

## USE THE UAV TECHNOLOGY IN DETERMINATION OF DIGITAL LAND MODEL

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**Abstract:** *The earth's surface is the place where a geographical phenomenon is constantly occurring. Thus, the representation of the relief becomes a reference field for the use of GIS systems. Surface modeling does not involve the representation of well-defined models in space, but provides valuable information on its continuous dynamics. The present study aims to achieve the digital model of the terrain in order to represent it as accurately as possible. The collection and transfer of data through UAV technology leads to an efficient management of data on obtaining digital terrain models, this study being largely structured on the presentation of the application side of UAV technology by highlighting the results obtained.*

**Keywords:** *UAV, GPS, photogrammetric flight, digital terrain model*

### 1. Introduction

UAV technology can be used in a variety of fields of activity in order to quickly obtain information from less accessible areas.

In Romania, the implementation of UAV technology is in a continuous development, the professional use of drones requiring a series of theoretical and practical requirements regarding their operation and maintenance and also the processing and use of the information obtained.

In order to carry out this paper, two stages were completed, the first consisting in setting up a database by acquiring frames from image capture using UAV technology, and in the second stage the collected data were processed and the digital terrain model was generated using specialized software.

### 2. Materials and Methods

The study area presented is located at an altitude of 1300 m, in the commune of Carlibaba, Suhard Mountains in the Western Indians, Suceava County. The acquisition of digital data was made in optimal wind and light conditions. To cover the entire surface of 1.6Kmp, 4 flights were performed at an altitude of 300m, recording 1063 images with a total size of 20GB.

For the frame acquisition process we used:

- a Trimble UX5 HP UAV, in the body of which are incorporated two GPS, one necessary for navigation and the second recording the location of each frame, a SONY Alfa7 camera with a resolution of 36 Mpixels and a battery;
- a Spectra Precision SP6.0 GPS;
- a tablet for flight planning and control.

The elaboration of the digital model of the terrain was made by going through and fulfilling the two stages described in the following.

**Step 1. Identify the site by conducting field visits and establishing work areas.**

During this stage, the optimal terrain / space for the location of the launch and landing stations of the drone was identified.

The flight planning for the area of interest includes information about the trajectory of the UAV, the flight altitude and its duration, the place of take-off and landing and the number of flights necessary to cover the area of the studied area of interest.

The flight plan was made by going through the configuration steps in the Trimble Aerial Imaging program, a program specific to flight mission planning.



Fig. 1. Flight plan planning

Following the planning of the aerial measurement program, the preparation of the overflow is carried out by mounting and installing in the work areas the equipment necessary to send the drone into the airspace, mounting the GPS station to collect static data, and the actual execution of flights by launching in the airspace of the UAV, capturing aerial images and collecting GPS data necessary for their processing.



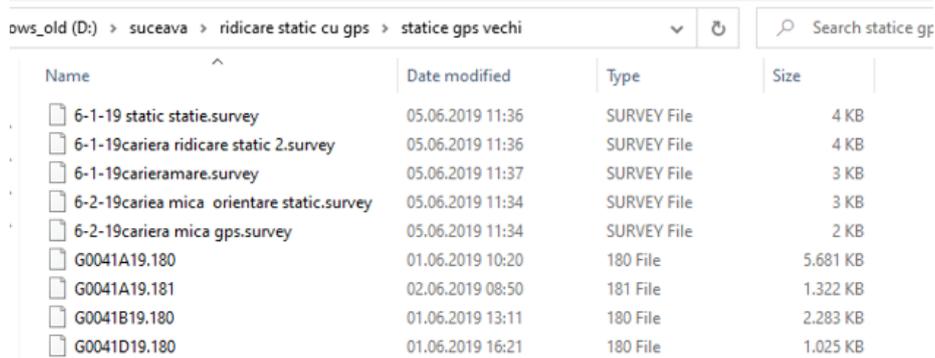
Fig. 2. Mounting the GPS station



Fig. 3. Preparing the drone for launch

**Step 2. Data processing**

The processing of the data from the database constituted by downloading the RINEX files from the GPS station and those recorded by the UAV following the overflight using the Trimble Aerial Imaging software, was done with the Trimble Business Center (TBC) software.



Name	Date modified	Type	Size
6-1-19 static statie.survey	05.06.2019 11:36	SURVEY File	4 KB
6-1-19cariera ridicare static 2.survey	05.06.2019 11:36	SURVEY File	4 KB
6-1-19carieramare.survey	05.06.2019 11:37	SURVEY File	3 KB
6-2-19cariera mica orientare static.survey	05.06.2019 11:34	SURVEY File	3 KB
6-2-19cariera mica gps.survey	05.06.2019 11:34	SURVEY File	2 KB
G0041A19.180	01.06.2019 10:20	180 File	5.681 KB
G0041A19.181	02.06.2019 08:50	181 File	1.322 KB
G0041B19.180	01.06.2019 13:11	180 File	2.283 KB
G0041D19.180	01.06.2019 16:21	180 File	1.025 KB

Fig. 4. Downloading data

By entering the data from the RINEX files and the frames in the TB software, is observed the trajectory followed by the UAV during the flight.

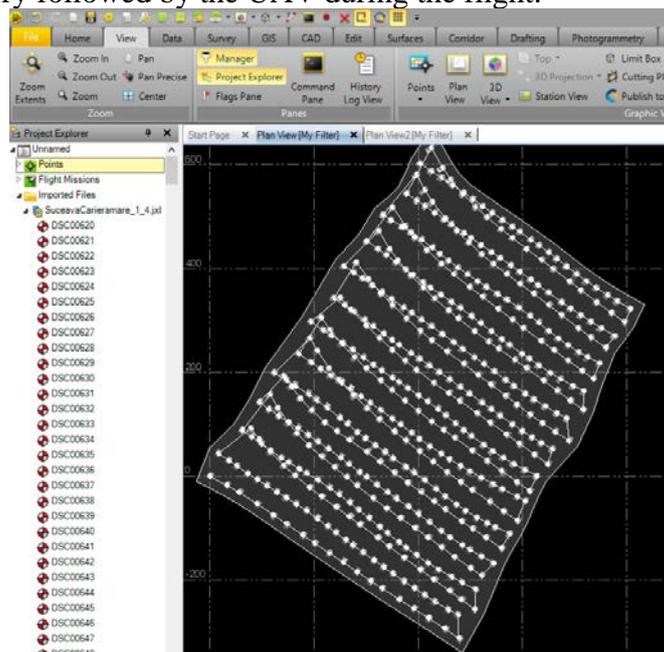


Fig. 5 The trajectory of the UAV during the overflight



By importing the digital model in raster format, resulting from the frame processing, the ArcMap 10.4 software generated the irregular triangular terrain network (TIN), a model necessary for the visual representation of the studied topographic surface.



Fig. 8 Three-dimensional visualization of the orthophotoplan

Also during this stage, a series of digital models were created necessary to visualize the studied field.

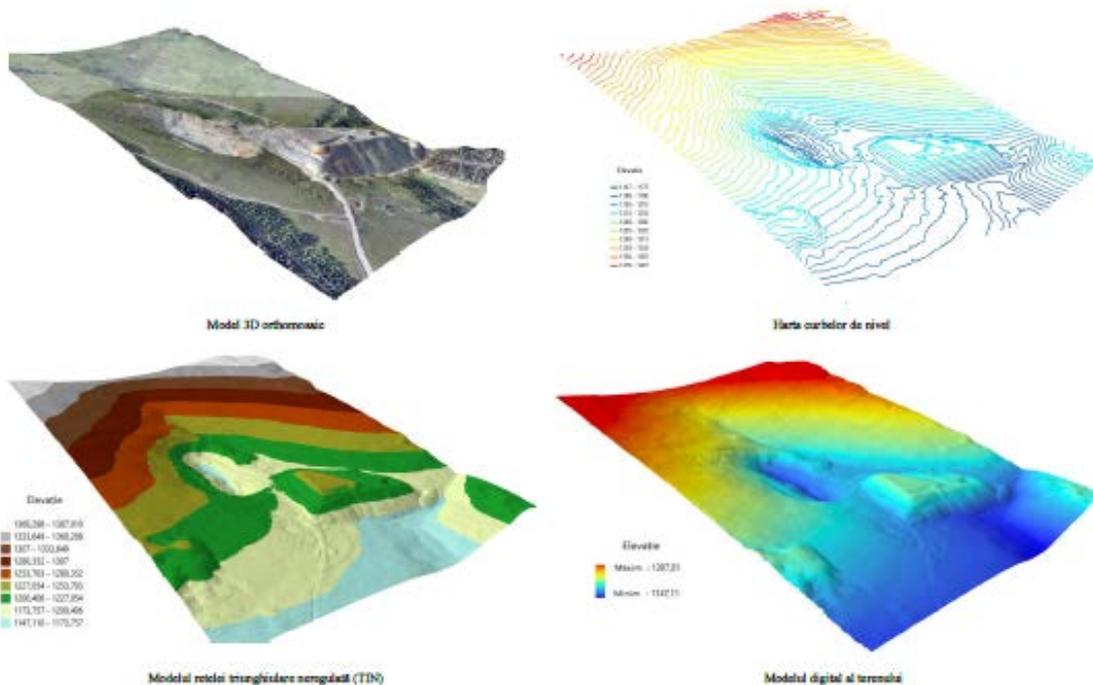


Fig. 9 Digital models

#### 4. Conclusions

Based on the realization of this paper, a number of advantages have been identified regarding the use of UAVs in measurement works, namely:

- UAV technology offers major advantages over the classical method by reducing the time of data collection and processing;

- Depending on the equipment used, the measurements performed provide a very high horizontal and vertical accuracy, a result verified by comparing the coordinates measured on the ground using GPS and the coordinates of the points in the resulting DTM;
- Realization of the digital terrain model (DTM), the digital surface model (DSM), the orthophoto plans and the three-dimensional model with low costs;
- Calculation of excavation and filling volumes on a certain area or on the entire studied surface and extraction of longitudinal and transverse profiles with a high density of points;
- Possibility of periodic monitoring of the area.

As in any business, there are a number of disadvantages, including the following:

- Depending on the type of drone used, in our case the Trimbel X5 HP UAV which is a fixed wing drone, it is necessary to allocate more space for takeoff and landing on the ground;
- Due to the high speed during the flight, it is impossible to intervene in its piloting with the help of the control tablet;
- Lack of a movable wing and high landing speed can be violent on the body of the aircraft causing damage;
- Due to the specific batteries of each type of UAV, flights may be limited in time, so the time and the size of the area to be measured are conditioned by this factor.

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