

EXPERIENCES GAINED FROM THE ERASMUS INTENSIVE PROGRAMME HERICT 2013

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Abstract

The Erasmus Intensive Programme “HERICT: ICT at the Service of Cultural Heritage” has brought together 40 students and 11 Professors from nine different European Universities for two weeks. The central idea of this summer school was Cultural heritage and how this may benefit from the discipline of Geomatics. Hence the students and professors present covered the disciplines of the users, i.e. Archaeologists and Architects, and the providers, i.e. Geomatics specialists. The coexistence of this interdisciplinary group of students and professors for two weeks in a remote and isolated village in Rhodos island has had significant influence. In this paper the experiences gained and the results of this summer school are presented and evaluated.

Keywords: Cultural heritage documentation, summer school, interdisciplinary education, experiential learning

1 INTRODUCTION

For two weeks in July 2013 a summer school with the title “HERICT: ICT at the Service of Cultural Heritage” has taken place in Rhodos island in Southeastern Aegean. The summer school was funded by the EU under the Erasmus Life Long Learning scheme as an Intensive Programme. The partners of this successful proposal were nine different Universities from all over Europe. National Technical University of Athens was the coordinator and the rest of the consortium included Hafen City University, Hamburg Germany, Technical University of Madrid, Spain, Nicolaus Copernicus University, Torun, Poland, University of Siena, Italy, Vilnius Gediminas Technical University, Lithuania, Cyprus University of Technology, Limassol Cyprus, University of the Aegean, Rhodes Greece and University of Florence, Italy. The nine partners were 5 from the discipline of Geomatics (Athens, Madrid, Hamburg, Vilnius and Limassol), 2 from the discipline of Archaeology (Rhodes and Torun) and 2 from the discipline of Architecture (Siena and Florence). This interdisciplinarity is the main key for the core idea of this summer school. Namely the presence of “Users”, i.e. Archaeologists and Architects, and “Providers”, i.e. Geomatics engineers ensured that both parties were offered the opportunity to get to know each other and understand each other’s needs, in order to proceed together hand in hand for the benefit of Cultural heritage documentation. In this context the “Providers” produce the necessary base maps and related

products for the “Users” to deploy their actions for the benefit of monuments. In this context, Professors and students have joint their efforts in order to achieve maximum results

2 ORGANIZATION

The IP was organized very carefully well in advance. Special arrangements were made with possible sponsors and local administrations in order to cover all possible needs. The students were accommodated in the village Apolakkia and the professors in Monolithos, approx. 10 km away. The old school building in Monolithos was offered for the lectures and the data processing, as well as the archaeological laboratory of the University of the Aegean in the same village.

2.1 Educational objectives

The objectives of the Erasmus IP HERICT are to exchange, augment, adapt and implement knowledge and ICT techniques for the support of archaeological fieldwork for the benefit of a multidisciplinary and international audience of students. Archaeology, Architecture and Geomatics students will benefit from the inevitable interaction with each other and from the supervising contribution of the professors. Hence, the thematic area of the proposed IP covers and integrates all three disciplines and focuses on the development and teaching of contemporary techniques for the technical support of the archaeological practice. It is also considered highly important to give the opportunity to students to get into contact with future methodologies and trends of the profession.

The target groups of the proposed IP are, obviously, the Archaeology, Architecture and Geomatics students, who will be the future professionals who will take care of the Cultural Heritage of Europe. In everyday professional life all are working together with persons with a different knowledge background. Students never, or very seldomly have this opportunity during their studies. It is believed that the proposed IP HERICT will give all of them this chance. At the same time student will get to know their counterparts and teachers from another University, a fact which will definitely contribute to their desire for mobility. The main activities foreseen during the two weeks of the IP include (a) understanding the needs of the archaeologists (b) develop and augment the existing ICT techniques and (c) implement them in real life conditions and (d) assess and evaluate the products.

The expected benefits are different for each target group, but they contribute to the development of a common “language” between the three main disciplines involved. Therefore, archaeologists will get in contact and familiarize themselves with ICT techniques and the way they could benefit from their implementation. Architects will enhance their knowledge in applying ICT techniques in the field of geometric documentation of Cultural Heritage. Finally Geomatics Engineers will have the opportunity to deepen their knowledge in ICT techniques and will get the chance of adapting and implementing them under real conditions. Participating Professors will also benefit from this extended communication and interchange of ideas, thus gaining invaluable experience which will pass to future students in their own Universities.

2.2 The archaeological site of Kymissala

The object of the practical implementation is proposed to be the excavation of the Kymissala area in Southwestern part of the island of Rhodes (Figure 1). This excavation is run under the supervision of the Dept. of Mediterranean Studies of The University of the Aegean in co-operation with the 22nd Ephorate of Prehistoric and Ancient Antiquities.



Figure 1: the island of Rhodes and the Kymissala area

The archaeological sites in the area of Kymissala are scattered within one of the most attractive areas of the NATURA 2000 network on the island of Rhodes, covering an area of approximately 10,000 acres. They include, among others, two necropolises, several settlements, the most important of which is Vassilika, an acropolis, remnants of the defending wall and many other monuments dating from the archaic to the Roman era.

2.3 Educational Programme

None of the Universities participating in this Intensive Programme offers in its curriculum exactly a similar course. Geomatics and Surveying Engineering Departments definitely offer their students the knowledge of the various ICT and technical tools, but they do not stress the practical needs that an archaeologist confronts in everyday practice. On the other hand, students of Architecture or Building Archaeology are more alert and sensitive towards archaeological work, but do not fully master the technological tools for providing the necessary and much needed support. Finally the Departments of Archaeology may offer an odd course on these techniques, but again it is somewhat isolated and neglected by the students themselves. HERICT, in this aspect, is striving to combine the merits of each discipline and make each one understand the needs of the others and work to provide knowledge and support. In this way it is believed that students will have to interact under the supervision of the professors and in this way they will forge a unique knowledge profile at the end of the course. Finally, Cultural Heritage is an integral part of the European's shared identity and is much desired to establish links of understanding among people of different nationalities within Europe.

For the current IP, it was decided to concentrate all efforts into the acquisition of the necessary data for processing low altitude digital imagery, thus producing large scale orthophotography of the whole area of the Vassilika settlement in Kymissala. In this respect the five "providers", i.e. Geomatics, groups would provide all technological means for acquiring the raw data, and the four "users", i.e. archaeology and architecture groups would set the specifications and needs for this task.

2.4 Contribution of Partners

For the preparation of the summer school all partners were actively involved. Each one undertook to prepare a different contribution for a successful fortnight. Almost all participating Professors prepared a lecture for the students, relevant to the main educational aim. At the same time, all instructors contributed

to the e-book through the relevant web page of the project (<http://herict.survey.ntua.gr/2013/>). Finally all contributed to the preparation of the final schedule.

It was obvious that all participants would acquire new knowledge from the interaction with fellow students and professors from other disciplines and also from other European countries, making the most of the different experiences and backgrounds. Apart from the academic benefits, it was certain that, although the duration of the proposed IP was short, there were going to be significant outputs, such as invaluable data and perhaps two dimensional and three dimensional documentation products, e.g. vector or image drawings and rendered 3D models of selected parts of the excavation.

2.5 Practical preparations

2.5.1 Instrumentation

Special arrangements were made for making sure that all necessary instrumentation and relevant equipment was available. High tech total stations and GPS receivers were brought by three of the Geomatics Universities. In addition three Geomatics Universities provided their Unmanned Aerial Vehicles (UAV), namely a kite, an octocopter and a small airplane, all capable of carrying digital recording means, such as digital cameras or videocameras. In addition most of the students were asked to have a laptop with them in order to facilitate the data processing phase.

2.5.2 WebPage

The web page of the IP was set up by the co-ordinating University (NTUA) in the educational Moodle® environment (<http://herict.survey.ntua.gr/2013/>). This web page included the project goals and objectives, a short profile for all participants, the e-book, which was gradually completed by the instructors themselves, information about the archaeological site, practical information of the area and other useful information about the interesting sights of Rhodes. In addition samples of previous surveys in Vassilika were also uploaded.

2.5.3 Living in Rhodes

As already mentioned, students and professors were accommodated in two neighbouring villages, Apolakkia and Monolithos, as their relevant capacity was limited. A coach was available for all transfers of the students to and from the village of Monolithos, where the main working area was set up in the old school building and the adjacent archaeological laboratory of the University of the Aegean. Lunches and dinners were offered for all participants in a restaurant in Monolithos. Transfers of all personnel to and from the excavation area for the four days of fieldwork were provided by the Hellenic Army, as the route was over rough forest roads. In the middle weekend cultural visits were arranged and the participants were offered the chance to visit the archaeological site of Kamiros, the Butterfly valley, the CAIR winery and the archaeological site of Lindos.

3 FIELDWORK

The fieldwork of the Erasmus IP HERICT was foreseen for 4 consecutive days. Data acquisition was planned including digital imagery, GPS measurements for ground control points, survey measurements, sketches, notes etc. All participants were transferred to the excavation area with the help of the Hellenic Army (Figure 2).

3.1 Student Groups

The students were divided into six groups. The groups were carefully formed before the beginning of the summer school and they were international and interdisciplinary. In this way communication between different nationalities and different scientific specialties was ensured. Each group contained both representatives from the “users” and the “providers”. Users were asked to formulate demands and specifications, as they understood the excavation better than the providers.

The six groups formed were as follows: Group A responsible for formulating general specifications for the desired products and also for the conduct of the fieldwork. Groups B1-B3 responsible for acquiring digital images with the three different UAV's, B4 was responsible for terrestrial laser scanning and B5 for all survey measurements with the GPS receivers and the total stations. Group B5 was co-operating with the three image acquisition groups in order to determine the necessary ground control points.



Figure 2: All participants at the archaeological site for the fieldwork

Every day after fieldwork all groups made a short presentation of their day activities to all other students and instructors. In this way all participants were familiar of the work of each group.

3.2 Data acquisition

Careful flight planning was necessary for positioning the targets for the pre-marked GCP's. Each of the three image acquisition groups was assigned a different target colour. After each flight and image acquisition, the data was downloaded and checked for their integrity. Group A was also responsible for collecting, archiving and storing all data acquired with their metadata. The main aim was that all data would be available for all partners after the end of the summer school. Therefore it should be carefully archived in such a way to be recognized for any future use.

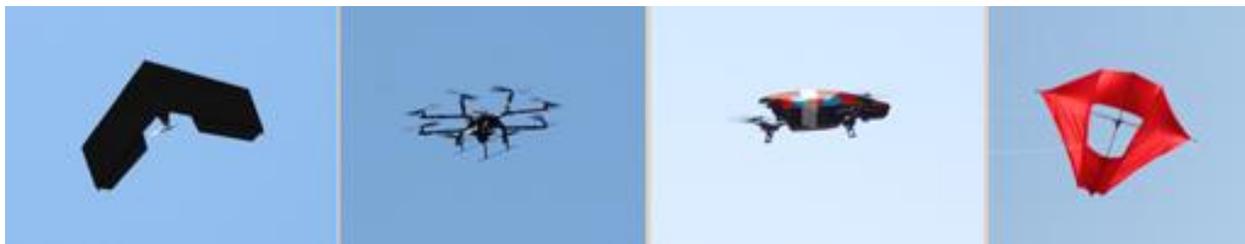


Figure 3: The UAV's used for acquiring the digital image data

The UAV's employed (Figure 3) were the Swinglet airplane by Sensefly, an octocopter developed by the Hafen City University and a Dunford Flying Machine kite. HCU also used a smaller UAV with a built-in camera for some experimental flights.

The terrestrial laser scanning group scanned the whole area with two different scanners, while the survey measurements group established a dense network of GPS points (Figure 4) in the area and used them as

basis for measuring the GCP's. All raw measurements and also all processed data were also collected and suitably archived with their metadata ready for future use.



Figure 4: Fieldwork in the Vassilika area

3.3 Specifications Group

Group A had a somewhat different task. They were asked to produce specifications for the fieldwork and the final products. There is an international gap in this field, as there are no universally acceptable specifications for monument documentation. Some efforts have been noted in the past (Blake et al. 2009, Barber & Mills 2011, Letellier 2007), but they are by no means complete. The group was engaged in lively and long discussions and managed to converge to a general text for specifications. This task has introduced the members of the group and all the other participants to the difficult task of formulating specifications for Cultural Heritage documentation

4 DATA PROCESSING

The second week of the summer school was devoted to data processing. Students and instructors were actively engaged in metric processing the digital images in photogrammetric software, cleaning and aligning the point clouds and calculating the co-ordinates of the points measured.

4.1 Images, GPS data and Point Clouds

Digital images and digital video sequences were processed using photogrammetric software in order to produce mosaics, Digital Surface Models and orthophotos. In addition camera calibration procedures were also employed, in order to get the internal geometry of the cameras and ensure more accurate results. Students came into contact with manual and automatic photogrammetric procedures and related products.

GPs data were also processed and the network established was adjusted to an acceptable high accuracy of 1-2cm. It was co-ordinated in a local and independent reference system, thus ensuring that the scale factor of the projection used in the area of Rhodos would not affect the results.

Finally, the point clouds acquired were aligned and cleaned in order to produce the main Digital Surface Model for the orthophotos to be produced in the future. Of course there were some areas with vegetation cover, in which it is impossible to have reliable DSM.

4.2 Technical Lectures

During the two weeks most of the Professors delivered interesting lectures (Figure 5), thus giving the opportunity to the students to acquaint themselves with the activities of the participating Universities. The themes of the lectures included the Kymissala excavation, the digital drawing from point clouds, the use of UAV's for monument documentation, photogrammetric methodology applied for Cultural heritage, related projects carried out in various parts of the world, and Cultural heritage management. This last lecture was delivered by two guest instructors from the University of the Basque Country in Spain.



Figure 5: Preparing for a technical lecture at the opening of the IP

5 RESULTS – CONCLUSIONS

5.1 International and Intercultural cooperation

The Erasmus Intensive Programme (HERICT2013) has mobilized students and teaching staff from nine different European Universities, from seven different countries and of three different specializations. The opportunity was offered to students from different countries to meet each other, exchange scientific and cultural experiences and thus plant the seed for getting to know European Culture. The fact that nine different Higher Education Institutions participated has ensured multidisciplinary, combination of different scientific approaches and a very high standard for the provided educational material. This is enhanced by the fact that the scientific areas and disciplines represented are quite different and cover Archaeology, Architecture, Building Archaeology and Geomatics in general. Hence each participant had a different volume of knowledge to contribute to the IP. It is common knowledge that across Europe, there is a lack of communication and understanding among these disciplines, hence activities like the proposed one, which bring them to cooperation are a pressing necessity.

This also ensured that the necessary scientific ingredients were there for developing innovative solutions for confronting the documentation of archaeological excavations based on ICT implementation (Geomatics) and dictated by the supporting knowledge. This definitely resulted to a unique course of very high standard. The practical application and implementation was carried out in “real life” situation, i.e. in a live excavation. This gave the participating students the opportunity to (a) exchange knowledge and integrate methodologies from different backgrounds and experiences gained in different countries (b)

mould with students and teachers from different disciplines and (c) achieve knowledge transfer and assimilation under real practical circumstances.

Through the implementation of the proposed IP schedule, ICT techniques and knowledge were exchanged, adapted and augmented for the benefit of the participating students, bearing in mind that a real excavation should be supported, while at the same time cultivating and increasing the sense of professionalism to the students.

5.2 Development of a Common Language



The **learning outcomes** of the Erasmus IP HERICT are important and concrete:

- The participating students have learned a communicating scientific “language”, a fact which will only bring benefits to European Cultural Heritage
- The communication between the different disciplines and different backgrounds will contribute to bridging the gap between Users (Archaeologists, Architects) and Providers (Geomatics - ICT experts).
- It is established that the sensitivity of young scientists towards the preservation of Cultural Heritage has been enhanced and increased their sensitivity towards this issue
- All participants have come into contact with contemporary and alternative digital techniques, adapted to serve specialized needs and have greatly appreciated their contribution.

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