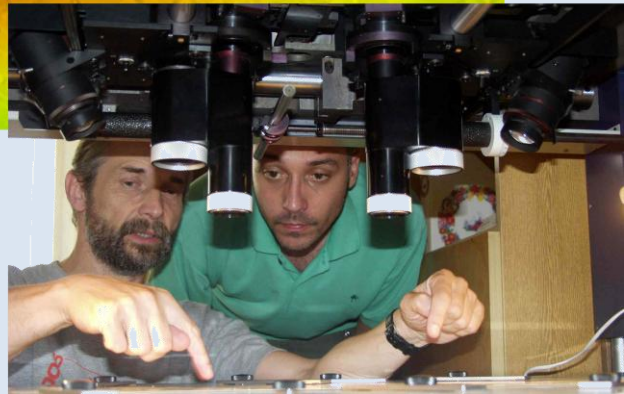
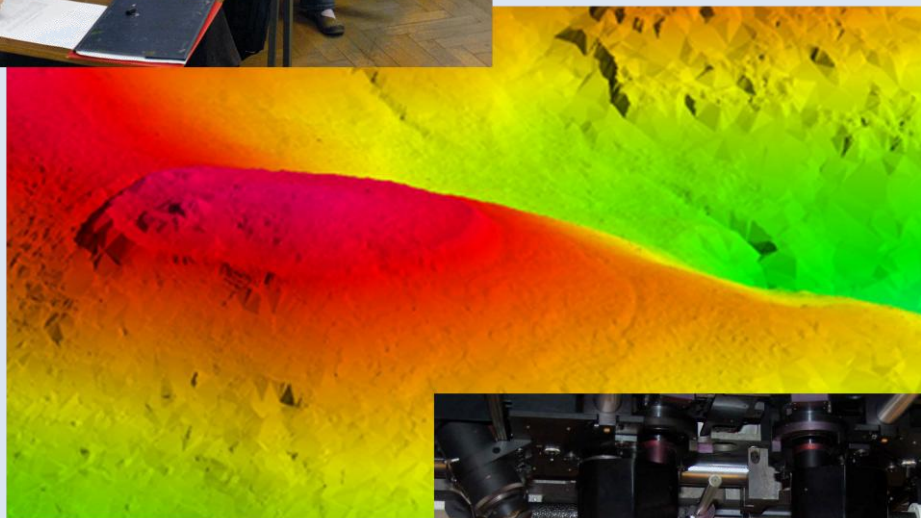


Education in Aerial Remote Sensing for Archaeology



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Courses in aerial archaeology at universities in the Czech Republic: an overview

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Origins and History

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

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

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

Current Teaching and Training

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

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

1. Introduction to RSA
2. Past and present of RSA
3. Heuristics/data collection – basics of visual low altitude aerial survey in archaeology (equipment and tools, crew work during flight, methods of recording and documenting)

identified sources), basics of aerial photography of historical landscape or earthworks, architecture and urban complexes

4. The principles of how we see buried or upstanding archaeological features from the air (e.g. cropmarks, soilmarks, shadowmarks)
5. Data processing
6. Basics of remote sensing of the Earth and use of the products of high-altitude photogrammetric aerial photography and satellite survey (orthophotos, satellite images, and airborne laser scanner data)

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

Practical Training

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

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

the exact location of sites by comparing map and GPS station data with photographs, editing, evaluating and finally saving them to a database.

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

New Developments

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

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

References

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



A group of students standing in front of the Cessna 172, OK-EKD, just a few moments before the start of a reconnaissance flight over the region of the Říp.