



Drone Collected Volumetrics

Small Unmanned Aerial Systems (sUAS, UAVs or drones) along with exciting new image processing algorithms are enabling a fundamental change in how stockpile volumetric computations are performed. It is now possible to create accurate three dimensional models of stockpile areas using inexpensive cameras carried by a low cost sUAS. From these 3D models, volumetric computations are easily derived. These new technologies result in significantly lower cost of collection, improved accuracy and non-disruptive data collection. Best of all, they keep data collectors out of harm's way with collection performed from a low altitude drone.

The Process

A small unmanned aerial system (sUAS) is equipped with an inexpensive camera. The area of interest is programmed into the sUAS flight control system and the sUAS automatically flies the area, collecting a large number of overlapping images. Following the flight, a fairly new software algorithm called "Structure from Motion" is used to generate a dense 3D model from the collected images as well as a mosaic of the images. Finally, an analytic software application is used to compute volumes, generate contours, and create cross sections and other derived data such as gridded elevation models.



DJI Inspire

Ground Control or RTK

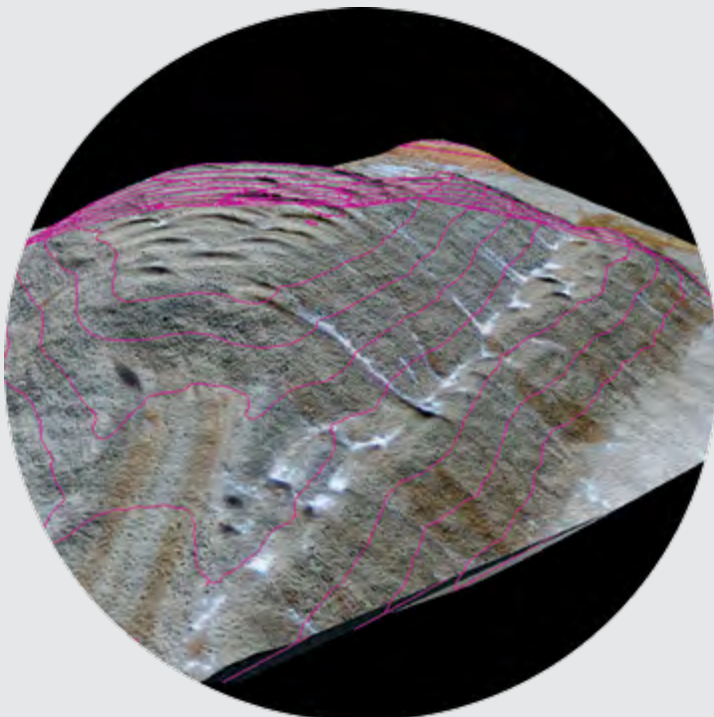
Ground Control Points are markers placed on the ground as either permanent marks (recommended for repetitive operations such as quarries) or temporary paint markings. The precise location of these markers is then determined using standard survey techniques. The marks show in the acquired images and are used to provide scale and precise location to the computed models. Alternatively, the drone can be equipped with a survey grade geopositioning system (Real Time Kinematic, RTK) to significantly reduce the need for ground control.

Collecting Data

The collection of data is accomplished by flying the drone, we recommend a camera-equipped multirotor platform, over the quarry or stockpile site. Under the control of a mission plan uploaded to the drone, the flight is fully automatic. The drone flies a pattern of lines, automatically triggering the camera at the appropriate locations. The drone then self-lands and shuts down.

Processing Data

The images and flight log are transferred from the drone to a computer by a USB cable. The images are then processed in an image processing application that generates both a 3D model (as a dense collection of very accurate points) as well as an image map (an orthophoto mosaic) of the site. RTK direct geopositioning data are used to provide precise orientation to a reference coordinate system.



A 3D Stockpile Model from LP360 fpr sUAS



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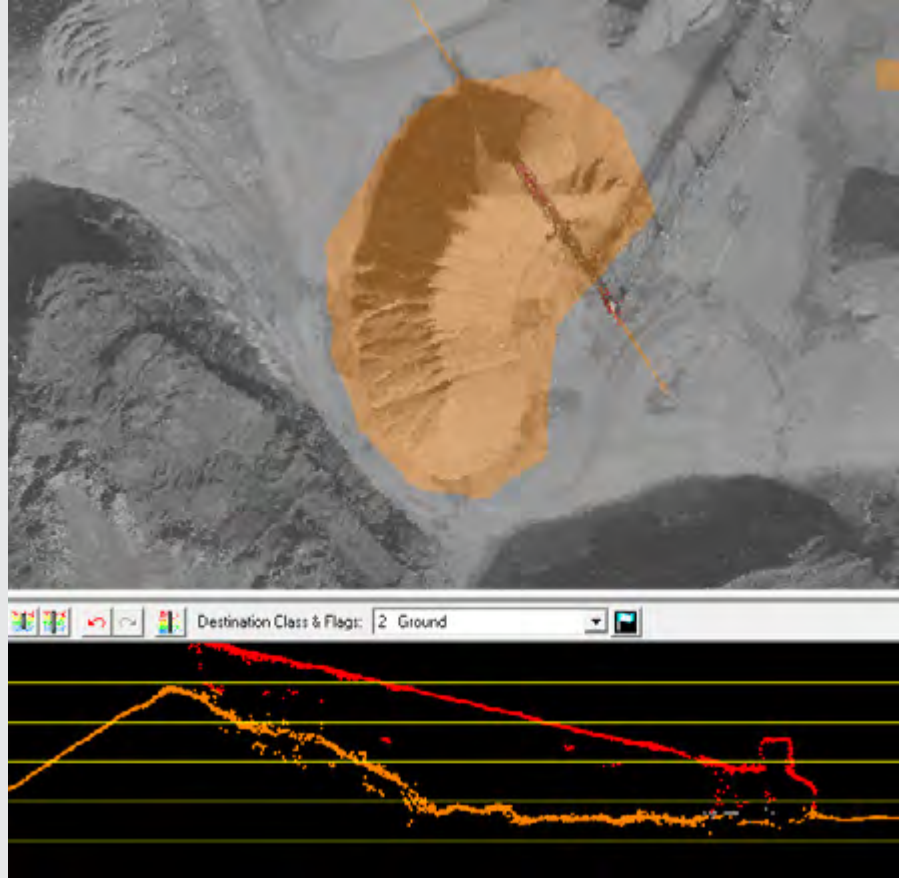
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Analytic Results

The point cloud and ortho generated in the previous step are analyzed in our application software, LP360 for sUAS. This application allows you to view the site in three dimensions, perform any necessary data cleaning and generate analytic products. Volumetric analysis can be performed by simply clicking on a stockpile. The toe is automatically drawn. The volume computation is then performed by an automated algorithm. In addition to volume computations, you can do linear distance and area measurements, generate contour maps, measure area, and create cross-sections and other products.



Distributing Results

AirGon offers its cloud-based Reckon system for storing and distributing site mapping data. Hosted in Amazon Web Services for extreme reliability, Reckon provides an easy way for customers to store and visualize orthophoto mosaics of sites, one-click volume results and downloadable volume reports as both pdf documents and tables ready to import into Excel. Reckon organizes data by site and by time, allowing you to easily review how a site is evolving over time.

RECKON

Cleaned data ready for volumetric computations in LP360 for sUAS.

A Reckon web view of a quarry site.

Deployment Models

There are two general deployment models:

Service Provider – this model uses an outside service provider, AirGon Services or an independent surveyor. The provider will consult with you to understand your needs. They will then fly the mission, process the data and deliver results. If you opt for AirGon Reckon web hosting, results are available to you via a simple web browser.

Owner/Operator - The small mapping systems are so easy to use that owners often operate the systems using existing staff. AirGon offers complete training that covers operations from mission planning to data processing. AirGon Reckon is available for storing and delivering data.

