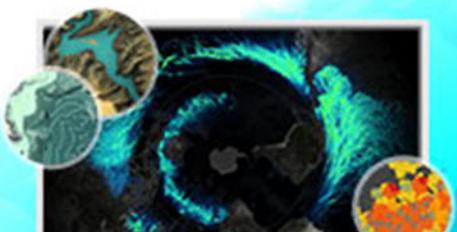


Exercise

Animated Maps

Section 6 Exercise 2

05/2018



Animated Maps

Instructions

Use this guide and ArcGIS Pro to reproduce the results of the exercise on your own.

Note: The version of ArcGIS Pro that you are using for this course may produce slightly different results from the screenshots you see in the course materials.

Time to complete

Approximately 85-95 minutes.

Software requirements

ArcGIS Pro 2.1

Introduction

Sharing GIS knowledge does not always require a printed or interactive online map; it can also be done with a video. This method is useful for communicating a specific storyline or analytical discovery, where it's simpler for users to see a scripted presentation of the data instead of exploring it for themselves. A video can also present large and cumbersome data in a streamlined way and, with the advent of social media, allows you to engage with a larger audience.

In ArcGIS Pro, videos are the output of an animation, and they are most often created as a final step after your 2D or 3D map is fully prepared.

An animation is authored by creating an ordered set of keyframes, where each keyframe contains the current view position, the visibility and transparency of the layers in the map, and the map's current time and/or range extent. When the animation is exported to a video file, intermediate frames are interpolated between the states captured in your keyframes.

What will you learn?

In this exercise, you will learn how to perform the following tasks:

- Author a simple fly-through animation in 3D.
- Change the visibility of content to help tell a story.
- Add on-screen text to provide additional information.
- Create an animation through time in 2D.
- Use dynamic overlay text to embed the map's date and time into the video.
- Create a stop-motion-style video using progressive display of features to simulate movement.

Note: When working with animation in ArcGIS Pro, you will encounter some new terms and may find this [list of essential terminology for animation](https://bit.ly/2IldTgV) (<https://bit.ly/2IldTgV>) help topic useful.

You will be using [three scenarios](#) in this exercise to showcase what you can do with animations in ArcGIS Pro. Let's get started!

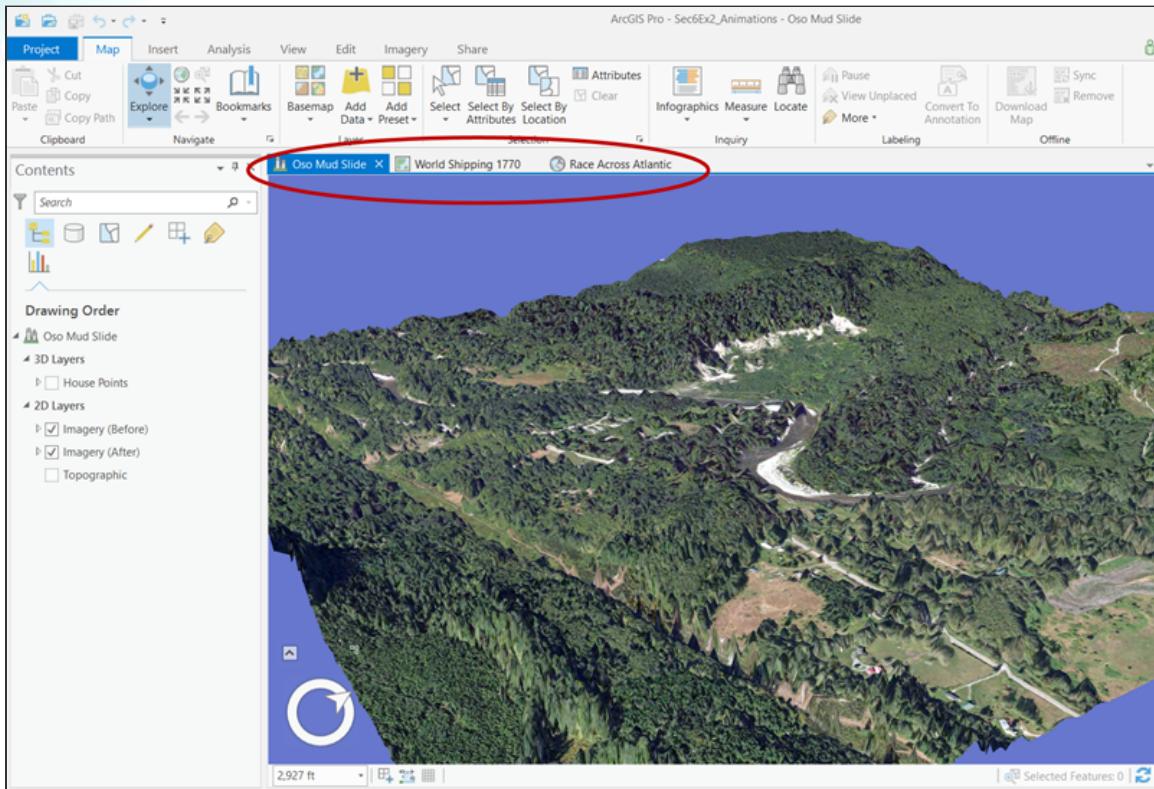
Step 1: Download the exercise files

In this step, you will download the exercise files.

- a Open a new web browser tab or window.
- b Go to <https://bit.ly/2IKRbET>, and download the exercise ZIP file.
- c Extract the files to a folder on your local computer, saving them in a location that you will remember.

Step 2: Open an ArcGIS Pro project package

- a If necessary, start ArcGIS Pro and sign in using the credentials provided at the start of this course (username includes _cart).
- b Click Open Another Project, and browse to the [Sec6Ex2_Animations.ppkx](#) ArcGIS Pro project.



The three scenes you will be working with in this exercise are now available at the top of the ArcGIS Pro map view.

To maintain the original project file, you will save your project with a different name.

- c From the Project tab, click Save As and type a name for your project, such as **Animations_<yourfirstandlastname>.aprx**.

Note: Be sure to add your name or another unique identifier to the project name so you don't overwrite the original project.

Scenario 1: Oso mudslide

Reusing a scene from the earlier Section 5 Exercise 1 - *Mapping Terrain in 3D*, you will view the before and after topography of the Steelhead Haven community, near Oso in Washington, with the tragic mudslide of March 22, 2014. The volume of debris and range of its destruction were truly frightening. A video highlighting the change in topography can effectively communicate the degree of damage that occurred.

You will create a looping 3D fly-through of the scene, fading between the before and after states of the topography, and generate an animated GIF that you can embed in a web page

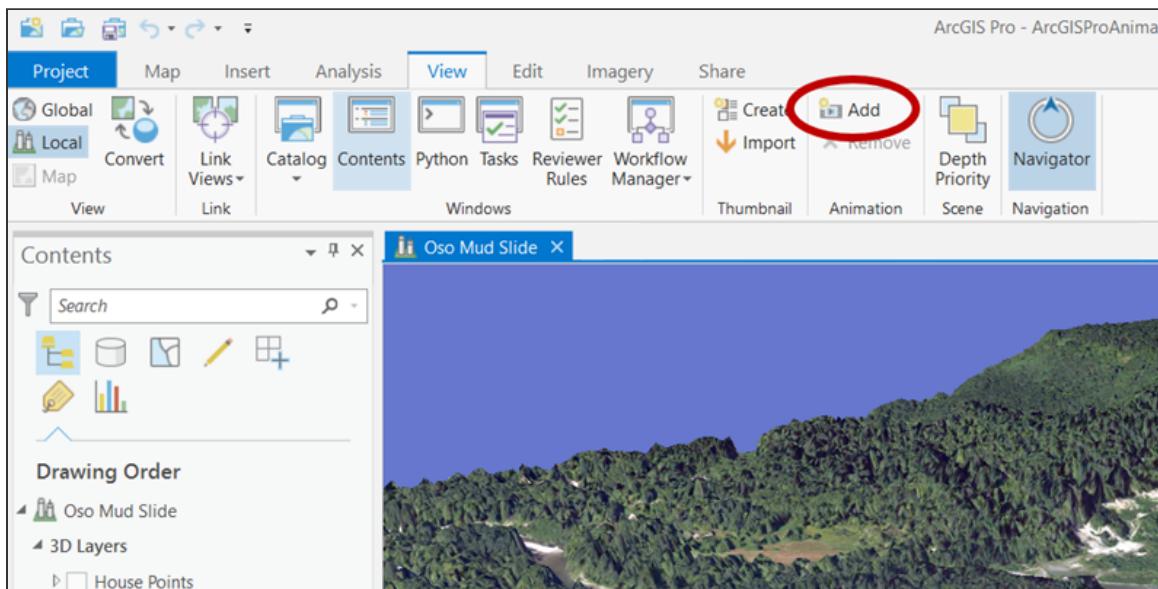
or on social media. A fly-through shows what you would see if you flew around the scene in a helicopter.

Note: If you'd like to see the finished video for this scenario, you can find the Sec6Ex2_Animations_Complete_OsoMudSlide.gif (62 MB) file in the Sec6Ex2_VideoResults folder on your computer in the location where you extracted the exercise files.

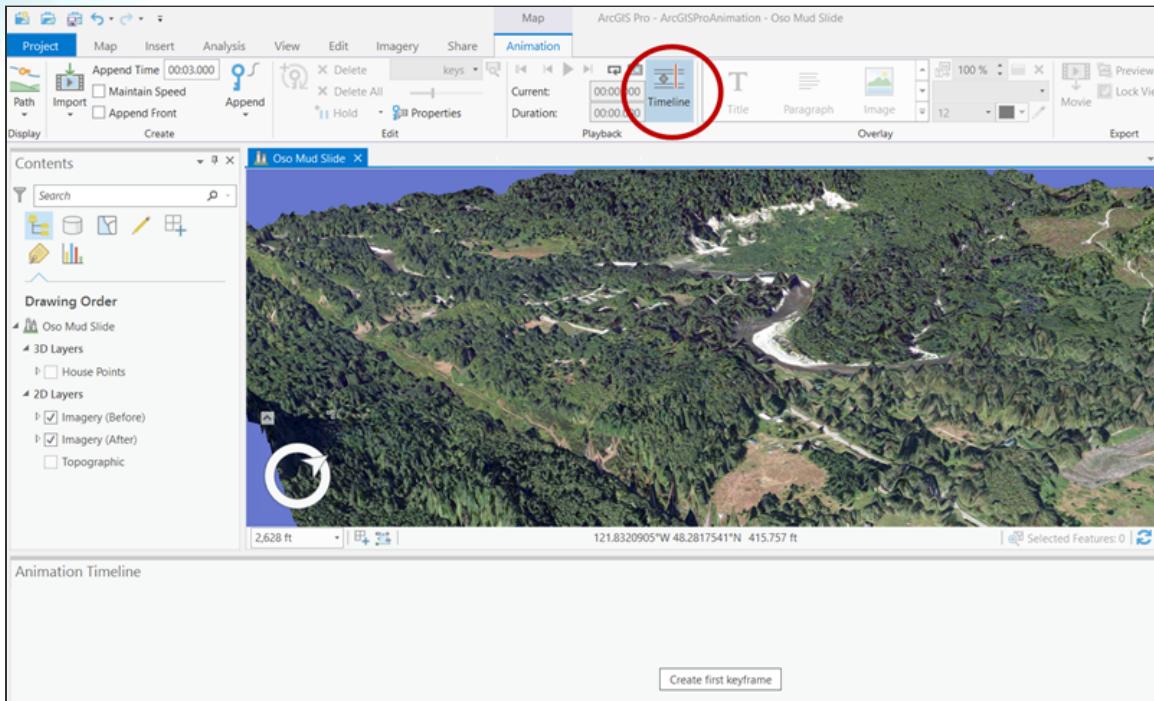
Step 3: Add an animation to the Oso Mud Slide scene

Maps can contain animations. The first step in making any animation is to add one to your map or scene.

- a With the Oso Mud Slide scene active, click the View tab and, in the Animation group, click Add.

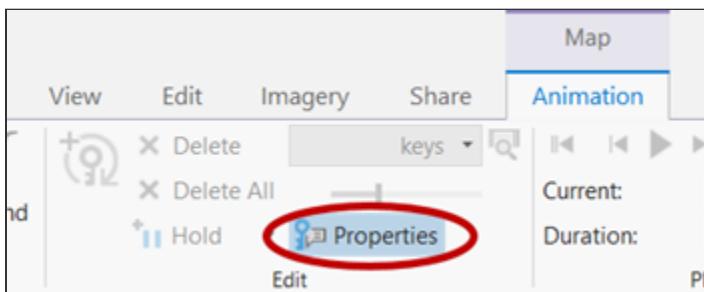


This adds an animation to the scene, which in turn reveals the Animation contextual tab and opens the Animation Timeline pane at the bottom of the window.



Note: If the Animation Timeline pane is not shown automatically, from the Animation tab, in the Playback group, click Timeline.

- b From the Animation tab, in the Edit group, click Properties.

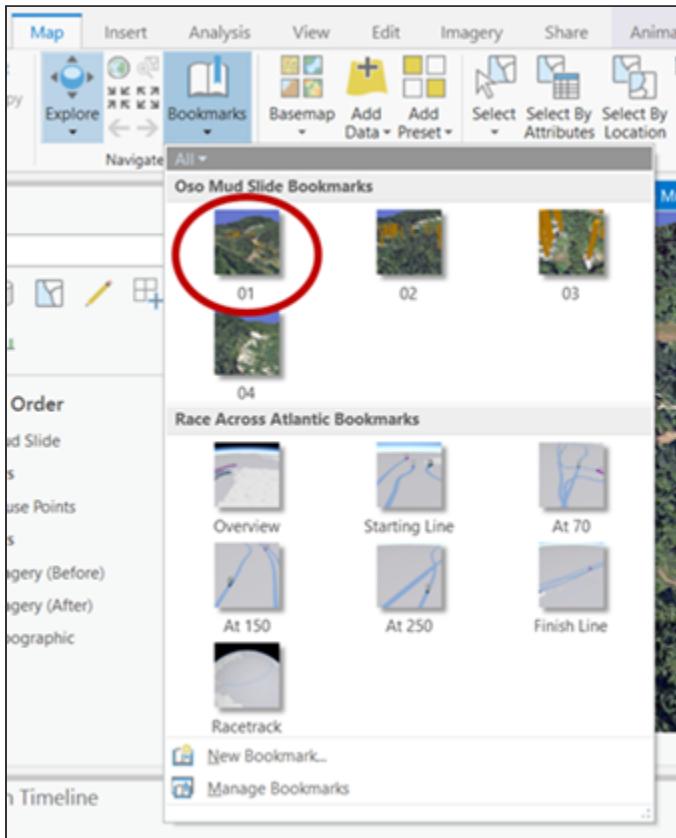


This opens the Animation Properties pane. The pane is initially empty, as you haven't yet created any keyframes. You will use this advanced configuration pane in later steps.

Step 4: Create the first keyframe

First, you need to define the starting point of the animation. When a keyframe is created, it captures the camera's location and the visibility states of all layers. Therefore, you should review the appearance of the scene before you create the keyframes.

- a From the Map tab, click the Bookmarks down arrow.
- b In the Oso Mud Slide Bookmarks section, choose the 01 bookmark.

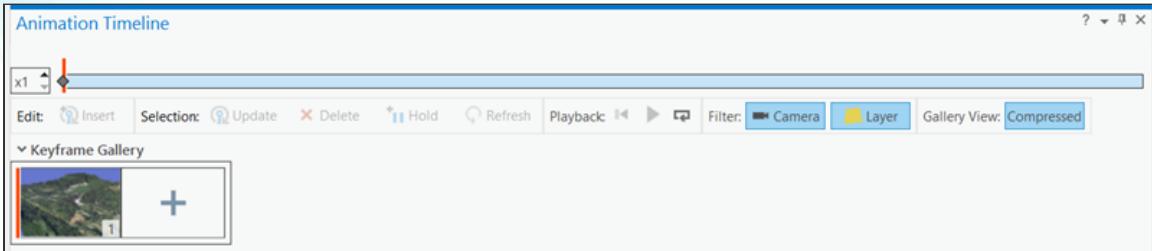


The initial layer properties have already been set. Note the following aspects:

- The HousePoints layer is switched off.
- The Imagery (Before) layer is switched on, with 0% transparency.
- The Imagery (After) layer is switched on, but set to 100% transparency.

Note: Later, you will see how transitioning layer transparency allows content to fade in and out.

- c In the Animation Timeline pane, click Create First Keyframe.



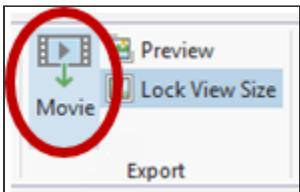
The Animation Timeline pane shows the keyframe that you just created. This will be the first image in your video.

Step 5: Set the video export properties

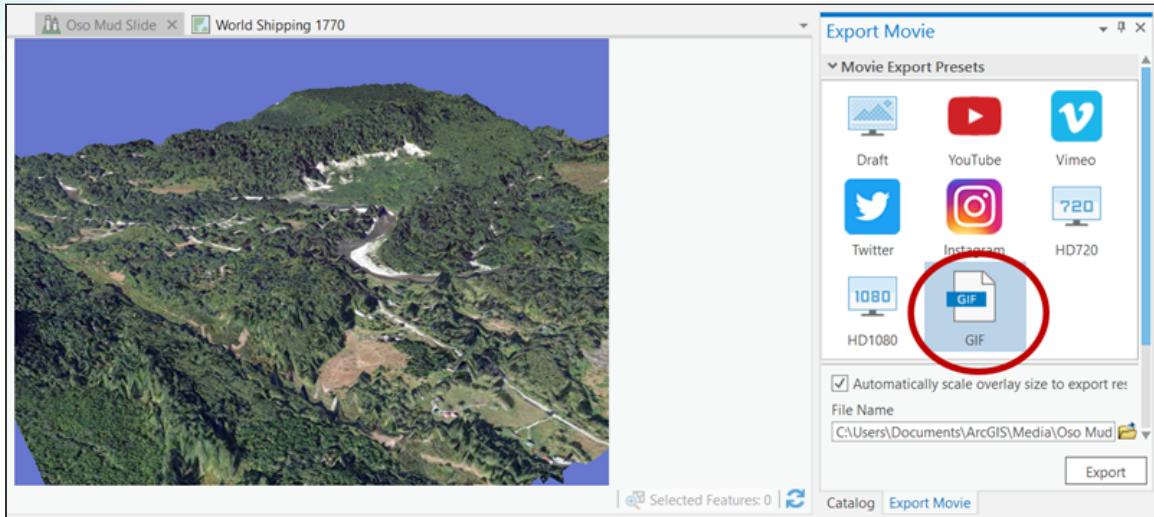
You might have noticed that part of the view is now being culled. This is done to indicate which section of the view will be captured in the video. By default, the video's aspect ratio and quality settings are configured for YouTube—that is, an MP4 video file with a resolution of 1,280 pixels wide by 720 pixels high.

In your case, however, you want to create an animated GIF for a web page.

- a From the Animation tab, in the Export group, click Movie to open the Export Movie pane.



- b In the Movie Export Presets section, click GIF.



This will both update the export file type and define a different export resolution: 640 pixels wide by 480 pixels high. This is a different aspect ratio than the YouTube preset, so you should see the framing of the view change again.

Note: In the Export Movie pane, you can expand the File Export Settings and Advanced Movie Export Settings sections for fine-grained control of the video export settings. Be aware that your export format might not support all possible aspect ratios.

Step 6: Create additional keyframes

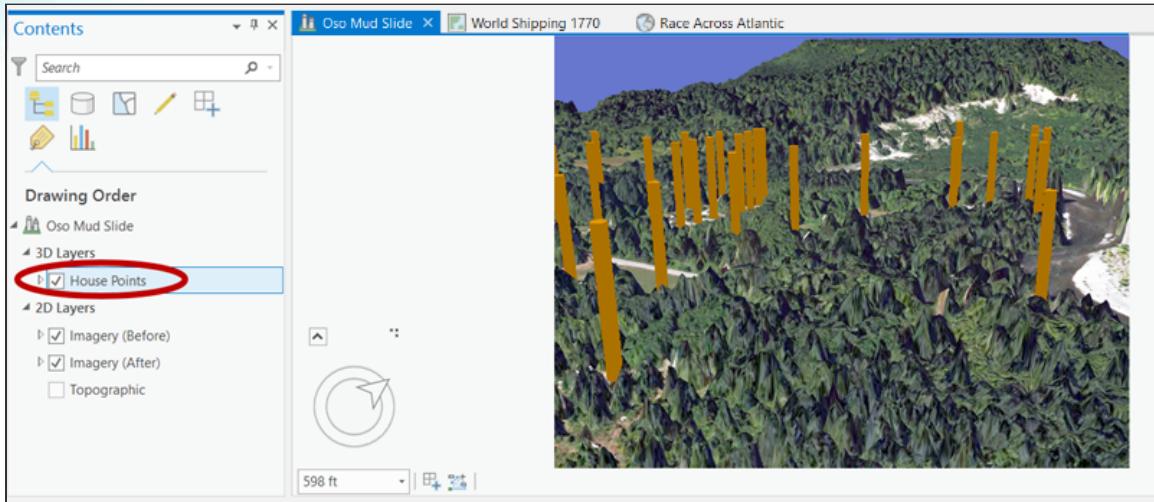
You add keyframes to make an animation, so you'll use the first half of the video to highlight the "before" state.

To assist with the authoring of this animation, the scene contains a series of pre-authored bookmarks that will position the camera for you.

Note: You can always re-run this exercise later to experiment with different flight paths.

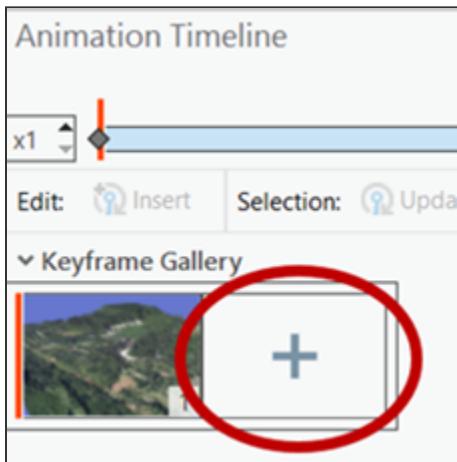
It's important that you use similar viewpoints for the "before" and "after" states so that the dramatic change can be seen from the same locations. Also, because you are creating an animated GIF, you need the video to be well-suited for looping. This means that the animation must finish in a way that transitions seamlessly into the start of the next iteration.

- a From the Map tab, click the Bookmarks down arrow.
- b In the Oso Mud Slide Bookmarks section, choose the 02 bookmark.
- c In the Contents pane, turn on the House Points layer.

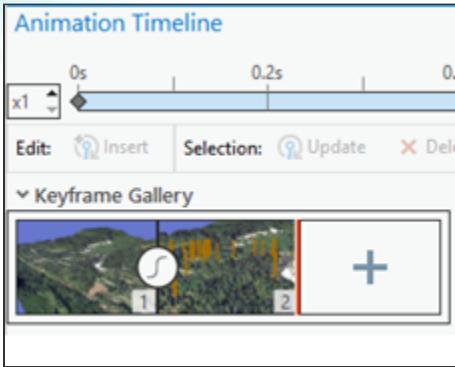


These real-world-sized orange columns show the locations of houses in the area and will become more visually important when the "after" state is shown.

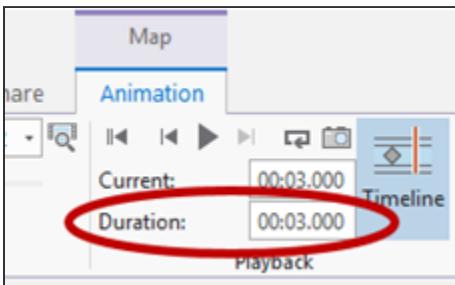
- d In the Animation Timeline pane, click the Append Next Keyframe (plus) button to add the current state of the scene as a second keyframe.



You now have a video with two keyframes with the default duration of 3 seconds. In the Animation Timeline pane, you can see the two keyframes.

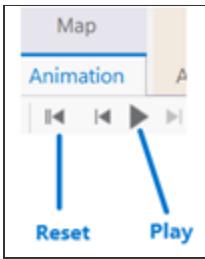


- e From the Map tab (Animation contextual tab), in the Playback group, you can see the animation duration.



- f From the Animation tab, in the Playback group, perform the following tasks:

- Click the Reset button to return to the start of the animation.
- Click the Play button to preview your fly-through (notice how the house points appear).



- g From the Map tab, click the Bookmarks down arrow and choose the Oso Mud Slide 03 bookmark.
- h In the Animation Timeline pane, click the Append Next Keyframe button to add a third keyframe.
- i Perform the previous two steps for the 04 bookmark location.

Next, you will smoothly transition the visible layers from the "before" state to the "after" state.

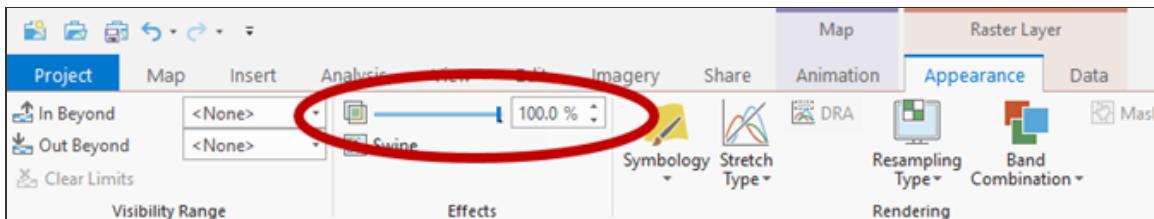
Step 7: Use transparency to fade between two layers

You will use layer transparency to fade between the two layers, rather than just switching layers on and off, so the switch between the two states is less jarring.

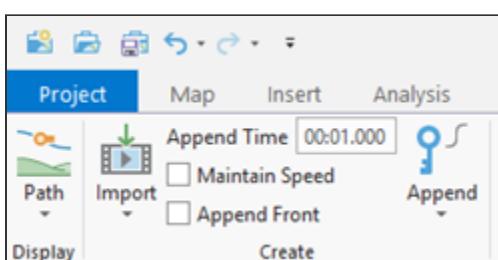
Changing the transparency, or opacity, of a layer in a map allows you to see more, or less, of the underlying layers. The transparency of any layer can be adjusted from 0 percent to 100 percent. The more transparent a layer is, the less visible it appears on the map and the more visible the other layers appear.

To fade between the two layers for this animation, you will use decreasing transparency values (from 100% to 0%) in successive keyframes to fade a layer in, and increasing transparency values (from 0% to 100%) to fade a layer out.

- a In the Contents pane, select the Imagery (Before) layer.
- b From the Appearance tab, in the Effects group, drag the transparency slider up to 100%.

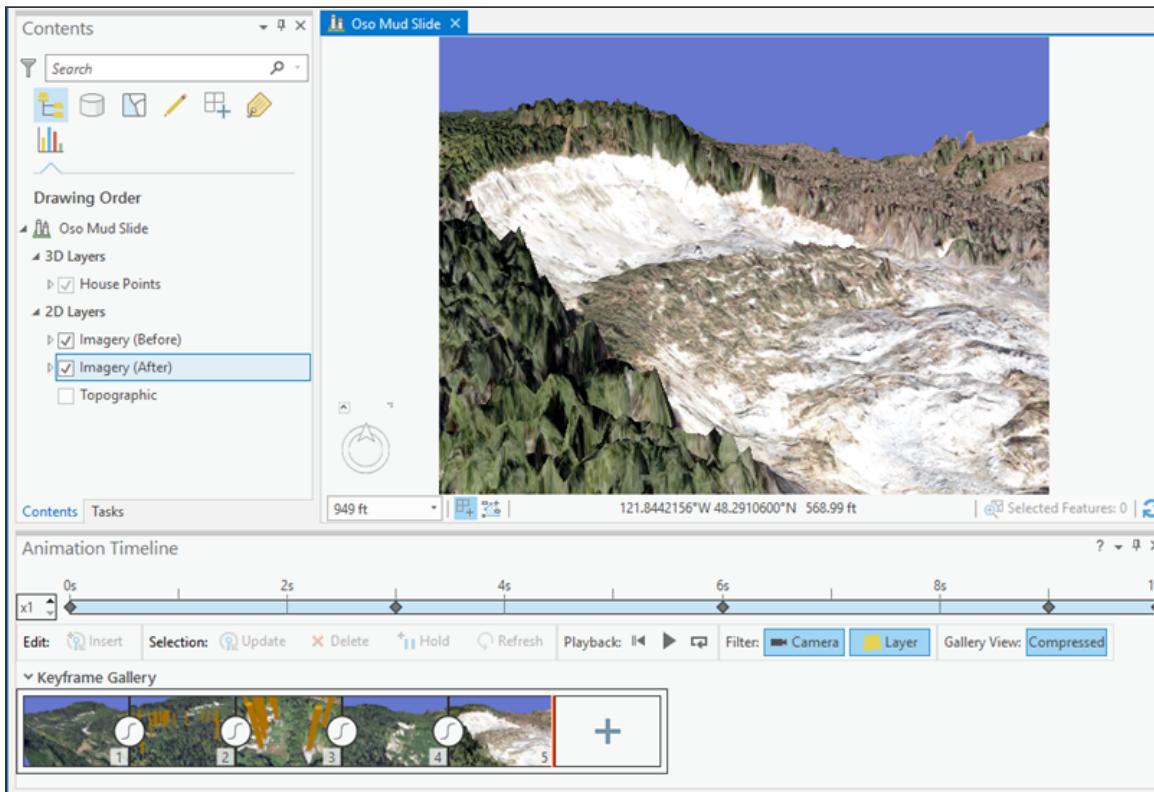


- c In the Contents pane, select the Imagery (After) layer and change the transparency to 0%.
- d From the Animation tab, in the Create group, reduce the default Append Time value down to 1 second.



You want a relatively fast transition between the two states, and 1 second is enough.

- e In the Animation Timeline pane, click the Append Next Keyframe button to add a fifth keyframe.



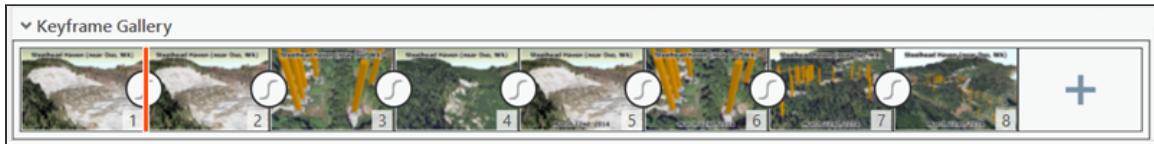
Next, you'll use the second half of the video to highlight the "after" state of the topography. And, for consistency with the camera path that was used in the first half of the video, you will revisit the same bookmark locations on the way back.

Step 8: Add more keyframes

First, you'll add a few more keyframes for the "after" state.

- a From the Animation tab, reset the default Append Time back to 3 seconds.
- b From the Map tab, click the Bookmarks down arrow and choose the 03 Oso Mud Slide bookmark.
- c In the Animation Timeline pane, click the Append Next Keyframe button to add a sixth keyframe.

- d Perform the previous two steps for the 02 and 01 bookmark locations to add them to the timeline.

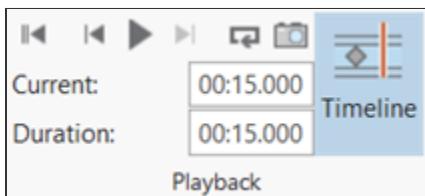


Finally, you will set up the transition back to the starting point so that the animated GIF will loop nicely. As with the earlier transition between the "before" and "after" states, you'll use a faster transition time.

- e From the Animation tab, reduce the default Append Time value down to 1 second.
- f In the Contents pane, select the Imagery (After) layer.
- g From the Appearance tab, drag the transparency slider up to 100%.
- h In the Contents pane, select the Imagery (Before) layer and adjust the transparency to 0%.
- i In the Contents pane, turn off the House Points layer.
- j In the Animation Timeline pane, click the Append Next Keyframe button to add a ninth (and final) keyframe.

You should have an animation with a total of nine keyframes and a duration of 20 seconds. That's still a little slow for the kind of looping video that you want, so you will make the whole video shorter.

- k From the Animation tab, in the Playback group, change the Duration from 20 seconds to **15** seconds.



- l Click the Reset button to return to the start of the animation.
- m Click the Play button to preview the animation.

Don't worry if the interactive playback looks a bit jerky; you are only previewing the animation. ArcGIS Pro will fully render each frame when it exports the animation, resulting in a smooth, continuous display when the final video is played.

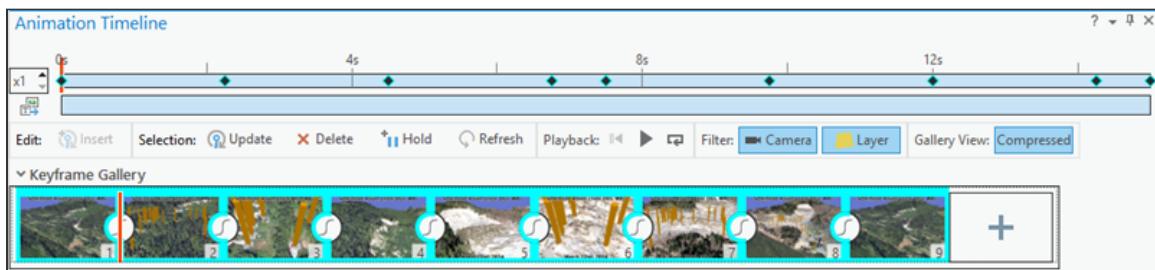
Note: In the Playback group, you can turn on the Camera Only Playback option to see the animation play with only the camera flight-path calculated. Slower playback performance is more common when layer transparency, map time, or map range is changing between exported frames.

Step 9: Add overlays

Your video now has a well-authored flight path and layer transitions, but there is nothing that explains where you are or *when* the event happened. You can add this kind of information using what are referred to as text or image overlays. When adding an overlay, you also define how long it should be shown in the video.

First, you will add a title that displays for the entire duration of the video.

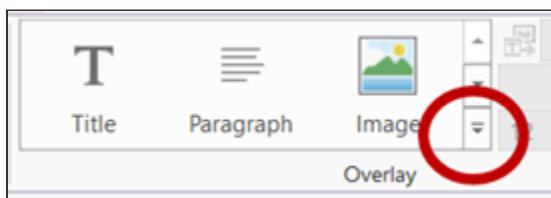
- a In the Animation Timeline pane, select all the keyframes.



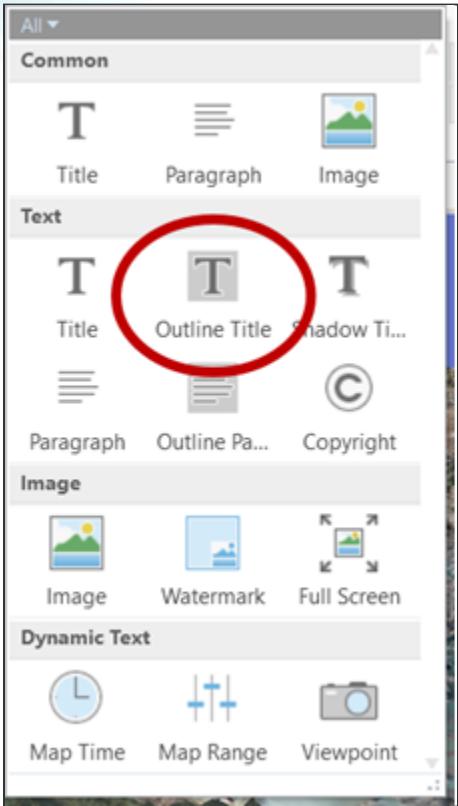
Hint: On your keyboard, press Ctrl while clicking each keyframe.

Overlays are connected to keyframe numbers (rather than time). When an overlay is added, it will display for the extent of the selected keyframes.

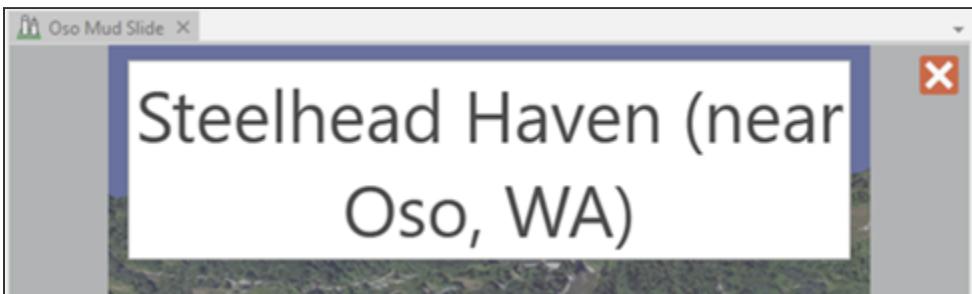
- b From the Animation tab, in the Overlay group, expand the gallery of overlay presets.



- c In the Text section, choose the Outline Title preset.

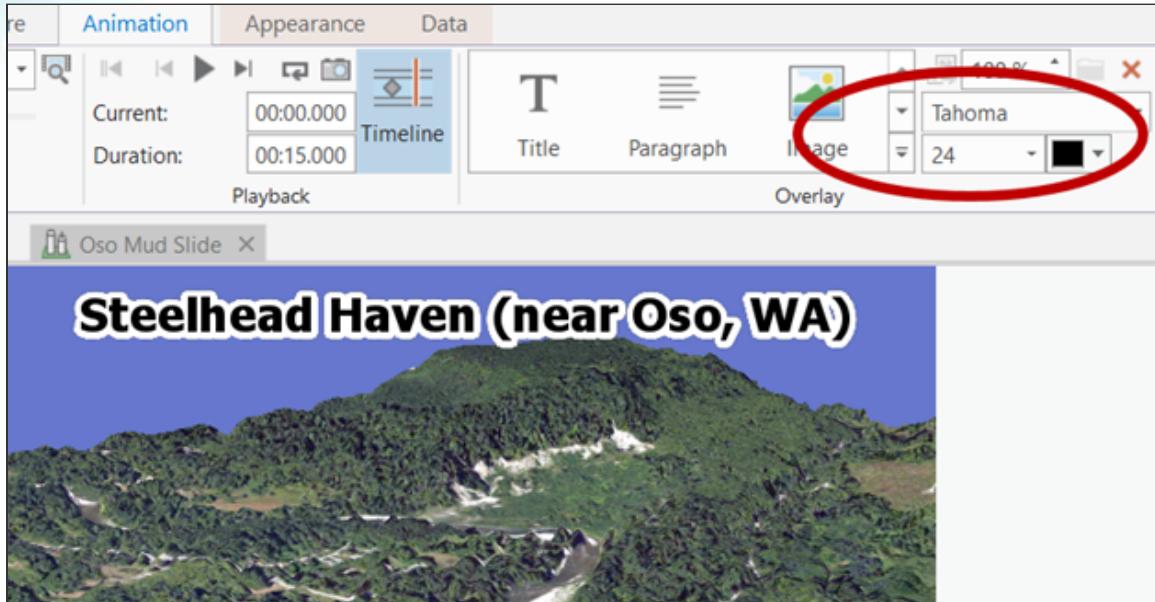


- d In the text box that appears in the map window, type **Steelhead Haven (near Oso, WA)**, and then click the red X in the upper-right corner to exit the text edit mode.



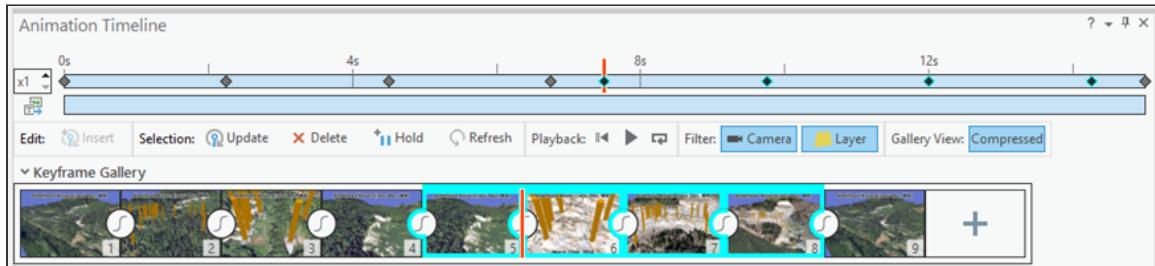
The overlay is created, but the default title text size is too wide for your video export size. You will make it smaller.

- e From the Animation tab, in the Overlay group, use the text editor controls to update the font settings so that the text displays as a single line (for example, as Tahoma font at 24 points).



Next, you want to show the date of the mudslide, but you want the text to appear when the content in the view switches from the "before" state to the "after" state.

- f In the Animation Timeline pane, select keyframes 5 through 8.



Hint: Click in the blank area of the Animation Timeline pane to deselect all the keyframes first. Then, use Ctrl-click to select keyframes 5 through 8.

This is the section of the video where the "after" state is being shown.

- g From the Animation tab, expand the gallery of overlay presets again.
- h Choose the Outline Title preset.
- i In the text box, type **March 22nd, 2014**, and then click the red X in the upper-right corner to exit the text edit mode.
- j From the Animation tab, in the Overlay group, use the text editor controls to update the font settings so that they match the title text (for example, as Tahoma font at 24 points).

The date overlay text is now in the view, but it is displayed in the top-center of the view and clashing with your earlier title overlay text. It needs to be placed elsewhere on the view.

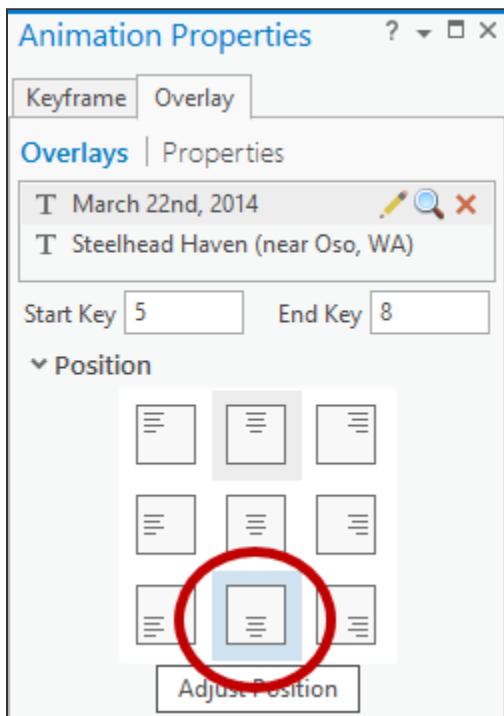
- (k) At the top of the Animation Properties pane, click the Overlay tab.

All overlays in the animation, whether text or image, will be listed here.

- (l) Select the March 22nd, 2014 overlay item.

Note: The Start Key is set to 5 and the End Key is set to 8.

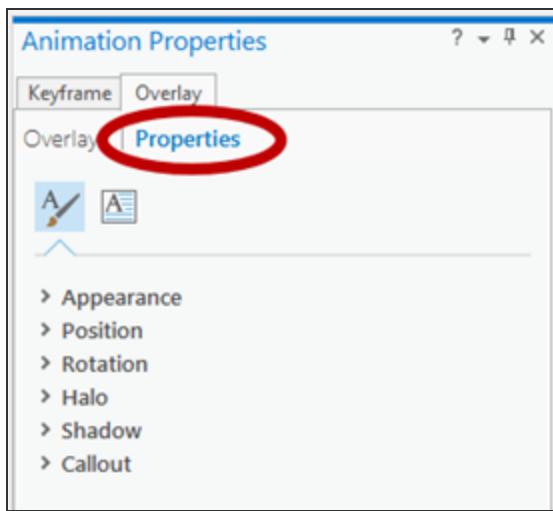
- (m) In the Position section of the pane, click the bottom-center alignment button.



The date is moved to the bottom of the view. While your background imagery may be different from the graphic below, your overlay text should now look like the following:



Note: In the Animation Properties pane, on the Overlay tab, you can click Properties to get full access to how the overlay text is symbolized, including halos, shadows, and callouts.



Step 10: Export the animation to a video

Your animation is now ready to be exported to a file to share with others.

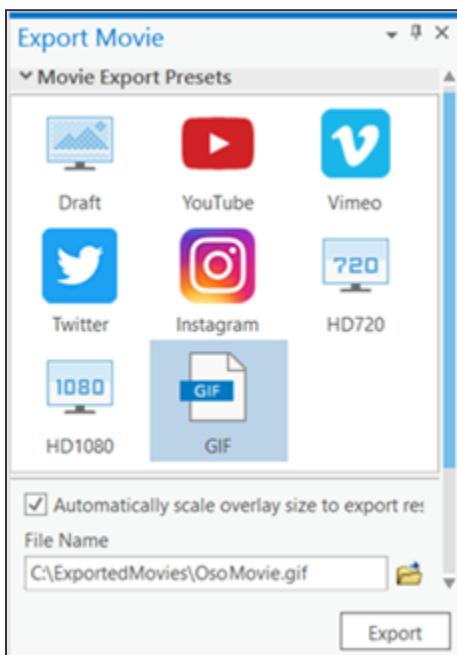
- a Close the Animation Properties pane.

It's a good idea to save your animation before exporting.

- b From the Project tab, click Save.

Note: When you export your animation, there is a default location for the output file. Typically, this is C:\Users\Documents\ArcGIS\Media. You may want to create a folder elsewhere on your computer for your exported movies that's easier to find. For this exercise and example, a folder named ExportedMovies was created.

- c In the Export Movie pane, specify an output file name, such as **OsoMovie.gif**.



- d Click Export.

The time required to export the animated GIF will vary depending on your computer, though usually it takes between 4 and 6 minutes. The progress and estimated time remaining are displayed at the bottom of the Export Movie pane, and you can discontinue the export at any time by clicking Stop.

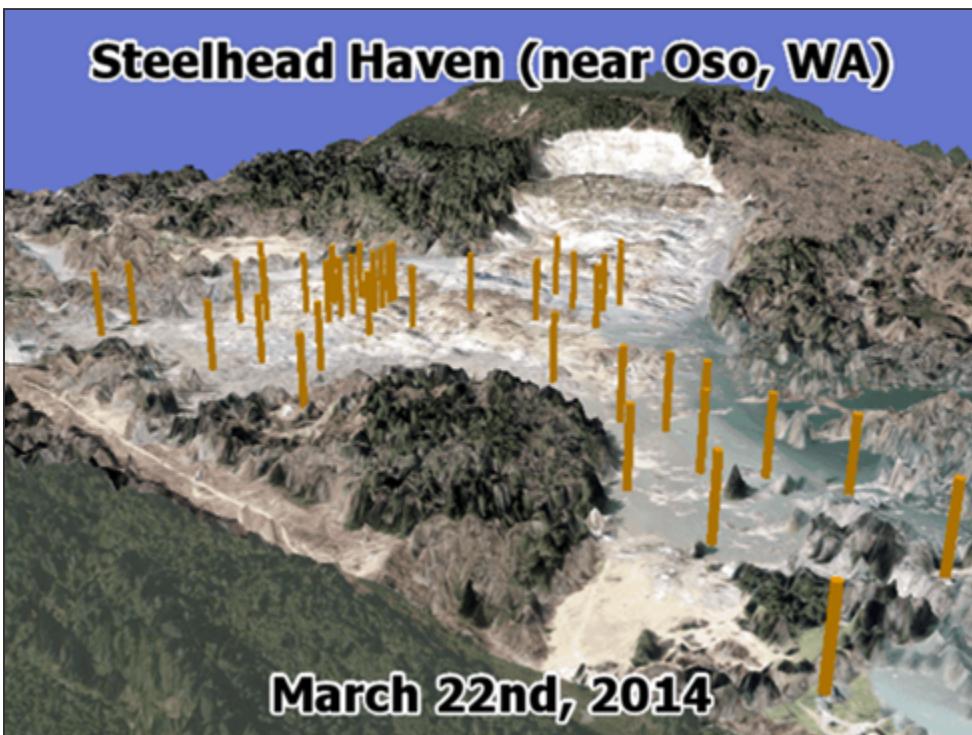
Note: The application remains active while the animation is exporting, so other work can be done. You could, for example, open the map for the next scenario and familiarize yourself with the content while you wait for the export to finish.

- e A message will display at the bottom of the Export Movie pane, indicating that the file has been created.



- f When the export is done, click Play The Video at the bottom of the Export Movie pane. You can also browse to the output file location and double-click the GIF file to view it.

The video will play in your default GIF viewing application, and it loops nicely back to the start after 15 seconds.



- g Save your project, and close the Oso Mud Slide scene.

In this introductory example, you created a simple fly-through animation in 3D. Can you see the value of a 3D animation for telling a story, showing change in time and space, bringing a static map to life, and helping your audience visualize and experience the scene as if they were there?

Note: If you'd like to compare your final map to mine, you can open the Sec6Ex2_Animations_Complete_OsoMudSlide.mpkx file in the Sec6Ex2_VideoResults folder on your computer where you extracted the exercise files. There is also a final Sec6Ex2_Animations_Complete_OsoMudSlide.gif video file in that same location for comparison purposes.

In the next scenario, you will create an animation through time in 2D.

Scenario 2: Ship traffic in 1770

In the 18th and 19th centuries, thousands of ships from seafaring nations explored the globe for commerce, war, and colonization. As they traveled, captains would capture their ship's position and other data in their logbooks. Hundreds of years later, an organization called CLIWOC (Climatological Database for the World's Oceans) would convert surviving information from British, Dutch, French, and Spanish ships' logbooks into a GIS database.

Note: Learn more about the data sources at <http://pendientedemigracion.ucm.es/info/cliwoc> (<https://bit.ly/2qJ80zC>).

For this exercise, you will be visualizing one specific year of content—1770—as an animated video that highlights the frequency and routes used by the ships of the day.

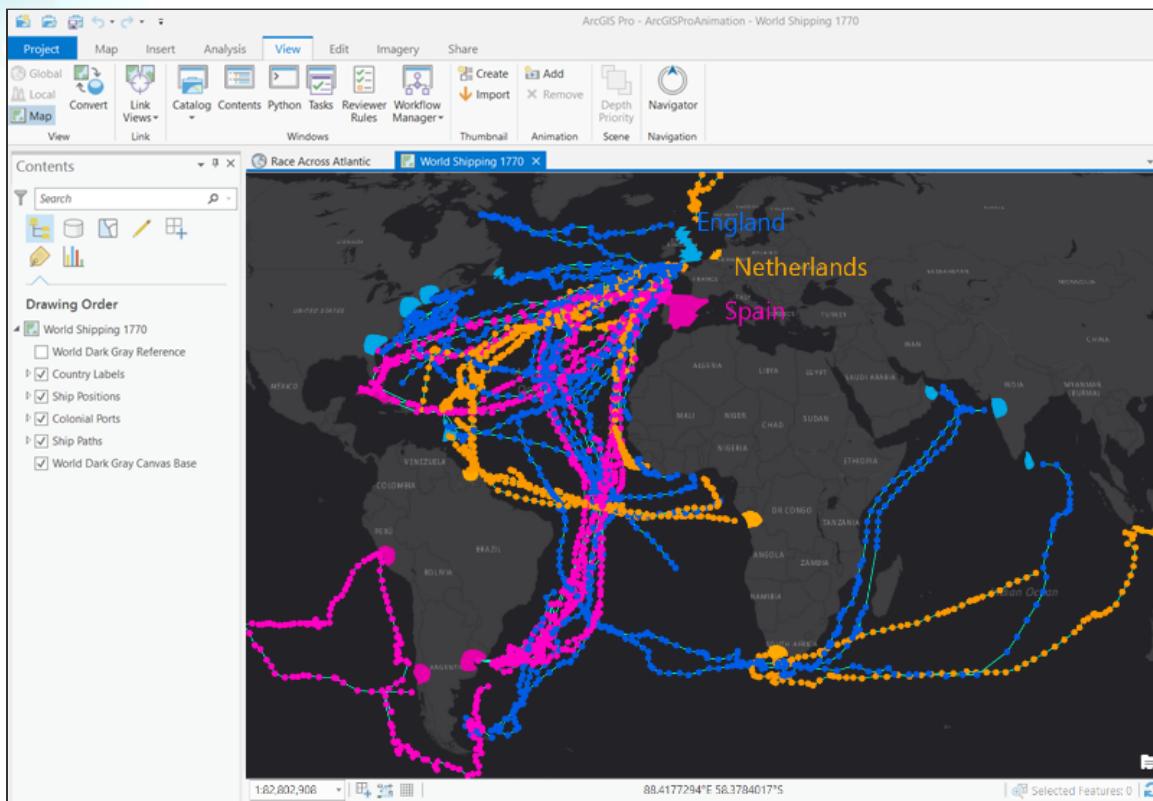
You will start with a simple 2D map showing ships and important colonial ports, use the date information for each ship to animate the content through time, and then share it as a video suitable for YouTube, Instagram, or Twitter.

Note: If you'd like a sneak peek of the finished video for this scenario, you can find the Sec6Ex2_Animations_Complete_WorldShipping1770.mp4 (416 KB) video in the Sec6Ex2_VideoResults folder on your computer where you extracted the exercise files.

Step 11: Open a map

- a At the top of the ArcGIS Pro window, click the World Shipping 1770 tab to open the map.
- b If it's still open, close the Animation Timeline pane.

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The World Shipping 1770 map has the following layers pre-authored for you:

- Country Labels: point features with labels for the three seafaring countries that you are focusing on: England, the Netherlands, and Spain. Three label classes have been applied so each country's name can be shown in a distinct color. This not only indicates where "home" is for each ship in the ocean, but it also provides an in-map color palette for other layers to use without the need for a viewer to reference a separate legend.
- Ship Positions: point symbols showing the (usually) daily ship locations calculated from captains' logs. The colors of the dots match the Country Labels.
- Colonial Ports: polygonal areas that show the home countries and the important colonial ports of the time (indicated as an area of influence of a few hundred miles). The colors of the polygons match those of the Country Labels.
- Ship Paths: simple, straight-line-connected paths for each ship's journey across the ocean. The spacing between vertices indicates the travel speed of the ship. The wider the gap, the faster the speed.

A couple of other design decisions for this map include the following choices:

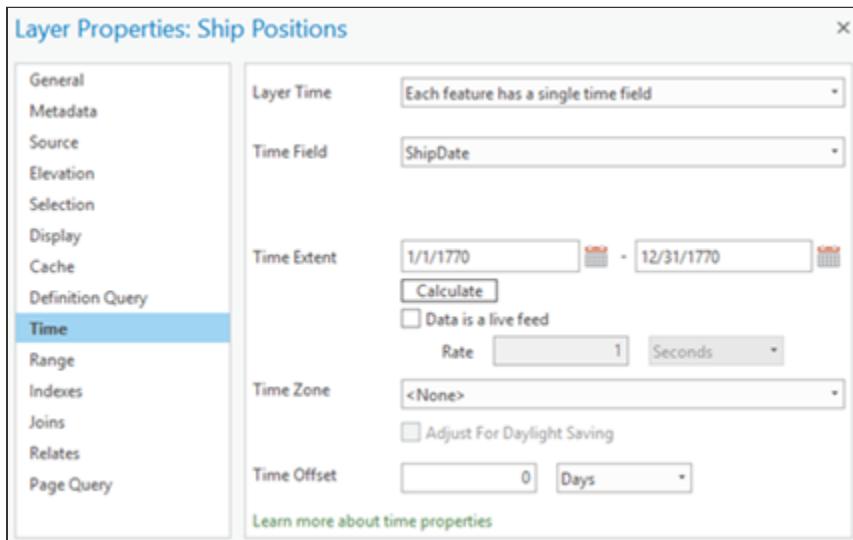
- The map is in the Robinson projection, a coordinate system specifically designed to show the whole world as a flat image, though it is neither equal area nor conformal. Most of the distortion is near the poles, which is not a concern for 18th-century shipping.
- It uses a muted basemap with no displayed text, allowing the colors of the shipping content to take center stage.

What's missing is the temporal component. [Temporal data \(https://bit.ly/2s4x7qj\)](https://bit.ly/2s4x7qj) is data that represents a state in time.

Step 12: Add time properties to a layer

Each shipping point has a property value that declares which date the position was logged. It does not include the time of capture, though, so you must assume that it was captured around the same time of day. You can use this date value to add time properties to the shipping points layer.

- a In the Contents pane, right-click the Ship Positions layer and choose Properties.
- b In the Layer Properties dialog box, click the Time tab.
- c For Layer Time, choose Each Feature Has A Single Time Field from the drop-down list.
- d For Time Field, choose ShipDate from the drop-down list.



The ShipDate field in the layer attribute table contains the date that the ship's position was captured in the captain's log. All the ships sailed in 1770; note how the Time Extent field in the Layer Properties dialog box is now populated with values from 1/1/1770 to 12/31/1770.

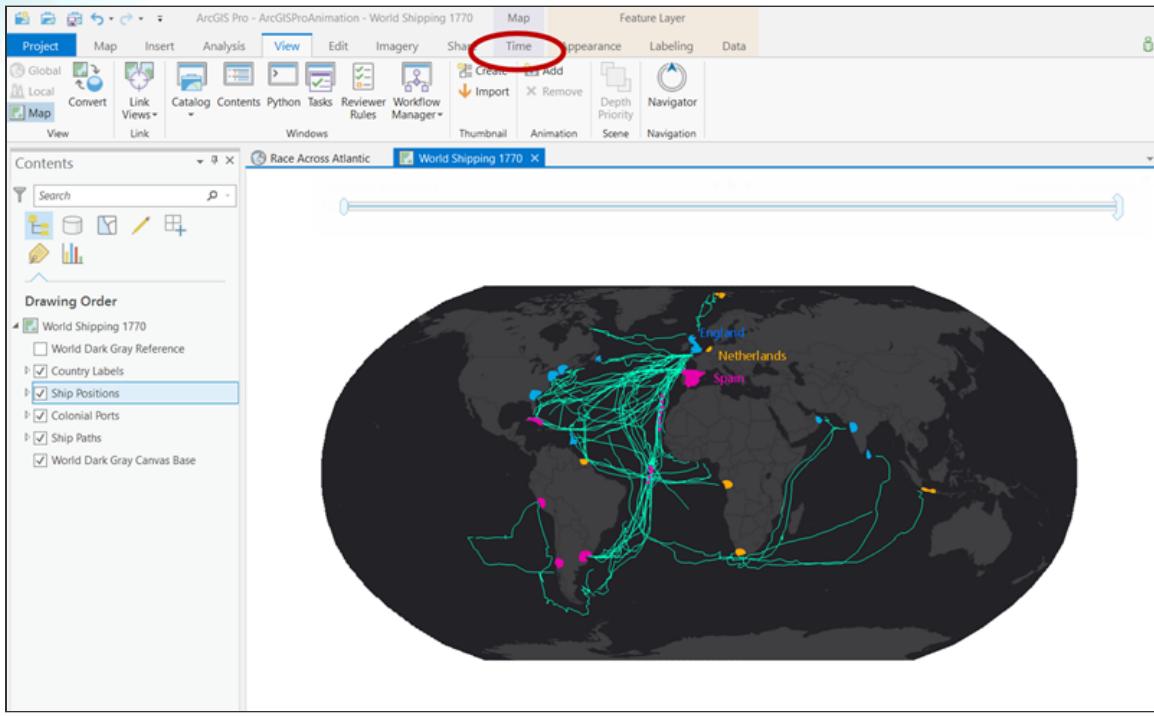
- e Click OK to close the Layer Properties dialog box.

A time slider will appear at the top of the map, providing controls that allow you to visualize temporal data. To use the time slider, you must enable time on one or more layers in the map. The red mark over the clock on the left side indicates that time has not been enabled for the map yet.



Note: You can hover your pointer over the time slider to view the full display as shown above.

Now that the map contains temporal layers, a Time contextual tab has been added to the ribbon.

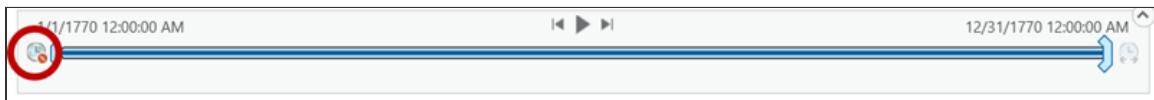


Note: Refer to ArcGIS Pro help to learn more about using the [time slider](https://bit.ly/2GPFBfz) (<https://bit.ly/2GPFBfz>).

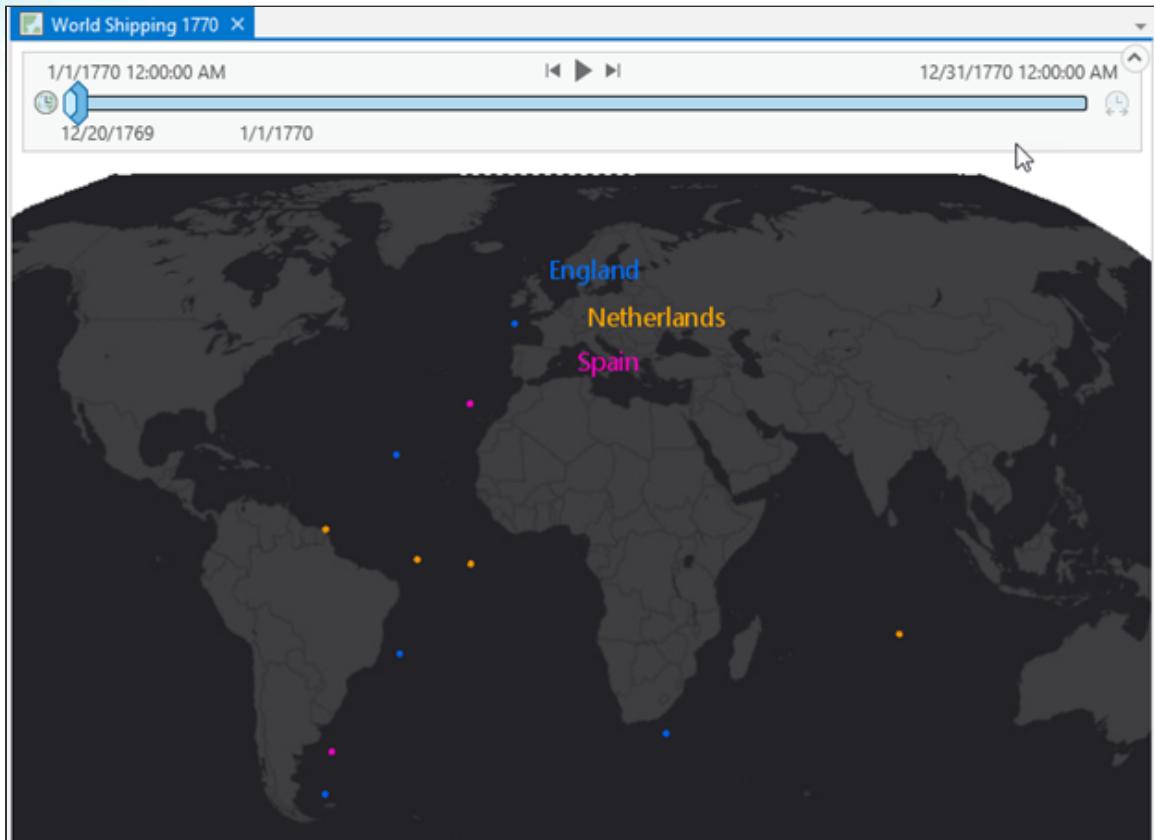
Step 13: Set the map time

Next, you will enable time in the map to explore the data through time using the time slider.

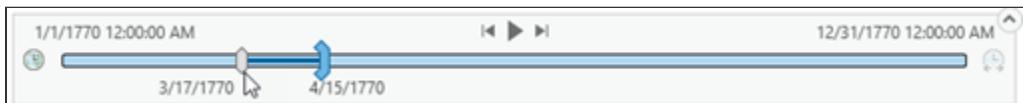
- In the Contents pane, turn off the Colonial Ports and Ship Paths layers.
- On the left side of the time slider, click the Enable Time button.



Most of the points on the map will disappear because they are now being filtered out by the time slider. Only those points that represent ship positions on January 1, 1770, are displayed.

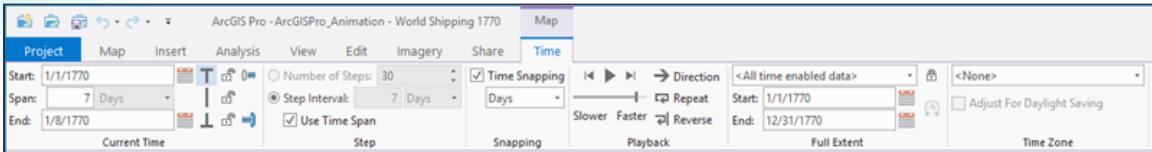


You can interactively drag the slider to see a different time span.



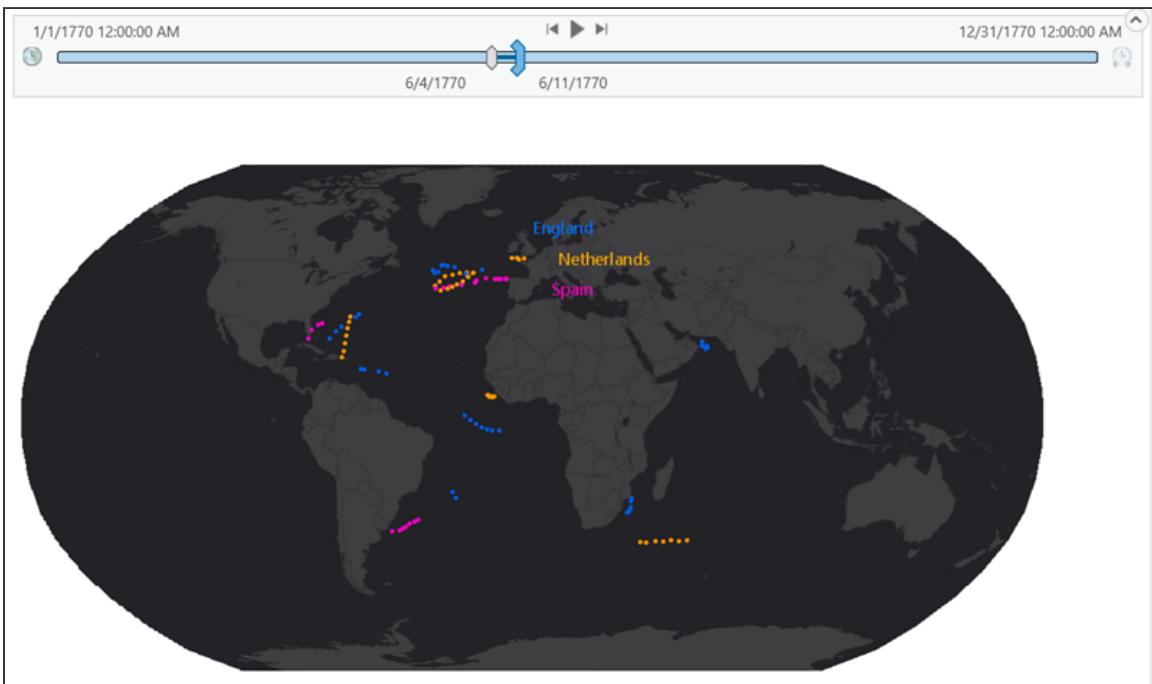
Note: You can drag the current time duration by dragging the right control, or increase or decrease the time extent by dragging the left control.

- c Click the Time tab to view all the configuration properties for map time.
- d In the Snapping group, check the Time Snapping box (if necessary), and set the units to Days.
- e In the Current Time group, set Start to **1/1/1770**.
- f Set the Span to **7** days.

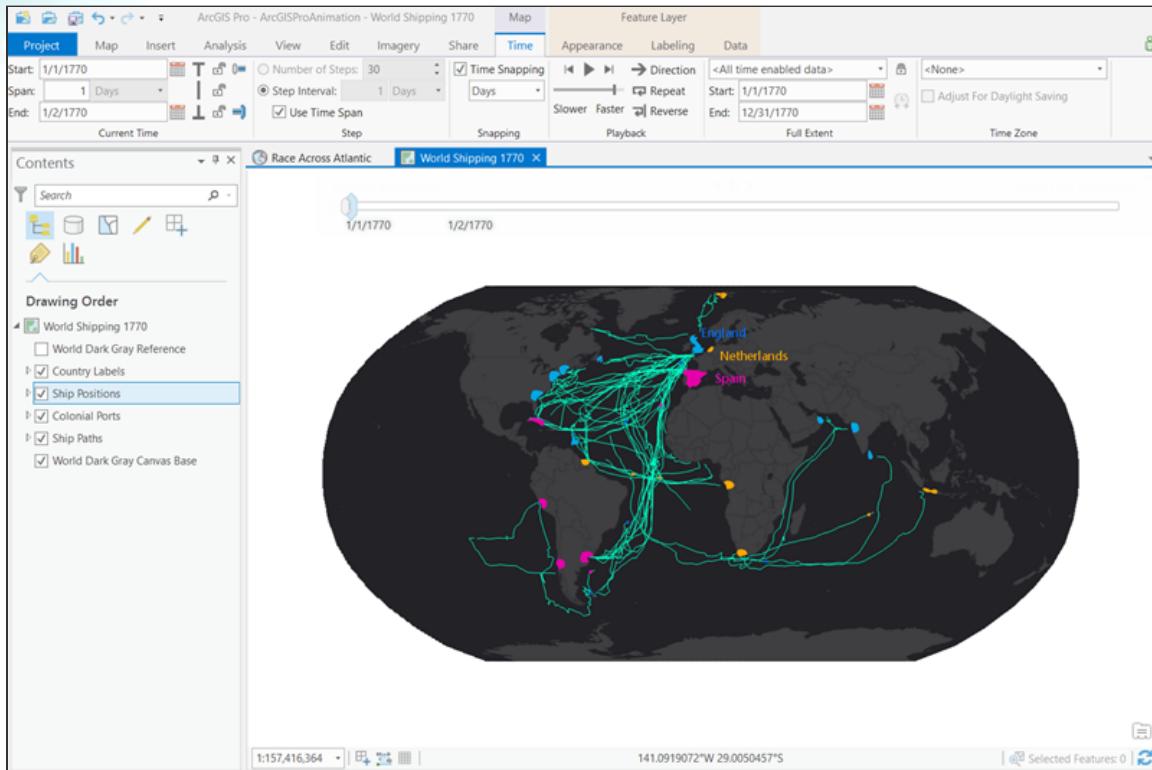


You will see that the End field is automatically filled in using the information that you provided for the two other fields.

- g In the Playback group, click the Step Forward button to step through time in a series of weeks. You will see the time slider jump ahead as you step forward.



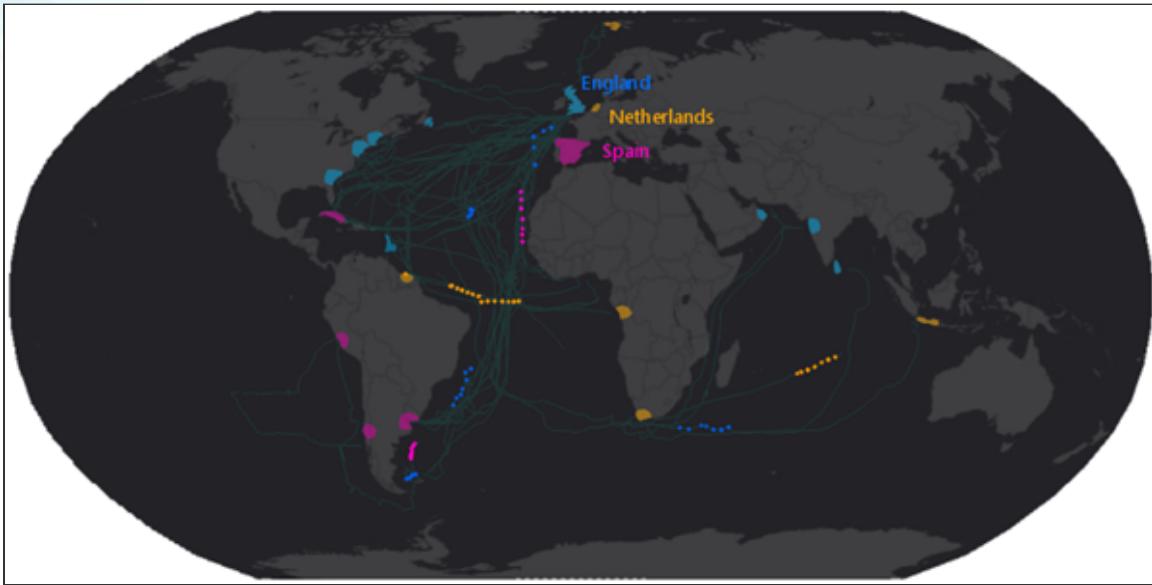
- h In the Current Time group, set the Start field back to **1/1/1770** and the End field to **1/7/1770**.
- i In the Contents pane, turn on the Colonial Ports and Ship Paths layers again.



Step 14: Reduce the visual impact of the Colonial Ports and Ship Paths layers

Because you want to highlight the frequency and routes used by the ships of the day, some adjustments are needed to reduce the visual impact of the map. The Colonial Ports and Ship Paths layers are too bright; they are distracting from the Ship Positions layer, which is the purpose of the video. You can reduce their impact by making them partially transparent.

- In the Contents pane, select the Colonial Ports layer.
- From the Appearance tab, in the Effects group, change the transparency setting to **50%**.
- In the Contents pane, select the Ship Paths layer and change its transparency setting to **90%**.



The appearance of the map changes, and the Ship Positions points now appear more prominently. The paths and ports are less prominent.

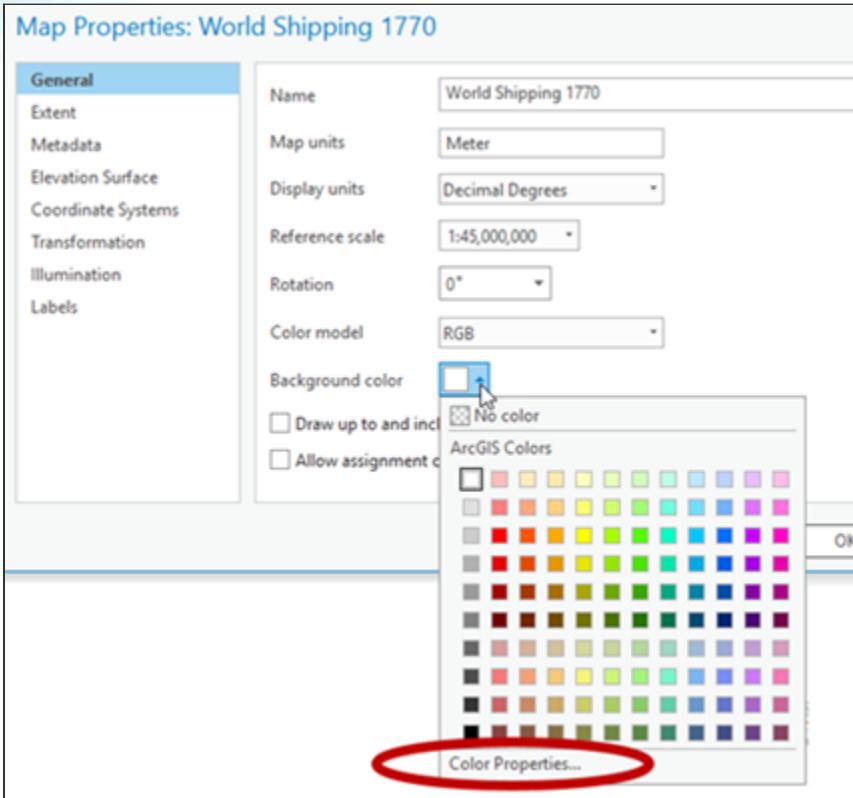
- d Save your project.

Next, you will define an animation for this map that will play through the year of data.

Step 15: Change the background color of the map

In this scenario, you will create a video for Twitter. First, you will change the background color of the map so that the dark gray fills up the entire video.

- a In the Contents pane, right-click the World Shipping 1770 scene and choose Properties.
- b In the Map Properties dialog box, from the General tab, click the Background Color down arrow.
- c In the Color Palette window, click Color Properties.



- d In the Color Editor, set the Red, Green, and Blue values all to **35**, and then click OK.



- e Click OK to close the Map Properties dialog box.

Next, you will add an animation for the map.

Step 16: Add animation to the map using temporal keyframes

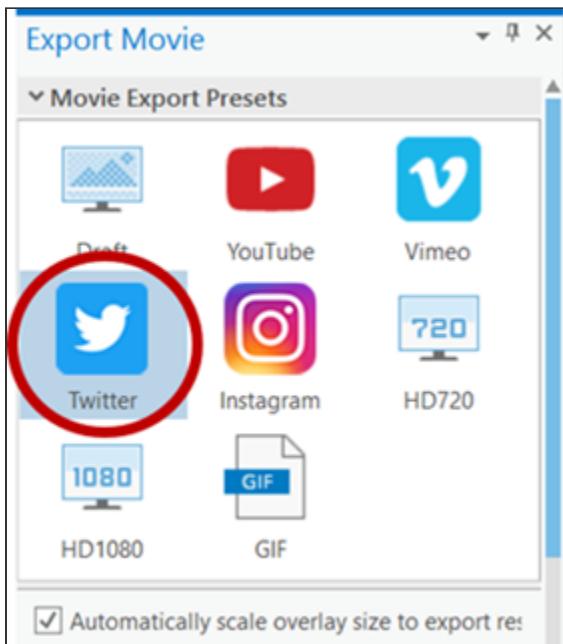
Similarly to how you added animation in the previous scenario to the Oso Mud Slide scene, you will create keyframes. For this scenario, you will create temporal keyframes to show changes in ship positions over the course of a single year.

- a From the View tab, in the Animation group, click Add to open the Animation Timeline pane.
- b In the Animation Timeline pane, click Create First Keyframe.

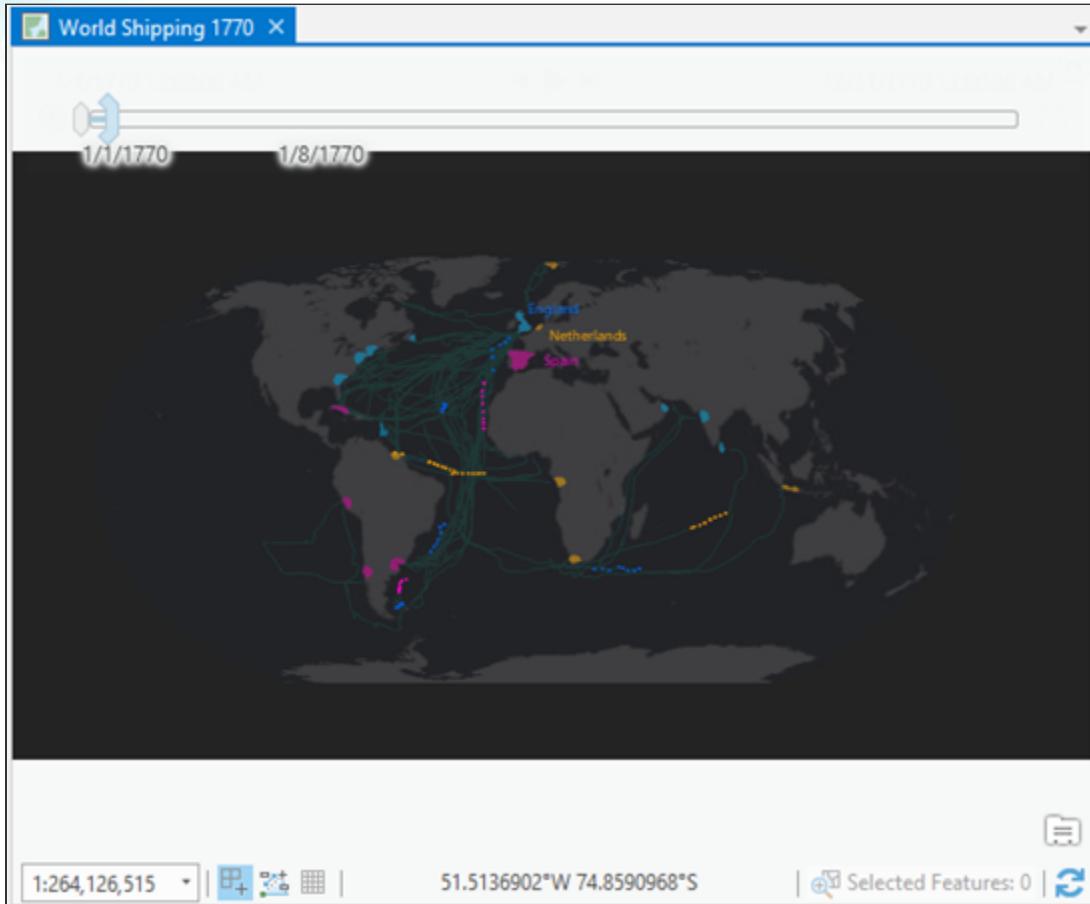
Note: Don't worry about the current map extent for now; you will update it shortly.

The view has been clipped to match the current export aspect ratio. You will check to see that it's set correctly for Twitter.

- c From the Animation tab, in the Export group, click Movie to open the Export Movie pane.
- d From the Movie Export Presets gallery, select Twitter.



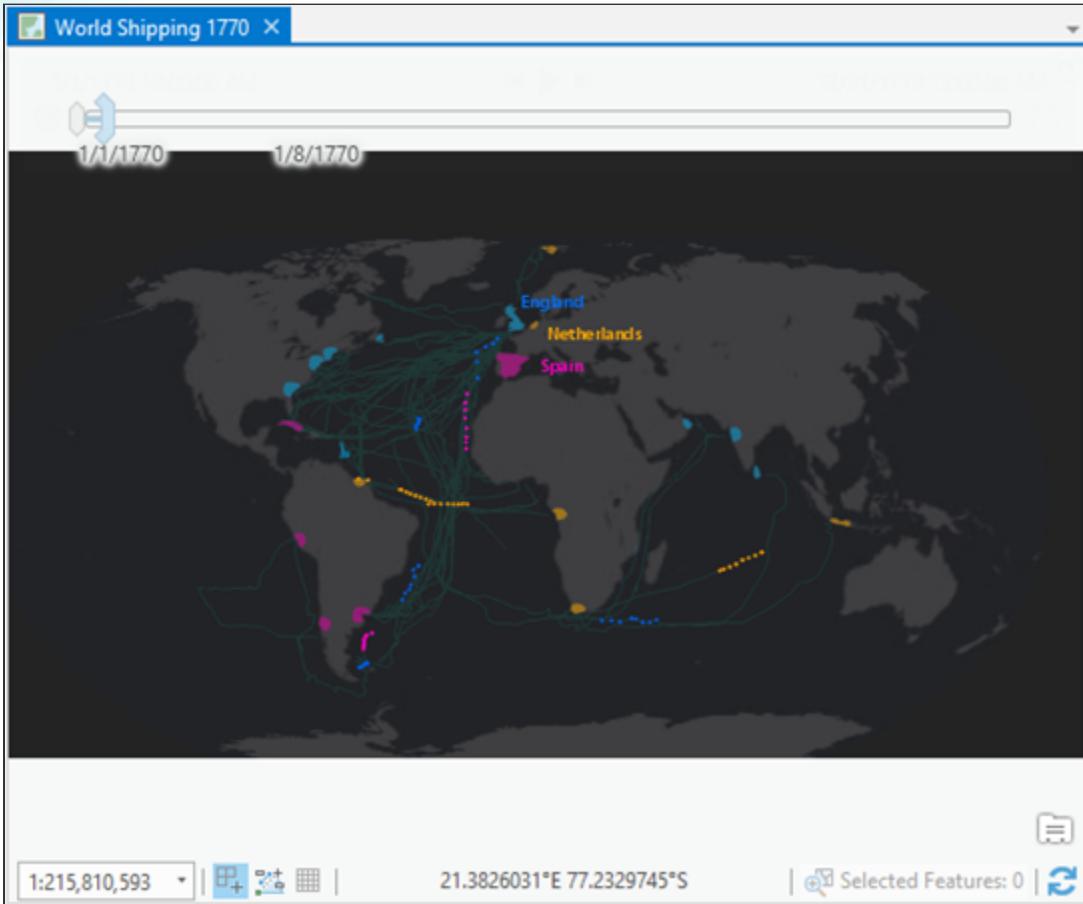
Twitter's recommended video resolution is 640 pixels wide by 360 pixels high. The display in your view is now clipped to reflect this aspect ratio and should look something like the following graphic:



When animating content in a temporal map, a technique that helps highlight the changing content (rather than the map) is to maintain the same extent for the duration of the video. This means that the only movement within the video will be the ship points.

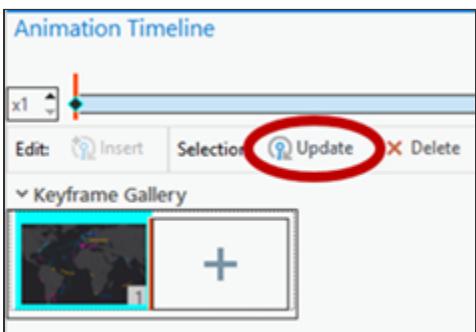
It also means your choice of extent, which won't change at all, is important.

- e Pan and zoom in the map until you get a display with Antarctica at the base of the frame and a small area of blank space at the top of the frame for a title, like the following graphic:



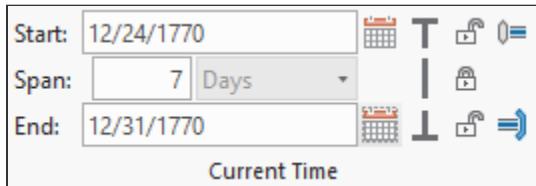
Note: It's okay if your map doesn't look exactly like this one; just get it as close as you can.

- f In the Animation Timeline pane, select the first keyframe and click Update.



This will be the starting point of the video. You will keep the same spatial extent for the entire video, so now you just need to define the change in temporal extent.

- g From the Time tab, in the Current Time group, perform the following tasks:
- Confirm that the Span is set to 7 days, and then click the Lock Span icon to the right of the Span field to maintain the 7-day duration.
 - Set the End field value to **12/31/1770** and press Enter.



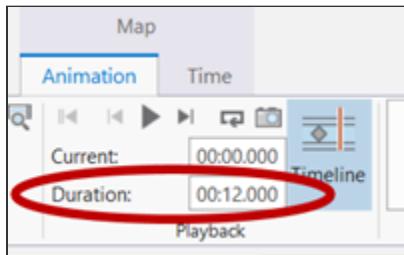
- h In the Animation Timeline pane, click the Append Next Keyframe (plus) button to add a second keyframe.



The temporal animation has now been defined using just two keyframes.

The video is currently defined to be the default length of 3 seconds. You can update the duration of the video to any length that you want. However, it is useful to choose a length that is easy to explain, such as a duration of 12 seconds to represent a playback speed of one second per month.

- i From the Animation tab, in the Playback group, set the Duration to 12 seconds, and then click the Reset button to return to the start of the animation.



- j Click the Play button to preview the animation.

The animation will play through time, and the dot trails will appear to move over the map. As stated earlier, don't be too concerned with the interactive playback performance because the export process will ensure that everything renders smoothly.

Step 17: Add overlay text to show the passage of time

The animation is presenting data through time, so including the changing dates within the video will help communicate how fast time is changing.

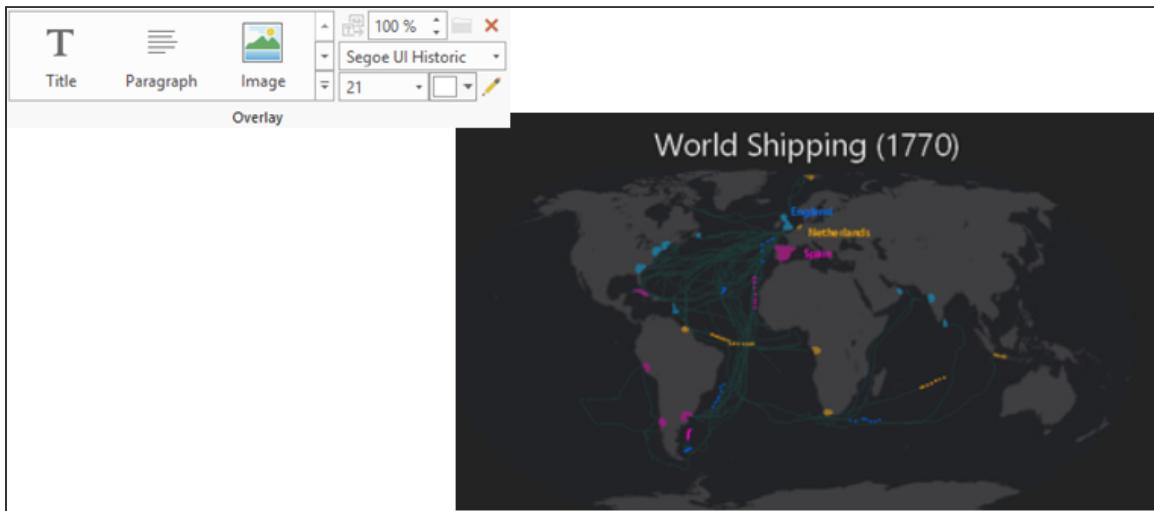
There is only a single year of content, so you can add that information in as static overlay text in the title.

- a In the Animation Timeline pane, select all the keyframes.

As overlays are added, they will display for the entire duration of the video.

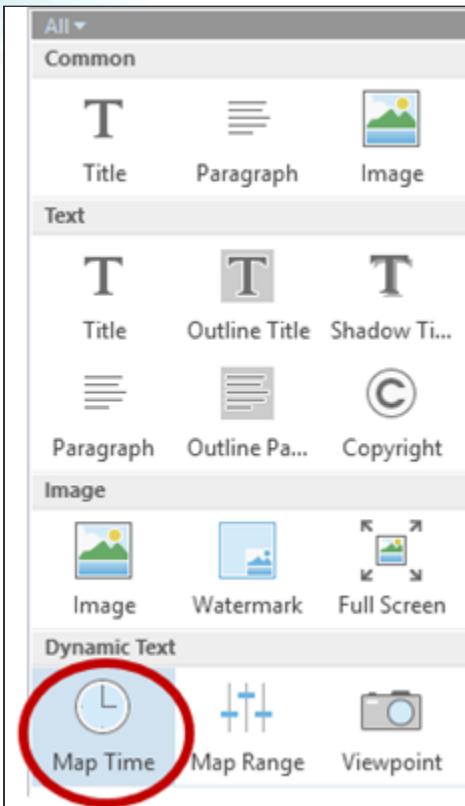
- b From the Animation tab, in the Overlay group, perform the following tasks:

- Click Title, type **World Shipping (1770)**, and click the red X to exit the text edit mode.
- Update the font to something like Segoe UI Historic, 21-point, White.



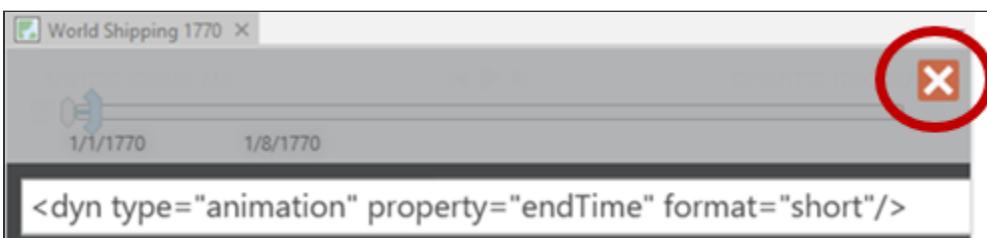
The day and month, however, are changing throughout the video. For dynamic overlay text, you will add in a specifically tagged element.

- c From the Animation tab, in the Overlay group, expand the gallery of preset items.
- d In the Dynamic Text section, click Map Time.



This will add a predefined tagged HTML element for showing dynamic time. You only want to see the end date, and you don't need the time of day displayed.

- e In the element, click at the beginning of the first line and delete the first line of text (for the startTime).
- f Click in the second line and remove the "|long" characters from the formatting section of the endTime line.
- g Click the red X to exit the edit mode.



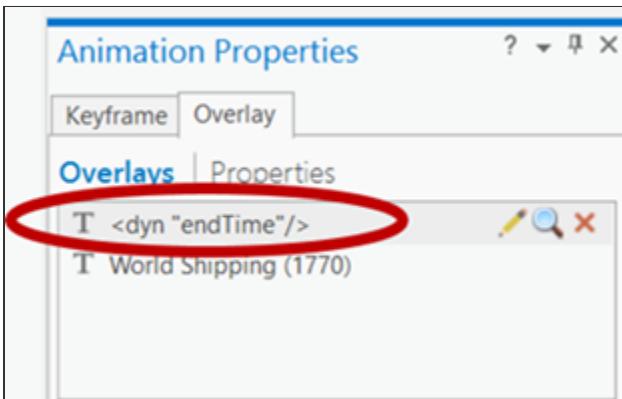
- h Update the font to match the title text that you set earlier (Segoe UI Historic, 21-point, White).



The end date for the first keyframe (1/8/1770) is now displayed in the upper-left corner of the frame. If you were to replay the animation, it would flip over to subsequent days in sync with the video.

You will now simplify and fine-tune how the dynamic text is shown.

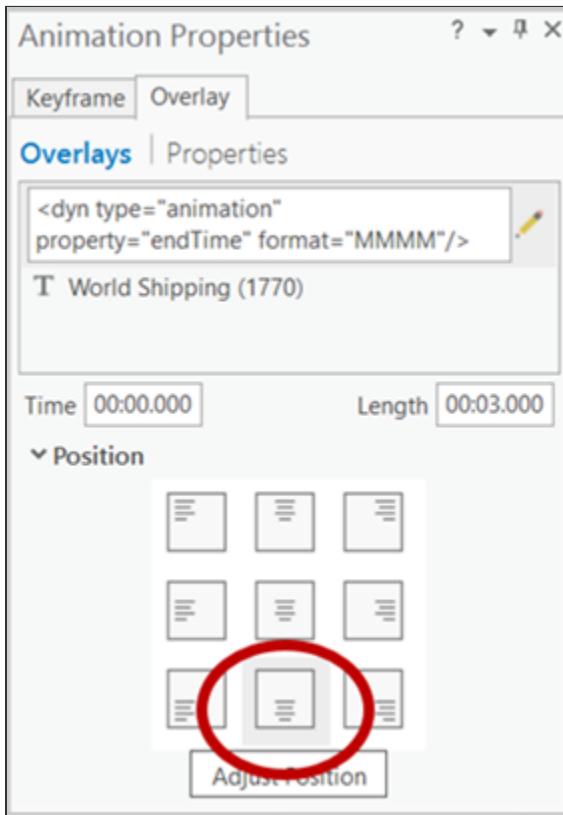
- i From the Animation tab, in the Edit group, click Properties to open the Animation Properties pane.
- j From the Overlay tab, click the <dyn "endTime"/> element to select it.



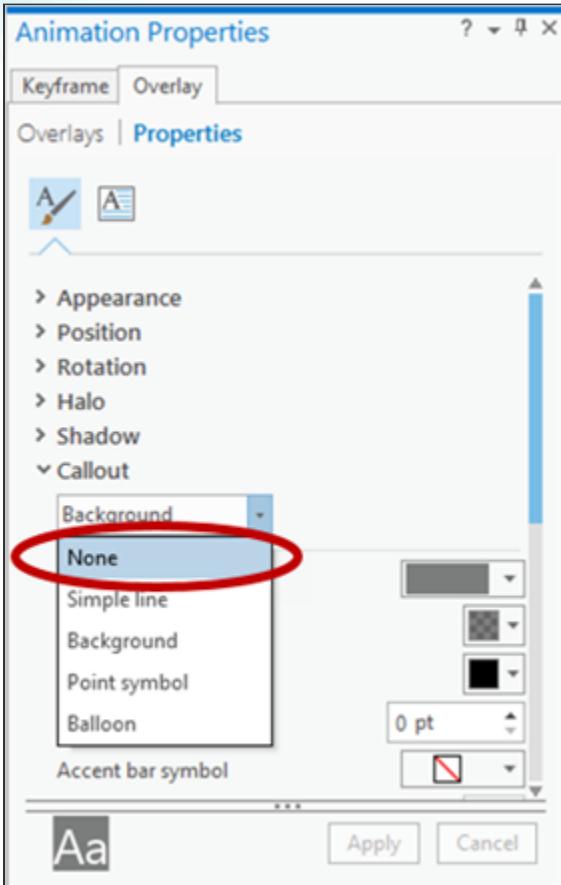
- k Click the Edit pencil icon to edit the text for the overlay and update the text to **<dyn type="animation" property="endTime" format="MMMM"/>**.

This will display just the month name, rather than the month/day/year numeric format.

- I In the Position section of the pane, click the bottom-center alignment button.



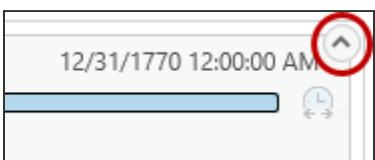
- m At the top of the pane, click the Properties tab to access the advanced properties for the text.
- n Expand the Callout section, and from the type drop-down list, choose None, and click Apply.



- From the Animation tab, in the Playback group, click the Reset button to return to the start of the animation , and then click the Play button to preview the animation.

This simplified presentation of the dynamic text is easier to read within the fast playback time, yet still communicates how time is passing within the video.

Note: When you're not using the time slider anymore, you can minimize it into the top-right corner of the view by clicking the collapse arrow in that same corner of the control.



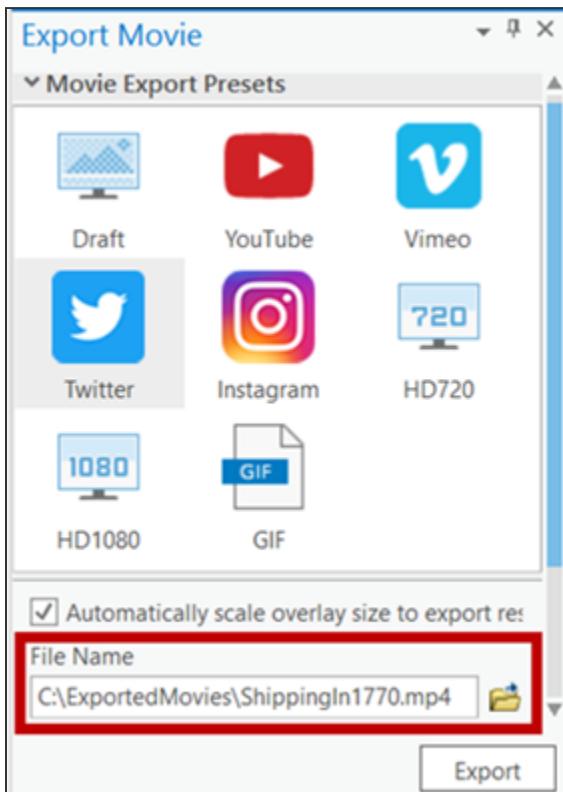
- Close the Animation Properties pane.

The animation is complete.

Step 18: Export the animation for use in Twitter

The animation is fully prepared for posting to Twitter.

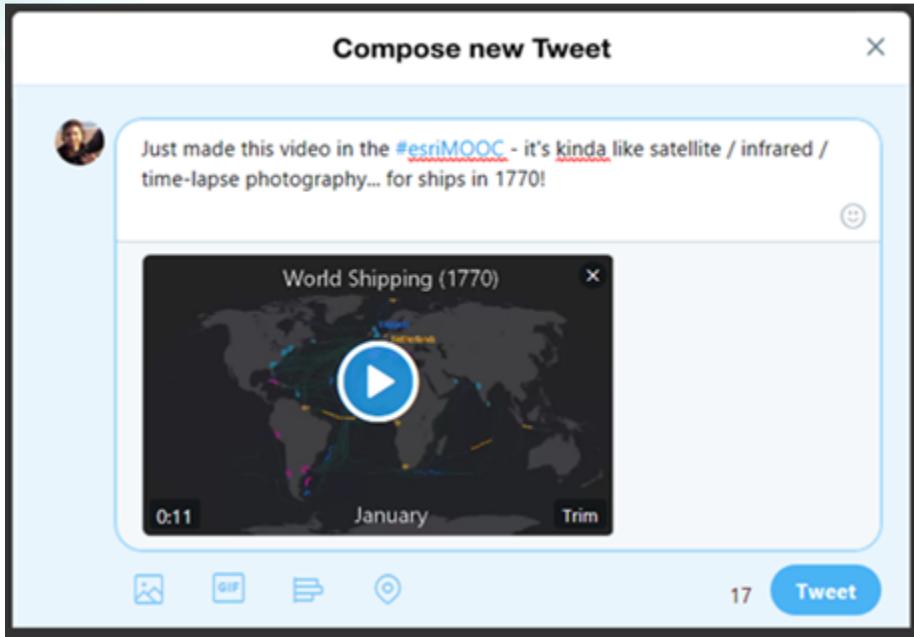
- a In the Export Movie pane, for the output folder File Name, type a name like **ShippingIn1770.mp4**.



- b Click Export.

Export time will vary, but the video should take approximately 3 to 4 minutes to export.

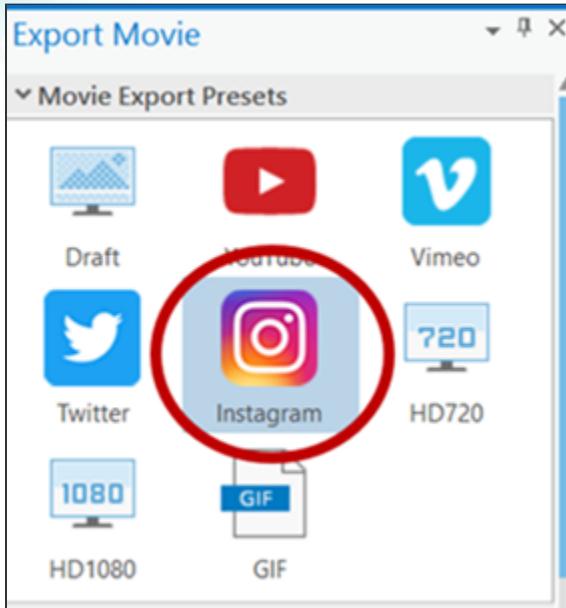
- c When it's completed, click Play The Video at the bottom of the Export Movie pane. You can also browse to the output file location and double-click the MP4 file to view it. If you're happy with it, and if you have a Twitter account, sign in to Twitter and post it with an interesting comment.



Step 19: Update the map extent for Instagram and export the video again

Different social media platforms have different recommended video settings, and some of them will affect how you author your animations. For example, Instagram is designed to host square videos, rather than landscape or portrait videos, so you need to allow for this. If you don't, sections of your video will be clipped out.

- a In the Export Movie pane, choose the Instagram preset from the gallery.



The map view will update to show the new square aspect ratio of 600 pixels wide by 600 pixels high that Instagram uses.



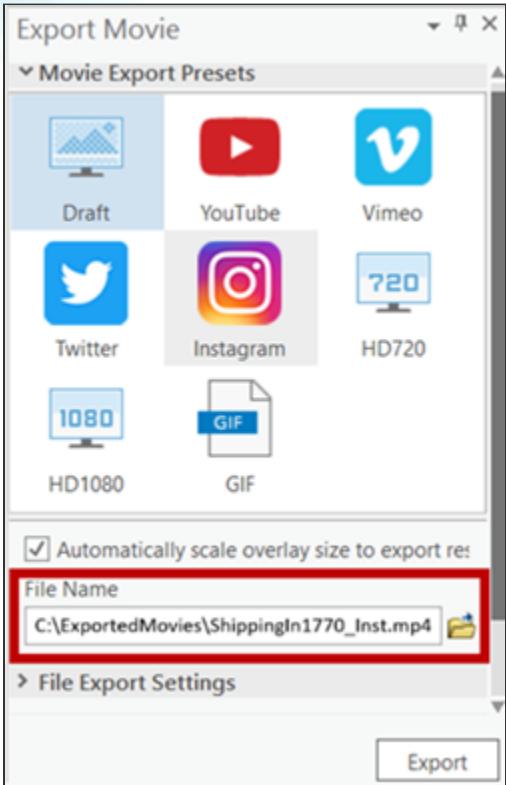
- b Pan and zoom in the map to update the extent that you would like captured in the video.

Hint: In this case, zoom in slightly and set an even amount of blank/dark space at the base and top of the screen for the title and month text.



- c In the Export Movie pane, type an output File Name, such as **ShippingIn1770_Inst.mp4**.

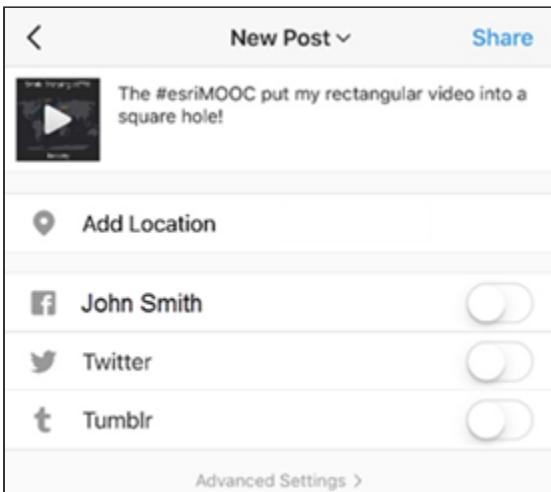
Note: Be sure to give the file a different name than you used for the Twitter version.



- d Click Export.

The video will take approximately 3 to 4 minutes to export again, this time in the resolution appropriate for Instagram.

- e When the export has completed, save your project, and then, if you have an Instagram account, sign in to Instagram and post the video.



In the final scenario for this exercise, you will use the same World Shipping dataset to create a stop-motion-style video, using a progressive display of features to simulate movement.

Note: If you'd like to compare your final map to mine, you can open the Sec6Ex2_Animations_Complete_WorldShipping1770.mpkx file in the Sec6Ex2_VideoResults folder on your computer where you extracted the exercise files. There is also a final Sec6Ex2_Animations_Complete_WorldShipping.mp4 video file in that same location for comparison purposes.

- ➊ Close the Export Movie pane, the Animation Timeline pane, and the World Shipping 1770 scene.

Scenario 3: Race across the Atlantic

With all the shipping activity in 1770, it was inevitable that multiple ships would make the same journey within the same year. For one route, from La Coruna in Spain to San Juan in Puerto Rico, there were three journeys made in 1770. The El Rey made the journey once, departing Spain on August 1, and the El Colon made the journey twice, departing Spain on March 3 and again on September 29. This raises the inevitable question of which ship made the journey the fastest, and how much faster.

You will create a video that shows this race by working with a dataset that has been normalized down to hours since the departure day rather than using actual dates. This means that the scene can display the three ship locations after 96 hours, or 4 days, and visually show who is leading the race at that point. To make this video, you will use a stop-motion technique not unlike what is used in a flipbook animation, a computer-generated movie (like *Toy Story*), or Claymation (<https://bit.ly/2ylhRLh>) (like *Wallace and Gromit*). This technique requires a single feature location and orientation for each output video frame, where the act of playing them one after another gives the impression of movement.

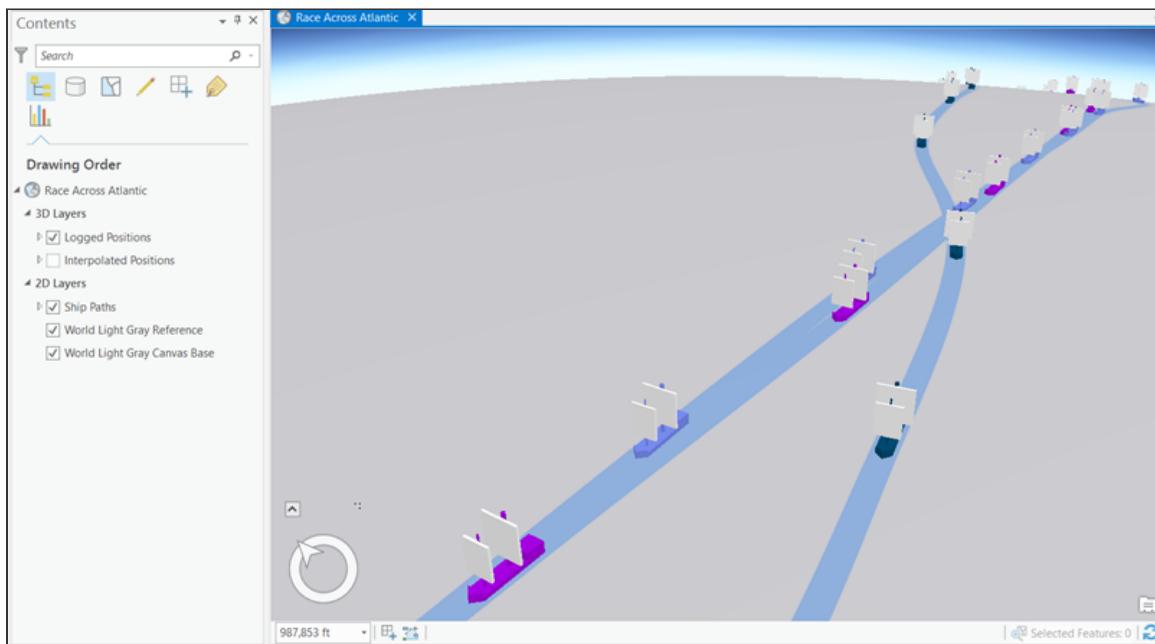
In this section, you will create a stop-motion-style animation (<https://bit.ly/1SvKmo6>) of the three ships, using a normalized starting time so that they can "race" across the Atlantic together. You will then share it as a YouTube-ready video.

This section of the exercise is more advanced than the previous two scenarios and may require significant revision time as you work to create exactly the kind of video that you want. You are encouraged to experiment; you can always save your work and come back later to refine it.

Note: If you'd like a sneak peek of the finished video for this scenario, you can find the Sec6Ex2_Animations_Complete_RaceAcrossAtlantic.mp4 (8 MB) video in the Sec6Ex2_VideoResults folder on your computer where you extracted the exercise files.

Step 20: Open a map

- a At the top of the ArcGIS Pro window, click the Race Across Atlantic tab to open the map. The scene is opened in Global view, which is used for large-extent, real-world content where the curvature of the earth is an important element.

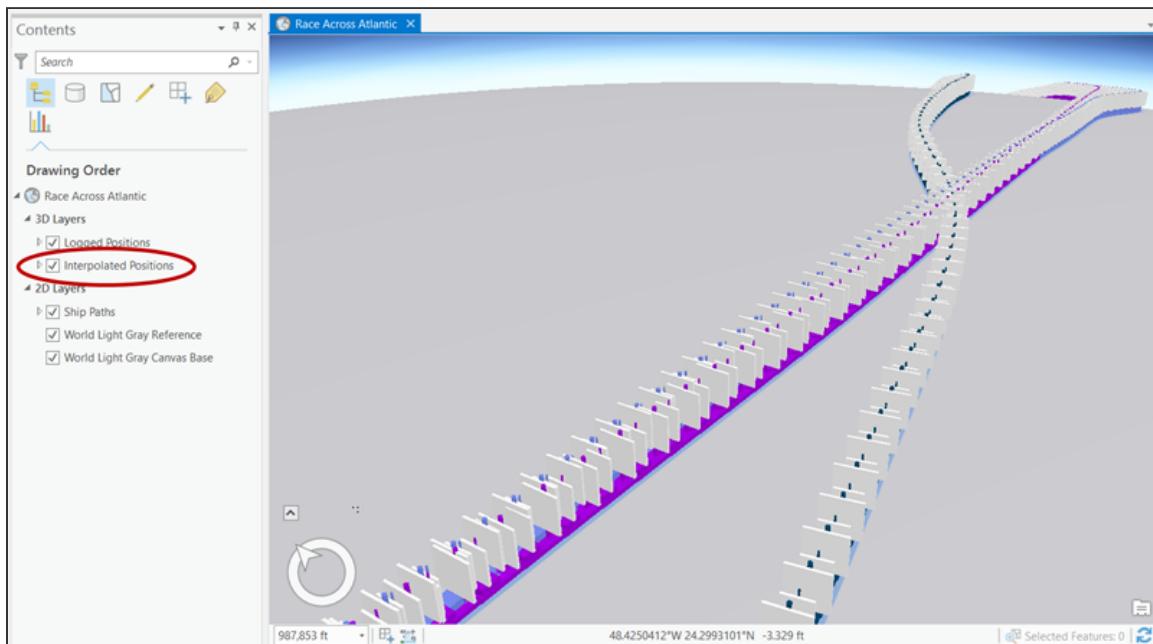


The Race Across Atlantic scene has the following layers pre-authored for you:

- Log Positions: the daily logged positions of the three ship journeys from Spain to Puerto Rico in 1770. Each position is symbolized by a large (75 kilometers tall) ship model, oriented along its travel path, so that all three of them can be viewed at the same time. If they were symbolized in their real-world sizes of 15 meters to 20 meters (45 feet to 60 feet) tall, then only ships very close to the camera would be visible.
- Interpolated Positions: estimated intermediate positions along the route that have been calculated between the officially logged ones. A Bezier curve was used to calculate the path between the known locations, and a constant travel speed (equal steps) was applied within each segment.
- Ship Paths: the routes taken for the three journeys. The width of the lines is set to 14 kilometers wide because this is (approximately) the visible distance from the top of a 50-foot-high mast. The lines show that, even if the ships had departed port on the same day, they would have rarely caught sight of each other.

- b Turn on the Interpolated Positions layer.

Note: In the Contents pane, check the box to the left of the Interpolated Positions layer.

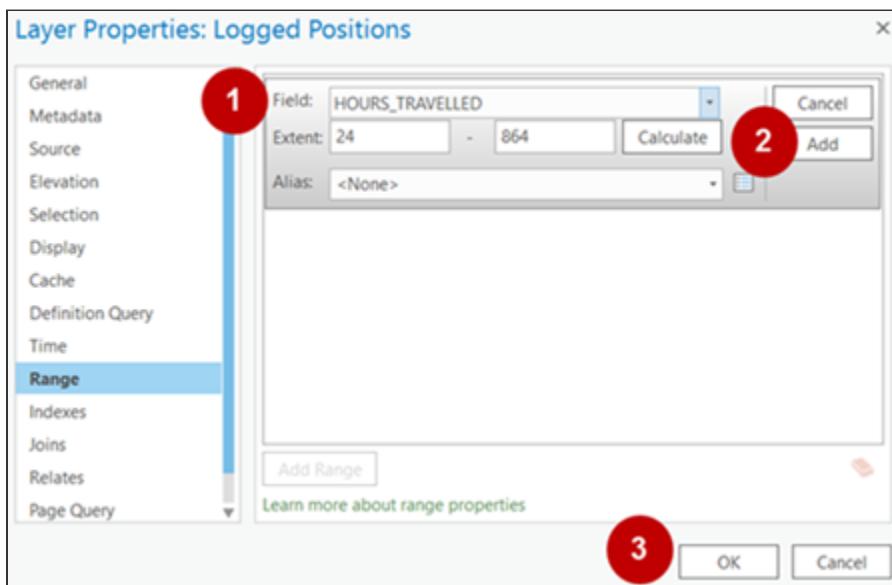


You will see that you have all the stop-motion locations that you need for the ships to have their transatlantic race. What is missing is the ability to show each feature in turn.

Step 21: Define a per-feature filter using range

You could set up a time-based filter for the layers, as each data point represents two hours of travel time. However, because you just want to step through the features in a logical order, you'll use a range filter instead. A range filter can be attached to any numeric field. In this case, it will be the Hours_Travelled field, which indicates how long it has been since the ship left port.

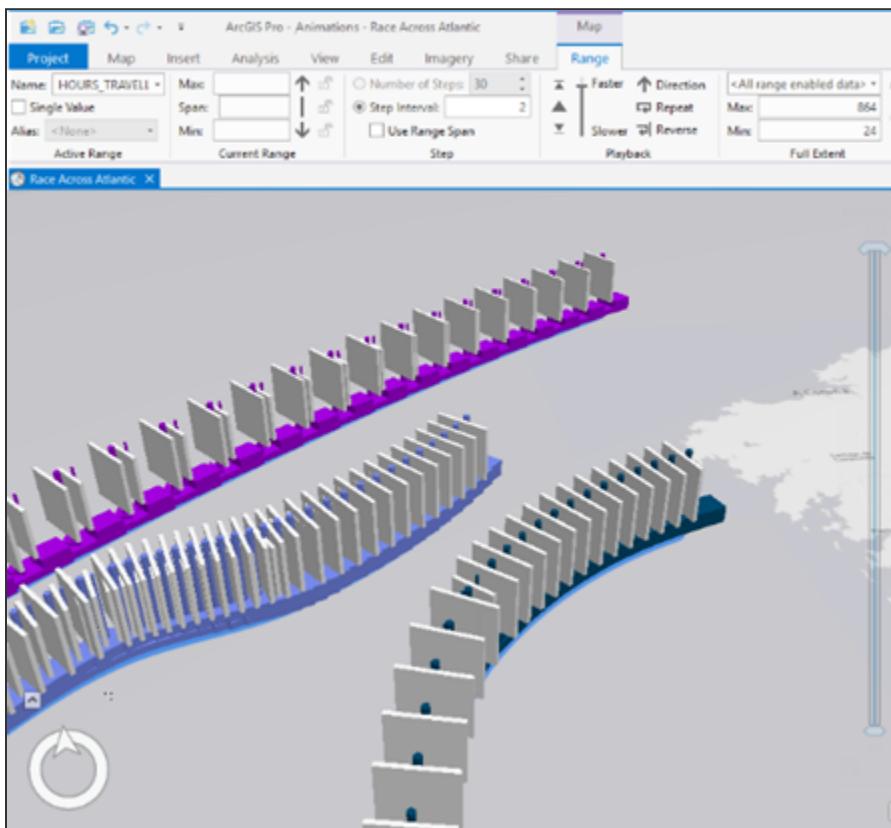
- a In the Race Across Atlantic Bookmarks section, choose the Starting Line bookmark.
- b In the Contents pane, right-click Logged Positions and choose Properties.
- c In the Layer Properties dialog box, click the Range tab, and then click Add Range.
- d From the Field drop-down list, choose HOURS_TRAVELLED, click Add, and then click OK.



You'll do the same thing for the Interpolated Positions layer.

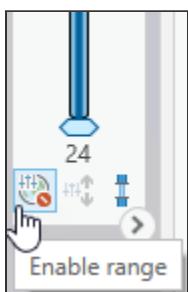
- e In the Contents pane, right-click Interpolated Positions and choose Properties.
- f In the Layer Properties dialog box, from the Range tab, click Add Range.
- g From the Field drop-down list, choose HOURS_TRAVELLED, and then click Add and OK.

A new on-screen slider control will appear on the right side of the view, along with a Range tab on the ribbon.

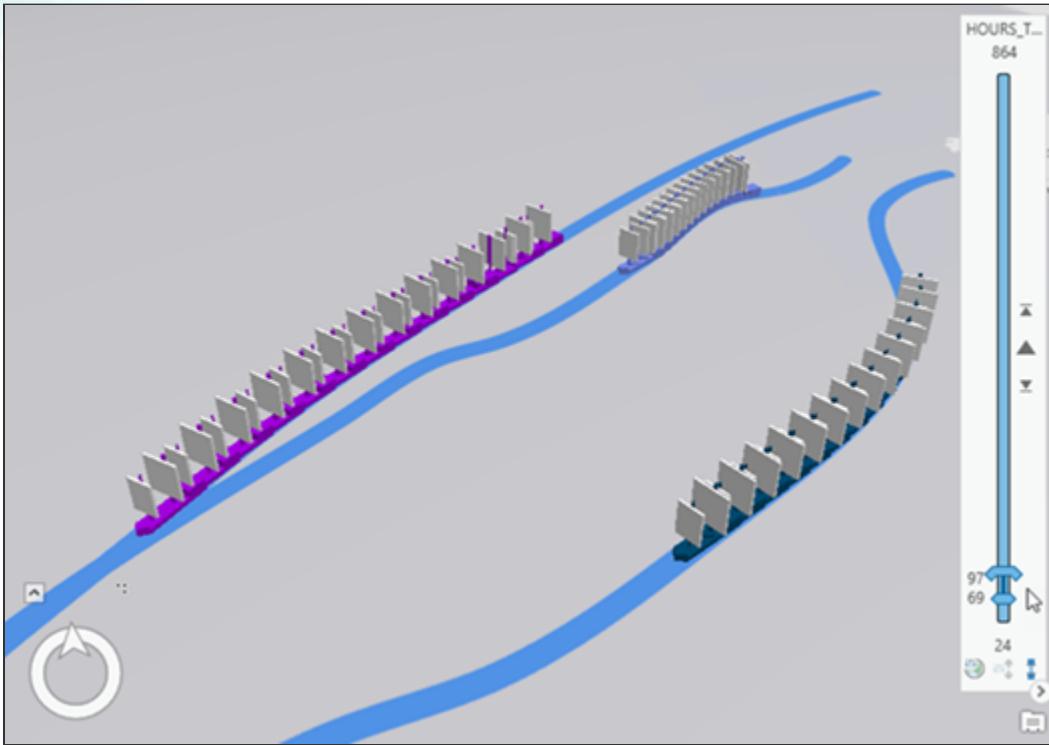


Your scene is now range-aware, but the filter is not being actively applied. You may notice that working with ranges is somewhat similar to working with time. Both have a slider, you can time-enable or range-enable a layer, and so forth.

- h** Point to the range slider, and in the bottom-left corner, click the Enable Range button.



- i** Interactively drag the range slider, and note how a subset of features is being shown.



- j Zoom out to see more of the ships' paths.

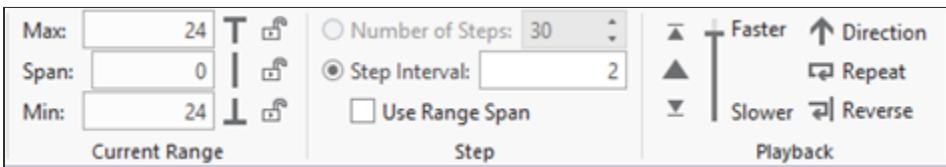
Multiple features are displayed because they all fit within the current range filter. You can set the specific values for the scene's current range and how it should step forward on the tab.

- k From the Range tab, in the Current Range group, set the Min to **24** and the Span to **0**.

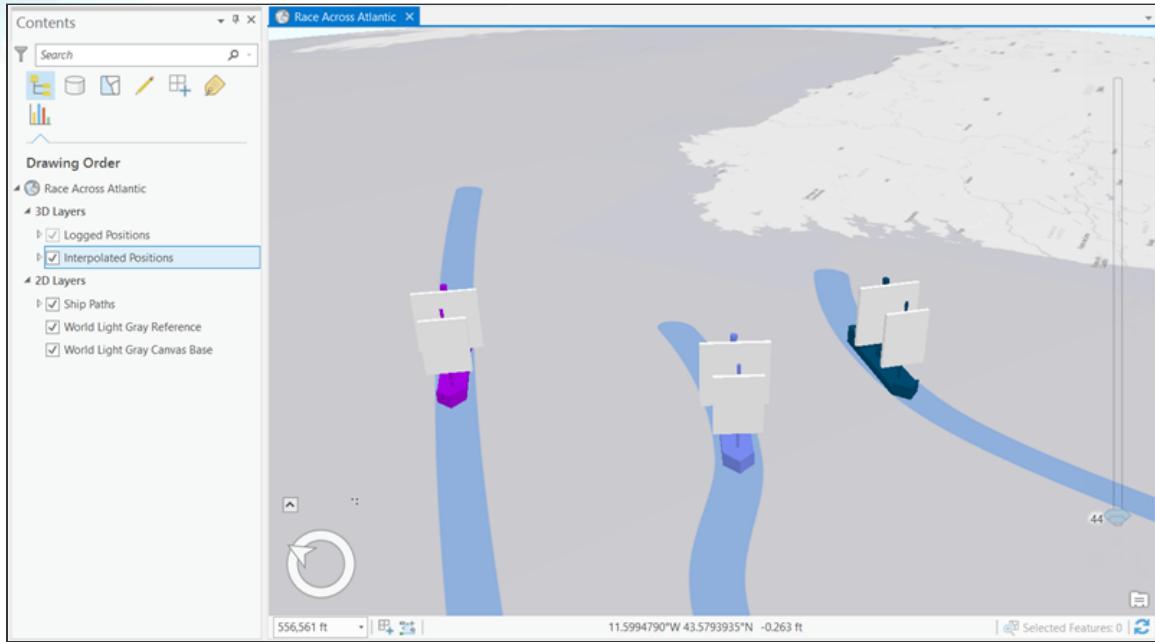
The minimum value means 24 hours into the journey, or after one day at sea. The span value of 0 means one slice of data. A span of 10, for example, would show 10 hours of content, and you would see multiple ships.

- l In the Step group, uncheck the Use Range Span box and set the Step Interval to **2**.

- m In the Playback group, click the Step Forward button.



You should see a single ship feature appear along each path for each step.



Note: If you have zoomed or panned the map, or if you have stepped forward a considerable number of steps, you may need to reorient yourself to the location of the start of the race to see the ships.

Step 22: Use the range filter to create a stop-motion animation

The range slider is now well-configured to make an animation. You want to create exactly one image, or frame, in the final video for each defined position of the ships, and you can use the range slider configuration to help you do that.

- a Zoom to the Starting Line bookmark.

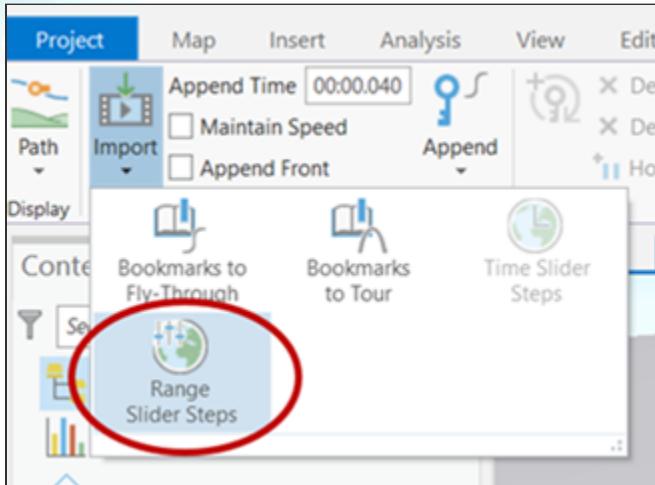
Hint: From the Map tab, in the Navigate group, click the Bookmarks down arrow and choose the Starting Line bookmark.

- b Click the View tab and, in the Animation group, click Add to open the Animation Timeline pane at the bottom of the window.
- c From the Animation tab, in the Create group, set the Append Time to **00.00.040**.

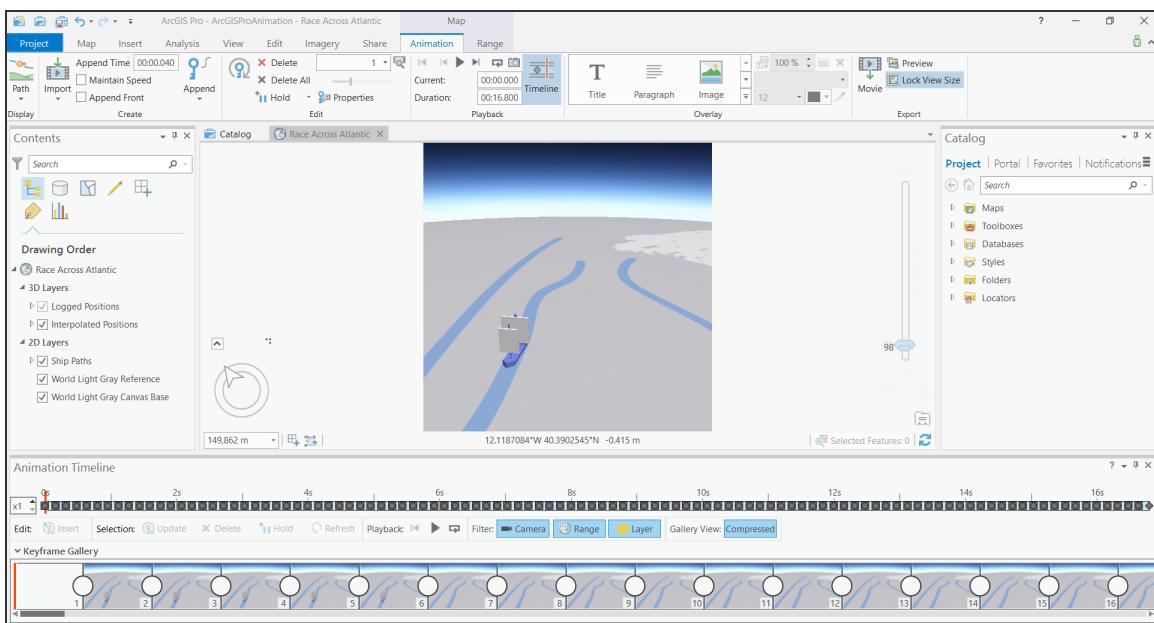
This will create an animation that shows 25 individual states of the range slider per second.

Note: This is important information for later when the video is exported.

- d From the Animation tab, click the Import down arrow and choose Range Slider Steps.



This will create an animation with 421 keyframes, one for each two-hour step through the range slider, with a current total playing time of about 17 seconds.



The end goal for this animation is a YouTube output. You will update the output format so that you can preview the display in the appropriate aspect ratio.

- e Open the Export Movie pane.

Hint: From the Animation tab, in the Export group, click Movie.

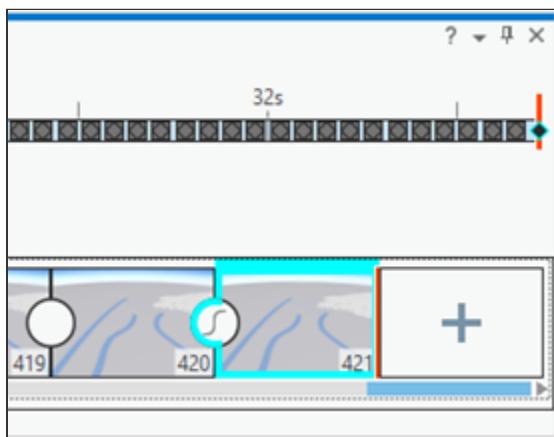
- f Choose the YouTube preset option from the gallery.

The 1,280 pixels wide by 720 pixels high clipped aspect ratio for the view will update.

- g In the Animation Timeline pane, scroll through the frames until you see the last keyframe, 421.

Hint: Click and drag the horizontal slider at the bottom of the Animation Timeline pane to scroll to the last keyframe.

- h Double-click the keyframe to move to that part of the animation.



Note: You can also right-click the keyframe and choose Zoom To.



The ships will disappear (because they have finished the race), but the camera has stayed in the same location. That is, it is still at the *starting* line. This is how the Import Range Slider Steps process works; it does not know where you want the camera to move to next, so it leaves it in the same place. You will update some of the keyframes so that the camera knows where to move.

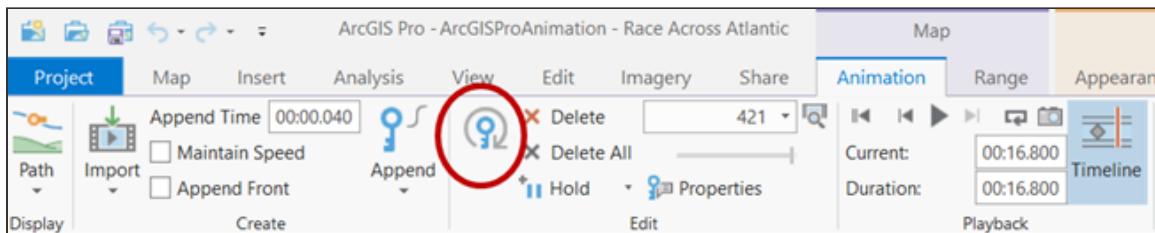
Step 23: Update the last keyframe to show the end of the race

You need to move the camera to the end of the race, and then update the keyframe. For simplicity, this camera position and others along the way have been created for you as bookmarks.

- a Zoom to the Finish Line bookmark.

Hint: From the Map tab, click the Bookmarks down arrow and choose the Finish Line bookmark.

- b From the Animation tab, in the Edit group, click the Update Keyframe button.

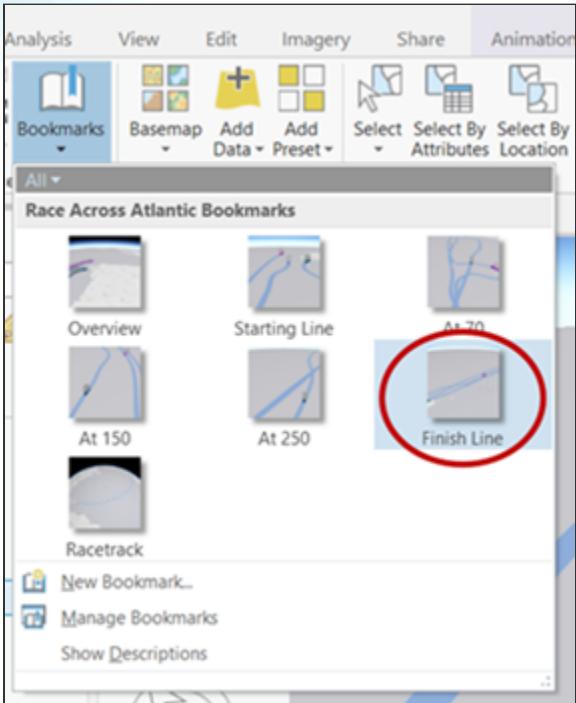


The last keyframe is when the *slowest* ship arrives. You need the camera to get to the finish line when the *fastest* ship arrives, and then hold the same viewpoint until all the ships finish. The data shows that the winner arrives in 29 days of travel, which means that there were 348 (29 x 12) range slider steps for it to arrive, so the arrival keyframe is #349.

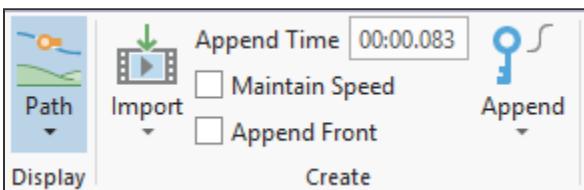
- c In the Animation Timeline pane, scroll through the frames until you see keyframe 349.
- d Zoom to keyframe 349.

Hint: Double-click the keyframe to zoom to it.

- e Zoom to the Finish Line bookmark.



- f From the Animation tab, in the Edit group, click the Update Keyframe button. You can confirm the camera's flight path by enabling a visual display of the line that represents the path.
- g Zoom to the Racetrack bookmark.
- h From the Animation tab, in the Display group, click Path.



Note: The button turns blue when it is enabled.



You are now looking at the camera's flight path. From this viewpoint, you can see that the ships' paths are curved, and the direct flight path between the start and finish (which is what you have now) will not keep the ships in view. Some of the intermediate keyframes must be updated to follow the race more closely.

Step 24: Update the intermediate keyframes

You will use bookmarks to update the intermediate keyframes.

Note: It was determined where a vertex was needed in your animation camera path that would keep you in line with the physical path that the ships took, and bookmarks were created for those intermediate keyframes. If the ships had gone more directly between the start and end port, you'd need fewer intermediate vertices.

- a In the Animation Timeline pane, scroll through the frames until you see keyframe 70.
- b Zoom to keyframe 70 to move to that part of the animation.
- c Zoom to the At 70 bookmark, and then update the keyframe.

Hint: From the Animation tab, in the Edit group, click the Update Keyframe button.

Now you will repeat the steps for keyframe 150.

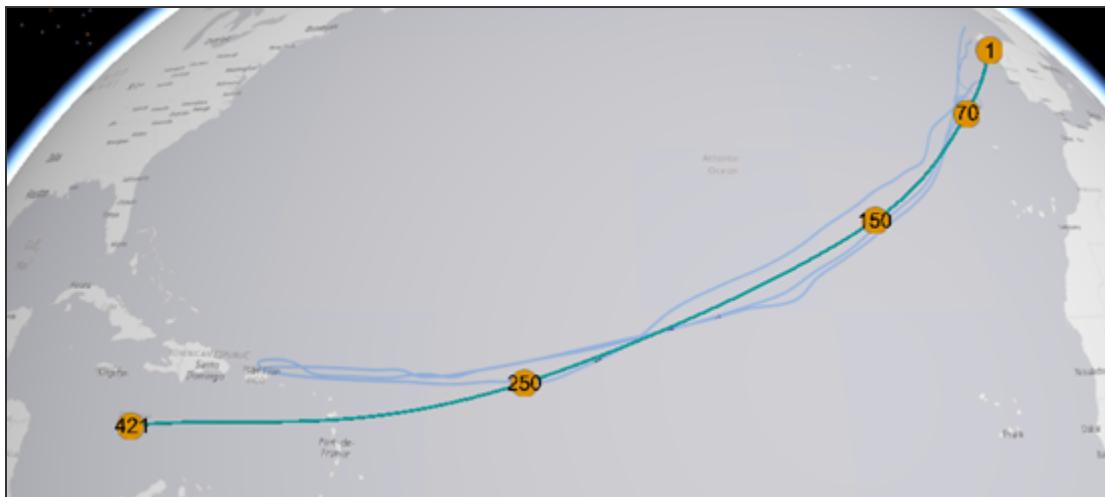
- d In the Animation Timeline pane, locate and zoom to keyframe 150.

e Zoom to the At 150 bookmark, and then update the keyframe.

f Repeat the previous two steps for keyframe 250.

Next, you will confirm the updated camera flight path.

g Zoom to the Racetrack bookmark.



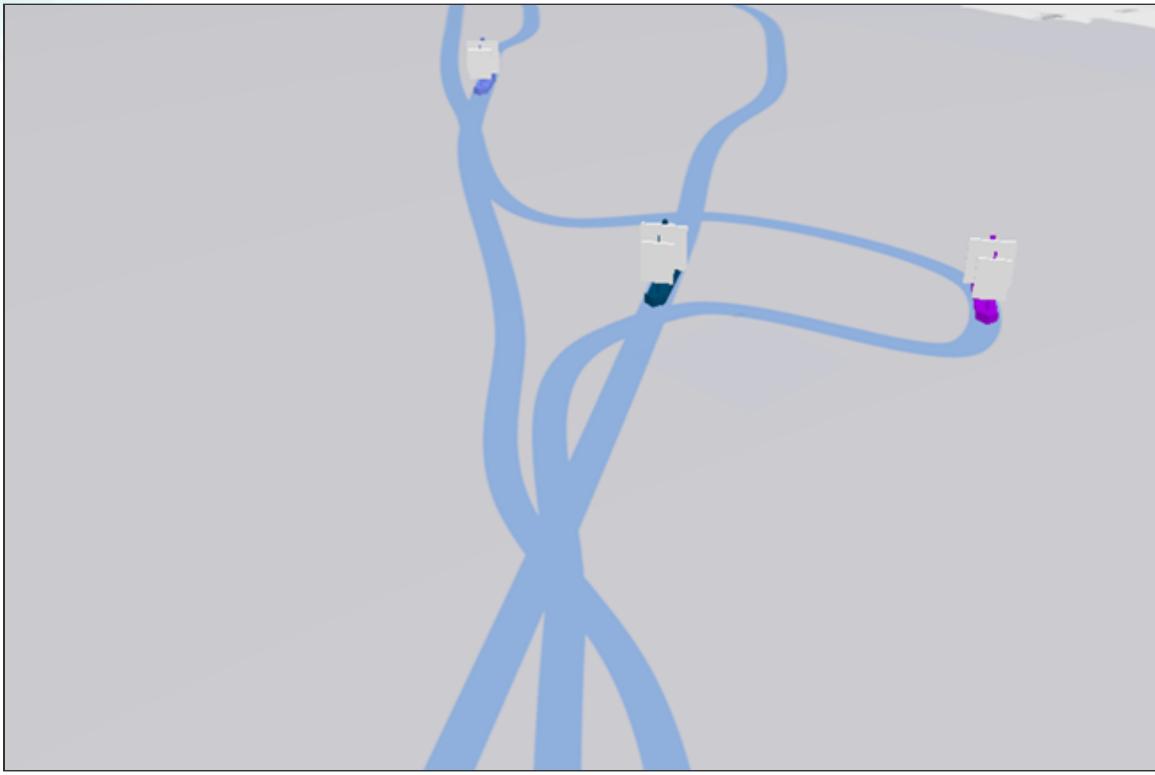
The camera path now follows the path of the ships.

h From the Animation tab, in the Display group, click Path to turn it off.

Note: The Path toggle button will be gray when it is off.

The camera will now fly along ahead of the ships as they race around the earth. You can confirm a few places along the route to preview how the animation will play.

i From the Animation tab, in the Playback group, set the Current field to **3** seconds, and press Enter.



- j Then, set the Current field to **7** seconds, and press Enter.
- k Finally, set the Current field to **9** seconds, and press Enter.

The camera path stays ahead of the ships and provides a helpful viewpoint to observe their progress.

Step 25: Add lead-in and lead-out sections

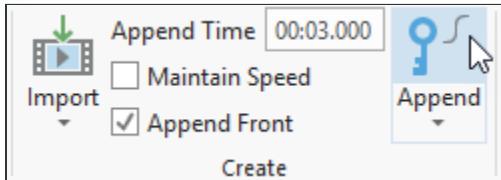
Next, you will add a 3-second lead-in animation to provide context for the starting point of the race.

- a From the Animation tab, in the Playback group, click the Reset button to reset the animation to the beginning.
- b From the Animation tab, in the Create group, set the Append Time to 3 seconds (**00:03.000**), and check the Append Front box.

This will append, or add, 3 seconds to the start of the animation.

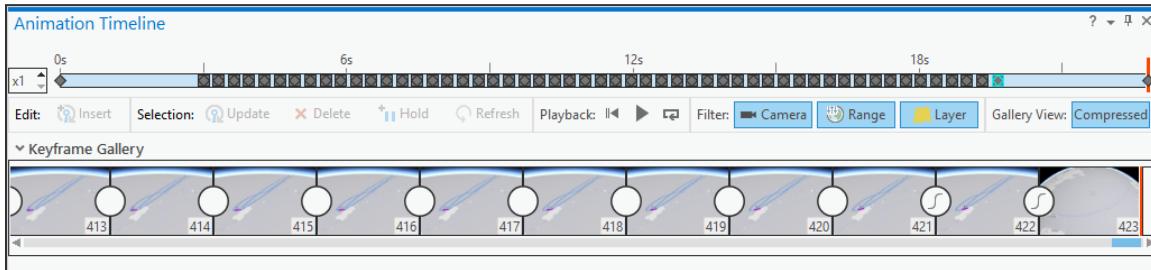
- c Zoom to the Overview bookmark.

- d From the Animation tab, in the Create group, click Append.



It's also useful to show the full extent of the race after it has been completed. You will add a 3-second lead-out section at the end of the animation.

- e In the Animation Timeline pane, scroll through the frames until you see the last keyframe (now 422).
- f Zoom to keyframe 422 to move to that part of the animation.
- g From the Animation tab, in the Create group, uncheck the Append Front box.
- h Zoom to the Racetrack bookmark.
- i From the Animation tab, in the Create group, click Append.



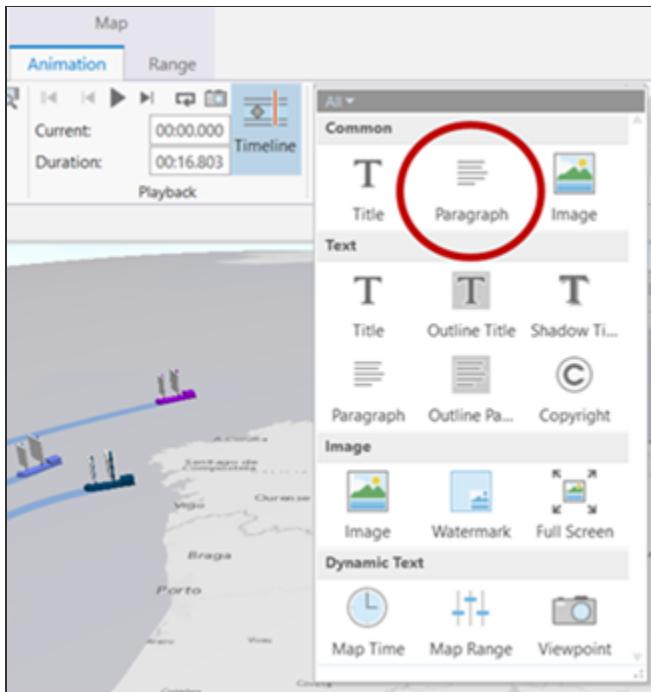
Your stop-motion animation now has 3 seconds of lead-in time and 3 seconds of lead-out time that help the viewer see the full extent of the race. A light blue block in the Animation Timeline pane represents the lead-in and lead-out.

Step 26: Add title text and an overlay image to identify the racing ships

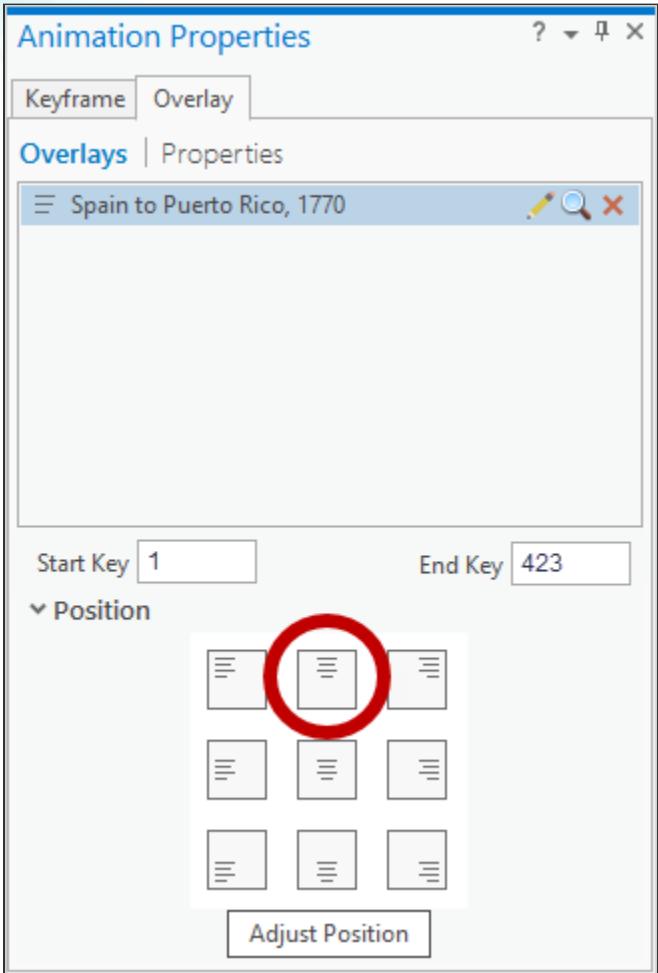
It would be useful for your video to show who was racing and when. You can add overlays to do this.

- a In the Animation Timeline pane, select keyframe 423.
- b Scroll the keyframe gallery all the way to the left so that you can see keyframe 1 in the timeline.

- c Press Shift and click keyframe 1 to select all the keyframes in the animation, from keyframe 1 through keyframe 423.
- d From the Animation tab, in the Overlay group, expand the gallery (if necessary), and click Paragraph.



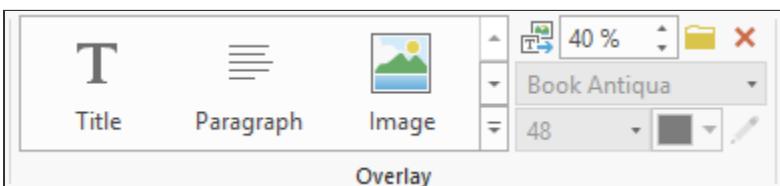
- e In the paragraph text box that opens over the scene, type **Spain to Puerto Rico, 1770**, and then click the red X to exit the paragraph text edit mode.
- f Update the font properties so that the overlay text looks and fits nicely (for example, to Book Antiqua, 48-point, White).
- g From the Animation tab, in the Edit group, click Properties.
- h In the Animation Properties pane, click the Overlay tab and set the Position to top-center.



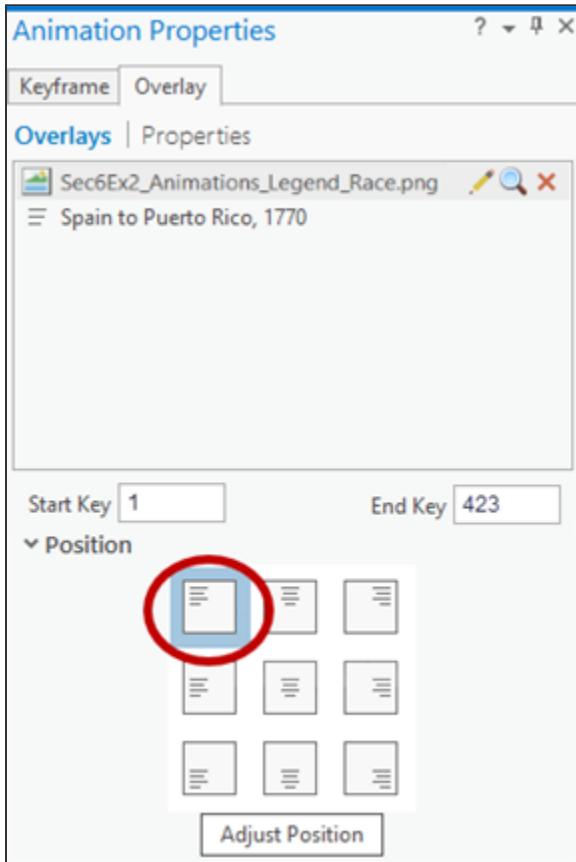
Note: The overlay's Start Key and End Key should be 1 to 423, to show for the entire video.

Next, you will add an image to your overlay. All keyframes should still be selected.

- i From the Animation tab, in the Overlay group, expand the gallery (if necessary), and click Image.
- j Browse to the folder where you downloaded the exercise files and choose the Sec6Ex2_Animations_ShipRaceLegend.png file.
- k In the Overlay group, set the Scale to **40%**.



- In the Animations Properties pane, select the Sec6Ex2_Animations_ShipRaceLegend.png element and set the Position to top-left.



The overlay includes the image on the left and will display for the duration of the video.

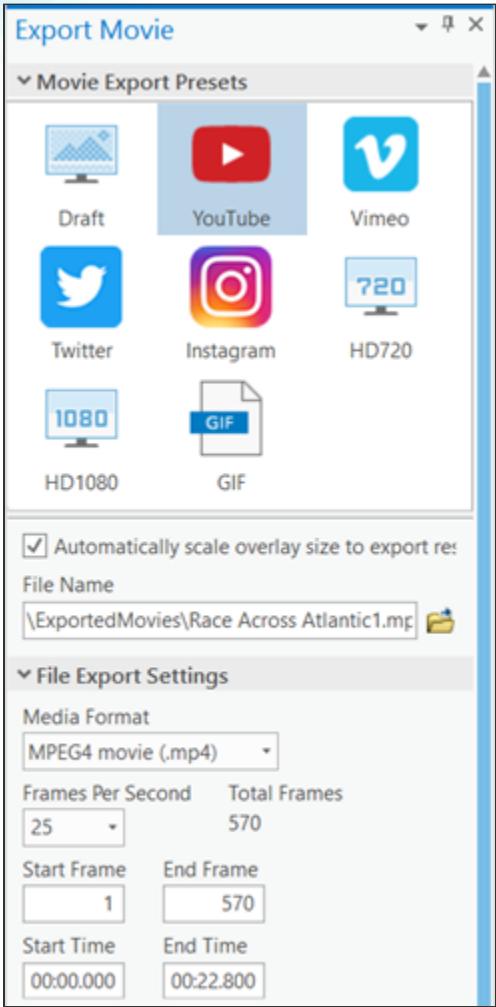


Step 27: Export the video

Your animation is now ready for export to video. Remember that you will need to set the export frame rate to match your stop-motion rate of 25 frames per second, which you defined earlier in this section.

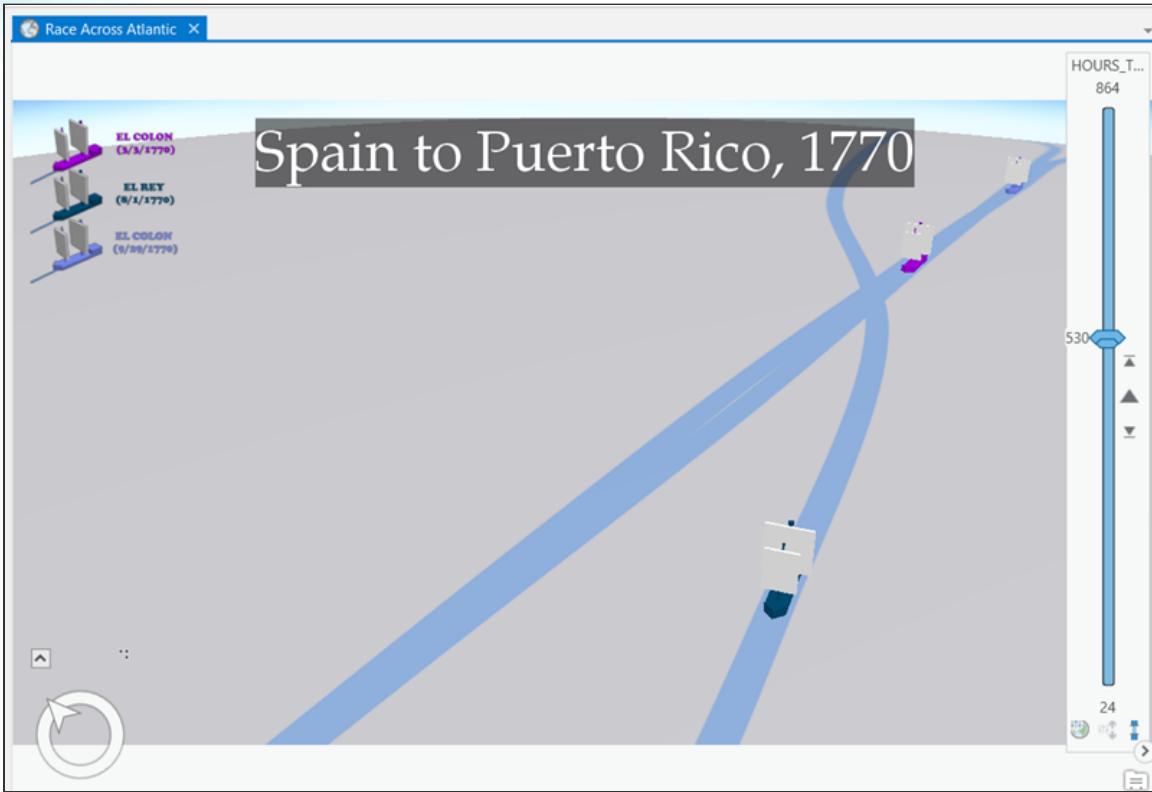
Note: The frame rate is the number of frames displayed per second (fps) in a video. The frame rate has a significant effect on the overall file size. Lowering the frame rate of your video can reduce the file size significantly. However, reducing the frame rate may affect the smoothness of the playback. For this video, you are using a rate of 25 frames per second, which is fast enough that the video looks good but not so high that the output file size is too large.

- a From the Animation tab, in the Export group, click Movie.
- b In the Export Movie pane, type an output File Name, such as **ShipRace.mp4**.
- c Expand the File Export Settings section and set Frames Per Second to **25**.



- d Click Export.

This animation will take longer to export than the previous ones because the content changes in every frame. The estimate will be shown at the bottom of the Export Movie pane and is usually around 4 to 6 minutes. When it has completed, and if you have a YouTube account, sign in to YouTube and post the video.



Note: If you'd like to compare your final map to mine, you can open the Sec6Ex2_Animations_Complete_RaceAcrossAtlantic.mpkx file in the Sec6Ex2_VideoResults folder on your computer where you extracted the exercise files.

- e Save your project, and then exit ArcGIS Pro.

Conclusion

There are many other capabilities available with animation. For example, you can set the transition type between keyframes to linear, fixed curve, hopped, and stepped, or you can use the scene's lighting to cast shadows through time. So, spending more time reading the ArcGIS Pro help [animation documentation](https://bit.ly/2qrYfz5) (<https://bit.ly/2qrYfz5>) or watching [ArcGIS Pro animation instructional videos](#) (<https://bit.ly/2EBHbvp>) is recommended.

One element of video construction not covered in this exercise is the audio component. ArcGIS Pro does not include the ability to add audio into your videos yet, so post-production work using third-party software, such as TechSmith Camtasia, GoPro, or Windows Movie Maker, would be required. If you have the time and resources to do so, audio can be extremely effective at providing detailed information, such as a narrated explanation of the content. It can also add mood and ambience, such as an appropriate background soundtrack.

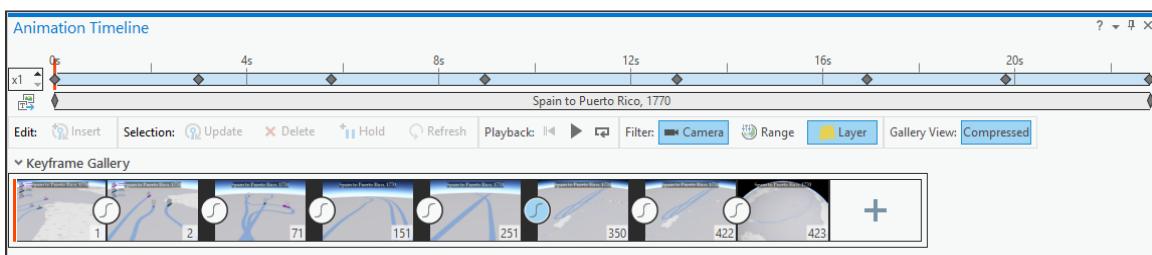
Whatever GIS story you want to tell, animation is a powerful way to get your message out to a diverse range of people. Good luck animating!

Stretch Goals

- If you're feeling adventurous, you can return to steps 4 and 5 and update the keyframes with camera properties to create a video where the camera tracks the ships from behind, the side, or above.
- You could also include additional features into the scene, such as marker buoys that show the leading point after days 5, 10, 15, 20, and 25, or perhaps lines indicating the distance from the Spanish coast or the distance remaining to Puerto Rico. Many potential videos can be created from this one scene, and you are the director!

Note: A keyframe captures and stores the state of the camera as it is created. These properties include the camera's position (X, Y, and Z) and viewing direction (heading, pitch, and roll), and they can be updated individually in the Animation Properties pane on the Keyframe tab. Refer to ArcGIS Pro help to learn more about animation properties (<https://bit.ly/2GNrSpw>).

The Animation Timeline pane allows you to filter out which keyframes are displayed in the gallery based on what properties that they contain. If you uncheck the Range option, you will only see keyframes that have Camera properties. In your case, that would be keyframes 1, 2, 71, 151, 251, 350, 422, and 423. (When you added a keyframe at the start in step 6, the intermediate keyframes that were updated earlier—like 70 and 150—were pushed back by one). This makes it simpler to fine-tune a specific subcomponent of your video.



Use the Lesson Forum to post your questions, observations, and map examples.