



Introduction to Oriented Imagery

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Terminology

Image geometry & metadata

- **Geotagged**
 - An image with metadata re: XY(Z) location of the camera
- **Oriented**
 - An image with location, defined field of view and direction (+ other camera parameters)
- **Georeferenced**
 - An image with pixels mapped onto the ground (not necessarily accurate)
- **Orthorectified**
 - An image that is accurately georeferenced using a terrain surface

Oriented Imagery

Access imagery at any angle for any location

- Pick location and find best available imagery
- Fast access and user-friendly viewing experience
- For many modes of imagery
 - Oblique, 360, Street View, Inspection, Handheld, Panoramic, Video...
- Integrated with GIS Applications
- Measurement (if suitable metadata available)
- Enable label and feature collection
- Your own source data, or from many partners & services



Street View



Drone close range inspection



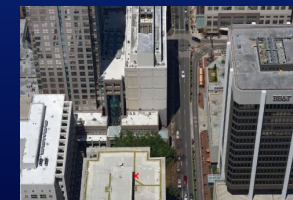
360 Image



Panorama



Video



Oblique / Aerial



WideAngle / FishEye

Oriented Imagery – Key Features

Beyond traditional mapping imagery

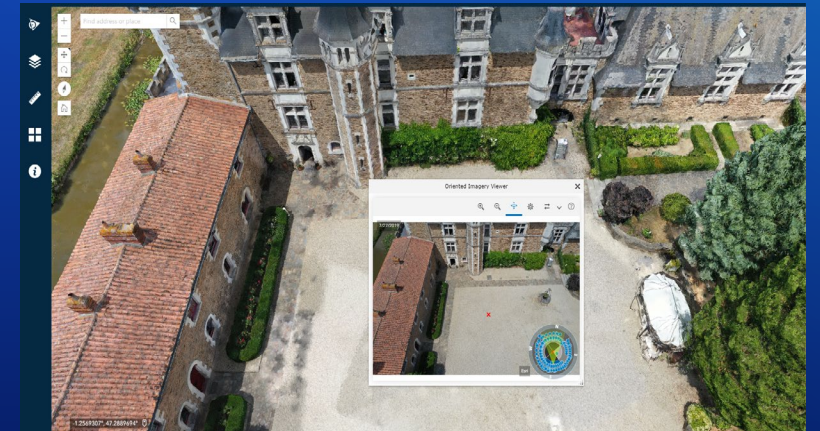
- Supports all forms of non rectified imagery
- Superimpose maps into imagery and imagery into maps
- View assets up close from multiple directions
- Integrate imagery with vector GIS, point clouds, mesh etc.

Lightweight data model for agile requirements

- In Desktop, Web & Mobile applications
- Create many solutions
- Support many types of image orientation
- Support different imagery in the same applications

Provide interoperable solutions across the platform:

- Manage the vast collections - (System of Record)
- Integrated into applications - (System of Engagement)
- Extract information - (System of Insights)



Oriented Imagery is for:

- **Anyone who...**
 - ... manages physical infrastructure
 - ... wants to visualize, locate, inspect, or measure their assets
 - ... needs situational awareness
- **Industries:**
 - State and Local Government, Public Safety, Commercial
 - Utilities, Petroleum, Transportation, Natural Resources
- **Use Cases**

View street-side 360 imagery for cities and streets

Record the location of all assets from street-side imagery

Insurance inspection and property assessment

Immediate access to today's drone imagery

Immediate access to drone imagery archives

Access ROV imagery for pipe interiors

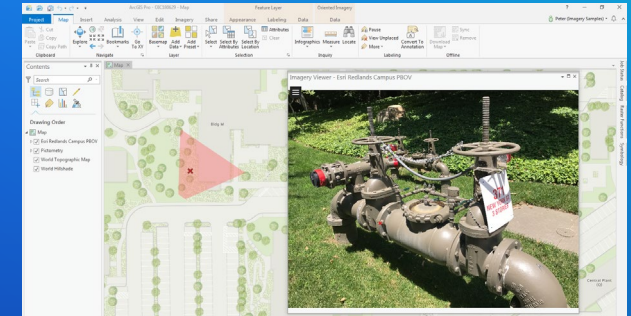
Oblique imagery from drones and aerial sensors

Inspection imagery of utilities
(insulators, building exteriors, dams)

View surveillance imagery in context

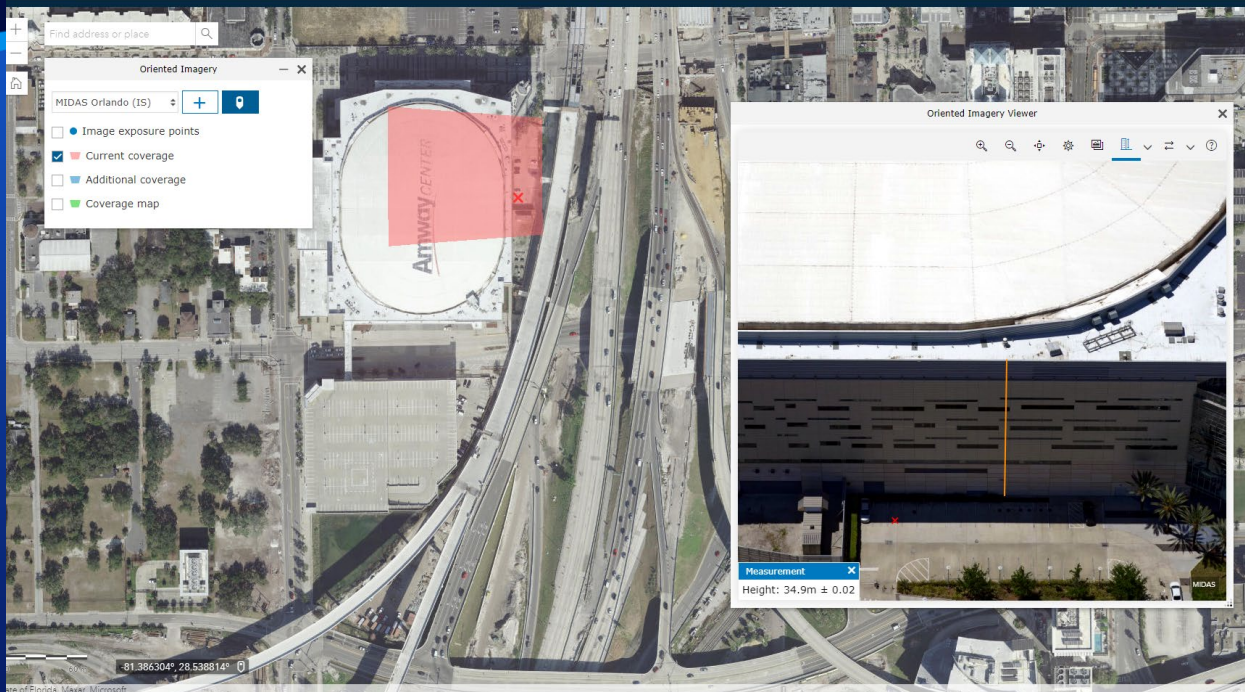
View drone video imagery in context

Indoor Asset management



What's new in 2.6?

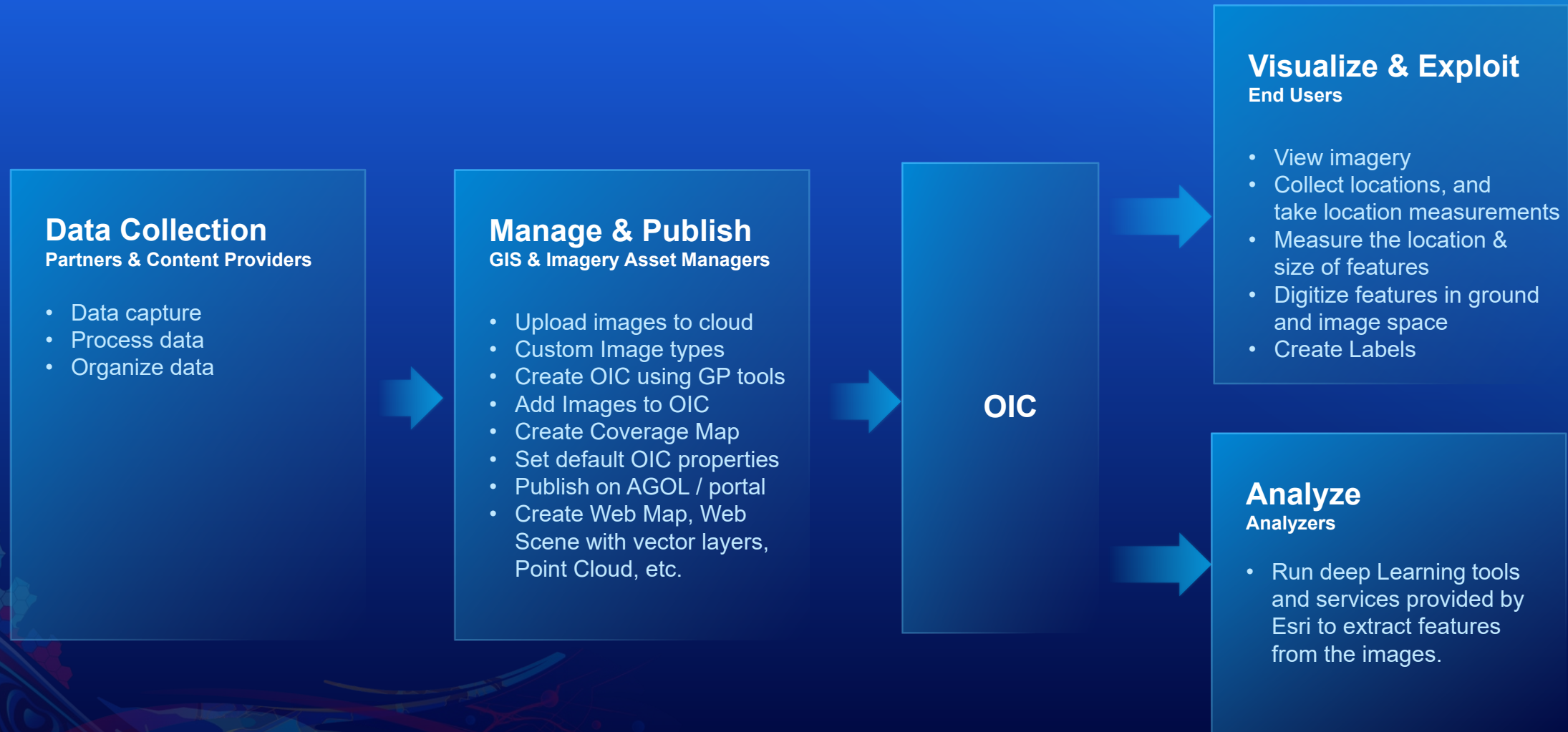
- Time selector to filter images based on days, weeks, months, and years
- Experience Builder widget for Oriented Imagery
- View and exploit local images (on disk) in Oriented Imagery ArcGIS Pro Add-In
- Superimpose images into scene (Scene view)
- 360 video support
- Increase the size of navigation tool
- Geospatial video Image type
- Updated UI for widgets and Sample Apps
- Best image computation enhanced to support all imagery



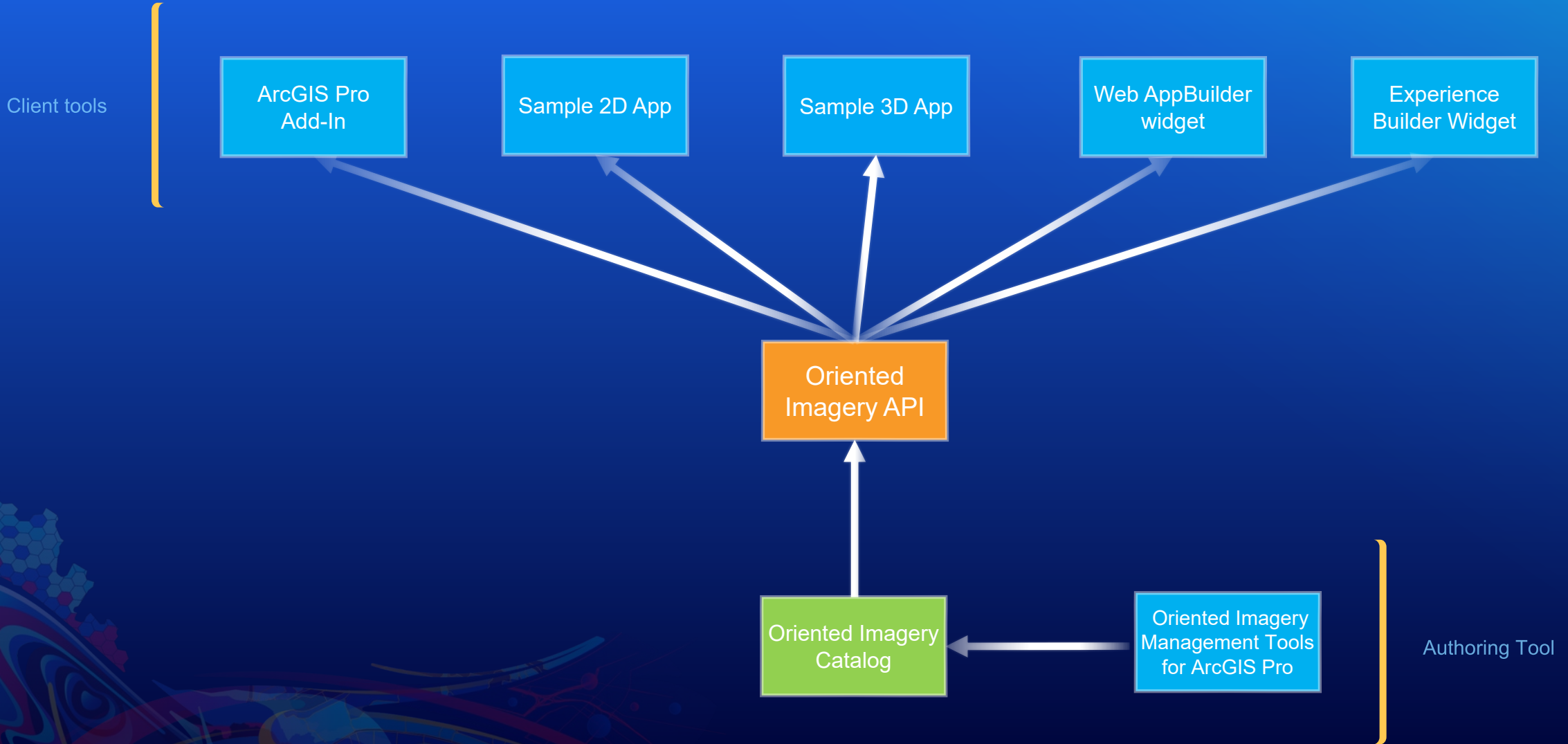
Overview of Oriented Imagery

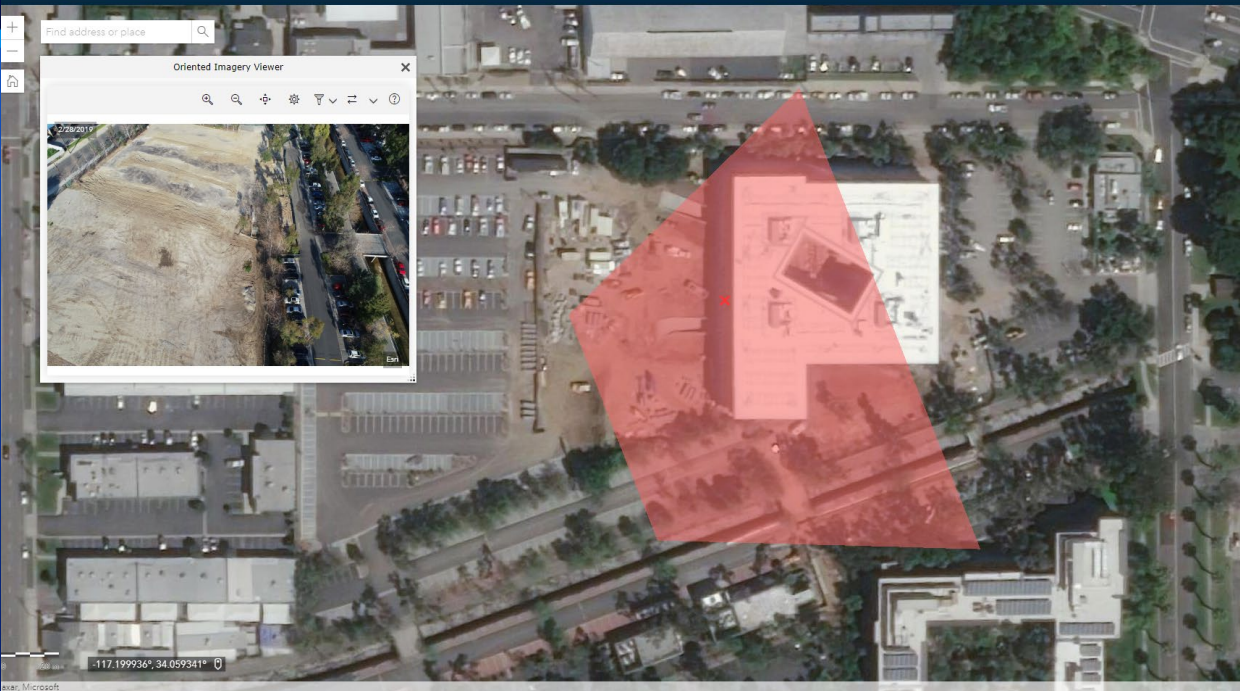
ArcGIS Pro Add-In & Sample Apps

Typical Oriented Imagery Workflow



Oriented Imagery tools





Building E Inspection

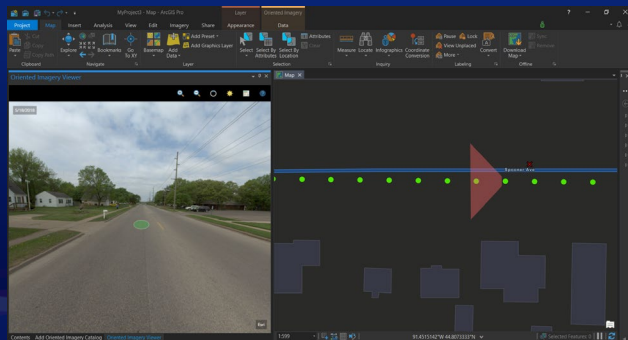
Esri Redlands Campus

Oriented Imagery Components

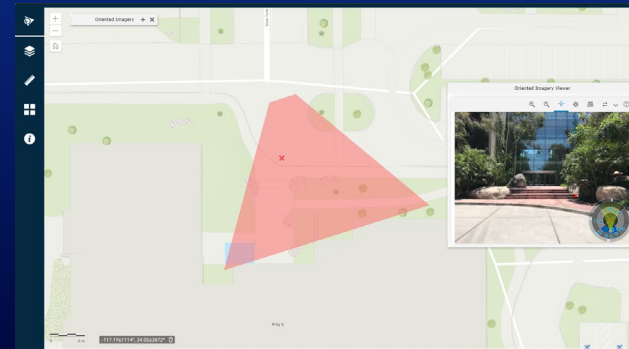
The background features a complex, abstract composition of overlapping shapes and patterns. On the left side, there are several overlapping circular and rectangular forms in shades of blue, red, and yellow. Some of these shapes contain internal patterns, such as a grid of small white dots or a hexagonal lattice. A stylized globe is visible in the lower right quadrant, rendered in dark blue with lighter blue highlights. The overall aesthetic is modern and technical, suggesting themes of data, technology, or global communication.

Oriented Imagery API

- Simple to integrate into applications
- Uses: JavaScript, WebGL, HTML5 and CSS3
- External Libraries:
 - 4.x JavaScript API for ArcGIS and Pannellum
- Creates coverage polygons / 3D Frustums of images
- Provides Ground2Image and Image2Ground transforms
- Provides feature collection Interface
- Superimpose features into image view
- Feature collection of Points, Lines, and Polygons, with attributes and simple renderers
- Multiple view support
- Web Scene Support with 3D frustum
- Drive camera to view and drive view to camera
- Enables 3rd party viewer integration



ArcGIS Pro



Web Apps

Oriented Imagery Catalog

An item in ArcGIS Online / Enterprise Portal

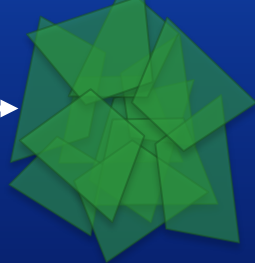
Security is handled at OIC and feature service level

Oriented Imagery Catalog
JSON
Name
Description
Tags
ServiceURL
OverviewURL
DefaultAttributes
CamHeading
CamPitch
CamRoll
HFOV
VFOV
...
MaxDistance
ImageField
ImagePrefix
VideoPrefix
DepthImagePrefix
DEMPrefix
SourceImagePrefix
MeasurementUnit
Variables
Filters

Variables used to declare repeated values

Overview Map

(VectorTiles, MapService, WMS)



Exposure Table (Feature Service)

Field	Description
Shape	Point geometry. XY or XYZ
Image	Link to Image – JPEG, MRF, TileHandler
Name	Visible Name
ExposureID	UniqueID
CamHeading	Heading of Camera – 0 North CW
CamPitch	Pitch of Camera – 0 Down, 90 Horizon
CamRoll	Roll of Camera - CW
ImgRot	Rotation of image in relation to camera
OIType	Oriented Imagery Type
HFOV	Horizontal Field of View
VFOV	Vertical Field of View
NearDist	Nearest useful distance
FarDist	Furthest useful distance
AvHtAG	Average Height Above Ground
CamOri	Camera Orientation - String
Accuracy	Accuracy of each parameter
CamOffset	Camera Offset - Optimization
ImgPyramid	Link to Image Pyramid if separate
DEM	Link to DEM – MRF, TileHandler
DepthImage	Link to Depth Image – MRF, TileHandler
Video	Link to Video
OffsetFromStrat	Offset(s) from start of Video
ExternalViewer	External Viewer to use
SortOrder	Order to sort records in gallery, Next, Previous
ExposureStationID	Group multiple image to same location
AcquisitionDate	Acquisition Date Time
...	Any user definable attributes



JPEG, MRF
Tile Handlers
Image Services,
Attachments

Oblique
Inspection
Terrestrial
Bubble
Separate
Multiframe
Panorama
Video
ImageService

Optional



JPEG, MRF,
TileHandlers

Can be very compact & efficient

Oriented Imagery Types and Sources

OI Types



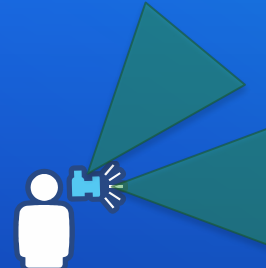
Aerial
Digital / Scanned



Drone



360



Street-view



Video*

Image Access From

Image Services (with geo)

Image Services (w/o geo)

Tile Handler

FL Attachments

MRF URL

JPEG URL

TIFF/COG URL (Planned)

.MOV with H-264 Codec* URL

Orientation
defined in
feature service

Created
from

Orientation Source

FeatureServiceWithAttachments

MosaicDataset

ImageService

FrameTable

Folder

ImageList

Image

EXIF/XMP

Table

Custom Imagery Types

Australis

Drone2Map

Fema

Pictometry

RieglRiPROCESS_CSV

Sanborn

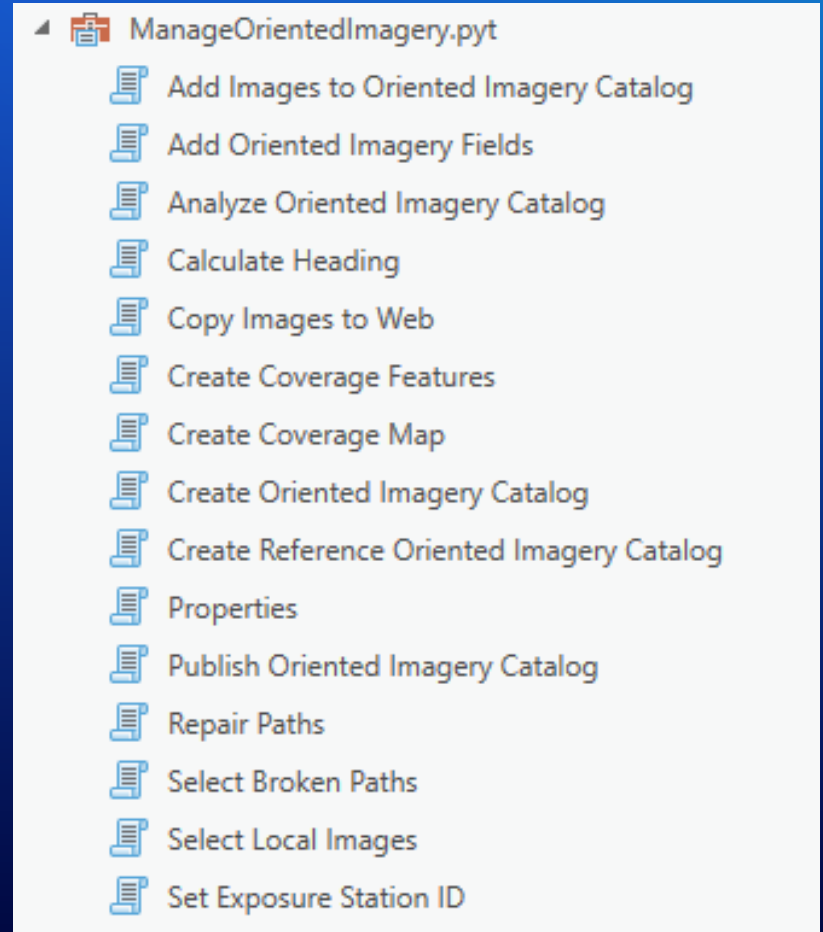
UltramapNadir

UltramapOblique

Oriented Imagery Management tool for ArcGIS Pro

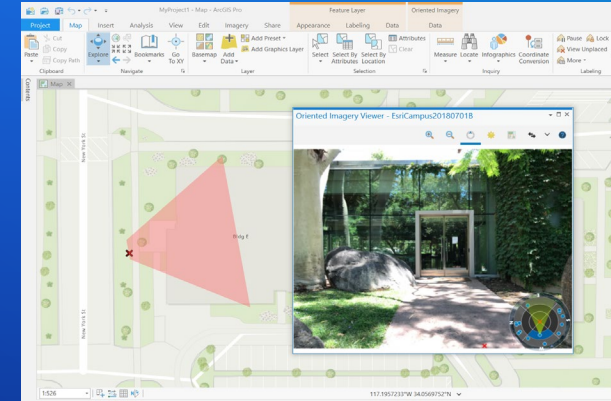
Extensive set of GP Tools for creating OIC from many different sources

- **Create Oriented imagery catalogs**
- **Add images to catalog using various image types like Frame table, Image list, Image Service, etc.**
- **Custom Imagery types**
- **Create coverage map**
- **Copy images to cloud (S3, Azure, Google)**
- **Create Attachments, MRFs**
- **Calculate heading**
- **Publish OIC, feature class, and coverage map to AGOL / Portal**

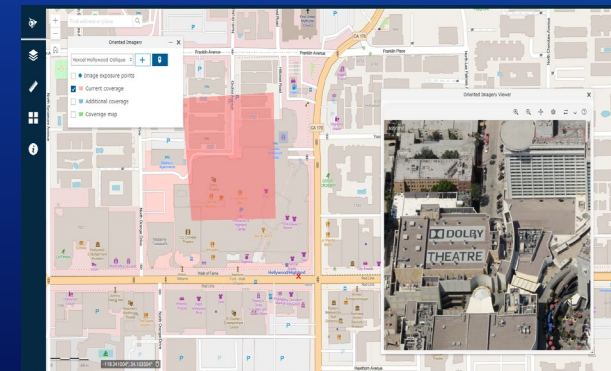


Visualization and Exploitation tools

- Select OIC to visualize
- Take measurements, digitize features, etc.
- Client Tools
 - Pro Add-In
 - Chromium (now part of Pro)
 - Oriented Imagery API
 - Sample Apps
 - Quickly review and test OIC
 - Users want to incorporate Oriented imagery into their applications
 - Web AppBuilder for ArcGIS
- Developer Tools
 - Web AppBuilder widgets – 2D and 3D
 - Experience Builder widget



Pro Add-In



Sample App

The screenshot displays the ArcGIS Pro interface. The main map area shows an aerial view of a residential neighborhood with a green arrow-shaped feature overlaid. The feature is composed of a series of green circles connected by a line, with a jagged green arrowhead pointing to the right. Below the map is a data table titled 'Exposure Points' with the following columns: OBJECTID, Shape, Name, Image, AcquisitionDate, CamHeading, HFOV, VFOV, OType, SortOrder, and ImgRot. The table contains 15 rows of data.

OBJECTID	Shape	Name	Image	AcquisitionDate	CamHeading	HFOV	VFOV	OType	SortOrder	ImgRot
1	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:36 PM	336.9696	100.3889	77.31962	T	0	0
2	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:36 PM	301.8061	100.3889	77.31962	T	0	0
3	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:37 PM	297.3419	100.3889	77.31962	T	0	0
4	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:37 PM	294.9955	100.3889	77.31962	T	0	0
5	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:38 PM	297.3826	100.3889	77.31962	T	0	0
6	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:38 PM	297.6862	100.3889	77.31962	T	0	0
7	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:39 PM	296.0425	100.3889	77.31962	T	0	0
8	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:39 PM	295.1545	100.3889	77.31962	T	0	0
9	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:40 PM	294.519	100.3889	77.31962	T	0	0
10	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:40 PM	293.4915	100.3889	77.31962	T	0	0
11	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:41 PM	289.3515	100.3889	77.31962	T	0	0
12	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:41 PM	287.0676	100.3889	77.31962	T	0	0
13	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:42 PM	287.9166	100.3889	77.31962	T	0	0
14	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:42 PM	286.7756	100.3889	77.31962	T	0	0
15	Point	RedlandsGoProHero8...	C:\Users\kush\048\Do...	6/6/2020 5:43:43 PM	286.8374	100.3889	77.31962	T	0	0

Oriented Imagery Web AppBuilder widget

Redlands

Oriented Imagery Resources

<http://esriurl.com/OrientedImageryResources>

- **Client Tools**

- **ArcGIS Pro Add-In**

- <https://www.esriurl.com/OrientedImageryDownload>

- **2D Sample WebApp**

- <https://oi1.img.arcgis.com/app/index.html>

- **3D Sample WebApp**

- <https://oi1.img.arcgis.com/app3D/index.html>

- **Authoring tools**

- <https://www.arcgis.com/home/item.html?id=36ee0bbbedca64a5a8b68d7c69ab51728>

- **Developer Tools**

- **Web AppBuilder widgets – 2D and 3D**

- <https://github.com/Esri/oriented-imagery>

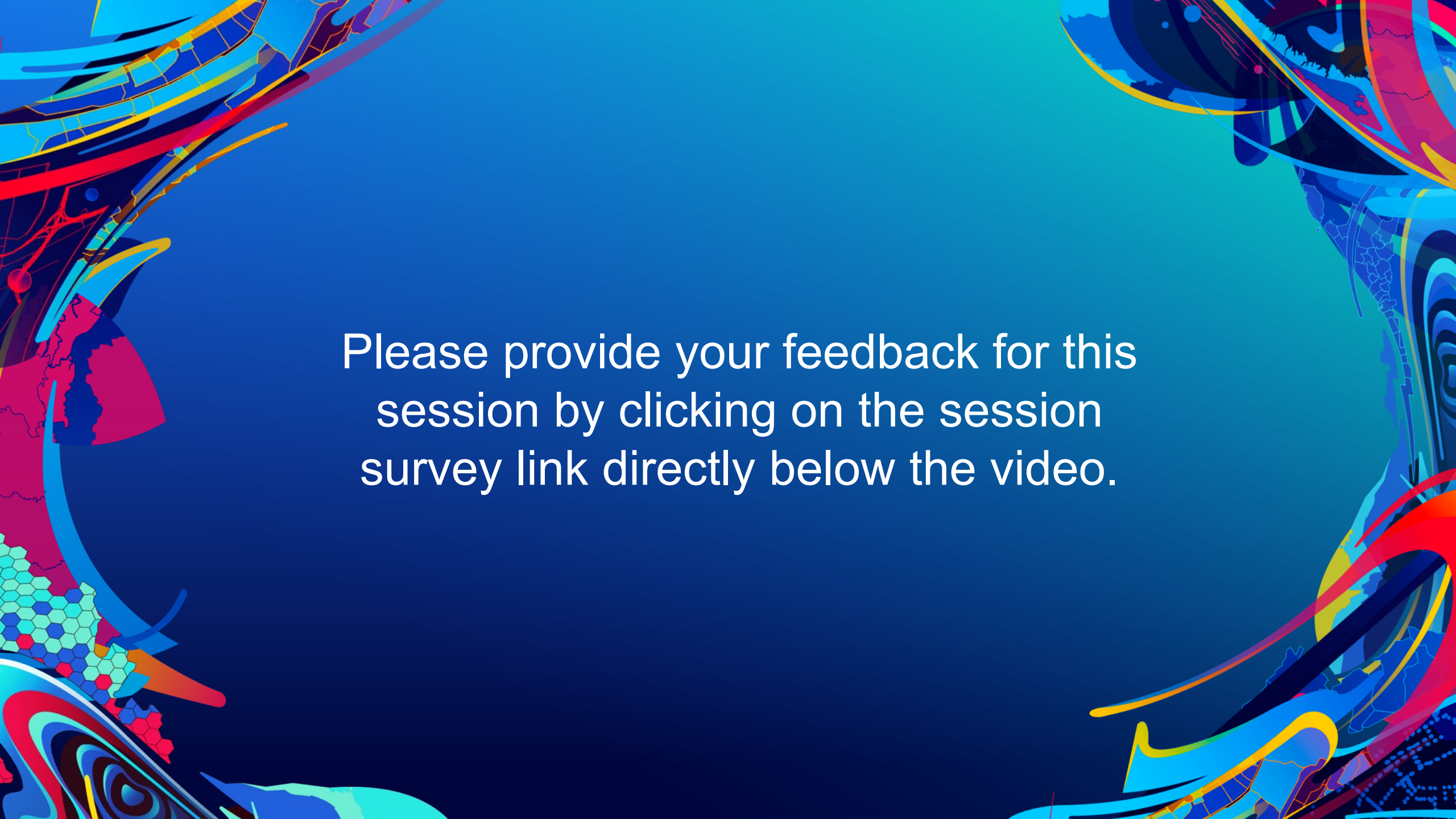
- **Experience Builder widget**

- <https://github.com/Esri/oriented-imagery>



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