# Working with Historical Imagery

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# Historic Aerial Imagery - Objectives

- **Manage & Share Collections of Historic Aerial Imagery**

- **View & use best imagery**
  - **By geography**
  - **By date, other attributes**

- **Geometric and Radiometric accuracy requirements vary**

- **Initial product :**
  - **Mosaic Dataset or Image Service**
  - **Approximate Georeferencing**
  - **Accuracy may be improved over time.**

- **Value:**
  - **Understand past**
  - **Legal ownership**
  - **Environmental reporting**
  - **Water rights**
  - **Property Boundaries**
  - **Finding UXO (Europe WWII)**

# Historic Aerial Imagery  - Sources

- **Film imagery from archives**
  - Rolls of aerial film (typically 24 cm), Cut films, Contact Prints
  - Panchromatic, True Color, Color IR
  - 1930's – 2000's
- **Large collections exist**

- **Being Scanned**
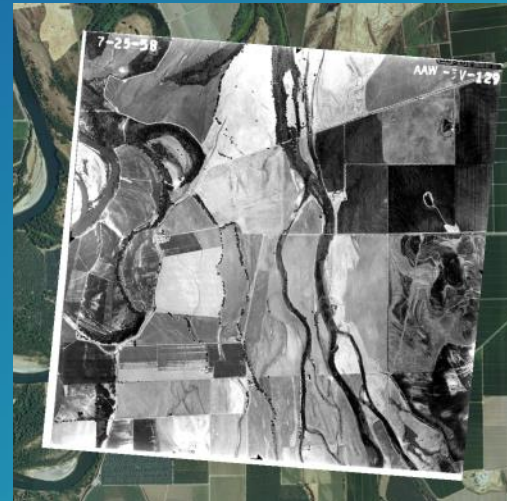
# Scanning

- **Typically scanned by**
  - Photogrammetric scanner
  - Table top scanner
- **Scan at about 20 microns / 1200ppi**
  - Higher resolution rarely needed
- **Record scan direction →**
- **Optimize Format and Compression**
  - TIF with JPEG_YCbCr compression  (Q80 ~ 7x)
  - Tiled with pyramids
  - **Use OptimizeRasters on GitHub**  (https://github.com/Esri/OptimizeRasters)
- **No need to generate statistics**
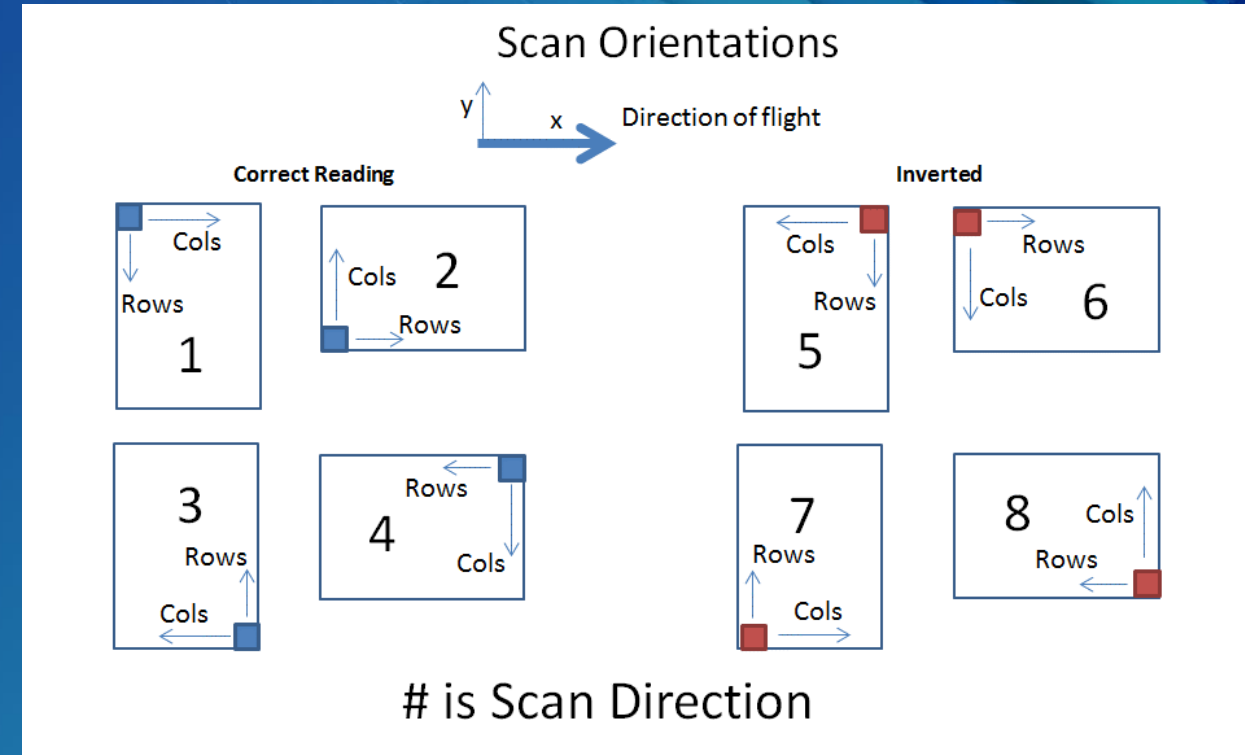
# Metadata

- **Georeferencing**
  - **None** – **Needs Manual Georeferencing**
  - **Poor** – **Index Map Needs to be digitized**
  - **Good** – **Digital Index from navigation data (> 1990)**
  - **Excellent** – **Output from AT**

- **Film Metadata**
  - **Date (s)**
  - **Camera Type (Optional)**
  - **Camera Calibration (Optional)**
  - **Run Numbers (Optional)**

- **DTM – Digital Terrain Model**
  - **Suitable may exist – Export from World Elevation on ArcGIS Online**
  - **Else need advanced workflow (see later)**

# Workflow Options

- **Basic**
  - **Manually Georeference**
  - **If a small number of images in flat areas**

- **Standard**
  - **Obtain/Create PhotoIndex**
  - **Create Mosaic Dataset using workflow**

- **Advanced**
  - **Perform Aerial Triangulation**
  - **For Large Numbers of Images**

# Basic Workflows

- Set TIF images to ReadOnly

- Georeference  individual frames using Georeferencing tool
  - Try Approx and then Auto Georeference to World Imagery (or other base)
  - Else manually measure tie points using imagery base map
  - Typically 6 spread out are sufficient
  - Use Projective Transform
  - Use "Save" , Do NOT use "Save As"
    - This results in set of georeferenced images with no sampling applied
- Optional
  - Create Mosaic
  - Create Tile Cache
  - Publish to ArcGIS Online

# Standard Workflow

- **Create Mosaic Dataset - Recommend to use ArcGIS Pro 2.0**
  - **Using best available georeferencing**
  - **Use one of following**
    - **Imagery created in Basic Workflow**
    - **Frame Camera Raster type if orientation available (eg if Aerial Triangulation already exists)**
    - **Use Historical_Imagery_GP_Tools if photoindex available (See next slide on creating digital photo index)**
      - See http://esriurl.com/ImageryWorkflows    Image Management Tools

- **Optionally**
  - **Publish as an Image Service**
  - **Refine geometry**
  - **Refine footprints**
  - **Refine color correction**
  - **Generate seamlines**
  - **Generate Overview**
  - **Create Tile Cache and publish to ArcGIS Online (or your portal)**
  - **Create Derived Mosaic Dataset that Combines all**

Historical_Imagery_GP_Tools
Geoprocessing Sample by ImageryWorkflowsTeam

Geoprocessing tools to assist with approximate orientation of historical imagery

Last Updated: Jun 26, 2017    Created: Jul 26, 2015
★★★★☆ (ratings: 1)   ⌁ views: 402

# Creating Digital PhotoIndex

- **From Photo Index or Print Laydown**
  - Digitize locations and frame numbers by run & film number
  - Build feature class → (x,y) point for approximate photo center
  - "How??" will depend on your data. Easiest method typically to:
    - Scan & georeference the Photo Index/Print Laydown
    - Manually create points for photo centers
  - Populate "Key Historic Imagery Parameters" Table (next slide)

- **Create Film Report**
  - Include other metadata about the flight – date, type of film, etc.
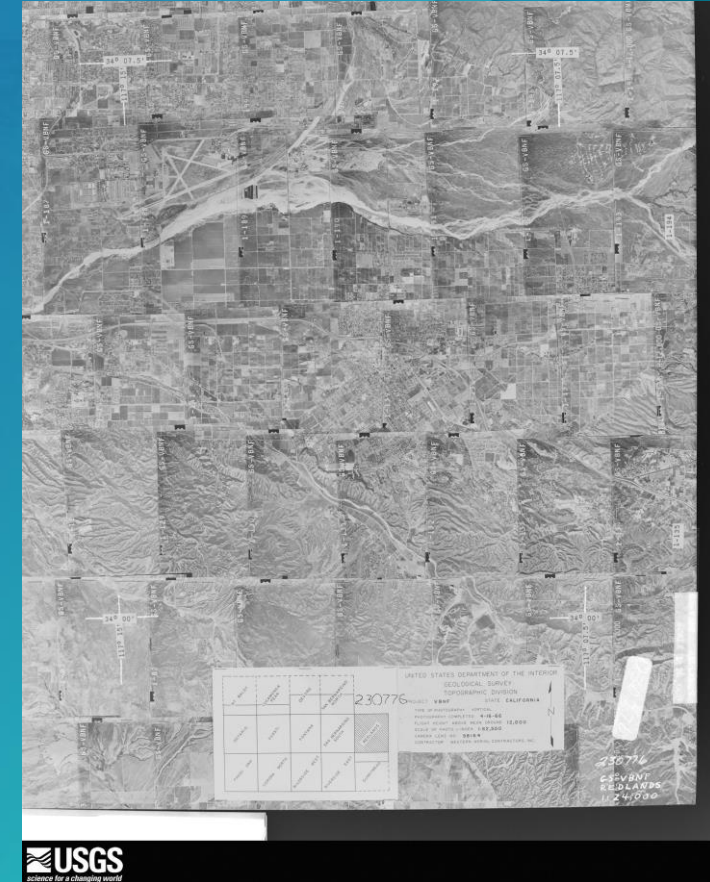
# Build "Key Historic Imagery Parameters" Table

**Approximate X,Y (Geometry)**

**COG (course over ground) – this will be calculated**

**'Raster' field:** path and file name to each scanned file

**PhotoScaleF –** Scale factor e.g. 5000 for 1:5000

**FocalLength** - In microns; e.g. 152400 for 6 inch

**ScanDirection –** per previous diagram

**ScanResolution –** in microns. If not known, can be estimated as 240000/Min(Cols,Rows)

**FrameSize –** in microns e.g. 180000 for 18cm. If undefined then assumed to be 23cm

**Frame –** As a 4 digit string, e.g. 0023 (not stored as an integer)
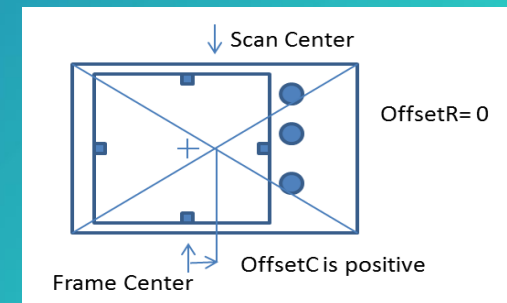
**Run –** As a string

**Film –** As a string

**Cols,Rows –** Number of Cols and Rows of the image. Will be obtained from Image if not defined

**OffsetC, OffsetR** - in microns. This is the offset of the camera center from the center of the scan. If undefined then assumed to be 0
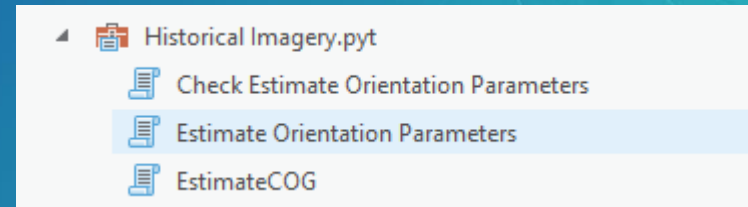
**Other parameters optional – from Film Report**
  **e.g. AcquisitionDate, ScanDate, ScannerModel, FilmType, etc.**

# Using Historical_Imagery_GP_Tools

- **Geoprocessing Tools "Historical Imagery.pyt" available for download**

- **Get from esriurl.com/imageryworkflows , ImageManagement**

- [http://www.arcgis.com/home/item.html?id=d1b4e3afeda7405fb34578207f0ad256](http://www.arcgis.com/home/item.html?id=d1b4e3afeda7405fb34578207f0ad256)



- **Will build table(*s*) required as input to the *Frame Camera* Raster Type**
  - *Frame Table and Camera Table* corresponding to Exterior orientation and Interior orientation
  - Can be separate geodatabase tables, or combined into one.

See in ArcGIS Help System:
**http://esriurl.com/FrameSchema**
**http://esriurl.com/CameraSchema**

# Using Historical_Imagery_GP_Tools  (2)



- **Run *EstimateCOG* → Input KHIP table**
  - This populates COG field


- **Run *Check Estimate Orientation Parameters***
  - This verifies required schema is populated before beginning a lengthy run.


- **Run *Estimate Orientation Parameters***
  - This builds single Frame & Camera Table required as input to *Frame Camera* Raster Type (workflow step 4)
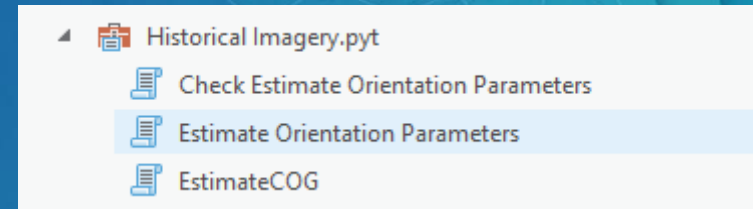
# Using Historical_Imagery_GP_Tools  (3) Create Mosaic Dataset

- **Use *Frame Camera* Raster Type**
  - **Input Frame+Camera table as input**
- **Measure amount of shrink to reduce footprints**
- **Shrink footprints using Calculate footprints by Geometry**
- **Set Mosaic Method = Closest to Center**
- **Create Overviews**

# (Workflow step 5 - optional) Block adjustment in ArcPro

- **Calculate tie points between images**
- **Input ground control points**
- **Adjust with 1st Order Transform  (Frame camera requires Desktop Advanced)**

# Advanced Workflow

- **Create Frame Table as per Standard Workflow**

- **Use OrthoMapping**
  - **Block Adjustment**
    - **GPS AccracyLow**
  - **DTM Generation**

- **Optionally (similar to standard)**
  - **Publish as an Image Service**
  - **Refine color correction \***
  - **Generate seamlines \***
  - **Generate Orthophotos \***
  - **Create Tile Cache and publish to ArcGIS Online (or your portal)**
  - **Create Derived Mosaic Dataset that Combines all**
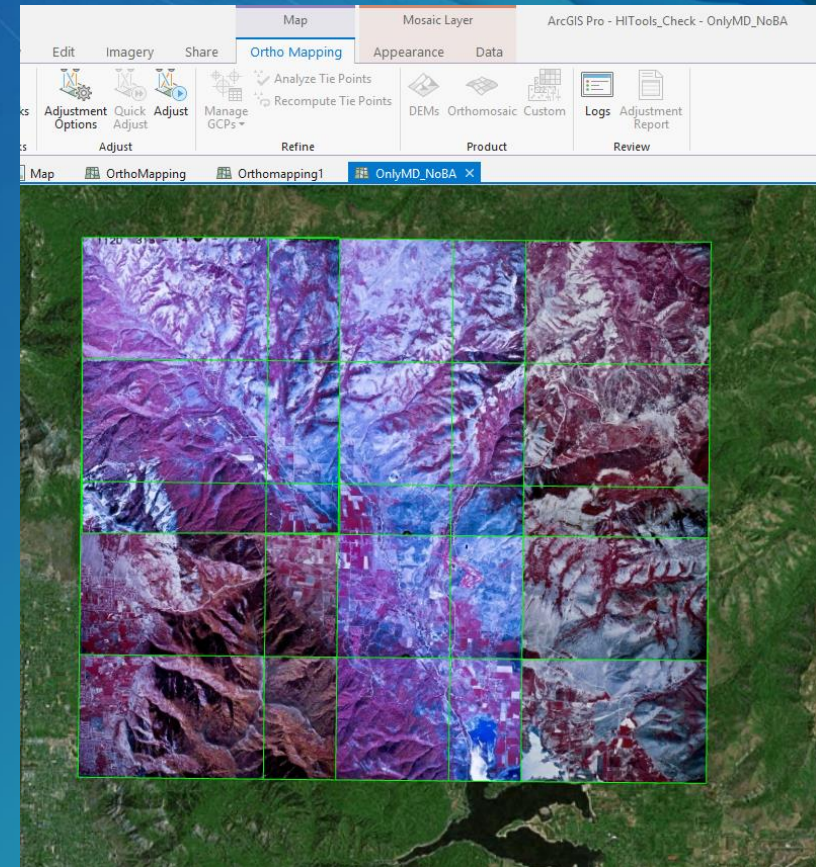


\*  Part of OrthoMapping workflow

# Publishing

- **As Image Services**
  - **Highest Image Quality (No data loss)**
  - **Provide Metadata**
  - **Access to All Overlapping data**
  - **Clip to Footprints**

- **As Raster Tile Cache (Provides Static Backdrop)**
  - **Generate in Desktop or Server**
  - **Publish through Server or to ArcGIS Online**

For More Details:    www.esriurl.com/imageryworkflows