them are part of the standard curriculum of each student.

The current curriculum for both Bachelor and Master can be found at the following link: http://spl.univie.ac.at/index.php?id=33714.

The current university calendar is presented at: http://online.univie.ac.at/vlvz?lang=de&kapitel=601&semester=current.

Demonstrating use of an early version of the specialist program AirPhoto to students, most of whom worked for the national conservation body, at Leszno (Poland) in 1998.
Aerial archaeology in German universities

Susanne Gerhard

This short note arises from research undertaken in 2007 on the provision of aerial archaeology teaching in German Universities. The data gathered only cover the academic year 2007 but include all 24 departments of (prehistoric) archaeology.

For the most part aerial archaeology seems to be taught only very briefly, partly in lectures (Vorlesungen) and partly in seminars (which can include student presentations as well as those by staff). Only Bochum (Baoquan Song) and Mainz (Peter Haupt) have an aerial archaeological practitioner on the staff.

The method of instruction varies considerably. Prospection methods may be mentioned among a multiplicity of other subjects. Jena, Kiel, Mainz, Muenchen and Muenster make or made use of external staff to present seminars that have a practical emphasis. Examples include Ralf Schwarz presenting on *Aerial Archaeology in Mitteldeutschland* and Walter Irlinger on *Basics of remote sensing – geophysics and aerial archaeology*. In both these examples the seminars are presented by staff of local heritage bodies.

However, while it the provision of formal teaching may not be encouraging, it is very far from the entire picture. On the initiative of Johanna Dreßler, a post-graduate student at Mainz, the German “community” is on the point of creating something more formal. A first meeting in Mainz in December 2008 ([http://www.univie.ac.at/aarg/php/cms/News/treffen-zur-luftbildarchaeologie-in-deutschland](http://www.univie.ac.at/aarg/php/cms/News/treffen-zur-luftbildarchaeologie-in-deutschland)), bringing together university teachers and students as well as heritage people, freelancers and volunteers, was very inspiring and ended with the idea to have a common website (perhaps hosted by the Institute of Pre- and Protohistory of Mainz University).

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Students and teachers attending the course at Barth (Germany) in 2006.
Courses in aerial archaeology at universities in the Czech Republic: an overview

Martin Gojda

Origins and History
The history of teaching aerial archaeology at universities in the Czech Republic dates back to the mid-1990s. Ten years earlier – still under the Communist rule – the Moravian researchers J. Kovárník (archaeologist) and M. Bálek (geodesist) took the first steps in the area of aerial survey, independent of each other. Their approach consisted primarily of the analysis of vertical aerial photographs stored in the archives of the Military Topographic Institute (the oldest photographs in this collection dating back to the 1930s). In this manner, they identified several archaeological sites, especially large enclosures dating to the Neolithic and Bronze Age. They also managed to take several survey flights over South Moravia, despite considerable legislative and administrative obstacles.

The first to initiate a course in aerial archaeology in the Czech Republic was M. Bálek of Masaryk University in Brno. His one-term (semester) course had been on offer among the optional courses at the University Institute of Archaeology and Museum Studies since 1996, and M. Bálek taught it until 2003 (Gojda 1998). Besides the theoretical coursework, he managed on several occasions to organize end-of-term one-day practical training in aerial survey, with his students taking one prospection flight in the Morava and Dyje river basins (in 1998-2000, the Institute of Archaeology AV ČR in Prague provided its manned survey aircraft for this purpose). After M. Bálek’s death, the author of this contribution was asked to continue the aerial archaeology course at Masaryk University and he has been teaching it to this day (the course runs every other year).

Between 1999 and 2001 aerial archaeology was also included in the options at the Institute of Prehistory and Early History of Charles University in Prague while being simultaneously run, this time as a compulsory course, by the Department of Archaeology at the University of West Bohemia (henceforth DA/UWB). In both cases, the one-term course was complemented with one-day practical training in an aircraft.

Current Teaching and Training
At present, only Pilsen University is providing a complete (theoretical as well as practical) course in remote sensing in archaeology (henceforth RSA) in the Czech Republic. This compulsory course is attended by second-year students of the Bachelor degree in the winter term of the academic year. It follows on from the subject of Non-destructive Archaeology, which is taken by first-year students, offering a basic overview of the mission, goals and methods of non-destructive procedures in current archaeological research.

A total of 12 two-hour lectures are divided into the following units:

1. Introduction to RSA
2. Past and present of RSA
3. Heuristics/data collection – basics of visual low altitude aerial survey in archaeology (equipment and tools, crew work during flight, methods of recording and documenting
identified sources), basics of aerial photography of historical landscape or earthworks, architecture and urban complexes

4. The principles of how we see buried or upstanding archaeological features from the air (e.g. cropmarks, soilmarks, shadowmarks)

5. Data processing

6. Basics of remote sensing of the Earth and use of the products of high-altitude photogrammetric aerial photography and satellite survey (orthophotos, satellite images, and airborne laser scanner data)

The remainder of the theoretical part of the course is devoted to geophysics in archaeological research (R. Křivánek, Institute of Archaeology, Czech Academy of Sciences). The main reason for its inclusion in the course in RSA is its extensive use in verifying and locating features/sites identified by aerial prospecting on the Czech territory over the past decade or so.

**Practical Training**

The extended practical part of the course has been taking place on a regular basis since 2004. Depending on conditions, it lasts one or two weeks, mostly in June, when the number of places displaying cropmarks on growing plants are highest (besides winter crops, cropmarks show on spring crops as well). Besides second-year undergraduates, the course can also be attended by first-year graduates. In both cases, the students’ participation in the practical part of the course in aerial archaeology is optional, the capacity of the department usually making it impossible to satisfy all those interested in taking part. It mostly takes place in the area of a solitary hill of Říp (in recent years mainly because the DA/UWB has been conducting research into the local prehistoric/medieval settlement (see Gojda 2007). This area has, due to the wealth of prehistoric settlement made visible as cropmarks, become a sought-after area for efficiently conducted aerial archaeological training of our students. The high density of sites (several dozen) on a relatively small area (about 100 km²) ensures considerable efficiency of survey flights, even in the cases when, in recent years, cropmarks over archaeological monuments have been appearing less markedly or less frequently for objective reasons. These courses are based at the airfield of the Aeroklub of the Czech Republic in Sazená, which provides important background for the practical part of the course (takeoffs and landings several times a day on a high-quality grass runway), the groundwork (a classroom for pre-flight preparation and the processing of data acquired during survey flights) as well as for other needs related to students’ training (e.g. projection of photographs and footage) and accommodation.

The training itself mostly involves groups of 5-6 students, who make up two crews, taking turns in two-day cycles. As allowed by circumstances, each crew takes one short introductory flight and, one or two longer survey flights. During these, students carry out visual monitoring of terrain surface, identification of places with cropmarks and their subsequent photographic documentation. In addition, they learn continuous navigation by means of paper maps, operating the GPS station (route recording, saving the location of points of interest, or more precisely the discovered sites) and they enter the flight data (including key information about the individual photographed areas) in a special paper form. Each student thus has an opportunity to become acquainted with activities that need to be continuously conducted during survey. In the classroom (immediately after landing), the crews download digital data from cameras and the GPS station to a computer, where they work further on them, identify
the exact location of sites by comparing map and GPS station data with photographs, editing, evaluating and finally saving them to a database.

Survey flights are conducted in a Cessna 172 aircraft (OK-EKD), owned since 1997 by the Institute of Archaeology, Academy of Sciences of the Czech Republic. Its operator T. Janiček (Paraklub Praha–Letňany) participates in the courses not only as pilot but also to co-ordinate crew members during flight. The aerial archaeological training was also repeatedly joined by Z. Smrž from the Archaeological Institute (Most) in the years 2005 and 2008, when the one-week courses took place in Northwest Bohemia, or more precisely in the Podkrušnohoří and Poohří regions (the basis being the Chomutov airfield). For completeness’ sake, let us add that in 2004, the courses took place in West and East Bohemia (airfields Plasy and Dvůr Králové n. L.).

New Developments
Since the summer term of the academic year 2008-09, the teaching of RSA at the Pilsen Department will be enriched with special lessons devoted to the analysis and interpretation of vertical aerial images. Besides an introduction to the work with contact photographs, the course will be aimed at the analysis of digital data by means of special software enabling effective three-dimensional visualization of stereopairs of aerial photogrammetric images and their subsequent interpretation. These lessons are included in the compulsory course on Landscape Archaeology, which opens in the first year of the Master’s (graduate) study programme.

The year 2009 will also see the first opening of an elective course in RSA, taught by the author of the contribution, at the Archaeology Section of the History Department of Palacký University in Olomouc. An abridged version of this course was taught – within the subject of Non-destructive Archaeology – abroad, at the Comenius University in Bratislava in 1998-2000. Since 2006, it has also been taken by students of Cardinal Stefan Wyszyński University in Warsaw, Poland.

References

The airfield Sazená (on the border between central and north Bohemia, 30 kilometres north of Prague) where most of the aerial archaeology courses organized by DA/UWB take place.

A group of students standing in front of the Cessna 172, OK-EKD, just a few moments before the start of a reconnaissance flight over the region of the Číp.
Beyond the cockpit - the role of aerial photographs for archaeology in UK Higher Education

Peter Halkon

This brief contribution summarizes a paper presented at the AARG conference in Copenhagen September 2007 and is therefore a reasonably up to date statement of the use of aerial photographs and aerial archaeology approaches in Universities in the UK. The statistics presented in Table 1 below were gained through the co-operation of colleagues, largely from the Subject Committee for Archaeology network and I am most grateful to them for supplying details. Other information was gathered from university websites.

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Table 1. Summary of institutions teaching aerial archaeology and level taught
(UG – Undergraduate PG – Postgraduate)

It is most encouraging from an AARG point of view that applications of aerial data are taught at least at introductory level in the first year at all the institutions listed. The majority continued in subsequent years with some aspect of aerial archaeology, particularly as part of landscape archaeology, an approach that is taken by many institutions (37%) at postgraduate level. The discipline is perhaps covered most extensively at Sheffield University, which has a long tradition of interest in the subject going back to the pioneering work of Derrick Riley, joined more recently by Glasgow (see Hanson & Brophy, this volume).

No UK universities possess a resource as rich as the Cambridge University Collection of Aerial Photographs, now based in the Unit for Landscape Modeling, an archive that probably
does not get as much use for teaching and research as it deserves. Cambridge also benefits from the services of Rog Palmer, who teaches for various undergraduate and postgraduate papers and offers other practicals.

A number of centres including Bangor have also done some interpretation work on aerial photographs as part of their workplace module (2nd/3rd year), for instance when working in the Gwynedd Archaeological Trust (a regional archaeological unit in Wales). The benefits of input by heritage agency professionals to academic teaching can also be seen in England, Scotland and Wales.

At Newcastle, as at many other institutions aerial photographs, maps and satellite data are deployed as an additional source for the study of archaeological sites, as a way of illustrating lectures. A number of Departments reported the increasing use of Google Earth and its Microsoft equivalent as a rapid way of zooming around some historic landscapes and viewing them from different angles.

Most correspondents concentrated on full-time undergraduate teaching in their replies, however at Hull, which runs a part-time Degree in Archaeology, aerial photographs have often been used by the writer, who has considerable experience in aerial archaeology, as a stimulus for projects and dissertations and several students have undertaken their own aerial surveys – something which would not be possible for most conventional university undergraduates.

It is impossible in this short note to give a detailed account of every aspect of the topic and many apologies to those colleagues whose work is not represented here, but it is pleasing to note that aerial archaeology seems firmly embedded within the Archaeology Higher education system in the UK. My own approach has been to embed the teaching of aerial photograph interpretation and the uses of aerial derived data in the context of landscape archaeology. Indeed, over 25 years of fieldwork with both extramural student and local archaeology society involvement the integration of aerial data with geophysics and artefact recovery within a landscape context has proved a highly successful approach. The strengths and weakness of data sources can be explored, with the integrated approach allowing students a fuller understanding of sites and landscape. Results of this approach can be explored through an interactive website at http://www.ironmasters.hull.ac.uk, and have recently been published (Halkon 2008).

Reference
Teaching aerial archaeology at Glasgow

W. S. Hanson & Kenny Brophy

The Department of Archaeology at Glasgow has a strong tradition of research and teaching in aerial archaeology.

**Undergraduate teaching**

The principles and importance of aerial archaeology are taught at Glasgow from first year through to Honours (3rd/4th year), though at different levels of intensity. There have always been introductory lectures and some exposure to oblique and vertical photographs in practical classes in the undergraduate programme, and every Archaeology Single Honours student must carry out the transcription of a cropmark site for their Portfolio of Practical Work. However, in 2008 the Department introduced a new Honours (3rd/4th year) optional module in Remote Sensing, providing an introduction to the underlying principles, character, limitations and applications of aerial photography and geophysical survey in archaeology, with a strong laboratory-based practical focus. It is intended that, as a result of taking the module, students will be confident in the basic interpretation of both types of survey data which are so fundamental to the discovery and elucidation of archaeological sites by non-invasive means. Indeed, such skills should be important for anyone working in archaeology.

The importance of aerial archaeology figures strongly too in wider practical teaching. The Department runs an annual Field School, currently based around the Strathearn Environs and Royal Forteviot (SERF) Project (Brophy 2008) in Perthshire, which is attended by 90% of students about to enter Junior Honours (3rd year). The analysis and investigation of plough-levelled sites recorded as cropmarks form a fundamental element of the research design of this project, including large-scale excavations of the Neolithic and Pictish complex at Forteviot and work on forts. In addition we are developing methodologies to monitor the continued plough-erosion of these sites within the study area. An ongoing programme of mapping of the plough-levelled sites is being carried out by our project partners RCAHMS. Every student who passes through this Field School is left in no doubt about the significance, and vulnerability, of the cropmark record.

**Taught Masters degree**

The Department set up a taught Diploma/Masters degree in *Aerial Photography and Geophysical Survey in Archaeology* in 1993 which is still unique in Europe. The aerial photographic element of the original joint programme covered photographic techniques, photogrammetry, cropmark formation processes, issues of bias and classification, and applications of aerial data. The programme also included a work placement in Edinburgh during which students were exposed to the range of professional aerial photographic work undertaken by the RCAHMS, and finally a dissertation, providing the opportunity to address a topic of their choosing in greater detail.

This programme has now been completely revised, expanded and ‘rebranded’ as *Aerial Archaeology*. The new programme commences in September 2009 and can be studied either at Diploma or Masters level. It combines expertise in aerial photographs and computing within the Department of Archaeology, with that in remote sensing and photogrammetry in the Department of Geographical and Earth Sciences. Students will now take six taught
modules: a basic research training module; interpretation and applications of aerial data; principles and practice of aerial archaeology (including the principles of photogrammetry and remote sensing); cropmark archaeology; Geographical Information Systems for archaeological projects; and an optional module (such as the interpretation and applications of geophysical survey; advanced archaeological survey methods; databases for archaeological projects; or a landscape related regional or period based module).

In addition, Masters students undertake an 8-10 week period of work placement with a relevant organisation engaged in professional aerial archaeological work, producing a portfolio containing extracts and examples of work undertaken, with associated commentary. Three organisations are now involved, though we would be more than happy to expand that number. The students also produce a Research Report, a significant piece of written work based on independent study, designed to allow them to explore a particular topic in more detail.

Thus, the new programme aims to provide instruction in principles, methods and application of aerial-based remote sensing techniques in archaeology and to develop students’ professional and practical skills in aerial archaeology. As such it is intended to produce graduates with good foundation knowledge and skills, as has been widely agreed is needed to ensure the establishment of a future generation of archaeological remote sensing specialists.

**Teaching staff**

The main teaching of aerial archaeology at Glasgow is undertaken by the two named authors. Bill Hanson was introduced to flying when studying for his PhD on Roman forts with Barri Jones. After his appointment at Glasgow he undertook reconnaissance in the Clyde valley over a period of some 15 years from the later 1970s, before turning his attention to Romania over the last decade in collaboration with Ioana Oltean, now at Exeter University. Though he has a particular research interest in Roman period monuments, he has broader interests in later prehistoric and Roman landscapes and the general application of aerial data in archaeological research.

Kenny Brophy got involved in aerial archaeology through his research work on Neolithic cursus monuments in Scotland, almost all of which are plough-levelled sites. After a brief period working for RCAHMS within the National Monuments Record of Scotland as liaison between the NMR and the Aerial Survey section, he returned to the Glasgow University Archaeology Department in 2000. His main research interests are in Neolithic Scotland, archaeological theory and landscape archaeology; as well as digging sites, he has been working for some time on a range of theoretical and interpretive perspectives on aerial archaeology.

Other staff who contribute to the taught postgraduate programme include Dr Jeremy Huggett on GIS, Dr Tessa Poller on theoretical approaches to aerial data, Professor Steven Driscoll on post-Roman landscapes and Dr Jane Drummond from the Department of Geographical and Earth Sciences on photogrammetry and remote sensing.

**Doctoral research programmes**

The Department also has a strong and continuing track record of successful doctoral programmes on aerial photographic related topics, focusing particularly on the integration of...
aerial photographic data into wider academic syntheses or on methodological issues (see references in Hanson 2008). More recently submitted theses include: Ali Aqdus *The application of airborne remote sensing techniques in archaeology: a comparative study* and Kirsty Millican *Contextualising the cropmark record: the timber monuments of the Neolithic of Scotland*, both of which are being prepared for final submission after successful *viva voce* examinations. Ensuring the continued generation of well-qualified, research-based graduates should avoid the danger of practitioners of aerial archaeology as a discipline being perceived as operating at a purely ‘technical’ level.

**The Centre for Aerial Archaeology**

In January 2008, in recognition of the Department’s role as a centre of excellence for teaching and research in Aerial Archaeology, the Faculty of Arts at the University of Glasgow formally agreed the constitution for the establishment of The Centre for Aerial Archaeology to be based in the Department, under the directorship of Bill Hanson, with Kenny Brophy as assistant director (Hanson 2008). One function of the Centre is to maintain and oversee the development of teaching, as exemplified in the major changes at both undergraduate and postgraduate level referred to above.

It remains our view, however, that aerial archaeology is undervalued and under resourced within the wider profession, an attitude that inevitably permeates down to the current student body, so that we need to be more proactive in promoting its potential benefits. If the subject is not being researched and taught widely across the University sector, then aerial photographic interpretational skills will continue to be the domain of the few and the research potential of the vast resource of aerial photographic data already acquired will never fully be realised. Thus the Centre seeks to encourage the wider promotion of the value of aerial data, particularly through publication either of landscape analyses or major typological studies, to provide further examples to the next generation of how such data has the potential to revolutionise our understanding of the past. It also seeks collaboration with other like-minded bodies actively engaged in aerial survey and research work in order to facilitate these aims.

Brophy, K. 2008 Digging cropmarks: the Forteviot cropmark complex, Perthshire, Scotland, *AARGnews* 37, 42-46

Hanson, W. S. 2008 The Centre for Aerial Archaeology, Department of Archaeology, University of Glasgow, *AARGnews* 37, 12-14
Academic education in aerial archaeology – between intentions and possibilities

Ioana Oltean

The joint initiative between the EAC and AARG, to assess the current state of aerial archaeology education across Europe and to develop basic strategies and standards for its future development, has been welcomed with great enthusiasm by some of us, myself included. As an undergraduate and taught postgraduate student in Cluj-Napoca, Romania, my education distinctly lacked exposure to aerial archaeology. Apart from a couple of pretty pictures of crop-marked sites published in back issues of French magazines, all that was presented to us, the students, was a short speech emphasizing the unreliability of the method for site discovery given the wide variability of conditions it relied upon, and the fact that in Romania this activity was, anyway, against the law. And … that was the end of it. Later on, however, my learning path led me to experience a variety of international styles and approaches: on-the-job learning as Bill Hanson’s research assistant; intensive training as an AARG summer school student in Leszno 1998; and finally, sitting in Michael Doneus’ 2000 Spring semester undergraduate module at the University of Vienna and in the postgraduate aerial photography module at Glasgow University in Autumn 2000. It was, therefore, very exciting for me to get involved in the AARG/EAC Education Working Party. Subsequently, the opportunity arose to put some of the resulting intentions and recommendations into practice when Exeter University asked me to design and deliver my own undergraduate module on the subject. I am looking at this experience as a testing platform of the feasibility of our report.

Why teach aerial archaeology?
Most of us would agree that what keeps us in the practice of aerial archaeology is the knowledge of its effectiveness as a tool for studying the landscape, and of course the satisfaction and enjoyment it gives us. But is this enough to convince a new, corporatized modern university to introduce or to enhance its existing teaching delivery in aerial archaeology? In line with the sustainability issues held dear in modern society, the question to be answered is what purpose such graduates would serve in the outside world; in other words, who would need their skills? AARG members and other practitioners know that aerial archaeology had a major role in the development of archaeological knowledge and practice over the last century, as the single most important method of site discovery and monitoring and as the most efficient tool for the study and reconstruction of archaeological landscapes. Yet, across Europe there are still archaeology practitioners who have not heard of aerial archaeology or, and this maybe worse, have a distinctly distorted view of its benefits, and ultimately will be reluctant to employ this approach. Therefore, the AARG/EAC Education Working Party report expressed the view that “the role of education in aerial archaeology should be to create both practitioners/specialists in the discipline and knowledgeable consumers/beneficiaries (either amateur public or professionals – such as archaeologists or officers in heritage protection and management) of its product (either images or cartographic data)”. In order to make the message more efficient and easier to implement, we thought about keeping our requirements simple through minimal (but effective) guidelines and requirements, which would make a customized approach essential. Apart from the local context provided by a variety of teaching cultures and professional frameworks, an important factor influencing the customization of academic teaching of aerial archaeology, is the
“professional market sector” it addresses: the formation of either consumers/beneficiaries (which was thought realistically to be the main aim in an undergraduate context), or that of practitioners (e.g. via postgraduate degrees and Continuous Professional Development qualifications).

**Aerial archaeology at Exeter**

Within the degree courses offered by our Department, the second and third year students can select a range of 15-credit modules, some of which have more emphasis on practical skills than others. The *Aerial Survey* module was therefore incorporated into an optional Level 2 methodological package of modules. In line with the principles and strategies outlined by the Working Party report for undergraduate teaching, its aim is to provide an introduction to aerial archaeology. Additionally, however, the module also intends to develop basic practical competence in aerial photographic interpretation and mapping. The content, organised in 10 three-hour sessions (each a combination of lectures and practicals), was also grouped according to the format requirements of the Department and to a new definition of aerial archaeology in terms of aerial/satellite remote sensing, expanding beyond survey based on traditional aerial photographic acquisition and analysis and including, therefore, basic information on various above ground remotely sensed data sources (airborne and satellite-acquired) and technologies (e.g. laser scanning methods; hyperspectral data). Topics covered include: the history of aerial archaeology; maps; identification of archaeological sites from the air; issues of morphology and classification; imagery types and acquisition (e.g. oblique aerial photographs; vertical aerial photographs; satellite imagery); an introduction to manual and digital transcription and mapping; and discussion of the role of aerial archaeology in landscape research and preservation. By the end of the module, students should be able to identify archaeological features on various types of aerial photographs, use stereoscopes, specific software, conventional and digital maps and create site plans based on aerial photographic interpretation. Also, they should be able to utilise specific terminology adequately, understand the role of aerial photographs in archaeological prospection, monitoring and protection and more generally in landscape studies, know the advantages and disadvantages presented by various types of imagery, such as oblique and vertical photographs or satellite images.

Student response to the introduction of this module confirmed a number of assumptions we started from in our analysis as a Working Party. The high number of students taking the module (19 students in its first year, with a further 16 in the current year) reflects, on the one hand, the popularity of the subject in Britain, mainly achieved through channels other than the University. On the other hand, however, this may indicate students’ desire to achieve lucrative professional skills, in particular through a module promising introduction to a number of computer software packages, such as ArcGIS and AirPhoto. Indeed, the majority of practical activities made use of Google Earth (e.g. in exercises of site recognition and visibility in various environments, oblique and vertical photo location, reconnaissance flight simulations, landscape analysis and reconstruction, basic interpretative sketching of features). The highest proportion of the assessed assignment is practical, including an in-class test of interpretation and manual mapping, a short essay and a report combining both site interpretation and mapping skills with contextualization within the wider landscape.

Universities today encourage the development of innovative, IT-heavy, learning and teaching. The first run of the Aerial Survey module last year, however, highlighted a number of issues
which had to be addressed. Most importantly, the nature of this module does not allow it to be taken large numbers (which is contrary to the encouragement of unrestricted choice of modules in force in our Department) and a maximum intake of students needs to be stated. Moreover, given the high usage of computers, sessions must be hosted within a suitably equipped teaching suite, with enough network and administrative flexibility to enable software installation and their periodic upgrading as need arises. Also, significant problems were created by the highly variable level of prior IT literacy of the students which prompted the inclusion in the revised module proforma for the current year of the statement: “as the module makes use of computer software, prior basic familiarity with computers would be an advantage”. This problem, along with the usage of several workstations in parallel makes the presence of a teaching assistant highly desirable. Unfortunately the practical character of the module and the exposure to software misuse or malfunctions increase the risk of student anxiety, which is, sadly, an ever-increasingly important factor in higher education today. This makes the establishment of extremely strict guidance and work outlines essential, and increases greatly the preparation time for each scheduled session. In addition, repeated problems encountered by students using AirPhoto and ArcGIS led to the replacement of an assessed assignment involving their use on a specified case study in the current revised version of the module.

**An encouraging start….**

Overall, the report of the Education Working Party gave me sufficient guidance and support in putting together this undergraduate module. The module succeeded last year in informing the students of the benefits that aerial remote sensing can bring to their professional practice and they are now more aware of how they can make this work for them. Some of these students went on to use these skills in their undergraduate dissertations, postgraduate landscape programmes, or in their work within professional bodies. Most encouraging has been the positive commentary on the student grapevine which ensured that the (capped-number) subscription list for the course filled rapidly for this year.
If we build it, will they come?
Facilitating the re-use of ARS exemplar teaching and educational material

Anthony Beck & Lyn Hughes

The Aerial Archaeology Research Group (AARG) and Europae Archaeologiae Consilium (EAC) working party on education was established in 2007 with the aim of developing broad-based strategies, providing standards and enhancing best-practice in relation to (cultural) heritage applications of Aerial/satellite Remote Sensing (ARS). This working party recognises that the ARS community should take action to enhance the nature of the teaching and education resources, identifying two principal groups:

- Specialists, professionals and academics.
- Non-specialist: including general educators and lifelong learning.

In addition, the working party recommended developing resources aimed at these two groups to facilitate structured education. The appropriate application of these resources will enhance the skills of specialist practitioners and increase the number, and expectations, of knowledgeable consumers in the archaeological community. This short report briefly discusses the issues surrounding developing, sharing and re-using educational resources. It does not cover the specific nature of the resource themselves. However, it does describe the deposition of two resources as a case study.

It is useful to define the characteristics of the proposed resources. Firstly, the resource should not contain inappropriate or out of date material. This is an issue of quality control and can be easily monitored and mediated. More importantly the resource should not be structured or stored in a manner that discourages the envisaged end users from using the resource. Appropriate re-use is the key indicator of success.

Resources have to be:

- accessible to all end users
- easy to integrate into current teaching and learning frameworks
- copyright free or have a clear use/licence position
- by preference be in ‘open’ formats or at least in industry standard formats
- easy to deposit

By implication the resources are likely to be digital and made available over the internet. Where necessary digital resources may need to be migrated.

What is a teaching or educational resource?
For the purposes of this discussion an educational resource is an item or collection of digital content. It could be a document, a dataset, an image, a video or even a website. Anything, in fact, that has an educational or teaching component to it. In addition the content may contain associated metadata. Metadata is ‘data about data’ and can significantly improve the identification, discovery, assessment and management of the resource.
Constraints for deposition (copyright and file format issues)

Just like any other form of published work the copyright position of any component data needs to be unambiguous - i.e. the copyright or licensing position of the educational resource must be clearly determined. If the depositor ‘owns’ the copyright of the resource then they have full control on how the resource should be copyrighted or licensed\(^1\). In order to maximise subsequent re-use an ‘open’ licensing or public domain position is encouraged. Under ‘open’ licensing conditions (such as copyleft, creative commons or share-alike) an author surrenders some, but not all, rights under copyright law. An author surrenders all copyright protection when content is placed in the public domain. Copyright and licensing agreements can become complicated, particularly when one is dealing with data purchased from a third party (e.g. satellite imagery\(^2\)). Where there is copyright ambiguity appropriate advice should always be sought.

The format in which the content is deposited is important. Formats are either open or proprietary (closed). Open formats are built upon transparent standards and publically available specifications. This means that only by using the format specifications can one correctly and completely access the data in the file. Open formats are intended to be software independent and there is less likelihood that these need migrating when software versions change. Proprietary formats have specifications which may not be publicly available. Only the company who owns the specification can correctly and completely access the data in the file. However, aspects of the specification may be shared with other companies so that the files can be re-used in other packages. Many proprietary formats require migrating when their dependant software version changes. There is no fundamental problem with maintaining content in proprietary systems but open formats are obviously preferable for deposition. All open document formats (such as those used in the free office suite OpenOffice) are based on open standards. Other relevant open formats include:

- Rich Text Format RTF (document)
- Portable Document Format PDF (document)
- Portable Network Graphics PNG (raster image)
- Joint Photographic Expert Group JPEG (lossy (geo) raster image)
- Tagged Image File Format TIFF\(^3\) ((geo) raster image)
- Scalable Vector Graphics SVG (vector image)
- Geography Mark-up Language GML (vector GIS)
- Keyhole Mark-up Language KML (vector GIS)

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\(^1\) As an aside, when publishing, rather than transferring ownership of images and photographs to the publisher why not donate them to an ‘open’ repository, such as the HEAacademy Archaeology Image Bank, and never have to request to use your own illustration/photograph again!

\(^2\) Modern satellite imagery is often purchased under licence. The licence details the constraints under which the imagery can be analysed, shared and published. From experience I try to make the licensee as large a group of organisations as possible to facilitate data sharing and re-use.

\(^3\) TIFF is a proprietary format with a public specification. Adobe, the owners, reserve the right to change the licence to the specification.
Resource discovery: Enhancing re-use
The choice of repository has profound implication for how the resource might be discovered. Common resource discovery tools are:

- Search engines and web directories (Google and Yahoo)
- Specialist search tools (domain portals such as ArchNet (http://archnet.asu.edu))
- Specialist resource centres (EDINA (http://edina.ac.uk/) or the Archaeology Data Service (ADS))

Domain professionals tend to look for well defined resources within specialist data centres or portals. Search engines and web directories, although useful, may also contain many irrelevant sites. Therefore, most specialists will deposit material in the data centres appropriate to their domain or affiliate their web-sites with domain portals.

However, this can generate a potential problem if the resources only become evident to a subsection of the envisaged end-users. Teachers, for example, will have their own specialist portals and data centres (see Boutwood & Winton, this volume). Depositing the resource in multiple locations so that different end-users are aware of its existence is not desirable, and the challenge then is to make these resources discoverable within different search environments. One potential answer to this is the use of metadata harvesting. Metadata harvesting is where metadata records within a data archive can be collected (harvested) by an external service. So, for example, a teaching resource data centre can harvest appropriate metadata from the AARG education archive (filtered by keywords) and expose the metadata and links on their own website4. The more descriptive the metadata the better the chance of locating the resource.

Where should the resource be stored: the repository
The repository refers to the location on the web where the resource is stored and there are many options available for hosting content. These can range from simply placing the content in a blog or wiki (blogger.com or Wikipedia) to specialist digital repositories (referred to as digital libraries: such as Go-Geo! (http://www.gogeo.ac.uk) or the ADS (http://ads.ahds.ac.uk)).

Any of these options are appropriate for hosting data. What differentiates them are cost, support, expertise and re-use potential. A cheap solution, such as Wikipedia or a blog, is free but may not provide appropriate licensing protection, copyright support or the ability to migrate resources. A digital library may offer all these options but they are likely to come at a financial cost. However, the most important issue is one of re-use. In this respect digital libraries offer significant advantages. Many digital libraries exchange, validate and harvest resource metadata commonly using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH).

Case Study: Preparation of content from the AARG visualisation workshop (Hull, 2007)
At the AARG visualisation workshop in 2007 Beck presented some work on contrast identification and the electromagnetic spectrum. This was illustrated with examples from

4 The Leeds University LUDOS object repository has the metadata of its geospatial content automatically harvested by the EDINA Go-Geo! data centre.
fieldwork undertaken in the semi-arid marl landscape surrounding Homs, Syria. It was suggested that this presentation should be used as an exemplar to illuminate issue surrounding the creation and deposition of an educational resource.

**Content**
The original slideshow presentation contained two distinct themes:

- **Theory:** discussing archaeological contrast and the electromagnetic spectrum
- **Case Study:** the application of satellite imagery in a semi-arid environment supported by soil analyses

For this exercise, two slideshow collections have been generated based upon these themes. These are image based resources and are intended to be self contained. Therefore, where a slide was not self explanatory then supporting text was placed in the notes section. If notes already exist then these could remain with the slides. However, every slide does not require supporting notes.

Creator, author and stakeholder information are identified on the first slide. Resource discovery metadata for each file are listed on the second slide (summarised in Table 1). A textual summary of the resource is included on the third slide. Supporting references are displayed on the fourth slide. These references could include the full text or notes from the original presentation and can provide essential context for the subsequent end-user. It should be noted that metadata standards, such as Dublin Core, contain many other metadata description elements.

<table>
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<th>Case Study: Archaeological site detection using satellite imagery in the semi-arid marl environment of Homs, Syria</th>
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<td>Homs, Syria, marl, detection, contrast, archaeology, remote sensing, satellite imagery, formation, analysis, enhancement, laboratory, soils</td>
</tr>
</tbody>
</table>

Table 1 Resource metadata

If appropriate the file metadata should be updated. This metadata contains further information about the resource. In PowerPoint this metadata is accessed by clicking file/properties.

**Copyright**
Beck has copyright of all the images used in the resource, with the exception of a single image donated by Dr Stefano Campana, who has given clearance to re-use the image in the resource. However, the resource also contained data derived from Ikonos satellite imagery used under licence from Space Imaging. The licence does allow the posting of derived data under the following conditions:

Post a derived product (irreversible processing performed) or degraded (with quality setting of no greater than 50% (level 5)) original product in a JPEG format, on an

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5 The licence also allows limited sharing of the source data.
Re-use position
As Beck owned the copyright on the illustrations and the re-use conditions of the Ikonos imagery was clear, an ‘open’ licensing stance was taken. The Higher Education Academy and the Archaeology subject centre has a remit to support and enhance teaching and learning in archaeology and therefore one of its roles is to provide a location for resources to be deposited and freely accessed by individuals or institutions for re-use. However, the ownership of the resource remains with the depositor and as such it should be assumed that copyleft terms apply. This means that it is free to re-use, but the owner must be clearly cited and copyleft conditions fulfilled. Further information about copyleft can be found at http://creativecommons.org.

Deposition format
It was decided to deposit the resource as a slideshow rather than as individual slides rendered as images. There are two reasons for this. A slideshow represents a collection of related and structured content and depositing a collection or group of material reduces the amount of metadata required. However, the resource was generated in the proprietary PowerPoint format, so the files were also converted into Open Document Format presentation files (odp) using OpenOffice. Unfortunately, even though the odp specification is open, PowerPoint does not include an odp import option. Therefore, as the majority of end-users are likely to use PowerPoint, and in order to ensure long-term re-use, both a PowerPoint and an odp version have been deposited. The metadata record can refer to two different, but related, resource objects.

Choice of repository
In practice the choice of repository was reasonably easy. As there is likely to be both copyright and licensing issues then community hosting options (such as Wikipedia) were discounted. This left specialist resource centres. Resource centres which limit access, such as EDINA (an academic only resource), were also discounted. The Archaeology Data Service (ADS) has an open access policy, under specific re-use conditions, but does not host educational resources per se (unless they are data resources). However, the ADS have collaborated with other institutions in developing a range of teaching and learning resources. One of these collaborators is the Higher Education Academy (HEAcademy) subject centre for Archaeology.

HEAcademy and the subject centres have a specific remit to support and promote high quality learning and teaching. It aims to be a one stop shop for teaching and learning resources. There is a specific archaeology section, no limits on whom can access the resource, no constraints on the type of target audience and, at present, the service is free. Although the education resources are still in development, the Archaeology subject centre is agreeable, in principle, to work with AARG to develop appropriate services. However, for the purpose of this exercise
the Archaeology subject centre proposed that we use their Online Exemplars deposition route. They will also look into opening up their metadata for resource harvesting.

**Deposition**
Deposition was a simple matter of providing the prepared content to HEAcademy. They dealt with any metadata issues and hosted the content. Once the resource was activated all resource stakeholders were informed of its location. The AARG education data is available at: http://www.heacademy.ac.uk/hca/resources/detail/Aerial_archaeology_research_group.

**Overview**
This case study has illustrated the deposition of a specific slideshow learning resource. There were some copyright and licensing issues associated with hosting the resource but these were not insurmountable. However, there are likely to be other issues when different content types are deposited in a repository. For example, the Archaeology subject centre repository is probably not the best location to deposit a geo-spatial dataset as this requires different expertise and management techniques. This would be better done via the ADS where a charge would be incurred for hosting and preparing the material.

The HEAcademy are committed to developing and hosting high quality teaching and education resources. In addition they are excited to work with AARG and the archaeological remote sensing community to develop and host appropriate material.

**Acknowledgements**
Many thanks are due to all the people at HEAcademy for hosting the exemplar material and making the writing of this section, at very short notice, much easier. Thanks are also due to Dr Jonathan Ainsworth (University of Leeds) and Dr Stuart Jeffrey (ADS) for providing valuable feedback on the technical content. Finally many thanks to Professor Graham Philip (Department of Archaeology, University of Durham) who gave permission for the Homs case study data to be released.

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Instruction in one of the university’s splendidly-equipped computer rooms in Helsinki (Finland) during a combined seminar-workshop held in 2004.
Is it all academic? Engaging wider audiences in aerial archaeology

Yvonne Boutwood & Helen Winton

The views expressed in this article are our own but the teaching material and courses we describe represent the cumulative effort of members of the Aerial Survey team at English Heritage. Particular thanks to Cathy Stoertz who commented on this paper.

A presentation to the 2002 AARG annual conference in Canterbury entitled ‘Spreading the word - from tiny tots to grandmas’ attempted to show that using aerial photographs is not the exclusive domain of academics and specialist professional aerial archaeologists. There are many opportunities, within a wide range of contexts, to engage new audiences and broaden access to aerial photographs. This approach embodies the spirit of the Aerial Archaeology Research Group’s constitution, which seeks to ‘advance the education of the public in archaeology…..’ The education debate at the 2007 AARG conference in Copenhagen and the AARG/EAC Working Party on Education provided further opportunities to review how far we have progressed in ‘spreading the word’.

Because English Heritage (EH) is the UK government’s statutory adviser on the historic environment for England, all of our Aerial Survey courses or lectures are conceived in the context of EH’s role in national research, heritage protection and promotion. In addition to initiatives by EH’s Education and Outreach departments, the National Monuments Record also carries out work to promote the use of aerial photographs in education. The Aerial Survey team must ensure, therefore, that it offers training and teaching that complements the work of other teams in EH as well as other institutions. Most of our teaching forms part of established higher education courses for professionals or university students. We also participate in EH events for the general public, give lectures and run courses for amateur archaeologists.

Our programme of teaching has developed in response to requests from different institutions and groups and is on a relatively small scale; our challenge, therefore, is to ensure that our resources are effectively targeted. Most of the training we do is designed to overcome the lack of skilled aerial photograph interpreters in the UK, and is in response to the need to train people to work in our own team or on contracted projects.

University courses

We provide modules for a number of English universities as part of postgraduate courses, usually contributing to Master of Arts (MA) or Master of Science (MSc) degrees. These are primarily landscape courses within Archaeology Departments. We are also beginning to receive requests to contribute to other themed postgraduate courses including, for example, courses on GIS and remote sensing for students who are interested in the applications of aerial photographs and lidar for studying landscapes. Medieval specialists, who primarily use documentary sources and historic maps, are also increasingly being encouraged to use aerial photographs as a source of information. We also hold a workshop for students of Historic Gardens and Cultural Landscapes who are interested in the horticultural, historical and archaeological information available on aerial photographs.

All postgraduate sessions are tailored to students’ explicit needs, including appropriate case studies, and the feedback from these courses is consistently very positive. Courses aim to give students the confidence to incorporate some element of aerial survey analysis in their dissertations or course work. A proportion of students may also eventually provide strong candidates for jobs that have an aerial survey component.

At undergraduate level, courses which include the use of aerial photographs are most commonly provided by university tutors. In support of this teaching, we offer half-day courses which focus on an
overview of aerial survey and its applications, and provide case studies and other material not generally included in the teaching resources available to university tutors.

**Professional training**

Anecdotal evidence suggests that, with some notable exceptions, aerial photographic analysis is still woefully inadequate in desk-based assessments for archaeological evaluations within the UK planning process. In order to address this problem, we have designed courses for archaeology and historic environment professionals, whether they are consumers of aerial mapping data, or want to interpret aerial photographs themselves. These courses are delivered in partnership with Oxford University Department of Continuing Education (OUDCE), one of the leading establishments in the UK providing professional training in the historic environment. The principal course focuses specifically on aerial photographs and mapping, but we also contribute to themed courses, such as the interpretation of military remains, or to themed weekends such as the recent conference on prehistoric landscapes. The aerial photographic course can count towards the UK Institute of Field Archaeologists’ continuous professional development scheme. As opportunities arise, other courses are developed to cater for specialist groups, for example EH Historic Environment Field Advisors who are responsible for monitoring protected archaeological sites.

Teaching for academic institutions and the professional sector came together in the Culture 2000 Project *European Landscapes: Past, Present and Future*, which involved sponsorship and support from a number of institutions across Europe. Culture 2000 and previous NATO-sponsored projects were delivered by an international group, many of whom are AARG members, taken from the European professional, academic, government and private sector. These courses concentrated on promoting aerial archaeology in Europe and were delivered to students and those working as professionals, often in countries where access to aircraft, aerial photography collections, or even maps had hitherto been impossible. The Aerial Survey team at EH has been involved in many Culture 2000 workshops and courses and in 2006 developed, with tutors from outside England, a course based in England for students and professionals from Europe and the UK.

**Raising public awareness**

The view from above is increasingly familiar and aerial photographs regularly appear on television news and drama programmes. The popularity of programmes like Time Team has had a huge impact in stimulating interest in local history and archaeology. The general public, including amateur
archaeologists and community groups, often have a considerable interest in their local history and archaeology. Such groups are flourishing in the UK and events and displays at heritage sites and museums, conferences and talks for archaeological societies, provide an opportunity for the public to use aerial photographs and for EH to raise public awareness of its resources. English Heritage’s National Monuments Record provides sessions aimed at encouraging people to use the archive and aerial photograph collections.

Using stereoscopes to capture the imagination of the general public at an EH event. Children (or Roman soldiers) respond particularly well to the enticement to “See in 3D”. This is an effective way to introduce archaeological uses of aerial photographs.

Our main contribution is to provide tailored workshops for community groups, usually local history and archaeology societies, training them to use aerial photographs and to appreciate the research in their area. We also take part in events at EH properties, for example as part of National Archaeology Week (now the Festival of British Archaeology) organised by the Council for British Archaeology, an educational charity working in the UK to involve people in archaeology. Last year we presented “Landscape Detective” displays and activities, which formed part of the Archaeology Trail at Fort Cumberland near Portsmouth. This introduced children and adults to less well-known aspects of archaeological work, such as aerial archaeology and analytical field survey, as well as better-known pursuits such as excavation and finds analysis.

**Promoting access to resources**

Provision of easily accessible resources, including aerial imagery, is the key to encouraging professionals, amateurs and community groups to use aerial photographs. Some published material is tailored to specific groups, for example school teachers. We contributed to an English Heritage teacher’s handbook by working with the National Monuments Record to provide case studies for lesson outlines with aerial photographs and plans, which were made available on compact disc (Corbishley 2004). On-line access to material and the use of E-learning programmes are also important tools in the development of accessible resources and the provision of tutorials. The Heritage
Flexible practical courses
The teaching we offer ranges from one-hour lectures to, more usually, one to three day courses; in the case of the Culture 2000 course, a nine day workshop was presented. All of our courses combine theory with practical work, providing an overview of the discipline of aerial survey and its application to landscape archaeology and conservation. In the time available, it is a challenge to cover the basic theory of aerial photograph interpretation, but the most rewarding aspect is devising exercises and teaching the practical skills of interpretation and mapping.

Our aim, within the relatively short time available on our courses, is to provide a set of skills which will enable students to understand how they can use aerial photographs in their own work or research. The background knowledge and experience of our students varies enormously depending on their academic, professional or personal experience of landscape archaeology. We have tried to address this disparity through the use of carefully chosen examples which build up the students’ basic knowledge before they tackle more complex landscapes or themes. We have developed a library of short illustrated lectures on a variety of topics, which allow the tutor to cover the essential aspects of aerial archaeology and adapt to the length of the course. These include, among many other topics: sources and theory of aerial photography; interpretation of earthworks, cropmarks and structures with examples chosen from most periods from the Neolithic to the twentieth century; themed topics such as industrial, coastal or military remains; case studies and examples from the wide variety of survey and conservation work which includes aerial photographs or aerial remote sensing as a component. These short sessions are supported by practical exercises for the student to do themselves, in pairs or in groups, with varying input from the tutor. This approach aims to provide a combination of theory and practice, so that the students can decide what is relevant for their own interests.

Although the courses vary in length, the basic format remains the same. We may change the emphasis depending on the needs of the group, but we certainly do not “dumb down” for non-academic or non-professional groups. On the contrary, it is often the individuals from the “amateur” sector who have the enthusiasm and breadth of local knowledge which enables the student to get the most out of aerial photographs.

Our courses are usually classroom based, but the Culture 2000 courses gave us the opportunity to teach a full range of skills, including reconnaissance and flight planning, cataloguing, analysis and mapping from aerial photographs. The Culture 2000 Cirencester course also included a field visit to one of the areas (Minchinhampton Common) studied in the classroom and from the air. While our classroom based format works well, we would welcome more opportunities to include field visits in our courses and perhaps even some follow-on fieldwork, as is the practice on longer academic courses in the UK and Europe. Ideally, courses should be part of a programme which includes other forms of survey technique. An example of this integration was the Culture 2000 project Landscapes of War, which included a day of workshops using multi-disciplinary approaches to understand and survey a World War II airfield in the Cotswolds.

Work experience and professional development
Short training courses can only offer a basic introduction to aerial photographs and encourage people to use them in their work or research, whilst talks to local societies stimulate an interest and broaden the range of people whom we reach. Cultivation of future generations of aerial photographic interpreters requires another approach. The provision of one-to-one tuition within a professional context has proved to be an effective way for individuals to acquire interpretation and mapping skills. Our involvement in this activity has been through EH funded projects, where individuals are trained and then supported when carrying out large area landscape projects which use National Mapping...
Programme ([http://www.english-heritage.org.uk/server/show/nav.1186](http://www.english-heritage.org.uk/server/show/nav.1186)) methodology to complement a range of approaches to archaeological survey.

Other opportunities to encourage future practitioners arise where university students undertake work placement, typically lasting between 3 months and a year, as part of their course. For graduates, or those already in employment, work placements can be arranged through learning bursaries in archaeology and heritage management. Our involvement in this process has been through the EPPIC scheme (English Heritage Professional Placement in Conservation), which is funded by EH, the Institute of Field Archaeologists and the Heritage Lottery Fund. These six month or one year placements allow sufficient time to train individuals and increase their chances of employment. Shorter term placements, for a month or less, facilitate research for postgraduates or provide some experience of working in aerial archaeology.

Professional training. Cathy Stoertz (English Heritage) discusses the archaeology of the Severn Estuary with Amanda Dickson and Steve Crowther (Gloucestershire County Council).

The on-the-job training and support typically includes interpretation, mapping and recording from aerial photographs and production of a report, sometimes a publication, based on research into the archaeology of a chosen area. Among the major partners in these schemes are local county-based Historic Environment Records. In this context, the training or support we provide represents a major commitment to setting standards and enhancing skills in the professional archaeological sector, by increasing the pool of trained aerial photographic practitioners. Continuing professional development is also provided for the existing complement of trained aerial photographic interpreters. Within the Aerial Survey team, we have opportunities to develop our own skills when we train new staff and get involved in teaching on courses. This system extends to teams working on contracted projects where EH supports training of new aerial photographic interpreters by the established team; however it is not always as easy to argue for adequate provision of funds to develop contacts with societies and universities as part of project work.
Our programme of teaching and training is, of course, just one of the many ways to encourage the use of aerial photographs. Through our varied approach, we hope to achieve a number of things: to broaden access and inspire people to use aerial photographs; to provide knowledge of the basic principles and standards required for those who contract a specialist; and to increase the numbers of trained aerial archaeologists who can work as specialists or generalists. We further hope that our different approaches will complement the work of other initiatives such as full time postgraduate courses. One way we could become more involved is by targeting professional educators, either by making teaching material available, or by advising on material and course structure.

Among the constraints on our noble aims are time, available personnel, and the extent of our department’s commitments within EH. To be effective trainers or teachers we need to continue to be active practitioners and so need the time to fulfil our other roles in the Aerial Survey team. A collective and collaborative approach among all participants should encourage a reflective attitude to training and professional development which, in turn, can influence our project management, survey techniques, and landscape analysis.

References
For further information on EH education and the NMR please see the Learning and Resources-Public Archive (NMR) pages, or for Aerial Survey see the Research and Conservation pages, at:
www.english-heritage.org.uk

http://www.english-heritage.org.uk/server/show/nav.00100300b004001

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Student taking a test for stereoscopic perception at Poznań (Poland) in 2007.
An aerial archaeology school in Denmark 2008

Lis Helles Olesen

In Denmark we have made repeated attempts to organise a week-long aerial archaeology school with international participation, but without success. Instead, we (the LAND network - http://www.luftark.net/) decided to run a low-priced school on the 4th and 5th of July 2008 arranged specifically for Danish archaeologists and archaeology students. The school comprised one day of seminar/workshop and one day with flying. This note outlines the main elements of the school.

The participants at the school in Holstebro Museum.

The programme
On Friday 4th July, following coffee and crusty rolls we had five presentations from members of the LAND network as follows:

Lis Helles Olesen: What is aerial archaeology and which marks do we search for?
Esben Schlosser Mauritsen: What can we find?
Claus Dam: Where do we find aerial photographs?
Claus Feveile: Practical uses of air photos in a museum.
Michael Vinter: How do we start?

After lunch we had a workshop on Interpretation and rectifying verticals and oblique aerial photographs, using AirPhoto. Nearly everybody had brought their own laptop, and all had some success in rectifying photos. However, the few hours allocated to this only gave a
sample of how AirPhoto works, and the interpretation of the photographs was not given much time. In the evening we had a nice gathering on the patio eating, drinking and talking. Many slept in the museum or in the open.

On Saturday 5th July the school was based at Stauning Airport, which gave us a nice work room and from whom we hired two Cessna’s with experienced pilots. After a short introduction, the time between 10.00 and 14.00 was spent flying and, post-flight looking through the photographs and discussing interpretation. We were extremely lucky with the weather conditions on the day, with sunshine and no wind, so that everyone managed to fly without getting airsick. We were also very lucky that the very dry spring and summer weather were such to produce lots of fine cropmarks.

All students got a map with a planned route and four locations with cropmarks which should be visited and photographed. These included Viking Age pit-houses, a Viking Age longhouse and two manor houses of medieval date. Some of the crop marks were fabulous, and although one was nearly gone because it was in spring corn, the conditions were fine for training powers of observation. Cropmarks were hunted and photographed, and students had to try to navigate the route and direct the pilot. That was challenging and not everyone succeeded. In all we had nine flights, each with two students and one of the four instructors from LAND. All students were enthusiastic and would have liked to fly for longer.

When the flights were completed the photographs were downloaded into laptops and studied. It was a bit difficult for us as instructors to follow up at this stage, because we were flying several times, and the television came and made some extra chaos.
Cropmarks of Viking Age pit-houses near Dejbjerg.

A medieval manor house enclosure near Ringkøbing Fjord, Western Jutland.
Costs
We made every effort to keep costs low so that everyone could afford the school. AARG provided 670 € sponsorship and Holstebro Museum provided facilities and manpower free of charge. This meant that the students had to pay only 17 € to participate. In the evening we bought pizza, beer and wine, which the participants had to pay for themselves. If you were one of the lucky ones who could go flying the price was 20 € for 30 minutes in the air.

Participants
The school attracted 35 enquiries to attend, mainly students, but also some archaeologists working in museums (in Denmark about 40 museums do archaeological work). That level of interest was excellent, but in practice we could only deal with 24 students at the school, and we had only money and time for 18 students to fly.

News media
Before the school we issued a press release and this produced some interest from the News media. A television crew came to the airport and followed us for some hours, interviewed and also filmed from the air. In the evening the item was shown on the News and was very good publicity for the school and aerial archaeology.

Summing up
We had a fine school with a good atmosphere. The school succeeded in giving the students an impression of what aerial archaeology is, but certainly not more than that. More generally, because of television coverage lots of people had a possibility so learn something about aerial archaeology. I think we have sown some seeds, and we hope that some of the students will take a continuing interest in aerial archaeology and want to join our network, and maybe some day will fly for themself.

We have been encouraged by this experience and intend to organise other aerial archaeology schools in the future, and will certainly consider running them at a larger scale. I encourage others to organise a school like ours – it provided a fine start for both students and teachers and is good publicity for aerial archaeology in general.
Training schools and workshops in the past decade – and their future in the next?

Chris Musson & Rog Palmer

Training schools
In the decade and more since the first aerial archaeology training school at Siofok Kiliti in Hungary in 1996 there has been a progressive elaboration of the ‘standard’ teaching programme. But one basic principle has remained unchanged – the more or less equal attention given to ground-based and to in-air experience for the students over their week or so at the school. Inevitably the balance tips slightly in favour of the in-air element, since some of the ground-based instruction relates directly to the flying activities, leaving a little less than half of the time for instruction and practice in the photo-interpretation, mapping and uses of aerial photographs. In the early days – in Hungary in 1996, Poland in 1998 and Siena in 2001 – this was understandable since one of the key objectives was to initiate the application of ‘aerial archaeology’ in parts of central/eastern Europe and the Mediterranean which up till then had made little if any use of the technique or (at least in the case of Italy) of exploratory aerial survey undertaken by archaeologists themselves (notes on most training schools, workshops and meetings have appeared in issues of AARGnews since September 1996).

In later schools, at Foggia (twice), Grosseto, Cirencester and three times at Barth in north Germany, the balance of time spent on the in-air and ground-based aspects of the course was more evenly spread, though the sheer excitement of the students’ first and subsequent flights tended to dominate their engagement with the course. Not for all, however, and at Cirencester, when the students were asked at the beginning on the first day to comment on their reasons for being there, 10 out of the 12 said that they had come primarily to find out how to use aerial photographs, for curatorial or record work for instance. It remains true, however, that even a brief taste of ‘life in the air’ can provide an important background for those whose professional work will involve them in the study and exploitation of aerial evidence rather than its initial acquisition.

Workshops
More recently, however, there have been a number of workshops and intensive training courses – in Helsinki (2004), Romania (2005), Slovenia (2006) and Poland (2007, twice) – that have concentrated entirely on ground-based study, interpretation and mapping. At the last of the ‘traditional’ training schools, at Foggia, Italy (2007), there was also a parallel course for a small group of more advanced students, concentrating on intensive interpretation and mapping, with only limited but carefully targeted aerial sorties as part of the experience.

So, over time, a more varied pattern of purpose and instruction has been emerging, and this seems likely to continue in the future, not least because an all-embracing ‘ground-and-aerial’ school for (say) 24 students and 10-12 instructors will now cost in the region of £40,000 or more to organise. Such amounts of money are likely to be progressively more difficult to find in the future, though AARG’s present attempts at promoting another project under the European Union’s Culture 2007-2013 Programme might make possible one more exercise of this kind, perhaps in the Iberian Peninsula, where active aerial exploration and recording by oblique aerial photography (and perhaps the use of existing photo collections) is still awaiting a ‘kick-start’.
Hungary 1996. ‘Students’ from Lithuania, Romania and Slovenia digitising their photo interpretations into the Aerial 4 rectification program.

Italy 2001. Italian students being taught (in Italian) by an Italian post-graduate who had studied with RP for 6 months on a Leonardo scholarship.

Armenia 2001. Discussion during an introductory course

Romania 2005. Field visit to an area of medieval settlement in the Mostiştea Valley that students had examined on aerial photographs.

Finland 2004. Icelandic students working with their own photographs.

Poland 2007. Student presentation at the end of a week learning photo interpretation, AirPhoto and MapInfo.
Future patterns
More likely, one suspects, the future will see a continuation of the usual pattern of two- or three-day conferences and one-day specialist meetings, but now supplemented by smaller schools and workshops of one kind or another and perhaps by a new round of initiatives involving short-term staff or student exchanges and/or training-on-the-job. The meeting planned for Iceland in 2009 (now postponed because of difficulties in acquiring funding until a later date) would have involved three days of ground-based discussion and instruction, followed by a single day of ‘taster’ flights to round off the experience without distracting too much attention from the rest of the course. In Denmark in 2008 the funding for a successful introductory meeting on aerial archaeology was organized by students from earlier training schools (see Lis Helles Olesen, in this volume). The pattern set by the two Polish workshops in 2007 may continue, either there or elsewhere, with a concentration on landscape and archaeological interpretation of existing material from the vast archives of oblique and vertical photographs accumulated over the decades. Such courses are infinitely less expensive to organize than those involving in-air experience. There may be other patterns that could be built upon, too, like the 19 days of intensive photo-interpretation and mapping undertaken by an international group of 10 staff and 33 students (several of them ‘graduates’ of earlier flying schools) at Ljubljana in 2006.

A different approach, however, either through Culture 2007-2013 or through exchange agreements or fund-raising of other kinds, might involve work-placements for students or young professionals to learn on-the-job by working alongside more experienced colleagues in organizations that are already engaged in aerial survey and photo interpretation and mapping. These might operate within individual countries, or internationally. Some organizations might wish to improve the ‘aerial consciousness’ of their staff by bringing in the skill of experienced external practitioners who would work in their offices and instruct their staff for periods of secondment – anything from a couple of weeks to a couple of months. There may be other patterns, too – English Heritage, for instance, is currently providing funding for flying programmes in four county councils in England where the training of new ‘observers’ by experienced practitioners forms an essential and forward-looking part of the exercise.

Looking further ahead, distance-learning, already an established pattern in certain disciplines such as Museum Studies, might form a useful part of an overall pattern for raising skill levels in the wider archaeological profession. Maybe AARG or others could put together an effective Internet-based introduction to aerial archaeology, in all its aspects, and then back this up by some kind of web-based discussion group through which students could question or seek advice from experienced practitioners who had agreed to take on this task?

Individual Initiatives
Returning to the last few years, and to individual initiatives by the present authors and other members of AARG, several placements have been completed with RP at Air Photo Services in Cambridge. These have involved students, usually one at a time and for periods varying from a few weeks to several months, from Poland, Italy, Romania, Latvia and Armenia. In all but one of these cases the students were able to gain sufficient ability and experience to work on money-earning projects and/or to be involved in research projects for collaborating organisations. Some of these resulted in publications, others in the preparation of work in advance of development. Other material has provided context for excavation syntheses, while one student’s time in Cambridge was designed with Cambridgeshire County Council’s
Historic Environment Record archaeologists as an internship to provide accreditation for an MA in Communication Science for Cultural Heritage at the University of Lugano in Switzerland.

There have been other initiatives, too. Following the Culture 2000 course at Bușteni in Romania in 2005, one of us (RP) has returned three times for periods of up to three weeks to work with staff at the Institute for Cultural Memory in Bucharest. During these visits training has mainly concentrated on photo interpretation and mapping, but the work has also extended to acquiring existing vertical photographs from their military guardians, incorporating mapped information into the Institute’s GIS and devising suitable documentation to relate interpretations of photographs to known sites and locations. Carmen Bem, who has become the principal aerial specialist at the Institute, has also spent time at Cambridge to increase her experience. In 2008 RP’s visit to Bucharest was timed to coincide with a period of airborne survey and he was able to help with procedures in the air and to ensure that photographs were securely documented after the flights. Flying from the same airfield, in the same aircraft but going in a different direction, CRM cooperated as visiting expert in another project, guiding Catalin Nicolae in the survey of an archaeologically rich valley landscape south-west of Bucharest. This involvement seems likely to continue, with further visits by RP and perhaps CRM planned for May-June 2009.

Cooperation with ‘graduates’ from earlier training schools has continued in parts of Italy, too. In May 2008 Bob Bewley and CRM worked with Valentino Romano of the University of Foggia in exploratory flying over the Tavoliere in southern Italy. These surveys not only added to the photographic collection for the area but also gave further air experience to the local archaeologists and have provided data to the University’s research projects.

We should perhaps also include here the continuing work in Armenia since a first contact with AARG in 2000 by Professor Hayk Hakobyan of the University of Yerevan. While the paramotor that we use there may be an unconventional and awkward flying machine (see AARGnews 26, 37-9), we are able to produce aerial photographs that both merit and require interpretation – often by making field visits to find out just what it is that has been photographed. Another part of the project has been to teach local archaeologists about some of the uses of aerial photos, one result being that there is now a course on the subject at the University of Yerevan. A more recent development is the initiative by Professor Hakobyan to photograph particular known sites in an attempt to see more detail, to provide context and to make an authoritative record from the air (http://www.archaeology.am/sites.html). Contact is retained with archaeologists and friends in Armenia and there is every hope that this will continue in the years to come (CRM and others are now plotting a rock-art project there!).

No doubt other members of AARG could describe similar help given to individual beginners in aerial archaeology. Perhaps they will write about these in future issues of AARGnews? At all events, it is to be hoped that individual help of this kind will form a productive part of a more varied pattern of aerial archaeology training in the future.
Students can be puzzled…

…or locked in a tight-turning aircraft

They can be asked to do silly things…

…and to pose for the traditional group photograph

But the networks and friendships that have been formed ensure that teachers have passed on to the next generation some basic knowledge – and hopefully some of their enthusiasm – about uses of ARS in archaeological research.