

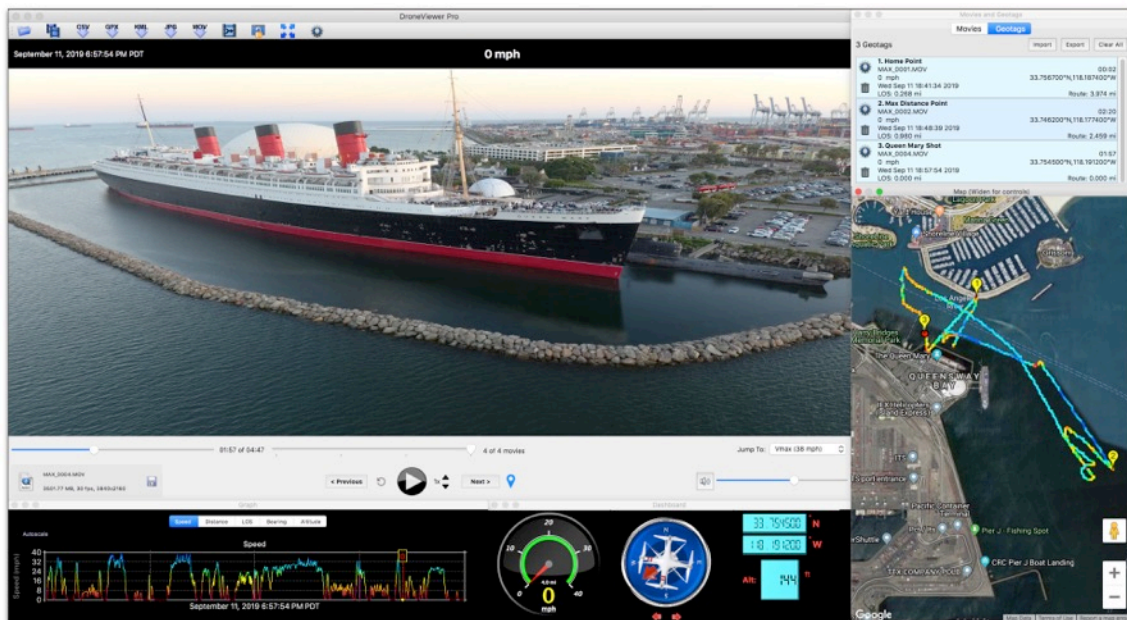


DroneViewer

USER'S MANUAL v1.2.5 18 July 2021

Welcome to DroneViewer!

DroneViewer is a Mac OS X and Windows application that displays your GPS-enabled GoPro and drone videos in a whole new way! With DroneViewer you can play your videos on the main screen while watching your drone's speed, distance, position, and bearing update on graphs, data displays, and maps. You can geotag key points in your route and jump back to them instantly. You can export portions of your videos to separate clips, or export just a single geotagged frame. You can save your route to common file formats such as comma-separated value (CSV), GPS-exchange (GPX), or Google Earth (KML), for further data analysis. Read on to learn more of DroneViewer's extensive capabilities.



DroneViewer on the Mac showing player window, dashboard display, speed graph, map route, and control panel

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FEATURES

- Resizable main viewing screen.
- Zoomable and translatable movie view.
- Heads-up display of date, time, speed, distance, position, and bearing.
- Geotag key points in your route, title them, and jump to these points instantly.
- Save geotags to a text file. Import geotags back into DroneViewer.
- See a listing of all movie files you load and hide files that are not of interest.
- “Real time” display of UAV’s location, speed, and route on a Google/Mapquest Map.
- Map pans automatically to keep drone centered, or you can keep map fixed.
- Click on map route to jump to that position in movie.
- Click on drone’s Graph trace to jump to that position in movie.
- Graphical displays of speed, route distance, line-of-sight distance, bearing, altitude, and satellites-in-view.
- Auto-scaling of graph data.
- Graph’s data traces are color-coded based on UAV’s speed.
- Compass display of drone’s direction.
- Weather display widget for retrieving weather conditions at the location and date of the currently-playing movie.
- Automatic transition between sequential movie files.
- Optionally skip the first n seconds of consecutive movies during playback.
- Variable playback speed control.
- Jump to fastest part of route, or to any loaded movie file instantly.
- Slider controls for direct access to any movie file or any position in a movie file.
- User-configurable instant replay button
- Display of current movie file name, duration, frame rate, and file size.
- Drag and drop loading of movie directories.
- Export movie segments of user-selectable duration and playback rate.
- GPS data export to CSV, GPX, and KML file formats.
- Export current movie window to PNG or JPG file.
- Merge multiple sequential movies into a single large video at one of 7 playback rates.
- Support for per-movie display settings and graph units.
- Click to reveal currently playing movie in the Finder/Explorer.
- Support for meters/sec, km/h or mph speed units.
- Support for timezone biasing to sync movies and data.
- Keyboard and mouse shortcuts.
- Controls for movie brightness and contrast (Windows version only).
- Support for internet connection via proxy server.
- Multiple language support: English, Chinese, more to come.

DRONE AND CAMERA COMPATIBILITY

DroneViewer is compatible with the trajectory data produced by the following popular drones. In addition, it is compatible with the GPS data embedded in the GoPro HERO5 Black, HERO6 Black, and likely the FUSION and HERO7 Black (untested at this time). Support for new models and data formats will expand as DroneViewer evolves.

Drone	Data Format
 Autel EVO 2 EVO X-Star Premium	Embedded Video Caption data in video file (EVO 2) ASS Video Caption file (EVO, X-Star Premium)
 DJI Mavic Mini DJI Mini 2	Embedded Video Caption data in video file
 DJI Mavic Air 2 Pro Mavic 2	SRT Video Caption file
 DJI Matrice 200	SRT Video Caption file
 DJI Phantom 4 Pro	Embedded Video Caption data in video file

 <p>DJI Phantom 3 DJI Phantom 4</p>	SRT Video Caption file
 <p>DJI Phantom 2</p>	FlyTrex Core 2 GPS logger & GoPro Hero
 <p>GoPro HERO5, HERO6 or HERO7 Black</p>	Embedded GPS data
Any Drone	GPX data file & video file

Details for creating and working with ASS, SRT, GoPro, GPX, and FlyTrex log files are presented below.

SYSTEM REQUIREMENTS

MAC VERSION

- macOS 10.14 or later
- Internet connection for Mapquest/Google Maps functionality
- 1600x1200 or higher screen resolution recommended

WINDOWS VERSION

- Windows 10 recommended but DroneViewer may also work under Windows 7 and 8 but these are not recommended.
- [K-Lite Codec Pack](#)¹. This pack includes codecs DroneViewer requires to play the various multimedia formats.
- Intel i7 processor with nVidia or AMD graphics card recommended, although it may run on lower-end systems
- 1600x1200 or higher screen resolution recommended
- Internet connection for Mapquest/Google Maps functionality

DIFFERENCES BETWEEN DRONEVIEWER AND DRONEVIEWER PRO

The following table lists the differences between **DroneViewer** (trial version), **DroneViewer**, and **DroneViewer Pro**:

Feature	DroneViewer (trial version)	DroneViewer (registered)	DroneViewer Pro
Maximum number of files that can be loaded at one time	1	10	100
Maximum number of Geotags	2	10	100
Max clip export duration (seconds)	5	Unlimited	Unlimited
Max GoPro HERO5 and HERO6 GPS track time per video	30 seconds	1 hour 6 minutes	1 hour 6 minutes
Licensing	Personal Use Only	Personal Use Only	Commercial and Personal Use

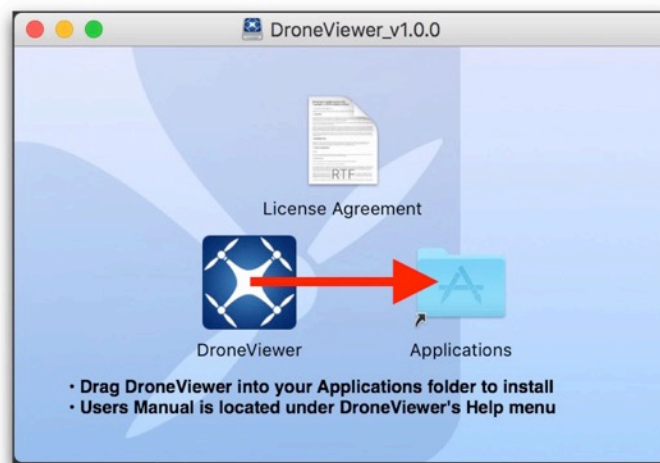
¹ K-Lite Codec Pack URL is http://www.codecguide.com/download_k-lite_codec_pack_basic.htm

INSTALLATION GUIDE

Installing DroneViewer takes just a few simple steps:

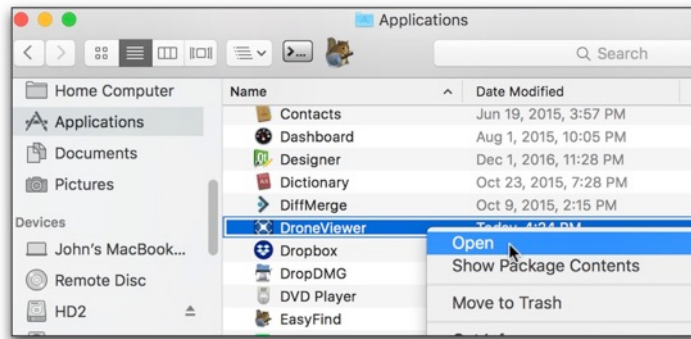
INSTALLING *DRONEVIEWER* ON MACINTOSH

1. Double-click on the .dmg file to mount the DroneViewer disk image in the Finder. You should now see the DroneViewer window in the Finder.



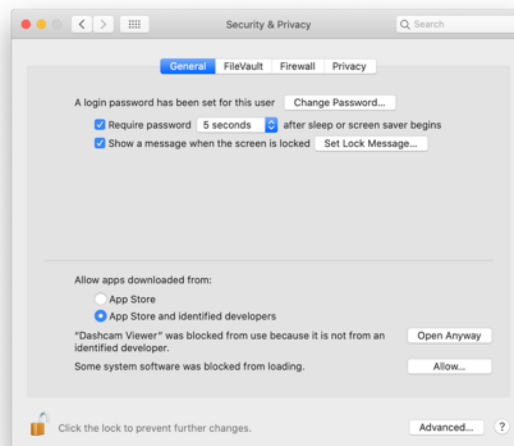
The contents of the DroneViewer .dmg file after mounting in the Finder.

2. Drag **DroneViewer** on to of the **Applications** folder shortcut. This will copy DroneViewer to your Applications Directory.
3. Open your Applications directory and locate the DroneViewer icon. Do not double-click on the DroneViewer icon. Instead, right-click on the icon and select **Open**.



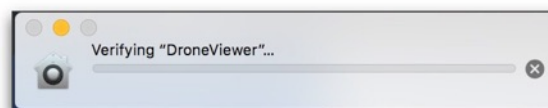
Open DroneViewer by right-clicking on its icon.

4. If you are running macOS Catalina and you see a message indicating “DroneViewer can’t be opened because Apple cannot check it for malicious software”, go to your Security & Privacy system preferences and select **Open Anyway**.



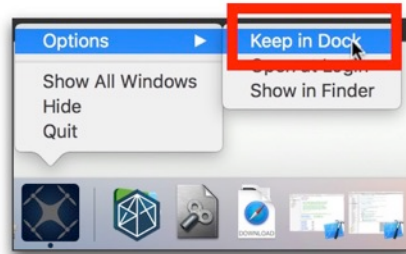
*In macOS Catalina, select **Open Anyway** to run DroneViewer the first time.*

1. The first time you run DroneViewer, the macOS may display the “Verifying...” window for a minute or so. This is normal. Please be patient!



The first time you run DroneViewer, macOS ‘verifies’ it. This may take a minute or so.

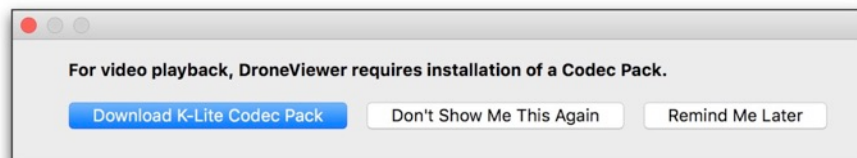
2. All done! The next time you run DroneViewer it should start-up immediately. To keep DroneViewer in the Dock, right-click its icon in the Dock and choose “**Keep in Dock**”.



Right-click on the DroneViewer icon in the Dock to keep there.

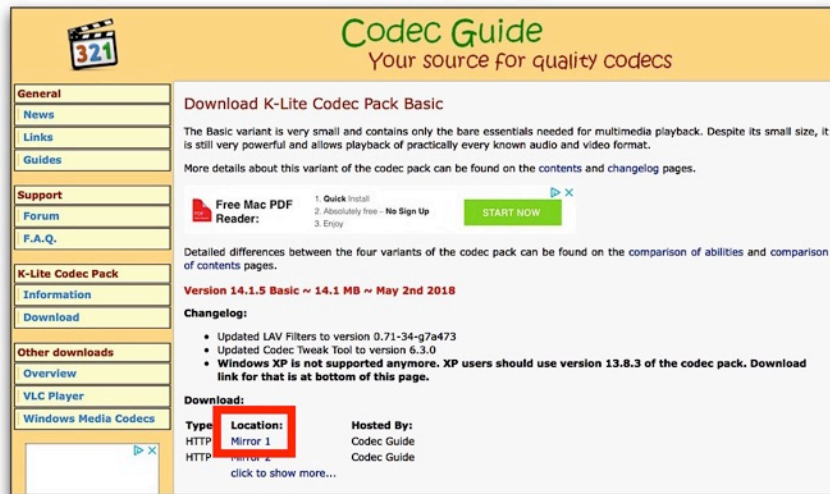
INSTALLING DRONEVIEWER ON WINDOWS

1. After downloading, run the setup.exe installer. Follow the prompts to complete the installation. Upon completion you should see a **DroneViewer** icon on your Desktop.
2. The first time you run DroneViewer, you will be prompted to install the **K-Lite Codec Pack Basic**. This is a free install that includes the codecs DroneViewer requires to play the various multimedia formats.



Click on the “Download K-Lite Codec Pack” button to be directed to the Codec Guide website.

3. Click on the ‘**Mirror 1**’ link to download the Pack and follow the installation instructions.

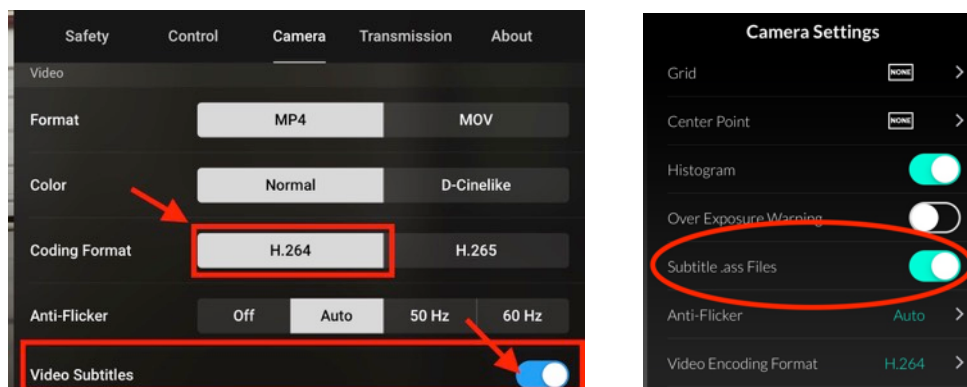


Click the Mirror 1 or Mirror 2 link to download the codec pack installer.

4. Quit and re-run DroneViewer to take advantage of the codec pack. Click the “Don’t Show Me This Again” button to dismiss the reminder.

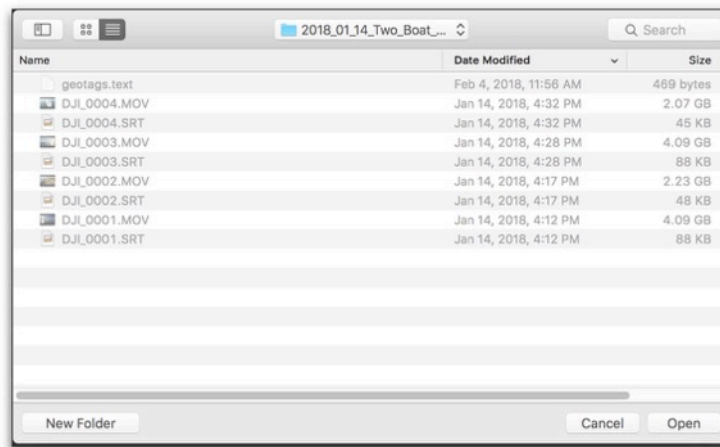
QUICK START GUIDE

1. **Before you fly:** if you’re using a DJI or Autel drone, go into the *DJI Go* App, *DJI Fly* App, or *AutelExplorer* App and **turn on the Video Subtitles** feature. Without this feature on, the drone will not store the drone’s trajectory data to an external file (SRT or ASS file) and DroneViewer won’t work properly.



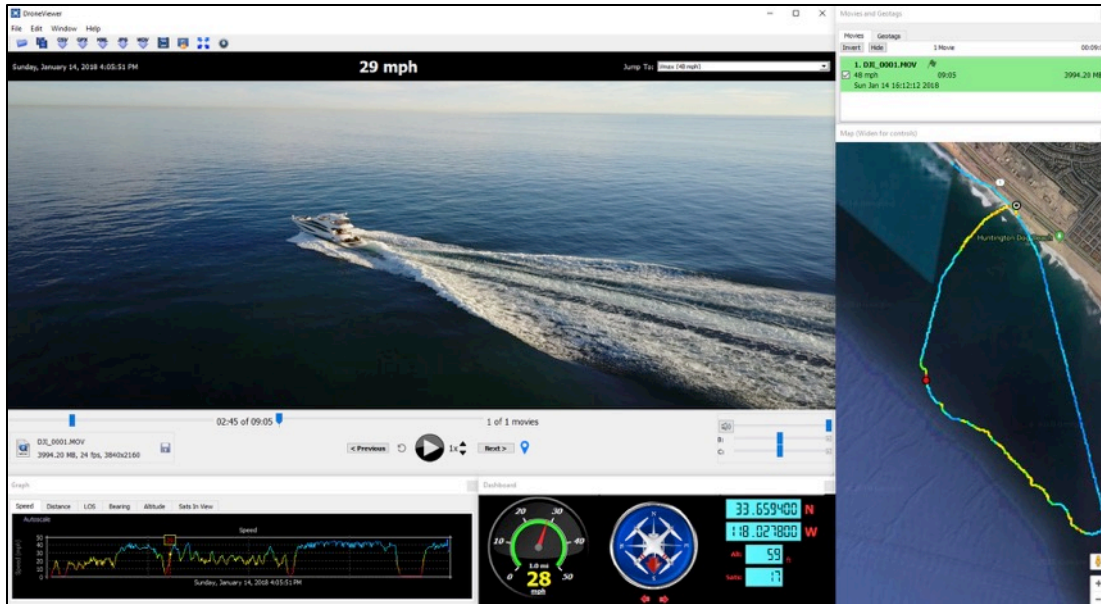
Be sure to enable Video Subtitles in your DJI Go, DJI Fly (left), or AutelExplorer app (right) before you fly. Also, use H.264 encoding for the video instead of H.265 or HEVC

2. If your drone offers the choice of H.264, H.265 (HEVC) video encoding **always select H.264**. H.265 is not supported on all platforms yet and may not play in DroneViewer.
3. You are ready to fly!
4. After your flight, run DroneViewer and load your drone or GoPro video files. For ASS, GPX, SRT and Flytrex CSV sources, DroneViewer will look in the movie file directory for GPS data. In order for DroneViewer to associate the movies with the correct data files, the data files must have the same base name as the movie files. For example, DroneViewer would expect to find the file *DJI_0007.GPX*, *DJI_0007.SRT* or *DJI_0007.CSV* if the movie *DJI_0007.MP4* was loaded. You can load them in three ways:
 - a. Select the *Open Movie Folder...* option from the menu or toolbar. Navigate to your SD card's movie folder. Click the Choose button.



Choosing the movie folder on the Mac. On Windows, you would not see the movie files listed in the browser—you would only see folders listed.

- b. Drag and drop your SD card's movie folder or individual movie files into a gray area of the DroneViewer's main window.
 - c. Select the *Open Movie Files...* from the menu or toolbar. Navigate to your movie folder and select the individual movie files you want to play.
5. **That's it!** DroneViewer will begin playing the first movie in the folder or in the list of movies that was selected. By default files are loaded according to file modification date (this can be changed to *name ordering* in the Preferences). When DroneViewer reaches the end of the movie it will jump to the next movie in the list and continue playing. It will do this until all movies have been played. Keep reading to learn more about DroneViewer's features and options.



DroneViewer running under Windows 10

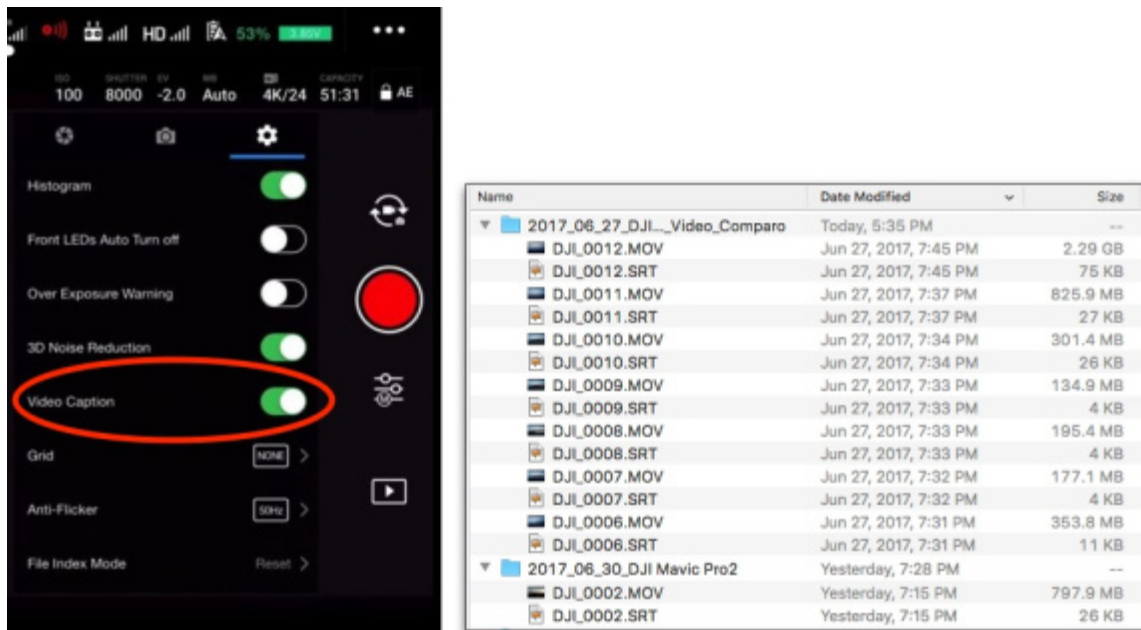
DETAILED START-UP GUIDE

The following is a step-by-step guide for using DroneViewer.

1. Before you start, make sure your drone or GoPro HERO's internal clock is set to the correct time zone for your area. DroneViewer relies on the file creation timestamps to sync the movie to the GPS data so this setting is important. If your camera's time zone has not been set correctly or if you are viewing videos and GPS data from someone outside your time zone, the time bias can be compensated for. See the Preferences and FAQ sections below on time zone biasing.
2. On the Autel, Phantom 3, Phantom 4 series, and Mavic Pro series be sure that you have **Video Captions turned on** in the AutelExplorer, DJI Go App, or DJI Fly App. This feature makes the drone store trajectory data that DroneViewer needs. Also, **be sure to record in H.264 video format**. H.265 (HEVC) playback may not work on all computers with DroneViewer.
3. For best performance, copy the contents of your drone's SD card to your computer's hard drive. Alternatively, if your Mac or PC has a built-in SD card slot, insert your SD card directly into your computer. As a fallback you can insert your drone's SD card into a USB card reader attached to your Mac or PC, but this may result in video stuttering or poor performance if your USB bus is not fast enough.

IMPORTING DRONE FLIGHT DATA FROM A DJI SRT FILES

If your DJI drone is controlled by the *DJI Go 4 App* (used to fly the Mavic Pro, Phantom 4) or the *DJI Fly App* (Mavi Air 2, Mavic Mini), then you can easily import your flight trajectory into DroneViewer. **Before your flight, be sure you turn on the Video Caption** option in the App's camera settings.



Turn on “Video Caption” in your DJI Go App or DJI Fly App settings to have your UAV create SRT files alongside your movie files. Note that the Mavic Mini and some Phantom 4 Pro models do not create a separate SRT file. Instead, they embed the SRT data into the video file itself.

This will make the drone create trajectory data for each video file. The SRT file contains the flight trajectory information. If you have a DJI Mavic Mini or Phantom 4 Pro v2.0, the SRT data is embedded in the movie file itself. If your DJI drone creates the SRT data in a separate file, make sure the SRT file is in the same directory as your movie and has the same root name.

Drag one of your movies into the DroneViewer window or select *Open Movie File* from the File menu. DroneViewer will process the data and you’ll see your drone’s flight path and current position as the movie plays. The speed and number of satellites-in-view are also shown in the Graphs.

A few caveats when working with SRT files:

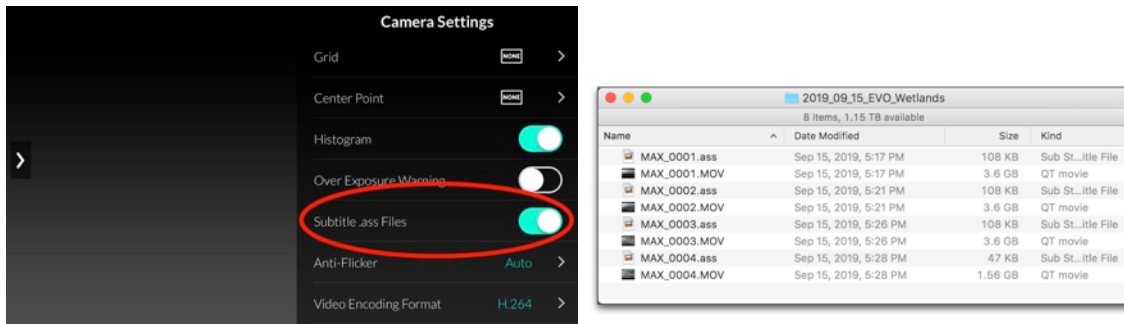
- If you rename the movie, be sure to rename the SRT file as well or else DroneViewer will not be able to find it.
- The speed of the drone is computed based on waypoints. While it’s great that DJI conveniently logs the drone’s flight data into an SRT file, the speed of the drone is not recorded to the file and the latitude and longitude are not stored in high precision. DroneViewer uses the time-stamped lat/lon values to estimate the

speed. The lack of precision means the drone speed and direction can be inaccurate and appear to vary wildly. DroneViewer applies a smoothing function to dampen the speed variations. While this helps, it's not a perfect solution. Ideally, DJI would modify their SRT file data to include native drone speed and higher-precision latitude and longitude. (There are other ways to extract the flight data to higher-precision but they are not as convenient as the SRT file method).

- DJI continues to tweak Mavic 2 Pro SRT file format. The latest version of firmware as of this writing (v01.00.0200, DJI Go 4.3.8) contains latitude and longitude data and will work with DroneViewer. Unfortunately, no altitude data is provided. Hopefully this will change in subsequent firmware updates. SRT files produced by earlier firmware do not contain any latitude and longitude information and therefore will not work with DroneViewer. Please be sure you are running at least FW v01.00.0200 on your Mavic 2 Pro. **UPDATE:** Mavic 2 Pro firmware v01.00.0510 or higher now adds altitude data to the SRT file.

IMPORTING DRONE FLIGHT DATA FROM AUTEL DRONES

If your Autel drone is controlled by the *AutelExplorer App* then you can easily import your flight trajectory into DroneViewer. Before your flight, be sure you turn on the **Subtitle .ass Files** option in the *AutelExplorer App* camera settings.



Turn on “Subtitle .ass Files” setting in your *AutelExplorer App* settings to have your UAV store flight trajectory data in the video itself (EVO 2) or in a separate ASS file (EVO, X-Star Premium)

On the EVO and X-Star Premium, this will make the drone create an ASS file for each movie. The ASS file contains the flight trajectory information. Make sure the ASS file is in the same directory as your movie and has the same root name.

On the EVO 2, the flight trajectory data is embedded in the video itself so no separate ASS file is created.

Drag one of your videos into the DroneViewer window or select *Open Movie File* from the File menu. DroneViewer will process the data and you'll see your drone's flight path and current position as the movie plays. The speed, distance, and altitude are also shown in the Graphs.

A few caveats when working with ASS files:

- *[EVO, X-Star Premium]* If you rename the movie, be sure to rename the ASS file as well or else DroneViewer will not be able to find it.
- The speed of the drone is computed based on waypoints. While it's great that Autel conveniently logs the drone's flight data into an ASS file, the speed of the drone is not recorded to the file and (as of EVO firmware 1.4.9) the latitude and longitude are not stored in high precision *[EVO, X-Star Premium]*. DroneViewer uses the time-stamped lat/lon values to estimate the speed. The lack of precision means the drone speed and direction can be inaccurate and appear to vary wildly. DroneViewer applies a smoothing function to dampen the speed variations. While this helps, it's not a perfect solution. Ideally, Autel would modify their ASS file data to include native drone speed and higher-precision latitude and longitude.
- Autel stores altitude relative to the standard WGS84 ellipsoid. Thus raw altitude values may appear as negative values even though the drone is above the earth's surface. DroneViewer allows you to correct for this in a number of ways. For example, select the "Geoid" option in the Preferences to have DroneViewer convert the WGS84 altitude to Mean Sea Level altitude. You can also select the "relative to first point" option to have DroneViewer display the altitude relative to the first data point loaded.
- *[EVO, X-Star Premium]* The ASS files produced by EVO firmware v1.4.9 (which say v4.00+ at the top of the file) contain syntactic errors in the longitude position. Autel has been notified of this error and hopefully it will be rectified soon. In the mean time, DroneViewer applies workaround for this bug so your drone's stated location should be correct. When the longitude is eventually fixed, DroneViewer should work with the corrected format as well.

IMPORTING GPS DATA FROM GPS-ENABLED GOPRO HERO CAMERAS

To load the GPS data embedded in GoPro HERO5, HERO6, and HERO7 Black video files, simply select your file(s) from the File->Open menu or drag the files onto DroneViewer. The data will be located, processed, and displayed. Note that the HERO cameras store altitude data relative to the WGS84 ellipsoid. This is different than Mean Sea Level and can result in negative altitudes for activities that actually occur on the Earth's surface. DroneViewer solves this problem by applying a Mean Sea Level (MSL) correction (known as a geoid undulation) to the HERO altitude data. If you do not want DroneViewer to apply the MSL correction, remove or rename the "egm96-15.pgm" located in DroneViewer's "geoid" directory (Windows) or in the DroneViewer.app/Contents/Resources/geoid directory (Mac).

The unregistered version of DroneViewer will display GPS data for the first 30 seconds of each video loaded. The registered and Pro versions will show GPS data for up to 66 minutes of GPS track per movie.



GoPro HERO5 Black video showing embedded GPS trajectory data DroneViewer Pro. The airplane pilot used the GoPro to both videotape and track his flight. [Note: UTC timezone, not PDT]

DroneViewer uses GPMF_Parser and GeographicLib, both under the [MIT License](#).

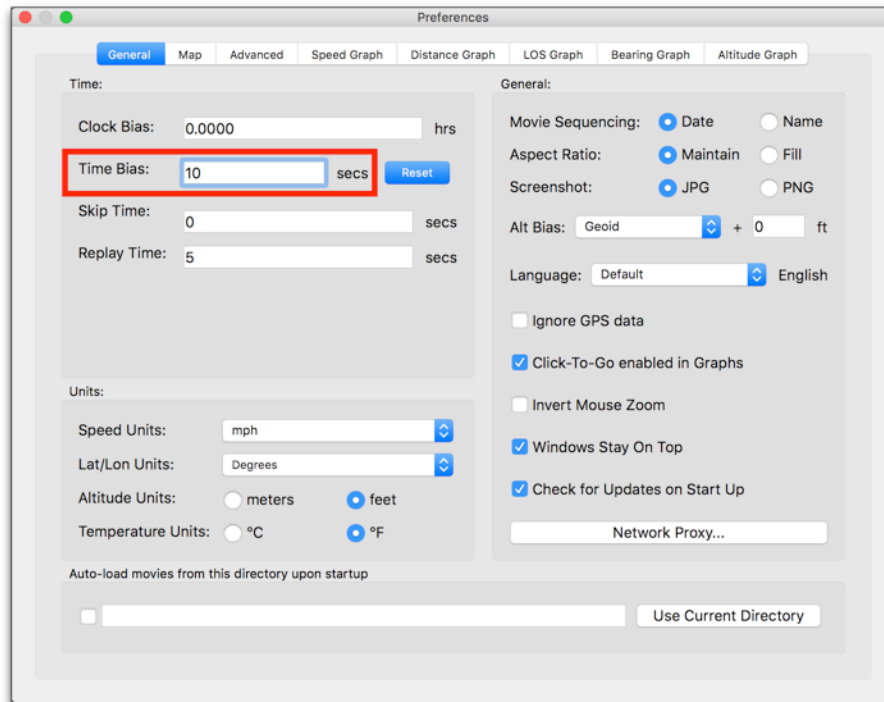
IMPORTING DRONE FLIGHT DATA FROM A GPX FILE

GPX is an XML-based navigational data exchange format consisting of tracks and waypoints. An example of a very short GPX file is shown below. This sample has one track consisting of 2 waypoints:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<gpx xmlns="http://www.topografix.com/GPX/1/1" version="1.1"
creator="DroneViewer Pro">
  <metadata>
    <name>Produced by DroneViewer Pro version 1.2.2</name>
  </metadata>
  <trk>
    <name>Track Start Time: 2019-09-21T16:45:35Z</name>
    <trkseg>
      <trkpt lat="44.6179330" lon="1.1762430">
        <ele>274.3</ele>
        <time>2019-09-21T16:45:35Z</time>
        <speed>0.0</speed>
      </trkpt>
      <trkpt lat="44.6179330" lon="1.1762430">
        <ele>274.2</ele>
        <time>2019-09-21T16:45:36Z</time>
        <speed>0.0</speed>
      </trkpt>
    </trkseg>
  </trk>
</gpx>
```

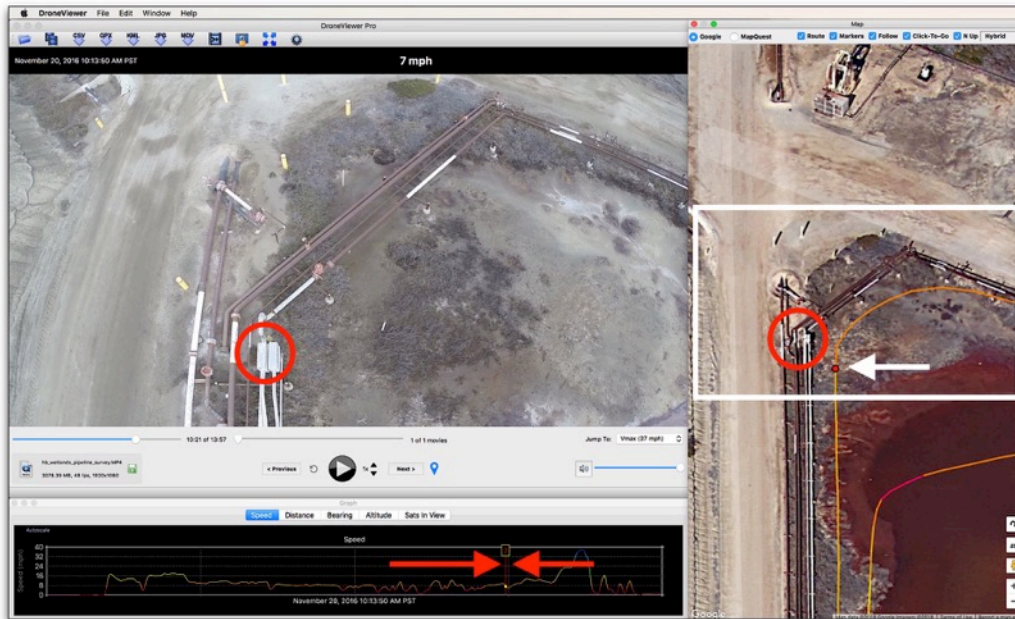
To load a GPX file into DroneViewer, you must give it a filename with the same base name as the movie it is associated with. For example, to load GPX data for a movie named *DJI_0007.MOV*, you must name the GPX file *DJI_0007.GPX*.

If there is a timing synchronization difference between the movie and the GPX file, you can compensate for this by adjusting the *Time Bias* in the Preferences after loading the movie/GPX file.



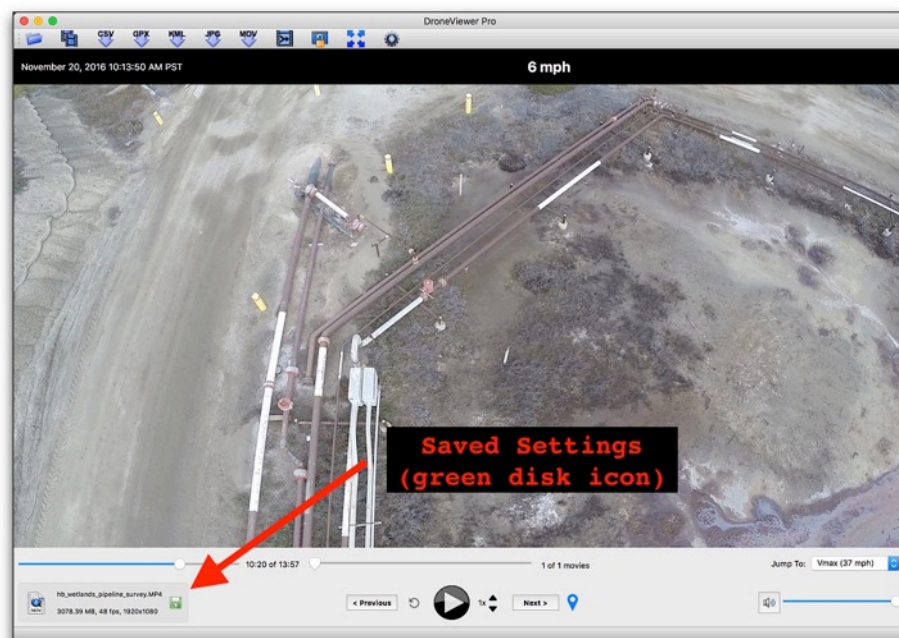
Enter a Time Bias to correct for video/GPX synchronization issues.

An easier way to make the Time Bias adjustment is to use the “,” and “.” keys when the Graph window is selected. These keys will adjust the Time Bias by -1 or +1 seconds. For coarser adjustments, the “m” and “/” keys will move the Time Bias by -10 and +10 seconds.



Adjust timeline using 'm', ',', '.', and '/' keys **when the Graph view is selected**. Use keypoints in the video and map to help with precise alignment.

When you are happy with the synchronization, click the Save Settings button, which looks like a disk icon in the Main window. The icon will turn green to indicate the settings, including the synchronization, have been saved.



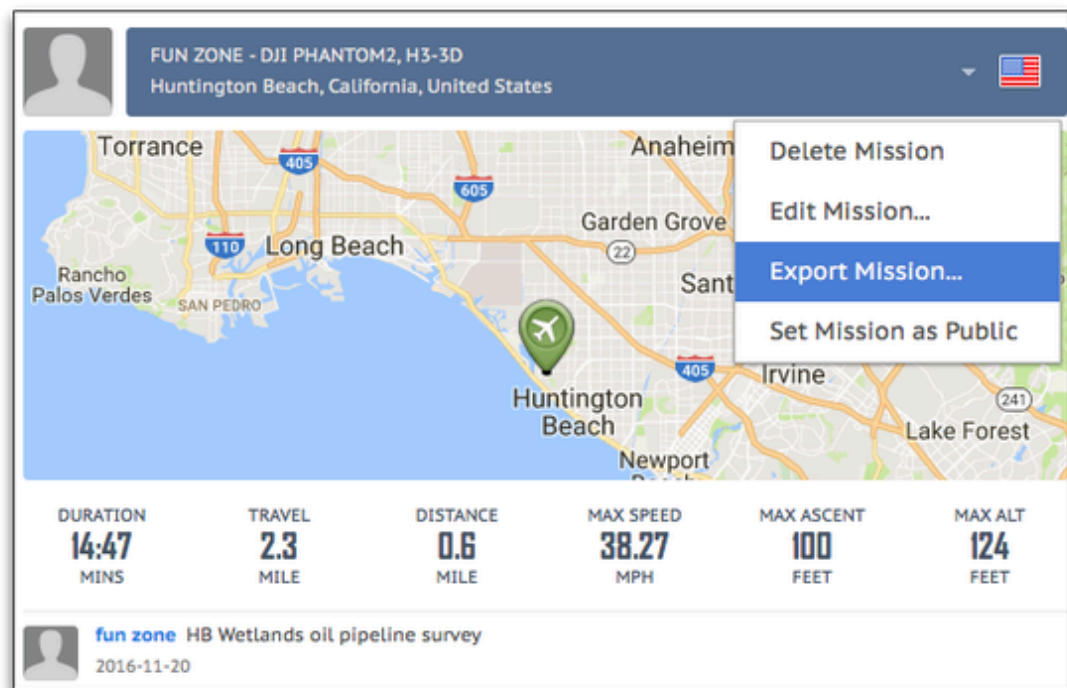
Saving the timeline settings

A settings file will be created in the same directory as the movie file. This file is automatically loaded every time you load this movie. If you're not happy with the synchronization, click the disk icon again to delete the settings file. Then you can try again.

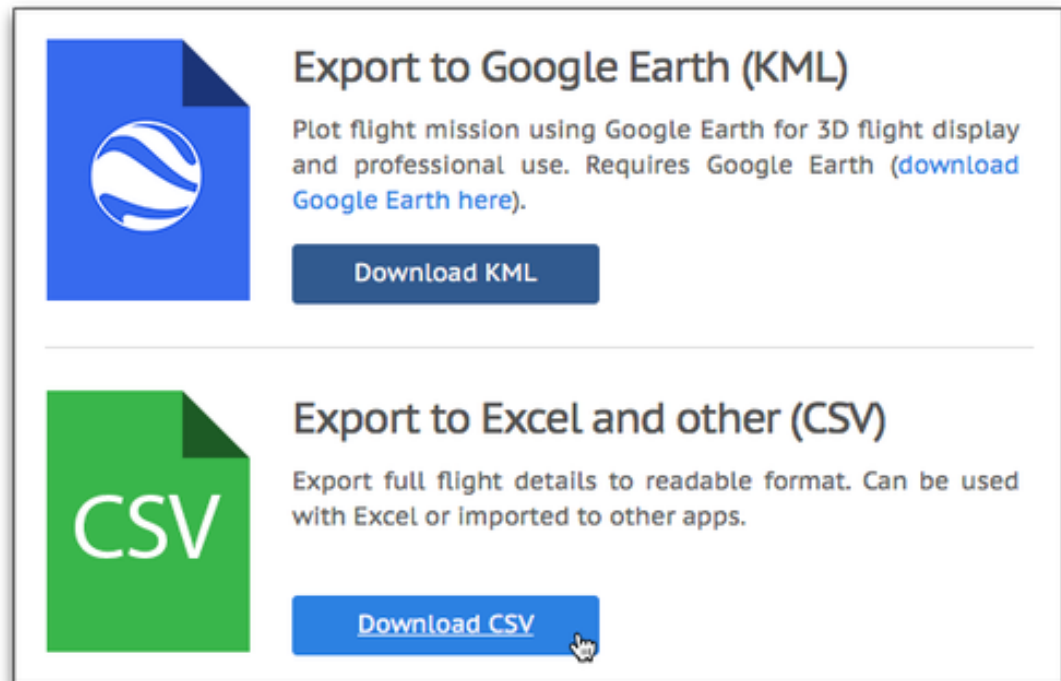
IMPORTING DRONE FLIGHT DATA FROM A FLYTREX CORE 2 CSV FILE

[FlyTrex](#) provides simple add-on logger that records your drone's flight data to a microSD card. The Core 2 is compatible with many drones but I have only tested this method with the DJI Phantom 2.

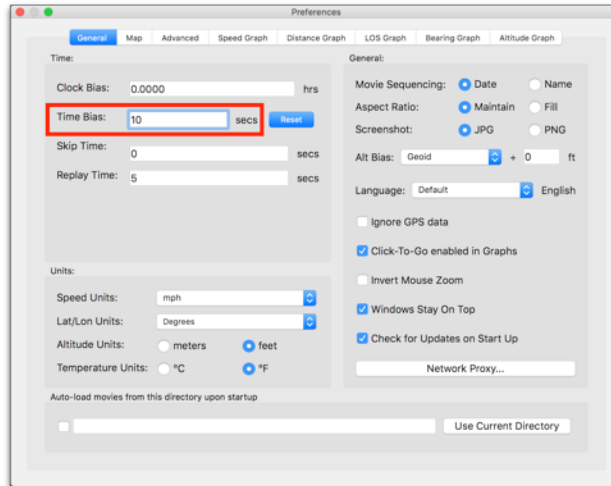
- After your flight, upload your FlyTrex Core 2 data file to the FlyTrex website. Click on the arrow at the top right of the mission and select Export Mission.



- Choose the Download CSV option to export your flight data.

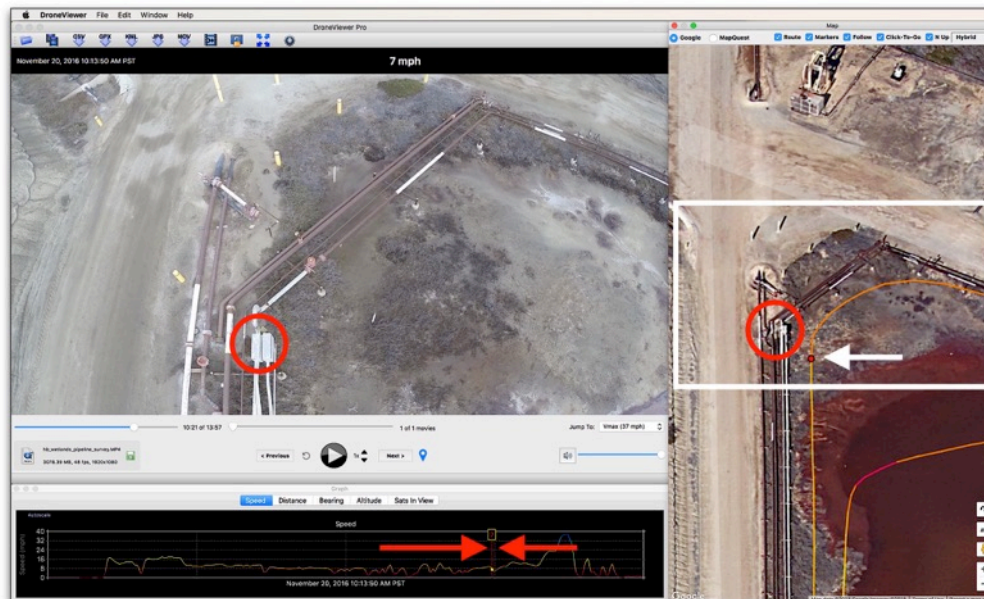


- Find the CSV file and drop it in the same folder as your flight movie. Rename the CSV file so it has the same base name as the movie file. For example, if your movie is called *oil_pipeline.mov* name the CSV file *oil_pipeline.csv*.
- When you load the movie into DroneViewer the GPS flight data will be loaded as well. Unlike the SRT method, you will need to adjust the synchronization of the GPS log to the video. This is due to the difference in time between when the video recording started and when the GPS log started. To override DroneViewer's automatic syncing feature, go into the Preferences and enter a **Time Bias** adjustment.



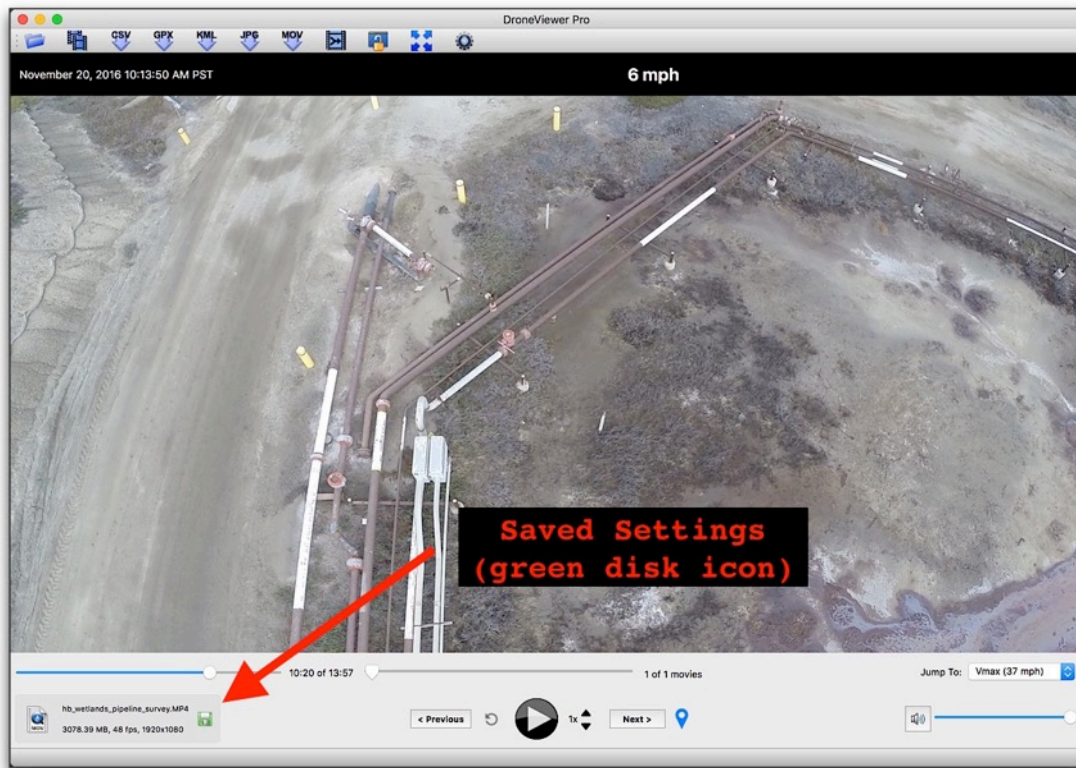
Adjust the Time Bias manually to adjust video/data synchronization.

- Close the Preferences window and click on the Graph window. Now you can use the 'm' and '/' keys to make coarse adjustments in the time-cursor position. Each click moves the cursor forward or back 10 seconds relative to the video. Use the ',' or '.' keys for fine (1-second) adjustments. Look for key points in the movie, such as take-off or landing, to insure good synchronization.



Adjust timeline using 'm', ',', '.', and '/' keys when the Graph view is selected. Use keypoints in the video and map to help with precise alignment.

- When you are happy with the synchronization, click the Save Settings button, which looks like a disk icon.

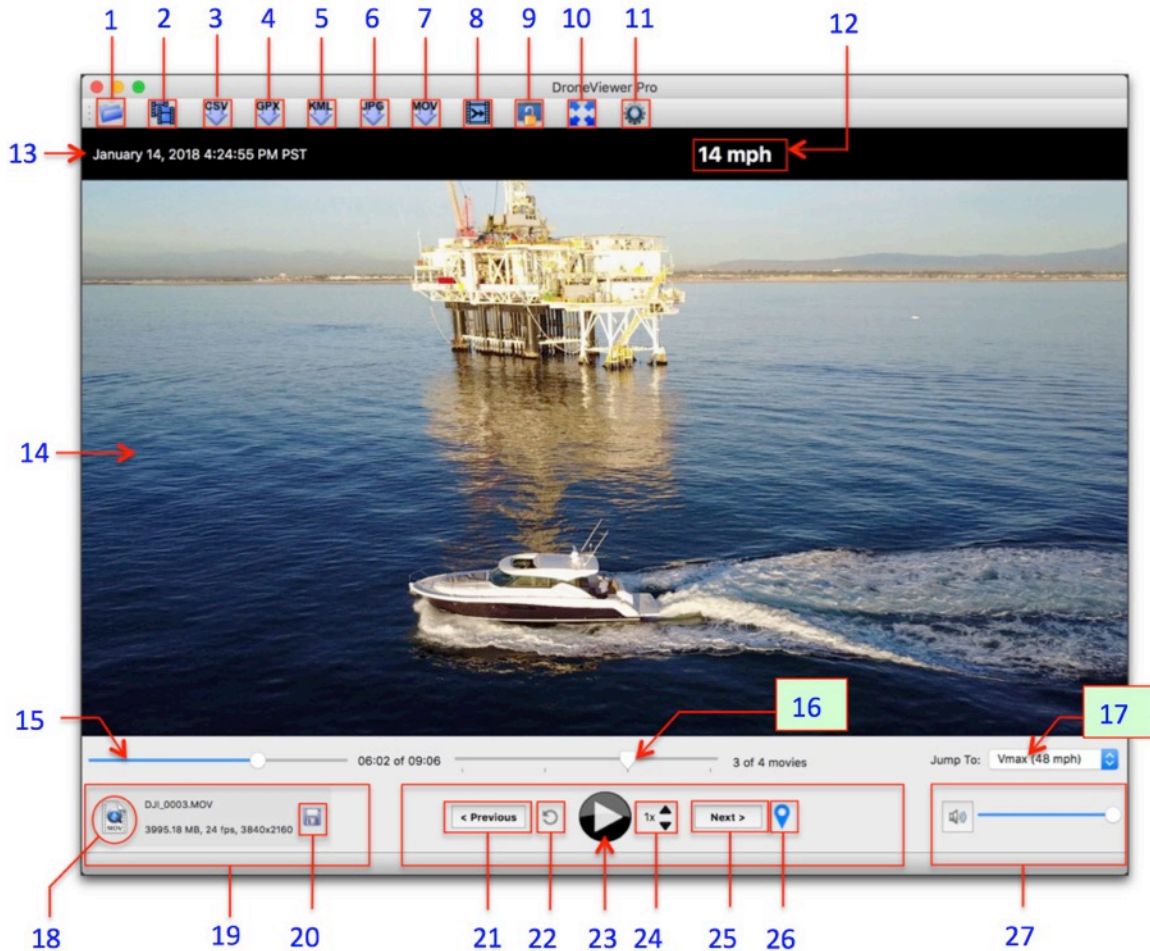


- The icon will turn green to indicate the settings, including the synchronization, have been saved. A settings file will be created in the same directory as the movie file. This file is automatically loaded every time you load this movie. If you're not happy with the synchronization, click the disk icon again to delete the settings file. Then you can try again.

FEATURES AND CONTROLS

After loading a series of movies, there are a number of features you can use. Most features are common in both Mac and Windows versions, although a few features are available only in one or the other platform.

MAIN VIEWER WINDOW



1. SELECT MOVIE FOLDER

Click this button to load a new folder of movies into DroneViewer.

Tip: You can drag a movie folder into the gray area of the window to load the movie folder.

2. SELECT MOVIE FILES

Use this button to load one or more individual movie files from a folder.

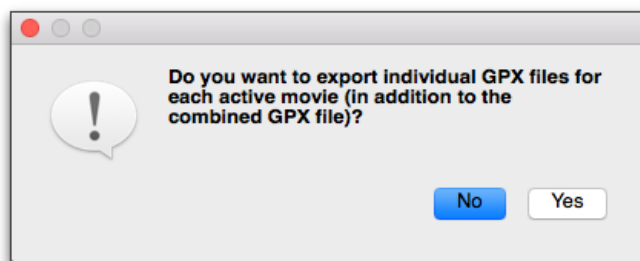
Tip: You can drag a movie files into the gray area of the window to load them.

3. EXPORT ALL GPS TRACK DATA TO CSV FILE

Select this option to export all of the GPS track data to a comma-separated-value file. You can then load this file into Excel or a text editor for further examination. Details on this feature are discussed later in the manual.

4. EXPORT GPS TRACK DATA TO GPX FILE(S)

Select this option to export your drone's navigation data to GPX files. DroneViewer will export the entire route as a single GPX file. You will also have the option to export each movie's individual GPS data to separate GPX files. The files will be named based on the movie names.



Click Yes to create individual GPX files for each movie segment, as well as a large GPX file for the entire route. Click No to create just the large GPX file for the entire route.

Since DroneViewer *reads* GPX files too, the single-file export feature can be used to load the GPS data back *into* DroneViewer. Since GPX files placed inside the movie directory are loaded ahead of the embedded GPS data in the movie, you can use this method to 'override' the GPS data for a given movie. This allows you to filter out bad data or insert corrected GPS information into DroneViewer.

GPX files are not just for use in DroneViewer. They are a formal data-exchange format and used by a number of software programs and [websites²](#).

5. EXPORT ALL GPS TRACK DATA TO GOOGLE EARTH KML FILE

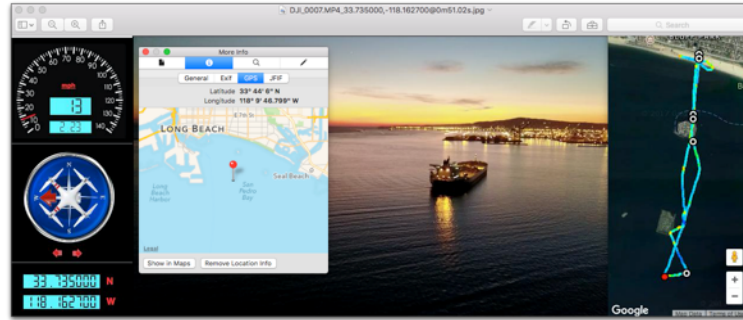
Select this option to export all of the track information to a Google Earth KML file. You can then load this file into Google Earth to see your UAV's position over time.

6. EXPORT VIEWER WINDOW TO JPG OR PNG IMAGE FILE ON DESKTOP

Click this button to take a screenshot of the main window. The image file will be written to the desktop with the movie filename, latitude, longitude, and time-of-movie embedded in the filename. For example, "DJI_0007.MOV_33.639860,-117.973782@0m1.25s.png".

If you select JPG (in the Preferences), the latitude and longitude will be written into the EXIF block of the JPG.

² Example: <http://gpsvisualizer.com>



Your drone's position is embedded in the EXIF section of the JPG image (Mac version).

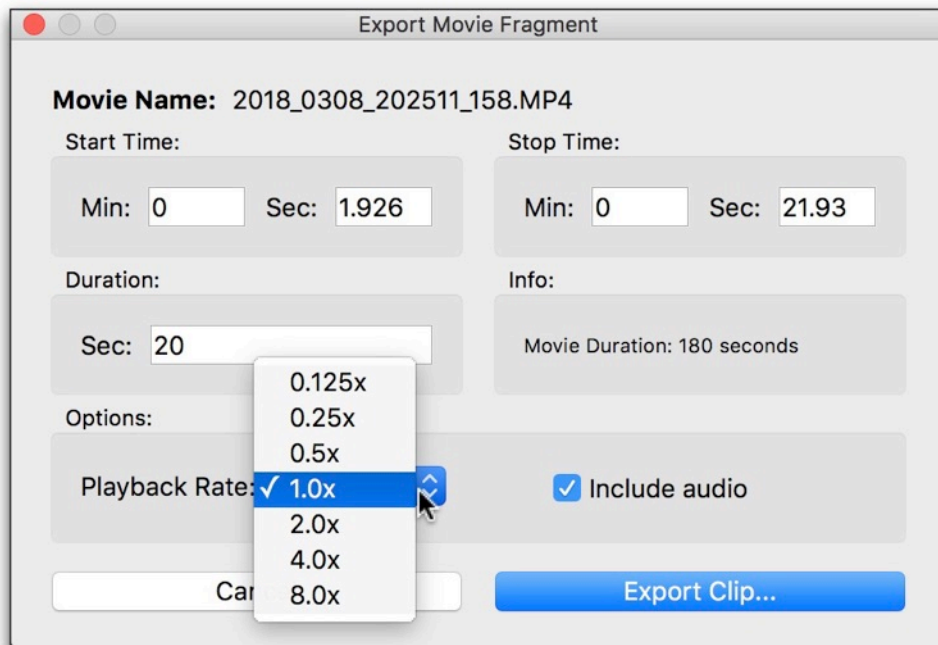
Image viewer applications that are EXIF-savvy, like Preview on the Mac, will automatically display the drone's position in a map.

Currently the EXIF feature is only available on the Mac version.

7. EXPORT A PORTION OF THE CURRENT MOVIE TO A SEPARATE MOVIE FILE.

Use this feature to export a fragment of a movie to a separate movie file. When you click this button you will be asked to enter the start time, duration, and/or stop time for the movie fragment. You will also have the option to exclude the audio track and change the playback rate. Slowing-down the playback rate will produce a slow-motion effect useful for isolating short events, like a collision. *Important:* When experimenting with playback rate, be sure to use the **GPL** version of ffmpeg. DroneViewer ships with the LGPL version. The GPL version has a much better default encoder and will produce superior video quality. The process for obtaining and installing the GPL version is listed in the FAQ section.

By default, the start time is the current point in the movie. You cannot extend the duration beyond the end of the current clip. Note that the GPS data will not be preserved.



After clicking the Export Movie button you enter the start time and duration for the new movie.

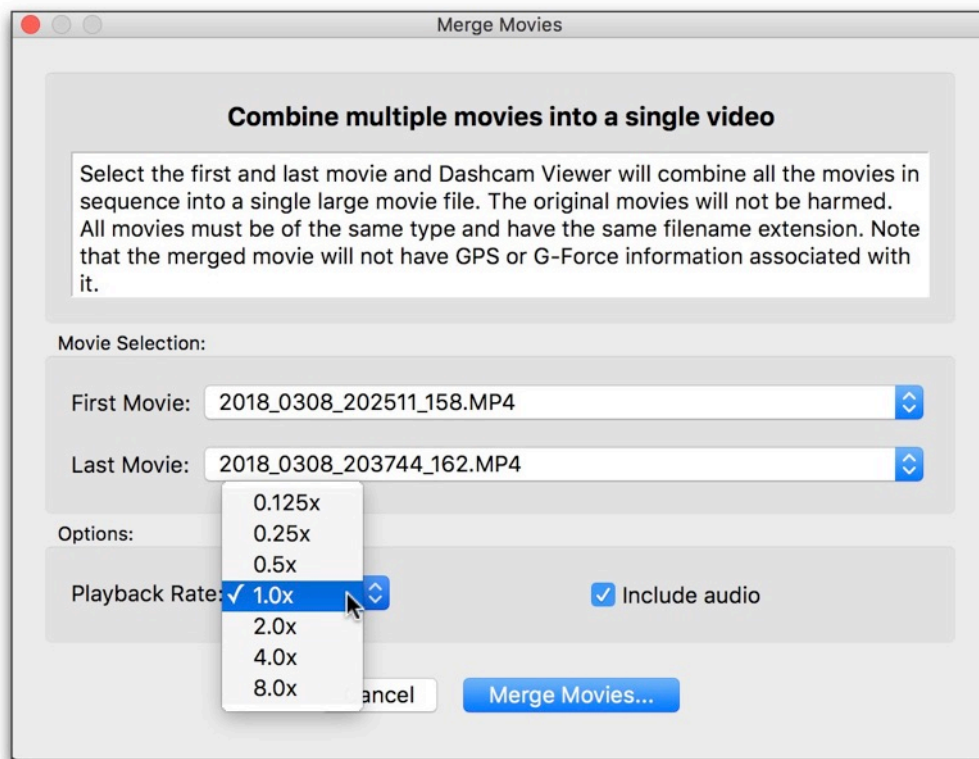
Note that the trial version of DroneViewer is limited to no more than 5-second clips.

8. MERGE MULTIPLE MOVIES INTO A SINGLE LARGE VIDEO

By clicking the Merge button you can combine multiple movies into a single large movie file. In addition, DroneViewer will create a GPX file containing the GPS data from the selected movies. Since the GPX file will have the same base name as the combined movie file, you can load the movie file back into DroneViewer and the GPX file will be detected and loaded as well. This can be useful for consolidating or organizing routes.

Additional options include the removal of the audio track and adjustment of the playback rate. If you choose a playback rate other than 1x, DroneViewer will create a second combination movie that plays back at the desired rate. Choosing accelerated playback rates is useful for condensing long flights into short vignettes.

Important: When experimenting with playback rate, be sure to use the GPL version of ffmpeg. DroneViewer ships with the LGPL version. The GPL version has a much better default encoder and will produce superior video quality. The process for obtaining and installing the GPL version is listed in the FAQ section.

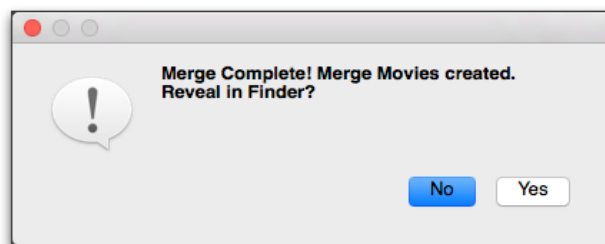


Merge Movies window

Select the first movie and the last movie. Only movies that are *enabled* in the Control Center Window will be available for merging. Movies that are disabled will not be a part of the merged movie, nor will their GPS data be exported.

Click the **Merge Movies...** button and enter the destination for the combined movie.

DroneViewer will use ffmpeg to combine all the movies between your first and last selections into a single large movie. There will be no loss in video quality so make sure your movie destination has enough space to hold the entire merged video. Also, make sure there are no quotes or commas in the source movie files' path. Upon completion the following window will appear:



All done!

Click **Yes** to go see your movie file and GPX file. Note that in the free version of DroneViewer does not support merging movies.

9. SYNC WINDOW MOVEMENT

If this option is toggled ON, all the windows will move together if any one of them is moved. If the option is OFF, then the windows can be repositioned independently. The idea is to first position the windows independently the way you like, then “lock” them into position by toggling this option on.

10. RE-CENTER MOVIE(S)

This option re-centers the movie in the window. This is useful if you had previously zoomed or panned the movie and now want to return to the nominal state.

Tip: On the PC version, clicking this button may clear the “black screen” issue seen sometimes when animation is paused.

11. MODIFY PREFERENCES

This toolbar button opens the Preferences window. See the section on the Preferences Window for more details.

12. CURRENT SPEED

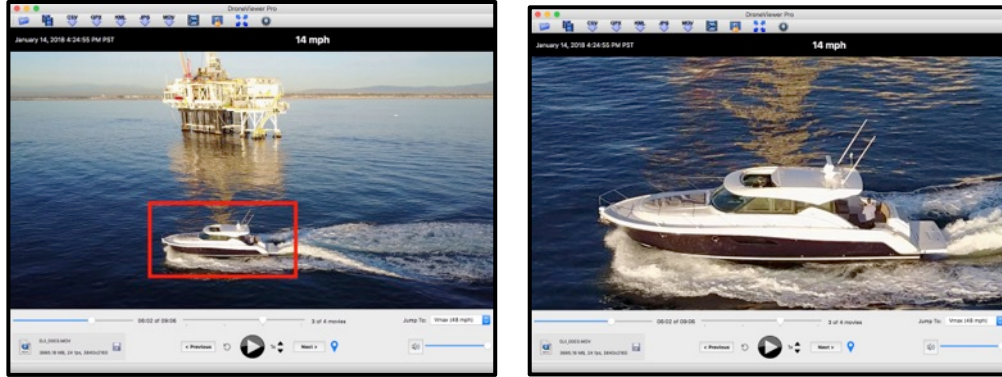
The current drone speed is displayed in the top-center of the Main Window. The units of speed can be changed in the *Preferences*.

13. CURRENT DATE/TIME

The date and time are shown in the top-left of the Main Window. DV uses the modification date of the movie to determine the time since GPS data may not be available at all times. Sometimes the modification date/time of a movie can change if the file is copied. Use the Clock Bias setting to compensate for this.

14. MAIN WINDOW

The Main Window displays the drone movies in sequence. You can translate and zoom the movie while it is playing as shown below.



Use the mouse to translate and zoom into the movie.

- Zoom in/out of the movie using the mouse wheel (or “q” and “e” keys).
- Pan the movie by click-dragging it in the Main Window.
- Re-center toolbar button to reset the zoom/translation settings

15.CURRENT MOVIE SCRUBBER

This slider bar is used to scrub through the currently playing movie. The graphs, map, and dashboard displays dynamically update as the movie is scrubbed.

16.MOVIE FILE SELECTOR

This slider allows you to jump to a specific movie in the sequence.

17.JUMP TO PULLDOWN MENU

Use this menu to instantly jump to a specific movie, or to jump to the fastest point in the movie sequence. The list shows the movie filename, start date, and duration.

18.REVEAL BUTTON

Click this button to reveal the current movie file in the Finder (Mac) or Explorer (Windows).

19.CURRENT MOVIE FILENAME, FILE SIZE, AND FRAME RATE

This box displays the current movie filename, file size, dimensions, and frame rate.

20.SAVE OR DELETE SETTINGS

This feature was specifically designed for situations where the camera and GPS data logger are separate units, like a GoPro Hero/Flytrex Core 2 combo (this feature is also useful when using a GPX file as a trajectory data source). In these cases, the adjustments you make to the clock settings to synchronize the GPS data and the movie action are preserved to a file and automatically restored when the movie is reloaded.

SAVE SETTINGS FEATURE EXPLAINED IN DETAIL:

If the *Save Settings* button is clicked, then whenever this movie is played the settings that were saved will be recalled and used. This is useful when playing a deck of movies that have widely varying speed ranges, altitude ranges, or time offsets and the user would like to sync and customize playback for each movie independently.

For example, when using DroneViewer to playback GoPro videos captured with a Phantom 2 and Flytrex Core GPS logger, the sync between the movie start and the GPS start will vary depending on when the pilot turned on the Phantom and GoPro. By using the m , . / keys (see Shortcuts), the timezone offset can be changed interactively so the Graph's time cursor position matches exactly what's playing in the movie viewer. Clicking the Save Settings will preserve this time offset so it need not be entered manually every time the movie is played.

Settings remain in effect until the next settings file is detected. You can specify default settings for movies that do not have specific a settings file. To do this run DroneViewer (but do not load any movies), adjust your settings via the Preferences or shortcuts, and then click the blue disk icon button ("Save Default Settings").

If the "Save Settings" disk icon is green, then a settings file for this movie has been detected and is being used. If the "Save Settings" disk icon is blue, then there are no specific settings for this movie. In that case the current settings will be used unless a default settings file was created. Note that if using the Settings feature to adjust movie syncing with GPS data, you should **deselect** the *Auto Fix Timezone Offset checkbox* in the Preferences window before saving the settings. Failure to do so will make DroneViewer ignore your custom timezone offset values, which are used for movie/GPS syncing. To delete a settings file simply click the green disk icon one more time.

Note: The Settings feature is an advanced capability and will generally not be necessary for SRT files. This is because SRT data files are automatically synchronized to the movie file.

21.PLAY PREVIOUS MOVIE

Use these buttons to jump back 1 movie in the sequence.

22.INSTANT REPLAY

Click this button to quickly replay the last few seconds of the movie. This is useful to review key events, such as a collision. The replay time can be set in the Preferences.

23.PLAY/PAUSE MOVIE

Toggle the play/pause button to start/stop the movie(s).

24.INCREASE/DECREASE PLAYBACK RATE

Increase or decrease the movie playback rate. On the Mac version, playback rates from ¼x to 5x are supported. On the Windows version, playback rates of 1/16x to 5x are supported. Note that some stuttering may occur if the playback rate is too fast for the computer.

25.PLAY NEXT MOVIE

Use these buttons to jump ahead 1 movie in the sequence.

26.CREATE GEOTAG

Clicking this button adds a new Geotag to the Control Center Window Geotag list. A Geotag is a bookmark that allows you to quickly jump to a particular point in the movie sequence. Geotags are shown as numbered markers in the Map Window. You can double-click on a Geotag within the Geotag list to instantly jump to that particular time in the movie sequence. The free version of DroneViewer is limited to creating 2 Geotags. See the section on the Control Center Window for more information.

27.VOLUME AND MUTE CONTROLS (WINDOWS VERSION HAS ADDITIONAL COLOR CONTROLS)

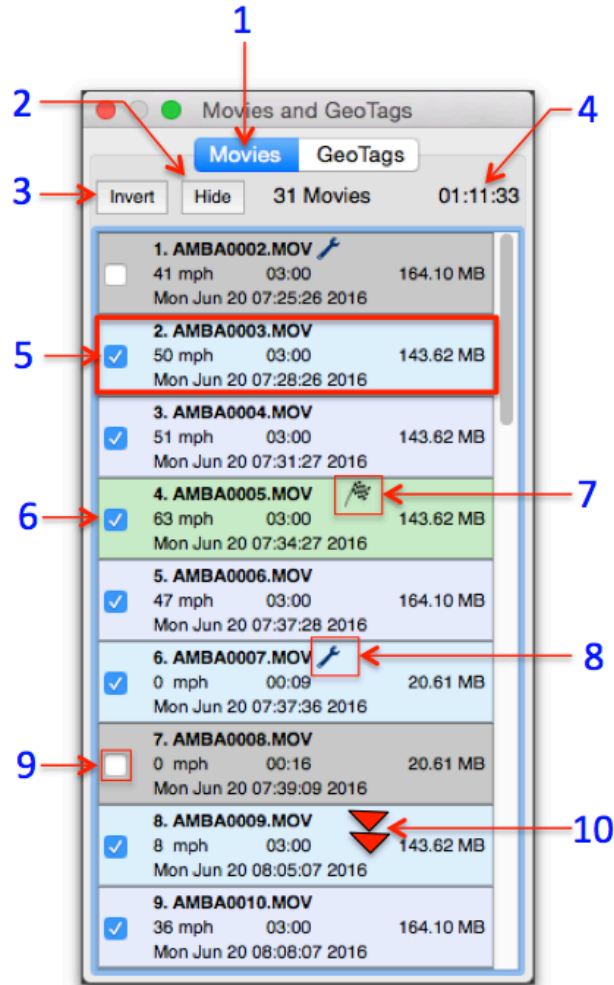
Click the speaker to mute the volume, or adjust the slider to change the volume. On the Windows version there are additional controls to adjust the brightness, and contrast.

CONTROL CENTER WINDOW


The Control Center provides instant access to your movies and geotags. The features and capabilities of each list are explained below.

MOVIES

The Movies list populates itself immediately after loading a series of drone movies. Each movie is analyzed upon loading and summary information for each movie is displayed. This information includes the filename, movie duration, file size, file start date, and maximum drone speed. The currently playing movie has a green background. Movies can be started by double-clicking a movie list item.




The Control Center's Movie List. In the list above, movies #1 and #7 are inactive and the currently playing movie is #4.

A wrench  icon to the right of the filename indicates that post-processing was performed on the movie's GPS data due to some problem with the data. Hover the mouse over the wrench icon to learn more information about the type of problem encountered. The possible problems encountered are:

- 1) Bad GPS position detected. At least one point has lat/lon of 0,0 deg.
- 2) Bad GPS time value detected in at least one point. Applying a fix.
- 3) At least one point has a speed value out of range. Applying a fix.
- 4) Found fewer GPS points than expected for this movie. Attempting workaround.
- 5) Some GPS data points out of chronological order. Applying a fix.

DroneViewer does its best to patch the problem but you may still notice data issues with these particular files.

The checkered flag  is displayed to the right of the movie filename having the fastest speed in the series.

You can remove a movie from the series by clicking off its checkbox. When you do this, its background will turn grey, it will not be double-clickable, its data will be removed from the Map and Graphs, and, if it was the high-speed movie, the checkered flag will find a new home. Click the *Hide* button to remove these inactive movies from the list. Click the *Show* button to bring these items back. The *Invert* button inverts the selection of inactive and active movies.

Features of the Movies list are itemized below:

1. [MOVIES LIST.](#)

Click this tag to toggle between the Movies and Geotags lists

2. [HIDE/SHOW BUTTON](#)

Clicking the Hide button will remove the inactive movies from the list. Click it again to reveal the inactive movies.

3. [INVERT BUTTON](#)

Invert will make the inactive movies active, and the active movies inactive.

4. [MOVIE COUNT AND DURATION](#)

The information line shows the number of active movies and their total duration.

5. [MOVIE INFORMATION](#)

Each item in the list shows the movie filename, movie duration, file size, file date, and maximum UAV speed. Note that the file date is retrieved from the file system so if the file was modified in any way the date displayed here may not correspond to the actual date/time of the recording.

6. [CURRENTLY-PLAYING MOVIE](#)

The currently playing movie has a green background. Double-click on any *active* (non-gray) movie to make it the currently playing movie.

7. [CHECKERED FLAG](#)

The checkered flag is awarded to the movie with the fastest speeds. Sorry, no prizes are given.

8. [WRENCH ICON](#)

The wrench icon appears next to movies whose GPS data needed some kind of post-processing. Hover the mouse on top of the icon to see a short explanation. Possible reasons for seeing the wrench icon include:

- 1) Bad GPS position detected. At least one point has lat/lon of 0,0 deg.
- 2) Bad GPS time value detected in at least one point. Applying a fix.
- 3) At least one point has a speed value out of range. Applying a fix.

- 4) Found fewer GPS points than expected for this movie. Attempting workaround.
- 5) Some GPS data points out of chronological order. Applying a fix.

9. ACTIVE/INACTIVE CHECKBOX


Clicking the checkbox *off* makes the movie inactive. Inactive movies are removed from the playback sequence and are shown with a gray background in the list. Their GPS data are also removed from the Map route and Graphs. Use this feature to remove uninteresting movies from the playback sequence. Click the checkbox on to make the movie active again.

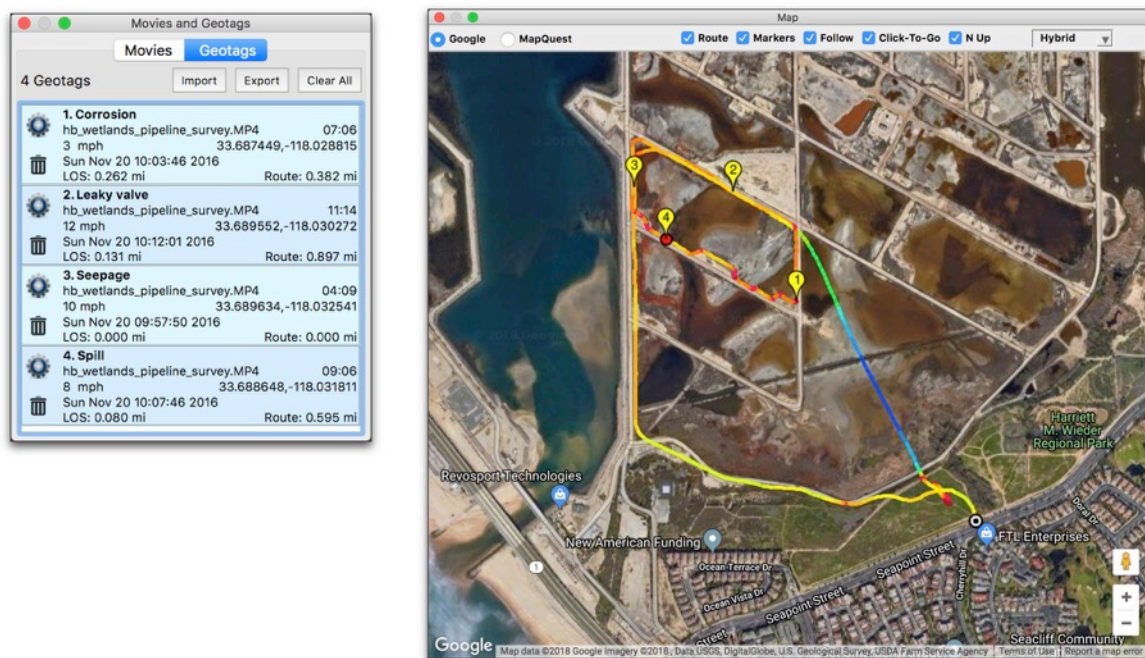
10. DOUBLE-CLICK MOVIE ITEM

You can double-click an active movie item in the list to jump to it. If playback was previously on, the movie will start playing immediately.



GEOTAGS

Geotags are key points in the movie sequence that you can highlight and return to instantly. They can represent important points in your sortie, such as the location of a well, a pipeline leak, or stranded hiker. Of course these are just examples. The use for geotags is limited only by your imagination.

To create a geotag you simply click the  icon in the Main Window at the point of interest. Alternatively you can tap the 'g' key on the keyboard. This will add an item to the Geotag list. A marker will also be added to the Map. For reference, the movie name, date/time, speed, location, and movie time will be shown in the list item.



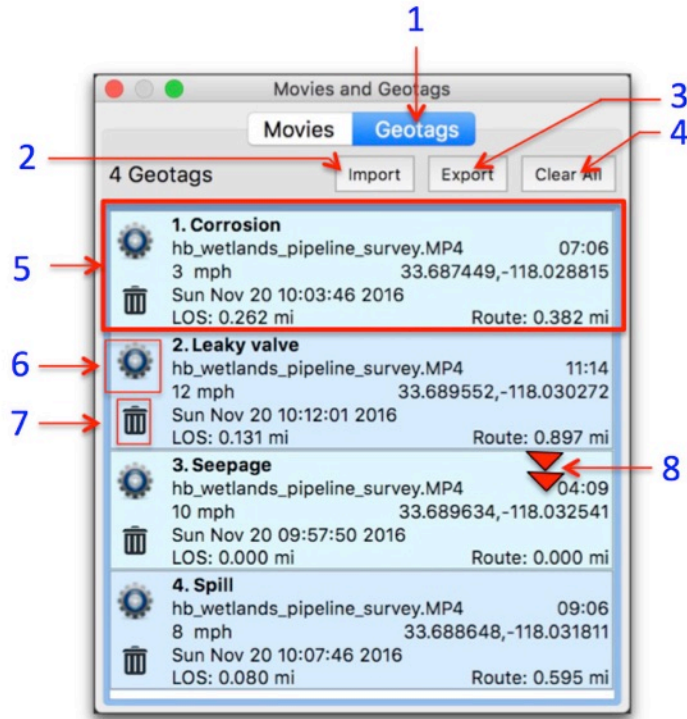
(Left) Geotag list, (Right) Geotags in the Map window. Note: Geotag names are fictional.

Double-click on a geotag in the list to jump to that point in the movie sequence. You can give each geotag a custom title by clicking on the gear  icon. To delete a geotag, click the trashcan  icon. To delete all the geotags in the list, click the *Clear All* button.

You can export your geotag data to a tab-delimited text file for external processing in Excel or another program. To do this, click the *Export* button and a .text file will be produced. You can also load the geotag .text file back into DroneViewer to see your saved geotags. **When exporting, it is important to save the geotag file to the same directory as the movie files if you want to reload it later.** Be sure to load the movies first before loading the geotag file. Geotags that refer to a movie that is not loaded will have a gray background and will not be selectable.

You can create two geotags with the free (unregistered) version of DroneViewer, up to 10 with the paid version, and 100 with the Pro version.

The Geotag functions are itemized below:



Geotags List. Note: these are fictional ID tags.

1. GEOTAGS LIST

Click this tag to toggle between the Movies and Geotags lists.

2. IMPORT BUTTON

Click this button to load a geotag file back into DroneViewer. Be sure to load your movies that are referenced by the geotag file first, then load the geotag file. If the geotag file references movies that are not loaded they will appear in the list with a gray background.

3. EXPORT BUTTON

Export the geotags to a tab-delimited file. If you plan to import these geotags back into DroneViewer be sure to save the geotags file to the same directory as your drone movies.

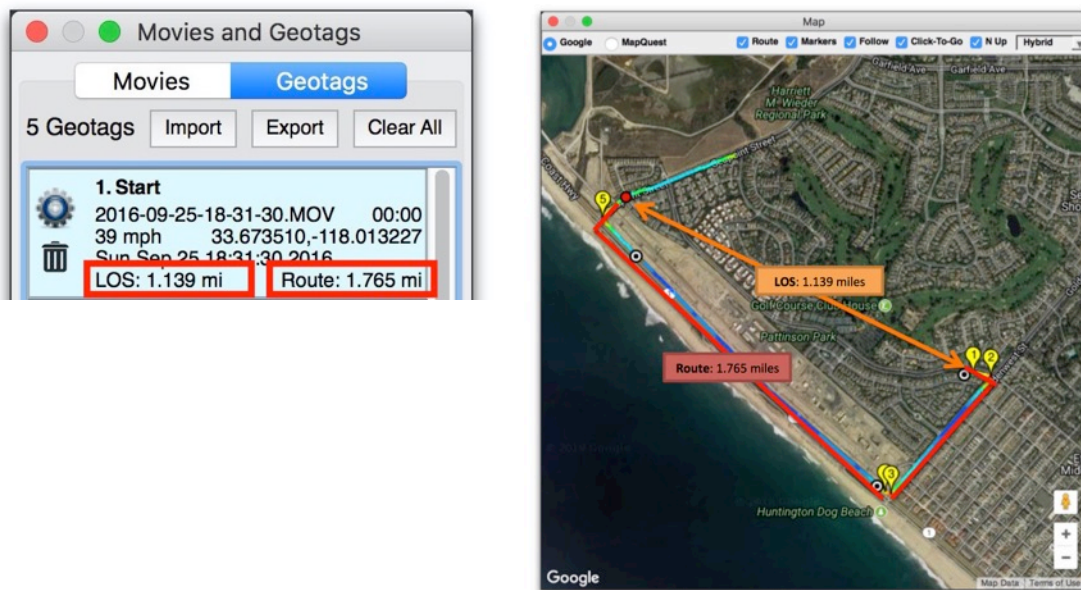
4. CLEAR ALL BUTTON

The *Clear All* button will delete all geotags in the list.

5. GEOTAG INFORMATION

The geotag list item displays meta information about the event including title, movie filename, time in movie, drone speed, date/time, and latitude and longitude.

In addition, the meta information includes two “live” distance measurements. The first is the Line-Of-Sight (**LOS**) distance magnitude from the geotag to the current position of the drone. This distance includes the altitude difference, if altitude data is available. The **Route** distance is the distance to from the geotag to the drone’s current position as measured along the route line.



Line-of-Sight (LOS) and Route distances explained

LOS distance is useful for UAV operators to determine the range of the aircraft to the pilot.

6. CHANGE TITLE

You can edit the default title of a geotag by clicking the gear icon.

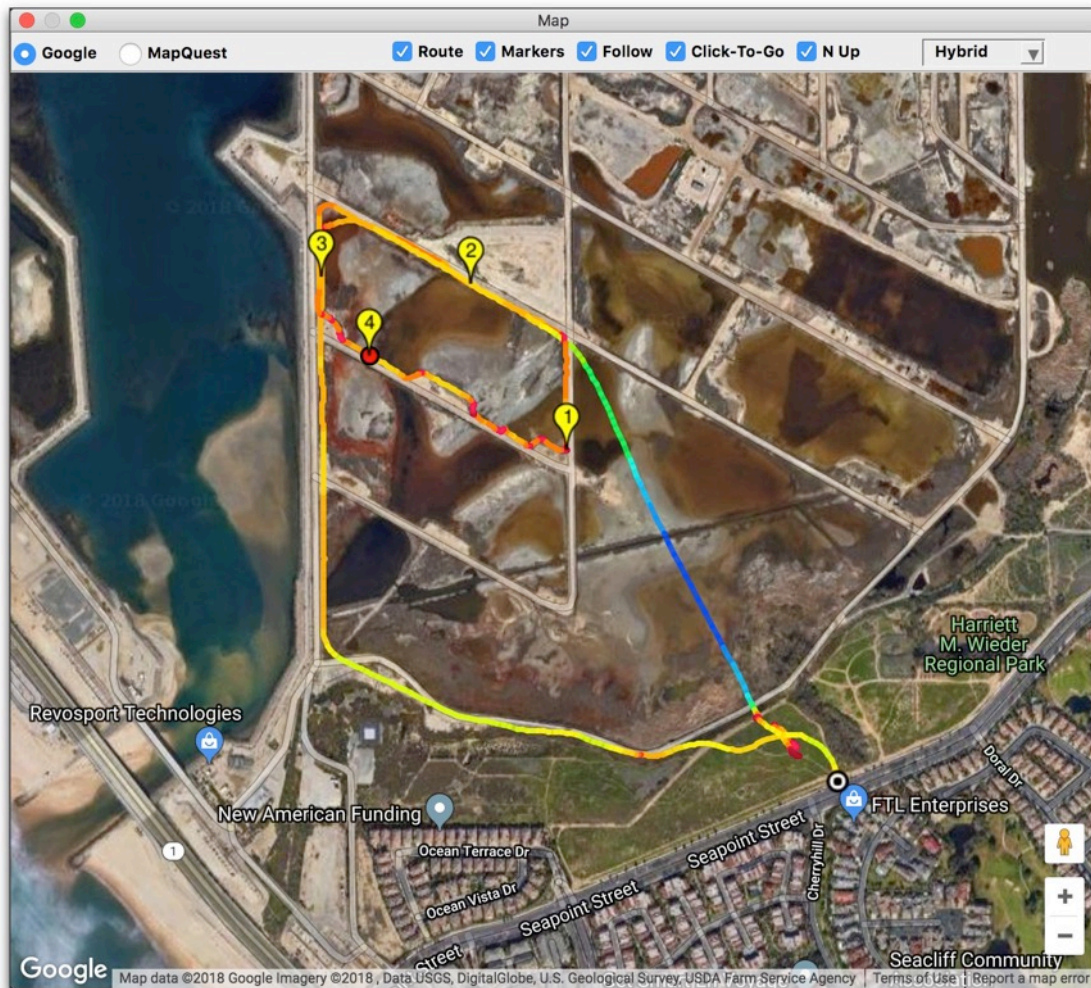
7. DELETE GEOTAG

Delete a geotag by clicking the trashcan icon.

8. GO TO A GEOTAG

Double-click a geotag to jump to that point in the movie sequence.

MAP WINDOW



Google hybrid map showing drone position, speed, route, and geotags

The Map view displays the time-history of drone's route as well as its current position. The *Route* line and movie start *Markers* can be individually toggled on or off in the view using the checkboxes at the top of the window.

Selecting the *Follow* checkbox will automatically pan the map to follow the drone. Unselecting this checkbox will freeze the map and the placemark point will move with the drone.

When the *Click To Go* button is checked, clicking on the map near drone's route line will make DroneViewer jump to that time in the movie sequence. This way you can quickly jump to any point in the movie sequence by simply clicking your position on the map. Deselect the *Click To Go* button to disable this feature.

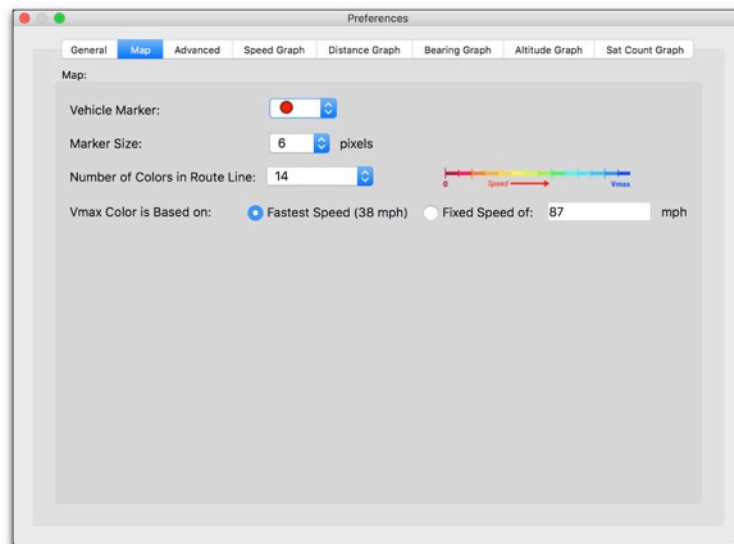
The *N Up* button controls whether the map is oriented in the North Up direction (the default) or is oriented dynamically based on the drone's direction. This feature only applies to Google Maps and only for certain regions that have high-resolution 3D imagery available. Regular "road" maps and "satellite" maps don't support rotation. Zoom-in deep to see if "3D imagery" mode appears for your region.

The Map window can be shrunk to a small size. If the window width is smaller than the minimum size for the control bar, then the controls will hide themselves. You can access the controls by simply increasing the width of the map.



Small map with controls hidden.

The UAV's speed throughout its journey is reflected in the color of the route line. Faster speeds are bluish and slower speeds are reddish. The color scale can be adjusted in the Map Preferences (see above).



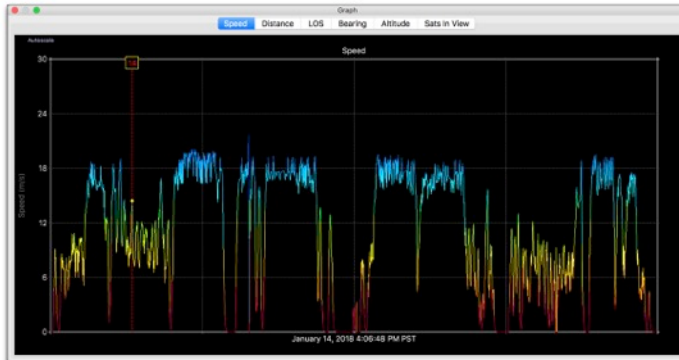
Map preferences for the route color scale

Choices include the number of colors in the scale and whether the maximum speed of the scale is based on a fixed speed or the fastest speed in the movie sequence.

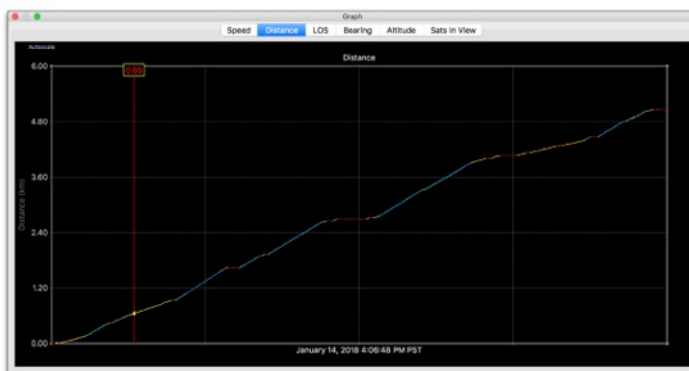
Standard Map controls apply (zoom in/out, switch from map to satellite layers). You can choose between Google and Mapquest map APIs. If you change the map type, please reload your movie files to refresh the routes and markers.

GRAPHICAL DATA DISPLAYS

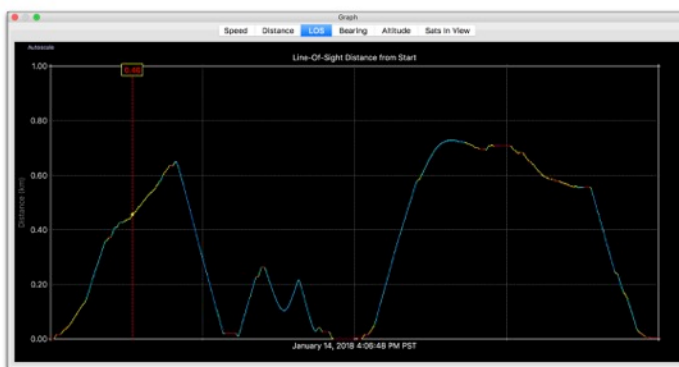
Tip: You can click in the Graph view to jump to a specific time in the movie sequence (on the Windows version, two clicks are required)



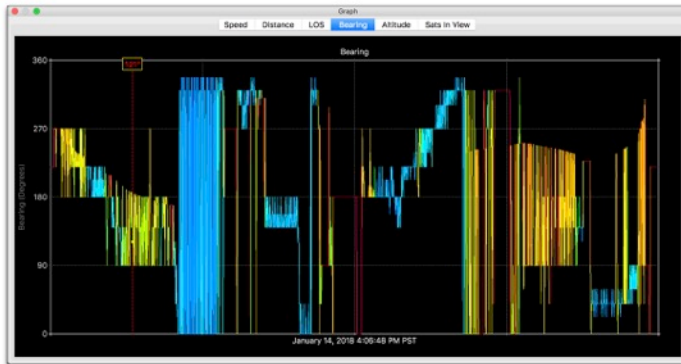
The **Speed** graph displays the combined time-history of the drone's speed over all of the data in the movie folder.



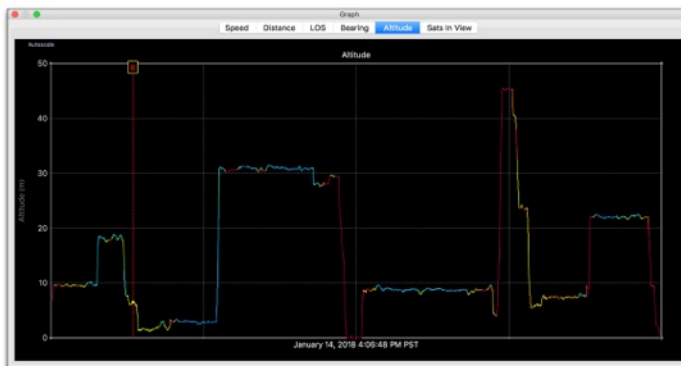
The **Distance** graph displays the distance covered by integrating the drones speed over time. The color-coding indicates drone speed at the time.



The **LOS** graph displays the line-of-sight distance of the drone from the start point.



The **Bearing** graph shows the history of direction for the drone. North is 0 or 360-deg, East is 90-deg, South is 180-deg, and West is 270-deg.



The **Altitude** graph displays the height of the drone above its home point.



The **Sats In View** graph shows the time history of available GPS/GLONASS satellites in used to make the geolocation "fix". In general, the more satellites in view the better the fix (and lower the HDOP). GNSS satellites are constantly in motion so the 9 satellites in view now may be a different 9 in an hour or so. Terrain and urban canyons will block visibility to the weak GNSS signals and worsen geolocation accuracy.

The data in the Speed, Distance, LOS, Altitude, and Sats in View graphs can be automatically scaled by clicking the *Autoscale* button in the top left of the graph. You can click in the graphs to jump to that time in the movie sequence (two clicks are required in the Windows version).

DASHBOARD WINDOW

The Dashboard displays current information about the drone's position, speed, bearing, and distance. In addition, the Dashboard can be used to switch speed units, lat/lon format, show the weather at the time and place of the flight, and show the flying day on a calendar.

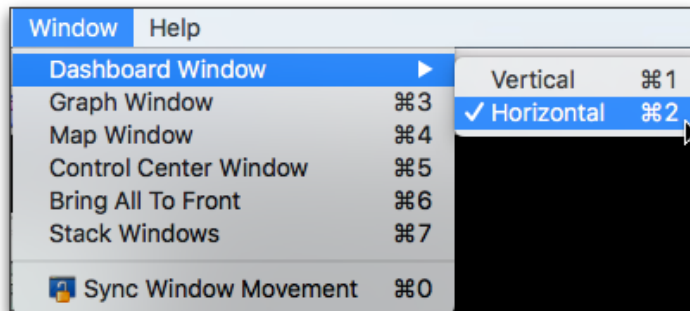
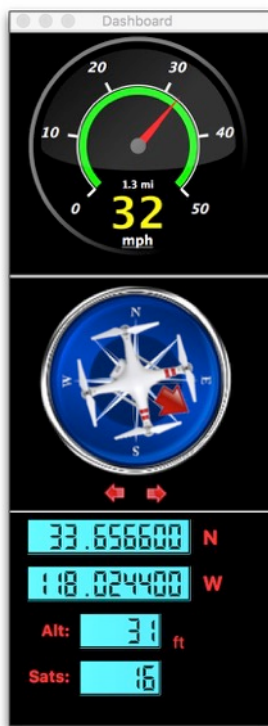


1. Computed speed, total elapsed distance, current date/time, mph-km/h-meters/sec toggle
2. Current UAV direction (bearing). Click the **arrows** to change this widget to weather or calendar views. Tap the 'f' key on the keyboard to switch between quadcopter icon or arrow icon in the compass.

If the "Get Weather" button is clicked, DV will attempt to retrieve the historical weather conditions at the UAV's latitude/longitude (#3) for the given date displayed (#1). DV uses <http://darksky.net> for the weather data.

3. Current drone position (latitude/longitude). Also, the drone altitude and number of GNSS satellites used in geolocation.

Note that bearing is only updated when drone speed is greater than 3 mph (or km/h) to avoid jitter.



Use the Window menu to orient the Dashboard horizontally or vertically.

Don't like the horizontal orientation of the Dashboard? You can orient the Dashboard vertically by choosing "Vertical" from the *Windows* menu.

You can reduce the width of the Dashboard widget until only the speedometer is shown. This minimalist size may be preferable for small displays.

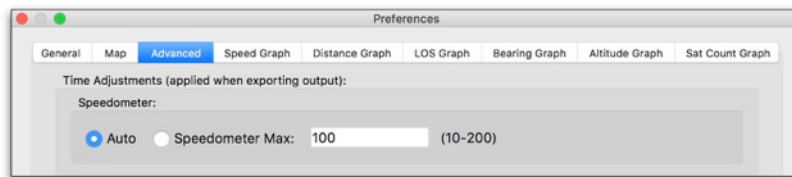


Dashboard resized to only show the speedometer.

To change speed units, click once in the speedometer.

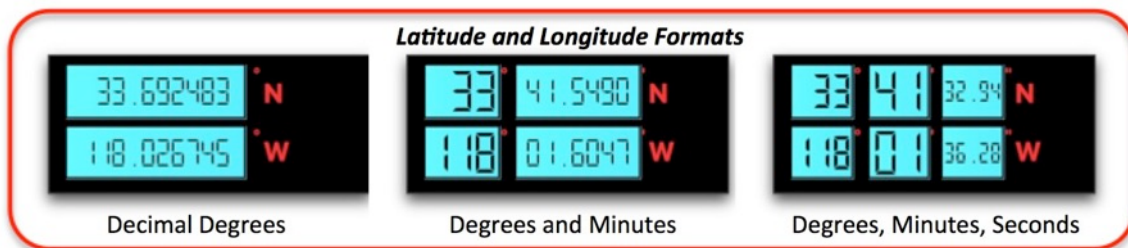
To change the behavior of the speedometer, double-click on it. This will bring up the

Advanced Preferences where you can have the Speedometer automatically or manually scale to a maximum value



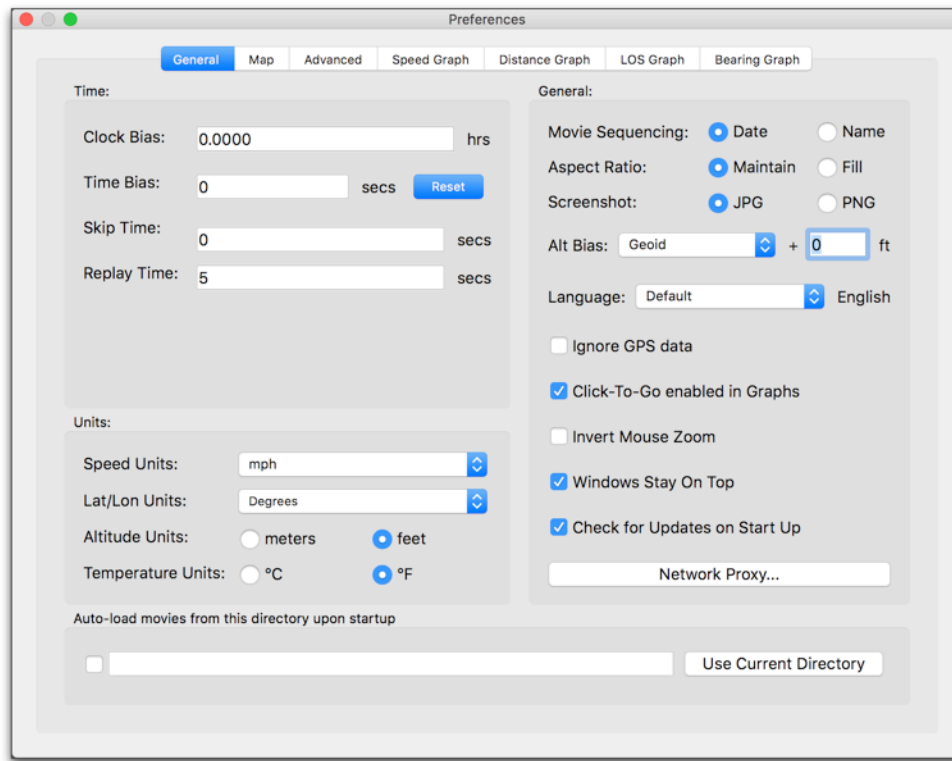
Double-click on the Speedometer to adjust scaling behavior.

To change the latitude and longitude format, click once in the lat/lon display or double-click in the display to jump to the units selection in the Preferences. The options are Decimal degrees, integer degrees+decimal minutes, or integer degrees+integer minutes+decimal seconds.



Click once in the lat/lon display to toggle through the various formats

PREFERENCES WINDOW



The Preferences window

TIME PREFERENCES:

- *Clock Bias* – bias used to synchronize the embedded movie timestamp with the displayed time. Use this setting to match the embedded movie timestamp to the timestamp displayed by DV. This setting does not affect the time biasing between the movie and the GPS data. For that, use the *Time Bias*.
- *Time Bias* – bias, in seconds, used to synchronize the GPS data and the video. This is useful if the drone video is out-of-sync with the Map, or the timezone is incorrectly set for your timezone, or if you are viewing movies creating by someone in a different timezone.
Tip: If the **Graph view is selected**, you can use the “,” and “.” keys to adjust the Time Offset plus or minus 1-second. Similarly, you can use the “m” or “/” keys to adjust the Time Offset by 10-seconds.
- *Skip Time* – this setting tells DroneViewer to skip the first n seconds of each movie during playback. This is useful if your drone has a built-in overlap of a second or so between consecutive movies. Enter the overlap time for (near) seamless

playback between consecutive movies.

- *Replay Time* – enter the amount seconds that the Instant Replay feature goes back in time.

UNITS PREFERENCES:

- *Speed Units* – select the units for the speed and distance displays.
- *Lat/Lon Units* – select the units for the latitude and longitude outputs. You can choose decimal Degrees, integer Degrees+decimal Minutes, or integer Degrees+integer Minutes+decimal Seconds. This setting affects the Dashboard GUI, the Geotags, and the CSV export functions.
- *Altitude Units* – select the units for the altitude graph and data display.
- *Temperature Units* – select the desired units for the temperature display in the historical weather widget.

GENERAL PREFERENCES:

- *Movie Sequencing* – This setting controls the play order of the movies. “By Date” is a better option for drone’s that write movie files in a continuous loop (i.e, new files overwrite older files as the SD card fills up). “By Name” is a better option for viewing a series of miscellaneous movies in a folder.
- *Aspect Ratio* – You can choose to have the movie fill the viewer window or maintain its native aspect ratio. In the latter case you will see black bars filling the unused space.
- *Screenshot* – Chose the desired image type for screenshots (invoked from toolbar in Main window). PNGs are lossless but take up about 8x the disk space. To the naked eye, JPG is almost identical to PNG and much smaller file size. On the Mac, the GPS coordinates of the drone are saved to the EXIF block of the JPG file.
- *Altitude Bias* – Altitude is an interesting metric. Some drone manufacturers, like Autel and GoPro, provide altitude values that are relative to the WGS84 ellipsoid. Other drones, like the DJI Mavic Pro, provide barometric altitude relative to ground. And some drones don't write any altitude at all. The altitude bias setting in DroneViewer allows you to convert the raw altitude values to the altitude form you prefer. For example, the *Geoid* setting biases the raw altitude values by an undulation value which is approximately the difference between WGS84 and Mean Sea Level (MSL). Therefore, this setting is preferred for the GoPro or Autel when MSL altitude values are desired. If Above Ground Level (AGL) altitudes are desired for the GoPro or Autel, select the *Point 1 Relative* setting. This setting subtracts the altitude of the first point loaded from all other points. Thus the

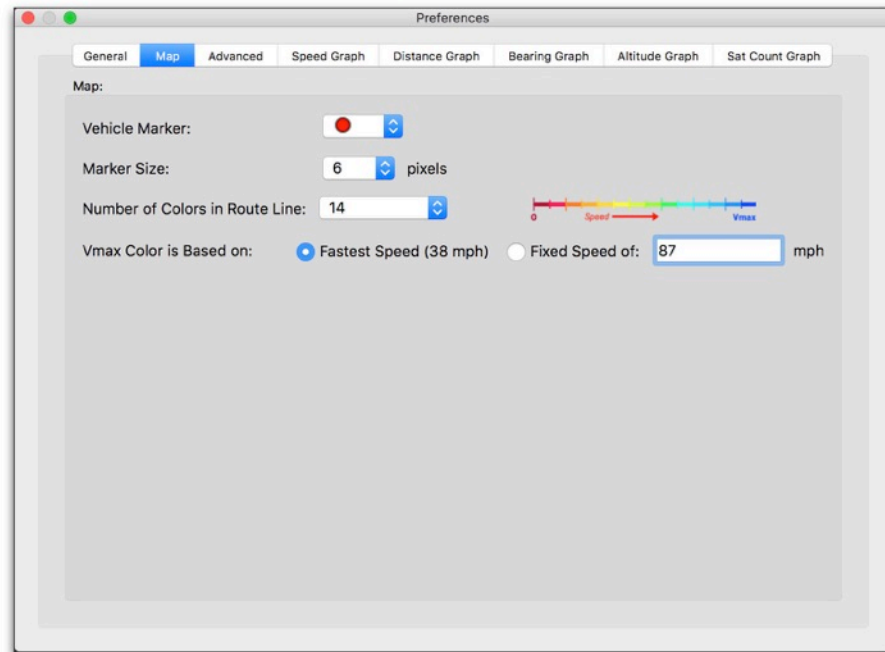
start altitude becomes 0. For the DJI Mavic Pro, which is already producing altitude natively in AGL, you would select the *None* bias. You can further fine-tune the altitude bias by manually entering a value in the input box to the right of the pulldown menu.

- *Language* – This setting allows you to change the language of the text and phrases used in DroneViewer. After making a change, restart DroneViewer to see the change. The *Default* setting will attempt pick a translation based on your computer's system setting. If a default translation is not available, then English will be used. Currently, Chinese is available and additional translations will follow. Be aware that newer portions of the GUI may still be in English.
- *Ignore GPS Data* – Use this option to load movies without attempting to load their GPS data. This will allow you to quickly load movies for viewing, but will not show their GPS data. The message “NO GPS LOADED” will appear at the top of the player window when this option is invoked. To prevent use, this option is set to OFF each time DroneViewer is run.
- *Click-To-Go Enabled in Graphs* – If this option is selected then clicking the mouse button in the Graph window will make DV jump to that point in the movie sequence (approximately). This is useful for immediately jumping to a point of interest in movie sequence, such as a sudden stop.
- *Invert Mouse Zoom* – This checkbox inverts the direction of zoom when using the scroll wheel to zoom in/out of the video window.
- *Network Proxy Settings* – If you connect to the internet via a proxy server, you can enter the server settings here. Restart DroneViewer after making changes for them to take effect.
- *Windows Stay On Top* – This option controls whether the ancillary windows (Map, Dashboard, etc.) float on top of the Main Window. When the ancillary windows float on top of the Main window, you have more control of the window configuration. However on some computers (Windows Surface) this feature may not be advantageous. If you deselect this checkbox, the Main Window can be placed on top of the ancillary windows. You must restart DroneViewer to make this change take effect.
- *Check for Updates on Startup* – If this button is checked, DroneViewer will check its server to see if a newer version is available. You can also invoke this option manually via the Help menu.

AUTOLOAD MOVIE DIRECTORY UPON START-UP PREFERENCES:

- It can be useful to have DroneViewer load a specific directory of movies upon startup. This can be achieved by typing the movie directory in the *Autoload Directory* field. Alternatively, you can click the *Use Current Directory* to automatically input the current movie directory into the field. To enable this feature make sure the checkbox to the left of the field is checked.

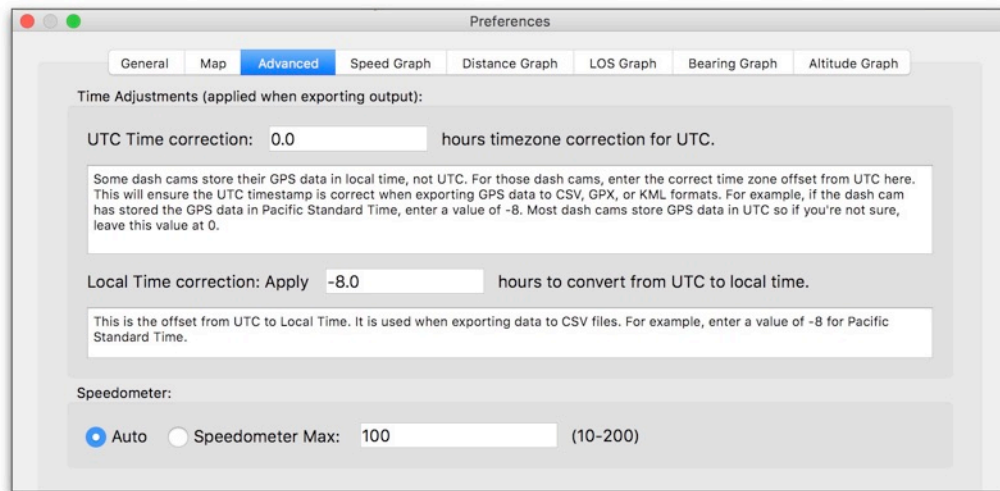
MAP PREFERENCES:



Map Preferences Window

- *Vehicle Marker* – choose either a colored round marker or default map placemark for the drone's location.
- *Marker Size* – select a size for the round vehicle marker.
- *Number of Colors in Route Line* – choose between 1, 5, 10 or 14 colors in the color scale used to indicate drone speed. A key of the colors used is shown to the right of the selection combo box. The scale ranges from a speed of 0 (red) to the maximum speed (blue, defined below)
- *Vmax Color is Based on* – In the color scale, blue indicates the fastest speeds in the drone's route. You can define the speed the blue color represents, either by a fixed value or the maximum speed achieved for the entire journey. The fixed value method is useful for comparing the speeds of one journey against the speeds of another journey.

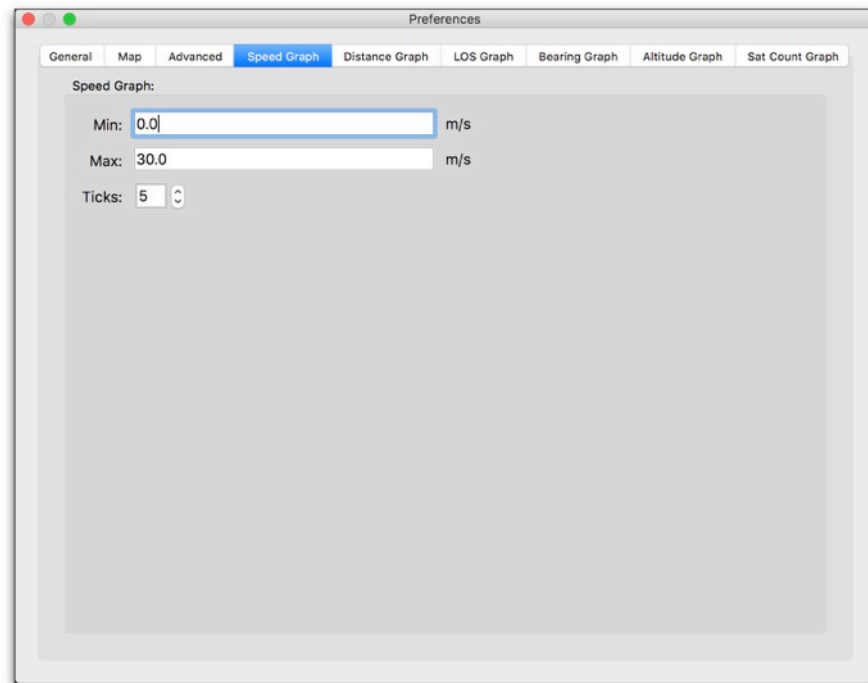
ADVANCED PREFERENCES:



Advanced Preferences Window

- *Speedometer* – Choose *Auto* to have DroneViewer scale the maximum speedometer value based on the videos you’ve loaded. If you want to manually set a maximum speedometer value, click the *Speedometer Max* button and enter the desired maximum speed. Note that the maximum speed is 200 (either mph, km/h, or m/s).
- *UTC Time correction* – Although most drone’s store their GPS data relative to UTC time, some store their GPS data in local time. For those drone’s, enter the correct time zone offset from UTC here. This will ensure the UTC timestamp is correct when exporting GPS data to CSV, GPS, or KML formats. **For most drones this preferences should be left at 0.** But if your drone records GPS data in local time, say Pacific Standard Time, you would enter a value of –8. This setting is applied when exporting data to CSV, GPX, and KML files.
- *Local Time correction* – Enter your timezone offset from UTC here. For example, if you were in the Pacific Standard Time zone you would enter a value of –8. DroneViewer will enter a default value based on your current timezone. This value is used when exporting data to a CSV file.

GRAPH PREFERENCES:



Graph Window settings

The y-axis scale and number of tick marks can be controlled independently for each graph. By default you will have settings for the Speed, Distance, Bearing Graph, Altitude, and Sats-in-View Graphs.

Min – choose the minimum value for the plot

Max – choose the maximum value for the plot

Ticks – select the number of gridlines/ticks for the plot

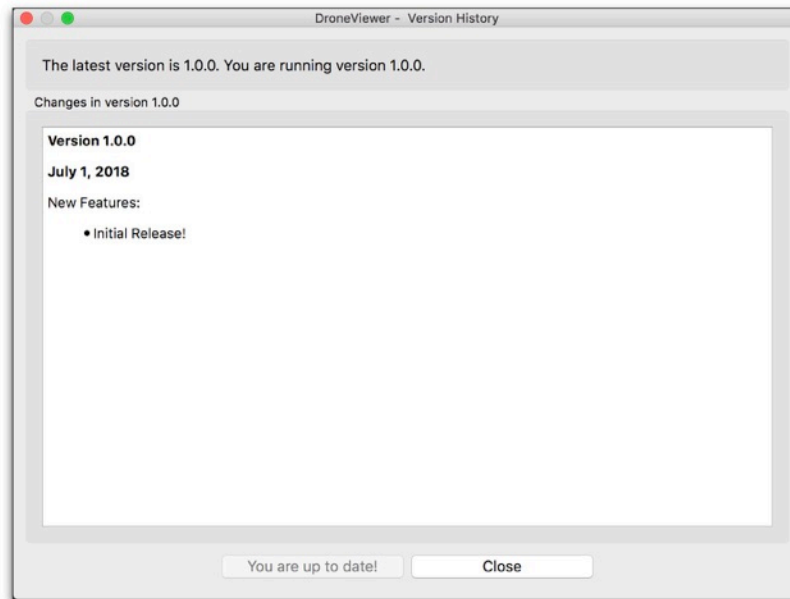
Tip: When a graph view is selected, the “1” and “2” keyboard keys will decrease/increase the Max value of the plot. The “3” and “4” will decrease/increase the number of gridlines.

Tip: You can click in a graph to jump to that point in the movie sequence. See the *Click-To-Go Enabled in Graphs* option above.

Note: Settings are preserved from run to run of DroneViewer.

ADDITIONAL MENU OPTIONS

CHECK FOR NEW VERSION



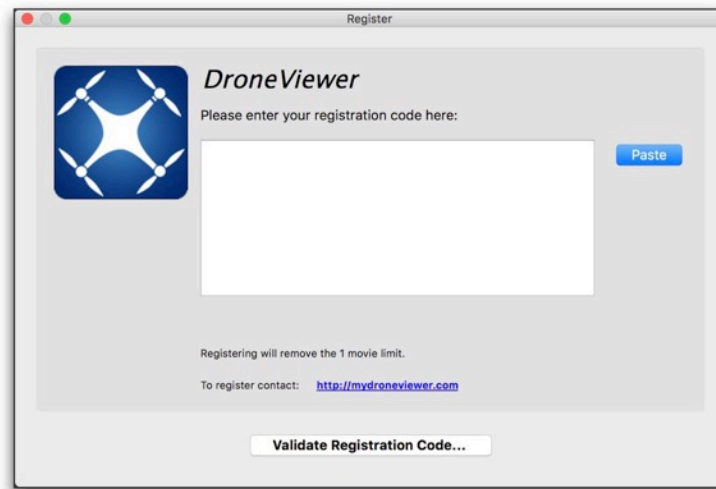
Check for New Version window

Check for New Version (under the Help menu) will go online to check if a newer version of DroneViewer is available. If so, clicking the bottom left button will download it to your computer. If you are up-to-date, the features in the current version will be shown. This feature can be toggled to run at program startup in the Preferences.

The modification history for DroneViewer can be found [here](https://s3.amazonaws.com/aws-website-dcv-downloads-c8kwd/drv/history.pdf)³.

³ <https://s3.amazonaws.com/aws-website-dcv-downloads-c8kwd/drv/history.pdf>

REGISTER DRONEVIEWER



Register DroneViewer to remove the 1-movie limitation

The **Register** option is located under the Help menu. After purchasing either DroneViewer or DroneViewer Pro from our [website](http://mydroneviewer.com)⁴, you will be sent a registration code which will remove the 1-movie limit. Use Command-C to copy the code to the clipboard and the **Paste** button to enter it in the Register field. Registering will personalize DroneViewer and your name will appear as the registered user under the About menu:

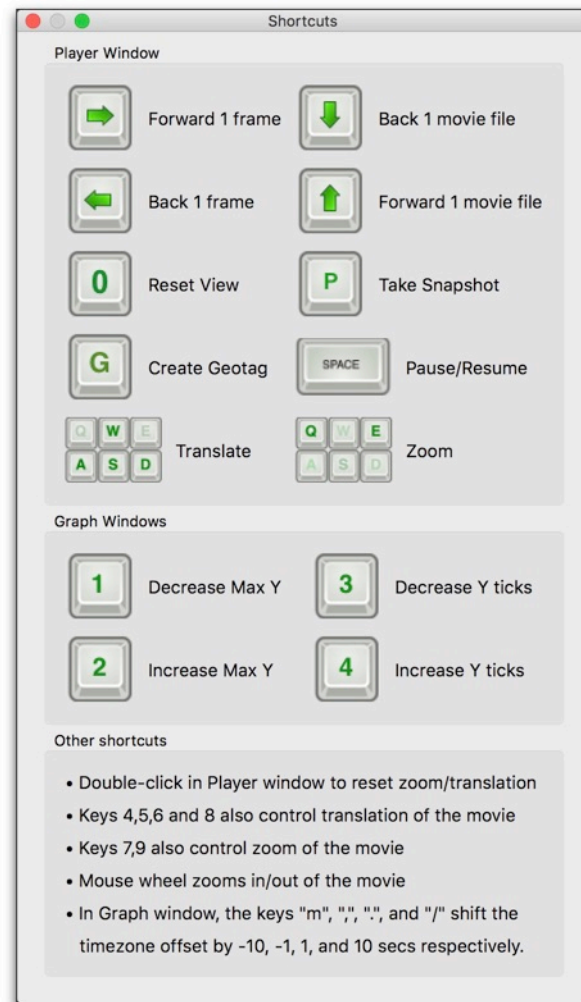


The About window displays the DroneViewer version and registration status

SHORTCUTS

⁴ <http://mydroneviewer.com>

A number of shortcuts have been added to facilitate use of the program. These include buttons to move forward frame-by-frame, take a screenshot, pause/resume, and more. Please see the list below:



Shortcuts window

PLAYER WINDOW:

- When the Main Window is selected, the spacebar will start/stop the video player and the arrow keys will jump forward or reverse as indicated above. The P key will take a snapshot of the viewer window and save it to the Desktop. The A,S,W,D (and 4,5,6,8) keys will translate the movie in the movie frame. The Q and E (and 7 and 9) keys will zoom out/in of the movie. The 0 key resets the zoom and translation to default values.
- Click the “g” key to create a Geotag at the current location.
- Cmd-F (Mac), Ctrl-F (Win), F11, and Alt-Return (Windows) will toggle Fullscreen

mode.

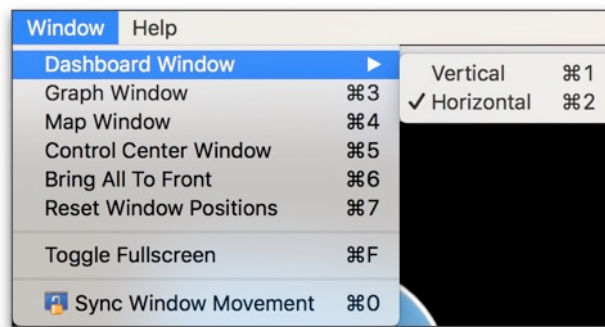
GRAPH WINDOW:

- When in a graph view, the “1” and “2” keyboard keys will decrease/increase the Max value of the plot. The “3” and “4” will decrease/increase the number of gridlines.
- The “m”, “,”, “.”, and “/” adjust the Time Offset by -10, -1, +1, and +10 seconds, respectively. This is useful for graphically synchronizing the video to the cursor in the graphs.
- Click anywhere in the data portion of the graph to jump to that point in the movie sequence. This feature can be turned off in the Preferences.
- Click the “g” key to create a Geotag at the current location.

ARRANGING WINDOWS

DroneViewer allows you to move and resize its 5 main windows. Sometimes the windows can become hidden or overlap in an inconvenient way.

To quickly bring all the windows back to their nominal positions, select *Reset Window Positions* from the Window menu.



Options available under the Window menu.

This will rearrange the program’s windows to their original configuration as shown below.



DroneViewer after Reset Window Positions was selected.

To maintain relative positioning of the windows, select the *Sync Window Movement* option and all 5 windows will move together if any one of them is dragged.

Use the *Toggle Fullscreen* option (Cmd-F) to expand the Main window to fullscreen and hide the ancillary windows. To return to the previous state, simply choose Cmd-F again (or F11 or Ctrl-F on Windows).

EXPORTING GPS DATA

Your drone's latitude, longitude, speed, and other data for all the tracks can be exported to a text file. Two file formats are supported: comma-separated value (CSV) and GPS Exchange format (GPX).

EXPORTING TO CSV

Select *Export to CSV File* from either the File menu or the toolbar button, give the file a name, and choose *Save*. A CSV file will be produced from the GPS data and include the following fields as columns:

- **Movie filename**
- **Date (Local)**
- **Time (Local)**
- **Date (UTC)**
- **Time (UTC)**
- **Latitude (Degrees)**
- **Longitude (Degrees)**
- **Speed (computed or from drone if available, in output units)**
- **Distance (Computed from waypoints)**
- **Line-Of-Sight distance from start point**
- **Bearing**
- **Altitude above start point**

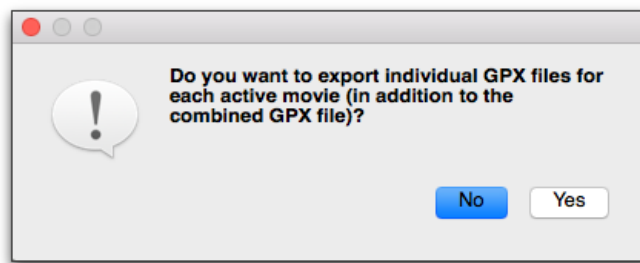
- Number of GPS satellites used in geolocation (if available)

CSV files can be imported into Microsoft Excel, Apple Numbers, and other programs for further data analysis.

Note: If the UTC date and/or time is not correct in the CSV file, you can apply an offset using the *UTC Offset* setting in the Advanced Preferences.

EXPORTING AND USING GPX FILES

Select *Export to GPX File* from either the File menu or the toolbar button, give the file a name, and choose *Save*. DroneViewer will export the entire route as a single GPX file. You will also have the option to export each movie's individual GPS data to separate GPX files. The files will be named based on the movie names.

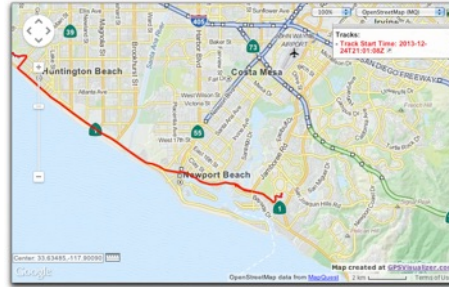


Click Yes to create individual GPX files for each movie segment, as well as a large GPX file for the entire route. Click No to create just the large GPX file for the entire route.

Since DroneViewer reads GPX files too, the per-file export feature can be used to load the GPS data back *into* DroneViewer. GPX files placed inside the movie directory are loaded *ahead* of other data types like SRT, so you can use this method to 'override' the GPS data for a given movie. This allows you to filter out bad data or insert corrected GPS information into DroneViewer.

The GPX file format is widely supported in the commercial GPS receiver market. There are a number of interesting websites that can analyze your data. One of my favorites is [GPS Visualizer](http://www.gpsvisualizer.com/)⁵, which has a plethora of GPS data analysis tools, maps, and plots.

⁵ <http://www.gpsvisualizer.com/>



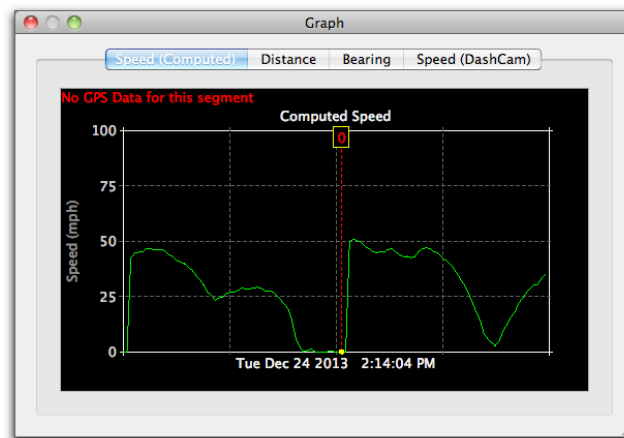
Drone's track exported to GPX file and viewed into [GPS Visualizer](#).

Another note about GPX files: Some popular activity cameras, like the GoPro Hero 4 series, do not have a built-in GPS receiver. However, if you are operating an external GPS receiver, like a Garmin eTrex or equivalent, in tandem with your activity camera you can export your GPS route from your receiver into GPX format. Give your GPX file the same base name as the activity camera movie file and make sure the two files are in the same directory (for example, "MyGoProMovie.MP4" and "MyGoProMovie.GPX"). When the movie is loaded into DroneViewer, DroneViewer will load the corresponding GPX file and use this as the GPS data source for the movie. If you need to make time offset corrections, you can do this using either the Graph shortcuts or the Preferences.

Note: If the UTC date and/or time is not correct in the GPX file, you can apply an offset using the *UTC Offset* setting in the Advanced Preferences.

FAQ

Q: I'm seeing the message "No GPS Data for this segment" on the Graph display. What does it mean?



A: The "No GPS Data" error message will be shown if DroneViewer cannot find a corresponding GPS log file for the currently playing movie. If this happens the speed, latitude, longitude, etc, readouts will indicate 0. It can also happen if the first movie file loaded has no GPS data associated with it. Try removing the first movie file from the folder and reloading the folder. Although infrequent, this can happen under normal operation.

Q: Why don't I see an altitude graph with the DJI Mavic 2 Pro?

A: The SRT file produced by the DJI Mavic 2 Pro does not contain altitude data as of this writing. DJI will need to produce updated firmware to remedy this issue.

Q: I have a Phantom 4 Pro V2.0 and I've turned on Video Captions in the Go App but SRT files are not created. Why?

A: The Phantom 4 Pro v2.0 embeds the SRT data into the movie itself. DroneViewer will detect this and decode the data. One difference between the SRT data in a separate file and embedded SRT data is that the embedded SRT data is not date/time stamped. Therefore the file creation date is used as the start date in the case of embedded SRT data.

Q: Will DroneViewer work with the Mavic Air?

A: Unfortunately the Mavic Air does not store trajectory data in the SRT file so DroneViewer will not display the drone's route. I don't know why DJI made that decision, but I can't think of any reason why the lat/lon/alt/speed couldn't be added. Mavic Air

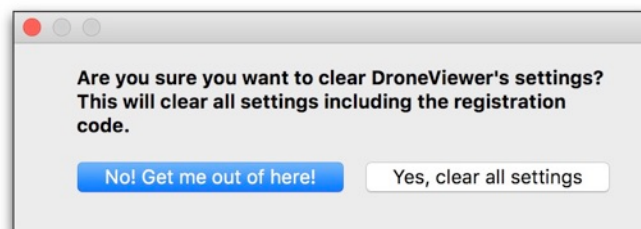
owners may want to contact DJI and request that flight log data be added to the SRT file. The Mavic Air 2 does store lat/lon/alt information in the SRT file, however.

Q: Why does my route look jagged? Why does my compass appear to spin erratically sometimes?

A: While it's great that DJI and Autel log the drone's flight data into an SRT or ASS file, the speed of the drone is not recorded to the file and the latitude and longitude are not stored in high precision (as of this writing). DroneViewer uses the time-stamped lat/lon values to estimate the speed. The lack of precision means the drone speed and direction can be inaccurate and appear to vary wildly. DroneViewer applies a smoothing function to dampen the speed variations. While this helps, it's not a perfect solution. Ideally, DJI and Autel would modify their file data to include native drone speed and higher-precision latitude and longitude. (There are other ways to extract the flight data to higher-precision but they are not as convenient as the SRT/ASS file method). *[Update: the EVO 2 does record lat/lon to high precision but still does not record speed].*

Q: How to I revert all of DroneViewer's settings?

A: Run DroneViewer with the Shift-key held down. You will be presented with the following dialog.



Clicking 'Yes' will erase all the stored settings, such as window positions, window sizes, button settings, map settings, and preferences. These settings will revert to defaults. **Also note that your registration code will need to be re-entered if you select this option.**

Q: When I merge movies nothing happens.

A: Be sure that the file directory path to the source movies does not have quotes or commas in it. Also, only the registered versions of DroneViewer will merge movies.

Q: In the movie window the player shows my drone moving but my speed is indicated as 0 mph.

Q: I see data plotted in the graphs but the cursor isn't moving.

A: Could be a couple of things. When the drone is first powered up after being off for a long period of time, it requires a minute or so to acquire signals from the GNSS satellites. During this time the drone's latitude, longitude, and speed are unknown and are displayed as "0" in DroneViewer.

This could also happen if the drone's timezone is set incorrectly. DV relies on the accuracy of the movie file's timestamp to sync the movie with the GPS data. The drone's timezone should be set to the computer's timezone. If not, the difference in timezones should be entered in the Preferences.

A third possibility is that the movie's original timestamps have been altered. This can happen if the files were copied from the SD card to another location. In some cases the copy process itself changes the file modification date. If this happens, use the "Auto Fix" button in the Preferences window to compensate for the difference in time. To avoid this issue, open the original SD card's movie folder in DV rather than opening a copy of the folder on a hard drive. The downside is that this may affect playback performance if the SD card is connected via a slow USB reader.

Another possibility is that DV is confused by extraneous files in the movie directory. Be sure not to add any files to the drone movie directory (i.e., GPX files).

Lastly, if nothing seems to fix the issue, try loading the set of movies files again but this time skip the first movie file. In other words, load all the movie files except the first one.

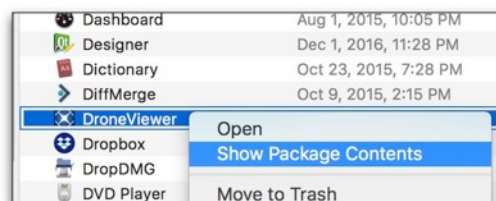
Q: Why can't I see all of my GPS data from my GoPro HERO5 Black's videos?

A: Please upgrade to Dashcam Viewer Pro to see all of your GPS data.

Q: When I use DroneViewer to export a movie clip the quality of the video is not as good as I expected. Any ideas?

DroneViewer ships with the LGPL version of [FFmpeg](http://ffmpeg.org)⁶. The GPL version has better codecs for exporting video. So the solution is to replace the LGPL version of FFmpeg with the GPL version off the internet. You can download the [Mac GPL ffmpeg here](https://evermeet.cx/pub/ffmpeg/snapshots/)⁷ and the [Windows GPL ffmpeg here](http://ffmpeg.zerano.com/builds/)⁸.

Mac GPL ffmpeg installation: The Mac download comes as a DMG file. Double-click on the DMG file and you'll see a disk image with a single file in it: ffmpeg. Double-click on ffmpeg to test run it. The first time you run it, your Mac may ask "are sure you want to run this program which was downloaded from the internet?". Click "Open" and it will run in the Terminal and immediately quit. Now you are ready to replace the old version as follows:

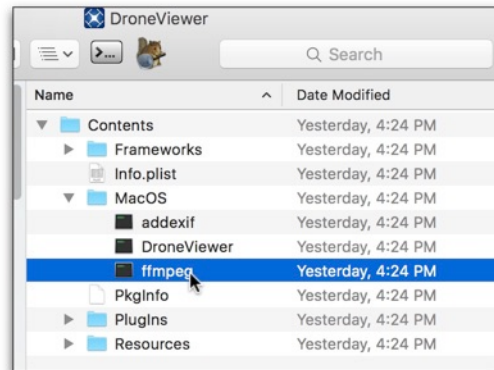


⁶ <http://ffmpeg.org>

⁷ <https://evermeet.cx/pub/ffmpeg/snapshots/> (get the latest .dmg file)

⁸ <http://ffmpeg.zerano.com/builds/>

- 1) Right-click on the DroneViewer icon and select *Show Package Contents*. This will open the contents in a new window.



Locating ffmpeg in the Mac version of DroneViewer

- 2) Open the **Contents/MacOS** folder. You will see the LGPL version of `ffmpeg`. Move it to a safe location outside of the package.
- 3) Now move the GPL version of `ffmpeg` into the MacOS folder. Close the package window and you're good to go!

Windows GPL ffmpeg installation: Unzip the ffmpeg package and copy the `ffmpeg.exe` (located in the `bin` directory) to the DroneViewer directory. You will be asked if you want to replace the existing `ffmpeg.exe`. Click Yes.

One caveat. Since each version of DroneViewer ships with the LGPL version, you will need to repeat this process every time you update DroneViewer.

Q: The timing between the movie and the drone's position on the map is slightly off. How do I fix it?

This can happen if the drone's clock is slightly off. To compensate for it, go to the Preferences and adjust the Time Bias. Then bring the Graph window to the foreground. Use the ',' and '.' keys to dynamically adjust the time cursor position until the Map position of the UAV and the movie match. To compensate plus or minus 10-seconds at a time instead of 1 second at a time, use the 'm' and '/' keys. When the UAV's position on the Map matches its position in the video, you can click the Save Settings in the Movie window so that when this video is played again the same adjustments will be applied.

Q: [Windows version] I get an error when I run DroneViewer, "The ordinal 4369 could not be located in the dynamic link library LIBEAY32.dll". What is causing it?

This problem seems to be related to multiple versions of LIBEAY32.dll on your system. Please see <http://superuser.com/questions/272752/intelligence-server-configuration-and-libeay32-dll-registration-error-microstr> for a solution.

Q: [Windows] Movies appear to stutter during playback.

A: This occurs on some Windows PCs, usually the lower-end models or older models. The ideal PC system is an i7 processor running Win10 and an nVidia or AMD processor.

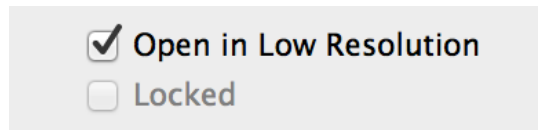
***Q:** The Map shows me flying through a building. What's up with that?*

A: Could be a number of things. For starters, obscuration of the sky by buildings and terrain can block line of sight to the GNSS satellites. Fewer GNSS satellites translates to higher dilution of precision (DOP) and less positional accuracy at the drone. Also, the GPS receivers and antennas in these cameras are commercial units are not designed for high accuracy.

***Q:** DroneViewer is hanging on my MacBook Pro with Retina display running Yosemite (OS X 10.10). Any idea why?*

We have found that the Graphs display on DroneViewer has an issue with some Retina Macs. Try this tip from <https://support.apple.com/en-us/HT202471>.

Open the DroneViewer using Low Resolution mode:



- 1) Quit the application if it is currently open.
- 2) In the Finder, choose Applications from the Go menu.
- 3) In the Applications folder that opens, click the application's icon so it is highlighted.
- 4) Choose Get Info from the File menu.
- 5) Place a checkmark next to "Open in Low Resolution" to enable Low Resolution mode.

Close the window and double click the Application to reopen it.

DISCLAIMER

DroneViewer is supplied “as is” and all use is at your own risk. This document is not intended to express or imply any warranty that the operation of the software will be uninterrupted, timely, or error-free. Under no circumstances shall Earthshine Software be liable to any user for direct, indirect, incidental, consequential, special, or exemplary damages, arising from or relating to this agreement or the software.

SPECIAL THANKS

Earthshine Software would like to thank Markus Staeger, Alex Soll, Andrew Zinkov, Bill Danson, Phuong Nguyen, Jo De Vulder, Dany Labrecque, Mehmet Baydar, John Westman, and Tamás R. for their help with foreign translations.

Finally, special thanks to my beautiful wife, Joy, for her encouragement and support with this project.

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Thank you!
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