HOW DRONES CAN HELP IMPROVE REFUGEE CAMPS

In September 2016, CartONG and the Swiss Foundation for Demining (FSD) participated in a six-day training and simulation for 13 staff of a large international organisation that is involved in the planning and management of refugee camps. The training assumed a rapid influx of refugees with up to 7,000 people in need of shelter. Large parts of the training focused on familiarising participants with the Autodesk software.

As part of the simulation CartONG and the Swiss Foundation for Demining (FSD) provided a demonstration of using mapping drones. The aim was to use drones as a tool to derive aerial imagery to help plan a settlement design on 1.8 km² of land that had been designated to house the fictitious refugees. CartONG was asked to provide the participants with aerial imagery, a Digital Terrain Model (DTM) and a Digital Surface Model (DSM) of the area. These files were originally produced by CartONG in Pix4D but could be imported into the Autodesk suite.

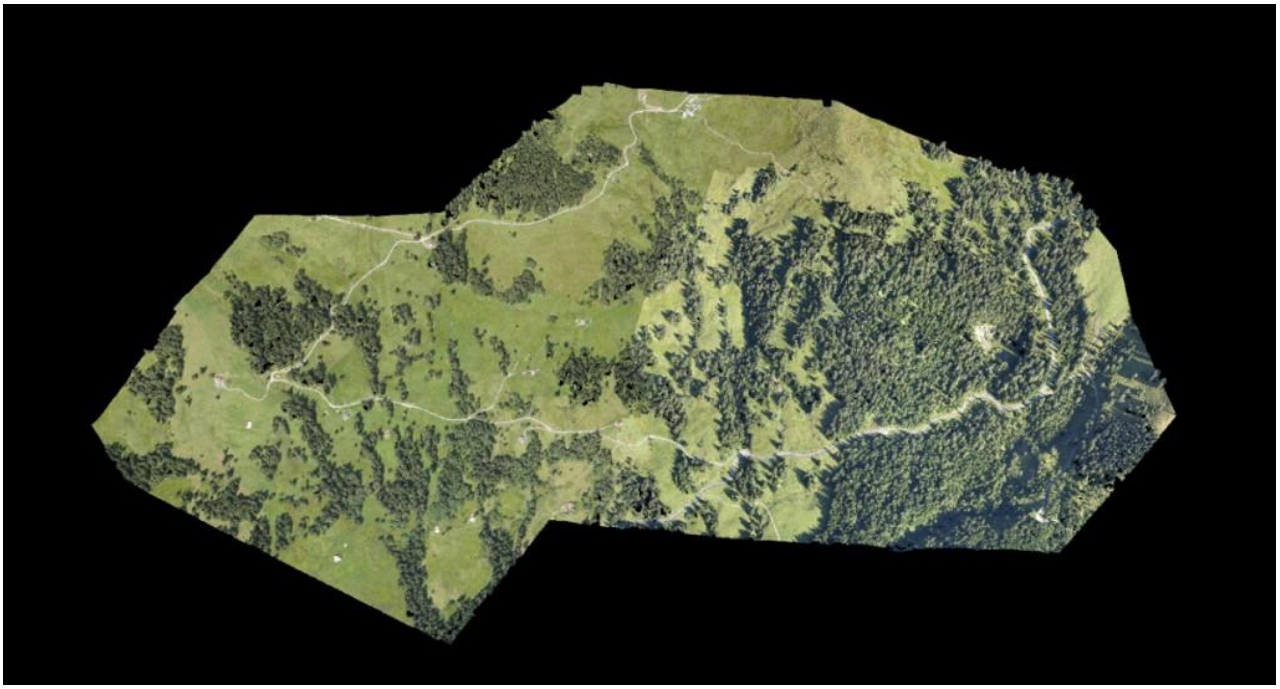

Figure 1 - Orthomosaic of the hypothetical camp site processed in Pix4D

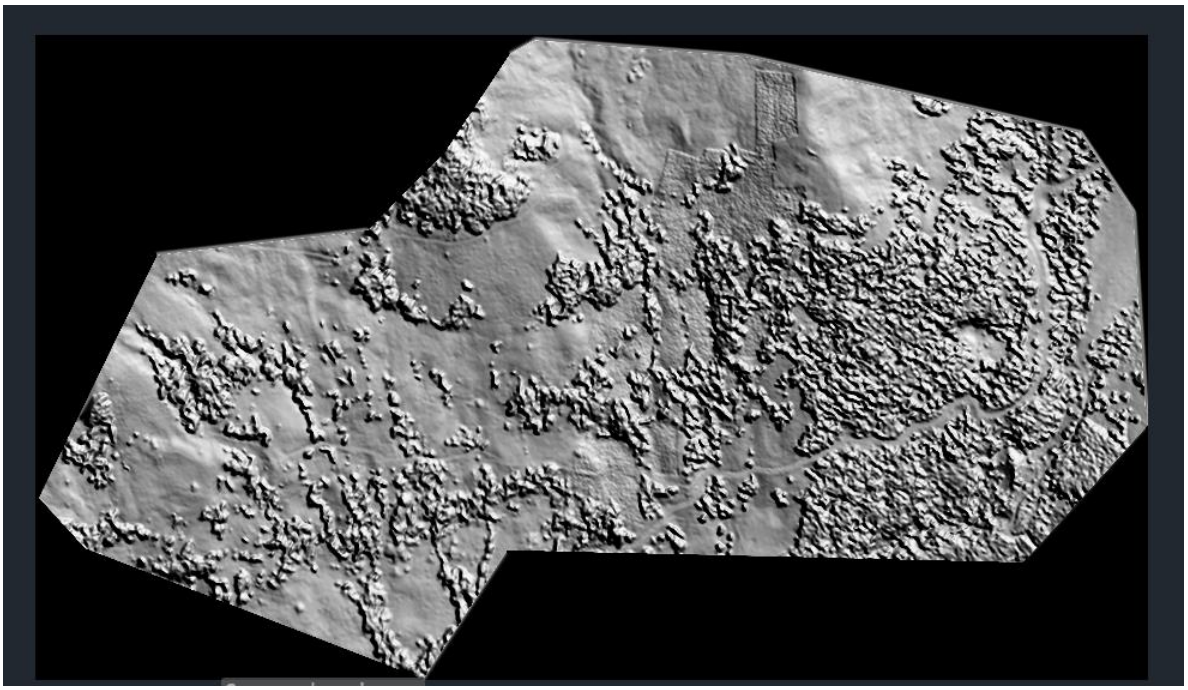

Figure 2 - Digital Surface Model of the same area

The total flight time to cover the area was 30 minutes, after which it took 40 minutes to create the point cloud, orthomosaic and contour lines and another hour to create the DTM from the DSM. CartONG used a fixed wing, eBee Sensefly drone with an optical (RGB) camera for this exercise.

Feedback

Site planners emphasised that high-resolution imagery would be very valuable when planning a new refugee camp or when working to improve an existing site. While the participants appreciated the free satellite imagery that is available through the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), the consensus was that the image resolution (15 to 90 m/pixel) of the ASTER images falls short of the needs of site planners. Drone imagery on the other hand can provide the required resolutions. For the simulation, CartONG captured imagery at a resolution of 12 cm/pixel which was sufficient. The eBee can achieve resolutions of up to 3 cm/pixel.

Participants also commented on how quiet the eBee was, compared to a quadcopter drone that was flown by a camera team in the vicinity.

The costs of approximately 18,000 Euro (20,000 USD) per eBee drone were also briefly discussed. A camp manager who had been requesting satellite imagery almost daily emphasised that compared to 500 USD per satellite image, the costs for the drone would be amortised quickly. Another participant pointed out that satellite imagery is subject to licensing restriction, which means that a buyer cannot share the data with all organisations working in a refugee camp. The drone imagery on the other hand would belong to the owner of the drone and could be shared publicly.

On a cautionary note, multiple participants mentioned that it can be very difficult or even impossible to get permissions from the authorities for drone flights in many countries. Since refugees are frequently displaced by armed conflict, rather than natural disasters, the assumption was that authorities in host countries might be very suspicious of the use of drones.

Main uses

One of its main uses would be as a tool to understanding topography and deriving slope and elevation information about a potential settlement site. Some important information products include:

- Topographical analysis with contour lines
- Slope and elevation analysis

With the help of these products, site planners would be able to easily determine the amount of usable land which in turn would inform how many people can be housed in a site. Taken together with the UNOSAT flood data, these information products would further enable site planners to calculate flood risks and include mitigation measures already in the planning phase.

Additional uses for the drone data that were mentioned by site planners included:

- Creation of a map with general services and facilities – this was deemed particularly useful for very big sites for which often no map exists.
- More precise planning of drainage, WASH facilities (pipes) and irrigation systems
- Change detection to see how camps evolve over time. One of the site planners suggested that this might for example show whether different groups within a camp are moving closer together or further away from each other. Obviously, this also requires knowledge of who is living where in the site.
- Documenting environmental impact: Aerial imagery can be used to document the state of a site prior to it being turned into a refugee site, as well as reforestation efforts where applicable. However, for this purpose satellite imagery is likely sufficient.
- Monitoring of road and drainage construction: while this can also be done from the ground, one of the participants emphasised that with the help of a drone it could be done much faster. This would then free up staff who could be assigned to other tasks.
- Drone images could improve the scientific rigour of household surveys by helping enumerators select a representative sample of homes.

One participant also shared an experience where refugees would move shelters within the camp because they did not agree with the layout of the site or preferred to be closer to specific community members. This made it difficult to track occupancy. In these cases, drones could help find the shelters, for example if each shelter had a number written on the roof.

Challenges related to the simulation

Flights

The simulation took part close to a Swiss mountain resort, where drone flights were hindered by an issue that is rarely encountered in humanitarian emergencies: paragliders. Two weeks before the simulation, CartONG mapped ⅔ of the target area with an eBee drone but could not complete the flights due to the large number of paragliders that were present at the same time.

Plans to complete the flights on the day before the simulation were thwarted by heavy fog with visibility of less than 25 meters. While drones are generally considered to be at an advantage compared to satellites or planes when it comes to cloud cover, the weather conditions on that day made flights impossible for two reasons:

1. Visibility was too low for the drone to see anything
2. Visibility was too low for the pilot to keep the drone in sight, which is a legal requirement in Switzerland.

Fortunately, the weather cleared up on the day of the simulation itself, which enabled the CartONG team to complete the flights at the last minute.

Figure 3 - CartONG staff looking at data that has just been collected by FSD's eBee drone. Photo: Timo Lüge

Data processing

The large number of trees in the target area presented a considerable challenge when creating the DTM. As the drone was not equipped with an expensive LIDAR sensor, the camera could not see through the canopy to the ground. Also, CartONG was using a beta version of Pix4D which is not able to automatically remove trees with an acceptable quality. This meant that the CartONG information manager had to remove the trees manually from the image and fill the gaps with the help of Pix4D with an approximation of elevation profile.

Technical Specifications & Credits

Type of system: Sensefly eBee
Deploying Agency: FSD/CartONG
Piloting Agency: CartONG
Dates of Deployment: September 2016
Author: Timo Lüge, ed. Denise Soesilo

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Humanitarian Aid and Civil Protection

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