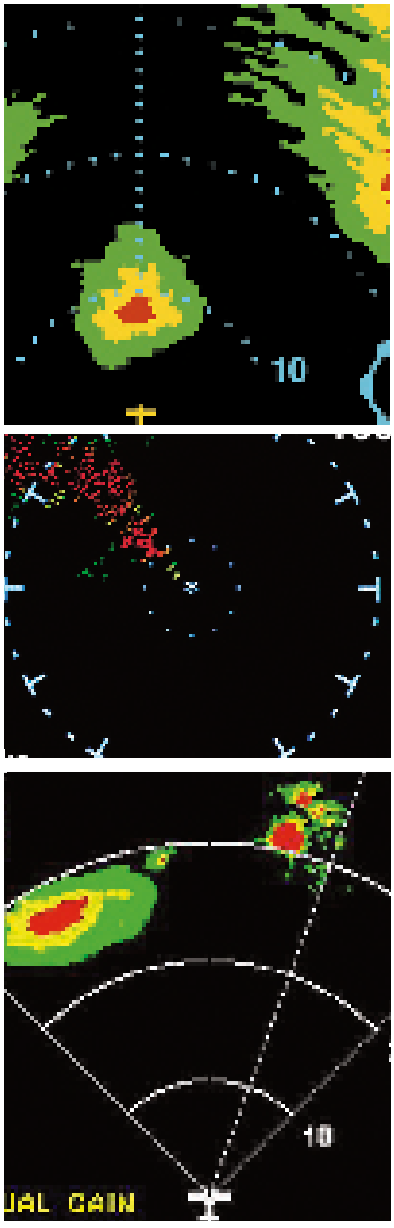
A Buyer's Guide: Weather Detection & Avoidance

Wx Worries? Several Sources Offer Graphic Help

BY DAVE HIGDON

COMPARISON CHARTS on pages 37 and 41



Many a good story starts with the phrase, "Once upon a time…" So it is with how pilots obtain weather information to inform their flight planning and mission decisions.

Once upon a time, aviators relied on what they could see ahead and forecasts relayed through various sources — which meant making a lot of new decisions en route.

Then, the government gave aviators Flight Service Stations, and from its personnel, pilots received more standardized wide-area information on which to base their go/no-go decisions.

But en route, what took over was, again, the EAS — the "eyeball avoidance system." At least by this point, pilots could augment what they could see out their cockpit windows with radio updates from FSS to make in-flight tactical decisions.

Soon, onboard weather radar followed, giving those pilots fortunate enough to have such systems another tool. Then came spherics devices to detect lightning, adding another live-information tool to the kit of thousands of aircraft with and without radar.

More recently, for before-flight help, pilots could use "The Weather Channel" and sundry Internet sources, complete with up-to-the-minute satellite and radar images — helpful before launch but, unfortunately, still long past current by the time a pilot actually faces inclement conditions.

Today's pilot has more help than ever thanks to more options for in-cockpit weather information, both text and graphical.

These options offer aviators a wide variety of weather information in the cockpit, in-flight and updated every few minutes for the duration of the flight.

Not only do these capabilities add new depth and currency to a pilot's knowledge, but they also serve to augment those other sources of in-cockpit information — radar, spherics and updates from FSS.

With such a plethora of sources available now, pilots of even the most modest aircraft can enjoy access to tools with capabilities rivaling those on the flight decks of sophisticated business-turbine and commercial aircraft.

Available from various sources, these options range from modern, digital color onboard radar playing out on large displays to satellite-based datalinks feeding imagery to everything from cockpit displays to hand-held GPS navigators and personal digital assistants.

WEATHER SYSTEM COMPARISONS — Detection Systems

MANUFACTURER	MODEL	DESCRIPTION	PRICE
Avidyne	TWX670	Lightning detection system (spherics) with color output and designed to display on a multi-function display.	$7,995
Garmin	GWX 68 GWX 68A	Self-contained, color-weather radar systems capable of playing on a variety of color displays; GWX 68A offers more power and range.	$21,000 $22,000
Honeywell Bendix/King	ART 2000	Digital color-weather radar systems.	$25,000
	ART 2100	Designed to play on a variety of color radar and multi-function displays; ART 2100 offers higher power and range.	$36,000
Insight Avionics	Strike Finder	A self-contained spherics device to detect the distance and direction of lightning strikes with optional heading stabilization.	$5,500 $6,500 (w/HS)
L-3 Communications	Stormscope WX-500	Remote-mounted full-function spherics device to detect lightning; designed to play on a variety of displays.	$7,130
	Stormscope WX-950	Stand-alone, self-contained spherics device with advanced features, including heading stabilization with compatible input.	$9,680
	Stormscope WX-1000	Remote-mounted full-function spherics device with 3ATI display; second display and heading stabilization optional.	$15,580

All starting prices are subject to change. Please contact an authorized dealer for current pricing.

And, with no one source solving all needs, it's not uncommon to find pilots arming themselves with multiple tools. After all, forewarned is forearmed — and, in the case of general aviation pilots, being forearmed is the best path to being forewarned.

Pick your options, pay the ticket, take the ride.

For those days when the best decision means not leaving the house, such equipment is not an issue.

On those days when weather conditions are dynamic, the distances are great and the number of systems ahead are multiple, seeing a radar image only minutes old — without onboard radar — watching the propagation of lightning strikes, a satellite image of clouds and a chart of winds can make the difference between a long, uncomfortably bumpy ride and one with some twists and turns avoiding the bumps and the discomfort.

This Buyer's Guide looks at systems available to the common general aviation cockpit. Included are spherics devices — those wonders detecting and displaying lightning strikes — and data-link weather hardware designed for in-flight use. New weather radar systems designed for OEM or replacement installation also are touched upon.

Basics Worth Noting

No one tool fulfills all needs. Even as advanced as these systems have become, all weather-information technologies suffer from limitations.

For example, onboard weather radar, while vastly improved by digital technology, still has limitations on how it portrays strong storms in close proximity to the antenna.

Weather imagery delivered via data-link is constrained by the system of collection and processing needed to deliver the image to the cockpit. Doppler weather radar images are always a few minutes old, reducing its viability

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for tactical use.

Lightning-strike graphics from data-link systems suffer with time limitations similar to the Doppler weather radar images delivered by the same service via the same hardware.

Still, for strategic planning, even short-term, such radar graphics give pilots access to storm information unavailable from onboard radar — and these services offer other useful graphics, such as satellite photos, winds aloft and more.

Spherics systems provide the best source of lightning data and, by extension, turbulence information — and it's as live as radar. But as excellent as they can be at showing where lightning and turbulence lurk, they offer less help detecting rain. Onboard radar and data-link Doppler images win out here.

These realities bolster arguments many seasoned pilots make for using the cafeteria approach to selecting weather-avoidance gear. According to this philosophy, deploying all three technologies in the cockpit serves as the gold standard approach.

Onboard radar systems and single-engine aircraft, however, have not been a common or affordable option for most owners of most singles.

For years, veterans argued for the addition of spherics for aircraft fortunate enough to have onboard radar — and arguing even more strenuously that spherics always beat flying with nothing more than EAS.

Today, those same voices argue for the minimal combination of a spherics system and onboard data-link weather as an excellent combination. It's far less expensive than radar — even with the costs of subscriptions — and available to a far wider variety of aircraft than radar.

What we can't see can hurt us — which is as true now as it was "once upon a time."

For this Buyer's Guide, let's start with detection systems and move to data-link hardware and their delivery services.

DETECTION SYSTEMS

AVIDYNE

TWX670 Tactical Weather Detection System

Avidyne calls the TWX670 "the first color, real-time, lightning-based tactical weather avoidance system for general aviation aircraft," and it offers pilots a new choice in a spherics device for detecting lightning.

The TWX670 tactical weather detection system offers pilots real-time weather-avoidance help at distances up to 200 nautical miles, as do other similar devices.

The TWX670 employs advanced, high-speed digital-signal processing, which the company says provides a significant advantage over previous-generation systems by allowing the TWX670 to display lightning in the 0-25 nm range, making the detector a true tactical weather detection and avoidance choice.

Avidyne's TWX670

But what truly sets apart Avidyne's lightning-detection system is its ability to display storm cells and their intensities. When set to its TWX mode, the TWX670 uses color to define each storm cell by its size and intensity with a collection of colored hexagonal grids that vary with the strength of the cell.

In the TWX670's cell mode, the display can show up to 1,024 strikes for up to three minutes at a time, with regional activity determining the color, but not age, and in real-time. Pilots can instantly see areas of higher intensity and still watch individual strikes as they occur.

A self-contained system detects electrical noise generated by onboard equipment to help technicians installing the TWX670 find and fix the sources and to help with antenna placement.

The TWX670 is designed to play on a suitable multi-function display and is an excellent complement to Avidyne's own MHD, a compact multi-hazard display designed to fit into a standard instrument hole.

For more information, visit Avidyne Corp. at www.avidyne.com.

GARMIN

GWX 68 Color Weather Radar System

Garmin's GWX 68 color weather radar system is a compact all-in-one antenna/receiver/transmitter providing four-color storm-cell tracking to an external color MFD, such as the company's own GMX 200, or the MFD of an integrated system, such as Garmin's G600, G900X or G1000 panels.

Garmin's GWX 68 on the GMX 200

Designed as a replacement option or for OEM use, Garmin's GWX 68 color weather radar system offers a powerful 6,500 watts of power through one of two antenna options, either a 10-inch phased-array antenna or a 12-inch unit (GWX 68A) — sizes that should fit behind most radomes flying in general aviation aircraft.

Garmin designed the GMX 68 with a selectable scan (up to 90 degrees) and outstanding pulse range, so it can more precisely image target areas.

The unit offers full pitch-and-roll stabilization to allow for smooth weather tracking when maneuvering. The GWX 68's side-view vertical scanning function gives pilots a tool to profile storm tops, gradients and cell buildup action at different altitudes relative to the aircraft, views available thanks to the system's ability to tilt the antenna vertically through a 60-degree range.

The vertical-scan ability also can be used to scan the ground ahead. How far ahead is up to the pilot, by selecting the desired scan range. The GWX 68 can display returns at ranges as short as 2.5 miles or as far away as 320 miles.

Garmin says the GWX 68 offers a functional weather-avoidance range of 270 nautical miles, while the 68A version, with its 12-inch phased-array antenna, works out as far as 305 nm.

For more information, visit Garmin at www.garmin.com.

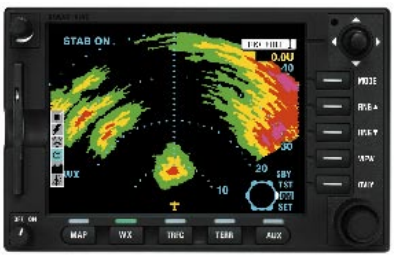
HONEYWELL BENDIX/KING

ART 2000/ART 2100

Digital Weather Radar

The Bendix/King ART 2000 and ART 2100 digital weather radar systems feature pioneering one-button vertical profiling and combined pitch and roll stabilization, which allows a pilot to selectively measure a storm's height and examine the angle of the storm front to help gauge changing conditions.

With 50 percent more power, 6,000 watts, the ART 2100 can paint weather as far out as 320 nautical miles. This model also provides a horizontal view as wide as 120 degrees and is available with either a 10-inch or 12-inch antenna.



Honeywell's ART 2000

The 4,000-watt ART 2000 images 90 degrees horizontally and ranges out to 240 nautical miles, and it also offers the same antenna size choices as the more powerful model.

Both models provide full EFIS compatibility and full control through an MFD interface. These four-color radars also provide the operator with fault annunciation, a readout of the tilt angle of the antenna, and the ability to independently drive two indicators.

For more information, visit www.honeywell.com.

INSIGHT AVIONICS

Strike Finder

A long-time player in the weather-avoidance field, Insight Avionics has steadily evolved its Strike Finder stand-alone spherics device, giving it improvements as they became available.

Insight Avionics' Strike Finder

The root capability, however, remained a constant: the ability to detect and display lightning strikes at distances out as far as 200 miles.

A single circuit board in the Strike Finder employs digital signal processing to produce an accurate display of a lightning strike's direction and distance. The weather-sealed sensor uses broadband digital sampling aids in the rejection of noise and a cleaned signal to the processor.

The latest change to the Strike Finder gave it a new ultra-bright LED display to replace the gas-plasma discharge display originally employed. The Strike Finder can be set to display lightning activity at ranges varying from 25 to 200 miles, with the outer of two range rings on the display corresponding to the setting being used. The inner ring on the display corresponds to half the distance of the outer ring, allowing pilots to weigh their distance from the weather.

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The Strike Finder also can be heading stabilized by one of two methods: a slave connection to an HSI or remote, or with the addition of Insight's own stabilization module.

With or without the module, the compact Strike Finder's main unit installs nicely into a standard 3.125-inch instrument opening in the panel. To aid in finding the spot with the least electrical noise, the Strike Finder offers built-in software to help an installer map the skin to find the sweet spot.

For Strike Finder owners with older plasma displays or without heading stabilization, Insight offers the option of factory retrofits for one or both.

For more information, visit Insight Avionics at www.insight-avionics.com.

L-3 COMMUNICATIONS

Stormscope WX-500, WX-950, WX-1000

Evolved out of the original Ryan Stormscope of decades ago, the Stormscopes available today from L-3 Communications benefit from the years of advances technology has enjoyed.

The original concept of the spherics device grew out of hearing on the old AM radio the static lightning strikes generate. Listen for, identify, process and find a way to usefully display those noise spikes and you've got a tool for steering around weather. After all, where there's lightning, there's usually convection, turbulence and, often, rain.

L-3 Communications' Stormscope WX-500

Ergo, where there's lightning, there's a good reason to make a detour.

Today's Stormscope line offers several flavors depending on the display option desired. However, they all share in baseline features: scalable range stepping from 25 to 200 miles; dual delivery modes, cell mode and strike mode; two view choices, a 120-degree arc ahead of the aircraft or a 360-degree view; and the ability to take input from a heading system to maintain the image orientation as the aircraft turns.

The cell mode identifies strikes that make up individual storm cells, best used when facing developed weather. The strike mode shows individual strikes for monitoring conditions when weather is clear or deteriorating.

From here, it's a matter of display choices.

For pilots interested in a standalone system with an integral display, the WX-950, with its CRT display, fits into a standard 3ATI opening.

The WX-1000 is a remote-mounted unit that connects to its panel-mounted display as well as an L-3 SkyWatch display. It also provides six programmable checklists and stores in memory all strikes detected regardless of the display range selected.

The WX-1000E further adds a GPS input and an IFIS output.

The WX-500 is designed solely to work with an external display, such as an MFD; in fact, the WX-500 can support multiple MFDs and display on a dedicated page or overlay on a moving map. It also can display over a moving map, simultaneously displaying Doppler weather radar images delivered by data-link.

For more information, visit L-3 Communications at www.l-3com.com.

DATA-LINK RECEIVERS

AVIDYNE

MLB700 for WSI InFlight Weather

Avidyne's MLB700 satellite data-link receiver provides reception from the Sirius Satellite Radio network, delivering WSI's InFlight weather service and, optionally, 130 channels of Sirius programming.

Both the WSI InFlight and the Sirius radio service require a subscription, and both models are designed to work with Avidyne's own EX5000 and EX500 MFDs.

Avidyne's MLB700 with remote

With the MLB700, the pilot gains access to WSI's composite NOWrad Doppler weather radar mosaic, displaying cell movement and height, forecast movement and data-link lightning-strike images.

Temperatures, winds aloft, TAF, METARs, AIRMETs and SIGMETs also are part of the downloaded updates delivered from the satellites every few minutes.

WEATHER SYSTEM COMPARISONS — Data-Link Receivers

MANUFACTURER	MODEL	DESCRIPTION	PRICE
Avidyne	MLB700	Data-link receiver compatible with the Sirius satellite radio network to receive WSI InFlight weather service; requires compatible MFD for display. Radio service optional; subscription required.	$4,745 (data only) $5,495 (data & radio)
Garmin	GDL 69 GDL 69A	Data-link receiver compatible with the XM Satellite Radio system to receive WxWorx weather service; requires a compatible MFD for display. Radio service optional; subscription required.	$4,195 (data only) $4,795 (data & radio)
Honeywell Bendix/King	KDR 510	Broadcast data-link receiver compatible with free FAA FIS and Bendix/King's Wingman services. Subscription required; requires compatible display.	$4,500
	KDR 610	Satellite data-link receiver compatible with XM radio's WxWorx weather service. Subscription required; requires compatible display.	$4,100

All starting prices are subject to change. Please contact an authorized dealer for current pricing.

The processor employs advanced Sirius chipsets and features a USB port for updating software. Its size and connections are designed for easy installation. A low-profile Sky-Focused satellite antenna optimized specifically for airborne operations improves signal reception and receiver performance.

For more information, visit Avidyne Corp. at www.avidyne.com.

GARMIN

GDL 69 Weather Data-link and Audio Receiver

Garmin's GDL 69 receives broadcast weather data from the XM WX satellite weather service and transmits the data to Garmin's popular avionics systems, such as the 400 series and 500 series navigators, the GMX 200 MFD, G600, G900X and G1000 integrated panel systems.

Garmin's GDL 69 on a G1000

Weather information received by the GDL 69 comes from XM Satellite Radio's XM WX weather service using location-specific WxWorx information. The XM system employs a pair of powerful S-band geostationary satellites positioned over the East Coast and West Coast to provide seamless coverage across the continental United States regardless of altitude.

WX Satellite Weather delivers near real-time high-resolution color NEXRAD radar images, as well as text and graphical METARs, current precipitation reports, lightning strikes, winds aloft, echo tops, TFRs and more.

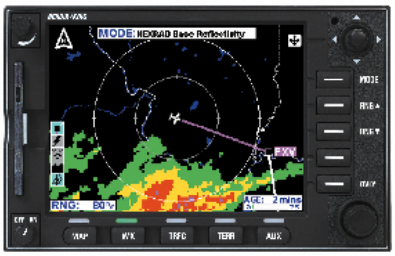
For pilots who also want uninterrupted entertainment on their flights, the GDL 69A adds access to XM Satellite Radio. The GDL 69A combines XM WX's weather services with XM's 160 channels of digital radio. As with other data-link services, XM WX Weather requires a subscription, as does the XM Satellite Radio service.

For more information, visit Garmin at www.garmin.com.

HONEYWELL BENDIX/KING

KDR 510 Data-link Receiver

Among the first data-link receivers available to pilots, the KDR 510 offers pilots the benefits of the FAA's free Flight Information Service — with text weather products, such as TAFs, METARs, PIREPS and more — as well as the option to subscribe to Bendix/King's Wingman service and receive enhanced products, such as Doppler weath-



Honeywell KDR data-link receiver for a KMD 550

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er radar images, graphical TAFs, METARS and more.

Services, both free and subscription-based, are broadcast via the same company-operated network of ground broadcast stations installed nationwide. The data is updated about every six minutes and a timer on the display shows the age of the current image. The company offers a range of subscriptions.

Bendix/King's compact KMD 250 MFD is equipped to work with the KDR 510 right out of the box. Other displays, such as the company's KMD 550 and KMD 850, require an adapter card to interface with the data-link receiver.

HONEYWELL BENDIX/KING

KDR 610 XM Satellite Data-link Receiver

Bendix/King also offers a satellite-based solution for pilots who want to add data-link weather to their aircraft: the KDR 610 for the XM WX Satellite Weather service.

Similar to its ground network counterpart, the KDR 610 receives regular updates of weather information, but instead of from the FIS and Bendix/King's dedicated system, the data is relayed via XM's satellites through its WX weather service. That means nationwide Doppler weather radar images, winds, rain, lightning strikes, graphical TAFs, METARS, TFRs and more, are updated about every five minutes.

Also similar to the KDR 510, the KDR 610 displays on a KMD 250 or, with the appropriate adapter card, a KMD 550 or KMD 850.

Because the XM satellite signal is available from the ground up across the contiguous United States, the satellite option appeals to pilots who regularly operate in areas where coverage of the ground-based network is thin or unavailable until above a certain altitude.

For more information, visit Honeywell at www.honeywell.com.

A Word About Data-link Services

For several years, pilots have had several options for receiving weather information in-flight via broadcast data-link and some form of cockpit display.

About a decade ago, two free avenues became open under FAA sponsorship via the Flight Information Service — one a ground-based broadcast system deployed by Honeywell's Bendix/King; the other a satellite-based network deployed in partnership with Echo Flight.

In addition to a display on which to show the information, aircraft needed a broadcast data-link receiver dedicated to one of these systems, and Bendix/King and Garmin offered the boxes.

Both had their limitations.

Bendix/King's ground-based network didn't cover all of the country, and in some parts of the country, coverage wasn't available below a minimum altitude. But when coverage was available — eventually for about two-thirds of the country — the data updates came steadily every six minutes or so.

The Echo Flight system provided down-to-the-ground coverage, in general, and across the entire country. However, it required the pilot to initiate an update with a request command on the displays compatible with the Garmin data-link transceivers. So, data came only after the pilot initiated a request and, during times of heavy traffic, could involve long waits for a response.

A few years ago, the nation's two satellite radio companies got into the act with their own services, spawning development of new dedicated receivers.

WxWorx is broadcast by XM Satellite Radio, and WSI's InFlight is handled by Sirius Satellite Radio. The two services share many attributes.

Both offer composite versions of the national Doppler weather radar network, as well as other graphic and text products.

At the same time, however, they differ in how they package and present data.

The receivers required have developed along proprietary lines, which means no satellite service has a receiver designed to work on any MFD. Instead, avionics manufacturers generally have cast their lots with one of the two services and fielded receivers designed primarily to work with their own displays.

Things could change, however, because the two satellite radio companies are in the process of merging.

Unless existing equipment limitations dictate a choice of a particular data-link receiver — which would lock you into the compatible service — comparing the services could be a useful exercise before making a decision on installing a receiver and compatible display.

And, if onboard radar is part of the package, finding a display compatible with both the radar system and the desired data-link receiver improves the pilot's satisfaction with the system purchased. ■