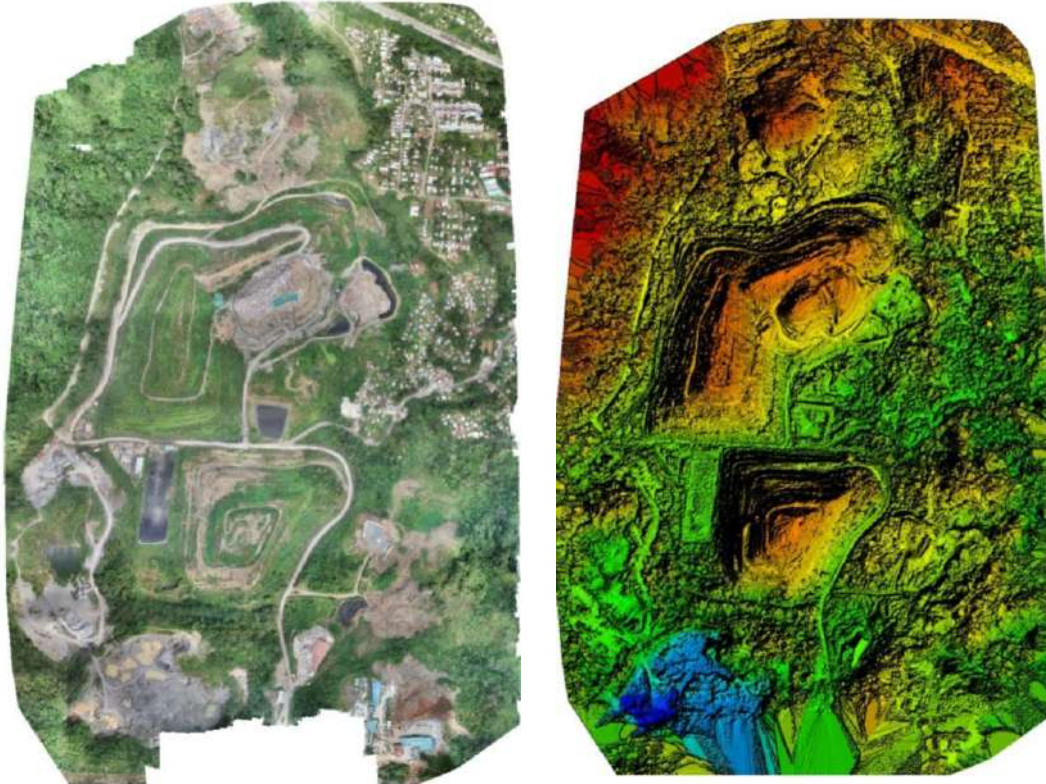


## Cerro Patacón landfill monitoring and supervision



*Orthomosaic and Digital Surface Model of the area*



*3D model of the landfill*

### OVERVIEW

<b>Flying Labs</b>	Panama Flying Labs
<b>Geographic area</b>	Ancón, City of Panamá (Panamá)
<b>Date</b>	October - December 2018
<b>Sector program</b>	DevRobotics

SCOPE	
<b>Stakeholders (clients)</b>	Panama Urban and Domestic Cleaning Authority (AAUD)
<b>Challenge</b>	In Panama City, there is only one sanitary landfill and since it is the only one, it is a large one. This makes the monitoring and supervision tasks complicated - currently, it is done on foot using hand-held digital cameras. This process is very inefficient, as it requires a significant amount of resources and generates high costs in the long run. It also prevents prompt planning and rapid response.
<b>Scope</b>	To show how, with the use of drones, the monitoring and supervision of the landfill can be carried out in a faster, more effective and cost-efficient way, relying on the capture of images for the generation of orthomosaics.
<b>Outcome</b>	<p>Phase 1: Train the personnel of the Cleaning Authority on the handling and use of drones, so that they can carry out the flights and landfill monitoring on their own.</p> <p>Phase 2: Drone flight over the Cerro Patacón landfill area.</p> <p>Phase 3: Processing and analysis of the captured data. The use of a drone for monitoring the Cerro Patacón landfill proved to be satisfactory. It made the monitoring process more efficient, saving the time necessary to reach the whole area on foot. Using orthomosaics introduced a significant improvement compared to using digital cameras.</p> <p>Phase 4: Train the personnel of AAUD in data processing and analytics.</p>
<b>Next steps</b>	After introducing drones as working tools, the Cleaning Authority team will be able to continue monitoring the Cerro Patacón landfill on their own, optimizing their everyday work more and more. Being able to generate new orthomosaics will allow them to easily compare the situation 'before' and 'after' and detect changes that have occurred in the landfill. Also, if there is a need for staff training for new personnel, Panama Flying Labs will be able to plan and implement such training.

DATA ACQUISITION	
<b>Size of area</b>	246.60 ha (2.466 km <sup>2</sup> )
<b>Drone</b>	DJI Phantom 4 Pro V2
<b>Sensor(s)</b>	RGB camera
<b>Flight plan software</b>	Pix4Dcapture
<b>Flight height</b>	120 m above ground level
<b>GSD (Accuracy)</b>	4.61 cm/pix

<b>Number of images acquired</b>	2025
<b>Number of flights</b>	11
<b>Time invested in data acquisition</b>	1 hr 17min
<b>Georeferencing</b>	Onboard GPS

#### DATA PROCESSING & ANALYSIS

<b>Processing software</b>	Pix4Dmapper
<b>Processing time</b>	4 hrs 30 min
<b>Data products</b>	Orthomosaic, 3D model
<b>Analysis tools</b>	Pix4Dmapper, QGIS
<b>Analysis outputs</b>	Orthomosaic, map of selected areas of interest
<b>Final outputs shared with stakeholders</b>	Orthomosaic, map of selected areas of interest, short fly-through video of the 3D model
<b>Data sharing</b>	Hard drive