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Viewpoint: Not All Airplanes Fly Alike

Gulfstream is under scrutiny because two pilots didn't fly the aircraft properly.

GULFSTREAM

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You may have heard that the Gulfstream GVII world is under FAA scrutiny these days and that the feds are “cracking down” on this new technology aircraft in what many see as an over-reaction after the Boeing 737 MAX certification debacle. Where the 737 MAX fleet was grounded for more than a year, the GVII’s penance seems to be nearly debilitating wind limits. If you aren’t operating either variant of the GVII, the G500 or G600, you might think this doesn’t concern you. But if you are flying an aircraft with any kind of computerized flight control system, even a simple “black box” yaw damper, it concerns you a great deal. To understand why, we need to look at the common pilot attitude that “all airplanes fly alike,” how that caught two pilots in the GVII, and how it could catch anyone flying a new aircraft type.

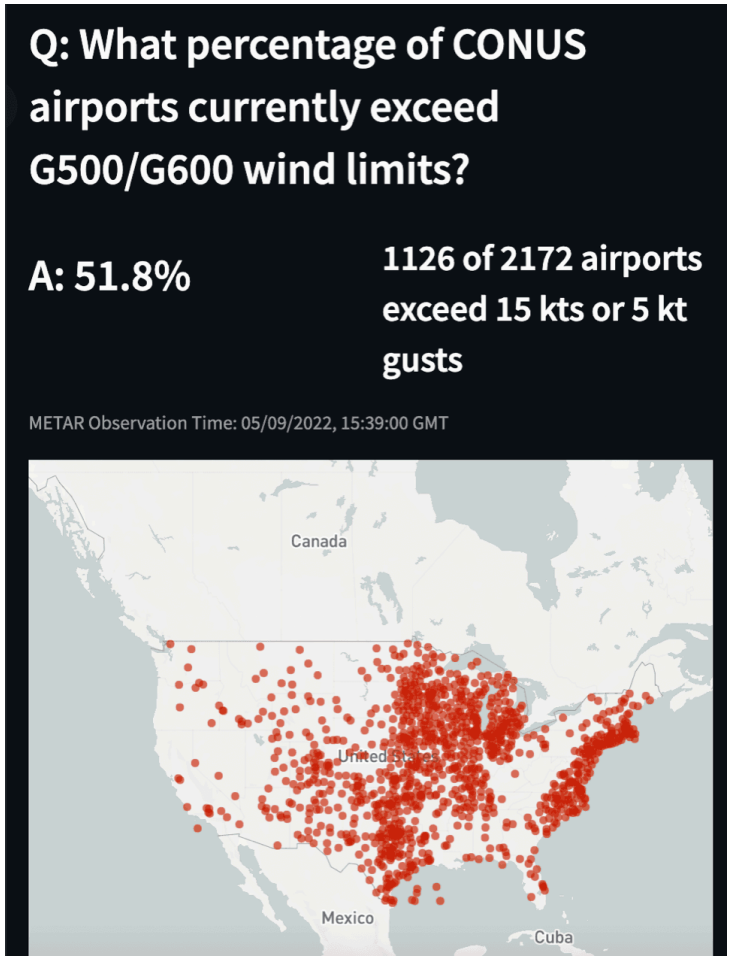
When the only thing in my logbook was a Cessna 150, I often heard from those flying complex aircraft with retractable landing gear and variable pitch props, that it was a whole new ball game. Those comments came again with the instrument rating and when moving on to twins. Then a curious thing happened: pilots started saying, “she flies like any other airplane.” I’ve heard this about jets--heavies, and even the supersonic aircraft that I’ve flown. The point seemed to be summed up in the old pilot joke made while

motioning with an imaginary yoke, “houses smaller, houses bigger.” Perhaps it is just false humility, showing younger pilots that anyone can master the next step up in airplanes. But to understand why the thought can be dangerous, consider the Gulfstream GVII type.

The GVII type is the second from Gulfstream to be completely fly-by-wire and the first to be controlled with a sidestick. Earlier Gulfstreams, such as the GIV, are “fly-by-cable” and are controlled with a more conventional yoke. It is said that the GIV flies like a tank and is built like one. The controls were heavy; it sometimes felt you were in a wrestling match when landing in a gusty crosswind. But the airplane could be flown smoothly if you knew how. The key point here, however, is that it could survive pilots with zero finesse.

The GVII, in stark contrast, does not fly like a tank and it certainly isn’t built like one. In 2020 a highly experienced Gulfstream pilot caused the aircraft to land so hard, that a landing gear door contacted the runway. It was a night landing at Teterboro Airport, New Jersey, in a gusty crosswind: from 60 deg. right of the nose, at 15 knots, gusting to 27 knots. I’ve landed in similar winds in both the GIV and GVII and believe the GVII handles the wind better, provided you fly the aircraft as it was designed. But you must first understand that a GVII does not fly like a GIV. Why is that? It is a matter of design.

The GVII can fly further, faster, more comfortably and use less gas than its older sibling. Flying from the London to New York, for example, the GIV struggles to maintain 0.80 Mach after climbing directly to 41,000 ft., makes



The “G-VII No Fly Zone” on a windy day (designer: Derrick Hodges)

it to its destination with minimum fuel reserves, while providing its passengers a cabin pressure around 6,000 ft. The GVII will do the same trip starting with less than a full tank of gas, climbing to 43,000 ft., cruising immediately at 0.90 Mach, and doing all this with a cabin pressure of just over 3,000 ft. All this economy and efficiency means the newer GVII is built lighter and, as much as the manufacturer would dispute this, more fragile. The flight control computers not only provide much of this efficiency, but act to protect the airframe from "ham fisted" pilots. The aircraft is designed to be flown with a light touch with the hand low on the stick. Pilots are told to operate the stick using pressures, not displacement.

In flight, the GVII is operating in normal flight control law, where stick position results in a g-response (short term) and speed stability (longer term). When warranted, the control law will transition to an angle-of-attack (AOA)-limiting sub mode, where stick position is used to command a target AOA. In this mode, full aft stick gives maximum allowable AOA, which may not be as much as the pilot intended. When aircraft pitch and sidestick input rates are high, the transition to AOA-limiting occurs earlier to avoid overshooting the limit. When this happens, an initial nose down input is commanded. In other words, if a pilot becomes too rough on the controls, a function of the flight control computer takes over. And that takes us back to the Teterboro incident.

The accident aircraft was flown at VREF+5, at the correct speed for a light wind day but 15 knots too slow for the winds that night. The airplane flight manual (AFM) at the time specified that "In strong wind conditions, add to VREF ½ of the steady state wind plus the gust increment to a maximum additive of 20 knots." With a 15 gusting to 27 knot wind, depending on if you round up or down, the correct speed should have been VREF+19 or VREF+20.

On short final, around 150 ft., the aircraft was flown with a crab established at about a 7-deg. sideslip in the conventional "wing low" crosswind technique. Gulfstream and many manufacturers of aircraft with wide wingspans recommend their aircraft be flown in a crab until initiating the flare to avoid a wingtip strike while landing wing low. Watching a parade of aircraft landing at Teterboro, I think most pilots hold on to the tried-and-true wing low method taught in their primary aircraft trainer. You can get away with this in the flying tank that is the GIV; the "fly-by-cable" simply obeys the pilot. In the GVII, AOA-limiting happens sooner if you have more than 4-deg. of sideslip and the pilot may not have the expected pitch authority when that happens.

Data analysis of the event also shows the pilot was using a series of rapid, large, alternating pitch inputs at low altitude followed by full aft stick through touchdown. This caused the AOA-limiting to occur even sooner and robbed the pilot of more available nose up control just prior to and during touchdown. Rapid control reversals are never a good thing in any axis, even on a conventionally controlled aircraft.

After the dust had settled, it was clear that the pilot used poor technique and violated required AFM procedures. The FAA's reaction was almost

predictable, requiring a new set of restrictions on the G500 only, even though the flight control system is identical to that on the G600. The recommended approach speed additive became mandatory, and the crosswind limit was reduced from 30 to 22 knots. The GVII AFM added this warning: "Rapid and large alternating pitch control inputs, such as an abrupt pull-push-pull, may reduce the airplane response to subsequent control inputs to less than what may be required for normal airplane handling."

Despite all this, two years later, another G500 experienced a hard landing in similar conditions after the pilot used a series of large, rapidly alternating pitch stick inputs. It appeared the approach speed additives and crosswind restrictions alone were not enough to counter the stick techniques. The FAA reacted with the most draconian restrictions available, short of grounding the fleet. Both the G500 and G600 are now limited to landing in winds up to 15 knots with no more than a 5-knot gust. Night landings must be made using vertical path guidance, such as with an ILS glideslope. Approaches must be stabilized by 1,000 ft. These restrictions will remain in effect until the flight control software is updated to allow for ham-fisted pilots. To date, the GVII fleet has had over 37,000 landings of which two have resulted in hard landings due to the AOA-limiting mode of the flight control computer. That's just 0.005%--and 100% of those were by pilots ignoring one or more AFM procedures.

How severe are these restrictions? GVII pilot Derrick Hodges provides an application called the "G-VII No Fly Zone," available at http://nfz.hdgs.me/. The first time I tried the application in May the answer was that more than half of the GVII capable airports in the continental United States had winds that either exceeded the 15-knot total wind or the 5-knot gust.

Many Gulfstream pilots blame Gulfstream for all this. I don't. Given the FAA's mindset following its poor handling of the Boeing 737 MAX issues of a few years ago, Gulfstream must give its unreasonable masters a penance. No, for this mess, I blame two Gulfstream pilots who believed the GVII flies like any other airplane, when clearly it does not.

The GVII is the nicest flying airplane I've ever flown, and I've flown a lot of nice airplanes. But I learned early on that I need to greet each new aircraft type as a new learning experience. A manufacturer's recommended technique almost always becomes my recommended technique. In many cases, I had to give up procedures I had been using for decades. But that is the price of learning to fly something new. The lessons here are both old and new, and they apply to all pilots flying all aircraft:

- No matter what aircraft you are flying, it is never a good idea to use large, rapid, alternating control inputs in any axis.
- Techniques learned in one aircraft, or even all aircraft you've flown previously, may not be advisable in your next aircraft.
- Even if you've been able to ignore AFM procedures and limitations with great success for a very long time, you may find a day where the results are not so kind. You might as well learn to fly the aircraft as designed on day one.

I implore all professional pilots to understand that not all airplanes fly alike. My reasons are purely selfish. Pilots who don't understand this have already cost my flight department a trip because the winds were gusting above 5 knots. But I also worry that I will someday be a passenger in a large commercial jet flown by a captain who believes his Boeing or Airbus flies just like a Cessna 150.

—**James Albright** is a retired U.S. Air Force pilot with time in the T-37B, T-38A, KC-135A, EC-135J (Boeing 707), E-4B (Boeing 747) and C-20A/B/C (Gulfstream III). Since turning civilian, he has flown the CL-604, Gulfstream GIV, GV, G450, and now the GVII-G500. He is the webmaster and principal author at Code7700.com