

CASE STUDY

Archaeological structures

3DT
Technology meets efficiency

Author

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Organizations Involved

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Background

Photonics active sensors based on LiDAR (Light Detection And Ranging) have been widely used to identify traces of buried archaeological structures.

The multi-echo technology allows the detection of depressions and elevations of the ground level, which may indicate a possible region of interest for more detailed field surveys, even in the presence of dense vegetation.

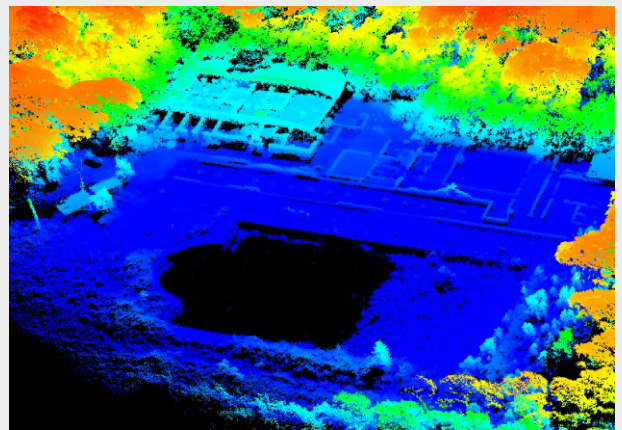
Nowadays, a Lidar payload can be installed in an Unmanned Aerial Vehicle (UAV) and easily deployed in the field in a matter of minutes, with a lower cost of data acquisition and unprecedented ground resolution.

The project

The research is aimed at systematically investigating the remains of the Imperial Domitian villa, located on the shores of Lago di Paola in Sabaudia, Italy, and is part of the "The Domitian Villa: An Imperial Residence in Sabaudia, Italy" project, winner of the 2019 Grant for the "Shelby White and Leon Levy" program.

The villa, second in size only to Hadrian's villa in Tivoli, Italy, was explored only in minimal part and probably extended much beyond the 46 fenced hectares of the current archaeological area. The site, largely still to be excavated, is characterized by complete coverage of maritime pines planted in the 1940s.

Visibility encountered during land surveying operations was poor, both because of the occasional bramble bushes and the pine needles completely covering the ground. Significant limits were also posed by the vegetation on measurement techniques based on GNSS.



The ruins of the Domitian villa as seen from an aerial pictures and their point cloud model.

PROJECT INFORMATION

Location

Sabaudia, Italy

Survey

3 flights, 70 m AGL, 3 m/s,
70% side overlap

Product used

Scanfly ULTRA

Web App

Smart Processing Lidar



The workflow

A total of 50 hectares were scanned with Scanfly Ultra in three different flights, performed on the same day in about 2 hours. Take-off locations were chosen to keep VLOS (Visual Line of Sight) conditions during each acquisition, according to the local regulations.

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For all the surveys, the UAV was set to a targeted altitude of 70 m above the take-off point with a horizontal ground speed of 3.0 m/s. Parallel flight lines were programmed to ensure a minimum side overlap of 60%. The trajectory was estimated with an RMS accuracy in the range of 3 cm using the RINEX corrections from the nearby base station of a CORS network.

The point cloud was generated in SmartProcessing Lidar, 3DT proprietary direct geo-referencing software, and featured an average ground resolution estimated at 508 pt/sqm, including both the vegetated part—mainly the crowns of the maritime pines, their trunks, a few emerged structures, and scrub—and the ground.

Results

Vegetation layers were filtered with dedicated algorithms, leaving the classified ground points with an average density of 25 pt/sqm. A DTM was then successfully generated with a spacing of 10 cm.

The analysis identified the traces related to the original terracing systems in the area and nine major anomalies related to buried buildings.

The results were then confirmed by direct investigations in the field.

In the scope of the research, published at <https://www.mdpi.com/907420>, the method was compared with alternate remote sensing techniques based on photogrammetry and multispectral sensors, which confirmed the LiDAR as the cutting edge technology in the field of archaeology surveys.

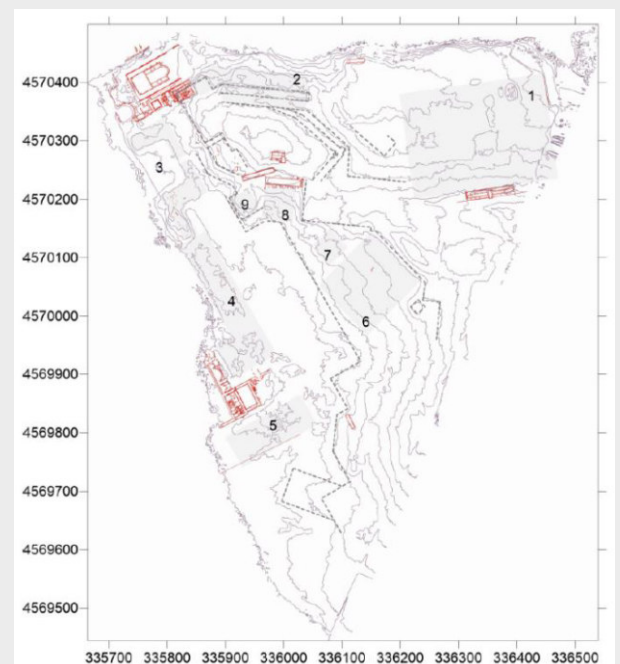
The Scanfly advantages

The combined effect of the multi-channel and the dual return technology of the 3DT Scanfly Ultra allowed penetrating effectively the vegetation layers to detect and measure hidden features on the ground level.

Scanfly Ultra is compact and easy to use: it can be deployed in the field and be ready to measure in less than a couple of minutes; downloading the data and generating a usable 3D model of the area of interest can be done immediately after the survey is complete.



Scanfly Ultra airborne and ready to fly.



The terrain anomalies related to buried building identified in the survey area.



scanfly



On board



Backpack



Flying