

The Magazine for the Accomplished Pilot

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IFR IN THE WORX

Real-time weather can be yours for less than last year's annual. But it ain't perfect.

by Scott C. Dennstaedt

I hate to fly blind. No, I don't mean flying under the hood. I mean flying without real-time weather information in the cockpit. I'd give up all my fancy avionics to keep a good source of weather information in front of me. Of course, I'd want to keep my ADF. Otherwise I'd miss the ballgame.

Real-time weather in the cockpit was once an easy choice because onboard radar was the only option. It was also either terribly expensive or nearly useless due to the size of the radar pod. Now you have many choices and the primary limits are how much you feel like spending and how many wires you can tolerate.

WxWorx (pronounced "wix-worxs") offers certified and non-certified systems that use XM Satellite Radio for a continuous source of near real-time cockpit weather. Add a GPS source and you get a nice moving map display with your position painted relative to the weather. For a \$50 monthly subscription and \$75 activation fee, WxWorx provides some of the most essential weather data a pilot can ask for. There are no minutes to track, but you'll pay the monthly fee whether or not you use the service.

Almost Real-Time

I'd never put out a cent for any weather system that does not include ground-based weather radar. Ground-based weather radar (see *Ground-based Weather Radar* April 2003 *IFR*) has an extremely high "glance value" that is critical when thunderstorms

linger nearby. WxWorx includes the reflectivity NEXRAD mosaic image for the continental U.S. The 16-level NWS image seen at most FBOs is cut down to seven levels. The resulting two-kilometer-resolution image is also smoothed.

The radar mosaic is broadcast every five minutes, with a time tag in the lower left corner associated with the current image. Here is a critical point: This time tag represents the time the image was downloaded, *not* the age of the radar data. It may not be representative of what you see outside of the cockpit. The image you see on your display could be latent by five to 10 minutes as compared to the actual weather.

As a test, I flew at a close, but safe, distance on the upwind side of a moving thunderstorm cell. My NEXRAD mosaic was the latest available, yet WxWorx placed me right in the center of this thunderstorm cell. If that doesn't get your attention, nothing will. Never forget that the NEXRAD is just a glimpse of recent history. You should always visually

separate yourself from the actual thunderstorm and use the weather product for situational awareness and as a gross vectoring aide.

It is also possible to loop the mosaic image for radar data that has been received in the last 30 minutes. The radar loop tells you three basic things: The direction and speed of movement of the line of precipitation, the direction and speed of the individual cells (which typically move differently within the line), and the overall trend toward a strengthening or weakening system.

Storm cell and identification and tracking markers (SCITs) appear as arrowhead lines for any cells exhibiting the characteristics of a potentially dangerous storm. These show the heading and speed of the storm cell, as well as the presence of hail, hail size, wind shear, and rainfall rate.

Echo Tops

Echo tops represent the highest radar echo (in msl) in a 4 km by 4 km grid with a reflectivity greater than 15 dBZ. Additionally, echo tops has a coarse spatial resolution (4 km horizontally and 5000 feet vertically) and generally underestimates real tops. They are not cloud tops as many pilots think of tops.

Meteorologists approximate the height of thunderstorms using echo



Right: A good mounting system keeps the data within your scan but clear of instruments and charts.

WEAVING IT ALL TOGETHER

With WxWorx it is not possible to see the image for a single WSR-88D (Nexrad Doppler Radar) site. The image you see is called a radar mosaic. It is built from the short-range (124 nm) Nexrad sites magically woven together into one continuous image spanning the entire country. This composite image is sent to your WxWorx receiver.

Here's how it all works: When the radar is operating in the severe-storm precipitation mode, it completes its volume scan (14 revolutions) in a little over five minutes. WxWorx combines the most recent revolution with the previous 13 images to build the radar mosaic. The oldest data in the composite is five minutes old. Add the time it takes to create the composite and the time it takes to uplink the data and you have an average latency of three minutes and 30 seconds with each update.

This image stays frozen on your display for an additional five minutes before it gets refreshed with an updated image. Despite the date-time stamp, you don't know the true age of the data presented at any particular location. Consequently, this product should never be used for tactical weather avoidance. I cannot emphasize this point enough.

The final radar image has ground clutter removed; however, some radar returns may be filtered out and are not displayed. Gust fronts and thunderstorm outflow-boundaries are clearly visible on the NWS NEXRAD single-site image but are filtered out by WxWorx.

tops. Higher echo tops generally mean stronger updrafts, and therefore, stronger thunderstorms. This will help those in the upper flight levels, but is not very helpful for the average piston driver.

Echo tops don't show the top of an icing layer. Supercooled cloud droplets or ice crystals reflect at less than 18dBz, but still represent an icing risk. Also, echo tops have a 5000-foot resolution and show nothing below 5000 feet. Winter precipitation images do show shades of white, grey and pink to indicate areas of snowfall, freezing rain or sleet (ice pellets) reaching the surface.

Lowdown on Lightning

Lightning data is second only to NEXRAD as critical weather information. Ground-based lightning detectors are extremely accurate, but private industry beat the feds to this technology and owns all of the equipment and the data. They sell the data at a very high premium and downgrade it for other users.

As a strike is detected by the ground-based system, it accurately records the location of the strike.

Since we are not paying for the premium lightning data, the lightning bolt symbol is placed at the closest four kilometer grid point as opposed to its actual location. Zoom in on the WxWorx display and you can see the grid. Dozens of strikes near the same grid point appears as one strike symbol. Do not to use this product for tactical weather avoidance.

Plenty More to Choose

If you are familiar with the Aviation Digital Data Service (ADDS) interactive displays, you will feel right at home with the WxWorx adverse weather display. AIRMETs, SIGMETs, and Convective SIGMETs are shown in graphical form. You can select the graphical icing, turbulence, IFR, or thunderstorm symbol to display the respective text in a separate window. Terminal forecasts (TAFs) as well as hourly and special surface observations (METARs) are provided by selecting the color-coded station model. Both TAFs and METARs can be displayed in coded and translated versions.

WxWorx also provides winds aloft, all-important TFRs, and oth-

er products. However, as with any product, it's not perfect. Accessing the complete METAR data requires some extra tapping. Without this effort, freezing rain is presented as "Light Freezing" and remarks don't appear. Remarks are where you find such important information as peak winds, sensor status, and thunderstorm activity so they do matter.

TAFs are technically only valid within five statute miles of the center of the airport's runway complex. Area forecasts (FAs) would be a nice edition to the WxWorx forecast products to fill the large gaps between TAF stations. The Aviation Weather Center (AWC) continuously monitors changes to the weather and will quickly amend an area forecast, which is the absolute best method to provide the pilot with the highest quality forecast. I'd also like to see Center Weather Advisories (CWAs) added. CWAs are the front lines of the convective world. Even when an area of convection doesn't meet the formal Convective SIGMET criteria,

Never use WxWorx for tactical weather avoidance. I cannot emphasize this point enough.

a CWA may still be issued. Fronts, including a short-range forecast, have been recently added to the mix of products available. An hourly surface analysis map would be better.

Panel-mounted solutions offer few wires but cost two to four times a portable solution — especially if you don't have an MFD already. Many portable solutions have wires galore. Bluetooth technology — where several devices can communicate wirelessly — is helping a bit as long as you don't mind dealing with batteries to power these standalone devices. Let

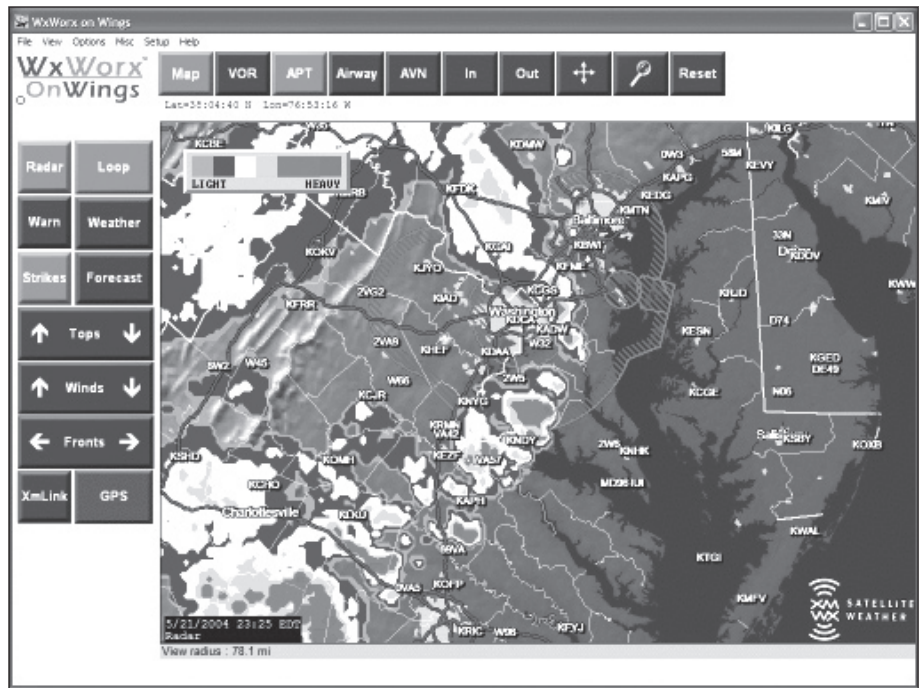
me be clear though; Wires are only a problem if you make them a problem. Many pilots have been creative in their ability to hide these wires and integrate them into the ship's equipment and power supply.

The Numbers Game

The non-certified version of WxWorx retails for \$930. Ah, but don't get too excited; this price only includes the software (including the mapping upgrade) and receiver, which is about the size of a portable CD player. You have to provide your own display device. If you already have an indoor/outdoor laptop or tablet PC, then you are golden. The WxWorx receiver conveniently connects to a PC USB port and the software runs under Windows. If you don't have a laptop or tablet, then this solution gets a bit more expensive. You will also need a GPS source for the moving map. A GPS powered by the USB port avoids an extra power wire, and a Bluetooth GPS eliminates one more connection to the portable computer. There are several GPS choices on the market under \$200.

Note that a portable PC must be sunlight-readable and fully dimmable for night flight for serious use in the cockpit. Tablet or portable PCs with sealed hard drives may just shut down or crash at altitudes above 10,000 feet. A tablet PC specifically designed for high-altitude operations or a PDA may serve you better if you are a high flier in a non-pressurized aircraft.

If you want to buy a turnkey system, check out NAVAirWx from Airgator. A typical bundle includes a display device (PDA or tablet PC), WxWorx XM Radio receiver, NAVAirWx software, wiring harnesses and a GPS device. Prices start at \$2,300. If you already have an appropriate tablet PC or PDA, you can still buy the NAVAirWx software, WxWorx XM receiver, GPS and integrated data and power harness. Prices start at \$1,700 for this configuration. My personal favorite is the NAVAirWx bundle with a capable PDA and Compact Flash GPS combination. This

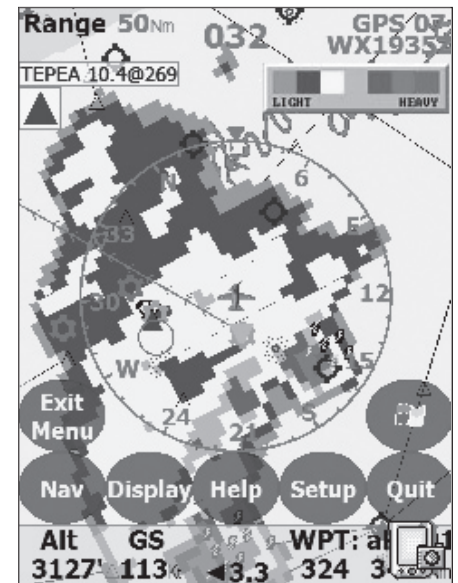


Above: The WxWorx radar mosaic (above) shows the most intense cells, can zoom in and out on specific cells, and pan across the map to show other locations.

Right: Airgator's NAVAirWx works on laptops, tablet PCs, and Pocket PC PDAs. With the NAVAir GPS flight planning capability you see your position and your flight plan relative to the weather.

provides the most cost-effective and complete cockpit-friendly solution. Bluetooth connections are appearing in PDAs too, which reduces that wiring hassle.

The NAVAirWx software is much more aviation-centric with better GPS and flight planning software system. In addition to weather, Airgator has recently added a subscription service for NACO terminal procedures called NAVAir Approach. NAVAirWx does not currently support all the data that is broadcast by XM. They do implement the primary elements such as NEXRAD, ground-based lightning, METARs, TAFs, echo tops and TFRs. Airgator is in the process of adding more of the available weather products to their software configuration, including other niceties such as terrain.



With so many options, choosing the best solution is a challenge. If you have any specific questions about any of the portable cockpit weather products, please feel free to e-mail me at scott@chesavtraining.com. Once you start flying with real-time weather, you'll never want to fly blind again.

Scott Dennstaedt is the founder of Chesapeake Aviation Training and conducts weather workshops nationwide.