

MODELLING THE ANCIENT RUINS OF KYMISSALA

A Field Trip to Rhodes



The ancient Hellenistic settlement of Vassilika of the Kingdom of Kymissala is located in the eastern part of the island of Rhodes, between the modern towns of Monolithos and Lakki. Following a devastating earthquake in the 15th century, the Kingdom failed to recover and Vassilika became fertile ground for

tomb raiding and rogue archaeological expeditions up until the latter part of that century. The ancient remains show only the basic structures of the roads and some ruins of the village's houses, but they are nevertheless important cultural heritage objects. To protect these remains, they need to be properly identified and documented by aerial photography and laser scanning so that archaeologists and architectural historians may continue to identify, monitor, investigate and expand the knowledge about European cultural heritage.



The need for geospatial data about the 2,500-year-old ancient ruins of Vassilika, Kymissala, was met within the ERASMUS Intensive Program by the 'HERICT' project. This was organised in 2013 by the Laboratory of

Photogrammetry of the National Technical University of Athens (NTUA) and brought together more than 40 students and scientists from several nations. In fact, excavations in the area were already in progress, having been started by the University of the Aegean (UoA) in 2008. The use of geospatial technology was seen as a critical component of that work, and spawned the ERASMUS partnership with NTUA, Nicolaus Copernicus University (NCU) of Torun, University of Siena (UNISI), University of Florence (UNIFI), Vilnius Gediminas Technical University (VGTU), Cyprus University of Technology (CUT), Technical University of Madrid (UPM) and the HafenCity University of Hamburg (HCU).

Figure 1, Ancient building footprints measured during the field campaign.

The main objective of HERICT was to build a common working language and exchange knowledge between the disciplines of architecture, archaeology and geomatics within a common cultural heritage project. Six enthusiastic students of geomatics from HCU were invited by their lecturers, Carlos Acevedo and professor Tom Schramm, to participate in the acquisition campaign in Vassilika for two weeks. They were highly motivated to extend their scientific competencies and very keen to develop their networking skills in an international and culturally rich setting.

Data acquisition

With a base camp at Lake Apolakkias, around 10km from the excavation sites, the group was divided into six multidisciplinary and multicultural teams in order to optimise the opportunities for knowledge exchange. The leading team was responsible for the general communication between groups, setting the campaign goals and managing the outputs. They also explained the importance of the ruins to the students of architecture and geomatics, and their data needs. For example, orthophotographs and laser point clouds would be used to identify ruins or room boundaries and spatial arrangements from above. Acquisition was completed over four days, with the following ten days spent on image processing and data analysis.

Figure 2, Laser scanning the site of Vassilika.

The second group was responsible for the geodetic network and determination of the 3D coordinates of ground control points.

The network was densified using two control points by a Trimble R8 GNSS receiver and a Trimble VX total station. It was important to finish this work early as the output was the basis for the georeferencing of the point clouds and orthophotos. Three groups were responsible for aerial image acquisition of the sites starting from the northern end. Three different flying systems were used in an experimental way to compare the quality of the results: multispectral aerial images were acquired using a UAV from CUT, an octocopter from HCU, and a kite from NTUA. While the UAV and the octocopter group had to wait for a windless day, the kite required some wind. Fortunately, each group performed successful flights. Ground targets were positioned using RTK measurements with the base station mounted over known control points (A4 sheets homogeneously distributed in open fields) to georeference the acquired orthophotos during post-processing. Simultaneously, the sixth group started at the southern end with laser scanning using the Z+F IMAGER 5010 and Trimble TX5 scanners, using the same ground control points. The result was a referenced point cloud of the entire archaeological site, from which a 3D model was generated.



Figure 3, The HERICT team pack up at the end of the field day.

A common language

At the end of the trip, the results of each group were presented and discussed regarding the three methods of aerial imaging. We experienced difficulties in stabilising the images obtained by the kite, whereas the octocopter and UAV methods were stable and relatively insensitive to wind conditions. We also learned that effective communication in interdisciplinary groups is challenging because of different work processes and technical needs, rather than cultural barriers. Time needs to be spent on building a common language as it is important for a geomatics engineer to understand the data needs and use cases in order to plan the appropriate acquisition campaign.

Now, a year on, we can look back on the excursion with pride. We were able to improve our professional and networking skills, and each individual contributed to the success of the project. At the same time we were able to practise these skills on a beautiful island in an area that rarely features on a tourist map. The shared experiences gained both during the practical work and in our free time contributed to the fact that members of the group still maintain contact with one another today.

More information about the project, the participants and the results are provided on <http://herict.survey.ntua.gr/2013/>.

The authors

Sören Leitz and Steffen Kagerah are students on the Geomatics master programme with specialisation in Geodetical Measurement at the HafenCity University of Hamburg, Germany. They have written this article also on behalf of the other HCU students who participated in the HERICT field trip to Rhodes: Sabrina Bingel, Gordeon Thie, Sebastian Sieh and Sebastian Prott.