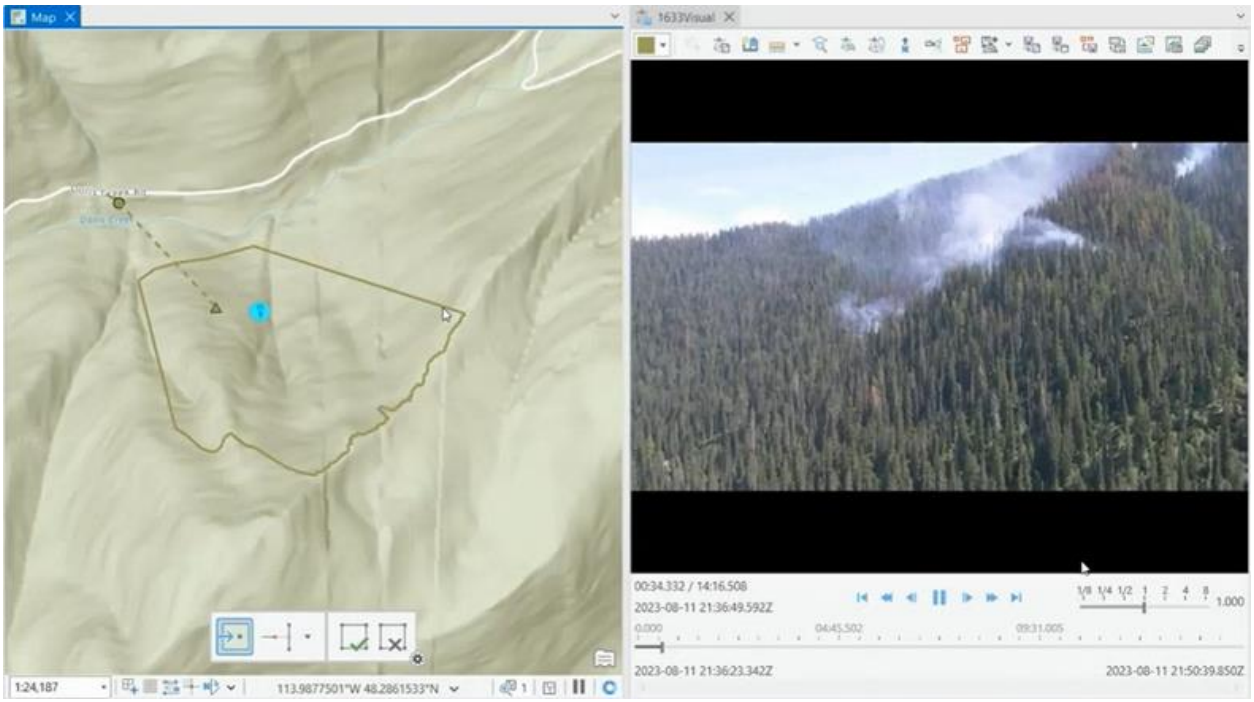
Full-Motion Video (FMV) in ArcGIS Pro Using IGNIS Flight Logs



Introduction

Full-Motion Video (FMV) in ArcGIS Pro allows users to analyze video with additional geographic context (e.g., a video footprint). This document walks through the required steps to prepare and analyze full-motion video footage (thermal and visible) in ArcGIS Pro when using IGNIS flight logs. It also covers some additional steps to further analyze and share your results. A walkthrough video of this workflow can be found here.

Prerequisites

- Must have **ArcGIS Pro and Microsoft .NET** installed on local computer or access to the VDI.
    - **ArcGIS Pro and Microsoft .NET** are available in the Software Center. If you have issues installing ArcGIS Pro, submit a service request to the GIS Help Desk (select the blue "Request Now" button).
        - Press the windows key on your keyboard  , search and open *"Software Center"*.

        - Search and download *"Microsoft Windows Desktop Runtime (64-bit)"* in the Software Center. This **MUST** be downloaded before ArcGIS Pro
        - Search and download *"ArcGIS Pro"* in the Software Center.
    - To access ArcGIS Pro in the VDI (not recommended) visit VDI Data Center SharePoint.

- If running ArcGIS Pro on your local computer, your computer must meet the minimum requirements.
    - CPU – 4 cores @ 2.6GHz, 8 logical processors.
    - Memory/RAM – 8 GB
    - To check if your computer meets these requirements, press the windows key  on your keyboard, search and open *"Task Manager",* and click on the *"Performance"* tab.
        - Click on *"CPU"* to view your CPU info. The number of cores and logical processors should be listed as well as the base speed.
            - It's okay if you are barely below the required speed (e.g., 2.57 GHz)
        - Click on *"Memory"* to view your memory/RAM info. Above the graphs, you should see the number of gigabytes (GB) of memory you have.
            - It's okay if you are barely below the required amount (e.g., 7.6 GB)

- You must be connected to the VPN for ArcGIS Pro to work.
    - Press the windows key  on the keyboard, search for and open *"Cisco AnyConnect Secure Mobility Client"*, select *"US Forest Service eVPN-LincPass"* from the dropdown menu, click *"Connect"*, and select *"Accept"* when prompted.
        - If *"Cisco AnyConnect Secure Mobility Client"* doesn't appear in the search results, you must download it from the Software Center.
            - Search and open *"Software Center",* search and download *"Cisco AnyConnect Secure Mobility Client"* from the Software Center.

- Must have the ***image analyst*** extension active in ArcGIS Pro.
    - Open ArcGIS Pro.
    - From the ArcGIS Pro home page, select "*Settings".*
    - On the left-hand side, select *"Licensing".*
    - When the *"Esri Extensions*" finish loading, select *"Configure your licensing options".*
    - When the licensing options finish loading, scroll down to find *"Image Analyst"*, check the box next to it, then click *"OK".*

Table of Contents

Main Workflow

There are two major steps to our FMV analysis – preparing files and processing. To prepare our files, we need to get the flight log from the tablet onto our computer, transfer the video from the sensor to our computer, and use a custom program to generate some additional files. To process, we need to open the "Video Multiplexer" tool in ArcGIS Pro and point it to our video, templates, and additional files that the custom program generated.

I. Prepare Files

A. Download the flight log (.csv file)

1. **Open the *"files"* app** on the tablet.
2. **Navigate to your IGNIS flight logs** *(Internal storage -> Documents -> Drone Amplified -> Flight Logs).*
3. **Press and hold** the appropriate flight log.
4. **Click "Share"** and choose a method to share.
5. **Download the flight log** to the *"flight_logs"* folder in the *"fmv_template" folder on your computer.*

B. Download the desired videos from the sensor.

1. This process differs between platforms and sensors, please consult the guide for your specific platform or sensor.
2. **Download the videos** to the *"videos"* folder in the *"fmv_template" folder.*
    a. NOTE: These must be the videos that correspond to the flight logs you downloaded.

C. For Thermal Videos: Open VLC player and convert the .avi file to an .mp4.

1. Media > Convert/Save
2. Add the video file, and click "Convert".
3. Choose profile: mp4. Name the file something other than the original.

D. Download a DEM (optional).

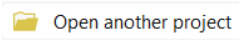
1. https://apps.nationalmap.gov/downloader/
2. Zoom in on map to desired area.
3. Check "Elevation Products".
4. Make sure 1/3 arc second is selected (10m DEM).
5. Click "Search products"
6. Hover over each option to see which one you need. If your flight area is on multiple DEMs, download both.
7. Click "Download link (TIF)".

II. Process in ArcGIS Pro

A. Open a project in ArcGIS Pro

1. Open ArcGIS Pro.
    a. If you forgot to connect to the VPN, close ArcGIS Pro and refer to the instructions under the Prerequisites section of this document.
2. Create a new project or use an existing one.
    a. To create a new project, **choose *"Map"*** under the *"New Project"* group near the top of the ArcGIS Pro home page. Give your project an appropriate name, choose where to save it, and **click *"OK"***.

    b. To open an existing project, find it under the *"Recent Projects*" group or **select *"Open another project"*** to the right. Navigate to the project you want to open and **double click** it.



B. Open the "*Video Multiplexer*" tool.

1. **Click on the *"Analysis"* tab** at the top of the ArcGIS Pro interface.
2. **Select *"Tools"*** within the *"Analysis"* tab.

3. The "Geoprocessing" pane should appear, **search *"Video Multiplexer"*** in its search bar.
4. **Select *"Video Multiplexer"*** within the search results.

C. Point the multiplexer tool to the correct files.

1. For each parameter, **select the folder icon** to the right of it, **navigate to the appropriate file,** and **double click** it.
    a. Input Video File
        i. Select the video to be analyzed here (thermal or visible).
    b. Metadata File
        i. Select the corresponding *"_visible.csv"* or *"_thermal.csv"* file that our custom application generated.
    c. Output Video File
        i. Select the location where the tool should save the new video file.
    d. Metadata Mapping File
        i. Select the *"Custom_FMV_Field_Mappings_Template.csv"* file located in the *"fmv_template"* folder.
    e. Timeshift File
        i. Select the *"_timeshift.csv"* file that our custom application generated.

f. Digital Elevation Model (optional)
    i. Select a digital elevation model (DEM) to use to improve the accuracy of processing.

2. When all the parameters have been assigned, **click *"Run".***
    a. NOTE: This may take a while if your video file is large.

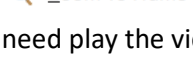
D. Add the new video to the map.

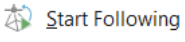
1. **Click on the *"Map"* tab** at the top of the ArcGIS Pro interface.
2. **Select "Add Data"** within the *"Map"* tab.
    a. NOTE: Click on the icon, not the arrow beneath it.

3. **Navigate to the new video** file the multiplexing tool created (it was saved wherever you specified for the *"Output Video File"* in section C above) and **double click** it.
    a. A standalone window will appear with the video displayed.

E. Setup the video for viewing.

1. **Dock the video window** to the side of the map.
    a. **Click, hold, and start dragging the window**, you will see some icons appear near the center of the screen.

    b. **Drag the window** to the icon on the right and **release your mouse click**.
        i. The video should now be docked on the right side of the map.
2. **Zoom the map** to the video frame.
    a. On the left side of your ArcGIS Pro project, there should be a pane titled *"Contents"*.
        i. If you don't see this pane, click on the *"View"* tab at the top of ArcGIS Pro and select *"Contents"*. You should now see the *"Contents"* pane.
    b. Under the label "Standalone Videos", right click the name of the video you added to the map and select "Zoom To Frame". 

        i. If nothing happens, you may need play the video for a few seconds and try again.
3. **Start following** for the video frame.
    a. Under the label *"Standalone Videos"*, right click the name of the video you added to the map and select *"Start Following"*. 

        i. NOTE: If you don't like this feature, you can move around the map and zoom in/out as you please by clicking on your map, selecting the *"Map"* tab at the top, and choosing the *"Explore"* tool. You can now click and drag the map and use the scroll wheel to zoom in/out.

4. **Press the play button** underneath the video.

a. ArcGIS Pro will now play the video and show you the video frame overlayed on the map.
b. If you followed steps 2 and 3, it should follow the video frame around the map as the video plays.
c. **NOTE: ArcGIS Pro speeds up the playback of thermal video. This is a software bug that is yet to be addressed.**
d. **NOTE: For Thermal videos, the playback is 2x as fast. Slow the video down.**

Appendix

The main workflow is the minimum to get your analysis started. In this section, we will explore some additional tools and resources to improve our analysis. We'll also look at how we can share our results.

I. Annotate the Video/Map

It may be useful to annotate the video to provide additional context to your analysis (e.g., to mark spot fires on the map). We can use ArcGIS Pro's built-in annotation tools located on the top of the video player to accomplish this.

A. Set up your view in ArcGIS Pro (Optional)

1. If necessary, open your ArcGIS Pro project and add your multiplexed video to the map (see instructions).
2. Set up the interface so you can see the map and video at the same time (see instructions).

B. Open the annotation tool.

1. **Click on the video**, under the "*Player*" tab at the top of ArcGIS Pro, find the *"Display Annotations"* icon and click on the drop-down menu.

*__Note__: You can export the annotations to provide to folks as a layer with the points you want (super useful when looking oblique)

2. Choose *"Annotate Point"*, *"Annotate Polyline"*, or *"Annotate Polygon"*.
    a. Points are for marking spots on the map (e.g., spot fire, hot spot, takeoff location, etc.)
    b. Polylines are for marking boundaries or line features (e.g., fire edge, roads, streams, etc.)
    c. Polygons are for marking closed boundaries or shapes with area (e.g., fire perimeter, vegetation zones, buildings, etc.)

C. Apply symbols more relevant to fire (Optional)

1. Look on the right-hand side of ArcGIS Pro, the *"Create Features"* pane has opened with different symbols we can use to annotate the video.
    a. By default, the symbols aren't well suited for fire applications. If you're using the *"fmv_template"* folder, we have custom symbols we can use.
2. On the left-hand side of ArcGIS Pro, see that an *"FMVAnnotations"* group has been added to the *"Contents"* pane. **Click on the arrow** next to the group to see what it contains.
    a. It will contain a layer called *"Point"*, *"Polyline"*, or *"Polygon"* depending on which type you chose in Part B.
3. **Right click** on the *"Point"*, *"Polyline"*, or *"Polygon"* layer and **select *"Symbology"***.
    a. Look on the right-hand side of ArcGIS Pro, the *"Symbology"* pane has opened. We can change the symbols we use for annotating in this pane.
4. **Click on the hamburger menu**  in the top right of the pane and **select *"Import Symbology"***.

5. **Click on the folder icon**  next to *"Symbology Layer"*, **navigate to** your *"fmv_template"* folder, go into the *"arcpro_annotations"* subfolder, and **double click the appropriate *.lyrx* file**.
    a. Point_Annotations_Fire.lyrx is for point annotations.
    b. Polyline_Annotations_Fire.lyrx is for polyline annotations.
    c. Polygon_Annotations_Fire.lyrx is for polygon annotations.

6. **Click *"Run"*** 

in the bottom right corner of the pane.
    a. If you look on the left side of ArcGIS Pro in the *"Contents"* pane, you'll see that the symbols have changed!
7. **Repeat this process** of adding annotation types and applying custom fire symbols if you plan on using other types (point, polyline, or polygon)

D. Annotate the video.

1. If you worked through section C, you may need to reopen the annotation tool. Click on the video, under the *"Player"* tab at the top of ArcGIS Pro, find the *"Display Annotations"* icon and click on the drop-down menu.


2. On the right side of ArcGIS Pro, the *"Create Features"* pane should have opened. **Click on the icon/annotation you want to add**.
    a. You can change annotations at any time in the *"Create Features"* pane.
3. **You can now click in the video or map view to add annotations**.
    a. You can do this while the video plays or is paused.
    b. How you add annotations depends on what type you're adding.
        i. Points – click once and your annotation will be created.
        ii. Polylines – click multiple times to sketch a line. Double click to finish the line.
        iii. Polygons – click multiple times to sketch a polygon. Double click to finish the shape.
4. You will see the annotations get added in the map view.
    a. To undo an annotation, click on your map and use *ctrl+z* or the undo button  at the top of the ArcGIS Pro interface.
        i. NOTE: Your map view must be active to do this. If you click on your map view, it will highlight blue to indicate it is active.
    b. If you want to see the annotations on the video itself, click this icon  on the top of the video player.

5. **Save your edits**.
    a. ArcGIS Pro doesn't automatically save the annotations you add. When you save the project, it should ask if you also want to save the edits you made. You can save the project with ***ctrl+s* or by clicking the save icon** at the top of ArcGIS Pro.

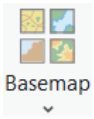

II. Change the Basemap

It may be useful to display a different basemap, such as satellite imagery, in your map view. This is simple to accomplish in ArcGIS Pro.

A. Change your basemap.

1. If the top edge of your map isn't highlighted blue, **click somewhere on the map** and it should become active.

2. **Click on the *"Map"* tab** on the top of ArcGIS Pro.
3. **Click on *"Basemap".***
    a. Different options will appear in a dropdown menu.



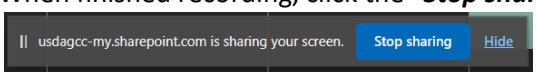
4. **Select your basemap.**
    a. Click on the basemap you want to apply to the map.
        i. Each basemap has strengths and weaknesses for information displayed and visual design.

III. Screen Record and Share via Stream (on SharePoint)

It may be useful to screen record your map/video view in ArcGIS Pro and share it with a coworker or supervisor. We can use Stream (on SharePoint) to accomplish this.

A. Record with Stream.

1. **Open** the Stream (on SharePoint) website.
2. **Sign in** on the top right, if needed.
3. Under *"Create new"*, **select *"Screen recording"***.
4. In the window that opens**, click the "X"** of the video circle in the bottom left.
5. Select ***"Start screen recording".***
6. In the pop-up, **choose the screen or window** to record and **click *"Share"***.
7. You'll see a countdown and then the recording will begin.
    a. NOTE: Your computer's microphone will be active during the recording, so feel free to talk, if desired.
8. When finished recording, click the ***"Stop sharing"*** button on the bottom of the screen.



B. Edit and share your clips.

1. When you stop recording, you will be able to preview and trim your clip(s).
2. **Click *"Finish"*** when done editing.
3. Stream will automatically upload the video to the SharePoint and give you the option to download your clip(s).

4. You can now share your clips hosted on Stream via the *"Share"* button, or you can use the application of your choice to share the downloaded clip(s).

IV. Screen Record with VLC

Sometimes you need to screen record without an internet connection. In this case, we can use VLC. We'll need to download it from the Software Center first before it can be used offline.

A. Download VLC from the Software Center

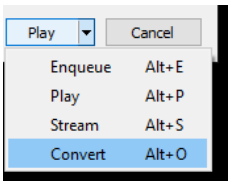
1. **Open the Software Center** and search for 'VLC'.
2. **Select 'Install'**.

B. Record your screen.

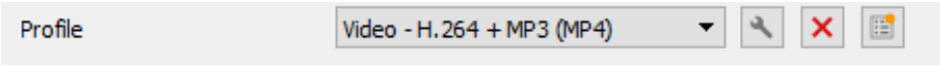
1. **Select 'Media'**, then **'Open Capture Device…'**
2. **Change the 'Capture mode'** to 'Desktop'.

3. **Change the frame rate** to 30 fps.

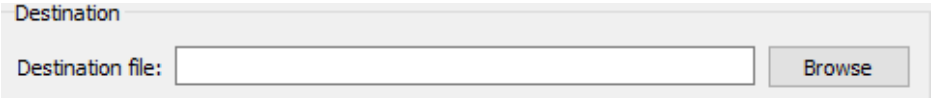
4. On the bottom of the interface, click the arrow next to 'Play' and **select 'Convert'**.



5. Make sure the 'Profile' is set to 'Video – H.265 + MP3 (MP4)



6. **Set a save destination** and filename for the screen recording.



7. **Select 'Start'** to begin the recording. When you're done, click the 'pause' button to end the screen recording.
    a. **NOTE: If you have multiple screens, all screens will be recorded.**

V. Export a Georeferenced PDF of Your Map

It may be useful to export a georeferenced PDF of your map to share with a coworker or supervisor. Georeferenced PDFs include location data in the image so it can be correctly placed in a mapping application. NOTE: This will not export the flight lines of your FMV.

A. Open the export tool.

1. If the top edge of your map isn't highlighted blue, click somewhere on the map and it should become active.

2. Under *"Share"* tab at the top of ArcGIS Pro, **click *"Export Map"***.
    a. The *"Export Map"* pane should open with different settings to edit.

B. Configure your export settings.

1. For *"File Type"* **select *"PDF"*** from the drop-down.
2. For *"Name"* **click the folder icon**, **navigate to** where you wish to save the pdf, **type in a name** for the file, and **click *"Save"***.

3. Under *"Image Size"***, check the box next to *"Show preview"***.
    a. This will show you a preview on your map of what the image will look like.
    b. Adjust the *"Width"* and *"Height"* values to adjust the size of the image.
4. Under *"PDF Settings"* **check the box next to *"Export georeference information"***.

C. Adjust your view and export.

1. Under the *"Map"* tab at the top of ArcGIS Pro, **select the *"Explore"* tool**.

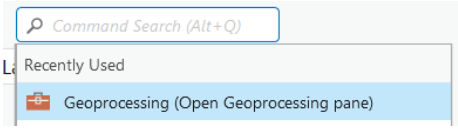
2. Position and zoom your map to the view you want for the pdf.
    a. Click + drag the map to move to the position you want.
    b. Scroll with the scroll wheel or touchpad to zoom to where you want.
3. **Click *"Export"*** at the bottom of the *"Export Map"* pane.
    a. Your georeferenced pdf will now export to the location you specified.

VI. Import a Georeferenced PDF

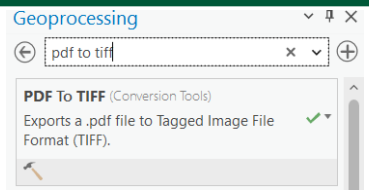
It may be useful to import a georeferenced pdf to use under a video mission. We will convert the PDF to a TIFF file to accomplish this.

A. Convert the PDF to a TIFF file.

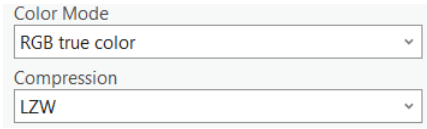
1. **Open** the ***"Geoprocessing"*** pane.
    a. If you don't already have the pane pulled up**, search *"Geoprocessing"*** in the search bar at the top of the screen.



2. **Search for *"PDF to TIFF"*** in the search bar.
    a. **Select** the *"PDF to TIFF"* tool.



3. **Enter the parameters** into the tool.
    a. **Select** the PDF you'd like to import for ***"Input PDF File".***
    b. **Enter the output location and name** you want for the TIFF file in ***"Output TIFF File".***
        i. It will default to saving the output TIFF in your project's folder.
    c. **Leave *"PDF Password"* blank.**
    d. **Leave *"PDF Page Number"* to 1** if you only have one page.
        i. If you have multiple pages in your PDF, make sure to **select the correct page number.**
    e. ***"PDF Map"*** is used if there are multiple Maps on a single PDF.
        i. **Leave as default** if there is only one map on your PDF.
        ii. If you have multiple maps on the PDF file, make sure to the **select the correct map.**
    f. ***"Clip Output to Map"*** is used if there's anything outside the map extent on the PDF file.
        i. **Leave unchecked** if there is nothing besides a map on your PDF (i.e., no key, title, etc.)
        ii. **Check the box** if you have anything outside of the map extent on the PDF.
    g. Leave ***"Color Mode"*** and ***"Compression"*** as is.

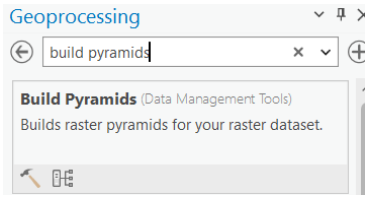


    h. **Check the box** next to ***"Write GeoTIFF Tags".***
        i. This is essential to make sure the TIFF file is georeferenced.

    i. **Hit Run**.
        i. The new TIFF file should automatically add to your project once the tool has finished running. If not, you'll need to add it yourself.

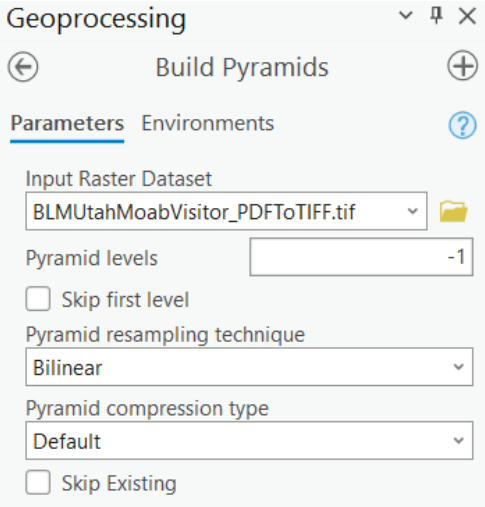
B. Build pyramids to improve display.

1. Your TIFF may appear grainy in ArcGIS Pro when zoomed out. These next steps will improve the image display at all levels of zoom.
2. **Open** the *"Geoprocessing"* pane.
    a. **Search** for the ***"Build Pyramids"*** tool.



    b. **Select** the TIFF file for ***"Input Raster Dataset".***

c. **Select *"Bilinear"*** for ***"Pyramid resampling technique".***
d. **Leave** the rest of the tool as **default.**



e. **Hit Run.**
    i. The TIFF display should now be significantly improved.

VII. Checkout an ArcGIS Pro License for Offline Use

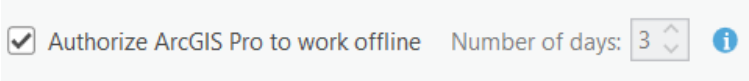
To use ArcGIS Pro, we must connect to the VPN to access a license. However, if we need to use it without an internet connection, we can 'checkout' a license for offline use. Please make sure to only checkout a license for as long as you need it.

A. Navigate to the ArcGIS Pro 'Licensing' page.

1. **Open ArcGIS Pro, select 'Settings'** from the home page, and **'Licensing'** from the left side of the interface.
    a. If ArcGIS Pro is already open and you're in a project, select **'Project'** at the top of the interface, then **'Licensing'** on the left side of the interface.

B. Checkout a license for offline use.

1. Enter the number of days you'd like to checkout a license.
    a. **Please only checkout a license for the amount of time you need it.**
2. **Check the box** to checkout the license.



VIII. Additional Resources

To explore additional functionality of FMV in ArcGIS Pro, check out these resources.

FMV in ArcGIS Pro – Overview Video (a walkthrough video that works through this document)
ArcGIS Pro – Full Motion Video player official documentation
ArcGIS Pro – Video Multiplexer geoprocessing tool
ArcGIS Pro – Symbolize feature layers
ArcGIS Pro – Share a layer package