

# flyNav

## Handbook

V1.42

W. Greger

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## Preamble

flyNav is a flight navigation software for Apple iPhone, iPad and Apple Watch. Due to the airports and airspaces databases are not certified for flying, you are not allowed to use this navigation software as your primary navigation tool.

This handbook describes all functions of flyNav in detail. However the screenshots may vary from your version because flyNav will be updated frequently. If you find any failures or inconsistency, please report them to me via Email: [info@flynav-app.com](mailto:info@flynav-app.com).

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# 1 General

## 1.1 Supported orientations

flyNav supports the following interface orientations:

Device	Landscape	Portrait
Apple iPhone	✗	✓
Apple iPad	✓	✓
Apple Watch	✗	✓

## 1.2 Locations service

flyNav need to use your location service. If you bring the app into the background, flyNav will turn of the location service after a few seconds until you bring the app back to the foreground.

## 1.3 Suspend mode

If flynav is in the foreground it will prevent your device to go in suspend mode. This is useful when you navigate with flyNav. However this will reduce the battery performance. If you don't navigate with flyNav, bring the app into the background or close flyNav to avoid a short battery life.

## 1.4 Barometric Altimeter

flyNav can display the altitude at standard pressure (1013,25 hPa), known as flight level, using the device internal barometric sensor. The following devices have build-in barometric sensors: iPad Air 2, iPad Pro, iPad Mini 4, iPhone 6 and iPhone 6+ **or newer.**

## 2 First start

If you start flyNav the first time, you have to accept the disclaimer (→ see preamble). Next, flynav will ask you to use the location service. If you want to use flynav for navigation, you need to press “Allow” here. Also flynav will ask you to download the latest airport database. Please press “Download”.

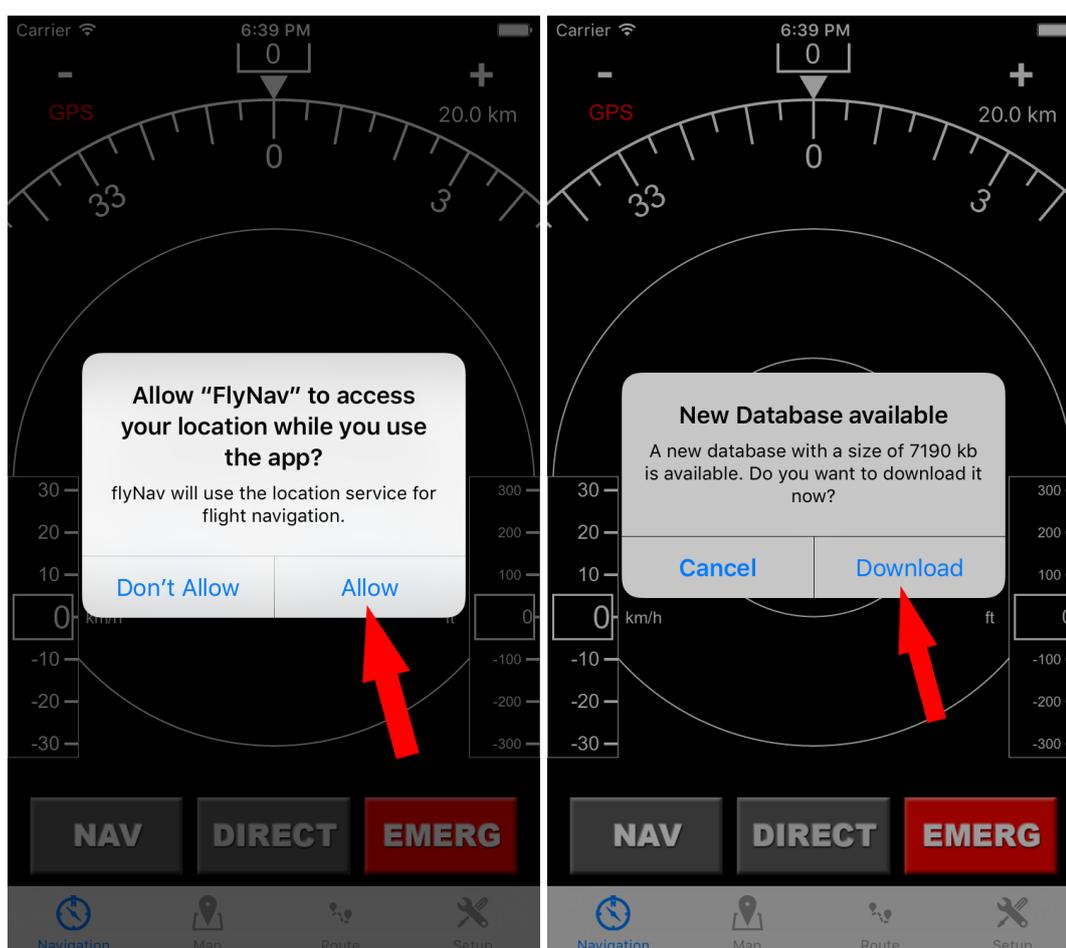


Figure 2.1: Locations service and download dialog after first start.

You’ll be informed when the update is finished. Next, you should setup flyNav as described in the following chapter.

## 3 Setup

This chapter describes how to setup the app. First of all you need to press the tap-bar icon on the right hand side. The setup menu is structured as a stacked table view. So you can easily navigate through the submenus. Just tap on the option you want to setup. If you want to go back to a higher menu level, just press the button on the top left.

The following table is identical to the menu structure of the app.

Level	Description	
<b>Airspaces</b>	Installed airspaces	This table shows all installed airspace databases. If you want to install a new database click on the plus in the top right corner. After that, flyNav will download a list of the available airspace databases. By tapping on the desired airspace database, flyNav will download the data from the server. You'll be informed when the download is finished. By default, there are no airspaces installed.
	Update local airspaces	By pressing this button, flyNav will check if there are updates available for the local installed airspace databases. If yes, flyNav will ask you to download the new database.
	Show classes	In this submenu you can select which airspace class type should be displayed in the map. To select or deselect a class just tap on the corresponding button. The class "MISC" is a placeholder for all classes that are not listed in the table. If you install own airspace data in the openair format you may activate this option.
	Show airspace labels	If this option is activated, all airspaces will have labels on the most left side. The label describes the class, the floor level and the ceiling level. The default value is on.
	Hide airspaces with floor > 10k ft	If this option is activated, all airspaces with a floor level above 10.000 ft will be hidden. If you normally fly below this altitude you should activate this option for a better overview. The default value is on (hidden).
	Report error in airspace database	If you find errors in the database, please report them to me. If you press this button an email form will pop up. Just fill it out, send it and I'll do the rest.
<b>Airfields</b>	Update airfields	If you press this button, flyNav will check if there is a new airport database available. If yes, flyNav will ask you to download it. In this case it is recommended to download the latest airport database.
	Show nav aids	If this feature is activated (default), nav-aids like

		VOR, DME and NDBs will be displayed on the map.
	Report wrong airfield location	If you find an error in the airport database e.g. a wrong airfield position, please report them. Please fill out the mail form and send it to me. I'll do the rest.
	Report missing airfield	
	Manage additional waypoints	Here you can manage your self-defined waypoints. You can edit them by tapping on the corresponding entry or you can delete them by swiping from right to left.
<b>Offline maps</b>	Installed maps	Here you can install offline maps based on OpenStreetMaps.
	Information	Some information about offline maps.
<b>Units</b>	Speed	Here you can select your preferred speed unit. You can select between km/h and kt. The default unit is km/h.
	Distance	Here you can select your preferred distance unit. You can select between km and nm. The default unit is km.
	Altitude	Here you can select your preferred altitude unit. You can select between ft and m. the default unit is ft.
	Volume	Here you can select you preferred volume unit. You can select between gallon and liter.
<b>Airplane Settings</b>	Glide ratio	You should type in the best glide ratio of your airplane. It describes the lost of altitude for a gives distance. For example, if your airplane loses 1m on a distance of 10m for best gliding, the ratio would be 0.1. This is also the default value. It is highly recommended to type in the actual glide ratio. <b>In other case, the emergency function won't work correctly.</b>
	True airspeed	Here you should enter the true airspeed of your airplane. This value will be used for ground speed and fuel consumption calculation.
	Fuel consumption	Here you should enter the typical fuel consumption of your airplane (unit: volume/hour).
<b>Flight Log</b>	Use METAR wind data	If this option is selected, flyNav will download METAR data from surrounding airfields and will calculate wind dependent route information like WCA, groundspeed,etc. The legs wind is calcu-

		late based on a vector sum described in chapter 4.2.
<b>Waypoint catch radius</b>	-	This value describes the distance (in your preferred distance unit) when a waypoint is interpreted as reached. For example, if the WP radius is 3 and the distance unit is km, flyNav will recognize a waypoint as reached when it is in a 3 km radius. If you select a too small value, flyNav may not recognize waypoints as reached. The default value is 3.
<b>Flight recorder</b>	Recorded flights	This table shows all recorded flights. If you tap on a flight record, a view will open which shows the take off and touch time time (in UTC), as well as the flight duration and the departing and destination airport. You'll also see the flown route. If you want to export the flight record (using GPX-format), just press the export button and a mail composer will pop up.  To use this feature you need to activate the automatic flight recorder under settings.
	Settings	Here you can switch the flight recorder on or off. If the flight recorder is switched on, it will automatically track your route as long as your speed is above the defined airborne trigger speed. The data will be saved in the apps documents folder in a subfolder called "FlightRecords" as GPX data. If you turn this function off, flyNav won't record your flight anymore.  The airborne trigger speed defines the speed to recognize that your airplane is airborne. You should setup a value that is below your stall speed. The default value is 50 km/h.
	Delete all entries	If you press this button you'll be asked to delete all flight record entries. If you confirm the request, all entries will be deleted. If you want to delete only a certain flight record, just go to the "Recorded flights" menu and pan a row from right to left and press delete.
	Ghost-Track	If this option is activated, a gray line will be showing your flown track on your map (when the navigation is active and the airplane is moving). This line will be deleted when you start a new navigation or if you deactivate this option. The default value is off.

<b>Contact</b>	Write email	If you press this button a mail form will pop up. I'm always interested in your feedback. So please use this function.
	Visit website	If you press this button, Safari will open up the flyNav website.

## 4 Planning a route

Generally there are three different methods to plan a route. Of course you can combine them to make the most efficient route planning. However this table shows which method is suggested for which boundary conditions.

Route boundary conditions	Recommended method
<ul style="list-style-type: none"> <li>• Route with multiple waypoints</li> <li>• User knows where waypoints are located on the map</li> <li>• Airspaces function should be used</li> <li>• Not all waypoints are airports or airfields</li> </ul>	Map planning
<ul style="list-style-type: none"> <li>• User don't know where the desired waypoint is located on the map</li> <li>• Static defined GPS coordinates</li> </ul>	Manual route planning
<ul style="list-style-type: none"> <li>• Short route with only one waypoint, which is a nearby airport.</li> </ul>	Direct function

### 4.1 Map planning

This method is normally the best way to plan a route. You can easily plan your waypoints by touch and drag the digital flight map. Open the map view by touching the map icon in the tap-bar.

**Map type selector:** You can select from four different map types. "Map" is the normal Apple map with vector-based graphics, which is recommended for the flight planning. The maps data will be downloaded from the Internet during you zoom and pan the map. However the data will stay in the memory for a while. So normally you can use this mode during a flight. It can happen, that the maps data won't be displayed when you loose your Internet connection. In this case you'll see a blank map. However in this case you'll still see the airspaces and airports because they are locally stored. If you installed an offline map, you should switch to "OSM" (OpenStreetMaps) in this case. To install

offline maps please go to Setup → Offline maps. Due to the reduced zoom level of the OSM, you should use “Maps” whenever they are available.

Sometimes it makes sense to use the hybrid mode for a route planning because you’ll get a much better impression of the environment and elevation.

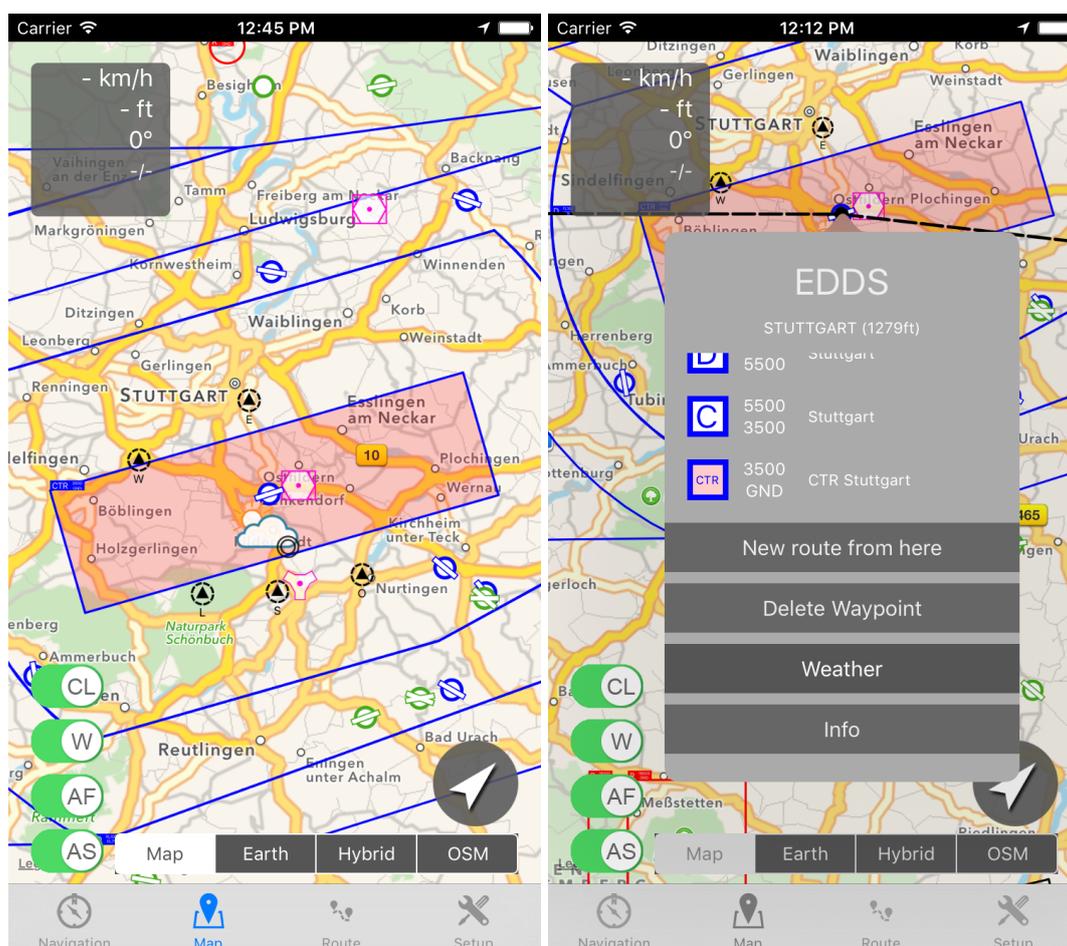


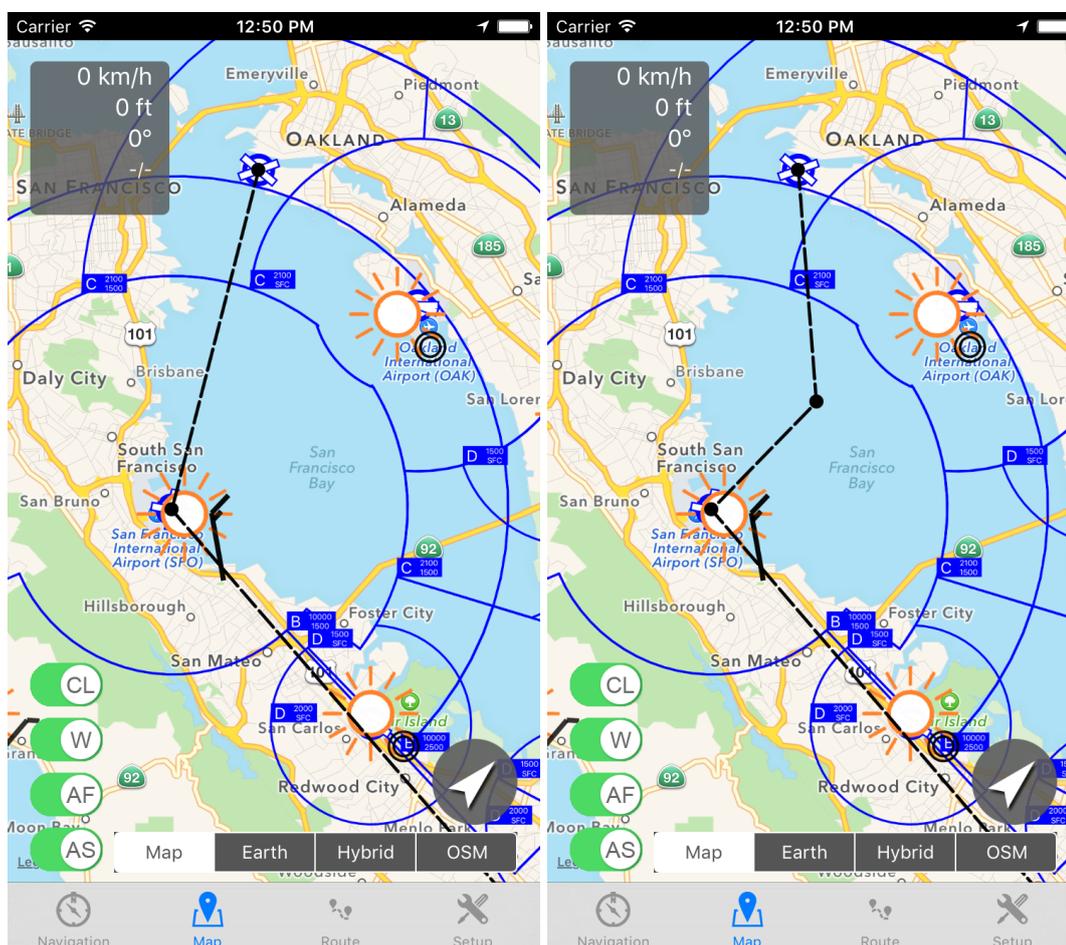
Figure 4.1: Map view in the route-planning mode. Make a long tap on an airport to start a new route.

**AF, AS and CL button:** The button “AF” will show or hide airports and airfields on the map. The button “AS” will show or hide all airspaces on the map (if installed). The button “CL” has no functionality in the planning mode.

**Current position:** Your current position is displayed as a pin. If you see an airplane instead, you already started the navigation.

To start a new route, make a long tap (>0.5 s) on the desired departing airport. Don’t move your finger too much. A popup menu will appear. Select “New route from here”. Now you should see a dotted line from your current location to your departing airport.

Now zoom and pan to your destination airport or airfield and make also a long tap on it. Select “Append waypoint”. You can add more waypoints by the same procedure.



*Figure 4.2: A planned route. Left hand side: Route with two waypoints (departing airport and destination airport). Right hand side: A route with an inserted free GPS-waypoint.*

**Generate waypoints:** Normally you want to generate some more waypoints. To do that, just make a long tap on the route and pan your finger to the desired location (without leaving the display). You should see a new waypoint.

**Airport snapping function:** You’ll see that flyNav has a snapping function for airports and nav-aids. So if you move a waypoint near to an airport, it will get snapped on the airports location. Normally that’s exactly what you want. However sometimes you just want to define a free waypoint nearby to an airport. In this case you can zoom more in (to increase the display distance between the desired waypoint and the airport) or you can deactivate the airports by pressing the “AF” button (which will deactivate the snapping function).

**Edit waypoints:** If you want to move a waypoint, make a long touch on it and pan your finger. The waypoint will follow your finger until you release the display.

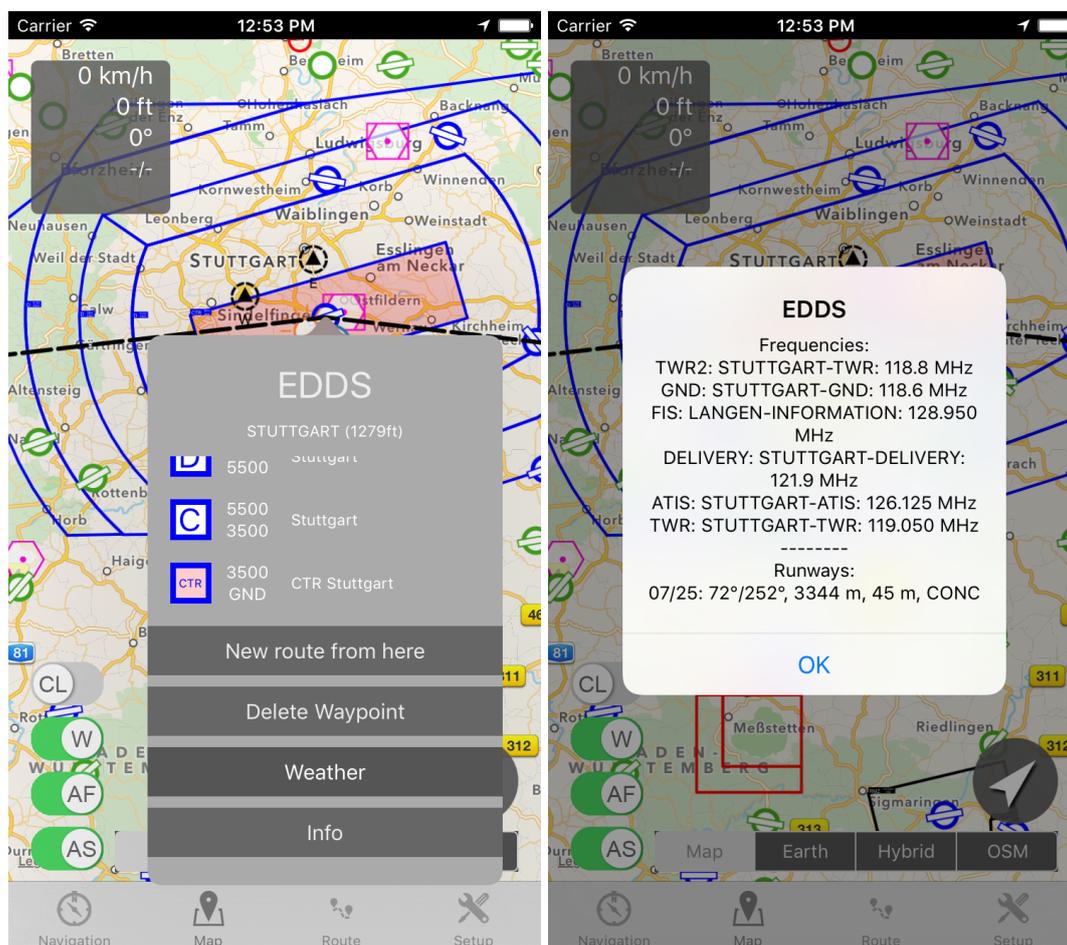


Figure 4.3: Right hand side: Airspaces analyzer. Left hand side: Airport information including runways and frequencies.

**Delete waypoint:** Of course you can delete waypoints. Just make a long tap on it (without moving your finger), a popup menu will appear, select “Delete waypoint”.

**Airspace analyzer:** If you want to analyze the airspace structure for a certain point, just make a long touch on the point and flyNav will display the corresponding airspaces for this point including the airspace class, the airspace floor and the ceiling.

**Airport Information:** If you want to get detailed information about an airport/nav-aid make a long tap on the airport and select “Info”. An alert view will appear with information about the runways and the radio frequencies (if available). The airports elevation will be plotted directly behind the airports name in the popup view.

**Weather Information:** If you turned on the weather fetcher by activating the “W” button in the map view, flyNav will fetch automatically the METARs of the surrounded weather stations and display the weather information on the map. The symbol right next to the station gives you an overview over the general weather situation. If you see an

exclamation mark be careful. This indicates critical weather like haze, mist, etc. Next to the symbol you see the wind indicator, which shows you the wind direction and strength. To get detailed weather information make a long touch on the weather symbol and tab on “weather”.

## 4.2 Manual route planning

Instead of planning your route directly on the map, you can plan it manually. This makes sense especially when you don’t know the position on the map for one or more waypoints of your route. Also you may want to define exact GPS-coordinates (e.g. for border crossings). Also the route view is great to edit, delete, save or load a route.



Figure 4.4: Route view. Left hand side: A blank route. Right hand side: A short route from KSQL to KHWD with one free defined GPS-Coordinate.

**Add airport/nav-aid/VRP as a waypoint:** To add an airport, airfield, nav-aid or VRP (visual report point) as a waypoint, just press the “+ICAO-WP” button. A table will appear. Don’t try to scroll through it to find your destination because it has more than 20.000 entries. Use the search bar to find your destination. You can search either by the

ICAO airfield identifier or the city where the airport/nav-aid is located. When you found the desired airport/nav-aid, just make a tap on it and it will be added to your route. In the title bar you'll see the total length of your planned route. When you start the navigation, the distances to the waypoints will be updated.

**Add GPS-coordinate as a waypoint:** To add a defined GPS-coordinate to your route just press the “+ GPS-WP” button. You can select between the degree format and the decimal format. If you select degree format please always start with the direction identifier (N/S, W/E) and type in the coordinate. The delimiters will be inserted automatically. It's important that you type in all fractional digits even when they are 0.

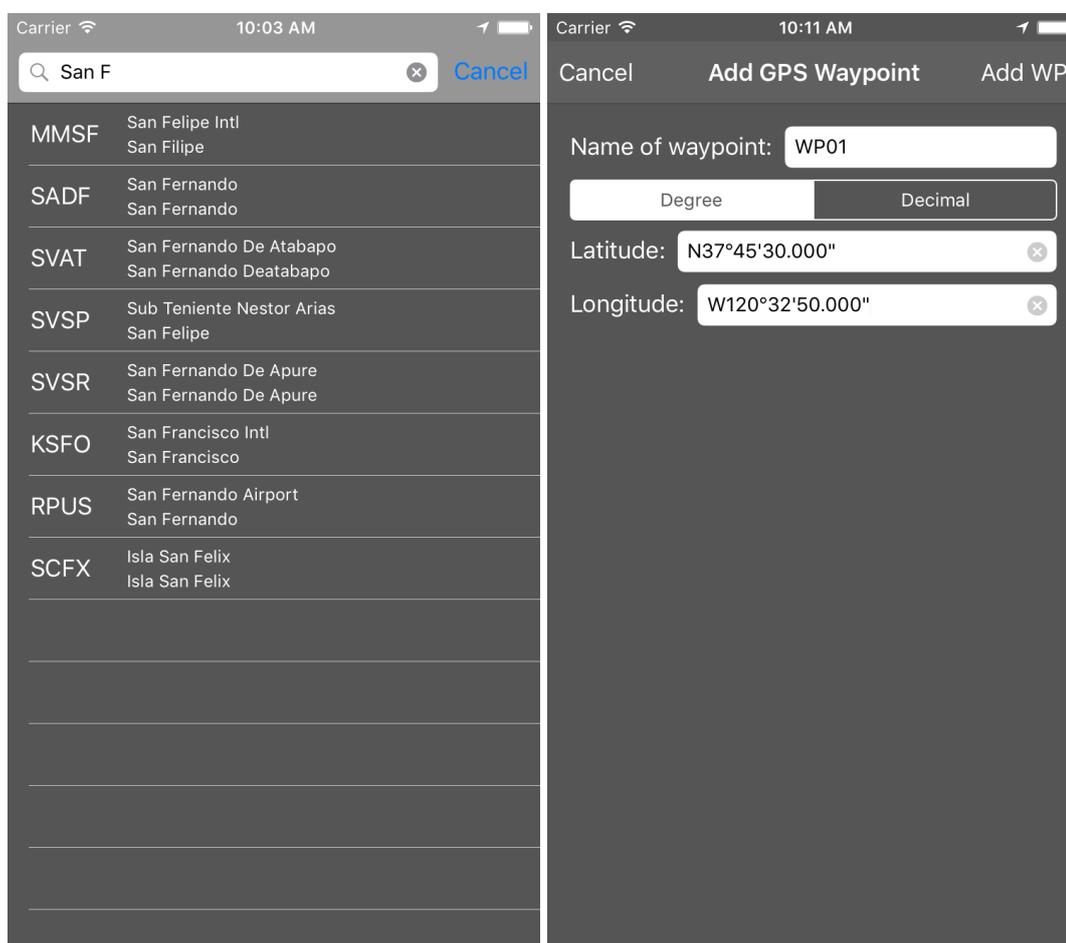


Figure 4.5: Left hand side: Add Airport as waypoint. Right hand side: Define a free GPS-coordinate.

**Delete or reorder waypoints:** On the top you have two buttons. With the delete button you can delete your current planned route. If you press it, flyNav will ask you for a confirmation to delete all route waypoints. If you want to delete only certain waypoints or you want to reorder waypoints, press the edit button in the top right corner. To change the position of a waypoint, just touch the corresponding row on the right side

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and move it on the desired position. To delete a waypoint, click on the minus. You can move your finger from left to right instead.

**Save & load route:** If you want to save your current route, just press the icon with the disc symbol, type in a name and press ok. If you want to load a route, press on the icon with the folder symbol and select a route from the table. If you want to delete a saved route, make a slide from right to left and tap the delete button.

**Reverse a route:** If you want to fly the same route back, you can use the reverse function (button with the two arrows). It will rotate all waypoints so that they are in a reverse order. Maybe you have to edit the route after that (e.g. if you have defined an alternate airport).

**On-route NOTAM:** flyNav is able to fetch relevant on-route NOTAMs. For this you need at least one airport or airfield on your route. Press the button with the book icon. flyNav will plot all NOTAMs between the first and last airport in your route with a buffer of 20 nm. If your route has waypoints, which are more far away than 20 nm from the direct route, flyNav may not plot all relevant NOTAMs! Also the NOTAM-server doesn't know all airports identifiers in the world, so you might get an error for especially very small airfields and airports. In this case please edit your route by adding a larger airport and then fetch the NOTAMs again.

**Flight-Log:** flyNav is able to generate a prefilled flight log form. The flight log is saved in the PDF-format and can be directly printed via AirPrint or it can be sent by email. To generate a flight plan just press the button with the clipboard icon.

If you have turned on the setup option “Flight Log” → “Use METAR wind data”, flyNav will try to download on-route weather to consider wind information for duration-, fuel- and WCA calculation. Please wait until the weather information is downloaded.

**Important: flyNav is not a weather briefing source. Use this function on your own risk! It's the responsibility of the pilot to double check the weather data by official sources and he needs to review the calculated legs winds.**

Beside the automatic weather download, flyNav also supports manual wind data. To add manual wind information, you have first to deactivate the setup option “Flight Log” → “Use METAR wind data”. After that just open a waypoint by tapping on it. In the text field “Winddata” enter the wind information in the following format <DIRECTION>/<STRENGTH>, whereas direction is the wind direction in degree and strength the wind strength/speed in knots, e.g. “270/10” for 270° and 10 knots.

**Important: Due to safety reasons flyNav will only consider wind data if you have entered the wind information for all waypoints.**

Independent of the source of the waypoint wind data (METAR download or manually entered), a leg wind has to be calculated based on the wind data of the two corresponding waypoints. flyNav calculates an average wind using half of the vector sum of both winds (A & B):

$$\vec{wind}_{AB} = \frac{\vec{wind}_A + \vec{wind}_B}{2}$$

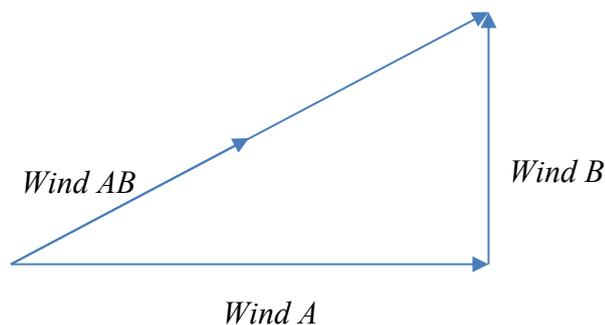


Figure 4.6: Calculation of leg wind based on vector sum.

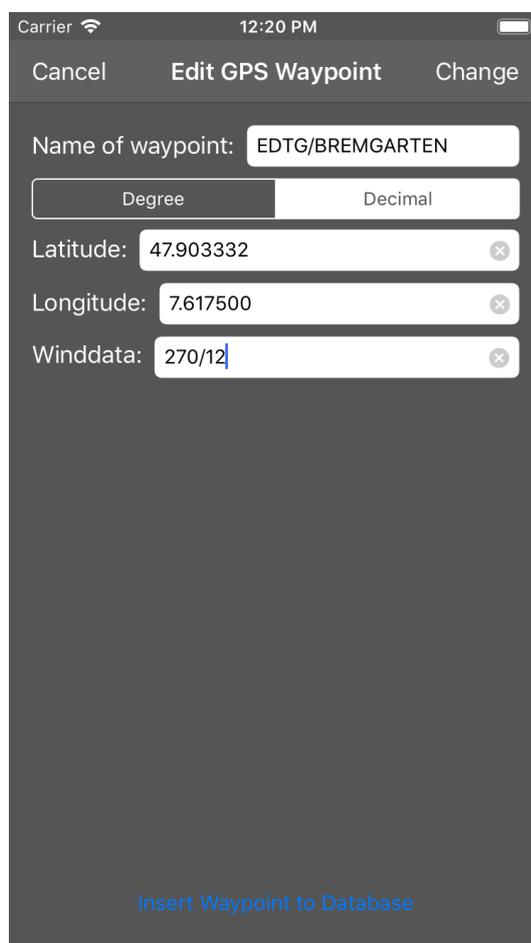


Figure 4.7: Edit dialog for waypoint to enter wind data, e.g. 270°, 12 knots.



waypoint to database”-button near to the button. Just press the button and the waypoint will be stored in the database on your phone.

You might want to edit or delete additional generated waypoints. To do that, just go into Setup → Airfields → Manage additional waypoints. If you tap on an entry, you can edit the name and the coordinates. If you swipe from right to left you can delete an entry.

#### 4.4 Plan a route with the direct function

If you just want to make a short flight to a nearby airport, you can use the direct function. To do this, go to the navigation view. If you changed your location during the last usage of the app, update your location by pressing the “NAV” button. Press it again to stop the navigation. Then press the “DIRECT” button. A table will pop up with two sections. Scroll down to the near airfields section. Select your desired destination. Your route is planned!

## 5 Route navigation

For the route navigation you can select between two views. The first one is the “classical” moving map view, which you may know from other Apps. However the map view is often not the best choice due to its worse clarity. flyNav supports also a navigation display, which is very similar to the navigation displays of huge airlines. It has a very plain style and shows only the important information. Due to this, the navigation display is even useable on an Apple watch. But it depends on your preference, which is the best view for you! You may use both views on a flight.

**Start / stop navigation:** Generally the navigation will be started and stopped in the navigation view or map view by pressing the button “NAV” (map view → button with arrow symbol in the bottom right corner). flyNav will prevent your device from going in suspend mode. To save your battery, you should bring flyNav to the background if you don’t use it. And don’t forget to stop your navigation first.

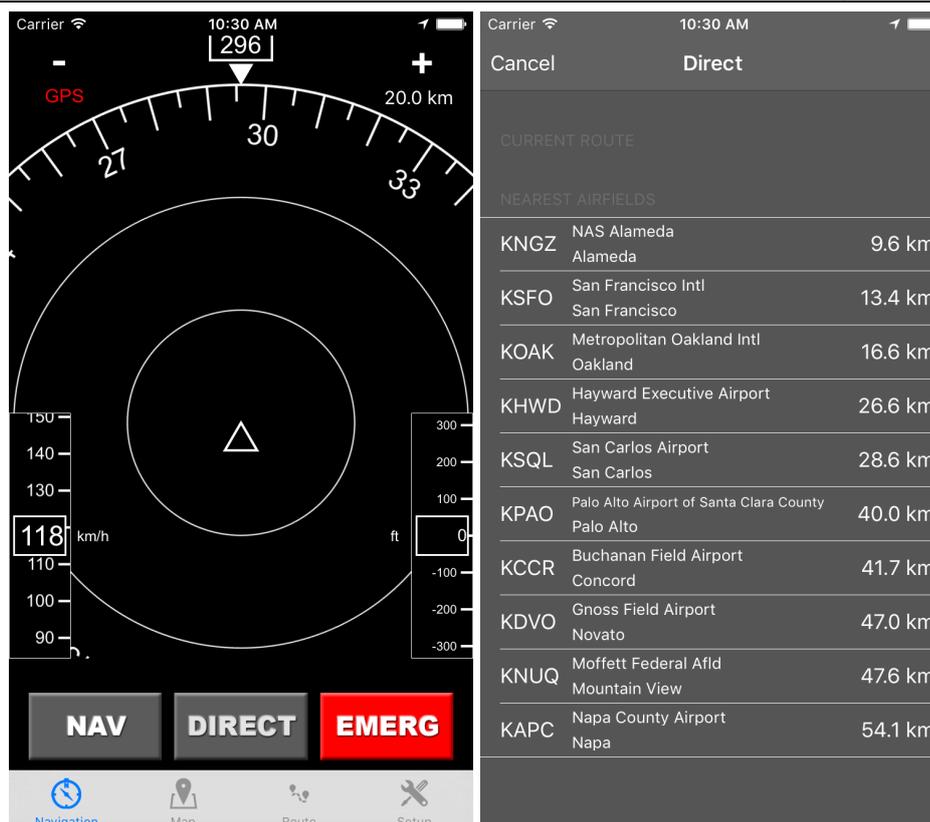


Figure 5.1: Plan a route with the direct function of the navigation view.

## 5.1 Moving-Map

If the navigation is started, an airplane instead of a pin should indicate your current position.

**Indicator box:** flyNav will display some information in the top left corner. It indicates your current ground speed, your altitude, your course and your take off and touch down time (in Zulu time).

**AF, AS, CL button:** If you prefer that flyNav orientates the map according to your course, please activate the “CL” (course link) switch. flyNav will also automatically move the map when your location is changing. You can hide or show the installed airspaces and airports by pressing the “AF” and “AS” buttons.

**5 Minutes indicator:** In top of the airplane icon you will see a red line. This is the 5 minutes indicator and shows the expected position in 5 minutes for the current speed and course. This is useful for reporting your location.

**Ghost-track:** When the ghost-track option is activated, flyNav will plot your actual flight track as a gray line. This line will be deleted when you start a new navigation.

**Edit route during navigation:** Of course you can edit your route during the flight. First you should deactivate the course link mode to prevent movement of the map. Then you can edit the route, as you know it from the route planning.

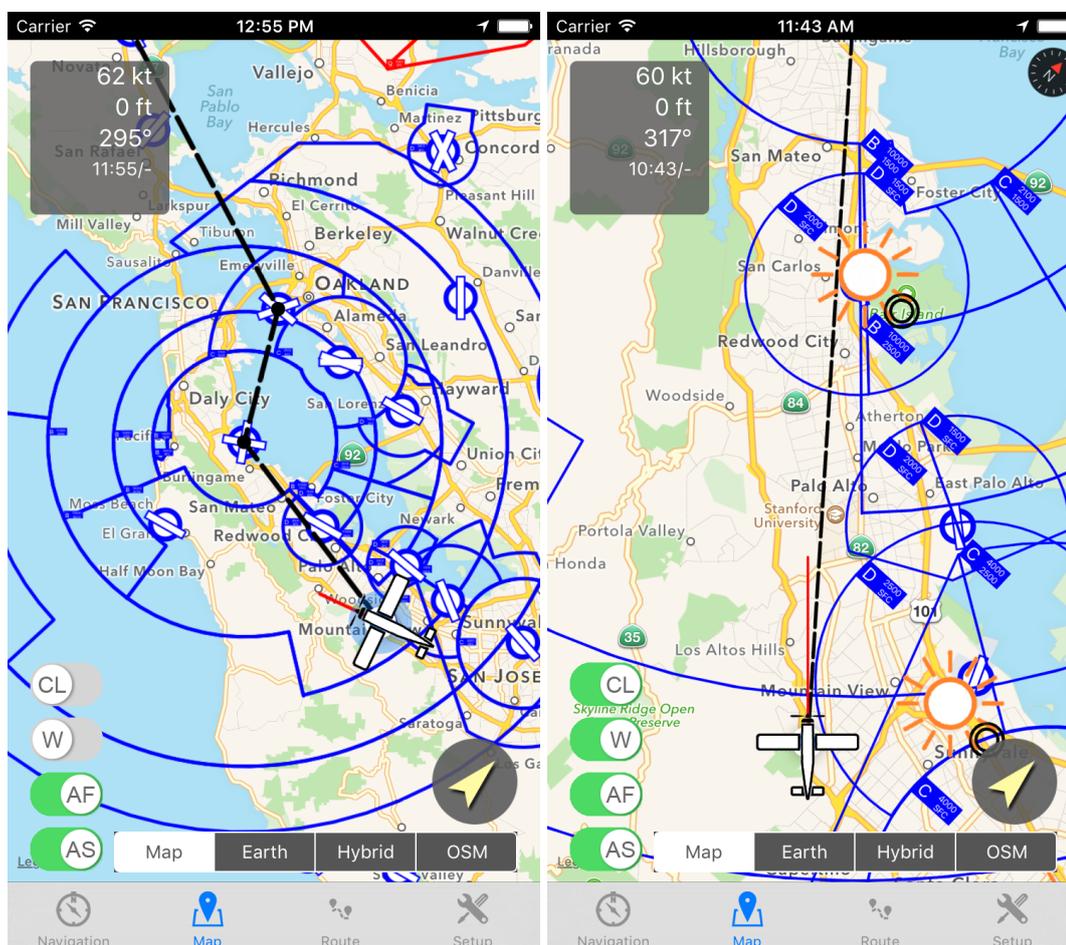


Figure 5.2: Moving map navigation. Left hand side: Map is orientated to north. Right hand side: With active “Course Link” mode (auto orientation) and weather view.

**Passing waypoint:** If the distance to the active waypoint is getting below your defined waypoint catch radius ( $\rightarrow$  setup), this waypoint will be marked as reached and hidden in the map view.

## 5.2 Navigation Display

The navigation display is a simple lateral navigation instrument, which shows you the most important information for your navigation.

**Course Circle:** The main indicator is the course circle, which displays your current course graphical. You see in total three circles. Each circle represents the current select-

ed zoom distance which is shown in the top right corner below the “+” button. For example a value of 80 km means, that the distance from the circle center to the first circle is 80 km, from the inner circle to the middle circle also 80 km and from the middle circle to the outer circle 80 km, so overall 240 km to the outer circle. In the middle of the instrument you see a small triangle, which represents your current location. All waypoints are plotted inside the circle relative to your current course. A red line at the course circle indicates the bearing to the next waypoint.

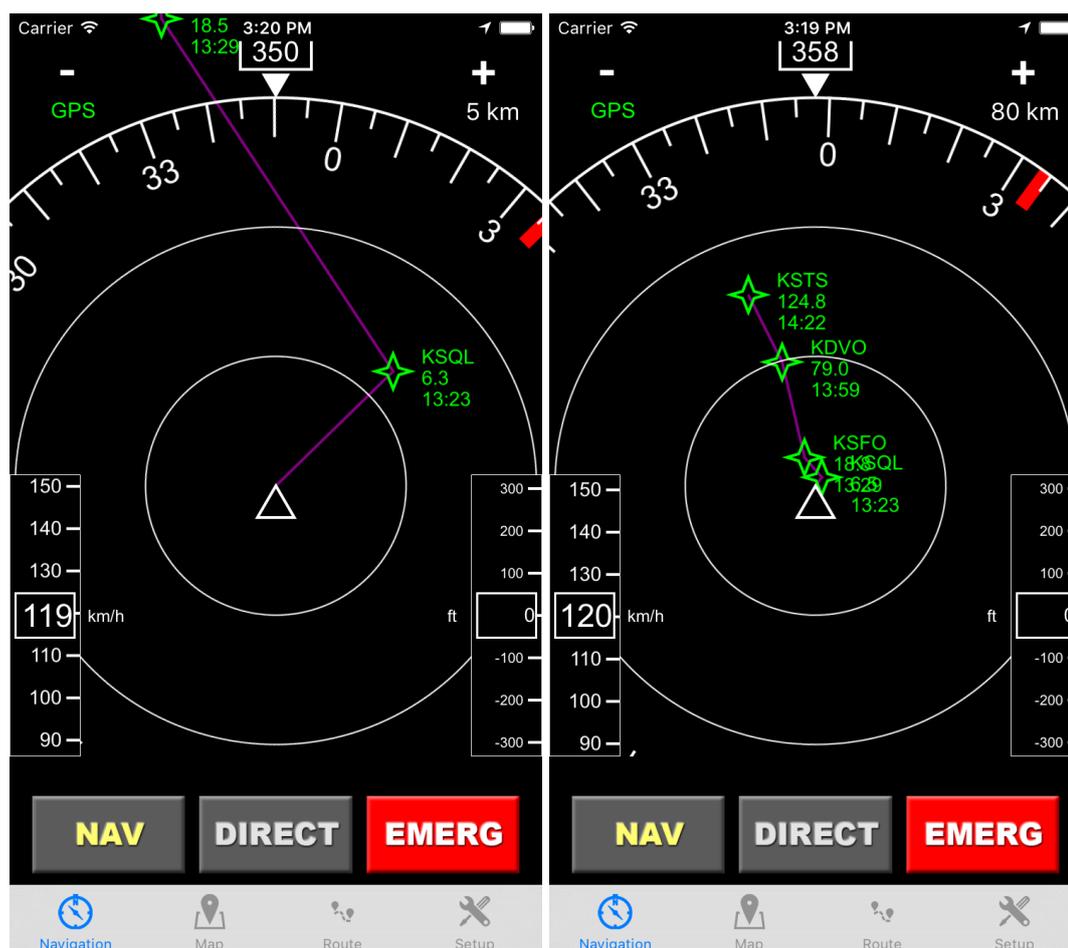


Figure 5.3: Navigation display with different zoom level.

**Waypoints:** The waypoints are indicated as green stars. On the right hand side you see the identifier of the waypoint. In case of an airport or airfield the ICAO identifier is used. Below the waypoint identifier you’ll see the distance in your selected unit (km or nm). If your speed is above 0, flyNav will also plot the ETA (in Zulu time) below the distance. If you pass a waypoint (distance gets below the selected waypoint catch radius) the waypoint will be hidden in the navigation display. If you don’t pass a waypoint directly, you can skip it using the direct function.

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**Zoom button:** To zoom into your route, just press the “+” button. If you press the “-“ button you will zoom out.

**GPS indicator:** The GPS indicator shows you the current accuracy of the GPS signal. If the indicator is red, GPS is turned off or the accuracy is worse than 100m. A yellow GPS label indicates an accuracy of 10m to 100m. For accuracies better than 10m, the indicator is green.

**Altitude & speed indicator:** On the right hand side you see your current altitude in the selected altitude unit. The altitude is calculated by the GPS signal, so the accuracy is not so high. If you fly on a flight level at standard pressure, the value deviates from your airplanes altitude indicator. On the left hand side you see your current ground speed in the selected speed unit.

If you use an iPhone 6, iPhone 6+, iPad Air 2, iPad Pro, iPad Mini 4 or newer, you can use the barometric altimeter which shows you the altitude for the standard pressure (1013.25 hPa), known as flight level. To switch to STD pressure just tap on the altimeter in the map view or navigation view during the navigation. To switch back to the GPS altimeter, just make another tap on the altimeter.

**“NAV” button:** With the “NAV” button you start or stop the navigation as described above.

**“Direct” button:** If you press the direct button, a table with two sections will be shown. The first section represents the waypoints of your current route. If you select a waypoint all waypoint between your current position and the selected waypoint will be skipped. This is a useful function, if you don’t pass a waypoint directly or if you want to make a shortcut. The second section represents the ten nearest airfields or airports. If you select one, the current route will be overwritten with the selected airport or airfield. This is useful if you need to change your route during the flight for example due to low fuel or a technical issue.

**Emergency button:** By pressing the emergency button, flyNav will automatically check if the nearest airfield is reachable by gliding. For this flyNav uses the altitude delta between the airplane and the airport, the distance of the airplanes location to the airports location and the glide ratio. It is important to setup a realistic actual value for glide ratio of the used airplane. You’ll find the value in your airplanes handbook. If the airport or airfield is reachable, flyNav will overwrite the current route with this airport or airfield and it will display the radio frequency for it. If flyNav determined that no airport is reachable, it will show an alert. Nevertheless, it’s your decision where you land your airplane!

## 6 Apple watch

flyNav is the first flight navigation app, which works together with the Apple Watch. Due to the displays size the functionality of the watch app is much smaller compared to the iOS version. Also the Apple Watch has no GPS module, so your iPhone need to be in range to use the App.

**Install the Watch app:** To install flyNav on your Apple Watch, open the Watch App on your iPhone, go to “My watch”, scroll down to the flyNav and tap on it. Now select “Show on Apple Watch”.

**Open the app:** Go to the home screen of your Apple Watch. You should see the flyNav icon. After tapping it, flyNav will open with the well-known navigation screen. There is only one difference. Right to the GPS indicator, a red dot will blink. This confirms that the communication between watch and iPhone works fine. If the indicator stops blinking, the communication has broken. In this case procedure as described in the troubleshooting.

**Navigation:** To start the navigation, make a force touch on the Watch’s display and press on the “Start” button. To stop the navigation, make again a force touch on the display and press the “Stop” button.



Figure 6.1: flyNav Watch App. Left hand side: Initial navigation screen with deactivated navigation. Middle: Navigation menu after making a force touch on the display. Right hand side: Started navigation.

On the watch you can also use the direct and the emergency function. If you press the “Direct” button, a table will pop up with the waypoints of your route, colored in white and the nearby airports, colored in gray. Select the desired waypoint and flyNav will change the route like the iOS version.

**Troubleshooting:** It seems that the communication framework between Watch and iPhone is still very buggy. If the communication is lost (indicator doesn’t blink any

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more), there are several methods to bring the communication back. First bring the watch to suspend mode via turning your hand down for a few seconds. Then move it up again, the display should go on and the communication indicator should blink. If not you should try to restart the watch app. To do this, you should hold the side button until you see a turn off dialog. Release the button and press it again until the flyNav is closed. Open flyNav again and check if the communication works. If the communication still won't work, you need to restart both devices. I know, that this is quite painful, but there seems to be no other workaround. If I find a better solution, or Apple will fix this issue, I'll update flyNav immediately.

## 7 Contact information

**Post address:** Walter Greger, Marina-Zwetajewa-Weg 8, 79111 Freiburg, Germany

**Email:** [info@flynav-app.com](mailto:info@flynav-app.com)

**Website:** <http://www.flynav-app.com>