

Aviation Apps

Deliver Growing Utility

by Matt Thurber

A revolution has grabbed hold of aviation, in the form of powerful handheld computers that rival the capabilities of built-in avionics. While portable devices aren't new in aviation, since the 2010 introduction of the Apple iPad, the variety and capability of the aviation "apps" (software applications) that have become available are nothing less than amazing. With the right combination of an iPad or Android device, a navigation app and an external GPS receiver and attitude and heading reference system (AHRS) device, pilots can fly with a synthetic-vision display that rivals panel-mounted avionics that cost from thousands to tens and even hundreds of thousands of dollars.

Of course, none of these apps or the devices that run them are certified by aviation authorities, but as backup advisory information they are unparalleled. And for many instrument and commercial pilots, replacing 40 pounds of paper charts with a lightweight iPad or Android tablet has been a back-saving boon. Increasingly, the paper that isn't being carried aboard aircraft includes not just navigation charts but also flight manuals. The complex systems that make modern aircraft so efficient and safe often come with extensive training manuals and explanatory documents. Why not carry all these in a handy portable device like the iPad? Most aircraft don't carry maintenance manuals on board, but with a tablet computer it's easy to do.

Pilots used computers for flight planning and performance calculations for a long time. Many aircraft have flight management systems (FMS) that can compute takeoff and landing runway requirements as well as weight and balance, but the avionics in the cockpit need to be switched on to use the FMS. Eclipse Aerospace's QRA app allows pilots to perform all necessary preflight and pre-landing calculations quickly, easily and accurately on an iPad. Even better, with flight planning and performance apps, pilots can play around with different scenarios in the comfort of home or a hotel room, while checking for weather updates, emailing and messaging, all well before driving to the airport.

For pilots, new security protocols enacted after the 9/11 attacks mean the eruption of rapidly changing

temporary flight restrictions (TFRs) over parts of the U.S., especially when the President travels. While it is easy to look up TFRs before takeoff on the Web or using a mobile device, a relatively new capability is now available in cockpits: free ADS-B weather and traffic data delivered to mobile devices and cockpit displays. Satellite-delivered weather capability, it should be noted, has long been available using XM WX, for a reasonable monthly fee. The huge advantage of ADS-B and XM data streamed into the cockpit is that pilots can view updated weather and pop-up TFRs well before they affect the flight. Many business turboprops and jets are equipped with broadband Internet access systems using satellites or air-to-ground communication networks, and these allow pilots to use their tablet aviation apps as if they were on the ground.

Aviation applications for small computers didn't begin with the iPad, and there is a long history of clever developers who leveraged the growing power of microprocessors to make flying safer and more efficient. At the same time, powerful computers live at the heart of all modern avionics equipment, and it seems that elements of iPad apps and sophisticated avionics are merging. Witness, for example, the growing adoption of touchscreen controls in avionics, a trend that is expected to accelerate rapidly. And this is because a new generation of pilots has grown up expecting to use touch gestures to pinch-zoom images on whatever display they happen to be using. Most modern cockpit avionics now display geo-referenced (own-ship) position on moving maps and approach charts, and many aviation apps offer this feature for mobile devices.

There are so many aviation applications already flooding the market that it is impossible to cover them all. Following are brief summaries of some of the key applications and hardware that pilots are employing, and this includes people flying light sport and experimental aircraft to business jet, airline and military pilots. Note that many of the iPad apps will not run on the original iPad and require iOS 6.0 or later (iPad 2 or later, including iPad mini). There aren't as many Android apps, but these are growing in capability and are covered as well.

iPad Apps



Adventure Pilot iFly GPS

Adventure Pilot makes its own portable GPS receiver and recently brought many of this device's capabilities to the iFly moving-map app. Some unique features in the iFly app are high-definition chart display, which sharpens the contrast on aeronautical charts to make them easier to view on the iPad; AutoTaxi+, which pulls up geo-referenced airport charts automatically after landing, including satellite views of the airport when no taxi chart is available; and "dynamic vector map mode," which adjusts detail as the user changes the zoom level. The iFly GPS app works with a variety of ADS-B and AHRS devices and costs \$109.99 per year for VFR/IFR charts.



Airbox Aerospace Aware

The Aware app, designed for VFR pilots flying in the UK, represents an example of ATC authorities blessing the use of a non-certified device (the iPad) for use in navigating in complex airspace. While the FAA has expressed unwavering opposition to the use of iPad apps for determining position in relation to restricted airspace, the UK's Nats air traffic control organization worked with Airbox to develop the Aware app. Cost is £24.99 for a single CAA chart or £59.99 with the full complement of CAA charts.



Airguide Publications/ Anywhere Education eKneeboard

Airguide's iEFB app is no longer available, having been replaced with the eKneeBoard app developed by Airguide's partner, Anywhere Education. The eKneeBoard app includes one of Airguide's pioneering features, overlay of geo-referenced approach charts oriented to the local geography and overlay of Airguide's Flight Guide diagrams as well. Other eKneeBoard features include performance-based flight planning, automatic calculation of top-of-climb and top-of-descent and built-in reference library of FAA and AOPA information. The app also offers access to courses on ATC procedures and pilot training, available for a fee. The app is free for download of one U.S. state worth of data. Yearly cost for nationwide U.S. charts is \$34.99, or \$79.99 with full U.S. Flight Guide enhanced airport information.

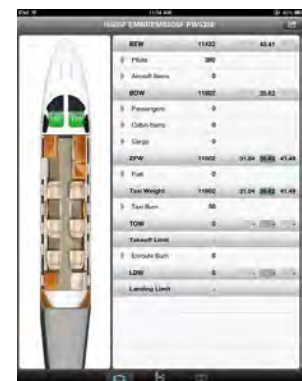


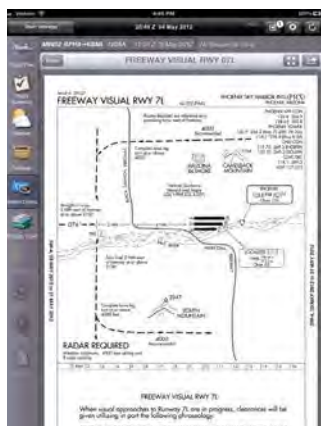
AOPA FlyQ EFB

The FlyQ EFB app is part of a series of FlyQ products. The simplest is the FlyQ Pocket app, which is available for iPhone and Android smartphones. The Pocket app is a source of information about airports and weather and offers a basic flight-planning service. Once a plan is entered into the Pocket app, it can be picked up and modified in FlyQ Web, the online version of the FlyQ service. Both Pocket and Web versions are free to AOPA members. The FlyQ EFB app is also synched with the Pocket and Web versions and brings a full suite of services, including wind-optimized flight-planning, charting, moving-map, synthetic vision, terrain/obstacle avoidance, agl altitude gauge, fuel prices, split-screen mode and other features. FlyQ EFB includes geo-referencing on maps and approach charts.

APG iPreFlight

Aircraft Performance Group's preflight performance planning services are available on the iPad in the iPreFlight app. That app calculates runway performance and weight-and-balance and can be used to plan the flight and check weather and notams. Performance calculations can also be done while offline. The planned flight information is all saved in an iPreFlight Book, which can easily be shared in an Adobe PDF version. Cost varies and depends on the number of aircraft in the operator's fleet.





Arinc Direct

Customers of Arinc Direct's flight-planning services can access all of their trips on the Arinc Direct app and update or modify a flight plan, and view weather information and status reports. Also available on the app are runway analysis (provided by Aircraft Performance Group), airport diagrams, takeoff minimums, approach charts, Sids and Stars, worldwide en route charting and overlay of flight plan and weather imagery on maps. The app is free, but users must be subscribers to Arinc Direct's services.

Bendix/King myWingMan EFB

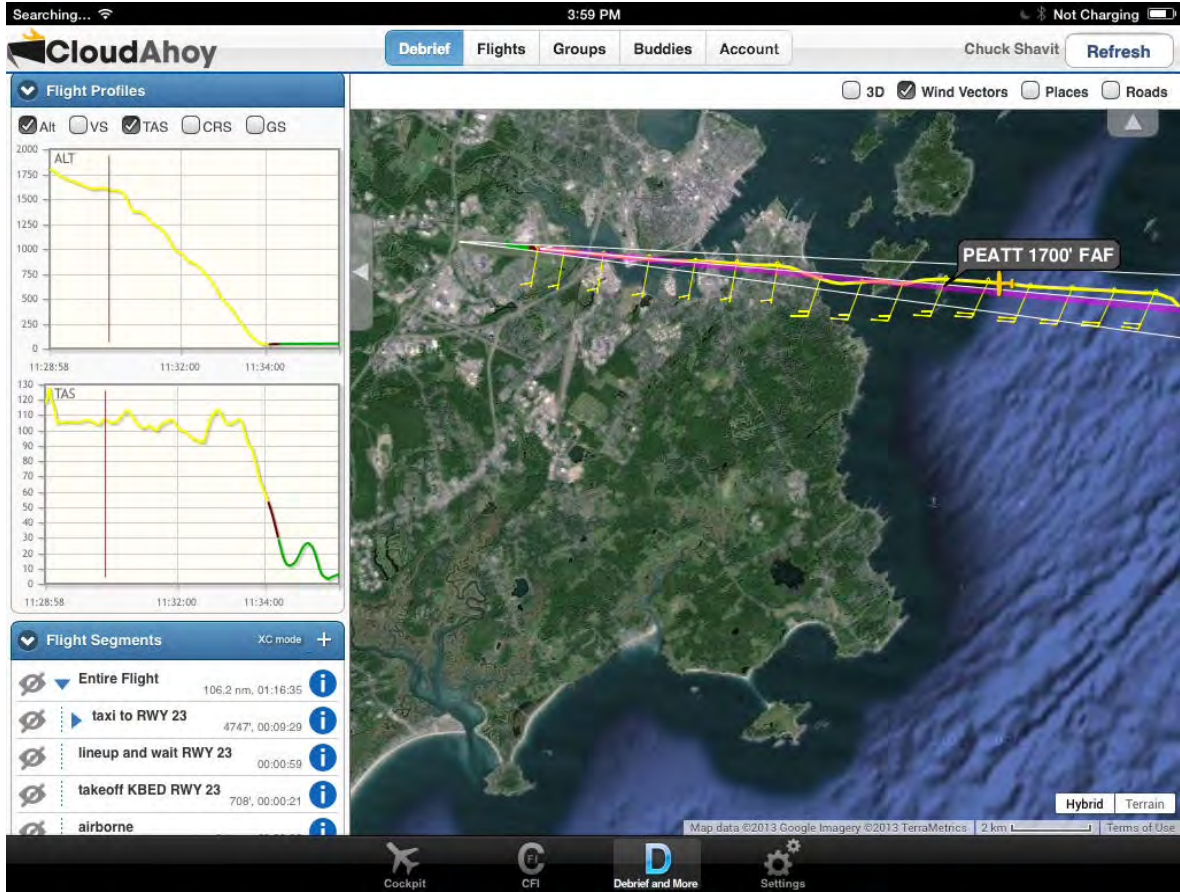
Bendix/King's myWingMan EFB is a full moving-map app, currently available only for the iPad (an Android version is under evaluation). The app offers two- and three-way split-screens so users can view terrain overlay on maps in one screen, synthetic vision in another and, say, an approach plate with geo-referenced position in a third. The 3-D synthetic-vision view also offers a "chase plane" perspective, as if watching the airplane from behind, as well as the ability to overlay the synthetic-vision terrain with VFR and IFR charts. With an external AHRS sensor, myWingMan can display an EFIS view with an attitude indicator. The myWingMan app currently offers coverage in the U.S. and Germany, with other European charts available soon. Coverage of Canada is also planned. VFR subscription is \$99.99 per year, and IFR is \$149.99.



Basic operating weight	26798 lb
+ Crew	400 lb
+ Passengers (count = 5)	850 lb
+ Baggage	151 lb
Zero fuel weight (32000 max)	28199 lb
+ Fuel (20000 max)	15000 lb
Ramp weight (48300 max)	43199 lb
+ Taxi burn	150 lb
Takeoff weight (48200 max)	43049 lb
- Enroute burn	14000 lb
Landing weight (38000 max)	29049 lb
Landing fuel weight	850 lb
Takeoff C.G. (507.74 in - 523.20 in)	518.43
Landing C.G. (506.60 in - 520.40 in)	516.95

Cavu Companies EFB-Pro

EFB-Pro's key feature is performance calculation for business jets, and the app can be used with or without an Internet connection. This allows pilots to recalculate landing performance, for example, while in the air should weather at the destination worsen. For preflight planning, EFB-Pro provides weight-and-balance calculations and net takeoff flight-path profile for calculating obstacle clearance weight restrictions, including real-time weather when Internet connection is available. EFB-Pro can also store user documents. Price varies, and users must have a Cavu Companies mobile account.



CloudAhoy

While many business jets already have built-in data-logging systems, CloudAhoy offers a simple and inexpensive way to log flight data and view a detailed debriefing of the flight afterwards. The CloudAhoy app works best with an external GPS providing position information, and it also runs in the background so other moving-map apps can be used at the same time. The data recorded from the flight is combined with chart, weather, airport and other data to provide a debriefing of the flight, with details on speed, position, maneuvers flown, overlays of approaches and so on. Each flight can be played back, too, in either the 2-D or 3-D mode (Google Earth must be installed on the debrief computer) or in a cockpit view mode. Flight logging is free, and viewing of debriefing data costs \$45 per year.

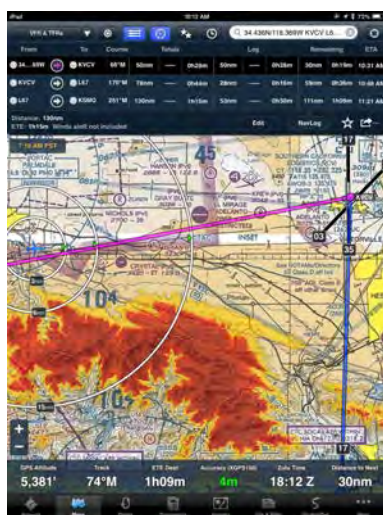


CockpitApps iLog

The iLog flight-logging app walks the user through all the aspects of a flight. The app's process overview shows all the elements on one page so the user can see everything that needs to be verified and recorded, beginning with on-duty time, RVSM review, departure and destination airports, fuel, block-out and takeoff time and so on. Pilots can record RVSM altimeter checks in flight, and after landing note touchdown and block-in time, fuel burned, flight time (night/day, approach types), off-duty time and VOR check details. If any required parameter is out of limits or near the limit, such as the VOR check, it will be flagged on the process overview page.

FltPlan Go

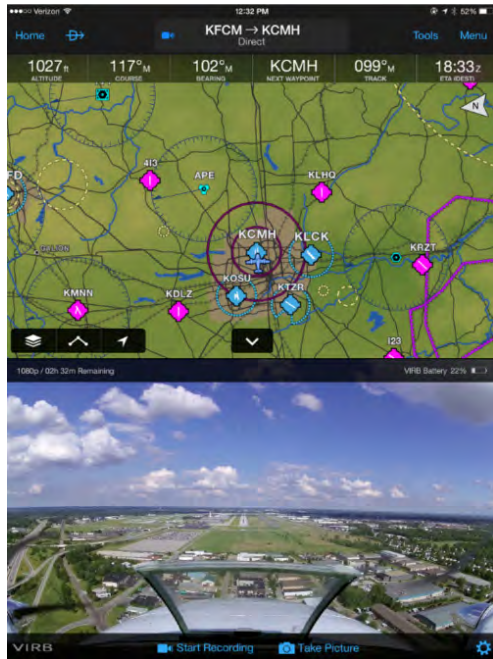
Although it has been available in the Apple App Store for a few months, FltPlan.com's free FltPlan Go iPad app was formally released in mid-January. The new app offers the advantage of using the same data in the app or on FltPlan.com's website. "Since the service was born on the web, FltPlan's servers save all flight-planning information and user documents," said company president Ken Wilson. "Should a pilot's mobile device, including an iPad, become unavailable, the pilot is just one Internet connection away from his data." Key features of the FltPlan Go app include a button to access the main FltPlan website, as well as buttons for airport data, charts, approach plates, a checklist feature, navlogs, weather, a scratchpad and a tool for drawing on approach charts, maps and navlogs. The checklist includes a switch to turn on voice readout. Maps and approach and taxi charts are geo-referenced. Other features include breadcrumb trails of flight path flown, rubber-band route planning, offline flight planning and editing and FBO and airport information with fuel prices. FltPlan Go works with Sagemtech Clarity ADS-B receivers and Sirius XM Weather.



ForeFlight Mobile

ForeFlight Mobile is a do-it-all iPad EFB app that pilots use for preflight planning, flight-plan filing and in-flight moving-map functions. Coverage includes the U.S. and Canada (with both en route and approach charts, most of which are geo-referenced). The moving map includes rubber-band adjustment of the planned flightpath, as well as support for Sids and Stars and a hazard and terrain-awareness function. When pilots are using geo-referencing on airport charts the hazard feature warns them when they are about to cross a runway. Fuel pricing information is included, as are aerial and street-map overlays. To help pilots visualize arrival runways, the app shows extended runway centerlines and also can display traffic pattern entries for the destination airport. A recent addition is the ability to overlay approach charts on top of VFR or IFR charts; the approaches are oriented geographically and can be dimmed or brightened and even include annotations that the user has drawn on the chart. Pilots can share flight plans using ForeFlight's cockpit sharing feature.

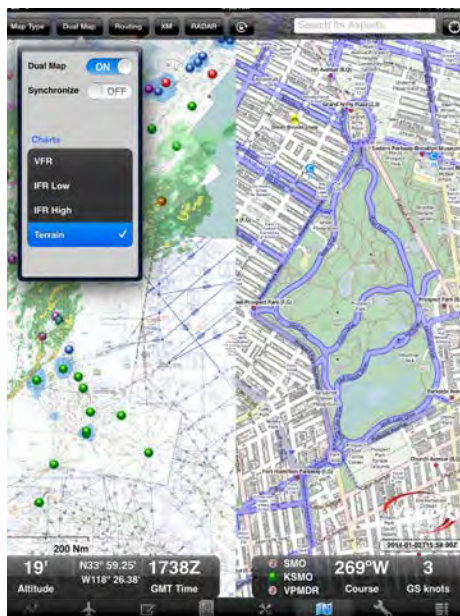
The latest release of ForeFlight includes support for IFR en route charts covering the Caribbean, Mexico and Central America, North Atlantic, Western Atlantic and North Pacific transoceanic charts. ForeFlight also works with the Appareo Stratus 1 and 2 external ADS-B receivers. ForeFlight is one of two moving-map apps, along with WingX Pro7, that can be used on the X-Plane and the Microsoft flight simulator programs, displaying the "position" of the simulated aircraft on the moving-map pages. ForeFlight also can display XM WX satellite weather when used with a Baron Services WxWorx Mobile Link receiver. Cost for ForeFlight Standard is \$74.99 per year, and the Pro version with geo-referenced approach charts, annotation feature on charts and the hazard advisor is \$149.99 per year.



Garmin Pilot

Garmin's iPad app has grown to rival the capabilities of its own portable GPS units and is noteworthy for another reason: the Pilot app is also available for Android tablets, one of the few that offers a high level of capability compatible with iPad apps for the Android environment. Garmin Pilot works with Garmin's GDL 39 ADS-B receiver, displaying traffic and weather data on the Garmin Pilot app and also providing a rock-solid GPS source for the moving-map. Garmin pilot also offers a two-screen split with an interesting twist. On the bottom screen, the user can choose from an assortment of displays that provide various functions. Some include charts, terrain, active flight plan navlog, a choice of four instrument panels or widgets. The widgets choices include Metars, Tafs, pireps, winds aloft, notams, area forecast, airports, airmet/sigmet, navigation data and airspaces. Garmin Pilot also can display XM WX satellite weather when used with a Baron Services WxWorx Mobile Link receiver. Flight plans can be shared with Garmin's D2 GPS watch. A recently announced new

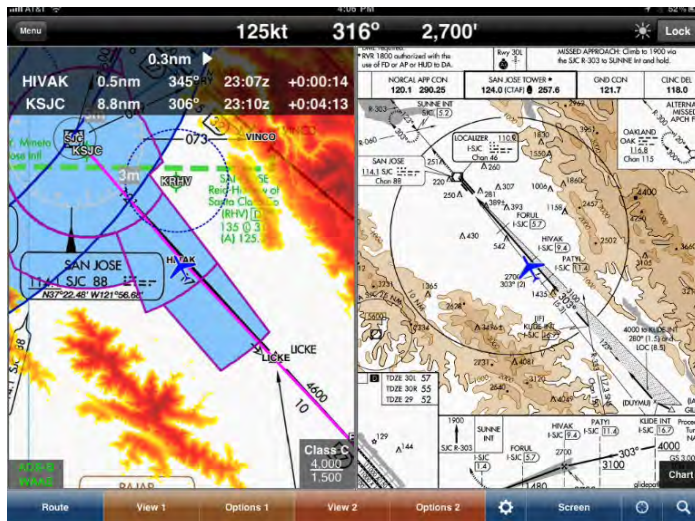
feature is the ability to control Garmin's Virb HD action camera with Pilot and view live video in the app. Three Garmin Pilot subscription choices are available: base (\$74.99/year, includes maps, approach charts, obstacles); VFR premium (additional \$49.99) adds terrain and terrain/obstacle alerts plus geo-referenced Garmin SafeTaxi airport charts; IFR premium (additional \$74.99) adds geo-referenced Garmin FliteCharts.



GlobalNavsource EFB

GlobalNavsource is one of the apps that can also display XM WX satellite weather when used with a Baron Services WxWorx Mobile Link receiver. The app is a full-featured moving-map and EFB program with some additional useful features. Approach charts, Sids and Stars, for example, are easily available from single buttons along the top of each airport page. A "mins" button adds the alternative minimums pages from the FAA Airport/Facility Directory, so there is no need to download the A/FD separately. For multiple approaches, the user simply swipes between pages on the screen. The app includes a dual map function, which can display VFR and IFR en route charts on one side and the same on another side of a split screen. A terrain page shows a map of the terrain features, and this can be zoomed down to street level, which shows a detailed map that could be used for navigating in a car. An aerial-view button provides a handy way to look over an unfamiliar airport before departure. GlobalNavsource also offers weather briefing and flight planning and filing capability,

including a unique "close VFR flight plan" function. Metars and Tafs come in both abbreviated and plain English format. GlobalNavsource is also available in airline and military versions, with chart global coverage and customized charts needed for the particular operations. The U.S. version of the app costs \$39.99 per year.



Hilton Software WingX Pro7

WingX Pro7 was an early adopter of many new aeronautical features on mobile devices and was the first to offer synthetic vision in an iPad moving-map app. The WingX Pro7 display can be split into three screens, which include two views of the moving-map/charts pages and one screen showing the route information. That way there is no need to turn off the moving map when revising a flight plan or searching for information about an airport. Each moving-map/charts page can display a variety of features, such as VFR/IFR en route charts, terrain, Class B

transition routes, attitude indicator, approach charts, route information and a notepad. WingX works with the Levil Technologies iLevil, Sagetech Clarity and other ADS-B receivers and AHRS devices. The AHRS device provides data to the attitude indicator page and to WingX's synthetic vision view. Synthetic vision can be used without an AHRS, but with the AHRS it will show attitude information as well as the view of terrain and obstacles. Even without synthetic vision, WingX's profile view of terrain adds another level of situational awareness. WingX also pioneered the aviation app "radar altimeter," which shows elevation of either the terrain under the aircraft or the agl elevation of the airplane. Pilots can share flight-planning information using WingX's FlightShare function. WingX also can display XM WX satellite weather when used with a Baron Services MobileLink receiver. With the X-Plane and the Microsoft flight simulator programs, WingX displays the "position" of the simulated aircraft on the moving-map pages. WingX Pro7 costs \$99.99 per year, and an additional \$99.99 for synthetic vision. For geo-referenced approach charts and taxi charts, a separate Seattle Avionics ChartData subscription is required (\$74.99).

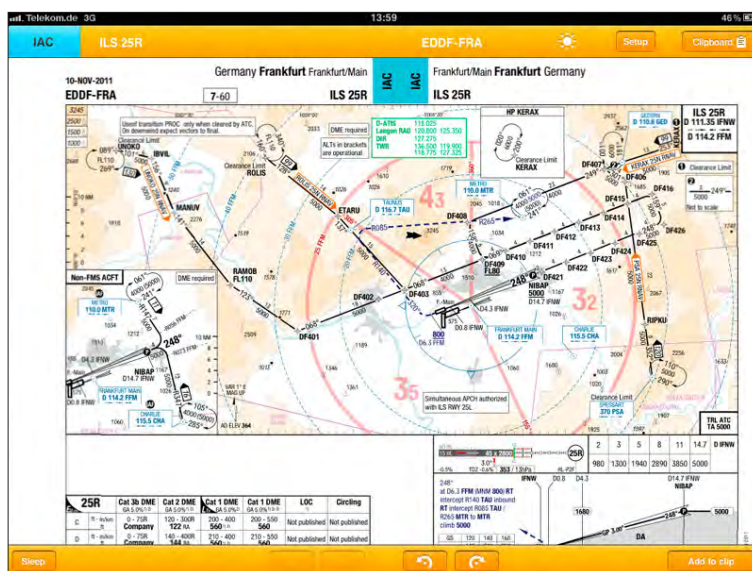


Honeywell MyGDC

Honeywell's iPad app is designed to provide access to its Global Data Center services and lets users check weather and plan and file flight plans for the U.S. and Eurocontrol regions. Global weather, including winds aloft, turbulence prediction and weather radar, can be overlaid over the planned route. Users can also download trip kit documents and review them offline. U.S. airport diagrams and approach procedures are included, as well as detailed airport information.

Jeppesen Mobile FliteDeck-iPad and Microsoft Surface

Jeppesen took a conservative approach to iPad app design and has slowly but steadily added features to its apps. The company began by offering an app that displayed maps and approach charts, but what is unique about Jeppesen is that its products are all vector-drawn. This means that each displayed chart is drawn from a database, instead of just pulling up an image of the actual chart. This saves a lot of space, and the entire worldwide Jeppesen Mobile FliteDeck app takes up fewer than 2 GB of storage. Mobile FliteDeck is now a full-featured moving-map app with weather overlays, geo-referenced maps and approach charts and flight-planning features, although it doesn't yet offer flight-plan filing. Price depends on data requirements, and regional downloads are available. Jeppesen also offers a VFR version of Mobile FliteDeck, with moving-map functionality, weather and TFR overlays and at a cost of \$49 per year. Jeppesen is bypassing the Android market and developing a new version of Mobile FliteDeck for Microsoft Surface tablets.



Lufthansa Systems Lido/iRouteManual Pro

The Lido app offers global aeronautical charts coverage and is generally oriented toward airlines, although many corporate pilots use Lido as well. The iRouteManual app displays charts but doesn't offer geo-referenced position information. Charts can be added to a clipboard for easy retrieval. Pricing depends on data required, and this can be customized for the operator.



Navtech iCharts

For pilots seeking an alternative to Jeppesen for worldwide chart coverage, Navtech's iCharts, like Lido/iRouteManual Pro, offers a solution. The iCharts app displays charts and documents but doesn't include geo-referenced position information. Charts can be annotated. Pricing depends on the data required, and for the most part Navtech is designed for airline operators.

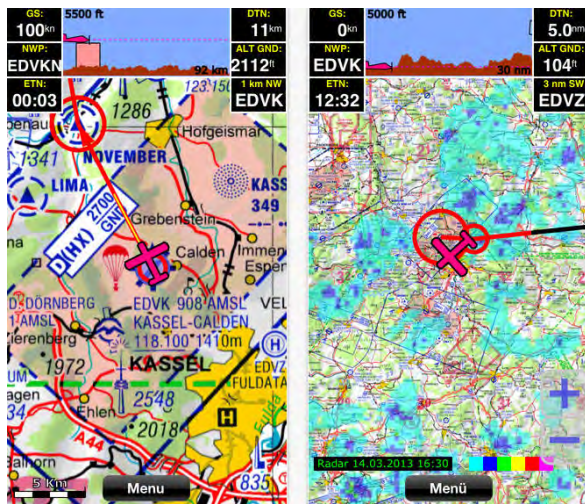
Radenna SkyRadar

Radenna was first out of the gate with an airborne ADS-B receiver, the SkyRadar unit, and it also makes the SkyRadar iPad app, although the company's ADS-B receivers also work with other moving-map apps. The SkyRadar app is a flight planner, weather resource and moving-map app and offers optional geo-referencing on approach charts. Features include terrain proximity display, flight data recording, seamless aeronautical charts, vector mapping of special-use airspace, restricted areas and so on. When coupled with the SkyRadar ADS-B receiver, the traffic and weather information can be overlaid on the map. A one-year subscription to the SkyRadar app runs \$64.99.



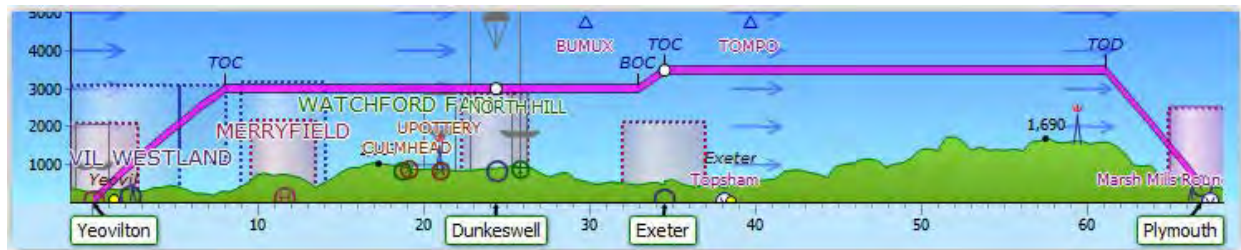
Rockwell Collins HGS Trainer

The Rockwell Collins HGS Flight app for the iPad may seem like a game, but it also helps promote the benefits of a head-up display (HUD) and teaches about HUD symbology and operation. HGS Trainer works on all iPad models and is a free download. The game offers players a choice between flying approaches with HUD symbology and a throttle control or starting out in the learning mode then progressing to higher levels. The app also includes information about Rockwell Collins Head-up Guidance HUD technology and links to more information about HUDs and regulatory material.



Sky-Map

Sky-Map is a European moving-map app that runs on Apple iOS and Android devices, although U.S. charts can also be used. The app features geo-referenced maps; display of track, altitude, distance and speed; nearest airports and gliding-distance circle; color-coded terrain display; automatic airspace warnings; route planning on map; weight-and-balance calculator; checklists and much more. The app handles three languages: English, French and German and it also works with the Levil Technologies AHRG-mini. Sky-Map app pricing starts at €159 without maps or €399 with Germany ICAO and approach charts.

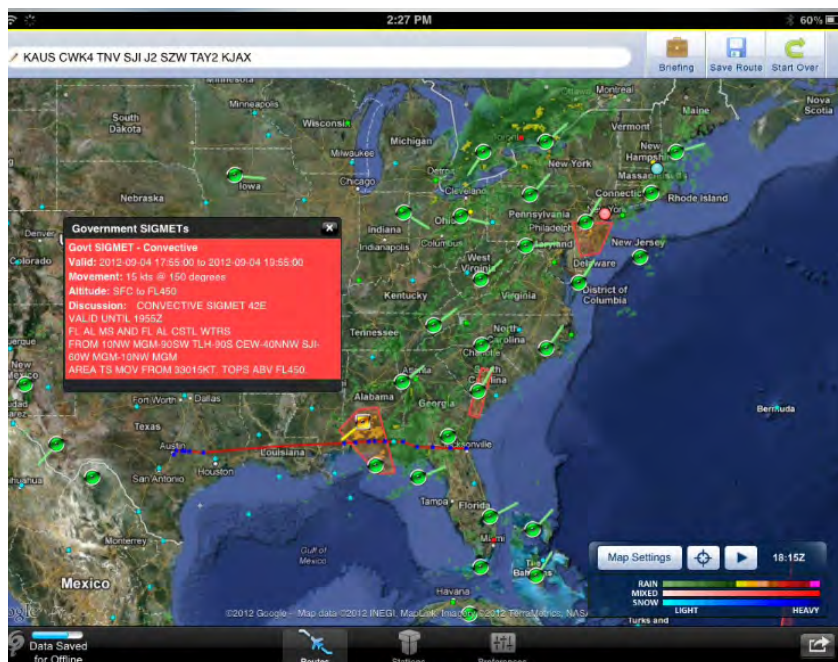


SkyDemon

SkyDemon is a comprehensive VFR moving-map flight planning and navigation app for European airspace and airports and includes a number of features that eliminate the need to use separate apps. One of the most interesting features is SkyDemon's Virtual Radar, a side (profile) view of the planned flight, with depictions of terrain, airspace, winds aloft and weather alongside the route. SkyDemon constantly updates notams and weather information during flight planning, and if there is a conflict the app pops up planning warnings. This makes it easy to change the route to avoid the hazard. The user can simply click on the warning to see on the map where the problem lies. SkyDemon includes a Live Pilot Log, which highlights each leg as the pilot flies the planned route, a fuel performance and cost calculator and weight-and-balance function. Approach plates are geo-referenced. For post-flight briefing, SkyDemon's Flight Log Analysis function shows a log of the flight or it can import GPX-format logs from Garmin and SkyMap GPS receivers. SkyDemon with full GPS navigation features costs \$246 for the first year, then \$122 for annual renewals.

X-Avionics Xavion

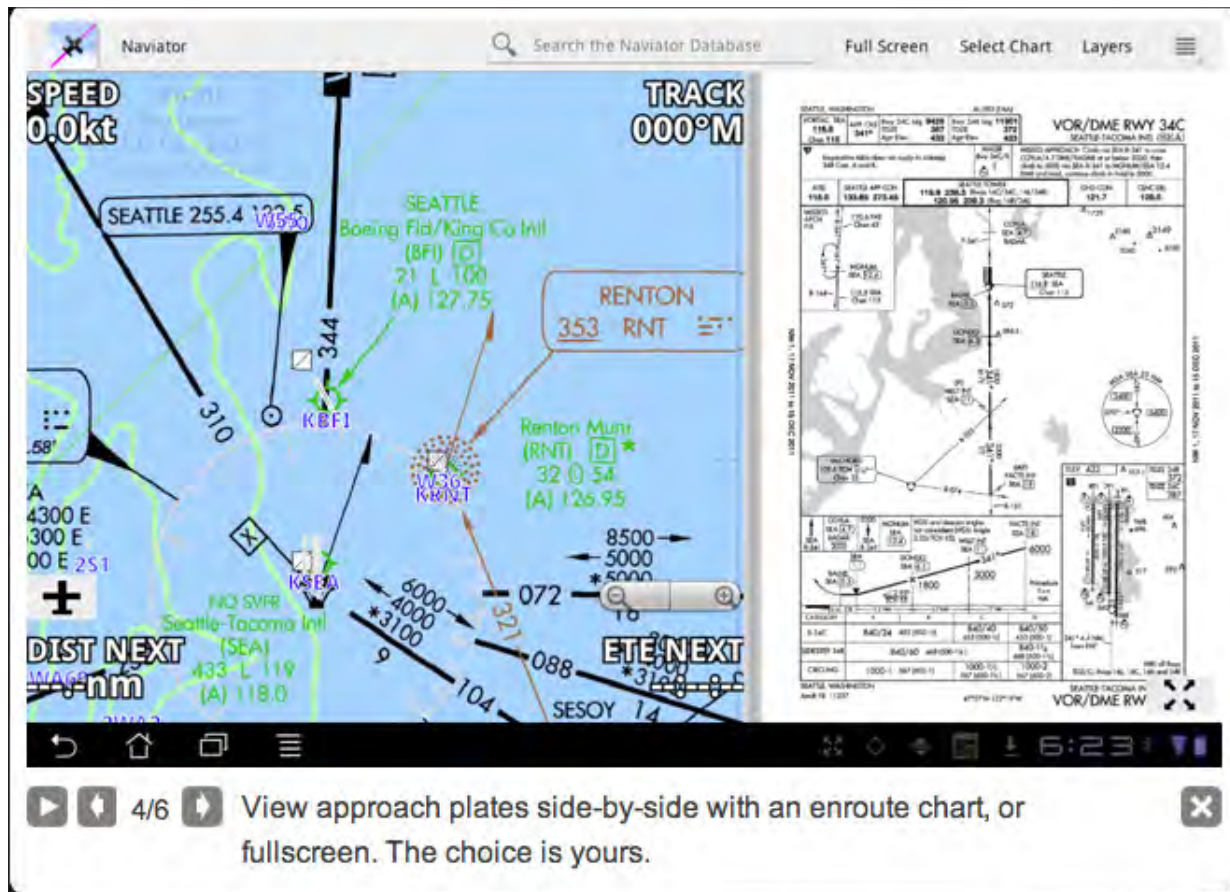
Xavion, which provides guidance to the nearest runway end and in case of engine failure, was developed by X-Plane simulator developer Laminar Research. The company tested Xavion extensively on X-Plane and used the simulations to hone the program's algorithms. A side benefit is that Xavion can be run on X-Plane to practice before trying it in a real airplane. Xavion's sensor inputs include GPS and the iPad/iPhone's gyros and accelerometers. While Xavion will work with the internal Apple GPS in 3G/4G devices, an external GPS yields better results. Xavion also works with external AHRS units made by Levil Technology. The Xavion presentation shows a moving map on the bottom and on top a synthetic-vision view overlaid with "airspeed" indicator, vertical speed, GPS-derived altitude, slip indicator, artificial horizon and magnetic track. During flight, Xavion constantly performs calculations to determine the path to a safe runway end in case the engine quits. The moving map shows the location of the airplane, and the area that is within gliding range is brightly colored. Black areas are unreachable. Airports are color-coded: green airports are safely reachable in a glide; yellow airports might present problems such as short or narrow runways or lie near the edge of maximum gliding distance; and red airports are beyond reach. Xavion costs \$99.99, although a version for X-Plane use only is available for \$9.99.



WSI Pilotbrief Optima

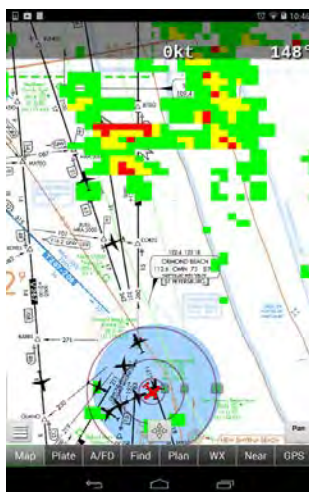
WSI's detailed weather products are available on the Pilotbrief Optima iPad app, including a variety of weather imagery and reports, forecasts, route weather and notam briefings and more. Users must subscribe to a Pilotbrief Optima account to receive weather information on the WSI iPad app.

Android Apps



123west Naviator

123west's Naviator moving-map and flight-planning app includes all the features that pilots enjoy, including geo-referenced charts, with airspace, airport, navaid and terrain coverage for Canada and a global database of airports and navaids. Sectional and en route charts can be viewed side by side with approach plates so the user can view geo-referenced position on both charts at the same time. Chart overlays include color-coded terrain warnings, and Naviator also offers a global weather forecast engine and graphical display of Metars and Tafs anywhere in the world. For areas in the world where aeronautical charts aren't readily available, Naviator users can import their own geo-referenced charts. Pre-made "bring your own charts" are available, for example, in World Aeronautical Chart format for Brazil. With FAA en route and approach charts and updates, Naviator costs \$34.99 per year. To add geo-referenced approach charts and taxi diagrams, a separate Seattle Avionics ChartData subscription is required (\$75).



Avare

Avare is an open-source Android app designed by a volunteer group of pilots. Most preflight planning and moving-map functions are included, such as geo-referenced VFR and IFR maps, approach charts and airport taxi diagrams. Other features include terrain/elevation maps, annotation on charts, preflight weather and TFR information and interfacing with external ADS-B receivers. Avare is free, but donations are requested.

Avilution AviationMaps

AviationMaps also can display XM WX satellite weather when used with a Baron Services WxWorx Mobile Link receiver. AviationMaps can also be used on the X-Plane and the Microsoft flight-simulator programs, displaying the “position” of the simulated aircraft on the moving-map pages. Cost: \$114.95 per year for the premium version, which includes geo-referenced approach charts and taxi diagrams. Weight-and-balance and QuickWeather companion apps are sold separately and don’t carry an annual subscription charge.

Garmin Pilot

The Android version of Garmin Pilot offers much of the same functionality as the iPad version, including Garmin’s familiar graphical HSI on the instrument page. Terrain/obstacles is not yet available on the Android version, although it does display a split map/traffic screen. Full flight planning and weather briefing is available, and weather imagery can be overlaid onto the VFR or IFR maps. Flight plans can be shared with Garmin’s D2 GPS watch. The NavTrack feature allows the user to view weather along the planned route of flight. The Pilot app works with Garmin’s GDL 39 ADS-B receiver to display free in-flight weather and traffic information. A 12-month full subscription, which includes geo-referenced FliteCharts, is \$149.98.

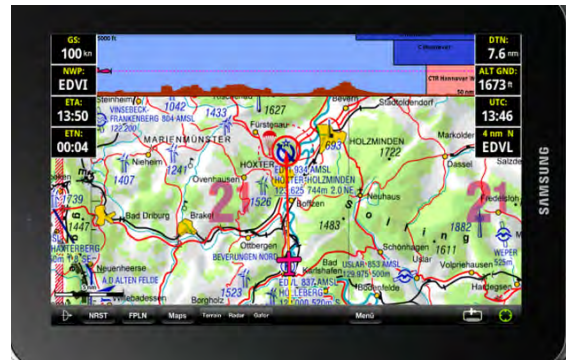


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The Android version of the SkyDemon software offers much of the same VFR preflight planning and moving-map functionality as the iPad app, including Virtual Radar, the profile view of the planned flight with depictions of terrain, airspace, winds aloft and weather alongside the route. The Android version doesn't currently offer geo-referencing on approach plates or a document browser, or the Live Pilot Log feature, which highlights each leg as the pilot flies the planned route. SkyDemon with full GPS navigation features costs \$246 for the first year, then \$122 for annual renewals.

Sky-Map

Sky-Map is a European moving-map app that runs on Apple iOS and Android devices, although U.S. charts can also be used. The app features geo-referenced maps; display of track, altitude, distance and speed; nearest airports and gliding-distance circle; color-coded terrain display; automatic airspace warnings; route planning on map; weight-and-balance calculator; checklists and much more. The app handles three languages (English, French and German) and it works with the Levil Technologies AHRS-G mini. Sky-Map app pricing starts at €159 without maps or €399 with Germany ICAO and approach charts.



ADS-B Receivers

As aviation apps and the devices that run them have proliferated, a variety of manufacturers have developed portable ADS-B in (automatic dependent surveillance-broadcast) receivers that can deliver free FAA-provided weather and traffic data. Weather (FIS-B or flight information systems-broadcast) and traffic (TIS-B or traffic information system-broadcast) can be quite useful, although there are some limitations. The traffic information, while seemingly comprehensive, also depends on an aircraft equipped with an ADS-B out transmitter to “wake up” an ADS-B ground station so it will transmit the TIS-B information from the ground station. Not all traffic will show if the aircraft receiving the information is not able to wake up the ground station, or if there are no nearby ADS-B-transmitting aircraft. Note also that there are two ADS-B frequencies—978 and 1090 MHz—and not all ADS-B receivers include both frequencies, thus potentially limiting the air-to-air traffic that can be seen by the receiver. Most of these devices include GPS receivers.

Product	Frequency	Apps	FIS-B	TIS-B	AHRS	Cost
Appareo Stratus 1	978 MHz	ForeFlight Mobile	●	●		\$599
Appareo Stratus 2	978 and 1090 MHz	ForeFlight Mobile	●	●	●	\$899
Dual Electronics XGPS170	978 MHz	123west Naviator, Adventure Pilot iFly GPS, Airguide/AnyWhere Education eKneeboard, AOPA FlyQ, Avilution, Bendix/King myWingMan, Hilton Software WingX Pro7, WSI Pilotbrief Optima	●	●		\$699.99
Garmin GDL 39	978 MHz	Garmin Pilot	●	●		\$799
Garmin GDL 39 3D	978 and 1090 MHz	Garmin Pilot	●	●	●	\$849
Levil Technologies AHRS G-mini (no GPS)	N/A	Adventure Pilot iFly GPS, AOPA FlyQ, Bendix/King myWingMan, Hilton Software WingX Pro7, Sky-Map, X-Avionics Xavion			●	\$795*
Levil Technologies iLevil SW (solar rechargeable)	978 MHz	Adventure Pilot iFly GPS, Hilton Software WingX Pro7	●	●	●	\$1,195
Levil Technologies iLevil AW (includes internal airspeed and pressure altitude sensors, for experimental aircraft)	978 MHz	Adventure Pilot iFly GPS, Hilton Software WingX Pro7	●	●	●	\$1,395
NavWorx Pads WxBox	978 MHz	Adventure Pilot iFly GPS	●	●		\$899

* (Also available with air data computer for \$995; for experimental aircraft)

Product	Frequency	Apps	FIS-B	TIS-B	AHRS	Cost
Sagetech Clarity SV CL01	978 MHz	Adventure Pilot iFly GPS, Airguide/AnyWhere Education eKneeboard, AOPA FlyQ, Bendix/King myWingMan, FltPlan.com, Hilton Software WingX Pro7, X-Avionics Xavion	●	●		\$1,150
Sagetech Clarity SV CL02	978 and 1090 MHz	Adventure Pilot iFly GPS, Airguide/AnyWhere Education eKneeboard, AOPA FlyQ, Bendix/King myWingMan, FltPlan.com, Hilton Software WingX Pro7, X-Avionics Xavion	●	●	●	\$1,400
SkyGuard UAT	978 and 1090 MHz	Hilton Software WingX Pro7, SkyRadar	●	●		\$675
SkyGuard Vision Pro (includes ADS-B OUT transmitter)	978 and 1090 MHz	Adventure Pilot iFly GPS, Hilton Software WingX Pro7, SkyRadar	●	●		\$1,475
SkyGuard Vision Pro with AHRS (includes ADS-B OUT transmitter)	978 and 1090 MHz	Adventure Pilot iFly GPS, Hilton Software WingX Pro7, SkyRadar	●	●	●	\$1,875
SkyRadar-DX (available March 2014)	978 and 1090 MHz	Adventure Pilot iFly GPS, Avilution, Hilton Software WingX Pro7	●	●	●	\$899