Enroute Flight Navigation

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Apr 15, 2024

Contents

Enroute Flight Navigation is a free 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 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.

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 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 right side of the screen.

- Choose the menu item *Aircraft*. The aircraft page will then open.

Fig. 1: Aircraft specifics

Please fill in the relevant data. While not every data item is used in the present version of **Enroute Flight Navigation**, we expect that future versions of the app will use all the data that is requested on this page.

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.
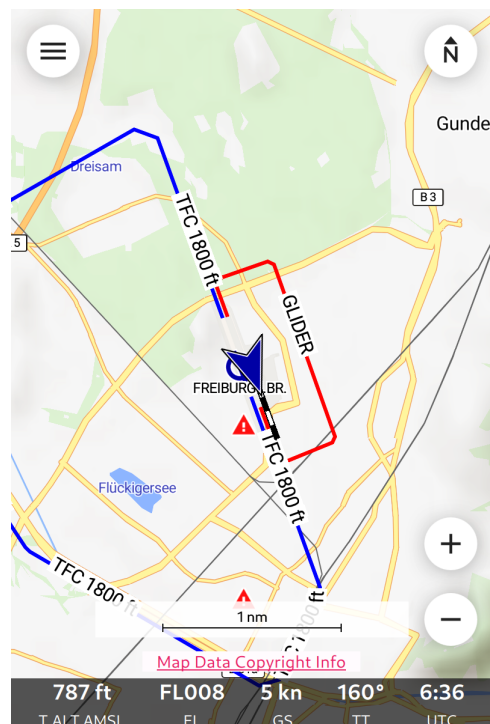

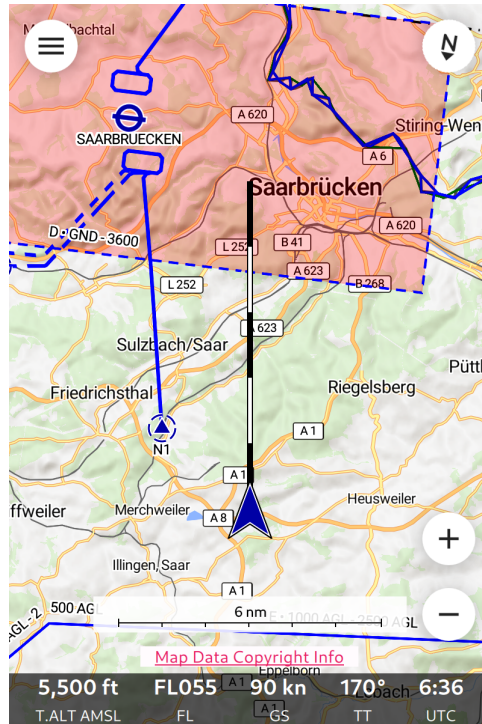Fig. 2: Moving Map Display on the Ground

Fig. 3: Moving Map Display in Flight

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.

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

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 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 *Connect Your Traffic Receiver* 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 Interactive Controls

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

Symbol	Function
☰	Open main menu
Ⓝ	Switch between display modes **north up** and **track up**.
◉	Center map about own position.
+	Zoom in
−	Zoom out
✈	Warning when the app is not connected to a traffic data receiver.

1.3.4 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.
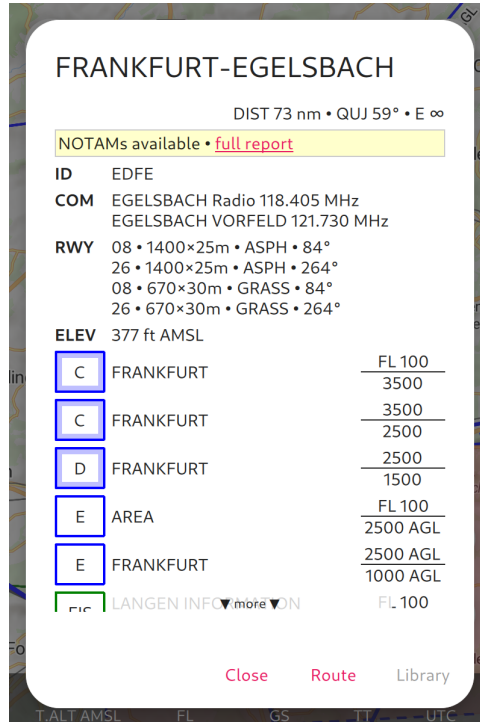
Fig. 5: Information about EDFE airport

The dialog uses the following abbreviations.

Abbrevia-tions	
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)

1.3.5 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 *Basic Use*.

Part I.

Tutorials

2. Basic Use

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

2.1 Connect Your Traffic Receiver

Midair collisions are a major reason for loss of lives in general aviation. Collisions often happen near airfields or in the traffic circuit. In order to enhance security, **Enroute Flight Navigation** can connect to your aircraft's traffic receiver, typically a FLARM device. Once connected, the moving map will show nearby traffic.
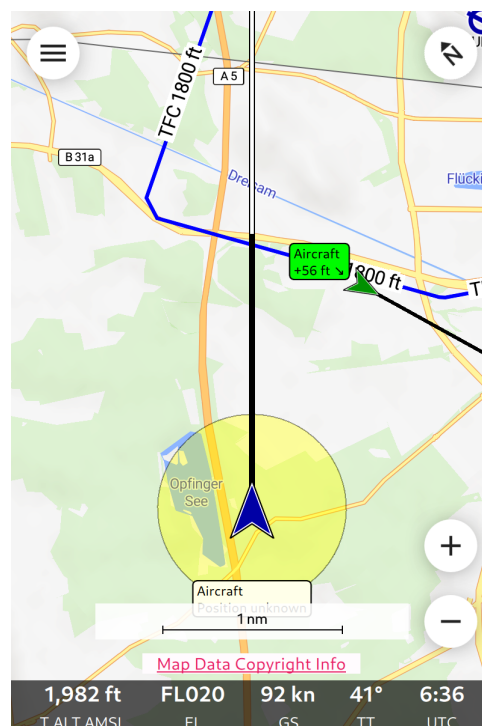
Fig. 1: Approaching EDTF with Traffic

The figure *Approaching EDTF with Traffic* shows what to expect. 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 sinking. 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.

Warning: **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.

2.1.1 Compatibility

Enroute Flight Navigation should work with all modern, standard-compliant traffic receivers. The author has tested the following receivers.

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

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*
- Stratux devices
- TTGO T-Beam devices

Note: Most traffic data receivers can only handle one concurrent connection. If more devices connect, this might lead to frequent loss of connection or loss of data. To be on the safe side, it might be useful to ask your passengers to disable Wi-Fi on their phone before boarding.

Note: For best results, use FLARM compatible devices. If your traffic receiver supports FLARM/NMEA as well as GDL90 output, 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.

2.1.2 Connect!

It takes three steps to connect **Enroute Flight Navigation** to the traffic receiver for the first time. 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.

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. Bluetooth is currently not supported.

- 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.

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: Connect to the Traffic Data Stream

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 select the entry. The "Traffic Receiver Status" page will open. The page explains the connection status in detail, and explains how to establish a connection manually.

Troubleshooting

The app cannot connect to the traffic data stream.

- Check that your device is connected to the Wi-Fi network deployed by your traffic receiver.

The connection breaks down after a few seconds.

Most traffic receivers cannot serve more than one client 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.

2.1.3 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").

2.2 Connect the SafeSky App

SafeSky is an anti-collision app and a real-time flight information service for all pilots flying any type of aircraft. The commercial premium version of SafeSky integrates with **Enroute Flight Navigation**. Once set up, the moving map of **Enroute Flight Navigation** will show nearby traffic, similar to the map display when connected to a traffic receiver.
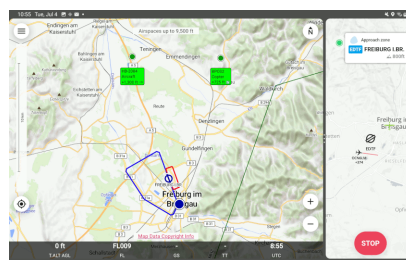

Fig. 2: SafeSky integration at work

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. The moving map of **Enroute Flight Navigation** will therefore show substantially less traffic than the SafeSky app.

> **Warning:** **Enroute Flight Navigation** does not issue traffic warnings. The app contains no collision avoidance algorithms.

2.2.1 Connect!

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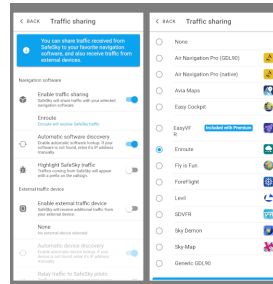

Fig. 3: SafeSky configuration screens

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.

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!
- If the entry "Traffic Receiver" is not highlighted in green, then select the entry. The "Traffic Receiver Status" page will open. The page explains the connection status in detail, and explains how to establish a connection manually.

2.3 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.

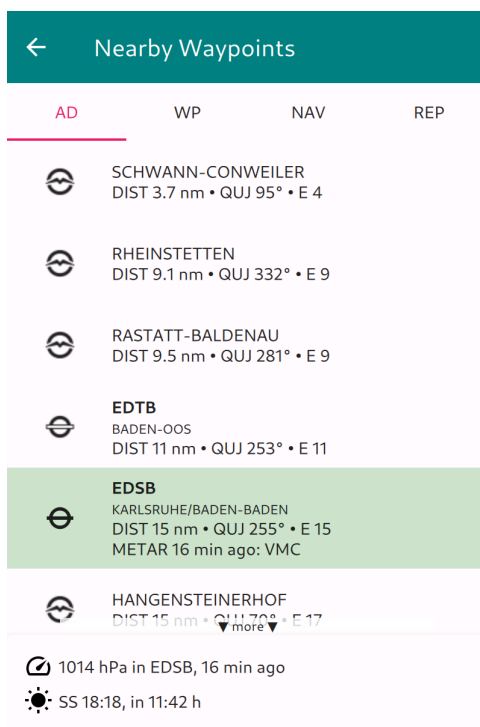
Fig. 4: List of Airfields Close to the Current Position

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

2.4 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.

The page body displays a list of stations that are within 85nm around your current position or your intended flight route. As you can see in the picture, the following information is shown.
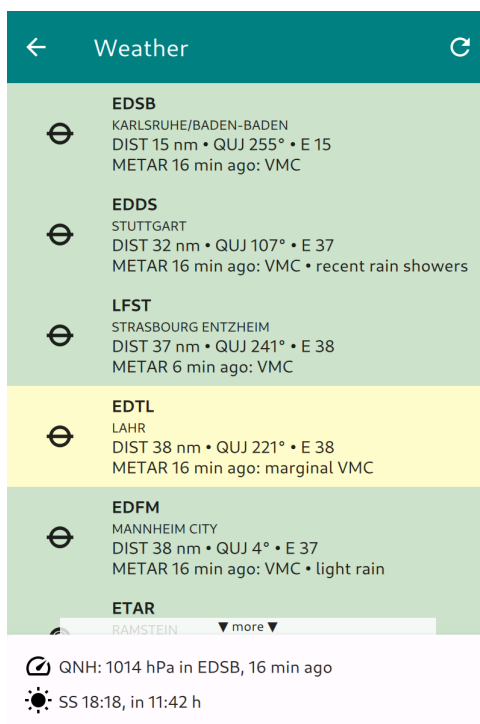
Fig. 5: Weather Information

- ICAO identifier for Station and Airport name

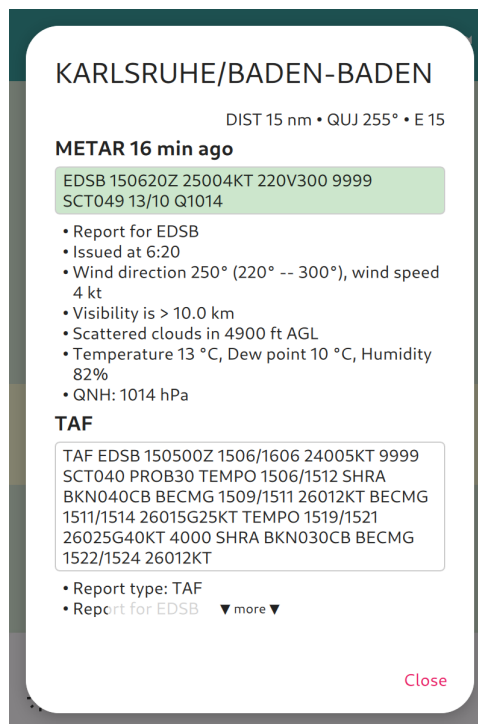- Distance and QUJ

- METAR summary

The entries are classified and 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 mile
IFR	Red	500 − 1,000 feet AGL	or	1 − 3 miles
marginal VFR	Yellow	1,000 − 3,000 feet AGL	or	3 − 5 miles
VFR	Green	>3,000 feet AGL	and	> 5 miles
no data	White	−	−	−

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

As you can see in the picture, the weather dialog shows the following information.

1. Station data including bearing and distance

2. METAR text (if available)

3. Decoded and translated METAR text

4. TAF text (if available)

Fig. 6: Detailed Weather Dialog

5. Decoded and translated TAF text

Depending on screen size, you might have to scroll down in order to read the full weather forecast.

2.4.1 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

2.4.2 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.

2.5 Plan a Flight

2.5.1 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.
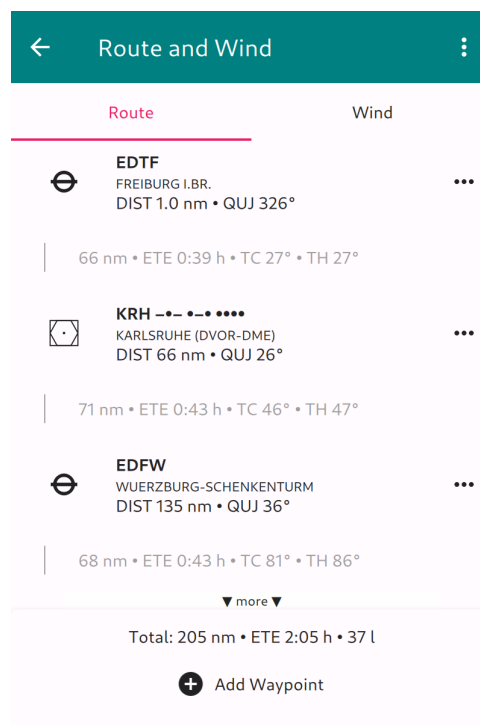
Fig. 7: Flight Route Window, Route Set

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

- 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.
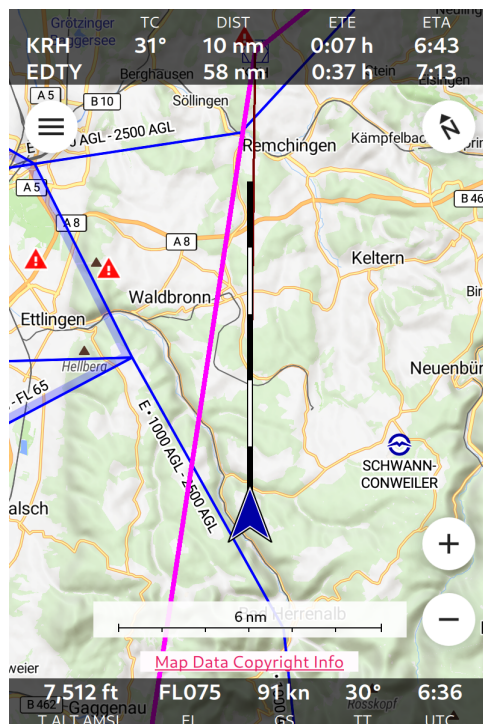
Fig. 8: Moving Map When Following a Flight Route

2.5.2 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.

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 GPX 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:
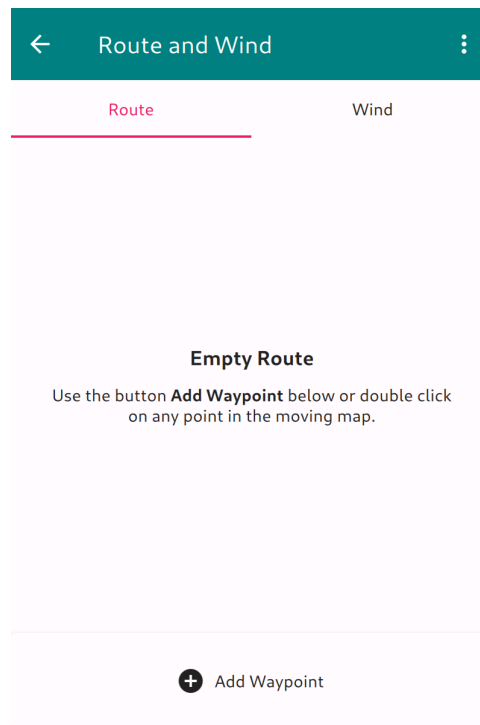
Fig. 9: Flight Route Window, No Route Set

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.

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.
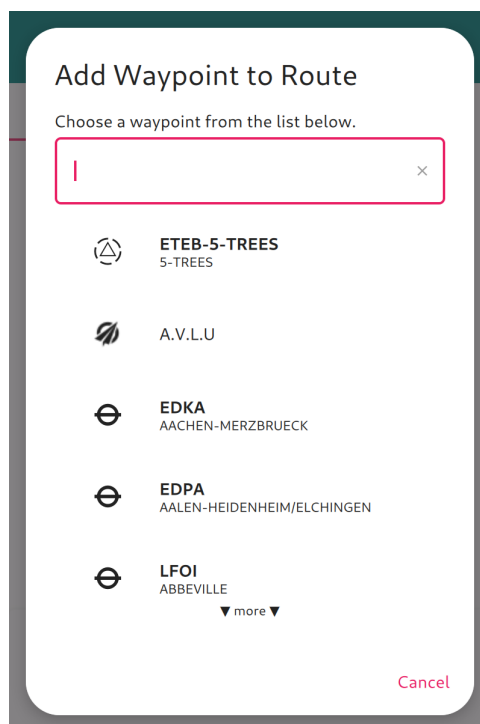
Fig. 10: Enter Waypoints by Name

- 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 GPX File From Another Program

To prepare your flight, you might want to use full-featured flight preparation software or online services. All programs known to us are able to export flight routes in GPX format, which can be read by **Enroute Flight Navigation**. The Section *Flight Planning Tools* explains the 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.

2.5.3 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.

2.6 Manage a Waypoint Library

2.6.1 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.

2.6.2 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.

2.6.3 View the waypoint library

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

2.7 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.

2.7.1 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"

2.7.2 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.

FlightGear

FlightGear works well, even though position information is only broadcast when the simulated aircraft is moving. The following two parameters in the text field of the settings dialog need to be set:

```
--generic=socket,out,1,255.255.255.255,49002,udp,foreflight-xgps
--httpd=8080
```

The figure *FlightGear Settings* shows settings window.
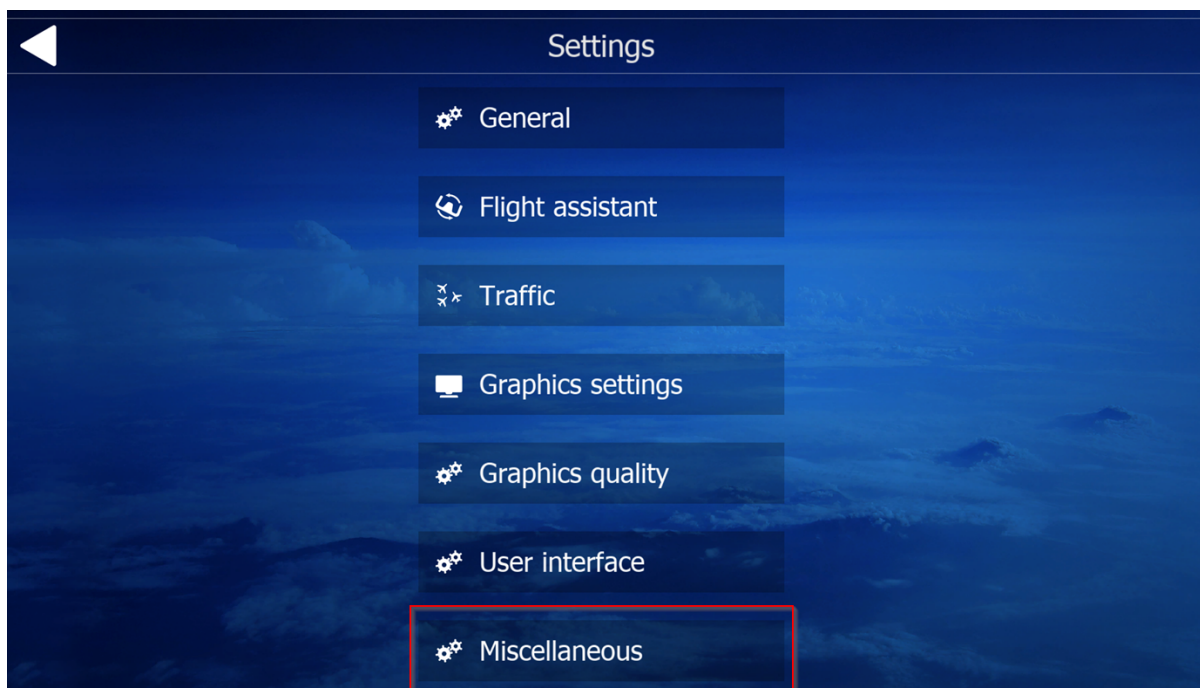
Fig. 11: Aerofly settings
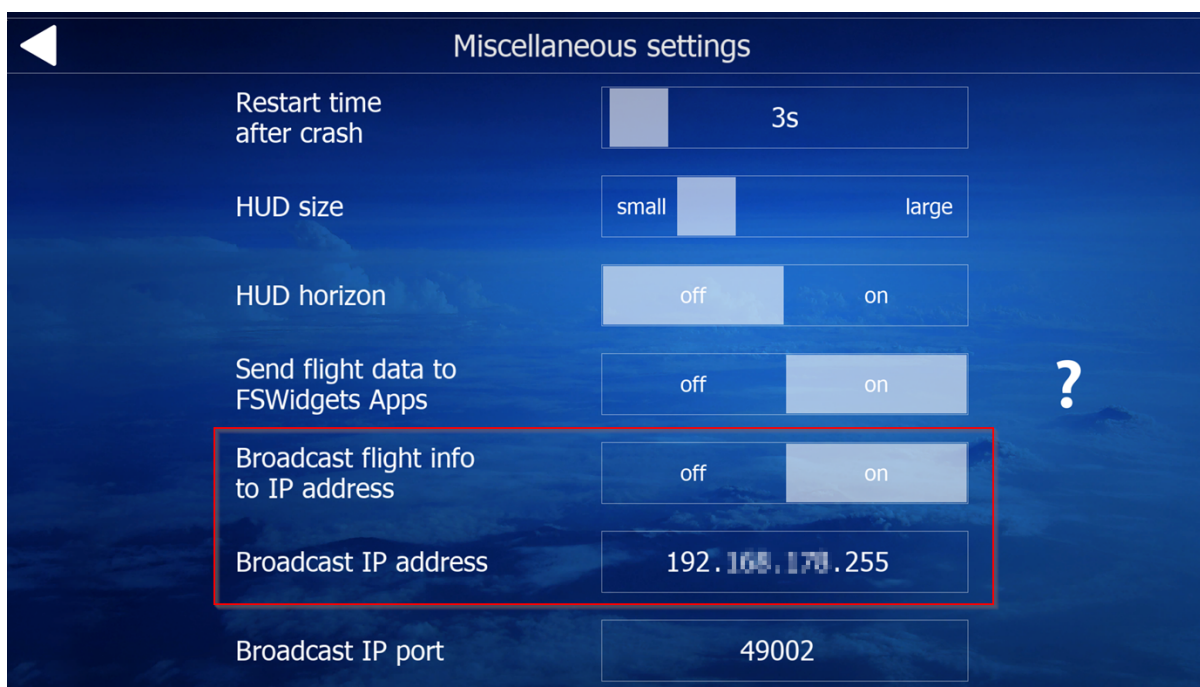
Fig. 12: Aerofly Miscellaneous settings

Additional Settings

Enter additional command-line arguments if any are required. See here for documentation on possible arguments.
Warning: values entered here always override other settings; click here to view the final set of arguments that will be used

```
--generic=socket,out,1,255.255.255.255,49002,udp,foreflight-xgps
--httpd=8080
```

Fig. 13: FlightGear Settings

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!

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.
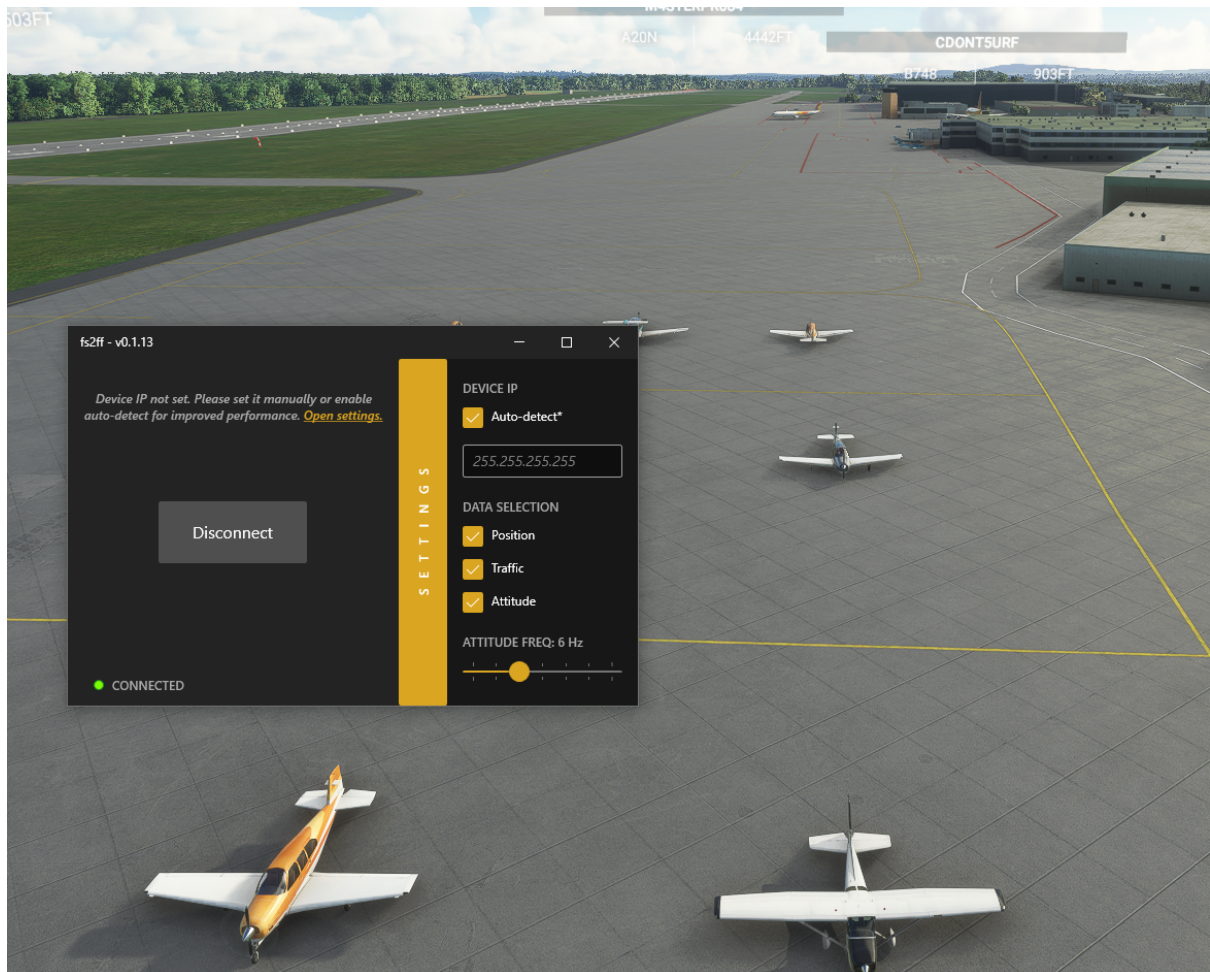
Fig. 14: fs2ff Settings

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.
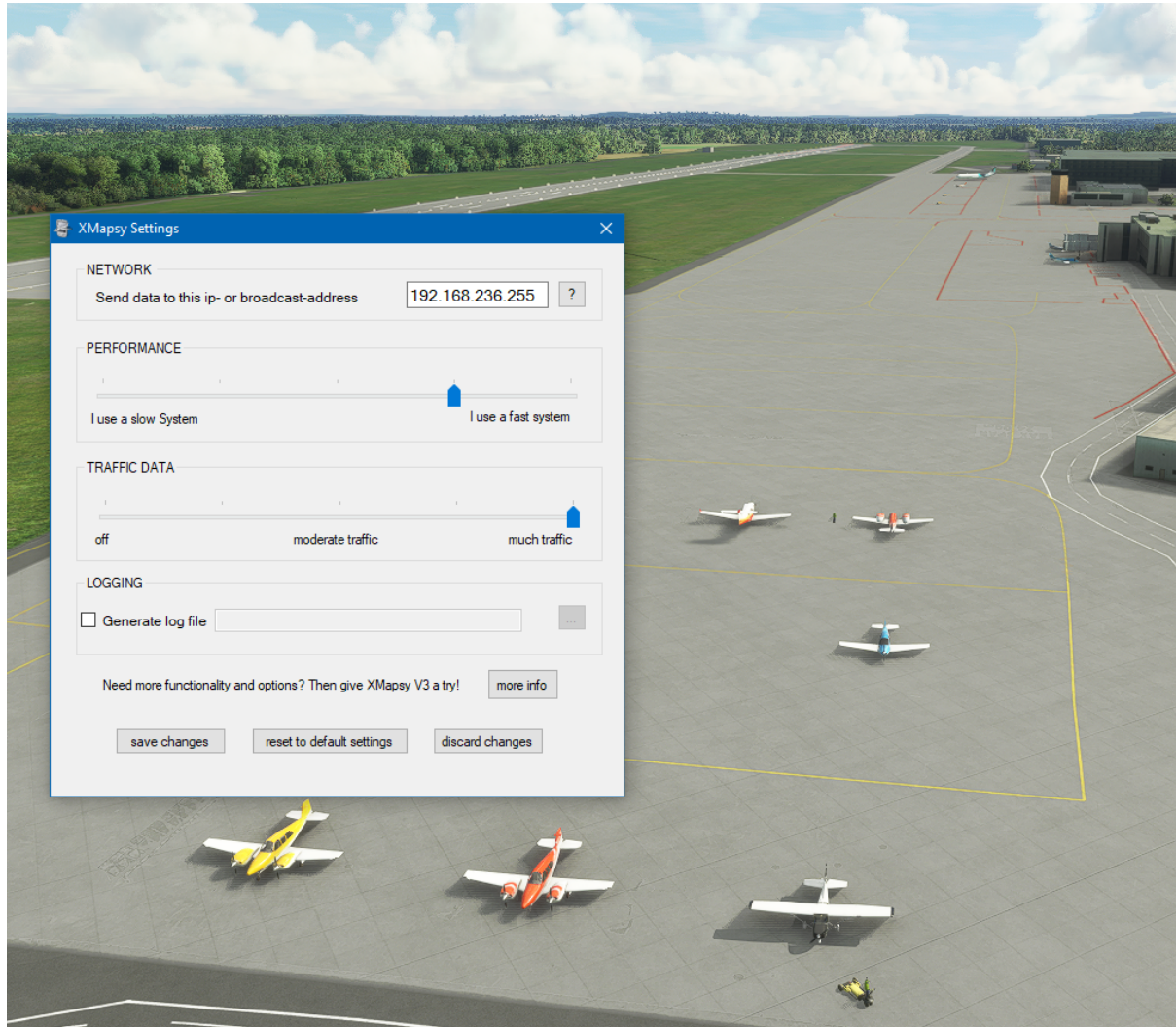
Fig. 15: XMapsy Essential Settings

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.
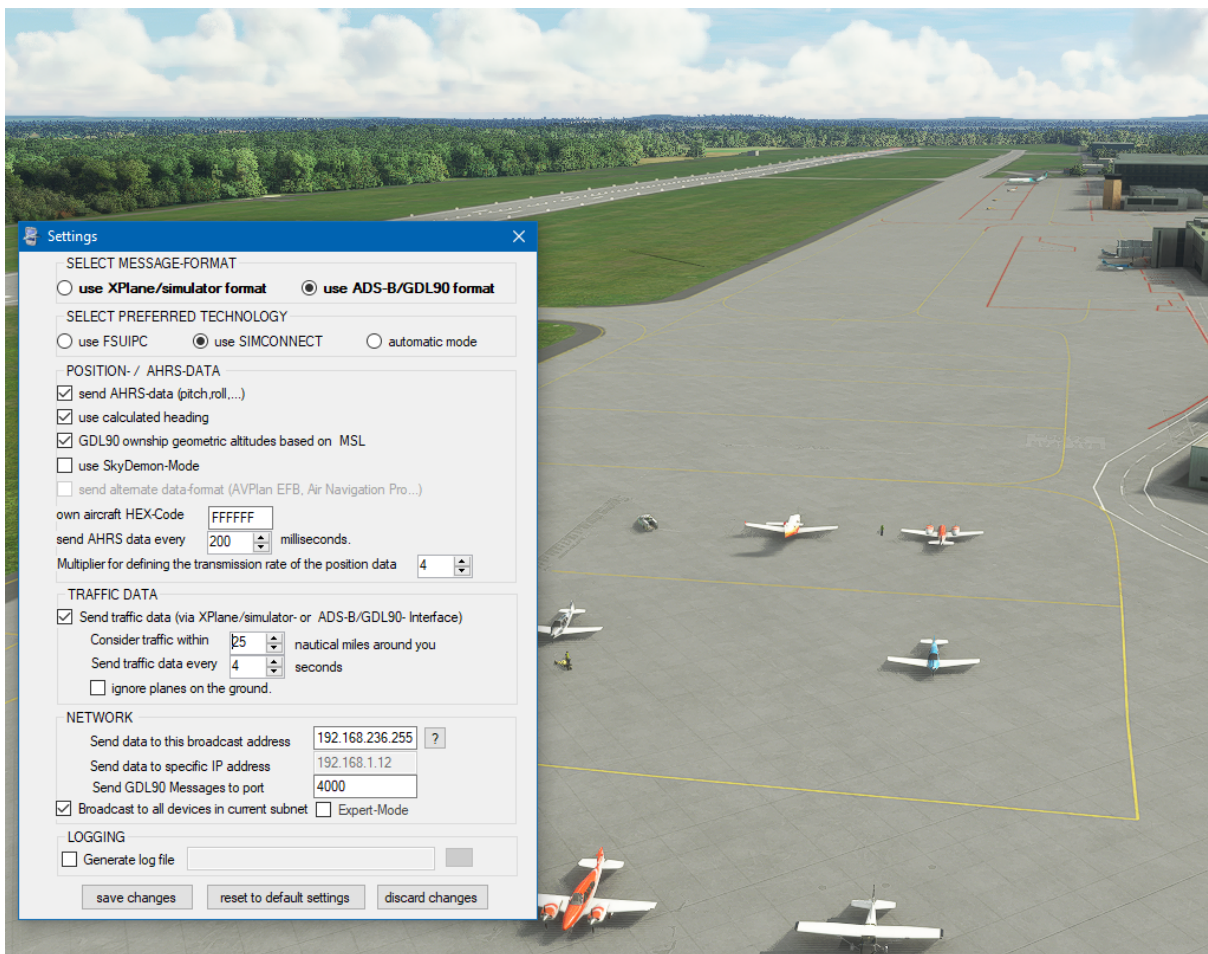
Fig. 16: XMapsy V3 Settings

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".
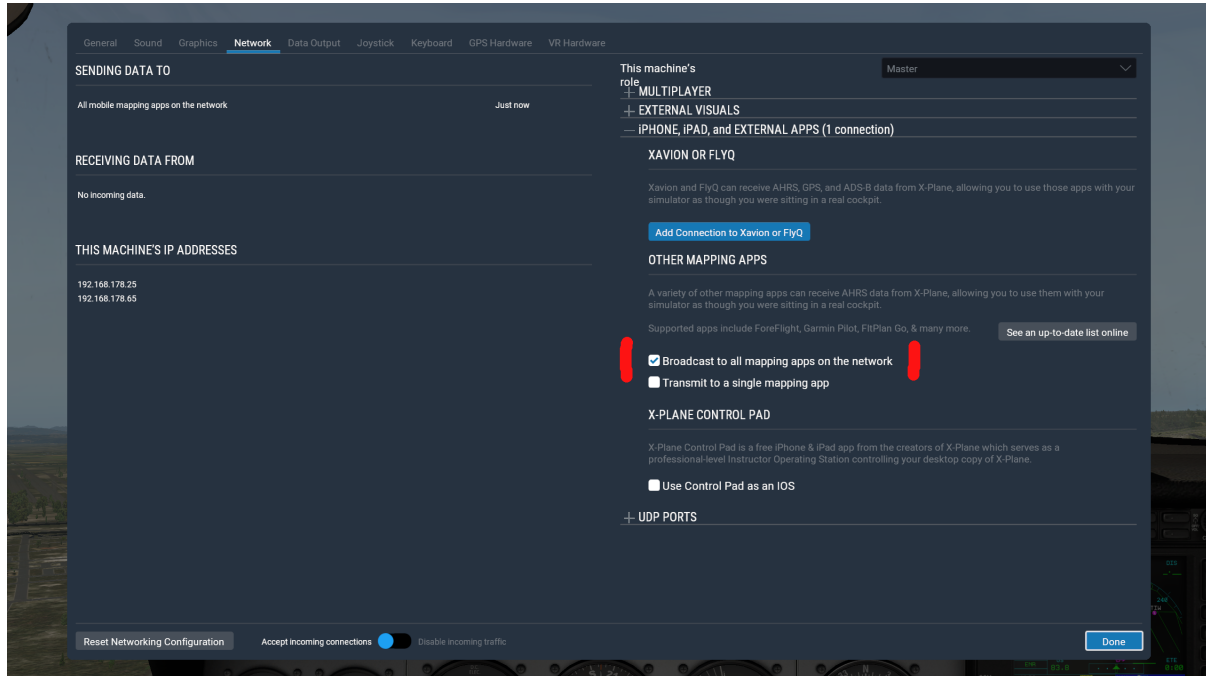
Other Programs

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.

2.7.3 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.

2.8 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!

2.9 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.

2.9.1 PayPal

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

2.9.2 Bank Address

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

3. Advanced Use

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

3.1 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**.

3.1.1 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".

3.1.2 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!

3.2 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 file containing raster data.

Note: In order to avoid confusion, we decided against mixing raster- and vector maps. As soon as a single raster map is installed, the moving map of **Enroute Flight Navigation** will **only** display that raster map. In particular, the moving map will no longer display the aviation data layer. Even though they become invisible, we still recommend installing our regular maps, because **Enroute Flight Navigation** needs the data to provide airspace and waypoint information.

3.2.1 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".

3.2.2 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.

Raster Maps in GeoTIFF Format

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

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.

- 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.
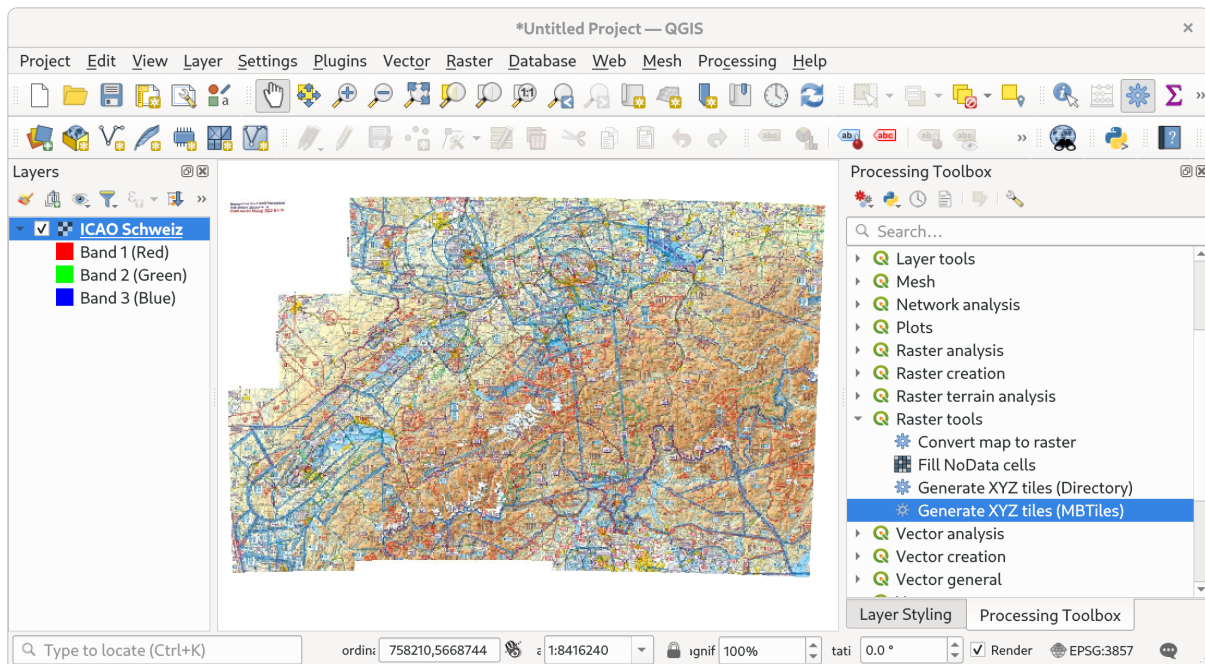
Fig. 1: QGIS Main Window

- 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.

3.3 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".
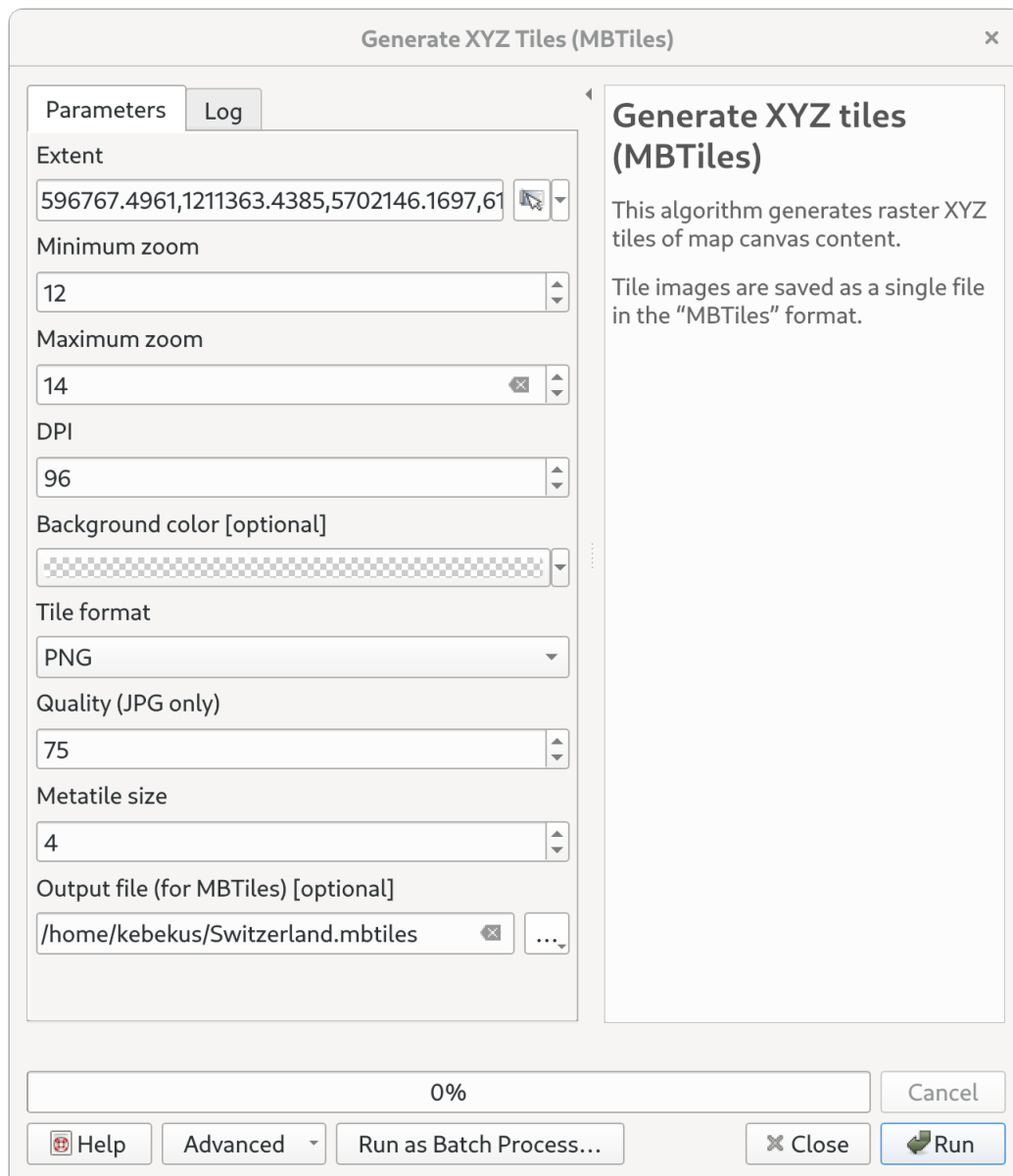
Fig. 2: QGIS Generate Tiles Dialog

3.4 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.
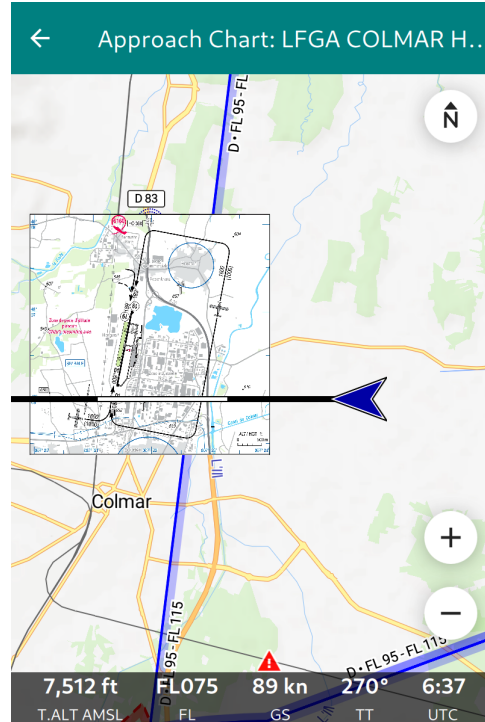
Fig. 3: Moving map display with embedded approach chart

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

- Geo-referenced image files in GeoTIFF format.

- 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!

3.4.1 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.

- Advanced users can use the GDAL command line utilities to convert raster graphic files into georeferenced GeoTIFF files. The section *Appendix: Create Approach Charts with GDAL* explains how to do this.

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

3.4.2 Import Approach Chart Files

Transfer the OpenAir 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.

3.4.3 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.

3.4.4 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.

3.4.5 Appendix: Create Approach Charts with GDAL

Advanced users might wish to create their own approach chart files in GeoTIFF format, perhaps from a PDF of their official AIP. One user has kindly provided the following tutorial, which explains how to accomplish this task on a Windows computer, using command line utilities.

Preparation

1. Download and install Google Earth for Windows.

2. Download and install GDAL for Windows. GDAL is a translator for raster and vector geospatial data formats.

Georeferencing and conversion to GeoTIFF

1. Download the relevant chart from the AIP. The chart will typically come as a PDF file.

2. Convert the relevant page of the AIP to PNG format. Most PDF viewer programs allow exporting a page to PNG.

3. Use any image viewer program (for instance: Windows Photos) to crop the PNG, removing margins and legends and leaving only the parts that you would like to see in **Enroute Flight Navigation**. Copy the obtained file to the folder where you installed GDAL.

4. Open Google Earth.

5. In the top menu, go to "Add" → "Image overlay."

6. Click on "Browse" and select PNG file created in step 3.

7. Set the "Transparency" to 50% between "Clear" and "Opaque."

8. Before pressing OK, adjust the image size, as it will be quite large, and move it to the airport area you're interested in. Since it is transparent, you can adjust the size and position until roads and rivers align with the Google Earth image underneath. It's not a very fast method, but you can change the transparency to check alignment.

9. When the graphic is aligned with the map, press OK.

10. Move the mouse to the upper-left corner of the VAC and note the coordinates at the bottom of the screen. Move the mouse to the lower-left corner of the VAC and note the coordinates.

11. Open a console by typing "CMD" in the command line. Navigate to the directory where you installed GDAL.

12. Type "SDKShell" and press Enter, this sets the paths

13. Convert the PNG file to GeoTIFF format using a GDAL command as follows:

```
gdal_translate -a_srs EPSG:4326 -a_ullr <upper_left_
↪longitude> <upper_left_latitude> <lower_right_longitude>
↪<lower_right_latitude> -mo "TIFFTAG_
↪IMAGEDESCRIPTION=Chart Name" -co COMPRESS=LZW input.png
↪output.tif
```

In the coordinates, north is positive, south is negative, east is positive, west is negative. A call for a map in norther Spain could read as follows:

```
gdal_translate -a_srs EPSG:4326 -a_ullr -6.620555 43.982777
↪-5.736666 43.387222 -mo "TIFFTAG_IMAGEDESCRIPTION=Asturias
↪" -co COMPRESS=LZW input.png output.tif
```

14. Copy the output.tif file to your mobile device and import it into **Enroute Flight Navigation** as described above.

4. 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.

4.1 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**.

4.1.1 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".

4.1.2 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.

4.2 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. Support for Apple iOS devices is planned.

4.2.1 Google Maps (Android App)

To share a location from the app Google Maps with **Enroute Flight Navigation**, proceed as follows.

- Open the App "Google Maps" 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". 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. Depending on the precise form of the data shared by Google Maps, one of the following things will happen.

  - **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.

  - **Enroute Flight Navigation** cannot immediately determine the geographic coordinates of the location from the data shared by Google. To obtain coordinates, **Enroute Flight Navigation** will then open Google Maps in an embedded browser window. For privacy reasons, you might be asked to authorize **Enroute Flight Navigation** to open the external website, and Google might ask you to accept their privacy policies. If all goes well, the embedded browser will close itself after a few seconds and the waypoint dialog will appear.

Note: If the embedded browser remains open for more than 30 seconds, then the coordinate lookup has failed. This can happen when there is no internet access. Close the embedded web browser page manually to continue using **Enroute Flight Navigation**.

4.2.2 Google Maps Go (Android App)

The app Google Maps Go is a lightweight version of Google Maps that runs online and therefore uses substantially fewer resources. To share locations with **Enroute Flight Navigation**, follow the procedure described above for *Google Maps (Android App)*.

Note: Coordinate lookup through an embedded browser window can often be avoided by using Google Maps Go instead of Google Maps. The author of **Enroute Flight Navigation** prefers using Google Maps Go for that reason.

4.2.3 Google Maps (Online)

The procedure depends on the platform in use.

- Android: Follow the steps explained in *Google Maps (Android App)* above.
- 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**.

4.2.4 HERE WeGo (Android App)

To share locations from the app HERE WeGo with **Enroute Flight Navigation**, follow the procedure described above for *Google Maps (Android App)*.

4.2.5 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**.

4.2.6 OsmAnd (Android App)

Location sharing from the app OsmAnd does not require coordinate lookup through an embedded browser and is therefore particularly easy and hassle-free. 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.

Part II.

Reference Manual

5. User Interface: Pages

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

5.1 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.
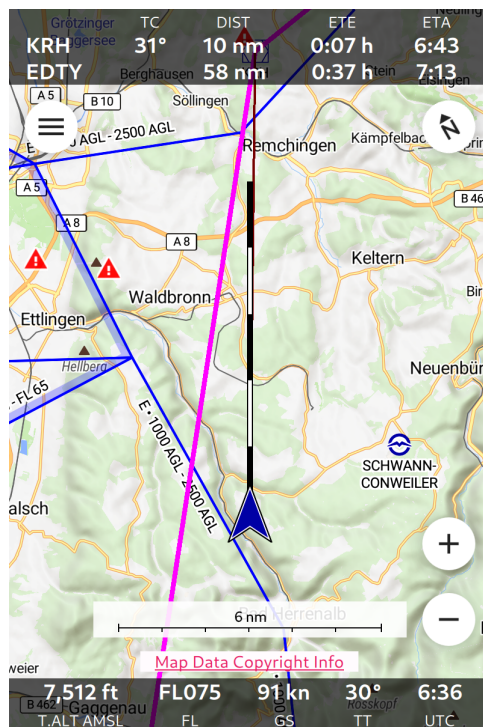
Fig. 1: The Main Page of **Enroute Flight Navigation**

- 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.

5.1.1 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."

5.1.2 Navigation Bar

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

Code	Meaning
T.ALT	True altitude (=geometric altitude).
FL	Flight level.
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 flight level 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.**

5.1.3 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
☰	Opens main menu.
Ⓝ	Switches between modes **north up** and **track up**.
◉	Sets autopan mode to "on".
+	Zoom in.
−	Zoom out.
✈	This control is shown when the app is not connected to a traffic data receiver. A click opens the traffic receiver status page.

5.1.4 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 value, 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.

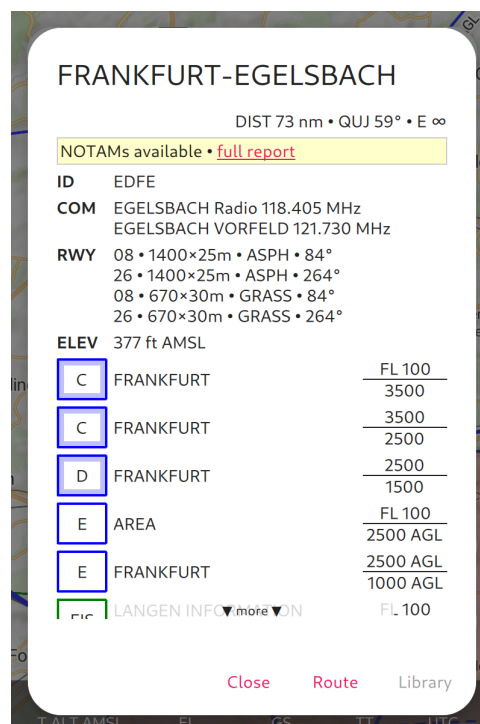- **Double Tap Gesture:** The double tap gesture is equivalent to tap-and-hold.

Fig. 2: Information about EDFE Airport

Ownship Position

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

Symbol	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 not 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.
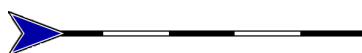
Fig. 3: Projected Flight Path for the Next Five Minutes

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 *Connect Your Traffic Receiver* explains how to establish the connection. The figure *Approaching EDTF with traffic* shows a typical situation.

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.
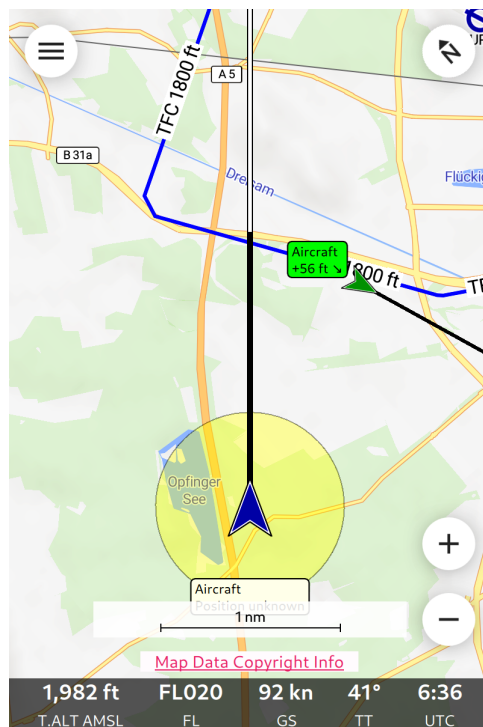
Fig. 4: Approaching EDTF with traffic

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.

Sym-bol	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.

5.2 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."

5.2.1 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 approximation 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.

5.2.2 Navigation Bar

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

Altimeter Mode

Use this settings item to chose if the altimeter shows height above ground level (AGL) or height above main sea level (AMSL).

Note: In order to compute height above ground, if terrain maps for your region must be installed. If terrain data is not available, the altimeter field of the navigation bar will display "−". If you are unsure if terrain data is available, open the main menu and go to "Library/Maps and Data" to check which maps are installed in your device.

5.2.3 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.

5.2.4 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.

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.

Show Privacy Warnings

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

5.2.5 Help

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

5.3 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.

6. User Interface: Workflows

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

6.1 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.

6.1.1 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.

6.1.2 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

6.1.3 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.

6.1.4 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.

6.1.5 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	GPX
Flight Routes	GeoJSON
Raster Maps	MBTILES
Vector Maps	MBTILES
Waypoint Collections	GeoJSON
Waypoints	CUP

6.1.6 Supported Text Data Items

Enroute Flight Navigation accepts data in the following formats.

Functionality	Sample
Google Map Link	
Shortened Google Map Link	xx
OpenStreetMap Link	
WeGo Link	
Shortened WeGo Link	
GEO URLs	

7. Technology

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

7.1 Traffic Data Receiver Support

7.1.1 Communication

Enroute Flight Navigation expects that the traffic receiver deploys a WLAN network via Wi-Fi and publishes traffic data via that network. In order to support a wide range of devices, including flight simulators, the app listens to several network addresses simultaneously and understands a variety of protocols.

Enroute Flight Navigation watches the following data channels, in order of preference.

- 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 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.

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.

7.1.2 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.

7.1.3 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.

7.1.4 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.

7.1.5 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.

7.2 Platform Notes

7.2.1 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.

7.2.2 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.

7.2.3 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

Part III.

Appendix

8. Data Sources

8.1 Map Data

8.1.1 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	Botswana	Class 2
Africa	Canary Islands	Class 1
Africa	Kenya	Class 2
Africa	Madagascar	Class 2
Africa	Mauritius	Class 2
Africa	Namibia	Class 1

Table 1 – continued from previous page

Continent	Country	Class
Africa	South Africa	Class 1
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
Europe	Slowenia	Class 1
Europe	Spain	Class 2
Europe	Sweden	Class 1

Table 1 – continued from previous page

Continent	Country	Class
Europe	Switzerland	Class 1
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

8.1.2 Base Maps

Our base maps are generated from Open Streetmap data.

8.1.3 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.

8.2 METAR/TAF

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

8.3 NOTAMs

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

9. Software and Data Licenses

9.1 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.

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Version 3, 29 June 2007

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  For the developers' and authors' protection, the GPL clearly
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↪and authors'
  sake, the GPL requires that modified versions be marked as
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  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
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  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
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↪precisely where it
  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
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  cannot be used to render the program non-free.

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↪and modification
  follow.

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↪and "recipients"
  may be individuals or organizations.

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

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  The Corresponding Source need not include anything that
↪users can regenerate
  automatically from other parts of the Corresponding Source.

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↪that same work.

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  conditions stated below. Sublicensing is not allowed;
↪section 10 makes it
  unnecessary.
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↪absence of any
  warranty; and give all recipients a copy of this License
↪along with the
  Program.

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↪convey, and you
  may offer support or warranty protection for a fee.

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  You may convey a work based on the Program, or the
↪modifications to produce
  it from the Program, in the form of source code under the
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  4, provided that you also meet all of these conditions:

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↪modified it, and
     giving a relevant date.

  b) The work must carry prominent notices stating that it is
↪released under
     this License and any conditions added under section 7.
↪This requirement
     modifies the requirement in section 4 to "keep intact all
↪notices".

  c) You must license the entire work, as a whole, under this
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     apply, along with any applicable section 7 additional
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     of the work, and all its parts, regardless of how they
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     Appropriate Legal Notices; however, if the Program has
↪interactive
     interfaces that do not display Appropriate Legal Notices,
↪your work need
     not make them do so.

  A compilation of a covered work with other separate and
↪independent works,
  which are not by their nature extensions of the covered work,
↪ and which are
  not combined with it such as to form a larger program, in or
↪on a volume of
  a storage or distribution medium, is called an "aggregate"
↪if the
  compilation and its resulting copyright are not used to
↪limit the access or
  legal rights of the compilation's users beyond what the
↪individual works
  permit. Inclusion of a covered work in an aggregate does not
↪cause this
  License to apply to the other parts of the aggregate.
```

```
6. Conveying Non-Source Forms.

  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:

  a) Convey the object code in, or embodied in, a physical
↪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
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    or for a charge), and offer equivalent access to the
↪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.

  A "User Product" is either (1) a "consumer product", which
↪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
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↪uses, or expects or
  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
↪with, or
  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
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↪adversely affects the
  operation of the network or violates the rules and protocols
↪for
  communication across the network.

  Corresponding Source conveyed, and Installation Information
↪provided, in
  accord with this section must be in a format that is
↪publicly documented
  (and with an implementation available to the public in
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  and must require no special password or key for unpacking,
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  copying.

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   relicensing or conveying.

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9.2 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.

9.3 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**.

- Adobe Glyph List For New Fonts. BSD 3-Clause "New" or "Revised" License.

- Anti-aliasing rasterizer from FreeType 2. Freetype Project License or GNU General Public License v2.0 only.

- Bitstream Vera Font. Bitstream Vera Font License.

- BLAKE2 (reference implementation). Creative Commons Zero v1.0 Universal or Apache License 2.0.

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- Clip2Tri Polygon Triangulation Library. MIT License.

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- Cycle. MIT License.

- D3D12 Memory Allocator. MIT License.

- Data Compression Library (zlib). zlib License.

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- Earth Gravitational Model. Public Domain.

- Easing Equations by Robert Penner. BSD 3-clause "New" or "Revised" License.

- Efficient Binary-Decimal and Decimal-Binary Conversion Routines for IEEE Doubles. BSD 3-clause "New" or "Revised" License.

- extra-cmake-modules. BSD-3-Clause.

- fontawesome. SIL Open Font Licence 1.1.

- forkfd. MIT License.

- Freetype 2. Freetype Project License or GNU General Public License v2.0 only.

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- 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.

- Material Design Icons. Apache License.

- Material Sphinx Theme. MIT License.

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- 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.

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- OSM Liberty. BSD License.

- PCRE2. BSD 3-clause "New" or "Revised" License with PCRE2 binary-like Packages Exception.

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- 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.

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- Valgrind. BSD 4-clause "Original" or "Old" License.

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- Vulkan Memory Allocator. MIT License.

- WebGradients. MIT License.

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- Wintab API. LCS-Telegraphics License.

- X Server helper. X11 License and Historical Permission Notice and Disclaimer.

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10. Privacy Policies

10.1 English

We do not collect our users' personal data. We do not store any personally identifiable information. However, to ensure functionality, the app must transmit the following data items to servers on the internet.

10.1.1 1. Map and Data Download Server

The app regularly checks for updates and allows downloading maps and data from a server at the University of Freiburg to your device. Your device's IP address must be transmitted to the server to provide this functionality. Knowledge of the IP address is necessary for the server to respond. However, the server does not store any personal data about you in its log files. In particular, it does not store the IP address of your device in its log files. We can assure this because the server is under our control.

10.1.2 2. METAR and TAF Server

The app shows METARs and TAFs for airfields near your current location and your currently planned route. It also shows METARs and TAFs for all waypoints you open in the app. To provide this functionality, a request containing the following data is transmitted to a server at the University of Freiburg:

- Your current location
- The currently planned route
- Waypoint coordinates
- Your device's IP address

Knowledge of the IP address is necessary for the server to respond. However, the server does not store any personal data about you in its log files. In particular, it does not store the IP address of your device in its log files. We can assure this because the server is under our control. The server cannot read any other data from your device in the process.

The server forwards the request to a web service at the Aviation Weather Center but hides your IP address, so the web service will never see it. The web services at the Aviation Weather Center are operated by the US government and are beyond our control. Detailed information can be found at www.aviationweather.gov/dataserver.

10.1.3 3. NOTAM Server

The app shows NOTAMs for places near your current location and your currently planned route. It also shows NOTAMs for all waypoints you open in the app. To provide this functionality, a request containing the following data is transmitted to a server at the University of Freiburg:

- Your current location

- The currently planned route

- Waypoint coordinates

- Your device's IP address

Knowledge of the IP address is necessary for the server to respond. However, the server does not store any personal data about you in its log files. In particular, it does not store the IP address of your device in its log files. We can assure this because the server is under our control. The server cannot read any other data from your device in the process.

The server forwards the request to a web service at the Federal Aviation Administration but hides your IP address, so the web service will never see it. The web services at the Federal Aviation Administration are operated by the US government and are beyond our control. Detailed information can be found at api.faa.gov/s.

10.1.4 Responsible

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

10.2 Deutsche Übersetzung

Wir sammeln keine persönlichen Daten unserer Benutzer. Wir speichern keinerlei personenbezogene Daten. Um zu funktionieren, muss die App allerdings die folgenden Daten zu Servern im Internet übertragen.

10.2.1 1. Server zum Karten- und Daten-Download

Die App prüft regelmäßig, ob Updates vorliegen, und ermöglicht den Download von Karten und Daten von einem Server der Universität Freiburg auf Ihr Gerät. Die IP-Adresse Ihres Geräts muss zum Server übertragen werden, damit das funktioniert. Der Server kann nur antworten, wenn er die IP-Adresse kennt. Der Server speichert aber keinerlei personenbezogene Daten über Sie in seinen Loggdateien. Insbesondere speichert er Ihre IP-Adresse nicht in seinen Loggdateien. Wir können das zusichern, da sich der Server unter unserer Kontrolle befindet.

10.2.2 2. METAR- und TAF-Server

Die App zeigt METARs und TAFs für Flugplätze nahe Ihrer aktuellen Position und der jeweils geplanten Route. Sie zeigt außerdem METARs und TAFs für alle Wegpunkte, die Sie in der App öffnen. Für diese Funktion überträgt eine Abruf folgende Daten zu einem Server der Universität Freiburg:

- Ihre aktuelle Position

- Die aktuell geplante Route

- Wegpunktkoordinaten

- Die IP-Adresse Ihres Geräts

Der Server kann nur antworten, wenn er die IP-Adresse kennt. Der Server speichert aber keinerlei personenbezogene Daten über Sie in seinen Loggdateien. Insbesondere speichert er Ihre IP-Adresse nicht in seinen Loggdateien. Wir können das zusichern, da sich der Server unter unserer Kontrolle befindet. Der Server kann in diesem Vorgang keinerlei andere Daten von Ihrem Gerät lesen.

Der Server leitet die Anfrage zu einem Web-Service in der Aviation Weather Center weiter, aber verbirgt Ihre IP-Adresse, die der Web-Service damit niemals sieht. Die Web-Dienste des Aviation Weather Center werden von der US-Regierung betrieben und sind jenseits unserer Kontrolle. Detaillierte information finden Sie hier: www.aviationweather.gov/dataserver.

10.2.3 3. NOTAM-Server

Die App zeigt NOTAMs für Orte nahe Ihrer aktuellen Position und Ihrer jeweils geplanten Route. Sie zeigt auch NOTAMs für alle Wegpunkte, die Sie in der App öffnen. Für diese Funktion überträgt eine Abruf folgende Daten zu einem Server der Universität Freiburg:

- Ihre aktuelle Position

- Die aktuell geplante Route

- Wegpunktkoordinaten

- Die IP-Adresse Ihres Geräts

Der Server kann nur antworten, wenn er die IP-Adresse kennt. Der Server speichert aber keinerlei personenbezogene Daten über Sie in seinen Loggdateien. Insbesondere speichert er Ihre IP-Adresse nicht in seinen Loggdateien. Wir können das zusichern, da sich der Server unter unserer Kontrolle befindet. Der Server kann in diesem Vorgang keinerlei andere Daten von Ihrem Gerät lesen.

Der Server leitet die Anfrage zu einem Web-Service in der Federal Aviation Administration weiter, aber verbirgt Ihre IP-Adresse, die der Web-Service damit niemals sieht. Die Web-Dienste der Federal Aviation Administration werden von der US-Regierung betrieben und sind jenseits unserer Kontrolle. Detaillierte information finden Sie hier: api.faa.gov/s.

10.2.4 Verantwortlich

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

10.3 Traduction en français

Nous ne collectons pas les données personnelles de nos utilisateurs. Nous ne stockons aucune information personnelle. Cependant, pour assurer la fonctionnalité, l'application doit transmettre les données suivantes aux serveurs sur Internet.

10.3.1 1. Serveur de téléchargement de cartes et de données

L'application vérifie régulièrement les mises à jour et permet de télécharger des cartes et des données depuis un serveur de l'Université de Fribourg sur votre appareil. L'adresse IP de votre appareil doit être transmise au serveur pour fournir cette fonctionnalité. La connaissance de l'adresse IP est nécessaire pour que le serveur puisse répondre. Cependant, le serveur ne stocke aucune donnée personnelle vous concernant dans ses fichiers journaux. En particulier, il ne stocke pas l'adresse IP de votre appareil dans ses fichiers journaux. Nous pouvons l'assurer car le serveur est sous notre contrôle.

10.3.2 2. Serveur METAR et TAF

L'application affiche les METAR et les TAF des aérodromes proches de votre position actuelle et de votre itinéraire actuellement prévu. Il affiche également les METAR et les TAF pour tous les waypoints que vous ouvrez dans l'application. Pour fournir cette fonctionnalité, une requête contenant les données suivantes est transmise à un serveur de l'Université de Fribourg :

- Votre position actuelle

- L'itinéraire actuellement prévu

- Coordonnées du point de cheminement

- L'adresse IP de votre appareil

La connaissance de l'adresse IP est nécessaire pour que le serveur puisse répondre. Cependant, le serveur ne stocke aucune donnée personnelle vous concernant dans ses fichiers journaux. En particulier, il ne stocke pas l'adresse IP de votre appareil dans ses fichiers journaux. Nous pouvons l'assurer car le serveur est sous notre contrôle. Le serveur ne peut lire aucune autre donnée de votre appareil au cours du processus.

Le serveur transmet la demande à un service Web au Aviation Weather Center mais masque votre adresse IP afin que le service Web ne la voie jamais. Les services Web de l'Aviation Weather Center sont exploités par le gouvernement des Etats-Unis et sont hors de notre contrôle. Des informations détaillées peuvent être trouvées sur www.aviationweather.gov/dataserver.

10.3.3 3. Serveur NOTAM

L'application affiche les NOTAM pour les lieux proches de votre position actuelle et de votre itinéraire actuellement prévu. Il affiche également les NOTAM pour tous les waypoints que vous ouvrez dans l'application. Pour fournir cette fonctionnalité, une requête contenant les données suivantes est transmise à un serveur de l'Université de Fribourg :

- Votre position actuelle

- L'itinéraire actuellement prévu

- Coordonnées du point de cheminement

- L'adresse IP de votre appareil

La connaissance de l'adresse IP est nécessaire pour que le serveur puisse répondre. Cependant, le serveur ne stocke aucune donnée personnelle vous concernant dans ses fichiers journaux. En particulier, il ne stocke pas l'adresse IP de votre appareil dans ses fichiers journaux. Nous pouvons l'assurer car le serveur est sous notre contrôle. Le serveur ne peut lire aucune autre donnée de votre appareil au cours du processus.

Le serveur transmet la demande à un service Web au Federal Aviation Administration mais masque votre adresse IP afin que le service Web ne la voie jamais. Les services Web de la Federal Aviation Administration sont exploités par le gouvernement des Etats-Unis et échappent à notre contrôle. Des informations détaillées peuvent être trouvées sur api.faa.gov/s.

10.3.4 Responsable

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

10.4 Traduzione italiana

Non raccogliamo i dati personali degli utenti. Non memorizziamo nessuna informazione personale. Comunque, per assicurare le funzionalità, la app deve trasmettere i seguenti dati sui server su internet.

10.4.1 1. Server di Mappe e Dati

La app controlla regolarmente gli aggiornamenti e consente di scaricare mappe e dati dal server di presso l'Università di Freiburg sul tuo dispositivo. L'indirizzo IP del tuo dispositivo deve essere trasmesso al server per fornire questa funzionalità. L'indirizzo IP è necessario al server per rispondere. In ogni caso il server non immagazzina nessun dato personale nel propri files log. In particolare, non immagazzina l'indirizzo IP del tuo dispositivo nei suoi file log. Possiamo assicurare questo in quanto il server è sotto il nostro controllo.

10.4.2 2. Server METAR e TAF

La app mostra METAR e TAF per aeroporti vicino la tua posizione corrente e il vicino il tuo piano di volo. Mostra anche METAR e TAF per tutti i waypoints che apri nella app. Per fornire questa funzionalità, viene trasmessa una richiesta contenente i seguenti dati al server all'Università di Freiburg:

- La tua posizione corrente

- Il piano di volo corrente

- Coordinate dei waypoints

- L'indirizzo IP del tuo dispositivo

L'indirizzo IP è necessario al server per rispondere. In ogni caso il server non immagazzina nessun dato personale nel propri files log. In particolare, non immagazzina l'indirizzo IP del tuo dispositivo nei suoi file log. Possiamo assicurare questo in quanto il server è sotto il nostro controllo. Durante il processo il server non può leggere nessun altro dato del tuo dispositivo.

Il server rimanda la richiesta a un servizio web al Aviation Weather Center ma nasconde il tuo indirizzo IP, così il servizio web non lo vedrà mai. I servizi web presso l'Aviation Weather Center (Centro Meteo dell'Aviazione) sono operati dal governo USA e non sono sotto il nostro controllo. Informazioni di dettaglio possono essere trovate a www.aviationweather.gov/dataserver.

10.4.3 3. Server NOTAM

La app mostra i NOTAM per i luoghi vicino la tua posizione corrente e il piano di volo. Mostra anche i NOTAM per tutti i waypoint che apri nella app. Per fornire questa funzionalità, viene trasmessa una richiesta contenente i seguenti dati al server all'Università di Freiburg:

- La tua posizione corrente

- Il piano di volo corrente

- Coordinate dei waypoints

- L'indirizzo IP del tuo dispositivo

L'indirizzo IP è necessario al server per rispondere. In ogni caso il server non immagazzina nessun dato personale nel propri files log. In particolare, non immagazzina l'indirizzo IP del tuo dispositivo nei suoi file log. Possiamo assicurare questo in quanto il server è sotto il nostro controllo. Durante il processo il server non può leggere nessun altro dato del tuo dispositivo.

Il server rimanda la richiesta a un servizio web al Federal Aviation Administration ma nasconde il tuo indirizzo IP, così il servizio web non lo vedrà mai. I servizi web presso la Federal Aviation Administration (Amministrazione Federale per l'Aviazione) sono operati dal governo USA e non sono sotto il nostro controllo. Informazioni di dettaglio possono essere trovate a api.faa.gov/s.

10.4.4 Responsabile

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

10.5 Polskie tłumaczenie

Nie zbieramy danych osobowych naszych użytkowników. Nie przechowujemy żadnych identyfikowalnych danych osobowych. Aby jednak zapewnić funkcjonalność, aplikacja musi przesyłać następujące elementy danych do serwerów w Internecie.

10.5.1 1. Serwer map i danych

Aplikacja regularnie sprawdza dostępność aktualizacji i umożliwia pobieranie map i danych na Twoje urządzenie z serwera na Uniwersytecie we Fryburgu. Aby móc korzystać z tej funkcji, adres IP Twojego urządzenia musi zostać przesłany do serwera. Aby serwer mógł odpowiedzieć, konieczna jest znajomość adresu IP. Serwer nie przechowuje jednak żadnych danych osobowych o Tobie w swoich plikach dziennika. W szczególności nie zapisuje adresu IP Twojego urządzenia w swoich plikach logów. Możemy to zapewnić, ponieważ serwer jest pod naszą kontrolą.

10.5.2 2. Serwer METAR i TAF

Aplikacja wyświetla komunikaty METAR i TAF dla lotnisk w pobliżu Twojej bieżącej lokalizacji oraz aktualnie zaplanowanej trasy. Pokazuje także METAR i TAF dla wszystkich punktów trasy otwieranych w aplikacji. Aby zapewnić tę funkcjonalność, do serwera na Uniwersytecie we Freiburgu przesyłane jest żądanie zawierające następujące dane:

- Twoja aktualna lokalizacja

- Aktualnie planowana trasa

- Współrzędne punktu trasy

- Adres IP Twojego urządzenia

Aby serwer mógł odpowiedzieć, konieczna jest znajomość adresu IP. Serwer nie przechowuje jednak żadnych danych osobowych o Tobie w swoich plikach dziennika. W szczególności nie zapisuje adresu IP Twojego urządzenia w swoich plikach logów. Możemy to zapewnić, ponieważ serwer jest pod naszą kontrolą. Serwer nie może w tym procesie odczytać żadnych innych danych z Twojego urządzenia.

Serwer przekazuje żądanie do usługi internetowej o adresie Aviation Weather Center, ale ukrywa Twój adres IP, więc usługa internetowa nigdy go nie zobaczy. Usługi internetowe Aviation Weather Center są obsługiwane przez rząd Stanów Zjednoczonych i są poza naszą kontrolą. Szczegółowe informacje można znaleźć na stronie www.aviationweather.gov/dataserver.

10.5.3 3. Serwer NOTAM

Aplikacja wyświetla NOTAM dla miejsc w pobliżu Twojej aktualnej lokalizacji oraz aktualnie zaplanowanej trasy. Pokazuje także NOTAM dla wszystkich punktów trasy otwartych w aplikacji. Aby zapewnić tę funkcjonalność, do serwera na Uniwersytecie we Freiburgu przesyłane jest żądanie zawierające następujące dane:

- Twoja aktualna lokalizacja

- Aktualnie planowana trasa

- Współrzędne punktu trasy

- Adres IP Twojego urządzenia

Aby serwer mógł odpowiedzieć, konieczna jest znajomość adresu IP. Serwer nie przechowuje jednak żadnych danych osobowych o Tobie w swoich plikach dziennika. W szczególności nie zapisuje adresu IP Twojego urządzenia w swoich plikach logów. Możemy to zapewnić, ponieważ serwer jest pod naszą kontrolą. Serwer nie może w tym procesie odczytać żadnych innych danych z Twojego urządzenia.

Serwer przekazuje żądanie do usługi internetowej o adresie Federal Aviation Administration, ale ukrywa Twój adres IP, więc usługa internetowa nigdy go nie zobaczy. Usługi internetowe Federalnej Administracji Lotniczej są obsługiwane przez rząd Stanów Zjednoczonych i pozostają poza naszą kontrolą. Szczegółowe informacje można znaleźć na stronie api.faa.gov/s.

10.5.4 Odpowiedzialny

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

10.6 Traducción al español

No recopilamos datos personales de nuestros usuarios. No almacenamos ninguna información de identificación personal. Sin embargo, para garantizar la funcionalidad, la aplicación debe transmitir los siguientes elementos de datos a servidores en Internet.

10.6.1 1. Servidor de descarga de mapas y datos

La aplicación busca periódicamente actualizaciones y permite descargar mapas y datos desde un servidor de la Universidad de Friburgo a su dispositivo. La dirección IP de su dispositivo debe transmitirse al servidor para proporcionar esta funcionalidad. El conocimiento de la dirección IP es necesario para que el servidor responda. Sin embargo, el servidor no almacena ningún dato personal sobre usted en sus archivos de registro. En particular, no almacena la dirección IP de su dispositivo en sus archivos de registro. Esto lo podemos asegurar porque el servidor está bajo nuestro control.

10.6.2 2. Servidor METAR y TAF

La aplicación muestra METAR y TAF para aeródromos cercanos a su ubicación actual y su ruta planificada actualmente. También muestra METAR y TAF para todos los waypoints que abres en la aplicación. Para proporcionar esta funcionalidad, se transmite una solicitud que contiene los siguientes datos a un servidor de la Universidad de Friburgo:

- Su ubicación actual

- La ruta actualmente planificada

- Coordenadas del punto de ruta

- La dirección IP de su dispositivo

El conocimiento de la dirección IP es necesario para que el servidor responda. Sin embargo, el servidor no almacena ningún dato personal sobre usted en sus archivos de registro. En particular, no almacena la dirección IP de su dispositivo en sus archivos de registro. Esto lo podemos asegurar porque el servidor está bajo nuestro control. El servidor no puede leer ningún otro dato de su dispositivo en el proceso.

El servidor reenvía la solicitud a un servicio web en Aviation Weather Center pero oculta su dirección IP, por lo que el servicio web nunca la verá. Los servicios web del Aviation Weather Center son operados por el gobierno de EE. UU. y están fuera de nuestro control. Puede encontrar información detallada en www.aviationweather.gov/dataserver.

10.6.3 3. Servidor NOTAM

La aplicación muestra NOTAM de lugares cercanos a su ubicación actual y su ruta planificada actualmente. También muestra NOTAM para todos los puntos de referencia que abre en la aplicación. Para proporcionar esta funcionalidad, se transmite una solicitud que contiene los siguientes datos a un servidor de la Universidad de Friburgo:

- Su ubicación actual

- La ruta actualmente planificada

- Coordenadas del punto de ruta

- La dirección IP de su dispositivo

El conocimiento de la dirección IP es necesario para que el servidor responda. Sin embargo, el servidor no almacena ningún dato personal sobre usted en sus archivos de registro. En particular, no almacena la dirección IP de su dispositivo en sus archivos de registro. Esto lo podemos asegurar porque el servidor está bajo nuestro control. El servidor no puede leer ningún otro dato de su dispositivo en el proceso.

El servidor reenvía la solicitud a un servicio web en Federal Aviation Administration pero oculta su dirección IP, por lo que el servicio web nunca la verá. Los servicios web de la Administración Federal de Aviación son operados por el gobierno de EE. UU. y están fuera de nuestro control. Puede encontrar información detallada en api.faa.gov/s.

10.6.4 Responsable

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

11. 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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11.1 Contributions

iOS Version The app has been ported to iOS by Simon Schneider. Simon is currently student pilot (PPL) and member of the Akaflieg Freiburg flight club, just like Stefan.

Programming Heinz Blöchinger has helped us with OpenAir support. After 15 years of alpine gliding, Heinz has fulfilled a big dream and now flies helicopters.

11.2 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 a naval aviator with a passion for everything challenging.
- **Polish:** Sławek Mikuła.
- **Spanish:** Luca Riva.

11.3 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)