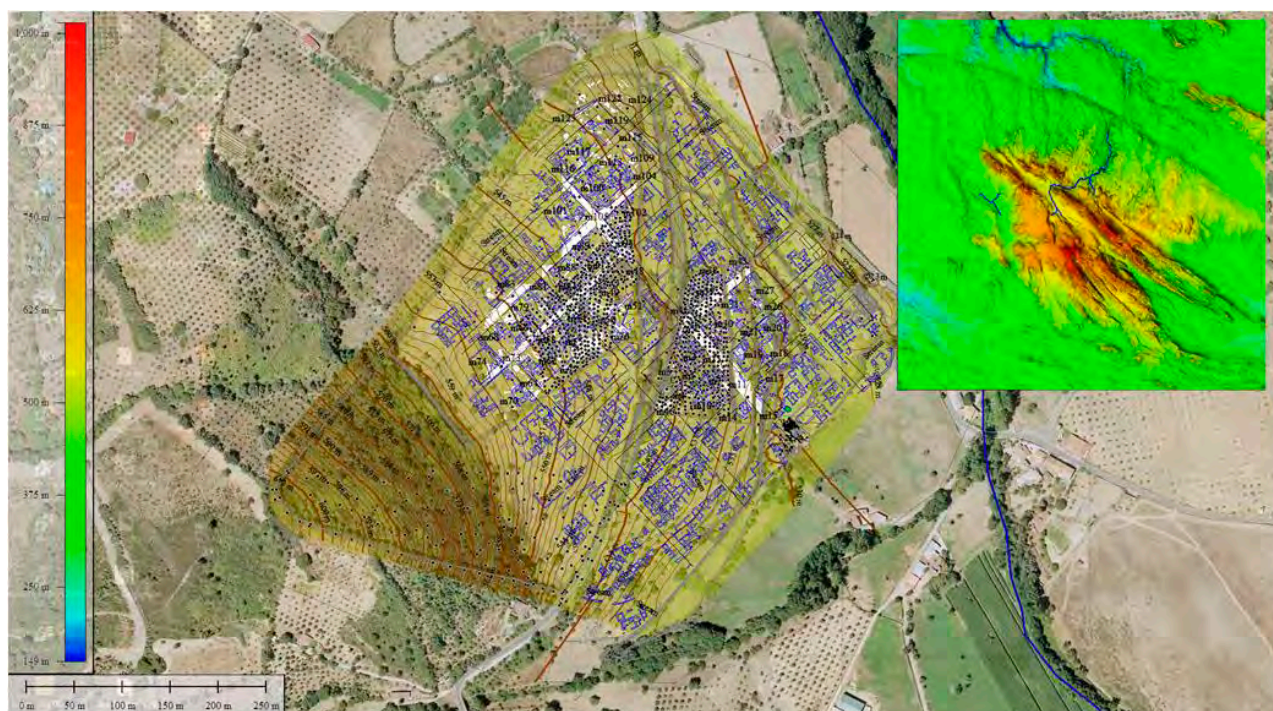




EC FP7 Programme "People" – Marie Curie Actions IAPP – Project RADIO-PAST*

NON-DESTRUCTIVE APPROACHES TO COMPLEX ARCHAEOLOGICAL SITES IN EUROPE: A ROUND-UP

FRANK VERMEULEN & CRISTINA CORSI (EDS.)



RADIO-PAST COLLOQUIUM

GHENT 15-17 JANUARY 2013

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GHENT UNIVERSITY 2013

E-PUBLICATION – ISBN 978-94-6197-109-8

DATE OF PUBLICATION – 15 APRIL 2013

[HTTP://WWW.RADIOPAST.EU](http://www.radiopast.eu)



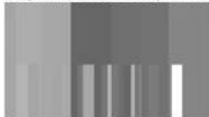
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INTRODUCTION

During three days in January 2013 some 125 researchers and policy makers joined in the congress centre “Het Pand” at Ghent University to discuss current possibilities and pitfalls in the use of non-invasive survey methods to study complex archaeological sites in Europe. The colloquium was organized within the framework of the European Marie Curie project “Radiography of the Past”, which is run by a consortium of seven European teams from Academia and Industry. Over the last four years, the project has developed as a forum for research and communication about non-invasive survey on complex archaeological sites in Europe, organizing integrated fieldwork operations on test-sites, formation weeks for young researchers, and finally this closing event at Ghent University, one of the project partners.

This successful international scientific meeting had sequential sessions about such topics as: Geoarchaeological Survey, Remote Sensing and Aerial Photography, Geophysical Survey, Digital Technologies and Visualisation, and Site Management and Valorisation. It concluded with an animated round table discussion by a group of survey project directors, rounding up possibilities and future directions of non-invasive survey on large and complex archaeological sites in Europe.

During the last twenty years, a set of methods of surface survey and non-invasive sub-surface prospection has been developed to investigate still buried, complex archaeological sites, aiming to limit destructive intervention such as excavation. Archaeological excavations, in fact, imply not only costly and time-consuming field campaigns, but also require an endless effort in restoration and preservation of what has been brought to light. For this reason, different “non-destructive” approaches have been successfully applied mostly to “deserted” complex archaeological sites, where the absence of continuity leaves great opportunities to test different techniques. These methods include different kinds of remote sensing, ground based geophysics, systematic recording of surface materials, GIS-based analysis and visualisation tools, geomatic and geomorphological survey.

The colloquium achieved a European round-up of these developments. The pooling of resources and very different skills to tackle each possible aspect related to “non-destructive” approaches allows not only to obtain “radiographs” of what is still buried in the ground, but also to work out new instruments for the interpretation and visualisation of results. In this latter area, the 3D vision of sub-surface evidence can provide a formidable medium to convey scientific information and to enhance cultural resource management on an international and interdisciplinary scale.

The main target of the colloquium was to join a series of European academic research leaders in the fields summed up above, to exchange opinions, discuss and develop some common goals and approaches for future research. At the same time promising young researchers would be able to participate actively in this process, as well as to present some of their own research and innovative methods. Finally, also commercial archaeological teams and stakeholders in the wide domains of archaeological landscape survey, visualisation and archaeological resource management will be able to participate and profit from this international meeting.

This electronic booklet assembles the abstracts of all oral presentations and posters at the colloquium. They represent the work done in over 30 countries in Europe and beyond, by researchers from some 20 European countries. The quality of the research presented here and the wide diversity of approaches, strategies and often innovative technologies confronted at the Ghent meeting have demonstrated that non-invasive archaeology and the need to develop it for research, presentation and site management is very much at the forefront of archaeological research policy in Europe today.

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UAS FOR ARCHAEOLOGY. NEW TECHNOLOGIES FOR RESEARCH AND DOCUMENTATION

Since many years, aerial orthophotos have been widely used for large and small-scale survey, documentation and report. For archaeological survey in the fields of preventive archaeology, cultural heritage planning and preservation, such tools as remote sensing, satellite or short-range image analysis are very useful but still expensive.

On a small scale, in archaeological excavation, the traditional manual documentation is often completed with ortho-images, obtained by cameras mounted on top of telescopic poles. Certainly, this procedure is a good improvement with respect to manual documentation, providing faster operations and more precise results. Nevertheless, such simple setup only allows taking photographs from a few meters height, and needs mosaicking software to produce whole area coverage and reduce distortions.

Until now, aerial remote sensing is mostly operated by manned aircrafts at high cost and subject to restrictions that make its use prohibitive for every-day survey. Recently, UAS (Unmanned Aerial System) technology in the archaeological field has seen a wider, though still sporadic, application.

In Sardinia (Italy) a first archaeological application has been realized over the area of Usini (Sassari) where, since many years, a team from the University of Sassari has been conducting interdisciplinary research on a Neolithic necropolis and its surrounding territory. The activity with UASs has been carried out in collaboration with the Sapienza University of Rome and the Oben srl enterprise, operating in drones design.

The UAS choice has fallen upon a one-meter-diameter octo-copter, permitting GPS waypoint navigation, auto take-off and landing, a payload of 4kg and 20 minutes cruise-range. We have demonstrated that, by relying on small UASs, it is possible to obtain satisfactory results in terms of cost, quality and ease of operation.

In particular this is true for photogrammetry procedures, which provide the most cost-effective and affordable way to do accurate aerial 3D scanning, measurement, and image-based modelling. The 3D model obtained from aerial image pairs permits a centimetre scale resolution, quite comparable to the sub-centimetre of a very expensive laser scanner product, and still very useful to understand and document the dynamics of the archaeological deposit formation.

The main target of this work has been a photogrammetric relief of the extremely long corridor of a Neolithic rock-cut tomb. The aerial survey above the contiguous area has also been concerned with a Roman necropolis, which later was cut through by a very large mine. By relying on images captured by UAS and by analysing grass anomalies, it has been possible to rapidly determine its extension. The methodology applied was based on flight planning, sensors setup, image processing and ortho-photo or 3D-model building.

Innovative data exploitation is also being developed, with the purpose of easily and automatically extracting and highlighting salient features to aid archaeologist in their analysis of the survey results. State-of-the-art image processing and data fusion techniques are going to be combined with machine learning and fuzzy logic algorithms.

Results obtained in the already reported first survey confirm the stipulated advantages of UAS-based surveying in terms of very low costs, rapid data acquisition, easy operation, high-resolution documentation and well geo-referenced maps and models.

UAS FOR ARCHAEOLOGY. NEW TECHNOLOGIES FOR RESEARCH AND DOCUMENTATION

RADIO-PAST
RADIOGRAPHY OF THE PAST
January 15-17, 2013
Ghent, Belgium



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S'Elighe Entosu (Usini, Italy). Neolithic necropolis.
Ortho-photo and 3D model of the tomb IV, obtained by aerial images



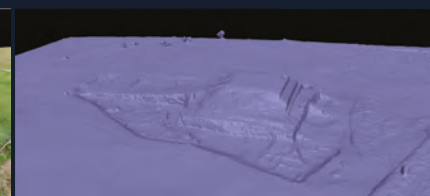
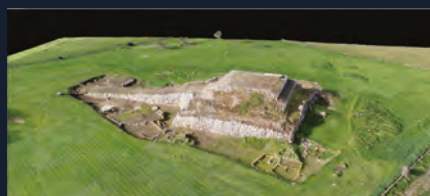
S'Elighe Entosu (Usini, Italy).
Ortho-photo of the Roman necropolis and post-Roman mine

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Monte d'Accoddi (Sassari, Italy).
3D model of the prehistoric shrine, obtained by aerial images

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