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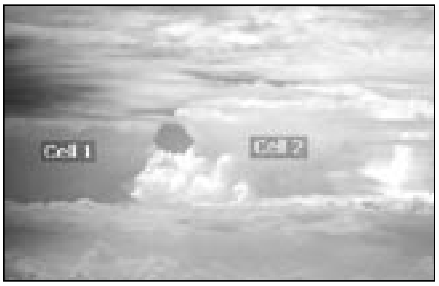

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WHY USE A STORMSCOPE?

With ground-based lightning downloaded to your cockpit, do you need spheric devices? It depends on your mission and your wallet.

by Scott C. Dennstaedt

You have two choices if you want lightning data in the cockpit: Ground-based lightning or on-board lightning detection from a spherics device such as a Stormscope. Your Stormscope may likely represent the only real-time weather you'll ever see in your cockpit, but it requires some basic interpretation. Once you understand these basics, it becomes a very valuable tool in your kit.

The Difference is Dollars

Ground-based lightning delivered via a data link or broadcast, on the other hand, requires less interpretation but comes with a bit of a delay. WxWorx and NAVAirWx deliver data in a timely fashion, but it will never beat the timeliness of your Stormscope. Ground-based lightning is normally coupled with other weather products such as ground-based weather radar (NEXRAD), surface observations, and forecasts.

Ground-based lightning data is very accurate and very expensive. I dare you to try to find a Web site that provides you with timely lightning data for free that covers the U.S. The best you can get is a national picture that is 15-30 minutes old and without the resolution needed for flight planning purposes.

The majority of the ground-based lightning data comes from the National Lightning Detection Network (NLDN). These lightning detectors have a margin of error for locating a cloud-to-ground strike of 500 meters. The ground-based lightning sensors instantly detect the electromagnetic signals given off when lightning strikes the earth's surface. Cloud-to-cloud and intra-cloud strikes are not detected.

Keep most of the strikes (in cell mode) out of the 25-mile range ring on your Stormscope.

With 500-meter accuracy, I'd choose ground-based lightning any day. Don't get too excited, though. Due to the cost, you'll not likely see a high-resolution product in your cockpit any time soon.

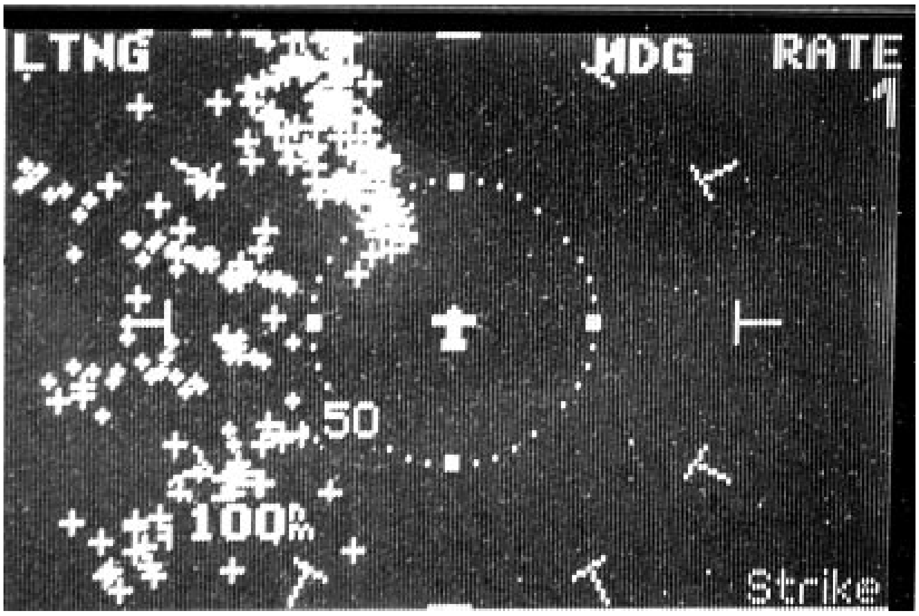
XM Satellite Weather through WxWorx broadcasts a four-km horizontal-resolution lightning product. This means that you will see a lightning bolt or other symbol arranged on your display in a four km grid. Every strike is shown at the closest grid point. There is also only one symbol, so you don't know if the hit is a single strike or 50 cloud-to-ground strikes detected minutes apart. These two facts mean you can't infer the strengthening, weakening, or intensity of the system.

With latency and refresh rates of five minutes and no intra-cloud or cloud-to-cloud strikes, I won't pay extra for ground-based lightning.

Stormscope Advantages

A Stormscope must be viewed as a gross vectoring aide. Don't use it like on-board radar. Nevertheless, it alerts you to thunderstorm activity and shows you the truly ugly parts of a thunderstorm. Where there's lightning, it's a guarantee of moderate, severe, or even extreme turbulence.

No lightning detection equipment shows every strike, but the Stormscope will show most cloud-to-ground, cloud-to-cloud and intra-cloud strikes. This allows you to see the intensity and concentration of the strikes within a cell or line of cells with a refresh rate of two seconds. It also shows you any intra-cloud electrical activity present in towering cumulus clouds, even when no rain may be falling.



Left: *The difference between this burried cable and a real storm is the very low rate (upper right) with all the strikes aged similarly.*

Right: *Three cells are clearly visible in the air and on the Stormscope. Cell number three has almost all recent strikes, cell number two is a mixture of new and old strikes, and cell number one has mostly older strikes. This is a common pattern when cells form along a line of thunderstorms.*

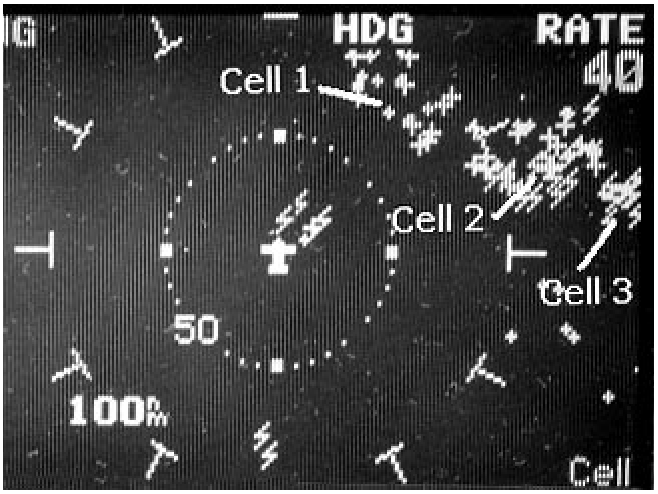
The Stormscope can detect any strike that has some vertical component (most strikes do). This is important since there are typically more intra-clouds strikes than cloud-to-ground strikes. Most of the storms in the Midwest have 10 times more intra-cloud strikes than cloud-to-ground strikes. A Stormscope doesn't suffer from attenuation like on-board radar. That is, it can "see" behind thunderstorms to paint cells in the distance out to 200 nm.

Stormscope Disadvantages

It doesn't take a full-fledged storm, complete with lightning, to get your attention. Intense precipitation alone is a good indicator of a strong updraft (or downdraft) and the potential for moderate to severe turbulence in the cloud. The Stormscope does not tell you anything about the presence or intensity of precipitation or the absence of turbulence.

Never use the Stormscope to penetrate a line of thunderstorm cells. Visible gaps in the cells depicted on the Stormscope may fill in rapidly. Fly high and always stay visual and you will normally stay out of serious turbulence.

A Stormscope display is often difficult to interpret by the novice. Radial spread, splattering, buried cables and seemingly random "clear-air" strikes can create a challenge for the pilot. It may take a couple years of experience to be completely comfortable interpreting the Stormscope display. Often what you see out of your window will confirm what you see on your display.



The biggest Stormscope error is the distance calculation along the radial from the aircraft. The bearing to the strike is pretty accurate. How far to place the strike from the aircraft is a bit more complicated and prone to error.

The only way to know the distance of the strike is to measure the strength of the signal generated by the strike. Stronger signals are typically closer and weaker signals are farther away, but not always. An average strike signature is used to determine the approximate distance of the strike.

Cleaning with Cell Mode

In strike mode on the Stormscope, strikes are displayed based on this average signature, whereas cell mode on the Stormscope uses a clustering algorithm that attempts to organize these strikes around a single location or cell.

Cell mode will even remove strikes that are not part of a mature cell. Most thunderstorm outbreaks are a result of a line of storms. Cell mode provides a more accurate representation to the extent of the line of thunderstorms.

Radial spread is not necessarily always a bad thing. You can use it to your advantage to distinguish between false or clear air strikes and a real thunderstorm. Most of the strikes of a real storm will be of the average strike signature and be placed appropriately. As mentioned above, stronger-than-average strikes will be painted closer to the airplane.

Looking at this in strike mode, a line of these stronger strikes will protrude toward the aircraft. The result is a stingray-looking appearance to the strikes. Confirm this by clearing the display. The same stingray pattern should reappear with the tail protruding once again toward the airplane.

Splattering is a pseudo-random pattern created when you are very close to a fairly strong cell (normally within five to 10 miles). Typically there will be a group of strikes that are displayed where the actual cell is located, but you may see dozens of strikes literally splattered all around the aircraft's location normally in the shape of a pie wedge.

It is very common to see a linear pattern of strikes if you taxi over a buried cable on the ramp or taxiway. This can be a bit disconcerting if you don't notice it until you are in the air. Typically the strike rate (strikes per minute) will be very low even though there are dozens of strikes shown; that's a clue that something is awry. Clear the display of these false strikes once you're airborne.

Using the Lightning Data

Clearing the Stormscope display frequently is a must. How quickly the display "snaps back" indicates the intensity of the storm or line of storms. Be sure to give these storms an extra-wide berth. Clearing the Stormscope in "clear air" will also remove any false strikes displayed so you can focus on any real cells building in the distance.

Both ground-based and onboard lightning detection systems use specific symbols to indicate the age of the data. For Stormscope data shown on the Garmin 430/530, a lightning symbol is displayed for the most recent strikes (first six seconds the symbol is bolded). The symbol changes to a large plus "+" sign after one minute followed by a small plus "+" sign for strikes that are at least two minutes old. Finally, it is removed from the display after the strike is three minutes old.

Cells with lots of recent strikes will often contain the most severe updrafts and may not have much of a NEXRAD radar signature. Cells with lots of older strikes normally signify steady rainfall reaching the surface, which may include significant downdrafts.

In a dual Garmin GPS configuration, I like setting the top Garmin to strike mode and the bottom Garmin to cell mode. Strike mode is a bit more sensitive and useful when towering cumulus clouds are starting to build. The display of lightning strikes will be a bit erratic but will likely show the initial stages of development.

Once the storms become mature, cell mode provides the best vectoring guidance. Cell mode minimizes the radial spread and gives you the best data for comparing cells you see on the scope with the visual picture en route.

Having a split configuration allows you to monitor new developments as well as mature thunder-

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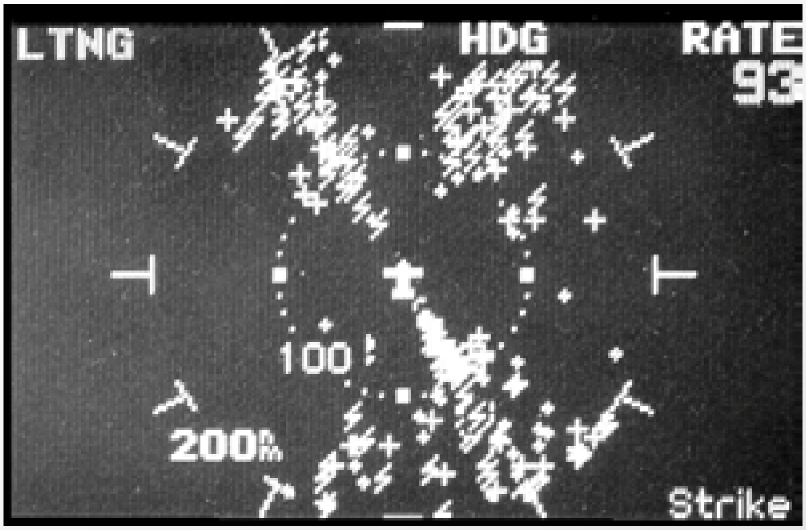
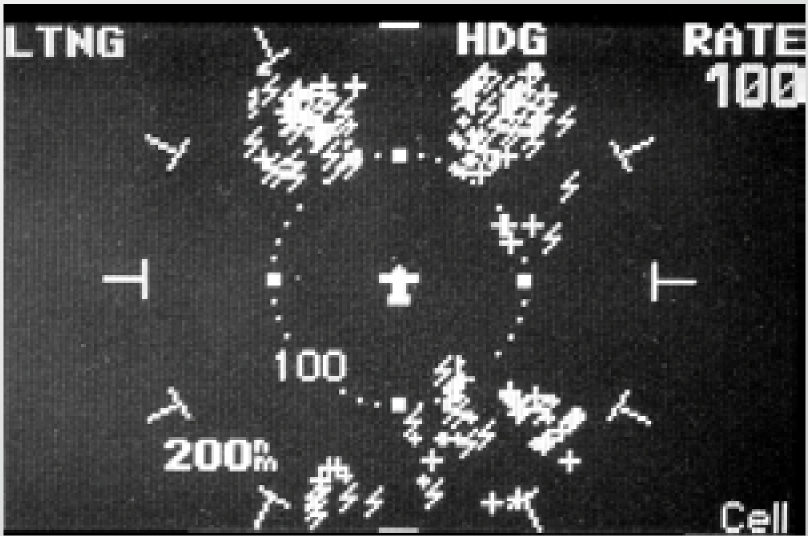
STRIKE MODE VS. CELL MODE

Stormscope data displayed on a Garmin 430 in strike mode show the effect of radial spread. Stronger strikes are displayed closer to the airplane and create a stingray-looking pattern with the tail always pointing toward the airplane.



When cell mode is selected, a software algorithm kicks in that removes many of the strikes protruding out toward the aircraft in an attempt to eliminate the radial spread. This leaves the pilot with a much improved picture of where the actual cells are truly located.



do extra work and putting them out. Of course, it's better to put them out than to put it into something harder than a bumpy cumulous.

The 516-foot obstacle just northeast of KTIW is the Tacoma Narrows Bridge. In order to accommodate ever-increasing commuter traffic, a second bridge is under construction and has some rather tall cranes around it. These cranes raised the MDA from 680 to 980 feet.

Had I checked the FDC NOTAMs I would have found the following:

!FDC 4/3116 TIW FI/T TACOMA NARROWS, TACOMA, WA.
GPS RWY 35 ORIG ...
S-35: MDA 980/HAT 688 ALL CATS.
VIS CAT C 2, VIS CAT D 2 1/4.
CIRCLING: MDA 980/HAA 688 ALL CATS.
VIS CAT C 2, VIS CAT D 2 1/4.
MCCHORD AFB ALTIMETER SETTING MINIMUMS ...
S-35: MDA 1000/HAT 708 ALL CATS.
VIS CAT C 2, VIS CAT D 2 1/4.
CIRCLING: MDA 1000/HAA 708 ALL CATS.
VIS CAT C 2, VIS CAT D 2 1/4.
TEMPORARY CRANE 675 MSL, 5780 E OF RWY 17.

Sure enough, 980 feet! The cranes are temporary structures and do not require updating to the approach charts. However, they were NOTAM'd longer than 30 days, so they weren't part of the FSS standard weather briefing.

I have been shooting approaches at KTIW for over five years, but a new job prevented my getting more than seven hours in the past five months. Why else would I be shooting approaches when the sun was shining in Seattle! If you haven't been there in a while, or if you are checking out some new digs, make sure you check out the FDCs.

Michael Mahoney is an instrument-rated, commercial pilot and head Kahuna of EGTrends (www.egtrends.com).

WHY USE A STORMSCOPE?

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storms. If you only have one display device, set it for strike mode for towering cumulus in the distance and cell mode for mature thunderstorms along or near your route.

Flight Strategy

A slick use of a Stormscope is assessing the convective picture out to 200 nm while still safely on the ground. Turn the unit on and in a few minutes you'll get a good picture of the challenge ahead. If you are flying IFR, you may want to negotiate your clearance or initial headings with ATC to steer clear of the areas that are painting on your display. I've cancelled a few flights based strictly on the initial Stormscope picture while I was still on the ramp.

One of the best strategies in a convective environment is always remaining in visual conditions. You might even want to cancel that IFR flight plan and remain with ATC using flight following. This gives you the freedom to make altitude and course adjustments as necessary.

Fly high above the haze layer to see the larger build-ups and towering cumulus from a greater distance. If you are continually asking for more than 30 degrees of heading change to get around small cells or significant buildups, then call it quits; you're too close or the line is too big.

Visual or not, keep most of the strikes (in cell mode) out of the 25 mile range ring on your Stormscope. If one or two strikes pop into this area, don't worry.

Don't discount the value of your spherics device. Combined with a subscription-based cockpit weather system, you have a great set of tools to steer clear of convective weather all year long.

Scott Dennstaedt is a meteorologist and CFI specializing in Cirrus and Lancair. He is also an IFR *contributing editor.*