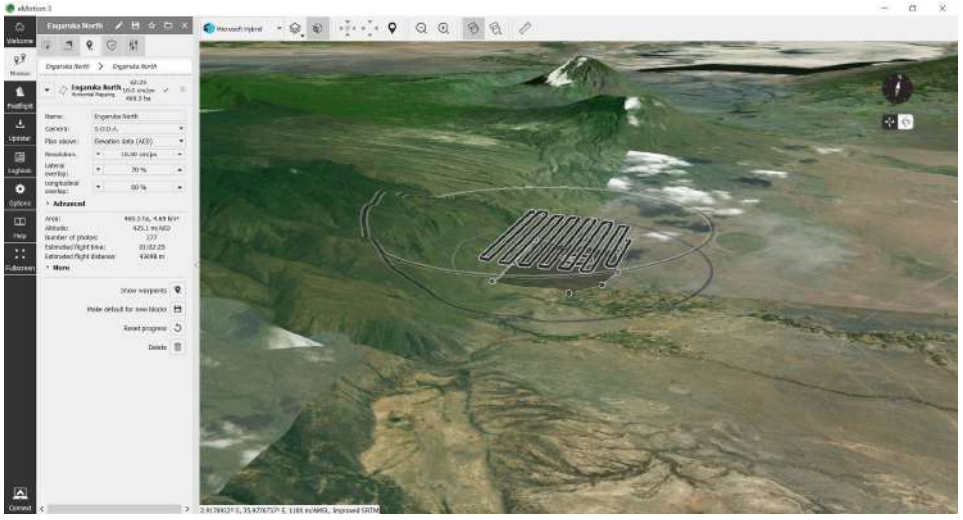
Drone 3D mapping of Engaruka archeological site



Planning the flight in 3D (eMotion flight planning software)

Tanzania Flying Labs team in action

OVERVIEW	
Flying Labs	Tanzania Flying Labs
Geographic area	Engaruka Archaeological Site, Arusha, Tanzania
Date	February - January 2019
Sector program	DevRobotics

SCOPE	
Stakeholders (clients)	Jomo Kenyatta University of Agriculture and Technology (JKUAT)
Challenge	Gully and rill erosion is a common phenomenon in Arusha. Such erosions can cut across or along archaeological features thus lead to their destruction. The rills are often too small to be analyzed using low resolution imagery with no terrain data.
Scope	Creating high resolution 2D and 3D mapping products for erosion analysis of the gullies and rills as well as the archeological features. The aim is to quantify erosion changes on the Engaruka Archeological Site.
Outcome	The drone photogrammetry survey covered three target areas of the Engaruka site, each measuring 500m by 500m. The survey covered four 200-300 meters long gullies, 100-200 meters long rill systems and archeological features such as an ancient fieldstone terrace (one-stone high linear feature). The results of data processing included high resolution orthomosaics of the three areas and 3D models of the fieldstone terrace and selected erosion formations. The photos were taken at different moments of the rainy season, which allowed to create a time-lapse sequence and high quality visualisation of the gullies and rills before and after the rains.
Next steps	Further in-depth analysis of the gully and rill formations and archeological features based on the project outputs. This will consist of an automatic or semi-automatic feature extraction, high detail analysis of the field terraces, analysis and visualisation of the gullies and rills systems focusing on how they cut across the archeological features as well as an evaluation of the erosion processes based on the time series. Several representative erosion formations (gullies and rills) will be selected for future monitoring before and after rains.

DATA ACQUISITION	
Size of area	819.3 ha (8.193 km2)
Drone	SenseFly eBee Plus, DJI/Phantom 4 Pro
Sensor(s)	RGB S.O.D.A, Canon M50 for ground photos
Flight plan software	DroneDeploy
Flight height	30m and 100m above ground level
GSD (Accuracy)	1cm/pix and 3cm/pix (corresponding to the flight height)
Number of images acquired	281
Number of flights	17
Time invested in data acquisition	3 days (3h25 of flight time)
Georeferencing	Ground Control Points

DATA PROCESSING & ANALYSIS	
Processing software	Pix4Dmapper
Processing time	7.5h
Data products	Orthomosaic, DEM, 3D meshes
Analysis tools	Pix4Dmapper
Analysis outputs	Time-lapse animation
Final outputs shared with stakeholders	Orthomosaic, DEM, 3D meshes, time-lapse animation
Data sharing	Soft copies