Photo by Julian Greenway

I'VE GOT WEATHER!

(… Now What Do I Do with It?)

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I'm carbon-dating myself again. When I was first learning to fly, there were no dinosaurs left, but there *were* still Flight Service Stations physically located at certain airports around the country. My home airport hosted an FSS (as opposed to today's Automated Flight Service Stations — AFSS), so one of my earliest lessons involved marching into the quietly humming facility to get an official weather briefing for my flight. I had completed ground school, so I knew to ask for a standard briefing. I knew the information was provided in a certain predictable sequence. I could listen and understand the general location/significance of air masses and frontal systems. I carefully noted the METAR and TAF data for the local flying area. And, for good measure, I always requested a printed copy — cheerfully delivered in an accordion-folded stack of paper from a dot-matrix printer — you know, the kind of paper with tear-off punch-hole strips on either side. So yeah, I could proudly tell my instructor that "I've got weather!"

Since private pilot training took place only in visual meteorological conditions (VMC), the fact that my "understanding" of that painstakingly acquired weather briefing data was, oh, maybe an

eighth-of-an-inch deep, was not terribly obvious to me. Because most of my subsequent training for the instrument rating also occurred in VMC, I was still painfully unaware of how little I really understood.

Do You "Get" What You've Got?

The gaps in my weather knowledge and understanding became crystal clear on a very cloudy day a few months later. Freshly rated as an IFR pilot, I was returning to my home airport from a family visit to North Carolina. Because I didn't really "get" the weather I got in my briefing, I inadvertently launched into rapidly deteriorating conditions — no kidding, widespread instrument meteorological conditions (IMC) that eventually forced a diversion, a holding pattern, and an instrument approach to near minimums. Thanks to solid training, my single-pilot, single-engine encounter with unexpected low IFR (LIFR) resulted in a safe landing and, as we like to say, the outcome was never seriously in doubt. Still, I'm not proud of the "go" decision I made that day. It was dumb, and it arose from inexcusable ignorance.

The experience does have a silver lining because 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 whatever type of weather presents itself.

Know Your Enemy …

One of the first things I did after my eye-opening experience was read to deepen my understanding of basic meteorology. Two books stand out. Even if you do no more than read the first few chapters, you will never regret time invested in Richard Collins' *Flying the Weather Map*. Collins' explanation of air masses and weather (frontal) systems did wonders to clear my previously hazy understanding of these critical concepts.

The second "go to" weather book in my aviation library is Ralph Buck's *Weather Flying*. The key takeaway from Buck's book is his deft summary of the three ways that weather can affect an aviator:

1. Weather can create wind or turbulence.
2. Weather can reduce ceiling and visibility.
3. Weather can affect aircraft performance through conditions such as high density altitude or icing.

With the help of these two accomplished pilot-authors, I began to actually understand the weather forecasts I saw on television and, more importantly, to understand the information provided in aviation weather briefing products. Thanks to Ralph Buck's framework, I also began to notice that data in aviation meteorological reports (METAR) and terminal aerodrome forecasts (TAF) is structured to provide information on each of the three ways that weather affects those who fly. 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 individual pilot (me) and the specific airplane I planned to fly.

… And Know Your Friends

The mention of "specific airplane" brings up another important part of the weather flying puzzle. Just as pilots differ widely in their levels of knowledge, training, experience, and piloting ability, it's a fact of life that some airplanes are more capable than others. So you need to think of the plane you're flying as your partner — your teammate in this activity. The weather analysis for every flight should thus consider the collective capabilities of the pilot and the airplane. I'll discuss that process in detail shortly, but first let me stress a couple of very critical points:

- No matter how skilled a pilot you are, you can't adequately compensate for what your airplane partner lacks in terms of performance capability. You may be Super Pilot, but there are limits to what kind of weather you can consider when you are flying, say, a *Super Cub*.
- Your technologically advanced airplane can be very helpful, but no airplane can adequately compensate for deficiencies in its pilot's knowledge, training, experience, or skill.

Getting the Picture

Now let's look at a structured approach to making sure you've really "got" weather.

Wind

The first item in both METARs and TAFs 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's 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.

Weather Decision-Making and Personal Minimums

GOAL: *Analyze capabilities of the pilot/plane "team" in terms of expected weather conditions.*	 **Wind & Turbulence**	 **Ceiling & Visibility**	 **"Performance Sappers"**
 **Pilot**	How much crosswind can I safely handle? What is the strongest crosswind I've experienced? How recent is my crosswind experience?	Instrument rated? Legally current? Proficient? What are the lowest conditions I've comfortably handled? What pressures do I face?	Have I calculated the required performance for these conditions? Am I proficient in the techniques and procedures needed to get the required level of performance from the airplane?
 **Plane**	What is the maximum demonstrated crosswind component for this aircraft? For turbulence, what is the design maneuvering speed (V_A), and what power setting will achieve it?	Is the aircraft legally equipped for IFR flight? Do all required instruments work properly? Is there any unfamiliar equipment?	Do the performance calculations show that the aircraft can perform as needed for these conditions? Can it still perform when I add a safety margin?

For 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 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. For me, that particular teachable moment came 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. 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.

Ceiling & Visibility

The second component of METARs and TAFs covers 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. Regardless of equipment, the airplane itself is not affected by the presence of clouds and precipitation. Therefore, weather decision-making in this area most logically focuses on the pilot.

For legal operation in IMC, a pilot must be both instrument rated and instrument current in accordance with Title 14 CFR sections 61.3(e) and 61.57, respectively. 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, 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 dual IFR-refresher training with a qualified instrument instructor.

Performance

The third major way that weather affects aviators is through its impact on aircraft performance. 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. As noted earlier, the best piloting skills in the world cannot overcome the airplane's physical performance limitations.

The temperatures in METARs, TAFs, and winds and temperatures-aloft reports can give you a good indication of prospects for icing and high density altitude. Unless your airplane is properly equipped for flight into known icing conditions (FIKI), you shouldn't need to think very hard about whether to launch in any kind of freezing precipitation. Remember, too, that even FIKI-equipped aircraft have limits. 'Nuff said.

Regarding other performance issues such as conditions involving high density altitude, please take your performance calculations with a big grain of salt and an even bigger added safety margin. If the ground school memory of doing triple interpolations to calculate a two-foot difference in takeoff distance has soured you on the utility of performance charts, rest assured there is an easier way. Simply use the next highest numbers shown on the chart to get a conservative "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.

Pulling It Together

Now that you understand the parts, let's put it all together. Once you have your weather briefing, start your analysis by focusing on the three big things: wind, ceiling/visibility, and performance issues. Note whether any of these items presents a challenge in any phase of the planned flight.

Next, drill down to the specifics. Review the capabilities of your airplane, and make an honest assessment of your own proficiency. For each weather item — wind, ceiling/visibility, performance issues — you need solid answers to two key questions: Am I up to this challenge? Does my airplane have the capability? If there are any doubts, then you've clearly identified a hazard that you'll need to properly mitigate before you put the finishing touches on a "go" decision.

The bottom line: developing your weather knowledge and expertise is well worth the time and effort you put into it, because truly "getting" the weather will help keep you — and your passengers — safe in the skies.

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Photo by Susan Parson