# Producing Ortho Imagery In ArcGIS

Hong Xu, Mingzhen Chen, Ringu Nalankal

# Agenda

- Ortho imagery in GIS
- ArcGIS ortho mapping solution
- Workflows
  - Satellite imagery
  - Digital aerial imagery
  - Scanned imagery
  - Drone imagery
- Q/A

# Ortho Imagery in GIS

## What is ortho imagery?

- Varieties of remote sensing data
  - Geometric distortions
- Ortho imagery
  - Geometric distortions have been corrected
- Ortho Mapping
  - Process and technology that products ortho imagery

# Ortho Imagery in GIS

## Previous workflow with remote sensing imagery in GIS

- Users to purchase ortho imagery
- Users to purchase imagery software to process

Raw images

3rd party Software

Processing


Use in GIS

# Ortho Imagery in GIS

ArcGIS integrates photogrammetry into GIS system

- Reduce project cost and production cycle
- Easy to use for GIS users

Raw images


Process and use in GIS

# ArcGIS Ortho Mapping

## Capabilities

- Generate ortho products
  - Orthomosaics
  - DEM (DTM/DSM)
- Support many types of data
  - Satellite images
  - Aerial images
  - Scanned images
  - Drone images
- Advanced License

# ArcGIS Pro Ortho Mapping – 3 Steps

Input image collection

1. Create ortho mapping workspace

2. Perform block adjustment

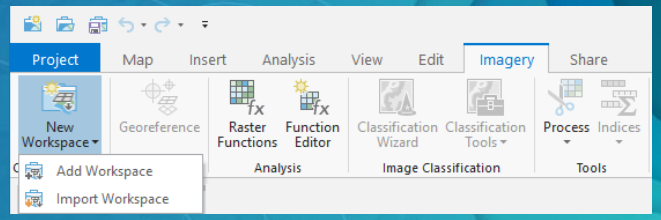
3. Generate ortho mapping products

DEM

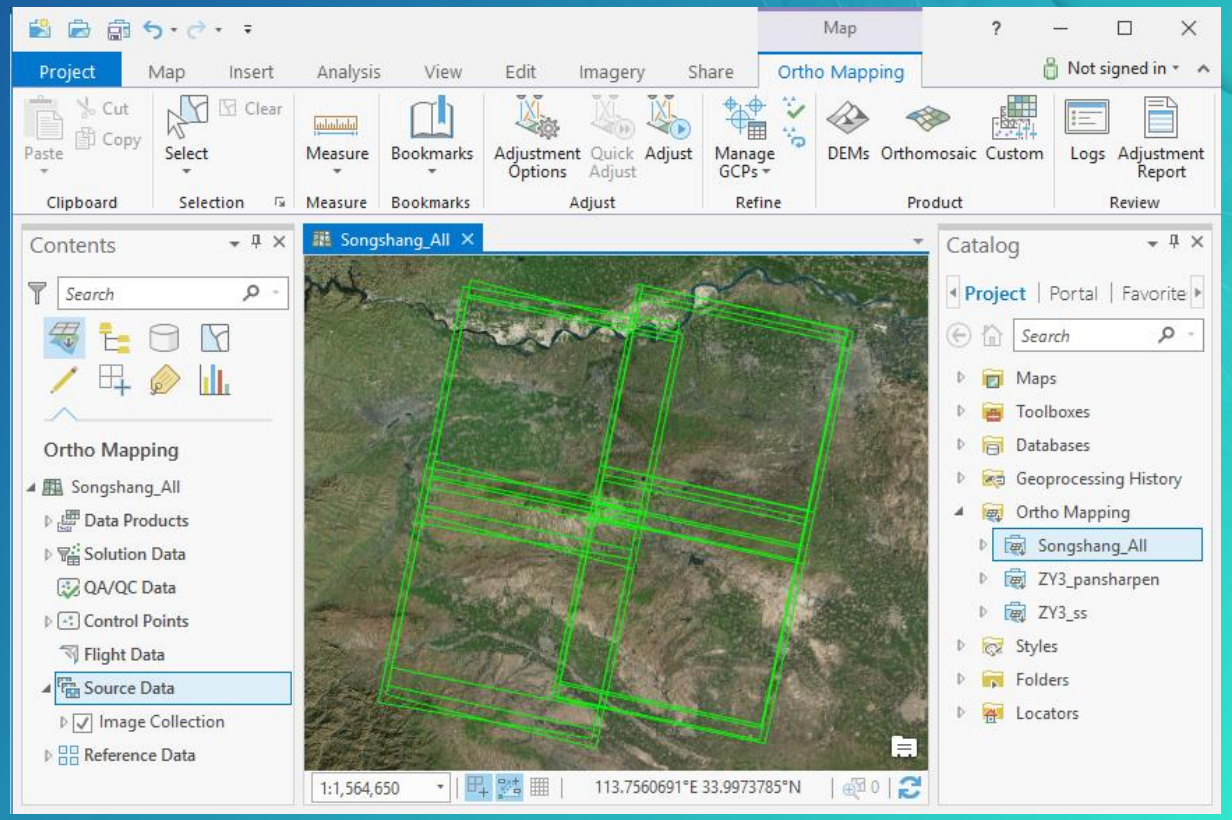
Orthomosaic

# 1: Ortho Mapping Workspaces

A sub Pro project that mange input, output, and intermediate files for an ortho mapping session




- Manages images using mosaic dataset
- Keeps track of the processing phases
- Support operations
  - Create, add, import, copy, delete
- Create from New Workspace wizard
  - Satellite, digital aerial, scanned, drone
- Consistent workflow of adjustment and product generation

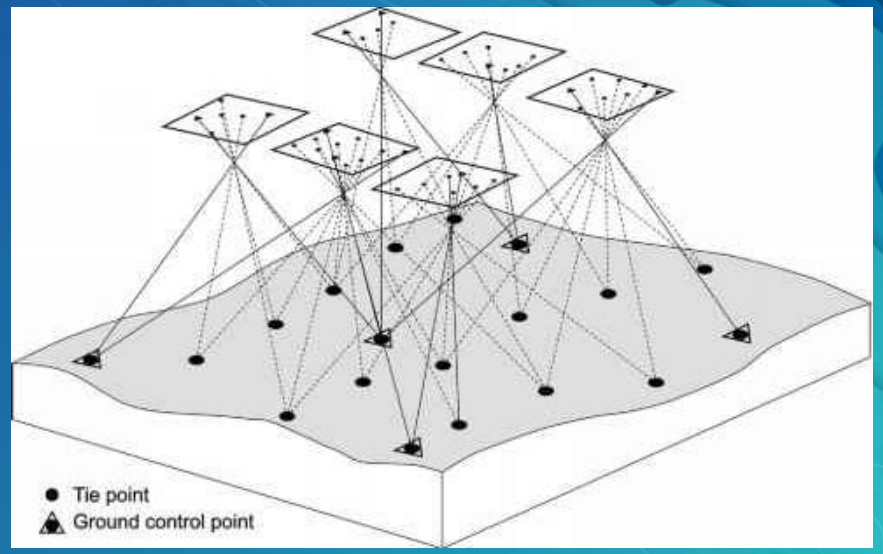


# 2: Adjustment

## Image matching and triangulation

- Compute control points
  - Tie points
  - Ground Control Points (GCPs)
  - Check points

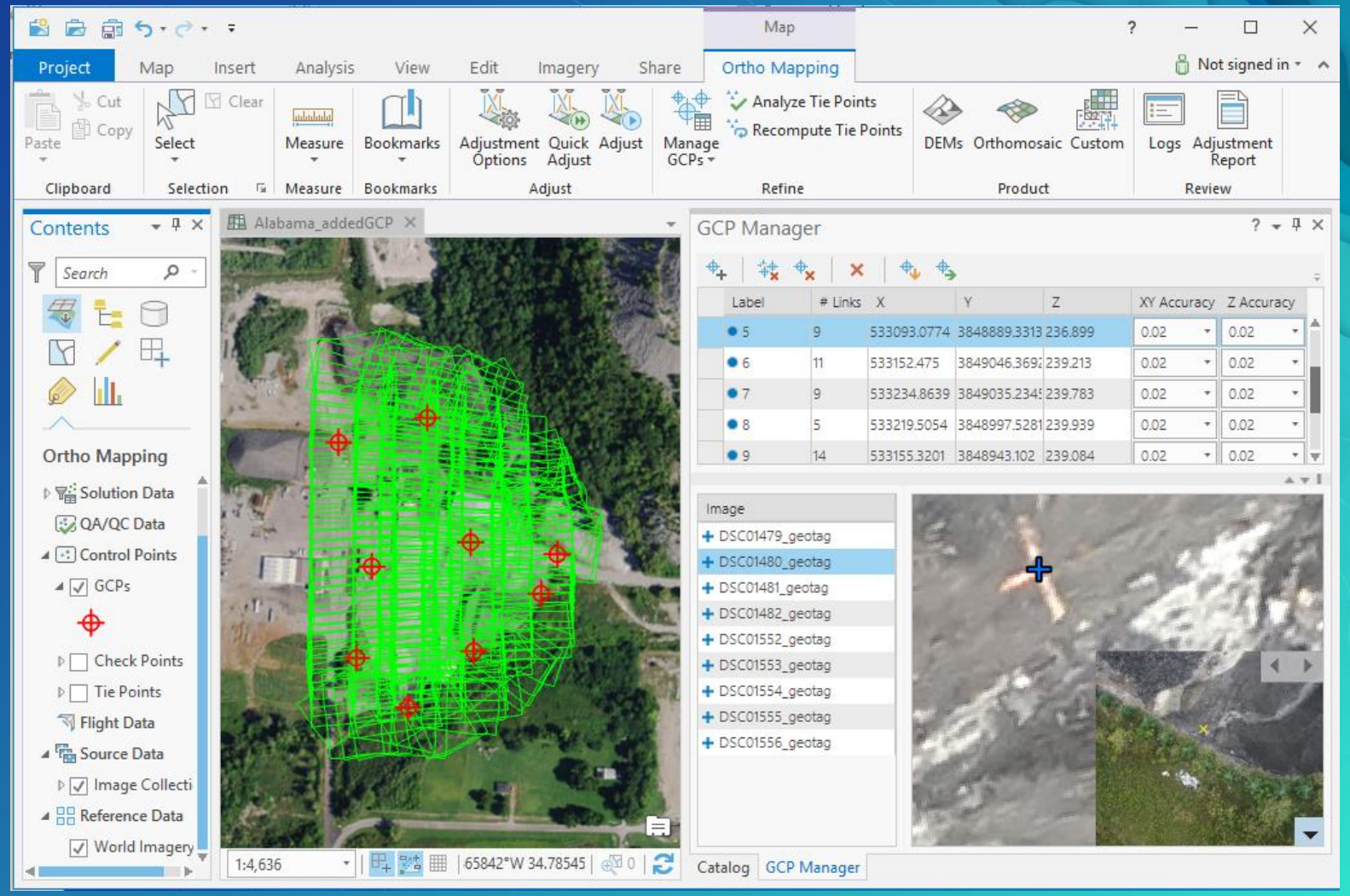
- Compute adjustment
  - Triangulation algorithm for frame camera model
  - Triangulation algorithm for RPC model
  - Apply transformation to each image



# 2: Adjustment

## Editing GCPs using GCP Manager

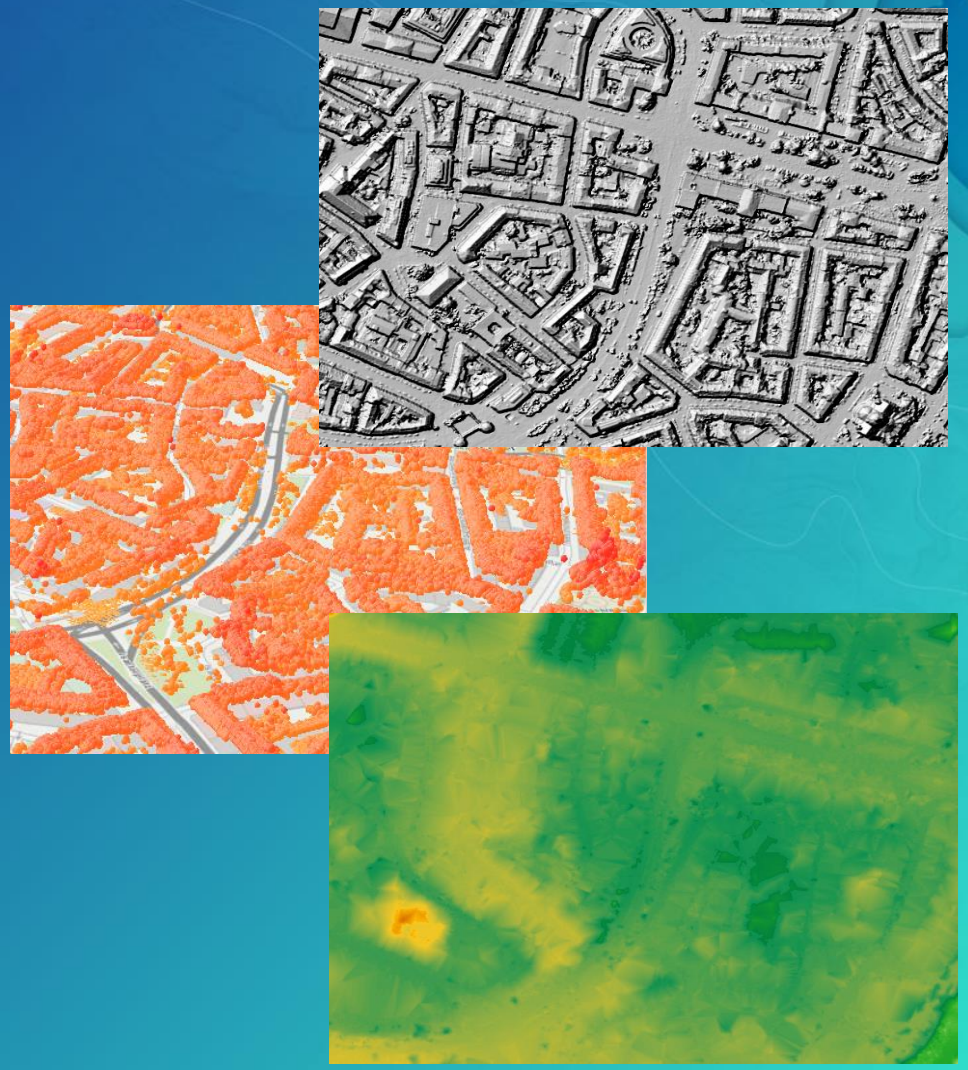
- Import GCPs
  - Txt, csv, table
  - Import GCP photos
- Manually add GCPs from Map
- Entering one tie point
  - Auto-generate the rest



# 3. Generate Elevation Product using DEM Wizard

Includes generating point cloud and interpolate DEM from it.

- Three methods for point cloud generation
  - Extended Terrain Matching (ETM)
  - Semiglobal Matching (SGM)
  - Enhanced Semiglobal Matching (ESGM)
- Output elevation data
  - Digital Surface Model (DSM)
  - Digital Terrain Model (DTM)
- Use for orthorectification



# 3. Generate Orthomosaic Product Using Mosaic Wizard

## Seamline

- Automatically generated seamlines
  - Voronoi method
  - Disparity method
  - Radiometry method
- Manually edit using Topology editing

- Seamline feather with user defined width

# 3. Generate Orthomosaic Product Using Mosaic Wizard

## Color Balancing

- Dodging or histogram methods
  - Color grid
  - 2rd order polynomial
- Calculate color surface from images
- User provide a target surface

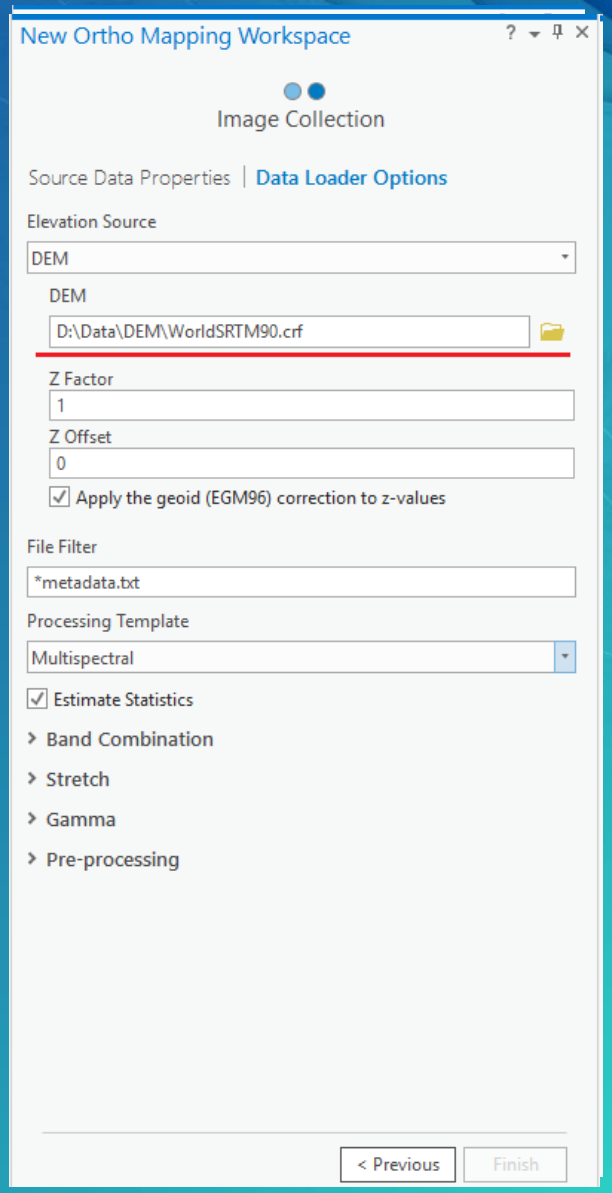
# 3. Generate Orthomosaic Product Using Mosaic Wizard

## Generate Orthomosaics and other products

- Orthomosaics
- Orthorectified mosaic dataset
- Tile cache
  - Using Tile Cache tools
- Ortho image scenes
  - Use Export Mosaic Items tool
- Ortho image tiles
  - Use Split Raster tool

# Workflow: Satellite Imagery

- Support many satellite data (39)
  - RPC model
- DEM is required for creating workspace
  - Local DEM dataset is recommended
- Support processing templates
  - Pan, MS, Pansharpen

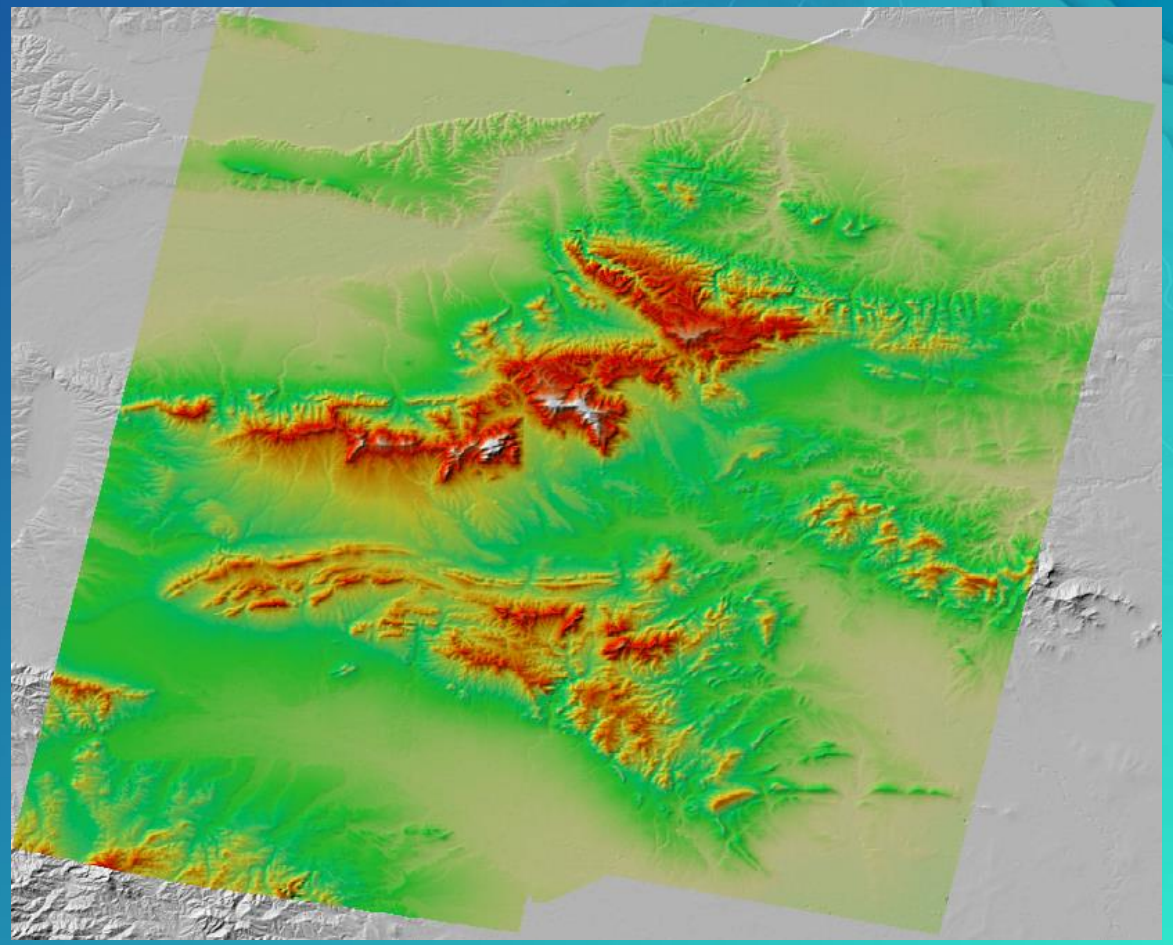


# Workflow: Satellite Imagery

## Example: ZY3 Songshan

FWD, NAD, and BWD scenes

Generated DTM (10m)



# Workflow: Satellite Imagery

## Example: ZY3 Songshan

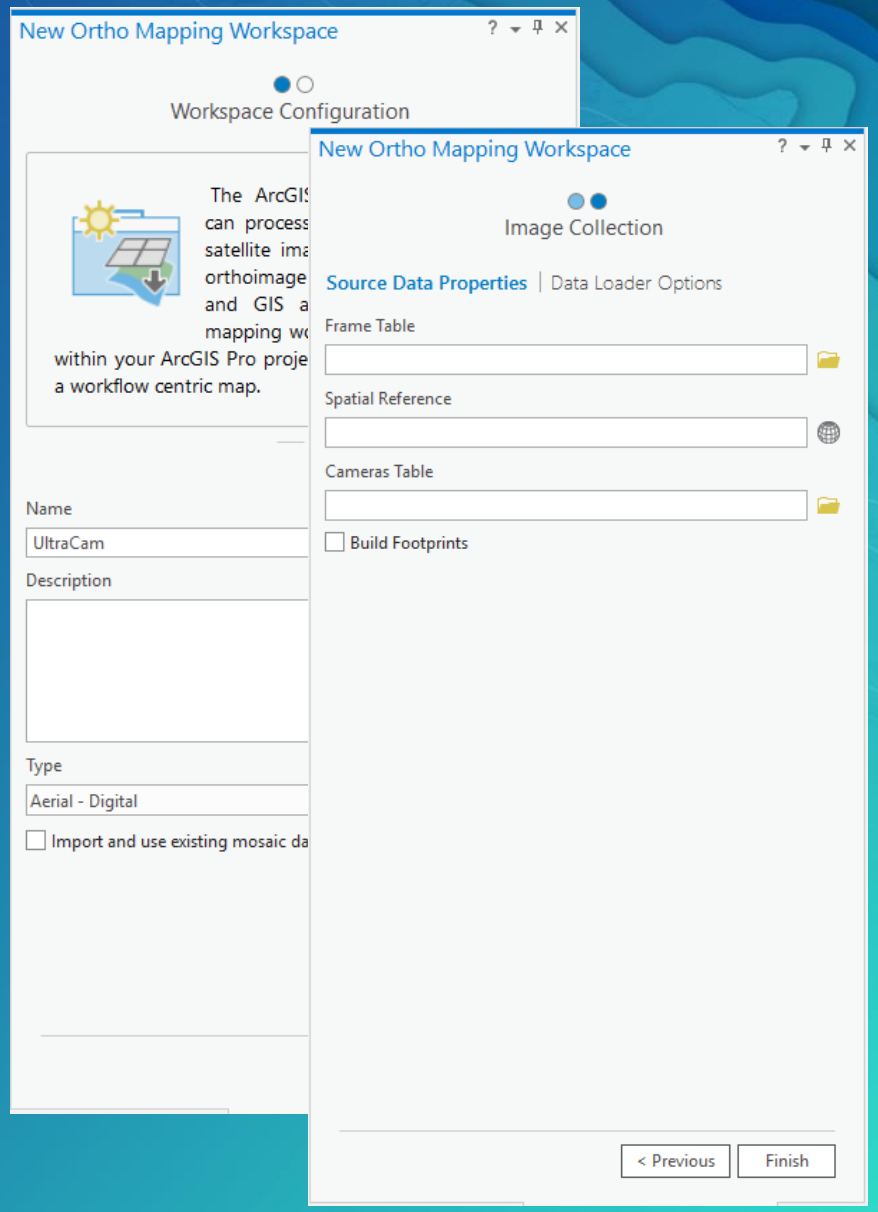
NAD and MS scenes

Pan-sharpen orthomosaics

# Workflow: Digital Aerial Imagery

## Camera table and frame table

- A camera table from internal orientation info
  - Focal length, pixel size, principle point
  - Image-to-film transform
- A frame table using external orientation info
  - Image perspective center
  - Omega, phi, Kappa, camera distortion parameters
- Create workspace from
  - The two tables
  - DEM data



# Workspace: Digital Aerial

Example: 16 aerial images, Z/I imaging DMC II 230

- Generated orthomosaic
  - Generated DTM for orthorectification
  - Computed seamlines using disparity method
- Generated DSM for hillshade analysis

# Demo

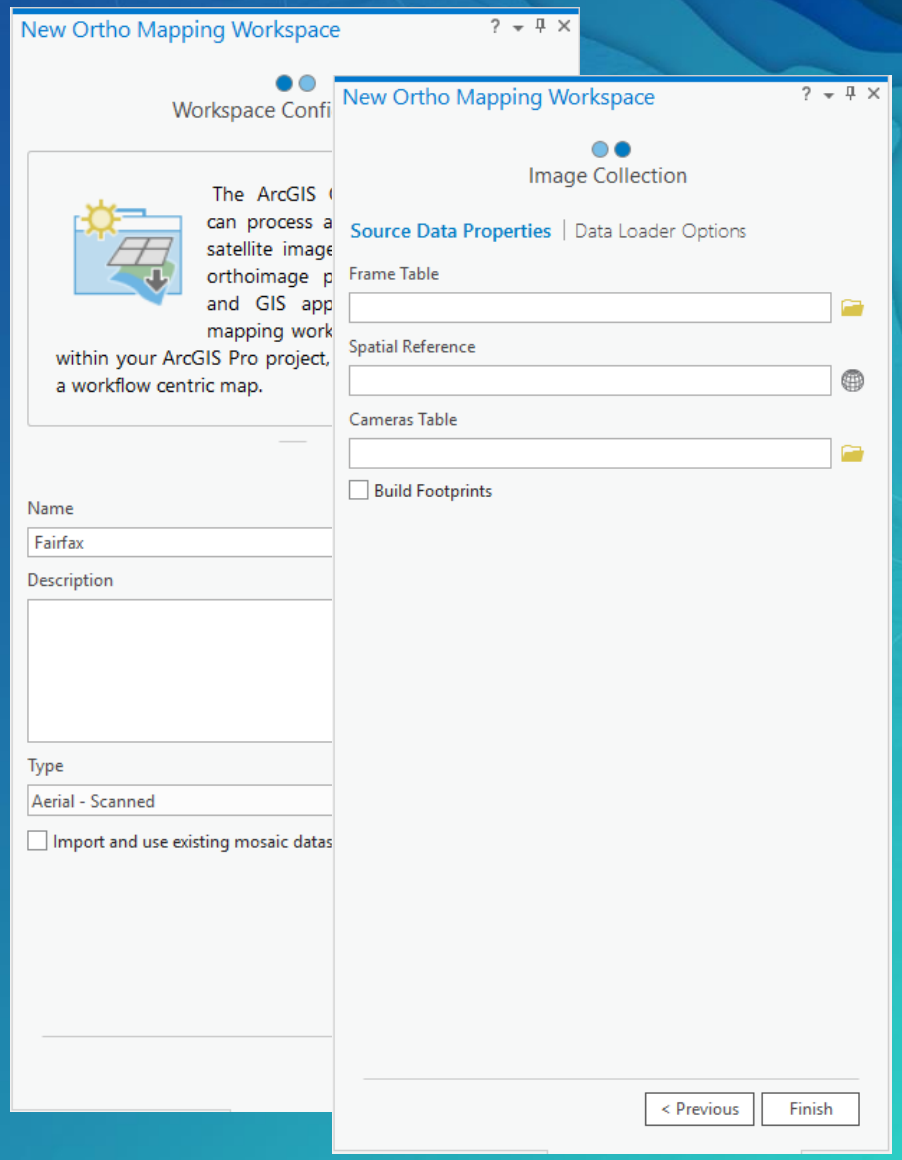
Creating Orthomosaics from satellite images

Creating DSM from aerial images

# Workflow: Scanned Aerial Images

## Camera and frame table

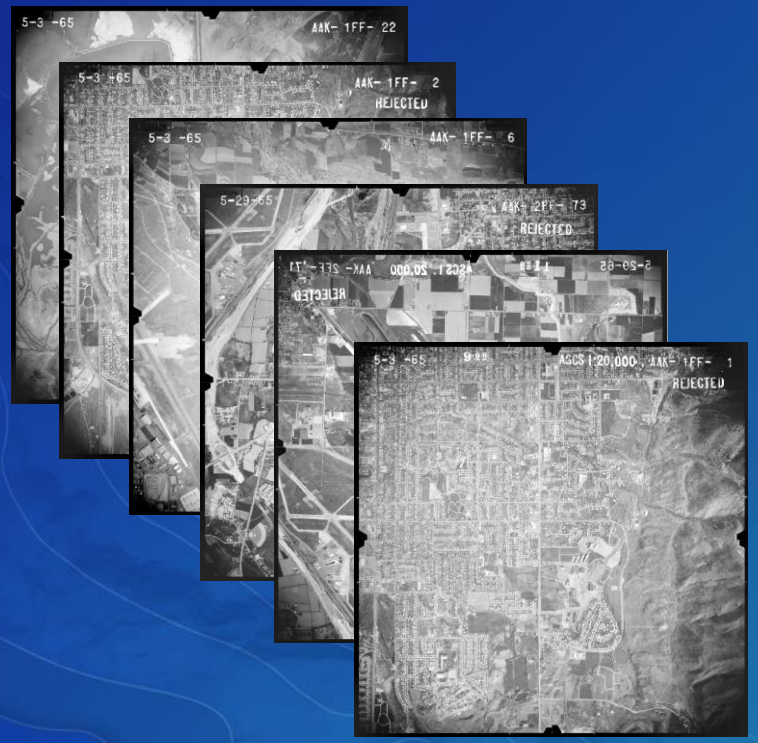
- A camera table from internal orientation info
  - Focal length, pixel size, principle point
  - Image-to-film transform
- A frame table using external orientation info
  - Image perspective center
  - Omega, phi, Kappa, camera distortion parameters
- Historical data workflow tools
  - Image footprint
  - Index map
  - Scan
- Create workspace from the 2 tables



# Workflow: Scanned Aerial Images

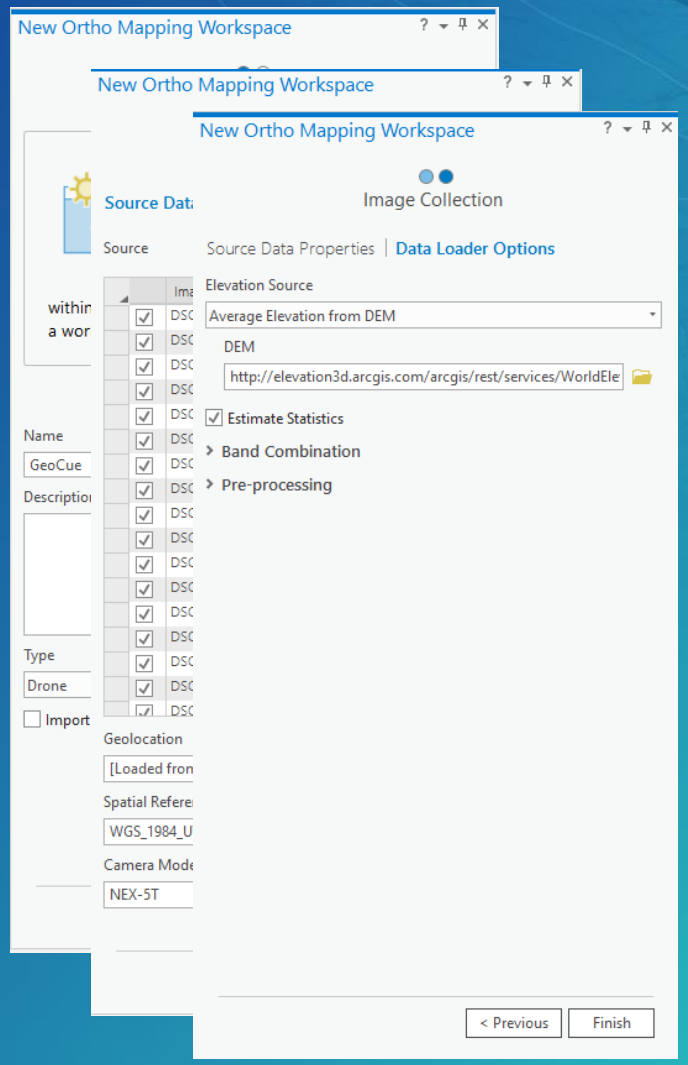
## Example: 44 photos of year 1965

- 13 GCPs manually added (NAIP as reference)




# Workflow: Drones

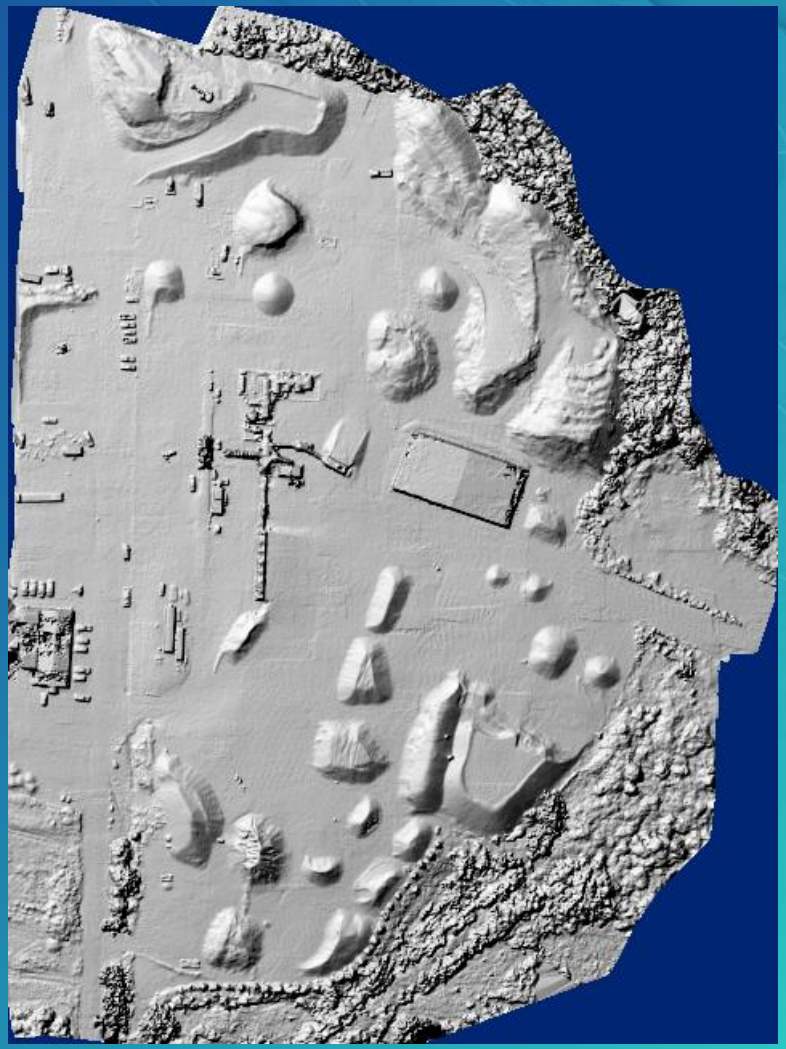
- Images with internal GPS (EXIF)
- Images with external GPS table
- Support a library of cameras
  - User defined camera parameters
- Elevation (dataset or a constant)



# Workflow: Drones

## Example 1: Measuring volume for a engineering site

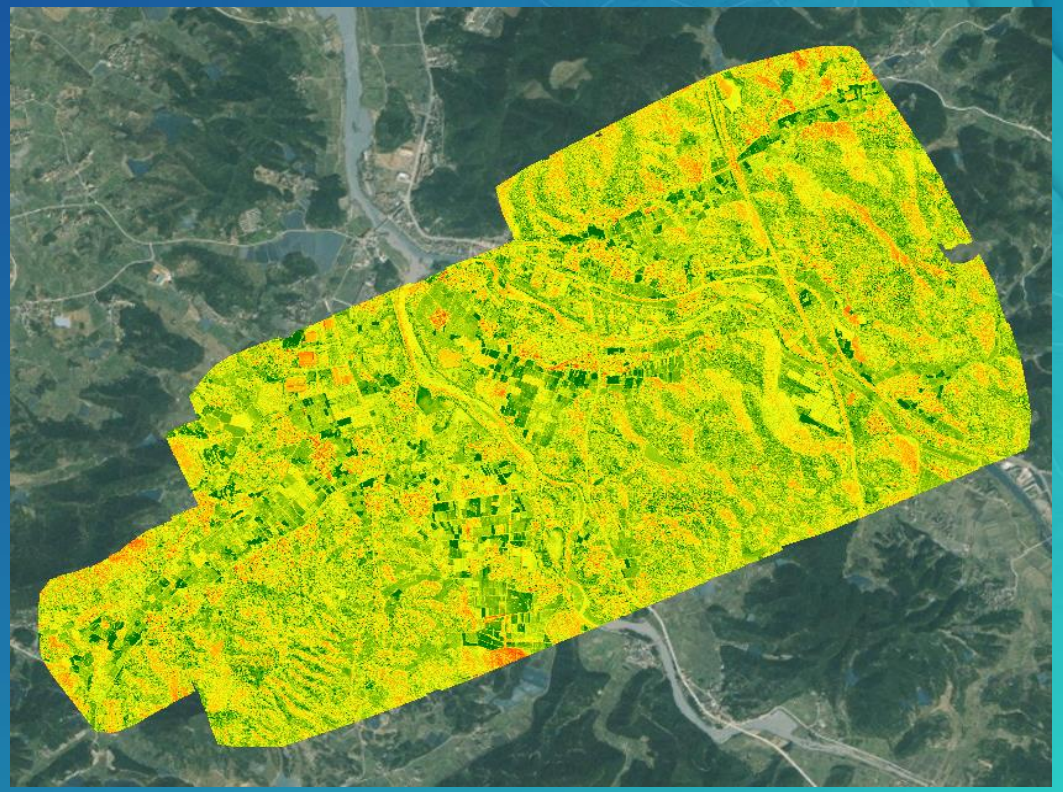
- Data
  - 225 images, GSD=0.016
- Processing
  - Projection error= 0.55 (pixel)
  - GCP = 0.39m z=0.14m
- Generate Orthomosaic
- Generate DSM
  - ESGM method
- Measuring volume
  - Surface Volume Geoprocessing tool



# Workflow: Drones

## Example 2: Mapping Crop Condition

- Data
- Adjust
- Generate orthomosaic
- Create water content map
  - with raster function (VARI)



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