

The Safe and Sensible Exploring of *Marginal VFR*

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■ The literature of flight safety starts with Weather, continues with Weather, and ends—in Horrible Examples—with still more Weather. The greenest student pilot knows that the majority of general aviation accidents are weather-associated, and he sets his personal minimums from the outset accordingly. Others may contract “go-itis”—not he. Others will trust that a hole will appear in the undercast at their destinations, that the somewhat lighter area off to the left is a break in the thunderstorm line, that the terrain will not rise or the deck lower. He has been firmly inoculated against such foolishness, and he is immune.

The bulk of his training will have been spent over familiar terrain, under 2,500 agl and well clear—very, very well clear—of all clouds. His cross-country work will also have taken place on nice, sunny days. The net result is that he will eventually be turned loose as a private pilot with a mortal terror of all hydroforms, having never been introduced to a cloud. He will indeed be a safe pilot, and a credit to his CFI, for a long, long time.

He will also, in all probability, seriously inconvenience himself and his passengers for years to come by missing scores of opportunities for safe and legal flying, because he regards the merest hint of “weather” as an absolute barrier to going aloft.

He can define “VFR” and “IFR” conditions, but what he cannot define, or even recognize, is “marginal VFR” conditions, which he assumes equate with being “in the soup.” If he even suspects they might be prevailing, he stays down.

It will take him a long time to start exploring “marginalia,” and to discover

that a good bit of it can be safely negotiated with little more risk than he assumed on his first unsupervised solo, providing he exercises ordinary common sense and, above all, foresight. Such explorations should result in a lowering of his personal minimums from their original levels, which are almost invariably unrealistically high, to what are still perfectly sound, safe and legal levels.

I am not suggesting for an instant that any chances be taken with the primary maxim “Better safe than sorry.” Nor am I suggesting that “exploration” be carried to the point of flirting with folly.

The point is that the danger comes from flying into clouds and from getting into situations where you cannot escape flying into clouds. But while weather changes and moves, and frequently does so with bewildering rapidity, about one-tenth of the “change” is in the weather, which you can’t control, and about nine-tenths is in your position, over which you do have considerable control.

The cloud with a Vmc remotely approaching that of the equipment you are flying (unless you favor Pietenpol Air Campers) has yet to be spawned. Clouds do not really chase you, and if you find yourself in one’s digestive tract the cloud is normally not at fault. It was there first, minding its own business—you’re the Johnny-come-lately.

Before getting into specifics, there are a few house rules that apply when the word “marginal” pops up. To begin with, this is no game for people with five or ten hours on their private ticket. True, they will have to start sometime, but they shouldn’t before they are completely at home in the air. If simply holding

course and altitude still occupies 80% of your attention—if you are vaguely uneasy with unfamiliar terrain beneath you, inordinately bashful about opening conversations with total strangers on the FSS circuit, on the whole prefer not to land at strange fields, and have a perfect horror of those with control towers—wait. You will be ready in the fullness of time, but don't start now.

Secondly, for obvious reasons this is a daytime ballgame which, by and large, should only be practised over flatlands. The odds against a VFR pilot in nighttime marginal conditions are so heavy only an idiot would play, and while you can go over, under, around or even through many types of weather, these options vanish in the case of invisible cumulostratus. It is also not a sage idea to warm up in the vicinity of busy TCAs; marginality is entitled to your full attention and should not be compounded by unnecessary burdens.

Thirdly, your navigation techniques—and I mean all of them—should be honed to a fine edge, starting with a thorough knowledge of your magnetic compass. The more equipment the better. A nav/com unit is the absolute minimum, and dual nav/coms, a DME, an ADF, and a transponder, not to mention RNAV, can be as useful to the VFR pilot as they are necessary to the IFR pilot. You should be completely familiar with your VOR, including its ancillary uses.

The last wind triangle the average general aviation pilot ever solves is the one he is given in prepping a cross-country flight on his private pilot flight check. Shortly after he launches out on his own, his checkpoints begin to drift farther and farther apart until they merge with the VOR stations. The more experienced he becomes, the more apt he is to join the "I know I'm on course even if I don't know where I am along it, I'll find out when the 'to/from' window flips" school, and far too many pilots leave their expensive DMEs twiddling their thumbs until the needles on the fuel gauges move to the left of the magical one-quarter mark—at which point that piece of equipment suddenly starts to exercise a truly extraordinary fascination.

Flying VFR in marginal weather can result in a ground track that looks like a fishing lugger beating to windward in a crowded anchorage. Be sure that, once you abandon those lovely straight lines you ruled on your sectional, you can locate yourself precisely at all times.

Finally, because of potential detours, gas is much more of a problem in marginal VFR conditions than it is in sparkling weather. Tot up the mileage for your projected cross-country, add a gen-

erous 20%, and then leave yourself a full hour's reserve.

All set? Fine. Let's examine marginality.

Weather Reporting

The newly minted pilot notices early on that there are often glaring discrepancies between what he hears in his weather briefing and what he sees from his cockpit when he gets to the scene. More often than not, the error is all to his benefit; the situation isn't half as bad as he assumed it was going to be. From this experience he is apt to draw a totally erroneous and dangerous conclusion: that the reporting system isn't so hot and in the interests of safety is trying to scare him.

The problem is not with the reporting but with the weather itself. Weather comes in such an infinite variety of forms that it simply can't be cut into standard packages and wrapped with neat verbal descriptions. The system can only provide general dimensions, and then only for frozen instants of time in the recent past. It is reasonably accurate about items that lend themselves to measurement: ceilings, temperatures, visibilities in the immediate proximity of the equipment. But the system can't possibly account for every square mile of a constantly changing situation, and it cannot evaluate "flyability," which is at best a nebulous concept.

If the system reports the existence of thunderstorms, you can be certain there will be thunderstorms. The system can even describe these storms, but it cannot foretell what you are going to find in the immediate vicinity of your aircraft when you get there.

Flying marginal weather involves three distinct phases, which you must examine during your briefing in order to reach a "go/no go" decision.

The first of these is your takeoff, the simplest phase of all. The system, which is at its best in measuring ceilings and visibilities at an airport, will in fact make the decision for you: the field is either open or it is below minimums and closed. Even if it's closed, however, there is one bit of marginalia you might be able to do something about.

Perhaps the most irritating situation of all for the VFR pilot is to plan an early morning takeoff on a cloudless day, when the whole world is enjoying balmy skies, only to find the field plagued with a patch of ground fog reducing horizontal visibility to a few hundred yards. More firm resolutions to start instrument training at once have been reached under such circumstances than at any other time, which is no help to those who don't have the rating. Pilots have been known to chance it anyway, which is neither safe nor legal, but don't go away. Ground fog frequently comes in the form of long, parallel windrows

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that drift slowly before they finally burn off. If there are no other problems, you can leave safely and legally in the intervals.

The second phase—and by far the most important for your decision—is destination weather. Because you can control your movements, you can, perhaps, negotiate anything you find en route. Your destination, however, is a fixed point and can't dodge; it has to accept whatever comes down the pike. Before venturing forth, be absolutely certain that where you intend to finish up—either the original destination or specific alternates—is, and will continue to be, firmly VFR. Exploring marginal VFR does not involve taking any chances with what you will find at the other end. Anything that even remotely smells like a closed field is a decided vote for a "no go."

Oddly enough, thunderstorms at your destination are not absolute barriers, although they may very well force you to a nearby alternate. The system can forecast thunderstorms, but it cannot predict if a particular field is going to have a cumulonimbus parked over it several hours in the future. Most metropolitan areas have half a dozen to a score of fields ringing the area; the chances of all of them being shut down by CNs at the same time are almost nil.

That leaves the en route phase, and



Photo by Don Downie.

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MARGINAL VFR continued

if the takeoff field and the destination are quite clear, the decision to go can be made even in the teeth of dire predictions of unpleasantness in between. "Go," in this case, does not mean "Go directly to your destination as you originally planned"; it only means "Go to the marginal area to see what it is actually like, being fully prepared to return, or at least to deviate, if passage is not feasible."

The point is that the decision to complete a trip can't be made on the ground, no matter how thorough your briefing was. Flyability at a given point in space and time can only be evaluated from the cockpit, aloft.

Cloud Decks

You're on your very first cross-country flight with your new ticket, winging your way from Houston to Brownsville at

8,500 feet. Houston was clear as a bell, and according to your briefing Brownsville had children in the second grade who had never seen a cloud.

Just west of Victoria, you suddenly see a cloud bank ten miles ahead, running north and south from far out in the Gulf of Mexico on your left to what, for all you can tell, is Canada on your right. If put on the rack, you would judge the floor to be at about 5,000 feet or thereabouts, and the tops are at your eye-level—perhaps.

Nothing remotely resembling such a dangerous situation was ever mentioned in all the hours you were practicing short-field landings and turns around a point, and you start to review your FARs to see where you stand, legally and otherwise.

At this point you may be forcibly struck by a thought to which, up to now, you have devoted remarkably little attention. You know all about staying away from clouds—1,000 feet over, 2,000 horizontally, and 500 under—but you suddenly realize you can't possibly begin to judge such distances with any accuracy at all. Flying between two clouds, you might reasonably decide that the one on your left was twice as far away as the one on your right, but you could easily fly well within 1,000 feet of the closer one before you were positive it was less than 2,000 feet away. On the occasions you were up with someone else doing the flying, you couldn't even judge your altitude within 2,000 or 3,000 feet, once you got much over 2,500.

Holes are even worse. On the ground, you could probably judge that a layer at 5,000 feet covered "two-tenths" or "eight-tenths" of the sky, but with the best will in the world you'd be several tenths off on anything in between. Aloft, with the deck at eye-level, you can't judge at all. The FARs tell you a hole must be at least 4,000 feet across, but the hole might be 1,500 feet across before you would worry that it was too small, or 6,000 before you were absolutely certain it was large enough.

Getting a grip on your rising anxiety, you review your options. There seem to be three: you can go over, under, or back.

You call on your friendly FSS dealer and check on Brownsville again. Those second-graders look like entering college without finding out about clouds: the area is absolutely clear. Whatever lies ahead is in a narrow band with the far side well clear of your destination.

Okay, bash on. The problem has been reduced to a choice of going over or under. Every nerve in your psyche is begging you to descend, "caught on top" being a fate you regard as equivalent to, if not worse than, death. But you have just been told that you aren't going to be caught on top; at the very worst

you will be flying over an undercast for a spell. Going down, moreover, would introduce aggravations.

West Texas is filled with what an Australian friend of mine once admiringly described as "miles and miles of bloody bugger-all." If that 5,000-foot-floor estimate of yours was right, you could proceed at 4,500, but if you were even a couple of hundred feet off you would have to go down to 3,000 or below. There is a thicket of Navy training fields down there, followed by the King Ranch, one end of which looks very much like the other end, which is very far away. Noted for its oil and cattle, the King Ranch is not noted for VORs, and you don't relish the idea of 150 miles or so on the deck with your eyes glued to a precession-prone gyro. So let's go up.

This brings you to 10,500 feet, with another 2,000 feet of legal airspace above that. Feeling as if you are flying into God's Great Pilot-Trap, you edge in over the cloud deck. You are reasonably certain that the puffy tops are a good 1,000 feet below you, even if an ominous bulge here and there makes you nervous. And while it all looks pretty solid, you keep flying over holes through which the ground is visible and through which you are reasonably certain you could descend without scraping the edges, even if you have no idea what the footage across is.

You are still worried about "buildups," having read innumerable accounts of what happens to pilots who ignore them. There are indeed buildups visible. They are tall, spindly columns arising here and there from the mass, for all the world as if someone parked in one of the crevasses had lit a wet-grass bonfire. Even to your inflamed imagination, they do not appear to be "boiling," nor do they display the slightest inclination to suddenly turn into thunderbumpers. They are, in fact, so skinny you suddenly realize they couldn't even hide a Fly Baby, and in a spirit of sheer bravado you actually slice one with your wing. Wow.

After a while, the cloud bank ends as abruptly as it started. You have just negotiated your first piece of marginal weather, and you will keep your engagement in Brownsville instead of spending the day in Victoria. With the Brownsville reports firmly in hand and the tops of the bank under 11,500, you were never in any danger of infracting an FAR; the bank might have been solid and gone all the way down to the deck and you would still have been safe as houses.

Granted, engine failure would have been a heartstopper. But engine failure is an emergency situation, another ballpark entirely, and the only absolute insurance against engine-failure problems

is never to take off at all.

Cloud decks, in short, must be examined. It is quite true that weather can extend up to 60,000 feet, but there are times when all of it is below 10,000. Surface stations may be experiencing all manner of meteorological atrocities, but your only concerns are your destination and what it looks like at your altitude. Only you can answer that, and even the FSS, with all the equipment in the world, might be dependent on a Pirep from you to find that out.

Nice, neat undercasts such as we have just described are child's play. Cumulus can take many forms, and can reach gigantic proportions without ever turning into cumulonimbus. Cumulus can be confused, extending from a ground-hugging floor to tops beyond imagining; it can be associated with fractionated stuff—the notorious “gunk” or “trash”—with wisps and shreds and tatters that may or may not be “clouds” at all.

There are situations the terminology of weather reporting cannot even describe, except for blanket terms like “marginal” or “obscured.”

There are, at altitude, vast, watery voids in which no cloud at all can be identified as such. Lift your eye to the horizontal; there is no horizon at all, and you'd swear you were in an overcast. Look down—you can see not only the ground, but also points you are absolutely certain are five miles and more away from the point under your plane. You are still technically VFR, and will remain so as long as you can see ground points three miles apart, even though lifting your eyes from the ground means you must fly “on the needles.”

This is, of course, an extreme example of marginality, and not to be entered upon lightly. What at the moment is a gray void ahead can become indubitable cloud with frightening rapidity, obliterating in an instant the single clue you had to the fact that you were “VFR”: the ground references. Flights in such areas are pushing beyond sensible limits, for the obliteration can occur to the sides and behind as well as in front.

The criterion for “flyability” is the same as it is in all cases: Are you absolutely certain that you are not only VFR at the moment but that you still will be in 15 minutes? If you have to think about the answer, you have no business being where you are and should turn around.

Thunderstorms

The presence of thunderstorms in any form constitutes automatic marginal conditions. Every nasty word ever written about them is true, and the only good thing about them is that if you ever find yourself in a cell, the risk of suffering a midair collision is lower than anywhere else in the sky.

Their mere existence, however, does not mean you must shun that part of the world. Like all hydroforms, they can only bite if you fly into them or their immediate vicinity, and there is no reason at all to do so as long as you can see them clearly. They come in all shapes and sizes, some of which you can see and some of which you can't, and no weather equipment in the world can beat your eyeball in distinguishing the two groups.

The key is visibility—of all of each thunderstorm. They can be circumnavigated as long as they are not embedded in associated trash that hides them, or as long as they are not so numerous and crowded that they hide each other. It may be a very long trip around (and if it is too long, the flight is off), but they are discrete entities and not endless. They can also, in certain circumstances, be flown under, although even more caution than usual must then be exercised. They should not under any circumstances, however, be overflown, since they can probably beat your rate of climb.

Let's look at “lines” first. You can, quite often, fly up to a thunderstorm line

in clear weather, to find progress barred by a “wall” of some description. If the wall is anything approaching solid, give up any idea of penetrating it. There may be a reasonably wide hole going in for a space, with plenty of room on either hand, but unless you can see the far end, not as a “light down the tunnel” but as obviously clear country behind the line, do not enter. Such “sucker holes” are almost invariably cul-de-sacs, and if you are foolish enough to enter one it may close behind you before you realize you are in a blind canyon.

Some “lines,” however, are completely different propositions. The CNs, which may be sizable, are strung out in a single rank five or more miles apart, connected by thin saddle clouds at their bases, for all the world like balloons tethered to a stay wire. The country beyond is clearly visible, as clear as it is on this side, and you can pop over or under the saddle as you choose, with nary a twinge.

The dividing line between two such extremes is difficult to describe, but perfectly clear when seen. You are inhabiting a block of air 4,000 feet across, 1,000 feet below you, and 500 above. Can you see, exactly and entirely, the passage you propose to move this block through—without scraping anything, and with only a minor deviation or two to skirt something—or will you have to “thread” it through, with the risk of getting wedged? Are you, in other words, flying in the clear, even when you are steering around something, or are you simply following the twists and turns of hemmed-in alleyways? Can you go just about where you want to, or is your course increasingly being forced on you? In one case you are dealing with flyable marginal weather; in the other, you may be technically legal at the moment but you are no longer safe.

If penetration is precluded, there are still two possibilities. Even the most formidable line ends somewhere, and the FSS can tell you if an end run is feasible. If it isn't, it's still worth taking a look underneath.

Almost anything might be going on under a well-developed line, and even if matters are relatively peaceful, mountains or hilly country could turn underflying into a risky proposition, so the answer in such a case would be to go away. As often as not, however, you may be in for a surprise.

The country is flat, and all that activity up there is emanating from an absolutely level, if extremely dark, overcast upwards of 5,000 agl. Visibility underneath is a good 20 miles or more, with only a trace of scud here and there, and the bases of the cells above are marked by almost black areas in the ceiling. There is precipitation all over the place—dozens of showers, in fact, ranging from transparent falls that hardly

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MARGINAL VFR continued

blur the horizon to white, opaque cloud-bursts. But for all their number, they do not blot out any appreciable segment of the horizon.

Such an area can be negotiated legally and safely, although you will undoubtedly have to zigzag here and there. The transparent showers constitute no more than a free wash job and can be flown right through; the opaque ones equate with clouds and must be given a 2,000-foot berth.

Fly at least 1,000 feet under the overcast. Precipitation falls remarkably slowly; you will see all of it, including showers that start in front of you. You will not be caught under hail that suddenly strikes down—hail, in fact, is a rarity down here, and far more of a danger to the IFR pilot above, who is on instruments and can fly into precipitation he can't see coming.

The two other thunderstorm-associated risks that occur outside the cells themselves are not major problems in a system as stable as this. Turbulence can be encountered anywhere (and naturally, you slowed when you went under), but you are not liable to encounter severe chop in an area you judged safe to enter. Nothing here is "boiling," nor—except perhaps for the black spots in the ceiling—does anything look particularly "angry." The showers—even the heavy, opaque ones—are actually reassuring. If they are coming straight down, with perfectly vertical edges, there will be little or no wind or turbulence. Avoid by at least five, and preferably ten, miles any precipitation with

steeply slanted or ragged edges, or precipitation sheathed by mist. Above all, avoid like the plague heavy precipitation that comes straight down and then spreads out like the pedestal of a lamp near the ground: it indicates violent downdrafts and ground squalls.

Even funnel clouds are no risk aloft, if you are in an area in which they occur. Needless to say, they are not to be investigated; clear the area at once and move straight away from them. Your plane is actually safer aloft, however, where you can outrun them, than it would be on the ground where it can't move.

Lightning usually occurs in a ring near the fringes of the black spots. Strikes from cloud base to ground are startling sights—and frightening if they come close. But the literature seems to agree that, at the most, three crashes in the last twenty years can be directly attributed to strikes—these having, by some fluke, set off partially filled tanks. (The literature, however, is silent about the hundreds of unexplained and unwitting crashes that have over the years occurred in thunderstorm areas.) Direct strikes, apparently, are rarities, do not damage the aircraft's occupants (if being scared out of your wits can be described as "undamaged"), and seldom leave more of a mark on the plane than a hole "the size of a half-dollar," with severe indigestion prevailing among the avionics. I do not care to risk holes the size of a half-dollar, or any other size, in the equipment I fly, nor do I fancy avionics with colitis, so I avoid flying under the black spots.

Isolated thunderstorms infesting an area pose similar problems. They vary

from youngsters with clearly defined parameters to monstrous, amorphous grandfathers that seem to blight entire sectionals. The criterion is still visibility and the presence or absence of associated phenomena that might hide embedded cells. If the storms are large, jostling each other and blotting out the horizon, so you really aren't sure what the near ones are hiding, or if the spaces between them are not really open but only messy interstices, go away. If, however, you can always tell where you will be in fifteen minutes, have several choices of where you want to be, and can skirt everything in sight by five miles or so, your risks in bashing on haven't risen appreciably.

The cells may even be fastened to a wild, confused-looking floor. The same rules apply, although such an undercast is nothing to skim over at the legal 1,000 feet. Get as high as you can, with the best overview possible. In circumnavigating, try to pass upwind of the cells, and stay out from under the anvil heads. There will be little or no precipitation above such a deck, but what there is might be hail.

In summary, flying marginal VFR weather is frequently feasible. Exactly the same principles apply in marginal weather as in clear: Stay out of clouds, and stay well ahead of your airplane. The safety margins are naturally lower than they are in CAVU weather, but this doesn't mean "no go." It simply means that the chances of having to make a "no go" decision are higher; be prepared at all times to make it.

And, especially if you are transponder-equipped, the various radar services will often take almost as good care of you as if you had filed IFR. In marginal areas, the vast bulk of the traffic is on IFR flight plans, and controllers are far more aware of the sporadic VFR flight. Departure Control may simply hand you off to a center, which will give you a code to squawk, pass on traffic advisories and weather information, fuss over your altitude, suggest vectors and even ask for Pireps, for all the world as if you'd filed IFR yourself. (But you haven't, as the center is fully aware. The controllers' concern is not entirely altruistic; their basic responsibility is to their IFR traffic, and they expect you to remain VFR.) The center frequency, with its continual chatter about conditions in that area, is in any event a good one to be plugged in to.

And let's get cracking on that instrument rating, huh? □