ATC AND SPEED CONTROL

You’re blasting along in the descent, airspeed up in the yahoo! range when ATC gives you a speed restriction. No, you’re not being penalized, the controller is trying to manage numerous arrivals and speed control is an essential tool.

by Paul Berge

Every air traffic controller harbors a recurring nightmare about thoroughly screwing up. Most aren’t scary metal-bending scenarios, but, instead, somnolent reminders of human fallibility. In short, there are some mistakes that are so embarrassing they just won’t fade away. One of mine was spawned years ago when I was working a radar approach sector and tried my best to force a turbo-prop commuter airliner to follow a sluggish Boeing 737.

I was an experienced controller but was suffering from a momentary bout of “jetitis,” the mistaken belief that jets are always faster than props. Any Piper Cheyenne pilot knows this ain’t so. All flights (with some exceptions) must reduce speed to 250 KIAS below 10,000 feet MSL (FAR 91.117). Therefore, jets—for all practical ATC purposes—become turbo-props, and when I tried to shoe-horn the 737 ahead of the commuter I ignored that rule.

The commuter crew complied with my ridiculous vectors and desperate speed adjustments, while the Boeing slowed to what seemed like Ercoupe speed. And to this day I still wake up hearing that commuter captain’s voice politely saying, “You know, approach, we should’ve been first.” He was right.

So What’s a Pilot To Do?

Somewhere in your IFR career ATC will whip a speed adjustment on you. It may not be convenient, but it should have a reason, and the more you know about ATC’s speed adjustment requirements, including limitations and phraseology, the easier you’ll swallow the bitter pill of throttling back. Surprisingly, the FAA’s own Instrument Flying Handbook (FAA-H-8083-15A) offers little insight into

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Fatigue Redux

Regarding Rick Durden’s column in the August issue, “Fatigue Redux” in which he asked for a better word than “fatigue”: there is only one word for flying tired, pooped, exhausted, fatigued or otherwise impaired and that is “spent.”

Keep up the good work.

Brett Stephens
Via E-mail

North to Alaska

I recently flew from my home in New Jersey across the country to Seattle, and then up the inside passage to Alaska. I flew around much of the southern portion of the state and then back across Canada.

Several times during the trip I asked myself why, with all the stuff I read, didn’t I know a particular bit of information.

Going north through Canada the XM Weather products stop at various latitudes. For example, NEXRAD radar stops at one place, while the cloud display stops further north.

I found that, in my Bonanza, with the XM antenna on the glare shield, when heading north, that far north, the XM satellite feed was obstructed by the roof because of the angle. When heading south it was no problem.

In Alaska, when you call WXbrief on a cell phone from the lower 48 you get Lockheed-Martin. Either use a local phone to get Alaska FSS or have the Alaska phone numbers.

I suggest you do an article targeted at the lower-48 IFR pilots who are planning to make their dream trip to Alaska. A little extra insider knowledge would make it go much smoother.

Mike McNamara
Via E-mail
REALITY 101

SINGLE-ENGINE; NO GO AROUND?

Most piston twins will climb on one engine. Sort of.

You’ve lost one, you’re on an instrument approach; it goes bad. Do you go around? From how low?

by Rick Durden

You loaded up your light twin early. Once buckled in, the kids went right back to sleep. Departure was into a 500-foot overcast and the climb went smoothly. Over Lake Michigan, above the undercast, you were thankful you had two engines snoring along.

You were between layers as the sun came up, placing you in the center of the most stunning art gallery you ever visited. Entranced, your spouse turned to you, raised a playful eyebrow and said, “Tell me, why do you fly?”

A little later, anticipating descent, plates out and briefed; you noticed the left engine oil pressure dropping and the oil temperature rising.

You tell your spouse what’s going on and what you’re going to do, then you pull the left throttle, prop and mixture controls all the way aft.

Shutdown and Secure

You run the shutdown and secure checklist, call Center and calmly tell the controller that you have an emergency, you’ve shut down an engine. You want to fly the published approach, which happens to be nonprecision.

Center advises you that destination weather is now 800 overcast with three-miles visibility.

All goes well. You break out about 900 feet AGL. You wait to extend the gear until you have the runway made. You’re a little fast and high, but you want money in the altitude bank.

At about 500 feet you drop the gear and make another power reduction. Suddenly the sight picture is all wrong.

You’re high, fast and 300 feet above the runway. With all the flaps and power off, you can get down, but not stopped.

Go Around or Land?

Single-engine go arounds can be done. Most everyone who has flown a twin has practiced them at one time or another. They aren’t easy, and they aren’t fun or pretty. But, as you practice them you get better at them and they are less intimidating.

But how long has it been since you practiced?

Do you want to do it for real right now? How was your first try the last time you practiced one?

My opinion in looking at a lot of single-engine go around accidents, almost all being Vmc rolls, is that the pilot tried to get performance out of the airplane that was never built in, could not resist the urge to raise the nose trying to get some more climb, and Vmc rolled into oblivion.

I also wonder very seriously about partial pilot incapacitation or simple incompetence if the pilot could not do a simple thing like set up for a landing. If s/he can’t do simple, what is going to happen with an attempt at difficult?

Touch Down Right Side Up

A twin can take an amazing amount of impact and protect its occupants when it hits right side up, or even better, is rolling along on the ground at something less than flying speed and runs into the airport fence. It does not do well in protecting the occupants when it hits upside down, especially after a Vmc roll.

Over the years I’ve come to the conclusion that we pilots can easily imagine tearing up an airplane and the embarrassment involved if we blow an approach and land too far down the runway; we have far more trouble internalizing rolling into eternity because the go around goes bad, so we try it.

Maybe we should rethink doing so.

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Speed control tends to be more art than science and controllers develop a feel for what works and what doesn’t.

(Continued from page 1)

this separation and sequencing practice. We’ll rectify that by exploring approach control’s speed control options.

Approach control separates and sequences traffic to an airport, runway or instrument approach procedure (IAP). Separation is achieved using vertical, lateral or longitudinal (in-trail) methods in the non-radar environment. Radar allows more flexibility and tighter minima.

Speed control—or speed adjustment, I’ll use the terms interchangeably—ensures approved separation and spacing. When properly applied, speed control avoids excess radar vectors, keeps the arrival pattern manageable and, it’s hoped, saves fuel.

More Art Than Science
Controllers are not paid to be pilots and may not understand your operating needs, so the ATC manual (7110.65) advises controllers to keep speed adjustments to a minimum and let the pilots fly their airplanes. As with flying, ATC is more art than science.

Controllers develop a feel for what works. Inexperience causes controllers to make unreasonable, possibly illegal, speed demands, so there are posted speed limits.

All speed adjustments are expressed in knots indicated (KIAS). The radar controller sees your groundspeed (within 10 knots) displayed on the radarscope. Speed adjustments are issued in 10-knot increments. Mach is generally used above FL240, so we’ll skip it here and stick with knots for this discussion. Pilots are allowed a plus-or-minus 10-knot window, although, it’s best to fly the assigned airspeeds exactly.

All aircraft automatically slow to 250 knots below 10,000 feet. When operating below 2500 feet AGL within 4 miles of a Class C or D airport or beneath a Class B shelf, the speed limit is 200 KIAS. If ATC asks you to exceed those limits, you’re required to decline. If ATC issues an airspeed restriction beyond your operating capabilities—too fast or too slow—decline, by saying, “Unable 150.” And then, offer an alternative speed, “How ‘bout 170?”

ATC can slow arrival jets below 10,000 feet to not less than 210 knots. Within 20 miles of the runway that can be reduced to 170 knots. Props can be slowed to 200 knots and within 20 miles of the runway reduced again to 150 knots. Helicopters can be slowed to 60 knots. Jet departures can only be slowed to not less than 230 knots.

Phraseology
The cleanest speed control phraseology sounds like this: “Twin Cessna 76F, reduce speed to 150 (one five zero).” Or: “…increase speed to 150.” Additionally, the controller, without knowing your IAS but aware of your groundspeed, can add or subtract knots like this: “…increase speed 20 knots.” Or: “…decrease speed 20 knots.”

The FAA’s Instrument Flying Handbook offers a poor example of ATC phraseology in Chapter 10: “Cessna 30 Alpha, slow to 100 knots.” The correct phraseology according to the ATC manual (7110.65) would be: “Cessna 30 Alpha, reduce speed to 100 knots.” Nit-picking? Sure, but in an incident investigation, the controller’s nits get picked, so, perhaps, the FAA should show consist-
tency in its publications. Just a thought.

ATC phraseology can be a bit more vague. “Maintain maximum forward speed,” and “Maintain slowest practical speed” are both FAA-approved phraseology but lack definitiveness. Just how much is “best”, and why specify “forward speed”? Except when working helicopters and blimps this might seem unnecessary. Still, it’s legit. “Keep yer speed up,” or, “What can ya give me to the marker?” is not approved ATC phraseology although commonly used.

Ending a Speed Restriction
When ATC no longer needs the speed restriction the controller says, “Resume normal speed.” It’s then, up to the PIC to fly at whatever speed meets both operational and regulatory (think 91.117) needs. If you’re on a published arrival procedure and are told to “resume normal speed” you must still comply with the published speed restrictions.

ATC should never issue a speed restriction inside the FAF or closer than five miles of the runway. When cleared for an instrument approach all ATC-issued speed restrictions are canceled unless restated in the clearance. When told to “Resume own navigation,” after being radar vectored, this allows you to navigate on course but by itself does not cancel any speed restrictions. When in doubt, ask.

Despite the best-laid plans of regulation and controller/pilot savvy, things often go to pot. Speed adjustments are one tool in the controller’s kit. As I said earlier, it’s more art than science, and sometimes the results will haunt the ATC artist into retirement. So, please, be patient when ATC takes your airplane by the throttle and slows your arrival.

As for the commuter crew I delayed all those years back with excess speed control. Well, you arrived safely, and I’ve never forgotten you.

Paul Berge is a CFII, former FAA air traffic controller and author of Private Pilot Beginner’s Manual (for Sport Pilots, Too).

A TOTAL DISDAIN FOR SAFETY

A pilot launches into IMC with his family. The decisions he made leading up to and during the flight are shocking. That no one stepped in is troubling.

by Armand Vilches

Sometimes an accident has so many causal chain links and proximate causes that trying to piece together the events leading to the mishap is much like thrusting your hand deep into a box full of “unsprung” mousetraps. You just know the result is going to hurt.

All of us involved in aviation have a serious responsibility to flight safety. It is and should always be our paramount goal. Accidents are both a financial and emotional drain for the people involved, but when safety is utterly disregarded, the associated costs and damage from an accident expand far beyond the individuals involved. Just the derogatory stories about “little airplanes” in the press generate significant harm to aviation.

For Ourselves and Others

We in aviation also have a moral responsibility to watch out for our brethren. It’s usually pretty easy; if we see someone taxiing out with the tow bar still attached, we will run, get the pilot’s attention, signal for a shutdown and explain the problem.

Yet we sometimes find ourselves in the dilemma of not wanting to intrude on the operating practices of another pilot. As difficult as it may be, walking up to a pilot and tactfully calling him or her aside, away from the passengers, to point out what appears to be an accident in the making is the right call. Unfortunately, tradition and law leaves the safe operation of an aircraft in the hands of the Pilot-in-Command, and sometimes that individual’s attitude towards safety leaves a lot to be desired.

Where Do We Start?

According to several accounts the 36-year-old private pilot was a popular preacher at a church in northern Illinois. He was also known as an aviation enthusiast who would use his classic Beech K35 Bonanza as a total disdain for safety.

The pilot’s Bonanza had numerous maintenance issues, including a lack of working radios. His chose to take his family on an IFR flight.

Paul Berge is a CFII, former FAA air traffic controller and author of Private Pilot Beginner’s Manual (for Sport Pilots, Too).
The pilot decided that a failed fuel pump was no big deal; he’d just use a little “Heet” to start the airplane. No, we did not make this up. —Ed.

a transportation tool and on occasion fly his friends to and from their business engagements. The pilot held single-engine land and instrument ratings and his medical application, six months before the accident, listed a total of 1300 hours of flight experience.

The aircraft’s most recent annual inspection was ten months before the accident. Based on the tachometer readings it appears the aircraft was flying about four hours per month. Of note in the aircraft’s logbook was an entry immediately above and dated 13 months prior to the annual inspection entry: “NOTE!! 2 YR TRANSPONDER CHECK IS PAST DUE, SO TRANSPONDER IS NOT LEGAL TO USE EVEN FOR VFR. [Mechanics name and his certificate number].”

Finding Mousetraps In The Box
The mechanic who routinely worked on the aircraft was interviewed by investigators. The picture he painted about the pilot’s safety attitude was not pretty. A month before the most recent annual inspection the pilot called in stating his Bonanza had a bad oil leak and the fuel pump was inoperative.

The two problems were corrected by the mechanic during the annual inspection, but the mechanic learned the pilot had been starting the aircraft using HEET, a popular automotive starting spray, to get around the inoperative fuel pump.

This must have been routine for the pilot, as he was observed using this procedure at several other airports. An airport commissioner, at one of these airports, went so far as to write a letter to the pilot in which he stated “We would also like a copy of your aircraft airworthiness certificate since you have been observed spraying a fluid into your aircraft and this presents a safety problem at the airport.”

Fuel Drains Corroded Shut
During the annual inspection a year earlier the mechanic found water in the fuel tanks and that the fuel drains would not open. These were repaired.

When the pilot returned to pick up the aircraft the mechanic casually asked if he had been draining the sumps. To which the pilot replied “Yes!” When the mechanic explained the drains had been corroded shut and had been replaced, the pilot nonchalantly replied “Oh yeah, I forgot to tell you about that.”

The mechanic lectured the pilot on the importance of draining the sumps, especially since the aircraft was outside all the time. This lecture was repeated at least one more time when the mechanic once again found water in the fuel tanks.

The pilot would routinely call the mechanic with issues, and the mechanic would provide recommendations. A lost fuel cap was one such call. The engine running rough and not developing full power, which required an aborted takeoff, was another. Since the mechanic was not asked to make the repairs he had to assume these problems were being taken care of elsewhere.

Hand-Propping a Bonanza
Then a call came in stating the starter had failed. For the last few trips the aircraft needed hand-propping to start the engine. It was then that the mechanic learned the rough running engine problem had never been addressed and the missing fuel cap had never been replaced. When the aircraft was brought in for service, the mechanic replaced the starter and the missing fuel cap, the injectors and screens were cleaned and water was once again drained from the sumps. The aircraft was started and it ran normally.

Once the repairs were complete, the pilot asked the mechanic to fly the aircraft back to another airport. The mechanic initially refused because the transponder check had never been performed. However, the pilot swore an avionics shop, at the airport, had made the inspection and he had the stickers with the sign off, but had never put them in the logbook. The mechanic agreed to make the flight to return the airplane. The flight was uneventful.

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During the subsequent accident investigation a witness from that avionics repair shop stated he could not find any record of having performed a VFR or IFR biennial certification for the period starting four years before the accident.

Of Course It Gets Worse
An employee of the local FBO who knew and had watched the pilot said “The owner did not perform preflight inspections before departure. Two or three months ago one of our line service technicians reported that one of the fuel caps on the aircraft was held on or at least covered with duct tape.”

Finally, an individual who worked at an avionics repair shop said the pilot came in the day before the accident wanting his aircraft’s COM-11A and GPS-100AVD fixed. The witness advised the pilot the COM-11A was not repairable and the GPS would need to be sent to the factory for service.

The pilot elected to leave the com radio (which had been pulled out) behind and keep the inoperative GPS in the aircraft. This witness then told investigators “To my knowledge [the pilot] left our shop without a working com or a working nav, unless you count his handheld, which he seemed very proud of! ... My personal experience with [the pilot] is he fixed things only when absolutely necessary.”

Final Flight
On an overcast September evening, the pilot, his wife, their two older sons, and their infant son boarded the Bonanza in Green Bay, Wisconsin. They were bound for Manitowish Waters Airport. The pilot requested and received an IFR clearance for VFR conditions on top, then northwest at 6500 feet.

The departure was routine. As the pilot was climbing he was instructed to continue the climb to 10,000 feet. The pilot then reported he had just broken out in the clear at 3,500 feet. Radar services were terminated. About an hour and half later, the aircraft began a descent in IMC into Manitowish Waters Airport. The weather conditions were 400 feet overcast with 10 miles visibility. The wind was 040° at three knots and the temperature and dewpoint were both at 14° Celsius. The weather was below minimums for the two published approaches into the airport, NDB RWY 32 and the GPS RWY 32.

On the Approach
The pilot’s wife, seated in the right front seat, thought the pilot was performing a normal IFR approach using a handheld Garmin eMap for navigation. She saw the runway lights before they hit something and recalls the pilot saying “OH NO, OH NO!”

One of the older sons recalled seeing the runway lights and hearing a rumbling and growling noise. Both older sons then heard their father say “It’s not working, it’s not working.”

The wreckage was found the next morning along a path approximately 1,500 feet south of the Runway 32 threshold. The non aviation GPS and a handheld radio marked JD-200 were found nearby.

Inside the aircraft investigators found expired instrument approach charts and a spray can of “HEET Starting Fluid”.

This accident cost a father and his infant son their lives, it also injured all three surviving family members, two seriously.

Sometimes We Have to Step In
The pilot was a cry for help. Whether he had a personality disorder or an anti-authority attitude or was simply monumentally foolish, he was a threat to himself and others. People who knew him had the opportunity to take action. At least one person, the mechanic, spoke to him about dangerous practices. It did no good.

When a pilot displays a total disregard for safety, especially when he or she is dragging innocents along, we have an obligation to act. If tactful counseling doesn’t work, it is time to call the local FAA office. It is rare, but there are times that calling the FAA and asking that it take steps to remove a problem from the system before tragedy occurs is essential.

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TECHNICALITIES

GARMIN G1000 ERROR MESSAGES

“Hmm, I’ve never seen that before.” Here’s a technical discussion about G1000 error messages, what they mean and how your flight will be affected.

by Fred Simonds

Turning on the avionics switch, the G1000 begins to boot. A PFD Warning message pops up: “FPL Waypoint Locked”. The machine continues to load, but you wonder what and how bad this is, and whether you can fly.

You turn to the G1000 Cockpit Reference Guide (CRG) (which is required to be aboard Cessnas per the POH Section 2, “Kinds of Operations Equipment List” table).

The CRG explains: A waypoint in the flight plan database does not exist in a database update, orphaning the waypoint. Unfortunately, the G1000 does not tell you which waypoint has been undercut.

As we get into something as technical as error messages, keep in mind that the Pilot’s Guide for the G1000 is not a substitute for the CRG. If you have any kind of glass, keep its CRG or Quick Reference handy. I suggest you copy relevant PDFs into your iPad.

Alert Organization

G1000 message alerts are organized by Line Replaceable Unit hardware modules, the database and in-flight alerts. Let’s decipher the cryptic messages so we can react correctly and safely.

First, a MANIFEST alert can occur in any LRU. The MANIFEST file is a list of all software part numbers and versions associated with an approved system configuration. A mismatch means that incorrect software is installed in a specified LRU, which isolates it from the others.

PFD and MFD Crosstalk

The GDU 1040 PFD and GDU 1042/1044 MFD displays are linked by Ethernet which Garmin calls Crosstalk (“Xtalk”). A Xtalk error means that the MFD and PFD are not communicating. This can be due to Xtalk itself (XTALK ERROR) or a MANIFEST error. The GDUs (Garmin Display Units) must have matching software versions. If not, a SW MISMATCH error results which also shuts off Xtalk.

If either device fails self-test, a SERVICE error message appears calling for service. The PFD and MFD each have configuration settings and backup configuration memory. A mismatch produces a PFD or MFD CONFIG error and pleads for service. There is additional configuration module memory backup in the PFD. Should it fail, a CNFG MODULE error results.

The G1000 detects a stuck key above the PFD or MFD bezel. A PFD or MFD “KEY” KEYSTK message results. It also detects stuck frequency swap transfer buttons (COM1 or 2 RMT XFR and NAV1 or 2 RMT XFR). Try to clear them by pressing the keys. Stuck mics produce a COM1 or 2 PTT error. An undetected stuck mic will shut itself off in 35 seconds.

Database Mismatch

A DB MISMATCH affecting flight can be either a version or type mismatch between the PFD and MFD with respect to the aviation or terrain database. A type mismatch results when, say, the Americas type is in one database and the European type database is in the other. An obstacle version or airport terrain database mismatch also precipitates this message. DB MISMATCH prevents Xtalk from crossfilling one GPS into the other, largely negating the value of the G1000’s redundant GPS.

The GMA Audio Panel

Yep, even the audio panel is digital. A GMA1 FAIL message not only means the panel has failed, leaving only COM 1 available, but the autopilot cannot be used because AP aural annunciations cannot be heard. GMA1 CONFIG means its configuration does not match its backup, requiring service. A GMA1 SERVICE message means the panel may still be usable, but needs service when able.

Garmin Integrated Avionics

Two GIA 63 units drive the MFD and PFD, respectively (see diagram on the adjacent page), also via Ethernet. If a screen fails it takes its GIA 63 with it. GIAs are essentially GNS 530A units minus displays. A SERVICE message denotes a likely non-fatal error in a COM, NAV, GPS or glideslope receiver. A FAIL message tells you what has failed, e.g., FAILED PATH means a data path connected to the GDU or GIA 63/W has quit.

Operational alerts you never want to see begin with RAIM UNAVAIL
in non-WAAS G1000s. It means that GPS satellite coverage isn’t good enough between FAF and MAP. My article, IFR GPS Regulations (January, 2010 IFRR) , offers operational guidance if a RAIM warning occurs.

Back to the VOR

LOI stands for Loss of Integrity. It means that the GPS may no longer be accurate. Reversion to VOR is recommended. Similarly, a GPS NAV LOST message can occur due to insufficient satellites, excessive position error or GPS failure. Such a message will likely cause an ABORT APR if you are on an approach. En route, the GPS will fall into dead reckoning DR mode. You still know that VOR stuff, right?

WAAS-capable GIA 63Ws can cause a HW (hardware) MISMATCH when one GIA detects a mismatch with the other, leaving only one WAAS-capable.

An APR DWNGRADE means that the approach has been downgraded to a non-WAAS LNAV approach. Use LNAV minima; if below that, miss.

The Garmin GEA 71 engine analyzer and GTX 33 transponder are LRUs that can generate CONFIG errors. In addition, the GTX 33 can generate a SRVC message calling for service or an outright XPDR1 FAIL alert.

AHRS

The Garmin Reference System (GRS 77) AHRS shows attitude and heading. If the Air Data Computer stops sending TAS information to the AHRS, it falls...
back on GPS information and triggers an AHRS1 TAS alert.

Four AHRS1 GPS messages denote maladies including use of the backup GPS path as the primary path has failed; not receiving any or defective GPS information; not receiving backup GPS information or operating in no-GPS mode.

**Magnetic North and South**

GPS units natively work in terms of true north. G1000s derive variation from a mathematical model. If the database version in AHRS1 does not match AHRS2, an AHRS MAG DB alert results. If the AHRS1 model is out of date, it complains by issuing an AHRS1 SRCV alert. The model loses accuracy near the poles, prompting a MAG VAR WARN if the displayed and actual values differ by more than two degrees.

Venturing north or south of 70 degrees latitude takes the AHRS beyond its approved limits, flags the heading as invalid and generates a GEO LIMITS alert.

**Data Link GDL 69A and 74A**

The GDL 69A can generate CONFIG and FAIL errors. I have experienced at least two data link failures where there was no corresponding alert because the antenna, not the LRU, failed. When the data link fails, text and graphical weather and TFRs are no longer displayed.

**Miscellaneous Messages**

A FPL WAYPOINT MOVE appears when a new database update relocates a waypoint. Garmin suggests verifying that any stored flight plans still contain correct waypoint locations. If you try to activate a stored flight plan with a locked waypoint, you get a LOCKED FPL message. Remove the problematic waypoint(s).

A DB CHANGE alert occurs when a procedure has been edited manually, and only occurs after a database update. Again, check that any procedures you modified remain correct and current.

If a new database deletes an obsolete approach or arrival stored in a flight plan, the dated procedure is removed from the flight plan, prompting a FPL TRUNC(ated) alert. You must update it by hand.

Some messages are self-explanatory: WPT ARRIVAL or STEEP TURN warning of one in 15 seconds. The G1000 warns of [Special Use] AIRSPC AHEAD less than ten minutes away. Two AIRSPC NEAR messages warn of SUA near and ahead and then less than two nm away. You should either have permission or your intercept procedures memorized by the time you are INSIDE ARSPC. Sorry, there is no FILE NASA ASRS or CALL AVN ATTY message.

A LEG UNSMOOTH is not a hit on your flying skills. It means that approaching waypoints will require steep turns and cause significant course deviations.

A VNAV alert says that it’s unavailable because a procedure turn or perhaps a vector, neither of which VNAV supports, occurs before the active vertical waypoint. It also alerts if there is excessive crosstrack or track angle error.

**Can You Fix It?**

When you’re trying to fix the problems, recycling the G1000 often clears spurious errors. Genuine software mismatches are unclearable; a reboot won’t fix it.

**The Go/No Go Decision**

To go or not is a decision you must make under the circumstances. GPS navigation is not required for VFR or IFR. But AHRS and ADC failures are no-gos. Garmin says that your knowledge of the airplane, flight conditions and other operational considerations are the determining factors in deciding what to do. Isn’t it fun to be a pilot?

Fred Simonds is a Gold Seal CFII, check airman and factory-certified G1000 instructor. See his web page at www.fredonflying.com.
WEATHER WISDOM

THUNDERSTORMS ARE NOT ALIKE

While even the smallest is a potential killer, knowing the variables that go into their creation can help make your flight safer and more enjoyable.

by David Ison

There is little argument among pilots and meteorologists that thunderstorms are dangerous and always potential killers. A lesser known fact about thunderstorms that is often overlooked or seldom discussed by both is that thunderstorms vary in intensity, size, shape, appearance, and frequency depending upon where one is located on the Earth.

There are spots on the planet where thunderstorms are expected like clockwork, such as the afternoon downpours in Florida, while there are some locations, such as California, where thunder is almost never heard. Also pilots who see those puffy, cotton-like Florida thunder-bumpers may not recognize their monster cousins that reside in the Great Plains and Midwest of the U.S.

No Excuse, Ever

While there is never, ever any excuse to tangle with a thunderstorm in any kind of airplane, it is important to recognize the differences among storms—to have an idea of what they look like, for visual avoidance, how long they can be expected to endure, just how bad they might be, and how common they are at any particular time of year.

Thunderstorms deserve every bit of the hideous rap they have earned in aviation. To start with, our language doesn’t have much in the way of words for levels of “severe”. The smallest thunderstorm is severe. They go up from there. So, as we go through this, keep in mind the language limitations and that a “moderate” thunderstorm would power New York City for days if we could harness the energy.

Any pilot who decides to fly through a boomer, or gets inside one by accident, may very well come out in tiny, little pilot pieces. But what separates the tornado and hail producing storms from the typical afternoon light show and moderate showers type?

NASA On the Job

To try to find the answers to these questions NASA launched the Tropical Rainfall Measuring Mission (TRMM) satellite in 1997. This spacecraft was fitted with a precipitation radar (PR), a microwave imager (TMI), visible and infrared scanner (VIRS), and a lightning imaging sensor (LIS).

The satellite was able to dissect storms as never before. The PR would cut storms in cross-sections providing vertical profile details. Also, the VIRS and top-down PR views would show details such as the storm cores and the tell-tale anvils being blown downwind. LIS data – remember that thunderstorm severity is directly proportional to the frequency of lightning – was a key component that greatly augmented findings of the other systems.

Weather Over Land

Not surprisingly, the most common location for the severe weather was over landmasses. There are a variety of reasons for this but a lot has to do with surface heating. Interestingly, it also has to do with higher aerosol concentrations thus giving water droplets something onto which to condense.

Are the clouds ahead benign or are they a vicious thunderstorm? Geography plays a role in thunderstorm appearance. If you are over Florida, it’s likely to be no big deal, over Kansas, it could be “Dorothy, come home!”
WEATHER WISDOM

Very frequent and very strong storm events occur in the Great Plains, Midwest, Great Lakes and eastern United States, southeast South America, and equatorial Africa.

The Time of the Season
It is also well-known that storms can be more intense at certain times of year, for example spring thunderstorms are often extra nasty in the “Tornado Alley” region of the U.S. Great Plains.

The diurnal cycle, a fancy way for saying day and night, influences the intensity of thunderstorms. Over land, the most likely time of day you’ll run into the thunderstorm with the highest precipitation top is 1630 local – with a 14% chance of the nastiness. Peak lightning activity (10%) was noted at around the same time but also at around 1900 local.

There is what appears to be a storm border residing along 35 degrees N and 35 degrees S. Little activity exists towards to poles on either side of these lines. And, what little activity there is tends to be weak, if that word could ever be used to describe a thunderstorm.

There are exceptions with extreme weather sometimes jumping into Canada and occasionally migrating as far north as 60 degrees N in Eurasia.

The fuel of the thunderstorm also affects its strength. Fast moving, strong cold fronts can cause some of the nastiest of storms that can last for days as they move across much of the country.

But typical, afternoon airmass thunderstorms fed by convective currents generally spawn mediocre storms that quickly die out as the sun goes down.

Intensity Classification
Because of the wide range of possibilities that might spew from a thunderstorm, forecasters are looking at better ways to classify them. Just as tornados (Fujita) and hurricanes (Saffir-Simpson) have severity ratings, thunderstorms are likely to have their own scale soon.

These rankings are proposed to be labeled TSI (weak) through TS5 (extreme) and will be categorized according to maximum winds, lightning frequency, rainfall rates, and other goodies such as hail, tornadoes, and the capacity to cause damage.

While no sane pilot wants to fly through even a TSI, if this information was coupled with geography, season, and other factors, pilots may be able to judge more accurately what the storm is likely to do, how likely it is that it may turn severe, and how long it will likely stick around.

Appearance
One thing that this research did not address is the importance of visual appearance. Whenever lightning makes it looks like the Fourth of July in a cloud, batten down the hatches.

Another thing to pay attention to is storm appearance versus where you are in the world. Down south you get obvious thunderstorms – big, textbook, cauliflower-like, cotton balls in the sky. They typically have black or gray, nasty looking bases that are fairly low to the surface and rain just about always reaches the ground in large quantities.

When you’re flying out west though, storms don’t always look the same. They may just look like a high gathering of stratocumulus, cirrostratus, and cirrocumulus meaning they have relatively high bases – like over 5,000 or more above the surface.

The appearance may be described as “leftovers” of a southern thunderstorm after it has fizzled itself out from the bottom up. But these seemingly innocuous buggers often pack a much more intense punch than their airmass relatives to the southeast.

The Big Picture
Keeping the big picture in mind; you’ll be able to better understand, predict, and deal with Mother Nature’s most notorious noise makers.

Taking note of the time of year, the time of day, geographic location and features, possible fuel for storms, and other key attributes such as the frequency of lightning, you’ll be able to take some mystery out of thunderstorms, improve your understanding of weather, and help you predict what the sky is going to do next.

David Ison has worked in the aviation industry for over 20 years, holds an ATP and is an associate professor of aviation at Rocky Mountain College.
by Burke Mees

In recent years, we have seen highly capable glass panels working their way into so many private and corporate airplanes, that they can now be considered commonplace.

Early on, the reviews of this new technology were written with a nearly unanimous tone of unbounded enthusiasm. The assumption was that they increased our situational awareness, made us safer, and everyone should love them except for the few retrograde malcontents who just don’t like new things.

As the newness faded, we began to learn from experience that the complexity of glass cockpits creates opportunities for new mistakes. We’ve become aware that they aren’t the unequivocal force for safety initially thought.

An Objective View
What is certain is that these new panels changed the way we fly IFR in significant ways. Now that the “Oh, wow, this is great!” smoke has cleared, we can step back and look at them for what they are: capable tools that have subtle weaknesses and require a certain amount of discipline and effort on our part to fully realize their potential advantages.

When I say ‘glass cockpit’ I’m referring to a panel organized around a GPS moving map that displays a programmed “magenta line” route on a screen that can show a staggering amount of information. More often than not, they are coupled to a flight director and autopilot.

No Standardization
Astonishingly, given that flight instrument presentation was standardized way back in 1968, there is no standard arrangement for glass cockpits. The lack of instrument standardization between aircraft has long been recognized as a safety of flight issue; in this we have taken a major step backward.

More time is now demanded of us to be proficient and safe. We have to spend a significant amount of time learning the details of each glass cockpit that we fly on top of the details of the aircraft itself; not a good situation where pilots are flying fewer hours each year.

Situational Awareness
Perhaps the most obvious benefit of glass cockpits (once you get used to a particular one) is the situational awareness they provide in the form of the moving map and other readily available information.

There is, however, more to situational awareness than just visualizing where you are on the moving map; it also involves efficiently managing all the tasks in an IFR flight and staying ahead of the program.

Now if the demands and complexity of the glass cockpit are poorly managed it is not unusual for a pilot to experience a net loss of situational awareness, a situation where the glass panel contributes to a reduction in the level of safety.

Into a Trance
For example, the typical glass cockpit requires extensive pilot inputs in the form of twisting knobs, pushing buttons and scrolling through pages. Flight instructors confirm that this often takes on a positively hypnotic quality that draws pilots into a heads-down trance.

If you're not careful, its easy to get absorbed into the panel to the point of neglecting other flying duties, especially scanning for traffic. Also these systems usually have messages, alerts and warnings that are specifically designed to get your attention, which can easily disrupt your routine and cause you to miss something more important.

The shiny newness of the glass cockpit is finally wearing off. The initial hype has given way to experience in the field. It has become evident that glass is another aeronautical tool, not a magic box. It can help pilots but it has shortcomings that can reduce flight safety to below that of the analogue panel. We can never forget that the most important piece of operating equipment in the cockpit is the pilot.
I regularly see pilots becoming so bogged down with attending to the panel that their situational awareness deteriorates to about the level of an instrument student flying his first NDB holding pattern in a strong wind.

The glass cockpit offers new ways to both maintain and lose situational awareness, and it is entirely up to us to make sure that the result is a net benefit. That requires the discipline to resist distractions and keep the big picture in focus.

The glass panel has a more active role in the flight than did the old set of round gauges. It takes care of our navigation chores, calls certain things to our attention, and if it is coupled to a flight director/autopilot, it participates in flying the airplane.

Good Copilot

In these ways, it plays the role of a good copilot, and it is always a matter of good CRM to understand the copilot’s personality; in this case an extremely good stick, but not very smart and in need of explicit instructions.

The copilot can be very helpful, but if you don’t watch carefully you can wake up to find you’ve been lead astray. If you provide good supervision, you have a great asset, but one that has zero judgment, so you have to be assertive in your role as PIC.

As a copilot, the glass cockpit’s strong point is that it does relieve us of a significant part of the workload. In theory, this should free up our attention and result in better situational awareness. In reality I often see something else happen: we lose some of our “edge”.

Stay Engaged

We stay engaged with the airplane by attending to the details. As we delegate more of those to the technology we can become less intimately involved with what is going on. This can compromise our situational awareness in small and subtle ways; How many times do we lose track of where we are because we are happily progressing along the magenta line?

How many of us would have trouble flying a raw data ILS to minimums because we’ve been letting the autopilot do it? How many times have things like these been a link in the accident chain? In the long run, if a system makes us less intimately involved with flying the airplane, is it really doing us any favors?

I believe that to get the most from glass cockpits, we need to devote special attention to staying actively engaged with the airplane and staying focused on what we’re doing.

It is a matter of situational awareness to understand our role in the airplane, and at first glance, it would seem that as we rely more on technology, the pilot becomes a less important part of the equation.

Strong PIC Needed

A lot of people are buying into that idea, and when the airplane can fly a good ILS by itself, it’s easy to think that we’re less important than we used to be. Really though, after spending some time in very capable glass cockpits, I realize that the more technology we have, the greater need there is for a strong PIC to properly manage it. The pilot is as important as ever.

Given that the glass cockpit has both benefits and pitfalls, the practical question is how do we use it to our net advantage?

Not surprisingly, because we keep learning this fact: the best advice for managing the high tech cockpit is to remember the basics. The complexities of the glass cockpit rely more than ever on things like good organization, discipline, knowledge, proficiency and judgment.

They are precisely the same things that have always been at the heart of good instrument flying. Certainly the details of how we fly IFR are changing, but what it takes to be a good instrument pilot remains very much the same.

Burke Mees flies commercially in our biggest state, where being an effective pilot in command has never gone out of style.
**CAN YOU THINK LIKE ATC?**

One of the best ways to anticipate what sort of clearance you are going to get is to think like a controller? Let’s see how well you can pull it off.

by Paul Berge

Much of the routine IFR flight is spent en route with arms folded, warding off sleep (just like ATC) while monitoring the radio, GPS and CHT. The real fun is found on the DP, the IAP and especially when slapped with an unplanned hold over a fix you can’t even pronounce let alone find on your Game Boy. Fun can turn to icy armpits if you fall behind, and one way to stay ahead is to think ahead of ATC.

Can you do it? Answers after the questions.

1. Tower controllers routinely assign initial headings to fly in a takeoff clearance, such as: “Turn right heading 330, cleared for takeoff.” When ATC assigns “fly runway heading” pilots are expected to:
   a. Track the course that corresponds with the runway’s extended centerline by applying appropriate drift correction.
   b. Crab into the wind so as to fly along the runway’s extended centerline after entering the clouds.
   c. Fly the heading that corresponds with the runway’s extended centerline and not apply drift correction.
   d. Fly a heading that maintains the runway’s extended centerline and advise ATC of drift correction angle.

2. Scenario: You’re holding short of runway 30 at intersection C-2 (see Figure 1) in your Bonanza, awaiting an IFR departure. The sky is clear, visibility 10, wind 010 at 10 knots. A Boeing 757 departs Runway 30 ahead of you, utilizing its full length. You call tower ready to depart, and tower says, “Hold for wake turbulence…” The 3-minute wake turbulence delay may be waived in this situation:
   a. If the tower assigns an immediate turn toward the east/northeast
   b. If the PIC initiates the request to waive the delay
   c. If the 757 is not operating as a “Heavy”
   d. Under no circumstances

3. ATC may initiate vectors for a visual approach to an airport with no weather reporting service provided:
   a. Ceilings in the area are reported at or above 1000 feet, visibility three nm or greater
   b. There’s a reasonable assurance that descent can be made visually
   c. A published instrument approach procedure exists there
   d. An operable RCO exists

4. Flight Visibility is the _________ _________ horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.
   a. forward unfocused
   b. specific forward
   c. average forward
   d. average surrounding

5. Where RVR (Runway Visual Range) equipment exists the tower shall issue RVR values to all arrivals and departures when the prevailing visibility is:
   a. 1 mile or less
   b. 1.5 miles or less
   c. 2 miles or less
   d. 3 miles or less

6. According to the ATC manual (7110.65), when possible, ATC “should” issue holding instructions how far in advance.
   a. 3 minutes

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“Hold for wake turbulence”

Figure. 1

Boeing 757 departed using full length
b. 3 miles  
c. 5 miles  
d. 5 minutes

7. When holding in radar environment (meaning ATC said, “radar contact”) the controller will be monitoring your holding pattern entry to make certain you enter via the appropriate, FAA-recommended method (which you know by heart and are ready to recite in the next question).
   a. True  
b. False

8. Speaking of question 7, what are the three FAA-recommended holding pattern entries?
   a. Parallel, racetrack, direct  
b. Parallel, teardrop, direct  
c. Published, teardrop, direct  
d. Rock, paper, scissors

9. If you’re cleared to hold over a fix and asked to report pattern entry, what time should you report?
   a. The initial time of arrival over the holding fix  
b. When established outbound  
c. When established inbound  
d. After one complete circuit

10. Fill in the blanks: Upon entering a holding pattern, the initial outbound leg is flown for ________ minute(s) at or below ________ feet MSL, and for ________ minute(s) above ________ feet MSL.
    a. 1, 14,000, 1-1/2, 14,000  
b. 1, 10,000, 1-1/2, 10,000  
c. 1-1/2, 14,000, 2, 14,000  
d. 1, 10,000, 1-1/2, 10,000

Quiz Answers:

1. c. Fly the heading that corresponds with the runway’s extended centerline and not apply drift correction. (AIM P/C Glossary)

2. d. Under no circumstances. (7110.65, 3-9-7) Boeing 757s are treated as “Heavies” (capable of takeoff weights over 255,000 pounds), and, therefore, the 3-minute wake turbulence delay from the intersection is mandatory and cannot be waived.

3. b. There’s a reasonable assurance that descent can be made visually. (7110.65 7-4-2) Controllers use any source—PIREPs, AWOS/ASOS from nearby airports, Weather Channel, taro cards, whatever—to form the weather picture.

4. c. Average forward. (P/C Glossary)

5. a. One mile or less (regardless of the value indicated). (7110.65 2-8-2)

6. d. Five minutes. Gives you time to configure and read the chart.

7. b. False. The controller does not enforce the FAA-recommended patterns entries. Many controllers don’t even know them, but we’ll bet that you do…

8. b. Parallel, teardrop, direct. Are other entry methods legit? (AIM 5-3-7) Answer d. Rock, paper, scissors, is the tie-breaker method used by controllers to decide which arrivals go first.


10. a. 1, 14,000, 1-1/2, 14,000. (Instrument Flying Handbook, 8083-15A, ch. 10)

Paul Berge is a CFII, former FAA air traffic controller and author of Private Pilot Beginner’s Manual (for Sport Pilots, Too)