

# International Summer School Digital Recording and 3D Modeling

Aghios Nikolaos, Crete, Greece, 24-29 April 2006



## Objectives:

The School aims to bring together young scientists and developers from image-based sciences (photogrammetry, remote sensing, computer vision, dimensional metrology) and advanced users to study and discuss the latest developments in digital recording and 3D modeling of complex objects and sites, with emphasis on those of cultural heritage value.

## Target Group of Participants:

PhD students and young researchers

Developers from sensor, software and system manufacturers

Advanced users of new sensor technologies and methods for digital recording

## Organizers:

ISPRS Commission VI Special Interest Group "Technology Transfer Caravan"

Department of Rural and Surveying Engineering, The Aristotle University of Thessaloniki (AUTH)

Institute of Geodesy and Photogrammetry, ETH Zurich

## Scientific Committee:

Emmanuel Baltsavias, Institute of Geodesy and Photogrammetry, ETH Zurich

Armin Gruen, Institute of Geodesy and Photogrammetry, ETH Zurich

Shunji Murai, Emeritus Prof., University of Tokyo

Maria Pateraki, Institute of Geodesy and Photogrammetry, ETH Zurich

Petros Patias, Department of Rural and Surveying Engineering, AUTH

## Sponsored by:



European Research Network on Excellence in Processing Open Cultural Heritage (EPOCH)



The Aristotle University of Thessaloniki



Japan International Cooperation Agency



Municipality of Aghios Nikolaos

## Acknowledgements:



The University of Stuttgart has provided support for the acquisition of data to be used at demos and exercises in the Summer School



The 13<sup>th</sup> Ephorate of Byzantine Antiquities has provided the required permissions to conduct the field work for the acquisition of the data

**Lecturers:**

Emmanuel Baltsavias, Institute of Geodesy and Photogrammetry, ETH Zurich  
Francois Blais, Institute for Information Technology, National Research Council Canada  
Claus Brenner, Institute of Cartography and Geoinformatics, University of Hannover  
Clive Fraser, Department of Geomatics, University of Melbourne  
Armin Gruen, Institute of Geodesy and Photogrammetry, ETH Zurich  
Shunji Murai, Emeritus Prof., University of Tokyo  
Maria Pateraki, Institute of Geodesy and Photogrammetry, ETH Zurich  
Petros Patias, Department of Rural and Surveying Engineering, AUTH  
Fabio Remondino, Institute of Geodesy and Photogrammetry, ETH Zurich  
Dimitrios Tsoulis, Department of Rural and Surveying Engineering, AUTH

**Rationale for the School:**

In recent years, we have witnessed dramatic advancements in the development of image-based and hybrid sensors and laser scanners. Medium format off-the-shelf CCD/CMOS cameras, panoramic cameras, very large format digital aerial cameras, laser scanners and diverse integrated systems are redefining the possibilities and basic rules for data acquisition. At the same time, progress in computer technology allows us to process the data with more advanced algorithms and within a shorter time span. New tools for 3D modeling, visualization, animation and VR/VE technologies enable us to come up with new, exciting products, which in turn lead to novel applications. The aim of this Summer School is to provide for an in-depth treatment of various aspects of data acquisition, modeling and representation. We will cover the following issues:

- Sensors and systems for sequential and simultaneous imaging
- Processing of high spatial resolution optical satellite data
- Very large format digital aerial cameras (frame- and linear array-based)
- Off-the-shelf terrestrial imaging, processing devices and systems
- Digital panoramic cameras
- Aerial and terrestrial laser scanners and image-integrated systems
- Recording with UAV platforms (e.g. remotely controlled model helicopters)
- Testfield and on-the-job calibration of cameras and laser scanners
- Precision processing of GPS and INS data for direct georeferencing
- Sensor and trajectory modeling
- Automation in data processing: Georeferencing, triangulation, image matching, feature and object extraction, texture mapping
- 3D reconstruction from laser scans and hybrid systems
- Advanced 3D surface modeling and surface co-registration
- Visualization
- Applications with emphasis on terrain and city modeling and cultural heritage
- Project studies and experiences

The teaching consists of a well-balanced program of lectures and software demonstrations. There will be opportunities to be exposed to some very fresh software modules both from commercial vendors and research labs. The participants are encouraged to bring and show their own software. We expect that the quality and experience of both the lecturers and the participants will provide an excellent environment for stimulating discussions and high-level information exchange.

### The Location:

The Summer School will take place at the Miramare Resort, an attractive hotel and bungalow complex, situated in a magnificent location just above the sea front, overlooking the picturesque town of Aghios Nikolaos and the Mirabello Bay. It is within walking distance from the town center, 60 km from Heraklion International Airport and offers many possibilities to visit the major attractions of Eastern Crete. The Resort provides rooms and suites with sea views, equipped with air-conditioner, direct dial phone, music and radio channels, satellite TV and minibar. The excellent facilities, together with a pleasant environment, will make this Summer School a unique experience.

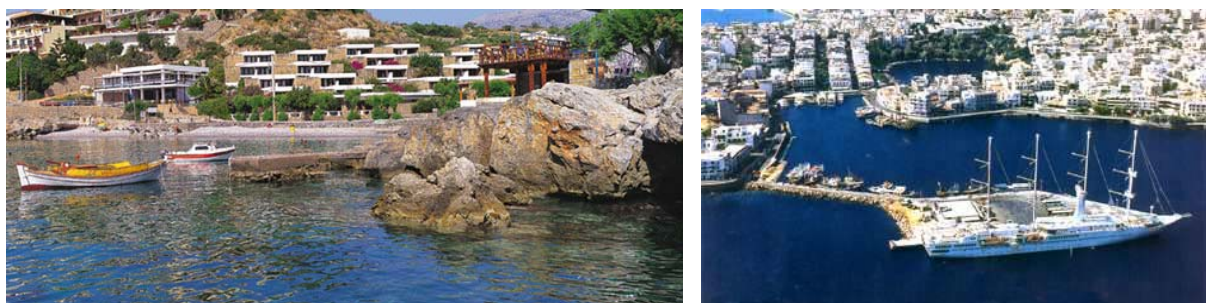
Aghios Nikolaos is an international and cosmopolitan town that welcomes thousands of visitors annually. The town is named after the small Byzantine church of Aghios Nikolaos (Saint Nikolaos), built in the 8<sup>th</sup> century. One of the most attractive features of the town is the lake with its natural surroundings of red rock and trees. Legend suggests that the goddess Athena bathed in its waters, which reach a depth of 64 m. The lake was connected to the sea in relatively recent times, with a canal opened at 1870. On the site where the town is built today there used to be the ancient "Lato pros Kamares", which was the harbour of "Lato Etera", an important and powerful city located near the village of Kritsa. The harbour continued to function throughout the Roman and Byzantine periods. During the Venetian occupation, the fortress Mirabello (meaning Beautiful View) was built, and it gave its name to the Prefecture and to the bay. Regrettably, nothing of the fortress remains today.

### Climate:

The natural landscape around Aghios Nikolaos is one of the most attractive areas of southeast Europe and the region has a very agreeable, temperate climate with mild temperatures and very low humidity.



Satellite image of part of Crete (left) and map of the Mirabello Bay area (right).



View of Miramare Resort from the sea (left) and the town of Aghios Nikolaos (right).

**The Program:**

<b>Monday, 24 April</b>	
<b>18:00 – 19:00</b>	<b>Registration</b>
<b>19:00 – 21:30</b>	<b>Icebreaker party</b>

<b>Tuesday, 25 April</b>	
<b>8:00 – 8:30</b>	<b>Registration</b>
<b>8:30 – 9:00</b>	Welcome – Introduction (recent technological and methodological developments, motivation for the Summer School, overview of contents) A. Gruen, S. Murai, P. Patias
<b>9:00 – 10:30</b>	High spatial resolution satellite sensors (overview, image quality, sensor modeling) <i>Lecturers:</i> E. Baltsavias, C. Fraser
<b>10:30 – 11:00</b>	<b>Coffee break</b>
<b>11:00 – 13:00</b>	Digital aerial cameras (overview, sensor and trajectory modeling) <i>Lecturers:</i> A. Gruen, M. Pateraki
<b>13:00 - 15:00</b>	<b>Lunch break</b>
<b>15:00 - 15:30</b>	Presentation of the data used in the case study (M. Pateraki)
<b>15:30 – 17:00</b>	Direct georeferencing (GPS / INS integration) <i>Lecturer:</i> D. Tsoulis
<b>17:00 – 17:30</b>	<b>Coffee break</b>
<b>17:30 – 19:00</b>	Testfield and on-the-job calibration of cameras <i>Lecturers:</i> A. Gruen, C. Fraser

<b>Wednesday, 26 April</b>	
<b>8:30 – 10:30</b>	Image matching, point transfer, DSM generation <i>Lecturers:</i> M. Pateraki
<b>10:30 – 11:00</b>	<b>Coffee break</b>
<b>11:00 – 13:00</b>	Automated and semi-automated object extraction (satellite, aerial and terrestrial sensors) <i>Lecturers:</i> E. Baltsavias, A. Gruen
<b>13:00 - 15:30</b>	<b>Lunch break</b>
<b>15:30 – 17:00</b>	Aerial laser scanning (systems, processing, applications) <i>Lecturer:</i> C. Brenner
<b>17:00 – 17:30</b>	<b>Coffee break</b>
<b>17:30 – 19:00</b>	Terrestrial laser scanning (systems, calibration, processing) <i>Lecturer:</i> F. Blais

**Thursday, 27 April**

**Full Day Excursion**

**Friday, 28 April**

<b>9:00 – 10:30</b>	Off-the-self digital cameras (systems, calibration, performance) <i>Lecturer: C. Fraser</i>
<b>10:30 – 11:00</b>	<b>Coffee break</b>
<b>11:00 – 13:00</b>	3D acquisition and modeling of close-range objects <i>Lecturer: F. Blais</i>
<b>13:00 - 15:30</b>	<b>Lunch break</b>
<b>15:30 – 17:00</b>	Registration and 3D modeling of aerial laser scanner data <i>Lecturer: C. Brenner</i>
<b>17:00 – 17:30</b>	<b>Coffee break</b>
<b>17:30 – 18:30</b>	Panoramic cameras and terrestrial laser integration <i>Lecturer: A. Gruen</i>

**Saturday, 29 April**

<b>8:30 – 10:00</b>	Texture mapping and visualization <i>Lecturer: F. Remondino</i>
<b>10:00 – 10:30</b>	<b>Coffee break</b>
<b>10:30 – 12:30</b>	Applications and project reports <i>Lecturers: S. Murai, P. Patias</i>
<b>12:30 - 13:00</b>	<b>Closing session</b>
<b>13:00 - 15:30</b>	<b>Lunch</b>

The Byzantine Church of Panagia Kera (13<sup>th</sup> - 14<sup>th</sup> A.D.) will be used as a case study for the Summer School. High-resolution digital terrestrial images and laser scanner data that were collected of the interior and exterior of the Church during a fieldwork campaign in September 2005 will be made available as demonstration and exercise material to be used by most of the lecturers. The data include:

- a) digital images, acquired with the 12 Mpixel NIKON D2X, with average resolution in object space of 2 mm for the exterior surfaces.
- b) laser scanner data, acquired with the Leica HDS 3000 system with single point accuracy of 6 mm and sampling distance better than 20 mm for the exterior and interior surfaces.
- c) control points (targets and natural points) measured with laser theodolite (2-4 cm accuracy).



Interior (left) and exterior (middle) images of Panagia Kera, and 3D point cloud of exterior surfaces of the monument (right) acquired with laser scanning.

### Full Day Excursion: Panagia Kera Basilika - Spinalonga – Moni Aretiou

*Panagia Kera*, which dates from the 13<sup>th</sup> to 14<sup>th</sup> Century AD, is the most popular Byzantine monument in Crete. It is located in Logari, 1 km east of Kritsa. This triple-nave Basilika is dedicated to the Assumption of the Virgin Mary, to Saint Anthony and to Saint Anna. It is adorned with superb frescoes covering particular themes, such as the representation of Saint Anna, other icons of the saints, and the fourteen scenes depicting the secret life of the Virgin Mary. Characteristic of all the wall paintings is their vividness, expressiveness and aesthetic perfection.

*Spinalonga* is the most famous island on Crete. This rock stronghold and fortress is located at the north-west entrance of The Bay of Elounda. The fortress was built during Venetian times and formed part the defense of Crete, particularly against the expansion of the Turks and incursions by pirates. From 1669 until 1715 it was a refuge for Venetians, Hainidons and escapees. Subsequently, until 1903 it was inhabited almost exclusively by Muslims and when these last residents left, the place became a leper colony by order of the Greek government. This operation was concluded in 1957, and from then on it has remained uninhabited, at the mercy of time, until recently when restoration of its buildings was commenced.

*Moni Aretiou* was the largest and most important from the many monasteries that bloomed in the area of Ano Mirambello. It was founded in 1600 and was a school for religious painting in the 17<sup>th</sup> century until its partial destruction from the Turks during the Greek revolution of 1821. Recently, its restoration begun.

A light lunch with meze (selection of appetizers) and raki will be served in Plaka, after the guided tour of Spinalonga. Plaka is a small village by the sea, located opposite to Spinalonga island. Dinner will be at a local traditional taverna with live Cretan instrumental music.

#### Timetable:

09:30	Departure from the hotel to Aghios Nikolaos port
09:45	Departure by boat to <i>Spinalonga</i>
11:00	Guided tour of <i>Spinalonga</i>
12:30	Departure by boat to Plaka - Lunch
14:00	Departure by bus to Ano Mirabello – Visit <i>Moni Aretiou</i>
16:30	Departure by bus to <i>Panagia Kera</i> - Guided visit of <i>Panagia Kera</i>
18:00	Visit of traditional Cretan village <i>Kritsa</i> - Coffee
20:30	Dinner at local taverna in <i>Kroustas</i> village with Cretan instrumental music



Views of Spinalonga island.

#### Registration Fee: 590.- CHF

The registration fee includes admission to all lectures, the CD with the technical program and teaching material, coffee breaks, icebreaker party and the full day excursion with lunch and dinner. Payment can be by bank transfer (preferred payment method) or cash at the Summer School (only in CHF). Persons staying at other hotels and accompanying persons, should buy vouchers for taking their lunch at the Miramare Resort (costs 20.- CHF per lunch). In addition, accompanying persons that wish to participate in the social events of the Summer School (icebreaker party and full day excursion) should register and purchase their tickets. The costs for the icebreaker party and the excursion are 16.- CHF and 80.- CHF respectively.

**Note:** Registrations will be accepted in incoming order. Since the number of participants is restricted to approx. 60, we strongly encourage early registration. Registrations can be confirmed only after the registration fee has been received by the organizers.

**Accommodation Information:**

The hotel Miramare Resort provides sea view rooms and bungalows at reduced room rates for the participants of the Summer School. The following prices are per room, including taxes and half-board accommodation (breakfast and lunch). The payment can be made at the hotel upon departure (by cash or major credit cards).

Single room	45.- EUR
Double or twin room	64.- EUR
Bungalow with sea view (up to 3 persons)	100.- EUR

We recommend to the participants to book into the Miramare Resort as early as possible, as it will serve as the venue for the lectures of the Summer School. Bookings can be guaranteed, if made by 5 March 2006 the latest. Accommodation in other hotels has to be arranged *by the participants individually* and a list of hotels in the area can be found at the WEB sites below.

**Travel Information:**

There are direct international flights to Heraklion airport (Kazantakis international airport) or via Athens. From Heraklion airport you can arrive in Aghios Nikolaos by bus or taxi. Frequent bus connections exist between Heraklion and Aghios Nikolaos and the timetable can be found at <http://www.crete-buses.gr/courses/heraklion/heraklio-en.htm>. The travel duration by bus is approximately 1.5 h and the ticket price is 5.- EUR, whereas by taxi the travel time is 1 h and the cost is 45.- EUR. You can also travel to Aghios Nikolaos or Heraklion by sea from Piraeus (Athens) with Ferry boats, operated by ANEK lines (<http://www.anek.gr/>), LANE sea-lines (<http://www2.forthnet.gr/internetcity/get/lane/>) and MINOAN lines (<http://www.minoan.gr/>).

**Pre- & Post Summer School activities:**

Crete offers various options for different activities and the time period of the Summer School is the best to visit the island, as the weather is neither cold nor too hot, hiking and traveling around are favored and visitors can enjoy a unique experience of life in Crete. It is also a good opportunity to experience the Orthodox Easter customs and religious ceremonies since the week of the Orthodox Easter precedes the week of the Summer School. The Resurrection on Holy Saturday evening with hundreds of fireworks is especially spectacular in Aghios Nikolaos. Both the western and eastern part of Crete offer various interesting leisure options and at the WEB sites below you can find a list of different sightseeing options, if you decide to spend some days in Crete before or after the Summer School.



Fireworks in Aghios Nikolaos at the Resurrection.

**Contacts:**

The registration and Miramare hotel booking form will be made available at the Summer School WEB site ( <http://www.photogrammetry.ethz.ch/summerschool> ), which will be activated soon.

For all aspects concerning registration, booking for the Miramare hotel, receipt from the organizers of an invoice (necessary for bank transfer) and financial aspects contact:

L. Steinbrueckner, [stein@geod.baug.ethz.ch](mailto:stein@geod.baug.ethz.ch), Tel. 0041-44-6333157, Fax 0041-44-6331101

For other information contact:

E. Baltsavias, [manos@geod.baug.ethz.ch](mailto:manos@geod.baug.ethz.ch), Tel. 0041-44-6333042, Fax 0041-44-6331101

**Useful Links:**

<http://www.miramarecrete.gr>  
<http://www.aghiosnikolaos.gr>  
<http://www2.forthnet.gr/internetcity/en-home.htm>  
<http://www.greeklandscapes.com/greece/crete/>  
<http://www.explorecrete.com>  
<http://www.chania.gr/index.jsp?lang=en>  
<http://www.west-crete.com/crete-nature-crete-gorges-crete-mountains.htm>  
<http://www.cretetravel.com/>  
[http://www.cretetravel.com/Activities/E4\\_walking\\_path.htm](http://www.cretetravel.com/Activities/E4_walking_path.htm)  
<http://www.bsa.gla.ac.uk/knosos/index.htm?vrtour>  
<http://www.interkriti.org/visits/kenourgio/zaros/>  
<http://www.interkriti.org/gortys/gortys.htm>  
<http://www.interkriti.org/culture/festos/phaist1.htm>  
<http://www.interkriti.org/visits/zakros.html>

Miramare hotel  
Municipality of Aghios Nikolaos  
Lasithi Tourist Guide  
Exploring eastern Crete  
Crete Portal  
Municipality of Chania  
Gorges in west Crete  
Crete travel guide  
Hiking the E4 path  
Knossos  
Zaros  
Gortys and basilica of Ag. Titos  
Festos  
Zakros