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Editorial

**TV aerials**

British TV has broadcast at least two aerial-related programmes in the past few months. The first of these, *Operation Crossbow* (BBC TV, May 2011) was about the search for V-weapons in WW2. The programme seemed to convey well some of the problems of photo interpretation – small scale photographs, what are we seeing, what can *that* be?...etc – and, in my opinion, was a very good tribute to the stereoscope as 3-D vision was the key to understanding a lot of the blurs and blobs on those photographs. The programme may help some of you understand why we present-day photo interpreters have rattled on to aerial photographers about the need for them to take stereo pairs.

In the same month (BBC TV, May 2011) was a too-long programme (90 minutes) covering Sarah Parcak’s claims to have found more than 1000 new sites in Egypt, including towns and pyramids, by examining the IR layer of satellite images. This programme threw away the 3-D view and used high tech instead with Parcak setting up tents in the middle of nowhere and working on a screen that was about 2m wide. Is this what real field archaeology is like in the 21st century? While we can’t blame Parcak for what TV producers and editors make of her work, a lot of this programme was utter rubbish derived, I expect, from the combustible combination of Egypt, pyramids, satellites and someone after a headline. Apparently Parcak’s release of this information before telling the Egyptian authorities upset a few important locals and she showed once again that she doesn’t know how to look at images. Presentations of this kind demonstrate why it is so important for AARG to mingle with the new generation of ‘satellite archaeologists’ and GIS users and help them gain the knowledge necessary to examine, understand and interpret images which are little different, except in their original scale, to those we have been working with for the past 100 years.

More info on both programmes can be found at:

**ArchLand training**

At the end of its first year, ArchLand seems to be getting off to a good start – certainly in its involvement with teaching/training. To my knowledge, there have been three workshop/schools – in France (Bibracte), Serbia (Kostolac) and Denmark (Velling) – that have been supported by ArchLand and I’ve had the first two of three students this year over for 3-4 weeks for one-to-one instruction with travel and living expenses paid by ArchLand. Axel Posluschny has been a driving force behind much of this, reminding partners to do this and that and trying to ensure that information on the web site is kept updated. And that’s a good place to seek the latest, news, reports and case studies:

The workshop at Bibracte was noted in the last issue of *AARGnews* and the present issue contains reports and photos from the schools in Serbia and Denmark. As one of the teachers in Serbia I have to say that this was my best course to date and was made so by the

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enthusiasm, interest and friendliness of the students, some of whom are coming to AARG and who have already created a network of like-minded people in the Balkans.

A dry 2011
The summer of 2011 has been exceptionally dry in many places and we celebrate this with the inclusion of a mixture of brief (and longer) reports, plus one about uses of a flying PC in Scotland. From my Cambridge point of view, the clay was packed with sites – so many, that after about three hours flying one day I said to my pilot. “Sod it, there are just too many, let’s go home.” Our GPS track that day showed hardly any straight lines. Many of those sites were close to the airfield and they remained to taunt us for a further three weeks. Did anyone think of commissioning vertical surveys or a satellite pass, as they would have mopped up these busy areas? Hertfordshire was similarly good and money was found to record parts of the county. One addition there was presented to me by Jana Platichova, one of Martin Godja’s PhD students, who was training with me for four weeks. Jana had spotted and photographed a double ditched enclosure on the approach to Luton and thus recorded a site that was out of bounds for the rest of us. Bob Bewley also photographed a site in Switzerland showing that it is wise to keep a camera handy in case anything is visible in these restricted areas. Quality, in these cases, is secondary to a unique record.

Teaching
A last-minute addition to this issue is the contribution by Tara Sutcliffe about teaching young archaeologists, the excitement of the stereoscope, and a reminder of the role that AARG may play in education. I had the chance recently to show someone aerial photos and use of a stereoscope for the first time. Once the images had fused and he had a 3D model comments, questions and enthusiasm poured forth. This is just the sort of thing that brings pleasure to teaching but rarely was someone’s perception quite so acute and the questions so well directed. “I wish my archaeology students were like you.” I said. This bloke was an (ex) investment banker.

This issue
Those of you working in parts of Europe are probably already familiar with Geoportal sites. These were created after an EU Directive which set a task to be achieved but no standards for its output. Most EU countries and quite a few around the fringes have Geoportal sites but some (eg the UK) seem to be ignoring the Directive although perhaps it was this that prompted the Ordnance Survey to put online a few worthless small-scale offerings. Irwin Scollar describes means of saving, joining and calibrating extracts from Geoportal sites that may provide base maps and accurately-located archaeological information. This facility is not only in AirPhoto, but also in the free AirPhotoSE which was given a fairly comprehensive bashing by the students attending the Serbia workshop.

With Geoportal and Google Earth we are moving towards a time when we’ll have easily-accessible aerial photos of any country we begin work in. But not all, as is apparent in Vedrana Glavaš’s contribution about her work on the karst landscape of Croatia. Photos on the internet are not yet good enough in that part of the world to identify archaeological features with confidence but there is already an awareness of how they may be able to help research and management of the heritage in the ?near future.

Thanks to all contributors who helped to make this issue slightly obese.
AARG as a “green island”: Chairman’s Piece

Włodek Rączkowski

Time for a summary

As my term as Chairman draws to a close I have taken time to sum up the last few years of AARG activity. The annual conferences and AARGnews are the two fundamental platforms where views, evaluations and comments on aerial archaeology research are exchanged. This goes on to shape the direction in which the organisation develops, fits future prospects. The bi-annual ‘Chairman’s Pieces’ in AARGnews are an opportunity to present a view of what is happening in the organisation. Looking back now from over these last few years and a number of Chairman’s Pieces, which issues seemed to be the most important?

My first Chairman’s Piece appeared in March 2009 (Rączkowski 2009a) and referred to the growing global crisis: “September 2008 saw the start of the financial and economic crisis around the world. Does this mean that the AARG will likewise find itself in the shadow of crisis in the next few years?”. Today, we ask ourselves this question: is this crisis apparent in the activity of the AARG?

For sure, the answer is neither simple nor unequivocal. The crisis has not led to significant perturbations in AARG. The Siena conference in 2009 and Bucharest in 2010 went according to plan and witnessed an increase in numbers of participants. The main problem for the Poznań conference (held jointly with EARSeL) is rather unexpected... over-subscription (over 100 participants!). The strategy of organising conferences in different countries seems to work well and this bodes well for the future, though it does also generate additional problems.

AARGnews comes out regularly, though it must be said that Rog is experiencing problems with a dearth of articles (rather paradoxically – increased AARG membership numbers / more conference participants and yet fewer articles). This is most certainly an issue which members should focus on and be subject to wider discussion – what should be the function of AARGnews? Should it be a newsletter of short snippets of information on events in the world of aerial archaeology, or be more a forum for the exchange of ideas, discussion, critical reflection, where current projects can be presented? I do appreciate that in the crazy system many countries have introduced, where academics are evaluated for the ‘impact factor’ of their publications, it will not be easy to support the scientific nature of the AARGnews. However, it can also be valuable to publish in a journal easily available in one’s own circle where regulations concerning publication are not as rigorous as in ‘peer review’ journals and there is a chance air various ideas, which perhaps are still being worked out, up for discussion. Surely this is particularly important for young aerial archaeologists?

AARG members’ publications are not restricted solely to the AARGnews. The past few years have seen the release of three publications under the umbrella of AARG (Cowley, Palmer 2009; Cowley, Standring, Abicht 2010; Cowley 2011). Each highlights a different field of AARG’s activity. The first is a summary of the education debate. The second amplifies two conference sessions dedicated to the use of historic aerial photographs which took place in Copenhagen (AARG 2007) and in La Valetta (EAA 2008). The third is AARG’s input to

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shaping of conservation policy in Europe and is the result of cooperation with the EAC, the fruit of labours from the Symposium on Remote Sensing for Archaeological Heritage Management in the 21st century in Reykjavik (2010).

In 2009 and 2010, Polish politicians were more than happy to present Poland as the one “green island”, indicating economic growth on an otherwise red map of Europe affected by a deep crisis. I believe the AARG has survived this worldwide crisis and may likewise be described as a “green island”. Unfortunately this does not include everyone. There are institutions in some countries which have been heavily affected by this economic crisis. I truly hope that those involved in the decision-making process understand the importance of aerial archaeology and that we will all survive without suffering too many casualties.

**ArcLand – new perspectives**

Although the core activity of AARG did not appear to be affected, the crisis was visible in the drop in the number of meetings, workshops, training courses. In 2007, the European Landscapes: Past, Present & Future project was completed and then there was... nothing. Though, perhaps this is a little too strong. The University of Siena has always organised, and continues to organise, summer schools, in which aerial archaeology has found a place. In 2008 the Luftbildarchäologie in Deutschland at the Institut für Vor- und Frühgeschichte Johannes Gutenberg Universität of Mainz one-day conference took place. Lis Helles Olesen commenced work on her *An Aerial View of the Past* (€650,000!) project in June 2009. There was also a number of smaller educational and conference events. Aerial archaeologists were active, though there was a lack of a common platform enabling wider activity, especially funding for joint action and expansion. A new European project was to fill this gap. AARG began discussing its form, aims and tasks in 2008, and in 2009 an application was submitted for the ArchaeoLandscapes Europe project, whose leader was to be the Roman-Germanic Commission of the German Archaeological Institute. The application was successful! Hurrah! From September 2010 AARG members have been able to participate in the biggest European project so far related to aerial archaeology with a budget of €5,000,000! The project’s web page (http://www.archaeolandscapes.eu/) ought to be just as important and frequently visited as the AARG website.

For the last few years the geography of the AARG has shifted. The number of members from continental Europe is growing. The AARG meetings in Ljubljana, Siena and Bucharest have most certainly had a positive influence. We still need to widen our scope of activity across Scandinavia, Eastern Europe, Spain, Portugal and France. The list of ArcLand Partners and Associated Partners shows that this aim is likely to be fulfilled. The preparations for the aerial archaeology school in Merida (Spain) in 2012 have already begun!

**Technology – no trace of crisis**

In the recent past the crisis has not been obvious in terms of technological development. Just a few years ago LiDAR was something new in archaeology, a dream, yet today it is treated as standard (Crutchley, Crow 2009). It is the same situation with satellite images, hyper- and multispectral sensors etc. Such an expansion of new technology has created a new working environment. Will aerial reconnaissance and oblique photographs, the elements which for years have been responsible for the success of aerial archaeology, become a thing of the past? Is not the organisation of workshops, during which aspects of how to take, interpret and rectify oblique photographs are covered, not proof of a conservative approach, continuing
models shaped in the mid 20th century? Will new technological developments not lead us to shut ourselves off in laboratories, to work solely in front of a computer screen?

**Threats**
Technology absorbs our attention, not only in aerial archaeology. More and more it invades our everyday life. Many are fascinated by iPods, smartphones, quadroters and a whole range of various gadgets. In the past, aerial archaeology has been witness to the latest technology and no doubt will continue to do so in the future. Who remembers the controversy surrounding the introduction of digital cameras, which are in common use today? The problem then is not the introduction of new technology, but not allowing it to dominate our thinking, not to treat it as the solution to all our problems (Rączkowski 2010a). Such an approach may well be misleading. To keep a balanced perspective we need always to think of problems connected to the interpretation of photographs, satellite images etc., and the identity of aerial archaeology. Our discussions (Rączkowski 2009b; Palmer, Cowley 2010) and conference programmes (eg. session Interpretation in Bucharest) increasingly frequently concern the importance of interpretation. Issues of interpretation present the greatest opportunities for the exchange of ideas, thoughts on how to approach the use of the information that aerial photographs (and other images) contain as well as the contexts which influence our perceptions and understanding of them. For certain this is a continual need, which allows us to retain a rational approach to technology.

Another threat always present in our practice (not just in the past few years) is the focus on objects (which thinking technologically can also lead to) and forgetting about subjects. What I mean here is the need to uncover the human aspect behind the objects we observe: cropmarks, soilmarks, earthworks, etc. (Rączkowski 2010a). It would be worthwhile here to paraphrase Flannery (1967) – we should reach the human being behind the cropmark. I have no doubt that this is what we should be aiming for and the humanistic approach is absolutely essential. I don't think that limiting oneself to technological aspects of image analysis (eg. automatic detection, and others) will permit conclusions to be made relating to the human aspect (see Stoertz 2010).

Yet another threat connected to the expansion of technology may be the gradual loss of identity. The blurring of issues thus far related to aerial archaeology in the ocean of diverse proposals of remote sensing methods is becoming more real. This does not mean that we should close our eyes to what is going on around us for it would lead to a return to the aerial archaeological ghetto. The progress made in recent years and the cooperation with organisations concerned with other remote sensing methods used in archaeology (eg. ISAP, EARSeL, ISDE) can only widen our horizons, be a positive stimulation (Rączkowski 2010b). However, we must continually analyse our actions critically, establish and develop that which is most important in aerial archaeology. And this demands internal discussion (Hanson 2008), a reinterpretation of what is most important to us – what, in our eyes, is the essence of aerial archaeology. Only the approach, characterised by Heiddergerian “authentic existence” will permit us to build a sense of our own worth, deepen our knowledge of the world, and at the same time fix the most important values of the aerial archaeology approach (Rączkowski 2011) and then apply the changes, which are taking place creatively in our thinking.
Hopes
But man does not live for science alone! Aerial archaeology is a fantastic adventure. An element of which is aerial reconnaissance. So it seems unlikely that even the best technology and the incredible usefulness of LiDAR, hyper- and multispectral sensors will be able to eliminate oblique photographs (oblique vs vertical – another point for debate?☺). The emotional commitment, the romantic adventure connected with exploring the world (including the past) are elements which will continue to be attractive, as they concern human nature. And these are also elements which positively influence the course of workshops and summer schools on aerial archaeology. Students respond enthusiastically, despite difficulties with the interpretation of the photographs. This same enthusiasm was present a few years ago (Musson, Palmer 2009) and again this year during the last two aerial archaeology training schools in Kostolac (Serbia) and Velling (Denmark). It is a permanent fixture. The great atmosphere, kindness shown, the willingness to exchange ideas and skills all build a positive aura around aerial archaeology and AARG.

AARG and ArcLand form an organisational framework enabling us to continue along this route. It seems therefore that the balance between science, critical reflection and adventure, enthusiasm and positive energy towards others is a recipe for success for AARG as a “green island”. Let this be a memento for the incoming chairman. ☺

References
Participated in AATS in Kostolac and lived to tell

Miroslav Birclin

It was “Great Expectations” meets “Fear of Flying” for me to be perfectly honest! Will the plane crash!? Will I be sick!? Will the expensive camera fall out of the aircraft window? ... The list goes on...

But, what can you do? As a freelance post-graduate archaeologist, I was very curious about the whole flying/photographing thing, and more than eager to accept Darja’s invitation to participate in AATS in Kostolac (Serbia) during the first half of June.

And there we were, a whole bunch of us rookies from all over the middle and south east Europe with no experience in aerial archaeology whatsoever (except for Johanna “Mitfahrgelegenheit” Dressler who is a pilot herself, only a few of us have had some flying before) and the team of hardened aerial archaeology professionals, ready to share their extensive experience and knowledge.

Darja greeted us on the first day of ground school and introduced us to Rog “Paparazzi” Palmer, Zoltán “Apsurdna situacija” Czajlik, Lidka Žuk, Gianluca “Small Software” Cantoro, Laci “Houston” Rupnik and Sara “Hand me your memory stick” Vučković, who were all going to be our instructors. And they instructed us well! For ten days we had most intensive, 10-11 hours a day, all around training in both ground school (photo reading, mapping, siting, stereo pairing...) and actual photographing from the air! At the end of each day we were really tired (but in a good way) from all the staring at our computer screens, trying to make the GIS, and other (bloody) programs to do what we wanted them to, or debating over a photo that Rog has given us, where you could not tell what was the ditch, the bank or just a.... well... whatever it was! Must admit the most fun in ground school, was trying to tell whether it was a bump or a dent, on some of Rog’s photos (especially when he would zoom out a bit, so we could tell what was actually in the pic), and also trying to figure out some mysterious photos that Lidka had for us... is it an archaeological feature, fertilizer or Mars surface?

We all (or at least I did) mumbled and grumbled when Darja told us that each of our photos taken from the air had to be archived and catalogued, but luckily enough, we had the Small Software wizard with us, so he had a program for placing and renaming JPGs in Excel sheets in no time! Gracie Gianluca!

In the air...Once the aircraft was off the ground... every fear, discomfort or concern was gone! So for all the archaeologists used to just field walking, digging and always looking down on trenches and ground plans... let me tell you this... FLYING IS GREAT!!! Not just that you feel great while up there! It is really very very useful! You can really gain a whole new perspective of things, see clearly the topography, geological features, archaeological remains... everything is laid out for you... ripe for the taking! Especially if you have a “grey eminence” like Zoltan in the back seat of the aircraft, and pilot like Aleksandar next to you.

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Kostolac 2011 photos by Laci Rupnik, Gianluca Cantoro, anon, Lidka Žuk, Gašper Rutar, Sarita Kapuzova
Well, all of that if you are able to tell the difference between the gas pipes and a road, or (bloody) fungi rings and burial mounds, or fertilizers and dug in dwellings... or any other thing that God put on earth so it could trick you into believing it was archaeology down there! Of course, you also need a nice kind of crops below! Corn is no good (or maybe Zoltan is on the verge of a breakthrough there), grass always lies, trees are in the way, clouds are too low, wind is too strong, some other blokes vaccinate foxes from the air....sun is on the wrong side of our planet... :) After every flight, we all get back to staring in the monitor, but now with that, a bit stupid, “I can fly” kind of smile on our faces.

When not working, we all had a pretty good time, getting to know each other, exchanging our different experiences, sharing knowledge, exploring the pubs (no one ever explained to me why you have to leave before the pub was closed), and enjoying our stay at “My beautiful Konak” with a nice hot bowl of famous Serbian moustache-fish soup.

But for real, the AATS was an eye-opening experience for most of us who never had dealings with aerial archaeology! Possibilities that arise from introducing this kind of remote sensing practice in archaeology are many and should certainly be promoted and adopted in regions like Balkans where they still are not being used, or are not used enough. During this 10 day training, we encountered many difficulties, some of them being to get used to a whole bunch of different grid systems from different countries, also many of us had not previously used the software needed for rectifying or mapping, sometimes we were not really accustomed to the cameras we used... But of course, all those problems were solved along the way.

One of the things that strikes me as very important is having a solid topographical knowledge of a region that you plan to survey from the air. Although archaeology is what it is all about, it does seem that knowing the topographical and geological features of the given terrain gives you the best chance of detecting and recognizing what you are actually looking at. Besides that, as Darja said, it would come in handy to know something about historical and modern agricultural practices, patterns of land use, biology, a thing or two on herding, local archaeology, history... so basically... everything :)

We all learned a lot, made many mistakes (what better way to learn?), and became aware of many problems that go alongside aerial archaeology. But thanks to our great team of instructors, we also got to know how to recognize those problems and overcome them. And last but not least... I think we made a nice little band of “cropmark seekers”, or “any-kind-of-mark seekers” that will spread the AATS word from Carpathians to the Adriatic.

Oh and just one more thing... no matter what you know, no matter what you looking for... no matter what you think, or want to see... just remember to try keeping your mind open to anything... and you might eventually become one hell of an aerial archaeologist! :)
Group photos from the ArcLand-supported training schools at Kostolac, Serbia (top) and Velling, Denmark (bottom)
Aerial Archaeology Training School, Denmark, 2-8 July 2011

Lis Helles Olesen1, Pete Horne, Chris Musson

The second of the current year’s aerial archaeology training schools, organised in partnership with the “An aerial view of the past - Aerial archaeology in Denmark” a project of the Holstebro Museum in Denmark, and LAND Aerial Archaeological Network Denmark, brought together 9 tutors and 16 students from 9 different countries across Europe in an intensive programme of ground-based instruction and in-air experience above the archaeologically-rich landscapes of Western Jutland.

Over five days at the Vestjyllands Hojskole study centre near Velling the students were introduced to the general principles of archaeological air survey, as well as the basic procedures of photo interpretation and mapping for communication with the general public, researchers and planners.

All students also took part in supervised flights from the nearby Stauning Airport, seeking out and photographing some of Jutland’s distinctive prehistoric, Viking and later archaeological sites, some of them unknown or only partially understood before their recording during the training school. A particular example was a crop-marked ring-ditch cemetery of probable prehistoric date, its scale and character now extended far beyond the sketchy outline previously available from limited soilmark evidence.

The students, now equipped with elementary skills in the collection and uses of ‘aerial’ information, will take back to their own countries and institutions an understanding of the value of aerial exploration and air-photo interpretation as tools for securing a better understanding and conservation of their own country’s varied archaeological and landscape heritage.

The ancient settlements, field systems and communication routes that they saw as striking patterns and colour variations in the landscape below them became ‘real’ as parts of their national heritage that are under unremitting threat of damage or destruction by construction projects or by year-on-year erosion by ploughing and other agricultural activities.

Stress was laid throughout the school on the ways that aerial evidence can broaden professional and academic understanding of past societies and capture the imagination of the general public in valuing the often fragile traces of the past that lie half-hidden in the landscape around them. The international exchange of skills, experience and understanding between the school’s tutors, pilot and students typified the aims of the ArchaeoLandscapes project, building upon the contribution that earlier projects within the EU’s Culture Programme have made over the past decade to the Europe-wide application of aerial photography and other forms of remote sensing for cultural purposes.

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Students (and tutors) at the school were introduced to new and more efficient ways of carrying out ‘traditional’ and time-consuming tasks, both in the air and in ground-based analysis of the collected evidence. Camera-mounted GPS units and independent flight-path loggers greatly simplified the aerial operation, especially for those flying for the first time. At the same time, however, the inevitable ‘glitches’ with instrument failure and operator error illustrated the time-honoured search for ‘back-up’ systems (formerly known as ‘two of everything’) at all stages of the operation.

An essential part of the school was an exercise in which each pair of students mapped and interpreted the content of photographs that they had themselves taken during their training flights. The wide range of results, and the way in which the students had also called upon lidar data, historical maps, national and national archaeological records etc, showed how well they had absorbed the lesson that ‘aerial’ information only becomes ‘real’ when combined with other sources of data in the search for credible – if sometimes widely varying – archaeological interpretations.

Such events, of course, are also great fun. They are the starting point of friendships and professional partnerships that will last down the years and spread the message of aerial archaeology, remote sensing and landscape studies across national boundaries and perceived cultural divisions. If other ArchaeoLandscapes events can prompt the same enthusiasm and commitment among those taking part, the gain for the common cultural heritage of Europe will have fully justified the investment in the planning and organisation of the Danish and other training schools in the remaining 4 years of the project.

Course Details

There were 31 applicants for the 16 places on the course.

Countries represented at the school:

    Tutors: Denmark (4), England (2), Poland (1), Slovenia (1), Wales (1)
    Students: Belgium (1), Denmark (6), Estonia (1), Faroe Islands (1), Finland (2), Netherlands (2), Norway (1), Poland (2).

    6 students received grants from ArcLand to assist their attendance.

The 5 full days of varied teaching, exercises and supervised project work included 2.5 hours in the air for each student.

Approximately 1000 sq km of the Western Jutland landscape were surveyed from the air, recording many archaeological sites including some totally newly discovered and others where important new information was identified.

One ‘statistic’ may provide an amusing footnote to the school. In the 22.5 hours of flying undertaken during the school less than ten seconds was spent on photography. (3700 photographs were taken in a total time of 6.74 seconds, 1/500th of a second for each exposure.)
A flying tablet PC: developments in digital flying maps for aerial survey at RCAHMS

Kevin H.J. Macleod and Dave C. Cowley

Introduction

Time in the air is a precious commodity. In order to ensure it is used effectively, the Aerial Survey Team at the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) has started using a rugged tablet computer in the air to inform both primary reconnaissance and the management of flights directed towards pre-defined targets. This is a development from the paper flying maps used in the past, and helps to address basic survey issues (Cowley and Macleod 2008) such as:

- ensuring that existing knowledge is available during survey regardless of the memory or experience of personnel on a flight
- ensuring that repeat photography is appropriate
- managing patterns of primary reconnaissance effectively
- cost-effective direction of sorties directed to recording buildings, urban areas and landscapes where the targets are usually predetermined

This paper describes these developments, the hardware and software used and the range of digital data carried. The system was introduced at the start of 2010 and observations on experience to date are also included.

Hardware and software

We chose the Xplore Technologies rugged tablet based on favourable reviews by RCAHMS colleagues using it in a variety of field applications with reflector-less Total Stations. The iX104 C4 tablet has an Intel Core Duo (U2500 @ 1.2Ghz) processor with 2GB RAM and 110GB of storage space. At the time of purchase the unit and some peripherals (battery charger/software) cost about £3400 (c. 11% of the 2010 aerial survey budget). Detailed specifications for the updated version of this unit can be found on the Xplore Technologies website (http://www.xploretchnology.com/products/iX104C5DMSR) and there is a review with some good images of the tablet (http://ruggedpcreview.com/3_slates_xplore_ix104c4.html) which outlines other aspects of the kit.

The screen size is 21cm x 16cm, similar to the Apple iPad, and there are no problems with reflections or viewing the screen from any angle in the aircraft. Indeed the latest unit is branded ‘Sunlight Readable’, and in our experience the screen technology has effectively eliminated this old problem. The screen is tough and highly scratch resistant – maintaining its clean and sharp look for over 150 flying hours to date. It is stylus pen driven (attached by a very strong cord), but responds easily to fingers, blunt pencils and biros if necessary. You can plug a mouse and bespoke keyboard in, but the Windows XP software comes with an instant on-screen pen driven keyboard which is easy to use with a little practice. It is performs quickly when operating the software and has handwriting recognition software, speakers, microphone and lots more bells and whistles. It is weighty, but this is not an issue as it simply sits on the rear seat in the aircraft beside the spotter/navigator (Figure 1). Since the screen is

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sensitive to touch, occasionally software can be accidentally minimised or an extraneous window may appear, but familiarity with repeated use in the aircraft has maximised its full potential and use.

The Xplore’s battery pack lasts for about 3 hours of continuous use, and is very easy to install and switch over, without having to power-off – however ArcGIS is quite sensitive so it is recommended to save and close the GIS before a battery change to avoid problems. The battery is automatically recharged when plugged into the mains, and each pack has a charge LED indicator which is very useful in the plane for working out the best one to use. There is also a mains recharger unit available which takes two battery packs.

**Digital data**

The operating system is Windows XP Tablet PC edition, and we have installed ArcGIS 9.2 as the main geographical information system since this is the core GIS software used by RCAHMS. ArcGIS 9.2 has a simple GPS extension which can be set up to control a handheld GPS set. This is connected via a robust screw-in 9-pin serial port. The GPS signal positions the ArcGIS screen at your location. The GPS extension in ArcGIS 9.2 controls the GPS signal so your flight path can be logged and displayed (e.g. at 5 second intervals). The flight path is fundamental in post-survey processing for identifying the location of sites photographed when cataloguing a sortie.

Digital data, including maps, the results of our aerial transcription programme and shapefiles of targets are vital to the effective use of such a system, and through the GIS can be easily manipulated, refreshed and managed. The principal datasets carried are:

- Ordnance Survey (OS) raster maps at 1:25,000, 1:50,000 and 1:250,000 scales – a seamless complete national coverage
- vector linework of all cropmark transcriptions, currently 2300 of the c. 8000 recorded sites
- raster images of all rectified aerial photographs generated during transcription
- point distribution of all cropmark sites (i.e. where mapping has not yet taken place)
- general lines of Roman roads and other known Roman archaeology
• pre-defined targets
• all previous flight paths – valuable during cropmark prospection for quickly deciding if a site was seen earlier in the season
• a simplified line of the Anglo-Scottish Border

All of these datasets are available without additional cost to the aerial survey team, either as products of their own work programmes, or through Government data provision. The tablet is set up to be networked in office, allowing direct transfer of large datasets like the OS raster mapsets. We are also investigating access to digital maps of air traffic control zones, military airspace and suchlike, though our survey aircraft also has a Skymap GPS with this information and we carry printed air charts as well.

**Flying tablet in practice**

The iX104 C4 tablet was introduced to our aerial survey at the start of the 2010 season, and has proved to be very useful over 150 flying hours to date. This application assumes a survey crew of three: pilot, photographer and spotter/navigator. The majority of RCAHMS aerial survey is undertaken in this way, which we believe carries major efficiencies over working with a smaller crew, with clear definition of complementary roles allowing rapid progress. Thus while the front seat observer/photographer has good forward visibility and is well-placed to provide general direction, their attention is completely focused on the target during photography and this is where the multi-tasking rear seat observer/navigator adds so much more value and efficiency, continuing to observe, lining up subsequent targets and ready to direct the pilot when photography has been completed.

A default ArcGIS project is held on the tablet, within which the datasets are available, split into simple structured group layers containing maps, archaeology, architecture and flightpaths (Figure 2). These can be easily switched on and off in their entirety, or specific subsets identified e.g. specific year flightpaths/all flightpaths. Since all information is readily available it is a simple matter to assess targets from multiple sources during flight. Simplicity and ease of reference is vital. The tablet is not used for inputting data during flight other than...
automatically logging the GPS track, as it is generally too busy during survey to do so; in-flight data input would also be a distraction from the primary purpose of observing. However, in-flight querying of data to ascertain specific attributes is straightforward.

At the start of each flight we plug in the GPS handset, await lock to satellites, and set up a shapefile for the flight, then input the GPS signal and set the log going – this is autosaved. Once up and running, the daily log can be added to the GIS project where it displays the path in real-time on the map. This confirms that that the GPS is working, though we also take a second GPS as a back-up. Logging sites photographed in preparation for cataloguing without the GPS is hard work so we have built in some back-up to avoid this happening.

The system has two real strengths beyond bringing multiple datasets into the air. Firstly, it allows you to know exactly where you are at all times: obvious perhaps, but Scotland is a surprisingly big country from a small plane, and place names are not visible on the ground from 2000 feet! Secondly, the positional icon on the GIS screen, in our case a red aeroplane with a distinctive ‘con trail’, displays the aircraft heading. This is immensely useful if you lose orientation when orbiting for photography/observation, as a quick glance at the screen instantly provides a general heading which can be used to direct the pilot. Such instant orientation is a considerable efficiency in air-time and is invaluable when working in controlled airspace.

In practice, for cropmark reconnaissance we have found that viewing scales of around 1:13,000 work best using the OS 1:25,000 map base – which shows all field boundaries (a major advantage). In urban areas, the landscape is viewed at about 1:30,000 with the 1:50,000 map as background. Zooming in and out using the pen stylus is simple and can be expedited with bespoke preset viewing scales, whereby the most appropriate OS maps can be set to appear at chosen scale thresholds. Panning is also straightforward. However, although the system shows you where you are, we have found that more general navigation works best with paper maps at scale of 1:250,000 or similar, which allow identification of villages, towns and roads, for example.

This system has highlighted the efficiencies provided by the navigator/spotter in the rear seat. We estimate that targeted photography efficiency has increased by at least 25%, and that there are less easily quantified, but significant efficiencies in reconnaissance, whereby the system allows us to undertake survey more effectively.

**Primary reconnaissance**

For cropmark prospection, the GIS holds the full point dataset of the known sites and all mapped linework, along with the associated raster imagery of the source photographs (Figure 3). Thus, it is immediately obvious where a cropmark site has already been recorded and what sites are thus new. Therefore, when passing previously recorded sites which might have reappeared we may simply take a couple of digital images of the site rather than orbit it taking multiple images. This saves a lot of time in the air and in the office.

The GIS also holds the master point dataset of all cropmark sites separated by decade, so we have a quick reference to when the site was last seen and recorded. All known and possible Roman roads and temporary camps are displayed as strongly colour coded lines, prompting vigilance for this particular aspect of Scotland’s archaeology. The historic OS maps have also
been loaded up, but at present have not been used since they provide too much visual data to assess in the plane.

Managing sorties of pre-determined targets

About half of RCAHMS aerial photography is directed towards architectural subjects in support of programmes such as Threatened Buildings Survey, Category ‘A’ listed buildings and ongoing urban and infrastructure development. The direction of these pre-determined sorties has also benefited from the application of the iX104 tablet. In 2011 these targets were routinely uploaded as shapefiles for architectural and landscape themes, including the major area redevelopments for the Commonwealth Games in 2014 and the extension of the M74 motorway in Glasgow, golf courses and specific urban survey areas. While routes are planned on the ground in advance, the tablet allows rapid and accurate placement of the aircraft which is especially valuable when working under close Air Traffic Control, where changes in flight-plan may be requested. Post flight, completed targets are identified in the in-office master dataset, and updated files re-imported into the tablet.

Summary and conclusion

The application of a GPS driven ArcGIS-based rugged tablet has revolutionised our practice in aerial survey, improving navigation and allowing us to rapidly assess monuments in the air. There is no question that the hardware is expensive, but we have no doubt that the significant time savings already realised by our increased efficiency in the air will recoup this outlay over two years. However, added to this direct ‘value for money’ is the benefit that the tablet facilitates efficient survey by providing us with invaluable datasets in the air, where they continually inform decisions on where to fly and what to record. Fundamentally, the new system extends our digital work-flows into the air, it completely removes the issues of updating and replacing paper maps, and it makes the incorporation of multiple targets into the aerial survey process a straightforward matter.

Calibrating GeoPortal Maps and Orthophotos

Irwin Scollar

In 2009, I reported in *AARGnews* on:


Since then, many hundreds of GeoPortal sites for both EU and non-EU members have been posted on the Web. Most cover small areas such as cities or provinces, but others produced by national mapping authorities cover whole countries. Most unhappily, some EU countries are conspicuous by their complete absence in complying with the directive, and a few others have produced absolutely worthless sites, possibly because of a desire to preserve a commercial interest in their orthophoto and large scale map collections.

When writing the INSPIRE directive, the EU authorities foolishly set no standards for the scripts which run a GeoPortal Web site. Hence user interaction varies greatly, and important information like national grid coordinates may be hidden or absent. Each site is different, but many include layers, including orthophotos and maps that may be of use for archaeological work. Therefore a minimal set of tools has been incorporated into AirPhoto and AirPhotoSE which permit extracting basic image and geographic information from most sites for further processing as far as is possible given the Tower of Babel of GeoPortal designs.

In addition to AirPhoto for use with GeoPortal sites, AirPhotoSE is a new free programme which may be downloaded from: [http://www.uni-koeln.de/~al001/airphotose.html](http://www.uni-koeln.de/~al001/airphotose.html)

It currently offers a list with links to over 40 GeoPortal sites, with new ones added frequently. More can be easily added manually if a user finds one which is not in the default list. Like AirPhoto, it can rectify oblique imagery and enter it into a map or an orthophoto as well as creating georeferencing data for subsequent use in a GIS.

All appropriate parameters are set using the GeoPortal itself in a simulated Web browser run from AirPhoto or AirPhotoSE. The programmes can not do this directly, since the scripting code of a chosen site is not standardized and is even sometimes encrypted. Parameters of interest include a choice of grid system, a scale and the theme to be shown, e.g. an orthophoto, a map, names and other features. Undesired features which should not be visible in output images must be disabled by using the options offered by the GeoPortal.

The programs monitor the Windows Clipboard continuously for any change made in the GeoPortal and place coordinate values saved to the Clipboard in the upper toolbar field or fields. Modified data from these fields may be re-entered into the GeoPortal's search fields if present.

An area of interest in a GeoPortal site may be captured, selected, and written to a disk file. Further screen captures can be made of adjacent and slightly overlapping images after

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changing the position of the image on the screen with the tools offered by the GeoPortal. These may be sequentially numbered using the initially chosen file name as a prefix and combined to produce an image of a chosen area at a larger scale and higher resolution than could be obtained in a single screen capture.

Many GeoPortal sites offer a search option using coordinates in one or more map grids to zoom to a point of interest. Most require entering East and North parameters in separate fields:

```
| Ost: 332500 | (Rechtswert) |
| Nord: 5980500 | (Hochwert) |
```

The content of a field can usually be edited. The value can be highlighted normally. Follow this with Ctrl-C to copy the data to the Clipboard. When two fields must be used, then the operation must be repeated on each field separately.

```
| Ost: 332500 | (Rechtswert) |
| Nord: 5980500 | (Hochwert) |
```

Some GeoPortal sites permit entering the search coordinate pair in a single data entry field:

```
Aerial Images 1 1 Topographic map 1 1 53009 100000
```

After highlighting the search values in the GeoPortal search field or fields and pressing Ctrl-C on the keyboard, the search values are also transferred and displayed on the uppermost toolbar of the AirPhoto/SE GeoPortal page. If the GeoPortal site supports search using the UTM-WGS84 grid and that grid has been selected, a UTM meridian strip field with an attached spinner will also be displayed on the upper toolbar. This permits correct calibration and mapping across meridian strip boundaries if present.
If the Microsoft ICE image compositing editor has been installed and you have saved two or more overlapping selections to disk, you can click on the Run ICE entry of the main menu to see how the separate image tiles align. AirPhoto/SE automatically detect an installed version of ICE. When satisfied with the results in ICE, the Save option from the GeoPortal menu will also write the list of image and coordinate data as a text file. This may be reloaded with the Load option if you have to interrupt your work.

The data is also recorded and saved to a default GeoPortal list text file. There is no limit to the number of areas you can save in ICE and open as a single image in AirPhotoSE. This permits loss-free enlargement of the image or map from many sites.

You can calibrate your result in AirPhotoSE while displaying the saved list text file from which you can transfer coordinate values into the calibration dialogue using copy and paste with the Clipboard. This will avoid numerical typing errors.

Although many GeoPortal sites place markers at the centre of an image found using their search option (as above), few do so in the same way and the markers are all different. If the site permits entering numerical text data near or at a marker automatically, that is very useful. If the site offers the option of drawing a national or international grid, this may be used for calibration. If not, additional tools permit manual entry of markers and grid coordinate values.

A few well designed sites offer both markers at a search point and coordinate values, usually in a national grid.
As shown, the programme can add a marker at a grid intersection showing numerical values, and even if a grid is not shown, the mouse cursor may be placed anywhere and numerical values entered at that point.

In such cases, a text list is kept by the programme for further use in actual calibration of a stitched image with varying overlaps which contains the file names of saved images and coordinate values e.g.

W:\scratch\lx005.bmp Center:   81000   100000
W:\scratch\lx006.bmp Center:   80000   100000
W:\scratch\lx007.bmp Center:   79000   100000

Geoportals are “works in progress”, and perhaps one day, international standards may emerge which make it possible to use the data in the same way everywhere, but that is not so now.
Problems of reconnaissance of the karst landscape – an example of the northern sub-Velebit littoral, Croatia

Vedrana Glavaš

1. Introduction
The Velebit mountain range in Croatia spreads along the Adriatic Sea for 145 km between the Vratnik mountain pass above Senj in the north-west to the Zrmanja River in the south-east (Figure 1). The width of this mountain range varies from 10 to 30 km, with an average of 14 km. Velebit is one of the most impressive karst landscapes in the world. With its numerous peaks, karst valleys and mountain-ridges consisting mostly of limestone it creates an image of a unique area in which each micro-region exhibits particular similarities and incredible differences. Velebit is a Dinaric mountain which, at present attracts mostly hikers, speleologists and various adventurers, but only rarely archaeologists. It is difficult to understand why, although its present low population and harsh climate suggest two reasons and some researchers maintain that this region was not attractive enough in the past for everyday living. However, intensive life on the mountain has been testified by many archaeological remains.

Figure 1. Northern sub-Velebit littoral. Source: Google Earth.

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Until recently, few researchers were engaged in the research of Velebit. However the author of this article belongs to the smaller group of present-day researchers. The author is also writing a PhD thesis on the theme of Romanization of autochtonous *civitates* in the region of northern and central Velebit. Since the Romanization process in this research is observed mostly from the spatial archaeology aspect, all recorded sites and the entire region need to be re-examined and analyzed in a modern way. Aerial photography and its analysis may help achieve this but, apart from the beginnings of such research by Darja Grosman in Dalmatia, these methods have not been applied in the region of the northern sub-Velebit littoral, nor elsewhere in Croatia.

2. Problems of field survey
In this brief review I will describe my reconnaissance of the north sub-Velebit littoral and highlight some problems that I have encountered in the process. Field survey in this region is far from easy presenting thereby a true challenge. As stated earlier, Velebit is a karst mountain with an almost completely bare coastal front, the only vegetation being low shrubs and macchia which make passing through certain areas quite difficult. Extremely strong north-eastern wind (bora), which is characteristic of the sub-Velebit channel and which blows for most of the year, often prevents reconnaissance. Furthermore summer is marked by great heat and droughts. Such climatic conditions were one of the reasons for the spread of transhumance into this area which was active on Velebit until the 1950s. For centuries the population spent summer months on the mountain in search of better-quality grass, pastures and water while relying solely on mountain resources for their own survival. Even today, it is quite difficult to pinpoint several favourable weeks for reconnaissance – at least regarding the meteorological conditions.

The second problem is terrain configuration which considerably slows down the survey of this area. The coastal part of Velebit is bare, rocky and full of natural holes and fissures. Greenery is rare so that, in certain areas, the landscape resembles the Moon’s surface. Difficulties arise when archaeological sites are situated off the present-day hiking trails. Off-road walking is extremely difficult requiring a lot of hiking experience in the karst terrain and good conditions. If the wind is strong, field survey of such areas is impossible because one cannot fight the wind and keep balance when walking on fissured limestone. In such cases reconnaissance is aimed at karst plateaus or the peak mountain zone. In addition some locations cannot be approached in certain seasons due to vegetation. Low shrubs and macchia represent vegetational cover characteristic of the coastal slope of Velebit. For instance, if a site is surrounded by such vegetation it can be analyzed only in winter, of course if other conditions are also favourable. This region cannot be surveyed in one period of the year, but throughout the seasons. Therefore it is necessary to have a carefully made plan, and to be ready to start a field survey at any moment.

Research of Velebit is aggravated by the fact that this region has been poorly explored, and only scanty information is known. There are many research aims, of which the first task is to inspect all the known sites and to locate and map them in space. They have been identified during previous cartographic analyses but the precise coordinates of most sites are not given in the literature. In the earlier publications spatial descriptions were usually used most of which are no longer recognizable in the field: e.g. ‘south of the telephone pole’, ‘20 m north of the road leading towards the village’, etc. Sometimes this presents a problem in locating the sites. In such cases Google Earth can be helpful but not always. Furthermore, the
resolution on Google Earth is low, and aerial photos are usually not available. In Croatia, orthophotographs were made for certain state institutions but their high cost and my limited financial means sometimes prevent their use.

The second aim of the research, which is conducted intensively and which will last for years, is a study of locations on which an archaeological site has not been recorded but where some other factors (toponym, terrain configuration) indicate its possible existence. In that case, first Google Earth images are examined in search of archaeological structures as well as any orthophotos which we have. Then the field survey is carried out and locations recognized as potential sites from aerial photos are examined as well as the entire surrounding area in quest of all structures which do not have characteristics of more recent building. If a new site is found, its precise location is recorded and all the necessary documentation is made. Newly-discovered and previously known sites are introduced into a GIS for more detailed analysis.

Written sources about Velebit are also meager. In an isolated region such as Velebit, oral tradition plays an important role in any field survey. In talks with the sparse local population I often heard legends about the “buried treasure”, “pot of gold”, “Turkish cemetery” and “Greek well”. Interviews with local shepherds and peasants are a part of this research, and legends related to a certain location regularly indicate an archaeological site. However the problem is that presently there are few reliable story-tellers as only few people still live on the mountain. In such situations every interview with a story-teller must be recorded, documented, and the information needs to be verified.

Since Velebit is a mountain which (fortunately) has few roads, many of which are not negotiable by car, it often happens (if meteorological conditions are ideal) that a few days are lost in a futile search for a site. Therefore lengthy, sometimes several-days-long walking is necessary. A lot of time and energy is lost in coping with the terrain which makes patience the key to success in such situations. After several years of continuous reconnaissance I still have a feeling that I have not moved from the start. Therefore new methods to “search” for sites seem necessary in order to accelerate this process. This is inevitably aerial archaeology although any features identified must be visited in the field to determine, if possible, the chronology of each site.

3. Research possibilities
On the coastal side of northern Velebit there are no agricultural activities at present since suitable land is almost completely absent. Although along the sub-Velebit littoral there are two characteristic plateaus with karst fields which used to be pastures for the cattle, this is no longer the case. The population has gone, as well as cattle-breeding and soil tillage. Once meager, but still usable, fields are overgrown with macchia, and erosion, helped by the influence of atmospheric agents, made the soil disappear in the karst fissures. What is presently visible is bare karst. The bora, which blows for most of the year in the sub-Velebit channel, also acts to remove cultural layers. Due to the strength of the bora, northern sides of any sites without vegetation are almost completely lacking a cultural layer. That is one of the main reasons why the hill-fort sites are completely bare and without sediment.

That is why, despite the fact that there is a great number of sites on the coastal slope of Velebit, it would be pointless to excavate some of these because the cultural layers are almost or completely missing.
However the situation is different at certain sites and we can create two categories of hill-forts based on their state of preservation. The first group is the smaller and consists of hill-forts which probably functioned as central settlements of Iron Age and later communities. They stand out in the landscape, and regularly contain a cultural layer which, if excavated, would provide an insight into the stratigraphy of the site although depth and survival are likely to be poor. However, all, or most, of these sites have a high level of erosion which is why preservation of the layers is questionable.

The second group of hill-forts is more numerous and consists of sites at which cultural layers are totally lacking because weathering has completely removed the soil leaving only karst and the defensive walls. Such settlements, perhaps used seasonally, functioned as residential units of a smaller group of people, dependent on a larger nearby centre.

Let us consider the site of Jablanova (Figure 2) in the vicinity of Sveti Juraj. Here we can suggest there was a paired system consisting of a great plateau, which was used for dwelling, and a prominent hill nearby, used for controlling the wider area. It is not possible to conduct classical archaeological excavations of the entire site which would offer an insight into stratigraphy. Rare pottery sherds which were not removed by erosion, can be dated to the Iron Age. Nothing more can be said about this site. On the once-inhabited plateau there are architectural remains as well as terraces formed by filling the fissures with smaller undressed limestone rocks. There is no cultural layer. The only thing that determines this location with certainty as a site is a wall in which some pottery sherds were found. It is evident that the archaeological research with the aim of determining stratigraphy of the site cannot be carried out. In such cases we can apply spatial analysis, mapping, conservation and presentation of the site. Considering the great number of sites in a similar condition, procedures of conservation and presentation of the site will probably have to wait for a while.
Figure 3. Remains of the boundary wall *inter Ortoplinos et Parentinos*. View from north-east.

Figure 4. Remains of the boundary wall, which extends in the NE-SW direction, are significantly easier to notice from the air (orthophoto) than during field survey. North is to the top. Source: ARKOD.
4. What is visible on the aerial photos?

Classical field survey in the Velebit region results in quite limited conclusions about the sites. If we focus research towards reviewing each separate site in the context of the entire landscape from the bird’s eye view, we can get a wider perception of the space, and better understanding of certain phenomena and human activities in space.

Practical applications of aerial photography, as a research method, are still poorly developed in Croatia. One of the reasons might be insufficient knowledge among archaeologists about the possibilities and cost-effectiveness of aerial photos although the price of orthophotos in Croatia is still reasonably high. On the photos that are in my possession, it is not always possible to distinguish a dry stone wall of the hill-fort from the rest of the surrounding karst. Crop marks are rare in this area due to lack of surfaces covered with vegetation. That means that aerial photographs might be obtained regardless of crop growth throughout the year, if the meteorological conditions are favourable. However there are situations when a site can be noticed on the basis of growth of macchia and low shrubs. The boundary wall in which Dolabella’s boundary inscription was found in situ is clearly-visible on the ground and from the air (Figure 3, 4). This inscription represents a boundary between Ortoplínos et Becos, two civitates, which extends 2,5 km in the NE-SW direction from sea towards the Velebit mountain. Macchia grows in the areas around the boundary dry stone wall but not upon it. Even an experienced eye will have difficulties in distinguishing this wall from the hundreds of recent dry stone walls which are almost identical regarding their building technique. On Google Earth the wall is barely visible, and it would probably remain unnoticed without previous knowledge of its position. Lower altitude aerial photos would definitely give a better view of the entire situation enabling easier location and interpretation of the site. Therefore I believe it is necessary to make aerial photos of the explored area.

5. Conclusion

Survey of the sub-Velebit littoral includes ground reconnaissance in difficult conditions, under extreme meteorological circumstances, in a landscape where only an experienced researcher can notice certain archaeological remains. Some stone structures may be noticed easier if photographed from an aircraft. This will enable better comprehension of the sites in their topographical and landscape context. Until such purpose-made aerial photographs are obtained, we are forced to use Google Earth and orthophotos which do not provide sufficient information.

Research on Velebit offers answers to questions asking why and how this region was inhabited, what the way of life was like and why certain locations were chosen instead of others. Velebit can only be understood if we spend more time on this mountain. Only field survey of this region, which seems absolutely unsuitable for life at present, can help us in understanding the previous living, which is necessary for all other analyses.

However analysis of photographs taken of Velebit from the bird’s eye view would enable much faster, more efficient and more economic realization of reconnaissance on the mainland as well as better understanding of the sites’ distribution and the entire region.

Impetus for writing this article was participation of the author in the Aerial Archaeology Training School in Kostolac in Serbia and a conversation with Rog Palmer to whom I tried to explain problems I had encountered in the reconnaissance of the karst landscape. Thereby I became aware of the potential of aerial archaeology and various possibilities which might facilitate field survey of this region.
News from New Zealand

Kevin Jones

Our Antipodean Kevin Jones, in New Zealand, reports that he made four long winter flights in 2010: over Auckland City (by helicopter), the Kaipara Harbour hinterland, the Waikato/Thames Valley and Hawke’s Bay. All areas have high concentrations of pa (hillforts).

Mangere Mountain, Auckland City, terraces, fortifications, storage pits ?600-200 y BP.

Gravel quarries (on terrace near edge of Lake Karapiro) c. 200-400 y BP, gravel added to gardens to assist heat and moisture retention.

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Earlier in the year Kevin recorded the c. 1937 Baring Head lighthouse reserve, near Wellington, using a 1941 vertical aerial photograph. Baring Head was a lighthouse and signalling station and radio beacon site; during WW II it was a radar station.

Baring Head lighthouse reserve area 17 February 1941. North is to the top. Crown copyright photo New Zealand Aerial Mapping no. 24773.

In 2009 Kevin had continued his interest in urban subjects, with an oblique aerial photograph series of Christchurch. Much of the city was struck down with biblical force in September 2010 and February 2011, the latter very destructive with remarkably high vertical accelerations of 2G. Land Information New Zealand carried out 10 cm colour orthophotographs of the damaged areas.

The photos are available at:

Kevin has also been doing some World Heritage related work on Pohnpei, a Micronesian island. Nan Madol is a complex of archaeological sites that comprises a set of stone-walled artificial islets constructed in channels that are situated on the inner part of a reef platform. Dating from as early as AD 500 there are about 100 archaeological features, a few of which still stand to the original full height of approximately 6 m. There is an excellent photograph on Google Earth at:

<table>
<thead>
<tr>
<th>Lat</th>
<th>6° 50' 21&quot;</th>
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<tbody>
<tr>
<td>Long</td>
<td>158° 19’ 42”</td>
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Flying in a Rainy Spring: Romanian Surveys in 2011

Irina Oberländer-Târnoveanu and Carmen Bem

Spring and early summer were very wet this year and we hardly found a suitable day for flying. That special day meant not just a no-rain day but the happy combination of weather, availability of the pilot, our own availability, equipment ready and planning at short notice. We missed at least two perfect clear days this way. What a loss at a time of such instable climate!

We continued to explore the landscape of Southern and South-East Romania, a project we started in the frame of the project European Landscapes: Past, Present and Future (Culture 2000 Programme, 2004 – 2007), enlarging the survey both towards East – by crossing the Danube in Central Dobrudja to the Black Sea Coast – and towards North – in the Sub-Carpathians hill area of the Prahova County (Figure 1).

Figure 1. The seven flight routes in 2011 on Google Earth.

Compared to the Danubian Plain we were already familiar with (along the Mostiştea, Neajlov, Argeş, Vedea and Teleorman rivers), the new areas offered a different landscape and photographing experience. Our main goals are to better geographically locate the sites recorded in the National Archaeological Record database, to contribute to the aerial photo archive of the European archaeology and to monitor and document changes in the landscapes that might put our cultural heritage in danger.

Not having much choice in deciding on the theoretically best period for aerial photos because of the unstable weather conditions, we had at least the opportunity to get familiar with different soils, river beds, linear archaeological features, sites and monuments, village and cemeteries patterns and help with aerial views of preventive excavations along the future

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motorways between Cernavoda and Constanța (in Dobrudja), and between Bucharest and Ploiești, in Ilfov and Prahova counties (Figure 1). We had four aerial surveys which include, in fact, seven flights: 1) 26 - 27 March, Ploiești/ Strejnic Airport – Constanța/ Tuzla Airport and back next day; 2) 29 - 30 April, Bucharest/ Cîlțești Airport – Constanța Tuzla Airport and back next day; 3) 28 - 29 May, Bucharest/ Cîlțești Airport – Constanța Tuzla Airport and back next day; 4) 17 June: Prahova. In total there were 19 flight hours. That is more than in the previous years and was possible due to our participation at the new European project Archaeolandsapes Europe (2010 - 2015) and its financial and logistical contribution.

The first three aerial surveys covered the Ialomița River Valley, the Lower Danube, and Central Dobrudja, an area first explored last year. We focused on some archaeological features identified in 2010 on the high southern terrace of Ialomița River and the line of fortifications known under the name of Trajan’s Vallum, crossing Central Dobrudja from Cernavoda to Constanța. The last ones were surveyed among others, by Ioana Bogdan-Cătăniciu and Ioana Oltean but the area is so rich in archaeology and so menaced by modern infrastructure (A2 motorway construction at present) and agriculture that documenting what can still be identified is never enough. We used several sources: old maps, satellite images, recent publications and archaeological reports.

Along the fortification lines consisting of earth and stone vallums crossing Central Dobrudja East – West from Constanța (ancient Tomis) to Cernavoda on the Danube we documented several Roman castra and towers (Figure 2), fortified precincts, medieval villages and other features. Some fortifications described in the 19th century and documented by Carl Schuchart on aerial photos during the first World War were destroyed later in the 20th century by infrastructure works, industrial exploitation, mechanised agriculture and vandalism (among these stone quarries in Medgidia, the Danube – Black Sea Channel, roads, irrigation channels and military works) while others cannot be identified anymore at ground level.

We learnt that the best time for taking photos in this area between the end of March and the end of May is late afternoon (17:30 – 19:30), when the humidity is lower and the shadows more visible. We also found that satellite images on Google Earth are not always informative because they are taken at times and seasons that are not the best for recording archaeological features. Some archaeological features we photographed are not detectable on Google Earth: compare, for instance, in Figure 3a our photo with the Trajan’s Vallum and the same area in the satellite image dated 26.08.2005 on Google Earth (Figure 3b).

On the Ialomița River we took photos of very interesting unknown sites such as that of Axintele (Ialomița county), a fortified Iron Age (?) settlement with double ditches and a central entrance gate flanked by two towers built in wood and light material (Figure 4).
Figure 3.a. The vallum and two Roman camps. Aerial photo: CIMEC 2011 (Carmen Bem).

Figure 3.b. The same area, satellite image on Google Earth 2005. The fortification on the right is not visible.

Figure 4. Fortified unknown Iron Age (?) settlement at Axintele, Ialomița county. Aerial photo: CIMEC 2011 (Carmen Bem).

Figure 5. The promontory of the Middle – Late Bronze Age cemetery in Cămpina-Slobozia, St. Nicholas Church. Aerial photo: CIMEC 2011 (Irina Oberländer).
The last survey explored an area north of Bucharest, very different from the landscape we were used to, especially in the higher hill area between the Middle Prahova Valley and the Teleajăn Valley. Seeing this area from the air for the first time, we were a bit unsure and could not entirely follow the initial plan. We were surprised how features on the map look like from above, found and shot some sites by chance and were not able to identify others. Flying late in the afternoon proved unwise because the river valleys are much narrower than in the plain areas and therefore darker and misty late in the afternoon. We also noticed how quickly the weather is changing in the upper areas because of the proximity of the high Carpathian Mountains. We surveyed some known archaeological sites such as the Roman earth camp of Sfârleanca, Prahova county, dated between 106 and 118 A.D. and placed in a strategical location at the border between lower and higher land and at the crossing of two river valleys going up towards the mountains) or the Middle Bronze Age cemetery of Câmpina – St. Nicholas Church in Slobozia neighbourhood, on the upper terrace of the Doftana River, close to the Prahova Valley (Figure 5). We took spectacular photos of medieval churches and manors (Bellu Manor Museum in Urlați, the archaeological site of Târgșor Vechi) and of a modern abandoned prison, Doftana (in Telega, Prahova County), built in 1895 – 1897, former communist memorial museum until 1990 (Figure 6), remains of salt exploitation (in Telega) and oil fields (North of Ploiești).

We made no new finds and sometimes the light was poor, causing us to miss some of the known sites, but our Prahova survey was still interesting and taught us some lessons for future investigations. We plan to come back in late autumn when soil marks may be more visible in this green area.
Cropmarks 2011 in Poland – is there a need for further discussion?

Włodek Rączkowski

Introduction – what do we know about the origin of cropmarks?
From the beginning of aerial archaeology, cropmarks have been a subject of great interest to archaeologists therefore, by now, we should have identified the factors influencing their appearance. From experience to date we all know that dry periods in particular affect the emergence of cropmarks. However, our knowledge of the complex processes which take place in the soil, buried archaeological features, vegetation etc., is based more on a common-sense approach than in-depth investigation. A more detailed analysis was undertaken in the 1970s when the connection between differential crop growth and moisture levels was identified by Jones and Evans (1975) who referred to pedology and crop cultivation. Evans and Jones (1977) analysed a series of aerial photographs of two archaeological sites (Glenlochar, Kirkcudbrightshire and Fisherwick, Staffordshire) taken over a number of years. The aim of that study was to explain the mechanisms causing the differential crop growth. Cropmarks in cereal fields usually appeared under dry conditions when there was less moisture in the top soil and a potential soil moisture deficit (PSMD) of approximately 50 mm arose (Evans, Jones 1977: 63). Information on PSMD can now be found online and may be used when planning aerial survey.

The in-depth analysis of soil types, sorption properties, the observation of PSMD levels and the resulting differential crop growth led the authors to define a number of regularities (Evans, Jones 1977: 75). First, if the soil moisture deficit increases in relation to the potential capacity of the soil then such conditions encourage cropmarks to emerge. Second, the depth of the soil affects how much water is held within the profile and cropmarks may appear (when the deficit of moisture is high) more in areas where the soil is deeper as compared to where it is shallow. Third, if the bedrock is compact and drainage is poor then weak cropmarks may emerge even during very wet years. Fourth, if a soil moisture deficit leads to the appearance of cropmarks then they will remain visible even if later rainfall provides a better water supply that levels out this deficit. Fifth, cropmarks on grass (pasture, meadow) compared to cereal crops cultivated on the same soil, appear when the soil moisture deficit is higher. Sixth, soil maps are useful for the prognosis of the probability of cropmarks appearing.

Similar studies were carried out by Riley (1979: 31) around Doncaster and Nottingham. He pointed out that apart from PSMD, the type of crop cultivated and if whether it was a winter or spring crop was also important. Riley showed the process of cropmarks appearing and changing using photographs of Standlake, Oxfordshire, where from 4 June to 16 July 1943, he regularly took photographs of barley fields. In his comments on the role of PSMD he pointed out the significance of which crop is being cultivated as the rate of water evaporation is affected not only by the soil type (heavier soils hold moisture for longer – also Riley 1983: 72), but likewise by the crops growing there. The speed with which water evaporates from the leaves is fundamental and so, therefore, their surface area may have a significant impact on the occurrence of PSMD.

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Considering the importance of the relationship between how much water is available for crops and the appearance of differential crop growth, further investigation in this direction was deemed necessary. Water plays a decisive role in the nourishment of plants as it contains the chemical compounds which are essential for their growth. Nitrogen and calcium are of particular importance. Their presence in the soil significantly influences how other elements are absorbed. Nitrogen accounts for how plants look, their height, greenness and the duration of vegetation. Calcium is responsible for how the sources of nourishment to be found in the soil are exploited by the plants themselves. Acidity levels can affect the absorption of phosphorus, magnesium, copper and even nitrogen and as a result, plant size and colour (Wilson 1982: 55).

For Martin (1971), the analysis of how often cropmarks and soilmarks emerge under certain soil and climate conditions became the basis for the formulation of the theory that it is possible to predict their appearance. The properties of the soil and the amount and frequency of rainfall determine when cropmarks and soilmarks appear and how long they may be visible for. Depending on the year, this period may vary by even up to six weeks.

Having such knowledge at our disposal we can then plan aerial survey and expect positive results. Furthermore, it is relatively easy to find information on PSMD, rainfall levels and the soil types in the regions which are of interest to us. It seems that we are properly prepared for what we may see from the air.

**Aerial survey 2011**
Prospects for aerial survey in Poland in 2011 looked promising. On one hand this was due to financial support, and on the other, to the spring drought which had lasted for quite some time. This year's aerial survey was financed by ArcLand, the National Heritage Board of Poland together with the University of Szczecin (as part of the project recording megalithic graves in NW Poland) and the Institute of Prehistory at the Adam Mickiewicz University in Poznań (the Kujawy Region) (Figure 1). When planning aerial reconnaissance in this part of Poland, knowledge of the soil types is not a major issue for me. This is due to the fact the the soil in this region is patchy and ‘multi-component’ as a result of the last glaciation. Generalised soil maps do not show the local conditions, small areas of specific soils (Kierszys, Rączkowski, Żuk 2007: 56-57). Our expectations and the aerial survey plans were based on the identification of the moisture conditions in 2011 and had to fit around various other commitments. As a result, aerial survey focusing on photographing cropmarks took place in two phases: 21-28 June and 14-19 July.

Figure 1. Aerial survey in Poland – June-July 2011. Source: author.
My experience so far has shown that in a “normal” year the end of June is still a little early for the observation of clear cropmarks in this region of Poland. However, as spring 2011 had been very dry we were expecting cropmarks to be visible already in June. The area affected by drought covered the whole of the north-west of Poland (Figure 2), including the area of the planned reconnaissance. It was reminiscent of the situation in 2000, and so expectations were running high. The clarity of the cropmarks was not so bad but not quite up to expectations. What is more, the fact that the crops were in a quite advanced state indicated that the harvest would be very early and may well be in progress by mid-July. This would have a negative affect on the results of the second phase of the aerial survey.

The weather deteriorated at the start of July and the rainfall meant that the harvest began in mid-July, only a little earlier than usual. This rescued the flying season in the last two weeks of July. This time, the cropmarks were extremely clear and readable (Figure 3).

Questions (and answers?)

The fact that the clarity of cropmarks varies during the growing season is nothing surprising. But after thinking about this year's results a few doubts emerged. I had always considered, to put it rather simply, that drought provided good conditions for the appearance and visibility of cropmarks. This time however, this mindset let me down (at least to a certain extent). Paradoxically the situation had arisen where after (or during) a drought the cropmarks were relatively well defined, but were much better after rain. Therefore I asked myself two basic questions:

- why were the cropmarks less defined in June than I had expected, despite the long drought?
- why, despite the rain at the start of July, did the cropmarks become more visible (Figure 4)?
Intuition and the information I had gathered loosely led me to arrive at answers which I consider to be justifiable. This does not mean however that I am right and I am open to other suggestions. In trying to find the answer to question 1, I decided to look at the problem from a wider time perspective than just the two-month drought. Wielkopolska is a region which for some time has been recorded as having a low level of precipitation (rain, snow). Average rainfall is about 500-550mm annually which is less than other regions across Poland (Woś 1994). Winter 2010/11 brought quite a lot of snow which lay on the ground for a relatively long time. The snow melt significantly affected the moisture levels in the soil. The spring drought of course did have a negative effect on crop growth (Figure 5), but this was tempered by the level moisture in the soil (particularly in the subsoil). As a result the main factor affecting the appearance of cropmarks – the deficiency of moisture – may not have been sufficiently intense, especially as far as winter crops were concerned.

In so far as such an explanation may be acceptable in regards to question 1, then what happened in the first two weeks of July causing the cropmarks to suddenly become so clearly visible? My attempt to find an explanation here moves in a slightly different direction. A long drought (Figure 5) clearly weakens the plants due to disturbed nutrient sources, even if this does not immediately result in visible cropmarks. Any irregularities in growth connected to drought also affect areas where the plants are less resistant to various diseases. The rainfall at the beginning of July (Figure 5 – final map) created good conditions for an increase in some diseases and molds. It is in such conditions (damp and warm) that the saprotrophic black mold, mainly from the Cladosporium genus, occurs. This colours the stalks and leaves a characteristic dark brown-black. The crops which are even just a little stronger (ie., positive cropmarks) are able to “defend” themselves longer and remain lighter in colour. This in fact provides a good contrast and makes differentiation in field conditions clearly visible. If this response to question 2 is acceptable then it seems that PMSD is not the only factor that affects the visibility and clarity of cropmarks. This indirectly affects other processes – eg., biological
Figure 5. Changing of Climatic Water Balance in the period from April 1st to July 20th. Each map represents situation in 10 days sequence successively. Source: www.susza.iung.pulawy.pl

– which can strengthen or weaken the cropmarks. The situation in other parts of Europe (eg., in Hungary – Czajlik 2009; Czech Republic – Gojda 2004; Germany – Christlein, Braasch 1982; Schwartz 2003) is similar. This is unlikely to be a fundamental aspect and local conditions affect biological processes in various ways. So each time we have to face a complicated knot of many factors which affect strength of action. Perhaps this is the reason why cropmarks so often “surprise” us, sometimes appearing, sometimes not.

Conclusions
A critical review of the cropmarks of the 2011 season points to the fact that more in-depth study on this topic is necessary. Research carried out in the 1970s focused mainly on one point – PMSD. Perhaps it would be worthwhile investigating the influence of other factors? I think that only by furthering our knowledge of this method will we be able to properly evaluate the effectiveness of aerial survey, understand the presence or lack of cropmarks. Not only is the aspect of archaeological features affecting crops important, but also the visual result. After all, this has a significant influence on whether or not we recognise the presence of archaeological features. My intuition does not necessarily have to be adequate, but it may inspire someone else to investigate deeper.

References


**Editor’s comment**

This issue of *AARGnews* was held until this contribution had been completed. Reading it – and subsequent email discussion with Wlodek – gave rise to a number of questions that have also been floating around in discussion by, and with, Bob Evans as a result of our involvement with DART and a lunchtime meeting with him in the past couple of weeks when he came to talk about Johanna Dreßler’s research. If I remember things correctly, some points can be summarised as follows:

The papers of the 1970s that pointed out the relevance of SMD were crucial in helping aerial photographers to begin to understand why, when and how crop marks may develop. Bob Evans revised his work in 2007 (in Mills and Palmer (ed) above) and has also noted that cereal crops of the 1970s (let alone those that Derrick Riley photographed in 1943 and used in his 1979 analysis) are very different to modern varieties which are shorter and have different leaf arrangements. Is new research or analysis needed to account for those crop differences?

Farmers now have the technology to selectively squirt small areas of each field in an attempt to balance the effect of soil type and depth so that crops ripen equally and at the same time. Are we likely to ‘lose’ archaeological information because of this? And, if so, is there anything we can do about it?

How useful is this ‘in depth’ knowledge anyway? Do we need to progress beyond the basic concept that a dry year gives us good crop marks? Are crop marks in April, or a dry May or June, a reliable sign that we need to commission vertical surveys or satellite passes rather than messing around ourselves trying to notice, then photograph, features in many individual fields?

We think there may be the potential here for a session at a future AARG meeting.
Happy Lands Enclosure at Wiggold, Ampney Crucis, Gloucestershire

Bob Bewley\(^1\) and Tim Darvill

Serendipity plays such an enormous part in the world of archaeology, and especially in aerial
reconnaissance. An e-mail from Tim asked if I happened to be doing any flying and, if so, would
I look at this site, which I had been keeping an eye on for him. By chance I was able to fly over
the site, during the excavations, and on the same day that there was a geophysical survey on site–
testing new kit. The reason for publishing it here is that when I popped in to see the excavations I
realised that the site was visible because of the promoted growth of dock weed (\textit{Rumex crispus or
obtusifolius}); not a plant known for its crop-mark potential, but everyone knows “dock leaves”,
for their healing properties – having been stung by nettles. If you look closely you can just see
the edge of the enclosing ditch in the wheat crop (top). The farmer had obviously cordoned the
area off (before sowing his wheat) so that excavations could take place in June.

The site was first recorded as a ring-ditch by O.G.S. Crawford on 19 May 1931 while travelling
by train along a now-defunct line. The enclosure is about 60m by 45m and is being investigated
as part of the Wiggold Prehistoric Landscape Project led by Tim Darvill of Bournemouth
University. Excavations in June 2011 suggested a two-phase development, with a pair of small
concentric ditches, the outer of which was recut around the west side as a massive rock-cut
boundary ditch 2m deep and about 3m wide. The site is not securely dated yet, but geophysical
surveys suggest that parts of the ditch circuit are causewayed. Other sites discovered in the area
include two three-sided Bronze Age enclosures, one dated through excavation to the Middle
Bronze Age, and a previously unrecognized Neolithic long barrow. Further details at:
http://eprints.bournemouth.ac.uk/6212/ and in Professor Darvill’s recently published book
Prehistoric Gloucestershire (Amberley Press, 2011)

The strange contraption on the back of the Land Rover is an array for geophysical survey, being
undertaken by staff from the Römisch-Germanische Kommission of the Deutsches
Archäologisches Institut in Frankfurt using a 16-sensor SynSys Gradiometer, pulled by a Land
Rover. The system provides readings at 25cm intervals at a transect spacing of 25cm and, with
GPS georeferencing, provides rapid high resolution surveys.

Photo by Bob Bewley. May 31st 2011

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Comments on flying, observations and photographs, 2011
(in no particular order)

Denmark
Flying in Denmark has been very bad this year because of the weather (dry April, but after that lots of rain and wind, and very little sun). So I think there is nothing to write about. We were very lucky at the AA school because there was a small area in the Southwest of Jutland where conditions for crop marks were quite well.

Lis Helles Olesen

The Netherlands and Greece
I can inform you that in March and May 2011 I performed flights in my country, The Netherlands. This concerned a small freelance job, assigned to me by the province of Drenthe. I focussed on the possible location of a lost Medieval water mill. I combined aerial reconnaissance with photo interpretation, GIS mapping and spatial analysis of all available information. This included historic aerial photographs, ancient topographic maps, LiDAR data, a multispectral image and other data. I also performed field reconnaissance, so it became a very 'complete' non-destructive approach! The result was a hypothesis about the location of the mill, the water systems and I also discovered other (possibly archaeological) features such as old roads, field systems, farms and changed river beds.

Because of the terrain (grassland) and land use, it proved to be a complicated job. I hope this job will lead to more similar jobs: as you know aerial archaeology is not a common approach in archaeology.

As far as my research in Greece is concerned: the Zakynthos Archaeology Project is now finished (2006-2010) and sadly aerial photography was never incorporated in the project, in spite of the intention. I tried very hard to make it possible, but due to the combined factors such as Greek legislations/restrictions and the project director's decisions, aerial reconnaissance is missing in this fascinating project. Historic aerial photographs were the information resources that I had to focus on, which led to the discovery of many sites that were skipped during field survey because of their marginal terrain.

Fortunately, I was selected for participation in the AA training school in Denmark. There I photographed many amazing archaeological features! Peter Horne was also impressed by what could be 'seen' from the air in Denmark. Bravo to the teachers Lis, Wlodek, Darja, Peter, Matt, Chris and others.

So far my update concerning application of aerial photography. So far, none of the other members of DECARS (Dutch Expertise Centre for Archaeological Remote Sensing) performed aerial photography in 2011.... Not even Willy Metz did, though she intends to start again soon!

Anke Stoker - The Netherlands
DECARS - ArcheoSynthese - the Zakynthos Archaeology Project

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DART - progress report, 20 June 2011
Two local aerial archaeologists, Robert Bewley (Cirencester) and Rog Palmer (Diddington) are undertaking regular flights over both sites. These photographs can be found on the DART website: http://dartproject.info/WPBlog/?page_id=63. On the 27th June 2011, the Environment Agency undertook a CASI hyperspectral, LiDAR and vertical photograph survey. These are collected at a ground resolution of 1m, 1m and 0.25m respectively. The LiDAR and vertical photographs cover approximately 20km² around each site and the CASI covers approximately 3km². In addition we put in a bespoke application to NERC’s Airborne Research and Survey Facility for hyperspectral flights after observing the impact that the ‘1 in 100 years’ drought event was having on cropmarks at Diddington. This was submitted on Friday 10th June, approved on Monday 13th June and flown on Tuesday 14th June. Many thanks to NERC for this flight. Concurrent spectro-radiometry readings were taken for both the CASE and NERC ARSF flights to compensate for atmospheric effects.


Ant Beck³

News from the Eastern part of Belgium
A few years ago, the Inter-municipal Archaeological Service PORTIVA became active in the vast area around the actual town of Tienen, a former Roman vicus in the heart of the Hesbaye loess region.
In cooperation with the aerial prospection team of the University of Leuven several systematic aerial survey flights have been flown over the PORTIVA area. Due to the extremely dry weather during the spring of 2011, in particular the months of April, May and June the aerial surveys were very successful and revealed spectacular new sites from different periods. Most of these sites showed up as cropmarks. Hereby we show a Bronze Age burial mound that emerged in June this year, a totally unknown site. The picture was taken in the immediate vicinity of the town of Tienen.

René Pelegrin⁴ – Luc Corthouts – Marc Lodewijckx – University of Leuven (K.U. Leuven)
Tom Debruyne – Inter-municipal Archaeological Service PORTIVA

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Summer 2011 England

After a harsh winter England experienced another dry spring and early summer. In April and May cropmarks were developing well across most of the country. By the beginning of June observations from local fliers and English Heritage (EH) reconnaissance teams suggested a good cropmarks season was likely and drought conditions were officially declared in parts of the country. Poorly responsive soils were particularly productive in East Anglia, parts of the East Midlands and the East Riding of Yorkshire. In the southern half of the country conditions in Bedfordshire and Cambridgeshire were similar to those in 1996, with many new sites recorded and new detail added to known ones. Here the majority of sites were late Prehistoric settlements, some of which were visible beneath ridge and furrow. The Suffolk clay lands proved to be relatively productive, especially inside the Military Air Traffic Zone at RAF Wittering. Helen Saunders in Essex reported that she had not seen the clay soils so responsive since she started flying in the late 1990s. As with Scotland the extreme north of England saw plenty of rain throughout the summer. South of the River Tees it was a different story with the glacial tills and boulder clays of Holderness in the East Riding of Yorkshire rewarding several flights with a high number of cropmarks, many reflecting sites of a complexity not commonly seen in the area. In Lincolnshire it was also the glacial tills that lie between the upland chalk and the low lying coastal plain that gave a good return on new sites. The coal measures in South and West Yorkshire also delivered a number of new sites. Unfortunately rain in the west ruined the cropmarks in late June and prevented teams in Herefordshire and Shropshire from getting airborne. The bad weather then spread further east at the beginning of July at a crucial time for cropmark development.

Damian Grady\(^5\) and Dave Macleod

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Cartigny Cropmarks, Switzerland.
Approaching Geneva Airport from the south west on an Easyjet flight on June 30th 2011, this time I was ready with my camera (Lumix TZ20), as I had spotted these cropmarks the previous week. The pilot positioned the aircraft perfectly for the photograph, not surprisingly as we were on finals, 5 nm, SSW of the airfield. The cropmarks look to be a series of pits (tree holes?) perhaps part of a former avenue leading from the main house to an orchard; is the circular enclosure perhaps an earlier ditch for the original copse?

Robert Bewley


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Hill End Farm, TL202237, Hertfordshire, UK
Near the end of a Wizz Air flight to London-Luton on 11th July 2011 I observed a cropmark in a field near the Hill End Farm. The weather was cloudy, grey sky with sunny intervals and the picture was taken about 7 km from the airport when the aircraft was quite low. We landed at approximately 2.50pm.

The feature is clearly archaeological, of roughly rectangular shape with rounded corners. It is double ditched and, in one of the shorter sides, a gap in both ditches is evident and is probably the entrance. Near the entrance is another type of feature indicated by cropmarks – part of a small circular ditch. There may be other structures in this field which could not be observed on this date.

The photograph also includes sufficient control information for the photo to be transformed and the site to be mapped. There is, of course, some distortion because the site is near the curve of the window but this seems to be the only record of the site as no photographs of it were found in red boxes at NMRC.

Jana Platichova

© Jana Platichova, 11 July 2011.
Bullock’s Haste, Cottenham, Cambridgeshire
The upper photo was taken in April 2011 during a flight to photograph excavations and alerted me to the possibilities of crop marked features in light soils (this is on river gravel). The photo below was taken late in August 2011 of the same field. This was during a tourist trip with Johanna Dressler who, at the time, was an ArcLand-funded student with me. We noticed a couple of other murky crop marks on this flight but I’m a bit puzzled by the clarity at Bullock’s Haste. Zoomed in, it is clear that there are vehicle marks all over the field so presumably this site is indicated by regeneration after harvesting. Any comments from the aerial botanists among you?

Rog Palmer

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Air Photo Services is 21

Rog Palmer¹ and Chris Cox²

Those of you with good memories or access to AARGnews 1 will remember a note on page 8 about our fledgling company, Air Photo Services. At that date, its longevity was a tentative prospect and was certainly not something that we would have foreseen as a means of keeping both of us alive and busy for the next 21 years. We celebrated this in August with a field trip to Avebury and environs plus a pint or few.

Our contacts in 1990, the date of AARGnews 1, were very few. Chris was doing some flying over the west Cambridgeshire clay that was funded by RCHME (in the good old days of exemptions) and Rog was doing occasional work for one or two local units. In the early years we put some effort (and beer) into meeting with, and convincing, county archaeologists that including requirements for expert interpretation of APs in briefs for pre-development work was a good thing and that certainly paid off and tended to define those parts of the country in which we worked. That spread a bit, especially after Alison Deegan (who we – mainly Chris – took on as a trainee sometime way back) established a similar operation in and around West Yorkshire. There is, however, still a tremendous national variety of opinions among county archaeologists and contracting units about how the air photographs ‘should be done’. Some are happy with scrawled ‘cropmarks’ on a 1:10000 map, others insist on 1:2500 level work that shows archaeological and non-archaeological features such as will (or should) be seen by diggers once topsoil has been removed. We know that many archaeologists and often the developers (who can, for example, avoid laying pipelines through backfilled quarries) find this useful.

APS has also extended into legal disputes – something we hadn’t thought of when we started in 1990 – but sometimes the aerial photographic evidence can be a primary source and the work has given us a few funny stories… Such as the ex-RAF interpreter who claimed there were bales of hay in a field after examining 300 dpi files, whereas stereo examination of 1:2500 enlargements showed the ‘bales’ to have four legs and to move. Or the bloke who suggested that bushes covering part of a caravan could be cabbages. Chris is the person to ask about legal work – Rog hates it.

Work at APS has been varied during the past 21 years but always interesting as the location of mapping projects are not chosen by us. Aerial photos, lack of photos and absence of control points can be frustrating at times as is our need for digital map data related to the National Grid contra the sometimes do-it-yourself maps made by, or for, developers. The flow of work is uneven and we have both had gaps when we began to think of looking for other jobs and the opposite where we have been juggling six jobs at the same time. If you want an easy life and steady income please avoid freelance work of this kind, but if you want varied work, a boss who will give you time off when you want it (more or less), and sufficient money (eventually) for survival then it may be an attractive alternative to working for someone else.

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The English Landscapes and Identities Project

Press release dated 12 July 2011 (Lucy Palmer)

A new five-year project is announced today looking at the history of the English landscape from the middle Bronze Age to the Norman period. The English landscape of fields, trackways and settlements is an ancient one. While much has changed over the 3,500 years since the agricultural landscape was laid out, surprising continuities exist. ‘The English Landscapes and Identities project’ will use a mass of mapped data for the period from the middle Bronze Age to the Domesday Book (AD1086) to explore continuities and changes in the use of the land in different parts of England.

The results will be publicly available on a website to be called ‘A Portal to the Past’, which is being created by the School of Archaeology at the University of Oxford. The project with funding of €2 million from the ERC (European Research Council) will not only map the whole of England, but also allow the research team to collect and analyse huge amounts of digital data – on a scale never attempted before.

The five-year project, launched today, will take as its starting point the middle Bronze Age when a settled agricultural landscape was laid out in England for the first time. It will then chart changes under the Iron Age inhabitants, the Romans, the Anglo-Saxons, and up to the arrival of the Normans under William the Conqueror, who commissioned the famous Domesday Book of AD1086, a country-wide survey providing a wealth of information about life in England at the time.

English Heritage has used aerial photographs of over half of England showing ancient sites of interest and this will form the basis for the project. Material will also be drawn from county archives, databases of ancient coins, and the Portable Antiquity Scheme (which records the archaeological finds made by metal detectors). Oxford researchers will also work with the British Museum, the Archaeology Data Service and local history experts with a good knowledge of the period to draw together the different regional histories and analyse what variations existed and why.

Eighteen areas of the country have been picked out as case studies demonstrating how land was commonly used in the past. For example, in the Upper Thames Valley patterns of ancient field settlements are still evident in the landscape today. The researchers will also carry out new research to link distributions of metalwork and landscape forms. In East Anglia a much metalwork was deposited by ancient communities and the researchers want to find out where on the landscape such deposits were made and whether this indicates that these were gifts to the gods or deposited for more pragmatic reasons.

Principal investigator Professor Chris Gosden, from the School of Archaeology at the University of Oxford, said: ‘England is extraordinary in the level of information about the ancient landscape. We want to discover what this huge database of information on ancient sites can reveal about England at a national level. Until now we have had fragments of information about landscape use during this period but this project allows us to form a bigger picture of overall patterns and regional variations within England.

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‘Variety characterises the English landscape, with dispersed settlements in the south-west and north-west contrasting with more clustered settlements in the Midlands and elsewhere. The project will also provide the public for the first time with online access to a wealth of archaeological information about any part of England.’

Oxford University’s School of Archaeology is collaborating with the University’s e-Research Centre to create this ambitious website, providing access to maps and databases on artefacts. John Pybus from the e-Research Centre said: ‘We are developing software to allow people to query the huge mass of archaeological data out there. Our software should allow cross-referencing and an ability to map national patterns in land use on a scale never attempted before. This will allow for a new understanding of archaeology at a local and national level.’

The Portal to the Past website is expected to go live in 2014. It will be available through the University of Oxford School of Archaeology website: http://www.arch.ox.ac.uk/news/items/99.html

Information, adverts, etc

Information for contributors

AARGnews is published at six-monthly intervals. Copy for AARGnews 44 needs to be with me by March 14. Editorial policy (for want of a better word) tends to be that if I am sent interesting contributions they go in up to an issue limit of about 50 pages. Vague instructions for contributors are on the AARG website.

Address for contributions:
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Workshop / holiday in the sun..?

A technical workshop "REmote Sensing Techniques in Archaeological Research" (RESTAR), organized by ArcLand’s partners from Crete.

The workshop will be held in Rethymno / Crete from 21st to 29th September 2012, you can find out more about this event at http://www.ims.forth.gr/workshop2012/.

A very limited number of grants is available to support students and scholars to participate in this ArcLand teaching event. Grant applications have to be submitted by 21st June 2012, using the application form and following the rules for grants which can be downloaded from the project’s grant document page.
High-flyers of tomorrow: teaching young archaeologists

Tara-Jane Sutcliffe\(^1\)

Having benefited myself from training in air photo interpretation and mapping (AARG News 42) I’m ever keen to share my knowledge and enthusiasm. As leader of the York branch of the Young Archaeologists’ Club (YAC) I have a captive audience: the challenge, however, is how to fit everything into only a two hour session for delivery to a mixed age group! Given the constitutional role of AARG for advancing the education of the public in remote sensing techniques I hope that this brief note will be of interest to members (cf. Cowley and Palmer 2009).

YAC is a British organisation for children aged 8-17 years of age who have, or, want to, develop an interest in archaeology and the heritage sector at large. It is administered by the Council for British Archaeology and run by archaeologists, museum professionals and teachers. Each month we hold a different-themed session and most recently these have included: a behind the scenes tour of the National Railway Museum; a monsters and angels trail around York Minster; and conservation techniques at the Yorkshire Museum. We play to our strengths with each session reflecting the professional experience of the group’s leaders. In March I invited our members to ‘come fly with me’ in an introduction to aerial archaeology and this fortuitously coincided with a piece on aerial archaeology in YAC’s magazine, the Young Archaeologist (Hanson 2011).

The session opened with a brief introduction to maps - what they are and why they are useful - and then we got straight down to our first exercise: siting a handful of aerial photographs on an Ordnance Survey base map. The children were quick to pick up the fundamentals of pattern recognition, looking for diagnostic shapes in the rivers, fields and road network depicted on the map and on the corresponding photographs. This was followed by a short PowerPoint presentation on the history of aerial archaeology; largely new ground for the children, it was a particular joy to share illustrations and anecdotes from the early years of aviation and photography.

A teachers’ pack has been produced by English Heritage to support learning using aerial photographs (Corbishley 2004). It contains case-studies linked to the National Curriculum and

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is accompanied by a CD of aerial photographs for which copyright restrictions have been
lifted for educational use. This resource proved particularly useful when it came to explaining
perspective in terms of different types of available aerial photographs, providing illustration
of Crawford's classic comparison of a cat's eye (oblique) view of a Persian rug and the
 corresponding human (vertical) view from above (figure 1).

This was followed up with a technical foray into ‘ways of seeing’ in terms of the formation of
cropmarks, parchmarks and soilmarks, for which, again, the teacher’s pack provided helpful
illustrative material (Corbishley 2004, 10-11). A selection of aerial photographs was used as
the basis of a guided ‘photo reading’ exercise: the children were asked to think critically
about the landscape, land-use and elements of the historic environment visible in the
photographs. Whilst less familiar with the range of potential archaeology to be identified than
older students, the YAC members were quick to appreciate the range of questions used by air
photo interpreters and, ever perceptive, even added some of their own.

The session closed with a paper exercise using the ‘network’ method that enabled the children
to transcribe an archaeological feature from an aerial photograph onto a base map. The
exercise is more often used with older students to demonstrate the
transformation now largely undertaken
in digital rectification programmes,
such as AERIAL and AirPhoto. An
example kindly supplied by English
Heritage was adapted so that the
children simply had to transpose,
scaling up the feature, rather than
having to rectify also (figure 2). This
was very successful and the members
(and leaders alike) left the session with
a sense of achievement and a piece of
work to proudly show their parents.

Perhaps the greatest pleasure in
providing the session for the children was in allowing them to view images in stereo:
receiving that familiar intake of breath and exhalation of amazement that “it's just like a
model”. I hope that I was able to spark an interest in aerial archaeology in the short time
available; the session certainly fuelled my own enthusiasm and I look forward to future
teaching and outreach opportunities.

References


Occasional Publication of the Aerial Archaeology Research Group No. 1.

Hanson, W.S. 2011. Aerial Archaeology in Transylvania, Young Archaeologist 147: 15.
Cropmarks

Interpreted by Rog Palmer

ModelTER

Translating the words in the web blurb below, ModelTER, seems to be about using ALS aerial images and other data to examine landscapes and to predict stability and change.

The LEA ModelTER (European Laboratory for Modelling of Landscapes and Territories over the Long Term) is a collaborative Franco-Slovenian team which aims to conduct research which will develop concepts and methods for the study of long-term socio-environmental relationships. Through various applications and research projects, the team studies territorial strategies and their links with systems of landscape production. The laboratory has a dual purpose: to model possible explanations of changes and to understand phenomena linked to stability, in order to provide useful indicators for sustainable development studies.


Orchards

Links to a recent study undertaken by the People's Trust for Endangered Species. Using aerial photographs and fieldwork the project has produced an inventory of England's traditional orchards.

http://news.bbc.co.uk/earth/hi/earth_news/newsid_9474000/9474777.stm

(Thanks to Tara Sutcliffe)

Aerial images in Magellan GPS

Magellan GPS introduced a new series of worldwide satellite and aerial imagery-enhanced maps for its Magellan eXplorist and Magellan Triton handheld GPS units. The new maps provide Magellan handheld GPS users with high-resolution satellite and aerial imagery from DigitalGlobe.

DigitalGlobe's images from around Earth give Magellan users access to virtually any area on the planet, from well-traveled national parks to rarely seen remote locations. A one-year subscription to these maps provides on-line access and unlimited downloads of hi-res imagery to a user's handheld GPS unit using Vantage Point, Magellan's desktop mapping software. The new DigitalGlobe-enhanced maps are compatible with the following Magellan handheld GPS units: eXplorist 310, eXplorist 510, eXplorist 610, and eXplorist 710; and Triton 400, Triton 500, Triton 1500 and Triton 2000.


(Edited from DigitalGlobe press release: 4 August 2011)

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Book (etc) of interest?

Rog Palmer


The Essex National Mapping Project (NMP) has been carried out by Historic Environment, Essex County Council as part of the English Heritage National Mapping Programme. More than 10,700 archaeological sites have been mapped and recorded over the course of the project, of which 13.2% were new to the Essex Historic Environment Record. Much of the analysis has been carried out using GIS, which has allowed the archaeological features that have been mapped to be viewed in a landscape context and in conjunction with other geographical information such as geology, topography and historic mapping. 200p, 106 illus

(from the Oxbow catalogue: [http://www.oxbowbooks.com/bookinfo.cfm/ID/90357/OnlyResult/Yes](http://www.oxbowbooks.com/bookinfo.cfm/ID/90357/OnlyResult/Yes))


Two popular archaeology magazines in the UK carried articles about flying in Wales and Scotland written by the people who do the work. While picturesque, these articles also tell of research that has been, and continues to be, carried out using aerial survey and aerial photographs and so go beyond the ‘somewhere from the air’ compendiums with which we are inundated.


Alastair Oswald and Matt Oakey. *Putting the prehistory of the North Pennines on the map.* *Research News* 16 (August 2011), 18-21

Two articles of possible interest from the latest edition of English Heritage’s *Research News*. Martyn writes about the land around Stonehenge, the airfield, and buying and selling that land in the early 20th century. Al and Matt give an example of the discovery of an unknown and unexpected prehistoric landscape in the Pennines that was identified during a special project that blended results from the National Mapping Programme with rapid field survey.

This issue of *Research News* (and some others) is available as a pdf file from: [http://www.english-heritage.org.uk/publications/research-news-16/](http://www.english-heritage.org.uk/publications/research-news-16/)

*Crop evapotranspiration - Guidelines for computing crop water requirements* - FAO
Irrigation and drainage paper 56
[http://www.fao.org/docrep/X0490E/x0490e00.htm#Contents](http://www.fao.org/docrep/X0490E/x0490e00.htm#Contents)

(Link sent by Irwin Scollar – of possible interest?)

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The Aerial Archaeology Research Group

AARG provides an international forum for the exchange of ideas and experience on archaeology and landscape studies using all forms of remote sensing, especially airborne and satellite based techniques.

AARG is actively involved in promoting the collection, interpretation and application of remote sensing data in fostering research, conservation and public understanding.

Since its foundation in the early 1980s AARG has vigorously encouraged discussion and cooperation through its annual conferences, workshops, specialist publications and biannual newsletter, *AARGnews*.

Membership is open to all who have an interest or practical involvement in aerial archaeology, remote sensing and landscape studies.

Johanna Dreßler M.A,
[aarg.secretary@googlemail.com](mailto:aarg.secretary@googlemail.com)

AARG is a registered charity: number SC 023162.

**AARG homepage.** [http://aarg.univie.ac.at/](http://aarg.univie.ac.at/)

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**Student bursaries.** AARG has a limited number of student bursaries for attendance at its annual meeting. These are aimed at supporting bona fide students who are interested in aerial archaeology and who wish to attend.

Anyone wishing to apply should write to Dave Cowley, RCAHMS, 16 Bernard Terrace, Edinburgh, EH8 9NX, Scotland ([Dave.Cowley@rchsms.gov.uk](mailto:Dave.Cowley@rchsms.gov.uk)) with information about their interests in archaeology and aerial archaeology, as well as their place of study. Annual closing date for applications to the annual AARG conference is 31 May, other meetings for which bursaries may be available will be advertised on an ad hoc basis.
PS – CUCAP Reopens

Just as I – literally – was going to send AARGnews to the webmaster, Bob Bewley emailed with the news that CUCAP will be officially reopening on 1st October 2011. I imagine this opening will be on the part-time basis that I had been informed about a few months ago, but it’s good to have the collection available again.

More good news is that Alun Martin has been appointed librarian. Alun was the previous part-time librarian who, from no knowledge of aerial photos, had become enthusiastic about broadening the user base of CUCAP and had many ideas about promoting the collection that were shunned by the previous administration. This is not necessarily promotion for archaeological users who know about the collection already, but to widen its use in, for example, social history – one of his own interests. I hope he is given the freedom to do this.

I’ve not been in to see Alun since I heard the news (because it’s 10pm for a start and CUCAP is probably not open) so I can’t provide contact details other than the old website that is still up and running. We’re promised a ‘new and improved’ online catalogue too – which is no bad thing.

http://venus.uflm.cam.ac.uk/

Time for some beer to celebrate.

Rog Palmer