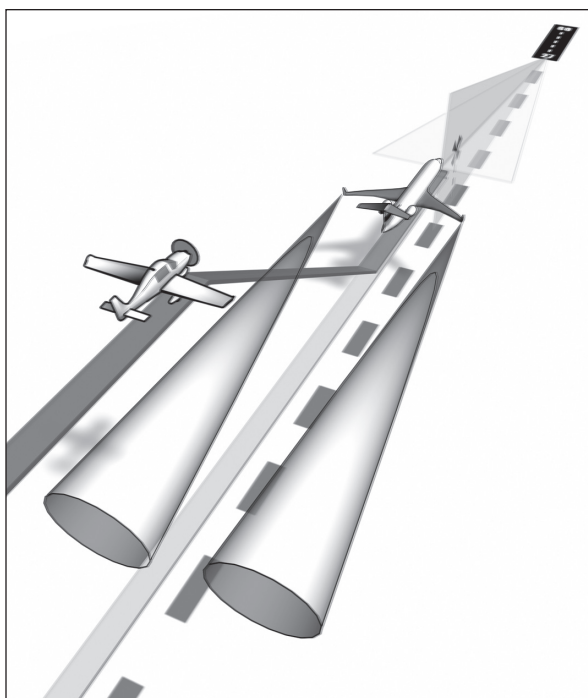


*The Magazine for the Accomplished Pilot*



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# NAVIGATING PAST T-STORMS

*Conventional wisdom of 20 miles is too much some days and not nearly enough other days. Here are a few tips to help tell the difference.*

by Scott C. Dennstaedt

My son watches a series on the Science Channel called *Survivorman*. I'm astonished how the host of the show, Les Shroud, knows every little detail on how to survive in all kinds of terrain and climate. He can tell you which berries will kill you or what insect makes for a delicacy. He's acutely aware just what beast is nearby by how the twigs along the path are snapped. Survival isn't about getting lucky. It's all about knowledge and paying close attention to those important details.

More and more pilots are venturing into the convective jungle armed with data but without the field-smarts of *Survivorman*. Spherics devices such as a Stormscope, datalink weather and a world of preflight analysis tools on the internet are there for the taking, but you must know how to recognize a bad situation from a benign to see real payoff.

## Clear, But Not Smooth

Most pilots are well aware of the dangers associated with in-cloud convective instabilities within thunderstorms, but are not as likely aware of the out-of-cloud turbulence risks near thunderstorms. Research meteorologists call the latter "turbulence near thunderstorms"—appropriately abbreviated TNT.

Etched into our minds are the thunderstorm dos and don'ts found in the AIM (7-1-29): "Avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus." And perhaps you may also remember, "Circumnavigate the en-

tire area if the area has 6/10 thunderstorm coverage."

Reality isn't that simple. I've seen moderate to severe turbulence 50 miles away from the visible thunderstorm cloud. There are also thunderstorms you can literally brush by. The key is knowing the difference.

## "Tame" Thunderstorms

Pulse or "air mass" thunderstorms are rarely severe and often are spread far enough apart that flight through the area only requires visual separation—i.e., just staying outside of the clouds themselves.

Although these cells can climb well into troposphere, most only get to be about 10 miles or less in diameter and they tend to stand out among mundane cumulus clouds around them. Pulse thunderstorms often move slowly since they are not typically part of a major weather system.

Supercell thunderstorms, on the other hand, often produce dangerous clear-air turbulence downwind that's essentially invisible. They often climb well into the lower stratosphere and are usually severe, containing torrential rains, strong gusty winds, intense lightning, large tornadoes and hail. Unlike a pulse thunderstorm, the anvil on a mature supercell thunderstorm is huge and the presence of mammatus clouds is a sign to keep your distance. Some supercell thunderstorms travel alone or can be found in small clusters.

Squall lines or solid lines of thunderstorms associated with a

*On approach into Beaumont, Texas (KBPT), I was watching a line of building cumulus and thinking about how I might go under this line without running into anything nasty. Visibility below was good (**below**), datalink showed only light echoes and no cloud-to-ground lightning and there were no visible rain shafts. Two minutes later, a rain shaft appeared (**right**). Within about 10 minutes, this whole line began to quickly fill in with heavy rain and lightning.*





MOSS BLUFF  
KCWF  
L 33  
CHARLETON  
PR1  
3R7  
JENNINGS  
3R2  
CRAWLEY  
L 89  
ECHO TOP  
AGE: 8min  
XM LTNG  
AGE: 3min  
SIGHTMET  
06/29  
11:30AM  
AIRMET  
06/29  
11:27AM  
METAR  
AGE: 2min

LAKE ARTHUR  
LAKE AND LAKE  
LAKE FISH LAKE  
LAKE MUD LAKE  
LAKE WHITE LAKE  
LAKE VERMILION BAY  
LAKE DEEP LAKE  
LAKE INCY  
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A black and white map of a coastal region, likely in Louisiana, showing towns such as New Iberia, St. Martinville, and Atchafalaya River. The map includes a compass rose, a scale bar indicating 20 NM, and various navigational markings like '20° 30' N' and '90° 30' W'.

Supercell thunderstorms, MCSs and thunderstorms associated with large-scale systems demand some distance if you plan to fly ahead of their paths. I like to stay at least 50 miles or more away. If there's an

The most important step dealing with deep convection while en route is grasping the current weather picture and how it may evolve before you depart. Knowing how the NEXRAD image might look three or four hours into the future is a key element of success.

With convective activity you'll typically be in one of two situations when you are planning your route. The sky may already be lit up with active thunderstorms showing up nicely on NEXRAD and protected by a fence called a Convective SIGMET (WST).

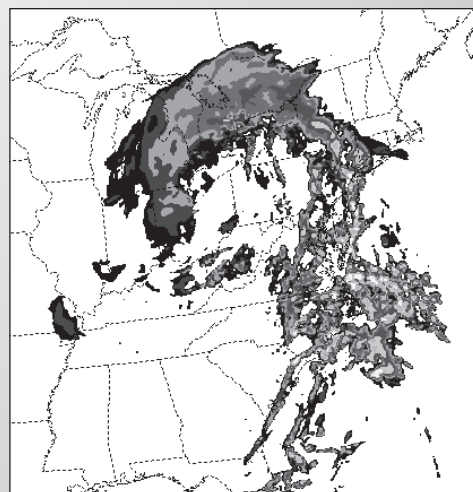
Or you could be looking at a case where the NEXRAD image is quiet with ground clutter and the convection will ignite during your flight. While it's much easier to plan your route when you're looking at active thunderstorms, further development not currently depicted can still

# SEEING TOMORROW'S NEXRAD TODAY

Text-based terminal and area forecasts can be tough to use in route planning and convective outlooks can cover too wide an area to be useful.

I like to use a product called simulated reflectivity ([www.nssl.noaa.gov/wrf/refl\\_loop.html](http://www.nssl.noaa.gov/wrf/refl_loop.html)). Simulated reflectivity is strictly a model-based forecast, but provides a graphical image similar to NEXRAD of what kind of convective environment might be in the making, timing of onset and direction of movement. It simulates (to some degree) what NEXRAD might look like in the future on an hour-by-hour basis—out to 36 hours. The forecast is generated twice a day and has a 4-km resolution.

The experimental enhanced thunderstorm outlook ([www.spc.noaa.gov/products/exper/enhtstm/](http://www.spc.noaa.gov/products/exper/enhtstm/)) from the Storm Prediction Center is another useful tool, and, in its new version, will be issued five times a day showing 12 hours worth of forecast chunked up into three, four-hour segments. —S.D.



occur impacting your route an hour or two into your flight.

## The High Road

I firmly believe that higher is normally better if it's an option. The goal is to get high enough to be several thousand feet above the haze layer. Flying higher allows you to remain in cloud-free air while en route, with unlimited visibility so you can see what you are up against. You can also steer clear of the cloud tops and the worst turbulence.

At 15,000 feet or higher big boomers will show up even 100 miles away, giving you plenty of time to formulate a plan to avoid them. This may put you in static air temperatures below zero degrees Celsius even during the warm season—another reason to remain clear of visible moisture when you are flying in the mid- or upper-teens. Flying above an active thunderstorm cell does carry some risk, however.

If you decide to go over the convection, you must be absolutely sure you know where the tops are located. Don't rely on echo tops from NEXRAD, since they are given with a resolution of 5000 feet in the vertical. The text of a convective SIGMET will provide an estimation of maximum tops, but even that forecast can be a crap-shoot at times since the Aviation Weather Center's method of determining tops relies on a quick

sampling of the cloud-top temperatures in the area using an infrared satellite image. A recent pilot report in the area of concern will be the best piece of data, but those are severely limited in number. This is a place where some advance weather knowledge to read radiosonde observations (RAOBs) can help. They may identify the equilibrium level, which is the altitude where the thunderstorm updraft will end its positive buoyancy and the atmosphere becomes stable.

## ***High cloud bases may lure you into thinking it is safe to weave around the cells down low.***

AIM 7-1-29 (a)(6) states, "Do clear the top of a known or suspected severe thunderstorm by at least 1000 feet of altitude for each 10 knots of wind speed at the cloud top." Dr. Bob Sharman, a research meteorologist at the National Center for Atmospheric Research (NCAR), says, "Flying over thunderstorm tops using the wind speed at the cloud top as a discriminator is naive and potentially dangerous." Turbulence above the tops could be much more severe than most pilots would think.

## Bottom Feeding

If you or your aircraft is limited to

flight at or below about 10,000 feet, your plan will hinge on how dense the area or line of thunderstorms really is. A line of thunderstorms of significant radar echoes (40 dBZ and greater) that is longer than 60 miles with at least 40-percent coverage, will qualify for the issuance of a WST. Similarly, an area of thunderstorms of significant radar echoes that is greater than 3000 square miles that has 40-percent or greater coverage will be issued a WST. It's going to be tough flying IFR in this kind of convective environment.

Putting down the IFR mantle and flying VFR can be a good choice. I personally use it on trips where flying IFR becomes a challenge. Flying under IFR and doing a 180 isn't going to work with ATC unless you are returning home or turning away to exit the IFR system. Even if you started IFR, sometimes it works best to just cancel and climb 500 feet. Stay with Flight Following and, when you are clear of the convection, air-file a new flight plan and get back into the IFR system.

Convection with very high cloud bases, called elevated convection, may lure you into thinking it is safe to weave your way around the cells down low, staying away from the rain shafts. However, dry air below a thunderstorm base is a perfect environment for the produc-

*(continued on page 22)*

is that the turn to haul back around to the 047 radial outbound for the approach exceeds the limits the approach designers allow. We'd hope few pilots would ever have to worry about this restriction, as it would mean they went about 40 miles out of their way.

Instrument flying is all in the details, whether it's just one or two little things or an entire approach rewrite. In this game, it always pays to be an "alert reader."

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## NAVIGATING PAST T-STORMS

*continued from page 11*

tion of a microburst, especially a dry microburst, which is essentially invisible. Hail, gust fronts, outflow boundaries and convective wind shear all can exist in the clear air around the bases of these cells.

What appears to look harmless now can turn real ugly in just a few minutes. Rain shafts with cold, dense downdrafts can appear out of the bases of any of these developing cells. Flying down low in the poor visibility hides the structure of the cells from your view. This prevents you from seeing which cells might have more of a chance to release such a torrent of wind, not to mention the thermal turbulence alone that makes

it difficult to read charts or change frequencies.

Your satellite-weather NEXRAD and lightning product won't help with this problem either, given the five- to eight-minute latency. One minute you think you are flying below or in the base of a harmless cumulus cloud only to find out that 10 minutes later, what looked like a harmless cloud now has a billowing tower starting to build its anvil shape.

### Turns for the Better

High or low, deviating around convection is almost always the best choice. But it requires good coordination with ATC and looking ahead 50 or 100 miles to avoid the constant vectoring or route changes.

A 10- or 20-degree deviation left or right is the norm with navigable cells. If you find yourself continually asking for more than 30 degrees left or right, you're probably too close to the cells or the area of thunderstorms is just too large. In these situations, I'll get as close to the line of thunderstorms as I can, land and wait for them to pass before departing. This gives me a chance to empty the bladder, refuel and check the weather for the remainder of my route.

When possible, fly on the upwind side of the cell. You want to avoid flying in front of the cell, as this is where most of the hazards with thunderstorms are found. If you have satellite-based weather, identify where the cell has just left and fly toward that point. By the time you get there, the cell or line you were concerned about will have moved off by five or more miles.

Whenever I fly along the northern Gulf Coast states during the day, I try to fly 15 miles or so offshore. I know this carries some risk, but most pulse thunderstorms are located inland rather than over the water. You'll have fewer cells to dance around, lessening your workload. This trend reverses at night.

### Your Best Shot

Just like you were taught to look

down the runway when landing, the same applies with a convective environment. The cell that's dead ahead is the immediate concern, but making it all the way to your destination most of the time means planning beyond the immediate next move.

Never lose sight of the big picture and all of the homework you did before your flight, and keep a close eye on changes that pop up en route. It's the attention to details that makes the survivors.

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*See Scott's online pilot weather training at [www.avwxworkshops.com](http://www.avwxworkshops.com)*

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## ANATOMY OF THREE CRASHES

*continued from page 18*

spun to the right and descended into the ground. Worse, the airplane was by my calculation about 264 pounds over gross weight.

How could a highly-rated, experienced pilot allow himself to be cornered this way?

Simple. He accommodated not one, but two, demanding requests. Whether he did this out of accommodating nature, thinking he could pull it off, or under duress, we'll never know. But clearly, the outcome was fatal for all.

### Putting Pieces Together

Learning how to analyze accidents is a valuable and perhaps life-saving skill. For those of us close to an accident, it's also a way of coping with the loss. Some of the take-aways apply to all the accidents. Some apply to only one. All have become part of my flying life since those days.

When we chair-fly and imagine handling an in-flight emergency, we tend to play out our actions slowly. We always have enough time to successfully handle the outcome. Real emergencies can happen quickly. Anders had three minutes to land. Jeff had seconds to catch the impend-

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