Drone Workflows with ArcGIS

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Imagery & Remote Sensing Capabilities

Comprehensive Imagery System

Imagery & Remote Sensing Capabilities

Comprehensive Imagery System

Mapping

- Ortho Mapping
- Reality Capture

Digitize your world with ArcGIS

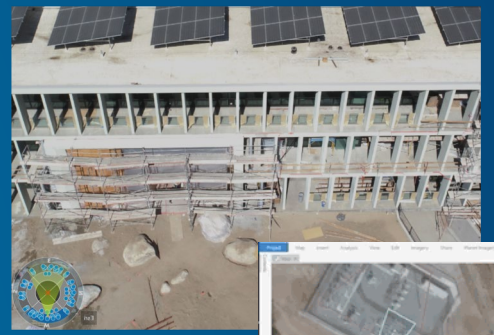
From sensor to accurate derived products

Orthomosaics

Dynamic Orthomosaics

3D Point Clouds & Meshes

Multispectral Orthomosaics



Inspection with Video (FMV) & Oriented Imagery

Digital Surface Models

Thermal Orthomosaics

360º Panoramas

The Workflow at a glance

- What
- Where
- How

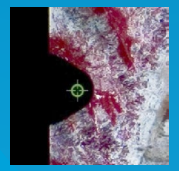
- The Field-Mission

- Select
- Quality
- GCP
- Product Definition
- Processing

Image Mapping in ArcGIS

From sensor to accurate derived products

Data Capture

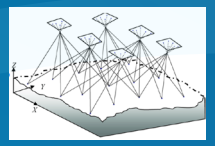


Drone Fleet Management

Drone Flight Planning

Drone Piloting

Processing



Block Adjustment

Aerial Triangulation

Ground Control

Output Products

Orthophotos

Ortho mosaics

DTM

DSM

2.5D Mesh

3D Point Clouds

3D Mesh

Feature Extraction & Editing

Stereo Feature Capture

Point Cloud Classification

Automated Feature Extraction

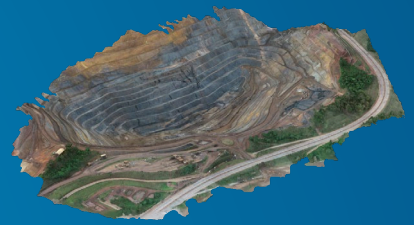
Point Cloud Editing

Pixel Editing

Multiple sensors – similar output – different requirements

2D Image Map Products:

- Orthomosaic
- Digital Elevation Model
- Digital Terrain Model



3D Elevation Products:

- Point Cloud (LAS)
- 3D Mesh Model

Oblique Photo Products:

- Inspection report
- Photos

Capture modes (generalized)

Satellite

NADIR
with slightly
oblique edges
(exceptions exists, like ZY3)

Aerial

Left
Right
oblique

NADIR

Forward
Backward
oblique

Drone/UAV

Horizontal

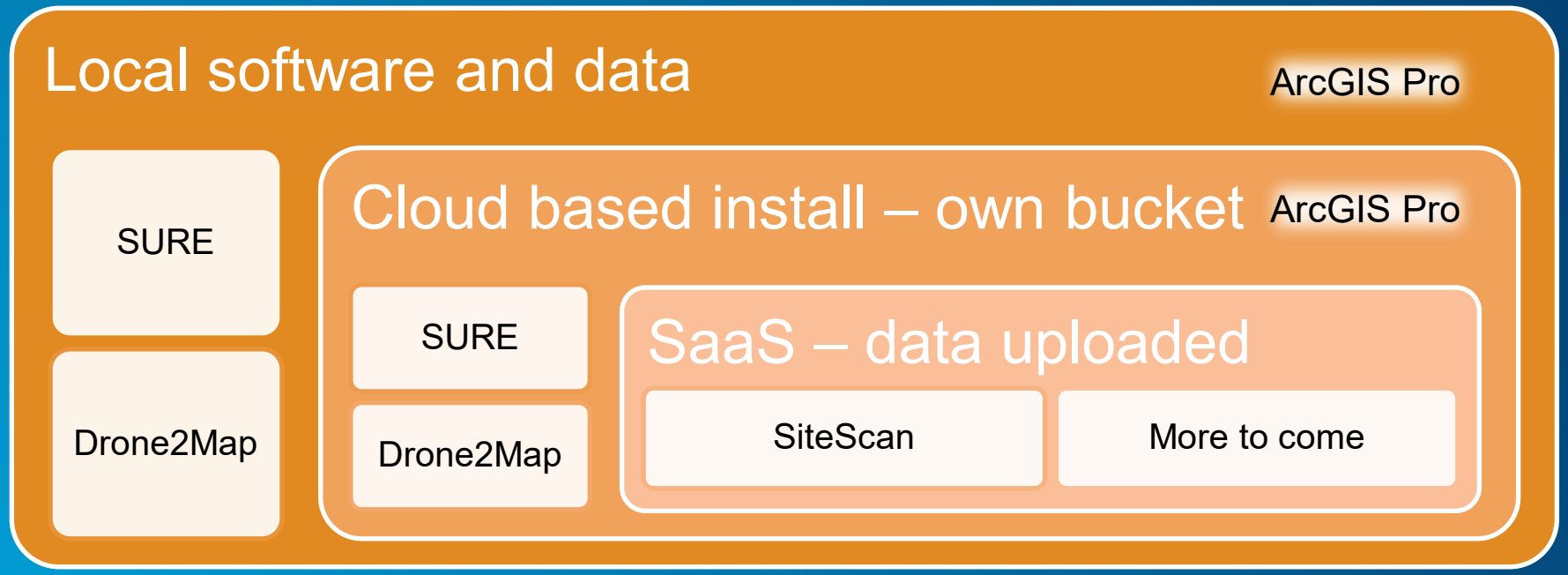
Forward
Backward
oblique

Left
Right
oblique

NADIR

What is my usage scenario

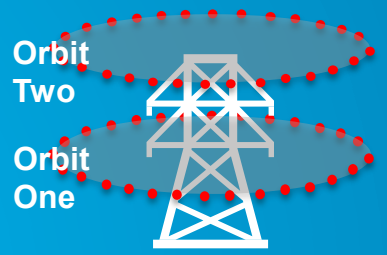
What is my analytical setup

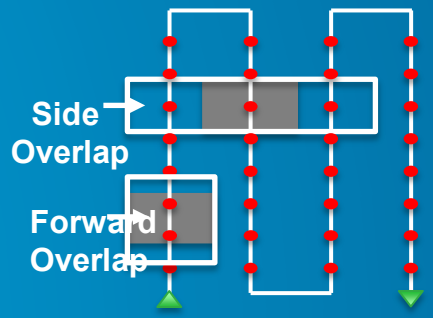


Requirements for good results

- Sufficient Image Overlap
- High quality positional accuracy
- Homogeneous lighting
- Avoid clouds, snow
- Remove Disturbances (water/glas reflectance, sky)
- Image resolution matching desired analysis capabilities

In-strip/cross-strip Overlap (%)	Key Attributes	Recommended Scene Type
60/30	Minimum coverage required. Central Image area is only covered by two images	Open landscapes from high altitudes
80/30	Recommended minimum coverage. Four suitable stereo pairs per image	Open landscapes from high altitudes
80/60	Reduces cross-strip stereo occlusions	Urban scenes without high-rises
80/80	Greatly reduces cross-strip stereo occlusions	Urban scenes with high-rises





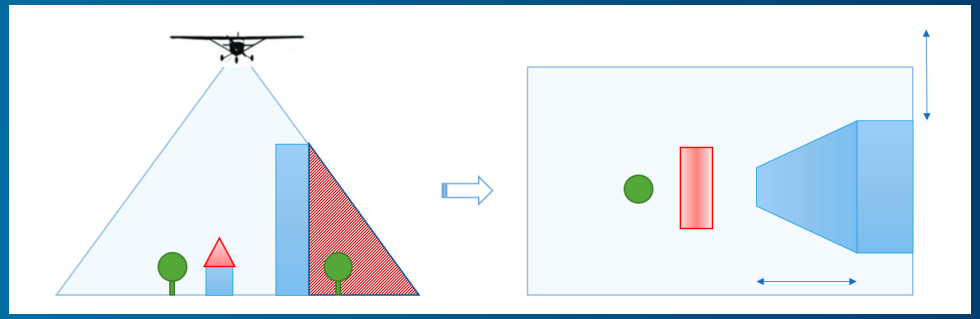


Image Mapping in ArcGIS

From sensor to accurate derived products

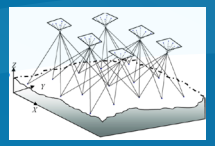
Data Capture

Drone Fleet Management

Drone Flight Planning

Drone Piloting

Processing



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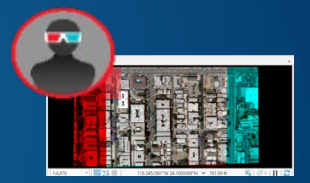
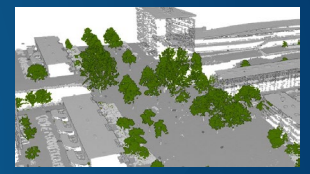
Feature Extraction & Editing

Stereo Feature Capture



Point Cloud Classification



Automated Feature Extraction

Point Cloud Editing

Pixel Editing

Site Scan

Drone2Map

Ortho Mapping

Ortho Maker

Drone processing options in ArcGIS

	Site Scan	Drone2Map	ArcGIS Pro * (Ortho Mapping)	Enterprise + Image Server (Ortho Maker)
Processing Environment	Web / Cloud	Desktop (office/field)	Desktop	Web (ArcGIS Enterprise)
Drone Flight app included	Site Scan Flight	Site Scan LE	Site Scan LE	Site Scan LE
Input data	Drone	Drone	Drone, Satellite, Scanned Film, Digital Camera	Drone
Data Products				
2D (orthomosaic, DSM, DTM)	✓	✓	✓	✓
3D (point cloud, mesh)	✓	✓		
Cloud connection from flight app	✓			
Drone Fleet Management	✓			
Analysis Capabilities	Some focused tools; Connect with ArcGIS for advanced analysis		Extensive (part of ArcGIS Pro)	Some focused tools + ArcGIS Enterprise

** Advanced license*

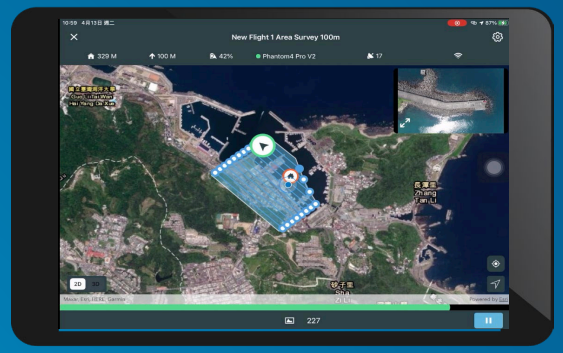
Drone flight planning and execution

Site Scan Flight for ArcGIS

Badouzi Port, Taiwan

Credits and thanks to 互動國際數位 Interactive Digital Technologies &

Site Scan Flight for ArcGIS



Site Scan Flight for ArcGIS

Cloud-connected flight planning and execution, automated fleet management

Requires a Site Scan license

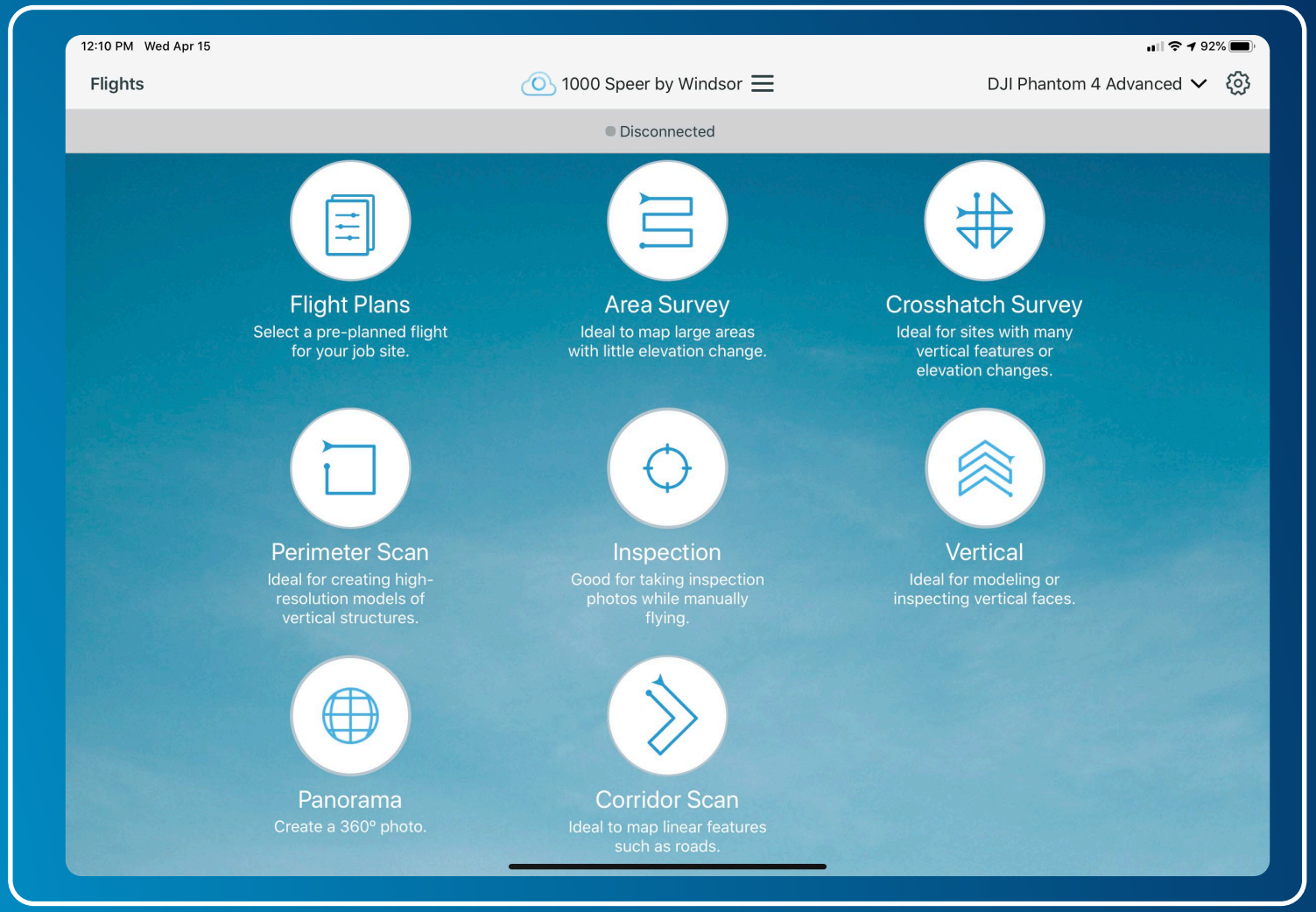
Site Scan LE (Limited Edition)

Disconnected flight planning and execution

Available to all Drone2Map users

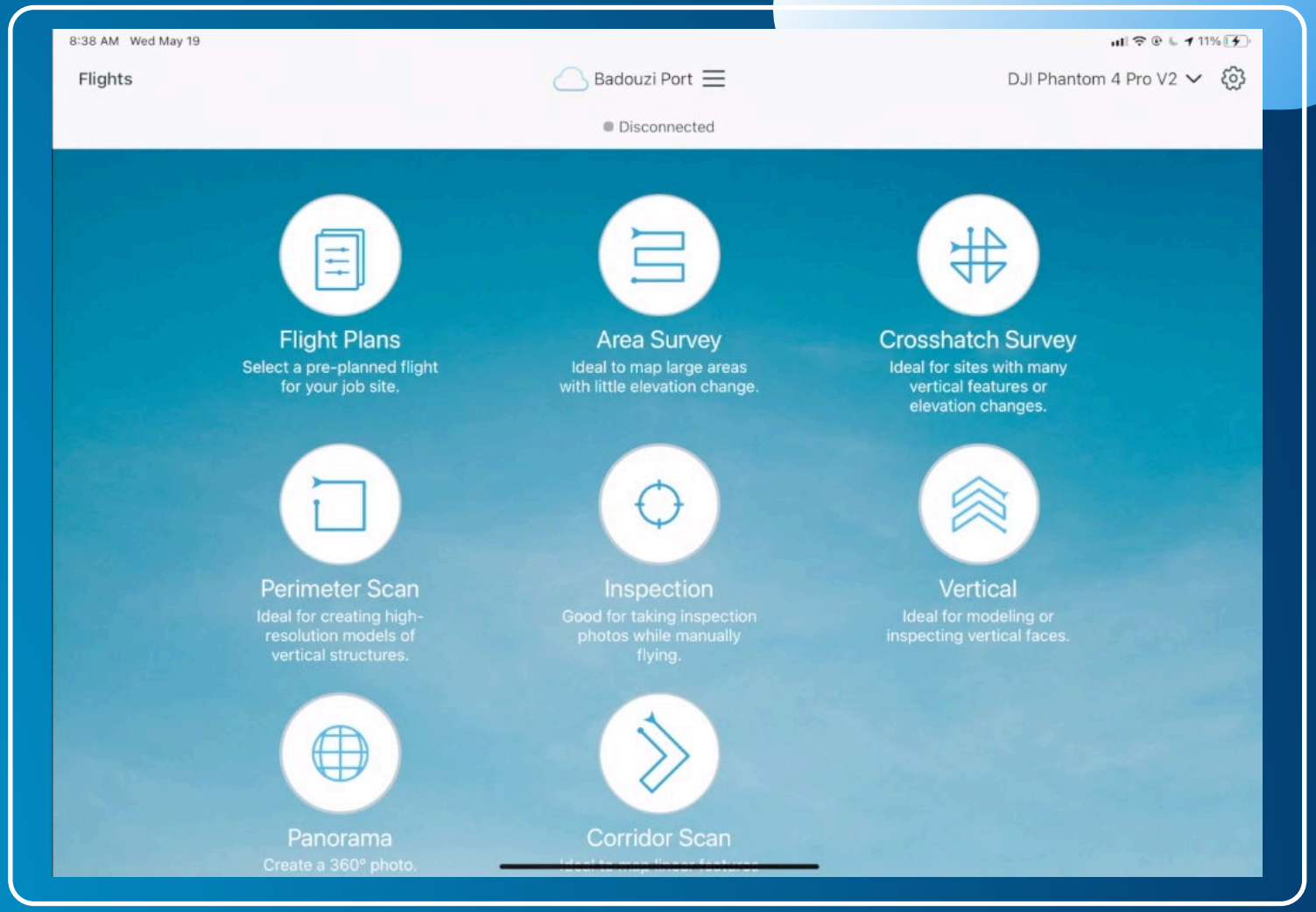
Site Scan Flight and LE

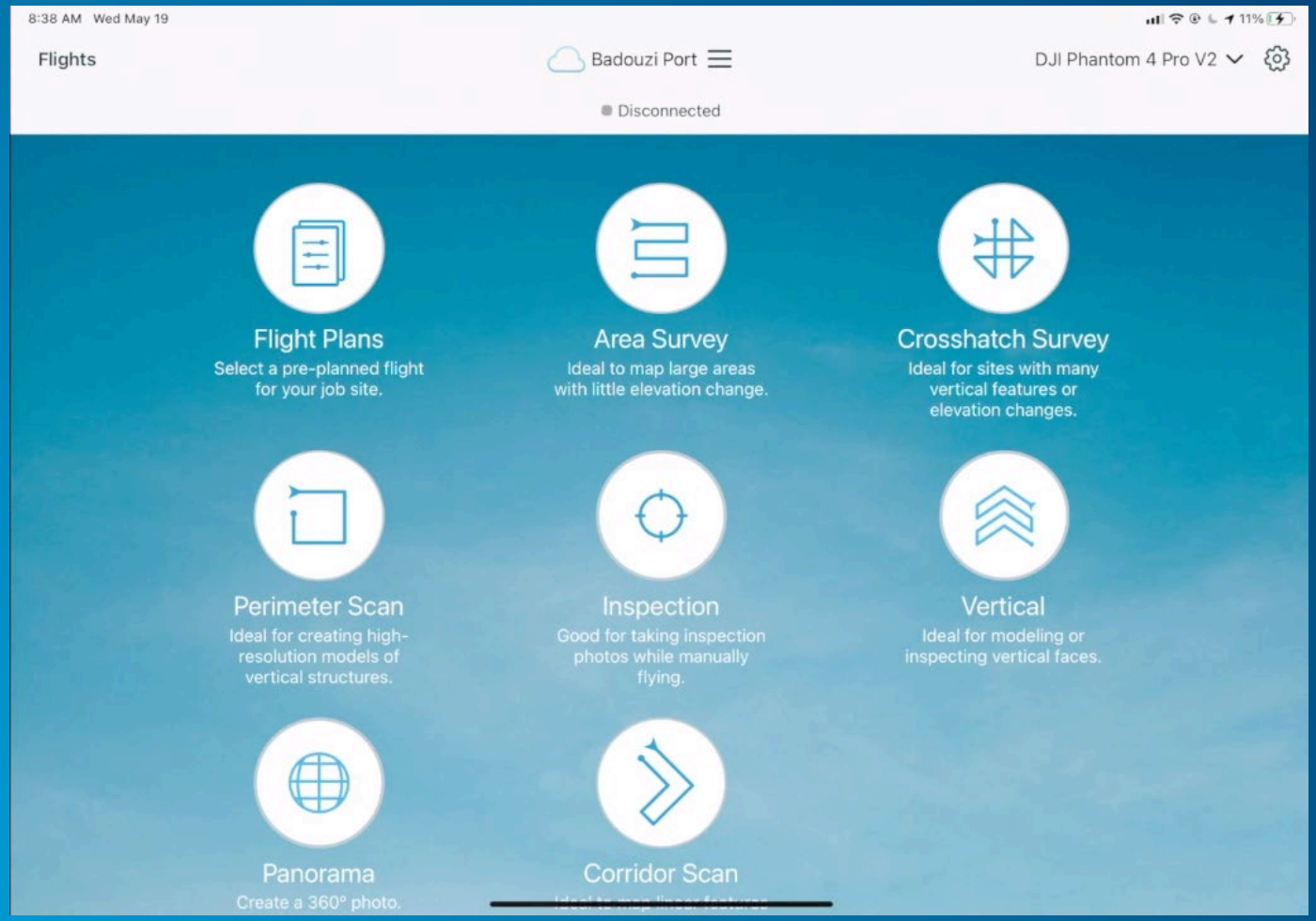
- iPadOS application
- Plan automated mapping & inspection flights in 2D & 3D
- Geospatial Video Log recording
- Terrain Follow capability
- Offline basemap download
- Display 2D & 3D data from ArcGIS Online or Enterprise
- QuickMap offline photo-mosaic stitching
- Field data management

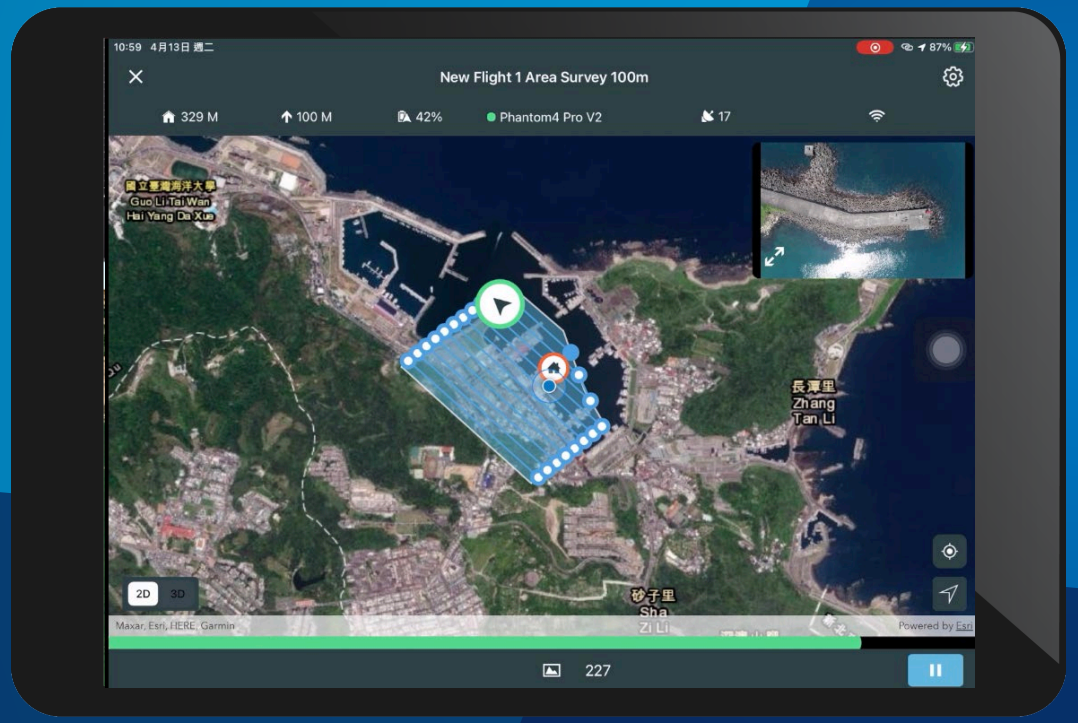


Site Scan Flight for ArcGIS

- **Cloud connected** functionalities requiring a Site Scan license:
  - Saving and **sharing of flight plans** between users
  - Display of previously processed flight data
  - **Automated Fleet management**
  - Organization-mandated **custom preflight checklist** forms
  - **Field-to-Cloud imagery upload**



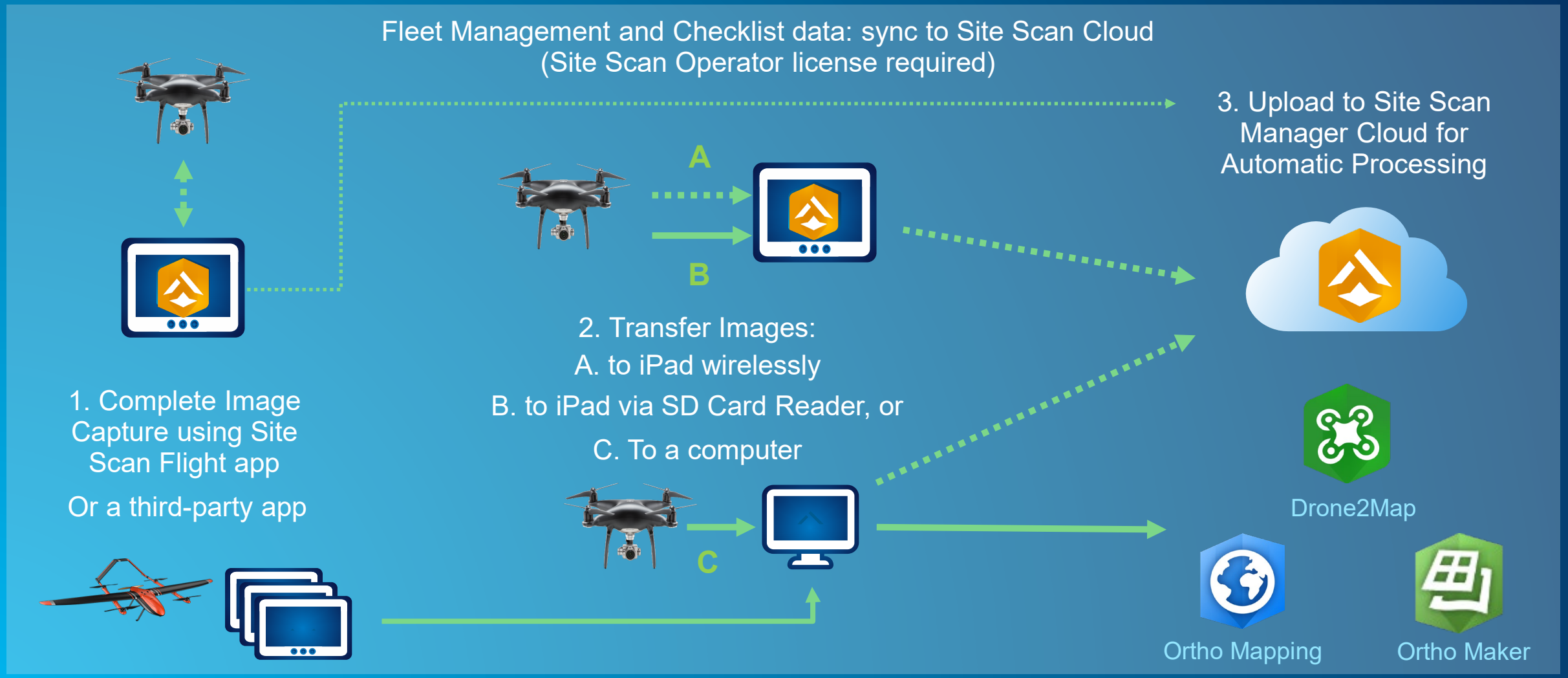

8:38 AM Wed May 19
11%
Flights
Badouzi Port
DJI Phantom 4 Pro V2
Disconnected
Flight Plans
Select a pre-planned flight for your job site.
Area Survey
Ideal to map large areas with little elevation change.
Crosshatch Survey
Ideal for sites with many vertical features or elevation changes.
Perimeter Scan
Ideal for creating high-resolution models of vertical structures.
Inspection
Good for taking inspection photos while manually flying.
Vertical
Ideal for modeling or inspecting vertical faces.
Panorama
Create a 360° photo.
Corridor Scan



Site Scan Flight Execution

Post-Flight

- Uploading Images and Fleet Management Data

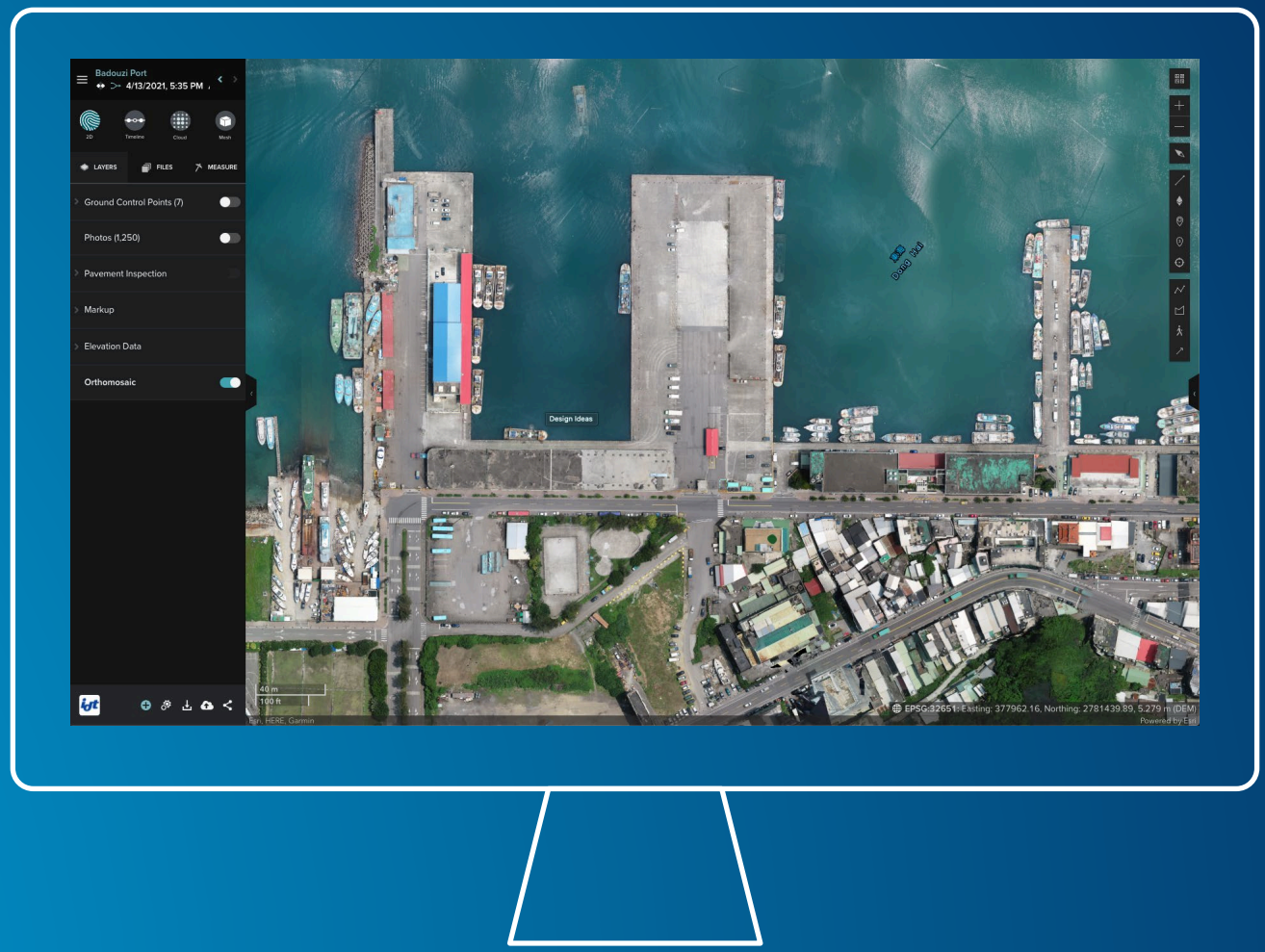


Drone Data Processing

Site Scan Manager for ArcGIS

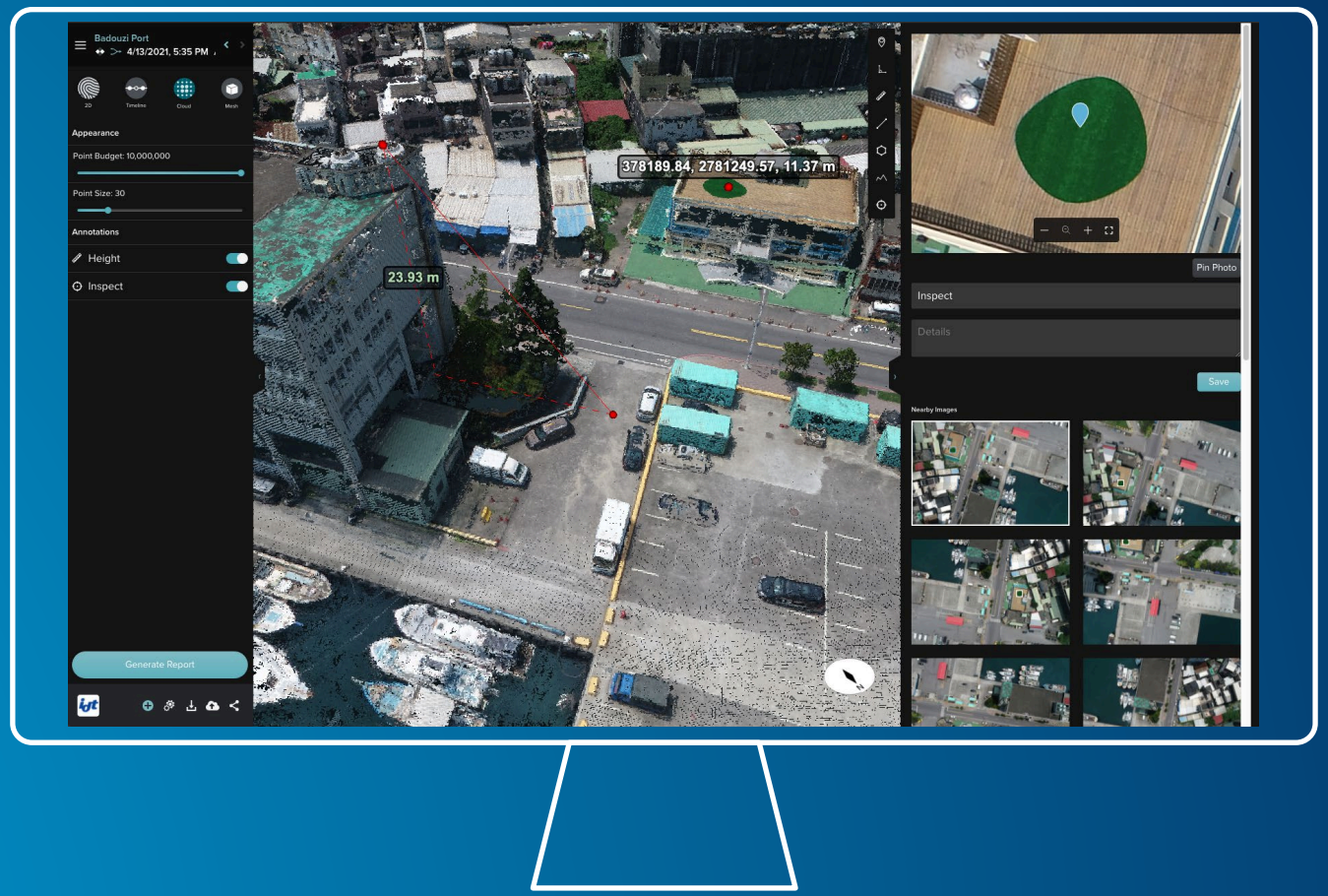
Site Scan Manager for ArcGIS

- Web application
- Unlimited cloud processing of drone imagery
- Secure hosting in the U.S. or E.U.
- Visualization, first-phase analysis and collaboration tool
- Publishing of processed outputs into ArcGIS Online or ArcGIS Enterprise
- Local export and sharing functionalities



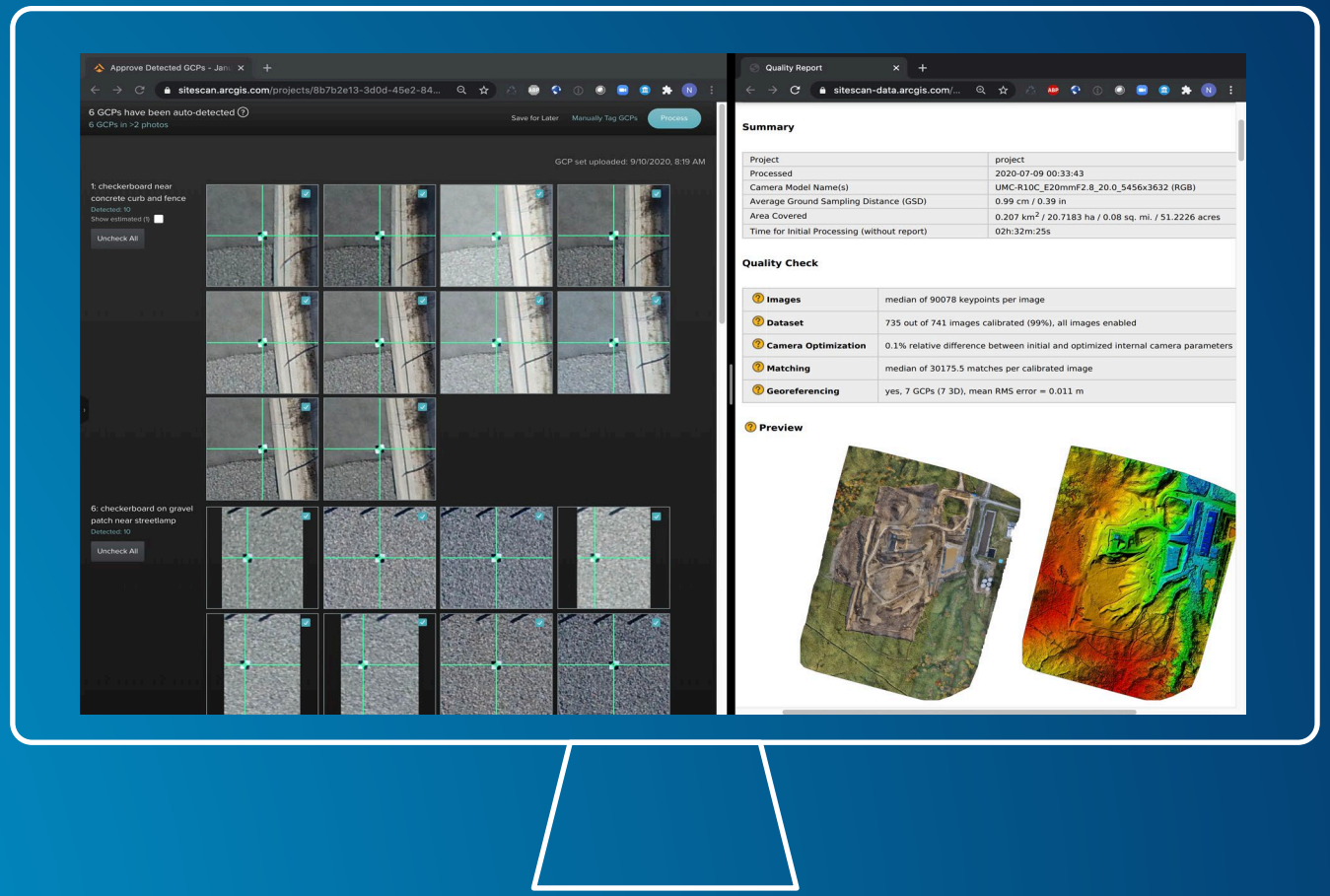
Site Scan Manager

- Perform linear, volumetric and cut/fill analysis with one click
- Display CAD and PDF overlays to perform Quality Control
- Generate inspection reports as PDF documents
- Navigate through inspection photos in 3D using the point cloud
- Easily share 2D & 3D Data outputs, or 360º Panorama photos with project teams and collaborators



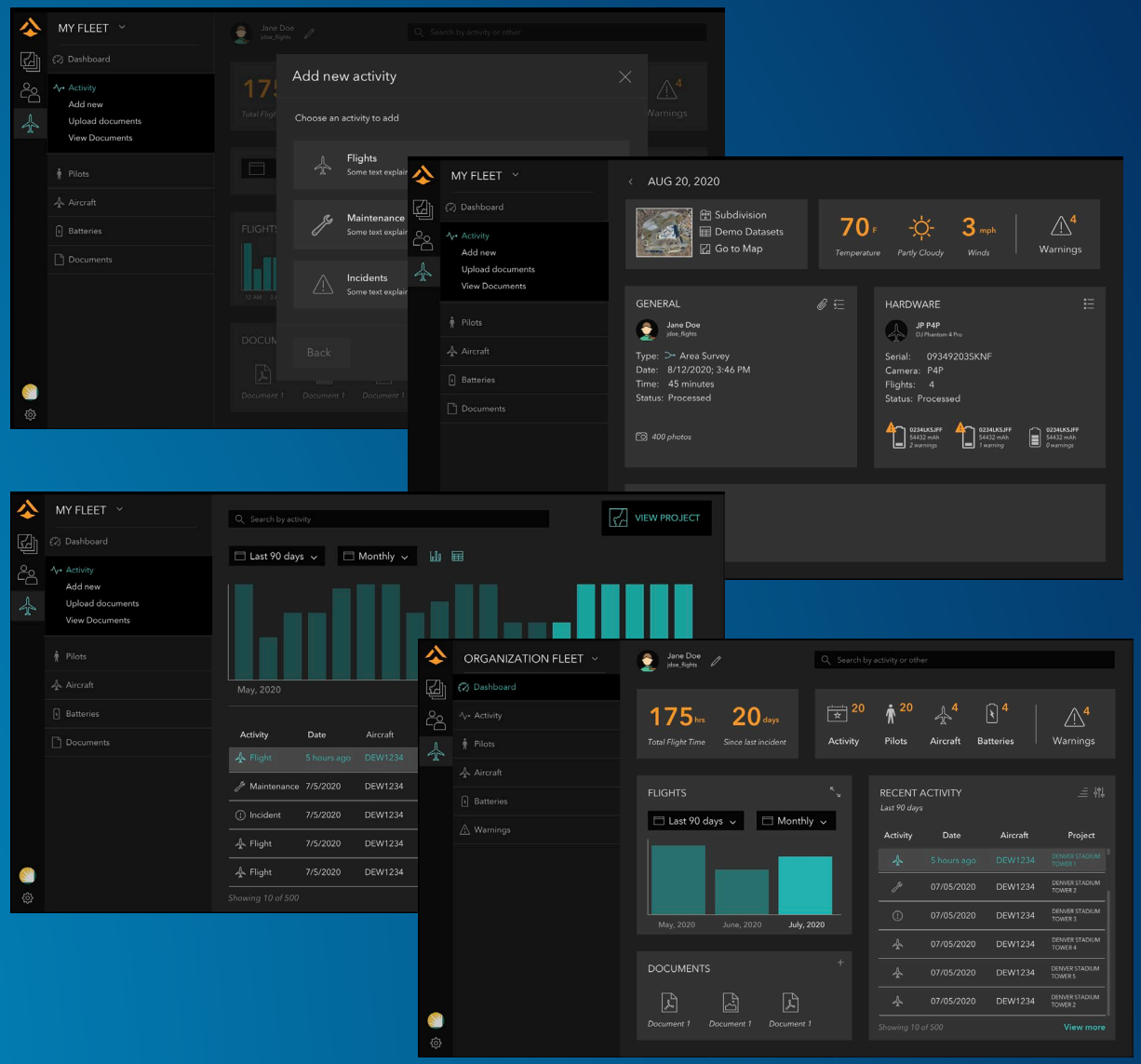
Site Scan Manager

- **Computer vision Ground Control Point detection**
- **Accuracy validation through checkpoints**
- **Processing & accuracy reports**
- **RTK and PPK support**

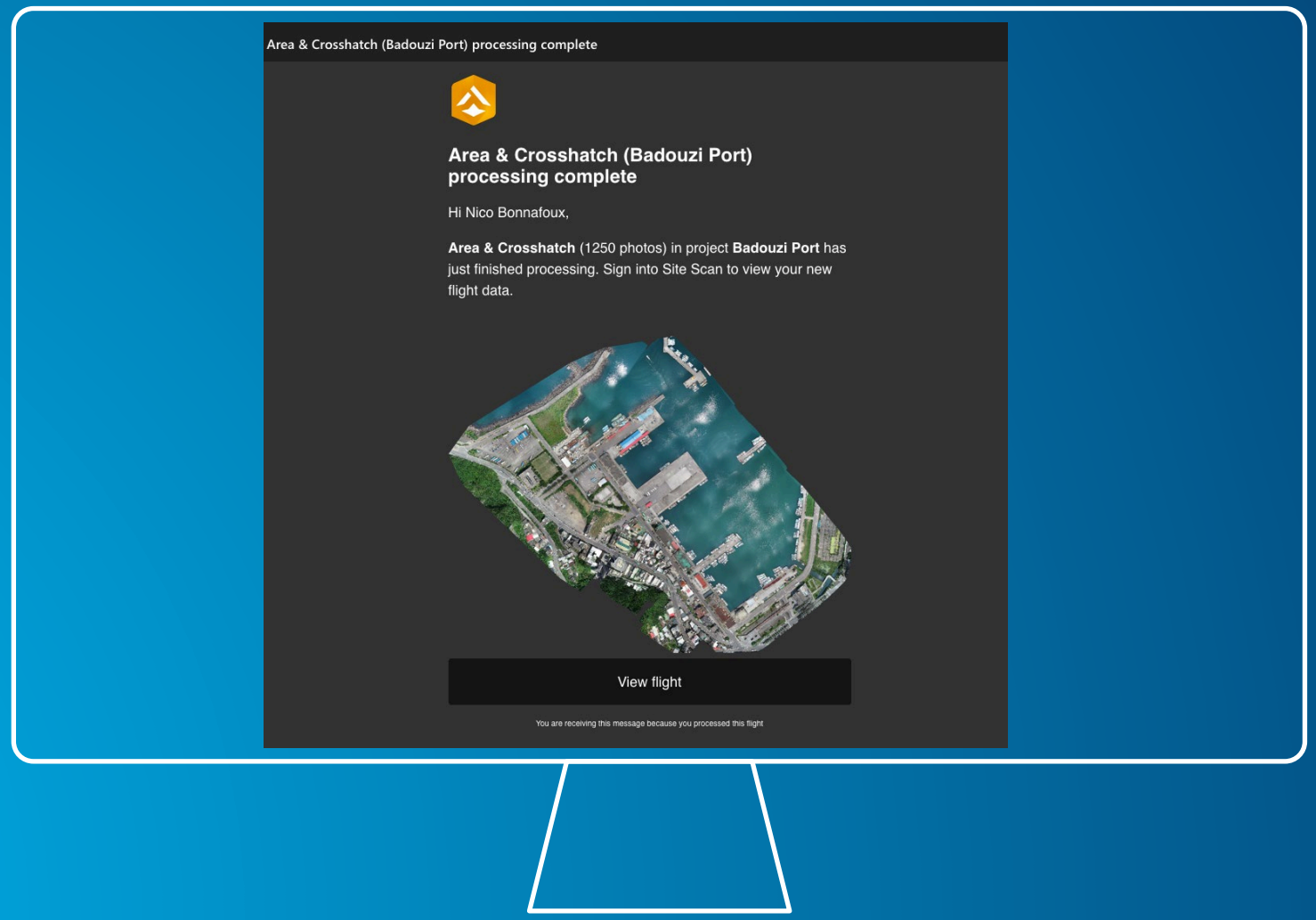


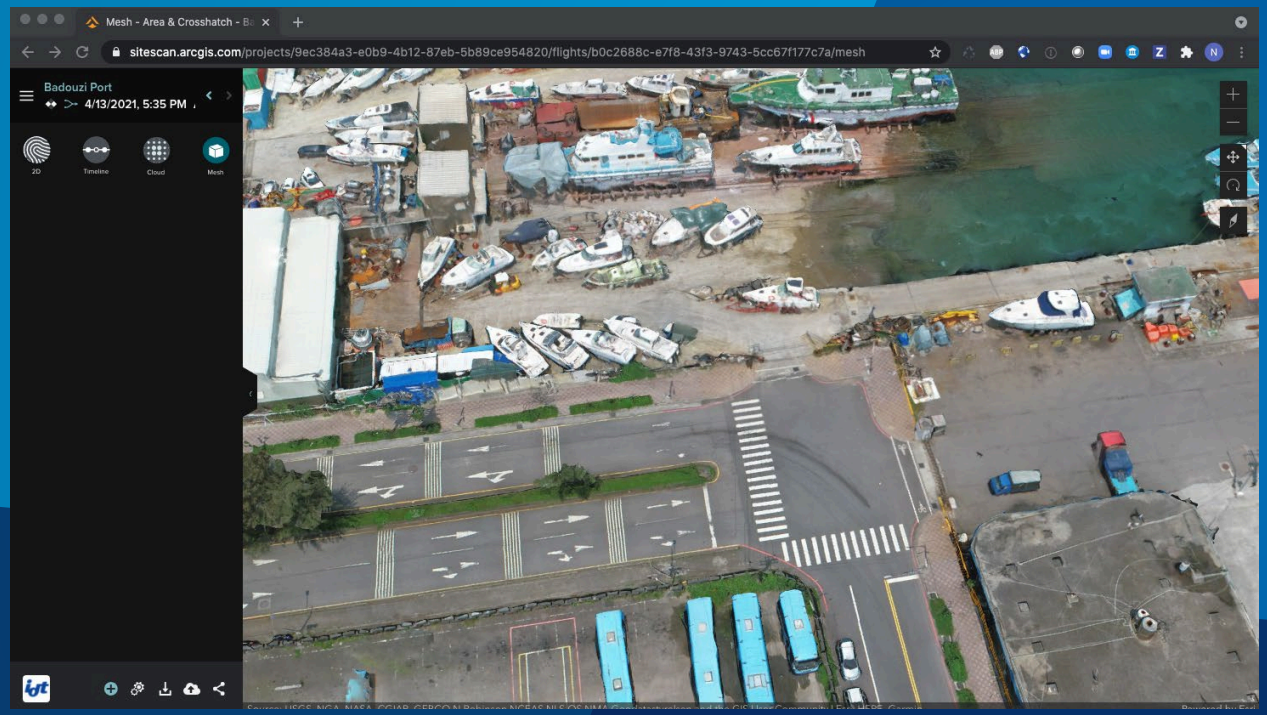
Site Scan Manager - Fleet Management

- Automatic recording of all flights conducted with the Site Scan Flight app & manual flight logging:
  - Pilot
  - Aircraft
  - Batteries
  - Weather…
- Dynamic operations dashboard
- Maintenance scheduling and tracking
- Data exports for reporting
- Pilot certificate and aircraft document tracking
- Incident tracking and administrator notifications



Site Scan Manager: Processing Complete Email Notification





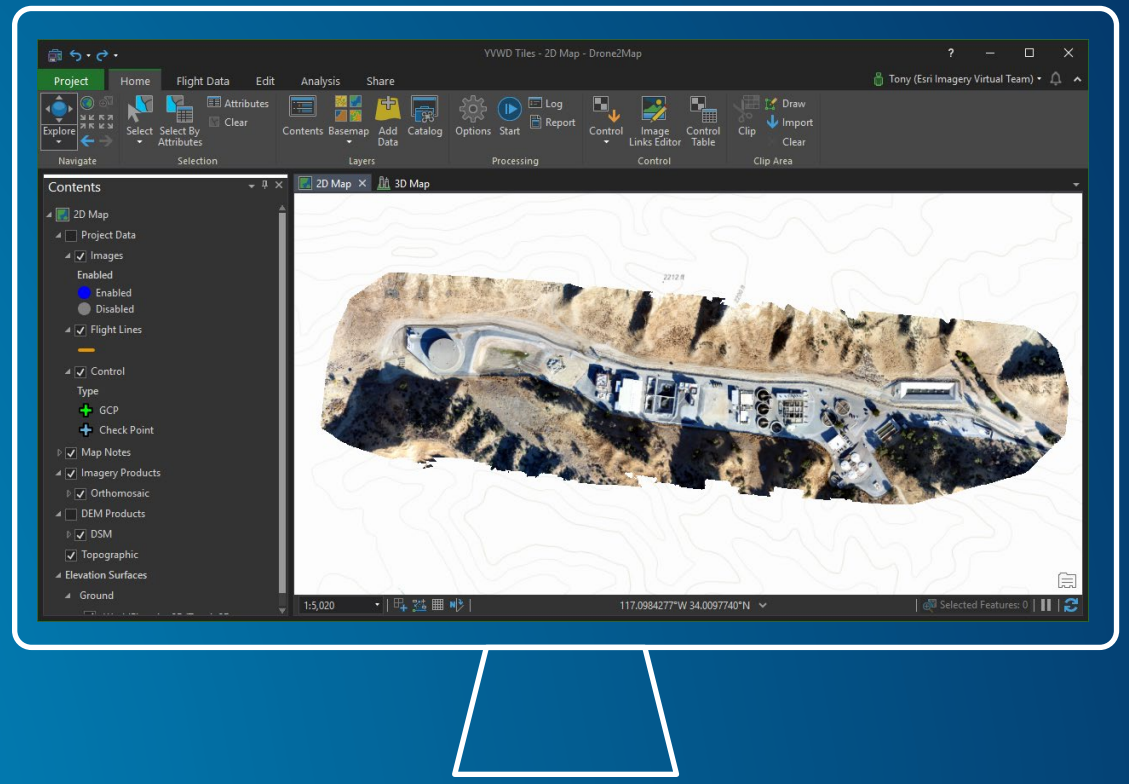
Processing in the cloud

Site Scan Manager for ArcGIS

ArcGIS Drone2Map

ArcGIS Drone2Map

- Standalone Desktop Application
  - Does not require ArcGIS Pro
  - Licensed with Creator Users Type
  - Open projects in ArcGIS Pro for advanced analysis
- Accurate high-resolution 2D & 3D products
  - Ground Control Points, Manual Tie Points, Check Points
  - RTK/PPK
- Secure local processing
- Import and publish data from ArcGIS Online or ArcGIS Enterprise



ArcGIS Drone2Map

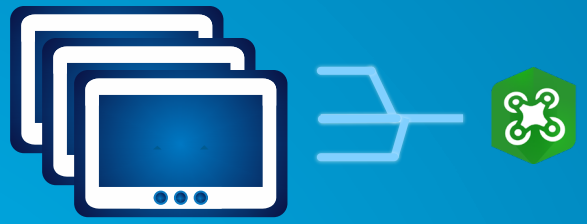
Compatible with the drone that fits your needs and budget

- Low operation cost
  - Compatible with entry-level and professional mapping drones
- Supports multiple payloads
  - RGB Cameras (<55 MP)
  - Multispectral Cameras
  - Calibrated Cameras
  - RTK/PPK
    - Integrated or external module

ArcGIS Drone2Map

Process geolocated images from any source

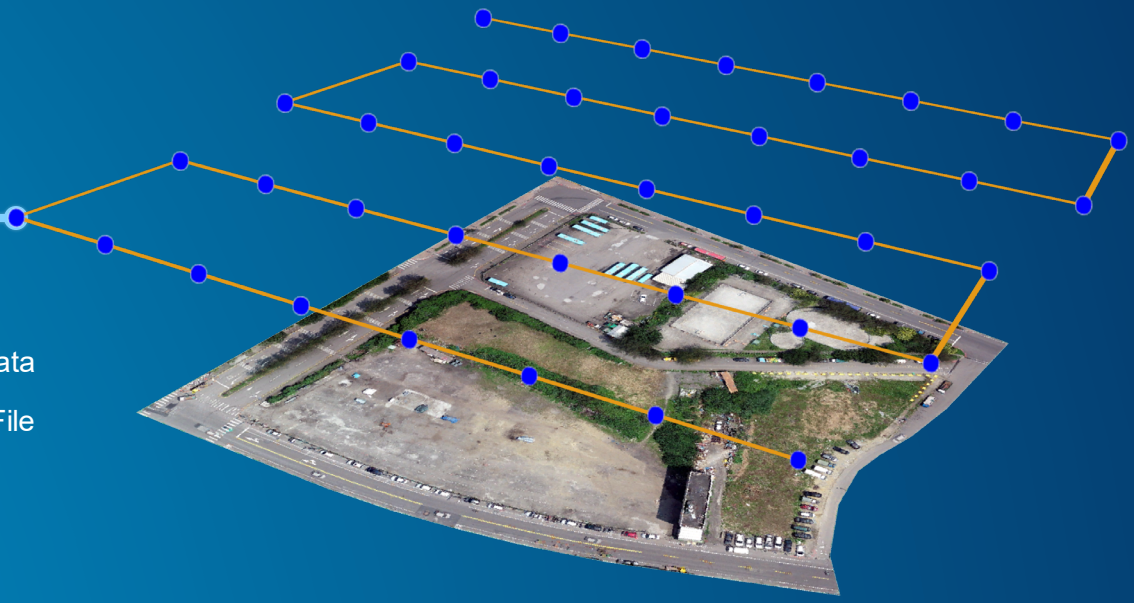
Optimized for Site Scan LE



Compatible with third-party flight planning apps

X
Y
Z

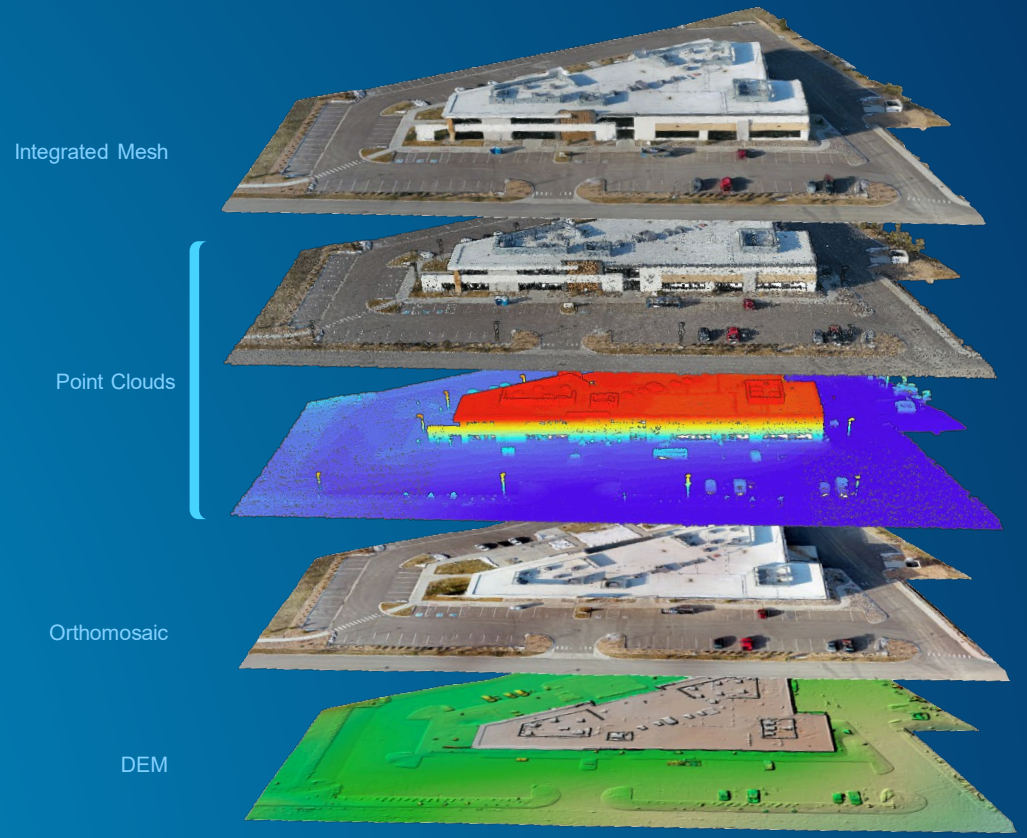
- Image Metadata
- Geolocation File

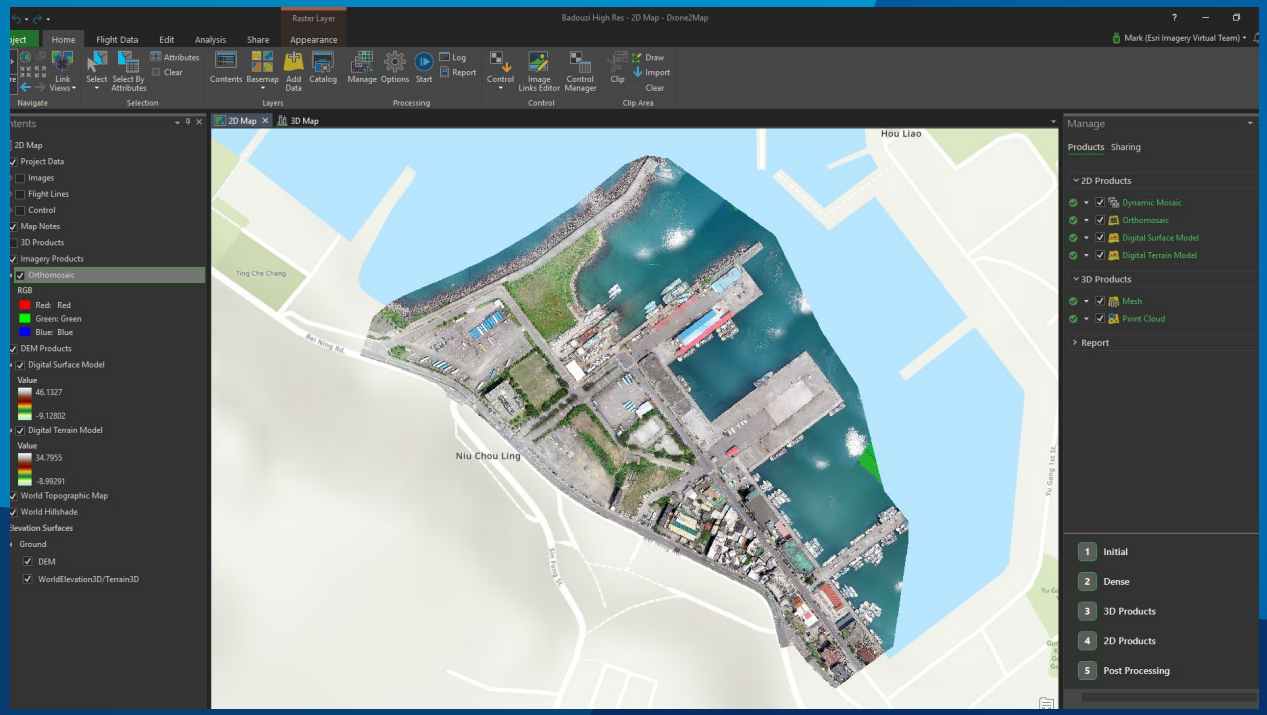


ArcGIS Drone2Map

Accurate high-resolution products

- 2D Products
  - Orthomosaics
  - Digital Elevation Models (DSM & DTM)
  - Contours
- 3D Products
  - Point Clouds
  - Integrated Mesh
- Save products locally or share to ArcGIS Online and ArcGIS Enterprise





Processing on Desktop & In the Field

ArcGIS Drone2Map

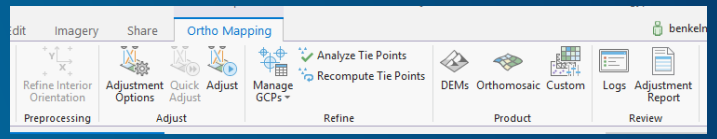
The other 2 Options

Ortho Mapping in ArcGIS Pro

Optional Ortho Maker in ArcGIS Enterprise with Image Server

Ortho Mapping

- **Ortho Mapping is a capability built into ArcGIS Pro (Advanced license required)**
  - **Create Orthomosaics & DEMs from Satellite, Aerial (digital & film) & Drone Imagery**
  - **Mosaic dataset of source images, orthorectified on-the-fly based on DTM**
    - **Enables multiple views from different perspectives, Stereo models for Image Analyst**
  - **Fine-grained control over output products (seamline & pixel editing)**
  - **Geoprocessing (GP) tools for process automation**



Ortho Maker

- **Ortho Maker is a web-based user interface for uploading and processing drone imagery through Ortho Mapping on Enterprise with Image Server**
  - **Output data products appear as web layers**

ArcGIS Enterprise

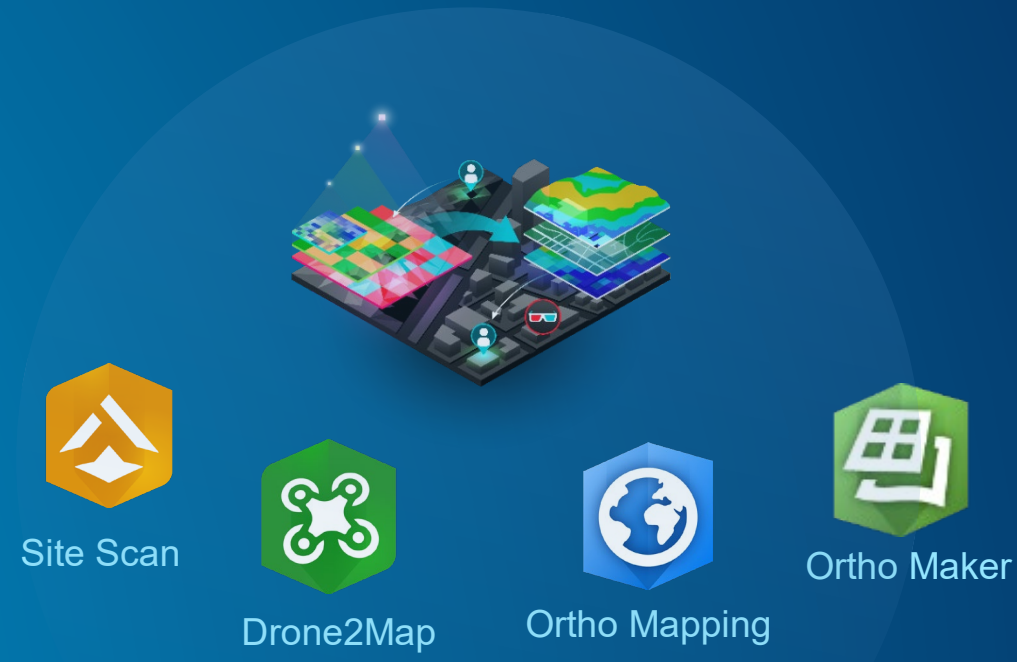
ArcGIS Image Server

Image Mapping options in ArcGIS

	Site Scan	Drone2Map	ArcGIS Pro (Ortho Mapping)	Enterprise + Image Server (Ortho Maker)
Processing Environment	Web / Cloud	Desktop (office/field)	Desktop	Web (ArcGIS Enterprise)
Drone Flight app included	Site Scan Flight	Site Scan LE	Site Scan LE	Site Scan LE
Input data	Drone	Drone	Drone, Satellite, Scanned Film, Digital Camera	Drone
Data Products				
2D (orthomosaic, DSM, DTM)	✓	✓	✓	✓
3D (point cloud, mesh)	✓	✓		
Cloud connection from flight app	✓			
Drone Fleet Management	✓			
Analysis Capabilities	Some focused tools; Connect with ArcGIS for advanced analysis		Extensive (part of ArcGIS Pro)	Some focused tools + ArcGIS Enterprise

Summary - Esri software for Image Mapping

- **Output data products**
  - **2D orthomosaics, 3D point clouds & meshes, Inspection images**
- **Operational environments**
  - **Field, Desktop, Enterprise, Cloud, Web**
- **Key considerations**
  - **Scalability**
  - **Automation**
  - **Drone fleet management**
  - **Drone based sensors**
    - **RGB, Thermal, Multispectral, Video**



Summary : Drone2Map

- StandAlone App for drone imagery processing with local data
- Recommended: Not to exceed 2000 images per project
- Process one project/flight at a time
- 2D results: Orthomosaics, DSMs, DTMs
- 3D results: textured mesh, classified RGB point clouds, 3D PDF
- Direct upload of orthomosaic, hillshades, & 3D textured mesh to ArcGIS Online
- Single button to import results into ArcGIS Pro
- Does not require ArcGIS
  - Tools e.g. 3D volume calculation enabled if ArcGIS Pro & Spatial Analyst installed
- Supports SiteScan (LE) flight planning App [see this Blog entry]
- Data management in ArcGIS Pro via *Imagery Workflows* download
  - http://esriurl.com/D2Mmanagement

New: Now uses SURE 3D Mesh engine!

Summary: SiteScan

- SaaS App for drone imagery processing with uploaded data
  ➔ Access anywhere
- Recommended: Not to exceed 2500 images per project (but not forced)
- Process multiple projects (or project-parts) in parallel
- 2D results: Orthomosaics, DSMs, DTMs, contours
- 3D results: textured mesh, RGB point cloud
- Direct upload of products to ArcGIS Online
- Additional export formats (CAD)
- Does not require ArcGIS
- Supports SiteScan flight planning App [see this Video]

New: Uses SURE 3D Mesh engine!

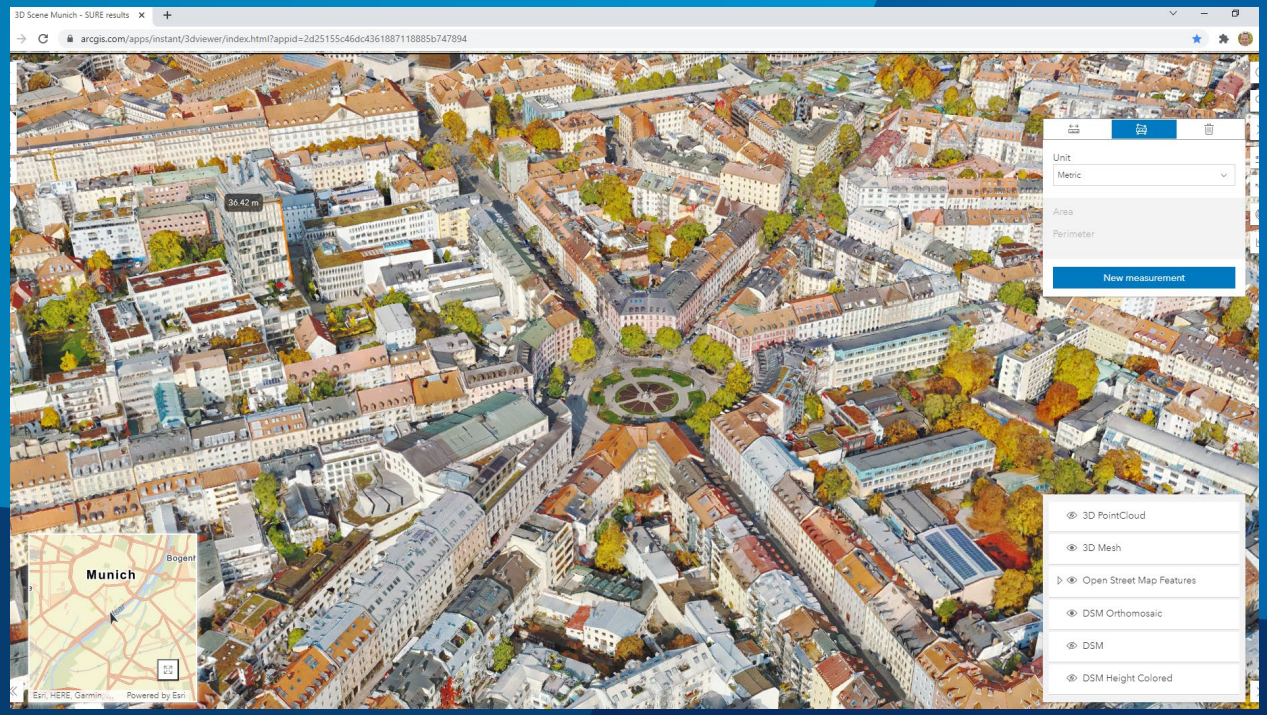
Link with Live-Samples

Not to confuse you …

Quick Glance: SURE for ArcGIS

- StandAlone App for Areal Imagery & lidar processing with local data
- Professional Aerotriangulation required as input
- Can be many thousands of Images per project
- Process on multiple machines in parallel is possible
- Processing duration can be considerable
- 2D results: DSM Orthomosaics, DSMs, Quality layers
- 3D results: textured mesh, RGB point clouds, 3D PDF
- Results can be used in ArcGIS right away
- Integration in ArcGIS ongoing (see also Drone2Map and SiteScan)

Quick Glance: SURE



A quick look

Find a full presentation here: https://links.esri.com/SURE21may


esri
THE
SCIENCE
OF
WHERE