

AIRTRACK NG OPERATIONS MANUAL  
REVISION 4.2.0 / DECEMBER 2023

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## REVISION HISTORY

Version	Date	Description
4.0.0	September 2023	Initial version of this document for AirTrack NG v4.0.0
4.0.1	September 2023	Added VFR and Custom Waypoints ND display settings.
4.0.2	October 2023	Small changes to Air Account section and registration.
4.0.3	October 2023	New defaults
4.1.0	October 2023	SimBrief flight plan import support
4.2.0	December 2023	Distribution changes

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## 1. INTRODUCTION

AirTrack is an application designed to integrate with flight simulators in real time over a local area network, providing remote flight display and control through glass cockpit instruments, as well as control over some of the simulation variables. It replicates instruments and panels found on real planes using devices such as tablets and computers. When connected to a flight simulator running on a computer, the parameters of the flight are transmitted to the application in real time over the network and displayed in the simulated panels; when acted upon, changes are then propagated back to the simulator allowing for remote control. For this to happen, flight simulators need to have an extra piece of software called a plugin running on them, which is responsible for interfacing the data with the network.

In other words, AirTrack allows for various spare external devices to be used as peripheral glass cockpit avionics panels to complement the flight experience, allowing the user to abstract from instruments in the plane and concentrate on the scenery being flown. Primary Flight Displays (PFD) or Navigation Displays (ND) are examples of such instruments.

In its present version AirTrack supports both the X-Plane (10, 11, 12, ...) for which it was originally developed, and the Microsoft Flight Simulator 2020. Older simulators such as FS9 or FSX are no longer supported and have been retired due to their age. Plugins currently exist for X-Plane and MSFS2020. In the future AirTrack may and will quite possibly support other simulators and flight data sources as it has been designed with horizontal expansion in mind.

## 2. TECHNICAL SUPPORT

If you need technical support, the first point of contact is the web site at: <https://haversine.com>

There is a forums section where you may be able to find answers to similar issues or post questions publicly at: <https://haversine.com/forums>

If you need to contact us you can do so using the web form at: <https://haversine.com/support> and we'll get back to you via email as soon as possible.

Alternatively, please visit us on our Discord server channels and give us a shout. If we're online you can talk to us there and then ask any questions you may have to try and get the issue solved. An invite is made available from: <https://haversine.com/discord>

Also feel free to give suggestions or make feature requests; it is not guaranteed that they will happen, but there is a roadmap with many things ahead and if more people show interest one feature over another that could impact its priority on the ToDo list.



### 3. QUICK STARTUP GUIDE / TLDR

In you're in a rush to start using AirTrack NG, this chapter quickly summarises the list of actions you should take in order to do so.

1. Purchase the app from the App Store to your iPad/iPhone/Mac devices. The Mac version can spawn multiple windows and even run on the same computer as the simulator (X-Plane).
2. Install the latest plugin for your simulator from: <https://haversine.com/downloads>
3. If you already have an Air Account from the previous version, head to the SETTINGS panel, select Air Account and enter your credentials there.
4. If you have a Navigraph subscription for Nav Data, go to the NAVIGATION DATA panel and login to Navigraph and download the latest AIRAC.
5. If you want to fly with other traffic on TCAS such as VATSIM or IVAO, select a source under AIR TRAFFIC.
6. On iPad, you may want to click on LAUNCH NEW WINDOW to run it dual screen.
7. Make sure the simulator appears and is selected as DATA SOURCE. If not you may need to configure the device's IP address manually on the plugin.
8. Launch a PFD on one window and an ND on another. Start flying and see your flight updating on the displays.
9. Visit the NAVIGATION and INSTRUMENTS section of SETTINGS to make some informed choices (you can go back anytime). In particular there are some non standard options for navigation display such as plane trail, show winds at any speed, outside temperature or show callsigns on TCAS which are non standard and which you may wish disable in order to increase realism (in exchange for less data).

## 4. ARCHITECTURE, PLATFORMS AND DESIGN

### 4.1 HARDWARE

AirTrack NG currently runs on iOS and macOS hardware only due to its origin in Swift. Currently it requires iOS/iPadOS 15 or above, making it compatible with every capable iPhone, iPad and iPod touch, as well as Mac Catalyst 15 which corresponds to macOS 12.0 Monterey or above, on any Intel or Apple Silicon Mac.

Future version of it may expand support to other Apple platforms (tvOS and the Apple TV, Apple Vision Pro, or iWatch could be candidates). Future ports may eventually support other platforms too such as Android, but none of this in any way guaranteed or currently planned.

### 4.2 NETWORK

Its architecture comprises the existence of one (or multiple) flight simulator(s) running on a computer (or several), providing flight data to a CANBUS style network interface provided by a plugin. It currently connects over IPv4 using the User Datagram Protocol (UDP) and a protocol named HSMP (Haversine Message Protocol). In its NG version 4 and above, AirTrack apps bind themselves to port 2423 of the device they run on. Previous versions of Classic run on port 2424. Plugins attempt to bind to port 59000 and above depending on availability.

AirTrack instances connect to this bus network as app instances and exchange information with the simulator. There may be multiple apps on the network simultaneously all connecting to the same simulator, displaying different instruments and controlling different parts of the flight model. There may also be multiple simulators.

Although designed to run over local area networks with high speed and low latency, providing there is transparent IP connectivity, there is no reason why AirTrack won't function across wide area networks too and sites physically disperse.

### 4.3 AIRTRACK INSTANCES AND PANELS

Each App instance then has at least one of what is called a **panel** providing one type of instrument or functionality. As of version 4, macOS and iPadOS apps can spawn multiple panels and thus provide multiple instruments, all running simultaneously on the same device. On iPadOS, side by side panels or Stage Manager is currently supported, while on macOS the user can also instantiate as many panels as desired from the File Menu.

While current simulators connect using the HSMP protocol, future interfaces may be developed using other types. In addition to simulators, AirTrack also has a built in Flight Data source which is based on the device sensors themselves, providing data about real world environment such as GPS coordinates, speed, course and altitude, as well as magnetic compass bearings if / when available on the device AirTrack is being ran on.

Within AirTrack itself, data source interfaces and views / panel logic is separated by a central module named the **AirTrack's Flight Management System - FMS**. The FMS keeps a unique copy of all relevant flight parameters (such as coordinates, speeds, traffic) and updates this data independently at times (e.g. ETA at waypoints, TCAS predictions or NavAids captures). Flight sources such as simulators or device sensors report and receive data to/from the FMS via interfaces (such as HSMP).

On the other side of AirTrack there are panels, i.e. views, which display the data from the FMS in a predefined expected format (e.g. PFD, ND, MCP). This means that two panels of similar types when running side by side will display the same data as it is sourced from the FMS's unique copy. A change in data will be reflected in all panels seamlessly, just as a change in settings and so forth. This allows for horizontal scalability of panels which can be tiled side by side and configured differently to display the same data in multiple formats (for example imagine an ND in MAP mode with range 40 and another ND in PLAN mode with range 320, both displaying the same aircraft's position).

Finally there is a third level of interfaces to the FMS which are neither flights nor panels; these provide access to third party external APIs such as weather models, ATC networks, Cloud Services or NavData sources, are a examples of these.

This layered block architecture coordinated by the FMS allows keeping functionality independent and thus the app to scale without any theoretical limits; have as many panels, flight sources and external APIs as technically possible, all interfacing to the same flight model simultaneously.

AirTrack was designed to run on multiple screen resolutions and sizes. In platforms that support it, panels can be resized to various sizes and tiled together. On the Mac, a panel can also run in full screen using the entire display (e.g. 4K/5K), and different panels can run on different displays.

## 5. WINDOWS, FRAMES, BUTTONS AND NAVIGATION

On screens that are big enough to support it, AirTrack runs with a hard frame / bezel contour on each panel. This frame has a metal texture and comprises different visual elements that make it look like a panel from of a plane's cockpit. The frame has buttons around it, which vary in layout depending on the panel in use.

The buttons on the top and bottom side of the frame are called control buttons. They perform different tasks within each panel, which are described below.

The buttons on the side of the frame (left and right) are line selector buttons (LSK). They are usually dynamical in number, depend on the height available, and present options for selection. Pressing them causes the entry next to them to be selected. Tapping on the text entry itself has the same effect as pressing the button, which is, to select it.

Buttons may have different colours to represent different states; a pale grey means the button is currently disabled while a lighter white means it is in standby, ready to be pressed. An amber colour means it is armed and pending action, and a blue or green colour means that option is currently activated.

There are two special buttons that are present in almost every panel: On the top left of the frame there is a **backwards** arrow button, and represents **Going Back** to the previous state in the app when tapped. If the back button is pressed for a longer time (press and hold, 1-2 seconds) it returns to the launcher panel. On the top right there is a **square** looking button which represents **Switch to Full Window** mode.

All panels can be viewed in either framed or full window mode. In full window mode only the inner contents of a page are shown and the frame itself is hidden. In order to return to framed mode, all panels accept a **double tap**, or **double click** which restores the frame. In summary, press square to go into full window mode, and double tap to get back to frame.

When the window space is too small, either by squeezing it on a Mac or by using multiple panels on an iPad, the hard frame is replaced by what is called a soft frame. LSK buttons turn blue and the buttons next to it disappear, so they can only be selected by clicking on the words. Control buttons are also displayed on the top or bottom of the window but without the 3D button visuals and with short words only instead.

If a window is wide enough there may be still two columns of buttons in soft frame mode. If not, they revert to one column only.

## 6. THE LAUNCH PAD

In most cases, AirTrack starts off with a panel called the Launch Pad. This is the root menu of all other panels. On the Mac and iPad, pressing **Back** will always return to the launch pad eventually. On the iPhone the Launch Pad is located on the right most tab bar icon identified as "MORE".

Pressing LSK buttons on the launch pad leads to other sub-sections and panels.

On macOS it is also possible to open new windows by selecting them from the File menu. Each of them can be launch pads themselves.

On iPadOS new windows can be spawned by using the Split View, Slide Over or Stage Manager options.

On iPhone / iOS, only one panel can be launched at a time due to its limited screen size.

The screenshot below depicts a launch pad window on Mac:



The different launch options can be seen on screen. We'll go through each of them individually in separate sections, but there is one special option which is self explanatory; LAUNCH, as the name suggests, spawns a new launch pad window.

## 7. PURCHASES - PRODUCTS AND SUBSCRIPTIONS

While perhaps the least appealing of all panels, this panel is essential and allows the user to purchase additional content. There are two types of purchase possible:

### 7.1 ONE TIME PURCHASES

Unless some kind of maintenance service is required, almost every module in AirTrack app can be purchased once and used forever. This may well be more cost effective in the long run, but comes with an implied additional cost too: as more modules are made available in the future, they will need to be purchased separately as one time purchases.

### 7.2 SUBSCRIPTION PURCHASES

Alternatively to one time purchases, AirTrack allows all of its features to be access by the means of a time limited subscription. Subscriptions are renewed automatically at the end of their period, but can be canceled or upgraded at any time before expiry.

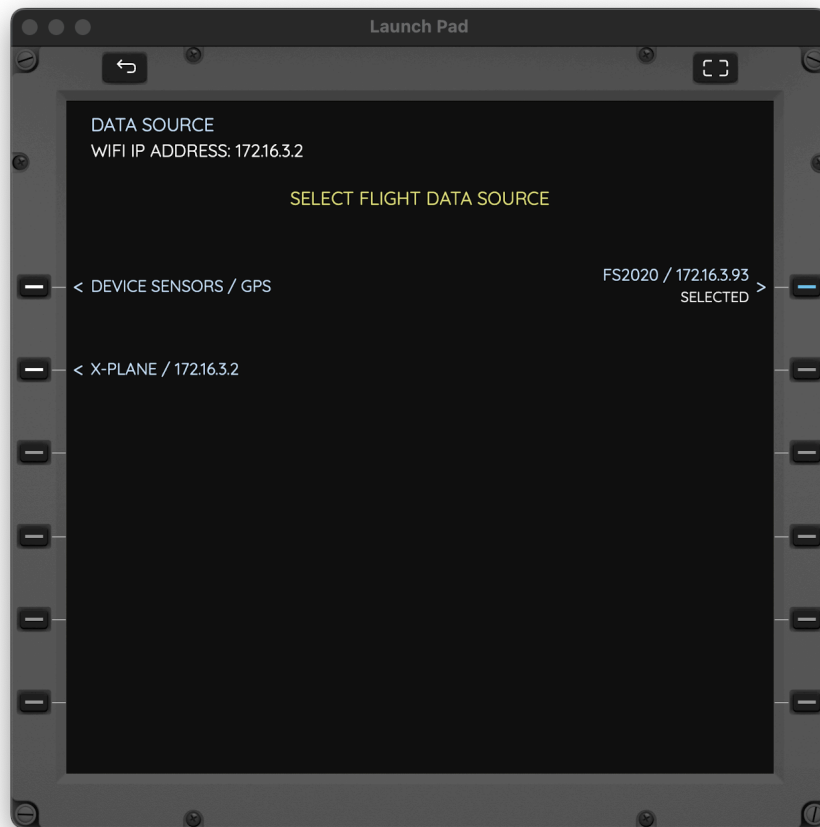
Subscriptions seamlessly give access to any future modules and products that may be released. They are also a way of incentivising us to continue developing AirTrack and bringing new features into being.

## 8. DATA SOURCE

The next relatively important selectable option in AirTrack is the **DATA SOURCE** page. It allows the selection of which flight data source (simulator) to connect to.

AirTrack comes with an embedded source called **DEVICE SENSORS / GPS** which makes it act as airplane avionics using the device's available sensors, i.e. GPS, Gyro, Compass, and thus forth, if available. It allows the simulation of a real flight from the surrounding environment. Access to it is requested on startup and can be denied if the user only intends on using AirTrack with a flight simulator.

Alternatively, as plugins are run on the local network with their simulators, they appear as selectable options on the **DATA SOURCE** page. See screenshot attached providing three possibilities of connection, Sensors, X-Plane and MSFS2020:



In most cases you won't need to visit this page; this is because sources are auto selected in the following order: 1) If a simulator is available it is auto-selected 2) If not, and if Device Sensors are granted access, this source is auto-selected. As most users only run one simulator at a time, it will always be auto-selected as soon as it becomes present on the network.

Auto-detection is done using multicast and sending packets to IP address 239.224.224.1 and UDP port 2423. This works on most systems but not all. If a simulator is running with a plugin and doesn't appear here, it may be necessary to add the AirTrack's IP address manually. In this case, note down the WiFi IP address on the top left of the screen and configure it on the plugin as a static IP.

## 9. AIR TRAFFIC

AirTrack comes with the capability of flying around surrounding Air Traffic and ATC. When enabled, these planes will appear in systems as as Navigation Displays as targets when TCAS is enabled, or in ATC radar panels. This page allows its configuration which is relatively simple:

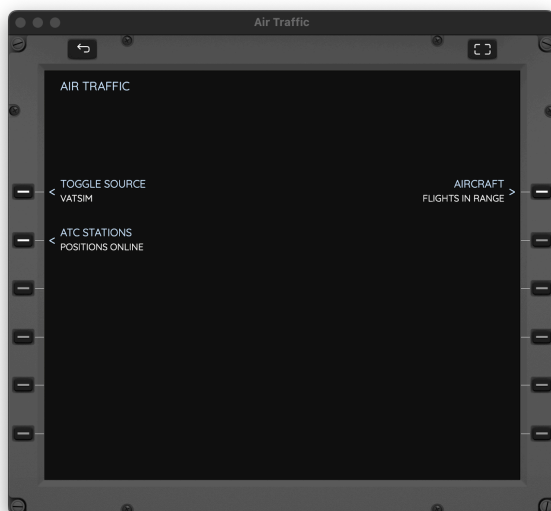
The **TOGGLE SOURCE** LSK switches the Air Traffic source between:

- **DISABLED** - No Air Traffic
- **FROM SIMULATOR** - Traffic is sourced from the simulator's AI. This is currently only available for X-Plane and not for MSFS2020.
- **VATSIM** - Traffic is sourced on the online VATSIM ATC network. Updates usually occur every 60 seconds only.
- **IVAO** - Traffic is sourced on the online IVAO ATC network. Updates usually occur every 60 seconds only.
- **REAL WORLD** - Traffic is sourced in an online ADS-B network of which Haversine takes part. There may or may not be coverage in your area, but when there is, users will see real planes in the sky as targets, so they'll fly along real world planes! This is a complementary best effort service provided by Haversine. Updates are real time as ADS-B messages are received, so every few seconds while in reach.

The **SIMULATOR** options requires the sim to be connected and support it.

The **VATSIM**, **IVAO** and **REAL WORLD** options require a working Internet connection.

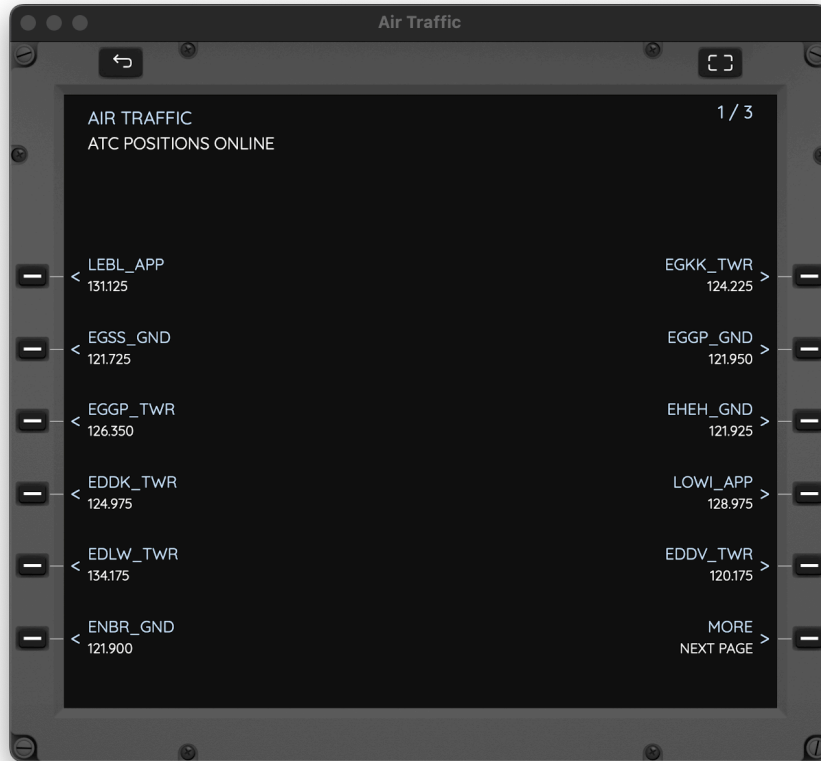
The **AIRCRAFT** LSK leads to a page showing surrounding aircraft, sorted by distance from us. Some screenshots below:



CALLSIGN	BRG	DIS	ALTITUDE	SPEED
-----	204°	5.5	3450 ↑	216
EJU76TR	290°	15.2	9875 ↓	357
ADM993P	175°	16.9	1475 ↑	118
-----	246°	17.6	13275 ↓	328
TAP16AL	197°	31.4	16900 ↑	338
DELML	066°	32.2	2425 ↓	112
RVP203	143°	35.3	2400 ↓	98
EXS24NX	094°	35.9	34050 ↑	511
RVP125	115°	41.6	3300 ↓	86
TAP059	247°	44.0	16575 ↑	365
AEA194	357°	48.5	40400 ↓	520
AEA056	339°	50.6	42975	516
DLH88X	031°	63.0	19675 ↓	324
TAP28TR	171°	65.8	28650 ↑	391
RYR7FH	053°	69.4	37000	411
ADM399	093°	72.3	4500 ↑	87
EJU82BN	107°	79.6	34900 ↓	389

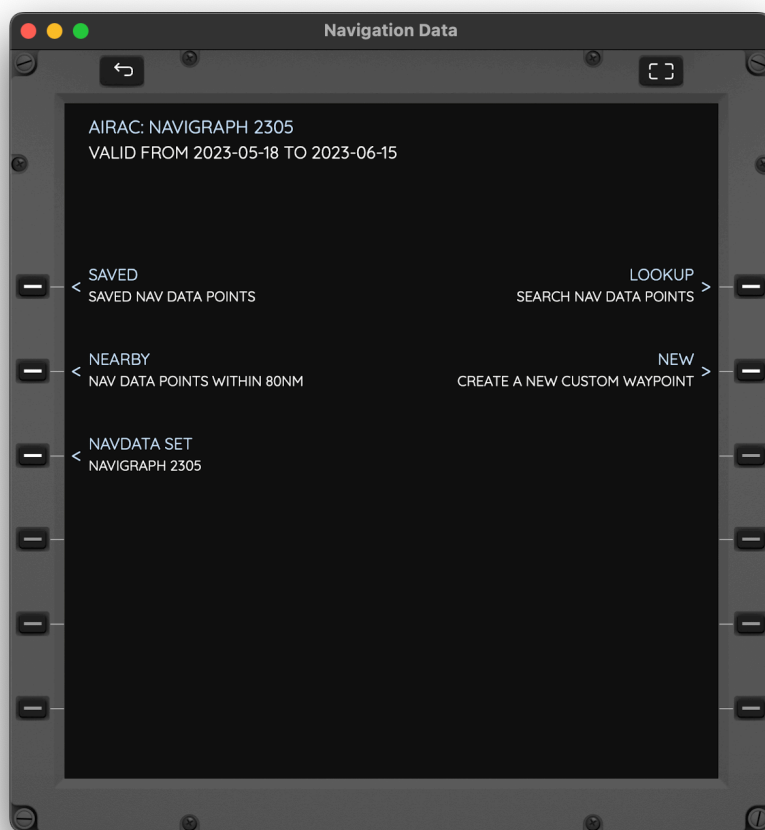


For the VATSIM and IVAO sources, the **ATC STATIONS** LSK displays the controllers currently online. Selecting them allows their respective frequency to be tuned into COM1 or STBY directly.



## 10. NAVIGATION DATA

Whether it is to create a flight plan, to proceed directly to somewhere, to perform a CAT III ILS approach or to know which frequency to tune, AirTrack heavily relies on a navigation database to operate to which we refer to as an AIRAC.



At first tap on **NAVDATA SET** to select. Different options will show up. If the nav data is out of date a warning is also displayed momentarily.

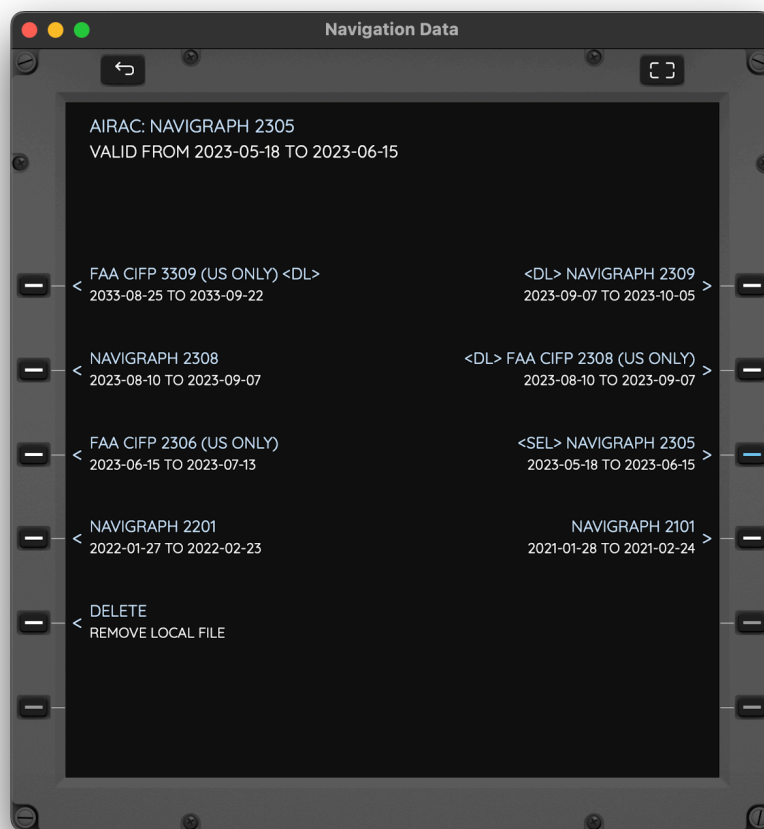
A set, or AIRAC, contains object such as Intersections, VOR/TACANs, NDBs, Airports, Runways, Localizers, Departure, Approach and Arrival procedures, Enroute Airways, Communication Frequencies, amongst other relevant navigation data.

## 10.1 NAVDATA SET

By default AirTrack ships with a significantly out of date AIRAC for demonstration purposes, i.e. with data that is most certainly no longer current and or valid. Do not ever use this data for anything other than flight simulation.

Navigraph subscribers have then the option of logging onto their account there and seeing their products displayed in AirTrack; in this case, the latest Navigation Data cycle for the current AIRAC period. Again this data is for Flight Simulation purposes only and should never be relied upon for anything other as it may as well be invalid or incomplete.

Lastly, with an entitling subscription, users may also download FAA CIFP nav data for the current cycle, which is then valid and current, but has the drawback of only covering the United States.



Tapping on a cycle allows its selection. If the cycle is not yet present on the device, it is downloaded from either Navigraph or Haversine depending on its type. An Internet connection is required for this.

It then stays on the device and subsequent selections will not trigger a download. In order to conserve storage space users may delete older AIRACS files no longer in use from the device by selecting DELETE.

Typically a Navigraph cycle uses 170MB of storage and an FAA cycle uses 26MB, although this is not guaranteed and may change in the future and data is added or removed.

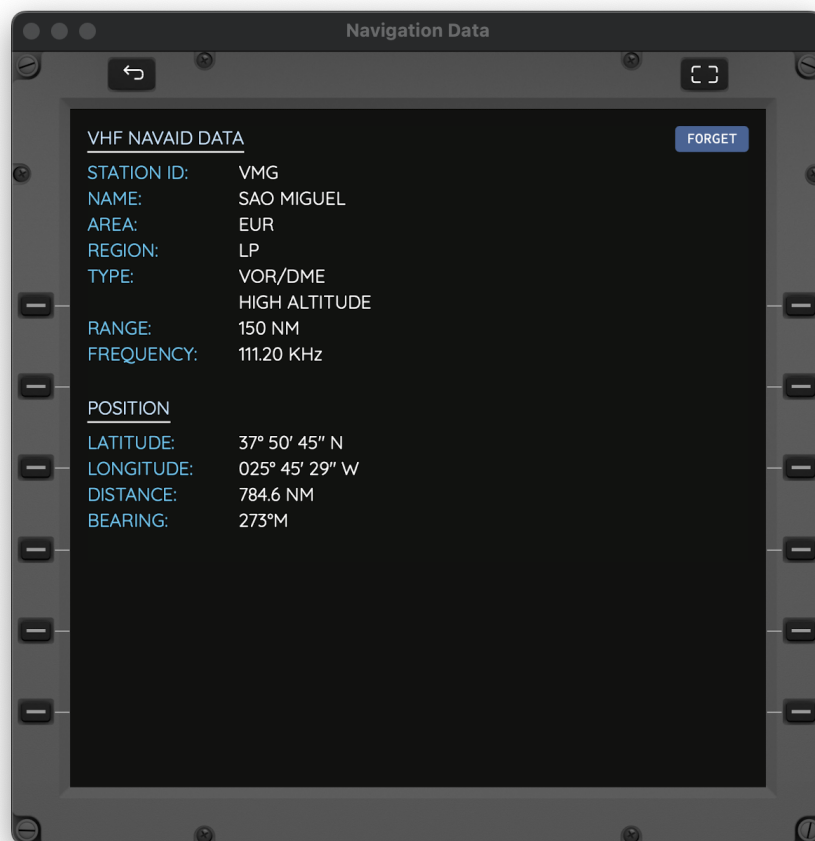
## 10.2 NEARBY

Once an AIRAC has been selected, its database contents can be queried using either the NEARBY, LOOKUP, or SAVED LSKs.

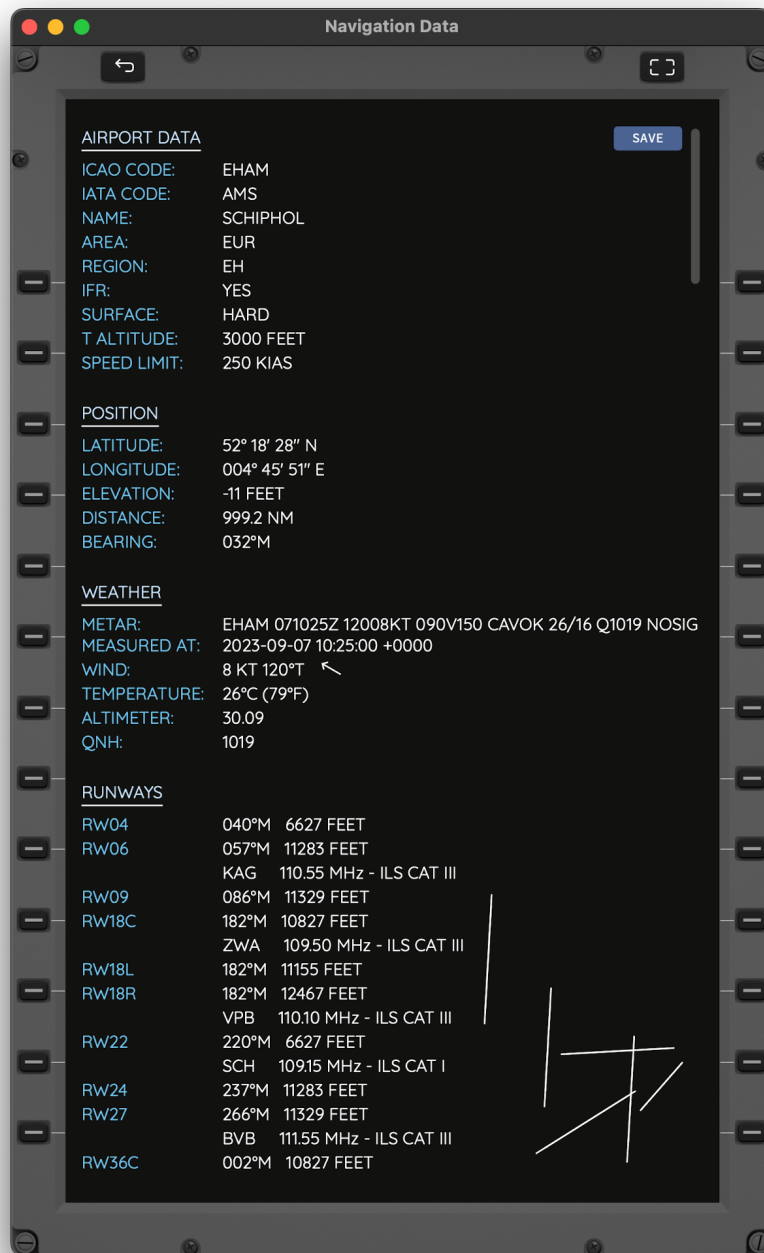
The NEARBY leads to a sub-page which allows the selection of the type of object to query between AIRPORTS, VOR/DME/TACAN, FIX, NDBS and CUSTOM WAYPOINTS. More on the latter ahead.

Within each of them a list of all objects within a range of 80NM of the current position is shown. If AIRPORTS are selected then a list of surrounding airports and airfields is shown. These are the airports present in the selected AIRAC set.

Tapping on each of the objects reveals information about it as well as position relative to us. Intersections will have type and areas, VORs will have their frequency too and so forth.



Airports contain a lot of useful information that may be used for flight planning. Take the following screenshot for Amsterdam Schiphol for example:



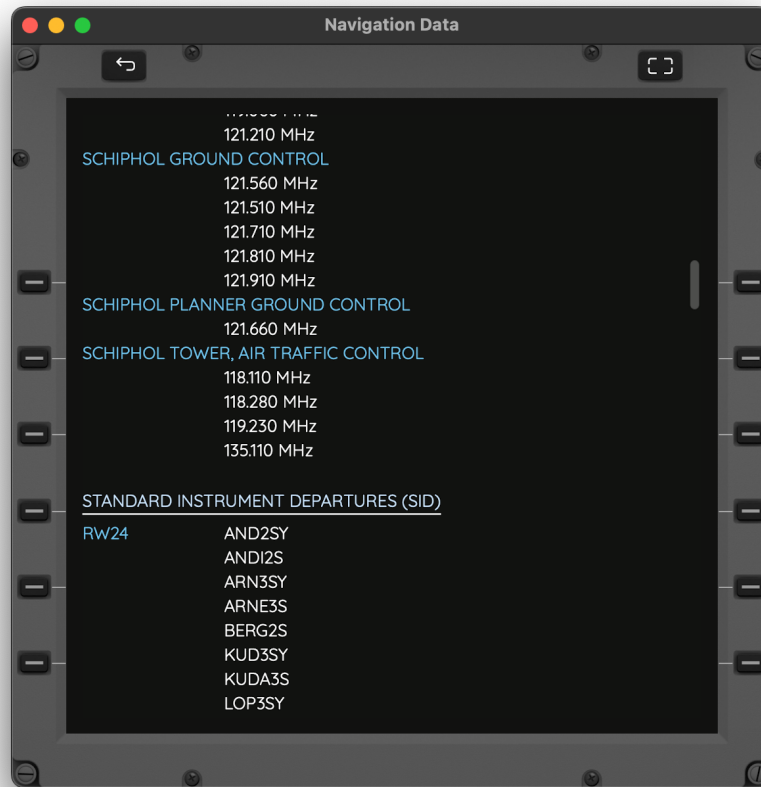
The first section reports on the airport or airfield, name, area, type of surface, transition altitude or level if they have been defined, as well as speed limits.

The second section provides position information relative to us as well as elevation.

At the point of loading a METAR request is performed over the Internet and the third section reports the current weather conditions at the given field. These are real world conditions as published on the METAR and not simulator conditions. They will match the simulator however is the flight is using real world weather, and will usually match the conditions present on VATSIM and IVAO who also use real world conditions.

The fourth section contains a list of runways at the airport, their length and heading. If a runway has a localizer or GLS, information about it is also displayed, such as its frequency or channel.

Next to this section a little drawing of the runways is displayed, giving an overall simplified view of their orientation and relative positioning.



The details page is scrollable. Scrolling down reveals additional information; communications frequencies, then the list of all SID, STAR and Approaches procedures for that airport.

Any of this NAVDATA objects can be saved for quick access later; in order to do so click on the blue button saying **SAVE**. The button should turn to **FORGET** which when clicked upon will cause the reverse, i.e. the object to be unsaved.

When using an Air Account (more ahead) in Settings, saved objects will also be uploaded to the cloud air account and will be downloaded to other devices using the same air account. In other words, when using an Air Account, if an airport is saved on a device it will appear as saved on all devices that share that account.

### 10.3 LOOKUP

Lookup provides a way of looking up any given navdata object by entering text that matches its name, identifier or ICAO/IATA code for airports. For example in order to find Chicago Ohare the words "KORD" or "CHICAGO" could be used. Results are shown sorted by distance from current position.

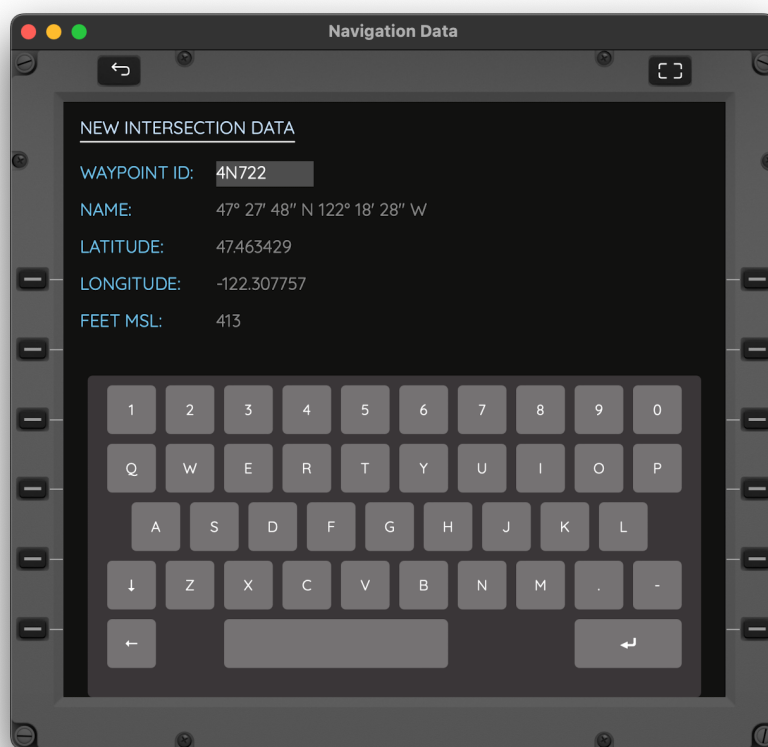
## 10.4 SAVED

Saved allows quick access to the points that have been previously memorised. It also allows quick access to objects that have been saved on another device using an Air Account. Again they are sorted by type and then presented on a list.

Bear in mind that while saving an object, that object must still exist on the selected AIRAC. If a user saves an airport and then switches to an AIRAC that doesn't contain that field, the airport will be displayed as a position instead as no data on it will then be available other than its coordinates.

## 10.5 NEW - CUSTOM WAYPOINTS

The last bit of navigation data available for navigation are custom waypoints. These are intersections, with an optional elevation, that are created by the user and given a short code / ID and a name. Once saved they can be used just like any other FIX to create flight plans or mark positions. They can also be used to create VFR points of interest by specifying their coordinates.

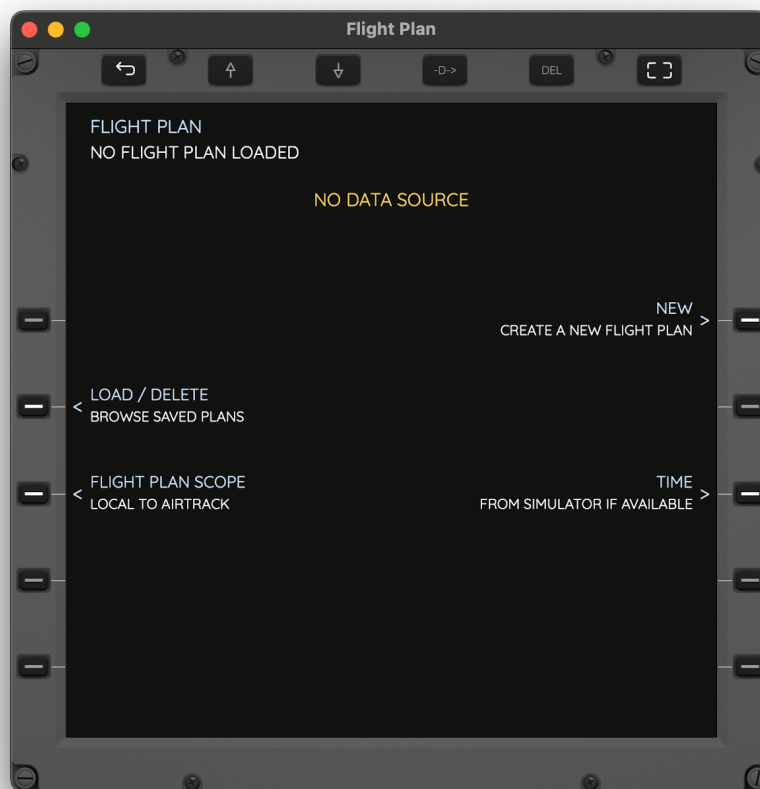


Custom waypoints are user specific and are independent from the AIRAC in use. Thus they persist when changing the nav data set. The ID part is the short name that is displayed in navigation displays or flight plans, equivalent to an ICAO code for airports.

Like standard types, custom waypoints are uploaded to the cloud if an Air Account is in use, and are presented to other devices for immediate use. Furthermore the online access of the Air Account allows listing them, updating them, or creating new ones using a web browser.

## 11. FLIGHT PLAN

The Flight Plan page allows users to manage just that, a flight plan to be flow on the simulator and to be displayed on Navigation Display pages and other parts of AirTrack. When entering it, you should see a page similar to the one below. Click on each of the LSKs to select an option.



### 11.1 FLIGHT PLAN SCOPE

By default, and if both the plugin and the simulated plane allows it, AirTrack receives the loaded flight plan from the simulator at periodic intervals. Any changes made on the simulator are then seen reflected in AirTrack. Depending on the simulator and plane, it may or may not be possible to write to the flight plan (in cases / planes where you can only do this through the CDU for example). In this case the Flight Plan is deemed read-only in AirTrack and cannot be updated from it, even though it is shown and visualised in relevant pages. All this happens when the scope is set to **INTERACTS WITH SIMULATOR**.

Alternatively the flight plan scope can be set to **LOCAL TO AIRTRACK**. In this case the plan exists only in AirTrack; any updates received from the simulator are ignored, and any changes made in AirTrack are not sent to it. This is especially useful when the plane being flown doesn't support any type of flight plan integration, or when using a datasource such as Location Services for example where no simulator exists.



## 11.2 TIME

This option affects the flight plan timing and all its measurements throughout the app. If set to **REAL TIME / USE DEVICE TIME**, all times will be real time ZULU. In other words, if the ETA to a given waypoint is 1800Z (displayed in the Flight Plan Details and Navigation Displays for example) that is actual real world time.

The other option is **FROM SIMULATOR IF AVAILABLE**. In this case the simulated time is used to report time sensitive data, i.e. if you're simulating a flight at 2am during January at 4pm in August, 0200Z will be displayed.

## 11.3 SAVE

This option saves the currently loaded flight plan on file so it can later be loaded in a single shot. Enter a plan name and press return to save.

If the user has an Air Account and is SIGNED IN, this option also uploads the flight plan to the cloud. The flight plan can then be viewed on the web site, or loaded onto other devices sharing the same Air Account.

## 11.4 LOAD / DELETE

Reversely, provides a list of flight plans to load from file or Air Account in a single shot.

In order to delete a flight plan, first press the DEL key on the top right; this will enter DEL mode. Then select the LSK of the flight plan to delete to have it erased.

## 11.5 LOAD FROM SIMBRIEF

If the user has a Navigraph account this option allows the last flight plan generated / dispatched on SimBrief to be directly imported and activated as the loaded Flight Plan. The plan can subsequently be edited, adjusted, or even saved locally. This option requires a login to Navigraph which is the same login used for NavData sets, so once logged into the session remains valid for both types of data / updates.

## 11.6 NEW OR EDIT

This option is only available with simulators / planes that support flight plan writing, or if the scope is set to Local. It allows a plan to be created from scratch, or edited, and leads to a new page with various options:



There are 4 ways to initialise a new flight plan; by entering an origin and destination airport, by pressing INIT, by loading from file, or by entering a route directly.

Entering an **ORIGIN** and **DESTINATION** is the most common way and inputs for the ICAO codes of the origin and destination airports respectively.

Alternatively, by pressing **INIT**, the flight plan is initialised with one single LATLON waypoint at the current coordinates. In other words the plan starts where we are currently and goes to any subsequent waypoints.

The flight plan can also be initialised by just entering a route. More on this ahead, but this could be used to create a flight plan along FIX waypoints only, without any actual airports.

In 99% of the cases, flight plans will have origin and destination airports and several other options are then revealed. Taking the screenshot below as an example after entering EGLL as the origin and EHAM as destination:



Most of the options are self explanatory, **RUNWAY** allows the selection of the respective runways, **DEPARTURE**, **ARRIVAL** AND **APPROACH** allow the selection of procedures (for the selected runways if selected). These are based on what is available in the currently selected AIRAC. When a procedure is selected, the points corresponding to it are added to the flight plan.

When selecting a runway, if current METAR information is available, the words "WIND BEST" will be shown with runways that are best candidates with regards to facing against the current wind direction.

## 11.7 ENTER ROUTE

The next step is to enter the actual route to be flown. For the purposes of route AirTrack considers the sequence of waypoints and airways between origin and destination, excluding the airports themselves, the runways, and the procedure points. If a SID is selected the first point of the route should typically be the same as the last point of the departure. Likewise the last point of the route should match the entry point of a STAR if one is selected.

A route can be entered by just typing in the sequence of waypoints separated by space. If an airway is specified it should be preceded by the entry point and succeeded by the exit point AirTrack will then decode all interim points of that airway and add them to the flight plan.

Example of a route: FIX AIRWAY FIX AIRWAY VOR AIRWAY FIX NDB

## 11.8 WORLD ROUTES

The flight planner comes with a built in feature that provides suggested routes that can be loaded with one click. When any two airports are given, AirTrack performs a query to cloud services and attempts to find routes that are usually flown between those airports. This is an Internet based operation so it requires connectivity to the Internet.

If found, these are then displayed as options, sorted by preference i.e. most likely adequate routes are shown first.



Currently the WORLD ROUTES feature is achieved by observing routes usually filed on VATSIM and by counting the number of distinct times they are filed. If a route is very often used on VATSIM it is then fair to assume that that route is as real as it gets and suitable to be flown.

In the future the criteria under which world routes are derived may changed and be improved with other networks and sources, but the most preferred routes will always be shown first.

Note that world routes may not be available for a given pair of airports. Also note that in some cases it may not be possible to load a world route; this could be either because the route has old waypoints or airways that are no longer valid, or because the currently selected NAVDATA set may be out of date and may not contain all the required points.

## **11.9 CRUISING ALTITUDE**

Cruising altitude may be used to give an indicative expected cruising altitude for the flight.

### **11.10 CLEAR**

Clears / unloads the flight plan

### **11.11 ACTIVATE**

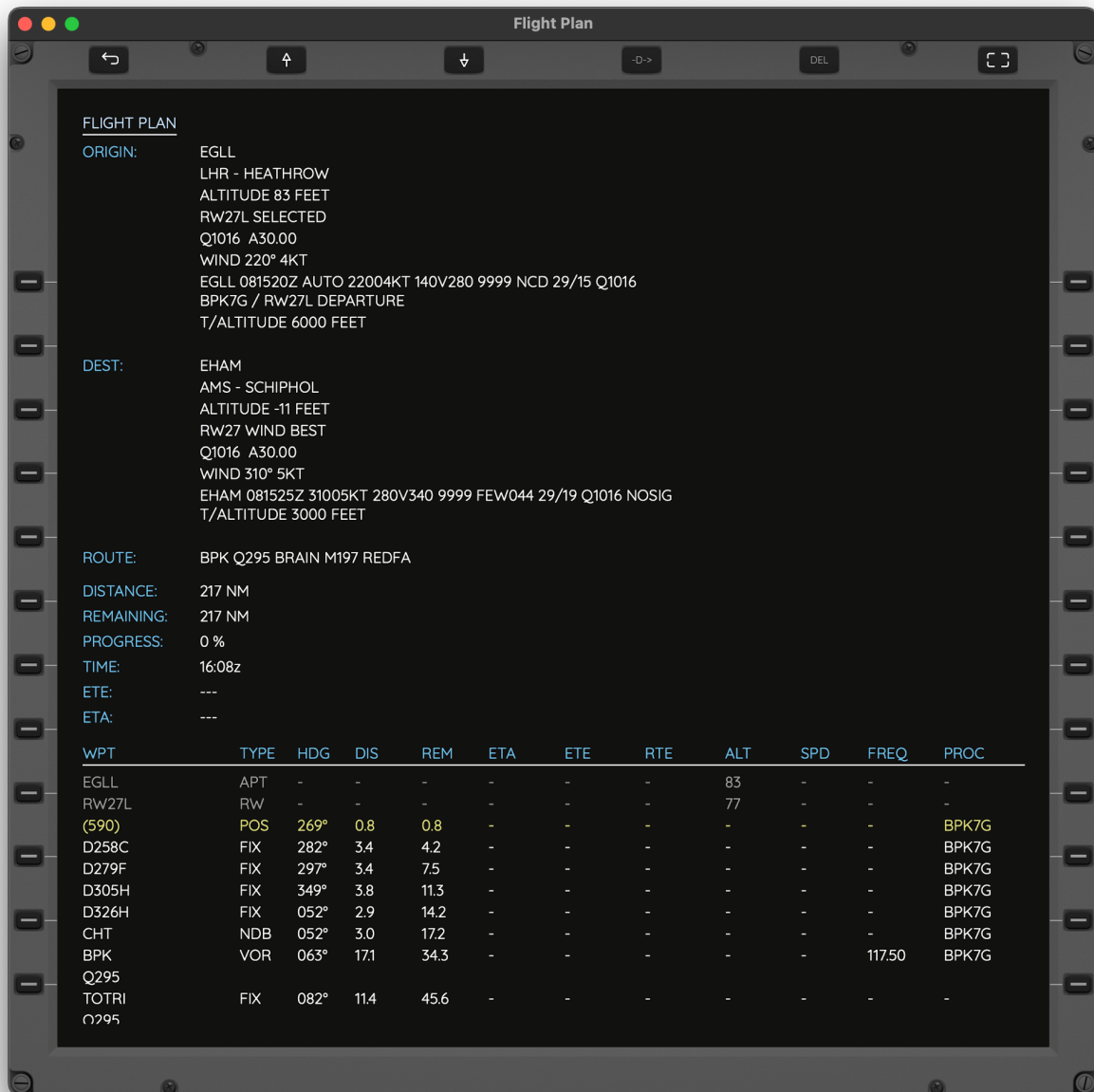
Initialises the flight plan by settings its first active leg as the first waypoint after departure.

### **11.12 DIRECT TO**

The direct to option allows the flight plan to be adjusted in order to go directly to a given waypoint. If the waypoint is on the currently loaded route, it is set as the next active waypoint. If the waypoint does not exist on the currently loaded route, the flight plan is erased and a new flight plan is created from the current location to the direct-to point given.

### 11.13 VIEW

Discloses a new page showing the flight plan in detail. This page is scrollable up-down. The following screenshot depicts a possible flight plan between EGLL and EHAM:



The ORIGIN and DEST sections represent the airports and options chosen. They may include:

- ▶ ICAO Code
- ▶ IATA code followed by airport name
- ▶ Runway
  - If selected, the runway will be shown with the word **SELECTED** following it.
  - If not selected, and if weather information is available and significant, the flight plan will attempt to suggest the best runway or runways to take off or land and will follow these by the words **WIND BEST**. These suggestions are displayed exclusively based on the current direction of the wind and by selecting the runway that more closely approaches it. At

present it does not take into account factors such as runway length or the existence of ILS for example. In other words it says, "given the current weather conditions, and assuming that you are able for all runway lengths and equipment, this is the best selection / angle to take off/land against wind". It gives a relatively good estimate of which runway is in use but this may not always be the case so always check with ATC.

- QNH / ALTIMETER - The current real world values in use sourced from the METAR
- WIND direction and speed, as present on METAR
- METAR in raw form, may or may not be available and is downloaded from the Internet. If so it depicts the current real world weather conditions, not the simulated conditions. Runway selection, QNH, Altimeter and Wind are based on this.
- T/ALTITUDE and T/LEVEL if available - Transition altitudes for the airport in question.
- SID, STAR and APPROACH procedures if selected

Following ORIGIN and DEST, the flight plan details then show the entered route (excluding procedures), the total and remaining distance, a progress indicator (if en-route), the current time and estimated values if en-route and moving.

The flight plan is then shown as the complete sequence of waypoints and airway memberships, one per line, containing information regarding the ID, type, relative bearing, leg and renaming distances, ETA, ETE and RTE (cumulative ETE) if the plane is moving and it can be estimated, as well as altitude and speed expectations if available from the simulator or defined through CRUISING ALTITUDE. This information depends on the space available and fewer fields may be displayed in narrow sized windows or devices. If possible, enlarge the window to see more.

#### 11.14 UP / DOWN / DIRECT TO / DEL

In order to select and proceed directly to a given waypoint (activate it), use the UP and DOWN arrows to select it and then press -D-> to go direct to it or DEL to delete it from the flight plan.

## 12. THE 737 NG MODE CONTROL PANEL

The mode control panel (MCP) is responsible for interacting with the simulator's plane auto-pilot controls and to display status information regarding this. Note that some planes may not have some functions, or not have auto pilot at all.

This version of AirTrack implements an MCP similar to that of Boeing 737 NG class of planes. When used with other planes, functionality may be adapted to provide a default behaviour. In the future, other MCP variants and panels will be made available in AirTrack.

The following picture depicts the general appearance of the MCP. Depending on window size, buttons will layout in different places attempting to adjust. In narrow screens such as the iPhone, keys and dials are split and organised by group functional pages in one of Speed, Heading, Altitude and Auto Pilot Master Switches.

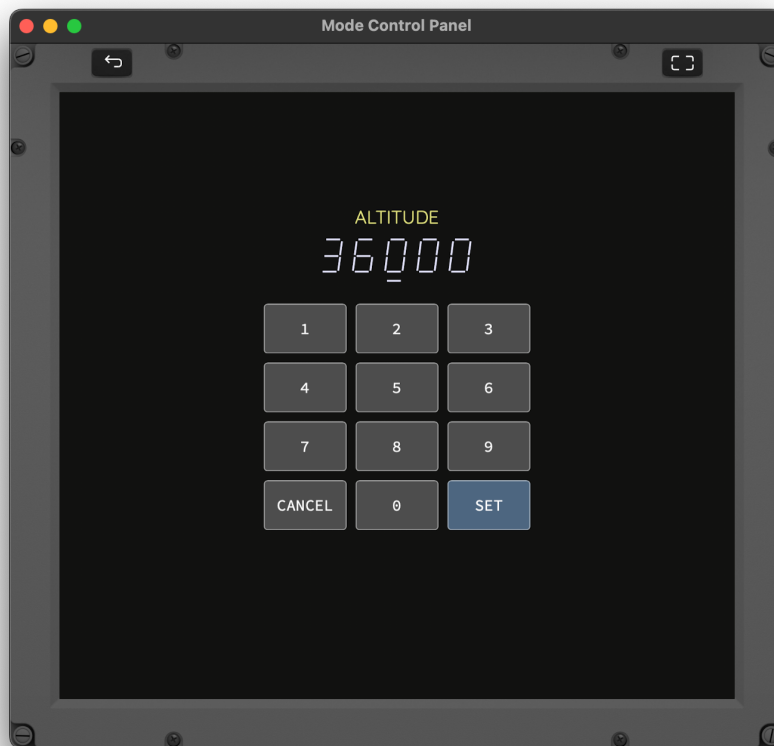


The square or rectangular shapes are buttons. Whenever they are tapped or clicked upon, an action is sent to the simulator instructing it to be pressed. The simulator may respond to the event or ignore it, depending on the plane being flown and if whether or not it supports that given button. Green shading of buttons indicates that their status is on or engaged.

The layout is in every way similar to the original Collins MCP found in the 737 NG.



The big numbers represent the MCP dials. In order to change a dial tap or click on the number that represents it. A new sub-window will appear similar to the following one:



Tap on each of the digits to select it and move to the next one. When ready click **SET**. The entered value will be sent to the simulator and, if accepted, will then be received from it back and will be displayed as the active value on the MCP. This provides a very quick way of entering new values without much hassle or having to wait for rotary encoders to reach the desired number.

## 12.1 BUTTONS

### FD

This represent the Flight Director states of Captain and Co-Pilot sides. Selecting them toggles the state.

### AT

Toggles the Auto-Throttle arm on and off.

## **N1, SPEED, LVL C AND VNAV**

Engage in one of the speed control modes.

### **C/O**

Swaps between IAS and Mach speed setting.

### **S/I AND A/I**

Speed Intervention and Altitude Intervention buttons. They are not defined for most planes and do nothing, but on planes that support it, actuate on the corresponding events.

### **ALT H AND V/S**

Engage Altitude Hold or Vertical Speed Mode

### **HDG S, LNAV, VOR L, APP**

Engage HDG SEL, LNAV, VOR/LOC or Approach modes for lateral and vertical (GS) navigation.

### **CMD A, CMD B, CWSA, CWS B, DISCONNECT**

Enable / Disable the auto pilot. Normally for most planes only CMD A is needed as they may only have one auto pilot. **DISCONNECT** causes all AP functions to stop at once.

## **12.2 DIALS**

- IAS/MACH DIAL - Speed for AP to follow
- HEADING - The heading of the plane
- ALTITUDE - The target altitude in feet
- VERT SPEED - Vertical Speed in feet per minute
- COURSE - 1 (LEFT) and 2 (RIGHT), correspond to OBS1 and OBS2 or course to consider on ND captain and first officer.

## 13. THE RADIO COMS PANEL

The Radio Panel in AirTrack displays of the aircraft's radio frequencies, allows the user to enter new frequencies and modes in each of the radios available.

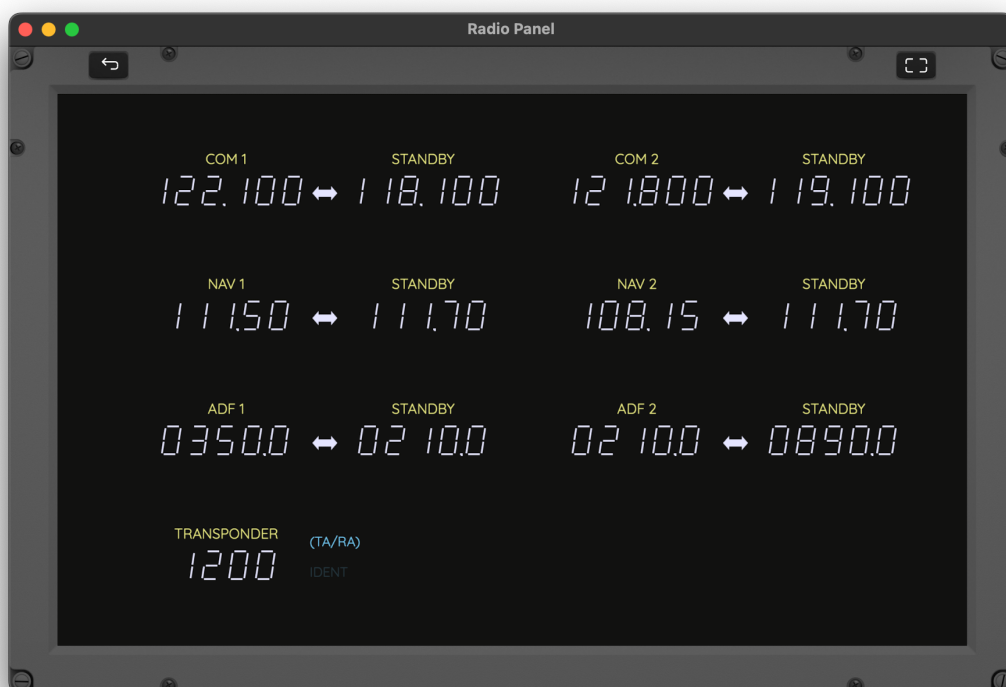
Each AirTrack instance has the capability of representing 7 radio units, namely:

- 2 x Navigation Radios named NAV1 and NAV2 with frequency ranges from 108.00MHz to 117.95 MHz and 25kHz spacing
- 2 x Communication VHF radios named COM1 and COM2 with frequency ranges from 118.00MHz to 136.975MHz and 25kHz or 8.33kHz spacing.
- 2 x Automatic Direction Finder radios named ADF1 and ADF2 with frequency ranges from 190kHz to 1750kHz
- 1 x Transponder Unit with a 4 digit octal transponder code

The NAV, COM and ADF radios each have an active and a standby frequency which can easily be swapped by pressing the **Transfer** (double sided arrow) button. AirTrack allows users to enter the frequency directly and with immediate effect into the radio by tapping on its active number, or to enter in the standby frequency by tapping on the standby number.

Much like the MCP, the RADIO stack has dials which can be tapped upon and quickly updated, plus a couple of buttons which are just text areas in this case, to control the transponder.

The following picture depicts one of its general views:



### 13.1 MULTIPLE RADIO PANELS

Depending on the size of the window (or device) in use, radios are either organized in a single page or are split between 4 pages, namely COM, NAV, ADF and XPD. In other words, in large display devices such as the iPad full screen, all radios are displayed at once, whereas on smaller devices such as the iPhone, radios are split between functionality pages.

The user can tap on a number to open a new window and then tap on the desired digits to enter a new value. Then tap on SET to set that frequency in the corresponding radio.

The frequencies are read from and sent to the simulator when one is being used as a datasource. In other cases the frequencies are kept internally in AirTrack and still allow for navigation to occur.

Some systems support multiple windows (Mac, iPad) and like other instruments, it is possible to display multiple instances of the Radio Panel. Unlike PFD and ND instruments however, these instances always relate to the same radios. This effectively means that if you switch NAV1 on one window, it will change the FMS's NAV1 frequency and this will reflect in all other radio panels, as well as any instruments that depend on it.

## 13.2 INTERACTION WITH THE PFD AND ND

The NAV and ADF frequencies directly influence and relate to some fields of the Navigation and Primary Flight Displays (i.e. to tune the nav-aid in use). As a general rule, NAV1 / ADF1 frequencies are used with the left side / captain and standalone instrument variants and NAV2 / ADF2 are used in the right side / first officer variant of these displays. Together with COURSE 1 and COURSE 2 of the Mode Control Panel, these frequencies and nav-aids allow NDs and PFDs to represent navigation indicators such as localizer or glideslope deviations. See the PFD and ND sections for details on this.

## 13.3 VOICE COMMUNICATIONS

The COM radios allow the tuning of ATC facilities. These are especially important when flying on a simulator with ATC as they allow the selection of the corresponding position on networks such as VATSIM or IVAO.

## 13.4 TRANSPONDER

The Transponder radio has a unique 4 digit octal code (the squawk code assigned by ATC). It also comprises a mode which can be cycled by tapping on it between TEST, STANDBY, ALT RPTG OFF, XPDR, TA ONLY and TA/RA. These last two modes enable the TCAS functionality on navigation displays by activating traffic and resolution advisory modes. In addition the transponder can be put on mode IDENT by tapping on the IDENT keyword.

## 13.5 SIMULATOR AND STANDALONE MODES

In most cases users will want to interact with a flight simulator, and providing it and its plugin support the radio interface, the Radio Panel will display the simulator's frequencies and will try to set them accordingly. There may however be cases where certain simulators don't support the radio interface, or more specifically, even if a simulator supports it, the particular plane being flown doesn't.

Imagine the case of flying plane Airbus 3XX in X-Plane for example, and you try to set a frequency in NAV1 in AirTrack but it reverts to the one set on the plane. Or that COM1 doesn't display the right frequency. This occurs when a particular plane has its own implementation of radios and doesn't follow the standard datarefs of the simulator for that purpose. If this happens you may still want to use AirTrack to navigate that plane. You can do this by selecting **Standalone Mode**.

This setting is available in the **INSTRUMENT SETTINGS** page of AirTrack under **RADIO STACK**. When selected (as opposed to **STANDALONE**) it effectively makes AirTrack keep its own version of the radio frequencies regardless of what the simulator reports and likewise will not attempt to write to them. AirTrack will thus act as an independent set of radios and navigation is therefore made possible by tuning the required nav-aid frequencies in it.

In summary, **SIMULATOR** mode attempts to read and write frequencies to the simulator (when this is supported) and **STANDALONE** makes AirTrack have its own set of radios which do not interact with the simulator.

Data-sources that don't support the radio interface (such as Device Sensors / GPS) always implement a **STANDALONE** mode regardless of this setting, i.e. they always have their own set of internal radios.

## 14. THE 737 NG PRIMARY FLIGHT DISPLAY

PFD panels are an essential part of AirTrack; they provide primary flight display which are updated in real time from the flight simulator and report things such as speed, altitude, heading and attitude, as well as flight state annunciators amongst other variables. They come in three variants, namely:

- Captain (left) side PFD with left side EFIS
- First Officer (right) side PFD with right side EFIS
- Standalone PFD with standalone EFIS

When launching a PFD the user is able to choose between one of the three modes. The same distinction exists and goes hand in hand with Navigation Display panels (described ahead).

The CPT side replicates the left side PFD of the plane and is associated with settings performed on the left side EFIS panel next to the MCP.

The FO side replicates the right side PFD and is controlled by the right side EFIS panel. In most planes there is no distinction and CPT and FO sides are mirrored and the same, but in certain planes that support it, they are presented separately.

AirTrack introduces a third type named standalone. In this type, each setting is local to the panel only and does not propagate to the simulator. This is particularly useful in Navigation Displays in order to have multiple NDs spawn simultaneously with different ranges, modes and display options.

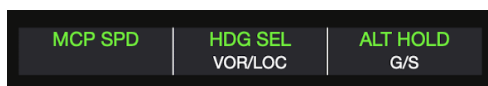
Another difference relates to the NAV radio they use for navigation. In the current version of AirTrack these are hardwired and the CPT side and Standalone PFDs always uses NAV1 radios for ILS approaches, whereas the FO side uses the frequency tuned into NAV2. The same applied for Navigation Displays and next / tuned waypoint (next section).

Currently AirTrack has one set of PFDs which is inspired in the PFD of the Boeing 737 NG family of planes included in the Boeing Instruments kit. In the future other plane types and PFD displays will be added.

The following picture depicts a typical view of the Boeing PFD in implemented in AirTrack NG with as much realistic detail as possible:



### 14.1 FLIGHT MODE ANNUNCIATORS



This is the rectangle on the top of the PFD with word boxes. They represent the speed mode (left column), roll mode (centre column) and pitch mode (right column). White keywords represent an ARMED state whereas green words represent ENGAGED. Modes are boxed for 10 seconds after being engaged. The following are currently possible modes:

Speed: ARM, N1, MCP SPD, FMC SPD, THR HLD, RETARD and GA

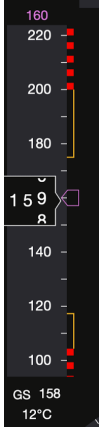
Roll: HDG SEL, VOR/LOC, LNAV. B/CRS, ROLLOUT, HDG HOLD, FAC, L VOR/LOC, L ROLLOUT, L FAC

Pitch: ALT HOLD, V/S, MCP SPD, VNAV SPD, VNAV PTH, VNAV ALT, TO.GA, FLARE, G/S, G/P, FLCH SPD, VNAV, G/P, G/S V/S, G/P V/S



Not all modes are available in all planes; in fact most planes will only have simple MCP SPD, ALT HLD, HDG SEL and such modes. The more specific variants are only displayed on special planes that support.

## 14.2 SPEED TAPE



On the left side of the PFD there is the SPEED TAPE. The value in the middle represents the current indicated air speed in knots (IAS) and the tape around it moves up and down with it. On the Device Sensors data source there is no IAS so this speed corresponds to GS, ground speed.

On the top in magenta reading 160 is the MCP IAS/MACH dialled speed, i.e. auto pilot speed. The magenta bug next to the central IAS follows it and positions itself on the tape according to the MCP speed. On the Boeing 737 NG the speed tape only starts moving at 45 knots. This can be overridden to a less standard behaviour in settings, making it move at any speed however small.

Below the tape there is the ground speed where it reads GS 158. This speed transitions to current Mach speed when mach is 0.4 and above and reverts back to GS when below 0.4. The box squares for 10 seconds when transitioning.

Below GS is a temperature. This is non standard, doesn't exist on the original 737 NG, and is provided as an add on goodie, enabled / configurable via settings. It is the outside temperature or OAT. On the Device Sensors source this is a simulation of the outside temperature by fetching the METAR temperature of the airport nearest to us, to it roughly represents how hot or cold it is outside.

The red and black tapes on the side of the speed tape represent maximum and minimum speeds for the aircraft, never to exceed, in the current configuration / flaps deployment. The orange extensions represent the maximum and minimum maneuver speed limits. Again, these may not be available for every plane, and are only displayed when available.

## 14.3 COMPASS



On the bottom of the PFD there is the compass. Depending on which mode AirTrack is set for, it represents the magnetic or true heading of the aircraft. The white line slightly deviated represents the course of the aircraft which can vary from heading due to side winds. It rotates as the plane's heading changes. The magenta 299H represents the MCP dialled heading, i.e. the auto pilot heading to follow in HDG SEL mode.

### 14.4 BARO

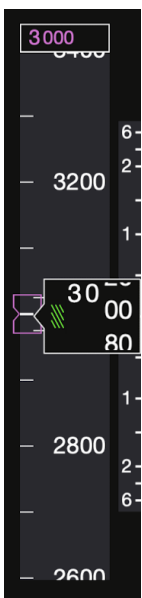


The section where it reads 29.92 is the BARO section representing the dialled altimeter setting or QNH depending on the settings mode we're on. Clicking on the **BAR** button switches between Altimeter and QNH. Clicking on + or - buttons increased or decreases it. Changing the altimeter / QNH also changes the indicated altitude as it depends on this setting.

Pressing the **STD** button changes the current air pressure to standard above transition altitude, i.e. 29.92 inHG or 1013HPA. In this mode a second pressure appears under the words STD which is the pre-selected pressure that can be adjusted. When pressing **STD** again the pre-selected pressure is transferred to the main baro setting. This would normally happen when descending back below transition level. Transition altitudes and levels are FL180 in the US and can be consulted for individual airports in the rest of the world in their NavData section.

With the Device Sensors source the baro setting is fixed to the air pressure / QNH currently measured. It serves no purpose other than indicating what it is outside. It can be configured from the settings menu to be sourced either from the METAR of the nearest airport, or from a pressure sensor if the current device has one.

### 14.5 ALTITUDE TAPE



On the right the on top or BARO pressure is the altitude tape. It moves up or down representing the indicated altitude in feet, which depends on the BARO setting and whether it is correctly configured. With the Device Sensors source this is either the GPS altitude or the altimeter derived altitude in devices that have a pressure sensor (iPhone). This is configurable via settings.

Similarly to speed, on the top in magenta is the MCP (auto-pilot) dialled altitude and next to it there is a magenta bug which positions itself accordingly.

Pressing the **MTRS** mode engages the metres display of altitude just above the main feet number reading followed by the letter M. On top of the tape the MCP altitude is also indicated in metres. Pressing **MTRS** again switches back to feet only mode.

### 14.6 VERTICAL SPEED



On the right of the altitude tape there is the vertical speed tape. It indicates climb and descent rates in feet per minute. A full number representation is displayed below when the speed is greater than 400 feet per minute.

### 14.7 MINIMUMS

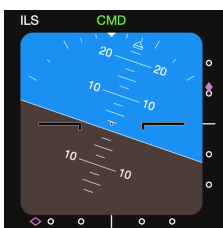
Using the **M+** and **M-** keys the minimums / decision height can be set, and is then represented in green just above left if BARO. It can either be BARO minimums in which case the word BARO will read, or RADIO minimums, in which case the word RADIO will read. If BARO, a green bug will also appear along the altitude tape indicating it.

Pressing the **MIN** button switches from BARO to RADIO and back. Pressing the **RST** button resets the minimums and hides them from the PFD.

The picture below illustrates a PFD in soft frame mode, without the metal bezel.



### 14.8 ATTITUDE



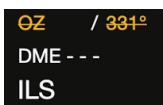
At the centre of the PFD there is the attitude display. It shows the roll and pitch in angles from the artificial horizon. It's land colour can be changed in settings.

If flight director guidance is enabled and supported by the plane, additional

magenta lines will appear in the centre and move according to the desired flight director path. The words OM, MM and IM appear on the top right corner of the AI when performing an ILS approach and crossing the outer, middle and inner marker respectively, if these have been defined. The words blink intermittently and an alert sound is also played.

With the Device Sensors / GPS source, the indicated attitude is the inclination of the device in 2 axis, roll and pitch. The other axis (yaw) is defined by the compass heading. In this situation the button named **CAL** will light up. When pressed, it calibrates the AI to the centre position regardless of which position the device is at, so that becomes the centre and any deviation from it is then measured in degrees. This is only available in devices that have a gyro and can provide attitude updates, e.g. iPads and iPhones, and not currently on the Mac.

## 14.9 APPROACH REFERENCE



When performing an ILS approach, on the top left of the Attitude indicator there is information regarding the approach.

The top line contains the tuned frequency or the ID of the localizer when captured. Next to it the MCP course is displayed. This is the left course for CPT and Standalone PFDs and right course (2) for FO PFDs.

If the NAV1 and NAV2 frequencies disagree (i.e. are not the same) the localizer ID or frequency appears crossed out in amber. Likewise if course 1 and 2 of the MCP disagree or differ, the bearing shown is also crossed out in amber. Thus, in order to perform an ILS approach make sure that NAV1 and NAV2 are tuned to the same frequency, and that the left and right course / OBS on the MCP is set to the same expected runway heading. You can find this heading from the corresponding airport's runway section in the navdata panel.

If the approach has a DME, the word DME will be followed by the distance in nautical miles until touch down. The ILS word appears under it if performing an ILS approach.

## 14.10 LOCALIZER POINTER AND DEVIATION SCALE



Below the AI there is a pointer / bug which moves left or right on approach indicating if the runway is to the left or to the right. It fills in with solid magenta when the bug is within 2.5 dots from the centre (i.e. near the localizer path). Each dot represents 1 degree of lateral deviation from the correct path.

When performing an ILS approach the goal is to keep the diamond in the centre dot.

## 14.11 GLIDE SLOPE POINTER AND DEVIATION SCALE



Similarly, on approaches with a glide slope, the magenta bug on the right of the AI represents the deviation from the desired altitude at that approach point. It fills solid when within 2.5 dots above or below the desired altitude. Each Dot represents 0.35 degrees of vertical deviation from the glide path.

## 14.12 RC - REMOTE CONTROL BUTTON

This button appears for pressing when AirTrack is connected to a flight simulator that supports remote control, and if the device being used has a gyro and is capable of generating attitude updates. When pressed it turns blue indicating that remote control is on. From then on, moving the device in any of the 3 spacial axis causes measured angles of roll, pitch and yaw to be sent to the simulator, acting on its control surfaces. In other words, RC enables **Joystick** mode where the device is the joystick and moving it in space causes the flight sim plane to react accordingly. Pressing RC again disables this mode.

## 14.13 FPV

The FPV control button actuates on Flight Path Vector of the respective EFIS panel on the plane if supported and implemented on the plugin.

## 14.14 CONFIGURABLE OPTIONS

In Settings -> Instruments -> PFD :

- IAS START SPEED - Defines if the speed tape starts rolling from 45 knots (the default in the 737) or from 0 knots
- OUTSIDE TEMPERATURE - Defines if OAT is shown below GS / Mach
- AI LAND COLOR - Toggles the color of the land on the AI from a more brownish to a more orange tone.

In Settings -> Navigation :

- SENSOR HEADING SOURCE - Defines if the heading is taken from the compass (if available) or follows the GPS track in the Device Sensor source
- SENSOR ALTITUDE - Toggles between the altitude reading from pressure sensor or from GPS in the Device Sensor source
- SENSOR QNH/ALTIMETER - Toggles between using the QNH / Altimeter from the built in pressure sensor (if available) or from the nearest airport's METAR

## 15. THE 737 NG NAVIGATION DISPLAY

Like with the PFDs, Navigation Displays in one of three modes:

- ▶ Captain (left) side ND with left side EFIS
- ▶ First Officer (right) side ND with right side EFIS
- ▶ Standalone ND with standalone EFIS

The Captain side relates to the left side EFIS panel of the plane, the First Officer side to the right side EFIS panel if one exists, and standalone simulate a totally independent panel for each ND. It is thus possible to have one ND open in APP mode for approach, another on MAP mode with a certain zoom level and yet another in PLN mode at another level.

In its current version AirTrack supports an ND that is based on the Boeing 737 NG / MAX family of planes. In the future more ND displays will be developed and made available within the app.

There is a lot to be said about the ND as it is an extremely advanced panel in AirTrack; in fact, possibly the most advanced of them all. Taking the screenshot below an example:



The control buttons on the top and bottom rows act on the respective EFIS panel. In the centre screen there is a navigation map or HSI.

## 15.1 MODE

The 737 navigation display supports one of 4 modes, namely:

- APP - For approach
- VOR - For VOR navigation
- MAP - The most used mode, displays a moving map along the path
- PLN - For planning and checking the flight plan

In addition, the APP, VOR and MAP modes support two variants, Centre (CTR) and Expanded (EXP) mode. EXP is the most used mode in that it only displays what lies ahead to a greater extent.

Pressing the **CTR** button switches between CTR and EXP modes.

Pressing the **MOD** button toggles between modes

The following images depict a same flight ND's on APP, MAP and PLN modes for comparison:



## 15.2 RANGE

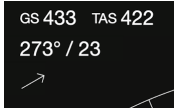
The ND supports one of 8 ranges, i.e. the distance in nautical miles to the perimeter of the ND circle. Range is shown on the map view with small white numbers next to the arcs. In the example above, the middle arc has the number 20 just above it, so the distance to the outer arc is 40, this the map is in range 40 NM.

The ND supports the following ranges: 5, 10, 20, 40, 80, 160, 320 and 640.

Pressing the magnifying glass + or - buttons increases and decreases the range by one notch.

### 15.3 SPEED / WIND

On the top left corner of the ND there is the Speed / Wind section.

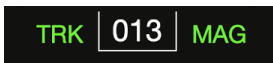


GS represents the current ground speed of the plane. TAS represents the True air speed. TAS is only displayed above 100 knots.

On the line below, if there are relevant winds, there is an indication of their direction and speed. In the above example, the wind is blowing from 273 degrees at 23 knots. The arrow just below them reflects the wind direction relative to the rest of the map / display, so if we change heading the arrow will move accordingly.

Winds are only displayed if speed is greater than 6 knots and hidden if drops below 4 knots. Also by default wind is only displayed when TAS is above 101 knots, although this can be overridden in settings.

### 15.4 TRK / HDG



The current Track or Heading is displayed on the centre top of the ND. Track is the direction to which the plane is actually moving whereas heading is the direction to which it is facing. With side winds they will differ by a few degrees as the plane needs to face a certain direction to compensate for the wind forces.

APP and VOR modes always display heading.

MAP mode displays track or heading depending on the plane configuration in settings. TRK is the most common / by default, whereas HDG is usually an airline option.

PLN mode doesn't display either TRK or HDG because it is always displayed North Up.

The words MAG or TRU follow the reading indicating if the plane is using magnetic or true north heading / tracks. TRU can be selected from a settings option and is usually only available on planes with the polar navigation option.



## 15.5 SELECTED RECEIVER VOR / ILS



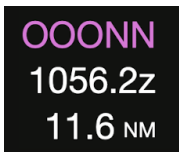
When using APP or VOR modes, the top right corner of the ND will show the selected receiver navigation reference. ILS1,2 is shown for APP ILS approaches, VOR1, 2 is shown for VOR mode. 1 and 2 refer to the NAV radios so captain side NDs will have 1 whereas first officer side will refer to 2 meaning they are using the NAV2 radio.

The tuned frequency is shown following this.

Below the selected course is displayed. This is the dialled course on the MCP and is the left side course or OBS1 for captain and right side course or OBS2 for first officer NDs.

If the VHF aid is in range, captured and has a DME, the distance to it will be down below following the word DME.

## 15.6 ACTIVE WAYPOINT



When flying in MAP or PLN mode, the top right corner of the ND displays the active waypoint being flown to (from the flight plan) in magenta.

If available, the expected time at which it will be reached is displayed below the waypoint ID in Zulu time, i.e. UTC.

Finally the remaining distance to it is shown below too.

## 15.7 DISPLAY OPTIONS

The 737 ND EFIS panel is equipped with a set of buttons that toggle the display of different objects of information on the display. These are WXR, STA, WPT, ARP, DAT, POS, TERR and TFC.

### WXR - WEATHER RADAR

WXR toggles the use of the weather radar. The current version of AirTrack doesn't support a weather radar but future versions may. In any case, the command is passed to the simulator's plane which may support and react to it.

In addition, when selected the WXR word appears on the bottom left side of the screen in cyan to indicate it.

The weather radar is only available in MAP, MAP CTR, APP and VOR modes. Furthermore it is mutually exclusive with Terrain mode (described ahead) so only one of them can be selected at a given time since they make different uses of the display.

In expanded modes, the weather radar causes range arcs to be displayed. The TFC option also causes range arcs to be displayed. If neither is active, range arcs are hidden.

### STA, WPT & ARPT

These three options toggle the appearance of "off-route" VHF stations, waypoint intersections and airports respectively. They are accompanied by cyan annunciators on the left bottom side of the ND to show their state. AirTrack also tints their buttons cyan when active.

These options / displays are only available in MAP and PLN modes. APP and VOR modes don't display off route waypoints.

If STA is selected, all nav aids are displayed in ranges below 80, i.e. 5, 10, 20 and 40. In ranges 80, 160, 320 or 640, only high altitude nav aids are displayed.

Off-route waypoints or intersections are displayed at ranges of 40 or below and are hidden at ranges at or above 80 to avoid cluttering. In addition to this, AirTrack filters out any terminal waypoints that don't belong to the airport being flown from/to in the flight plan.

Depending on settings, the AirTrack's ND displays will also display VFR waypoints together with their long descriptions.

Custom / user waypoints are always displayed.

On route points or manually tuned VHF nav aids are always displayed.

If there are too many waypoints on display, AirTrack produces the message **EXCESS DATA** in amber.

### DATA

The data switch toggles the display of additional data when showing the route being flown on the ND. If enabled, each waypoint will also contain the altitude or flight level at which it is expected, as well as the estimated time of arrival at it (ETA). This is only available in MAP, MAP CTR and PLN modes.

### POS

In MAP modes only, if the POS option is enabled and a valid VOR signal is being received from one of the selected navigation sources, VOR radials to it are displayed towards VOR1 and VOR2. In ADF navigation the relative bearings towards the NDBs are displayed instead.

**TERR - TERRAIN**

Terrain mode / display is available in MAP, MAP CTR, APP and VOR modes. It is not shown in APP CTR, VOR CTR or PLN modes.

The original 737's terrain option is displayed based on altitude above ground and how high a plane is from it, with red, amber, green and magenta colours. It also usually comes with the option of VSD on the navigation display. The current version of AirTrack does not support this mode even though this is in the roadmap.

AirTrack is however shipped with map data of the whole world (which partially explains its large app size) and the terrain option makes use of this in order to display a map of the world land mass, with stressed out contours, and including rivers and lakes. The image below illustrates a screenshot of AirTrack on an iPad, with a PFD on the left side and an ND with TERR mode enabled on the right, as it flies over the ocean approaching land.



Terrain mode and weather radar mode are mutually exclusive.

## 15.8 TFC - TRAFFIC AND TCAS

The AirTrack FMS implements its own Traffic Collision and Avoidance (TCAS) system based on surrounding air traffic. The source of such traffic can be set to the flight simulator's AI traffic, but can also be set to external sources such as VATSIM or IVAO traffic and ADSB real world traffic. The implementation is full in that it doesn't depend on the plane being flown on the simulator, and as such TCAS is available at all times.

In order to enjoy full TCAS, make sure the transponder is set to TA/RA mode in the radio settings.

The 737 NG Navigation Display module displays TCAS information as calculated by the FMS following its specification in the Boeing's operations manual and according to the following criteria:

1. Surrounding aircraft are shown in the ND in MAP, MAP CTR, APP and VOR modes only. They are thus not shown in APP CTR, VOR CTR or PLN modes.
2. Aircraft are detected if they are within a 80NM horizontal range and within 2700 feet upper or lower from the current altitude MSL being flown. Upper and Lower extended ranges are not currently implemented.
3. By default, aircraft appear in their relative positions on the ND in a non filled white diamond shape. If their relative altitude is available, it is represented above or below the symbol with a plus or minus sign and a two digit number. This number represents the relative altitude to us in hundreds of feet, so a target reading +03 is said to be flying 300 feet above us and a target with -15 is 1500 feet below our current altitude.
4. If the intruder traffic is climbing or descending at a rate of +/- 500 feet per minute or more, and if this information is available from the source, an arrow indicating UP or DOWN is displayed next to the symbol, revealing that the aircraft is climbing or descending accordingly.
5. Traffic is only displayed if TA or TA/RA transponder mode is enabled. In this case the TFC annunciator will show TFC in cyan on the lower left region of the ND. Traffic is also only shown if the TFC option has been enabled (pushed) on the EFIS control panel.
6. For ND ranges of 80NM or lower and when traffic is being displayed, a circle made of 12 dots is drawn around our current position, representing a range of 3NM. In other words, anything within those dots is less than 3NM from our current position.
7. In addition to standard traffic the TCAS system is able to calculate the closest point of approach and determine if the traffic represents a threat according TA and RA criterion.
8. TA traffic is advisory only and does not require resolution; pilots should just stay alert and look for the traffic. A TA condition is met if the traffic will be nearest to us in a window of 20 to 48 seconds (depending on altitude and manoeuvrability) and if it falls within our protected window

which is currently defined as +/- 850 to 1200 feet vertically and fixed at 3.3NM range horizontally.

When TA traffic is present the ND will show this traffic as it did for the standard traffic but in amber and a filled circle.

In addition the **TRAFFIC** warning will be displayed in amber on the right of the ND as depicted in the picture below. This **TRAFFIC** sign is always displayed in all modes and regardless of TFC being enabled or not.

If the target is outside the range of the ND, the warning **OFFSCALE** will also be displayed on top the world TRAFFIC.



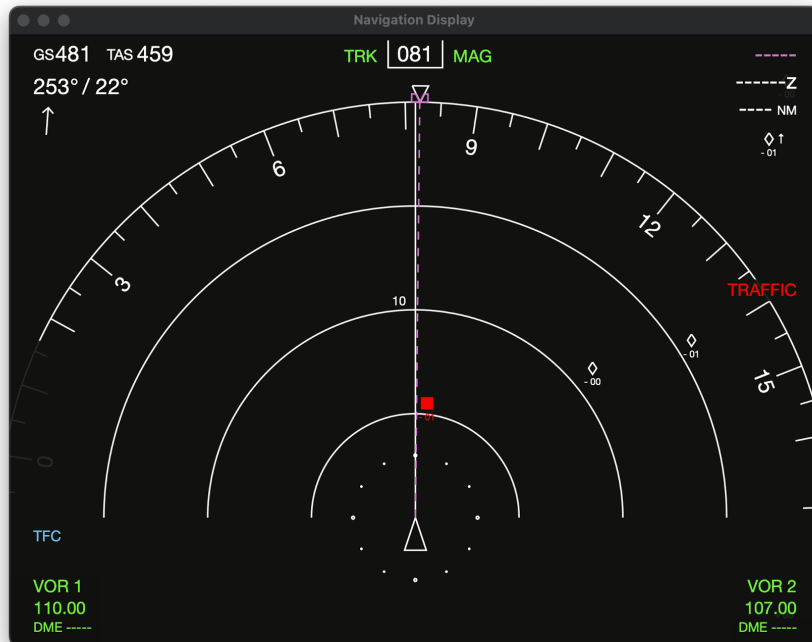
9. In addition, the TCAS FMS is able to calculate traffic that is in collision course and therefore requires resolution. The aircraft voice systems will normally shout this accordingly. Unlike TA traffic, RA traffic is displayed in red and as a square on the ND. Like with TA, the annunciators **TRAFFIC** and **OFFSCALE** are presented, but in red. If there are both TA and RA aircraft in range, the annunciators will display in red.

RA traffic is considered a threat if its closest point of approach is in 15 to 35 seconds (depending on altitude) and it conflicts with the protected window which is defined as +/- 600 to 800 feet vertically and fixed at 2.1NM horizontally.

RA traffic is only displayed if the transponder is set to TA/RA mode. If TA only mode is selected they will not be displayed and will be replaced by TA targets (as they will meet their requirements). The cyan annunciator **TA ONLY** will be displayed on the lower left of the ND under TFC.

Furthermore RAs are only available when flying at 1000 feet above ground or higher, so if not airborne or below 1000 feet AGL, RAs are automatically converted to TAs and **TA ONLY** is shown.

The following image depicts an RA target being displayed on the ND:



10. If targets are not considered a threat as TA or RA, but if they lie within 6NM and 1200 feet from us, they are considered proximity traffic and are displayed in a filled diamond shape instead of the standard traffic's unfilled form.

11. If TCAS is off or unavailable (not selected as transponder mode for example) the **TCAS OFF** annunciators are shown in amber on the lower left of the ND to represent this state.

## 15.9 ROUTE, PLAN MODE AND STEP

When a flight plan is entered in the FMS, its route is displayed in ND panels accordingly as a sequence of starts and magenta lines. It appears in MAP, MAP CTR and PLN modes only.

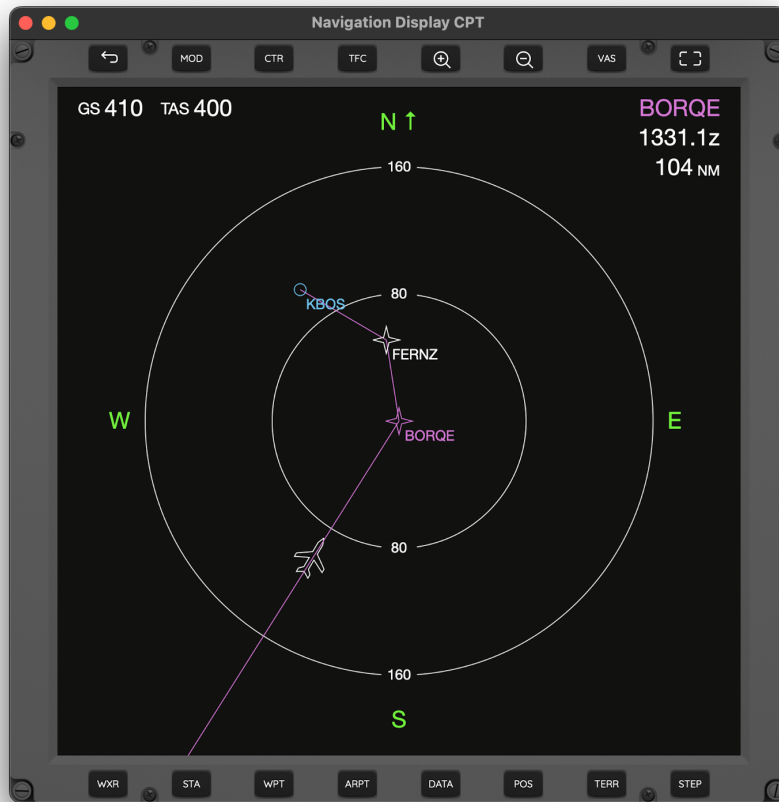
Take the following screenshot as example; the magenta star on BORQE represents the next (active) waypoint whereas white stars represent other waypoints on the route. An airport is represented as a circle, as a circle with a little dash if a runway has been defined and ranges is 80 or above, and as a full detailed runway if one is defined and ranges are at or below 40.



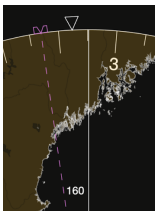
PLN mode allows the examination of the route / flight plan. It is always displayed with true north up, much like on a map. Unlike in other modes, PLN mode is centered on the waypoint rather than on the aircraft's current position. This is currently the active / next waypoint, but for planning and verification purposes, the ND allows stepping through each of the route points and have the map centred on it at each level.

This stepping is usually achieved with a specific LSK on the MCDU, but because not all planes have this option, AirTrack implements this as its own standalone concept and has its own dedicated button for named named **STEP**. In order to see it in action, switch to PLN mode with a flight plan loaded and click on STEP to see the flight plan centre on each of the waypoints ahead at a turn.

The following picture illustrates the ND in PLN mode, centered on BORQE:



## 15.10 HDG / TRK AND AP BUGS



When in APP, VOR or MAP modes, and depending on them, the ND usually face the heading or track vertically. In any case, the inverted white triangle represents the heading. The white line drawing from the centre represents the track.

The magenta bug, plus dotted line in APP, VOR, MAP and MAP CTR (not in APP CTR, VOR CTR or PLN) represents the dialled autopilot heading select course.

## 15.11 VOR / ADF NAVIGATION

This type of navigation is achieved by switching the ND to VOR mode and takes into account the NAV1, NAV2, ADF1 and ADF2 radios.

Each ND has two VOR/ADF selectors and allows referencing against two VOR or ADF stations. On the real 737 this is done through two switches on the EFIS panel. AirTrack achieves this with one single key named **VAS**. Tapping on it will toggle between modes. The lower left and right corners of the screen will tell if VOR, ADF or OFF mode is select. If in VOR the word VOR is displayed in green. If ADF, the word ADF is displayed in cyan. Otherwise the corner doesn't display any identification.



As an example let's imagine we're approaching VOR ACK - NANTUCKET. We tune its frequency, 116.20 MHz, on NAV1, switch to MAP mode, and select POS.



The radial to the VOR is identified as 244; rotate COURSE 1 to 244 so it becomes in line with the radial and switch to APP mode.



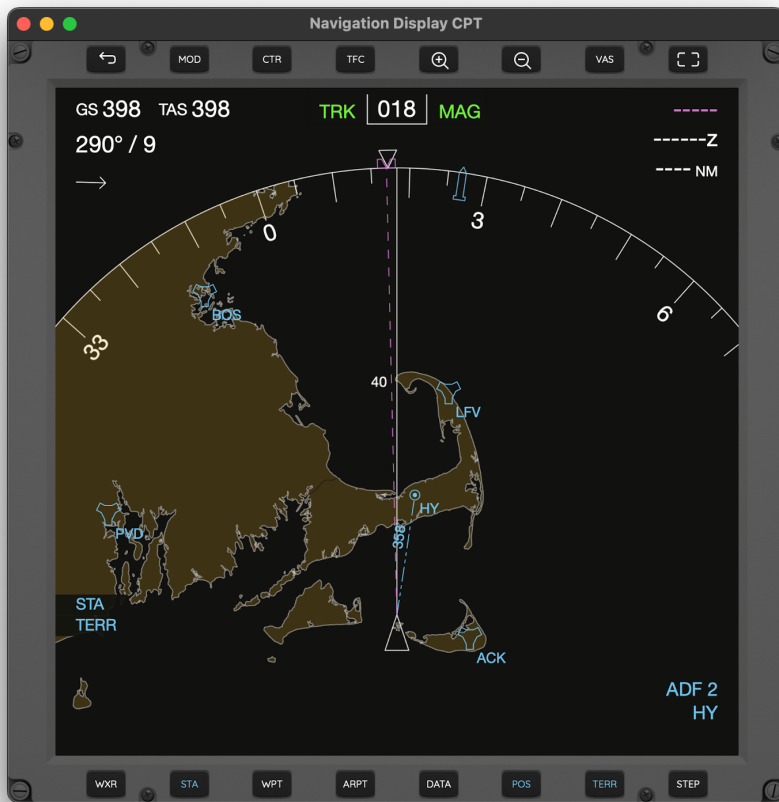
You'll notice the message EFIS/MODE NAV FREQ DISAGREE in amber. This is because you are currently in APP mode but have tuned in a VOR, meaning VOR mode should be selected instead. The same message will appear if a localizer is tuned in and the ND is in VOR mode indicating the reverse, i.e. that it should be in APP mode for ILS approaches.

Now switching to VOR mode:

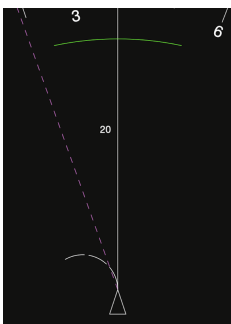


You'll notice the middle magenta bar in the centre, meaning we are in line with the VOR's radial. We should then adjust our course to it and keep the bar in the middle. Each circle either side represents 5 degrees of deviation in VOR mode.

Now let's take the NDB HI - BOGEY HYANNIS at 342kHz on ADF2 and switch off VOR. The following picture illustrates it; the cyan arrow on top of the circle points to it and because we have POS on, a line is drawn towards it too.



### 15.12 ALTITUDE RANGE ARC AND POSITION TREND VECTOR



When climbing or descending, the green arc shown represents the point at which the MCP altitude will be reached based on the current vertical and ground speeds.

The white arc at the nose of the plane represents the position trend vector, and where the there plane will be at the end of 30, 60 and 90 seconds respectively. In the range of 20NM, only two segments are shown (30, 60) and when below 10NM only one segment is shown (30 seconds).

### 15.13 ILS / APP MODE

APP mode is used to perform ILS approaches. As an example let's assume we are landing in KBOS - Logan International.

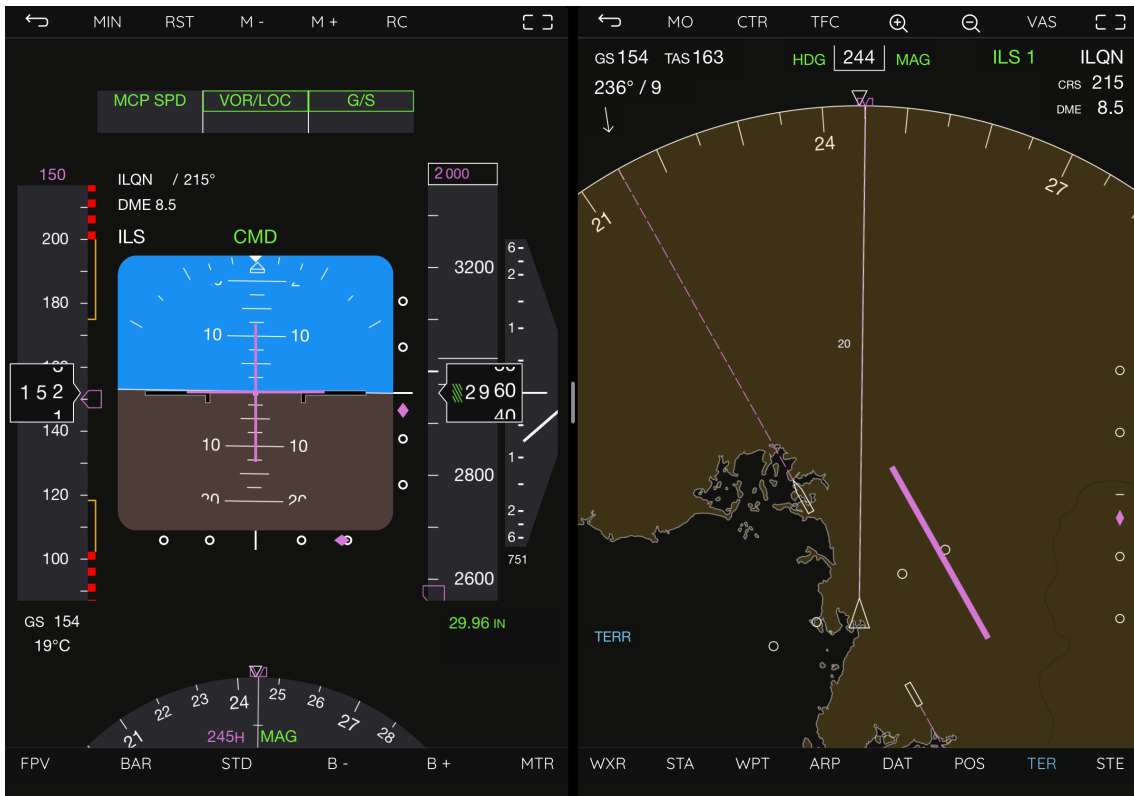
A brief look at Navigation Data for KBOS reveals that wind is from 220 degrees at 10 knots and as such runway 22L is best. We tune 110.30 MHz in both NAV1 and NAV2. The current altimeter in Boston is 29.96 so we set this in BARO on the PFD. The runway heading is 215 degrees so we set this on both COURSE 1 and COURSE 2 of the MCP. Reduce speed, set flaps, get on an intercept course for the approach and press APP on the MCP to arm both LOC and GS.

APP mode shows the same lateral deviation bar that was shown in VOR mode now aligned at 215 degrees. It's side slip represents the deviation from the desired course where each round dot is 1 degree deviation (thus maxes out at 2.5 degrees).

The following image shows the PFD and ND in APP mode pre-capture. Notice that the top right portion has the localizer ILQN identified at 10.3NM distance.

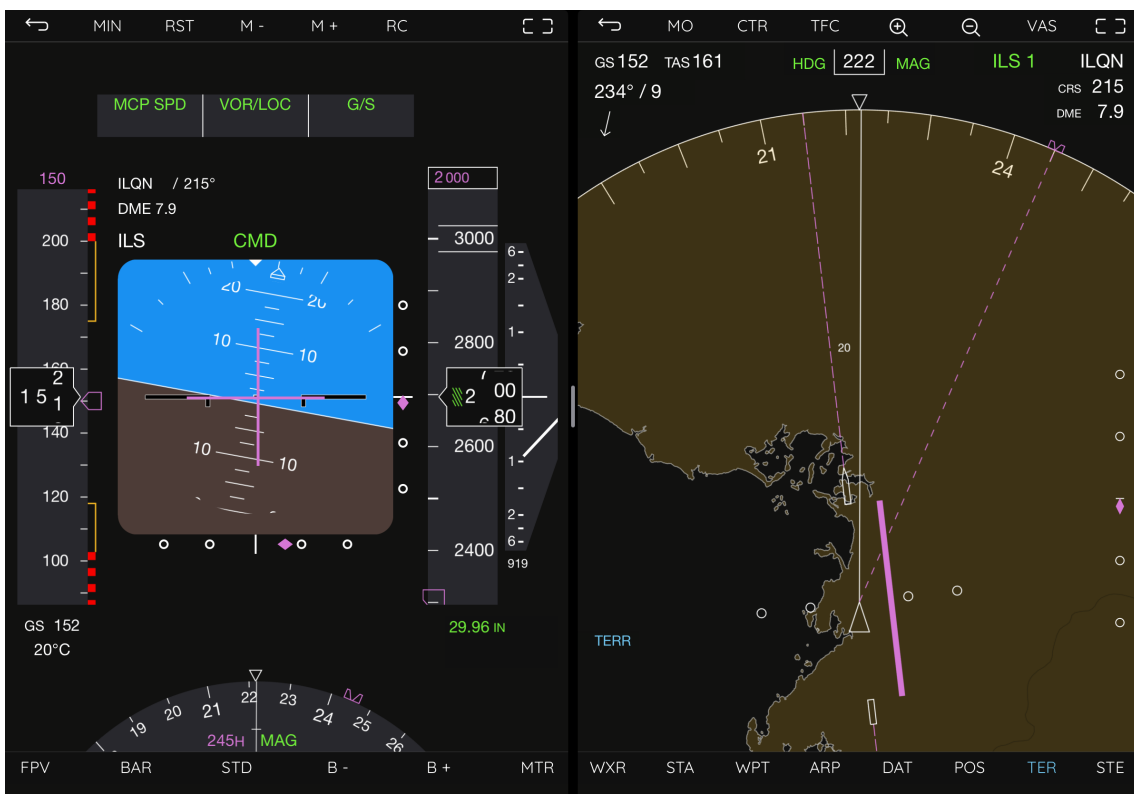


When captured the plane starts to turn and the magenta bar starts moving towards the middle.



Notice also the position the side magenta diamond which keeps in the middle meaning it is in line with the glideslope.

A bit closer, also adjusting vertical speed as we were too high:



When fully aligned the following screen illustrates the position of the needles. And that's it, touch down soon.



## 15.14 CONFIGURABLE OPTIONS

In Settings -> Navigation:

- HEADING REFERENCE
- FIX / WAYPOINT TYPES
- FLIGHT PLAN SCOPE
- AIR TRAFFIC SOURCE
- SENSOR HEADING SOURCE

In Settings -> Instruments -> Navigation Display

- MAP MODE / HDG OR TRACK UP
- PLANE TRAIL / LEAVER OR HIDE
- SHOW WINDS BELOW 101KT TAS
- TCAS CALLSIGN DISPLAY OR NOT
- TCAS ONLY WHEN AIRBORNE OR ALWAYS
- TCAS SHOW ALL TRAFFIC / ENVELOPED WITHIN 2700 FEET

## 16. EFB CHARTS AND DOCUMENTS

The **EFB FILES** panel allows storage, browsing and viewing of PDF documents and approach charts in Electronic Flight Bag style. While primarily planned for charts and approach plates, it can be used for browsing any other PDF documents relevant to the flight dynamics too; aircraft operations manuals, checklists, or any other relevant notes.

### 16.1 BROWSING FILES

EFB charts and documents are stored in a directory style structure similar to a filesystem. Starting from the root level, there are folders levels. Each level may contain either sub-folders or files. Selecting the corresponding LSK enters the folder or displays the file.

Tapping or clicking on the back key returns to the previous level (or closes the file display mode).

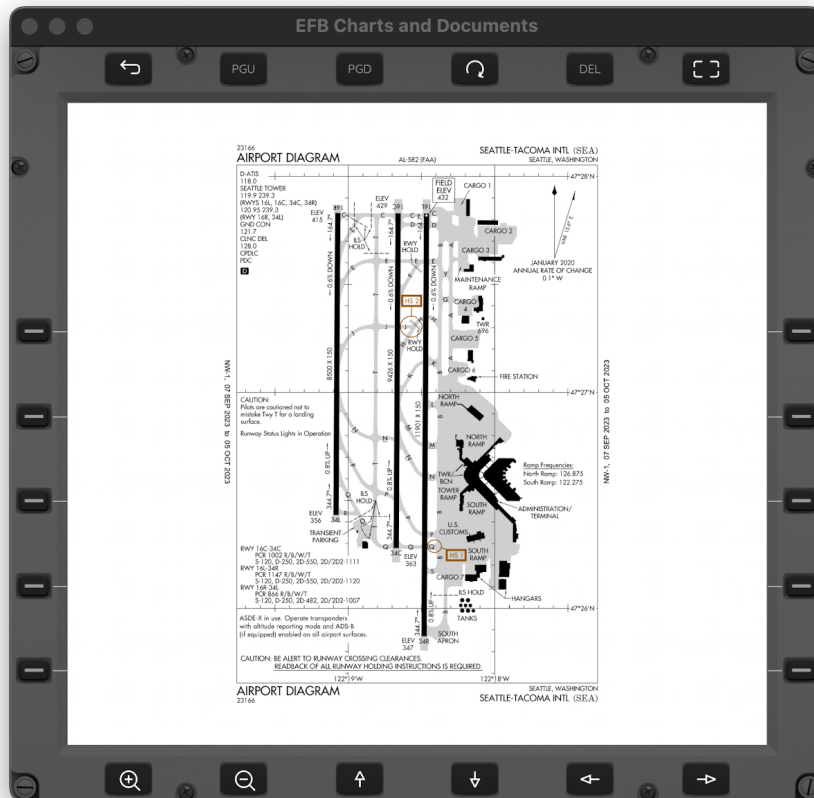
Selecting the option **GO BACK** at the bottom acts as the back key and returns one level. When there are more entries that can be displayed on a page, the number of page is indicated in the top right corner and the option **MORE** allows toggling through each of the pages.

For files the size displayed is the file size. For folders or directories is the size of its entire contents including sub-folders.



## 16.2 VIEWING A FILE

If the option selected is a valid PDF file, its contents are displayed and some of the browser keys are made active.



**PGU** and **PGD** move one page up / down respectively for PDF documents with multiple pages. This can also be achieved by swapping left/right or up/down in un-zoomed mode.

Some chart pages may display or be encoded in the wrong orientation. The **ROUND ARROW** button allows toggling the page the page orientation in 90, 180 and 270 degrees in order to make it horizontal and readable.

Like other panels in AirTrack, the full screen key shows the chart in full screen. Double-click to return to framed mode.

The **magnifying glass keys** allow zooming in and out. The arrow keys allow navigating in a zoomed image in each of the four directions. The arrow keys can be “long pressed” for a continuous movement.

To quickly return to the launch panel, long press the back to move to root and then click on it again to move to the launch panel.



### 16.3 LOCAL AND REMOTE FILES

AirTrack allows two types of files and folders; local and remote / cloud based.

Local files and folders are permanently stored on the device. In order to use them a folder named **CHARTS** should be created and populated with folders and PDF files.

The folder should then be copied to AirTrack using one of the following methods:

On the Mac, copy to the app's documents directory, usually:

```
/Users/username/Library/Containers/com.haversine.airtrack/Data/Documents
```

On iPhone and iPad versions, use either the Mac Finder on macOS or iTunes on Windows to locate the Files section, then select AirTrack and copy / drag-and-drop the CHARTS folder to it. Then launch / navigate to the EFB FILES section and the files and folders should appear there.

Remote files on the other hand are stored in the cloud; they can either be user files that users store in their personal **Air Account** sections of the [haversine.com](http://haversine.com) web site, or public files that Haversine publishes and are available to everyone. Some of these files may require a product or subscription.

When selected, remote files are downloaded onto the device before being shown. They then stay stored on the device in a temporary internal folder so the next time they are selected they don't need to be downloaded again. iOS may delete these remote cached files if it needs space and deems them not used enough as it assumes they can be downloaded again.

### 16.4 FAA CHARTS

At the time of writing, AirTrack's Charts and Documents panels comes with access to a folder named **FAA CHARTS** which contains publications from the FAA for the US territory. Currently they include Digital Terminal Procedure Publications with over 5GB of plates covering most of the airfields in the US with diagrams, departure and arrival procedures, approaches, for each of them.

More FAA products may be added to the collection in the future. These charts required an entitling subscription. They are processed every 28 days and kept up to date.

### 16.5 DELETING FILES

Deleting files or folders of charts is straight forward: click on the DEL key to arm and then select the file or folder you wish to delete. This will release storage space on the device, and can be applied to either the local files section or from the cached / remote files.

## 17. SETTINGS - CONFIGURABLE OPTIONS

AirTrack comes with a load of configurable options and these will only tend to increase. They affect different aspects of the app, from visual user interface changes to navigation options. Some settings are general while others are specific to one sort of panel. Changing one setting has an immediate impact in all panels that depend on it and changes to it are usually immediately reflected on these. Settings are divided into categories which can be access from different menu pages.

### 17.1 AIR ACCOUNT

Air Account settings relate to the free and optional cloud account that allows sharing app resources across multiple devices seamlessly. For details please see:

<https://haversine.com/account>

The Air Account was introduced with AirTrack Classic and was expanded to other apps such as AirEFB. AirTrack NG supports all data that was previously stored with Classic seamlessly so if an account already had charts or routes stored, they should show up in NG too.

In summary, anything linked to the Air Account can be re-downloaded onto new devices or across app installs. Resources include user charts (with up to 1GB of storage space), routes, custom waypoints and navigation data sets.

Registration is free from within the app. Users need to specify just a username / nickname, a contact name and an email address on which to receive the initial password. The following are then used to login on the Air Account panel:

- USERNAME - The account's username
- PASSWORD - The password used to log onto the web site
- SIGN OUT / IN – Temporarily disables / enables air account services

### 17.2 NAVIGATION

These are settings pertaining to the way AirTrack performs navigation that are not specific to one particular type of panel or instrument. They currently comprise:

#### HEADING REFERENCE

MAGNETIC OR TRUE - Used in PFD, ND, Flight Planner and Navigation Data, defines whether to prefer magnetic or true north headings / bearings. On Boeing style instruments this is usually an airline option found on planes capable of performing polar routes which require true north navigation.

## FIX / WAYPOINT TYPES

An AIRAC may include some waypoints / intersections that are considered VFR (Visual Flight Rules) and some that are meant for IFR (Instrument Flight Rules). Showing them all on panels such as the ND can be cluttering and counter productive, especially because VFR waypoints tend to have a less descriptive ID and be known by their name. On the other hand for VFR flying in low ND ranges it may be desirable to show them.

This option allows toggling between IFR / VFR only or BOTH. It is applied to the FMS so it affects all panels that use it, including NDs, the Flight Planner and Navigation Data.

## FLIGHT PLAN SCOPE

This option is also accessible from the Flight Plan page. It toggles between a flight plan local to AirTrack in that it is not sent or updated from a flight simulator, or interacting with the simulator. Not all simulators support flight plan access and within them some planes only allow read only plans whereas other planes allow read and write.

AirTrack attempts to integrate with them accordingly in every way possible, but when it is totally incompatible with a plane, it may be desirable to switch to Local Mode.

In Interaction Mode:

- If a flight plan can be read from the simulator, it is read and displayed in AirTrack
- If a flight plan can be updated in the simulator, changes performed in AirTrack are also attempted on the simulator
- If neither is possible, AirTrack will still send the route to the simulator, which is then propagated to other instances of AirTrack running side by side, but will not interfere with the plane itself.

In Local Mode:

- The flight plan stays within the app. Any changes can be made to it but are only seen in the app instance. Users should load the same plan that they are flying in the simulator in this case in order to make it as similar as possible.

## AIR TRAFFIC SOURCE

This option is also available from the Air Traffic Panel. It allows the selection of where to obtain surrounding air traffic from. Current sources are:

- None - No surrounding air traffic
- Simulator - If possible, AI traffic from the SIM will be sent to AirTrack
- VATSIM - Traffic is sourced from the VATSIM online network

- IVAO - Traffic is sourced from the IVAO online network
- REAL WORLD - Traffic is sourced from real world planes flying in real time with a mode S transponder. This option is complementary and provided on a best effort basis by a community of contributors worldwide. Not all locations have coverage and it may be inoperable at times.

## SENSOR HEADING SOURCE

When using the Device Sensors data source, in devices that have a built in compass, this option defines if the heading used for navigation is taken from the compass itself, or if it is taken from the GPS course which is then considered to be the heading as well. If you're using an iPhone to navigate you may prefer to just use the course in order to be able to move the device freely without needing to point to a certain direction. It is also useful when magnetic readings are not possible due to interference.

## SENSOR ALTITUDE

When using the Device Sensors data source, in devices that have an altitude capable pressure sensor, this option toggles between using it to source the current altitude, or if the altitude should be sourced from the GPS reported altitude instead.

## SENSOR QNH / ALTIMETER

When using the Device Sensors data source, in devices that have a pressure sensor, this option defines if the BARO setting (shown in the PFD for example) is taken from that sensor's reading, or if it derived from the QNH / Altimeter setting of the METAR of the nearest airport with a valid one.

## 17.3 UNITS

UNITS settings toggle the units to use throughout the app wherever they are applicable. They include:

### DISTANCE UNITS

Toggles distance reported in nautical miles or feet, kilometres or metres or statute miles.

### SPEED UNITS

Toggles speed is reported in knots, kilometres per hour or miles per hour.

### ALTITUDE UNITS

Toggles altitude reported in feet, metres.

### TEMPERATURE UNITS

Toggles temperature readings between Celsius and Fahrenheit

## LAT LON FORMAT

Toggles between Degrees/Minutes/Seconds, Degrees/Minutes or Decimal degrees representation of coordinates (latitude and longitude).

## TIME OF DAY / CLOCK

For tasks that require time, toggles between using the simulator's time if available, or the real world time provided by the device's clock.

## 17.4 INSTRUMENTS

Instruments are sub-divided into categories.

### PRIMARY FLIGHT DISPLAY

#### IAS START SPEED

On Boeing style PFDs the indicated airspeed (IAS) tape only starts moving at 45 knots by design. This option allow it to be changed so it starts moving as soon as there is movement detected, i.e. at 0.

#### OUTSIDE TEMPERATURE

Boeing style PFDs have no temperature reading. AirTrack however has had this extra feature which shows the outside temperature (OAT). This option allows toggling whether it is shown or not.

#### AI LAND COLOR

Just a matter of personal preference, this option allows choosing the land color of the PFD display from a darker brown or a lighter orange based tone.

### NAVIGATION DISPLAY

#### MAP MODE

This is usually an airline option. Whether to show the track (direction of movement) up in the ND, or to show the heading (compass, direction of facing) when in MAP mode. HDG mode can be particularly useful with the Device Sensors data source in that it allows users to move the device around and see the surrounding waypoints moving accordingly, whether with TRK mode they will only move when the GPS course changes.

#### PLANE TRAIL

There is no trail display in the Boeing NDs. This option allows enabling it causing a light block track line to be left behind the plane when flying representing the travelled path.

#### SHOW WIND

In Boeing instruments, ND winds are only displayed when the true airspeed is above 101 knots. This option toggles its display to any speed, making it more suitable for when using the Device Sensors data source as 101 knot speeds may not be possible. The

default in AirTrack is to show always and this setting allows it to change it for increased realism.

#### **TCAS CALLSIGN**

The default display of TCAS traffic on the ND does not include a callsign, but if we have it, why not show it too in a simulation? This option makes the callsign of surrounding traffic to appear below the target. The default on real aircraft is to not show a callsign, although we made it a default in AirTrack as it is useful information that is available.

#### **TCAS SHOW TRAFFIC ALTITUDE**

Whether to show TCAS traffic only when airborne or always even if in parking position. The default on real aircraft is to show only when airborne but in AirTrack we made this to show always as it is nice to see who's airborne even when "ashore".

#### **TCAS SHOW TRAFFIC ENVELOPE**

The TCAS implementation in real planes only captures and considers traffic within a + / - 2700 feet altitude envelope. As AirTrack is a simulation, it can actually show targets at any altitude and this option allows showing them too for curiosity purposes. Note that these targets will not generate TAs or RAs as they are outside a collision course. If you want to

#### **VFR AND CUSTOM WAYPOINTS**

Toggles between the display of names or short code IDs for VFR and custom waypoints where it is often preferable to see their descriptive name rather than ID in map mode. On the other hand if the ND is too cluttered, changing to identifiers reduces its complexity.

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#### **MAP MODE WPT TYPES**

Toggles the type of waypoints to display on the ND in MAP mode, through ALL, AIRAC only or Custom waypoints only.

#### **RADIO STACK**

Toggles the use of the radio stack (NAV, COM, ADF, XPDR) frequencies from the simulator if available, or local to AirTrack only.

### **17.5 GENERAL SETTINGS**

Anything that is specific to the app globally.

#### **AUDIO / KEYCLICKS**

Toggles whether to play a clicking sound when pressing things in the app or not.

## 17.6 NON DEFAULT SETTINGS

The following panel settings have defaults that are non standard, i.e. their default behaviour is different than the one expected on the original aircraft panels. For increased realism you may wish to switch them back to their defaults.

PFD IAS START SPEED, PFD TEMPERATURE, ND SHOW WIND, ND PLANE TRAIL, TCAS CALLSIGN, TCAS SHOW TRAFFIC ALTITUDE, TCAS SHOW ENVELOPE.

## ANNEX A - EDITORIAL NOTES

In order to illustrate different functionality, this operation manual contains various screenshots taken at different situations when using AirTrack in different devices. Images may not always correspond to the exact final screens viewed by the user as they may have been taken in a different device at a different resolution and window size. For example, a screenshot depicting the PFD may be taken in macOS stretched to a given size; it will appear different on an iPad, if in Portrait or Landscape, or on an iPhone. They all refer to the same situation and should be seen as illustrative examples.

Furthermore, AirTrack is expected to evolve and sometimes minor graphical changes are introduced between versions to adapt or make it more graphically appealing. While this manual will try to keep its images as close to reality as possible, it will inevitably happen that some images will eventually differ from the screenshots of the current version. They will however retain the same purpose and overall illustrative functionality. They will be updated periodically but not all minor changes might always be depicted (for example, if a small screw is added to the frame of version X.Y, it might not be practical or time effective to have to recreate all screenshots present in this manual).

## ANNEX B - APP HISTORY

AirTrack was initially thought of as an X-Plane simulator companion for its version 9.0 in 2010, designed to run on the first iPhone model and connect to it over wifi, providing just a few flight parameters to the palm of one's hand. As mere curiosities, at this point in time, there were no iPads or tablets yet and everything fitted and ran on a 320x480 pixel/point screen and 40MB of available memory. X-Plane ran on both powerpc and intel machines which made it trickier to handle due to endianness differences in architectures. The original app was released in the summer of 2010. It had manual memory management pre-ARC. It was written in the now obsolete Objective-C language.

It was well received by the community, which led to new features being added such as the ND, Charts, FMC and so forth, and subsequently more apps appeared to complement it such as AirFMC and AirEFB. AirTrack has is used widely everyday around the world.

A lot of its code has been since improved and refactored in Swift which, together with Obj-C, is the main reason why AirTrack doesn't run on Android devices. But despite constant updates along the years, much of its code was now very old, unstructured, still buggy, and unmanageable. It was necessary to rewrite it from scratch in new / modern swift design patters for it to be scalable and future proof, and this led to a split, its original was renamed AirTrack Classic up to version 3, and an entirely new app was made, giving birth to version 4 and above under AirTrack NG.