Enroute Flight Navigation

Release 2.2.4

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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, 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.

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.

Part I

Getting started

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 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 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 web site Don't kill my app 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 is connected to power via a USB cable, note that there are devices where display and/or CPU use more energy than USB can deliver.

GETTING STARTED

2.1 Installing the App

Enroute Flight Navigation is available as an Android App in the Google Play Store. To install the App Enroute Flight Navigation you may use the following steps:

- Open Google Play Store

- Select "Apps"

- Search for "Enroute Flight Navigation"

- Touch the Symbol

- Select Install

2.2 Installing maps

To use Enroute Flight Navigation you have to install Maps covering the area of flight. For installing Maps the following steps have to be followed:

- Open the Menu by touching the area in the upper right side of the screen

- Open the menu item 'Settings'

- touch the item 'Maps' in the *Libraries* section

- Select the desired Maps by clicking the download Symbol

The Map display is composed of two layers selected in the respective Tabs of the 'Map Library' screen: * Aeronautical Map * Base Map

> **Caution:** Make sure Aeronautical and Base Map are installed for desired area of flight to avoid flight into areas without map display.

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.

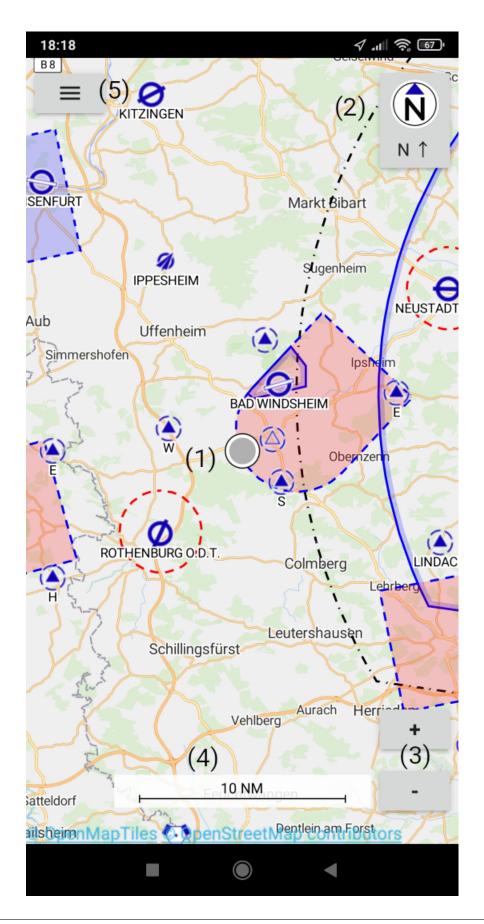
2.3 Flight mode and ground mode

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.

Legend:

1. Own Position (No valid GPS position)

2. North Indicator, also area to switch between track up and north up

3. Zoom area to increase map scale (+) and reduce map scale (-)

4. Map Scale reference indicator

5. Menu area

There are two basic ways to plan a flight route:

- Menu - Route:

  - Enter Waypoints

  - Edit existing Route

  - Enter Wind data

  - Enter Aircraft data

- **Double touch Maps and open Waypoints**

  - Direct will make a route from present position to Waypoint

  - '+' to Route will add the Waypoint to the current Route

A Route will remain in Enroute Flight Navigation until overwritten or removed. Routes may be saved or shared.

Flight Mode

When Enroute Flight Navigation senses a speed above the threshold it will automatically switch to flight mode. For the displays given in flight mode refer to Figure 3: Flight Mode (Track Up) In flight mode the following additional items will be displayed: * The own position will be changes from a dot to an arrow * A segmented flight path for the next 5 minutes will be indicated * A flight data line will indicate the following GPS data: * Altitude in feet (or meters if metric units selected) * Ground Speed in knots (or km/h if metric units selected) * Track in reference to true north * Universal Coordinated Time (UTC)

Legend:

1. Own Position

2. Flight Path Vector (5 Minutes)

3. North Indicator, also area to switch between track up and north up

4. Center on Position area

5. Zoom area

6. Menu area

The Enroute Flight Navigation map display is automatically centered to display the own position to have about 80 % of the display area in direction of flight. The map display may be shifted by touching the display and moving it to the desired position. After shifting the "Center on Position" Symbol will be displayed. After touching he "Center on Position" Symbol the map will be centered to give maximum map area in direction of flight again.
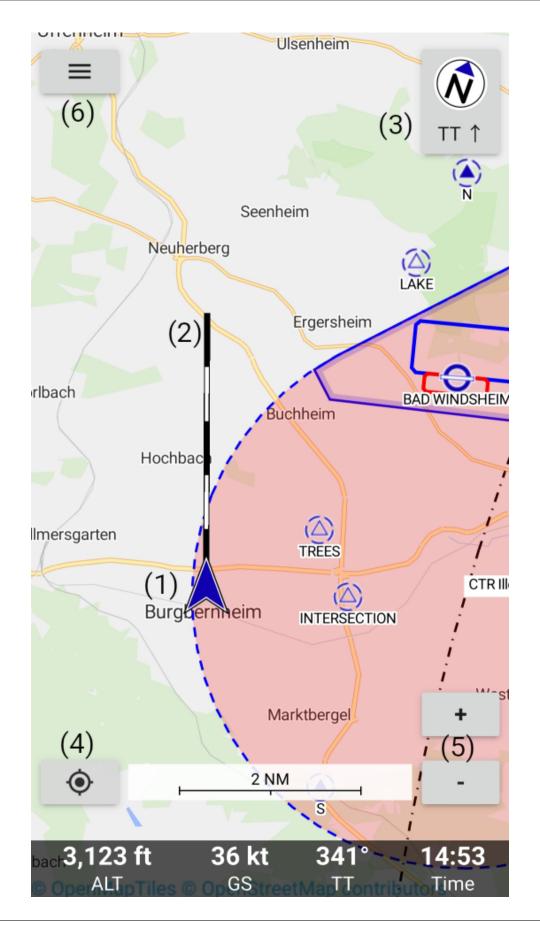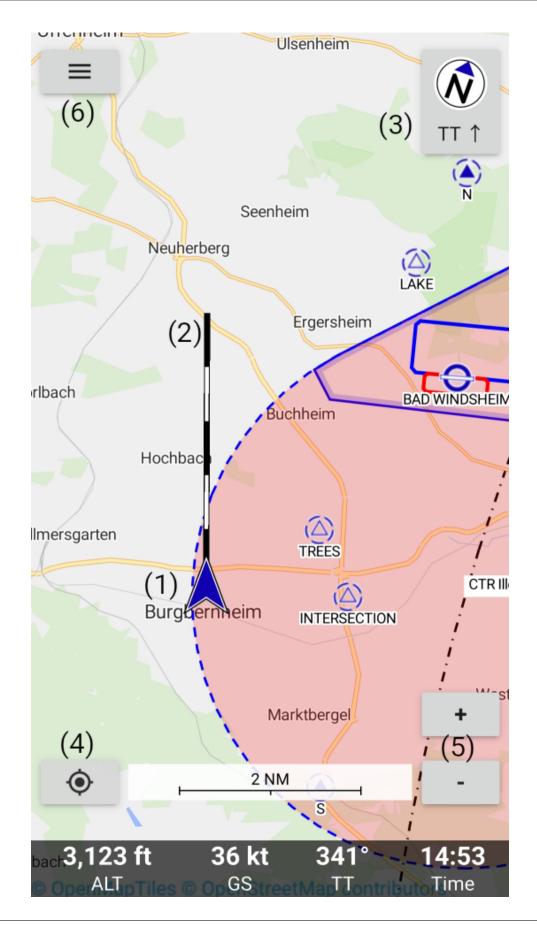
Track Up and North Up Mode

The Enroute Flight Navigation map display may be switched between a Track Up display and a North Up display by touching the gray window in the upper right area. Touching the display orientation area toggles between North up and Track Up.

Legend:

1. Own Position

2. Flight Path Vector (5 Minutes)

3. North Indicator, also area to switch between track up and north up

4. Zoom area

5. Scale

6. Menu area

The North Up mode provides a map display always showing the map north up. The Enroute Flight Navigation map display in North Up mode will center the display to provide about 80% area in direction of flight. In case the map display has been manually rotated the area besides the direction arrow will show the map orientation in degrees.

2.4 Your first flight

Now you are ready for the first use of Enroute Flight Navigation General operation is very intuitive. The primary purpose of Enroute Flight Navigation of displaying a moving aeronautical map is directly available after starting the app. Before using the moving map function you have to make sure the GPS of your mobile device is operating properly. The own position indicator will be gray if GPS position is not available and will be displayed in blue color if GPS position is available. The own position will be indicated as round shape when no motion is sensed and displayed as arrow with flight path marker when moving.

> **Warning:** Make sure the GPS position is correct and valid to avoid loss of situational awareness. Loss of situational awareness is a common cause of severe accidents in aviation.

To show a planned route on the moving map display you may:

1. **Use 'Direct'**

   - Double Touch the desired Waypoint

   - Select 'Direct'

2. **Plan a route**

   - Double Touch the desired Waypoint

   - Select (+) 'to Route'

The planned route will be displayed as light green line on the map display. More detailed information on route planning will be given in the dedicated section.

Airspace awareness

Information related to any selected point on the Map will be displayed when double touching a point.

The displayed Information for arbitrary points will include:

- Distance to point

- True bearing to point

- Airspace classification including related frequencies and transponder code

The displayed Information for reporting points or Navaids will include:

- Distance to point

- True bearing to point

- Designation, controlling agency and radio frequencies

- Airspace classification including related radio frequencies and transponder code

The displayed Information for airfields will include:

- Distance to point

- True bearing to point

- Meteorological information summary if available

- Designation, controlling agency and radio frequencies and Navaids

- Airfield data for Runways and field elevation

- Airspace classification including related radio frequencies and transponder code

More information on the features and operation will be given in the 'Further Steps' part of the Enroute Flight Navigation manual.

The following topics are described in more detail Enroute Flight Navigation 'Reference' section of the manual:

- Display of Airspace
- Display of Aeronautical Data
- Weather Data
- Settings

FURTHER STEPS

When using Enroute Flight Navigation on a frequent basis you may want to get into some more detail on the features and configure the app.

3.1 Menu

Functions not directly accessible on the moving map display and more options are accessed via the menu symbol in the upper left edge of the moving map display.

When touching the Menu area in the left upper corner of the screen the menu will open and give the following options:

- Route — see Flight Routes described below

- Nearby Waypoints — will show the closest 20 aerodromes, navaids or reporting points

- Weather — will open the weather display

- Set Altimeter — allows to enter current altitude to have altitude displayed using an offset

- Settings — see below

- **Information**

    – Satellite Status — will open a sub-window showing the status of GPS reception

    – Manual — will show this manual

    – About Enroute Flight Navigation

    – Participate

    – Donate

- Bug Report — will open a link to provide feedback

- Exit — will shut down the application

Only some reference to Menu items is given in this section. More details may be found in the 'Reference' section of the manual.

3.2 Settings

The settings Menu will allow to customize Enroute Flight Navigation and give access to program status. The settings Menu gives the following options:

- **Hide Airspace above FL 100** — allows to select display of airspace above FL100 displayed.
- **Automatic flight detection** — allows to select the display of flight mode on the ground
- **Flight Routes** — will show a window with the previously stored routes
- **Maps** — will show a window with the available and previously installed Aviation and Base Maps
- **Use metric units** — allows to select display in metric units
- **Use English** — allows to select English Language for display

Note: The items to be selected by the on-off slider will enable the related function. The current status of the selected item is shown below the item.

Note: If you do not select "Hide Airspace above FL 100" the FIS frequencies for the Airspace C above FL100 will be displayed. In general this frequencies are also applicable below FL 100.

Note: When Automatic flight detection is not selected the display will always be in flight mode.

Note: If "Use English" is not selected the standard language selected for your device will be used if available.

3.3 Waypoints

Waypoints are the central element of aeronautical navigation. A waypoint is selected by touching the moving map at the location of the waypoint display. Waypoints may also be directly added to a route by list selection or search.

The following types of Waypoints are available:

- Aerodromes
- Reporting points
- Navaids
- Arbitrary points on the map.

For Aerodromes the full set of information will be displayed:

- Aerodrome symbol indicating type of airport
- Aerodrome designation
- Distance and Bearing to Aerodrome
- Meteorological information if available
- Aerodrome communication information
- Airspace data

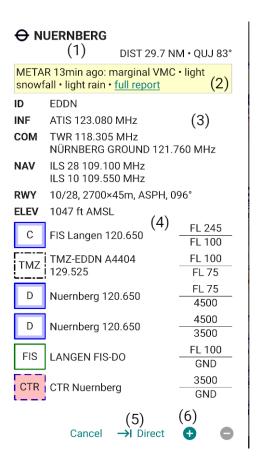For Reporting Points the following information will be displayed:

- Reporting Point designation

- Distance and bearing to Reporting Point

- Reporting Point communication information

- Airspace data

For Navaids the following information will be displayed:

- Navaid symbol, designation and type

- Distance and bearing to Navaid

- Navaid ID, frequency and elevation

- Airspace data

For Arbitrary Points the following information will be displayed:

- Point designation if manually entered

- Distance and bearing to Point

- Airspace data

Legend:

1. Waypoint designation, bearing and distance

2. Waypoint meteorological information (only shown for airports if available)

3. Communication information related to waypoint (only shown if applicable)

4. Airspace information for waypoint

5. Area to select direct Navigation to waypoint

6. Area to add waypoint to current route

3.4 Flight Routes

Enroute Flight Navigation provides direct planning of one flight Route. A Route will remain present until it is cleared. Route planning is entered via the Menu point Route. The Menu is entered via the Menu Symbol in the upper left corner of the map area. Then the Route Symbol has to be touched to go to the Route area.

A Route may be planned in the following ways:

- "Direct" in the waypoint window will provide a Route between current position and desired waypoint

- "+" symbol in the waypoint window will add the waypoint to the last position of the Route.

- "Add Waypoint" in the Route window will open a selection window for a waypoint and add the selected waypoint to the route.

The Route Display will show the following information:

- Symbol of the waypoint

- Designation of the waypoint

- Route Point Menu

- **Navigation Data**

    - Distance between way points

    - Time calculated between way points using the cruise speed set in the "Aircraft and Wind" page

    - True Course between way points

    - True Heading between way points

Note: A Route may also be imported from a GPX file from another PC. After sending the GPX file as Email attachment Enroute Flight Navigation will offer to open the GPX file.

The Route Point Menu provides the option to:

- Move a waypoint up in the Route

- Move a waypoint down in the Route

- Remove a waypoint from the Route

The Route Menu is entered by touching the Route Menu Symbol on the Route page. For Arbitrary Points the standard designation "Waypoint" may be changed by touching the pencil symbol and entering a designation.
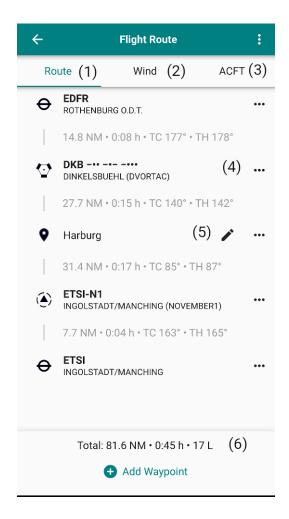
The following options are available from the Route Menu:

- Open a previously stored route from the library

- Save the current route to the library

- View the route library

- Share the Route in JSON or GPX format

- Open the Route in another APP using the JSON or GPX format

- Clear Route

- Reverse Route

The previously created and stored routes will be kept in a data base within Enroute Flight Navigation. Routes consist of the data for the selected way points. The Route data may be exported for use in other applications.

The Route display has 3 Sub windows:

- Route

- Wind

- ACFT

Legend:

1. Route sub-window

2. Selection area for wind sub-window

3. Selection area for aircraft sub-window

4. Route point sub-menu

5. Edit route point designation for arbitrary waypoints

6. Total distance, flight time and fuel consumption for flight route

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Route – Aircraft and Wind

The Aircraft and Wind sub-pages of the Route page allows to enter aircraft performance and wind data required for navigational calculations. The Aircraft Data will be used to determine the distance of the flight and the true course. The Wind data will will be used to calculate the true heading and duration of the flight. The duration of the flight will determine the fuel used. Enroute Flight Navigation only offers a very superficial flight planning and cannot replace a full flight planning, but is only intended to provide quick reference.

> **Warning:** Always perform a full flight preparation in accordance with the flight manual of the aircraft used. The use of Enroute Flight Navigation as primary flight planning may cause accidents leading to loss of lives.

The Wind sub-page of the Route page offers the following input fields:

- Direction in degrees
- Speed in knots

Only one speed, fuel consumption and wind may be entered for the whole route.

The Aircraft sub-page of the Route page offers the following input fields:

- **Aircraft**
    - Cruise Speed: Average Speed for Route
    - Descent Speed: Allows to enter a different speed for the descent phase (Currently not used)
    - Fuel Consumption: Average Fuel consumption per hour

Part II

Reference manual

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.

FIVE

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

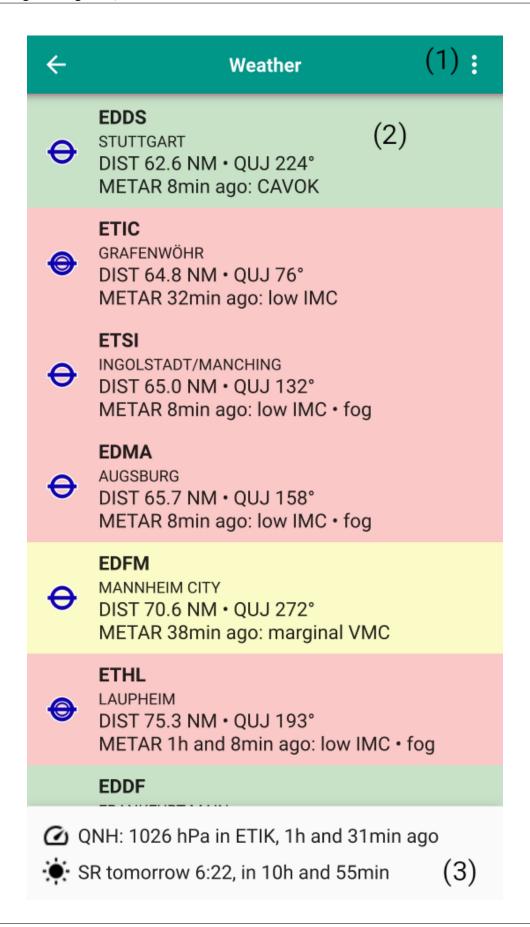- Time of METAR and summary weather state

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:

1. Station data including bering and distance

2. Current meteorological report

| | Weather | (1) ⋮ |

EDDS (2)
STUTTGART
DIST 62.6 NM • QUJ 224°
METAR 8min ago: CAVOK

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 (3)
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

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 (4)
1010/1012 6000 BKN006

Report type: TAF
Report for EDDS (5)
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

Close

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

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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	Yel-low	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

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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 III

Appendix

SIX

SOFTWARE LICENSES

TODO