Enroute Flight Navigation

Release 2.2.4

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Getting started

Enroute Flight Navigation is a free flight navigation app for Android and other devices. 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[1], 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, codes, elevations 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 near-weekly updates and cover large parts of the world.

Enroute Flight Navigation includes flight weather data downloaded from the NOAA - Aviation Weather Center[2].

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.

[1] https://akaflieg-freiburg.de/
[2] https://www.aviationweather.gov/

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[3]

> 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.

[3] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:281:0001:0066:EN:PDF

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.

1.2 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.

1.3 Operating system limitations

We expect that most users will run the software on mobile phones or tablet computers running the Android operating system. Android is not officially approved or certified for aviation. While we expect that the app will run fine for the vast majority of Android users, please keep the following in mind.

- The Android 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, most notably One Plus, Huawei and Samsung equip their phone 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 excempt apps from "battery saving mode", but the settings are usually lost on system updates. Google's own "Pixel" and "Nexus" devices do not have these problems. See the website Don't kill my app[4] for more information.

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.

[4] https://dontkillmyapp.com

2 Installation and setup

2.1 App installation

Installation on Android devices **Enroute Flight Navigation** is available as an Android App in the Google Play Store[5].

An unofficial version of the app is also available at F-Droid[6]. While the author of **Enroute Flight Navigation** endorses publication at F-Droid, he has not tested this unofficial app for quality.

Installation on Linux desktop machines **Enroute Flight Navigation** is available for free download at flathub.org[7] and snapcraft.io[8]. Most likely you will also find the app in the software management application on your computer.

After installation, start the app. Depending on the platform, you might need to grant the necessary permissions. You will be asked to accept the terms and conditions.

2.2 Map download

Enroute Flight Navigation cannot be used without geographic maps. Two types of maps need to be installed for every region where you fly.

- Aeronautical maps. These contain airspaces, airfields and navaids. Some maps also contain reporting points, airfield traffic circuits and control zone entry/exit routes.
- Base maps. These contain geographic data, such as rivers, roads, railroads and land use.

Follow these steps to install the maps that you need.

- Open the Menu by touching the menu button in the upper right side of the screen. The button is marked with the symbol '≡'.
- Choose the menu item *Library*, then *Maps*. The map management page will then open.
- On the map management page, click or tap on the desired maps. The maps will be downloaded and installed on your device.

[5] https://play.google.com/store/apps/details?id=de.akaflieg_freiburg.enroute
[6] https://f-droid.org/de/packages/de.akaflieg_freiburg.enroute/
[7] https://flathub.org/apps/details/de.akaflieg_freiburg.enroute
[8] https://snapcraft.io/enroute-flight-navigation

Please download only those maps that you will actually need. The infrastructure and bandwidth for map downloads is kindly sponsored by the University of Freiburg, under the assumption that the cost stays within reasonable limits. You will also find that the app performs much better if it does not have to process many megabytes of map data.

Note: Do not forget that you need aeronautical maps **and** base maps for the desired area of flight. The base maps are large. Make sure that you have a good internet connection before you download maps. It might be inadvisable to download base maps via the mobile phone network.

2.3 Done.

Once the map download has finished, **Enroute Flight Navigation** will process the map data and update the map display after a minute or so. Tap or click on the arrow symbol '←' or use the Android 'Back' button to leave the map page and return to the main screen.

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 any play with the app. Continue with the next section and take it for your first flight.

3 Before your first flight

Now you are ready for the first use of **Enroute Flight Navigation**. General operation is very intuitive. 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.

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 are used to. You can 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.

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.

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

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.**

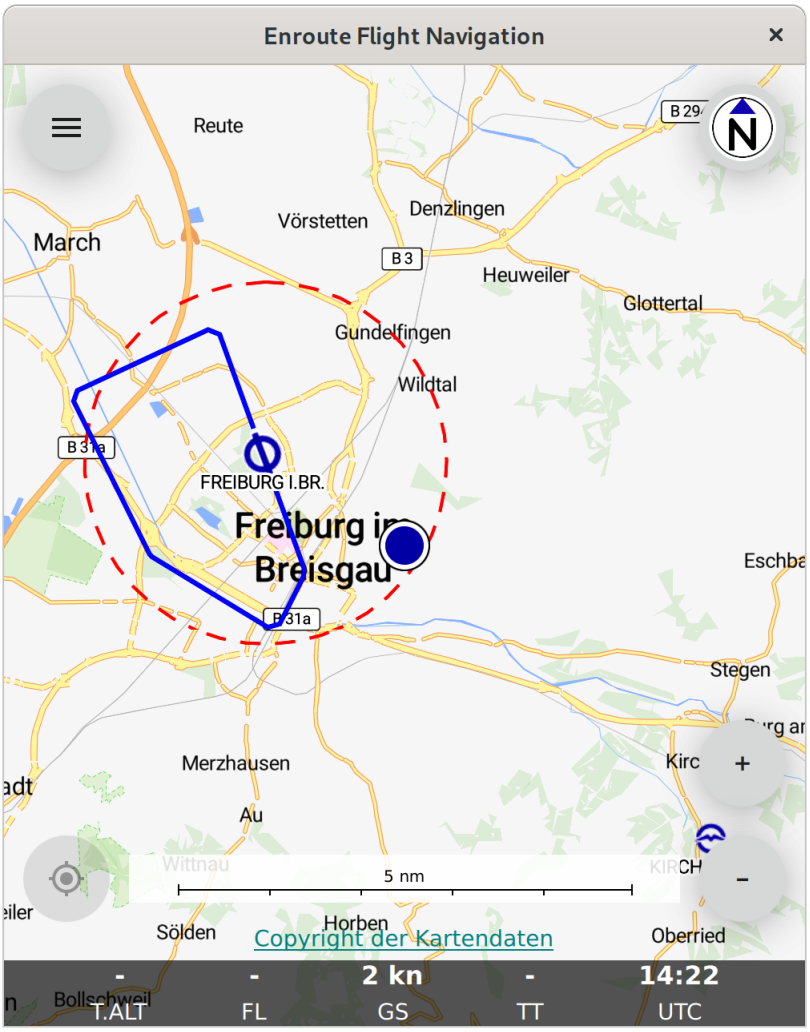


Fig. 1: Moving map display on the ground

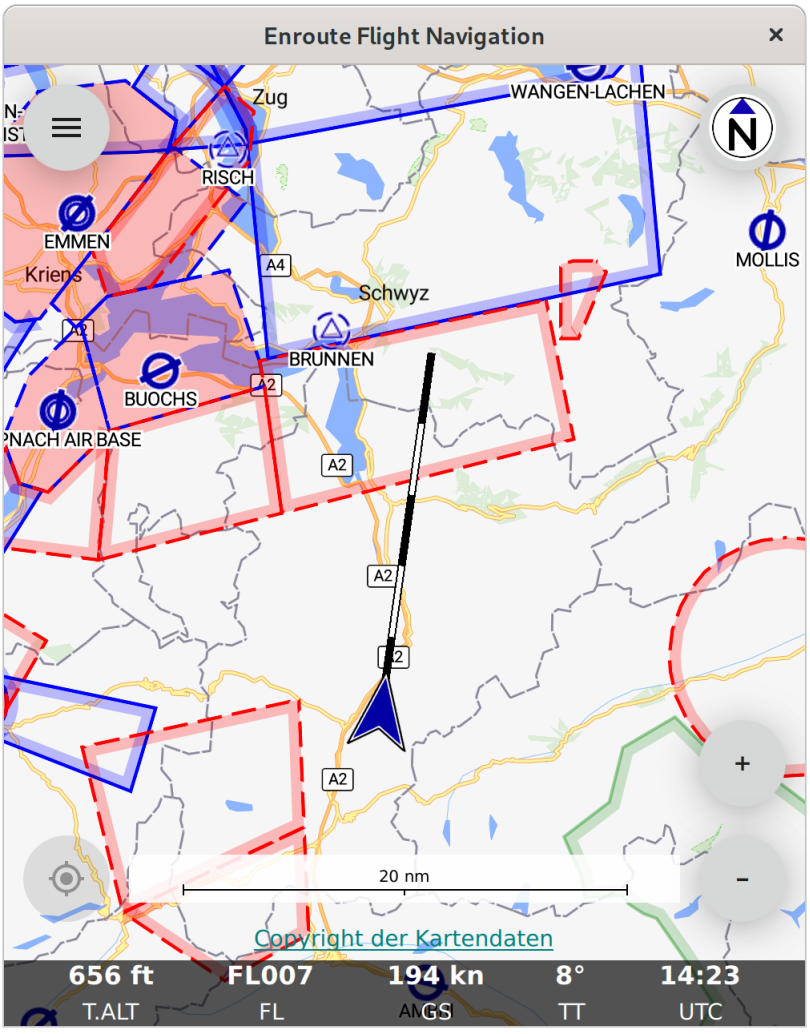


Fig. 2: Moving map display in flight

3.2 Interactive controls

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

	Open main menu
	Switch between display modes **north up** and **track up**.
	Center map about own position.
	Zoom in
	Zoom out

3.3 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 Stuttgart airport* shows how this will typically look.

3.4 Go flying!

Enroute Flight Navigation is designed to be simple. We think that you are now ready to take **Enroute Flight Navigation** 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 *Further Steps*.

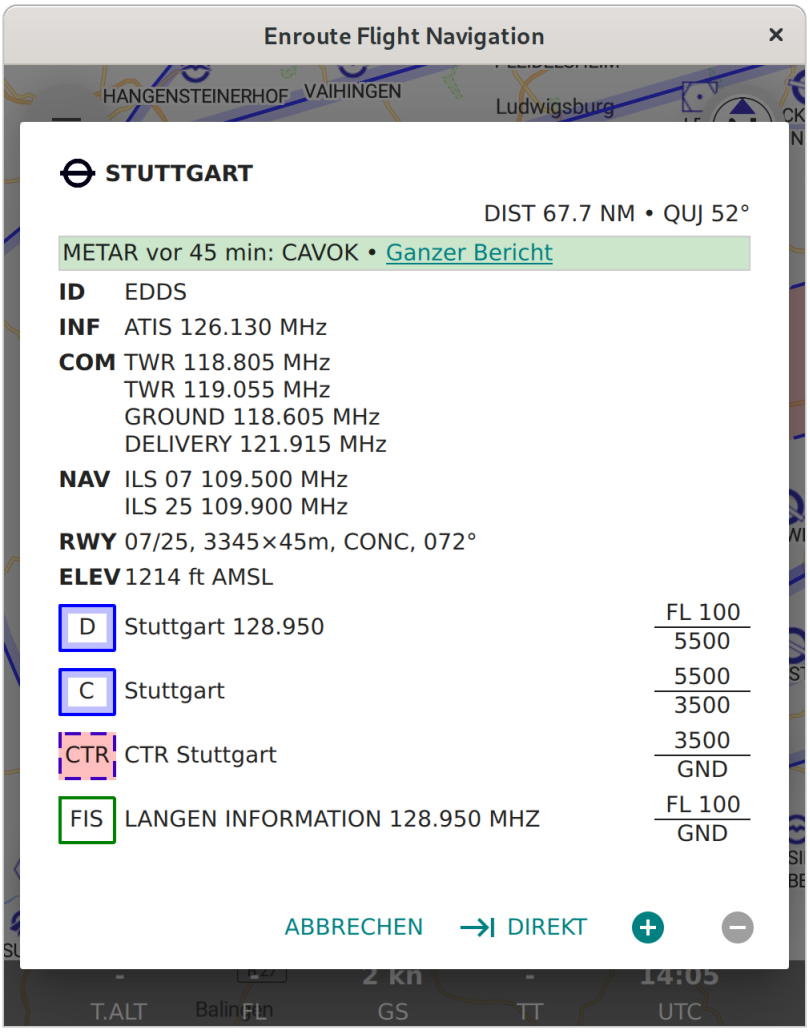


Fig. 3: Information about Stuttgart airport

4 Connect your traffic receiver

In order to display nearby traffic on the moving map, **Enroute Flight Navigation** can connect to your aircraft's traffic receiver (typically a FLARM device). In order to show only relevant information, **Enroute Flight Navigation** will not display traffic more than 1,500 m above or below the own position.

The app author has tested the **Enroute Flight Navigation** with the following traffic receivers.

- AT-1 AIR Traffic[9] by Air Avionics[10] with software version 5.

Users reported success with the following traffic receivers.

- Stratux devices[11]
- TTGO T-Beam devices[12]

Note: To show only relevant traffic, **Enroute Flight Navigation** will display traffic factors only if the vertical distance is less than 1.500m and and the horizontal distance less than 20km.

4.1 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 devices are 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. This is currently **not** supported. Set up your device so that no additional password is required.

[9] http://www.air-avionics.com/?page_id=253
[10] http://www.air-avionics.com/
[11] http://stratux.me/
[12] https://www.amazon.de/TTGO-T-Beam-915Mhz-Wireless-Bluetooth/dp/B07SFVQ3Z8

4.2 Connect to the traffic receiver

It takes two 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.

4.2.1 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.

4.2.2 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.

4.3 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.

5 Connect your flight simulator

Enroute Flight Navigation can connect to flight simulator software. The app has been tested with the following programs.

- X-Plane 11[13]

Users have reported success with the following programs.

- X-Plane 10[14]

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.

5.1 Before you connect

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

- 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"

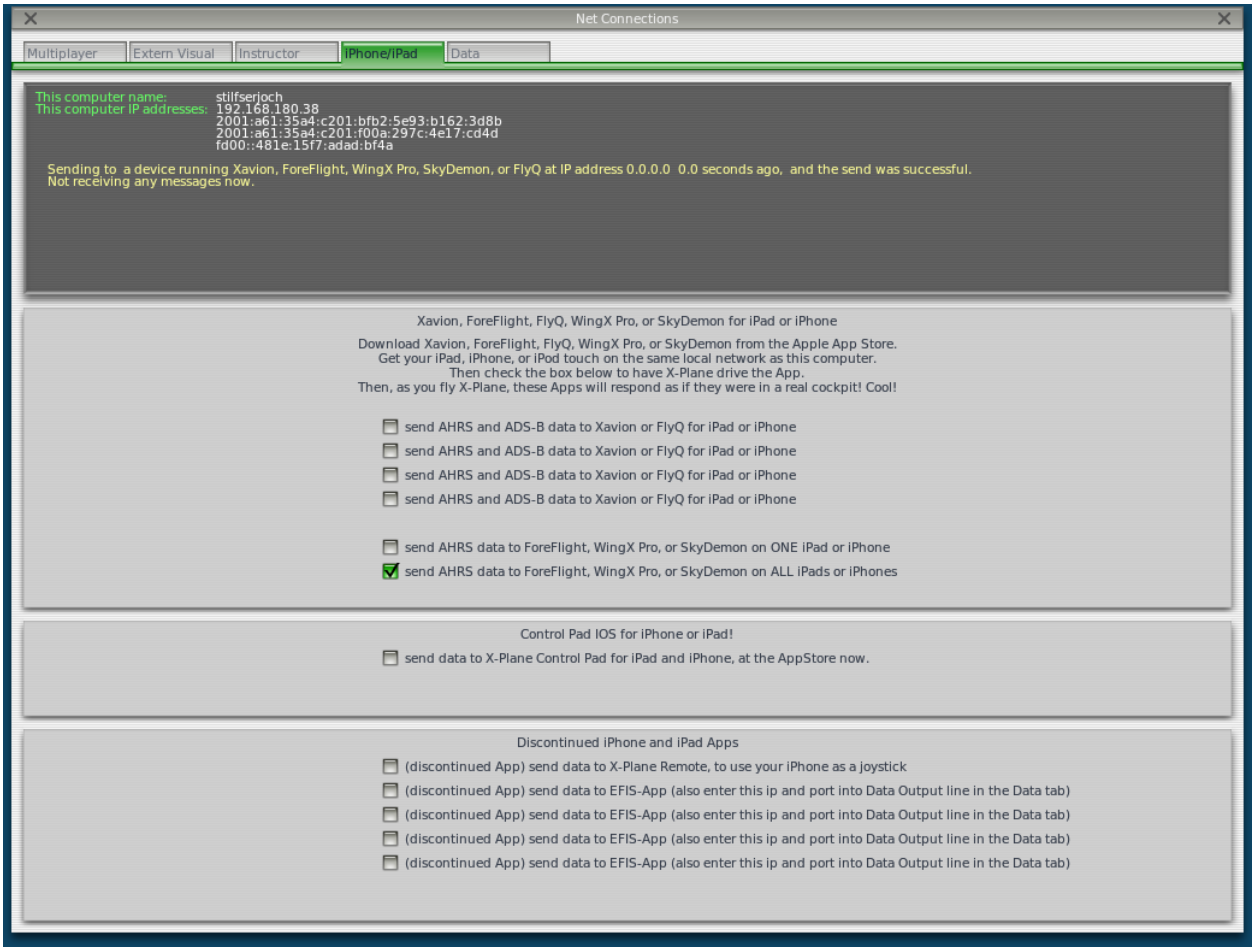
[13] https://www.x-plane.com/
[14] https://www.x-plane.com/

5.2 Set up your flight simulator

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

5.2.1 X-Plane 10

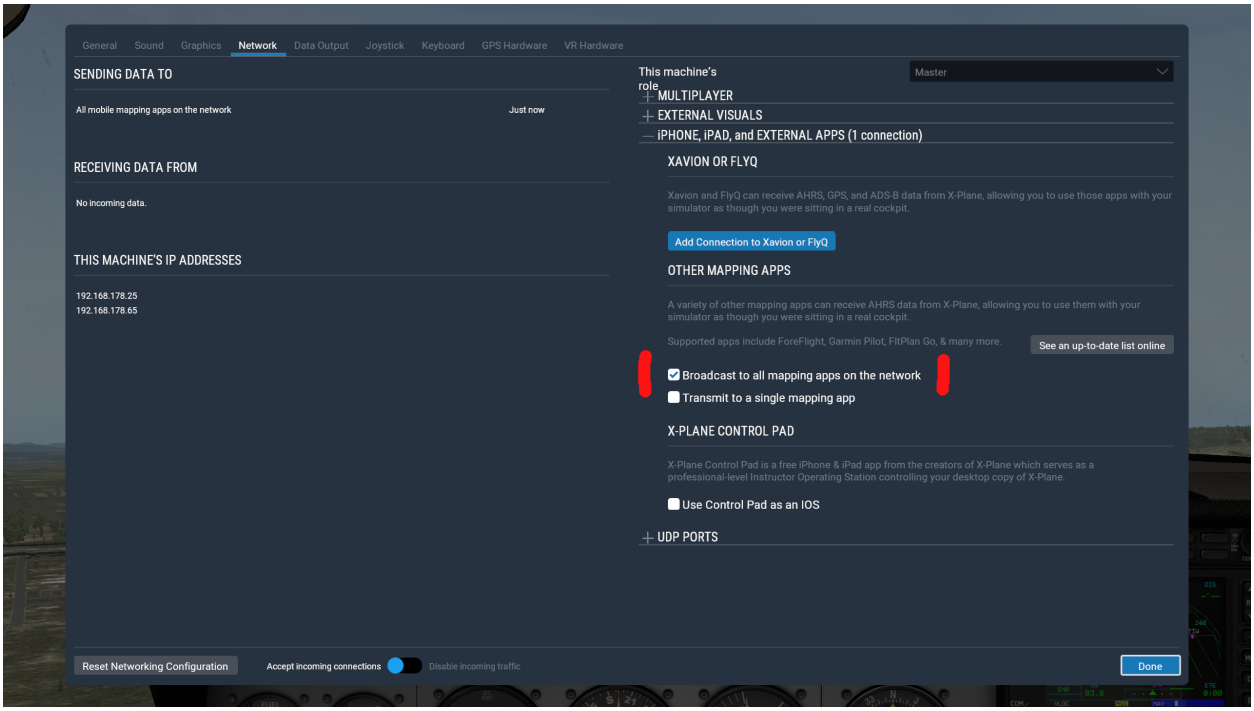
Follow the explanation on this page[15], which explains how to connect X-Plane 10 to the commercial app ForeFlight. In short: Open the "Settings" window and click "Internet Options". There, go to the "iPhone/iPod" tab and turn on the "ForeFlight" option. Please be sure to disable output of data on tab "Data".



[15] https://www.x-plane.com/2012/08/foreflight-charts-supported-in-x-plane-10-10-beta-9/

5.2.2 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".



5.2.3 MS Flight Simulator

UNKNOWN AS OF NOW.

5.2.4 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.

5.3 Troubleshooting

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

6 Make a donation

Enroute Flight Navigation is a non-commercial project of Akaflieg Freiburg[16] and the University of Freiburg[17]. The app has been written by flight enthusiasts in their spare time, as a service to the community. The developers do not take donations.

If you appreciate the app, please consider a donation to Akaflieg Freiburg, a tax-privileged, not-for-profit flight club of public utility in Freiburg, Germany.

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

[16] https://akaflieg-freiburg.de/
[17] https://uni-freiburg.de/en/

7 Map Data

The Information displayed by the Map of Enroute Flight Navigation is provided by the following resources:

- openAIP
- open flightmaps
- Map Tiler
- Open Street Map

To get more detailed Information on these Resources you may touch the link on the lower edge of the map Display Map Data Co

- https://www.openaip.net
- https://www.openflightmaps.org
- https://www.maptiler.com
- https://www.openstreetmap.org

Open AIP

Open AIP has the goal to deliver free, current and precise data for air navigation to everyone. Open AIP is a web based and crowd-sourced platform. The Open AIP provides the basic source aeronautical data for display in Enroute Flight Navigation.

Open Flight Maps

Open Flight Maps is an open-source project providing aeronautical data for a high quality VFR Map. Open Flight Maps is providing some additional information, where available.

The detailed split of the data sources for the Enroute Flight Naviagtion map is shown below:

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

Map Tiler

Is a software application to combine multiple layers of data for maps and provide the map in a format for loading and display. The Enroute Flight Naviagtion base maps are edited versions of maps kindly provided by Klokan Technologies through the OpenMapTiles project.

Open Street Map

Open Street Map (OSM) is a collaborative project to create a free editable map of the world. The geodata underlying the map is considered the primary output of the project. The creation and growth of OSM has been motivated by restrictions on use or availability of map data across much of the world, and the advent of inexpensive portable satellite navigation devices. The Open Street Map data is used to crate the base maps.

8 Other

The Map display is composed of two layers selected in the respective Tabs of the ‘Map Library’ screen:

- Aeronautical Map
- Base Map

Aeronautical Maps

The Aeronautical Map layers is showing the airspace data on the Map screen. If no Base Map is installed for the area only the information coming from the Aviation Map data is displayed.

The Aeronautical Map contains:

- Airfields
- Airspace boundaries
- Navaids
- Reporting points and routes (if available)

The display used for aerospace data is using the following basic color scheme:

- **Red:**
  - Line with shadow inside for Restricted Airspace
  - Shadow with dashed blue border for Aerodrome Control Zone (CTR)
  - Dashed Line for Parachute Jumping Exercise area
  - Line for Glider or Microlight Traffic pattern
- Blue:
  - Line with shadow for controlled airspace (A, B, C, D)
  - Shadow with dashed blue border for Radio Mandatory Zone (RMZ)
  - Airport, reporting point or Navaid symbols
  - For Route or Traffic Pattern for powered aircraft
- Green:
  - Line with shadow for Natural Reserve Area (NRA)
  - Line for airspace control sector boundaries

- Black:
  - Dashed Line for Transponder Mandatory Zone (TMZ)

Class 1 and Class 2 maps:

- 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 tier 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.

Details on the maps may be found at <https://akaflieg-freiburg.github.io/enroute/maps/> The Aeronautical Map data is selected on the "Map Library" – "Aviation Data" page accessed via the "Settings" Menu. To update the list of available maps the "..." option in the upper right corner of the screen may be used. You may install or uninstall the aviation Map data for a county by the selection on the right hand side of the country list. To find a country you have to scroll up and down in the list.

Note: To have optimum presentation of the **Enroute Flight Navigation** map display install the Aviation Map and the Base Map for all areas you intend to use **Enroute Flight Navigation**.

Caution: No airspace information will be provided in country when the Aeronautical Map is not installed for it.

Note: **Enroute Flight Navigation** will automatically check for updated Maps on the Enroute server and show a pop-up window after start if updated maps have been detected. You will be asked if you want to update the map or delay the update.

Base Map

The Base Map layers is showing the geographic data on the Map screen. If no Base Map is shown for an area it will be shown in the white background color. If no Aviation Map is installed for the area only the information coming from the Base Map data is displayed. The Base Map is organized in tiles. This will result in not stopping the Base Map display abruptly at the border of an installed country, but showing some overlap. The Base Map will show:

- Landmass
- Water Surface (oceans, lakes and rivers)
- Forests
- Main Roads
- Railroad lines
- City names

Note: To have optimum presentation of the **Enroute Flight Navigation** map display install the Aeronautical Map and the Base Map for all areas you intend to use **Enroute Flight Navigation**.

Note: **Enroute Flight Navigation** will not show most cultural build ups and limits or settled area boundaries to reduce the map size.

8.1 Flight mode and ground mode

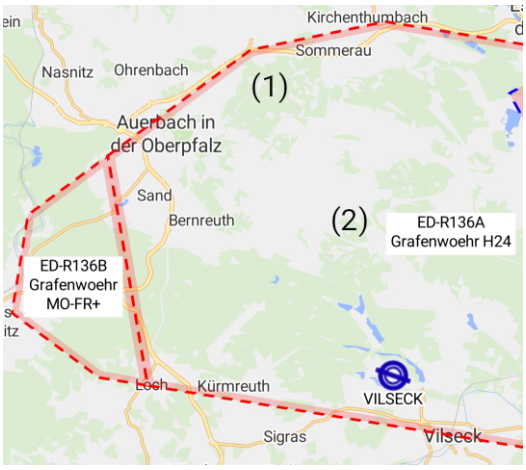
Ground Mode

Ground Mode is displayed by **Enroute Flight Navigation** whenever the sensed speed is below the threshold and the Menu item 'Automatic Flight Detection' is not set to 'Always in Flight Mode'. Ground Mode does not display the Flight Data line at the lower end of the screen and is intended for flight planning.

9 Airspace Display

The display of airspace will generally follow the common ICAO symbology. Restricted Airspace Restricted airspace will be surrounded by an intense red dashed line and a thick transparent red line inside the restricted area boundaries. When selecting a point inside the restricted area by double touching the screen the information to the related area is given with the waypoint pop-up window:

- Area Name
- Area altitude limits
- Area activation time



Legend:

1. Outline of Restricted Airspace
2. Designation and activation time of airspace

9.1 Controlled Airspace

All boundaries of controlled airspace are shown by a solid blue line and a thick transparent blue line inside the airspace. Figure 13: Controlled Airspace When selecting a point inside the controlled airspace by double touching the screen the information to the related area is given with the waypoint pop-up window:

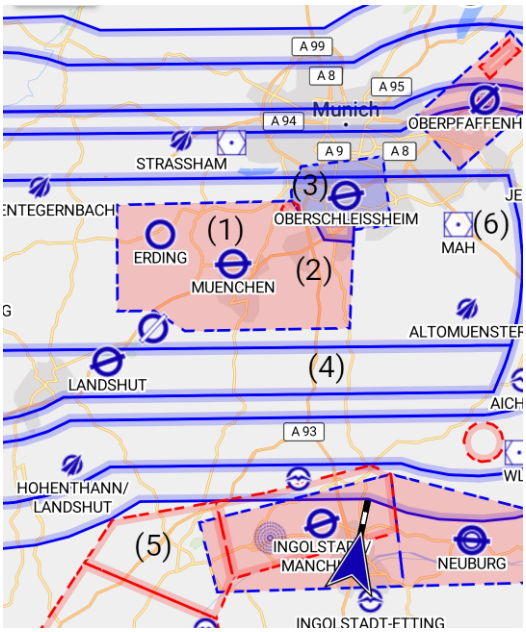
- Area Name
- Area altitude limits

Caution: All controlled airspace (Class A – Class D) are shown in the same way even if different restrictions or ATC clearance requirements may be present.

9.2 Control Zone

The Control Zone of an airport is shown with a dashed blue line filled in transparent red color. Figure 13: Controlled Airspace When selecting a point inside the Control Zone (CTR) by double touching the screen the information to the related area is given with the waypoint pop-up window:

- Area Name
- Area altitude limits



Legend:

1. Airport ICAO Symbol
2. Airport Control Zone (CTR)
3. Radio Mandatory Zone (RMZ)
4. Boundary of Controlled Airspace
5. Restricted Airspace

9.3 Transponder Mandatory Zones

Transponder Mandatory Zones TMZ are shown with a black dashed outline. When selecting a point inside the Transponder Mandatory Zone (TMZ) by double touching the screen the information to the related ares is given with the waypoint pop-up window:

- Area Name
- Area altitude limits
- Monitoring Frequency
- Mode 3 Squawk

9.4 Radio Mandatory Zone

Radio Mandatory Zones (RMZ) are shown with a solid blue dashed outline and filled in transparent blue. When selecting a point inside the Radio Mandatory Zone (RMZ) by double touching the screen the information to the related area is given with the waypoint pop-up window:

- Area Name
- Area altitude limits
- Radio Frequency

9.5 Parachute Jumping Areas

Parachute Jumping Exercise areas (PJE) are shown with a solid red dashed outline. When selecting a point inside the PJE by double touching the screen the information to the related area is given with the waypoint pop-up window:

- Area Name
- Area altitude limits
- Radio Frequency

9.6 Nature Reserve Areas

Nature Reserve Areas (NRA) are shown with a solid green outline. When selecting a point inside the NRA by double touching the screen the information to the related area is given with the waypoint pop-up window:

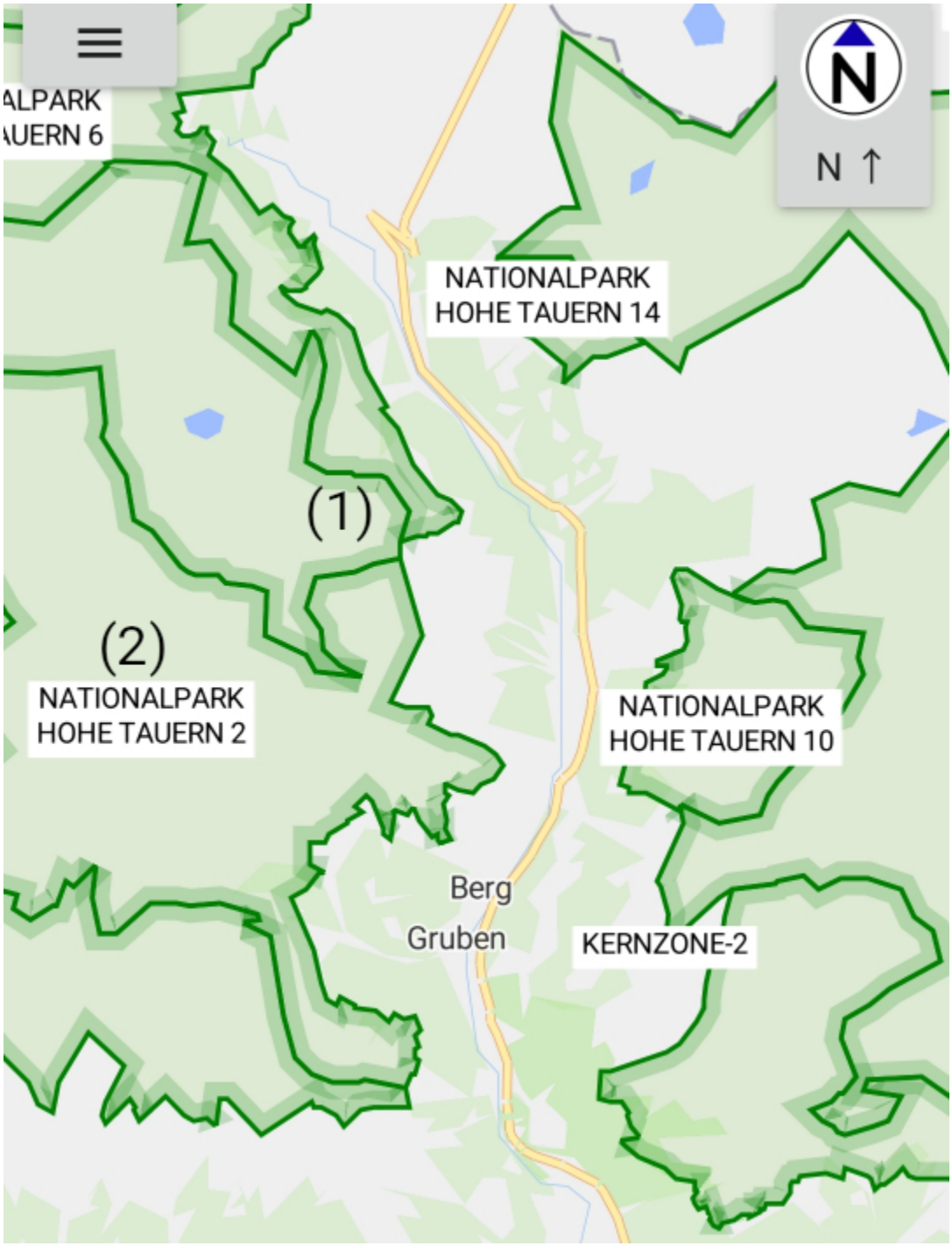
- Area Name
- Area altitude limits

Caution: Check restrictions applicable for flying inside NRA when planning your flight. For example in Austria high fines are applicable when flying inside NRA.

Figure 14: Nature Reserve Area

Legend:

1. Outline of Nature Reserve Area (NRA)


ALPARK
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(1)
(2)
NATIONALPARK
HOHE TAUERN 2
NATIONALPARK
HOHE TAUERN 10
Berg
Gruben
KERNZONE-2

2. Designation of NRA

9.7 Airfields

The symbology used to display airfields follows the ICAO rules. Airfield Information When selecting an airfield by double touching the screen the related information is given in a pop-up window:

- Airfield Name and Identifier
- Radio Frequency including COM and Information frequencies
- Navaid frequencies
- Runway orientation, dimensions and surface
- Field elevation
- Data for associated airspace

9.8 Approach and Departure Routes

Approach routes to airfields are shown as solid blue lines. The designation of the route is written along the paths. The associated reporting points are shown as blue triangles with a dashed circle and the reporting point designation. Approach Routes will be shown by a solid line and Departure Routes will be shown as dashed lines. Note Approach Routes will only be displayed when zooming into the area. Traffic Pattern Traffic pattern 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. Note Traffic pattern will only be displayed when zooming into the area.

10 Weather

The Weather page is opened via the Menu by touching the “Weather” entry. The Weather page will display the station overview list for all currently available meteorological reports within 200 NM of the current position.

Legend:

1. Weather Menu
2. Station data
3. Meteorological data closest to own position

The weather data is downloaded from the National Weather Service of the United States of America.

Note: When opening the Weather page the first time you will have to confirm that you agree to download data from the NWS server to use this service.

The menu of the Waether page will allow to:

- Update the METAR and TAF data
- Disallow he internet connection

The Weather overview window will provide the following information based on the METAR:

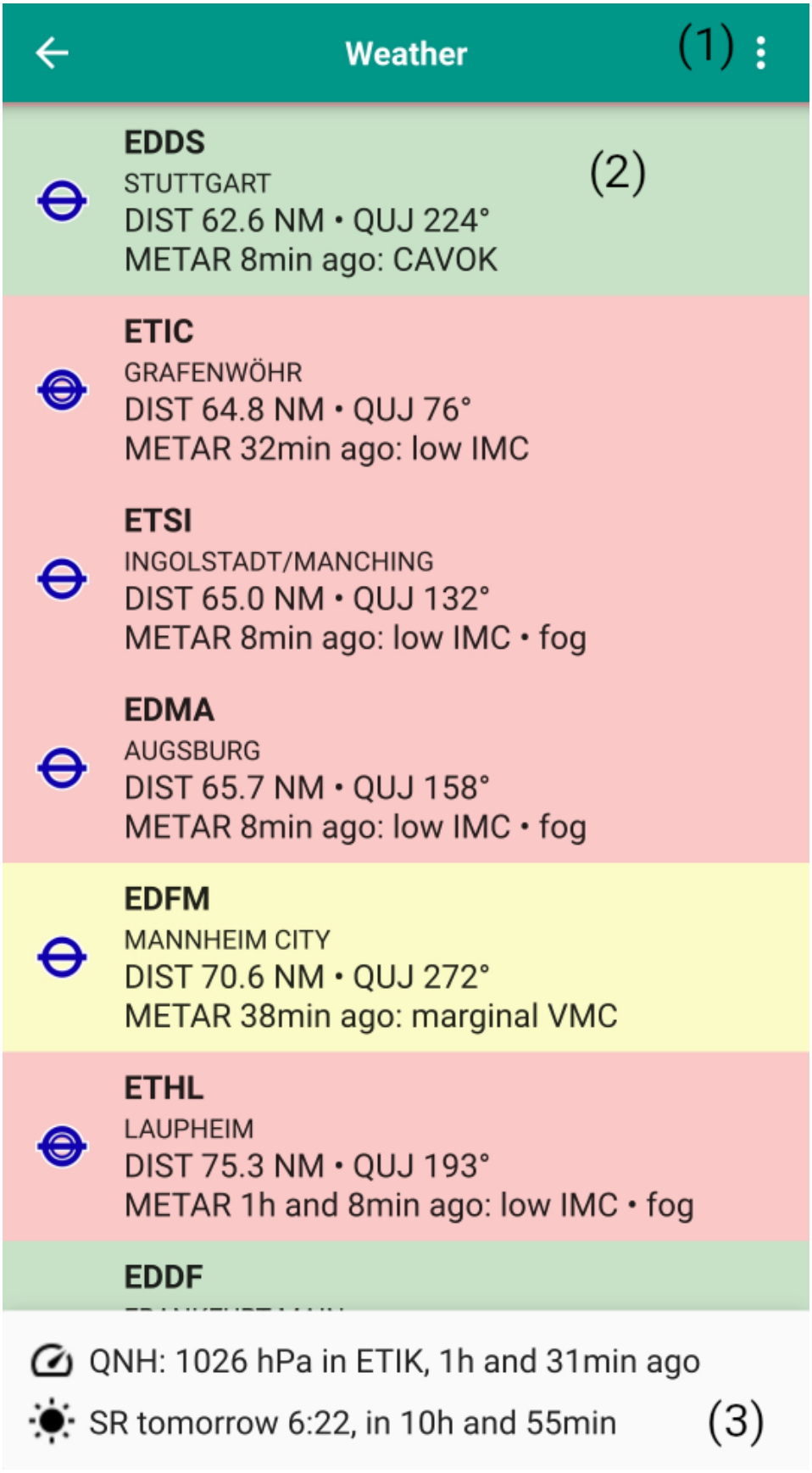
- ICAO identifier for Station and Airport name
- Distance and magnetic Bearing to Airport
- Time of METAR and summary weather state

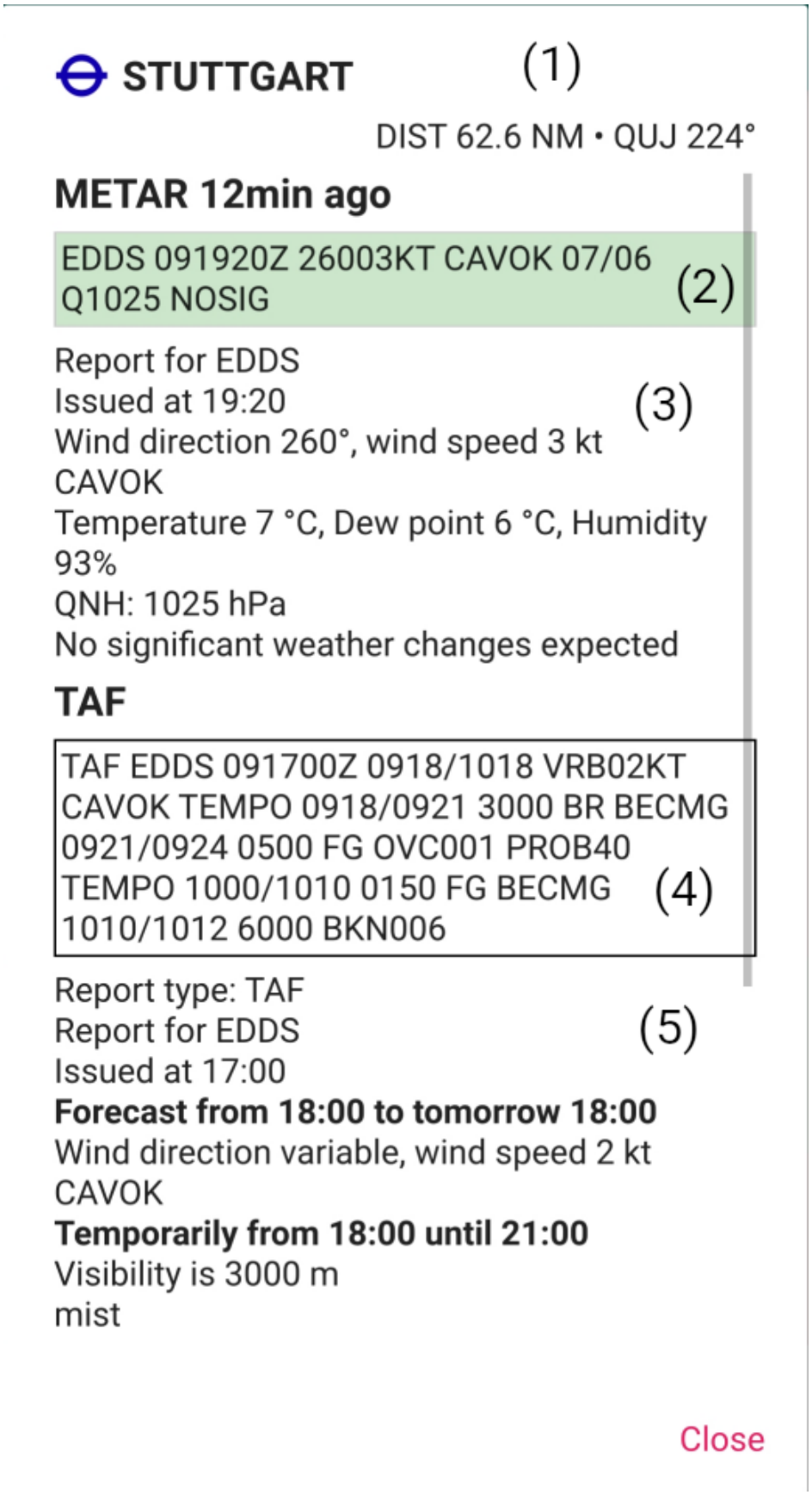
On the lower end of the weather page the following data relevant to your current position will be displayed:

- QNH
- Location and time of the report the QNH was extracted
- Sunset during day or Sunrise during night at current location
- Remaining time until sunset or sunrise

The information of each airport will be color coded by a system established by the US National Weather Service. The coding scheme is explained in the table below. When touching a station line METAR and TAF (if available) will be shown in a weather detail sub-page

Legend:


Weather
(1)
EDDS
STUTTGART
DIST 62.6 NM • QUJ 224°
METAR 8min ago: CAVOK
(2)
ETIC
GRAFENWÖHR
DIST 64.8 NM • QUJ 76°
METAR 32min ago: low IMC
ETSI
INGOLSTADT/MANCHING
DIST 65.0 NM • QUJ 132°
METAR 8min ago: low IMC • fog
EDMA
AUGSBURG
DIST 65.7 NM • QUJ 158°
METAR 8min ago: low IMC • fog
EDFM
MANNHEIM CITY
DIST 70.6 NM • QUJ 272°
METAR 38min ago: marginal VMC
ETHL
LAUPHEIM
DIST 75.3 NM • QUJ 193°
METAR 1h and 8min ago: low IMC • fog
EDDF
QNH: 1026 hPa in ETIK, 1h and 31min ago
SR tomorrow 6:22, in 10h and 55min
(3)


STUTTGART
(1)
DIST 62.6 NM • QUJ 224°
METAR 12min ago
EDDS 091920Z 26003KT CAVOK 07/06 Q1025 NOSIG
(2)
Report for EDDS
Issued at 19:20
Wind direction 260°, wind speed 3 kt
CAVOK
Temperature 7 °C, Dew point 6 °C, Humidity 93%
QNH: 1025 hPa
No significant weather changes expected
(3)
TAF
TAF EDDS 091700Z 0918/1018 VRB02KT CAVOK TEMPO 0918/0921 3000 BR BECMG 0921/0924 0500 FG OVC001 PROB40 TEMPO 1000/1010 0150 FG BECMG 1010/1012 6000 BKN006
(4)
Report type: TAF
Report for EDDS
Issued at 17:00
Forecast from 18:00 to tomorrow 18:00
Wind direction variable, wind speed 2 kt
CAVOK
Temporarily from 18:00 until 21:00
Visibility is 3000 m
mist
(5)
Close

1. Station data including bering and distance
2. Current meteorological report
3. Decoded view of Current meteorological report
4. Weather forecast for station
5. Decoded view of weather forecast

Note: To view the full weather forecast you have to scroll down in most cases

Caution: The color coding used for station weather does not match to European VFR criteria. Assessment of meteorological flight conditions has to be done via an officially approved source of flight weather.

Category	Color	Ceiling		Visibility
IFR Instrument Flight Rules	Red	500 to below 1,000 feet AGL	and /or	1 mile to less than 3 miles
MVFR Marginal Visual Flight Rules	Yellow	1,000 to 3,000 feet AGL	and /or	3 to 5 miles
VFR Visual Flight Rules	Green	greater than 3,000 feet AGL	and /or	greater than 5 miles

Note: By definition, IFR is ceiling less than 1,000 feet AGL.

Note: By definition, VFR is ceiling greater than or equal to 3,000 feet AGL and visibility greater than or equal to 5 miles while MVFR is a sub-category of VFR.

Part I

Appendix

11 Software licenses

11.1 License of Enroute Flight Navigation

The program **Enroute Flight Navigation** is licensed under the GNU General Public License V3[18] or, at your choice, any later version of this license.

11.2 Third-Party software included in this program

- This program includes several libraries from the Qt project[19], licensed under the GNU Lesser General Public License (LGPL) version 3[20].
- This program includes the library qhttpengine[21], which is licensed under the MIT license[22].
- This program includes the library OpenSSL[23], licensed under the Apache License 2.0[24].

11.3 Data included in this program

- This program includes versions of the Google Roboto Fonts[25], which are licensed under the Apache License 2.0[26].
- This program includes several Google Material Design Icons[27], which are licensed under the Apache License 2.0[28].

[18] https://www.gnu.org/licenses/gpl-3.0-standalone.html
[19] https://qt.io
[20] https://www.qt.io/download-open-source
[21] https://github.com/nitroshare/qhttpengine
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[27] https://github.com/google/material-design-icons
[28] https://github.com/google/material-design-icons/blob/master/LICENSE

- The style specification of the basemap is a modified version of the OSM liberty map design[29], which is in turn originally derived from OSM Bright from Mapbox Open Styles. The code is licensed under the BSD license[30]. The OSM style Bright from Mapbox Open Styles is licensed under the Creative Commons Attribution 3.0 license[31].

11.4 Base maps

- The base maps are modified data from OpenMapTiles[32], published under a CC-BY 4.0 design license[33].

11.5 Aviation maps

- The aviation maps contain data from openAIP[34], licensed under a CC BY-NC-SA license[35].
- The aviation maps contain data from open flightmaps[36], licensed under the OFMA General Users´ License[37].

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[29] https://github.com/maputnik/osm-liberty
[30] https://github.com/maputnik/osm-liberty/blob/gh-pages/LICENSE.md
[31] https://github.com/maputnik/osm-liberty/blob/gh-pages/LICENSE.md
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12 Technical Notes

12.1 Platform notes

12.1.1 Android

Wi-Fi locking

> When running on Android, the app 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.

12.2 Traffic Receiver

12.2.1 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)[38], Version 7.13, as published by FLARM Technology Ltd.[39].

[38] https://flarm.com/support/manuals-documents/
[39] https://flarm.com/

- Datagrams in GDL90 format must conform to the GDL 90 Data Interface Specification[40].
- Datagrams in XGPS format must conform to the format specified on the ForeFlight Web site[41].

12.2.2 Known issues

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.

12.2.3 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.

[40] https://www.faa.gov/nextgen/programs/adsb/archival/media/gdl90_public_icd_reva.pdf
[41] https://www.foreflight.com/support/network-gps/