Enroute Flight Navigation

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Enroute Flight Navigation is an *award-winning* flight navigation app for mobile phones and pads. Designed to be simple, functional and elegant, it takes the stress out of your next flight. The program is free. It has been written by flight enthusiasts, as a project of Akaflieg Freiburg, a flight club based in Freiburg, Germany.

Enroute Flight Navigation features a moving map, similar in style to the official ICAO maps. Your current position and your flight path for the next five minutes are marked, and so is your intended flight route. A double tap on the display gives you all the information about airspaces, airfields and navaids – complete with frequencies, weather reports, and runway information.

The free aeronautical maps can be downloaded for offline use. In addition to airspaces, airfields and navaids, selected maps also show traffic circuits as well as flight procedures for control zones. The maps receive daily updates and cover large parts of the world.

While **Enroute Flight Navigation** is no substitute for full-featured flight planning software, it allows you to quickly and easily compute distances, courses and headings, and gives you an estimate for flight time and fuel consumption. If the weather turns bad, the app will show you the closest airfields for landing, complete with distances, directions, runway information and frequencies.

Consult the homepage of **Enroute Flight Navigation** for more information.

1. Getting Started

This chapter walks you through all the steps that are necessary to get started with **Enroute Flight Navigation**. Enjoy!

1.1 Think Before You Fly

Enroute Flight Navigation is a free software product that has been published in the hope that it might be useful as an aid to prudent navigation. It comes with no guarantees. It may not work as expected. Data shown to you might be wrong. Your hardware may fail.

This app is no substitute for proper flight preparation or good pilotage. Any information **must always** be validated using an official navigation and airspace data source.

> **Warning**
>
> Always use official flight navigation data for flight preparation and navigate by officially authorized means. The use of non-certified navigation devices and software like **Enroute Flight Navigation** as a primary source of navigation may cause accidents leading to loss of lives.

We do not believe that the use of **Enroute Flight Navigation** fulfills the requirement of the EU Regulation No 923/2012:SERA.2010

> Before beginning a flight, the pilot-in-command of an aircraft shall become familiar with all available information appropriate to the intended operation.

To put it simply: relying on **Enroute Flight Navigation** as a primary means of navigation is most likely illegal in your jurisdiction. It is most certainly stupid and potentially suicidal.

1.1.1 Software Limitations

Enroute Flight Navigation is not an officially approved flight navigation software. It is not officially approved or certified in any way. The software comes with no guarantee and might contain bugs.

1.1.2 Navigational Data and Aviation Data

Navigational– and aviation data, including airspace and airfield information, are provided “as is” and without any guarantee, official validation, certification or warranty. The data does not come from official sources. It might be incomplete, outdated or otherwise incorrect.

1.1.3 Operating System Limitations

We expect that most users will run the software on mobile phones or tablet computers running the Android or iOS operating system. Neither Android nor iOS is officially approved or certified for aviation. While we expect that the app will run fine for the vast majority of users, please keep the following in mind.

- The operating system can decide at any time to terminate **Enroute Flight Navigation** or to slow it down to clear resources for other apps.
- Other apps might interfere with the operation of **Enroute Flight Navigation**.
- Many hardware vendors equip their Android devices with "battery saving apps" that randomly kill long-running processes. These apps cannot be uninstalled by the users, do not comply with Android standards and are often extremely buggy. At times, users can manually exempt apps from "battery saving mode", but the settings are usually lost on system updates. See the website Don't kill my app for more information.

1.1.4 Hardware Limitations

Enroute Flight Navigation runs on a variety of hardware platforms, but we expect that most users will run the software on mobile phones, tablet computers and comparable consumer electronic devices that are not certified to meet aviation standards. Keep the following in mind.

- Your device might not be designed to operate continuously for extended periods of time, in particular if the display is on.
- Your device can overheat. Batteries can catch fire.
- Battery capacity is limited. Even if your device is connected to power via a USB cable, the display and/or CPU might use more energy than USB can deliver.

1.2 Installation and Setup

1.2.1 Hardware Considerations

Enroute Flight Navigation is designed to run on mobile devices. During flight, it relies on the device's built-in SatNav receiver as a primary source for position information. If no SatNav receiver is available, **Enroute Flight Navigation** can use your aircraft's traffic data receiver as a fallback source.

> **Note**
>
> At the time of writing, Apple iPad devices contain a SatNav receiver only if a cell phone modem is also installed. Unless your aircraft is equipped with a traffic data receiver that broadcasts position information, iPad devices without SatNav receiver cannot be used for flight navigation.

1.2.2 App Installation

Installation on Mobile Devices
: **Enroute Flight Navigation** is available for free on Google Play and on the App Store. Binaries for Android are available for sideloading here.

Installation on Mac Computers with Apple Silicon
: **Enroute Flight Navigation** is available for free on the App Store.

Installation on Linux Desktop Machines
: **Enroute Flight Navigation** is available for free on flathub.org. Depending on your Linux distribution, you might also find the app in the software management application on your computer.

1.2.3 First Start

After installation, start the app. The app will walk you through the first setup steps. You will be asked to accept the privacy policy and terms and conditions. Depending on the platform, you might need to grant the necessary permissions for the app to run.

Enroute Flight Navigation cannot be used without geographic maps. As the last step, the app will suggest downloading maps that are relevant for your current location. Once the map download has finished, **Enroute Flight Navigation** will process the map data and update the map display after a minute or so.

1.2.4 Set Aircraft Specifics

We recommend that you tell **Enroute Flight Navigation** a little about your aircraft before you fly.

- Open the Menu by touching the menu button in the upper left corner of the screen.
- Choose the menu item *Aircraft*. The aircraft page will then open.

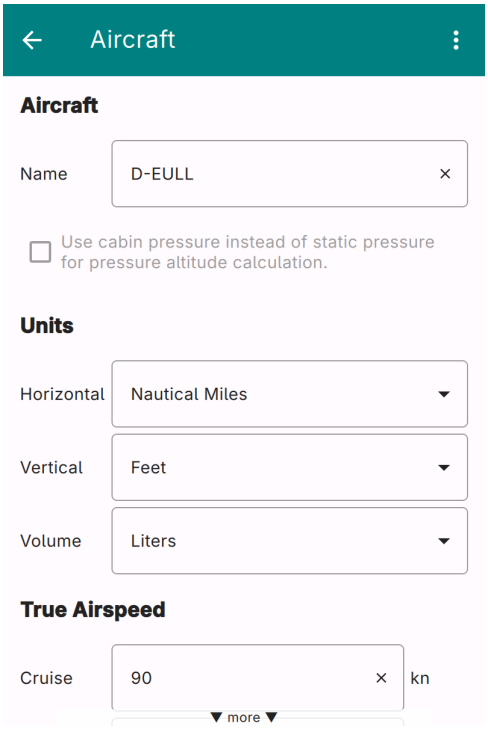


Fig. 1: Aircraft specifics

Please fill in the relevant data. We recommend that you do not activate the option "Use cabin pressure…" for now, as checking option changes the way that **Enroute Flight Navigation** determines pressure altitude. Check the section *Aircraft* in the reference part of the manual for a detailed description of all the settings.

Tap or click on the arrow symbol '←' or use the Android 'Back' button to leave the map page and return to the main screen.

1.2.5 Done.

You are now ready to go. There are many things that you could set up at this stage, but we recommend that you simply look around and play with the app. Continue with the next section and take it for your first flight.

1.3 Before Your First Flight

If you have followed the steps outlined in *Installation and Setup*, then you are now ready to use **Enroute Flight Navigation**. The user interface is designed to be as intuitive as we could make it. Still, we recommend that you take a minute to make yourself familiar with the moving map display and with the basic controls before you take the app on its first flight. The section *Main Page and Moving Map* covers the moving map in more detail.

1.3.1 The Moving Map

After startup, the app will show a moving map, similar in style to the standard ICAO maps that most pilots know. Use the standard gestures to zoom and pan the map to your liking. The figures *Moving Map Display on the Ground* and *Moving Map Display in Flight* shows how the map will typically look.

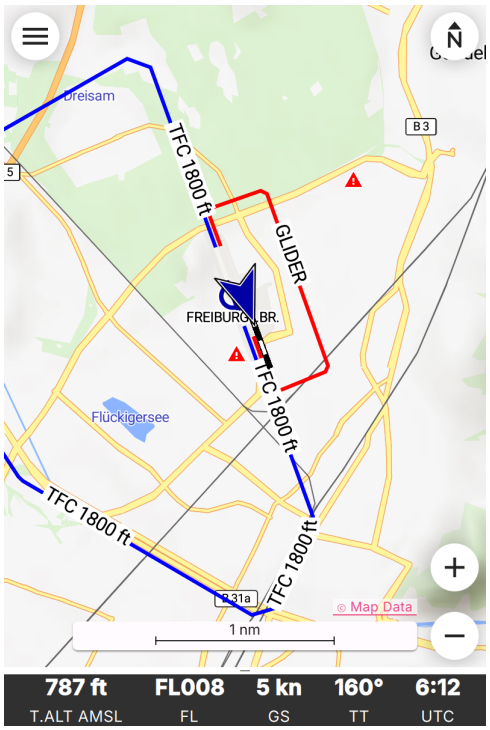


Fig. 2: Moving Map Display on the Ground

Initially, your own position is shown as a blue circle (or gray if the system has not yet acquired a valid position). Once you are moving, your own position is shown as a blue arrow shape. The flight path vector shows the projected track for the next five minutes, sized so that each of the black and white segments corresponds to one minute.

> **Note**
>
> When you start the app for the first time, you will probably see a bright red aircraft symbol in the lower left corner of the map. This symbol indicates that the app is not connected to the traffic data

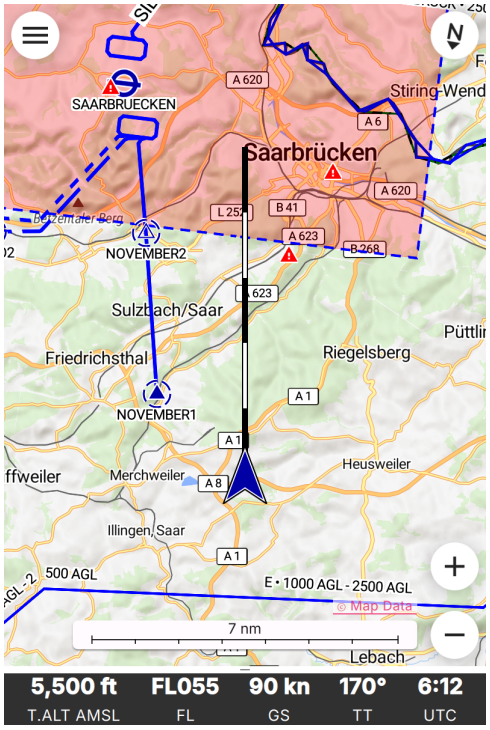


Fig. 3: Moving Map Display in Flight

Fig. 4: Projected Flight Path for the Next Five Minutes

receiver of your aircraft, so that traffic will not be shown on the moving map.

Once you are familiar with the app, please have a look at the Section *Sense and Avoid* of this manual.

1.3.2 The Navigation Bar

The bottom of the display shows a little panel with the following information.

Code	Meaning
T.TALT	True altitude (=geometric altitude) above sea level.
FL	Flight level.
GS	Ground speed.
TT	True track.
UTC	Current time.

The flight level is only available if your device is connected to a traffic receiver (such as a PowerFLARM device) that reports the pressure altitude. Flight level and current time are hidden if the display is not wide enough.

Warning

Vertical airspace boundaries are defined by pressure altitudes (with respect to QNH or standard pressure). Depending on temperature and air density, the pressure altitude will differ from the true altitude that is shown by the app. **Never use true altitude to judge vertical distances to airspaces.**

1.3.3 Airspace Side View

Starting with version 3.0.0, **Enroute Flight Navigation** is able to show a side view of the airspace and the terrain. You can open the side view by swiping upwards from the Navigation Bar at the bottom of the page. At present, you will probably see a warning: "Unable to compute sufficiently precise vertical airspace boundaries because barometric altitude information is not available."

We recommend ignoring the side view for now. The warning will go away once you follow the steps outlined in the subsequent section *Sense and Avoid* to establish a data connection between **Enroute Flight Navigation** and your traffic data receiver. The section *Airspace Side View* in the reference part of this manual explains why barometric altitude information (=static pressure) is needed, and lists ways to provide the data.

1.3.4 Interactive Controls

In addition to the pan and pinch gestures, you can use the following buttons to control the app.

Sym-bol	Function
	Open the main menu.
	Switch between modes **north up** and **track up**.
	Open the raster map menu. Only visible when raster maps are installed.
	Set autopan mode to “on”.
	Zoom in.
	Zoom out.
	Open airspace side view.
	Open the traffic receiver status page. Only visible when the app is not connected to a traffic data receiver.

1.3.5 Information About Airspaces, Airfields and Other Facilities

Double tap or tap-and-hold anywhere in the map to obtain information about the airspace situation at that point. If you double tap or tap-and-hold on an airfield, navaid or reporting point, detailed information about the facility will be shown. The figure *Information about EDFE airport* shows how this will typically look.

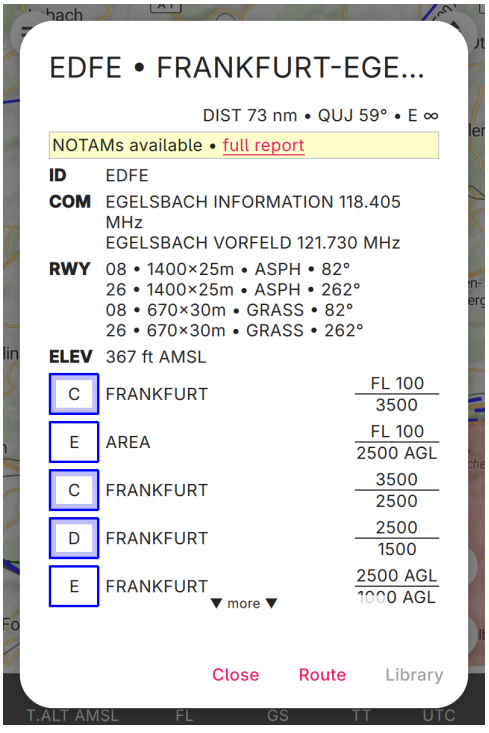


Fig. 5: Information about EDFE airport

The dialog uses the following abbreviations.

Abbreviations	
DIST	Distance to the waypoint
QUJ	True track to the waypoint
E	Minimal gliding ratio required to reach waypoint in 300 m AGL (disregarding terrain)

Click on the link ‘full report’ for a list of NOTAMs relevant for the EDFE airfield.

1.3.6 Go Flying!

Enroute Flight Navigation is designed to be simple. We think that you are now ready to take the app on its first flight. There are of course many more things that you can do. Play with the app and have a look at the next section *Sense and Avoid*.

2. Sense and Avoid

Midair collisions are a major reason for loss of lives in general aviation. While anti-collision systems are still not mandatory in several European countries, it is clear that no responsible pilot will fly without such a system. **Enroute Flight Navigation** can connect to your aircraft's traffic receiver and show nearby traffic in the moving map.

To check the connection to your traffic data receiver anytime, open the main menu and choose *Information/Traffic Data Receiver*.

2.1 What to Expect

Enroute Flight Navigation is compatible with practically every traffic avoidance system on the market. After an initial one-time setup, you can expect that **Enroute Flight Navigation** automatically connects to your traffic data receiver as soon as you board your aircraft, power on the avionics and go flying. The figure *Approaching EDTF with Traffic* shows what the moving map will look like when traffic is detected.

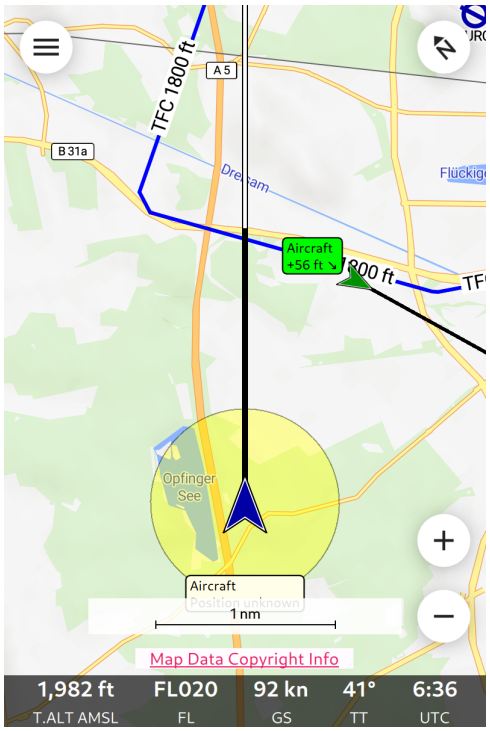


Fig. 1: Approaching EDTF with Traffic

The figure shows two traffic factors.

- There is one aircraft in the downwind section of the traffic circuit. The traffic has approximately the same altitude as the own aircraft and is descending. The green color indicates "no alarm".
- There is one aircraft nearby whose precise position is unknown to the traffic receiver; this is often the case with traffic that has only a Mode-S transponder. The traffic is most likely found

within the yellow circle. The yellow color indicates that the traffic might be close enough to be dangerous.

The section *Main Page and Moving Map* covers the traffic display in detail.

> **Note**
>
> To show only relevant traffic, **Enroute Flight Navigation** will display traffic factors only if the vertical distance is less than 1,500 m and the horizontal distance less than 20 nm. Aircraft on the ground will not be shown at all, provided that your traffic data receiver reports the flight status.

2.1.1 Flarmnet Data

Enroute Flight Navigation is able to use the database from Flarmnet.org to identify aircraft and to show the aircraft registration in the moving map display. The process does not require user interaction: once the app connects to a FLARM device and receives traffic information, the Flarmnet database will automatically be downloaded and updated with every map update. If desired, the database can also be downloaded manually on the page "Maps and Data" (open the main menu and go to "Library/Maps and Data").

2.1.2 Limitations

Traffic Warnings

Enroute Flight Navigation does not issue traffic warnings. The app contains no collision avoidance algorithms. Color coding of traffic according to relevance works best with FLARM devices.

Platform Support

Access to Bluetooth radio is severely limited on iOS platforms. For that reason, Bluetooth communication is not supported at all on iPhone or iPad devices.

Applications are not allowed to read the Wi-Fi status on iOS platforms. For that reason, **Enroute Flight Navigation** cannot determine the ID of the traffic data receiver when connecting via Wi-Fi. As a result, traffic data receiver passwords cannot be stored when using iPhone or iPad devices.

2.2 Connect via Wi-Fi

Wi-Fi is the recommended method to connect **Enroute Flight Navigation** to your traffic data receiver. Compared with Bluetooth, Wi-Fi connections are reliable, hassle-free and work automatically with minimal setup.

2.2.1 One-time Setup

Step 0: Before You Connect

Before you try to connect this app to your traffic receiver, make sure that the following conditions are met.

- Your traffic receiver has an integrated Wi-Fi interface that acts as a wireless access point.
- You know the network name (=SSID) of the Wi-Fi network deployed by your traffic receiver. If the network is encrypted, you also need to know the Wi-Fi password.

- Some devices require an additional password in order to access traffic data. If this is the case, you will need to know this password.

Enroute Flight Navigation supports all major protocols for traffic data sharing, including "FLARM/NMEA" and "GDL90". If your traffic receiver supports FLARM/NMEA as well as GDL90 output, then configure it to always use FLARM/NMEA. The GDL90 protocol has a number of shortcomings that **Enroute Flight Navigation** cannot always work around. See the Section *Known Issues with GDL90* for more details.

Step 1: Enter the Traffic Receiver's Wi-Fi Network

- Make sure that the traffic receiver has power and is switched on. In a typical aircraft installation, the traffic receiver is connected to the 'Avionics' switch and will automatically switch on. You may need to wait a minute before the Wi-Fi comes online and is visible to your device.
- Enter the Wi-Fi network deployed by your traffic receiver. This is usually done in the "Wi-Fi Settings" of your device. Enter the Wi-Fi password if required. Some devices will issue a warning that the Wi-Fi is not connected to the internet. In this case, you might need to confirm that you wish to enter the Wi-Fi network.

Most operating systems will offer to remember the connection, so that your device will automatically connect to this Wi-Fi in the future. We recommend using this option.

Step 2: Check Connectivity

After your device has entered the traffic receiver's Wi-Fi network in Step 1, everything else should be automatic. To check, open the main menu and navigate to the "Information" menu. If the entry "Traffic Receiver" is highlighted in green, then **Enroute Flight Navigation** has already found the traffic receiver in the network and has connected to it. Congratulations, you are done!

If the entry "Traffic Receiver" is not highlighted in green, then something has gone wrong. The section "Troubleshooting" below might help you find the issue.

2.2.2 Daily Operations

Once things are set up properly, your device should automatically detect the traffic receiver's Wi-Fi network, enter the network and connect to the traffic data stream whenever you go flying. Here is a breakdown of what will happen.

- As soon as you board your aircraft and power on the avionics, the traffic receiver's Wi-Fi network will become visible to your device.
- In a typical scenario, your device might already be connected to a Wi-Fi in a nearby building. In that case, nothing will happen for the moment. As you taxi to the runway, your device leaves the range of that network and automatically connects to the traffic receiver's Wi-Fi network as the next best alternative.
- Traffic information will be shown in the moving map.

2.2.3 Troubleshooting

The app cannot connect to the traffic data stream

Open the main menu and navigate to the "Information" menu. If the entry "Traffic Receiver" is not highlighted in green, then **Enroute Flight Navigation** does not receive any traffic data or traffic data receiver heartbeat. Work through the following steps to identify the issue.

Step 1: Check Wi-Fi

Open the Wi-Fi settings of your device and confirm that your device is indeed connected to the traffic data receiver's network. If not, then reconnect. It might help move your device closer to the traffic data receiver's Wi-Fi antenna.

Some traffic data receivers offer a web-interface that can be accessed with your web browser. In that case, check if you can access the web-interface with your browser. Close the web browser afterwards, because some devices cannot concurrently operate the web interface and transmit traffic data.

Step 2: Check Connection

If you are sure that your device has connected to the correct Wi-Fi network, then return to **Enroute Flight Navigation** open the main menu and go to "Settings/Data Connections". Look at the connections of type "TCP" and "UDP".

- If none of the TCP/UDP connections has status "Connected", then **Enroute Flight Navigation** cannot see your traffic data receiver in the Wi-Fi network. This means that your traffic data receiver is not available at any of the IP address/Port combinations known to **Enroute Flight Navigation**.

  Check the manual of your traffic data receiver or Wi-Fi interface and note the connection type (TCP or UDP), IP address and port that the traffic data receiver uses. Go back to **Enroute Flight Navigation** and check whether the combination of IP address and port appears in the list of data connections.

  If a data connection for that IP address and port exists but cannot connect, then there is a communication issue that we cannot resolve. It might be interesting to check if another app is able to communicate with your traffic data receiver.

  If a data connection for that IP address and port does not exist, then please do the following.

  - Contact us! We want to support all traffic data receivers on the market, and we will be glad to support your traffic data receiver as well. For this, return to the main moving map screen of **Enroute Flight Navigation**, open the main menu and go to "Bug Report".
  - Check if your traffic data receiver can be configured to use one of the supported IP address/port combinations. If possible, this will ensure that users of **Enroute Flight Navigation** can connect to your traffic data receiver without manual configuration.
  - Configure a new data connection for the IP address/port combination used by your traffic data receiver. The section *Settings: Data Connections* explains how to do that.

- If one or several of the TCP/UDP connections have status "Connected" but no heartbeat is received, then you are out of luck. **Enroute Flight Navigation** does not receive any data or cannot understand the data it receives. Please contact us! We want to support all traffic data receivers on the market, and we will be interested to hear about your case. For this, return to the main moving map screen of **Enroute Flight Navigation**, open the main menu and go to "Bug Report".

Step 3: [Censored Profanity]

If **Enroute Flight Navigation** has connected to your traffic data receiver via a TCP/UDP connection but does not receive heartbeat of traffic data, then you are out of luck. Please contact us, as we would like to hear about your case. Return to the main moving map screen of **Enroute Flight Navigation**, open the main menu and go to "Bug Report". It might be worth checking if other apps experience similar problems.

The connection breaks down frequently

There are two common causes for unstable connections.

Limitations of your Traffic Data Receiver

Some traffic receivers and some Wi-Fi adaptors cannot serve more than one client concurrently and abort connections at random if more than one device tries to access.

- Make sure that there no second device connected to the traffic receiver's Wi-Fi network. The other device might well be in your friend's pocket!
- Make sure that there is no other app trying to connect to the traffic receiver's data stream.
- Many traffic receivers offer "configuration panels" that can be accessed via a web browser. Close all web browsers.

Electromagnetic Interference

Electromagnetic interference is a major problem in many avionics installations. This is not easily solved. Try moving your device closer to the Wi-Fi antenna and try to install the antenna in other locations.

2.3 Connect via Bluetooth

Enroute Flight Navigation is able to connect to your traffic data receiver using the Bluetooth Classic radio standard. Compared with Wi-Fi, Bluetooth connections are less reliable and require manual configuration. We found that many Bluetooth adaptors are build with cheap and unreliable hardware and implement industry standards only partially, if at all.

2.3.1 Bluetooth Protocols

Quite confusingly, Bluetooth is an umbrella term for two unrelated and completely incompatible radio communication protocols that operate in the same frequency range.

- Bluetooth Classic, marketed under the names "Bluetooth", "Bluetooth Basic Rate" and "Bluetooth Enhanced Data Rate" is the standard radio protocol powering headphones and in-car entertainment systems.

  Bluetooth Classic supports only point-to-point connections, so that only one single app can access traffic data at any given time. Pilots and co-pilots must therefore decide who gets to see traffic data and configure their devices appropriately.

- Bluetooth Low Energy, marketed under the names "Bluetooth", "Bluetooth LE" and "Bluetooth Smart" is a slower radio protocol designed for very low power operation and flexible network topologies.

> **Note**
>
> At present, **Enroute Flight Navigation** supports only Bluetooth Classic communication. Bluetooth Low Energy is supported as a technology preview and should not be used in production environments.

> **Note**
>
> Access to Bluetooth radio is severely limited on iOS platforms. For that reason, Bluetooth communication is not supported at all on iPhone or iPad devices.

2.3.2 One-time Setup

Step 0: Before You Connect

Before you try to connect this app to your traffic receiver, make sure that the following conditions are met.

- Your traffic receiver supports Bluetooth Classic radio.
- You know the Bluetooth name of your traffic receiver.
- Bluetooth is switched on in your phone.
- Bluetooth is switched on in your traffic data receiver and set to 'discoverable mode'.
- If possible, configure your traffic data receiver to always be in 'discoverable mode'.

> **Note**
>
> The steps described here might also work if your device uses the Bluetooth Low Energy radio standard, which is only supported as a technology preview. If you use Bluetooth Low Energy, please let us know how it worked for you. Our development team is very interested in your feedback.

Step 1: Configure a Data Connection to the Bluetooth Classic Device

Follow the steps described in the Section *Settings: Data Connections*.

Step 2: Check Connectivity

After the data connection to the Bluetooth Classic device has been configured in Step 1, everything else should be automatic. To check, open the main menu and navigate to the "Information" menu. If the entry "Traffic Receiver" is highlighted in green, then **Enroute Flight Navigation** has already found the traffic receiver and has connected to it. Congratulations, you are done!

If the entry "Traffic Receiver" is not highlighted in green, then something has gone wrong. Open the main menu and go to "Information/Traffic Receiver". Make sure that your device is in discoverable mode and use the button "Reconnect". Failing that, you are out of luck.

2.3.3 Daily Operations

Once things are set up properly, your device should automatically detect the traffic receiver's Bluetooth adaptor and connect to the traffic data stream whenever you go flying. We recommend the following procedure.

- Bluetooth Classic can handle only one data connection. Before boarding, clarify which device should connect to the traffic data receiver. Ask your co-pilot and all passengers to switch off Bluetooth in all other devices. Make sure that there are no undetected devices (e.g. in someone's baggage) that could interfere with your data connection.

- A few moments after you power on the avionics, the traffic receiver's Bluetooth adaptor will become discoverable. Start **Enroute Flight Navigation** while the traffic data receiver is discoverable.
- **Enroute Flight Navigation** will connect to your traffic data receiver via the configured Bluetooth data connection and show traffic information in the moving map.
- If the data connection gets lost in mid-flight, **Enroute Flight Navigation** will automatically try to re-connect. Depending on your hardware, it might be necessary to restart the traffic data receiver in order to enter discoverable mode.

2.4 Connect via the Serial Port

Enroute Flight Navigation is able to connect to your traffic data receiver using serial port connections. Connections via USB are also supported. Compared with Wi-Fi, serial port connections are equally reliable, but require manual configuration. By nature, serial ports support only point-to-point connections, so that only one single app can access traffic data at any given time. Pilots and co-pilots must therefore decide who gets to see traffic data.

> **Note**
>
> **Enroute Flight Navigation** expects a stream for FLARM/NMEA sentences from the serial port device. **Enroute Flight Navigation** is not able to integrate into a CAN-Bus environment.

> **Note**
>
> Serial port devices are currently not supported on the Android platform. For that reason, serial port communication is not available at all on Android devices.

> **Note**
>
> Serial port devices are not supported by the iOS platform. For that reason, serial port communication is not available at all on iPhone or iPad devices.

2.4.1 One-time Setup

Step 0: Before You Connect

Before you try to connect this app to your traffic receiver, make sure that the following conditions are met.

- The hardware is set up.
- Your traffic receiver is switched on and broadcasts FLARM/NMEA via its serial port.
- Your device is connected to the serial port and no other app uses the serial port connection.

Step 1: Configure a Data Connection to the Serial Port Device

Follow the steps described in the Section *Settings: Data Connections*. You will need to know or guess the name of the serial port on your device.

Step 2: Check Connectivity

After the data connection to the serial port device has been configured in Step 1, everything else should be automatic. To check, open the main menu and navigate to the "Information" menu. If the entry "Traffic Receiver" is highlighted in green, then **Enroute Flight Navigation** has already found the traffic receiver and has connected to it. Congratulations, you are done!

If the entry "Traffic Receiver" is not highlighted in green, then something has gone wrong. Open the main menu and go to "Information/Traffic Receiver". Make sure that your device is in discoverable mode and use the button "Reconnect". Failing that, you are out of luck.

2.4.2 Daily Operations

Once things are set up properly, your device should automatically detect the traffic receiver's Bluetooth adaptor and connect to the traffic data stream whenever you go flying. We recommend the following procedure.

- Connect your device to the serial port cable.
- After you power on the avionics and the traffic receiver has booted, start **Enroute Flight Navigation**.
- **Enroute Flight Navigation** will connect to your traffic data receiver via the configured serial port connection and show traffic information in the moving map.
- If the data connection gets lost in mid-flight, **Enroute Flight Navigation** will automatically try to re-connect.

2.5 Compatibility List

Enroute Flight Navigation should work with all modern, standard-compliant traffic receivers that offer Wi-Fi or Bluetooth Classic connectivity. If you have experience with a device not listed here, then please let us know!

2.5.1 Wi-Fi Enabled Devices

The author has tested the following receivers.

- AT-1 AIR Traffic by Air Avionics.
- PowerFLARM Fusison by FLARM Technology Ltd, in Wi-Fi mode.
- Stratux devices
- PowerFLARM Core by FLARM Technology Ltd, and AIR Connect Wi-Fi Adaptor by Air Avionics.

Users reported success with the following traffic receiver hardware.

- Classic FLARM and the ICFly Connect Wi-Fi adaptor, set to IP 192.168.1.1 and TCP Port 2000.
- SkyEcho2 – but see the Sections *Known Issues with SkyEcho Devices* and *Known Issues with GDL90*
- PilotAware Rosetta

- pingUSB – but see the Sections *Known Issues with pingUSB Devices* and *Known Issues with GDL90*

2.5.2 Bluetooth Classic Enabled Devices

The author has tested the following receivers.

- PowerFLARM Fusison by FLARM Technology Ltd, in Bluetooth mode.
- Classic FLARM and XCVario.
- Classic FLARM and SH-B23A(SH-B30) Bluetooth 2.0 to RS232 Serial Adaptor by DSD TECH.

Users reported success with the following traffic receiver hardware.

- Classic FLARM and HC-06 Bluetooth Adaptor.

2.5.3 Bluetooth LE Enabled Devices

Users reported success with the following traffic receiver hardware.

- SoftRF Badge Edition.

Part I.

Tutorials

3. Basic Use

The following tutorials walk you through the basic functionality of **Enroute Flight Navigation**.

3.1 Find Nearby Waypoints

If the weather turns bad, **Enroute Flight Navigation** can help you find the best place to land. Open the main menu and choose the item “Nearby waypoints”. You will be presented with a list of the closest aerodromes, together with distances and directions. Click on any item to open a dialog with detailed information, including lists of runways and communications frequencies. The dialog has a button “Direct” the replaces the current route with a route that brings you directly to the aerodrome.

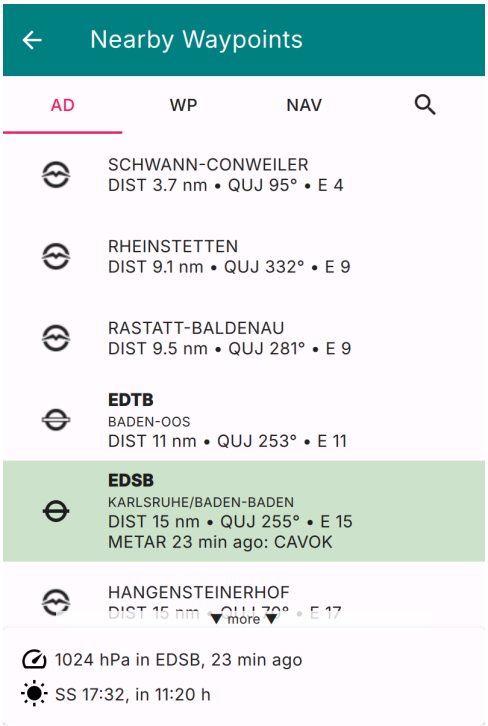


Fig. 1: List of Airfields Close to the Current Position

Apart from aerodromes, there are additional tabs that list nearby waypoints, navaids and reporting points.

3.2 Check Weather

Enroute Flight Navigation can show METAR reports and TAF forecasts from nearby airfields along your route. The data is updated frequently, provided that an internet connection is available. To check weather, open the main menu and choose the item “Weather”. The weather information comes from the “Aviation Weather Center”, a website of the US government. When you open the page for the first time, **Enroute Flight Navigation** asks for your permission to access that site.

Warning

The weather information shown by **Enroute Flight Navigation** might be outdated or otherwise wrong. Assessment of meteorological flight conditions has to be done via an officially approved source of flight weather.

As soon as weather information has been downloaded, the page will look like this.

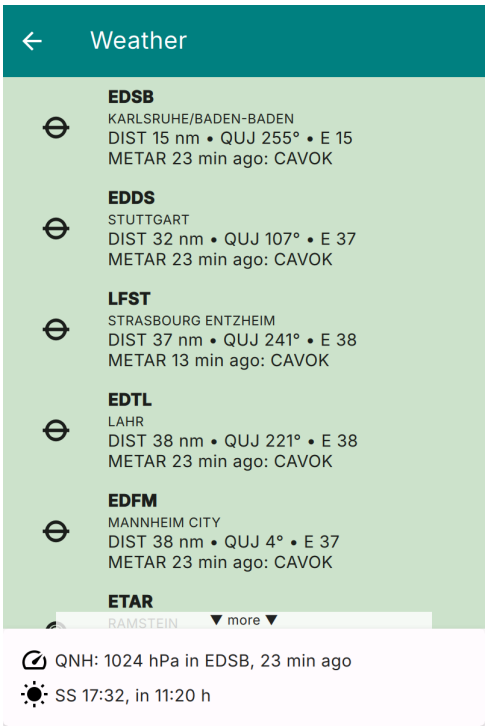


Fig. 2: Weather Information

The page body displays a list of stations that are within 85 nm around your current position or your intended flight route. As you can see in the picture, the following information is shown.

- ICAO identifier for Station and Airport name
- Distance, QUJ and required gliding ratio for direct flight to the station. See the section *Direction Summary* for more detail.
- METAR summary

The entries are classified and colored according to the “aviation flight categories” typically used in the United States; see the section *METAR and TAF Dialog* for precise definitions.

- Red: IFR and low IFR conditions
- Yellow: Marginal VFR conditions
- Green: VFR conditions
- White: No data

Touch any item in the list to open dialog window with more details. The dialog window will look like this.

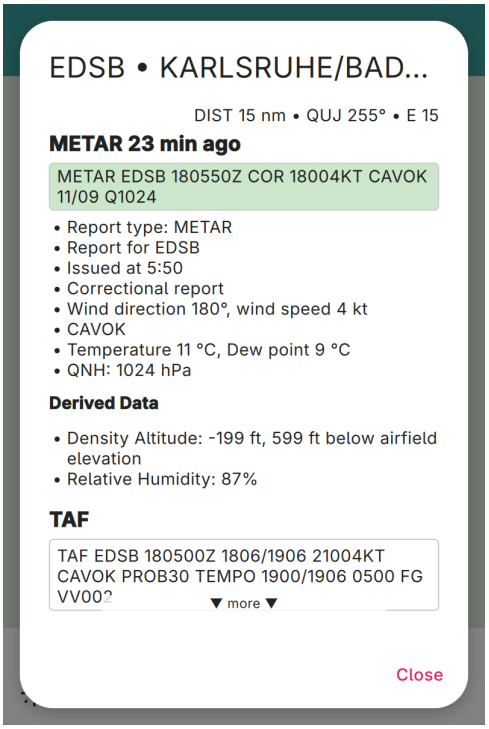


Fig. 3: Detailed Weather Dialog

Depending on screen size, you might have to scroll down in order to read the full weather forecast. The section *METAR and TAF Dialog* describes the dialog in full detail.

3.2.1 Page Footer

The footer of the page shows the following data.

- QNH of the closest airfield, as well as location and time of the report
- Time of next sunset or sunrise at current location
- Remaining time until sunset

3.2.2 Refresh Button

The refresh button in the title bar at the top right of the page allows checking for updates of METAR and TAF data. **Enroute Flight Navigation** checks for updates at regular intervals, so that there is no need to trigger an update manually. The refresh button might however be useful to force an update in setting where the device had no internet connection for a while.

3.3 Plan a Flight

3.3.1 What to Expect

Enroute Flight Navigation offers essential flight planning functionality: you can display the route on the moving map and compute travel time and fuel consumption estimates. The following image shows the Flight Route Window in a typical situation.

As soon as you are flying and following the route, the moving map will show additional items that help you navigate.

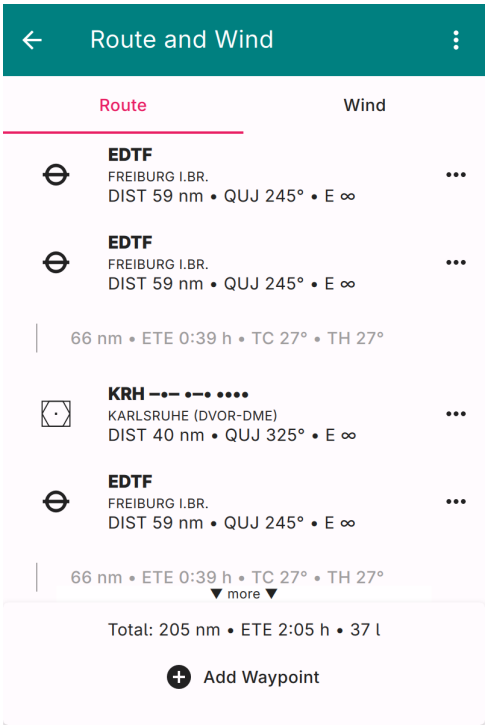


Fig. 4: Flight Route Window, Route Set

- The moving map shows the intended flight as a magenta line.
- The map shows the path from the current position to the next waypoint as a thin red line.
- An info box shows distance, ETE, and ETA for the flight to the next and the final waypoint.

The following image shows a typical situation.

Note

Enroute Flight Navigation shows the info box only when airborne, closer than three nautical miles to the intended route and further than three nautical miles from your destination.

3.3.2 Set Up a Route

This chapter will take you through the necessary steps to set up a route.

Step 1: Set Aircraft Characteristics

To compute travel time, **Enroute Flight Navigation** needs to know the cruise speed of your aircraft. If you have followed this manual, you have entered this piece of data after you downloaded the aviation map. If not, then please check the Section *Set Aircraft Specifics* again.

Step 2: Specify Wind

Enroute Flight Navigation also needs to know about the wind. If you are not on the page "Route and Wind," open the main menu and choose the item "Route and Wind." Select the tab "Wind" and enter an estimate for wind direction and speed that you expect to encounter during your flight.

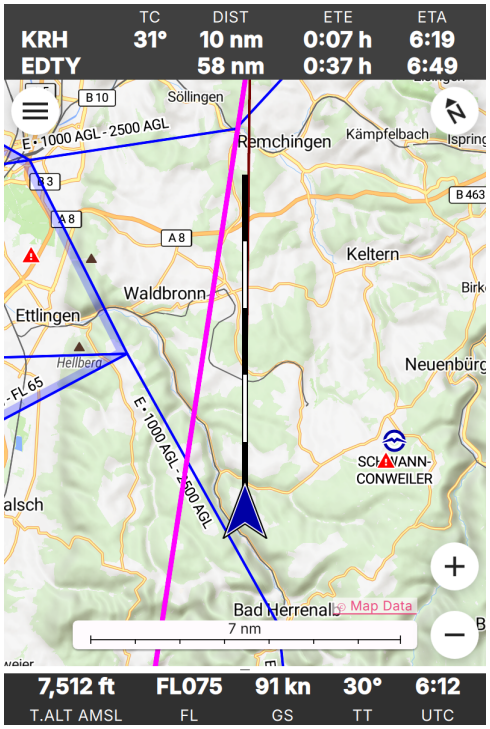


Fig. 5: Moving Map When Following a Flight Route

Step 3: Specify Waypoints

Enroute Flight Navigation needs to know where you want to go. There are several ways to specify the waypoints in your route.

- Enter waypoints by name
- Select waypoints in the moving map
- Load a route from the route library
- Import a file from another program

Most users will enter the waypoints manually. Still, we explain all four methods in some detail.

Option 1: Enter Waypoints by Name

If you are not on the “Route and Wind” page, open the main menu and choose the item “Route and Wind.” On the page, select the “Route” tab. The page will initially look like this:

A tap on the field “Add Waypoint” at the bottom of the page will open a dialog window showing a long list with all waypoints from all aviation maps you have installed. Enter a few letters of the waypoint name (“Freiburg”) or ICAO code (“EDTF”) to narrow the list down. Once the desired waypoint becomes visible, a click will add it to the route.

Click on the field “Add Waypoint” again to enter more waypoints.

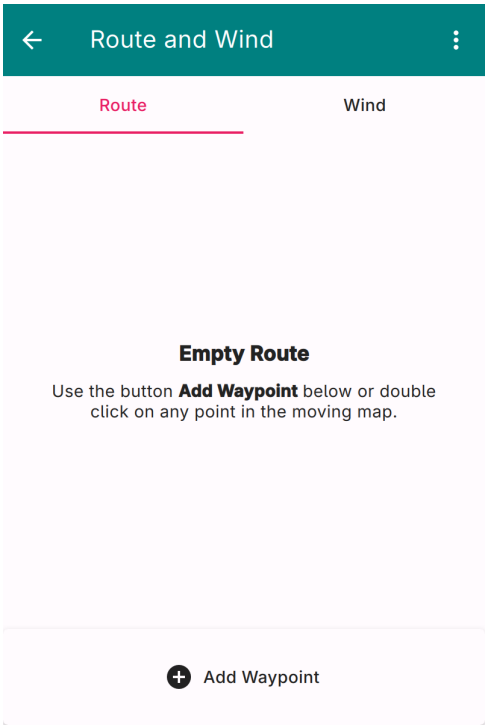


Fig. 6: Flight Route Window, No Route Set

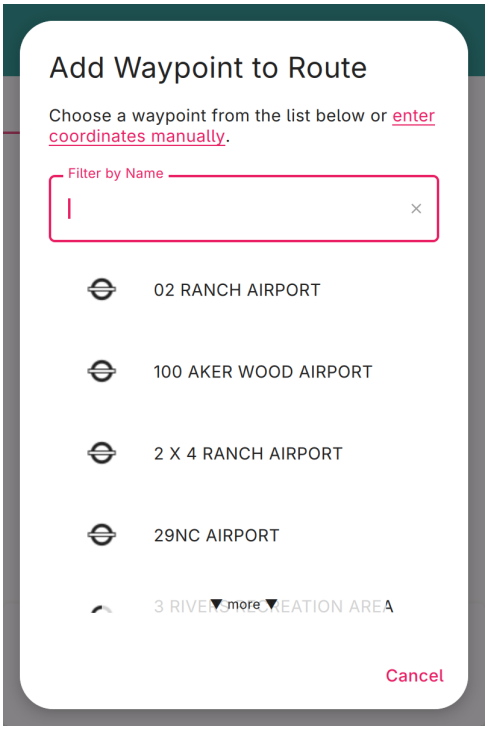


Fig. 7: Enter Waypoints by Name

Option 2: Select Waypoints in the Moving Map

It is possible to add waypoints directly from the moving map.

- Double-tap or tap-and-hold on any point of the moving map. The waypoint description dialog will open.
- Tap on the "Route" button to add the waypoint to the current route. A menu will open.

The waypoint can be added in several ways.

- Tap on "Direct to" to discard the current route and to add the current position and the given waypoint to your path.
- Tap on "Append" to append the waypoint to your route. The waypoint becomes the last point of your route.
- Tap on "Insert" to insert the waypoint into your route. Depending on the geographical position, the waypoint becomes the first point of your route, the last point of your route, or it will be inserted into the middle of the route. This function is particularly useful to add a detour while in flight (for instance, to avoid an active parachute jumping exercise area).
- If the waypoint is already present in your route, you can tap on "Remove" to remove the waypoint from the route.

Option 3: Load a Route From the Library

Section *Save route for future use* will show how to save a route to the library for future use. If you have already saved a route to the library, go to the open the main menu and choose the item "Library/Routes." The route library page will open. Choose a route by tapping on the respective item in the list.

Option 4: Import a File From Another Program

To prepare your flight, you might want to use full-featured flight preparation software or online services. The Section *Flight Planning Tools* highlights a few tools typically used in our club.

All programs known to us are able to export flight routes in GPX format, which is one of the formats that can be read by **Enroute Flight Navigation**. A full list of supported file formats is found in the Section *Supported File Formats*.

The Section *Import Data* explains the import process in detail.

Step 4: Edit the Route if Necessary

It might be necessary to edit the route. If you are not on the "Route and Wind" page, open the main menu and choose the item "Route and Wind." On the page, select the "Route" tab.

Global Functions

The three-dot-menu in the upper right corner of the screen allows reversing the route or deleting it entirely.

Waypoint-Specific Functions

The three-dot-menu to the right of each waypoint allows one to delete a specific waypoint or move it up and down in the list. You can edit waypoints that do not refer to pre-set airfields, navaids, or reporting points. Tap on the pencil symbol to open a dialog that allows you to set a name and edit the coordinates.

3.3.3 Save Route for Future Use

Once you are happy with the route, you might want to save it for future use. If you are not on the "Route and Wind" page, open the main menu and choose the item "Route and Wind." On the page, select the "Route" tab. The three-dot-menu in the upper right corner of the screen allows saving the route to the library.

3.4 Manage a Waypoint Library

3.4.1 What to Expect

Enroute Flight Navigation allows you to build a small library of waypoints that can be used in flight routes and shared with others. For the typical user, the library might contain a list of touristic landmarks ("Hohenzollern Castle"), or perhaps a list of emergency landing fields. The waypoints from the library are shown in the moving map.

> **Note**
>
> The waypoint library has been designed with small libraries in mind. If you import files containing thousands of waypoints, you might find that the moving map of **Enroute Flight Navigation** slows down considerably.

3.4.2 Add Waypoints to the Library

There are two ways to add waypoints to the library.

- Select points from the moving map
- Import waypoint files

Option 1: Select Points from the Moving Map

To add a waypoint from the moving map, tap-and-hold onto the moving map, so that the waypoint description dialog opens. In that dialog, click on "Library/Add…" Before saving, it is possible to assign a name and to edit the coordinates of the waypoint.

> **Note**
>
> To avoid data duplication, it is not possible to add airfields, navaids or reporting points to the waypoint library. If you tap-and-hold onto an airfield, you will find that the Item "Library" is disabled in the waypoint description dialog.

Option 2: Import Waypoint Files

Enroute Flight Navigation is able to import waypoints from files in CUP, GeoJSON or GPX format. Transfer the file to your device (using Bluetooth file transfer, Google Drive, sending yourself an e-mail, or any other communication channel) and open the file on your device. The Section *Import Data* explains the process in detail.

Our friends at streckenflug.at maintain a database of landout fields that can be downloaded here.

3.4.3 View the waypoint library

To open the waypoint library, go to the main menu and choose the item "Library/Waypoints."

3.5 Connect Your Flight Simulator

Enroute Flight Navigation can connect to flight simulator software. When setup correctly, position and traffic information is sent from the flight simulator via Wi-Fi to the device that runs **Enroute Flight Navigation**.

The author has tested **Enroute Flight Navigation** with the following flight simulator programs.

- *FlightGear*
- *X-Plane 11* for desktop computers

Users have reported success with the following programs.

- *Aerofly FS*, Version 2 and 4 for desktop computers
- *MS Flight Simulator*
- X-Plane, Versions 10, 11 and 12 for desktop computers

Please contact us if you are aware of other programs that also work.

> **Note**
>
> **Enroute Flight Navigation** treats flight simulators as traffic receivers. To see the connection status, open the main menu and navigate to the "Information" menu.

3.5.1 Before You Connect

This manual assumes a typical home setup, where both the computer that runs the flight simulator and the device that runs **Enroute Flight Navigation** are connected to a Wi-Fi network deployed by a home router. Make sure that the following conditions are met.

- Open the "Settings" page in the main menu and tap on the entry "Primary position data source" and select the "Traffic data receiver" as the main source. **As long as the built-in satnav receiver is selected, all position information provided by your flight simulator is ignored.**
- The computer that runs the flight simulator and the device that runs **Enroute Flight Navigation** are connected to the same Wi-Fi network. Some routers deploy two networks, often called "main network" and a "guest network".
- Make sure that the router allows data transfer between the devices in the Wi-Fi network. Some routers have "security settings" that disallow data transfer between the devices in the "guest network"

3.5.2 Set Up Your Flight Simulator

Your flight simulation software needs to broadcast position and traffic information over the Wi-Fi network. Once this is done, there is no further setup required. As soon as the flight simulator starts to broadcast information over the Wi-Fi network, the moving map of **Enroute Flight Navigation** will adjust accordingly. To end the connection to the flight simulator, simply leave the flight simulator's Wi-Fi network.

Aerofly FS

Aerofly works well with **Enroute Flight Navigation** if the program is set to broadcast flight information via the network. Open the menu “Miscellaneous settings”, activate the option “Broadcast flight info to IP address” and enter the correct „Broadcast IP address“. The figure *Aerofly Miscellaneous settings* and shows the settings that work for one of our users.

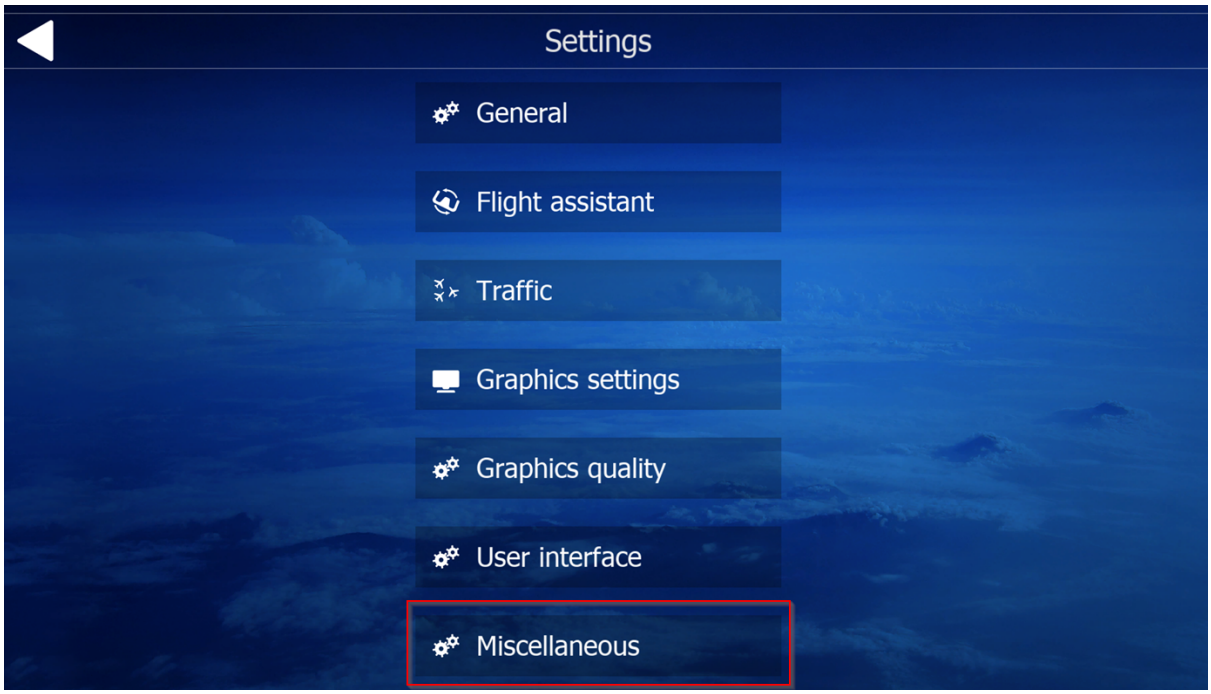


Fig. 8: Aerofly settings

FlightGear

FlightGear works well, even though position information is only broadcast when the simulated aircraft is moving. Follow the instructions on this website to configure FlightGear. **Enroute Flight Navigation** will then work automatically, without any specific configuration.

MS Flight Simulator

In order to communicate with other programs, the MS Flight Simulator requires additional software. Users reported that **Enroute Flight Navigation** works well with the following EFB-connector programs.

- fs2ff (free, open source)
- XMapsy Essential (commercial, inexpensive, does not provide barometric altitude data).
- XMapsy V3 (commercial, more expensive, provides barometric altitude data).

The web site of the commerical EFB program ForeFlight lists additional EFB-connector programs that might also work.

Note

In MSFS2020 cold and dark mode, traffic in the air will not been shown. You have to power on the avionics!

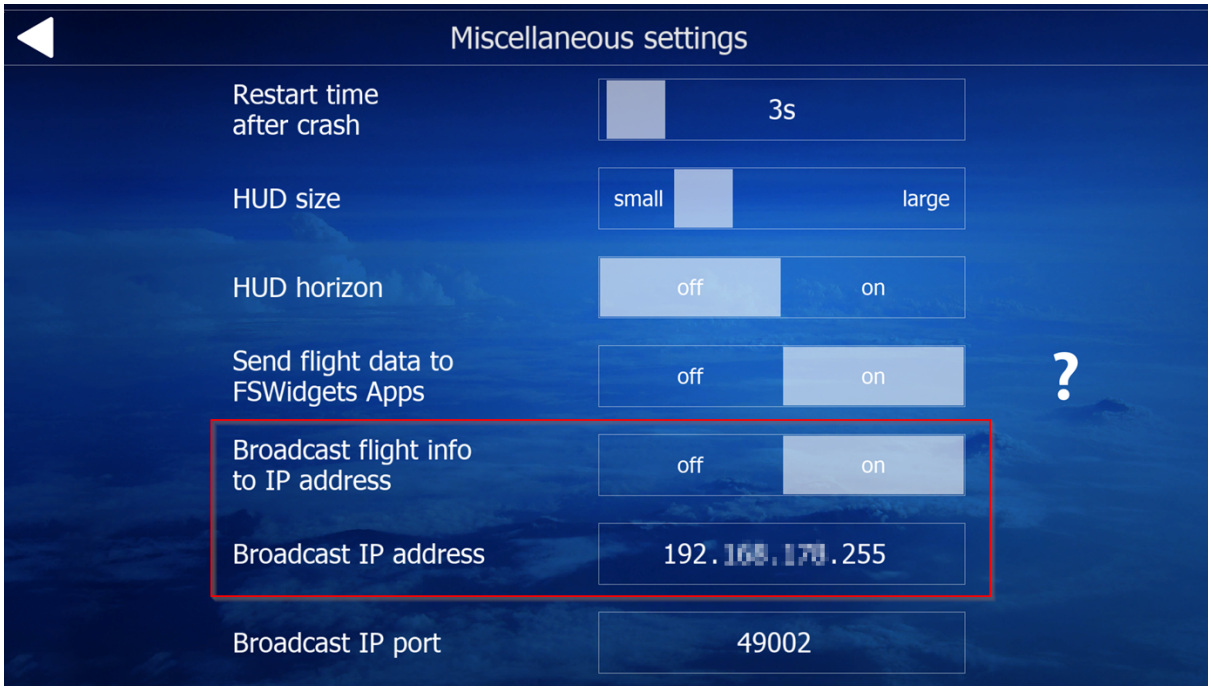


Fig. 9: Aerofly Miscellaneous settings

Note

At the time of writing (04Aug21), the MS Flight Simulator reports only traffic that has a tail number. This is likely due to a bug in the MS Flight Simulator software.

fs2ff

The program fs2ff does not require any complicated installation or setup, just download and run. The latest release of fs2ff can be downloaded here. Detailed instruction are found here. The figure *fs2ff Settings* shows extremely simple settings window.

XMapsy Essential

If you use XMapsy Essential, you need not to set up anything. Just start XMapsy Essential and start MSFS2020. The broadcast address will be setup automatically. The figure *XMapsy Essential Settings* shows the settings.

XMapsy V3

If you use XMapsy V3, set the "Message-Format" to "ADS-B/GDL90" and the "Preferred Technology" to "SIMCONNECT". To receive the correct altitude, be sure to check the box "GDL90 ownship geometric altitudes based on MSL". The figure *XMapsy V3 Settings* shows verified XMapsy V3 settings for proper work with MSFS2020. The Broadcast address will be determined by XMapsy and should not be touched except you have extended network configuration experience.

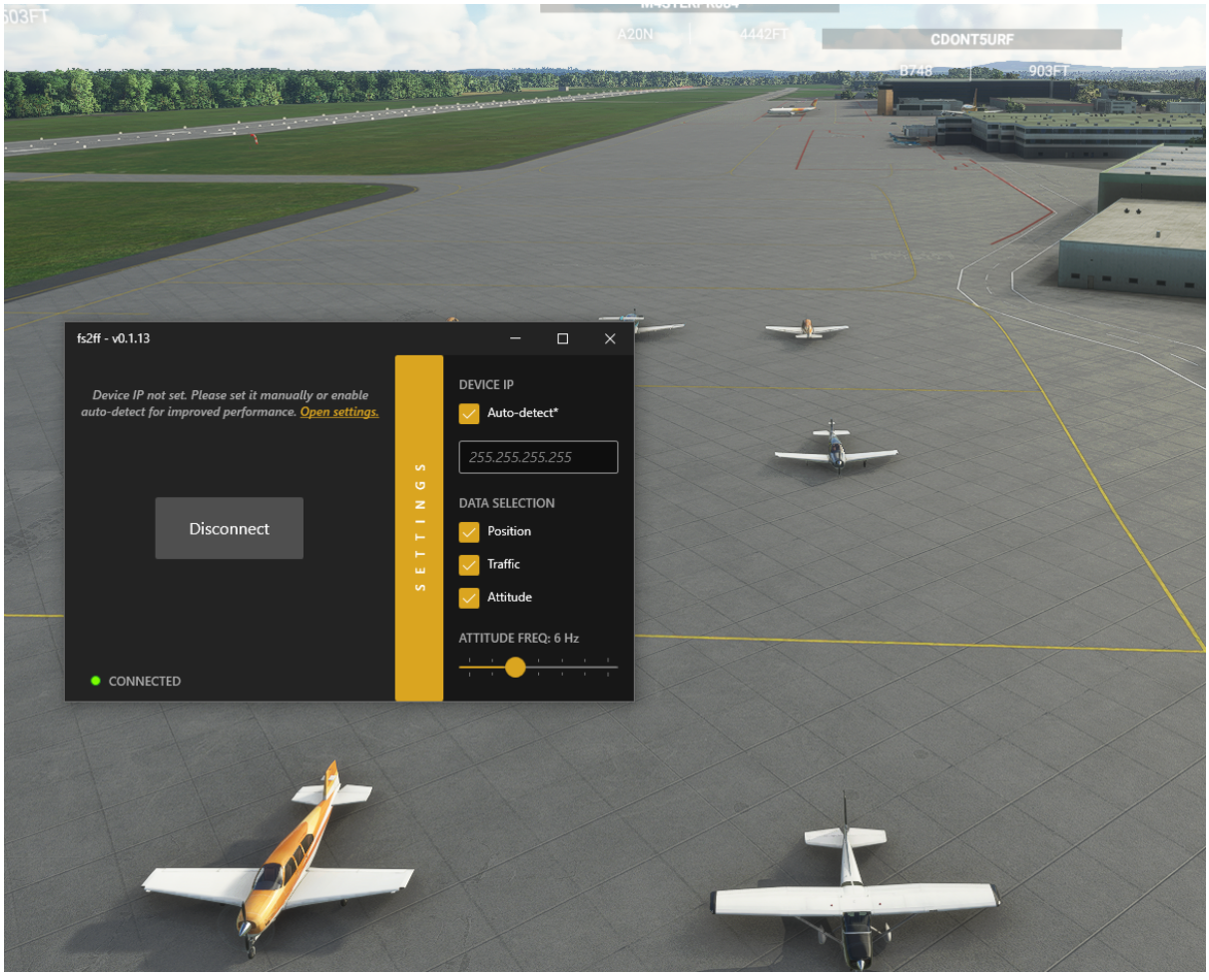


Fig. 10: fs2ff Settings

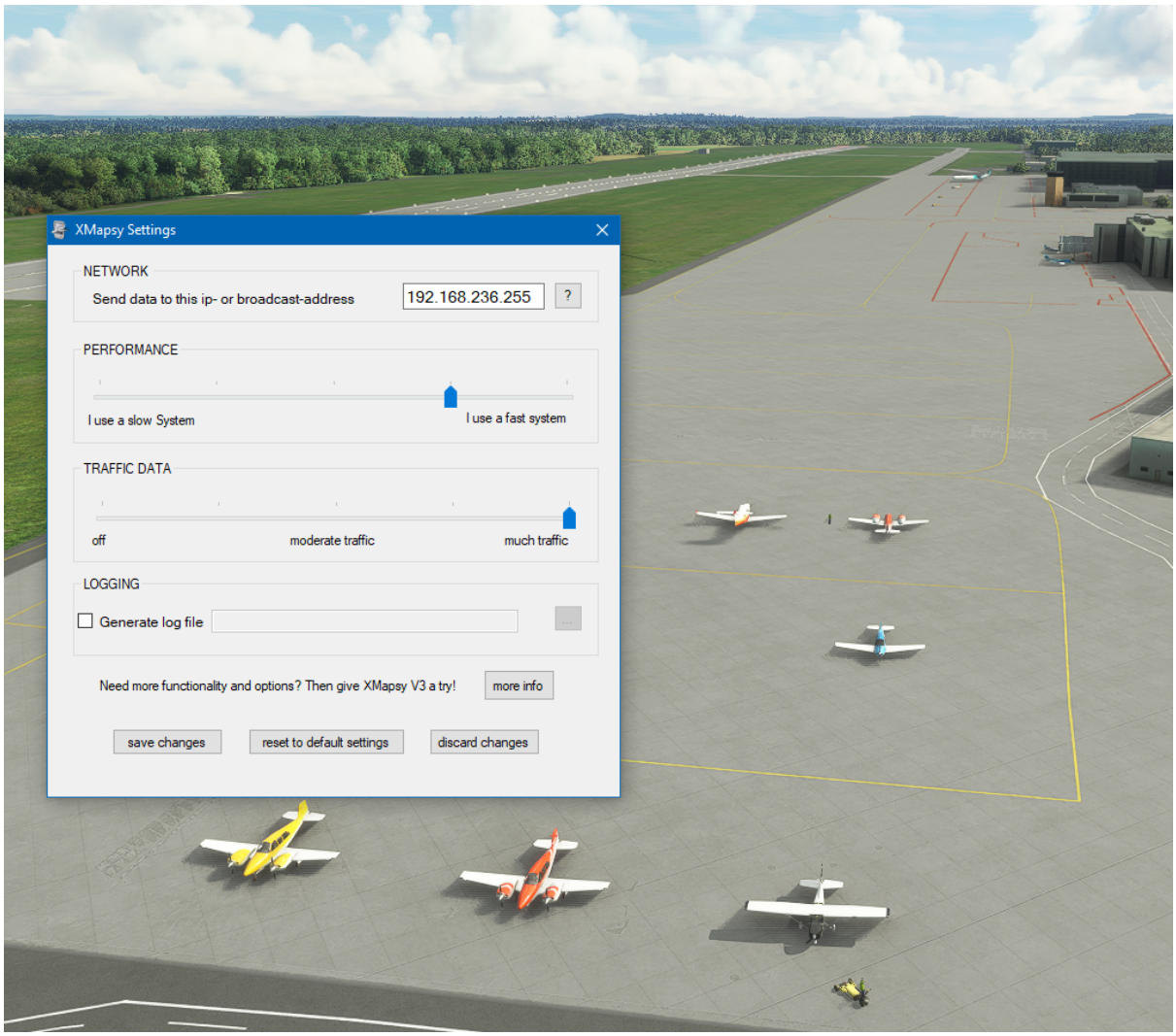


Fig. 11: XMapsy Essential Settings

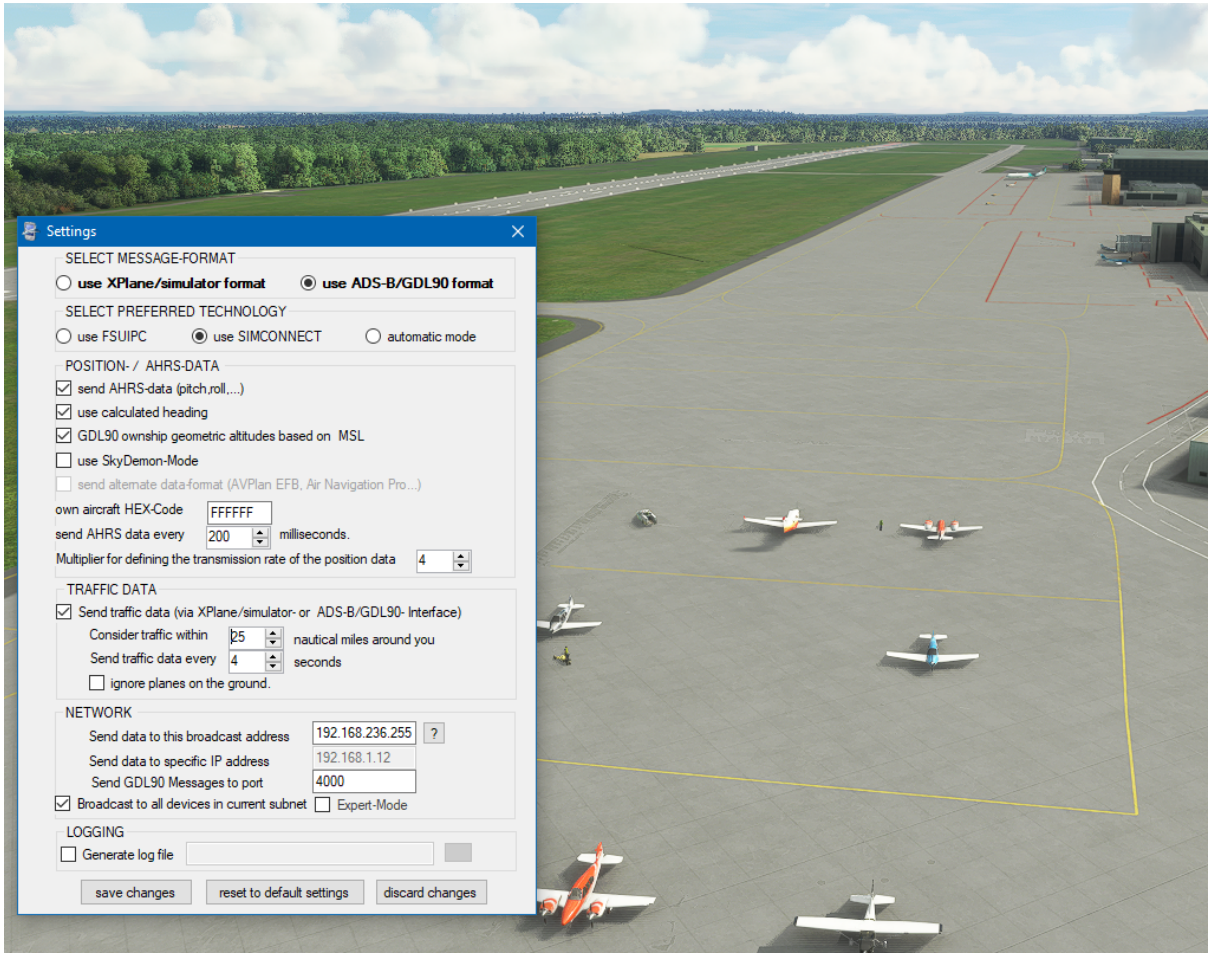
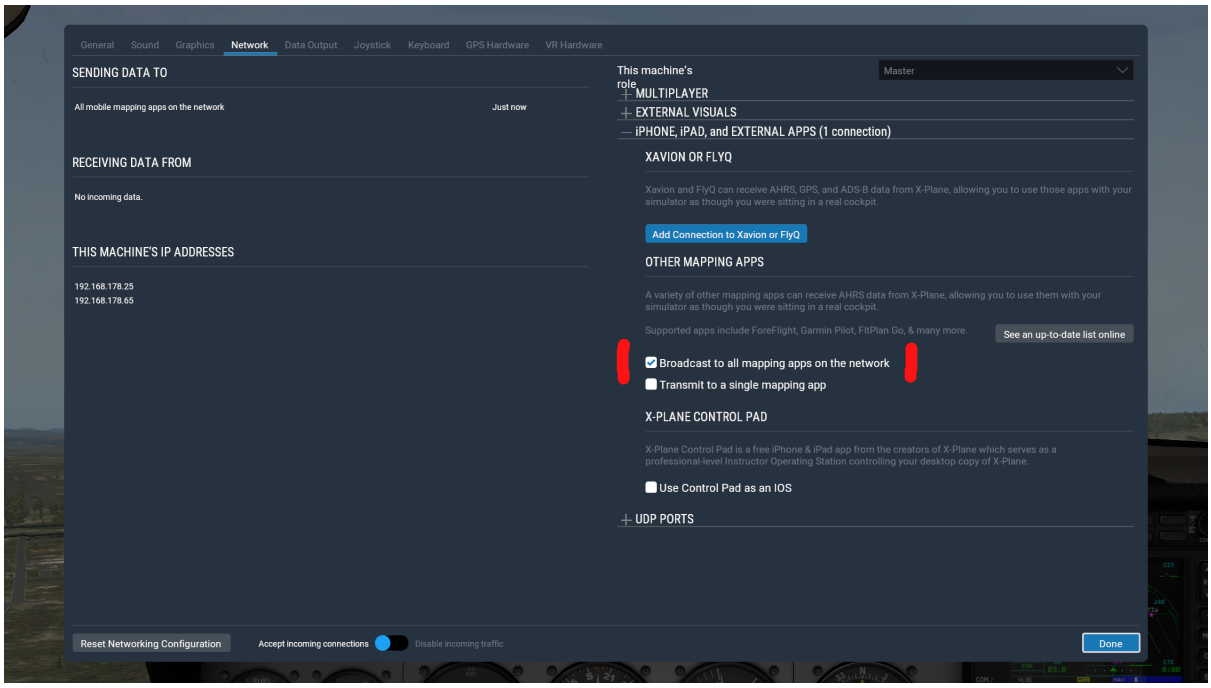


Fig. 12: XMapsy V3 Settings

X-Plane 11

Open the “Settings” window and choose the “Network” tab. Locate the settings group “This machine’s role” on the right-hand side of the tab. Open the section “iPhone, iPad, and external apps” and select the item “Broadcast to all mapping apps on the network” under the headline “other mapping apps”.



Other Programs

The flight simulator needs to be set up to send UDP datagrams in one of the standard formats “GDL90” or “XGPS” to ports 4000 or 49002. Given the choice, GDL90 is generally the preferred format.

3.5.3 Troubleshooting

Enroute Flight Navigation treats flight simulators as traffic receivers. To see the connection status, open the main menu and navigate to the “Information” menu. If the entry “Traffic Receiver” is highlighted in green, then **Enroute Flight Navigation** has already found the program in the network and has connected to it. If not, then select the entry. The “Traffic Receiver Status” page will open, which explains the connection status in more detail.

3.6 Report Issues or Make a Suggestion

We aim to provide high-quality software. Fixing errors is therefore always our first priority. We are grateful for every report that we get, and we would also like to hear your suggestions for improvement.

To make sure that your report reaches the correct person, please proceed as follows.

- Open the main menu and go to “Bug report”.
- The page “Bug report” will open.
- Choose the part of our software that your would like to report.
- At the end, you will be presented with contact information and a short explanation how the error is best reported.

Note

Please keep in mind that **Enroute Flight Navigation** is developed by a very small team of programmers in their spare time. While we try to answer every request, we often receive more mail than we can handle. Please be patient!

3.7 Make a Donation

Enroute Flight Navigation is a non-commercial project of Akaflieg Freiburg, supported by the University of Freiburg. Flight enthusiasts have written the app in their spare time as a service to the community. The developers do not take donations.

If you appreciate the app, please consider donating to Akaflieg Freiburg, a tax-privileged, not-for-profit flight club of public utility in Freiburg, Germany. The club will use your donation to promote aviation as a recreational sport; this includes funding the further development of **Enroute Flight Navigation** and its infrastructure. Donations to Akaflieg Freiburg are tax-deductible in Germany. Contact info@akaflieg-freiburg.de for a tax statement.

3.7.1 PayPal

Donate with PayPal: click here or scan the QR code below.

3.7.2 Bank Address

```
IBAN:    DE35 6809 0000 0027 6409 07
BIC:     GENODE61FR1
Bank:    Volksbank Freiburg
Message: Enroute Flight Navigation
```

4. Advanced Use

The following tutorials walk you through more advanced functionality of **Enroute Flight Navigation**.

4.1 Import Custom Vector Maps

Enroute Flight Navigation comes with a set of general-purpose base maps in vector format, which have been carefully optimized for memory consumption and display speed. Still, there might be situations where a user might prefer different maps: If you fly a rescue helicopter, you might prefer high-detail vector maps for your particular region.

Enroute Flight Navigation is able to import MBTILES files containing vector data. Vector data must follow the standard OpenMapTiles schema. Vector maps are rendered in the same style that **Enroute Flight Navigation** uses for its own maps. It is possible to install vector maps along with the maps provided by **Enroute Flight Navigation**.

4.1.1 Import Maps

Transfer the MBTILES file to your device and open the file on your device. The Section *Import Data* explains the process in detail.

To view and manage your maps, open the main menu and go to “Library/Maps and Data”.

4.1.2 MBTILES Map Data Sources

The website maptiler data provides excellent vector maps that can be installed alongside the base maps provided by **Enroute Flight Navigation**, in order to provide high-detail maps for specific regions of interest.

Please let us know if you know of other map data sources!

4.2 Import Custom Raster Maps

Enroute Flight Navigation comes with a set of general-purpose base maps in vector format, which are shown together with the aviation data in a style that we consider suitable for most aviation purposes. Still, there might be situations where a user would like to use their own base maps.

- Where available, some users might prefer to use official ICAO charts of their countries.
- Some users might prefer raster maps that follow a different style.

Enroute Flight Navigation is able to import MBTILES files containing raster data.

> **Note**
>
> Even if you decide to use raster maps, we still recommend installing our regular maps, because **Enroute Flight Navigation** needs the data to provide airspace and waypoint information.

4.2.1 MBTILES Map Data Sources

The website open flightmaps provides excellent aviation maps in raster format for a variety of European countries, as well as South Africa and Namibia. We are aware of aviation authorities that offer ICAO raster maps in GeoTIFF format. The Section *Map Generation and Conversion Tools* explains how these can be converted to the MBTILES format suitable for **Enroute Flight Navigation**.

4.2.2 Import Raster Maps

Transfer the MBTILES file to your device and open the file on your device. The Section *Import Data* explains the process in detail.

4.2.3 Manage Imported Raster Maps

To manage the raster maps installed in **Enroute Flight Navigation**, open the main menu and go to "Library/Maps and Data".

4.2.4 Use Imported Raster Maps

As soon as raster maps are installed, a button with the label  will become visible on the moving map page. A tap on the button will open the Raster Map Menu, which shows all raster maps installed. Tap on an entry to show the relevant map inside the moving map display. Tap on the same entry again to hide it.

> **Note**
>
> In order to avoid confusion, at most one raster map will be shown at any given time.

4.3 Import Airspace Data

Enroute Flight Navigation comes with a set of aviation maps that cover large parts of the world and are updated frequently. In addition, users can import airspace data in standard OpenAir format. Aviation clubs and airfield operators use this feature to distribute OpenAir files to their members to highlight noise-sensitive areas or airspaces available by local agreement.

Airspaces defined in imported data will be shown in addition to the standard aviation maps included with **Enroute Flight Navigation**.

To import airspace data, transfer the OpenAir file to your device and open the file on your device. The Section *Import Data* explains the process in detail.

To view and manage your maps, open the main menu and go to "Library/Maps and Data".

4.4 Import Visual Approach Charts

Enroute Flight Navigation can import image files with visual approach charts and display them on the moving map. The figure *Moving map display with embedded approach chart* shows how this will typically look.

Enroute Flight Navigation accepts visual approach charts in one of the following formats.

- Geo-referenced image files in GeoTIFF format.

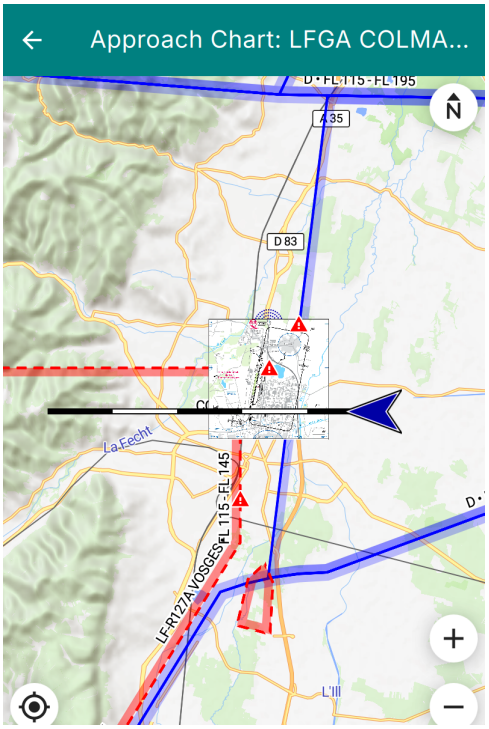


Fig. 1: Moving map display with embedded approach chart

- TripKits that contain collections of approach charts for a specific area or flight route. The AIP Browser DE can produce TripKits for Germany.

> **Note**
>
> GeoTIFF is a complex format that supports many use cases, ranging from astronomy to high-precision land survey. **Enroute Flight Navigation** only supports a subset of the GeoTIFF standard. If you encounter a GeoTIFF file that **Enroute Flight Navigation** does not recognize, please open an issue report. We will be glad to help!

4.4.1 Obtain Approach Chart Files

- Michael Paus' free software AIP Browser DE can generate GeoTIFF images and TripKits for all German airfields. The data comes from Germany's official AIP, as provided by DFS Deutsche Flugsicherung GmbH.
- GeoRef Tool is a free, web-based application that allows users to upload an image (e.g., aerodrome charts, approach plates) and manually georeference it by assigning reference points. The tool then generates a GeoTIFF file that can be imported into Enroute or other flight navigation software. This enables pilots and navigators to integrate custom maps with accurate geographic positioning, enhancing situational awareness during flight planning and navigation.

  For more details, visit the GeoRef Tool Website

Please get in touch with us if you are aware of other data sources. We will be glad to list them here.

4.4.2 Import Approach Chart Files

Transfer the GeoTIFF of TripKit file to your device and open the file on your device. The Section *Import Data* explains the process in detail.

> **Note**
>
> TripKits are ZIP files with specialized content. Trying to open a TripKit file, some file management utilities will automatically unpack the ZIP file rather than offering to open it in **Enroute Flight Navigation**. Along similar lines, GeoTIFF files are image files with specialized metadata and some file management utilities will launch an image viewing application rather than offering to open a GeoTIFF file in **Enroute Flight Navigation**.
>
> If you encounter problems opening a TripKit or GeoTIFF file, look for an icon or menu item labeled "Open with…". Some utilities open an appropriate context menu after a tap-and-hold gesture.

4.4.3 Manage Your Approach Chart Library

On the moving map screen, open the main menu and go to "Library/Maps and Data". The page "Map and Data Library" will then open. The page has a "VAC" tab listing the approach charts. Use the context menus to uninstall charts and retrieve basic information.

The three-dot menu at the top right of the screen allows clearing your approach chart library.

4.4.4 Use Approach Charts

Once approach charts are installed, open the main menu and go to "Approach Charts". The page "Visual Approach Charts" will then open. The page lists all approach charts installed in your device, sorted by distance to the current position. Tap on a chart to open "Approach Chart" page, which shows a slightly simplified moving map with the approach chart superimposed on top of the usual map layer. As usual, tap on the left arrow symbol in the page title to close the page and return to the standard moving map display.

In order to avoid surprises in flight, **Enroute Flight Navigation** will not open the approach chart page automatically.

> **Note**
>
> The menu entry "Approach Charts" is only visible if approach charts are installed on your device. If you cannot find the menu entry, install some approach charts first.

4.5 Receive Traffic Data via the Internet

Starting with version 2.34.0, **Enroute Flight Navigation** is able to receive traffic data from the Open Glider Network and display traffic data in the moving map as long as no proper traffic data receiver is available.

> **Warning**
>
> While OGN data can be useful in certain scenarios, we recommend against using traffic data from internet services in real flight.

- Internet connectivity is not reliable in flight. Even when flying over populated areas, expect the internet connection to fail for about half of the time.
- Experience shows that data is frequently laggy and often outdated.
- You will not be visible to others.

We strongly feel that no responsible pilot should ever fly without a proper traffic data receiver, such as a FLARM or ADS-B device.

To configure a data connection to the Open Glider Network, proceed as follows.

4.5.1 One-time Setup

Step 1: Configure the Connection

Follow the steps described in the Section *Settings: Data Connections*.

Step 2: Check Connectivity

After your connection has been configured, everything else should be automatic. To check, open the main menu and navigate to the "Information" menu. Choose the entry "Traffic Receiver". The page "Traffic Data Receiver" will open.

On the page "Traffic Data Receiver", look for the text field "Connection Status". If the text field is highlighted in yellow and starts with "OGN glidernet.org APRS-IS connection", then your connections has been configured successfully.

4.5.2 Daily Operations

Once things are set up properly, **Enroute Flight Navigation** will automatically connect to the "Open Glider Network". For reasons of flight safety, **Enroute Flight Navigation** will always prefer connections to proper traffic data receivers and will switch connections as soon as a data receiver becomes available.

5. Additional Software

Enroute Flight Navigation is compatible with many other software tools. This section explains a few of the more popular options. Please let us know of other software what we should list here.

5.1 Flight Planning Tools

While **Enroute Flight Navigation** offers essential flight planning functionality, flights are best planned with full-featured software on a big-screen computer. The following software is compatible, tested, and known to work well with **Enroute Flight Navigation**.

5.1.1 autorouter.aero

autorouter is a free online flight planning tool. While primarily aimed at IFR flights, it is popular with VFR pilots because it offers convenient briefing packages, including NOTAM, weather, and airport plates. The autorouter website also offers comprehensive flight plan management, an interface to Eurocontrol services, and a messenger bot that can be used to manage flight plans and access up-to-date airspace information/

The autorouter website is able to export flight routes in GPX format, which can be read by **Enroute Flight Navigation**.

- Open the website autorouter.aero on the device that runs **Enroute Flight Navigation**. Then log in.
- On the main page, open the tab 'Routes'. You will be presented with a list of routes that you have prepared.
- Choose the route that you would like to import into **Enroute Flight Navigation** and click on the button "View", which is found at the bottom of the list.
- After parsing the route for a few seconds, you are presented with a list of tabs. The tab "Route details" is already open. Open the tab "Briefing information".
- Open the item "Choose the desired information" and select "GPX (Google Earth, EasyVFR)" from the drop-down menu.
- Click on "Download"
- The next step depends on the operating system of the device that runs **Enroute Flight Navigation**.
  - On Android or iOS, open the file on your device. The Section *Import Data* explains the process in detail.
  - On Linux/Desktop, use the file manager to drag-and-drop the GPX file into the window of **Enroute Flight Navigation**.
- A dialog window will open. **Enroute Flight Navigation** needs to know if the GPX file contains a flight route or a list of waypoints that you wish to import into the waypoint library. Choose the button "Route".

5.1.2 FL95.de

FL95.de is a free online flight planning website popular in Germany and surrounding countries. It is able to export flight routes in GPX format, which can be read by **Enroute Flight Navigation**.

Since FL95.de is not designed for the small screens of mobile devices, we recommend using it on a desktop or laptop computer. Proceed as follows.

- On a desktop or laptop computer, open the website FL95.de in your web browser.
- Use the website to plan a flight.
- Once done, open the tab "Laden Speichern Drucken"
- At "GPS-Export", choose "Dateiformat: GPX" and click on "Datei erzeugen".
- FL95.de will generate a file (typically called "FL95_EDTF_nach_EDTF.gpx") that will be downloaded via your web browser. Most browsers store the file in the "Download" folder of your home directory.
- The next step depends on the operating system of the device that runs **Enroute Flight Navigation**.
  - On Android or iOS, transfer the GPX file to your device and open the file on your device. The Section *Import Data* explains the process in detail.
  - On Linux/Desktop, transfer the GPX file to your device and use the file manager to drag-and-drop it into the window of **Enroute Flight Navigation**.
- A dialog window will open. **Enroute Flight Navigation** needs to know if the GPX file contains a flight route or a list of waypoints that you wish to import into the waypoint library. Choose the button "Route".

The manual of FL95.de contains more detailed information.

5.2 Mapping Tools

Enroute Flight Navigation is able to import location information ("Map Pins") from popular mapping tools. This feature has been requested by helicopter pilots working in medical evacuation, rescue and police operations. It can also be used by general aviation pilots who would like to add landmarks ("Hohenzollern Castle") to their flight routes or to their waypoint library.

Note

The functionality described here is only available in version 2.30.9 or later. At the time of writing, the functionality is only available on the Android and Linux/Desktop platforms.

Note

Due to a change in Google's policies in early 2025, location sharing from the apps "Google Maps" and "Google Maps Go" is no longer supported. The app "HERE WeGo" has technical issues. As an alternative, use the online version in your browser of consider the app OsmAnd.

5.2.1 Google Maps (Online)

The procedure depends on the platform in use.

- Android:
  - Open the website Google Maps. You might need to confirm that you wish to use the website in your browser instead of the app.
  - Double-click into the map to mark a location. A dialog with location information will open at the bottom of the screen.
  - Click on the button "Share". It might be necessary to scroll the button row sideways for "Share" to become visible.
  - You will be presented with a list of contacts and apps that you can share the location with. Choose **Enroute Flight Navigation** from this list. If **Enroute Flight Navigation** is not listed, it might be necessary to use the button "More" to present an extended list of apps that are able to accept Google Map Share.
  - **Enroute Flight Navigation** will open a waypoint description dialog for the location marked by Google Maps. As usual, use this dialog to add the location to your route or to the waypoint library.
- Linux/Desktop:
  - Double-click into the map to mark a location.
  - Copy the text from the URL field of your text browser to the clipboard. Depending on the browser, this can be done with a context menu after a right-click into the URL field, or by activating the text field and then using the keyboard shortcuts Ctrl+A Ctrl+C.
  - Activate the window of **Enroute Flight Navigation** and paste the text using Ctrl+V. Alternatively, drag-and-drop the text from the URL field of your browser into the window of **Enroute Flight Navigation**.

5.2.2 Here WeGo (Online)

Open the website HERE WeGo in your web browser and follows the instructions listed above for Google Maps.

5.2.3 OpenStreetMap (Online)

The procedure depends on the platform in use.

- Android:
  - Double-click into the map to mark a location.
  - Open the main menu of your web browser and choose "Share".
  - You will be presented with a list of contacts and apps that you can share the location with. Choose **Enroute Flight Navigation** from this list.
  - **Enroute Flight Navigation** will open a waypoint description dialog for the location.
- Linux/Desktop:
  - Double-click into the map to mark a location.

- Copy the text from the URL field of your text browser to the clipboard. Depending on the browser, this can be done with a context menu after a right-click into the URL field, or by activating the text field and then using the keyboard shortcuts Ctrl+A Ctrl+C.
- Activate the window of **Enroute Flight Navigation** and paste the text using Ctrl+V. Alternatively, drag-and-drop the text from the URL field of your browser into the window of **Enroute Flight Navigation**.

5.2.4 OsmAnd (Android App)

For location sharing from the app OsmAnd, proceed as follows.

- Open the App "OsmAnd" and mark a location by tapping into the moving map. A dialog with location information will open at the bottom of the screen.
- Click on the button "Share". A dialog will open that allows choosing the data format.
- Choose the data format "geo:". A dialog with appropriate apps will open.
- Choose **Enroute Flight Navigation**.
- **Enroute Flight Navigation** will open with a waypoint description dialog for the location marked by Google Maps. As usual, use this dialog to add the location to your route or to the waypoint library.

5.3 Map Generation and Conversion Tools

As explained in Section *Import Custom Raster Maps*, **Enroute Flight Navigation** is able to import and use third-party raster maps in MBTILES format. However, most government offices publish aviation maps in GeoTIFF format rather than MBTILES. GeoTIFF is suitable for use in geodata information service systems, but unsuitable for map display on low-powered devices.

This section lists several official sources for aviation maps and explains how to convert GeoTIFF to MBTILES format.

5.3.1 Data Sources

We are aware of websites that offer raster maps in GeoTIFF format. At present, **Enroute Flight Navigation** cannot handle GeoTIFF files, but there are tools that convert GeoTIFF to MBTILES.

- Official ICAO maps for Denmark are available from the danish AIM Naviair
- Official ICAO maps for Spain are available from the Spanish Insignia Servicio de Información Aeronáutica
- Official ICAO maps for Switzerland are available from the Swiss Federal Office of Topography swisstopo
- Official VFR raster charts are available from the United States Federal Aviation Administration

5.3.2 Conversion Tool: QGIS

Users have successfully used the free tool QGIS to convert GeoTIFF files to MBTILES, which can then be used with **Enroute Flight Navigation**.

Since QGIS is a powerful tool that is not always easy to use, one user has kindly provided the following short tutorial.

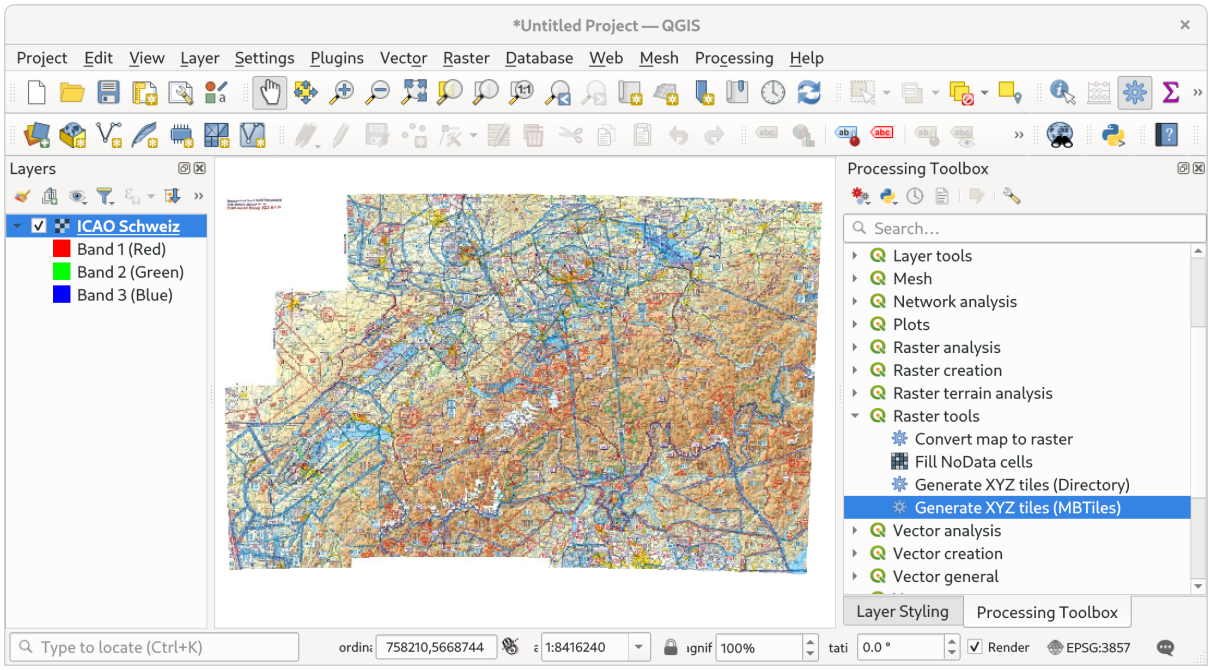


Fig. 1: QGIS Main Window

- Install QGIS on your desktop computer. On Fedora Linux, we found that the packages provided by the default software repository were outdated and lacked the necessary functionality. We followed the installations instructions on the QGIS website to install a current and full-featured version of the program.
- Open QGIS. Create a new project and open the GeoTIFF file in QGIS by dragging-and-dropping the GeoTIFF file into the QGIS window. The content of the GeoTIFF file should become visible.
- Choose the menu item “Project/Properties…” to open the dialog window “Project Properties”. There, set the coordinate reference system to EPSG:3857. To locate the reference system, use the text field “Filter” and search for EPSG:3857.
- Use the menu items under “View/Panels/…” to ensure that the panels “Layer” and “Layer Styling” are visible. Select the layer of your GeoTIFF file and in the “Layer” panel. Then, go to the “Layer Styling” panel and set “Resampling” to “Bilinear” for better image render quality.
- Use the menu items under “View/Panels/…” to ensure that the panel “Processing Toolbox” is visible. Inside the “Processing Toolbox”, double-click on “Raster Tools→Generate XYZ Tiles (MBTILES)”. The dialog “Generate XYZ Tiles (MBTILES)” will open. Fill the necessary parameters, as seen in the image below. We found the function “Draw on Map Canvas” useful to specify the map extent. Pay attention to the maximum zoom level, as the time and file size increase significantly after zoom level 12. Depending on the size of your GeoTIFF and on the number of zoom levels you use, it may take a while to generate the MBTILES file.

5.4 Traffic Information Tools

There are several “traffic information” or “anti-collision” apps on the marked targeting general aviation pilots. These apps typically perform two functions.

- They receive traffic data via the internet and broadcast the information to apps like **Enroute Flight Navigation** which can then show traffic in the moving map, and

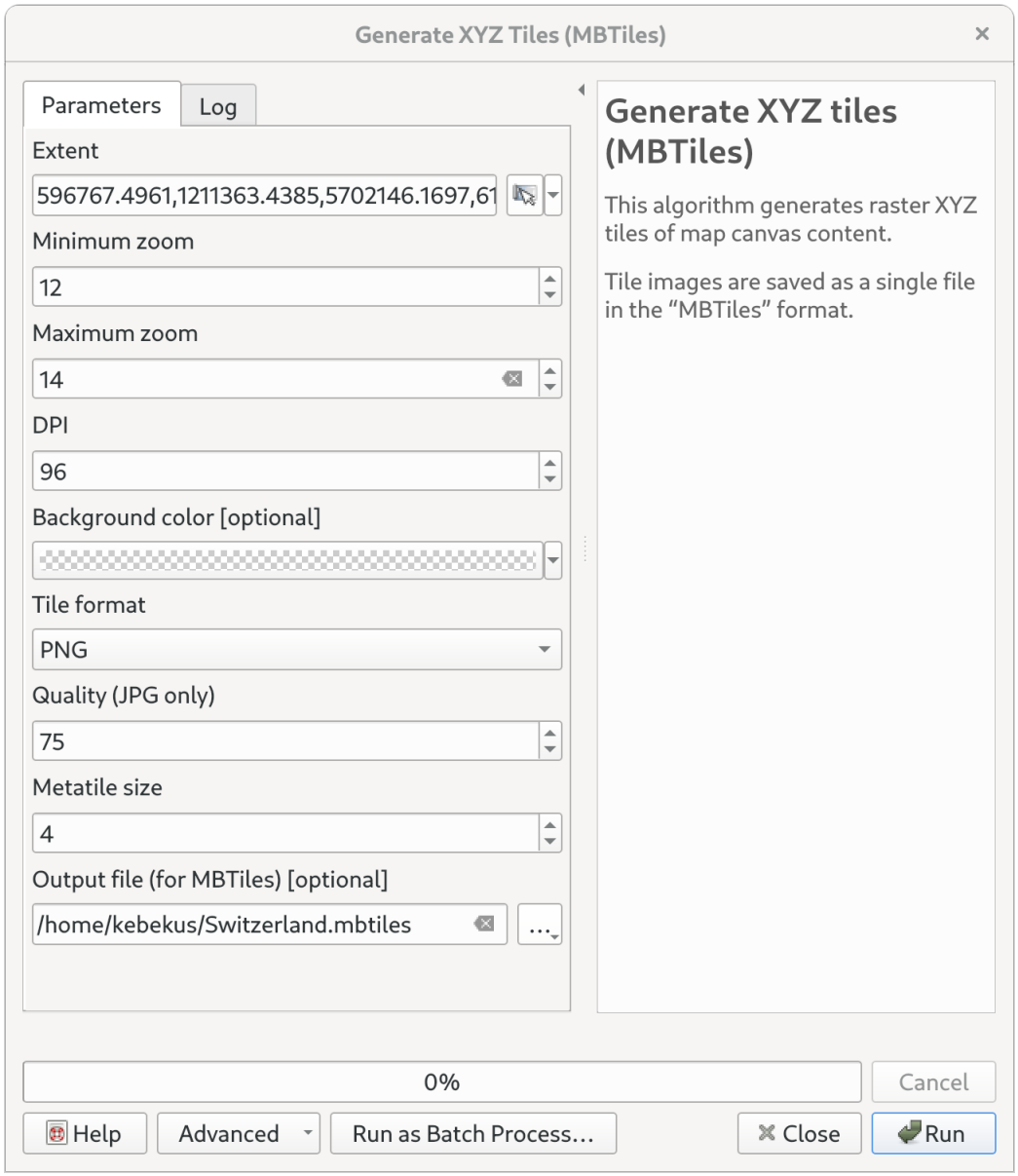


Fig. 2: QGIS Generate Tiles Dialog

- The report the current position to servers on the internet, so other users of the system can be warned of your presence.

Enroute Flight Navigation integrates well with these apps. This section describes two of the more popular solutions, "CCAS VFR-Kollisionswarnsystem" and "SafeSky"

> **Warning**
>
> While traffic information apps have valid use cases, for instance in flight simulation or to give ground operators an overview of local traffic, we strongly recommend against using traffic data from internet services in real flight.
>
> - Internet connectivity is not reliable in flight. Experiments in Germany have shown that internet connection to fail for about half of the time, even when flying over densely populated areas. This problem will likely increase in the future, as modern 5G antennas have a stronger directional characteristic than traditional ones.
> - Experience shows that the data is frequently laggy, incomplete and often outdated.
>
> We strongly feel that no responsible pilot should ever fly without a proper traffic data receiver, such as a FLARM or ADS-B device.

5.4.1 CCAS VFR-Kollisionswarnsystem

CCAS VFR-Kollisionswarnsystem is a free anti-collision app that works without registration or setup, and integrates well with **Enroute Flight Navigation**.

> **Warning**
>
> "CCAS VFR-Kollisionswarnsystem" wrongly reports the cabin pressure measured by the sensor in your device as static pressure. In closed-cabin aircraft, where cabin pressure is typically not equal to static pressure, this can lead to **wrong barometric altitude readings in Enroute Flight Navigation**, and in turn to **involuntary airspace violations**.
>
> Be aware that cabin pressure and static pressure disagree even in aircraft without pressurized cabin.

One-time Setup

There is no setup required, but it might make sense to check the integration once before you start using "CCAS VFR-Kollisionswarnsystem" on a regular basis.

To check the integration, start the app "CCAS VFR-Kollisionswarnsystem". Then, go to **Enroute Flight Navigation**, open the main menu in **Enroute Flight Navigation** and navigate to the "Information" menu. If the entry "Traffic Receiver" is highlighted in green, then **Enroute Flight Navigation** has connected to the app. Congratulations, you are done!

Daily Operations

Before you start your flight, start "CCAS VFR-Kollisionswarnsystem". Everything else is automatic.

5.4.2 SafeSky

SafeSky is a commercial anti-collision app. The commercial premium version of SafeSky integrates with **Enroute Flight Navigation**.

One-time Setup

The following steps configure SafeSky to forward traffic information to **Enroute Flight Navigation**. In **Enroute Flight Navigation**, no configuration is required.

Step 0: Before You Connect

Traffic sharing is a premium feature of SafeSky. Before you connect, make sure to have a valid premium subscription.

Step 1: Enable Traffic Sharing

In the main menu of Safe Sky, choose the box "Traffic Sharing". The page "Traffic Sharing" will open.

- Choose the option "Enable traffic sharing"
- Touch the field below "Enable traffic sharing" to open the list of supported navigation apps. Choose "Enroute" from the list and touch the button "back" to close the list.
- Touch the button "back" to close page "Traffic sharing". Leave the main menu and return to the SafeSky main page.

That's it. As soon as you choose "TAKE OFF" in SafeSky to start a flight, SafeSky will start a background process that shares traffic data with Enroute Flight Navigation.

Step 2: Check Connectivity

To check the SafeSky integration, choose "TAKE OFF" in SafeSky. Then, go to **Enroute Flight Navigation**, open the main menu in **Enroute Flight Navigation** and navigate to the "Information" menu. If the entry "Traffic Receiver" is highlighted in green, then **Enroute Flight Navigation** has connected to the SafeSky app. Congratulations, you are done!

Daily Operations

Before you start your flight, open the SafeSky app and choose "TAKE OFF". Everything else is automatic.

Part II.

Reference Manual

6. User Interface: Pages

The user interface of **Enroute Flight Navigation** is organized in pages. This section describes the most relevant pages in full detail.

6.1 Main Page and Moving Map

The main page is the page that you will use the most often. This is also the page that opens when you start the app. The following image shows the Main Page in a typical flight situation.

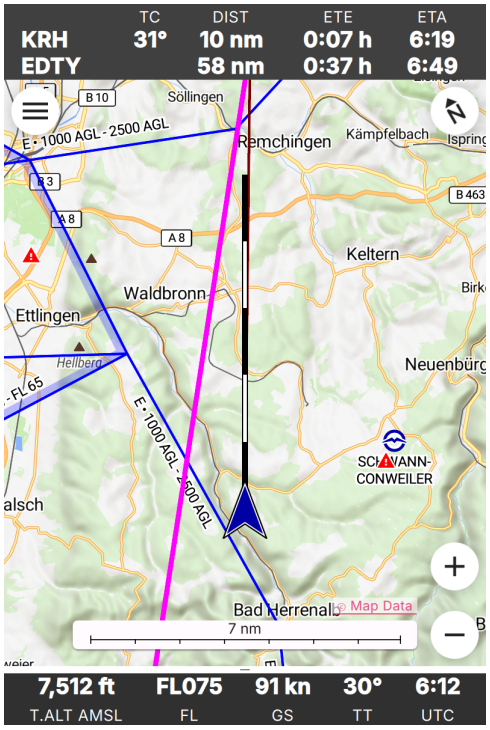


Fig. 1: The Main Page of **Enroute Flight Navigation**

- At the top of the screen, you see the *Route Information Bar* with information about the remaining flight route.
- The page body shows a moving map with your current position and a number of interactive controls.
- At the bottom, the *Navigation Bar* displays information about the current flight situation.

This manual uses the words “Bearing Mode” and “Autopan Mode” to describe two settings that govern the behavior of the map display.

Bearing Mode
: The moving map can operate in two “bearing modes”. In the mode “north up”, the map is rotated so that the north direction is up, as you would expect from a paper map. In the mode “track up”, the map is rotated according to your direction of movement, so that your flight direction is up.

Autopan Mode

If the autopan mode is on, the map is automatically moved, so that the position you aircraft is near the center of the map display. If the autopan mode is off, the map is not moved and the position of your aircraft might not be visible on the map.

6.1.1 Route Information Bar

If you have defined a flight route following the steps outlined in the section *Plan a Flight*, then the top of the Main Page will show a tabular panel with one or two lines of information about the remaining route that you still have to fly. The first line of the table refers to the next waypoint, the second line to the final waypoint in your route.

Code	Meaning
—	Name of the waypoint.
TC	True course to the waypoint (only shown for course to next waypoint).
DIST	Distance to the waypoint.
ETE	Estimated Time Enroute to the waypoint.
ETA	Estimated Arrival Time at the waypoint, in UTC.

- The units for the distance are chosen according to the settings on the Aircraft Page.
- If the information cannot be computed (e.g. because the positions is unknown, or because you are flying too far away from the route), the panel shows a brief error message.
- Close to the final destination, the panel shows the words "Near destination."

6.1.2 Navigation Bar

The bottom of the display shows a little panel with the following information.

Code	Meaning
T.ALT	True altitude (=geometric altitude).
P.ALT	Pressure altitude, in flight level format.
GS	Ground speed.
TT	True track.
UTC	Current time.

- Depending on the settings made in the *Settings*, the field T.ALT shows the altitude above sea level or the altitude above ground. This is indicated with the standard abbreviation "AMSL" or "AGL".
- The units for the altitude display are chosen according to the settings on the Aircraft Page.
- The pressure altitude is only available if your device is connected to a traffic receiver (such as a PowerFLARM device) that reports the pressure altitude.
- The units for the ground speed display are chosen according to the settings on the Aircraft Page.
- Flight level and current time are hidden if the display is not wide enough.

Warning

Vertical airspace boundaries are defined by pressure altitudes (with respect to QNH or standard pressure). Depending on temperature and air density, the pressure altitude will differ from the true altitude that is shown by the app. **Never use true altitude to judge vertical distances to airspaces.**

6.1.3 Interactive Controls

The page body shows the following interactive control buttons that can be used together with the standard gestures to operate the app.

Symbol	Function
	Open the main menu.
	Switch between modes **north up** and **track up**.
	Open the raster map menu. Only visible when raster maps are installed.
	Set autopan mode to “on”.
	Zoom in.
	Zoom out.
	Open airspace side view.
	Open the traffic receiver status page. Only visible when the app is not connected to a traffic data receiver.

Main Menu

Use this menu to access all other pages, access settings and exit the app.

Raster Map Menu

This menu is visible when raster maps are installed. It shows all raster maps installed, and allows choosing one of them for display. See the section *Import Custom Raster Maps* for more details.

6.1.4 Moving Map

The moving map shows a physical map with shaded terrain relief, overlaid with aviation data. At low zoom values, the map looks similar to the standard 1:50.000 ICAO maps. At higher zoom values, the map will also show traffic circuits and control zone procedures, as you would expect from an approach chart.

Note

Traffic circuits and control zone procedures are available for select countries only. See the section *Map Data* for more details.

The moving map shows the following additional items

- If you have set an *Airspace Altitude Limit* on the *Settings*, the map will show a little reminder at the top of the screen, with a text such as "Airspaces up to 9500 ft".
- To give you a rough estimate for the horizontal distances, the map features a scale. Depending on screen orientation, the scale is shown at the bottom or at the left of the screen.
- At the very bottom of the screen, there is a copyright notice. Click on the notice to open a dialogue window with more detailed information.

Gesture Controls

The moving map can be controlled by standard gestures.

- **Mouse Wheel:** On desktop computers, the mouse wheel zooms in and out.
- **Pinch Gesture:** On touch-screen devices, the pinch gesture zooms in and out.
- **Pan Gesture:** On touch-screen devices, the pinch the pan gesture moves the map and sets the autopan mode to "off".
- **Tap-and-hold Gesture:** Tap-and-hold anywhere in the map to open the waypoint description dialogue. This is the quickest way to obtain information about airfields, navaids, reporting points, terrain elevation and airspace. The figure *Information about EDFE Airport* shows how this will typically look.
- **Double Tap Gesture:** The double tap gesture is equivalent to tap-and-hold.

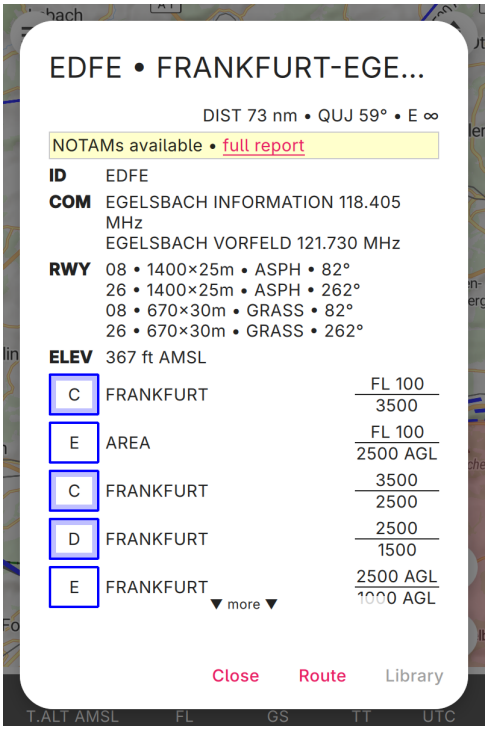


Fig. 2: Information about EDFE Airport

Ownship Position

The ownship position is shown prominently in the moving map, using one of the following symbols.

Sym-bol	Function
	SatNav is not working. The symbol shows the last known position.
	SatNav is working, and the aircraft is not moving. The symbol shows the current position.
	SatNav is working, and the aircraft is moving. The symbol shows the current position. The arrow shows the direction of movement.

As soon as you are flying, the app shows the projected flight path for the next five minutes. The flight path vector is sized so that each of the black and white segments corresponds to one minute.

Fig. 3: Projected Flight Path for the Next Five Minutes

Traffic Information

Enroute Flight Navigation can connect to your aircraft's traffic receiver (typically a FLARM device) and display nearby traffic on the moving map. The section *Sense and Avoid* explains how to establish the connection. The figure *Approaching EDTF with traffic* shows a typical situation.

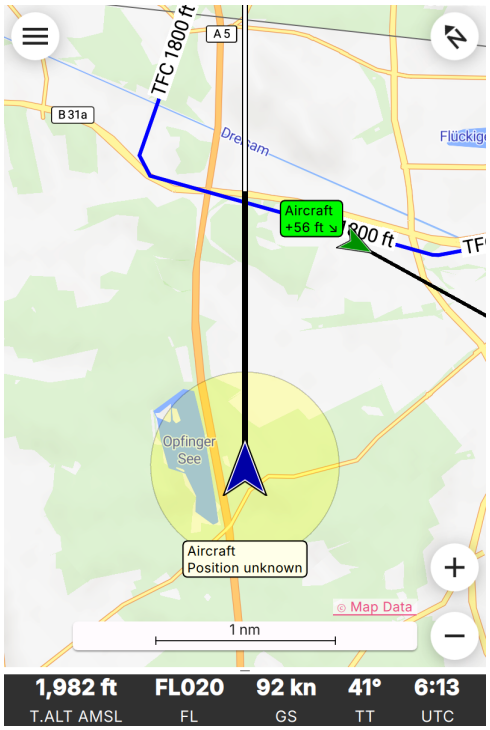


Fig. 4: Approaching EDTF with traffic

To show only relevant traffic, **Enroute Flight Navigation** will display traffic factors only if the vertical distance is less than 1,500 m and the horizontal distance less than 20 nm.

> **Warning**
>
> **Enroute Flight Navigation** shows traffic on the moving map, but does not issue traffic warnings. The app contains no collision avoidance algorithms.

Color Coding

Enroute Flight Navigation uses colors to indicate the potential danger of the traffic. This works best when the app is connected to a FLARM device. In this setting, the colors have the following precise meaning.

Color	Meaning
Green	No alarm.
Yellow	Alarm level 1. Collision predicted in 13-18 seconds.
Red	Alarm level 2 or higher. Collision predicted in less than 13 seconds.

Traffic Factors

The moving map display two kinds of traffic.

- Traffic whose precise position is unknown to the traffic receiver; this is often the case with traffic that has only a Mode-S transponder. This kind of traffic is indicated in the moving map by a transparent circle around the ownship position. The traffic is likely to be found inside that circle.
- Traffic whose position is precisely known. This traffic is typically equipped with a FLARM or ADS-B transmitter. The symbols used to display this traffic in the moving map are explained below. If the traffic is known to be moving, its projected flight path is indicated with a black-and-white flight vector, similar to the symbol shown in the Figure *Projected Flight Path for the Next Five Minutes* for the ownship flight vector.

Symbol	Function
	The traffic is not moving, or its movement is unknown. No alarm.
	The traffic is not moving, or its movement is unknown. Alarm level 1. Collision predicted in 13-18 seconds.
	The traffic is not moving, or its movement is unknown. Alarm level 2 or higher. Collision predicted in less than 13 seconds.
	The traffic is moving, the arrow shows the direction of movement. No alarm.
	The traffic is moving, the arrow shows the direction of movement. Alarm level 1. Collision predicted in 13-18 seconds.
	The traffic is moving, the arrow shows the direction of movement. Alarm level 2 or higher. Collision predicted in less than 13 seconds.

Traffic labelling

The traffic is labelled with the following pieces of information about the traffic, to the extent known.

- Traffic type. This is one of “Aircraft”, “Airship”, “Balloon”, “Copter”, “Drone”, “Glider”, “Hang Glider”, “Jet”, “Paraglider”, “Skydiver”, “Static Obstacle” and “Tow Plane”.
- The traffic callsign.
- The relative vertical distance, in the units for the distance chosen in the settings on the Aircraft Page. A positive value indicates that the traffic is above you.
- An arrow symbols pointing upwards, downwards or sideways indicates the vertical speed of the traffic.

> **Note**
>
> Traffic callsigns are shown only if the “FLARM Database” has been installed in the page “Map and Data Library”.

Flight Route

If you have defined a flight route following the steps outlined in the section *Plan a Flight*, the route will be highlighted in magenta line. The direct path to the next waypoint is highlighted in dark red. The image *The Main Page of Enroute Flight Navigation* shows how this will look.

Waypoints and NOTAMs

The moving map show waypoints using the following standard ICAO symbols. In addition, it highlights locations with active or future NOTAMs.

Symbol	Function
	Locations with active or future NOTAMs
	Glider flying site
	Aerodrome with grass runway
	Closed aerodrome
	Military aerodrome with grass runway
	Military aerodrome with paved runway
	Military aerodrome
	Aerodrome with paved runway
	Aerodrome
	Microlight flying site
	Hydroport
	Doppler-VOR with DME
	Doppler-VOR
	Doppler-VORTAC
	Mandatory reporting point
	NDB
	Reporting point
	VOR with DME
	VOR
	VORTAC
	Generic waypoint (from flight route or waypoint library)

Note

Enroute Flight Navigation only displays NOTAMs located near your present position, along your flight route, and near locations for which the waypoint dialog has been opened.

Procedures and Traffic Circuits

Traffic circuits for motorized aircraft are shown as blue lines. Traffic circuits for gliders or Ultralight aircraft are shown as red lines. Entry and exit routes to traffic pattern are indicated by open ends of the pattern. The traffic circuit will show the traffic circuit altitude when the information is available.

Entry routes into control zones, transversal routes as well as holding patterns are shown as solid blue lines. Exit routes are shown as dashed blue lines.

6.1.5 Airspace Side View

Starting with version 3.0.0, **Enroute Flight Navigation** is able to show a side view of the airspace and the terrain. To open the side view, swipe upwards from the Navigation Bar at the bottom of the page.

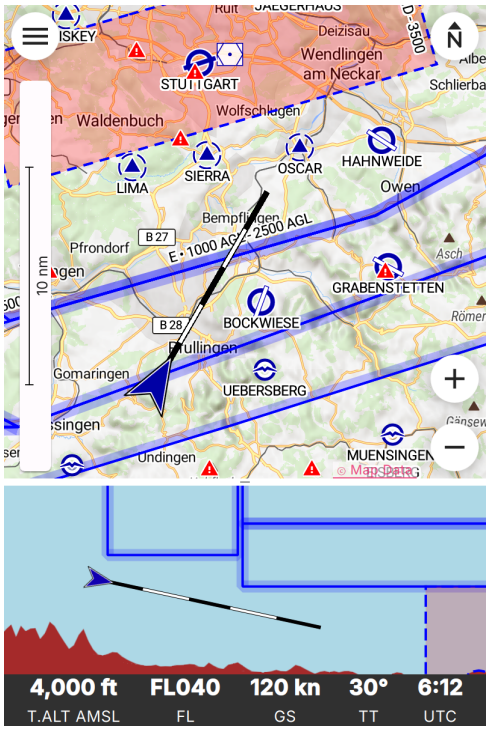


Fig. 5: Side View of the Airspace while Approaching EDDS

Dependence on Static Pressure Information

The side view is only available if **Enroute Flight Navigation** has access to static pressure information. If static pressure information is not available, **Enroute Flight Navigation** will show a prominent warning.

Why does **Enroute Flight Navigation** need static pressure for the airspace side view?

> Vertical airspace boundaries are defined as barometric altitudes, either over QNH or over the standard pressure level. As a consequence, the geometric altitude of airspaces changes with the weather: Airspaces are typically much lower on cold winter days than they are in summer. In order to show your aircraft in relation to airspaces, **Enroute Flight Navigation** therefore needs to know the barometric altitudes of your aircraft, or equivalently, the static pressure.

How can I provide static pressure data?

> Follow the steps outlined in chapter *Sense and Avoid* to connect **Enroute Flight Navigation** to a traffic data receiver that provides static pressure data. Since ADS-B data uses barometric altitudes, any traffic data receiver that receives ADS-B will most likely be suitable. In particular, all PowerFLARM devices provide the necessary data.
>
> If your mobile device is equipped with a high-precision pressure sensor **and** if you fly an aircraft where static pressure and cabin pressure agree, you use the option "Use cabin pressure…" on the page *Aircraft* to enable the use of cabin pressure data. However, please read the warnings and notes on the page *Aircraft* carefully before you enable this option.

But other apps show side views without static pressure data!

> We do not know the internal workings of other apps. However, we do not see how sufficiently reliable information can possibly be provided without static pressure data.
>
> We fly general aviation aircraft in Germany and Switzerland, where vertical separation between jet aircraft and airspace limits is sometimes no more than 500ft. In view of the extremely severe consequences of airspace violations, we decided against showing questionable data.

Scale

To provide the most relevant data at a glance, **Enroute Flight Navigation** uses different map scales for horizontal and vertical directions. In most scenarios, vertical distances are greatly exaggerated.

- In horizontal direction, the scale of the Side View follows the scale used in the moving map.
- In vertical direction, **Enroute Flight Navigation** chooses a scale to guarantee that the current position, the flight path for the next 7.5 minutes and a height hand of 6,000ft are visible.

Side View Features

The side view shows the ownship position and the flight path vector using the same symbols as in the moving map; we refer the reader to the Section *Ownship Position* for a detailed description. If the aircraft is not moving at sufficiently high speed for a flight path vector to show, the direction corresponding to "right" is shown in a text field at the top of the view.

Airspaces

For clarity, the side view does not show all the airspaces that you can see in the moving map. The following airspaces are shown.

- Airspaces of class "A", "B", "C" and "D": Outlined with a solid blue line, with light blue border.
- Control Zones: Outlined with a dashed blue line, filled in light red.
- Danger Zones, Restricted and Prohibited Airspaces: Outlined with a dashed red line, with light red border.
- Nature Preserve Areas: Outlined with a dashed green line, with light green border.
- Radio Mandatory Zones, Traffic Information Areas, Traffic Information Zones, Aerodrome Traffic Zone: Outlined with a dashed blue line, filled in light blue.
- Parachute Jumping Exercise Areas, Special Use Airspaces: Outlined with a dashed red line.

6.2 Aircraft

The Aircraft Page is used to configure the settings that depend on your aircraft. For convenience, you can save the current settings as a new aircraft in the aircraft library, and you can select an aircraft from the library to load its settings.

6.2.1 Page Header

The three-dot-menu in the top right corner of the page header opens a menu with the following functions.

View Library…
Open the Aircraft Library Page, where you can select an aircraft from the library.

Save to library…
Save the current aircraft settings as a new aircraft in the aircraft library.

6.2.2 Page Body

The body of the page contains the data entry fields described below.

Aircraft

Name
Enter a name for your aircraft.

Use cabin pressure…
If this option is checked, Enroute Flight Navigation will use the pressure sensor of your mobile device to measure the pressure altitude and determine vertical distances to airspaces. This option is only available if your device has a pressure sensor.

> **Note**
>
> If available, Enroute Flight Navigation will always use the pressure altitude provided by an external traffic data receiver instead of the pressure altitude calculated from the pressure sensor of your mobile device.

Precise measurement of pressure altitude is safety critical. Consider the following before you decide to enable the option “Use cabin pressure…”.

- The pressure sensor of your device is probably not certified for use in aviation.
- In typical GA aircraft, static pressure and cabin pressure do not necessarily agree, with an error depending on airspeed and on the configuration of the heating and ventilation systems.
- Do not enable this option unless you convinced yourself that the data provided by your sensor is good enough for the intended use.
- Do not rely on data shown in this app.
- Always use an approved altimeter to judge vertical distance to airspaces.

> **Warning**

We strongly recommend connecting **Enroute Flight Navigation** to a proper traffic data receiver. While option "Use cabin pressure…" might have its use for pilots flying balloons, paragliders or gyrocopters, think twice before using it in a motorized plane or glider.

Units

Select the units you want to use for horizontal and vertical distances, and fuel volume.

True airspeed

Enter typical values for the aircraft's true airspeed.

Cruise
: This speed is used to calculate estimated time enroute (ETE) and estimated time of arrival (ETA) for your route.

Descent
: This speed is currently not used. It will be used in future versions to improve the accuracy of ETE and ETA calculations.

Minimum
: This speed is used to determine whether your aircraft is flying or not.

Fuel Consumption

Enter a typical value for the aircraft's fuel consumption. This value is used to calculate a very rough estimate of the fuel required for your route.

6.3 Settings

Enroute Flight Navigation is designed to be simple. The number of user settings is deliberately small. To access the user settings, open the main menu and choose "Settings."

6.3.1 Moving Map

The settings grouped under "Moving Map" change the appearance of the map display.

Airspace Altitude Limit

If you never fly higher than 5.000ft, you will probably not be interested in airspaces that begin above FL100. **Enroute Flight Navigation** allows you to set an altitude limit to improve the readability of the moving map. Once set, the app will show only airspaces below that limit. Tap on the entry "Airspace Altitude Limit" to set or unset the altitude limit.

Once you set an altitude limit, the moving map will display a little warning ("Airspaces up to 9,500 ft") to remind you that the moving map does not show all airspaces. The app will automatically increase the limit when your aircraft approaches the altitude limit from below.

Warning

Airspace boundaries are often flight levels. The true altitude of a flight level depends on meteorological conditions (such as the temperature gradient) and is not known to **Enroute Flight Navigation**. When deciding which airspace to show, the app will use an approximation. The approxima-

tion might be off by 1,000ft or more in extreme weather. **Always leave an ample safety margin when setting an airspace altitude limit.**

Gliding Sectors

In regions with high glider traffic, local regulations often allow gliders to fly in airspaces that are otherwise difficult to access, such as control zones. The moving map displays these "Gliding Sectors" in bright yellow. If you are not flying a glider, the gliding sectors are probably not relevant. Hiding the gliding sectors might improve the readability of the moving map.

6.3.2 Navigation Bar

These settings apply to the Navigation Bar, shown at the bottom of the moving map screen.

6.3.3 User Interface

Large Fonts

Use this option to enlarge fonts for improved readability.

Night Mode

The "Night Mode" of Enroute Flight Navigation is similar to the "Dark Mode" found in many other apps. We designed the night mode for pilots performing VFR flights by night, whose eyes have adapted to the darkness. Compared with other apps, you will find that the display is quite dark indeed.

Voice Notifications

Pilots should not be looking at their mobile devices for extended periods of time. Enroute Flight Navigation is therefore able to read notification texts in addition to showing them on the screen. Since we expect that not everybody likes this feature, this setting item allows switching voice notification on and off.

Show All Warnings

This entry is visible if you have disabled warnings by selecting "Do not ask again" or "Dismiss warning" in an appropriate dialog. Tap on this entry to re-enable all warnings.

6.3.4 System

Primary Position Data Source

Enroute Flight Navigation can either use the built-in satnav receiver of your device or a connected traffic receiver as a primary position data source. This setting is essential if your device has reception problems or if you use **Enroute Flight Navigation** together with a flight simulator.

- You will most likely prefer the built-in satnav receiver for actual flight. The built-in receiver provides one position update per second on a typical Android system, while traffic receivers do not always provide timely position updates.
- If you use **Enroute Flight Navigation** together with a flight simulator, you **must** choose the traffic receiver as a primary position data source. Flight simulators broadcast position information of simulated aircraft via Wi-Fi, using the same protocol that a traffic data receiver would

use in a real plane. As long as the built-in satnav receiver is selected, all position information provided by your flight simulator is ignored.

> **Note**
>
> Setting a traffic receiver as a primary position data source is safe even when the app is not connected to a traffic receiver. When no traffic receiver is connected, **Enroute Flight Navigation** will automatically fall back using the built-in satnav receiver of your device.

Data connections

Tap on this entry to view the list of data connections that **Enroute Flight Navigation** uses to communicate with traffic data receivers, and to register traffic data receivers that communicate via Bluetooth.

Ignore Network Security Errors

This entry is visible if you have asked the app to download data via insecure internet connections after a secure connection attempt failed. Uncheck this item to revert to the standard policy, which enforces secure connections.

Clear Password Storage

This entry is visible if you have connected to a traffic data receiver that requires a password in addition to the Wi-Fi password and if you have asked the app to remember the password. Tap on this entry to clear the password storage.

6.3.5 Help

The items grouped under "Help" refer the user to this manual.

6.4 Settings: Data Connections

This page lists all data connections that **Enroute Flight Navigation** uses to communicate with traffic data receivers. It shows that status of each connection and allows adding/removing connections to Bluetooth devices that cannot be automatically configured. The page also allows configuring additional data connections through a variety of communication channels.

6.4.1 User Interface

The body of the page displays a list of configured connections. Tap on a connection to obtain more detailed information.

- Data connections are colored in green if **Enroute Flight Navigation** receives heartbeat signals from a traffic data receiver via that connection.
- Data connections are colored in red if **Enroute Flight Navigation** failed to open the connection.

The footer of the page contains two buttons.

- The button "Reconnect" resets all configured connections and starts a new connection process for each. This can be useful in settings where a connection failed and where you do not want to wait until the next reconnection attempt starts automatically.

- If **Enroute Flight Navigation** cannot detect your traffic data receiver automatically, use the button "New Connection" to configure a connection. The remainder of the present manual section explains how this is done.

6.4.2 Configure New Data Connections

In a typical setup, where traffic data receivers broadcast information via one of the standard Wi-Fi channels, the default data connections allow **Enroute Flight Navigation** to automatically detect (and connect to) all customary devices. In that case, no user interaction is ever required. There are however settings where **Enroute Flight Navigation** cannot detect your traffic data receiver automatically. Depending on the communication channel, the following subsections describe how to configure a new data connection in that case.

Bluetooth Classic

The **Enroute Flight Navigation** is able to communicate with your traffic data receiver via the "Bluetooth Classic" radio standard. The radio standard "Bluetooth Low Energy" is supported as a technology preview only and should not be used in production.

> **Note**
>
> Due to limitations of the iOS platform, Bluetooth is not supported on iPhone and iPad devices.

To avoid any ambiguity, this manual refers to the device running **Enroute Flight Navigation** as the "phone", and to your Bluetooth-enabled traffic data receiver as the "Bluetooth Device". To configure a new data connection between your phone to the Bluetooth device, proceed as follows.

- Ensure that your Bluetooth device is switched on and in "discoverable" mode.
- Note that "Bluetooth Classic" devices support only one data connection. If you use "Bluetooth Classic", the following steps will fail if another phone is trying to connect to your Bluetooth device. Ensure that there are no other phones around that could interfere with your phone. Keep in mind that other phones might be in someone else's bag, stowed away in a nearby car, or in the office building next door.
- Ensure that Bluetooth is switched "on" in your phone.
- Depending on the precise version of your operating system, you may need to pair your phone with the Bluetooth device. Pairing never hurts, so we recommend pairing if possible. Note that some Bluetooth device cannot be paired.
- Open **Enroute Flight Navigation** on your phone, navigate to this page and tap on "Add Data Connection" at the bottom of the page. A device discovery dialog will open.
- The device discovery dialog shows a list of all nearby Bluetooth devices. Please wait for a few minutes until all devices have been connected. If necessary, tap on the button "Scan for Devices" to re-start the device discovery process.
- Choose the relevant Bluetooth device from the list. A data connection to your Bluetooth device has now been configured.
- **Enroute Flight Navigation** will try to connect to your Bluetooth device. Check the connectivity status by looking at the relevant entry in the list of data connections.

In the future, **Enroute Flight Navigation** will automatically detect and connect to your traffic receiver a few minutes after it becomes visible on Bluetooth radio.

Serial Port

The **Enroute Flight Navigation** is able to communicate with your traffic data receiver via the serial port. Serial port communication via USB is supported.

> **Note**
>
> Due to limitations of the iOS platform, serial port communication is not supported on iPhone and iPad devices.

- Ensure that your traffic data receiver is switched on and connected to the serial port/USB input of your device.
- Open **Enroute Flight Navigation** on your phone, navigate to this page and tap on "New Connection" at the bottom of the page and choose "Serial Port Connection" from the menu. A device discovery dialog will open.
- The device discovery dialog shows a list of all nearby serial ports in your device. If necessary, tap on the button "Scan for Devices" to re-start the device discovery process.
- Choose the relevant serial port from the list. A data connection to that serial port has now been configured. Enroute will determine the necessary parameter (such as bit rate) automatically.
- **Enroute Flight Navigation** will try to connect to your traffic data receiver via the serial port. Check the connectivity status by looking at the relevant entry in the list of data connections.

In the future, **Enroute Flight Navigation** will automatically detect and connect to your traffic receiver a few minutes after it is connected to your device.

TCP via Wi-Fi or LAN

The Transmission Control Protocol (TCP) is one of the main protocols of the internet. Traffic data receivers based on FLARM typically use TCP to transmit traffic data via Wi-Fi and LAN networks. To configure a TCP connection, you need the following data.

- The internet address of the traffic data receiver in its network. This is typically a string of the form "192.168.1.1".
- The port number. This is a number between 0 and 65535, but most FLARM based devices use port 2000.

> **Note**
>
> To simplify the setup process, **Enroute Flight Navigation** includes a number of predefined TCP connections. These suffice to connect to any traffic data receiver that we have seen. Manual configuration of TCP connections should never be necessary. If you are aware of hardware that uses an internet address/port combination not covered by the predefined connections, then please open the main menu and use the entry "Bug Report" to let us know.

To configure a new TCP data connection, proceed as follows.

- Read the manual of your traffic data receiver to find out what internet address and port number it uses.
- Start the traffic data receiver.

- Connect to the Wi-Fi or LAN network of your traffic data receiver.
- Open **Enroute Flight Navigation** on your phone, navigate to this page and tap on "New Connection" at the bottom of the page and choose "TCP Connection" from the menu. A dialog will open.
- Enter the IP address and port number used by your traffic data receiver. While all devices that we have seen use IPv4 addresses of the form "192.168.1.1", IPv6 addresses and internet host names are also supported. Tap on "OK". A new data connection has been configured.
- **Enroute Flight Navigation** will try to connect to your traffic data receiver. Check the connectivity status by looking at the relevant entry in the list of data connections.

In the future, **Enroute Flight Navigation** will automatically detect and connect to your traffic receiver a few minutes after it becomes visible on Wi-Fi or LAN.

UDP via Wi-Fi or LAN

The User Datagram Protocol (UDP) is one of the main protocols of the internet. Flight simulators and traffic data receivers based on Garmin hardware typically use UDP to transmit traffic data via Wi-Fi and LAN networks. To configure a UDP connection, you need the following data.

- The port number. This is a number between 0 and 65535, but most devices use ports 4000 or 49002.

> **Note**
>
> To simplify the setup process, **Enroute Flight Navigation** includes a number of predefined UDP connections. These suffice to connect to any traffic data receiver that we have seen. Manual configuration of UDP connections should never be necessary. If you are aware of hardware that uses a port not covered by the predefined connections, then please open the main menu and use the entry "Bug Report" to let us know.

To configure a new TCP data connection, proceed as follows.

- Read the manual of your traffic data receiver to find out what port number it uses.
- Start the traffic data receiver.
- Connect to the Wi-Fi or LAN network of your traffic data receiver.
- Open **Enroute Flight Navigation** on your phone, navigate to this page and tap on "New Connection" at the bottom of the page and choose "UDP Connection" from the menu. A dialog will open.
- Enter the port number used by your traffic data receiver. Tap on "OK". A new data connection has been configured.
- **Enroute Flight Navigation** will try to connect to your traffic data receiver. Check the connectivity status by looking at the relevant entry in the list of data connections.

In the future, **Enroute Flight Navigation** will automatically detect and connect to your traffic receiver a few minutes after it becomes visible on Wi-Fi or LAN.

OGN glidernet.org Connection

The Open Glider Network is a network of ground station and internet servers operated by volunteers. It collects FLARM and ADS-B data and distributes this data in real time via internet service.

Starting with version 2.34.0, **Enroute Flight Navigation** is able to display traffic data from the Open Glider Network in its moving map. To configure a data connection to the Open Glider Network, proceed as follows.

- Open **Enroute Flight Navigation** on your phone, navigate to this page and tap on "New Connection" at the bottom of the page and choose "OGN glidernet.org Connection" from the menu.
- **Enroute Flight Navigation** will show two warning dialogs, pointing to technical restrictions of internet services in flight, aviation safety concerns, and consequences for data privacy. Read these text with care and click on "OK" only if you understand the implications.

In the future, **Enroute Flight Navigation** will automatically connect to the "Open Glider Network". For reasons of flight safety, **Enroute Flight Navigation** will always prefer connections to proper traffic data receivers and will switch connections as soon as a data receiver becomes available.

6.4.3 Remove a Data Connection

We recommended removing data connections that you will no longer use. In order to remove a data connection, locate the data connection in the list, tap on the three-dot menu and choose the menu item "Remove". Note that default data connections cannot be removed.

6.5 Information/SatNav Positioning

The page **SatNav Positioning** provides status information on the satellite positioning system. To access the page, open the main menu and choose "Information/SatNav Positioning."

6.5.1 Status

This field shows the data connection currently used and lists the types of data presently received.

6.5.2 Position

This field shows the position reported by the satellite navigation system.

6.5.3 True Altitude

This field shows the true altitude reported by the satellite navigation system.

True altitude AGL or AMSL is the vertical distance from the aircraft to the terrain or to the main sea level, respectively.

Warning

True altitude is not the same as barometric altitude, which is the altitude shown on your aircraft's altimeter. Depending on weather conditions, true altitude and barometric altitude may differ substantially. Never use true altitude to judge the vertical distance from your aircraft to an airspace boundary.

6.5.4 Other

The last field on the page shows the timestamp of the last position report. If available, it also shows the magnetic variation for your current position.

6.6 Information/Traffic Data Receiver

The page **Traffic Data Receiver** provides status information on the data connection between **Enroute Flight Navigation** and your traffic data receiver. To access the page, open the main menu and choose "Information/Traffic Data Receiver."

6.6.1 Connection Status

To ensure reliable operation, traffic receivers emit "heartbeat messages" at frequent intervals. The text field "Connection Status" shows if heartbeat messages are received through any of the configured data channels. If yes, this field shows the data connection currently used and lists the types of data presently received.

6.6.2 Traffic Data Receiver Status

If heartbeat messages are received, this field shows status messages reported by the traffic data receiver, including results of internal self-tests of the traffic data receiver hardware. If no heartbeat messages are received, this field is invisible.

6.6.3 Position

If your traffic data receiver provides its own SatNavS position, this field shows the position reported by the traffic data receiver. If no heartbeat messages are received, or if the traffic data receiver does not provide its own SatNav position, this field is invisible.

6.6.4 True Altitude

If your traffic data receiver provides its own altitude information, this field shows the true altitude reported by the traffic data receiver. Otherwise, this field is invisible.

True altitude AGL or AMSL is the vertical distance from the aircraft to the terrain or to the main sea level, respectively.

Warning

True altitude is not the same as barometric altitude, which is the altitude shown on your aircraft's altimeter. Depending on weather conditions, true altitude and barometric altitude may differ substantially. Never use true altitude to judge the vertical distance from your aircraft to an airspace boundary.

6.6.5 Pressure Altitude

If your traffic data receiver provides its own pressure altitude information, this field shows the pressure altitude reported by the traffic data receiver. Otherwise, this field is invisible.

Pressure altitude is the altitude in the standard atmosphere at which the pressure is equal to the current atmospheric pressure. This is the altitude displayed on the aircraft's altimeter when set to the standard pressure of 1013.2hPa. This is also the altitude shown on the transponder.

6.6.6 Traffic

If heartbeat messages are received, this field lists all the traffic reported by the traffic data receiver, sorted in order of importance. If no heartbeat messages are received, this field is not shown.

Traffic opponents are classified as "Relevant Traffic" and "Irrelevant Traffic". Traffic is considered relevant if the vertical distance to the traffic opponent is less than 1,500 m and the horizontal distance is less than 20 NM. Only relevant traffic is shown in the moving map.

6.6.7 Help

If no heartbeat is received from any traffic receiver, two buttons "Connect to a traffic receiver" and "Connect to a flight simulator" will become visible. A click on any of these buttons will open the appropriate page of the manual.

6.6.8 Page Footer

The page footer shows one or two additional buttons.

Reconnect

This button is visible if no heartbeat is received from any traffic receiver. After a click on this button will disconnect all configured data connections and attempt to reconnect. This can be useful if **Enroute Flight Navigation** did not automatically connect, or if you do not wish to wait for the next automatic reconnection attempt.

Configure Data Connections

A click on this button will open the page "Data Connections", described in the section *Settings: Data Connections*. There, you can view the status of every single data connection, and configure new connections if required.

6.7 Information/Device Sensors

The page **Device Sensors** provides status information on the sensors built into your mobile device.

6.7.1 Status

This field indicates whether your device is equipped with an air pressure and a temperature sensor.

6.7.2 Sensor Data

These fields report on current cabin pressure, cabin height and temperature.

6.8 Information/About

The page **About Enroute Flight Navigation** shows basic information about the app and the system. To access the page, open the main menu and choose "Information/About Enroute Flight Navigation."

The page presents four tabs with information about the app, its authors, the software license, and the current system.

System information can be helpful to the developers **Enroute Flight Navigation**. The button "Share Info" at the bottom of the "System" Tab can be used to share the information with other apps, such as your e-mail program, and forward it to the developers.

7. User Interface: Dialogs

This section describes the most relevant dialog windows of **Enroute Flight Navigation** in full detail.

7.1 METAR and TAF Dialog

Enroute Flight Navigation shows METAR reports and TAF forecasts using the following dialog.

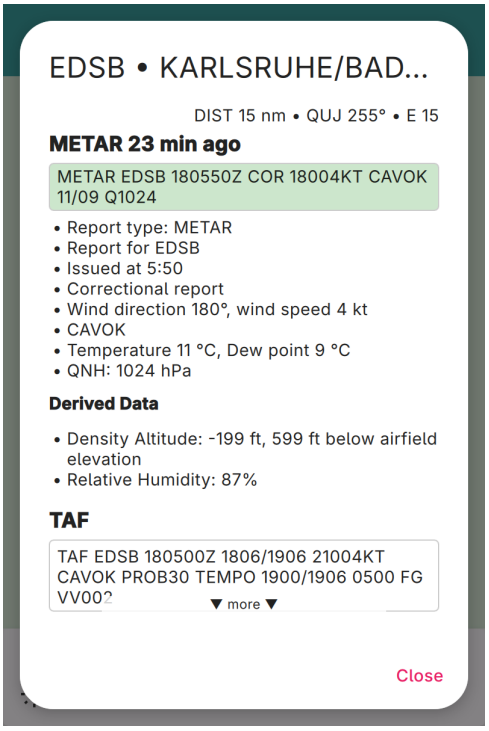


Fig. 1: METAR and TAF Dialog

This section describes the dialog window in detail.

> **Warning**
>
> The weather information shown by **Enroute Flight Navigation** might be outdated or otherwise wrong. Always use officially approved sources of flight weather information to assess of meteorological flight conditions.

7.1.1 Title and Subtitle

The title bar shows the name and ICAO identifier of the station whose METAR and TAF are shown. Identifiers are shown only if the window is wide enough.

If current positioning data is available, the window shows a subtitle line with directions for flight to the weather station. The section *Direction Summary* explains the direction line in more detail.

7.1.2 METAR Section

The METAR section starts with a headline that prominently displays the age of the METAR. The following data is shown further down.

Raw METAR Text

The raw METAR text is displayed in a box that is colored according to the "aviation flight categories" typically used in the United States. The coding scheme is explained in the table below. Note that this color coding might be different from the scheme typically used in your country. Green color does certainly **not** imply that it is advisable (or legal) to fly.

Category	Color	Ceiling		Visibility
low IFR	Red	<500 feet AGL	or	<1 statute mile
IFR	Red	500 – 1,000 feet AGL	or	1 – 3 statute miles
marginal VFR	Yellow	1,000 – 3,000 feet AGL	or	3 – 5 statute miles
VFR	Green	>3,000 feet AGL	and	> 5 statute miles
no data	White	–	–	–

Decoded METAR Text

Enroute Flight Navigation is able to decode METAR texts. The decoded information is shown in the form of an itemized list.

We found that many METAR reports deviate from the standard format, often following national or local traditions to include additional data. While **Enroute Flight Navigation** includes a sophisticated decoding algorithm, it might fail to interpret every METAR report correctly.

Derived Data

For convenience, **Enroute Flight Navigation** shows a number of data items that are not directly contained in the METAR, but can be inferred from METAR data. If enough information is available, then the following data is presented under the headline "Derived Data".

Density Altitude

> The density altitude is computed using a rather sophisticated algorithm that takes QNH, airfield elevation, temperature and humidity into account. The value presented might therefore differ from rule-of-thumb estimates taught in flight schools. For details concerning our algorithm, check the source code of **Enroute Flight Navigation**, which is freely available on GitHub.

Relative Humidity

> Relative humidity is computed using a standard formula from temperature and dew point information contained in METAR data.

Warnings Concerning Aircraft Performance

> Warnings are shown if rule-of-thumb estimates suggest that density altitude degrades performance of typical SEP aircraft to a point where takeoff-distance increases by more than 25% or climb rates decreases by more than 25%, when compared to standard conditions at sea level.

Explanatory Text

Whenever warnings are shown, **Enroute Flight Navigation** also displays a brief explanatory text. The text contains hyperlinks that can be used to hide the explanatory text, or hide all performance warnings altogether. Use the *Settings* page to re-enable warnings after they have been switched off.

Enroute Flight Navigation uses the standard rule-of-thumb estimate that the takeoff-distance increases by 15% and the climb rate decreases by 7.5% for every 1,000 ft of density altitude. While this might be a reasonable estimate for typical SEP aircraft, it might be conservative for aircraft with a turbocharged engine.

Warning

Do not rely on **Enroute Flight Navigation** to assess aircraft performance. We do not guarantee that density altitude is computed correctly. The rule-of-thumb estimate for aircraft performance might not apply to your specific aircraft.

Density altitude and aircraft performance are safety-critical. While the number presented in **Enroute Flight Navigation** can give you a first impression, always use approved methods to compute density altitude for your locality. Always refer to the officially approved flight manual to assess aircraft performance.

7.1.3 TAF Section

The raw TAF text is displayed in a white box, followed by the decoded TAF text. As with METAR text, we cannot guarantee that **Enroute Flight Navigation** is able to decode every TAF correctly.

8. User Interface: Other Elements

This section describes elements of the graphical user interface that appear throughout **Enroute Flight Navigation**.

8.1 Direction Summary

The user interface of **Enroute Flight Navigation** contains numerous items that present information about specific geographic points. Examples of geographic points include waypoints in your flight route or METAR/TAF stations. If positioning data is available, every item prominently display a brief direction summary with the following data.

- **DIST:** Distance from your current position to the geographic point, shown in the unit of measurement set in your aircraft preferences.
- **QUJ:** True course from your current position to the geographic point.
- **E:** Gliding ratio required to reach the geographic for your current position by straight flight, arriving in 300 m AGL. If the gliding ratio is negative or extremely high, the symbol '∞' is shown.

> **Warning**
>
> The gliding ratio is computed without regard for terrain. There might be a mountain in your way!

9. User Interface: Workflows

This part of the manual describes procedures that are used throughout the app.

9.1 Import Data

Enroute Flight Navigation offers a robust file import feature, allowing users to import data from various external sources. This document provides a step-by-step guide on how to utilize this functionality. A list of supported file formats and text data items is found at the end of this section

There are four ways to import files into **Enroute Flight Navigation**.

- Import Files and Text Data Shared by Other Apps
- Import Files from Local or Remote Storage
- Drag-and-Drop (Linux Desktop only)
- Copy-and-Paste (Linux Desktop only)
- Command line (Linux Desktop only)

We expect that most users on mobile devices will import files that are shared by other apps. Users on Linux desktop computers will probably prefer drag-and-drop.

9.1.1 Import Files and Text Data Shared by Other Apps

Enroute Flight Navigation is able to import files from all apps that allow file sharing. On Android, **Enroute Flight Navigation** also accepts text data shared by other apps. While the list of these apps is endless, we expect that most users employ one of the following programs to transfer and access files and data.

- Web browsers allow downloading and opening files from the internet.
- Apps such as Google Maps share text data items.
- File management apps can open files stored on your device.
- Most file management apps also allow opening files stored on cloud services connected to your devices. Some cloud service come with specialized apps.
- Email apps can open files attached to your mail messages, instant messaging apps can open files attached to chat messages.
- Both Android and iOS come with specialized apps that allow sharing files between devices, using Bluetooth or Wi-Fi connections.

The precise procedure for opening a file depends on the app in use. In a typical scenario, do the following.

1. Identify and open an app that is able to access the file. This could be a web browser for files from the internet, a file manager for files stored on your device, or an email app for files attached to your mail messages.

2. Navigate to the file that you with to import. You might have to point your browser to the correct website, open the correct folder in your file manager, or open an email that has the relevant file attached.
3. Open the file. In some scenarios, it suffices to click on the file name or file icon. Other apps require you to click on an appropriate button or menu entry, typically called “Open” or “Share”.
4. The operating system will identify the file type and present you with a list of apps known to handle files of this type. Choose **Enroute Flight Navigation** from this list.
5. **Enroute Flight Navigation** will open and import the file.

> **Note**
>
> TripKits are ZIP files with specialized content. Trying to open a TripKit file, some file management utilities will automatically unpack the ZIP file rather than offering to open it in **Enroute Flight Navigation**. Along similar lines, GeoTIFF files are image files with specialized metadata and some file management utilities will launch an image viewing application rather than offering to open a GeoTIFF file in **Enroute Flight Navigation**.
>
> If you encounter problems opening a TripKit or GeoTIFF file, look for an icon or menu item labeled “Open with…”. Some utilities open an appropriate context menu after a tap-and-hold gesture. Alternatively, import the file from local or remote storage, as explained in the next section.

9.1.2 Import Files from Local or Remote Storage

There are scenarios where the operating system cannot identify the file type and does not offer to open a given file with **Enroute Flight Navigation**. In these settings, **Enroute Flight Navigation** offers an alternative mechanism to import files.

1. Transfer the file to your device and save it in the local file storage. Alternatively, save the file in cloud storage service that is connected to your device.
2. Open **Enroute Flight Navigation**. Use the main menu to navigate to one of the pages listed below.
3. Open the three-dot-menu in the top right corner of the screen and choose the item “Import”. A file dialog will open.
4. Select the file and click on the button “Import”.

> **Note**
>
> There are systems where the file dialog shows only files of one specific type. If you cannot see your file, look for a button or drop-down-menu in the file dialog that allows choosing the file types.

Pages with File Import Functionality

The following pages of **Enroute Flight Navigation** offer import functionality.

Page	File Type	Function
Route	GeoJSON	Flight Route (replaces current flight route)
Route	GPX	Flight Route (replaces current flight route)
Library/Route	GeoJSON	Flight Route (added to library)
Library/Route	GPX	Flight Route (added to library)
Library/Maps and Data	MBTILES	Raster Maps
Library/Maps and Data	MBTILES	Vector Maps
Library/Maps and Data	OpenAir	Airspace Data
Library/Maps and Data	GeoTIFF	Approach Chart
Library/Maps and Data	ZIP/TripKit	Approach Chart Collection
Library/Waypoints	CUP	Waypoint Collection
Library/Waypoints	GeoJSON	Waypoint Collection
Library/Waypoints	GPX	Waypoint Collection

9.1.3 Drag-and-Drop (Linux Desktop Only)

If you are running **Enroute Flight Navigation** on a Linux desktop computer, you can import a file by dragging its icon from the desktop and drop it anywhere in the **Enroute Flight Navigation** window. You can import text data items by dragging the text into the **Enroute Flight Navigation** window.

9.1.4 Command Line (Linux Desktop Only)

When starting **Enroute Flight Navigation** from the Unix command line, it is possible to pass file names as command line arguments.

9.1.5 Supported File Formats

Enroute Flight Navigation accepts data in the following formats.

Functionality	File Format
Airspace Data	OpenAir
Approach Charts	GeoTIFF
Approach Chart Collection	ZIP/TripKit
FLARM Test Data	Text file
Flight Routes	Garmin FPL
Flight Routes	GPX
Flight Routes	GeoJSON
Flight Routes	PLN
Raster Maps	MBTILES
Vector Maps	MBTILES
Waypoint Collections	GeoJSON
Waypoints	CUP

9.1.6 Supported Text Data Items

Enroute Flight Navigation accepts text data items in the following formats.

- Google Map Link
- Shortened Google Map Link

- OpenStreetMap Link
- WeGo Link
- Shortened WeGo Link
- GEO URLs

10. Technology

This part of the manual describes technical aspects of **Enroute Flight Navigation**.

10.1 Traffic Data Receiver Support

10.1.1 Communication

In order to support a wide range of devices, including flight simulators, **Enroute Flight Navigation** listens to several data channels simultaneously and understands a variety of protocols. By default, **Enroute Flight Navigation** watches the following data channels. This should cover a large part of the devices presently on the market.

- A TCP connection to port 2000 at the IP addresses 10.10.10.10, where the app expects a stream of FLARM/NMEA sentences.
- A TCP connection to port 2000 at the IP addresses 192.168.1.1, where the app expects a stream of FLARM/NMEA sentences.
- A TCP connection to port 2000 at the IP addresses 192.168.10.1, where the app expects a stream of FLARM/NMEA sentences.
- A TCP connection to port 2000 at the IP addresses 192.168.4.1, where the app expects a stream of FLARM/NMEA sentences.
- A TCP connection to port 2000 at the IP addresses 192.168.42.1, where the app expects a stream of FLARM/NMEA sentences.
- A UDP connection to port 4000, where the app expects datagrams in GDL90 or XGPS format.
- A UDP connection to port 49002, where the app expects datagrams in GDL90 or XGPS format.

Users can configure additional data channels between **Enroute Flight Navigation** and traffic data receivers with Bluetooth Classic interfaces.

10.1.2 Data Formats

Enroute Flight Navigation expects traffic data in the following formats.

- FLARM/NMEA sentences must conform to the specification outlined in the document FTD-012 Data Port Interface Control Document (ICD), Version 7.13, as published by FLARM Technology Ltd..
- Datagrams in GDL90 format must conform to the GDL 90 Data Interface Specification.
- Datagrams in XGPS format must conform to the format specified on the ForeFlight Web site.

10.1.3 Known Issues with GDL90

The GDL90 protocol has a number of shortcomings, and we recommend to use FLARM/NMEA whenever possible. We are aware of the following issues.

Altitude measurements

According to the GDL90 Specification, the ownship geometric height is reported as height above WGS-84 ellipsoid. There are however many devices on the market that wrongly report height above main sea level. Different apps have different strategies to deal with these shortcomings.

- **Enroute Flight Navigation** as well as the app Skydemon expect that traffic receivers comply with the GDL90 Specification.
- ForeFlight has extended the GDL90 Specification so that traffic receivers can indicate if they comply with the specification or not.
- Many other apps expect wrong GDL90 implementations and interpret the geometric height has height above main sea level.

MODE-S traffic

Most traffic receivers see traffic equipped with MODE-S transponders and can give an estimate for the distance to the traffic. They are, however, unable to obtain the precise traffic position. Unlike FLARM/NMEA, the GDL90 Specification does not support traffic factors whose position is unknown. Different devices implement different workarounds.

- Stratux devices generate a ring of eight virtual targets around the own position. These targets are named “Mode S”.
- Air Avioncs devices do the same, but only with one target.
- Other devices create a virtual target, either at the ownship position or at the North Pole and abuse the field “Navigation Accuracy Category for Position” to give the approximate position to the target.

Enroute Flight Navigation has special provisions for handling targets called “Mode S”, but users should expect that this workaround is not perfect.

10.1.4 ForeFlight Broadcast

Following the standards established by the app ForeFlight, **Enroute Flight Navigation** broadcasts a UDP message on port 63093 every 5 seconds while the app is running in the foreground. This message allows devices to discover Enroute’s IP address, which can be used as the target of UDP unicast messages. This broadcast will be a JSON message, with at least these fields:

```
{
   "App":"Enroute Flight Navigation",
   "GDL90":{
      "port":4000
   }
}
```

The GDL90 “port” field is currently 4000, but might change in the future.

10.1.5 Known Issues with SkyEcho Devices

Enroute Flight Navigation works fine with SkyEcho devices. There are, however, several shortcomings that users should be aware of.

Unidirectional FLARM
: The SkyEcho can receive FLARM signals, but cannot send them. The SkyEcho device cannot be seen by other FLARM users. The author of **Enroute Flight Navigation** is not convinced that unidirectional FLARM is a good idea.

FLARM Output
: uAvionix follows an unusual business model. The FLARM/NMEA output of the SkyEcho is encrypted. To read the FLARM data, all apps need to include commercial, closed-source decryption libraries that must be purchased by the app users. The author of **Enroute Flight Navigation** feels that this is incompatible with the idea of free, open source software.

  To communicate with SkyEcho devices, **Enroute Flight Navigation** will switch to the GDL90 protocol.

Altimeter readings
: SkyEcho includes an integrated barometric altimeter, but does not have any access to static pressure. To estimate the barometric altitude, the SkyEcho correlates cabin pressure altitude to altitudes of nearby traffic. The author of **Enroute Flight Navigation** is not convinced that this method gives altimeter readings that are sufficiently reliable for aviation purposes.

10.1.6 Known Issues with pingUSB Devices

Enroute Flight Navigation works fine with pingUSB devices. There are, however, several shortcomings that users should be aware of.

Unidirectional ADS-B
: The pingUSB can receive ADS-B signals, but cannot send them. The pingUSB device cannot be seen by other ADS-B users. The author of **Enroute Flight Navigation** is not convinced that unidirectional ADS-B is a good idea.

Altimeter readings
: pingUSB reports the **barometric** altitude of traffic opponents, but does not include a static pressure sensor required to measure the barometric altitude of the own aircraft. As a result, **Enroute Flight Navigation** cannot compute the relative height between the traffic and the own aircraft. The author of **Enroute Flight Navigation** is aware of apps that compare the **barometric** altitude of traffic to the **geometric** altitude of the own aircraft (which can be measured via GPS), and hence show misleading traffic information. The author is not convinced that pingUSB should be used for aviation purposes.

10.2 Platform Notes

10.2.1 Android

Network Security Problems on Outdated Devices

Like most other programs, **Enroute Flight Navigation** uses Transport Layer Security (TLS) for secure communication with servers on the internet. The technology relies on digital certificates that are built into the Android operating system and can only be updated by the device manufacturer through system security updates. Regretfully, manufacturers of Android devices are often not interested in after-sales support and provide updates only for a very short period of time, if at all.

If a device does not receive regular system updates, the certificates will expire after a while, and secure network connections are no longer possible. As covered in the media, many users of systems running Android 7.1 (or below) started to experience problems on 30. September 2021, when an important certificate expired.

When certificates expire, some apps will stop working. Other app authors prefer to hide the complexity of secure communication from their users and write apps that will silently revert to insecure communication. These apps appear to run as normal, but leave communication (and eventually the system) open to tampering and manipulation.

The author of **Enroute Flight Navigation** believes that pilots should be able to make an informed decision about the security of their systems. **Enroute Flight Navigation** will tell the user of any network security errors. Users can then decide to do one of the following.

- Replace the device by a more recent model, preferably from one of the few manufacturers who offer long-time support for their products.
- Accept the risk of insecure communication and ignore network security errors in the future.

Note

The author, who is concerned about short-lived digital products, uses a Fairphone personally. Fairphones are long-lasting, can be repaired easily and receive many years of security updates. Other brands might have similar offers.

Screen Backlighting

Enroute Flight Navigation overrides the system settings of your device and ensures that the screen backlighting is always on. To save battery power, the screen can be switched off manually with the hardware "power button" of your device.

Screen Locking

Enroute Flight Navigation stays on top of the lock screen of your device. It will therefore be shown immediately as soon as the screen is switched on. You can therefore use **Enroute Flight Navigation** without unlocking your device.

Wi-Fi Locking

When running on Android, **Enroute Flight Navigation** acquires a Wi-Fi lock as soon as the app receives heartbeat messages from one of the channels where it listens for traffic receivers. The lock is released when the messages no longer arrive.

10.2.2 iOS

Users may experience a degraded workflow when connecting to a traffic data receiver that requires a password, in addition to the password required to enter the Wi-Fi network. Privacy features of iOS prevent **Enroute Flight Navigation** from accessing the SSID of the Wi-Fi network, which makes in impossible to identify networks and suggest correct passwords from the password storage.

10.2.3 Linux Desktop

The following command line options are supported.

Option	Description
-h, –help	Displays help on commandline options.
–help-all	Displays help including Qt specific options.
-v, –version	Displays version information.
–sg	Run simulator and generate screenshots for Google Play
–sm	Run simulator and generate screenshots for the manual

10.3 Altitude Measurement

10.3.1 Types of Altitude used in Enroute Flight Navigation

Enroute Flight Navigation uses several notions of altitude.

True Altitudes

- **Geometric Altitude** or **True Altitude AMSL** is the vertical distance between your aircraft and the main sea level. To avoid confusion, geometric altitudes are typically indicated in the form "T.ALT 6500 AMSL".
- **Absolute Altitude** or **True Altitude AGL** is the vertical distance between your aircraft and the terrain. To avoid confusion, absolute altitudes are typically indicated in the form "T.ALT 6500 AGL".

Enroute Flight Navigation computes the absolute altitude is computed using satellite navigation data and a terrain elevation database.

Barometric Altitudes

- **Pressure altitude** is the value shown by your altimeter when set to the standard value 1013.2hPa. To avoid confusion, pressure altitudes are typically indicated in the form "FL 65".
- **Altitude** is the value shown by your altimeter when set to QNH. To avoid confusion, altitudes are typically indicated in the form "6500".
- **Cabin altitude** is the altitude at which an aircraft flying in the ICAO standard atmosphere experiences a static pressure equal to the pressure in the cabin of your aircraft.

Altitude and pressure altitude is used to define airspace boundaries and vertical aircraft positions.

> **Warning**
>
> In Central Europe, true altitudes and barometric altitudes typically differ by 5-10%, but we have seen differences of 15% on warm summer days in Germany. Never use true altitudes to judge vertical distances to airspaces!

Enroute Flight Navigation computes altitude and pressure altitude from static pressure data reported by traffic data receivers and from QNH data reported by nearby airfields. If **Enroute Flight Navigation** is not connected to a traffic data receiver or if the traffic data receiver does not report static

pressure, then no pressure altitude is available. **Enroute Flight Navigation** measures cabin altitude using the pressure sensor installed in your mobile device.

> **Note**
>
> As a rule of thumb, any traffic data receiver that handles ADS-B signals will report static pressure, as static pressure is required to interpret ADS-B data. In particular, all PowerFLARM devices use and report static pressure.

Density Altitude

Density altitude is the altitude at which an aircraft flying in the ICAO standard atmosphere experiences an air density equal to the density measured by the ambient pressure/temperature sensors of your device.

Enroute Flight Navigation computes the density altitude from METAR data, but only for airfields reporting the necessary data.

Part III.

Appendix

11. Known Issues and Troubleshooting

11.1 Android

Enroute Flight Navigation runs on a huge variety of Android platforms; at the time of writing, Google Play lists over 13,000 different device models. The developers cannot possibly test the software on every single device and ask for your understanding that they cannot provide support for specific models.

11.1.1 Graphic Errors

A very small number of users reported broken graphic and flickering that rendered **Enroute Flight Navigation** unusable on their devices. The cause of the problem is unknown because the developers could not reproduce the issue on any of their devices.

We have obtained reports that deleting the cache of the app solves the issue. For that, open the Android Settings and navigate to “Apps / Enroute Flight Navigation / Storage and cache / Clear Cache”.

11.1.2 Resuming from Hibernation

Sporadically, **Enroute Flight Navigation** fails to start after being minimized for a certain period. The app hangs on the splash screen. As a workaround, terminate the app by swiping its window off the screen and restart it.

12. Data Sources

12.1 Map Data

12.1.1 Aeronautical Maps

Our maps available for offline use, so that the app does not require any internet connection in flight. The maps are updated once per day, provided that new data is available. Note, however, that we do not **guarantee** regular updates.

The aeronautical maps are compiled from databases provided by the openAIP and the open flightmaps projects. While openAIP covers most of the world, the open flightmaps cover fewer countries but contain more detailed information.

Map Feature	Data Origin
Airfields	openAIP
Airspace: Nature Preserve Areas	open flightmaps
Airspace: all other	openAIP
Navaids	openAIP
Procedures (Traffic Circuits, …)	open flightmaps
Reporting Points	open flightmaps

List of maps

For simplicity, our maps are divided in “Class 1” and “Class 2”.

- Class 1 maps are compiled from openAIP and open flightmaps data. These maps contain complete information about airspaces, airfields and navaids. In addition, the maps contain (mandatory) reporting points. Some of our class 1 maps also show traffic circuits and flight procedures for control zones.
- Class 2 maps are compiled from openAIP data only. They contain complete information about airspaces, airfields and navaids.

Below is a complete list of the maps that we offer.

Continent	Country	Class
Africa	Algeria	Class 2
Africa	Botswana	Class 2
Africa	Canary Islands	Class 1
Africa	Kenya	Class 2
Africa	Madagascar	Class 2
Africa	Malawi	Class 2
Africa	Mauritius	Class 2
Africa	Morocco	Class 2

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Table 1 – continued from previous page

Continent	Country	Class
Africa	Namibia	Class 1
Africa	Réunion	Class 2
Africa	South Africa	Class 1
Africa	Tunisia	Class 2
Asia	Bahrain	Class 2
Asia	Japan	Class 2
Asia	Laos	Class 2
Asia	Nepal	Class 2
Asia	Qatar	Class 2
Asia	Sri Lanka	Class 2
Asia	Unit. Emirates	Class 2
Australia Oceanica	Australia	Class 2
Australia Oceanica	New Zealand	Class 2
Australia Oceanica	Vanuatu	Class 2
Europe	Albania	Class 2
Europe	Austria	Class 1
Europe	Belgium	Class 1
Europe	Bosnia and H.	Class 2
Europe	Bulgaria	Class 1
Europe	Croatia	Class 1
Europe	Cyprus	Class 2
Europe	Czech Republic	Class 1
Europe	Denmark	Class 1
Europe	Estonia	Class 2
Europe	Finland	Class 1
Europe	France	Class 2
Europe	Germany	Class 1
Europe	Great Britain	Class 1
Europe	Greece	Class 1
Europe	Hungary	Class 1
Europe	Iceland	Class 2
Europe	Ireland	Class 2
Europe	Italy	Class 1
Europe	Latvia	Class 2
Europe	Liechtenstein	Class 2
Europe	Lithuania	Class 2
Europe	Luxembourg	Class 2
Europe	Malta	Class 2
Europe	Moldova	Class 2
Europe	Montenegro	Class 2
Europe	Netherlands	Class 1
Europe	North. Ireland	Class 1
Europe	Norway	Class 2
Europe	Poland	Class 1
Europe	Portugal	Class 2
Europe	Romania	Class 1
Europe	Serbia	Class 2
Europe	Slovakia	Class 1

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Table 1 – continued from previous page

Continent	Country	Class
Europe	Slowenia	Class 1
Europe	Spain	Class 2
Europe	Sweden	Class 1
Europe	Switzerland	Class 1
Europe	Turkey	Class 2
North America	Canada	Class 2
North America	United States	Class 2
South America	Argentina	Class 2
South America	Brazil	Class 2
South America	Colombia	Class 2
South America	Falkland Is.	Class 2

12.1.2 Raster Maps

- Switzerland, Digital Glider Map provided by the Federal Office of Topography swisstopo
- Switzerland, Digital Aeronautical Chart ICAO provided by the Federal Office of Topography swisstopo

12.1.3 Base Maps

Our base maps are generated from Open Streetmap data.

12.1.4 Terrain maps

Our terrain maps are derived from the Terrain Tiles Open Dataset on Amazon AWS. The underlying data sources are a mix of:

- 3DEP (formerly NED and NED Topobathy) in the United States, 10 meters outside of Alaska, 3 meter in select land and territorial water areas
- ArcticDEM strips of 5 meter mosaics across all of the land north of 60° latitude, including Alaska, Canada, Greenland, Iceland, Norway, Russia, and Sweden
- CDEM (Canadian Digital Elevation Model) in Canada, with variable spatial resolution (from 20-400 meters) depending on the latitude.
- data.gov.uk, 2 meters over most of the United Kingdom
- data.gv.at, 10 meters over Austria
- ETOPO1 for ocean bathymetry, 1 arc-minute resolution globally
- EUDEM in most of Europe at 30 meter resolution, including Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and United Kingdom
- Geoscience Australia's DEM of Australia, 5 meters around coastal regions in South Australia, Victoria, and Northern Territory
- GMTED globally, coarser resolutions at 7.5", 15", and 30" in land areas

- INEGI's continental relief in Mexico
- Kartverket's Digital Terrain Model, 10 meters over Norway
- LINZ, 8 meters over New Zealand
- SRTM globally except high latitudes, 30 meters (90 meters nominal quality) in land areas

Attributions

- ArcticDEM terrain data DEM(s) were created from DigitalGlobe, Inc., imagery and funded under National Science Foundation awards 1043681, 1559691, and 1542736;
- Australia terrain data © Commonwealth of Australia (Geoscience Australia) 2017;
- Austria terrain data © offene Daten Österreichs – Digitales Geländemodell (DGM) Österreich;
- Canada terrain data contains information licensed under the Open Government Licence – Canada;
- Europe terrain data produced using Copernicus data and information funded by the European Union - EU-DEM layers;
- Global ETOPO1 terrain data U.S. National Oceanic and Atmospheric Administration
- Mexico terrain data source: INEGI, Continental relief, 2016;
- New Zealand terrain data Copyright 2011 Crown copyright (c) Land Information New Zealand and the New Zealand Government (All rights reserved);
- Norway terrain data © Kartverket;
- United Kingdom terrain data © Environment Agency copyright and/or database right 2015. All rights reserved;
- United States 3DEP (formerly NED) and global GMTED2010 and SRTM terrain data courtesy of the U.S. Geological Survey.

12.2 METAR/TAF

METAR and TAF data is provided by the Aviation Weather Center, an office of the United States Department of Commerce.

12.3 NOTAMs

NOTAMs are provided by the Federal Aviation Administration, an office of the United States Department of Transportation.

13. Software and Data Licenses

13.1 Enroute Flight Navigation

The program **Enroute Flight Navigation** is licensed under the GNU General Public License V3 or, at your choice, any later version of this license.

```
GNU GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

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Preamble

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  other kinds of works.

  The licenses for most software and other practical works are
↪designed to
  take away your freedom to share and change the works. By
↪contrast, the GNU
  General Public License is intended to guarantee your freedom
↪to share and
  change all versions of a program--to make sure it remains
↪free software for
  all its users. We, the Free Software Foundation, use the GNU
↪General Public
  License for most of our software; it applies also to any
↪other work released
  this way by its authors. You can apply it to your programs,
↪too.

  When we speak of free software, we are referring to freedom,
↪not price. Our
  General Public Licenses are designed to make sure that you
↪have the freedom
  to distribute copies of free software (and charge for them
↪if you wish),
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```
  that you receive source code or can get it if you want it,
↪that you can
  change the software or use pieces of it in new free programs,
↪ and that you
  know you can do these things.

  To protect your rights, we need to prevent others from
↪denying you these
  rights or asking you to surrender the rights. Therefore, you
↪have certain
  responsibilities if you distribute copies of the software,
↪or if you modify
  it: responsibilities to respect the freedom of others.

  For example, if you distribute copies of such a program,
↪whether gratis or
  for a fee, you must pass on to the recipients the same
↪freedoms that you
  received. You must make sure that they, too, receive or can
↪get the source
  code. And you must show them these terms so they know their
↪rights.

  Developers that use the GNU GPL protect your rights with two
↪steps: (1)
  assert copyright on the software, and (2) offer you this
↪License giving you
  legal permission to copy, distribute and/or modify it.

  For the developers' and authors' protection, the GPL clearly
↪explains that
  there is no warranty for this free software. For both users'
↪and authors'
  sake, the GPL requires that modified versions be marked as
↪changed, so that
  their problems will not be attributed erroneously to authors
↪of previous
  versions.

  Some devices are designed to deny users access to install or
↪run modified
  versions of the software inside them, although the
↪manufacturer can do
  so. This is fundamentally incompatible with the aim of
↪protecting users'
  freedom to change the software. The systematic pattern of
↪such abuse occurs
  in the area of products for individuals to use, which is
↪precisely where it
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  is most unacceptable. Therefore, we have designed this
↪version of the GPL to
  prohibit the practice for those products. If such problems
↪arise
  substantially in other domains, we stand ready to extend
↪this provision to
  those domains in future versions of the GPL, as needed to
↪protect the
  freedom of users.

  Finally, every program is threatened constantly by software
↪patents. States
  should not allow patents to restrict development and use of
↪software on
  general-purpose computers, but in those that do, we wish to
↪avoid the
  special danger that patents applied to a free program could
↪make it
  effectively proprietary. To prevent this, the GPL assures
↪that patents
  cannot be used to render the program non-free.

  The precise terms and conditions for copying, distribution
↪and modification
  follow.

TERMS AND CONDITIONS

0. Definitions.

  “This License” refers to version 3 of the GNU General Public
↪License.

  “Copyright” also means copyright-like laws that apply to
↪other kinds of
  works, such as semiconductor masks.

  “The Program” refers to any copyrightable work licensed
↪under this
  License. Each licensee is addressed as “you”. “Licensees”
↪and “recipients”
  may be individuals or organizations.

  To “modify” a work means to copy from or adapt all or part
↪of the work in a
  fashion requiring copyright permission, other than the
↪making of an exact
  copy. The resulting work is called a “modified version” of
↪the earlier work
```

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```
  or a work "based on" the earlier work.

  A "covered work" means either the unmodified Program or a
↪work based on the
  Program.

  To "propagate" a work means to do anything with it that,
↪without permission,
  would make you directly or secondarily liable for
↪infringement under
  applicable copyright law, except executing it on a computer
↪or modifying a
  private copy. Propagation includes copying, distribution
↪(with or without
  modification), making available to the public, and in some
↪countries other
  activities as well.

  To "convey" a work means any kind of propagation that
↪enables other parties
  to make or receive copies. Mere interaction with a user
↪through a computer
  network, with no transfer of a copy, is not conveying.

  An interactive user interface displays "Appropriate Legal
↪Notices" to the
  extent that it includes a convenient and prominently visible
↪feature
  that (1) displays an appropriate copyright notice, and (2)
↪tells the user
  that there is no warranty for the work (except to the extent
↪that warranties
  are provided), that licensees may convey the work under this
↪License, and
  how to view a copy of this License. If the interface
↪presents a list of user
  commands or options, such as a menu, a prominent item in the
↪list meets this
  criterion.

1. Source Code.

  The "source code" for a work means the preferred form of the
↪work for making
  modifications to it. "Object code" means any non-source form
↪of a work.

  A "Standard Interface" means an interface that either is an
↪official
```

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  standard defined by a recognized standards body, or, in the
↪case of
  interfaces specified for a particular programming language,
↪one that is
  widely used among developers working in that language.

  The “System Libraries” of an executable work include
↪anything, other than
  the work as a whole, that (a) is included in the normal form
↪of packaging a
  Major Component, but which is not part of that Major
↪Component, and (b)
  serves only to enable use of the work with that Major
↪Component, or to
  implement a Standard Interface for which an implementation
↪is available to
  the public in source code form. A “Major Component”, in this
↪context, means
  a major essential component (kernel, window system, and so
↪on) of the
  specific operating system (if any) on which the executable
↪work runs, or a
  compiler used to produce the work, or an object code
↪interpreter used to run
  it.

  The “Corresponding Source” for a work in object code form
↪means all the
  source code needed to generate, install, and (for an
↪executable work) run
  the object code and to modify the work, including scripts to
↪control those
  activities. However, it does not include the work's System
↪Libraries, or
  general-purpose tools or generally available free programs
↪which are used
  unmodified in performing those activities but which are not
↪part of the
  work. For example, Corresponding Source includes interface
↪definition files
  associated with source files for the work, and the source
↪code for shared
  libraries and dynamically linked subprograms that the work
↪is specifically
  designed to require, such as by intimate data communication
↪or control flow
  between those subprograms and other parts of the work.

  The Corresponding Source need not include anything that
```

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```
↪users can regenerate
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↪modifications to produce
  it from the Program, in the form of source code under the
↪terms of section
  4, provided that you also meet all of these conditions:
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  permit. Inclusion of a covered work in an aggregate does not
↪cause this
  License to apply to the other parts of the aggregate.
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  You may convey a covered work in object code form under the
↪terms of
  sections 4 and 5, provided that you also convey the machine-
↪readable
  Corresponding Source under the terms of this License, in one
↪of these ways:

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↪product (including
     a physical distribution medium), accompanied by the
↪Corresponding Source
     fixed on a durable physical medium customarily used for
↪software
     interchange.

  b) Convey the object code in, or embodied in, a physical
↪product (including
     a physical distribution medium), accompanied by a written
↪offer, valid
     for at least three years and valid for as long as you
↪offer spare parts
     or customer support for that product model, to give
↪anyone who possesses
     the object code either (1) a copy of the Corresponding
↪Source for all the
     software in the product that is covered by this License,
↪on a durable
     physical medium customarily used for software interchange,
↪ for a price no
     more than your reasonable cost of physically performing
↪this conveying of
     source, or (2) access to copy the Corresponding Source
↪from a network
     server at no charge.

  c) Convey individual copies of the object code with a copy
↪of the written
     offer to provide the Corresponding Source. This
↪alternative is allowed
     only occasionally and noncommercially, and only if you
↪received the
     object code with such an offer, in accord with subsection
↪6b.

  d) Convey the object code by offering access from a
↪designated place (gratis
     or for a charge), and offer equivalent access to the
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↪Corresponding Source
      in the same way through the same place at no further
↪charge. You need not
      require recipients to copy the Corresponding Source along
↪with the object
      code. If the place to copy the object code is a network
↪server, the
      Corresponding Source may be on a different server
↪(operated by you or a
      third party) that supports equivalent copying facilities,
↪provided you
      maintain clear directions next to the object code saying
↪where to find
      the Corresponding Source. Regardless of what server hosts
↪the
      Corresponding Source, you remain obligated to ensure that
↪it is available
      for as long as needed to satisfy these requirements.

  e) Convey the object code using peer-to-peer transmission,
↪provided you
      inform other peers where the object code and
↪Corresponding Source of the
      work are being offered to the general public at no charge
↪under
      subsection 6d.

  A separable portion of the object code, whose source code is
↪excluded from
  the Corresponding Source as a System Library, need not be
↪included in
  conveying the object code work.

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↪means any
  tangible personal property which is normally used for
↪personal, family, or
  household purposes, or (2) anything designed or sold for
↪incorporation into
  a dwelling. In determining whether a product is a consumer
↪product, doubtful
  cases shall be resolved in favor of coverage. For a
↪particular product
  received by a particular user, “normally used” refers to a
↪typical or common
  use of that class of product, regardless of the status of
↪the particular
  user or of the way in which the particular user actually
↪uses, or expects or
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  is expected to use, the product. A product is a consumer
↪product regardless
  of whether the product has substantial commercial,
↪industrial or
  non-consumer uses, unless such uses represent the only
↪significant mode of
  use of the product.

  “Installation Information” for a User Product means any
↪methods, procedures,
  authorization keys, or other information required to install
↪and execute
  modified versions of a covered work in that User Product
↪from a modified
  version of its Corresponding Source. The information must
↪suffice to ensure
  that the continued functioning of the modified object code
↪is in no case
  prevented or interfered with solely because modification has
↪been made.

  If you convey an object code work under this section in, or
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  specifically for use in, a User Product, and the conveying
↪occurs as part of
  a transaction in which the right of possession and use of
↪the User Product
  is transferred to the recipient in perpetuity or for a fixed
↪term
  (regardless of how the transaction is characterized), the
↪Corresponding
  Source conveyed under this section must be accompanied by
↪the Installation
  Information. But this requirement does not apply if neither
↪you nor any
  third party retains the ability to install modified object
↪code on the User
  Product (for example, the work has been installed in ROM).

  The requirement to provide Installation Information does not
↪include a
  requirement to continue to provide support service, warranty,
↪ or updates for
  a work that has been modified or installed by the recipient,
↪or for the User
  Product in which it has been modified or installed. Access
↪to a network may
  be denied when the modification itself materially and
↪adversely affects the
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  operation of the network or violates the rules and protocols
↪for
  communication across the network.

  Corresponding Source conveyed, and Installation Information
↪provided, in
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13.2 Geographic Maps

As a flight navigation program, **Enroute Flight Navigation** heavily relies on geographic map data. The geographic maps are not included in the program, but are downloaded at runtime. They are compiled from the following sources.

- The base maps are generated from OpenStreetMap open data, licensed under the Open Data Commons Open Database License.
- The aviation maps contain data from openAIP, licensed under a CC BY-NC-SA license.
- The aviation maps contain data from open flightmaps, licensed under the OFMA General Users´ License.

13.3 Software and Data Included in the Program

Depending on platform and configuration, the following components might be included in the installation of **Enroute Flight Navigation**.

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- Freetype 2 - Portable Compiled Format (PCF) support. MIT License and MIT Open Group variant.
- Freetype 2 - zlib. zlib License.
- Gear Icon. MIT License.
- Georama. SIL Open Font License 1.1.
- Google Fonts. Apache 2 License.
- Google Material Icon Font. Apache Licence 2.0.
- Gradle wrapper. Apache License 2.0.
- Guidelines Support Library. MIT License.
- HarfBuzz-NG. MIT License.
- JavaScriptCore Macro Assembler. BSD 2-clause “Simplified” License.
- jQuery. MIT License.
- KDAB’s helper class for single-instance policy applications. MIT License.
- KWin. BSD-3-Clause.
- libdus-1 headers. Academic Free License v2.1, or GNU General Public License v2.0 or later.
- LibJPEG-turbo. Independent JPEG Group License and BSD 3-Clause “New” or “Revised” License.
- LibPNG. libpng License and PNG Reference Library version 2.
- libpsl - C library to handle the Public Suffix List. BSD 3-clause “New” or “Revised” License.
- libzip. 3-clause BSD license.
- Linux Performance Events. GNU General Public License v2.0 only with Linux Syscall Note.

- lunr.js. MIT License.
- Map of Europe from Wikipedia. Creative Commons Attribution 3.0 Unported.
- Material Design Icons. Apache License.
- Material Sphinx Theme. MIT License.
- Material Symbols and Icons. Apache License Version 2.0.
- MD4. Public Domain.
- MD4C. MIT License.
- MD5. Public Domain.
- Metaf library. MIT License.
- Mipmap generator for D3D12. MIT License.
- Native Style for Android. Apache License 2.0.
- OpenGL ES 2 Headers. MIT License.
- OpenGL Headers. MIT License.
- openSSL library. Apache 2 License.
- OSM Liberty. BSD License.
- PCRE2. BSD 3-clause “New” or “Revised” License with PCRE2 binary-like Packages Exception.
- PCRE2 - Stack-less Just-In-Time Compiler. BSD 2-clause “Simplified” License.
- Pixman. MIT License.
- Poly2Tri Polygon Triangulation Library. BSD 3-clause “New” or “Revised” License.
- QEventDispatcher on macOS. BSD 3-clause “New” or “Revised” License.
- QHttpEngine. MIT License.
- Qt Toolkit, Libraries and Modules. GNU General Public License v3.0.
- Secure Hash Algorithm SHA-1. Public Domain.
- Secure Hash Algorithm SHA-3 - brg_endian. BSD 2-clause “Simplified” License.
- Secure Hash Algorithm SHA-3 - Keccak. Creative Commons Zero v1.0 Universal.
- Secure Hash Algorithms SHA-384 and SHA-512. BSD 3-clause “New” or “Revised” License.
- Shadow values from Angular Material. MIT License.
- SipHash Algorithm. Creative Commons Zero v1.0 Universal.
- Smooth Scaling Algorithm. BSD 2-clause “Simplified” License and Imlib2 License.
- SQLite. SQLite Blessing.
- sRGB color profile icc file. International Color Consortium License.
- The Public Suffix List. Mozilla Public License 2.0.
- TIFF Software Distribution (libtiff). libtiff License.
- TinyCBOR. MIT License.

- Titillium Web Font. SIL OPEN FONT LICENSE Version 1.1.
- underscore. MIT License.
- Unicode Character Database (UCD). Unicode License Agreement - Data Files and Software (2016).
- Unicode Common Locale Data Repository (CLDR). Unicode License v3.
- Valgrind. BSD 4-clause “Original” or “Old” License.
- Vulkan API Registry. Apache License 2.0 or MIT License.
- Vulkan Memory Allocator. MIT License.
- Weather icons from the Noto Emoji collection. Apache License 2.0.
- WebGradients. MIT License.
- WebP (libwebp). BSD 3-clause “New” or “Revised” License.
- Wintab API. LCS-Telegraphics License.
- Work Sans font by Wei Huang. SIL Open Font License 1.1.
- X Server helper. X11 License and Historical Permission Notice and Disclaimer.
- XCB-XInput. MIT License.
- XSVG. Historical Permission Notice and Disclaimer - sell variant.

14. Privacy Policies

14.1 English

This Privacy Policy outlines the data handling practices for the app **Enroute Flight Navigation**. We prioritize your privacy and do not collect or store personally identifiable information. However, for the app to function properly, it must communicate with certain servers on the Internet. The following sections list the servers that **Enroute Flight Navigation** communicates with and explain the communication purposes.

By using Enroute Flight Navigation, you agree to this Privacy Policy. We may update this policy periodically, and any changes will be posted within the app.

14.1.1 1. Data and Anonymization Server (enroute-data)

Enroute Flight Navigation regularly communicates with the server **enroute-data.akaflieg-freiburg.de** (referred to as **enroute-data**), operated by Hetzner Online GmbH on behalf of Akaflieg Freiburg. The server's primary role is to facilitate the app's functionality while maintaining user privacy.

1.1. Data Collected

In every communication with **enroute-data**, your device's IP address is transmitted to the server. The server needs to know the IP address to respond.

The server stores the following data items in its log files.

- **Pseudonymized IP Address**: The last byte of your IP address is replaced with a random number, ensuring it cannot identify you.
- **Access Data**: Date and time of access, error codes, and data sent.
- **Software Information**: The name of the web browser or software in use if the visitor's software provides this information to the server. **Enroute Flight Navigation** does not provide this information and sends a standard text ('Mozilla/5.0') instead.
- **Operating System:** The operating system's name if the visitor's software provides this information to the server. **Enroute Flight Navigation** does not provide this information.

1.2. Communication: Data Download

The app checks for updates and downloads data from **enroute-data** to provide current maps and aviation data. Your IP address is transmitted in the process.

1.3. Communication: NOTAM, METAR and TAF

Enroute Flight Navigation shows NOTAMs, METARs, and TAFs for airfields near your current location and your currently planned route. It also shows NOTAMs, METARs, and TAFs for all waypoints you open in the app. To provide this functionality, requests are transmitted to the server **enroute-data**

at regular intervals and whenever new data is requested. In addition to your device's IP address, the following data items will be sent.

- Your current location
- The currently planned route
- Waypoint coordinates

The server forwards requests for NOTAMs to a Federal Aviation Administration web service but hides your IP address, so the service will never see it. The Federal Aviation Administration's web services are operated by the US government. We do not control the data handling practices of these external services. Detailed information can be found at **api.faa.gov**.

14.1.2 Other Servers

At the user's request, **Enroute Flight Navigation** may display external websites in an embedded browser window or ask the operating system to open external apps such as Google Maps. These external sites and apps are beyond our control and may collect their own data.

Users expect web browsers to follow hyperlinks immediately but may not expect the same behavior elsewhere in the app. To account for these expectations, **Enroute Flight Navigation** operates as follows.

- **Embedded Browser Windows**: Clicking a hyperlink is considered authorization to open the external site.
- **Outside Embedded Browser Windows**: The app will ask for explicit user authorization before opening any external site or app.

14.1.3 Responsible

Stefan Kebekus, Wintererstraße 77, 79104 Freiburg im Breisgau, Germany

14.2 Deutsche Übersetzung

Diese Datenschutzrichtlinie beschreibt den Umgang der App **Enroute Flight Navigation** mit Daten. Wir legen großen Wert auf Ihre Privatsphäre und sammeln und speichern keine personenbezogenen Daten. Damit die App jedoch ordnungsgemäß funktioniert, muss sie mit bestimmten Servern im Internet kommunizieren. In den folgenden Abschnitten werden die Server aufgeführt, mit denen **Enroute Flight Navigation** kommuniziert, und die Zwecke der Kommunikation erläutert.

Mit der Verwendung von Enroute Flight Navigation stimmen Sie dieser Datenschutzrichtlinie zu. Gelegentliche Änderungen dieser Richtlinie sind möglich. Sie werden innerhalb der App bekanntgegeben.

14.2.1 1. Daten- und Anonymisierungs-Server (enroute-data)

Enroute Flight Navigation kommuniziert regelmäßig mit dem Server **enroute-data.akaflieg-freiburg.de** (genannt **enroute-data**), betrieben von der Hetzner Online GmbH für die Akaflieg Freiburg. Die Hauptaufgabe des Servers besteht darin, die Funktionalität der App zu ermöglichen und gleichzeitig die Privatsphäre der Nutzer zu schützen.

1.1. Gesammelte Daten

Bei jeder Kommunikation mit **enroute-data** wird die IP-Adresse Ihres Geräts zum Server übertragen. Der Server benötigt die IP-Adresse, um zu antworten.

Der Server speichert die folgenden Daten in seinen Loggdateien.

- **Pseudonymisierte IP-Adresse**: Das letzte Byte Ihrer IP-Adresse wird durch eine Zufallszahl ersetzt. Damit können Sie nicht identifiziert werden.
- **Access Data**: Datum und Uhrzeit des Zugriffs, Fehlercodes, und gesendete Daten.
- **Software Information**: Der Name des Web-Browsers oder der verwendeten Software, falls er von der anfragenden Software übertragen wird. **Enroute Flight Navigation** liefert diese Information nicht und sendet stattdessen einen Standardtext ('Mozilla/5.0').
- **Operating System:** Der Name des Betriebssystems, falls er von der anfragenden Software übertragen wird. **Enroute Flight Navigation** überträgt diese Information nicht.

1.2. Kommunikation: Daten-Download

Die App prüft auf vorhandene Updates und lädt Daten von **enroute-data**, um aktuelle Karten und Luftfahrtdaten bereitzustellen. Ihre IP-Adresse wird in diesem Prozess übertragen.

1.3. Kommunikation: NOTAM, METAR und TAF

Enroute Flight Navigation zeigt NOTAMs, METARs und TAFs für Flugplätze in der Nähe Ihrer aktuellen Position und Ihrer aktiven geplanten Route. Es zeigt auch NOTAMs, METARs und TAFs für alle Wegpunkte, die Sie in der App öffnen. Um diese Funktion zu bieten, werden Anfragen zum Server **enroute-data** regelmäßig und außerdem bei der Abfrage neuer Daten gestellt. Zusätzlich zur IP-Adresse Ihres Geräts werden noch folgende Daten gesendet.

- Ihre aktuelle Position
- Die aktuell geplante Route
- Wegpunktkoordinaten

Der Server leitet NOTAM-Anfragen zu einem Dienst der Federal Aviation Administration weiter, verbirgt aber Ihre IP-Adresse, sodass dieser Dienst sie niemals sehen kann. Die Dienste der Federal Aviation Administration werden von der US-Regierung betrieben. Auf die Datenverarbeitung dieser externen Dienste haben wir keinen Einfluss. Genaue Informationen finden Sie auf **api.faa.gov**.

14.2.2 Andere Server

Auf Anforderung des Benutzers kann **Enroute Flight Navigation** externe Webseiten öffnen. Diese werden enteder in einem eingebetteten Browser angezeigt, oder das Betriebssystem wird eine externe App (wie z.B. Google Maps) öffnen. Diese externen Webseiten entziehen sich unserer Kontrolle und sammeln eventuell Daten.

Benutzer erwarten, dass der eingebette Browser jeden Link sofort öffnet. Ausserhalb des eingebetten Browsers werden die Benutzer unter Umständen ein anderes Verhalten erwarten. Um diesen Erwartungen zu entsprechen, verhält sich **Enroute Flight Navigation** folgendermaßen.

- **Innerhalb des eingebetteten Browsers**: Ein Klick auf einen Link wird als Autorisierung gewertet, die externe Seite sofort zu öffnen.

- **Außerhalb des eingebetteten Browsers**: Die App fragt ausdrücklich nach Berechtigung, bevor sie eine externe Seite oder App öffnet.

14.2.3 Verantwortlich

Stefan Kebekus, Wintererstraße 77, 79104 Freiburg im Breisgau, Germany

14.3 Traduction en français

Cette politique de confidentialité décrit les pratiques de traitement des données pour l'application **Enroute Flight Navigation**. Nous accordons la priorité à votre vie privée et ne collectons ni ne stockons d'informations personnelles identifiables. Cependant, pour que l'application fonctionne correctement, elle doit communiquer avec certains serveurs sur Internet. Les sections suivantes répertorient les serveurs avec lesquels **Enroute Flight Navigation** communique et expliquent les objectifs de la communication.

En utilisant Enroute Flight Navigation, vous acceptez cette politique de confidentialité. Nous pouvons mettre à jour cette politique périodiquement et toute modification sera publiée dans l'application.

14.3.1 1. Serveur de données et d'anonymisation (enroute-data)

Enroute Flight Navigation communique régulièrement avec le serveur **enroute-data.akaflieg-freiburg.de** (appelé **enroute-data**), exploité par Hetzner Online GmbH pour le compte d'Akaflieg Freiburg. Le rôle principal du serveur est de faciliter les fonctionnalités de l'application tout en préservant la confidentialité des utilisateurs.

1.1. Données collectées

Dans chaque communication avec **enroute-data**, l'adresse IP de votre appareil est transmise au serveur. Le serveur doit connaître l'adresse IP pour répondre.

Le serveur stocke les éléments de données suivants dans ses fichiers journaux.

- **Adresse IP pseudonymisée**: le dernier byte de votre adresse IP est remplacé par un nombre aléatoire, garantissant ainsi qu'elle ne peut pas vous identifier.
- **Données d'accès**: date et heure d'accès, codes d'erreur et données envoyées.
- **Informations sur le logiciel**: le nom du navigateur Web ou du logiciel utilisé si le logiciel du visiteur fournit ces informations au serveur. **Enroute Flight Navigation** ne fournit pas ces informations et envoie un texte standard (« Mozilla/5.0 ») à la place.
- **Système d'exploitation:** Le nom du système d'exploitation si le logiciel du visiteur fournit ces informations au serveur. **Enroute Flight Navigation** ne fournit pas ces informations.

1.2. Communication: téléchargement de données

L'application vérifie les mises à jour et télécharge les données de **enroute-data** pour fournir des cartes et des données aéronautiques actuelles. Votre adresse IP est transmise au cours du processus.

1.3. Communication: NOTAM, METAR et TAF

Enroute Flight Navigation affiche les NOTAM, METAR et TAF pour les aérodromes proches de votre position actuelle et votre itinéraire actuellement prévu. Il affiche également les NOTAM, METAR et TAF pour tous les points de cheminement que vous ouvrez dans l'application. Pour fournir cette fonctionnalité, des requêtes sont transmises au serveur **enroute-data** à intervalles réguliers et chaque

fois que de nouvelles données sont demandées. En plus de l'adresse IP de votre appareil, les éléments de données suivants seront envoyés.

- Votre position actuelle
- L'itinéraire actuellement prévu
- Coordonnées du point de cheminement

Le serveur transmet les demandes de NOTAM à un service Web de la Federal Aviation Administration, mais masque votre adresse IP afin que le service ne la voie jamais. Les services Web de la Federal Aviation Administration sont gérés par le gouvernement américain. Nous ne contrôlons pas les pratiques de traitement des données de ces services externes. Des informations détaillées sont disponibles sur **api.faa.gov**.

14.3.2 Autres serveurs

À la demande de l'utilisateur, **Enroute Flight Navigation** peut afficher des sites Web externes dans une fenêtre de navigateur intégrée ou demander au système d'exploitation d'ouvrir des applications externes telles que Google Maps. Ces sites et applications externes échappent à notre contrôle et peuvent collecter leurs propres données.

Les utilisateurs s'attendent à ce que les navigateurs Web suivent immédiatement les hyperliens, mais ne s'attendent pas nécessairement au même comportement ailleurs dans l'application. Pour répondre à ces attentes, la **Enroute Flight Navigation** fonctionne comme suit.

- **Navigateur intégré Windows**: cliquer sur un lien hypertexte est considéré comme une autorisation d'ouvrir le site externe.
- **En dehors du navigateur intégré de Windows**: l'application demandera l'autorisation explicite de l'utilisateur avant d'ouvrir un site ou une application externe.

14.3.3 Responsable

Stefan Kebekus, Wintererstraße 77, 79104 Freiburg im Breisgau, Germany

14.4 Traduzione italiana

Questa Privacy Policy evidenzia il processo di gestione dei dati per **Enroute Flight Navigation**. Diamo priorità alla tua privacy e non raccogliamo o immagazziniamo nessun dato personale. Comunque, per far funzionare bene, la app deve comunicare con certi servers su internet. La sezione seguente elenca i servers con cui **Enroute Flight Navigation** comunica e spiega gli scopi della comunicazione.

Usando Enroute Flight Navigation, sei daccordo con questa Privacy Policy. Potremmo aggiornare questa policy periodicamente, e ogni modifica sarà evidenziata nella app.

14.4.1 1. Dati e anonimato dei server (dati di Enroute)

Enroute Flight Navigation comunica regolarmente con il server di **enroute-data.akaflieg-freiburg.de** (chiamato anche **enroute-data**), operato per conto di Akaflieg Freiburs da Hetzner Online GmbH. Il ruolo primario del server è di facilitare le funzionalità della app preservando la privacy dell'utente.

1.1. Raccolta dati

In ogni comunicazione con **enroute-data**, l'indirizzo IP del tuo dispositivo è trasmesso al server. Il server ha bisogno di conoscere l'indirizzo IP per rispondere.

Il server immagazzina i seguenti dati per proprio file log.

- **Indirizzo IP pseudonimo**: L'ultimo byte del tuo IP è rimpiazzato con un numero casuale, per garantire l'anonimato.
- **Accesso ai Dati**: Data e ora dell'accesso, codici di errore e dati inviati.
- **Informazioni sul Software**: Il nome del browser web o del software in uso se il software del visitatore fornisce queste informazioni al server. **Enroute Flight Navigation** non fornisce queste informazioni, invia invece un testo standart ('Mozilla/5.0').
- **Operating System:**: Il nome del sistema operativo se il software del visitatore fornisce questa informazione al server. **Enroute Flight Navigation** non fornisce questa informazione.

1.2. Comunicazione: scaricamento di dati

La app controlla gli aggiornamenti e lo scaricamento dei dati da **enroute-data** per fornire le mappe installate e dati aeronautici. Il tuo indirizzo IP è fornito nel processo.

1.3. Comunicazioni: NOTAM, METAR e TAF

Enroute Flight Navigation mostra NOTAM, METAR e TAF per gli aeroporti vicini alla tua posizione corrente e la tua rotta pianificata. Mostra anche NOTAM, METAR e TAF per tutti i punti intermedi che apri nella app. Per fornire questa funzione, le richieste sono trasmesse ai server di **enroute-data** ad intervalli regolari o ogni volta che un nuovo dato viere richiesto. Oltre all'IP del dispositivo, vengono trasmessi i seguenti dati.

- La tua posizione corrente
- Il piano di volo corrente
- Coordinate dei waypoints

il server inoltra la richiesta di NOTAM ai servizi web della Federal Aviation Administration ma nasconde il tuo IP,così il servizio non può vederlo. I servizi web della Federal Aviation Administration sono operati dal governo USA. Noi non controlliamo la gestione dei dati di questi server esterni. Informazioni più dettagliate possono essere trovate su **api.faa.gov**.

14.4.2 Altri server

A seguito della richiesta dell'utente, **Enroute Flight Navigation** può mostrare siti web esterni in un browser incorporato o chiedere al sistema operativo di aprire una app esterna come Google Maps. Questi siti esterni e app sono oltre il nostro controllo e potrebbero raccogliere i tuoi dati.

Gli utenti si aspettano che il browser segua il link immediatamente ma lo stesso comportamento non deve essere atteso in altre parti della app. Per giustificare queste aspettative, **Enroute Flight Navigation** opera come segue.

- **Finestra del Browser integrato**: Cliccare su un link è considerato come una autorizzazione ad aprire il sito esterno.
- **Finestra di un browser integrato esterno**: La app chiederà esplicitamente all'utente l'autorizzazione prima di aprire qualsiasi sito esterno o app.

14.4.3 Responsabile

Stefan Kebekus, Wintererstraße 77, 79104 Freiburg im Breisgau, Germany

14.5 Polskie tłumaczenie

Niniejsza Polityka prywatności opisuje praktyki przetwarzania danych w aplikacji **Enroute Flight Navigation**. Priorytetowo traktujemy Twoją prywatność i nie gromadzimy ani nie przechowujemy danych osobowych. Aby jednak aplikacja działała prawidłowo, musi komunikować się z określonymi serwerami w Internecie. W poniższych sekcjach wymieniono serwery, z którymi komunikuje się **Enroute Flight Nawigacja**, i wyjaśniono cele komunikacji.

Korzystając z Enroute Flight Navigation, wyrażasz zgodę na niniejszą Politykę prywatności. Możemy okresowo aktualizować tę politykę, a wszelkie zmiany będą publikowane w aplikacji.

14.5.1 1. Serwer danych i anonimizacji (enroute-data)

Enroute Flight Nawigacja regularnie komunikuje się z serwerem **enroute-data.akaflieg-freiburg.de** (określanym jako **enroute-data**), obsługiwanym przez firmę Hetzner Online GmbH w imieniu Akaflieg Freiburg. Podstawową rolą serwera jest ułatwianie funkcjonalności aplikacji przy jednoczesnym zachowaniu prywatności użytkownika.

1.1. Informacje zbierane

Przy każdej komunikacji z **enroute-data** adres IP Twojego urządzenia jest przesyłany do serwera. Serwer musi znać adres IP, aby odpowiedzieć.

Serwer przechowuje następujące elementy danych w swoich plikach dziennika.

- **Pseudonimizowany adres IP**: ostatni bajt adresu IP jest zastępowany losową liczbą, dzięki czemu nie można go zidentyfikować.
- **Dane dostępu**: data i godzina dostępu, kody błędów i przesłane dane.
- **Informacje o oprogramowaniu**: nazwa przeglądarki internetowej lub używanego oprogramowania, jeśli oprogramowanie odwiedzającego udostępnia te informacje serwerowi. **Enroute Flight Navigation** nie dostarcza tych informacji i zamiast tego wysyła standardowy tekst („Mozilla/5.0”).
- **System operacyjny:** nazwa systemu operacyjnego, jeśli oprogramowanie odwiedzającego udostępnia te informacje serwerowi. **Enroute Flight Navigation** nie udostępnia tych informacji.

1.2. Komunikacja: Pobieranie danych

Aplikacja sprawdza dostępność aktualizacji i pobiera dane z **enroute-data**, aby zapewnić aktualne mapy i dane lotnicze. W trakcie tego procesu przesyłany jest Twój adres IP.

1.3. Komunikacja: NOTAM, METAR i TAF

Enroute Flight Navigation pokazuje NOTAM, METAR i TAF dla lotnisk w pobliżu Twojej bieżącej lokalizacji i aktualnie zaplanowanej trasy. Pokazuje także NOTAM, METAR i TAF dla wszystkich punktów otwartych w aplikacji. Aby zapewnić tę funkcjonalność, żądania są przesyłane do serwera **dane-enroute-data** w regularnych odstępach czasu oraz za każdym razem, gdy wymagane są nowe dane. Oprócz adresu IP Twojego urządzenia przesłane zostaną następujące dane.

- Twoja aktualna lokalizacja
- Aktualnie planowana trasa
- Współrzędne punktu trasy

Serwer przekazuje żądania NOTAM do usługi internetowej Federalnej Administracji Lotniczej, ale ukrywa Twój adres IP, więc usługa nigdy go nie zobaczy. Usługi internetowe Federalnej Administracji Lotniczej są obsługiwane przez rząd Stanów Zjednoczonych. Nie kontrolujemy praktyk przetwarzania danych w tych usługach zewnętrznych. Szczegółowe informacje można znaleźć na stronie **api.faa.gov**.

14.5.2 Inne serwery

Na żądanie użytkownika **Enroute Flight Navigation** może wyświetlić zewnętrzne strony internetowe we wbudowanym oknie przeglądarki lub poprosić system operacyjny o otwarcie aplikacji zewnętrznych, takich jak Mapy Google. Te zewnętrzne witryny i aplikacje są poza naszą kontrolą i mogą gromadzić własne dane.

Użytkownicy oczekują, że przeglądarki internetowe będą natychmiast podążać za hiperłączami, ale nie mogą spodziewać się takiego samego zachowania w innych miejscach aplikacji. Aby uwzględnić te oczekiwania, **Enroute Flight Navigation** działa w następujący sposób.

- **Okna wbudowanej przeglądarki**: kliknięcie hiperłącza jest uznawane za autoryzację do otwarcia witryny zewnętrznej.
- **Poza oknem wbudowanej przeglądarki**: aplikacja poprosi użytkownika o wyraźną autoryzację przed otwarciem jakiejkolwiek zewnętrznej witryny lub aplikacji.

14.5.3 Odpowiedzialny

Stefan Kebekus, Wintererstraße 77, 79104 Freiburg im Breisgau, Germany

14.6 Traducción al español

Esta política de privacidad describe las prácticas de manejo de datos para la aplicación **Enroute Flight Navigation**. Priorizamos su privacidad y no recopilamos ni almacenamos información de identificación personal. Sin embargo, para que la aplicación funcione correctamente, debe comunicarse con ciertos servidores de Internet. Las siguientes secciones enumeran los servidores con los que se comunica **Enroute Flight Navigation** y explican los propósitos de la comunicación.

Al utilizar Enroute Flight Navigation, acepta esta Política de privacidad. Podemos actualizar esta política periódicamente y cualquier cambio se publicará en la aplicación.

14.6.1 1. Servidor de datos y anonimización (datos en ruta)

Enroute Flight Navigation se comunica periódicamente con el servidor **enroute-data.akaflieg-freiburg.de** (denominado **enroute-data**), operado por Hetzner Online GmbH en nombre de Akaflieg Freiburg. La función principal del servidor es facilitar la funcionalidad de la aplicación manteniendo la privacidad del usuario.

1.1. Datos recolectados

En cada comunicación con **enroute-data**, la dirección IP de su dispositivo se transmite al servidor. El servidor necesita saber la dirección IP para responder.

El servidor almacena los siguientes elementos de datos en sus archivos de registro.

- **Dirección IP seudonimizada**: el último byte de su dirección IP se reemplaza con un número aleatorio, lo que garantiza que no pueda identificarlo.
- **Datos de acceso**: Fecha y hora de acceso, códigos de error y datos enviados.
- **Información de software**: el nombre del navegador web o software en uso si el software del visitante proporciona esta información al servidor. **Enroute Flight Navigation** no proporciona esta información y en su lugar envía un texto estándar ('Mozilla/5.0').
- **Sistema operativo:** el nombre del sistema operativo si el software del visitante proporciona esta información al servidor. **Enroute Flight Navigation** no proporciona esta información.

1.2. Comunicación: Descarga de datos

La aplicación busca actualizaciones y descarga datos de **enroute-data** para proporcionar mapas actuales y datos de aviación. Su dirección IP se transmite en el proceso.

1.3. Comunicación: NOTAM, METAR y TAF

Navegación de vuelo en ruta muestra NOTAM, METAR y TAF para aeródromos cercanos a su ubicación actual y su ruta planificada actualmente. También muestra NOTAM, METAR y TAF para todos los puntos de referencia que abre en la aplicación. Para proporcionar esta funcionalidad, las solicitudes se transmiten al servidor **enroute-data** a intervalos regulares y cada vez que se solicitan nuevos datos. Además de la dirección IP de su dispositivo, se enviarán los siguientes elementos de datos.

- Su ubicación actual
- La ruta actualmente planificada
- Coordenadas del punto de ruta

El servidor reenvía solicitudes de NOTAM a un servicio web de la Administración Federal de Aviación, pero oculta su dirección IP, por lo que el servicio nunca la verá. Los servicios web de la Administración Federal de Aviación son operados por el gobierno de EE. UU. No controlamos las prácticas de manejo de datos de estos servicios externos. Puede encontrar información detallada en **api.faa.gov**.

14.6.2 Otros servidores

A petición del usuario, **Enroute Flight Navigation** puede mostrar sitios web externos en una ventana integrada del navegador o solicitar al sistema operativo que abra aplicaciones externas como Google Maps. Estos sitios y aplicaciones externos están fuera de nuestro control y pueden recopilar sus propios datos.

Los usuarios esperan que los navegadores web abran los hipervínculos inmediatamente, pero es posible que no tengan el mismo comportamiento en otras partes de la aplicación. Para tener en cuenta estas expectativas, **Enroute Flight Navigation** funciona de la siguiente manera.

- **Navegador integrado de Windows**: hacer clic en un hipervínculo se considera autorización para abrir el sitio externo.
- **Windows externo del navegador integrado**: la aplicación solicitará autorización explícita del usuario antes de abrir cualquier sitio o aplicación externa.

14.6.3 Responsable

Stefan Kebekus, Wintererstraße 77, 79104 Freiburg im Breisgau, Germany

15. Authors

The app **Enroute Flight Navigation** was written by Stefan Kebekus, flight enthusiast since 1986 and member of the Akaflieg Freiburg flight club. Stefan flies gliders and motor planes.

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15.1 Contributions

- **iOS Version:** The app has been ported to iOS by Simon Schneider, who also maintains the iOS port. Simon received his PPL license in 2024. Like Stefan, he is a member of the Akaflieg Freiburg flight club.
- **Programming:** Heinz Blöchinger has helped us with file import functionality. After 15 years of alpine gliding, Heinz has fulfilled a big dream and now flies helicopters.
- **Programming:** Christian Engelhardt implemented the OGN network connection, flight plan export and started the implementation of height density calculation. Christian is a PPL pilot in southern Germany, studied electrical engineering and working as an embedded software Engineer.
- **Programming:** Tom Linz completed height density calculation. He received his PPL license in late 2024. Tom works as a development engineer for safety systems.
- **Programming:** Markus Marks helped to implement the side view. Based in southern Germany, Markus is an enthusiastic glider pilot software developer working in embedded systems.
- **Programming:** Simon Schneider implemented the first working version of the side view.

15.2 Translations

- **French:** Adrien Crovato and Luca Riva. Both are private pilots and aerospace engineers. Luca is also doing aerobatics.
- **German:** Markus Sachs. Markus flies trikes and is an enthusiastic 'Co' on everyting else that flies.
- **Italian:** Ivan Battistella and Antonio Fardella. Antonio is an ultralight pilot with a passion for everything challenging.
- **Polish:** Sławek Mikuła.
- **Spanish:** Luca Riva.

15.3 Alumni

- Luca Bertoncello (Italian translation)
- Adrien Crovato (Integration of weather information)
- Michael Horbaschk (Manual)

- Szymon Kocur (Polish translation)
- Heiner Tholen (User interface)
- Johannes Zellner (Geoid correction for altitude)

16. Awards

16.1 Innovation Award 2023 of the Hellmut Niethammer Foundation

The app **Enroute Flight Navigation** was awarded the Innovation Prize of the Hellmut Niethammer Foundation in October 2023. The prize goes to the Academic Aviation Group Freiburg, under whose umbrella the app was developed. The Hellmut Niethammer Foundation promotes air sports in Baden-Württemberg. The prize honors projects in clubs for innovative developments on the way to climate-neutral flight operations, contributions to a sustainable future for air sports and technical developments for the entire field of air sports.

16.2 Innovation Award 2021

In summer 2021, the readers of the German aviation magazine Aerokurier have chosen **Enroute Flight Navigation** as one of the three most important innovations of the year in the category "Avionics". Read the full article here.