

3D vision of an ancient city

by Katherine Lehmuller

The archaeological site, Laodikeia, is one of the largest and most important archaeological sites in Turkey today. Located 6 kilometres (3.7 miles) north of the modern day city Denizli, Laodikeia extended its borders to cover more than 90,000 square metres (968,750 square feet) and has at least 10 important building ruins, including one of the seven major churches of Early Christianity mentioned in the Book of Revelation from the New Testament. Built in a first-degree earthquake zone, the city suffered from multiple devastating earthquakes and was rebuilt many times before its residents finally abandoned it and moved away around 600 AD.

The municipality of Denizli was able to secure financial support and for the last 10 years, extensive excavation and restoration work has been done by Pamukkale University's Department of Archaeology and Ministry of Culture and Tourism under the leadership of Prof. Celal Şimşek authorised by the Council of Ministers. Due to the ancient city's size and because Laodikeia is one of Turkey's most important heritage sites, much time and expense has been dedicated to creating maps and models of the

site in order to document its progress and also to plan for future excavation in the coming season. Recently, the department decided to try working with an unmanned aerial vehicle (UAV) and hired the Aibot X6 from Aibotix. They were extremely happy with the results.

"We could implement the Aibotix flight missions into our yearly workflow. It is quite a fast and beneficial way to see what we have done in one excavation period because the high resolution ortho-photos show progress outstandingly," says Şimşek.



■ Highly detailed image of the sacred temple.



Using the Aibotix UAV to generate data for a 3D city model took the team very little time to accomplish. H. Bora Yavuz, working as a technical consultant for Sistem A.Ş., Leica Geosystems' distributor in Turkey, explains, "With conventional methods, it would take almost 10 days with five skilled people just for the field work alone and if you consider the modelling processing, we would have probably needed another 10 days in the office using trained operators. Now, using the Aibot X6 hexacopter UAV and software, we made a city model within five hours and we needed only one trained person for the entire mission."

After Leica Viva GS15 receivers were used to establish ground control points in the field later used for geo-referencing, a compact 16.2 MP digital camera was strapped to the Aibot X6 copter's camera mount. The Aibotix software, AiproFlight, was used to plan the flight mission of the copter and enabled planning flight details such as keeping the copter at a 70-metre (230-foot) height throughout the entire recording and allowing a model accuracy of 3 centimetres (1.18 inches) ground sample distance (GSD). After this, the actual flight's direction, resolution and route were planned and uploaded onto the Aibot X6. When this was done, data acquisition during the flight was entirely automatic.

Because of the Aibot X6's special panning camera mount, 45 degree image angles were possible with an overlap of 80 percent, and could generate detailed images of side walls, for example.

For processing, the images were geotagged using the ground control points established in the field by special processing software Agisoft Photoscan Pro, which created 3D models and processed high resolution ortho-photos very efficiently and smoothly.

"It has never been simpler to obtain a high quality data set of aerial imagery for documentation, to have an accurate digital topographic model, and most importantly, a high resolution ortho-photo of the area that shows every single stone in its actual position. Besides, this UAV is safe and fast," explains Özhan Kaynarca, company owner Ölçen Harita Surveying Services. ■

For more information about the ancient city of Laodikeia, please visit: www.laodikeia.pau.edu.tr

About the author:

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