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## SUMMARY

AirTrack is an iPhone, iPod and iPad Universal App designed to integrate with multiple data-sources in order to report flight and navigation data in real-time in a way similar to what can be found in real aircraft. The App can be connected to a flight simulator in order to track and control its flight, and can use the device's built-in sensors in order to simulate different navigation instruments, reporting measured attitude, heading, course, speeds, and position amongst other variables.

This document describes the app and its functionality explaining how it is organized, what each of its options are and how to use them effectively for navigation.

It is assumed that the reader is familiar with, or has at least some degree of knowledge in air navigation and IFR concepts.

## 1 SETTINGS AND DATA

### 1.1 FLIGHT DATA

AirTrack relies on a basic principle of operations; it receives data from “somewhere”, it processes that data and displays it in multiple formats. If the data source (where the data comes from) so allows it, AirTrack can also feed information back to it, thus triggering some kind of behavior.

At present, AirTrack supports the following types of data source:

#### 1.1.1 DEVICE LOCATION SERVICES DATA SOURCE

The Device Location Services data source uses the iPod, iPhone or iPad sensors in order to derive flight data at periodic intervals. The data it is able to obtain as well as its accuracy naturally depend on the type of device in use. As an example, iPods without GPS or cellular can only estimate the current position based on IP information and WiFi network access so they will take longer or may not even be able to acquire it, whereas fully capable GPS and 3G devices are able to determine the current position with more accuracy and at more frequent intervals.

The following variables are read from the device location services data source:

- Latitude
- Longitude
- Elevation (from GPS)
- Course (when moving)
- Heading (in devices with compass)
- Ground Speed
- Roll
- Pitch
- Yaw (in devices with a gyro)

In addition to this, AirTrack simulates certain other variables internally as if they were present in the data source, e.g.:

- Radio frequencies and auto-pilot states are maintained internally.

Weather conditions such as temperature and winds are downloaded from the Internet for the nearest airport's METAR if a data connection is available.

#### 1.1.2 FLIGHT SIMULATOR DATA SOURCES

The second type of supported data source is a flight simulator. AirTrack was designed to integrate with the X-Plane flight simulator from day one. By the means of installing a small

plugin/interface and having a WiFi network connecting the iPod/iPhone/iPad and the computer, AirTrack is able to receive a significant amount of data from the simulator and show it on its different display pages. Furthermore, AirTrack can also be used to change flight variables such as auto-pilot states or entering route plans, and feed these back to the simulator so that they can be acted upon.

At present, AirTrack can be used with the following flight simulators:

- X-Plane 9 from Laminar Research

- Flight Simulator 2004 from Microsoft (with limited functionality)

- Flight Simulator X from Microsoft (with limited functionality)

In order to use AirTrack with one of these you will have to download and install the corresponding plugin from the <http://air.ipobjects.com/> web site.

### 1.1.3 AHRS-G FROM LEVEL AVIATION

AirTrack also supports the AHRS-G Mini product from Level Aviation (please see [aviation.level.com](http://aviation.level.com) for details). This device is an external Attitude and Heading Reference System built for experimental aircraft, and measures roll, pitch, vertical speed, air speed and pressure altitude, all with great precision.

On order to use it with such an AHRS, turn it on and select its SSID in the list of your iPod, iPhone or iPad's WiFi networks. Following that, launch AirTrack and the datasource should appear automatically on the list.

Parameters such as the GPS position are not provided from the external device; in this case AirTrack uses its own location hardware to determine position.

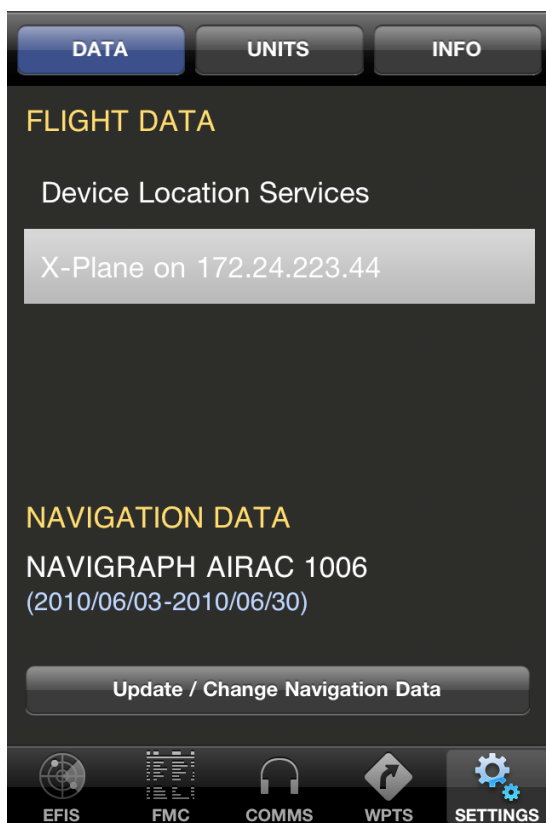
### 1.1.3 SELECTING THE FLIGHT DATA

When launched, AirTrack will display a list of available data sources. Unless access is specifically denied by the user, the Device Location Services data source will appear in one row.

To use AirTrack with a flight simulator you will need to run its plugin and startup the flight simulator. In addition, both the computer and the iDevice must be on the same IP sub-network and, if any firewalls exist, they must be configured to allow them to exchange traffic.

You can have as many computers running different instances of simulators as wished and they will all be displayed. Likewise you can have multiple iDevices and connect them all to one or several simulators.

As soon as this happens the simulator data source should pop-up in the flight data section of AirTrack as illustrated on the screenshot on the side. Tap on it to select it as the active data source and tap on Device Location Services to go back to GPS based mode.



The selected data source will be highlighted with a grey bar as shown on the screenshot on the side.



## 1.2 NAVIGATION DATA

Navigation Data identifies the database of NAVAIDs currently in use, including FIX, VOR, NDB, airport, runway and localizer points as well as en-route airways, SID and STAR procedures amongst other records.

You can change the active navigation data-set by selecting the navigation data button.

### - NAVIGRAPH AIRAC 1006 -

This is now the default; it includes FIX, VORs, VOR-DMEs, VORTACs, NDBs, airports, runways and Localizers from all over the world as well as en-route-Airways and SID and STAR procedures for major airports.

Use this if you need airways, SIDs and STARs or if you don't fly X-Plane . This cycle expired on the 30th of June 2010 so any updates since then are not reflected.

### - X-PLANE AIRAC -

This is the default NAV database distributed with X-Plane. It is maintained by Robin Peel and is freely available for download from: <http://data.x-plane.com/>

You can download one of the latest X-Plane AIRACS from the Navigation Data page. These AIRACs are free. While quite accurate, their database is not as up-to-date as Navigraph's 1006 and it doesn't contain SID's and STARs. AirTrack also doesn't use its Airways so you won't be able to enter these in flight plans.

It does however contain each and every Airport, VOR, NDB or FIX that is used in X-Plane which the Navigraph's doesn't, so you should use this if having the exact same database in AirTrack and X-Plane is important or if you plan to navigate to or through a point that does not exist in the other.

### 1.2.1 SWITCHING BETWEEN NAVIGATION DATASETS

You can switch between navigation databases at any time by selecting “Update Navigation Data”. A list of the available AIRACs will be displayed.

In order to get updates you need to be connected to the Internet. When this is the case the remote AIRACS will be displayed for download.

You can also remove old / obsolete AIRACs by swiping from right to left in order to save disk space. Each AIRAC is approximately 25 to 30 MBytes.

Navigraph AIRACs are published every 28 days and are made available for redeem and download. To get them you need to register with Navigraph ([www.navigraph.com](http://www.navigraph.com)) and purchase some credits with which you can get an access code for a given FMS data set. Once you have this code from them you can just insert it in the redeem box and the new database will be downloaded to your device. Alternatively to doing it on AirTrack, you can also do it online on your Air Account web section, in which case the cycle will become available to all the devices you have associated with your account.

Please note that Navigraph AIRACs are only valid for the 28 day period they are bought plus 3 subsequent periods, so for 112 days, and are automatically deleted afterwards.

### 1.3 UNITS AND SETTINGS

Units and a few other configurable options can be tuned in the SETTINGS section of AirTrack. On the iPhone and iPod this menu is displayed in a different page whereas on the iPad it is shown together with navigation and flight data as shown below.



The following things are configurable by the means of tapping on the appropriate button to toggle:

> TIME - Changing time alters the way in which ETAs are given throughout the app. The options are UTC (Zulu) or Local Time, where local time is determined by the device's timezone (and not by where you are flying).

> ALTITUDE - Changes altitude units throughout the app. The options are FEET (the default) and METRES. The PFD will always display the altitude in feet but when metres are selected, a second number will be displayed above the current altitude showing the current elevation in these units.

> TEMPERATURE - Changes the units in which temperatures are reported. The options are degrees Celcius or Fahrenheit.

> DISTANCE - Changes the units of distance. The options are nautical miles (the default), kilometers or statute miles.

> SPEED - Changes the units in which speeds are reported. The options are knots, km/h or mi/h. Note that the PFD will always display the speed in knots but if km/h or mi/h are selected, a second box will be displayed with the speed in one of these units.

> BAROMETRIC SETTING - Changes the units of barometric pressure. The options are inHg (inches of mercury, used in the US) and hPa (hectopascal, used in Europe and other places in the world).

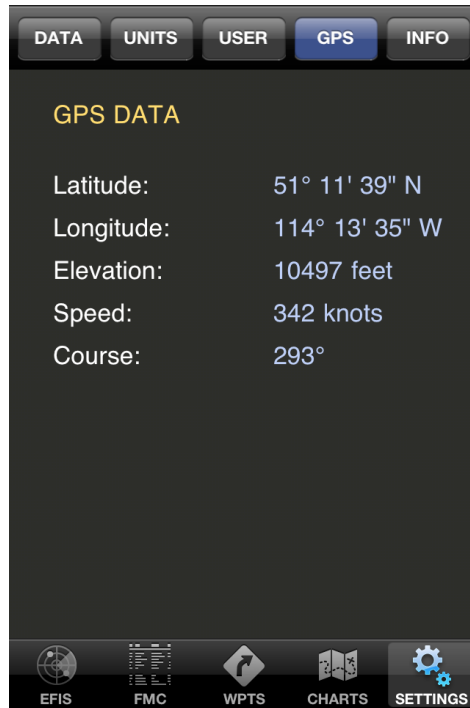
> HDG Mode - This setting is specific to the Device Location Services data source type only. Furthermore, this option is only available in devices that have a built-in compass. It essentially determines the way to obtain the current heading. While COMPASS may seem like the obvious choice, the fact is that the iPhone / iPad compass is very sensitive to sudden movements, positioning and surrounding interference makes it sometimes unsuitable for determining the current heading. As an alternative option you can chose COURSE which only works when you are moving but might give you a more accurate and stable direction of flight.

> NORTH ORIENTATION - Which north to use as a reference, magnetic or real. Note that with Device Location Services magnetic north requires a built-in compass and on old devices without it magnetic north will be same as real north and the magnetic variance will be always 0.

> AIR TRAFFIC - This option determines the source of Air Traffic to show as surrounding traffic in the MFD as well as the source of ATC to show COMMS section of online controllers. The options are NONE, VATSIM or IVAO. When in VATSIM or IVAO, the list of pilots and controllers of this virtual flight simulation networks that are currently online will be downloaded to the device at periodic intervals (in the order of minutes) and displayed in the appropriate sections.

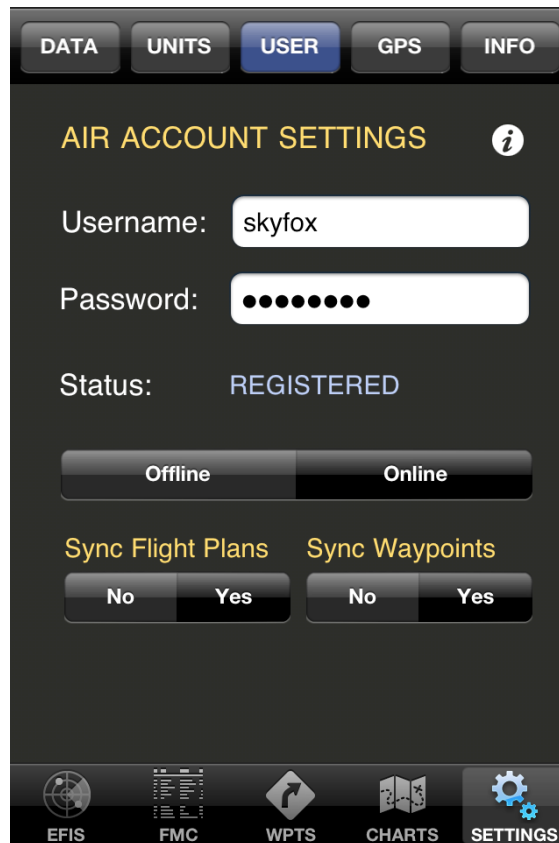
## 1.4 GPS DATA

The GPS DATA section displays the current Latitude, Longitude, Elevation, Speed and Course, in real-time, as they are received from the GPS unit. The screenshot below illustrates this on an iPhone.



## 1.5 USER SETTINGS

The User Settings page allows users to associate the device to an Air Account and to use cloud-based services. For this users need to register in order to obtain a username and password which are then entered in the appropriate boxes. Registration is free and can be done online at: <http://air.ipobjects.com/register>



Once registered, tapping on the “Online” button will bring the device to contact the cloud server and to become registered (i.e. connected). Tapping on the “Offline” button disables identity cloud services temporarily (for as long as it remains offline).

Amongst other things, cloud services allows resources such as waypoints or flight plans to be synced to the cloud and down to other devices associated with the same account. They also allow these to be saved and restored in case of loss of data. In other words, users can create waypoints and routes once, save them and distribute them automatically to other devices.

## 2 WAYPOINTS

The WAYPOINTS section of AirTrack allows users to query the built-in database of nav aids, airports and waypoints. It also allows users to create custom waypoints at specific coordinates. The following screenshot illustrates waypoints on the iPad.



There are two distinct display modes: SAVED AND NEARBY.

SAVED comprises a list of saved points, i.e. points that the user considers interesting and saved for later retrieval.

NEARBY, as the name suggests, lists the waypoints found in the database around the current position and within a 60 nautical miles range.

The selectors APT, VOR, NDB, CWP, FIX and CTY toggle if these kind of waypoints are displayed or not in the list of saved and nearby points. Their meaning is as follows:

APT	Airports
VOR	VORs, VOR-DMEs, VORTACs
NDB	NDBs
CWP	Custom (User) Waypoints
FIX	FIX Intersections
LOC	Localities and cities

By tapping on one of the waypoints on each list you can select it and thus, reveal further information about the selected point.

On the iPad this information is displayed next to the list of waypoints. On the iPhone and iPod this information is shown on a new page altogether. You can use scroll finger gestures to move the information up and down and reveal further details about the selected waypoint.

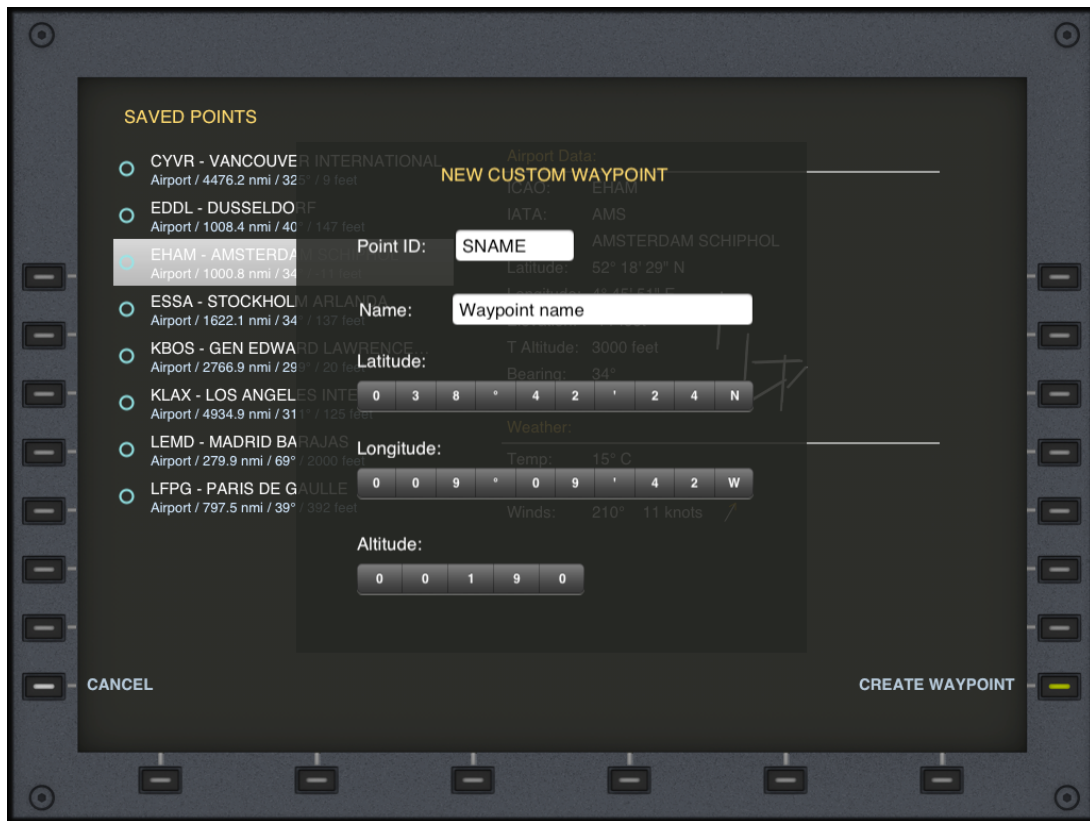


The information displayed for each waypoint type depends both on the type of waypoint selected as well as its navigation database. Specific information about a waypoint may not be available at a given database and consequently may not be displayed. The following table summarizes the different information elements given as well as their applicability to waypoint types:

	APT	VOR	NDB	CWP	FIX	LOC
Waypoint ID	✓	✓	✓	✓	✓	✓
Latitude	✓	✓	✓	✓	✓	✓
Longitude	✓	✓	✓	✓	✓	✓
Elevation	✓	✓	-	✓	-	-
Bearing (from current position)	✓	✓	✓	✓	✓	✓
Distance (from current position)	✓	✓	✓	✓	✓	✓
Name	✓	✓	✓	-	-	-
Class / Type	-	✓	-	-	✓	-
Range	-	✓	✓	-	-	-
Frequency	-	✓	✓	-	-	-
IATA code	✓	-	-	-	-	-
Transition Altitude / Level	✓	-	-	-	-	-
ATC Frequencies	✓	-	-	-	-	-
Runways and ILS Freq.	✓	-	-	-	-	-
Weather (METAR) (downloaded from the Internet)	✓	-	-	-	-	-
Population	-	-	-	-	-	✓

## 2.1 ADDING CUSTOM WAYPOINTS

You can add custom / user defined waypoints to AirTrack at any time by selecting “NEW CWP”. This will open up a pop-up window as the one displayed below and give the user the possibility of entering a unique point ID comprising up to 7 characters, a longer name, its latitude, longitude and altitude.



Tap on the latitude/longitude/altitude digits to toggle-cycle them.

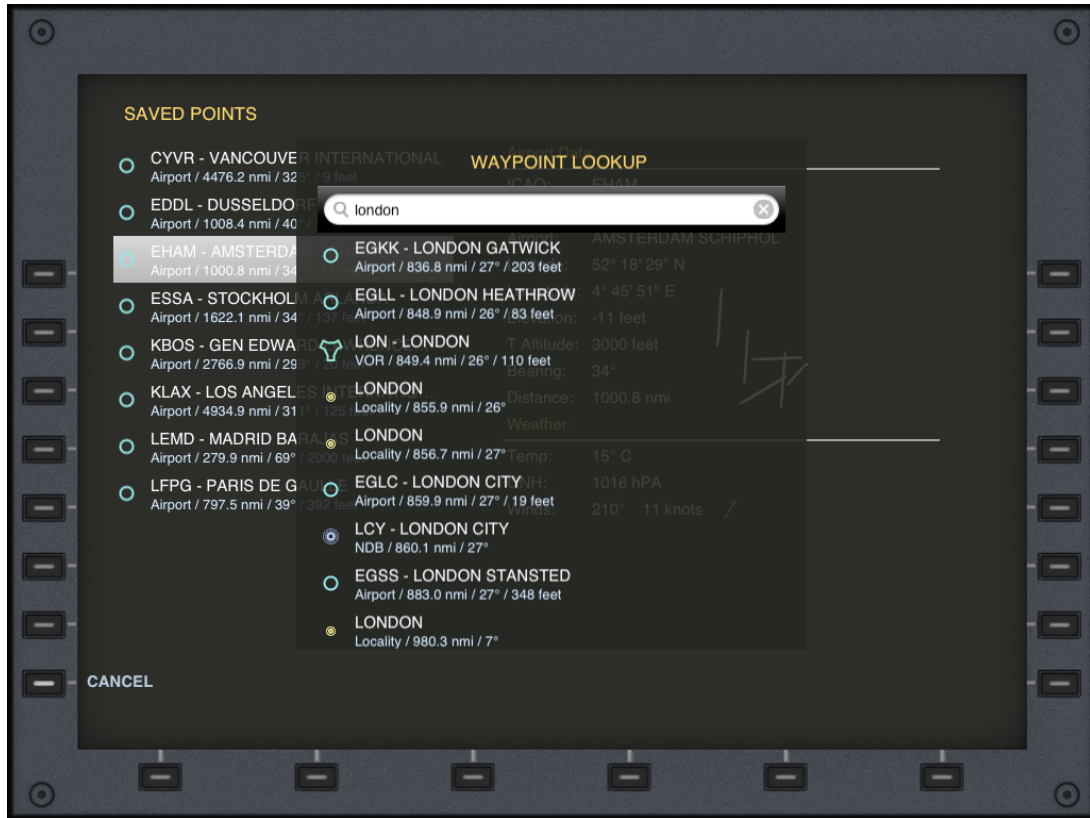
When opened, the new custom waypoint window will be pre-filled with the current coordinates and altitude, allowing you to save your exact current position as a waypoint.

Custom waypoints can be displayed in the MFD and can be used for flight planning in the FMC.

When finished, click on CREATE WAYPOINT to add it to the database.

## 2.2 LOOKING UP EXISTING POINTS

When in SAVED POINTS mode, AirTrack also allows you to lookup existing Aiports, VORs, NDBs, Intersections and Localities. Click on LOOKUP to bring the search page and enter either a waypoint ID / code or a name as a basis for the search.



AirTrack will show all the points matching the specified name or ID. Select one from the list to add it to the list of saved waypoints.

Note: These points are always on the database and available for navigation. This option just make it so that you can quickly access them later by selecting them from the saved waypoints list.

## 2.3 CLOUD POINTS

Both custom and saved waypoints can become cloud points. If so, the newly created or saved points are uploaded to the cloud in the first opportunity (when there is connectivity) and will become available on the web panel of the user's air account. If more than one devices are associated to the same air account, these same waypoints are then automatically down-streamed to the remainder devices.

In order to be considered a cloud point, a waypoint needs to have been created or saved when the "Sync Waypoints" flag is set under "User Settings". If not, the point is considered local and is not uploaded to the cloud.

In addition to seamless syncing, one other advantage of cloud custom waypoints is that they can either be created or edited online, so users can add their favorite spots online and have them down-casted to all of their devices in one go.

## 3 COMMS

### 3.1 RADIOS

The COMMS section of AirTrack concerns radio communication and is mostly only useful if you are using AirTrack with a flight simulator. It allows the user to change radio frequencies, operate the transponder and see which ATC controllers are online when flying in VATSIM or IVAO.

Although not meant for Device Location Services, the radios can be virtually-tuned with this data source types too. This will of course not tune any radio in a real aircraft or your car stereo, but may be used to simulate navaid based navigation on the MFD. For instance, tuning in a real ILS frequency in NAV1 or NAV2 will cause its helper needles to be shown in the MFD when in NAV1 or NAV2 modes and approaching the runway.

The screenshot below illustrates it on the iPad; on the iPhone and iPod the NAV, COM, ADF and XPDR pages are presented separately and for space optimization can be found under the COMS button on the EFIS menu.



Tap on any frequency to open a dial-pad; enter the desired frequency and it will change.

Tapping on the white arrow allows you to transfer the standby frequency to the active and vice-versa.

### 3.2 TRANSPONDER

The transponder code can also be changed using the COMMS method, by pre-selecting a standby code and transferring it to active.

In addition AirTrack provides two buttons related to the Transponder:

- The mode toggle, swapping between transponder mode STANDBY and CHARLIE.
- The AUTO transponder mode - When activated this mode makes AirTrack control the transponder mode toggle. When AirTrack detects that you are moving above a reasonable speed it will automatically move the transponder mode to C. When moving slowly on the ground, AirTrack will toggle back the transponder mode to standby.

Note: The transponder features of AirTrack have no use when operating in Device Location Services. They are only meant for being used with flight simulators where the transponder code and state are reflected.

### 3.3 ATC

The ATC COMMS page will only be available if you have either VATSIM or IVAO selected as the source of air traffic under settings.

In this case, a new page will be shown and the list of online controllers on that network will be displayed, containing their positions, frequencies and names.

This list is periodically refreshed from the Internet (every minute).

Note: It may take up from 2 to 5 minutes or more for the list to be updated as this is the time it takes for the VATSIM and IVAO servers to refresh themselves.

## AirTrack 3.1 Operations Manual

By selecting an ATC position with the provided UP and DOWN buttons you will be able to send the selected frequency directly to the COM1 or COM2 radios, thus avoiding having to tune it manually.

## 4 THE FMC

The FMC or Flight Management Computer pages is where AirTrack flight planning starts. It allows you to receive, create, save and load flight plans which can be tracked in the MFD.

Before proceeding, please note that although it is called an FMC, its functionality is still limited; as an example, it does not yet perform complex fuel and speed calculations and neglects much of the information that a real FMC processes.

In AirTrack's FMC a flight plan is a sequence of waypoints with optional altitudes. These points can be any of those found in the waypoints database or can be just a pair of latitude/longitude coordinates identifying any point on the globe. The FMC is responsible for maintaining the flight plan.

The following screenshot illustrates a flight plan loaded into the FMC, as seen on an iPad in landscape mode. On the iPhone and iPod the FMC pages are split, each showing a piece of information according to its type.





#### 4.1 RECEIVING A FLIGHT PLAN

If your data source so permits it, you can enter or load a flight plan with it and it will be transmitted to AirTrack.

At present, only simulator data sources such as X-Plane, FS9 and FSX can do this, i.e. you can enter a flight plan in the simulator and it will be sent to AirTrack over the air.

The opposite, receiving a flight plan, only works with X-Plane and does not work with Microsoft FS9 and FSX data sources.

#### 4.2 SAVING AND LOADING PLANS

Plans can be saved in AirTrack and loaded for later retrieval. These actions are self-explanatory and are performed by the buttons SAVE AND LOAD.

A loaded plan is always local and is sent straight away to the simulator if possible.

To delete a flight plan from AirTrack completely, press the LOAD button and swipe your fingers from right to left on top of the flight plan you wish to remove under a delete button appears and then press it to confirm deletion.

#### 4.3 CLOUD FLIGHT PLANS AND ROUTES

Similarly to waypoints, when using an Air Account if the user enables “Sync Flight Plans”, all flight plans saved on the local device are uploaded to the cloud and sent down to other devices associated with the same account. In other words, users can create a flight plan on one device and it will become available in all others. If the “Sync Flight Plan” option is disabled, the plans created then are considered local and are not uploaded to the cloud.

#### 4.4 CLEARING A FLIGHT PLAN

To clear a flight plan from memory (not deleting it) press the CLEAR or CLR FMC button once when no leg is selected.

#### 4.5 SELECTING A LEG

The UP and DOWN FMC buttons allow you to browse through the different legs of a flight plan. The selected leg is identified by a small white > symbol preceding the leg number.

If the flight plan has more legs than those that can be displayed on one page the NEXT button allows you to move to the next page, containing the additional legs. Likewise the PREV button allows you to go back to the previous page.

#### 4.6 IDENTIFYING THE ACTIVE LEG

Any crossed waypoints are displayed in GREEN rows. The currently being flown to waypoint or active leg is shown in YELLOW. Any subsequent waypoints are shown in BLUE.

In other words, the active leg is displayed in YELLOW.

#### 4.7 DELETING A LEG

Legs or waypoints can be removed from the flight plan by pressing the CLEAR or CLR button after being selected with UP/DOWN and NEXT/PREV.

#### 4.8 ACTIVATING A LEG

The active / YELLOW leg / point being flown to can be changed at any time by selecting a different point with the UP/DOWN/NEXT/PREV buttons and by pressing -D>.

Doing this causes all points before to turn green and all after to turn blue.

#### 4.9 STARTING A PLAN WITH INIT

Plans can be started either by giving them an initial real waypoint or by pressing the INIT button.

The INIT button is used to start a new plan from the current position by automatically adding a first waypoint of type POS (position) with the current latitude, longitude and altitude.

Warning: The INIT button causes AirTrack to clear any currently loaded plan and you start with an empty plan.

Another way to start a plan is of course to add a real point as the first point, such as an Airport for example, and thus not using INIT at all.

#### 4.10 ADDING A NEW WAYPOINT / LEG TO A PLAN

In order to add a new waypoint to the flight plan press NWP. This will cause a page to pop-up. Then enter the ID of the point you wish to add to perform a search. The following screenshot illustrates this procedure on the iPad.



Scroll up and down the list to locate the desired waypoint and tap on it.

Certain points such as airports and runways have pre-defined altitudes which will be copied to the altitude selection bar. Most nav aids however don't, allowing you to select at

which altitude you wish to reach them. In order to do so, tap-and-cycle the digits of the altitude bar in order to select an altitude or flight level.

Choosing an altitude allows you to use vertical navigation in the auto-pilot (VNAV) so that the aircraft tries to reach that point at the given altitude or FL.

Doing so is not mandatory however and you may choose not to enter an altitude at all and simply use other means for maintaining a flight level.

When finished, press ADD POINT TO ROUTE. The point will then be added to the current flight plan according to the following rule:

If no waypoint was selected prior to pressing NWP, the point is added to the end of the flight plan.

If a point was selected prior to pressing NWP, the new point is added just before the selected point. All points after, including the selected point, are shifted forwards in order to give space to the new point.

#### 4.11 FLIGHT PLAN POINT TYPES

Flight plans can be created as a sequence of any of the following point types:

FIX, VOR, VOR-DME, VORTAC, NDB, LOC (cities and localities), CWP (custom waypoints) and Airports.

Airports themselves have other sub-point-types that can also be added to the plan individually, namely RUNWAYS, LOCALIZERS, SIDs and STARs. When looking up an airport by its ICAO code you will also be presented with a list of these to choose from in addition to the airport itself.

Finally, the AirTrack's FMC supports another special kind of point-type, the en-route AIRWAY pseudo-point. Details on how to use these are presented further on.

##### 4.11.1 RUNWAYS AND LOCALIZERS

Adding runways or localizers as terminal waypoints have certain advantages over adding airports only to the flight plan:

- They have more precise coordinates, generally of the beginning of the runway.
- They make it so that the runway is drawn on the MFD as such, showing you its direction and localizer range.
- Adding localizers for approach also automatically sets up the MFD (when in MFD mode) allowing you to visualize ILS approach needles as you capture the localizer and approach the runway.

You should add a runway or localizer when you know the runway in which you will take-off or land. You can always add them “on-the-go” after you have loaded a flight plan by selecting the second or last waypoint and adding the runway or localizer before them.

#### 4.12 SID and STAR PROCEDURES

When looking up an airport, if the selected navigation database has SID and STAR procedures for that airport these will be also shown as a kind of “pseudo-points”.

Selecting them and adding them causes the FMC to decode them and add all their intermediate points to the flight plan.

If a point has altitude restrictions such as at or below or at or above, the limiting altitude will be set as the waypoint’s altitude in the flight plan. For between , the half altitude will be used.

#### Notes on procedures:

In its current version, AirTrack only decodes FIX, NDB, VOR and Runway procedure points. RNAV / phantom points are not yet supported, neither are procedure turns and arcs.

At present only the Navigraph data sets have SID and STAR procedures. If you select the X-Plane AIRAC as a data-source you will not be able to use these.

#### 4.13 ENROUTE AIRWAYS

The AirTrack's FMC also supports en-route airways as a kind of "pseudo-waypoint". This is essentially an Airway decoder in that what it does is replacing the airway by all its intermediate points between a pair of entry and exit points.

As soon as the airway is decoded it ceases to exist in the flight plan and its points are treated independently.

In order to use an airway you must first add the point at which you will enter the airway and make it so that that point is the previous point. In other words, airways will only be looked up if the point prior to where they are being added belongs to them.

As an illustrative example, lets consider that you want to take the Airway UL980 from GORLO to LOGAN. In order to do it you would take the following steps:

a) Add GORLO intersection to your flight plan as a waypoint

Press NWP and lookup / search for UL980 - Since GORLO belongs to the UL980 airway, it will be shown as a possibility. Tap on it to select it and add the airway to the flight plan.

Now press NWP again. You will notice that instead of being given a search bar, you will be provided with a list of airway points; these are the possible exit points of the airway when entered at GORLO. Select LOGAN and add the point to the route.

At this point, all intermediate points belonging to UL980 are added to the flight plan, replacing UL980. In our example, these are REFSO and XAMAN.

The flight plan then became GORLO -> REFSO -> XAMAN -> LOGAN without you needing to know in advance that REFSO and XAMAN were part of UL980.

#### 4.13.1 AIRWAY RESTRICTIONS

The decoder takes into account the following airway restrictions and only presents entry and exit points after making sure that they comply with them:

> DIRECTION - If a given airway segment is uni-directional, the decoder will not allow you to cross the airway in the opposite direction by not providing its possible exit points.

> FLIGHT LEVEL - When entering a plan with altitudes, the minimum and maximum allowed airway flight levels will be taken into account to decide if an entry point is suitable.

In the above example, the segment between GORLO and REFSO is defined for FL195 to FL660. Consequently, if you try to lookup UL980 with GORLO at FL150, the airway will not be found because you cannot enter it at that level.

> STEP CLIMBS - If in the middle of an airway a step climb is required and the entry flight level is not compliant with it, the decoder will automatically adjust the point at which it occurs as well as subsequent points to the minimum or maximum required level.

In the above example LOGAN is defined from FL260 to FL460 so if you enter GORLO at FL210 the level will be automatically adjusted to FL260 when reaching LOGAN.

Note: Flight level and step climb restrictions only apply when using altitudes/levels in the flight plan.

#### 4.14 EN-ROUTE FIGHT DATA

In addition to simplifying navigation in the MFD or possibly interacting with the flight simulator by the means of flight plans, the FMC section of AirTrack also serves the the purpose of providing en-route information about the flight’s course.

Looking again at the FMC screenshot:



The FMC page shows information about the route and each of its waypoints. Due to their reduced screen dimensions on the iPhone and iPod this information is split across multiple pages. On the iPad it is show in a single page as the above. For this lets consider the presented screenshot.

The first column represents the point/leg number where 0 is the starting point and the first leg being the segment between points 0 and 1.

The second column represents the point ID and the third column the point type.

If the point has a frequency, this will also be shown as the fourth column when displayed on the iPad in landscape mode. In all other cases the frequency is not shown.



The next three columns represent time estimates: DUR is the duration of the leg, REM is the remaining total time to reach that point and ETA the estimated time or arrival at that point.

In the current version of AirTrack time estimates are calculated at instant ground speed and hence do not take into account different wind factors nor climb or descent speeds.

Due to this, when looked while en-route the estimated time of arrival at the terminal airport will generally be earlier than the actual arrival time since the FMC does not take into account the descent speed or restricted speed in the terminal area, which is typically lower. It does however provide a rough estimate, which is all it is.

The next column shows the course required to reach a point from the previous point.

The following two columns above represent total segment distance (DUS) and the remaining distance to reach that point from the current point (REM).

The next column shows the desired target altitude or level for reaching that point with VNAV and is only displayed if entered.

And finally the last two columns shown above reveal the point's latitude and longitude and are only displayed in landscape mode due to screen size constraints.

#### 4.15 ROUTE STATISTICS

In addition to per-leg statistics, the FMC page also shows some overall statistic indicators, namely:

- Tracked Distance and Tracked Average Speed over that distance - AirTrack “keeps an eye” on movement and time and calculates the average speed.
- Total Planned Distance - The total distance of the flight plan.
- Distance to Destination: The distance from the current point to the destination, taking into account all the yet-to-be-crossed waypoints and their segment distances.
- Flight Progress - An indicator of how much % of the flight has been carried out so far.
- Remaining Flight Time - An estimation of the time required to reach the end of the flight plan.

- Estimated Time of Arrival - An Estimation of when the last flight plan point will be reached.
- Current Time - The system's current time (derived from the device's internal clock).

All flight statistics are calculated at regular intervals and are constantly being updated. They naturally depend on where you are, how fast you are going at that precise instant, what the winds are, and are just estimations of such.

The AirTrack's FMC which is responsible for calculating these may implement more complex estimations in future versions, but as mentioned before, all statistics are currently calculated at instant ground speed.

#### 4.16 POSITION REPORTS

When flying Oceanic where there is no radar coverage, pilots are often required to give position reports when crossing flight plan points. This generally requires them to prepare what they must say to ATC in a standard form.

AirTrack simplifies this process by taking the statistics and forming a position report sentence.

In order to obtain a position report, you must have a flight plan loaded, must be en-route and moving, and must have crossed the first waypoint.

In order to do so, press the PR button and a pop-up message will appear similar to the one shown on the next screenshot. Repeat what it says to ATC in order to comply with oceanic regulations.

**WARNING:** Never ever use the position report given by AirTrack to ATC in a real world situation. For a start, mach, temperature and winds are most certainly incorrect with Device Location Services data sources, and the rest of the measurements are rough and crude estimates and might be totally wrong. This feature is intended **EXCLUSIVELY FOR FLIGHT SIMULATION.**

#### 4.17 TRACKING AND THE RST BUTTON

The Tracked Distance and Tracked Average Speed are measured from when the app is launched and the data source selected. They have an associated measured interval.

In order to reset them, i.e. in order to start tracking and calculating the average speed from a given moment onwards, press RST.

#### 4.19 FLYING DIRECT TO

The Direct To (-D>) buttons serves two purposes; to select the currently active waypoint if a waypoint is selected already, or to enter a new direct-to destination. When entering a direct-to destination the FMC jumps to the entered waypoint if it is present on the existing flight plan, or inserts it in the current route as a new one if not.

Say you are lost and need to quickly find your way towards a given airport, navaid or locality. Just press -D>, enter the waypoint, and your flight plan will be adjusted so that it becomes your next destination. If no flight plan is loaded a new one will be created starting at your current location.

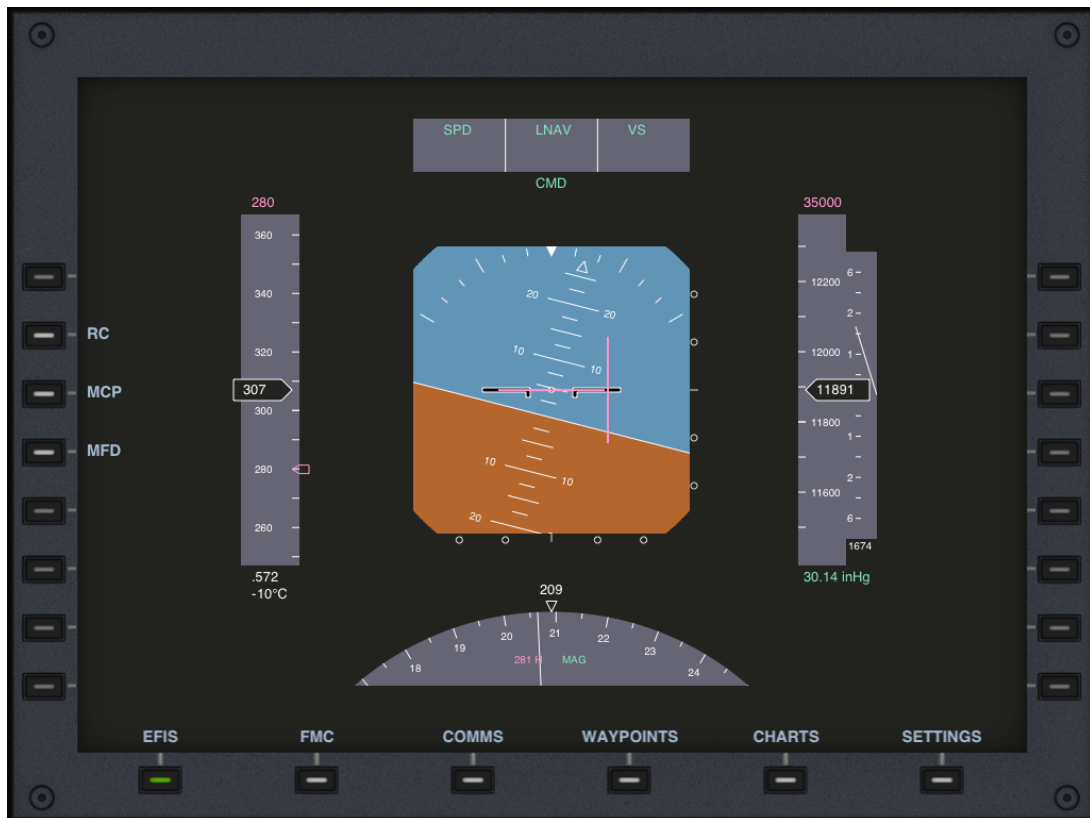
You can then go to the MFD and follow the flight plan line in order to reach it, see how far it is or how long it takes at your current speed.

## 5 EFIS

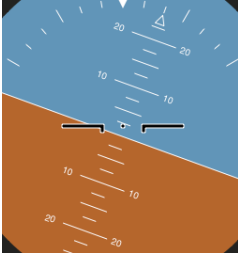
### 5.1 PFD

The EFIS / PFD page of AirTrack replicates the Primary Flight Display of a Boeing and produces real-time visual cues and measurements as received from the selected data source. This chapter describes what each of its displayed hints means.

The screenshot below illustrates an AirTrack PFD-only view on an iPad.



### 5.1.1 ATTITUDE INDICATOR

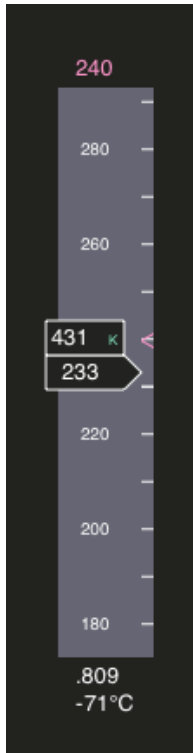


The attitude indicator is in the centre of the PFD, showing the instant roll and pitch angles. The line between brown and blue is the horizon.

When using Device Location Services, the attitude is given in real time and is derived from the device's accelerometers and gyro if available. Also with this kind of data-source, pressing the CAL button allows the AI to be calibrated at 0/0 at its current position.

When used with a flight simulator the attitude is derived from the simulator. In this case the CAL button is replaced by the RC button. Once activated, AirTrack enters in remote control mode, meaning that any movements you make with the device are sent back to the simulator in order to control its roll, pitch and yaw if a gyro is available. Pressing RC once again deactivates remote control mode.

### 5.1.2 SPEED TAPE



Just to the left of the Attitude Indicator is the Speed Tape and as the name suggests, this section represents speed.

The number in the middle black box is the instant Indicated Air Speed (IAS) when using a simulator and is always given in KIAS.

With Device Location Services it is not possible to measure the air speed and hence, this number is the Ground Speed (GS) instead.

If KM/H or MI/H are selected in settings, a second box will be displayed in the PFD just above IAS/GS with the speed in km/h or mi/h and a green K or M respectively.

In the side example the aircraft is moving at 233 KIAS which correspond to 431 km/h.

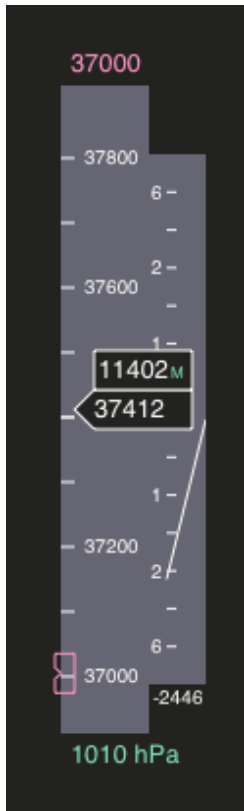
The grey tape moves up and down as the speed increases or decreases. With flight simulators, red and orange strips appear on the right side of the speed bar representing stall speeds.

The magenta bug just next to the IAS box and the magenta number on top represent the dialed speed as set in the auto-pilot or MCP.

Just below the tape is the IAS or GS speed represented in Mach.

Finally, below it all is the outside temperature. In Device Location Services mode the device is not capable of determining the outside temperature; in this case what AirTrack does is to download the METAR of the nearest airport from the Internet (if possible) and display its reported temperature.

### 5.1.3 ALTITUDE TAPE



To the right of the Attitude Indicator is the Altitude Tape.

Similarly to speed, the number in the middle black box is the current altitude and is always displayed in feet.

If METRES are selected in settings for altitude, a second box will be displayed in the PFD just above the altitude box with the altitude in metres and followed by a green M.

The grey tape moves up and down as the altitude increases or decreases.

The magenta number on the top represents the dialed altitude in the auto-pilot; likewise the magenta bug at 37000 on the image represents where this dialed altitude is located.

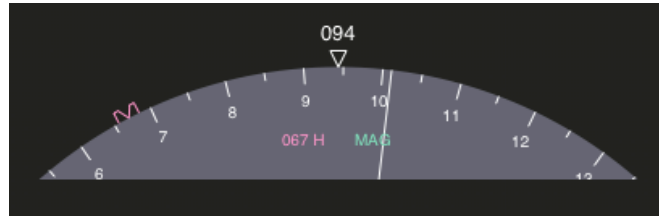
The green number below is the barometric pressure setting, displaying units of QNH in hecto-pascal. If selected under settings this value can be switched to inches of mercury for use in the US.

The barometric pressure value will show STD when at standard barometric pressure, i.e. 29.92 inHg or 1013hPa. You should always have your altimeter set to STD pressure when above transition altitude / level.

Finally on the right most side the needle, which moves up and down, represents vertical speed in feet per minute. The vertical speed value is also displayed below its needle, in white, when above 100fpm or below -100fpm.

### 5.1.4 COMPASS

The section just below the attitude indicator represents the compass. Take the screenshot below as reference.



The number on top is the current heading in degrees. The white triangle bug is always on the top just below it.

The magenta number indicates the dialed heading in the auto-pilot or MCP and the magenta bug represents this dialed heading in the compass circle.

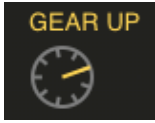
If magnetic north is selected under settings the word MAG is displayed in green. Otherwise, if true north is selected, the word TRU will be shown in white.

Last but not least comes the white needle which, in the example picture, lies on top of 101 degrees approximately. This needle represents the TRACKING direction or COURSE, i.e. towards where you the plane is actually flying or you are actually moving.

Under no wind conditions this tracking needle will move towards the heading direction, i.e. will be shown as a vertical line. But as cross winds hit you, you will gradually move towards one direction even though you are facing another. The tracking needle shows you the direction of flying or movement as opposed to the direction of heading.



### 5.1.5 GEAR AND FLAPS



The GEAR and FLAPS annunciators are shown under certain conditions on the PFD, just below the barometric pressure. They are only available with flight simulator data sources.

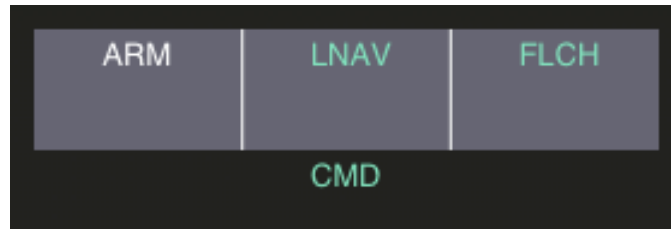
Flaps are shown as a clock whereby the yellow needle moves clockwise from 9:00 o'clock (totally retracted) to 7:30 o'clock (totally deployed). This is just a visual cue and has no special relation to the number of degrees of flap deployment. The flaps clock is only shown when the gear is down or when there is some level of deployment.

The GEAR annunciator is shown when the gear is down or when the gear is up and there is some level of flap deployment.

When en-route with the flaps retracted and the gear up neither of these annunciators is displayed.

### 5.1.6 FLIGHT MODE ANNUNCIATOR

The last section of the PFD concerns the flight mode / auto pilot annunciator.



As it would be expected, this part of the PFD has little purpose when using AirTrack with Device Location Services to detect real movement as there is no way for the app to control a plane's auto-pilot system. Its intent is therefore for flight simulation where it replicates the auto-pilot statuses.

As a general rule, engaged or captured states are shown in GREEN and armed states are shown in WHITE.

The first column represents speed and can display the following values:

- > ARM (white) - The Auto-Throttle is armed but not engaged.
- > SPD (green) - The auto-pilot has the SPEED mode engaged.
- > N1 (green) - N1 speed mode engaged.

The second column represents lateral navigation and can give the following states in either white (armed) or green (engaged, captured).

- > HDG - Heading Hold Mode - The plane follows the dialed heading.
- > LNAV - Lateral Navigation FMC Mode - The plane follows the route loaded in the FMC.
- > LOC - VOR / LOC Mode - The plane follows the tuned localizer or VOR.

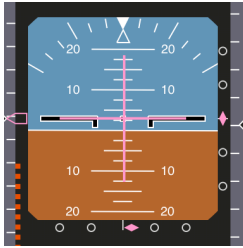
The third column represents vertical navigation. It can have the following states in either white(armed) or green (engaged, captured):

- > ALT - Altitude Hold Mode Engaged - Maintains a certain altitude
- > VS - Vertical Speed Mode Engaged - Maintains a constant climb or descent rate
- > FLCH - Flight Change or Level Change Mode - When changing flight level
- > G/S - Glide slope - G/S Mode - The plane follows the tuned ILS glide slope

At certain times the annunciators may show two states of the same kind, one armed and one engaged, the latter above the former. This happens when, for example, you are using HDG HOLD (engaged) to capture a flight path (LNAV) or localizer (LOC).

Finally, the CMD / FD green annunciator below the grey box tells if the auto-pilot is in control of the plane (CMD) or if only the flight director is active (FD).

### 5.1.7 ILS/VOR Navigation and Flight Director



With flight simulator sources two flight-director magenta lines (one vertical and one horizontal) represent the desired flight path.

The magenta rhombus just below the attitude indicator represents lateral deviation when performing an ILS approach or navigating towards a VOR radial. Say you've tuned in an ILS frequency in NAV1, are in range of the localizer, 5 miles out. If the lower rhombus is to the right of the center point this means that the runway is to the right, if it shows to the left you should turn left. In order to perform a perfect landing the rhombus should be in the middle.

The same applies when navigating towards a VOR radial by tuning it in NAV1, NAV2 or the FMC and by setting a desired course with OBS1 or OBS2.

Sensitivities differ when in APP or VOR modes; APP mode is designed for approach where each of the circles to the sides represent 1 degree of deviation. In VOR mode each circle distance represents 6 degrees of deviation.

In addition to the lateral deviation bug, when performing an ILS approach a second rhombus is displayed on the right side of the attitude indicator representing glide-slope vertical deviation. This bug is only shown when in glide-slope range (within 10nm and acceptable vertical distance) and only if the selected ILS approach has glide-slope facilities (some airport runways may only have localizer / horizontal beacons).

Similarly to the lateral deviation procedure, the rhombus is displayed below the centre if the optimal glide-slope path is below your current altitude and up if otherwise. Each circle interval represents 200 feet.

## 5.2 MFD

The MFD or Multi-Function Display provides a Navigation Display (ND) for navigation by displaying the current position of the aircraft as well as navigation points around it. This chapter provides details on its modes of operation and how to use its capabilities to perform common IFR navigation tasks.

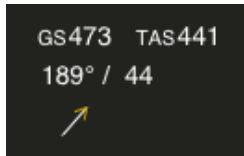
When used together with the FMC, the MFD provides a way for navigating with no visibility or at night in that you practically don't ever need to look outside when performing a virtual or simulated flight.

The MFD was developed with the intention of trying to reproduce a real ND as found on a Boeing 737-NG as much as possible. Many of its details are presented in either the same or very similar ways.

The screenshot below illustrates an iPad with an MFD only view in APP / Expanded mode:



## 5.2.1 SPEED AND WINDS



The top -left corner of the MFD concerns speed and winds and is available for all MFD modes.

The first number (473 in the example) is ground speed following GS. The second number (441 in the example) is True Air Speed following TAS.

Speeds are given in the chosen units which means that if you change them to km/h or mi/h they will be displayed in these.

TAS is only shown when above 100 knots.

The second row concerns winds where the first number (189 in the example) is the wind direction and the second number (44 in the example) is the wind speed.

The wind direction is given in real or magnetic degrees according to the selection made in settings. Likewise, the wind speed is given in the chosen speed units.

The arrow below shows the direction of wind relative to the current orientation of the MFD. In other words, it points to where the winds are blowing to, relative to the display.

Wind information is hidden when the wind speed is below 4 knots and is only displayed again when it increases above 6 knots.

Keep in mind that with Device Location Services (GPS) the winds are not real (as they are not measured). If available, they are downloaded and derived from the nearest airport's METAR and hence, they will make little sense at cruising altitudes.

### 5.2.2 DISPLAY MODES

Similarly to the Boeing's ND, AirTrack supports 4 distinct display modes:

- MAP mode                      - Used during flight
- PLN mode                      - Used for visualizing a flight plan
- VOR mode                      - Used for VOR radio-based navigation
- APP mode                      - Used for performing precision approaches

MAP, VOR and APP can be displayed in one of two ways: CENTERED and EXPANDED while PLAN mode has its own special visualization rules.

In order to change modes, locate the button that says either APP, VOR, MAP or PLN and press it to toggle between modes.

### 5.2.3 CENTERED AND EXPANDED MODES

The MAP APP and VOR modes can be displayed in either CENTERED OR EXPANDED sub-modes.

In centered view the MFD will look like a compass rose which rotates according to the heading or direction of flight and provides an overall 360 degree view of what's around much like an HSI.

In expanded mode the MFD focuses on "what's ahead" instead and only displays a subset of a 180 degree view, depending on the screen orientation.

The centered mode is suitable for localizing yourself and seeing what's behind. It is often use at take-off to give a sense of orientation.

The expanded mode is the most common view mode used during the flight and at approach as it provides more details on "what's coming" and neglects "what's past".

In order to toggle between centered and expanded views press the CTR button.

The screenshot below shows the AirTrack's MFD in centered mode.



## 5.2.4 MAP MODE

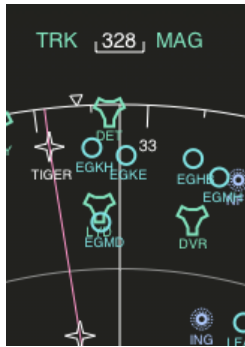
MAP mode is the most commonly used mode and is intended for most phases of flight, so much so that many pilots don't ever use any other mode. Similarly to other modes it shows waypoints and nav aids around, traffic and the flight plan amongst other things.

It can be displayed in centered or expanded sub-modes.

The plane is either always in the middle (in centered mode) or in the bottom (in expanded mode) and is represented by the white triangle pointing upwards.



## 5.2.5 TRACKING



MAP mode is different from APP and VOR modes in that instead of showing your current heading, it shows your current tracking, i.e. the direction of flight instead of the direction of facing. Under no wind conditions they are the same, but as soon as some degree of wind forces start hitting the plane they start to differ.

At the very top is the direction of tracking or course. In the example on the side this is 328 degrees.

If magnetic degrees are selected under settings the word MAG will be shown in green next to it. Otherwise the word TRU will be shown in white.

The white vertical line going down represents the direction of tracking. Now if you look carefully at the example screen on the side you will see a small white inverted triangle on the top-left.

This is the heading direction, i.e. where the plane is facing. In MAP mode it moves as the winds influence the flight pattern. If you remember from the previous example, winds were from 189 degrees at 44 knots so in order to fly 328 the plane has to face slightly to the left, i.e. to around 323 degrees.

Tracking is extremely useful because it shows you where you are moving towards which is ultimately what you are likely to be interested in.

### 5.2.6 THE SNAKE



The snake is the arc shown on top of the plane symbol and represents rate of turn.

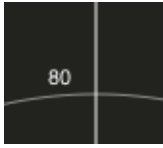
In other words, as you start turning, the arc starts moving to one side or another showing you where you will be in the future at that very same rate of turn.

There can be up to three distinct segments. Their ends represent where you will be, at the current rate of turn, in 30, 60 and 90 seconds respectively.

The 30 second arc is always shown, whereas the 60 second arc is shown only when at a 20NM EFIS range and the 90 second arc is shown when above 20NMs of range.

The snake is always shown in MAP mode but unlike the Boeing's MFD, AirTrack also shows it in APP and VOR modes when these are displayed in expanded views.

### 5.2.7 EFIS RANGE



The white number shown half-way between the plane's position and the top of the compass is the range and it represents the distance from the center of the circle to its crossing line.

If knots are selected, it represents knots, otherwise kms or miles.

The range indicator is displayed in all MFD modes to give you an idea of how far things are.

In order to change the range, i.e. zoom-in or zoom-out, you can use finger pinch gestures to widen or close the radius of visibility, or you can use the simulator's EFIS range switch to change between standard 10, 20, 40, 80, 160, 320 up to 640 nm.

With finger gestures you can make AirTrack display any range between 1nm and 640nm.

### 5.2.8 EXCESS DATA

Whenever there are too many waypoints on screen, so many that it becomes impossible to tell one from another, AirTrack gives an EXCESS DATA message and auto-decreases the range until less points are displayed.

The number of allowed points on screen varies from view to view and is at the current implementation limited to 200 per page.

The EXCESS DATA message can appear in any visualization mode.

### 5.2.9 NAVIGATION POINTS









The MFD will show the points on the navigation database that are immediately around the center position according to their selection mask and range.

Each point type has a different symbol and is displayed with its ID code below.

Points are displayed exactly where they are on the map.

The point selector buttons allow you to enable or disable a given point type's display. Remember that you cannot have more than 200 points per page so it is standard practice to disable certain points types when operating at 320 or 640nm ranges for example, so that you don't get the EXCESS DATA message.

The following table summarizes the different point types, their symbols, their toggle buttons and their display restrictions.

Symbol	Type	Button	Range restrictions
	Airport	APT	
	FIX	WPT	Above 40nm, only high-altitude intersections
	VOR	VOR	Above 40nm, only high-altitude VORs
	VOR-DME	VOR	Above 40nm, only high-altitude VOR-DMEs
	VORTAC	VOR	Above 40nm, only high-altitude VORTACS
	NDB	NDB	Above 40nm, only high-altitude NDBs
	Custom WP	CWP	Custom Waypoint
	Locality	LOC	Locality or City

## 5.2.10 TRAFFIC



When an air traffic source is selected under settings such as VATSIM or IVAO, and there is has an Internet connection available, AirTrack tries to download surrounding traffic every minute according to the selected EFIS range.

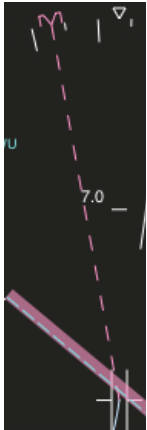
If other aircraft are found surrounding your center position, and if the traffic toggle is enabled, these other planes will be drawn in the MFD with a symbol similar to the one on the side and their call-sign underneath.

Traffic can be switched on and off by pressing the TCA button.

Note: When flying on VATSIM or IVAO, in order for your aircraft not to be displayed incorrectly as surrounding traffic make sure that you set your call-sign right in the simulator or plugin so that AirTrack can hide it.

Note: Although AirTrack tries to download traffic every minute, it does so via a central server which then queries the IVAO and VATSIM network servers at its own rate and according to the requested refresh rates. This effectively means that you should expect traffic updates every 2 to 5 minutes only.

### 5.2.11 THE HEADING HOLD AP NEEDLE



Presented in MAP, VOR AND APP modes, the heading hold AP needle shows the heading direction that is dialed in the auto-pilot.

It is the long dotted magenta line that extends from the center to the edge of the compass circle. As you move the heading dialer or changed the planned heading, it moves.

The magenta bug and the white triangle on the side match when the dialed heading is the same as the current heading, i.e. when the auto-pilot has achieved its target direction in HDG HOLD mode.

### 5.2.12 PLAN MODE

PLAN mode differs from other modes in three significant ways:

- It is always shown with the TRUE NORTH UP
- It is always shown in centered mode (with a full 360 degrees overview of space)
- If an FMC plan is loaded and has an active leg, the point in the center of the circles is the next waypoint and not the current position.

The screenshot below illustrates AirTrack in PLN mode. The airplane symbol moving along the purple line represents the current position and heading. In this example the plane is moving towards WRB which is shown in the center of the circle.





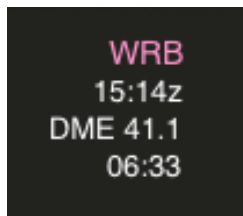
### 5.2.13 DRAWING THE FLIGHT PLAN

The previous screenshot also shows a sequence of magenta lines connecting stars; this path represents the flight plan, as entered in the FMC, if one is available with the following rules:

- Crossed segments are drawn in white. The current and future segments are drawn in magenta.
- The next waypoint star is drawn in magenta while other points are drawn in white.
- Latitude / Longitude points are drawn with a small green circle instead of a star.
- Terminal airports are drawn with a white circle.

When the terminal point is a runway or localizer and the range is equal or below 40nm, a runway symbol is used to represent the runway instead of the airport symbol, also reflecting the runway direction and, if applicable, the localizer range.

### 5.2.14 THE NEXT WAYPOINT



Whenever a flight plan is loaded in the FMC and one of its legs activated, the top-right-corner or MAP and PLN modes will shown it in magenta as the image on the side.

If movement is detected the second line will show the estimated time or arrival (ETA) at that same waypoint in either zulu or local time, and the fourth line will show how long it will be until the waypoint is reached. These calculations are performed at instant ground speed so they neglect climb or descent rates or speed restrictions imposed in terminal areas.

The third line shows the remaining distance to the waypoint.

### 5.2.15 VOR MODE

Before going into details on APP mode, lets consider VOR mode. As the name suggests, this mode is used with VOR radio based navigation. Like with other modes, it displays all surrounding waypoints and can be used with either centered or expanded views.

VOR mode works primarily with the OBS/COURSE selectors and the NAV radios.

You tune in a VOR frequency in NAV1 or NAV2 and you tune in a VOR radial in OBS1 or OBS2.

As soon as you are in range, i.e. your distance to the VOR, VOR-DME or VORTAC is smaller than its range for your altitude, the VOR radial you dialed in OBS1 or OBS2 is drawn on top of the VOR on the map and the course needles are adjusted to that same radial.

The following screenshot illustrates navigation towards the HEC (HEHLINGEN) VOR-DME in VOR mode.



Its frequency, 117.30 Mhz, has been tuned in NAV1 and we are in range, so the radial out of HEC is drawn in green. Because OBS1 was set to 045 degrees, the direction of the radial is 045.

The direction of the course needle is also 045. This is the large white needle with a pointy end above, as well as its magenta part.

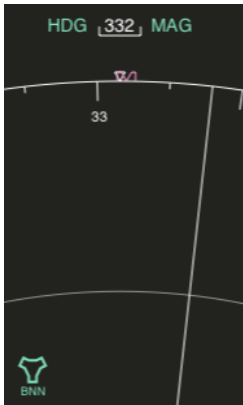
At the edge of the compass rose diameter you can see a small green arrow (on top, just below HDG). At the opposite side you can see the end of the arrow. This arrow shows the direction that you need to fly in order to reach the VOR.

Now in the example above we are intercepting the VOR radial 045 (drawn with a green dotted line). Because this radial is to our right, the magenta needle is also to our right. As we approach the radial the magenta needle will move and meet its white counterpart; when the two are lined up you cross the radial.

One difference from MAP and PLN modes is that in the top-right corner of the MFD the next waypoint section is shown differently; in this case it says VOR (1/2) and it shows the dialed radial instead of the ETA.

Another difference is the world DME; because the VOR has a co-located DME (Distance Measurement Equipment), the DME section shows you how far you are away from the VOR.

### 5.2.16 HEADING INSTEAD OF TRACKING



Unlike MAP mode, VOR and APP modes show the current heading on top, preceded by the green word HDG.

You will notice that the inverted white triangle is now always centered. The white line however moves indicating the tracking direction.

In the side example, although the plane is headed towards 332 degrees magnetic, it is actually moving towards 343 due to the side winds.

## 5.2.17 THE N1/N2/ADF1/ADF2 ANNUNCIATORS



The N1/ADF1 and N1/ADF2 annunciators are shown in the bottom-left and bottom-right corners of the MFD in APP, VOR and MAP modes.



The left side always refers to the first set of radios and the right side to the second set of radios.

They represent what is tuned in the NAV1/ADF1 and NAV2/ADF2 radios respectively.

When the tuned frequencies don't capture any signal, the annunciators simply show their frequencies and say the words NAV or ADF. This is the default mode.

As soon as you are in range of a tuned frequency, the corresponding annunciator captures it and shows its name instead of the frequency. The captured signals can be VORs, VOR-DMEs, VORTACs, NDBs or Localizers for ILS approaches.

As before, if a DME is co-located with the station and shares the same frequency, the word DME will be followed by the measured distance to the point.

### 5.2.18 VAS - THE VOR-ADF SELECTOR

Real planes often have a VOR/ADF selector button or a pair of these, one for the first set of radios and one for the second. AirTrack provides this functionality through the VAS button.

Pressing it toggles through the following modes:

- > NAV1 / NAV2
- > NAV1 / ADF2
- > ADF1 / NAV2
- > ADF1 / ADF2
- > DISABLED / DISABLED

The VOR / LOCALIZER / VHF based annunciators are displayed in green. The NDB / ADF based annunciators are shown in light blue.

The VAS switch essentially toggles which nav aids to consider for navigation and targeting, if VOR/LOC based or NDB based, and selects their radio.

### 5.2.19 THE AP SOURCE SELECTOR - NAV1 - NAV2 - FMC

The AP source selector determines which waypoint to consider as next and consequently, to be displayed in the top-right corner of the MFD.

The possibilities are:

- > NAV1 - The waypoint tuned into and captured by the first set of radios, either NAV1 or ADF1 depending on VAS.
- > NAV2 - The waypoint tuned into and captured by the second set of radios, either NAV2 or ADF2 depending on VAS.
- > FMC - Irrespectively of what is tuned into and captured by NAV1,2 or ADF1,2, use the next waypoint as entered in the FMC as the next waypoint and show it on the top-right of the MFD page.

You can change the AP source in AirTrack by locating and pressing the key that either says NAV1, NAV2 or FMC, according to the source selector current status.

Notes:

When in FMC mode the direction of the course needles and VOR radials is determined by the FMC course and not by OBS1 or OBS2, i.e. the direction from the previous waypoint to the VOR.

Furthermore, navaid ranges don't apply when navigating in FMC mode; this is because the FMC has its own database of points and knows where VORs are with regards to it so it doesn't need to be in range in order to show them.

### 5.2.20 ADF / NDB NAVIGATION



Much like VOR navigation, in order to navigate towards an NDB:

- 1) Tune the NDB frequency in ADF1 or ADF2 or enter it in the FMC
- 2) Be within its range
- 3) As soon as this happens, the ADF annunciator will report the name of the captured NDB and the light blue needles at the edge of the compass as the ones on the side pictures will show the direction of flight towards that same NDB.



Since NDBs don't have direction it doesn't make sense to consider their radials. You can however rotate the OBS needles by dialing different course/obs headings.

## 5.2.21 APPROACH MODE

Approach mode is very similar to VOR mode, the only difference being that it is aimed at performing localizer approaches instead of flying with VORs.

As the name suggests, it tends to be useful when approaching an airport. As VOR and MAP modes, it can be displayed with either expanded or centered views.

As VOR mode, it can use either NAV1, NAV2 or the FMC as a source for the next way-point, which is likewise displayed on the top-right corner of the screen.

The major differences between APP and VOR modes, as implemented, are:

- > APP mode relies on localizers as VHF points.

- > Instead of radials, localizers have a single fixed bearing and range in the direction of the runway.

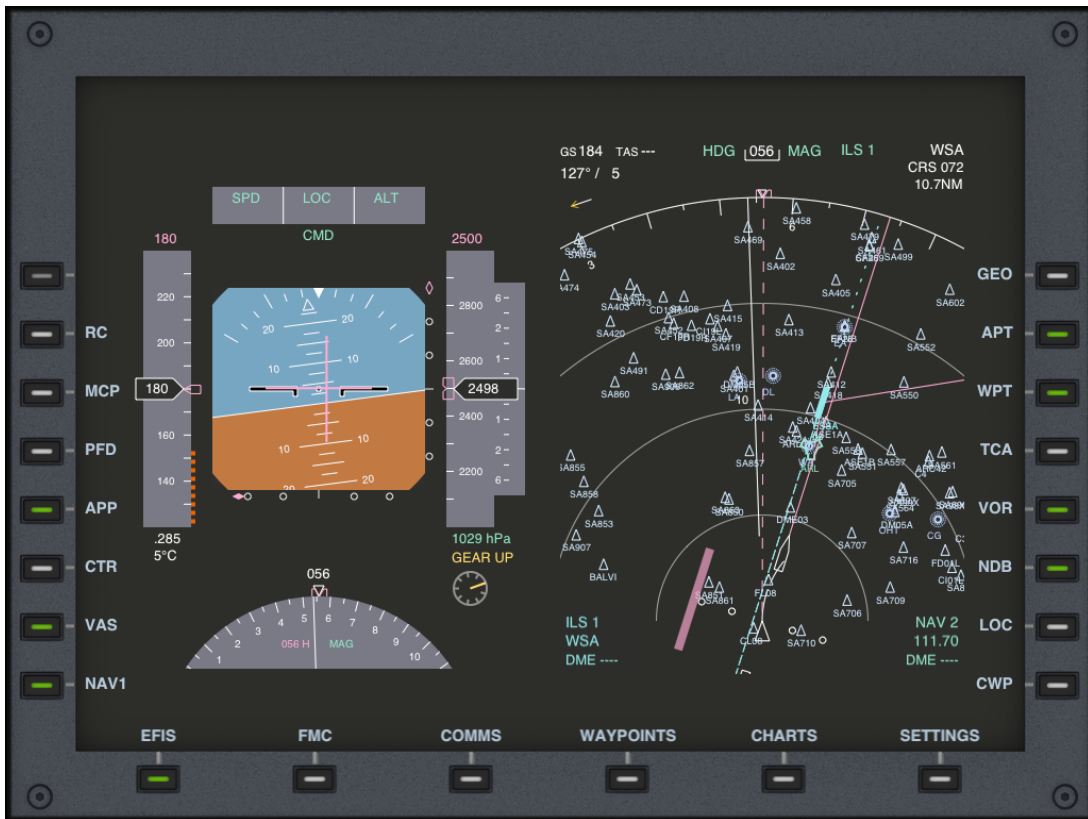
- > The OBS dialed courses become irrelevant once you capture the localizer; its bearing takes precedence and the AirTrack APP mode adjusts the course needles automatically and accordingly.

- > The rules for capturing the localizer and thus making the magenta bar move towards the center are different:

- 1) You must not be higher than 4500 feet of altitude from the ground altitude.
- 2) You must be within a 10 degree each side (20 degree total) cone of the direction of the localizer when further than 10nm but within its range, or within a 30+30 degree cone when at less than 10nm distance from it.



The screenshot below illustrates an iPad in CFD mode (combined PFD and MFD) and the MFD during an ILS approach.



Again the magenta needle moves towards the centre as we capture the ILS direction which is given by the green line. The extend of the green line determines the localizer range, typically 18nm.

### 5.2.22 CFD MODE

As mentioned, on the iPad and because the screen is large enough you can select a PFD only mode, an MFD only mode, or CFD - combined mode (the default). To do this press the EFIS button more than once or the PFD/MFD/CFD button.

### 5.2.23 EFIS MODE/NAV FREQ DISAGREE

If you see the message EFIS MODE/NAV FREQ DISAGREE displayed in orange as in the screenshot below, don't panic, it's perfectly harmless.



It just means that:

You are in APP mode and the tuned / captured frequency navaid is a VOR

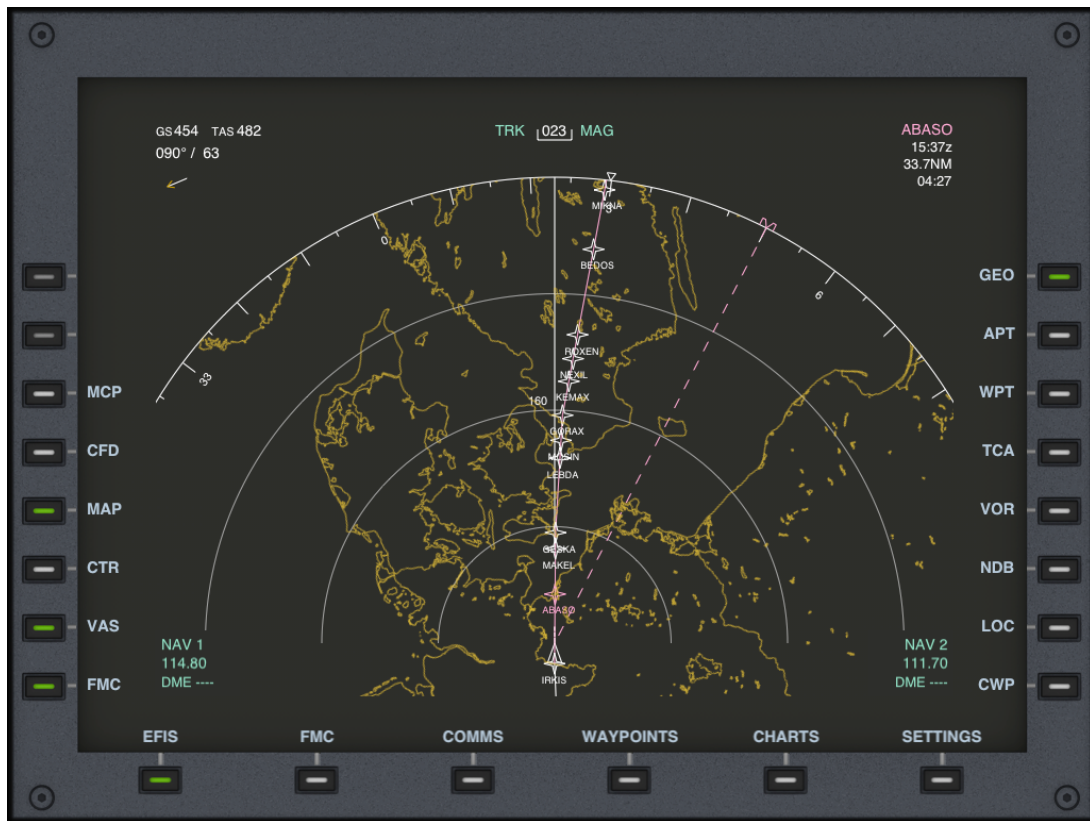
You are in VOR mode and the tuned captured /frequency navaid is a Localizer.

Just swap to VOR/APP mode and the warning will disappear.

### 5.2.24 GEO MODE

The GEO mode button toggle activates and deactivates the display of the world's coast and border contours as a map is drawn on demand in the background of the MFD and adjusts itself according to its display modes. The whole world is included.

The screenshot below illustrates an MFD with GEO mode map ON together with a flight plan.



Unlike other display selectors, the world contours take considerable time to load; this is because they are drawn on demand, in real time, according to the aircraft's current position, the selected display mode and the type of screen. Therefore, please allow some seconds for the world contours to load after you select GEO or whenever you change views.

How long it takes to draw them or how fast they are drawn depends on the hardware in use, on the complexity of the location you're in and on the range selected. Drawing a relatively short range (20NM) is relatively quick whilst drawing at 640NM range takes a while. Drawing in an old iPhone also takes considerably more time than drawing on a recent released piece of hardware.

### 5.3 THE MODE CONTROL PANEL - MCP

The Mode Control Panel is accessible using the MCP button on the EFIS. On the iPhone and iPod the MCP is divided in two parts since all dialers don't fit in one screen. On the iPad, as shown below, everything is displayed in a single page.



The MCP interacts with the auto-pilot of a flight simulator; it has no purpose when used with Device Location Services other than changing the position of the magenta needles and indicators on the PFD and MFD.

But when used with the simulator it can control the auto-pilot by sending commands to it, and it can be used to show its states.

Tapping on each of the seven numbers allows you to change:

- > The target altitude / flight level
- > The barometric pressure
- > The target IAS/MACH speed
- > The target vertical speed

- > The dialed radial of a VOR as tuned in NAV1 (COURSE 1)
- > The dialed radial of a VOR as tuned in NAV2 (COURSE 2)
- > The heading hold direction

In addition, its status buttons allow you to toggle AP states and send these to the simulator; the buttons change in color from white (disabled) to yellow (armed) to green (enabled/captured).

The following table summarizes their purpose and action:

Button	Purpose
FD	Enable / Disable the director
CMD	Auto-Pilot is in control / Triggers FD
SRC	Toggles AP source between NAV1, NAV2 or FMC
AT/ARM	Arms / Releases auto-throttle
SPD	Engages SPD HOLD mode - Requires AT/ARM
C/O	Toggles between IAS and MACH speed modes
N1	Engages N1 speed mode
VNAV	Engages / Disengages Vertical (FMC) navigation
LVL-CHG	Engages Level-Change or Flight Change mode
ALT HLD	Engages / Disengages Altitude Hold Mode
V/S	Engages Vertical Speed mode
LNAV	Engages or arms lateral navigation (FMC)
HDG SEL	Engages / Disengages Heading Hold mode
VOR / LOC	Arms the VOR/LOC capture
APP	Engages approach mode and glide slope intercept

## AirTrack 3.1 Operations Manual

The relationship between the different modes and buttons depends on the aircraft and the implementation in use. Some buttons and modes have dependencies on others, for example:

Engaging / capturing LNAV mode causes HDG mode to disengage

VNAV and ALT mode are mutually-exclusive

All AP modes only work when you have the auto-pilot turned on, which means, having at least the flight director turned on (or CMD which requires it).

## 6 CHARTS

The CHARTS section provides access to the embedded cloud-charts viewer.

Charts are made available for download on the cloud (i.e. the Internet) so in order to receive them your iDevice needs to be connected to the Internet. Please note that charts may comprise a relatively large amount of data so you may want to avoid downloading them if you are using cellular data and have data limits imposed by your carrier.

### 6.1 CHARTS NAVIGATOR

The charts navigator is the interface that allows access to charts. Charts are organized hierarchically in folders; a typical chart hierarchy comprises country, airport and chart-type sub-folders, although this may vary and is ultimately determined by how things are organized in the cloud.

The following screenshot illustrates the charts navigator on the iPad. You will see that it is on the US > MA > BOSTON > BOS section, on which there are APD, DP, HOT, IAP, LAH, MIN and STAR subsections.



By tapping on one of the available sections you can go deep into it and reveal its contents. An UP button provides upwards navigation in the directory tree, i.e. goes up one level.

On the iPad if there are more entries than buttons, a MORE button will give access to the remaining entries.

Sections and charts are cloud-based i.e. are made available on the cloud and are remote to AirTrack at first. As soon as a new section or chart is added to the cloud, it appears on AirTrack providing it is connected to the Internet. Likewise if one chart or section is removed from the cloud, it will be removed from AirTrack at the first opportunity.

Charts and sections depend on a user's profile so users are encouraged to be logged in with an Air Account in order to have the biggest number of charts and resources made available.

## 6.2 DOWNLOADING AND SYNCING

Charts and sections are made available in the cloud for download and are therefore remotely available. When a user selects a chart it is then downloaded and stored in the local device and it thus becomes local.

Local charts and sections are available even when you are not connected to the Internet. They are for instance available while in-real-flight at 39000 feet.

Local charts and sections consume storage space; a CLEAR button is provided in the charts navigation, with which either a single chart or a full section hierarchy can be deleted, thus releasing storage space from that point downwards. The charts and sections remain available in the cloud as remote, and can be downloaded again if wished.

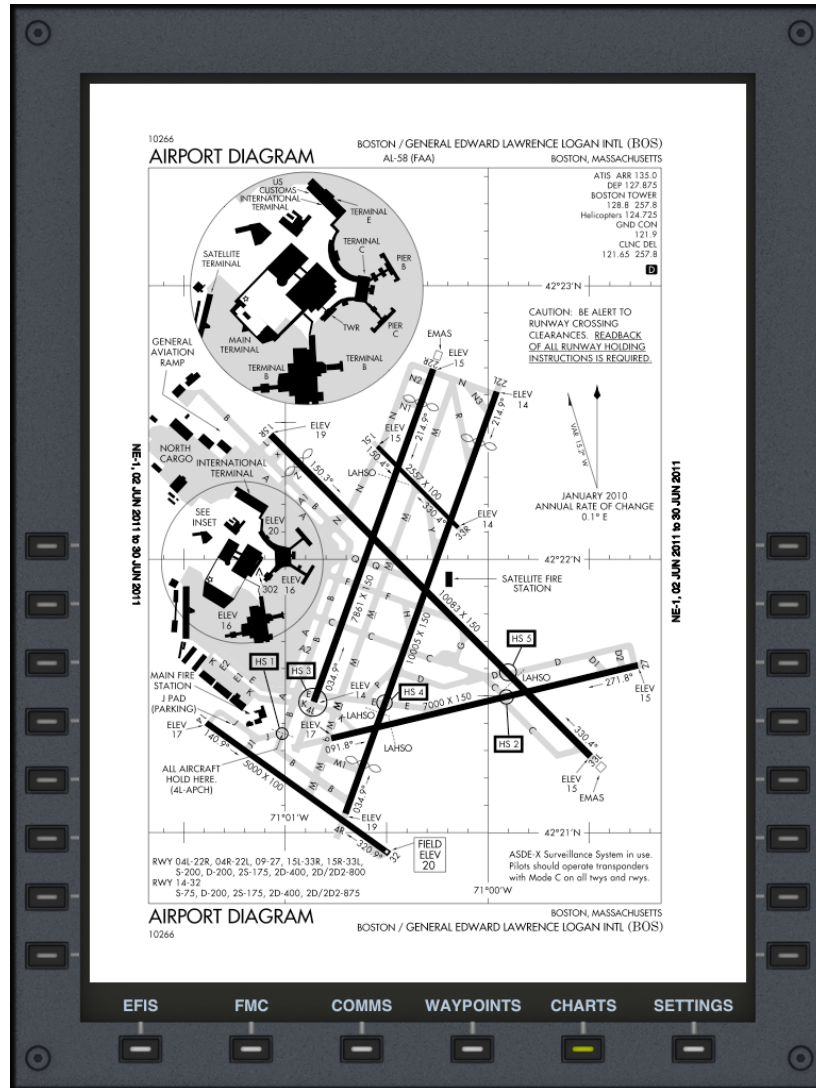
Charts are stored when they are selected and downloaded. In addition to doing this for each and every chart, one by one, a SYNC button provides a means to download all the charts and sections available from a given point downwards.

Say you're flying to Amsterdam - EHAM, and would like to take with all all the charts available for this airport. You'd navigate down to EHAM and press SYNC on the ground to



download all charts available, at which point they are all locally stored and available for consultation when airborne without internet connectivity.

### 6.3 THE CHART VIEWER



Clicking on a chart causes it to be downloaded from the cloud, locally stored and shown. The user can then zoom in or out using pinch gestures, and move left, right, up or down with scrolling. Rotating the device orientation also causes the chart to be redrawn according to the new display space.

Charts may have one or more pages; if they have more than one, a NEXT button on the right will allow the next page to be selected whilst a PREV button on the left will allow the user to return to the previous page. On the iPad the words PREV and NEXT are omitted in order to provide more space for the chart.

Clicking on the CHARTS page button (which turns yellow on the iPad) when displaying a chart closes it and brings AirTrack to the Charts Navigator, allowing for other charts and sections to be selected.

#### 6.4 CHART AVAILABILITY

Due to their respective copyrights, most charts cannot be distributed freely and when they can, keeping an always up-to-date chart cycle would consume considerable resources and time. For this reason users will not see many charts available for free, public and automatic download.

In addition to free charts, some charts or sets are made available via inApp purchases. Users can click on them as if they were to download them in which case they will be presented with an option to purchase them.

Last but not least, with an Air Account users can now upload, have and manage their own charts on the Air Web Site. User charts are personal in that only their owners see them when logged in. Charts can be organized in folders or sections. The charts of a given user will automatically appear for download in all AirTrack instances that the user logs in with.

## CREDITS AND ACKNOWLEDGEMENTS

AirTrack was developed by Haversine Ltd but not all work was performed in-house. Some portions of AirTrack are based on work from other entities and people. The following is an acknowledgement and THANKS for their work:

- ▶ The X-Plane nav aid database is built from the original version of the X-Plane Airport & Navigation Data compiled by Robin Peel who kindly allowed us to use it, and which can be freely downloaded from <http://data.x-plane.com/>. It is released under the Free Software Foundation General Public License (GPL) which can be found at: <http://www.gnu.org/licenses/gpl.html>.
- ▶ [NAVIGRAPH](http://www.navigraph.com) who provided all the support and help required to integrate and make the latest FMS AIRAC data available to AirTrack. You can visit them at [www.navigraph.com](http://www.navigraph.com).
- ▶ The localities database was derived from the information made available by [geonames.org](http://geonames.org) and its data source is freely available for download released under the Creative Commons License 3.0 available at <http://creativecommons.org/licenses/by/3.0/>.
- ▶ Some of the icons found in the tab bar were authored by Joseph Wain and were downloaded from: <http://glyphish.com/>.
- ▶ The plugin for Microsoft Flight Simulator 2004 and X is developed by the partner company, Mobiclip S.L.
- ▶ The Weather is periodically downloaded from the US National Weather Service.
- ▶ The world coast and border lines were compiled from the data made freely available by the US National Oceanic and Atmospheric Administration's ([noaa.gov](http://noaa.gov)) - National Geophysical Data Center.

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