What’s New in Imagery

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5 Key Imagery Capabilities

Visualization & Exploitation

Analysis

Content

Management

Map Production
The Complete Platform for Imagery

Map Production

Analysis

Visualization & Exploitation

Management

Content
The ArcGIS Imagery System

ArcGIS Pro +ArcGIS Image Analyst
ArcGIS Enterprise
ArcGIS Image Server
ArcGIS Online Content
Cloud Storage
On Prem Storage
Remote Sensing
Raster Datasets

Imagery Content Projects

• Sentinel 2
• World Elevation
• Landsat
• NAIP

• Partners
  - Maxar, Planet, Airbus, Deimos Imaging, Vexcel, NearMap, ClarkLabs,…
Image Management and Dissemination

ArcGIS Pro – Authoring of Mosaic Datasets
Extensive tools for Image Management

ArcGIS Image Server
Scaling imagery
- Imagery Hosting
- Dynamic Image Services
- Raster Analytics
- Ortho Mapping
On Premises and Cloud
Managing Imagery

- Mosaic Dataset
- Oriented Imagery
- Orthos
- DEM/DTM/DSM
- Categorical
- Multi-Dimensional
Mosaic Dataset
Optimum data model for image management

- Highly Scalable, from Small to Massive Volumes of Imagery
- Defined in GeoDatabase (File or Enterprise)
- References sources
- Maintains metadata
- Defines processing to be applied

Recommend to use ArcGIS Pro
ArcGIS Image Server
Making Imagery Accessible

**Image Hosting**
- Upload your imagery
- Creating Imagery Layers

**Dynamic Image Services**
- On The Fly Processing
- Dynamic Mosaicking

**Raster Analytics**
- Distributed processing
- Scalable analytics

**Ortho Mapping**
- DTM Generation
- Orthophotos
- Ortho Maker

**Cloud Storage Connection (ACS)**
Simplified credential management
Support: AWS/Azure/Alibaba

**New Portal Experience**
Create Imagery Layer
- As One Layer – Single Image
- As One Layer – Many images
- As Many Layers

Users can simply upload imagery and have served as imagery layers
Demo
Portal user experience to create imagery layers
Multidimensional Raster
Optimizing other dimensions

CRF – Optimized for cloud storage and processing
Multidimensional CRF – Optimize for multiple variables/dimensions
Transposed CRF – Enable rapid dimension access and analysis
Map Production from Imagery
Creating precise imagery derived products

**ArcGIS Pro Advanced - Ortho Mapping**
- Imagery from Satellite, Aerial Cameras & Drones
- Aerotriangulation & Block Adjustment
- Orthophoto production
- Digital Elevation Model Generation (DSM & DTM)

**ArcGIS Image Server - Ortho Maker**
- Ortho Mapping on ArcGIS Enterprise (drone only)

**ArcGIS Image Analyst – Stereo**
- Stereoscopic (true 3D) viewing
- 3D feature editing

**Drone2Map for ArcGIS**
- Easy to use orthophoto & DEM production
- Standalone desktop app
Ortho Mapping

Drone2Map
Stand Alone App for Windows

ArcGIS Pro
Ortho Mapping Workflow

Ortho Maker
WebApp on
ArcGIS Image Server
Ortho Mapping

Ortho mosaics & DEMs from Satellite, Aerial & Drone Imagery

Rapid streamlined processing

ArcGIS Pro Advanced

ArcGIS Pro Advanced + ArcGIS Image Server App + ArcGIS Image Server

Input image collection → Create ortho mapping workspace → Perform block adjustment → Generate ortho mapping products → Orthomosaic → DEM

Pro 2.2 Scanned Aerial Imagery Support
Ortho Mapping – ArcGIS Pro at 2.4
End-to-end ortho mapping workflow to process imagery

- **Support for multispectral cameras (drone)**
- Orthorectification accurate & scalable
- Continuing emphasis on improving block adjustment, DTM generation, & usability of tools
Ortho Maker
Web based user interface for uploading and processing Ortho Mapping workflows on Drone Imagery

Drone Imagery (local storage) → Ortho Maker → Drone Imagery (in data store) → ArcGIS Enterprise → ArcGIS Image Server → Products (Web Image Layer)

*Ortho Maker is not a product sold separately, it is a capability of ArcGIS Enterprise + ArcGIS Image Server*
Ortho Maker – ArcGIS Enterprise 10.7
Web interface for Drone image processing in ArcGIS Enterprise

- GCPs from Feature Service (ArcGIS Collector workflow)
- Calculate stockpile volumes

Available with ArcGIS Image Server
Drone2Map in ArcGIS
Generate 2D and 3D products from drone imagery

- Orthorectified mosaics
- Terrain models
- Point clouds
- 3D meshes

• Process in the field or in the office (laptop)
• Batch processing of multiple collects
• Share flight data and derivative products to ArcGIS Online or ArcGIS Enterprise

orthomosaics
DSM & DTM
point clouds & 3D meshes
smart inspection & 3D PDF
more…
<table>
<thead>
<tr>
<th>Prior</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Process drone images to create orthomosaics &amp; digital surface models (2D workflow)</td>
<td>• New architecture for deeper integration with ArcGIS</td>
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<tr>
<td>• Create RGB encoded point clouds with Ground, Vegetation, Buildings, and Roads classified. Also create realistic 3D textured meshes (3D workflow)</td>
<td>• Rapidly available <em>Dynamic Mosaic</em> (mosaic dataset)</td>
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<tr>
<td>• Simple workflow for non-technical personnel</td>
<td>• Configure the UI to optimize unique workflows</td>
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<tr>
<td>• Add ground control to ensure high spatial accuracy</td>
<td>• Access Catalog, Filter on file attributes, much more</td>
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<tr>
<td>• Easily share output products to ArcGIS Online</td>
<td>• Visualize the point cloud, multiple renderings</td>
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<tr>
<td>• Direct data load into ArcGIS Pro project</td>
<td>• Work directly with elevation values in the DSM</td>
</tr>
<tr>
<td>• Measure 3D stockpile volumes or excavations</td>
<td>• New indices for visualizing multispectral data</td>
</tr>
<tr>
<td>• Support for multispectral cameras (Red Edge, Sequoia, Sentera, Slant Range)</td>
<td>• Mathematically rigorous accuracy report using Check Points</td>
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**Resources**

- Workflow with links to help, sample data, videos, more
  [http://esriurl.com/D2Mworkflow](http://esriurl.com/D2Mworkflow)

Stereo Display and Data Capture

- **Stereo display**
  - “Stereo Map” view in ArcGIS Pro
  - Easy navigation of stereo pairs
  - Support Anaglyph, active shutter & passive glasses

- **Stereo feature extraction**
  - 3D cursor - capture points, lines, polygons

- **Stereo measurements**
  - Pro measurement tools are “stereo aware”

- **Workflows for data preparation**

*Focused on GIS user requiring stereo vs professional data capture*

Requires ArcGIS Image Analyst
Analysis
Extracting Information from Imagery

ArcGIS Pro
Core capabilities
Raster Functions – Image Processing (Base)

ArcGIS Image Analyst
Raster Functions – Image Processing (IA)
Machine & Deep Learning
Image Space
Full Motion Video
Stereo
Pixel Editor
Analysis of Multidimensional data

ArcGIS Spatial Analyst
Raster Functions – Image Processing (SA)
Distance modelling
Hydrological modelling

ArcGIS Image Server
Raster Functions – Image Processing (All)
Scaling using Raster Analytics

System of Insight
# Raster Functions

## ArcGIS Pro

- ~50 Raster Functions
  - Math Operators
  - Statistics
  - Conversion
  - Multiband Math
  - Interpolate
  - Band Math & Indices
  - Surface Generation & Analysis
  - Correction
  - Python Raster Functions

## ArcGIS Image Analyst

- ~60 additional Raster Functions
  - Image Segmentation
  - Classification
  - Overlay (Sum)
  - Statistics
  - Math

## ArcGIS Spatial Analyst

- ~15 additional Raster Functions
  - Distance & Density
  - Hydrology
  - Overlay (weighted)
  - Viewshed
  - Nibble

## New functions in Pro 2.4

- Euclidean back direction
- Flow length
- Sink
- Snap pour point
- Stream order
- Cost path as polyline
ArcGIS Spatial Analyst – Additional Raster Functions
Raster analysis and image processing

Distance functions
- Wildlife corridor assessments
- Determining Routes
- Cross Country Mobility
- Modelling fire growth
- Determining first responder management areas

Hydro raster functions
- River classification
- Identify errors in DEMs
- Creating watersheds
- Floodplain delineation

Functions also implemented as optimized distributed processing in ArcGIS Image Server on ArcGIS Enterprise – Raster Analytics
Enterprise 10.7 – Map Viewer Enhancements

• Analysis workflows
• Author, edit, run raster functions using Web UX
• Raster function editor - Visual modeler experience for building imagery and raster

Requires ArcGIS Image Server with Raster Analytics configured
Demo – Function Editor in the Map Viewer

Presenter(s)
ArcGIS Image Analyst for ArcGIS Pro
Extract Information from Imagery

**Stereo Mapping**
Visualize imagery and capture 3D feature data in a stereo viewing environment.

**Image Classification**
Perform object-based and traditional image analysis using image segmentation and classification tools and capabilities.

**Perspective Imagery**
Work with oblique imagery oriented in a natural perspective mode to facilitate effective image interpretation applications.

**Motion Imagery**
Work with geospatially enabled video data together with your GIS data to assist in timely, well-informed decision support.

**Advanced Raster Functions**
Perform real-time raster analysis and image processing on an extensive suite of remote sensing data types, and save your results if desired.

*More functions in 2.4*

**Advanced Multidimensional Analysis**
Perform advanced raster modeling with multidimensional geospatial data using geoprocessing tools, Python, Notebooks, and the ArcPy API.

**Pixel Editor**
Redact sensitive areas from images, clean up raster analysis results, and edit DEMs.

**Deep Learning**
Perform image feature recognition using deep learning techniques.

*Enhancements to training workflows in 2.4*

**New in 2.4**

**Significant Enhanced in 2.4**
Pixel Editor

Redaction

Analysis Cleanup
(LandUse, Thematic Rasters, …)

DEM Editing

Part of ArcGIS Image Analyst
Demo – Pixel Editor
Presenter(s)
Multidimensional Analysis

- Apply raster functions to a slice of multidimensional mosaic datasets

- Apply Raster Functions along a dimension
  - Required custom python code
  - Out of the box for all local functions

- ArcGIS Pro – Geoprocessing
  - Aggregate multidimensional raster
  - Generate multidimensional anomaly

- ArcGIS Pro UX
  - Charting tools updated to take advantage of multidimensional CRF

- ArcPy multidimensional raster analysis API

Part of ArcGIS Image Analyst
Demo – Multidimensional Analysis
Presenter(s)
Deep Learning with Imagery in ArcGIS

Arcgis supports end-to-end deep learning workflows

• **Tools for:**
  - Labeling training samples
  - Preparing data to train models
  - Training Models
  - Running Inferencing

• **Supports all 4 imagery deep learning categories**

• **Clients**
  - ArcGIS Pro
  - Map Viewer
  - Notebook Server

*Part of ArcGIS Image Analyst, Runs distributed on ArcGIS Image Server*
4 categories of Deep Learning to Imagery in ArcGIS

- **Pixel Classification**
  - Example: Impervious Surface Classification

- **Object Detection**
  - Example: Palm Tree Detection

- **Instance Segmentation**
  - Example: Building Footprint Extraction

- **Image Classification**
  - Example: Damaged House Classification
ArcGIS – Deep Learning Workflow
End-to-end deep learning workflow

Tools to generate training samples
- Image Analyst in ArcGIS Pro
- Image Server on ArcGIS Enterprise

Model Training
- using ArcGIS Notebooks

Inferencing
- Image Analyst in ArcGIS Pro
- Image Server on ArcGIS Enterprise
ArcGIS – Deep Learning Workflow

Using deep learning models

Inferencing

• ArcGIS Image Analyst
• ArcGIS Image Server
Deep Learning Clients in ArcGIS

Wide range of experiences using deep learning
Demo – Pixel Classification
Presenter(s)
Demo – Hurricane Michael Damage Assessment
- Instance segmentation
- Image classification
Presenter(s)
Image Visualization and Exploitation

Integrating imagery into dynamic applications to aid understanding

**ArcGIS Pro**
- ArcGIS Image Analyst
  - Image Space, Mensuration
  - Stereo
  - Motion Video
- Oriented Imagery

**Web**
- ArcGIS Excalibur
  - Map Viewer – Imagery features
  - **Image Configurable Apps (Image Viewer / Mask / Visit)**
  - WABIS – WebAppBuilder Widgets for Image Services
- Oriented Imagery

**Mobile**
- Focused Apps
- LT Mosaic Dataset in RunTime
Motion Imagery (FMV) - ArcGIS Pro 2.4

Increased integration of video into GIS

- Equivalency with ArcMap now complete
  - Geospatial Search
  - Video Measuring Tools (distance and area)

- VMTI (Video Moving Target Indicator)
  - MISB ST 0903.4
  - USDI Object Tracking Initiative for DOD

- Frame Chipping
  - Select region of video frame and copy to clipboard

Data provided by USMC. For internal use only
Imagery Exploitation - Web-Based Structured Observation Management

Excalibur

Search & Discover

Exploitation
Ortho & Oblique Viewing
Feature ID
Measurement

Analytics
On-the-Fly Processing

Project Tasking & Management

Observation

Search and Discover

Activity-Based Analysis

GIS View

Image Space

Delivering Next Generation Imagery Workflows
Oriented Imagery

Access imagery at any angle for any location

- Pick location and find best available imagery
- Fast, intuitive access and navigation
- Measurement (if suitable metadata available)
- Feature collection - Stores both image and ground locations
- For many modes of imagery
  - Oblique, 360, Streetview, Inspection, Handheld, Panoramic, Video...
- Collect own source or Integrate with many partners data & services
Components

https://www.esriurl.com/OrientedImageryDownload

• Authoring tools
  - Creation of Oriented Image Catalogs from many sources
    - EXIF, Drone2Map, tabular
    - Customizable to any source that provides orientation metadata
  - Upload images to cloud storage or use existing services
  - Publish Oriented Image Catalogs to ArcGIS Online / ArcGIS Enterprise Portal

• Client Tools
  - ArcGIS Pro Add-In – From Market Place
  - 2D widgets (for JS API 3.x)
  - Developer API (for 2D and 3D apps) On Github

Available from the Esri Marketplace
(Early Adopter)
Oriented Imagery API 2.0
Find and display all the images that contains the asset being inspected

V1
- Simple to integrate into applications
- Uses: JavaScript, WebGL, HTML5 and CSS3
- External Libraries:
  - JavaScript API for ArcGIS and Pannellum
- Creates coverage polygons of images
- Provides Ground2Image and Image2Ground transforms
- Provides feature collection Interface
- Enables 3rd party viewer integration

V2
- Superimpose features into image view
- Feature collection of Points, Lines, Polygons and Labels, with attributes and simple renderers
- Multiple view support
- Web Scene Support, with frustum
- Drive camera to view and drive view to camera
- Integrate Camera view into scene
- Improved styling
Imagery Summary of What’s New

• Management
  - Image Hosting in portal

• Map Production
  - Drone2Map for ArcGIS V2 – Enhanced UI

• Analysis
  - Function Editor in Portal WebMap Viewer
  - Pixel Editor
  - Optimized Multidimensional Raster Analysis
  - Extensive Deep Learning Tools

• Visualization & Exploitation
  - Excalibur
  - Oriented Imagery (V2)

www.esriurl.com/imageryworkflows
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Select the session you attended

Scroll down to “Survey”

Log in to access the survey

Complete the survey and select “Submit”