Reality Mapping: A complete Digital Twin

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SOUTHERN AFRICA ESRI USER CONFERENCE 2025

What is a digital twin?

Mirroring the real world with GIS

A digital twin is a virtual representation of reality, including physical objects, processes, and relationships. When built on a foundation of geography, it becomes a geospatial digital twin.

- **Geospatial**
  - Accurate representations of complex systems require robust maps and spatial analytics from geographic information system (GIS) technology.
- **Time aware**
  - GIS-based digital twins go beyond 3D models as they reflect change over time—showing historic, current, and future states.
- **Scalable**
  - From single facilities to large built and natural systems, geospatial digital twins scale to meet changing needs.

What is Reality Capture?

Digitally documenting physical environments

Reality capture is the process of digitally recording the physical world to create accurate, data-rich models that serve as the foundation for digital twin generation.

- **Capture**: Using technologies like LiDAR, photogrammetry, and 3D scanning to capture spatial and visual details of real-world assets.
- **Digital Model Creation:** Converting captured data into georeferenced, detailed 3D models that form the basis of a digital twin.

What is Reality Mapping?

Virtual Representation of the real world

The process of creating accurate digital representations of the physical world using images, lidar, or both.

- *Leveraging high-resolution drone imagery, LiDAR data, mesh models, and CAD/BIM files to visualize both indoor and outdoor environments as detailed, photorealistic 3D scenes.*
- *One can seamlessly integrate indoor floorplans, building systems, and real-world context to create immersive digital twins that support planning, analysis, and facility management.*
- *Advance 3D visualization and spatial intelligence tools, you can transform complex spatial data into clear, actionable insights.*

Digital Twins – Maturity Curve & Stages

Motivated by Outcome

Digital Thread

AUTONOMOUS
Self Learning and Decision making without Human Interaction
Autonomous Operations | Adaptive | AI Assistance & Decision

COMPREHENSIVE
Simulations of Outcomes to make recommendations
Scenario based Modelling | Remote Controlled Inspections

PREDICTIVE
Capable of Predicting outcomes
AI / ML | Forecasting & Simulations | Advance Analysis

INFORMATIVE
Connected to sensors from multiple sources in real time
IoT Sensors | Analytics | Corrected Data Environments | Virtual Models (Dynamic)

DESCRIPTIVE
Virtual Representation of the Physical Assets or Networks
Reality Mapping | Virtual Model (Static) | 2D/ 3D Visualisations

Digital Twin Components

Create	Use	View
• ArcGIS Flight • ArcGIS SiteScan • ArcGIS Drone2Map • ArcGIS Pro Reality Mapping • ArcGIS Reality Studio	• ArcGIS Pro • ArcGIS Pro Extensions • ArcGIS Enterprise • ArcGIS Experience Builder	• ArcGIS Experience Builder • ArcGIS Scene Viewer • ArcGIS Dashboards

Scope & Objective → Collect & Build → Run & Operate

ArcGIS Reality

Multi-Platform, Multi-Sensor, Multi-Scale, Multi-Deployment

Process & Manage

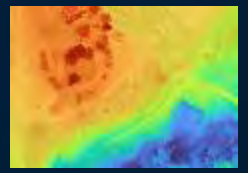
3D

Mesh

Point Cloud

Digital Elevation Model

Terrain Model

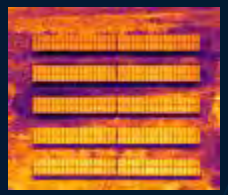


Surface Model

True Ortho

Natural Color

Multispectral



Thermal

Oriented Imagery

Still Images & Video

Input Imagery

Drone
Aerial
Satellite

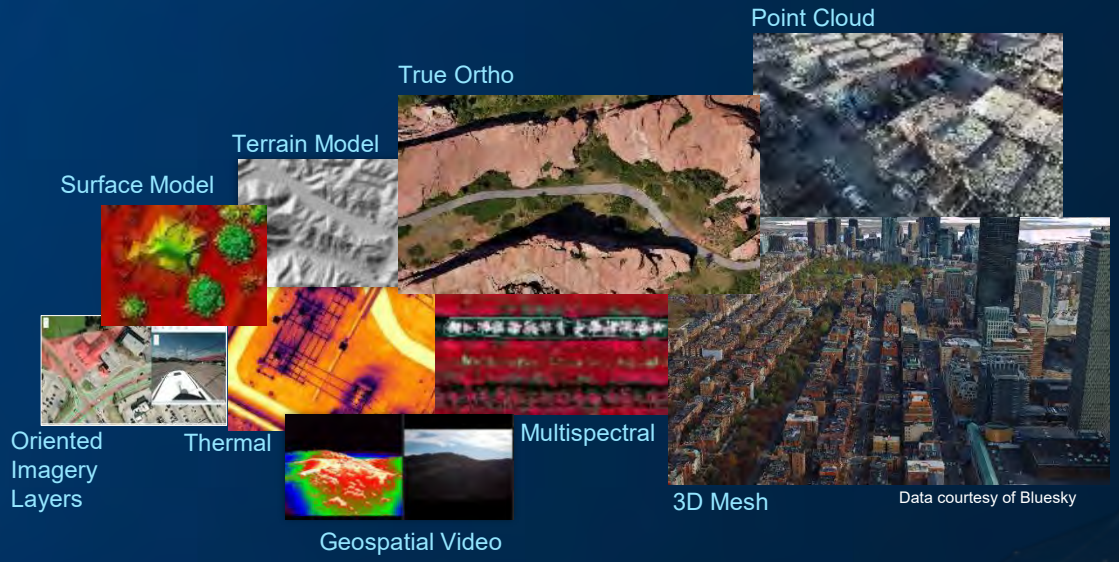
RGB
Thermal
Multispectral

Analyze & Share

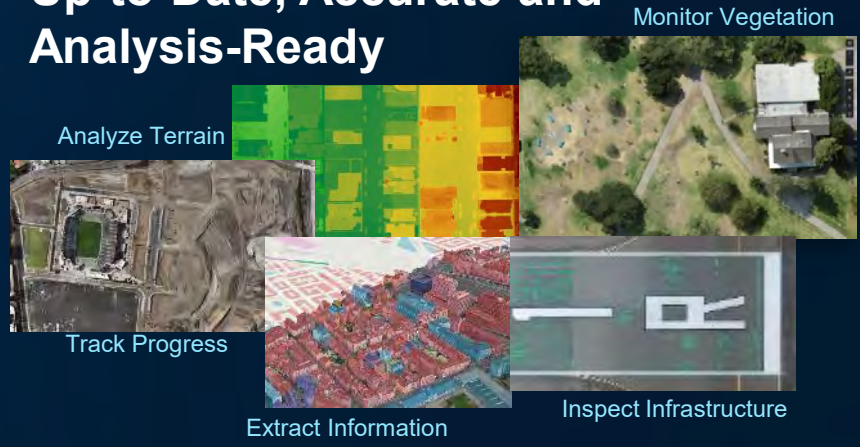
Reality Mapping in ArcGIS

Creating Accurate Digital Representations of the World

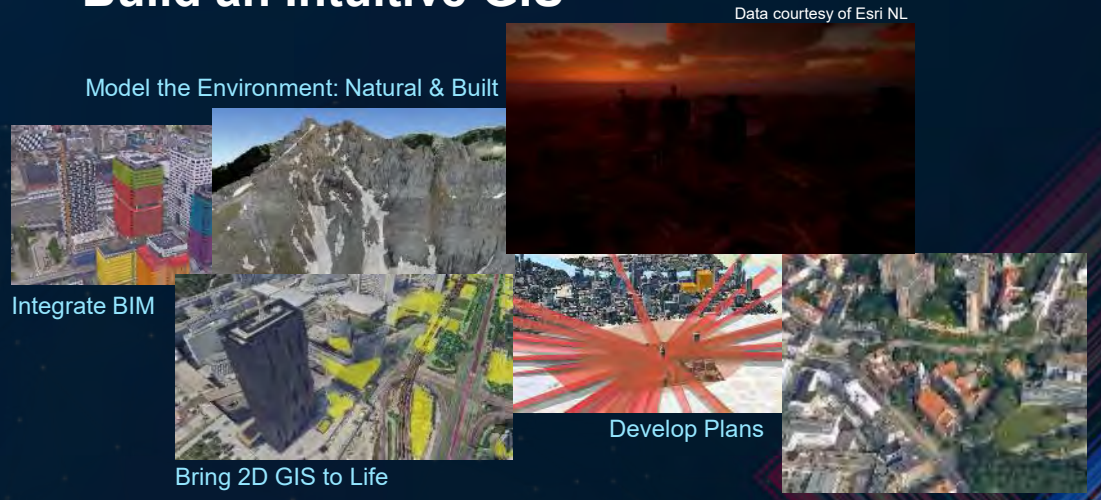
Generate Foundational Content



Up-to-Date, Accurate and Analysis-Ready

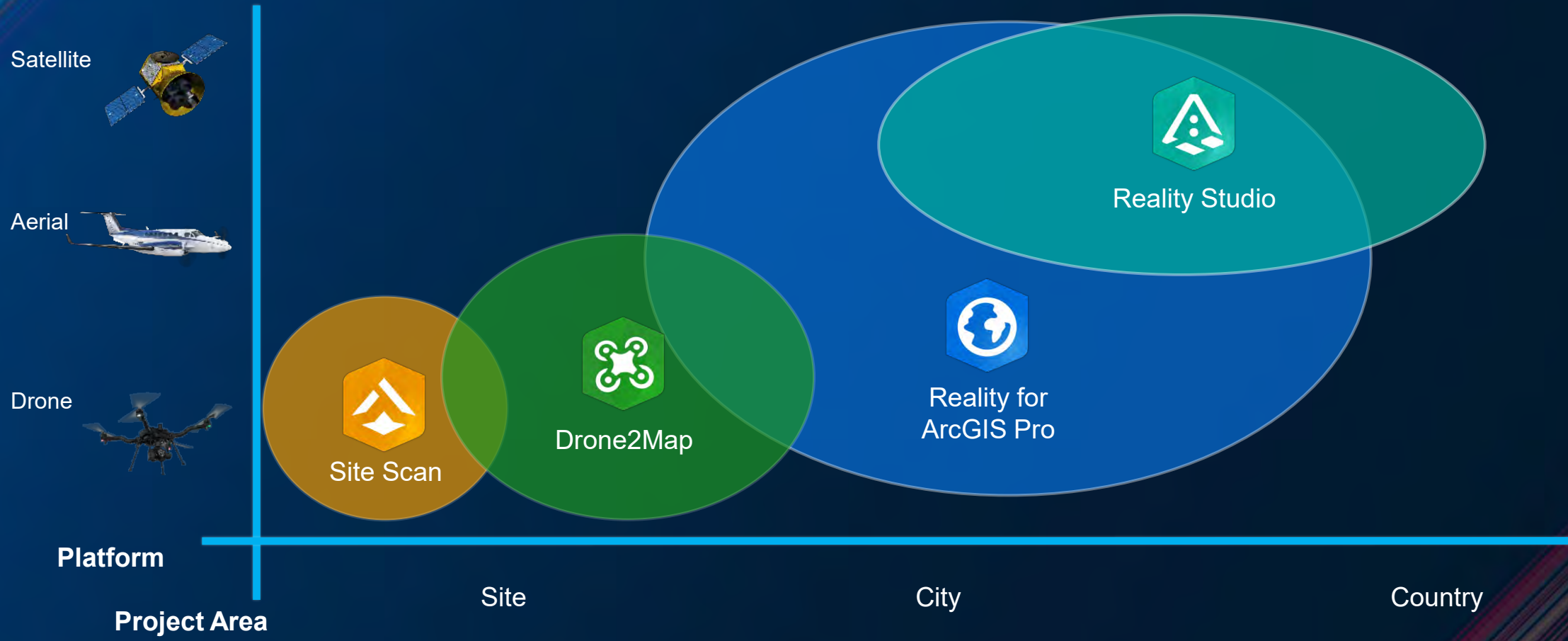


Build an Intuitive GIS



ArcGIS Reality Engine Suite

Product Family



Site Scan for ArcGIS

Complete drone reality mapping on the cloud

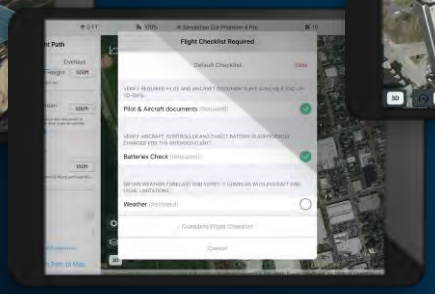
- Capture, process and analyze drone imagery at scale
- Easily share content:
  - Invite read-only users
  - Create public Sharelinks
  - Publish to ArcGIS Online and ArcGIS Enterprise
- Manage your pilots and fleet

ArcGIS Flight

Drone data capture for the ArcGIS system

- iPad application for 3D flight planning
- Offline use with downloadable basemaps
- Overlay and plan from GIS content
- Automated and repeatable mapping
- Geospatial video capture and inspection
- Process imagery with ArcGIS Reality, including direct upload to Site Scan cloud.

Terrain Following



Checklists

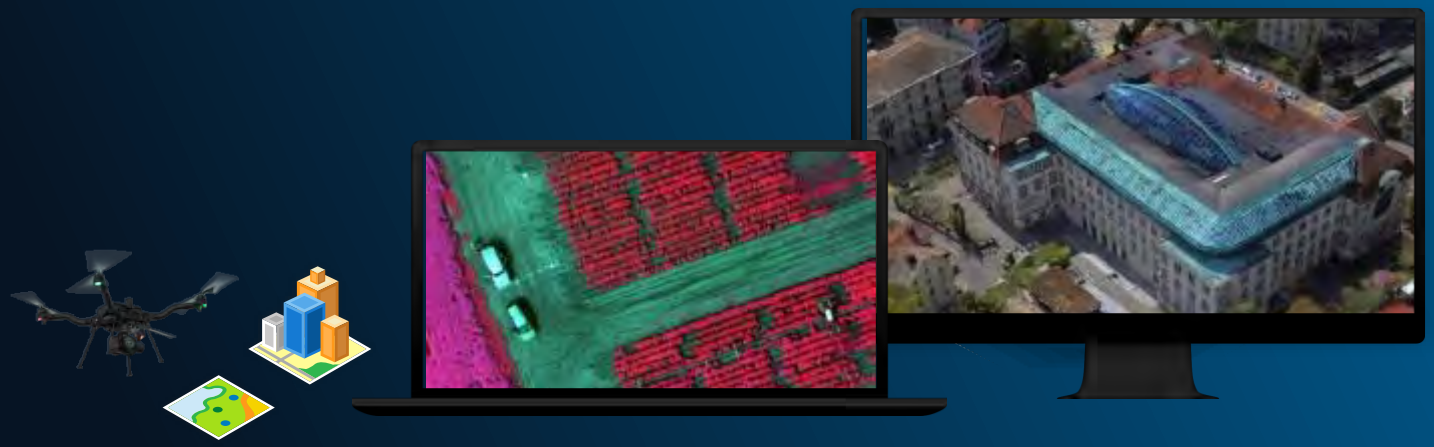
Vertical Scan

ArcGIS Pro FMV

ArcGIS Drone2Map

Drone reality mapping on desktop

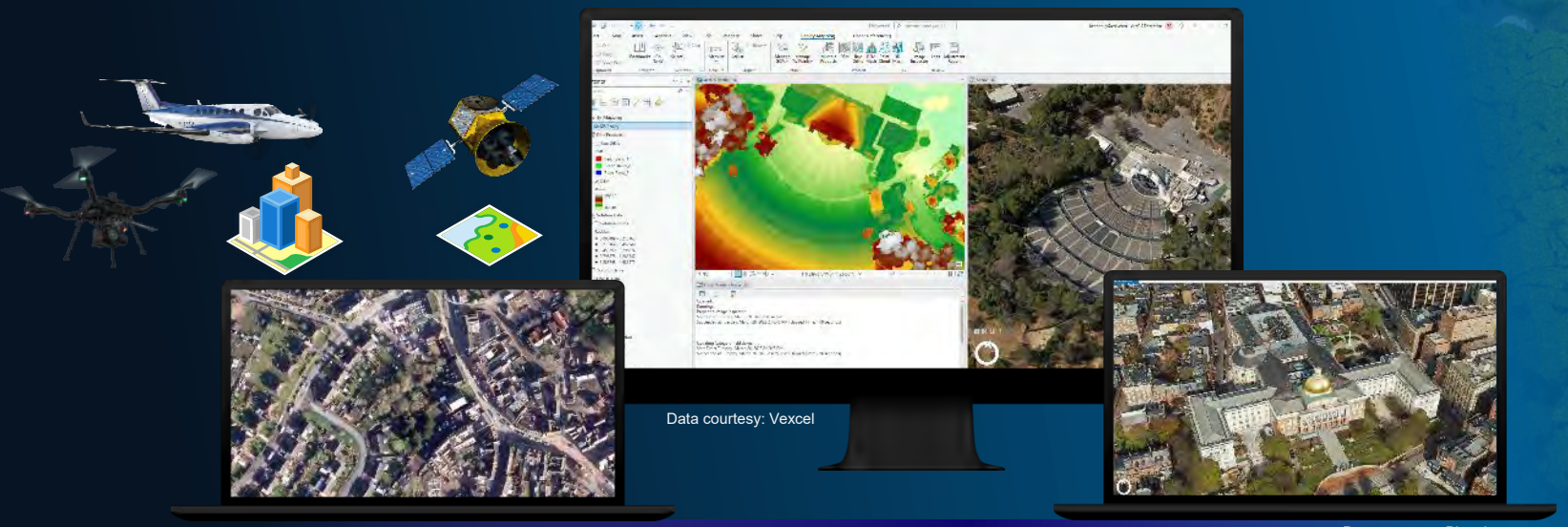
- 2D Processing including True Ortho in Drone2Map Standard
- 2D and 3D with Drone2Map Advanced, including point cloud & 3D Mesh
- Rapid offline processing options
- Multispectral calibration and processing capabilities
- Thermal Infrared support
- Export to ArcGIS Pro, ArcGIS Online, ArcGIS Enterprise



ArcGIS Reality for ArcGIS Pro

Reality mapping in ArcGIS Pro

- Reality mapping from drones, crewed aircraft, and satellites
- Create 3D outputs directly in ArcGIS Pro
- Includes Ortho Mapping tools for large area 2D mapping, including satellite imagery
- Automate production workflows using geoprocessing tools



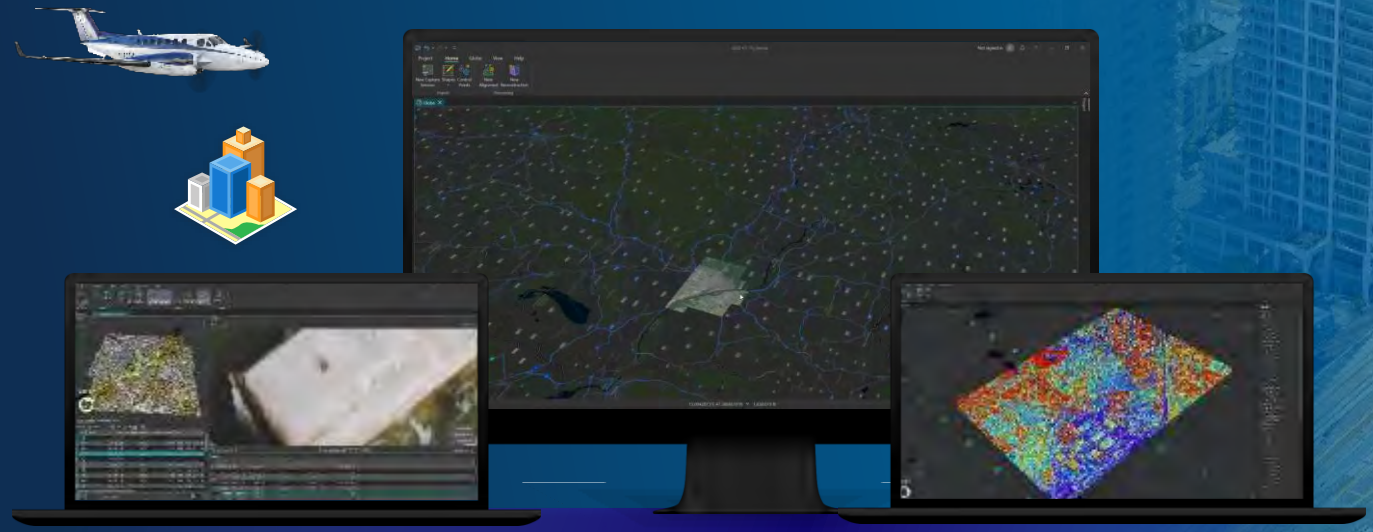
Data courtesy: Vexcel

Data courtesy: Bluesky

ArcGIS Reality Studio

Aerial reality mapping at scale

- Large-area reality mapping for cities and countries
- 3D map-centric interface
- Supporting aerial multi-head sensors
- Achieve survey-grade accuracy
- Local distributed processing for improved efficiency



ArcGIS Reality Engine

Drone2Map

Site Scan

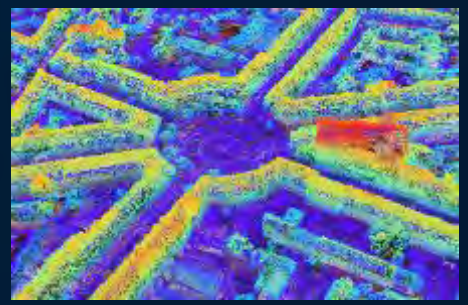
Reality Studio

Reality for ArcGIS Pro

ArcGIS Reality Engine

Digital Surface Model

True Ortho



Point Cloud

3D Mesh

The Digital Twin Workflow

ArcGIS Reality & ArcGIS Image

Sensors

Reality Capture

Cloud Storage

On Prem Storage

Reality Mapping

Reality Studio

Reality for Pro

Drone2 Map

Site Scan

ArcGIS

Image Analysis

Image Analyst

Image Online

Image Server

Image Dedicated

Video Server

ArcGIS Pro

Map Viewer

Excalibur

Imagery Derived Insights

Change Detection

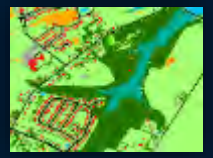


Image Classification

Object Detection

Point Cloud Classification

Tech Workshop

1. ArcGIS SiteScan
2. ArcGIS Flight
3. ArcGIS Drone2Map
4. ArcGIS Reality for ArcGIS Pro
5. Enterprise Experience Builder
6. Case Study - SUFM

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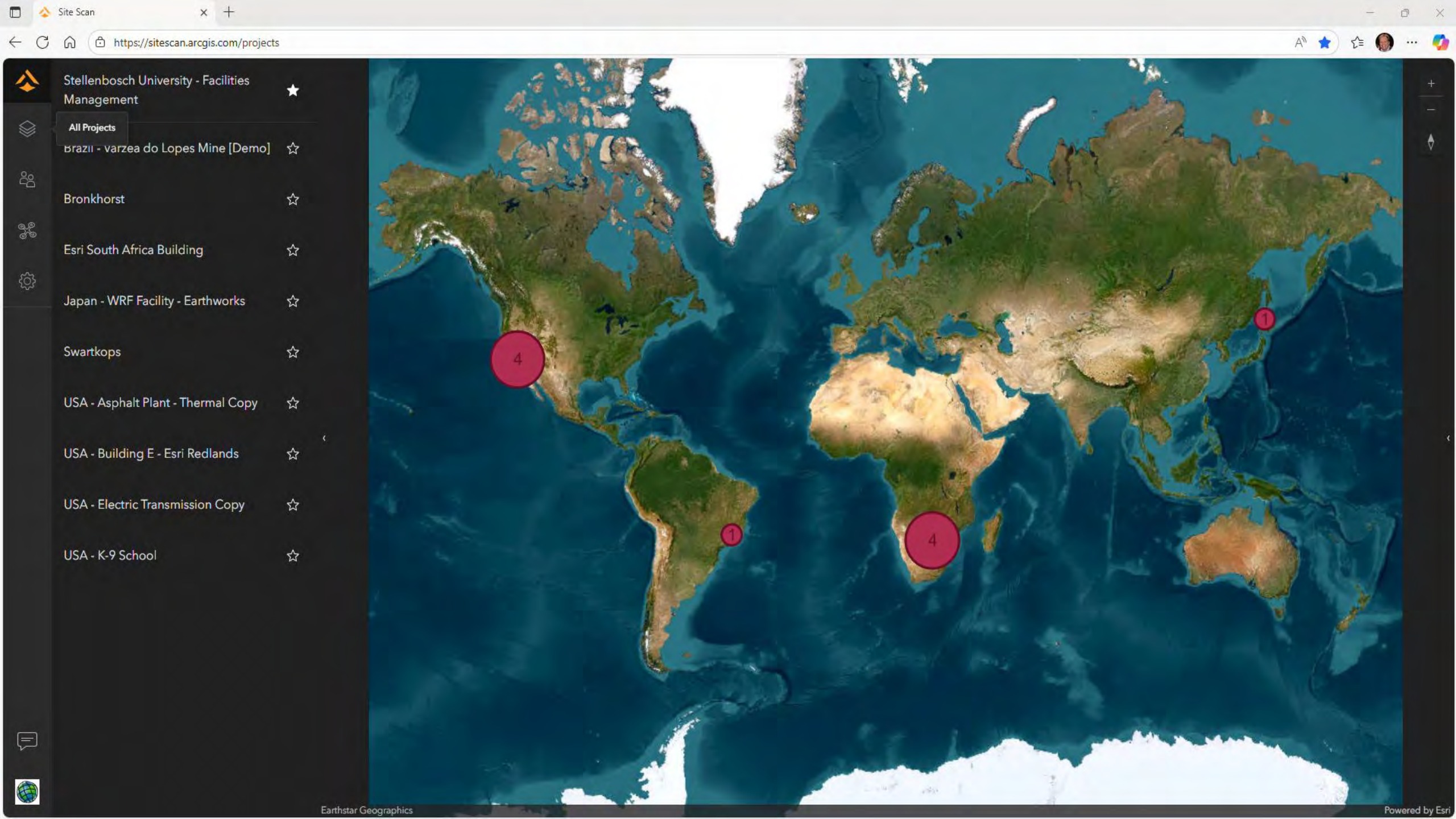
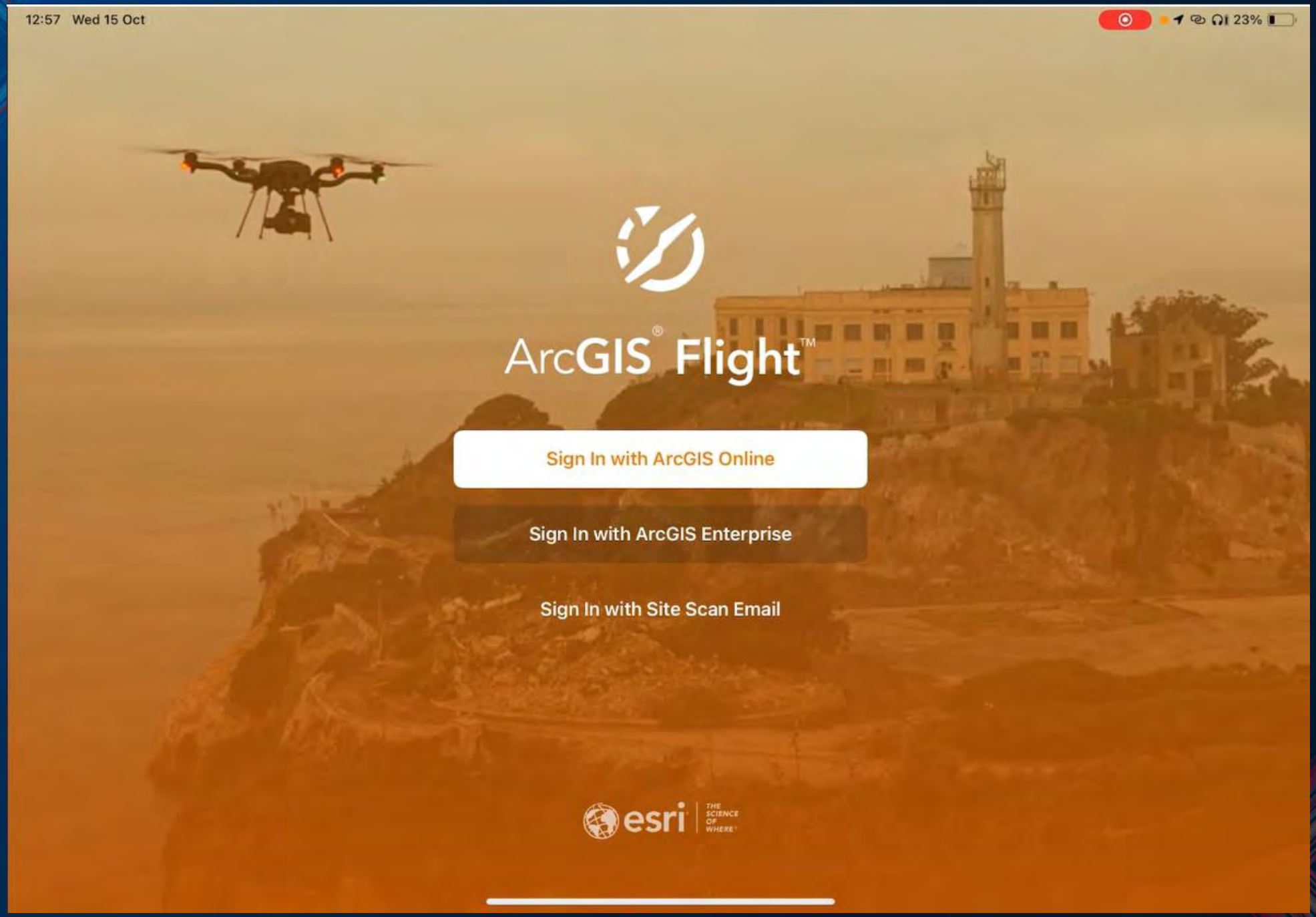
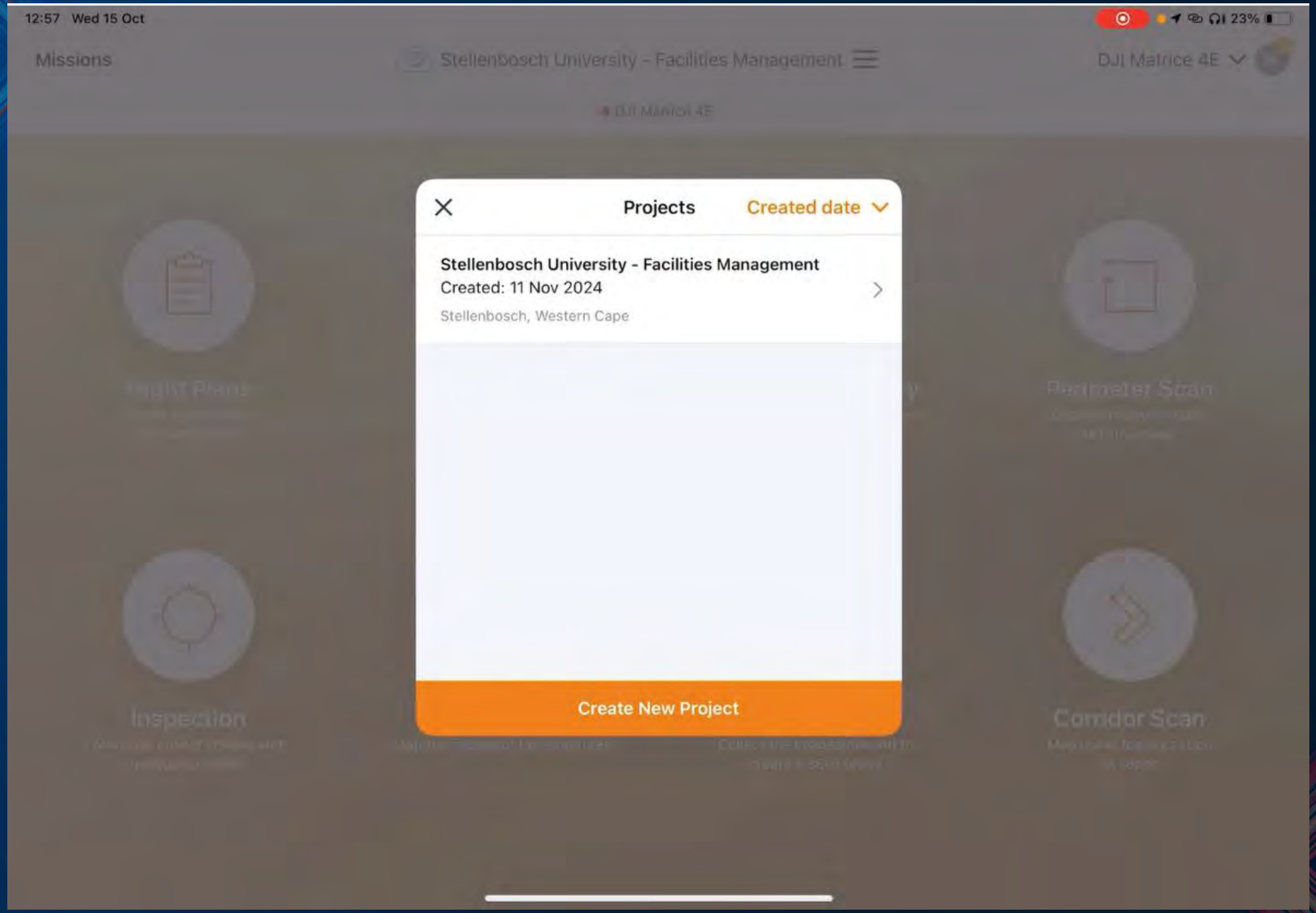
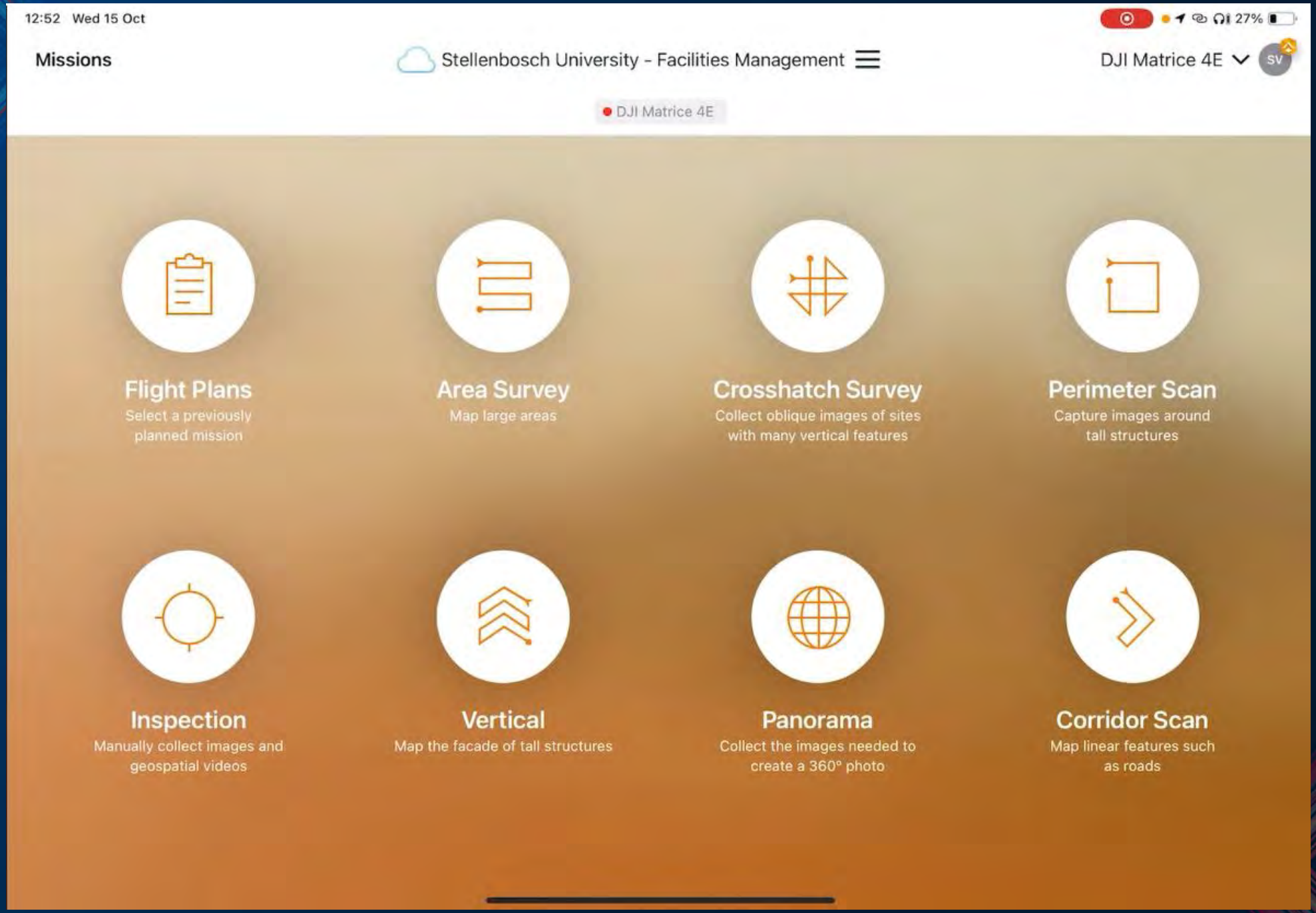
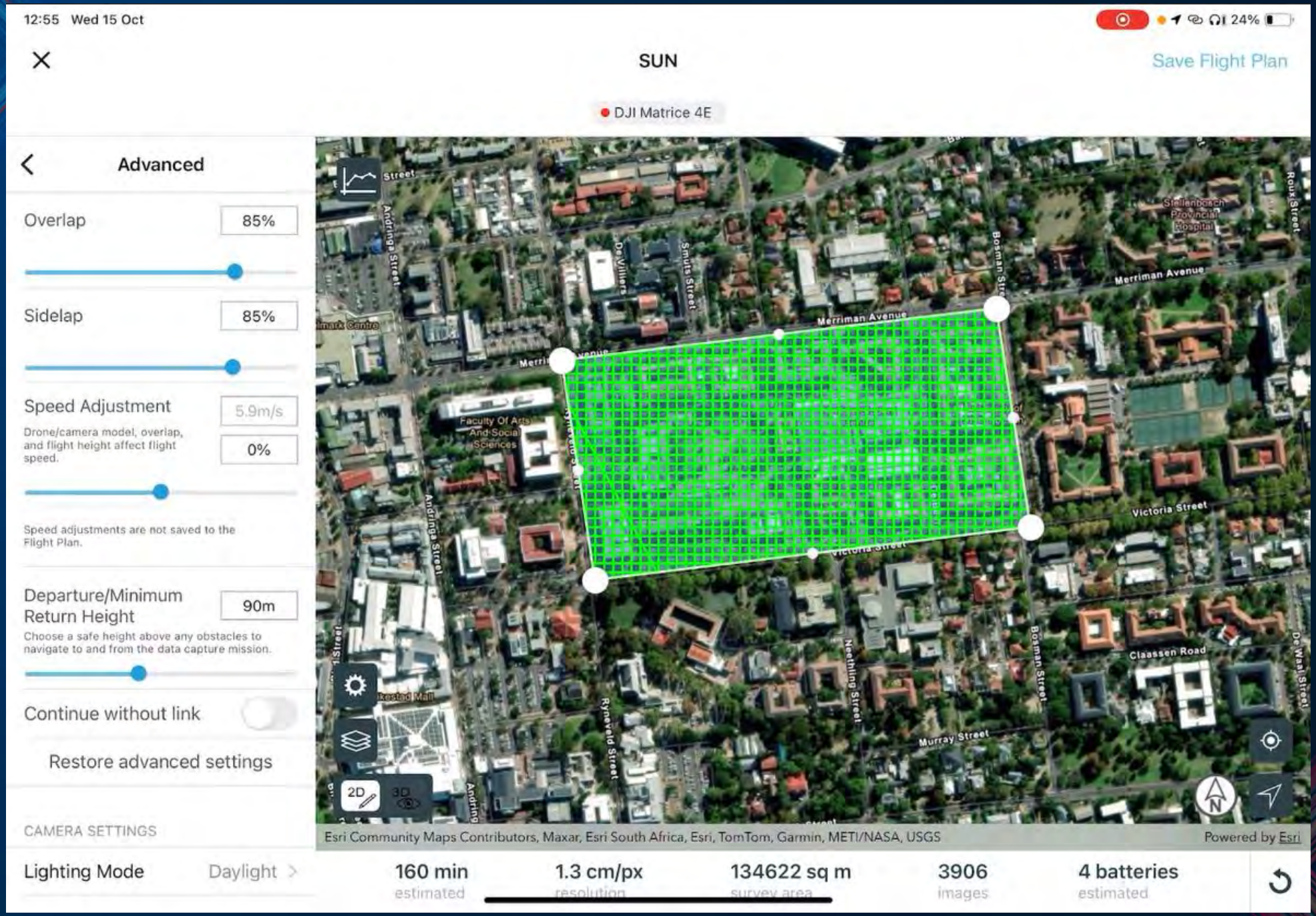
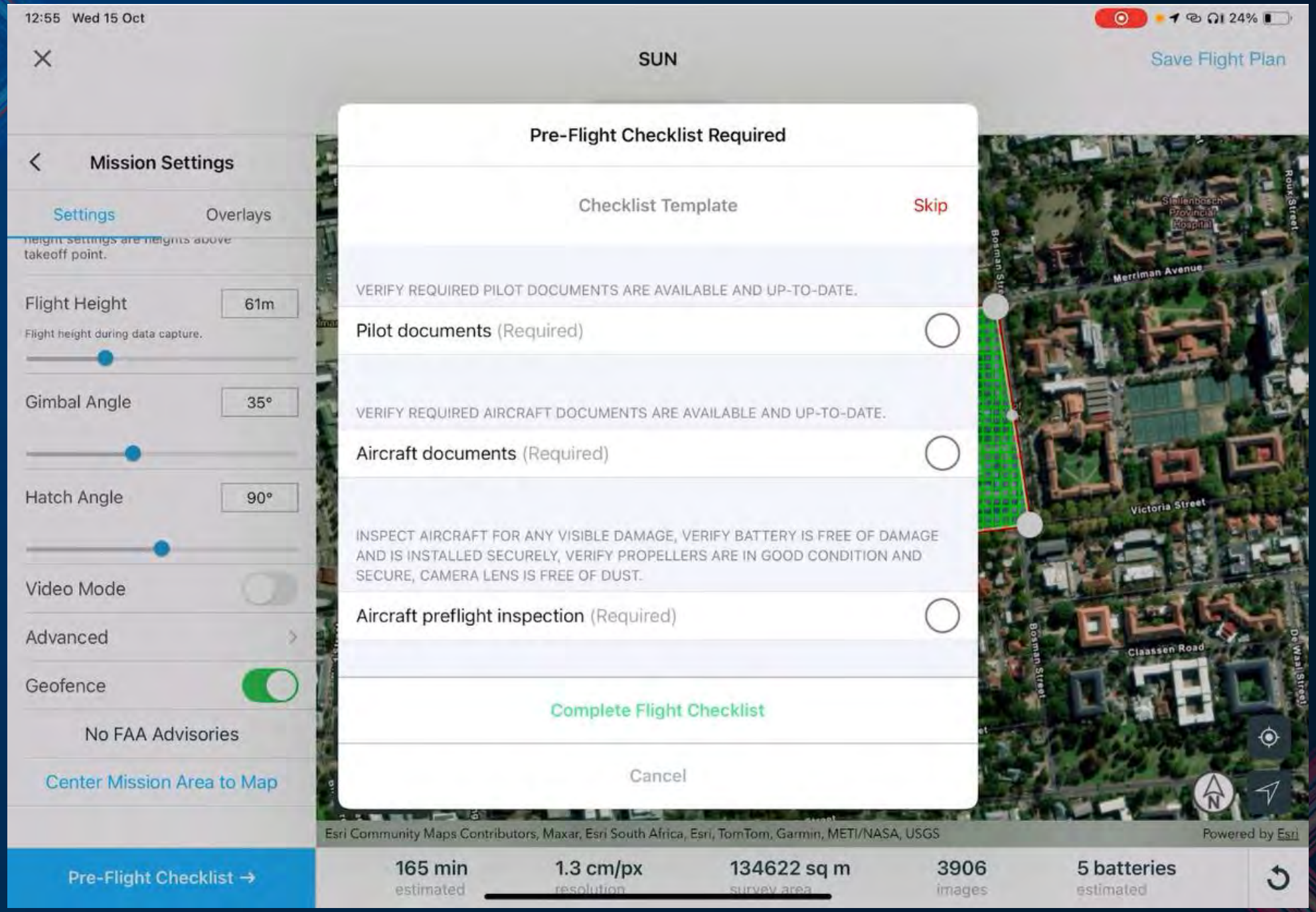

Site Scan
https://sitescan.arcgis.com/projects
Stellenbosch University - Facilities Management
All Projects
Brazil - Varzea do Lopes Mine [Demo]
Bronkhorst
Esri South Africa Building
Japan - WRF Facility - Earthworks
Swartkops
USA - Asphalt Plant - Thermal Copy
USA - Building E - Esri Redlands
USA - Electric Transmission Copy
USA - K-9 School
4
1
1
4
Earthstar Geographics
Powered by Esri


12:57 Wed 15 Oct
23%
ArcGIS® Flight™
Sign In with ArcGIS Online
Sign In with ArcGIS Enterprise
Sign In with Site Scan Email
esri
THE SCIENCE OF WHERE


12:57 Wed 15 Oct
23%
Missions
Stellenbosch University - Facilities Management
DJI Matrice 4E
Projects
Created date
Stellenbosch University - Facilities Management
Created: 11 Nov 2024
Stellenbosch, Western Cape
Create New Project
Inspection
Corridor Scan


12:52 Wed 15 Oct
27%
Missions
Stellenbosch University - Facilities Management
DJI Matrice 4E
SV
DJI Matrice 4E
Flight Plans
Select a previously planned mission
Area Survey
Map large areas
Crosshatch Survey
Collect oblique images of sites with many vertical features
Perimeter Scan
Capture images around tall structures
Inspection
Manually collect images and geospatial videos
Vertical
Map the facade of tall structures
Panorama
Collect the images needed to create a 360° photo
Corridor Scan
Map linear features such as roads


12:55 Wed 15 Oct
24%
SUN
Save Flight Plan
DJI Matrice 4E
Advanced
Overlap
85%
Sidelap
85%
Speed Adjustment
5.9m/s
Drone/camera model, overlap, and flight height affect flight speed.
0%
Speed adjustments are not saved to the Flight Plan.
Departure/Minimum Return Height
90m
Choose a safe height above any obstacles to navigate to and from the data capture mission.
Continue without link
Restore advanced settings
CAMERA SETTINGS
Lighting Mode
Daylight
Merriman Avenue
Victoria Street
Claassen Road
Murray Street
Bosman Street
Andringa Street
Ryneveld Street
Neethling Street
Faculty Of Arts And Social Sciences
Stellenbosch Provincial Hospital
Esri Community Maps Contributors, Maxar, Esri South Africa, Esri, TomTom, Garmin, METI/NASA, USGS
Powered by Esri
160 min
estimated
1.3 cm/px
resolution
134622 sq m
survey area
3906
images
4 batteries
estimated


12:55 Wed 15 Oct
24%
SUN
Save Flight Plan
Mission Settings
Settings
Overlays
takeoff point.
Flight Height
61m
Flight height during data capture.
Gimbal Angle
35°
Hatch Angle
90°
Video Mode
Advanced
Geofence
No FAA Advisories
Center Mission Area to Map
Pre-Flight Checklist →
Pre-Flight Checklist Required
Checklist Template
Skip
VERIFY REQUIRED PILOT DOCUMENTS ARE AVAILABLE AND UP-TO-DATE.
Pilot documents (Required)
VERIFY REQUIRED AIRCRAFT DOCUMENTS ARE AVAILABLE AND UP-TO-DATE.
Aircraft documents (Required)
INSPECT AIRCRAFT FOR ANY VISIBLE DAMAGE, VERIFY BATTERY IS FREE OF DAMAGE AND IS INSTALLED SECURELY, VERIFY PROPELLERS ARE IN GOOD CONDITION AND SECURE, CAMERA LENS IS FREE OF DUST.
Aircraft preflight inspection (Required)
Complete Flight Checklist
Cancel
Merriman Avenue
Victoria Street
Claassen Road
Bosman Street
Roux Street
De Waal Street
Esri Community Maps Contributors, Maxar, Esri South Africa, Esri, TomTom, Garmin, METI/NASA, USGS
Powered by Esri
165 min
estimated
1.3 cm/px
resolution
134622 sq m
survey area
3906
images
5 batteries
estimated

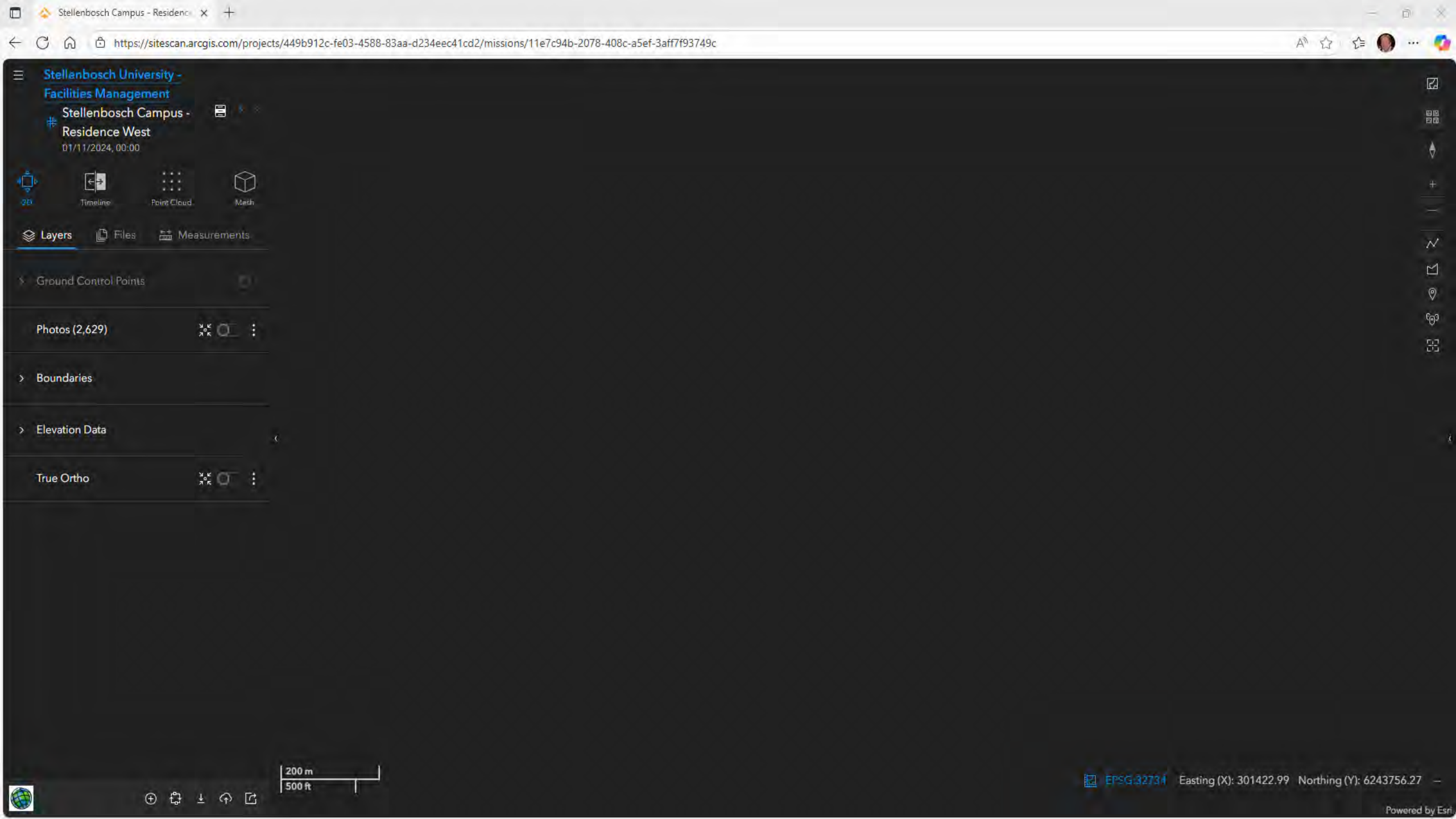
Invite New Members | Merge Missions | New Mission

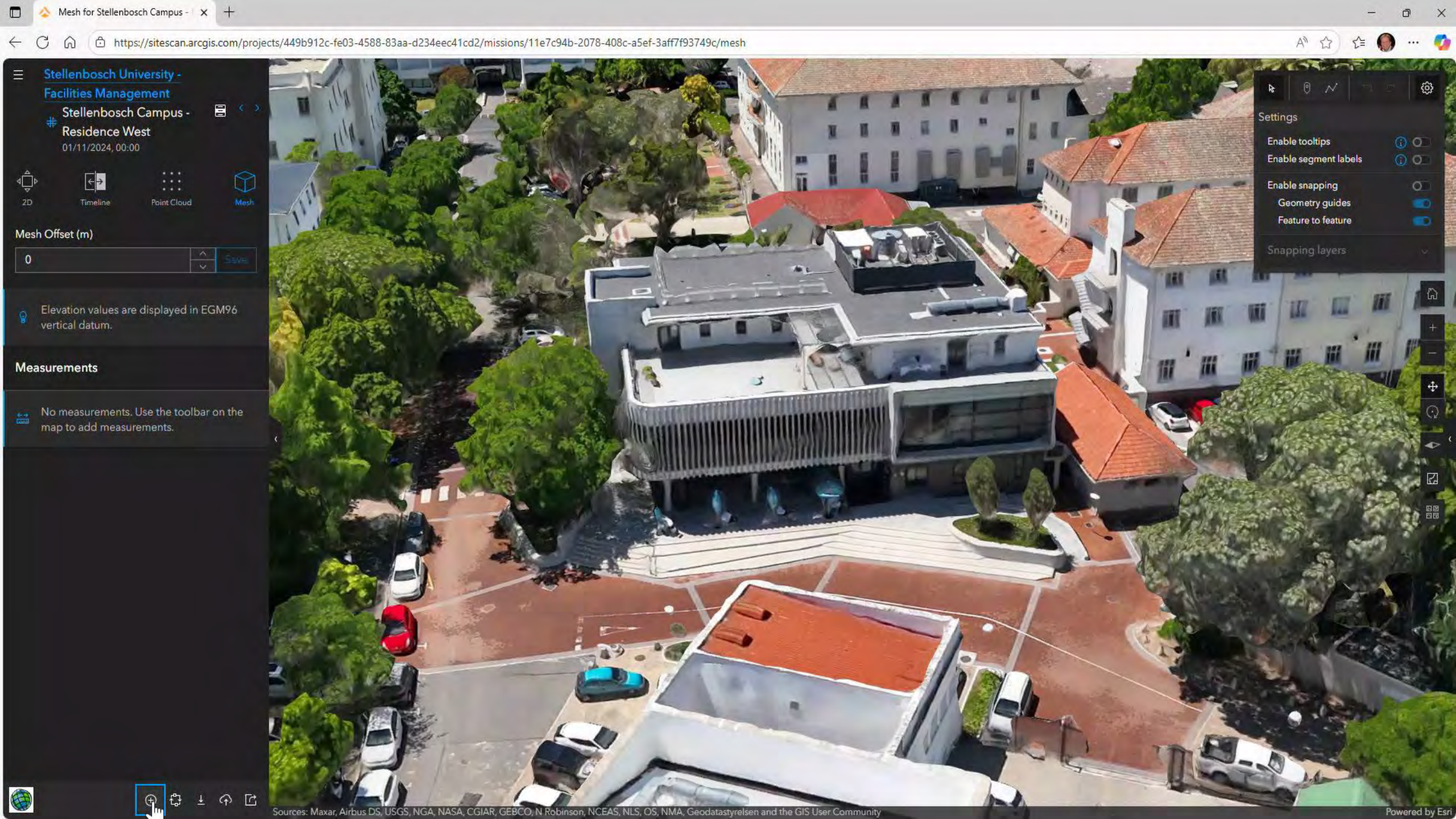
- Missions
- Flight Plans
- GCPs
- Files
- Settings
- Members
- Forms
- Skydio Integration

Sort By Recent

Grid View

This project doesn't have missions


Stellenbosch Campus - Residence
https://sitescan.arcgis.com/projects/449b912c-fe03-4588-83aa-d234eec41cd2/missions/11e7c94b-2078-408c-a5ef-3aff7f93749c
Stellenbosch University - Facilities Management
Stellenbosch Campus - Residence West
01/11/2024, 00:00
2D
Timeline
Point Cloud
Mesh
Layers
Files
Measurements
Ground Control Points
Photos (2,629)
Boundaries
Elevation Data
True Ortho
200 m
500 ft
EPSG:32734
Easting (X): 301422.99
Northing (Y): 6243756.27
Powered by Esri


Mesh for Stellenbosch Campus -
https://sitescan.arcgis.com/projects/449b912c-fe03-4588-83aa-d234eec41cd2/missions/11e7c94b-2078-408c-a5ef-3aff7f93749c/mesh
Stellenbosch University - Facilities Management
Stellenbosch Campus - Residence West
01/11/2024, 00:00
2D
Timeline
Point Cloud
Mesh
Mesh Offset (m)
0
Save
Elevation values are displayed in EGM96 vertical datum.
Measurements
No measurements. Use the toolbar on the map to add measurements.
Settings
Enable tooltips
Enable segment labels
Enable snapping
Geometry guides
Feature to feature
Snapping layers
Sources: Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, GEBCO, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen and the GIS User Community
Powered by Esri

ArcGIS Drone2Map

ArcGIS Pro for Reality Mapping

Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

ENHANCING STELLENBOSCH UNIVERSITY'S SPATIAL INTELLIGENCE

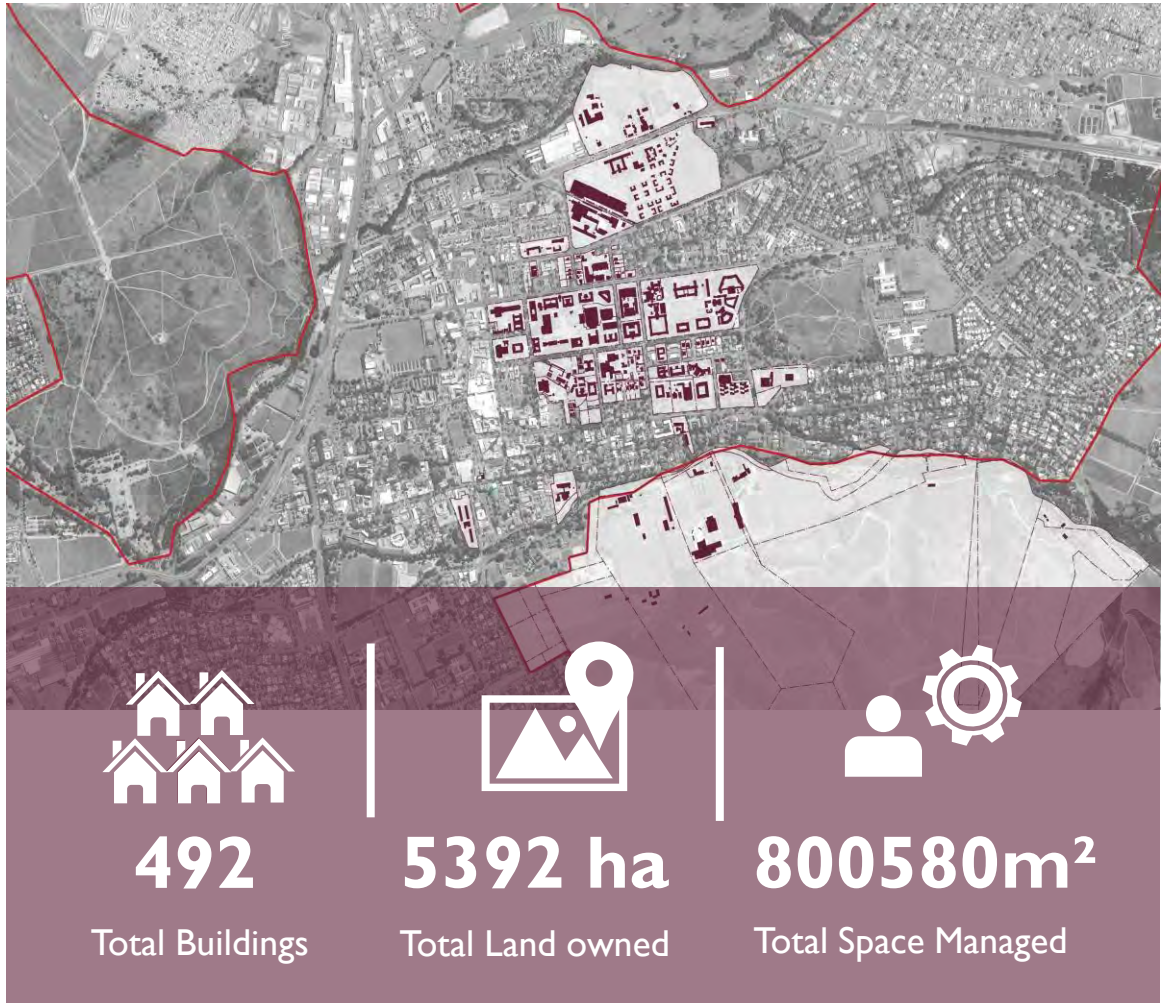
Presented by: Jermaine Hendricks

30 October 2025

"Creating spaces that inspire excellence at Stellenbosch University"

CURRENT LANDSCAPE

Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT



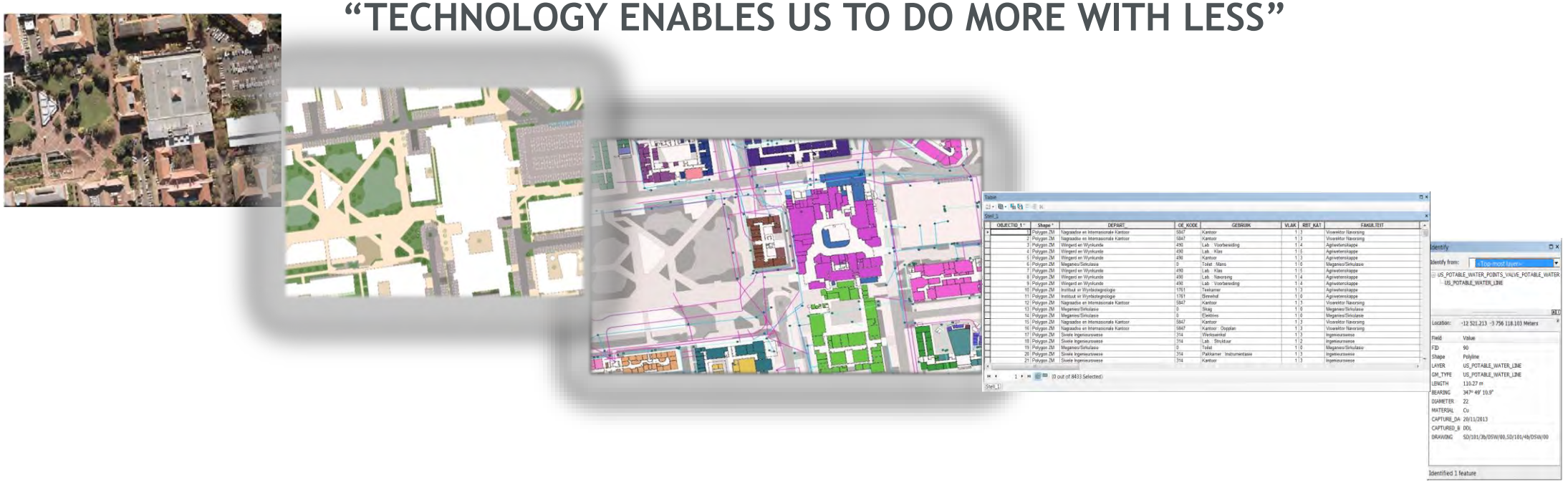
- SUFM operates on an enterprise ArcGIS platform, serving as the cornerstone for spatial data management across multiple campuses and facilities.
- Our strength and growth come from collaborating to advance GIS to apply the science of geography to solving problems and making a difference.

The Evolution of Geographic Information System (GIS) at Stellenbosch University Facilities Management (SUFM)

- To tackle the complexities of managing a university campus, Stellenbosch University recognized the need for a robust Geographic Information System (GIS).

- GIS technology has revolutionized decision-making processes in facility management and plays an important role in achieving operational efficiency. Innovative technology enable SUFM to achieve their missions.

“TECHNOLOGY ENABLES US TO DO MORE WITH LESS”



Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

"The road to success is always under construction."

– Arnold Palmer (US pro golfer)

492

Buildings

(787 972 m2)

29 873

Lecture Room Seats

9 117

Parking Bays

1 300

CCTV Cameras

1 235

Flowerbeds

(93 981 m2)

10 736

Trees

29 628

Kms / month

Security vehicle patrol

(Stellenbosch University , 2025)

STELLENBOSCH UNIVERSITY
FACILITIES MANAGEMENT

Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

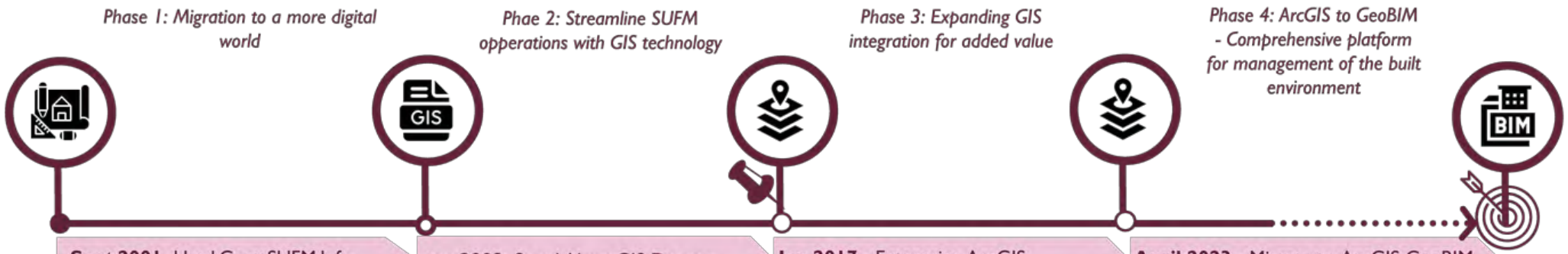
forward together
sonke siya phambili
saam vorentoe

Photo by Stefan Els

Facilities Management | Property Services

The Evolution of Geographic Information System (GIS) at Stellenbosch University Facilities Management (SUFM)

Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT



Sept 2001- Hard Copy SUFM Info

- Hard copies of SUFM info.
- Long term vision of digital twin embedded in SUFM vision since 2001.

Jan 2002- Stand Alone GIS Dataset

- Development of SUFM 1st GIS data set.
- Migrate from hard copy (excell, building plans) to a more digital geo-spatial world.
- Integration of alphanumerical data and floor plans of buildings/infrastructure.
- Continuous development and management of different SUFM GIS datasets (spatial, cadastral, infrastructure services, building footprints, hard and soft surfaces, etc)

Jan 2017 - Enterprize ArcGIS

- SUFM investing in Enterprise ArcGIS.
- Significant step ahead.
- Cornerstone of decision making at SUFM.
- Integration possible with BMS and other SU sytems (Planon, SUNStudent, SUNFin, etc)
- Mobile and accessible data.
- Collaboration with various role-players within SU and external (International an national)
- Digital Twin/BIM functionality
- Internationaly benchmarked as best practice
- Only true source of SU spatial Info

April 2023 - Migrate to ArcGIS GeoBIM

- Establishment of BIM platform
- Innovative solution to link spatial data with detailed building data.
- Visualize and analyze building structure in spatial context.
- Digital twin enabler
- Central source of all detail building information.

INSTITUTIONAL VALUE

- Comprehensive spatial insights
- Enhanced facilities management
- Improved navigation and accessibility
- Integration with existing systems
- Future-proofing our spatial infrastructure

"If you change nothing, nothing will change."

– Tony Robbins

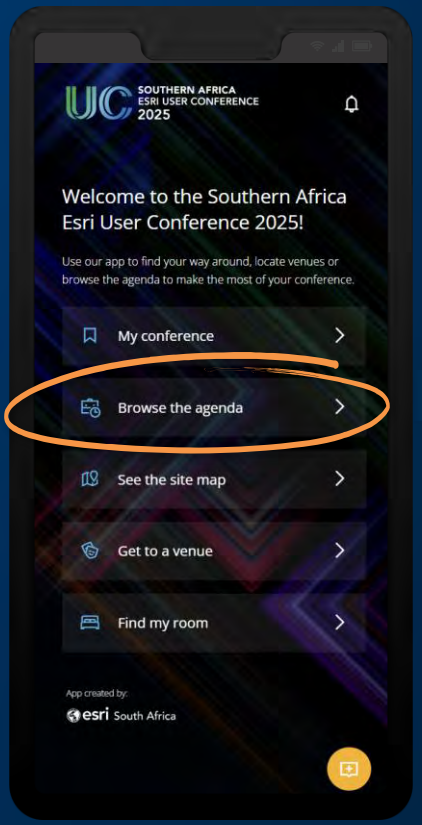
Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

Thank you
Dankie
Enkosi

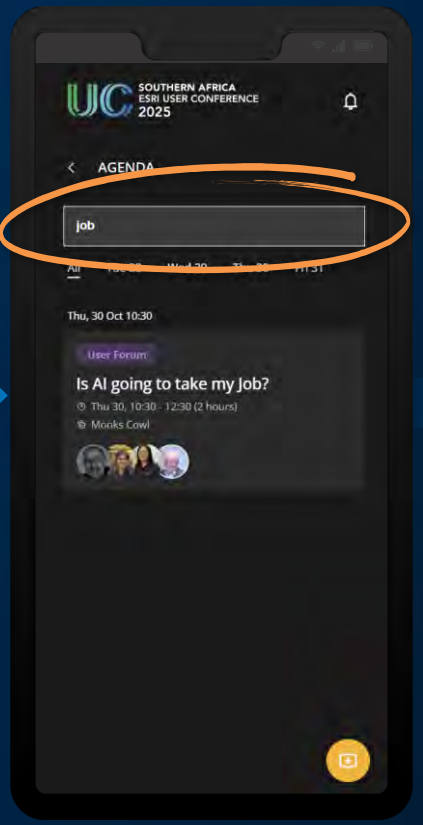
Photo by Stefan Els

Please share your feedback in the UC app

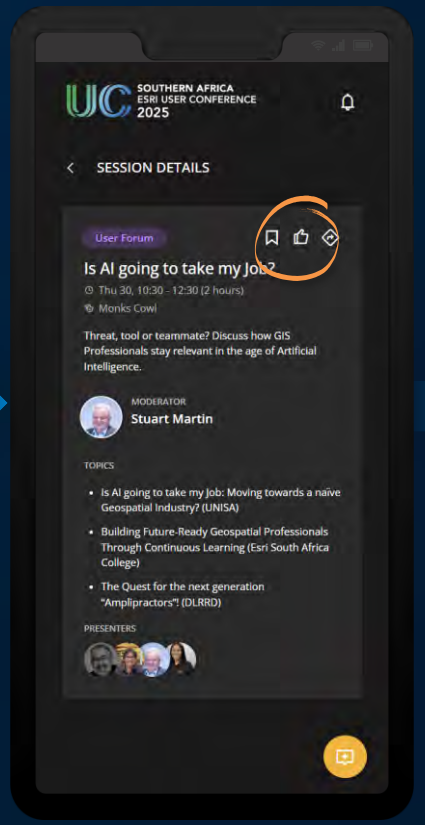
Open
uc.esri-southafrica.com
and browse the agenda



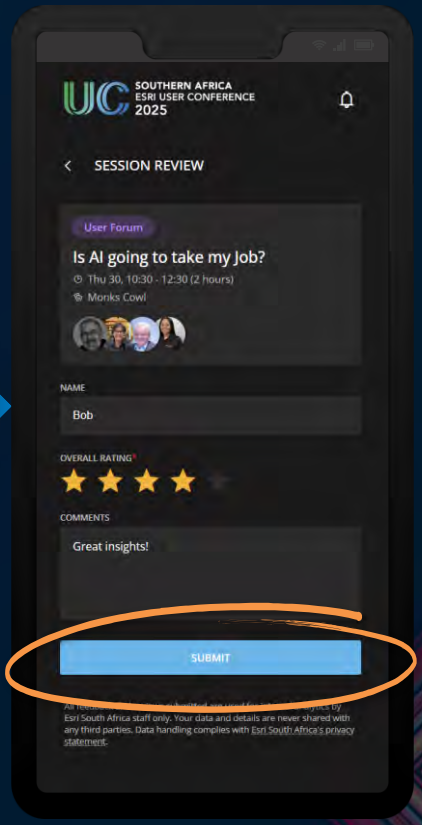
Search and select the session you attended



Click the “thumbs up” icon



Complete and submit your review



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2025