

# Flying With XM WX

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## Neat stuff.

The official name is XM WX Satellite Weather. Most pilots just call it XM Weather.



XM Weather products provided by WxWorx (displayed here on a Garmin G1000) give pilots all the graphic and text information they need to strategically conduct a flight that will avoid the worst of the weather.

The neat thing about it is that it offers virtually all available weather information and can be received and displayed on handheld units or on a variety of panel-mount units. There is an instrument panel docking station system available for the Garmin 396 and 496 handhelds that eliminates many of the wires that adorn the cockpit when these are used as a pure handheld, or mounted on the control column. Some of the panel-mount units don't yet have the capacity to display all the information that XM broadcasts.

Another neat thing is that a popular Control Vision PDA-based unit with a moving map and XM Weather display sells for \$1,495. A Garmin 396 is advertised for \$2,195 and a 496 for \$2,795. Any serious pilot, whether renting, flying club airplanes or owning an airplane, can now have the same in-flight weather information that is available to those flying the most sophisticated turbine airplanes, and for not a lot of money. This includes GPS navigation, even WAAS in some cases. And it is an easy and sure bet that more pilots will fly into this thunderstorm season with Nexrad displayed in the cockpit than ever before. Those Garmin units literally flew off the shelves last Christmas.

Most of the buzz about XM Weather relates to the Nexrad weather radar mosaic and lightning display. That is as it should be. The other items, the metars, TAFs, airmets, sigmets, winds, freezing levels, synoptic pictures and more, are and have been available elsewhere. Many of these products have a relatively long life and can be obtained

before takeoff. When flying, the metars, TAFs and convective sigmets are readily available by calling an FSS or, in the case of metars, by listening to ATIS, ASOS and AWOS broadcasts. But the radar picture you look at before takeoff is guaranteed to change and XM Weather brings those changes to the cockpit.

To this ancient pelican XM Weather is nothing short of miraculous. As I first became acquainted with thunderstorms and airplanes we had only a diagram of temperature and dewpoint with altitude (from weather balloons) to use to get an idea of the possibility of storms. How stable is the air? How much moisture is available? A storm is reported on a metar (formerly a sequence report) when thunder can be heard by the observer. (With the automatic stations it is done electronically.) Reported storms were, in the bad old days, the only indication that the stability, or lack thereof, and the humidity were just right for the formation of a storm. Now, the big picture of weather is available at a glance.

Before we talk about how this is used, a grain of salt. There is no magic enabler here, no yes/no windows. It is information that has to be interpreted and used properly in conjunction with everything else that is available. At least one pilot flying with Nexrad information has come to grief in proximity to a thunderstorm. As this becomes more widely used, only time will tell whether or not we'll have less thunderstorm-related accidents. If pilots use it to push too hard in weather, we could have more accidents.

Where to start learning about the possibility of storms before takeoff? The area forecast combines the more complex convective outlooks to simplify the expectation of thunderstorms. Isolated means not many storms are expected. Widely scattered means to pay attention. Scattered or areas means you might have to work at it. Numerous or widespread means the forecasters think it will be an active day.

The synopsis is important too. Where is the low pressure area and where are the fronts? These features do not even start to pinpoint the location of possible storm activity but they can be the triggers.

Finally, before flight look at the radar picture and the convective sigmets. This can show you what is happening now. It might also suggest a best initial routing if there are storms nearby. However, and especially if the flight is a few hundred miles or more, that flight planning look at convective weather is valid only for a few minutes or miles. It will change.

One other thing to look at is your watch. This is a total generalization but it has long been a rule of thumb that if

thunderstorms have a weakest moment, it is around midmorning. Then as the day wears on, conditions are likely to become livelier.

The beauty of XM Weather is in being able to keep up with the weather radar picture as the flight progresses. Maybe the look before takeoff suggested that a zig or zag of, say, 50 miles might work. The operable word there is "might." Thunderstorms ebb and flow and move, and only a dynamic picture of activity can help you keep your airplane out of harm's way.

In relation to convective weather, XM displays Nexrad, lightning, echo tops and a satellite mosaic. In relation to individual storm cells it will also show tops of precipitation return, the strength of the return, and a motion arrow, the tip of which indicates where the storm is expected to be in 15 minutes. That is a forecast, though a 15-minute forecast is usually pretty accurate.

For light airplane pilots, the tops don't mean much other than the higher they are, the meaner the storm is likely to be. There's no way you are going to top a storm. For pilots, the lightning information has to be used with a grain of salt because it is only cloud to ground lightning. Cloud to cloud lightning often begins well in advance of cloud to ground and it is also something to stay away from.

So, while all the XM Weather information is good, it is the Nexrad mosaic that says the most about where the nose of the airplane should be pointed. The other information might be considered supplementary, to be used only in connection with Nexrad.

Let's look at some scenarios.

First, consider a trip about 500 miles long with an area of weather related to a stationary front along the way. This area is showing some red and yellow return but the gradient is shallow. Gradient is simply the distance over which the picture changes color. A steep gradient, where the green and yellow give way to red and darker red in a short distance is indicative of convective weather.

All the technical folks will tell you that the levels of precipitation are depicted the same on airborne weather radar and Nexrad. In actual practice, that is simply not true, especially when the airborne radar uses a 10-inch antenna. I have flown through a lot of red on the Nexrad picture that with my ship's radar I would never have done so.

With XM there are other tools to use to verify it is okay to fly through an area of rain. If no storm cells are identified,

that is a definite plus. If there is no cloud to ground lightning, that is also good. But the best thing is always the Nexrad picture where shallow gradients and a mostly green and yellow picture suggest that there is no wing-bending turbulence in there. I'd add that working out a route that traverses only green or no return gives the best ride.

We do have to realize that any time it is wet it can be bumpy. And there is one particular condition where it can be extremely turbulent in the lower levels without a clear warning from lightning or Nexrad or a ship's radar. When a front is occluding, usually a cold front overrunning a warm front because of a strong circulation around a low, the air is really bothered. The turbulence is wind shear turbulence and even though it lacks the extremely strong up- and downdrafts of a thunderstorm, it can really blur the view of the instrument panel.

After tangling with one occlusion, I have flown hundreds of miles out of the way to stay away from others. Get far enough away from the low and all you have to fly through is a plain old cold front. If ever you are flying from where there is a strong southeasterly flow into an area where there is a strong southwesterly flow, you might be about to learn the occlusion lesson. The closer the two points are, the stronger the lesson.

The strong southwesterly flow aloft ahead of and just behind a surface cold front is another time to pay attention. There is a lot of wind shear turbulence here and any showers that show on Nexrad are best avoided if possible because the turbulence will be enhanced in the showers. Green and yellow would mean a lot more here than in a stationary front.

Next, consider a condition where severe thunderstorms are forecast. Where there is usually a correlation between lightning and precipitation, in severe storms there might be lightning shown ahead of the storm's precipitation. This in itself is an indication of severity. Give it a wide berth. There are guidelines on the distance to stay away from storms. Five miles from the precip is the word for garden-variety storms. For severe there is a bigger number but everything here is open to question. Severe turbulence can be found in any cloud associated with a thunderstorm so the key to a better ride when there are severe storms around is in staying out of all the clouds as well as away from the precip. And, regardless of how far away Nexrad shows the precipitation to be, watch out for those wispy looking clouds. They can grab you by the tail and give you a thorough shaking. I remember a controller once questioning the extent of my deviation around a severe storm but I was basing it on the view and the ride, not on the distance from precipitation.

Another thing that Nexrad gives is a radar picture of the terminal area toward which you are flying. It is here, looking at the relationship between thunderstorms and an airport, that you get the best demonstration of how conditions change rapidly and how we didn't really have a handle on this until we got Nexrad.

If there is any suggestion of storms for an arrival, I start looking at the arrival area right after takeoff to get a picture of how things are moving and developing. And there have been times when my en route planning changed several times over a few hundred miles.

The gradient of a storm is steeper on the advancing side of the storm and the direction from which it is getting its moisture feed. It is normal to say the east side around to the south is strongest in the Northern Hemisphere, but that is not always true. A westerly moving storm bested an airline 727 at New Orleans years ago, and I always wondered if the crew could have been thinking in terms of an easterly moving storm when scoping that one out. Whatever, they made the wrong decision. With Nexrad we can see the direction of movement and properly deal with a maverick storm.

When we are looking at a storm and an airport from a distance, the decision we are trying to make is whether it would be better to get around on the east side and go in ahead of the storm, or wait until the worst of the storm is past the airport and then come in from the back side. The beauty of Nexrad is that you can see all of the storm. With airborne weather radar, looking at one from the back side, you may not see the worst because of attenuation, which occurs when nearby rain uses up all the radar's ability to detect and display precip. Likewise, when looking at a storm visually, the back side will look a lot tamer than the advancing side. The complete picture helps in the decision-making process.

Nexrad isn't going to make an on-time arrival possible if the storm gets there at your ETA. What it does is keep you abreast of how things might work. I would hasten to add that when the weather is active, the best word on the surface weather at the airport comes from the ATIS, ASOS or AWOS. The metar from XM Weather just won't be as current as the dynamic broadcast.

I got weather in my cockpit five years ago when it first came out and I still have that now-obsolete Bendix/King uplink system. I'm also flying with XM through a Garmin 496. When in-cockpit weather started, the big buzz about the Nexrad picture was latency. That's bureaucrat for age. How old is the radar picture we look at and how much difference does age make? The picture on the panel does have some age because the radar information has to be

gathered, processed and then broadcast to the airplane. The age shown on the screen is the time since it was received in the airplane. In the beginning we figured a total of 15 minutes as an average from the Nexrad radar sweep to our screen.

Does that make a difference? I'll tell you a story about that, one that illustrates limitations of all our weather systems.

One of the first things you notice on a Nexrad picture is that it might show some green when it isn't actually raining. It's just telling you that the cloud is wet, but the main thing to understand about this is that you have to relate the general weather situation to the display. Light green might mean one thing one day and another thing on a different day.

I was droning along in the mid-teens. There was a lot of building cumulus around and I had to dodge a few. Up ahead I could see one that appeared to be building well above my level. There was nothing on Nexrad or on the ship's radar or on the Stormscope.

I kept watching the cloud grow and it was clear to the eye that it would not be one to fly through. It was not yet making rain or sparks but it did look like a big head of cauliflower.

The very first thing that showed on my panel was on the Nexrad display. It started as a little bit of green, then turned yellow, then red. By the time it turned red there was some green and yellow showing on the ship's radar and it had started sparking on the Stormscope. So, if flying in a condition where thunderstorms might develop, don't expect any system to tell you about turbulent clouds before they reach the thunderstorm stage.

Another day, I was flying in a post-cold frontal condition with a lot of clouds and some instability showers. I couldn't see these showers because of the other clouds. Nor did they show on the ship's radar or the Stormscope. But they were green return on the Nexrad picture. So this was a day to avoid all green return for a nice smooth ride.

If you know the basics of the weather system and if you use the Nexrad picture conservatively, the rides might be okay if not smooth.

It might seem that Nexrad wouldn't be valuable to a VFR pilot because V is for visual. It is valuable, though. Having the big picture of precipitation can enable better route planning for VFR flights. Also, we know that when it starts raining the visibility might be okay to start but low clouds will eventually form in the rain area. They might be

scattered clouds, scud, but that can make VFR flying difficult. So, knowing where it is raining is important to VFR pilots.

In thunderstorm areas, VFR can often be the best way to go and with Nexrad the whole picture is there to help in planning a route that avoids the storms.

Certainly a lot of pilots who fly VFR will have XM Weather and while the other products will be of use, the Nexrad picture will too.

Any pilot who has flown a lot with airborne weather radar will tell you that it requires a lot more interpretation than the Nexrad picture does. And radar pilots will almost all say that for close work, there's no substitute for that live radar picture from an onboard system. But what I have found is that with Nexrad, I don't get close any more. I bought a new radar about six months before I got a Nexrad display and have just not used it much.