The Whither *and* Whether *of* Flying in Weather

Photo by H Dean Chamberlain

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One of the oldest aviation clichés holds that a pilot certificate or rating is primarily a "license to learn." Nowhere is that saying more appropriate than it is for the newly rated instrument pilot.

Like many pilots, I was eager to exercise my new privileges by getting the wings wet almost before the ink on my temporary certificate dried. Having passed the instrument rating practical test, I was confident of my ability to operate in the system, to shoot approaches, and even to enter and fly holding patterns. I had mastered the art of the scan and the rhythm of cross-check, interpret, and control. My knowledge of instrument flight rules (IFR) and procedures was solid.

As I quickly learned, though, my understanding of weather—specifically, how to think about weather in terms of a given flight—was as patchy as the clouds I so proudly passed through on my first IFR flight.

The gaps in my knowledge became crystal clear on a very cloudy day a few months later when I launched into rapidly deteriorating weather that eventually forced a diversion and an instrument approach to near minimums.

I'm not proud of the "go" decision I made that day, but the experience does have a silver lining. As you might imagine, it provided powerful motivation to become a dedicated and lifelong student of aviation weather. Eventually, it also led to discovering a simple, but very effective, framework for deciding whither and whether to fly in weather of all kinds.

As Simple as 1-2-3

It is important to get a detailed weather briefing and I was always very dutiful about obtaining and printing out weather information from Flight Service (FSS) or one of the online direct user access terminal (DUAT) providers. Even more critical, however, is knowing how to pull the most important pieces of information from piles of printer paper and apply them to the flight you're about to make.

Easier said than done. There was a time when I stared at those faithfully acquired weather printouts with the same expression of earnest

You've Filed Your Flight Plan, Now What?

James Williams

You've dutifully downloaded your weather briefing from DUATS, called a Flight Service briefer with a few questions, and filed a flight plan. Now what?

As described in this article, weather concerns are not limited to the weather itself: They also involve the aircraft and the pilot. But, as mentioned, there are other things that affect your decision making.

Environment

Personal minimums should change depending on the environment. If it's your home airport, you are more likely to have less restrictive minimums because it is familiar—you know where the rocks are. Wind is a key weather factor, but that really depends on how much of a crosswind is present. A good question is this: What runways are available? In the case of a takeoff, you are limited to the runway (or runways) at the departure airport. But, you may have nearby alternatives at your destination. A 15-knot quartering tailwind on one runway could be a headwind on another.

Another question should be what approaches are available. This means both at your departure point and destination, again considering alternates for the destination. If you have multiple instrument landing systems (ILS), you might be more comfortable with less-restrictive minimums than if there were just a lone nondirectional beacon (NDB) approach within 50 miles of your destination or departure.

Equipment

The article focuses primarily on currency and proficiency in dealing with low visibility and ceilings, but there is another important factor—technology. GPS has not made it to every aircraft yet. If you don't have GPS, you don't have as many options. Moreover, if you don't have a WAAS- (wide area augmentation system) capable GPS receiver, you don't have access to all the new WAAS approaches. Another consideration arises from the recent loss of an Intelsat WAAS satellite, one of only two. What if WAAS isn't available? Satellite losses are uncommon, but not impossible. With an extremely limited supply of satellites and the long replacement lead time, services could be compromised. WAAS is more sensitive to this issue, but even basic GPS has only a limited number of spares in orbit. You can't control these factors, but you should be aware of them.

The Bottom Line

This is hardly a comprehensive list of the decision-making factors to consider; rather, it is more of a starting point. The idea is to weigh these and previously mentioned factors and balance the risks, wherever possible eliminating or mitigating as much risk as you can. Can you switch destination airports for one with more approaches or better weather? Can you find a route that has more possible diversion airports along the way than the first one your planning software produced?

Take a good look at your flight and ask: Is there anything I can do to make it safer? Let us know what you come up with. You can write us at SafeyBriefing@faa.gov.

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confusion my Cocker Spaniel displayed when I tried to explain the importance of a bath. She didn't get that picture any more clearly than I got the flick on weather. The Spaniel never did understand the bath rationale, but the light-bulb moment for my understanding of aviation weather came courtesy of a simple concept in Robert Buck's *Weather Flying* book. As Buck explains, there are just three ways that weather affects an aviator:

1. Weather can create wind.
2. Weather can reduce ceiling and visibility.
3. Weather can affect aircraft performance.

Eureka! With this framework, I began to notice that data in aviation meteorological reports (METAR) and terminal aerodrome forecasts (TAF) is structured to provide information on each of these three weather conditions. I finally had not only the tools needed to mine the most critical pieces of information from the printout, but also the foundation for evaluating a specific day's weather in terms of both the specific pilot—me—and the specific airplane I planned to fly.

When the Wind Blows

In both METARs and TAFs, the first item provides information on an airport's wind direction and velocity. A key to wise weather decision making is to consider these numbers in relation to both the pilot and the plane.

With respect to the pilot, the primary issue is proficiency and comfort with a known or forecast crosswind. If you are not comfortable with the crosswind component at the departure airport, it's a good day to stay on the ground or, better yet, hire a qualified instructor to help scrub the rust off your crosswind takeoff, approach, and landing skills. If it is the crosswind at the destination airport that gives you pause, the next step in the windy weather decision-making process is to determine whether the winds are more favorable at alternate airports within range. When crosswind comfort is an issue at either end of the flight, it also pays to check wind at airports along your route in the event that diversion becomes necessary.

Regarding the airplane, the primary issue is its maximum demonstrated crosswind component, which is usually in the range of 12-17 knots for light GA aircraft. Though it is not a legal limitation, a GA pilot is wise to regard this value as a personal limitation. Here's why. Aircraft manufacturers develop aircraft performance data through rigorous flight tests. These activities are conducted by professional test pilots who are, as the phrase goes, "simulating average pilot skills." However hard we try, non-commercial GA pilots still may not obtain the aircraft performance that a professional who is "simulating" an average pilot's skill level can achieve.

Also, even if the true maximum crosswind component is higher than the published (demonstrated) value, there is inevitably a point at which full deflection of a given airplane's rudder, in combination with aileron input, will not be sufficient to correct for the drift resulting from a stiff crosswind. Pilots refer to this condition as "running out of rudder." I speak from experience when I report that it does get your attention. That particular teachable moment came for me on a gusty autumn day when I was first learning to fly from the right seat of a Cessna 150. Even with the right rudder pedal jammed all the way to the floorboard, the trusty little trainer was no match for the crosswind at that particular airport.

Photo by Susan Parson

Bottom line: Regardless of pilot proficiency in crosswind flying, it is also critical to consider whether the airplane is up to the challenge. A crosswind that is perfectly manageable in the beefy twin-engine Piper *Aztec* may well be too much for a tiny two-seat trainer.

Flying Blind

The next component of METAR and TAF reports ceiling and visibility, conditions that are the primary reason for learning to fly by reference to instruments. For legal instrument flying, an aircraft must be properly equipped and certified for IFR. Since, regardless of equipment, the airplane itself is not affected by the presence of clouds and precipitation, weather decision making in this area most logically focuses on the pilot.

For legal operation in instrument meteorological conditions (IMC), a pilot must be both instrument rated and instrument current in accordance with Title 14 Code of Federal Regulations section 61.57. For *safe* operation in IMC, though, the pilot must also be proficient in basic attitude flying, instrument operating rules and procedures, course intercepts and tracking, holding, approaches, and all other aspects of instrument flying.

The existence of the IFR currency requirement bespeaks the perishable nature of instrument flying skills. As many pilots have discovered, though, maintaining just the legal minimum requirement for currency may not be enough for proficiency and confidence. If you haven't flown in IMC recently, or if you have any doubts about your proficiency level, it behooves you to get some practice with a safety pilot or, better yet, some dual instrument-refresher training with a qualified instrument instructor.

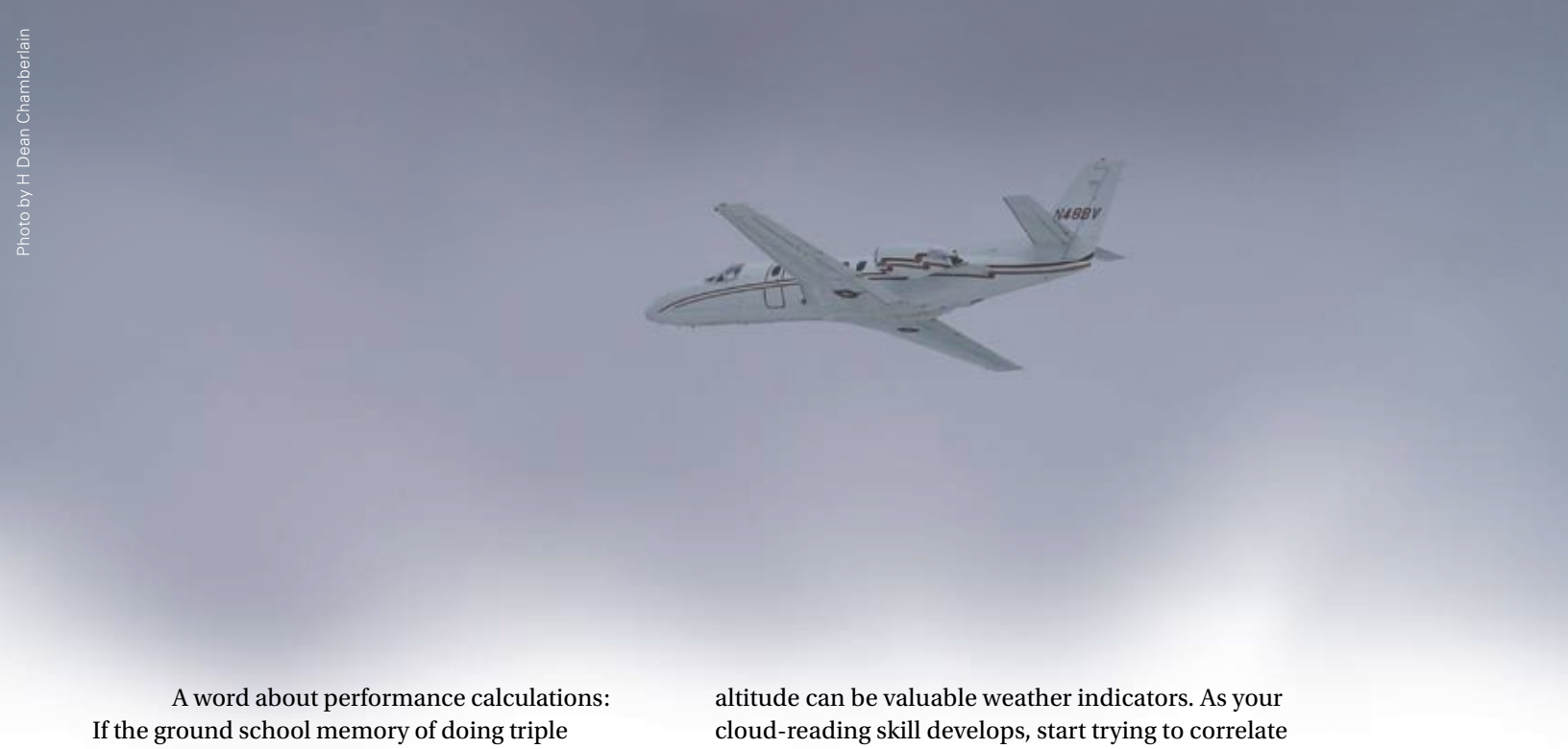
Let's assume you are rated, current, and proficient. Is that enough? Another part of being proficient and safe in IMC is knowing and adhering to your individual personal minimums. One way to approach this important task is to consider—honestly—how comfortable and proficient you are in the basic weather categories for aviation. VFR, marginal VFR (MVFR), IFR, and low IFR (LIFR). Be sure to account for day versus night operations in each category. For instance, I am very comfortable flying in day MVFR in my home airspace, but night is a different story. My own personal minimums also prohibit intentional operation into LIFR conditions. The minimums I set for IFR vary according to how much recent time I have flying in IMC, and how recently I have practiced flying instrument approaches. (Note: For specific tips and techniques for developing your own personal minimums see "Getting the Maximum from Personal Minimums" in the May/June 2006 issue of *FAA Aviation News*.)

Photo by H Dean Chamberlain

The Little Engine That Couldn't

The third major way that weather affects aviators is through its impact on aircraft performance. The temperatures in METARs, TAFs, and winds and temperatures-aloft reports can give you a good indication of two weather phenomena that will undoubtedly sap your airplane's operating capability: icing and high density altitude.

An airplane is a machine, and all machines have performance limits. Consequently, a vital part of deciding whether to fly in weather likely to include such performance-reducing elements as icing or high-density altitude is to have a rock-solid understanding of what your airplane can—and cannot—do. The best piloting skills in the world cannot overcome the airplane's physical performance limitations. Think of it this way: Even if you are super pilot, there are hard limits on what you can expect when flying a *Super Cub*.



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A word about performance calculations: If the ground school memory of doing triple interpolations to calculate a two-foot difference in takeoff distance has discouraged you from regular use of the performance charts for your aircraft, rest assured there is an easier way. Simply use the next highest numbers shown on the chart to get a "ballpark" estimate, and then add a 50–100 percent safety margin.

For the purists: Yes, precision is important, but only to a point. If you calculate a takeoff distance of 1,242 feet in high-density altitude conditions and the last two feet (or even the last 42 feet) really make a difference in whether you can operate or not, you should stop and consider whether it is wise to fly at all in those conditions. As the saying goes, there are no emergency takeoffs.

Learning after Landing

A final thought: When you complete a challenging flight in weather, you may want nothing more than to go home and unwind. The immediate post-flight period, however, is one of the best opportunities to increase the weather knowledge and understanding that will guide effective decision making. Make it a point to learn something from every weather encounter. At the end of a flight involving weather, take a few minutes to mentally review the flight you just completed and reflect on what you learned from this experience.

Still another way to develop your weather experience and judgment is simply to observe and analyze the weather every day. When you look out the window or go outside, observe the clouds. What are they doing? Why are they shaped as they are? Why is their altitude changing? This simple habit will help you develop the ability to read clouds and understand how shape, color, thickness, and altitude can be valuable weather indicators. As your cloud-reading skill develops, start trying to correlate the temperature, dew point, humidity, and time of day to the types of clouds that have formed. Take note of the wind, and try to visualize how it wraps around a tree or whips around the corner of a building. This exercise will help you become more aware of wind at critical points in your flight.

If you are not comfortable with the crosswind component, hire a qualified instructor to help scrub the rust off your crosswind takeoff, approach, and landing skills.

Weather is a fact of life for pilots. Developing your weather knowledge and expertise is well worth the time and effort you put into it, because weather wisdom will help keep you—and your passengers—safe in the skies.

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For More Information

General Aviation Pilot's Weather Guide
http://www.hf.faa.gov/WeatherDecisionGuide/preflight.aspx

General Aviation Pilot's Guide to Preflight Weather Planning, Weather Self-Briefings, and Weather Decision Making
http://www.faa.gov/PILOTS/safety/media/ga_weather_decision_making.pdf

Best Practices for Mentoring in Flight Instruction
http://www.faa.gov/training_testing/training/media/mentoring_best_practices.pdf

Getting the Maximum from Personal Minimums
http://www.faa.gov/news/safety_briefing/2006/media/mayjun2006.pdf