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1 What is GPSailing?

GPSailing is a computer program that takes GPS information in form of GPX files and generates a playback video of the tracks. It is optimized for use by sailors and coaches.

2 Requirements

2.1 Operating system

The program can be run in Windows, Linux or Mac computers.

2.2 Java

JRE version 1.8u45 is required.

2.3 RAM

Recommended: 1 GB free

2.4 GPS data logger (TRACE)

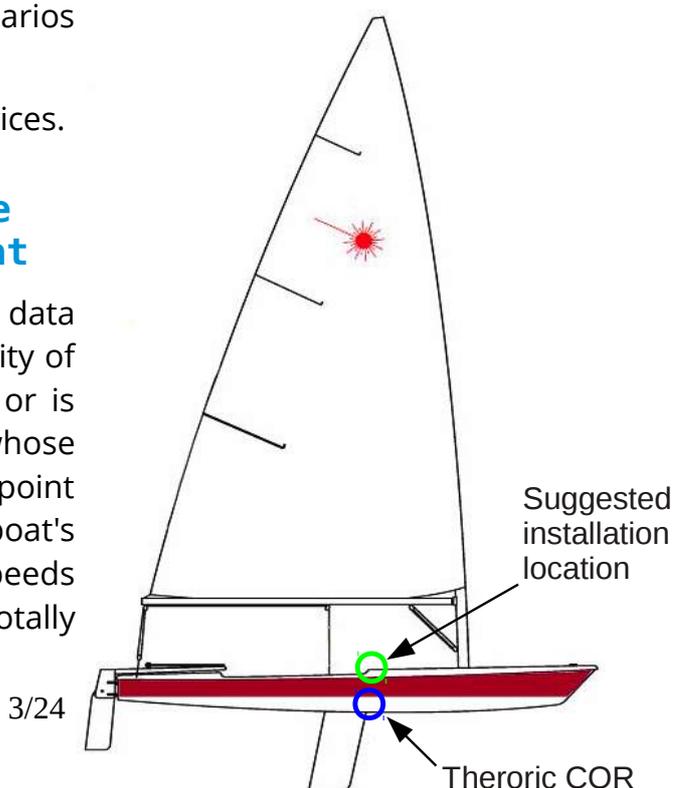
In order to take advantage of GPSailing's features you need to have a GPS device that logs tracks in GPX file format. GPSailing has been optimized for use with the TRACE action sports tracker. We highly recommend TRACE for recording your training sessions. For many sailing classes it is even a legal GPS device for use in regattas. Find full details and instructions at www.traceup.com.

TRACE is water-proof, is very low-weight, very accurate and records tracks at a very high rate (5 Hz). TRACE has been tested by olympic sailors and optimist sailors. So we have covered the most demanding scenarios and the results are excellent.

We are authorized retailers of TRACE devices.

2.4.1 Installation of the GPS receiver on the boat

The installation position of the GPS data logger is important as it affects the quality of the data recorded. When a boat turns or is knocked by waves there are motions whose magnitude is much larger as the point considered is further away from the boat's center of rotation (COR). The induced speeds caused by these spurious motions can totally



ruin the signal captured by a high precision GPS receiver like TRACE. Therefore it is very important to minimize these induced motions by installing the GPS receiver as close to the center of rotation of the boat as possible. A boat's center of rotation (COR) is located close to the center of gravity of the boat. Which can be approximated to a position close to the hull's bottom at the keel or centerboard. We recommend installing the GPS receiver on a leveled surface in this area.

2.5 Anemometer data logger (EasyWind)

In order to maximize the possibilities with GPSailing EOLO Edition you need to have a device that collects and logs wind data accurately in GPX file format. GPSailing has been optimized for use with the EasyWind wind analyzer. We highly recommend EasyWind to document the wind conditions for your races and your training sessions. Find full details and instructions at <http://www.oceandrivers.com/easywind/>.

EasyWind is waterproof, is miniaturized, and records wind data with high accuracy. EasyWind was used at the Rio Olympic Games by 10 different countries.

We have a dealership agreement with OceanDrivers. Contact us!

3 Installation of GPSailing in your computer

Copy the file GPSailing.jar in your preferred folder and you are ready to go.

4 Launching GPSailing

GPSailing is a Java application. You just need to double-click on the file GPSailing.jar and the program window will launch.

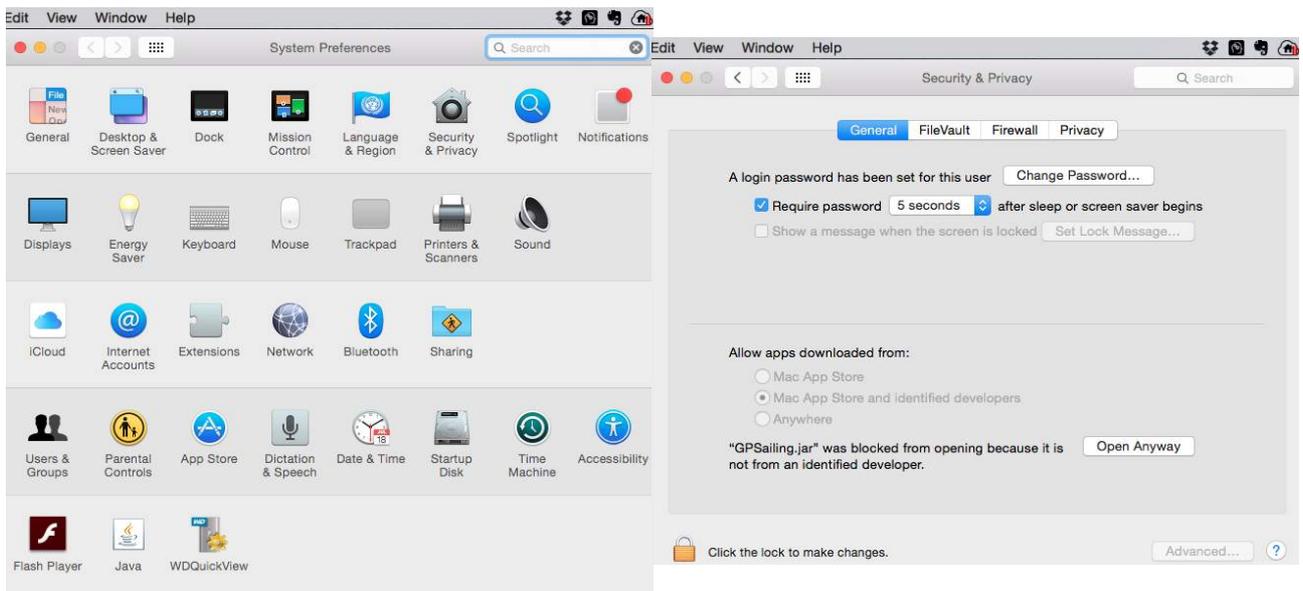
If for any reason Java is not in the PATH of your system or if the extension .jar is not associated to java in your system, you will need to launch the application from a terminal or command prompt and type:

```
C:\folder\containing\GPSailing> path\to\java -jar GPSailing.jar
```

4.1 Mac users

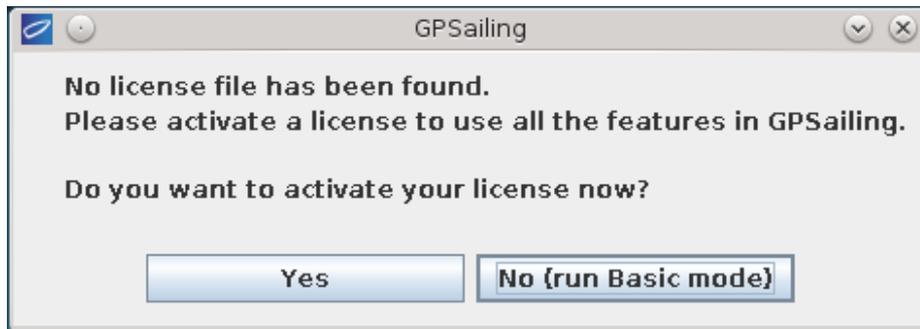
Mac users may need to expressly authorize the system to execute GPSailing. These are the steps to follow.

1. Open the system menu and select "System Preferences"
2. Choose "Security & Privacy"
3. At the message "GPSailing was blocked from opening..." click on Open Anyway.



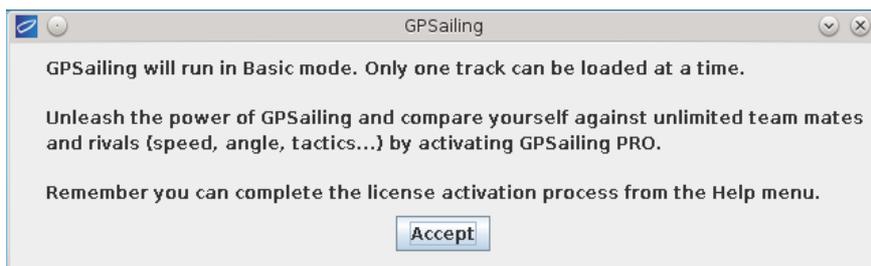
5 License and activation

The first time GPSailing executes in your computer the following window is presented.



5.1 GPSailing BASIC (DEMO mode)

GPSailing BASIC is free. You can download it and start using it. GPSailing BASIC will allow you to use GPSailing indefinitely but only 1 GPS track can be included in every video you generate. This mode is designed for sailors that train alone and want to analyze their technical performance.



5.2 Activating GPSailing PROFESSIONAL and/or EOLO

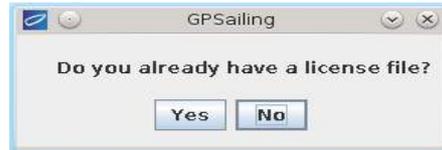
If instead you are interested in reviewing your training session or your regatta compared against the performance of your fellow competitors you will need a GPSailing PROFESSIONAL license.

Also, if you are interested in including information from an anemometer to have specific performance data on the boat you will need GPSailing EOLO. This is most interesting for coaches who train several boats and need to analyze the performance and tactics of several boats simultaneously.

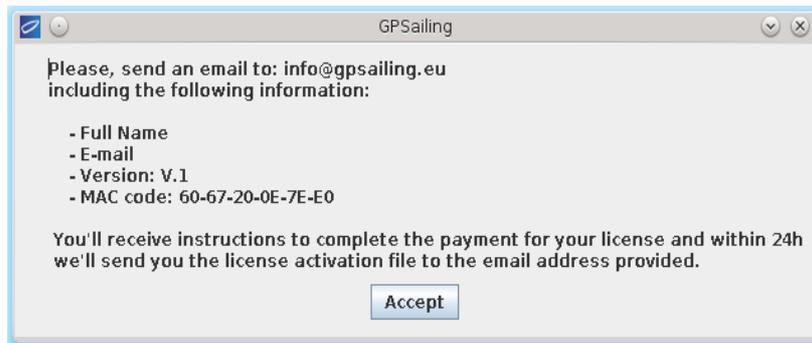
A GPSailing PROFESSIONAL license will enable you to generate videos with several GPS tracks at once, while a GPSailing EOLO license will enable you to include data from up to 3 anemometers. The GPSailing PROFESSIONAL and GPSailing EOLO licenses are valid for 1 year and can be combined.

5.2.1 License Activation File

In order to activate GPSailing, you need a valid License Activation File.



If you do not have a license activation file, you need to contact your sales representative and provide him the following information:



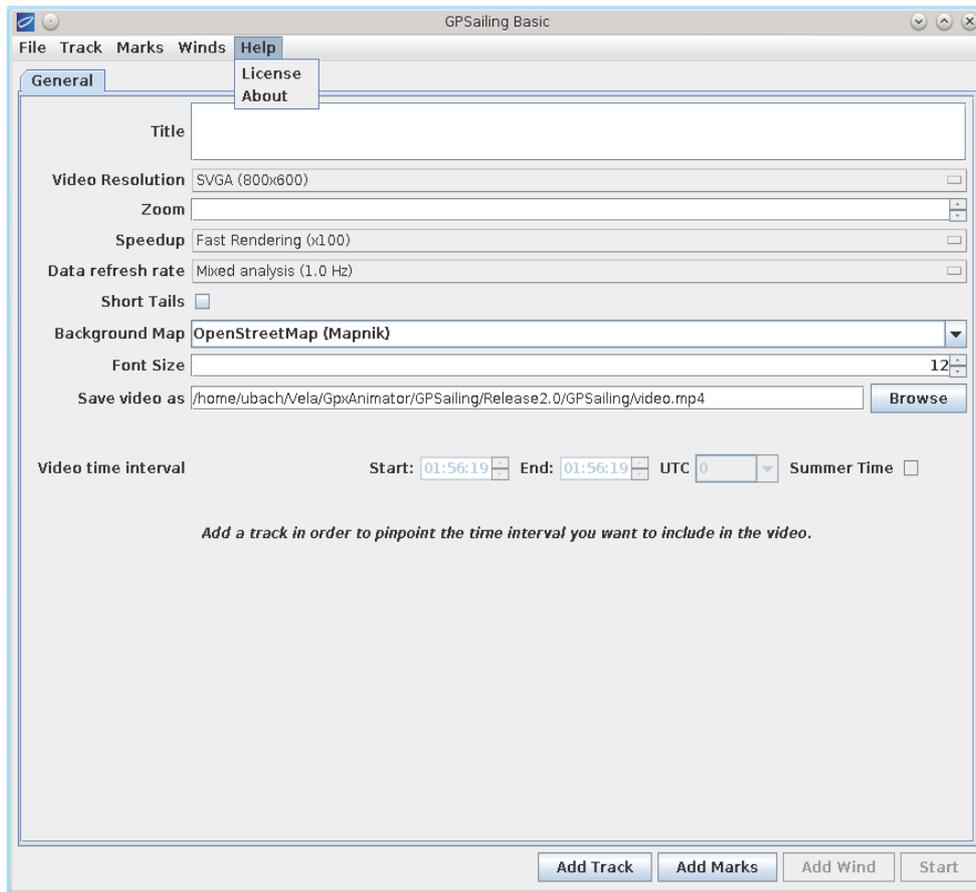
The program will provide you a MAC code that identifies your computer. This is necessary to generate the license activation file for your computer.

Send the following information:

- your full name
- your email address
- version of GPSailing
- MAC code of your computer provided by GPSailing
- whether you want the PROFESSIONAL license, or the EOLO license, or both

to info@gpsailing.eu . You will receive instructions to complete the payment for your license and within 24h we'll send you the license activation file to the email address provided.

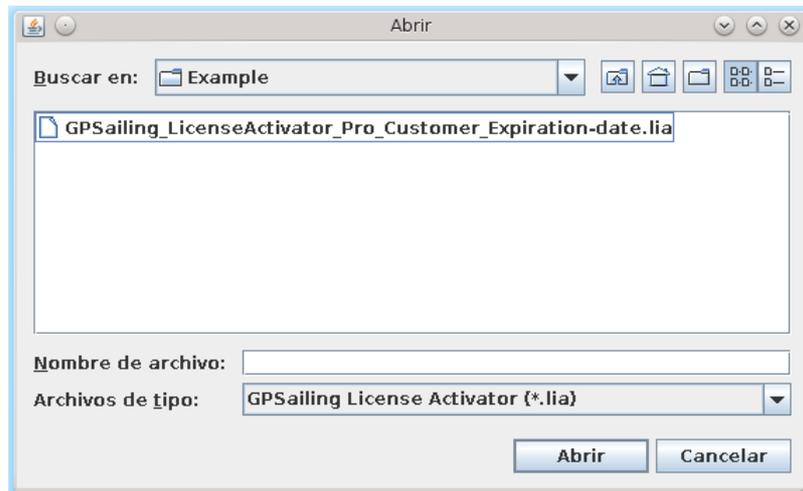
Once you receive the license activation file you can launch GPSailing again and follow the dialogues or else, within GPSailing you can select **Help** at the top menu and click on **License**.



The License window is presented. By clicking the **Activate license** button, you can access again to the license activation dialogue.



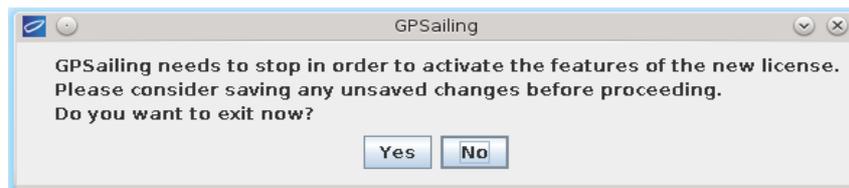
At the file browsing window select the license activation file provided.



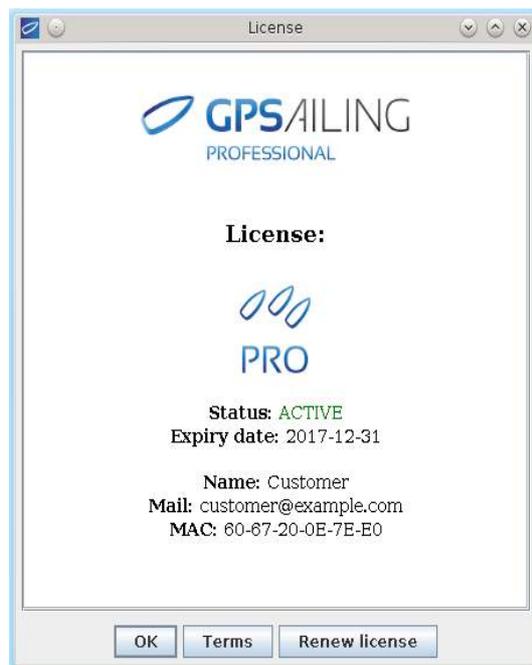
If everything is correct, the program will inform that GPSailing is now activated.



In order to complete the activation process the program needs to reboot.



After you launch the program again you can check that the program is indeed activated by checking the license window.



5.2.2 License expiration date

Your license window shows an expiration date. We generate the license activation files with a validity of 1 year. At the conclusion of the period of validity we will email you a reminder to renew your license.

5.2.3 Can I run GPSailing in a different computer?

GPSailing BASIC can be run in as many computers as you want. The License activation file is specific for every computer.

If you decide to upgrade your computer and you no longer use the computer for which the license activation file was issued, we will provide you another license activation file for your new computer free of charge (subject to conditions). The previous license will not be renewed at the end of the validity period and only the new license activation file may be renewed.

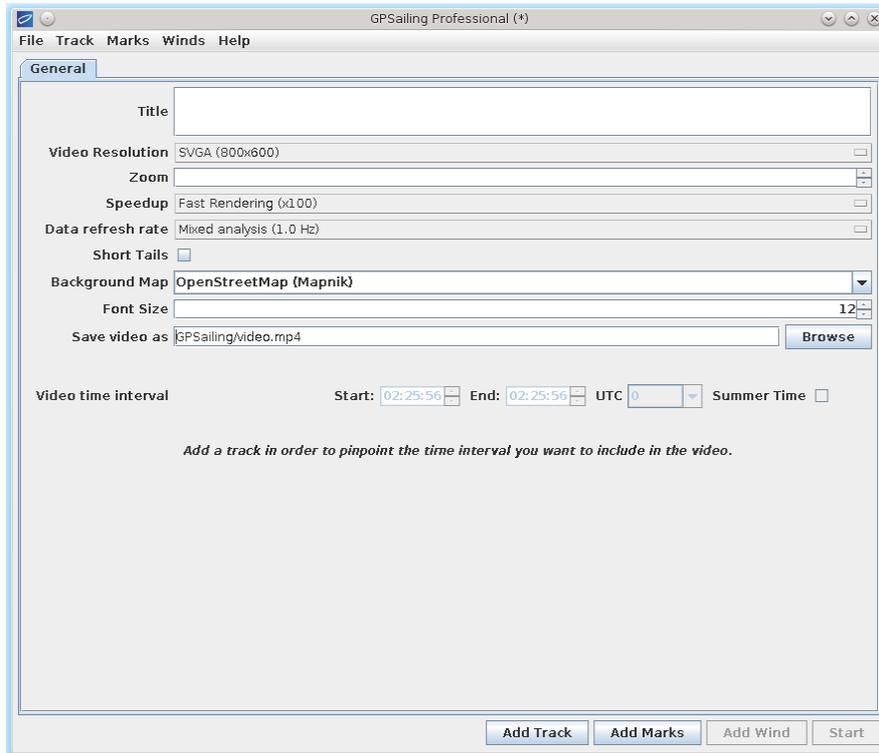
5.3 Tampering with license activation files

The license activation files shall not be tampered with. Doing so will invalidate the license file.

If you accidentally modify your license activation file, chances are that GPSailing will generate an error. If that is the case, contact us and we will happily provide you with the valid license activation file.

6 General tab

The General tab has the fields that define the generation of the video.



6.1 Title

The Title field is intended to give the user the opportunity to render a customized text overlaid on the video. This can be the name of the regatta, the event, or training camp. It can also be the credits of the club or team, for example.

The contents of this field are rendered at the bottom left corner of the video frame.

6.2 Video resolution

The user can select the resolution preferred for generating the video.



The higher the resolution the longer it will take for the video to be generated, and the size of the resulting file will be larger.

We recommend using a high definition resolution combined with a video player that supports zooming and panning (see 10 on page 23 for a list of recommended players). This allows you to see the action in detail without loss of resolution in the video.

Whatever the case, the user can customize the dimensions of the video frame selecting Custom. Dont be shy!

Video Resolution	Custom	
Width		2048
Height		1536

Note

Depending on the video resolution selected, the size of the map tiles downloaded as explained in 6.7 can differ for a given minimum and maximum GPS coordinates. Therefore, if the video frame is not fully optimized when using a background map we suggest changing the video resolution in order to obtain a better adjustment.

6.3 Zoom

By default, GPSailing selects the zoom level that better adjusts the video frame dimensions to the minimum and maximum GPS coordinates of the tracks so that the frame is optimized. Leave the field blank to accept this behavior.

Nevertheless, the user can select different zoom levels from all the world (2) to just a few meters across (19). This is useful in combination with a background map (see 6.7) in order to have land references.

6.4 Speedup

GPSailing can generate videos at different playback speeds.

Fast Rendering (x100)	▼
Natural Time (x1)	
Tactical Review (x10)	
Fast Review (x60)	
Fast Rendering (x100)	

- **Natural Time** generates a video that plays 1 second of action in 1 second of video. This option is recommended for detailed performance analysis and for advanced analysis using the video analysis software Er1C Sailing. Selecting this option, the user will be able to synchronize this video with other video sources.
- **Tactical Review** generates a video that plays 10 seconds of action in 1 second of video. This option is recommended for tactical briefing sessions.
- **Fast Review** generates a video that plays 1 minute of action in 1 second of video. This option is recommended for managers that need to browse the action very quickly. Or for long regattas.

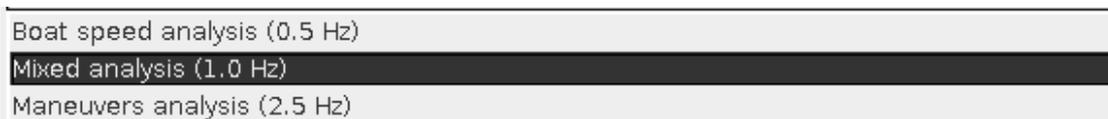
- **Fast Rendering** generates a video that plays 100 seconds of action in 1 second of video. This option is recommended for preliminary runs and to make sure the configuration options are correct before making the final run.

In all cases the video generated has a frame rate of 5 frames per second. This is a frame rate sufficient to give a sense of continuous motion. It is also convenient to generate small video file sizes. And in the case of Natural Time, it takes advantage of all the data generated by TRACE.

The lower the speedup, the longer it will take to generate the video, and the size of the resulting file will be larger.

6.5 Data refresh rate

While GPSailing renders the video at 5 frames per second, this frequency is too high for the human eye to read numbers (sailing speed and course of every boat). Therefore, GPSailing downsamples the frequency at which presents these numbers in the screen.



For every measure presented, GPSailing performs a non-overlapping moving average centered around the instant corresponding to the center of the interval during which the data is presented. The span of data used to perform the moving average. For example, for the highest setting (2,5Hz) the data is shown every 2 frames. Therefore, the average of those two instants is taken, since we have data from the GPS at 5Hz. This ensures that all the information is used, but at the same time that no richness in the data is lost unnecessarily.

For analysis focused on boat speed performance, where the boats basically sail in a straight line and try to achieve the maximum speed over the maximum possible time, select **Boat speed analysis (0,5 Hz)**. This will give you values averaged over 2 seconds for maximum consistency.

For analysis focused on maneuvers performance, where the boats perform numerous maneuvers and fine detail is required in order to identify the slowest speed and the acceleration and deceleration of the boat through the maneuver, select **Maneuvers analysis (2,5 Hz)**. This will give you values averaged over 0,4 seconds (2 data points) for maximum precision (and also the very limit for the human eye). You will most probably use the slow motion playback features of your player in order to take advantage of all the information.

For everything in between, choose **Mixed analysis (1,0 Hz)**.

6.6 Short Tails

GPSailing can generate videos that limit the length of the tails of the boats' tracks.



Leaving this option unselected results in generating a video with the full tails of the boats rendered for the full duration of the video. However, this can generate too much clutter in some cases.

When selecting this option a slider appears. The user can decide which percentage of the length of the video shall the tails last. For example, if the GPS tracks represent a 2 laps windward-leeward course, and the user selects a Tails Duration of 50%, then the tails will last 1 lap approximately.

Warning!

Selecting a **Tails Duration** of **100%** has the same result as leaving **Short Tails** unselected. But the algorithm will make the generation of the video much slower. We strongly recommend against selecting high values of Tails Duration because it lengthens the time to generate the video quadratically.

6.7 Background map

The user can select whether to render a background map or not.



The default option will download the map tiles according to the zoom level and the area of the GPS tracks from the Open Street Map project server. With this option, the user can get a sense of any possible land effects on the wind patterns. Beware that the map tiles have a specific size for every zoom level and resolution chosen. Therefore, the area included in the frame may vary depending on the resolution specified and the zoom level (auto-)selected (see 6.3).

If the user runs GPSailing without internet connection, the background map cannot be used. Therefore, the None option should be selected. This is also very convenient if the user is not concerned at all about the surrounding land and wants to adjust all the frame to the racing area.

6.8 Font size

The font size specifies the font size used to overlay text on the video frame. The texts displayed are:

- Title field at the bottom left corner (see 6.1).

- GPS date and time (UTC adjusted, see 6.10) at the bottom right corner.
- Boats legend (names, speeds and courses) at the top right corner.
- Anemometers legend (names, TWS and TWA) at the top left corner.

Notice that as the video resolution is increased, the user will need to increase the font size in order to read the texts.

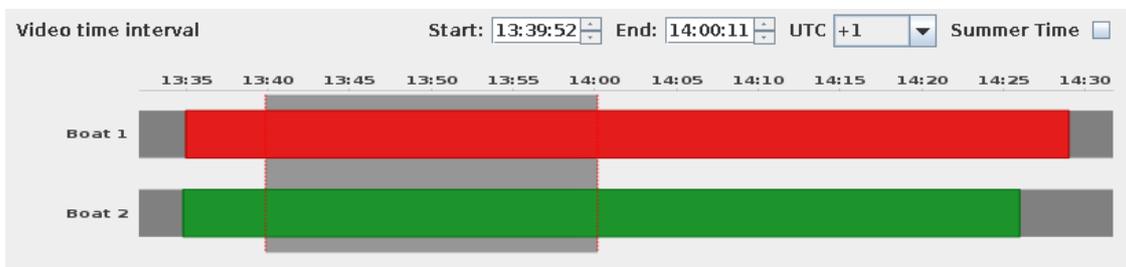
6.9 Save video as

This field includes a browse button where the user can select the folder and file name of the video generated (full path).

It is necessary to include in the file name the **.mp4** extension.

6.10 Video time interval

GPSailing provides a very convenient tool to select which part of the GPS tracks should be used to generate the video. A sailing session can include several exercises or races. And there might be a long time in between exercises or events. GPSailing generates a timeline highlighting the time intervals that contain data for each GPX file. The user can select a subinterval within the time line. GPSailing will generate the video spanning just the subinterval selected by the user. The user can define the limits of the subinterval by means of the Start and End time spinners, or by dragging the ends of the shadowed interval.



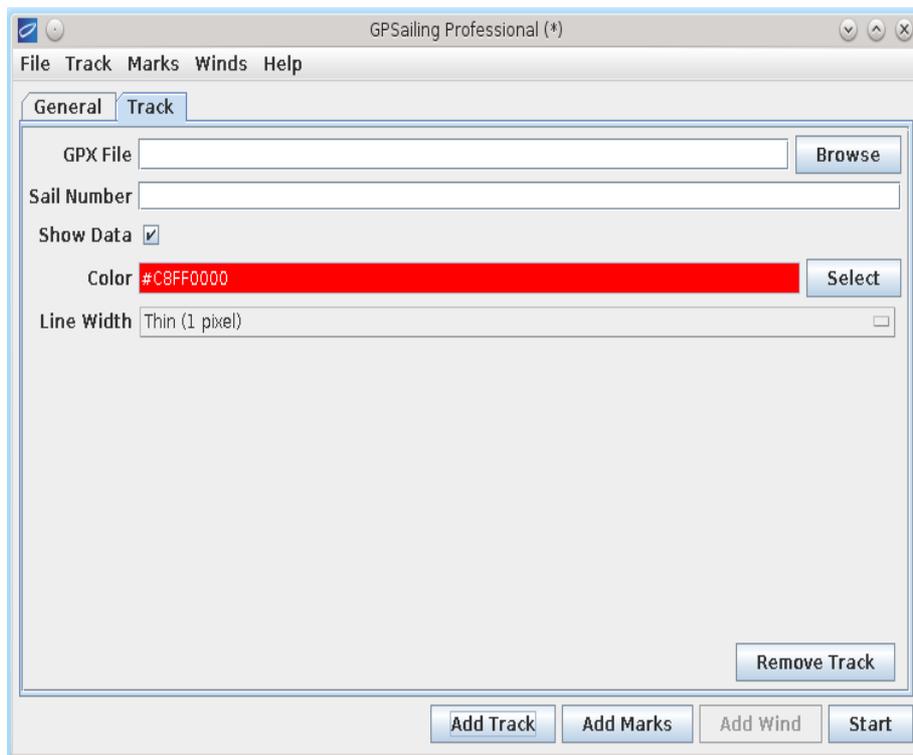
GPS logs provide the Coordinated Universal Time (UTC). The user can select the Time Zone and whether the daylight saving time policy (Summer Time) is in use. The local time in the time line will adjust accordingly to these settings, as well as the time displayed at the bottom right corner of the video.

If the user has a record of the times when the exercises or races started and ended the selection of the subinterval is immediate.

TRACE allows the user to stop recording (logging) data without switching the GPS off and therefore being ready immediately to resume logging. A GPS log that contains pauses will be displayed accordingly in the timeline. This is a visual aide to select the subinterval to generate the video that will span the race or the exercise.

7 Track tab

By pressing the **Add Track** button, a new Track tab is generated.



GPSailing BASIC Edition can only add 1 track. In order to add more than 1 track, you need to purchase a GPSailing PROFESSIONAL Edition license.

Tip

if you add several boat tracks, you can change their order in the legend by dragging their corresponding tabs.

7.1 GPX File

The GPX file field provides a Browse button to navigate the filesystem and select the GPX file containing the GPS track of the boat. For TRACE devices you can download the GPX track file of your uploaded session from the following website using the same account username and password as for the TRACE app in your smartphone: <http://snow.traceup.com/settings/gpx>.

7.2 Sail Number

The Sail Number identifies the boat whose track is recorded in the gpx file. The user can write the boat sail number or whichever identifier is preferred. This identifier is included in the legend at the top right corner of the video frame.

7.3 Show Data

If selected, the speed and course data from the GPS will be displayed alongside the Sail Number in the legend of the video.

The GPX file format is a standard up to some extent. The course and speed fields don't have standard tags in the GPX format. GPSailing has been designed to work with TRACE. Chances are that another GPS logger will not provide this information in the GPX file or that a customization is needed to extract this information from the GPX file if you are using a GPS logger other than TRACE.

We have tested GPX files generated by Garmin. The speed is correctly logged. But some Garmin devices do not log the course on the GPX file.

7.4 Color

A palette of 12 colors that work well with the sea background color is predefined. Each boat has an associated color for its icon in the video and its tail.



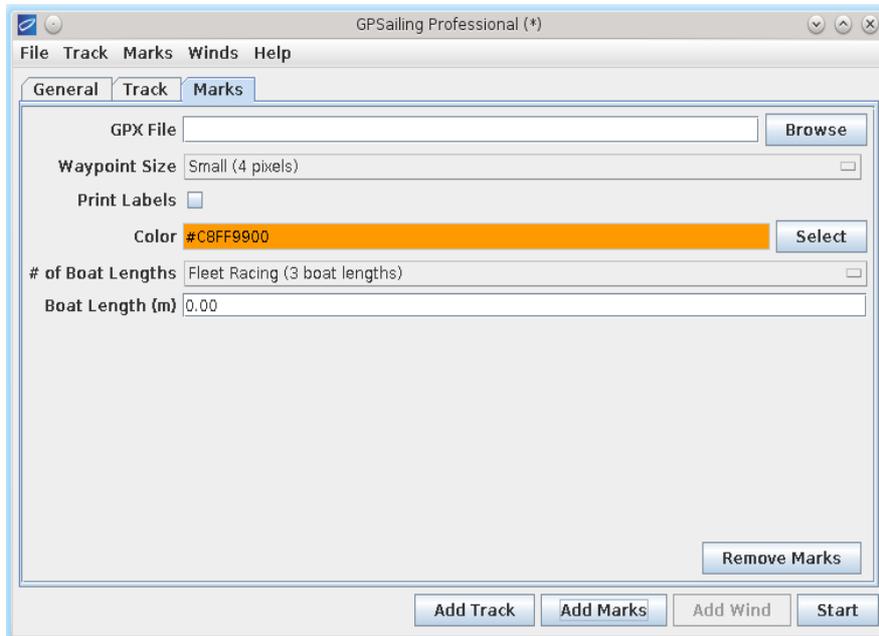
The user can also select a custom color using any of the 4 color code schemes provided.

7.5 Line width

GPSailing gives the option to render tails 1 pixel wide or 2 pixels wide. The size of the boats changes accordingly. This is to take into account the different possible resolutions selected in video resolution. Also, it allows to distinguish boats of different sizes.

8 Mark tab

GPSailing gives also the option to provide a waypoints file in GPX format containing the positions of marks.



With the use of a GPS or a GPS enabled smartphone, the coach can mark the location of the marks used in the race or exercise. The marks logged will display in the video at the correct location. This is particularly important to analyze the performance of the sailors at starts.

8.1 Waypoint size

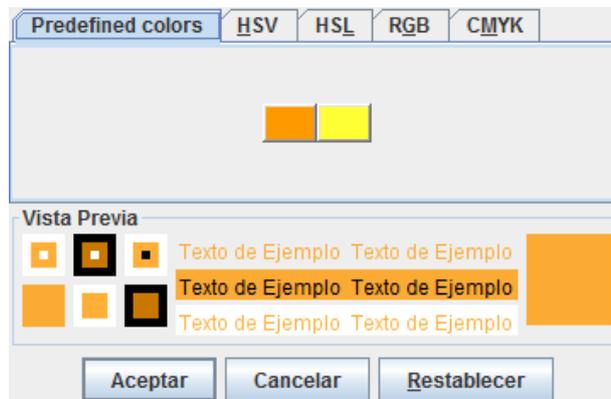
The waypoint size allows the user to adjust the size in pixels to the video resolution. Small (4 pixels across) is recommended for lower video resolutions. Large (8 pixels across) is recommended for the higher definition resolutions.

8.2 Print labels

When logging waypoints using a GPS or a GPS enabled smartphone, the user can include a label for every waypoint. By selecting this option, the labels included in the GPX file will be displayed alongside the marks in the video.

8.3 Color

Each file can contain a set of marks. All the marks within the same file will be displayed using the same color. A 2 color palette has been predefined. Nevertheless,



the user can define any other color.

8.4 Zone

By specifying a boat length other than 0, GPSailing will draw the zone circle around every mark.

# of Boat Lengths	Fleet Racing (3 boat lengths)
Boat Length (m)	4.70

The radius of the zone will be the **Boat Length (m)** times the **# of Boat Lengths**, which depends on the racing format.

Match/Team Racing (2 boat lengths)
Fleet Racing (3 boat lengths)
Radio Sailing Racing (4 boat lengths)

8.5 Recommended Apps

We recommend the app GPS Essentials (www.gpsessentials.com) for Android smartphones.

We recommend the app Waypoints (<http://www.blackmoleapps.com/waypoints>) for iPhone and iPad.

We encourage the users to provide us feed back on which applications they fancy to use to record the locations of marks and use the waypoints files in gpx format with GPSailing.

8.5.1 Recording the location of marks

1. Sail to or very close to the position of the mark, race committee boat or visor

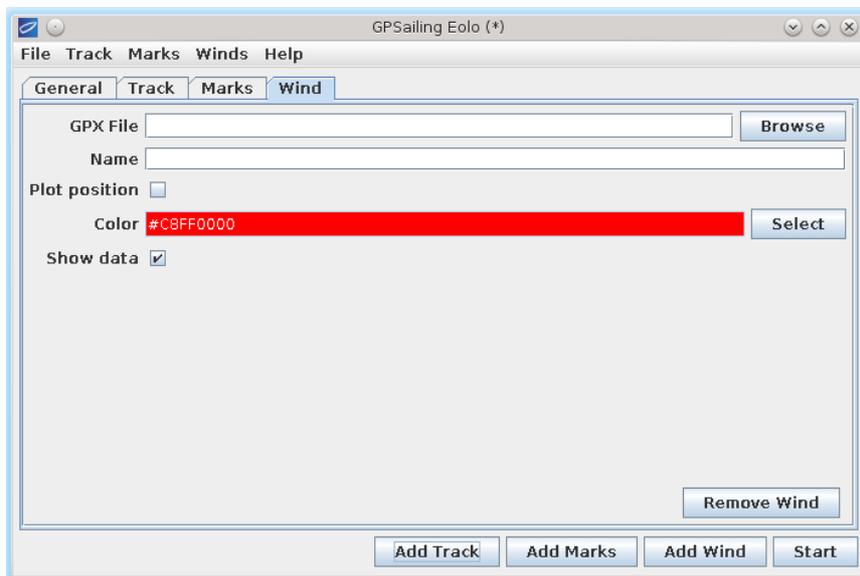
boat.

2. Generate a waypoint at your current location. You may include a name label to this waypoint.
3. Repeat this operation with all the marks you choose.
4. If the mark changes position, generate a new waypoint with a new name label.
5. Upon arrival to port, export all your waypoints to a GPX file.

Tip: You can generate different GPX files for different sets of marks and import the different sets to different Add Mark tabs, to assign different colors for each set of marks.

9 Wind tab

In the EOLO edition of GPSailing the Add Wind button becomes active.



By opening a new Wind tab the user can import a GPX file with wind data. GPSailing has been designed to work alongside the EasyWind anemometer system (see 2.5 on page 4). GPSailing Eolo edition can include data from up to 3 anemometers simultaneously. Since the data files of each anemometer include the location of the anemometer, GPSailing can give an estimation of the actual wind at every point of the race course depending on the distance to the anemometers. This allows to estimate the true wind direction at the position of the sailboat.

9.1 Name

This field serves to distinguish the different anemometers. It will also be included in the anemometers legend at the top left corner of the frame.

9.2 Plot position

It can be of interest to know the location of the anemometer in case it is mounted on a moving platform. If this box is selected, a fan symbol will be displayed at the location of the anemometer. The anemometers don't have a tail associated with their track.

9.3 Color

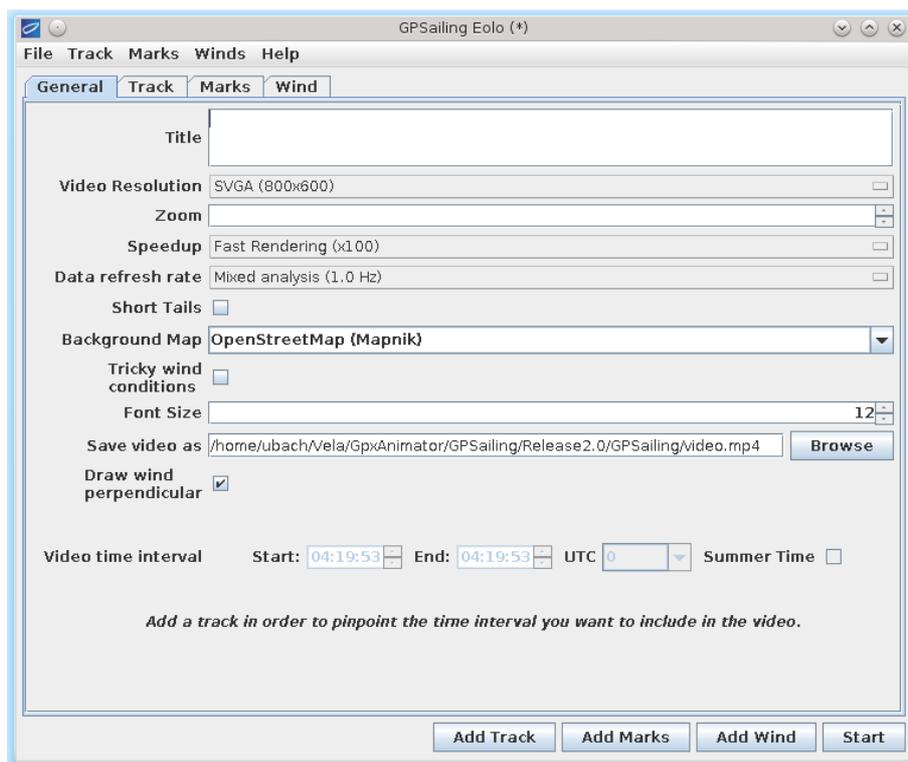
The user can select the color given to each anemometer, which facilitates their identification in the legend.

9.4 Show data

If checked, the legend will include the readings of TWS (true wind speed) and TWD (true wind direction) sensed by the anemometer.

9.5 EOLO options in the General tab

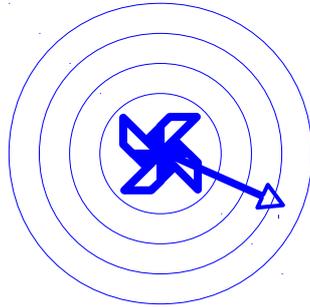
By activating the Eolo license, GPSailing shows some additional options in the General tab.



9.5.1 Tricky wind conditions

If selected, the program will refrain from estimating the actual wind direction at the sailboat position based on the distance from the anemometers. Sometimes can happen that the wind does very bizarre things (we all have experienced it sometime).

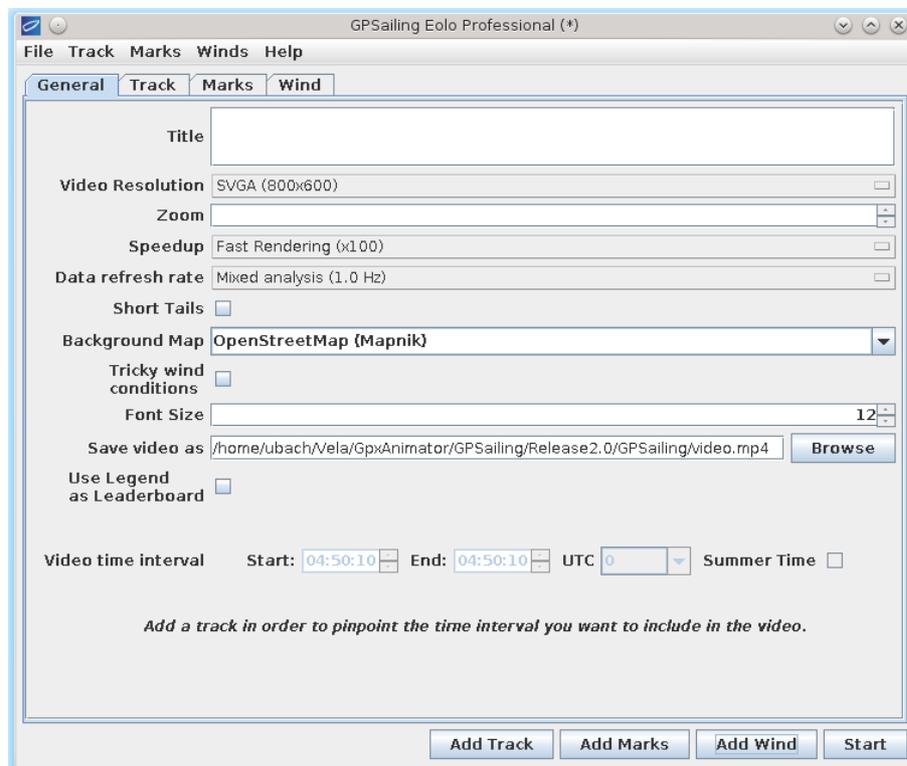
In these cases it is worse showing information that might not be accurate. Instead, GPSailing will change the representation and if the plot position for the anemometer is selected, then a graphical representation of the wind direction and wind intensity will be given at the position of the anemometer.



The fan symbol will be enclosed by concentric circles. The length of the arrow determines the wind intensity, and its direction the wind direction. The inner circle corresponds to a wind intensity of force 2 in the Beaufort scale. And the outer circle corresponds to a wind intensity of force 5 in the Beaufort scale.

9.5.2 Draw wind perpendicular / Use Legend as Leaderboard

For the GPSailing Eolo edition, the program will offer the option to draw the wind perpendicular at the bow of the sailboat.



If in addition to the Eolo license, the user has also activated the Professional License, then this option changes to **Use Legend as Leaderboard**. This turns the legend at the

top right corner of the frame into a leaderboard, where the boats are ordered according to their position with respect to the wind and the course they are sailing.

The boat symbols in the legend rotate depending on the course they are sailing. If they are beating, their bows point upwards. If they are running, their bows point downwards. And if they are reaching, their bows point sideways. All the boats beating are presented grouped at the top of the leaderboard. While all the boats running are presented at the bottom of the leaderboard. Within each group the boats are presented according to their position with respect to the wind (being the windward-most at the top and the leeward-most at the bottom). Therefore, the boat leading in a beat will be placed at the top of the leaderboard and the boat leading in a run will be placed at the bottom of the leaderboard.

GPSailing will draw the wind perpendicular crossing the bow of the boat leading in the beat and the bow of the boat leading in the run. In addition, if there is a windshift in the racing area that make unclear which boat is windwardmost, then GPSailing EOLO PROFESSIONAL will signal all those boats that are potentially in the lead. Note that GPSailing EOLO Edition can identify windshifts only if you have more than one anemometer.

10 Recommended video players

GPSailing's output is an mp4 video file. In order to make the most of this video, and analyze the details, it is recommended to have the capability of zooming and panning to the action area. If the video has enough resolution this zooming and panning can be performed at no expense of the visual quality of the image presented.

10.1 ER1C Sailing

Our absolute best recommendation if you want not only to play back but also to create your own database of relevant actions, tactics, and situations combined with other video sources: your ultimate training review tool.

<http://www.er1csports.com/en/product/er1c> Contact us for a quote.

10.2 Media Player Classic – Home Cinema

This is a free software video player that supports zooming and panning. <https://mpc-hc.org/>

The zoom and pan feature requires a numpad in your keyboard.

Available to Windows users only.

10.3 MacVCD X

This is a video player for Mac OS that also supports zooming and panning. <http://mireth.com/products/macvcd/>

We haven't used it thoroughly yet, so we cannot make a strong recommendation.
Available to Mac OS users only.

10.4 ***MX Player***

This is a free media player available at the Android Play Store. It supports zooming and panning and it is ideal to share your training sessions with your friends.

10.5 ***iOS Media Player***

As of version 9, iOS Media Player supports zooming and panning. This is great news! Since it is an ideal tool to share your training sessions with your friends.

Beware though of our warning regarding the bug in iOS 9.0 with respect to the TRACE App.

10.6 ***VLC***

This player is discouraged because it cannot playback videos at low frame rates.