

November/December 2020

FAA BRIEFING *Safety*



AVOIDING Controlled Flight Into Terrain



**Federal Aviation
Administration**

7 From the Ground Up
How the FAA is
Keeping Controlled
Flight Out of Terrain

**16 Trust, But
Verify**
Take AIM to
Avoid Terrain

**19 Extra Eyes in
the Sky**
Advanced Tools
For CFIT Avoidance



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ABOUT THIS ISSUE ...



The November/December 2020 issue of FAA Safety Briefing focuses on mitigating one of the leading causes of general aviation accidents – controlled flight into terrain, or CFIT. Feature articles and departments explore the many CFIT-related resources and technological tools available to pilots, as well as numerous strategies, tips, and best practices that can help keep CFIT at bay.

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FAA **BRIEFING** Safety

The FAA Safety Policy Voice of Non-commercial General Aviation

DEPARTMENTS

- 2 **Jumpseat:** an executive policy perspective
- 3 **ATIS:** GA news and current events
- 6 **Condition Inspection:** a look at specific medical conditions
- 26 **Checklist:** FAA resources and safety reminders
- 27 **Drone Debrief:** drone safety roundup
- 28 **Nuts, Bolts, and Electrons:** GA maintenance issues
- 29 **Angle of Attack:** GA safety strategies
- 30 **Vertically Speaking:** safety issues for rotorcraft pilots
- 31 **Flight Forum:** letters from the Safety Briefing mailbag
- 32 **Postflight:** an editor's perspective

Inside back cover

FAA Faces: FAA employee profile



So Things Don't Go Bump in the Night Avoiding Terrain While Flying Night VFR



10 **Look Up, Look Out**
See and Avoid CFIT Strategies for VFR Pilots

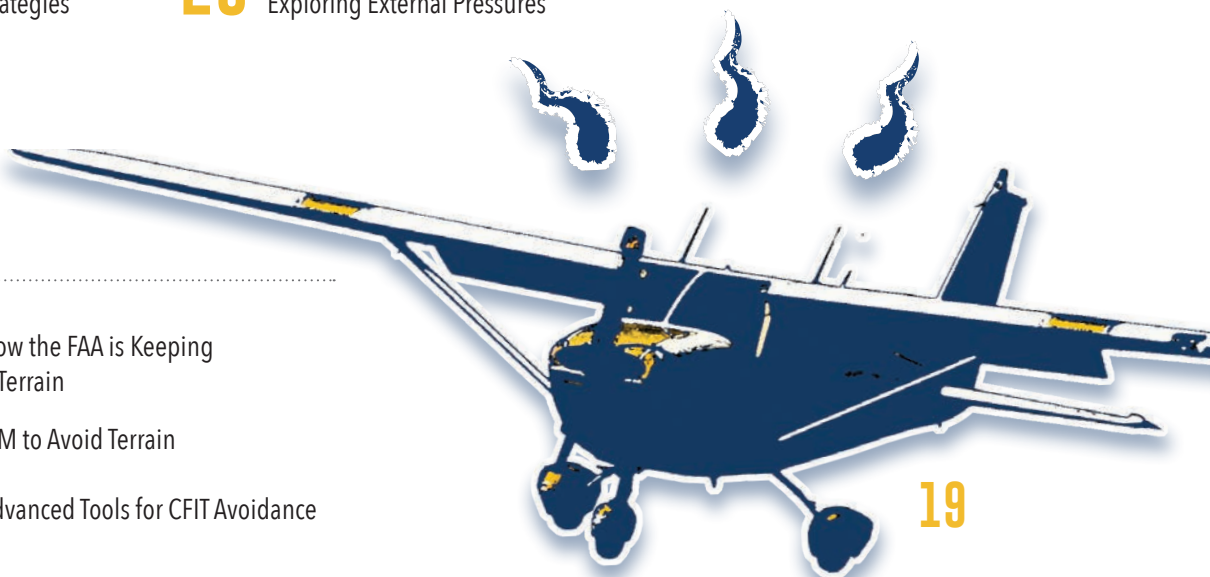


23 **Are We There Yet?**
Exploring External Pressures

7 **From the Ground Up** How the FAA is Keeping Controlled Flight Out of Terrain

16 **Trust, But Verify** Take AIM to Avoid Terrain

19 **Extra Eyes in the Sky** Advanced Tools for CFIT Avoidance





A "C" TO AVOID



You don't have to be in aviation at all to know that "CFIT" is the acronym for "controlled flight into terrain." The fact that it's a commonplace rather than just another esoteric element in the aviation lexicon unfortunately says a lot about the prevalence of this perennial cause of aviation accidents. It's not just in GA, either; commercial aviation has had its share of CFIT accidents. The term's notoriety also bespeaks its terrible toll: at least half of all CFIT accidents result in fatalities.

CFIT is defined as an unintentional collision with terrain (the ground, a mountain, a body of water, or an obstacle) while an aircraft is under positive control. Most often, the pilot or crew is unaware of the looming disaster until it is too late. CFIT most commonly occurs in the approach or landing phase of flight. In a typical year, there are about 40 CFIT accidents.

Seeing and Not Avoiding

So how does such a thing happen? Given this information, you might

think that CFIT accidents occur mostly at night, or in instrument meteorological conditions (IMC). Or you might suppose that most arise from the painful pattern of what accident reports describe as "continued VFR flight into IMC." That is certainly one cause. However, the General Aviation Joint Steering Committee (GAJSC) observed that a clear majority of the CFIT accidents in a typical year occur in daylight, and with visual conditions.

So again, how does CFIT happen? How could anyone continue controlled flight into terrain that you can easily see and avoid?

Situational Awareness

It seems that the most common type of pilot error in CFIT accidents is the pilot's loss of situational awareness — failing to know at all times what the aircraft's position is, how that position relates to the altitude of the surface immediately below and ahead, and how both relate to

the course being flown. Situational awareness vanishes for a variety of reasons. It could be navigation equipment malfunctions; either known problems that distract the pilot or subtle issues that mislead the pilot into misguiding the aircraft. It could arise from limitations in human performance (e.g., illness, fatigue, stress) or in mechanical performance (e.g., high density altitude, tailwinds on approach).

Today's aviators have the benefit of many tools to maintain appropriate clearance from the ground. There are electronic warning systems, including GPS databases and terrain awareness warning systems. Technological advances in situational awareness have certainly reduced the number of GA CFIT accidents. However, the GAJSC found that overreliance on automation can be a precursor to many CFIT events. Awareness of automation limitations and pilot proficiency in flying with and without automation are key to safe flight.

The bottom line is clear: Nothing can fully compensate for a pilot's failure to plan carefully in advance, and to stay aware and alert throughout the flight. To help with that effort and contribute to the CFIT avoidance goal, the magazine team is devoting this issue of *FAA Safety Briefing* to exploring common causes and various conditions in which CFIT accidents occur. We'll look at ways to avoid the complacency and misplaced confidence that can contribute to CFIT. Finally, we'll point to some tips and best practices to help you stay safely in the sky until you make a controlled landing at your intended destination.

AVIATION NEWS ROUNDUP

FAA Launches New Podcast Series

During the summer, the FAA launched an exciting new podcast series titled “The Air Up There.” Billed as a podcast for people who are curious about the wide world of aviation, the series covers the future of flight, drones, and ways to make the National Airspace System safer, smarter, and more efficient. Some recent episodes covered the new norms for general aviation amid the COVID-19 public health emergency, as well as an inside look at how the FAA’s air traffic control team is keeping our skies safe. For more information, including how to subscribe, go to faa.gov/podcasts.



Leidos to Develop New Display System

Leidos, the company that provides the FAA’s Flight Services, will design and develop a system to provide real-time access to essential weather, aeronautical, and National Airspace System (NAS) information through a common Enterprise-Information Display System (E-IDS).

The scalable, cloud-ready solution will replace five legacy systems as

part of the FAA’s Next Generation Air Transportation System modernization project.

The single award contract, valued at approximately \$292 million, includes a four-year base period and 11 one-year options. It calls on Leidos to perform the critical activities required to deliver E-IDS, including: program management, systems engineering, design and development, system test and evaluation, training, production, and site implementation.

The system is to run on a combination of physical resources at more than 400 FAA NAS facilities and on FAA virtualized platforms using FAA cloud services. The E-IDS provides FAA access to efficient configuration and data management tools to meet the current and evolving needs of NAS stakeholders.

FAA Announces Grants for Aviation Careers

In an effort to invest in the future aviation workforce, the FAA has announced the establishment of two grant programs designed for aviation workforce development; one for pilots, and one for aviation maintenance personnel.

The FAA’s Aircraft Pilots Workforce Development Grant Program aims to expand the pilot workforce by helping high school students receive training to become pilots, aerospace engineers, or unmanned aircraft systems operators. The program will also prepare teachers to train students for jobs in the aviation industry.

The FAA’s Aviation Maintenance Technical Workforce Development Grant Program aims to increase interest and recruit students for careers in aviation maintenance. The pro-

gram will provide grants to academia and the aviation community to help prepare a more inclusive talent pool of aviation maintenance technicians, and to inspire the next generation of aviation maintenance professionals.

In fiscal year 2020, Congress appropriated \$5 million to create and deliver a training curriculum to address the projected shortages of aircraft pilots and aviation maintenance technical workers in the aviation industry. Eligible groups may apply for grants from \$25,000 to \$500,000. Potential applicants are encouraged to visit the program website at bit.ly/AvGrants.

AvGas Testing and Evaluation

The FAA, fuel suppliers, and aerospace manufacturers continue to develop high octane, unleaded fuel formulations. The goal of these efforts is to identify fuel formulations that provide operationally safe alternatives to 100LL (low lead). The Piston Aviation Fuels Initiative (PAFI) program continues to support the efforts of fuel producers as they bring forth alternative, unleaded fuels for testing and evaluation.

The FAA requires the fuel producers to complete the following “pre-screening” tests prior to a candidate fuel formulation entering into more extensive testing through the PAFI program:

1. Successful completion of a 150 hr. engine endurance test on a turbocharged engine using PAFI test protocols or other procedures coordinated with the FAA;
2. Successful completion of an engine detonation screening test using the PAFI test protocols or other procedures coordinated with the FAA; and,



3. Successful completion of a subset of the material compatibility tests using the PAFI test protocol or other procedures coordinated with the FAA.

Development and pre-screening testing is taking place at both private and public testing facilities across the country. The FAA's William J. Hughes Technical Center is providing engine-testing services through Cooperative Research and Development Agreements (CRADA) with the individual fuel companies. While COVID-19 has delayed the completion of the pre-screening tests, the tentative schedule is to re-start formal PAFI testing in 2021.

The FAA will provide additional details to the public regarding the fuel authorization process via the federal register as required per Public Law 115-254 (FAA Reauthorization Act of 2018 HR 302, Section 565). The FAA also continues to support other fuel applicants who have decided to pursue engine and airframe approvals that would allow the use of their fuel formulations via traditional certification processes. For more information, go to faa.gov/about/initiatives/avgas.

New Video Helps Pilots Avoid Wrong Direction Takeoffs

Wrong surface operations are a serious and continuing issue at airports throughout the National Airspace System (NAS). The majority of these



New FAA video highlights the risks of wrong direction intersection takeoffs.

incidents involve general aviation aircraft and pilots. A new FAA video (youtu.be/FET0oUgCLOI) focusing on wrong direction intersection takeoffs describes the risks associated with them, and demonstrates various strategies and tips that will help pilots avoid these situations. Also check out the FAA's From the Flight Deck video series on YouTube where you can watch actual approach and taxi footage from airports across the U.S. Visit faa.gov/go/FromTheFlightDeck for a map of all 30 locations.

Drone Safety for the Spanish-Speaking Community

The FAA has launched a pilot program to translate into Spanish select web content for recreational unmanned aircraft systems (aka drone) operators.

The program is expected to reach the nearly 25.6 million people living in

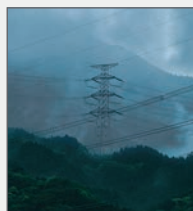
the United States with limited English proficiency and will focus on Spanish, the second most spoken language in the U.S. The FAA seeks to remove barriers for this segment of the U.S. population interested in drones. The FAA website will have basic drone safety information for recreational flyers with a selection of existing web pages translated into Spanish.

There are regulatory and legal requirements for certificated pilots, including remote pilot certificate holders operating in accordance with the requirements of 14 CFR parts 61 or 107, to read, write, speak, and understand English. There are no similar requirements for recreational drone flyers. The FAA will analyze the results of this outreach effort and may consider additional project phases in other languages in the future.



FLY SAFE Fact Sheets

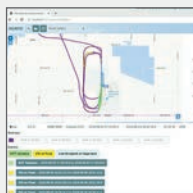
Visit bit.ly/GAFactSheets for more information on these and other topics.



NOVEMBER

CFIT

Tips for avoiding controlled flight into terrain accidents.



DECEMBER

Aircraft Performance Monitoring

Learn how to improve your aircraft performance predictions and better adhere to operating limitations.



FROM THE FLIGHT DECK

FEDERAL AVIATION ADMINISTRATION
PRODUCTION



KNOW BEFORE YOU GO.



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FAA

NOW PLAYING





WHEN SEEING ISN'T BELIEVING

Mitigating the Hazard of Visual Illusions

A review of aircraft mishaps quickly reveals that visual illusions and/or poor visibility have been factors in the majority of aircraft accidents.

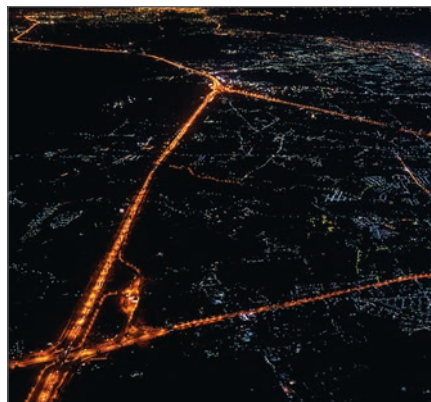
Unless you are actively instructing or preparing for a new certificate/rating, chances are that it has been a while since you last thought about the different types of visual illusions and the impact they have on flight safety. With few exceptions, these illusions make it appear that you are too high/too low and too close/too far from the runway. When pilots sense they are too high or too close, they tend to land short and/or hard. When illusions indicate a pilot is too low or too far, they tend to land long and risk overruns.

The illusion of being either too high or too low can result from a black hole effect, water refraction from rain on the windscreen, haze, narrow runways, upsloping terrain or runways, and bright approach lights.

Conversely, conditions that make pilots think that they are too low and risk landing long are caused by wide runways, down-sloping terrain or runways, very clear air (such as at high altitude airports), and low intensity lighting systems.

Many of us have experienced false horizons from sloping cloud decks or from ground lights on slopes. It's important to recognize that entry into fog, even when the ground is visible, can induce a sensation of pitching up. The tendency to pitch down can be catastrophic if close to the ground, a tower, or building.

As with spatial disorientation, we are all susceptible to visual illusions. Illusions are the result of how we have learned to perceive the world around us. We can compensate with pre-flight



preparation, as well as the use of aircraft instruments and navigation tools.

If you are instrument qualified, maintain proficiency. If not, work with an instructor to gain proficiency so you can correctly use flight instruments and instrument approach procedures to increase situational awareness throughout a visual approach. Title 14 Code of Federal Regulations (14 CFR) section 91.103 requires pilots to review all available information prior to flight, but consider more than just fuel, runways, and weather. Evaluate the potential for visual illusions based on runway configuration, runway lighting, forecast weather, and terrain (black hole potential, slopes, off-airport lights, etc.). Forewarned is forearmed. Preserve your night vision and consider the use of supplemental oxygen.

Another good practice that can help combat visual illusions is to use a flight training device or simulator to fly to your destination under a number of different scenarios (e.g., changing time of day, weather, and runways). Then use the tools available at your destination. As noted, an instrument procedure can provide valuable guidance, but only if you are trained and proficient in using it. Many airports have either a visual

AS WITH SPATIAL DISORIENTATION, WE ARE ALL SUSCEPTIBLE TO VISUAL ILLUSIONS.

approach slope indicator (VASI) or precision approach path indicator (PAPI). These are typically set at a 3-degree descent angle, but can be greater. Even without these aids, GPS can help pilots maintain a safe altitude until close to the airport and provide guidance on an appropriate approach angle for a straight-in approach. A good rule-of-thumb for descent is 300 feet of altitude for each nautical mile from the runway.

In summary, visual illusions may be unavoidable, but you can mitigate the risk. No one plans to land short, to land hard, or to overrun the runway, yet we still do. Know what to expect before departure, maintain proficiency, and use the tools available to you.

LEARN MORE

Several FAA handbooks, including the Pilots Handbook of Aeronautical Knowledge, the Helicopter Flying Handbook, and the Instrument Flying Handbook describe visual illusions in detail along with accompanying illustrations. bit.ly/FAAhandbooks

The Flight Safety Foundation (FSF) has an excellent discussion of visual illusions in Approach and Landing Accident Reduction Task Force Briefing Note 5.3 (skybrary.aero/bookshelf/books/812.pdf) and in an article here: flightsafety.org/hf/hf_nov-dec99.pdf



FROM THE GROUND UP

By Tom Hoffmann

How the FAA is Keeping Controlled Flight *Out of* Terrain

On a near moonless night in November 2007, two Civil Air Patrol pilots boarded their Cessna T182T *Turbo Skylane* and departed North Las Vegas Airport headed southwest to Rosamond, Calif. About 13 minutes into the otherwise routine flight, the aircraft impacted a near vertical rock face on the southeast side of Mount Potosi, about 1,000 feet below its summit. Despite the pilots' vast experience (over 53,000 hours of flight time between them), a nearly new turbocharged aircraft, and a Garmin G1000 capable of displaying terrain proximity information, the crew didn't maintain adequate terrain clearance during climb out. The NTSB cited rising terrain, darkness, the pilot's loss of situational awareness, and ATC failure to issue a terrain-related safety alert as contributing factors.

This chilling account of controlled flight into terrain, or CFIT (*see-fit*), is all too familiar. While technological advances over the years have curtailed the rate of CFIT to some extent, it remains a persistent problem, especially within the general aviation (GA) community. As the example illustrates, there's usually a lot to unpack with CFIT accident scenarios. Many have multiple contributing factors, but CFIT accidents typically share one common thread: lack of situational awareness. In this article you'll learn more about what CFIT is and why it happens, along with some new strategies aimed at mitigating this long-standing and often fatal problem.

The Facts

Let's start by understanding what CFIT is and what it isn't. According to FAA Advisory Circular (AC) 61-134, *General Aviation CFIT Awareness*, CFIT occurs when an airworthy aircraft under the control of a qualified pilot is flown into terrain (water or obstacles) due to the pilot's inadequate awareness of the impending collision. Note the qualifiers — airworthy aircraft, qualified pilot, with pilot's lack of awareness. A mechanical failure in flight or pilot's loss of control would not be categorized as a CFIT.

According to 2003 AC 61-134, CFIT accidents accounted for about 17-percent of all GA accident fatalities at that time. That rate has decreased in recent years, but not by enough. The FAA and the General Aviation Joint Steering Committee (GAJSC), a joint government/industry safety effort, have consistently ranked CFIT as a top three GA accident causal factor for the last two decades. A recent GAJSC analysis (2011-2019) shows a total of 171 CFIT accidents (as recorded at that time), placing CFIT number three on the list of accident causal factors (loss of control and powerplant system component failures rank ahead of CFIT).

A Team Approach

So what causes a capable pilot in a structurally sound airplane to have an unexpected and unwanted cumulo-granitus encounter? That's the question the GAJSC set out to answer by chartering the CFIT Working Group



Government and industry members of the GAJSC's CFIT working group conducted one of their offsite meetings at Honeywell's Aerospace Global Headquarters in Phoenix, Ariz., where they were able to tour the company's Boeing 757 Flying Testbed aircraft.

(WG) in 2017. This team consisted of about two dozen government and industry aviation experts, including representatives from the Aircraft Owners and Pilots Association (AOPA), Experimental Aircraft Association (EAA), FAA, Honeywell, Jeppesen, National Business Aircraft Association (NBAA), Piper Aircraft, Society of Aviation and Flight Educators (SAFE), and Textron Aviation.

Over the course of two and a half years, with meetings every six to eight weeks, the team meticulously pored over details from 67 CFIT accidents (from 2008-2018) using a well-tested data analysis process. Their goal: to better understand CFIT causes and to develop suitable strategies to prevent them.

The humbling part of CFIT is that it can happen to anyone, anytime, and in any kind of terrain.

"It was an exceptional experience, one that was very personal and incredibly humbling," says Kieran O'Farrell, acting manager of the FAA's Specialty Aircraft Examiner Branch and government co-chair of the CFIT WG. With 24 years of Alaska floatplane flying under her belt, Kieran knows a thing or two about CFIT. "I lost 17 friends in aircraft accidents," she says, "and 15 were due to CFIT." After WG meetings, Kieran often found herself pondering the sobering accounts of accident scenarios. "I saw myself in a number of these accidents," she says, "doing things

no different than these people did." That personal connection further fueled her resolve to find answers.

Onsite Insight

The WG also benefited from on-site meetings with diverse organizations that added key insight to the team's findings. They visited AOPA headquarters to gather member feedback and engaged with employees at both Honeywell and Jeppesen. The WG also met at the campuses of Embry-Riddle Aeronautical University in Florida and the University of Alaska, seeking opportunities to discuss CFIT firsthand with aeronautical students. Another meeting at NetJets' corporate headquarters in Columbus, Ohio, provided critical insight into the complex and demanding world of part 135 operations.

This up-close and personal approach was especially helpful with one of the biggest challenges — getting inside the accident pilot's head. Identifying the kinds of stress or distractions a pilot experienced in the lead-up to a CFIT flight is extremely difficult and sometimes impossible. "There's always a part of the picture that's hard to see," says Kieran. "No pilot wakes up and says today's the day I'm going to die in an airplane. There's always something else, whether they dialed in the wrong approach, or just thought they were somewhere else. Wishful thinking never levitates an airplane over that mountain."

The team worked hard at piecing all available information on each accident together to better understand the range of reasons behind each tragic outcome. In one fatal

scenario, a pilot rushing to attend a funeral was likely dealing with a level of grief and “get-there-itis” that contributed to a lack of sound decision-making.

Team Takeaways

After scores of meetings and detailed discussions, the CFIT WG sorted and ranked a series of intervention strategies based on feasibility and effectiveness. From that list the team compiled a final set of recommended Safety Enhancement (SE) topics that could have the greatest impact on addressing and mitigating root causes of CFIT accidents. The SEs addressed CFIT mitigation strategies from different perspectives, including training and education, policy, and technology. There is also a large human factors component that addresses external pressure to continue a flight. These more insidious factors can have a huge impact on your decisions (or indecisions) during flight. *(If you're interested in reviewing the SEs, along with a description of the WG's methodology and conclusions, you can read a report expected to appear this fall on GAJSC.org.)*

“SE” for Yourself

This issue of *FAA Safety Briefing* is largely focused on the subjects of those SEs, so please read on to learn what's being done to combat CFIT. You'll find information on some powerful and precise technological solutions making their way into the GA fleet, best practices for CFIT avoidance at night and in IMC, and remedies for treating the deadly affliction of “get-there-itis.”

“Our ultimate goal is to provide pilots with the right tools, education, and technology to be situationally aware of where they are both physically and mentally in the airplane,” says Kieran. “That might mean reaching out to pilots and tasking industry in different ways than we have in the past.” The SEs are a mechanism to do just that by stressing key educational points and driving innovation towards safer and more affordable solutions.

Thinking Outside the Box

On a broader scale, Kieran also hopes WG efforts promote a culture shift to improving a pilot's critical thinking skills. One example she often touted during WG meetings was the unintentional IMC escape plan. She notes that the 180-degree turn is too narrowly focused and relies more on muscle memory than a brain-based calculation. To prove the point, Kieran phoned a flight instructor she knew during one meeting who connected her with a pilot in training to ask about IMC escape plans. Despite his effort to explain how he would avoid such a situation in the first place, the 180-degree turn response confirmed Kieran's suspicion.

“It's not necessarily the wrong answer, but is it the same answer if you're in Florida or Alaska, or if you're in icing?” she asks. “Maybe it's better to climb up out of it. It's situa-

Our ultimate goal is to provide pilots with the right tools, education, and technology to be situationally aware of where they are both physically and mentally in the airplane.

tionally dependent.” For Kieran and the team, this kind of scenario reinforces the need to better develop a pilot's critical thinking skills and situational awareness. That's easier said than done, but they are optimistic about the initiative to overhaul the WINGS Pilot Proficiency Program to help with the culture shift.

The CFIT WG also stressed the need for technology advances to bolster real-time situational awareness of weather and terrain. Products like electronic flight bags (EFBs) or a digital co-pilot could warn pilots of rising terrain in three miles, or of an approach not aligned with the runway. Augmented reality goggles could reveal terrain cloaked in clouds or darkness. Some of these and other promising and potentially game-changing technologies are already being developed for GA.

The FAA and its GAJSC partners are committed to finding ways to support and develop a range of CFIT mitigation strategies. “The humbling part of CFIT is that it can happen to anyone, anytime, and in any kind of terrain,” says Kieran. The accident described at the beginning of this article reinforces the point, despite there being no shortage of pilot experience or helpful technology. Kieran adds that “the way to avoid it is to properly make use of all available tools and keep your ‘SA’ at all times.” The hard part is conveying this advice in a way that registers. The CFIT WG Safety Enhancements are an important step towards not only better understanding, but also helping to advance a data-driven game plan that tackles CFIT prevention in new and more meaningful ways. The future of CFIT-less skies is bright.

Tom Hoffmann is the managing editor of *FAA Safety Briefing*. He is a commercial pilot and holds an A&P certificate.

LEARN MORE

FAA Advisory Circular 61-134, *GA CFIT Awareness*
[bit.ly/AC61-134](https://www.faa.gov/air_traffic/tips_and_advisories/tip_134)

CFIT Video – What More Can We Do?
[Youtu.be/JBxg6hgbAr8](https://www.youtube.com/watch?v=JBxg6hgbAr8)

CFIT Brochure
[bit.ly/CFITbrochure](https://www.faa.gov/air_traffic/tips_and_advisories/tip_134)



Look Up, Look Out

See and Avoid CFIT Strategies for VFR Pilots

By Jennifer Caron

So why does a VFR pilot, with positive control of a fully functioning aircraft, accidentally fly it into the ground? Or into the side of a mountain, or a body of water, or any obstacle?

Despite the fact that many pilots have enhanced cockpit technologies on their side, these unintentional collisions, defined as controlled flight into terrain (CFIT), consistently ranked as a top three general aviation (GA) accident causal factor over the last two decades.

You would think that CFIT accidents involve inexperienced pilots flying in dark night or instrument meteorological conditions (IMC). In fact, in a typical year more than 75-percent of CFIT accidents occur *in daylight*, and more than half take place in visual conditions, with either VFR or instrument-rated pilots at the helm.

When it comes to VFR flying, a CFIT accident does not have to happen. With proper preflight preparation and smart decision making, you can see and avoid CFIT.

Plan, Prepare, Prevail

The key to combating CFIT accidents starts on the ground, and sound preflight planning is step one. Be proactive. Know what you're getting into; know where you're going; know your capabilities; and know your resources *prior to takeoff*.

Good situational awareness begins with a good preflight risk assessment. Preflight checklists are your friends — use them. The PAVE, 5P, and IMSAFE checklists will help you make a well-reasoned go/no-go decision and determine your personal level of risk for any flight. Take advantage of the various flight risk assessment tools (FRATs). FRATs easily integrate with charting programs, cockpit displays, and weather imagery.

Be sure to obtain and understand a preflight weather briefing, and don't forget that webcams in some locations can provide a real-time look at the weather along your route. Check again for the return flight. While en route, stay tuned to the outside world — heads up, eyes out — for unexpected weather. Keep track of conditions behind you, so you know if you can simply reverse course in a pinch. In summary, prepare for the unexpected — have a plan for what you'll do if you encounter less than stellar conditions.

Know Your Route

Get familiar with your route before takeoff. Review Notices to Airmen (NOTAMs) and airport layouts. With a pre-planned mental map in mind, you'll spend less time heads-down and more time looking out the window to see and avoid other aircraft, terrain, and obstacles.



The four elements of the PAVE risk assessment checklist.

Identify a pre-planned diversion or suitable landing areas near or along your route. For example, check the charts for an alternate airport for every 25 to 30 nautical mile segment of your route.

Review VFR charts for minimum safe altitudes, obstacles, and terrain elevations to determine safe altitudes before your flight. Give yourself some breathing room. That means at least a mile from airspace and 2,000 feet vertically from terrain that you're trying to avoid. Use maximum elevation figures (MEF) to minimize chances of an inflight collision.

Expect the Unexpected

Always keep in mind that no flight is routine. Learn to expect the unexpected. You can't prepare for every eventuality, but you can take some positive steps to know in advance what you're capable of dealing with should you find yourself in an adverse situation.

Develop a set of personal minimums and tailor them to your current level of training, experience, currency, and proficiency. VFR weather minimums are a must, but it's also a good idea to have personal minimums for wind, turbulence, and operating conditions that involve things like high density altitude, challenging terrain, or short runways.

Never adjust personal minimums to a lower value for a specific flight. If you're comfortable flying in a 10 knot crosswind, don't push your limit to 15 knots just to satisfy disappointed passengers who may pressure you to complete the flight. Remember, PIC means pilot-in-command. It does NOT mean passenger-in-command.

Managing pressure is one of the most important steps in flight planning and CFIT avoidance because it's the one thing that can cause a pilot to ignore all the other risks. The key to managing pressure is to be ready for and accept delays. Have a backup plan B and maybe even a C to avoid the "I must get there" mentality — that determination to get to your destination at all costs, regardless of the risks that lie ahead. "Get-there-itis" has caused pilots to overfly en route fueling options, running short of fuel before reaching the destination. It clouds your judgement, and tempts you to continue a VFR flight into IMC.

Don't Mix VFR and IMC

Continued VFR into IMC is an ongoing threat to GA safety and is the deadliest CFIT accident precursor, proving fatal in most cases. Never continue a VFR flight into deteriorating visibility, especially if you are not instrument rated, current, and proficient.

Photo by Abigail Keenan.



If you're flying into a remote area or unfamiliar environment, use Google Earth for a sneak peek at where you're going and what type of terrain and obstacles you might encounter along the route. Use a flight simulation program or device to practice flying into the area. Many feature realistic graphics that offer a good picture of your destination.



See and avoid dangerous assumptions. Good visual meteorological conditions (VMC) on departure doesn't mean you'll see the same clear air at your destination. If you're already flying in marginal VFR weather conditions (MVFR), consider the likelihood of encountering IMC. Mother Nature is fickle. Weather is dynamic. Visibility can fall from unlimited to zero very quickly. Panel-mounted or handheld NEXRAD displays can be 15 to 20 minutes behind — or more. Give a wide berth to any weather you're trying to avoid.

Another tip for avoiding CFIT is to always remember the priorities: **Aviate, Navigate, Communicate**. Your first task is to fly the airplane, followed by navigating to avoid impacting terrain. Talk only when you've got the first two tasks under control.

Don't Put All Your Eggs in the Automation Basket

Pilots have access to more information in the cockpit than ever before, which probably contributes to the reduction in CFIT accidents over the last 20 years. Technology such as terrain awareness/warning systems, autopilots, ADS-B, and moving map displays all help to mitigate CFIT accidents. Problems can arise if you don't understand the technology, or if you try to use it beyond what it's designed to do. Get training on how they work, keep databases current, know how to interpret the information they provide, and understand how to detect equipment malfunctions.

If you fly with an autopilot, bear in mind that automation dependence can lead to complacency and degraded hand-flying competence and confidence. Strive to balance use of automation with hands-on flying to keep your flight control skills smart and effective.

Keep your skills sharp between flights too. Try making simulated flights over routes you intend to fly and consider a few what-if scenarios. *One caution: simulator flying is not adequate preparation for flights to challenging locations such as mountains, obstructed short runways, and high density altitude environments.* For those, consult a flight instructor who knows the area well.

Never continue a VFR flight into deteriorating visibility, especially if you are not instrument rated, current, or proficient.

Be Realistic About Aircraft Performance

You need to understand how aircraft performance is affected by density altitude, particularly in mountainous terrain. High density altitude, combined with a shorter or obstructed runway and aircraft at/near gross weight, has resulted in collisions with obstacles on takeoff. Carburetor or induction system ice can reduce climb performance with the same result. Tailwinds on approach or takeoff can also contribute to CFIT accidents.

Give Yourself Some Extra Altitude

Keep a close eye out for power lines and supporting structures during approach and landing. Not every tower is published on aeronautical charts, and many power lines are not marked or lighted. Wire strikes are common in agricultural operations, but more than half are not associated with aerial application flying. Most occur below 200 feet above ground level (AGL).

Give yourself some room and a little extra altitude. Even 500 feet will keep you above 90-percent of the wires. A lesson from the helicopter community is to fly overhead at a safe altitude and check the area for towers and hazards before descending to a lower altitude.

It Doesn't Have to Happen

A CFIT accident should never happen to any pilot, especially one who is maintaining visual contact with the terrain. Plan, prepare, and make smart decisions based solely on the safety of your flight.

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LEARN MORE

CFIT Brochure
bit.ly/CFITbrochure

FAA Safety Enhancement Topic: CFIT/Automation Overreliance
bit.ly/CFITAutomation

FAA Safety Enhancement Topic: Mountain Flying
bit.ly/2pu6UP8

FAA Safety Team Video: CFIT
[Youtu.be/yERx9Wx-itM](https://youtu.be/yERx9Wx-itM)

So Things Don't Go BUMP IN THE NIGHT

Avoiding Terrain While Flying Night VFR

By Paul Cianciolo

They had been flying for a half-hour when John Hicks noticed that the Cessna's airspeed had dipped, so he mentioned it to the flight instructor. His teacher, sitting next to him in the cramped cockpit, pushed in the throttle, accelerating the aircraft with such power that Hicks' head was rocked back. It was then that he lifted his eyes, peered out the windshield and saw what was directly before them in the darkness enveloping the George Washington National Forest: a mountain.

At more than 120 mph, the 2,500-pound plane sliced through a cluster of Appalachian hardwoods in a remote corner of northwestern Virginia. The tip of the left wing snapped off and the right wing struck a tree so hard that it streaked the trunk with red paint. Hicks heard metal rip, glass shatter, tree limbs break, the engine scream. And yet the Cessna 172, he realized, hadn't stopped moving."

This excerpt is from a 2016 narrative by John Woodrow Cox, an enterprise reporter at *The Washington Post*. It's an all-too-common example of controlled flight into terrain — or CFIT as we call it, which is third on the list of causal factors of general aviation fatal accidents.

The flight instructor in this story did not survive; the learner did. He was also my soon-to-be flight instructor, who was a friend and fellow auxiliary airman. Don't think this can't happen to you. With nearly 6,000 flight hours; an airline transport pilot certificate for airplane single-engine land, multiengine land, and helicopter ratings; a commercial pilot certificate for airplane single-engine sea, airplane multiengine sea, and glider ratings; a flight instructor certificate for airplane single-engine, multiengine, and instrument, and glider; and a first-class medical certificate, the instructor still missed something as large as a mountain while flying under visual flight rules (VFR) on a clear night.

The NTSB determined that the probable cause of this accident was "the flight instructor's decision to conduct a night training flight in mountainous terrain without conducting or allowing the student to conduct appropriate preflight planning and his lack of situational awareness of the surrounding terrain altitude, which resulted in controlled flight into terrain."

Off by 300 Feet

Most pilots involved in CFIT accidents are not instrument-rated, so we'll start by going back to basics. Avoiding terrain at night is easier if you use the altitudes shown on VFR charts as part of your preflight planning.

Review the maximum elevation figures (MEF) shown in quadrangles bounded by ticked lines of latitude and longitude and represented in thousands and hundreds of feet above mean sea level (MSL). MEFs are determined by rounding the highest known elevation in the quadrangle, including terrain and obstructions (trees, towers, antennas, etc.) up to the next 100 foot level. These altitudes are then adjusted upward between 100 to 300 feet. Pilots should be aware that while the MEF is based on the best information available, the figures are not verified by actual field surveys.



NTSB Photo.

If you need a refresher on chart symbology or the depiction of information and/or symbols on visual charting products, download the *FAA Aeronautical Chart Users' Guide* at bit.ly/FAAChartGuide.

In the case described earlier, the flight instructor, who was instrument rated, was conducting a demonstration of the autopilot with an altitude hold set for 3,000 feet. The airplane impacted the side of the mountain at 3,100 feet MSL, which was approximately 300 feet below the top of the ridgeline. A review of the intended flight path on the sectional chart would have provided a better baseline altitude for the autopilot hold.

Automation Bias

Another key precursor for CFIT is a pilot's overreliance on automation. This can lead to pilot complacency and degraded hand-flying competence and confidence. That's why this is a safety enhancement topic identified by the General Aviation Joint Steering Committee (GAJSC).

Automation is by no means a bad thing; today's autopilots with associated navigation equipment can greatly reduce cockpit workload and help pilots fly with greater precision

CFIT is a situation that occurs when a properly functioning aircraft is flown under the control of a qualified pilot into terrain (water or obstacles) with inadequate awareness on the part of the pilot of the impending collision.

and accuracy. However, you must be keenly aware of an automation system's capabilities and limitations. That means understanding when your system is operating normally, and when a failure requires you to step in and fly manually.

Many GA autopilots also lack the ability to integrate aircraft position and terrain information, which was part of the issue that led to the accident in the example. The aircraft that was originally scheduled for use in this training flight was equipped with a Garmin G1000 glass cockpit with terrain awareness capability. However, a last minute change in aircraft to an old-school cockpit eliminated the technology the instructor may have counted on using.

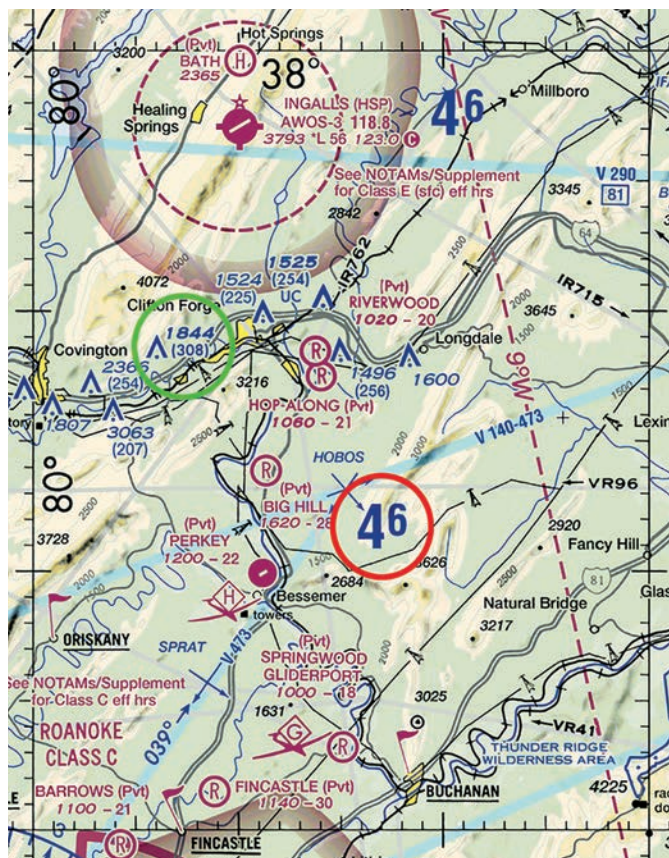
Transition training, also a safety enhancement topic identified by the GAJSC, is important whenever you're operating an unfamiliar aircraft or avionics system. This includes stepping from a glass cockpit with all the bells and whistles to traditional analog dials and gauges.

Perils of Perception

Another nighttime peril is vulnerability to any of the many kinds of illusions. Especially at night, the flight environment creates sensory conflicts that make it difficult to determine spatial orientation. Statistics show that approximately 10-percent of all GA accidents can be attributed to spatial disorientation.

Another illusion is the black hole effect, which occurs when you land from over water or non-lighted terrain and runway lights are the only source of light. Without peripheral visual cues to help, it is challenging to maintain orientation. Any downsloping or upsloping terrain will make the runway seem out of position. Bright runway and approach lighting systems with few lights illuminating the surrounding terrain may create the illusion of less distance to the runway. If you believe this illusion, you may lower the slope of your approach and impact terrain before reaching the runway.

You can prevent illusions of motion and position by maintaining a reliable visual reference to fixed points on the ground or, when the ground is not visible, to flight instruments. At night, your outside visual references on the ground may cause illusions when you see those references from different altitudes.



In this chart quadrant example, the maximum elevation figure (MEF) circled in red represents 4,600 feet above mean sea level (MSL). The obstacle circled in green represents a man-made obstruction 1,844 feet MSL and 308 feet above ground level (AGL). In extremely congested areas, the FAA typically omits the AGL values to avoid confusion.

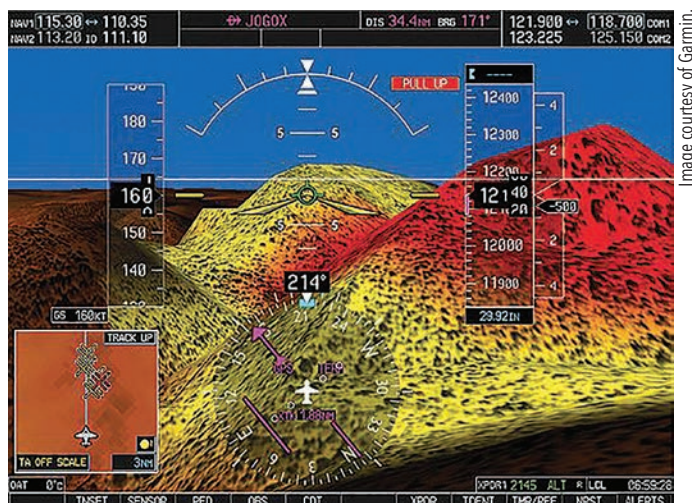
Tips for Avoiding CFIT

An NTSB safety alert about CFIT in visual conditions explains that nighttime visual flight operations are resulting in avoidable accidents. They give the following tips to avoid becoming involved in a similar accident:

- CFIT accidents are best avoided through proper pre-flight planning.
- Terrain familiarization is critical to safe visual operations at night. Use sectional charts or other topographic references to ensure that your altitude will safely clear terrain and obstructions all along your route.
- In remote areas, especially in overcast or moonless conditions, be aware that darkness may render visual avoidance of high terrain nearly impossible and that the absence of ground lights may result in loss of horizon reference.
- When planning a nighttime VFR flight, follow IFR practices such as climbing on a known safe course until well above surrounding terrain. Choose a cruising altitude that provides terrain separation similar to IFR flights (2,000 feet AGL in mountainous areas and 1,000 feet AGL in other areas).
- When receiving radar services, do not depend on air traffic controllers to warn you of terrain hazards. Although controllers will try to warn pilots if they notice a hazardous situation, they may not always be able to recognize that a particular VFR aircraft is dangerously close to terrain.
- When issued a heading along with an instruction to “maintain VFR,” be aware that the heading may not provide adequate terrain clearance. If you have any doubt about your ability to visually avoid terrain and obstacles, advise air traffic control (ATC) immediately and take action to reach a safe altitude if necessary.
- ATC radar software can provide limited prediction and warning of terrain hazards, but the warning system is configured to protect IFR flights and is normally suppressed for VFR aircraft. Controllers can activate the warning system for VFR flights upon pilot request, but it may produce numerous false alarms for aircraft operating below the minimum instrument altitude — especially in en route center airspace.
- For improved night vision, the FAA recommends the use of supplemental oxygen for flights above 5,000 feet.
- If you fly at night, especially in remote or unlit areas, consider whether a GPS-based terrain awareness unit would improve your safety of flight.

Hindsight is 20/20

One more fact about the accident described here is that there was a survivor. Survival itself is another safety



This synthetic vision view shows the terrain in 3D with red shading where the terrain is above the current altitude of the airplane and risk of impact is imminent. The yellow shading indicates a risk of collision. The use of enhanced vision systems is another safety enhancement topic identified by the GAJSC.

enhancement topic identified by the GAJSC. Every pilot needs to prepare for the unexpected.

Accidents can happen quickly so being prepared is key. Three factors will impact your ability to survive: knowledge, discipline, and planning. Don't panic. Calm, thoughtful action is what will help you survive the time until you're rescued. Most importantly, have the will to survive!

The survivor of this accident could not access a cell phone nor did he have a working handheld radio. Though the emergency locator beacon (ELT) was pinging, it was an older 121.5 MHz ELT. Aircraft reported hearing an automated distress tone just after sunset on a cold Saturday night, but nobody started looking until family members reported an overdue aircraft the next morning.

It is not required by regulation, but you still might consider upgrading to a 406 ELT for added safety and a quicker response time.

Paul Cianciolo is an associate editor and the social media lead for *FAA Safety Briefing*. He is a U.S. Air Force veteran, and an auxiliary airman with Civil Air Patrol.

LEARN MORE

NTSB Safety Alert – CFIT in Visual Conditions
[ntsb.gov/safety/safety-alerts/Documents/SA_013.pdf](https://www.ntsb.gov/safety/safety-alerts/Documents/SA_013.pdf)

FAA Advisory Circular 61-134, GA CFIT Awareness
[bit.ly/AC61-134](https://www.faa.gov/regulatory/policy/other/AC61-134)

For more about flying at night, check out our Nov/Dec 2015 N.I.G.H.T. issue of *FAA Safety Briefing*
[bit.ly/FAASB-Arc](https://www.faa.gov/publications/media/2015/11/20151101)

By Susan K. Parson

TRUST, BUT VERIFY

Take AIM to Avoid Terrain

You are an instrument-rated pilot, preparing to fly an instrument-equipped airplane on a day when instrument meteorological conditions (IMC) require the use of both. You are flying from a non-towered airport, and weather conditions won't allow departing under VFR. No problem. You find the right frequency or phone number and call clearance delivery. The controller rattles off a clearance in the familiar C-R-A-F-T (Clearance

Limit, Route, Altitude, Frequency, Transponder Code) format and you copy it down.

You note a couple of instructions that differ from the IFR clearance you would get at a towered airport. You know the "hold for release" drill, because of course you can't launch into IMC until air traffic control (ATC) ensures that you will have the required separation from other IFR traffic. The other phrase, issued just before the controller reads your route clearance, is "upon reaching controlled airspace"



Oh, Say Can You See?

Before you do anything else, you need to verify that you can depart the non-towered field and climb to the altitude where controlled airspace begins without hitting anything in your path. Hopefully you took that into account during preflight planning but avoiding a departure controlled flight into terrain (CFIT) accident requires one last review of your surroundings and your game plan. When I lived on the East Coast, I sometimes flew to a non-towered airport in the North Carolina foothills. The typical first fix in an IFR clearance was to a VOR that sat atop a nearby mountain. It was on me, as pilot in command, to avoid any terrain or other obstacles located along the immediate departure path. Depending on the runway in use and climb gradient, a simple straight-out departure to that mountain-top fix might not work out so well. So, what to do?

ODPs provide obstruction clearance via the least onerous route from the terminal area to the appropriate en route structure.

If Not, Use the ODP!

Here’s where having a solid command of the Aeronautical Information Manual’s (AIM) section on Instrument Departure Procedures (see AIM 5-2-9) is not just handy, but essential. Please read this entire section of the AIM carefully, but here are a few high points.

Departure Procedures (DPs) exist to provide obstacle clearance protection information to pilots. They come in two basic flavors. The one you might best remember is the

	Standard Instrument Departures (SIDs)	Obstacle Departure Procedures (ODPs)
ATC Clearance	ATC clearance must be received prior to flying a SID.	<i>Recommended</i> [emphasis added] for obstruction clearance; does not have to be requested or assigned and may be flown without ATC clearance. You might wish to include plans to use the ODP in flight plan remarks and/or advise ATC of your intent to use the ODP when obtaining clearance and/or IFR release.
Basic Purpose	SIDs are ATC procedures to provide obstruction clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement and to reduce pilot/controller workload.	ODPs provide obstruction clearance via the least onerous route from the terminal area to the appropriate en route structure.
Depiction	SIDs are always printed graphically.	ODPs can be textual or graphic. The procedure title for graphic ODPs includes (OBSTACLE). An ODP developed solely for obstacle avoidance has a “T” on IAP charts and DP charts for that airport.
Performance	All DPs assume normal aircraft performance.	
Required Obstacle Clearance	Unless specified otherwise, required obstacle clearance for DPs assumes: — Crossing the runway departure end at least 35 feet above the departure end of runway elevation. — Climbing to 400 feet above the departure end of runway elevation before making the initial turn. — Maintaining a minimum climb gradient of 200 feet per nautical mile (FPNM) until reaching minimum IFR altitude (MIA), unless a crossing restriction requires the pilot to level off.	
Vectors	If ATC vectors an aircraft off a previously assigned DP, ATC assumes responsibility for terrain and obstruction clearance (minimum 200 FPNM climb gradient is assumed).	

Table 1: Key differences between Standard Instrument Departures (SIDs) and Obstacle Departure Procedures (ODPs).



Standard Instrument Departure (SID), used at busier towered airports to increase efficiency and reduce communications needs and departure delays. While SIDs might have an obstacle clearance function, it is entirely possible for a SID to exist only for ATC purposes. Either way, ATC will explicitly include a SID as part of your clearance.

That's not the case for Obstacle Departure Procedures (ODPs), which are published for the purpose the very name expresses. There are several important things to know about ODPs, and it's no exaggeration to say that your safety and your life could depend on having that knowledge. Table 1 (derived from the text of AIM 5-2-9) is intended to help you see some of the key differences more clearly.

DPs of a Different Sort

The AIM section on DPs also includes information on DVAs — Diverse Vector Areas — and VCOAs (Visual Climb Over Airport). In brief, a DVA is an area in which ATC may provide random radar vectors during an uninterrupted climb from the departure runway until above the Minimum Vectoring Altitude or Minimum IFR Altitude (MIA). The DVA provides obstacle and terrain avoidance in lieu of using an ODP or SID.

A VCOA procedure is a departure option for an IFR aircraft to visually conduct climbing turns over the airport to the published “climb-to” altitude from which to proceed with the instrument portion of the departure. Pilots must advise ATC of the intent to fly the VCOA option prior to departure.

Careful planning is the key to avoiding CFIT during IFR flight, especially during IMC operations.

Don't Miss on the Missed Approach

The missed approach procedure (MAP) poses another CFIT hazard. It is one of the most challenging maneuvers a pilot can face, especially when operating alone (single pilot) in IMC. Safely executing the MAP requires a precise and disciplined transition that involves not only aeronautical knowledge and skill — the natural areas of focus in most training programs — but also a crucial psychological shift. There is little room for error on instrument missed approach procedures, and a pilot who hesitates due to deficits in procedural knowledge, aircraft control, or mindset can quickly become a CFIT statistic. Carefully study the MAP as part of your approach briefing, and don't deviate from the published altitudes and headings.

See the Big Picture

Careful planning is the key to avoiding CFIT during IFR flight, especially during IMC operations. Before you even get to the airplane, you need to: (1) identify terrain and obstacles on or in the vicinity of the departure airport; (2) determine whether an ODP is available; (3) determine whether obstacle avoidance can be maintained visually or if the ODP should be flown; (4) consider the effect of degraded climb performance and the actions to take in the event of an engine loss during the departure; and (5) check the Terminal Procedures Publication for Takeoff Obstacle Notes. You'll be glad you did.

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Original photo by Maj. Robert Bowden, CAP.

Advanced Tools for CFIT Avoidance

By James Williams

With great power comes great responsibility.” You’ve probably heard that aphorism a few times over the past couple decades. The rise of superhero movies and series reboots over that time have hammered that witty point home. The line also resonates well with pilots because it does capture a certain *raison d’être* of flying. In a way what we do have is a real world superpower. A century ago, it was the preserve of only the most daring people, and a few decades earlier than that, it was literally impossible.

As with any hero, there must be a rogue’s gallery. In this issue we focus on controlled flight into terrain (CFIT). CFIT is a dangerous villain because it strikes often, even as it seems so obviously avoidable. Other articles in this issue cover various methods of CFIT avoidance, but I’m here to talk about using great powers.

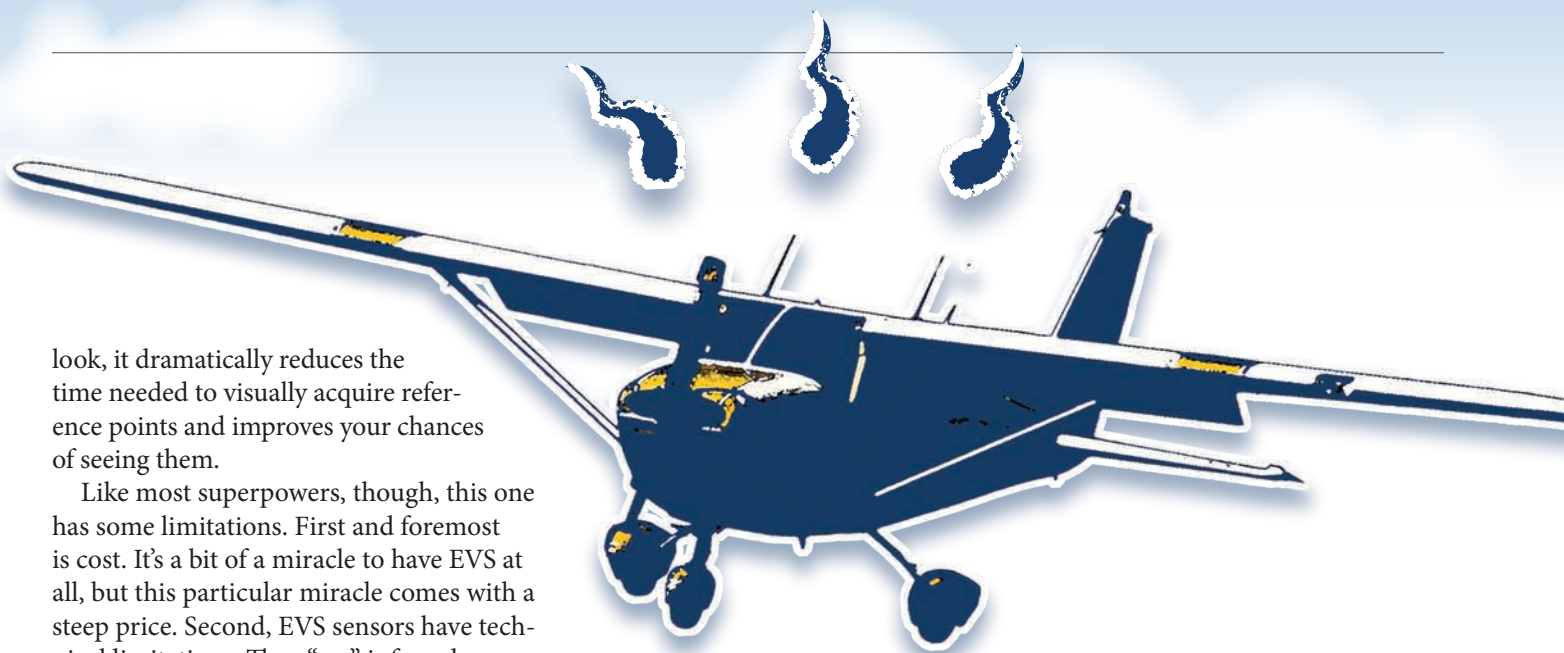


X-Ray Vision

Who wouldn’t want X-ray vision? When I started flying a little more than two decades ago, I would have called you crazy if you told me I could have such capabilities in a general aviation (GA) airplane. But enhanced vision systems and synthetic vision systems (EVS and SVS) have made good on that promise.

There are now a host of superpowers to avoid CFIT available to almost every GA pilot who wants them.

EVS uses sensors like infrared cameras to “see” in different ways to include in the dark and through most weather. So EVS can help you avoid CFIT both at night and in poor weather. You need to be aware that EVS is not an EFVS (enhanced flight vision system). EFVS has specific hardware and display requirements in addition to training and currency requirements. EFVS allows a pilot to use the display information to proceed on an approach beyond the minimums. An EVS system can only be used to get you to a point where you must be able to see the runway environment with your own eyes. EVS thus lets you position yourself for the best possible chance to make the landing. It will let you “see” where to look for reference points that can be seen with the EVS system, before they can be seen by your natural vision, in addition to keeping you aware of your general surroundings and possible obstacles. Think of it like a traffic callout that helps you spot another aircraft, whether from Automatic Dependent Surveillance-Broadcast (ADS-B) systems or from ATC. By telling you where to



look, it dramatically reduces the time needed to visually acquire reference points and improves your chances of seeing them.

Like most superpowers, though, this one has some limitations. First and foremost is cost. It's a bit of a miracle to have EVS at all, but this particular miracle comes with a steep price. Second, EVS sensors have technical limitations. They "see" infrared wavelength which means they struggle to detect things like the LED lights that are becoming more popular on airports due to their high performance and improved efficiency. Part of that efficiency improvement is from dramatically reducing wasted heat energy as seen with other lighting forms. The problem for EVS is that waste energy is what the sensor "sees." Some EVSs include multiple sensors that can detect LEDs, but this adaptation adds cost and complexity.

If your budget or hardware appetite doesn't allow for EVS, there is another option: synthetic visions systems (SVS). SVS produce a similar end product — a depiction of the outside world sans weather and darkness — through an entirely different method. The synergy of highly accurate position detection, with high quality geographic data and increasingly common display screens, allows for the world to be "reverse engineered" around you by knowing exactly where you are and what geography and obstacles are in that area. This allows the SVS to "draw" a picture of the outside world regardless of conditions. In that way, it can have an advantage over the vision capability in some EVS, since those can be degraded in specific circumstances.

SVS can also be added to some avionics suites with far less expense and modification to the aircraft if you already have a compatible display and position information source. In fact, some manufacturers were able to add this function to existing devices in the aftermarket.

But as with EVS, SVS does have its limitations. Most critical is that what you see on the display is only as good as your position source and your database. Also, since SVS is showing you what *should* be there rather than what *is* there, it can't display things like traffic, vehicles, or wildlife on the runway. So SVS should be used somewhat more strategically than EVS. SVS does allow for a major step forward in terms of CFIT avoidance that is much more accessible than an EVS, even if it isn't quite as powerful.

Spidey Sense

While it doesn't get as much attention in the most modern interpretations, your friendly neighborhood wall-crawler and web-spinner was known to be able to detect immediate danger headed his way. This spidey sense, as it was termed, probably could be handy in an airplane. The same tools that help make SVS a reality can also provide extra terrain awareness and warnings. The concept has been around for a while in the form of Terrain Awareness Warning Systems (TAWS). TAWS, and its predecessor, the Ground Proximity Warning System (GPWS), were developed specifically to combat CFIT accidents in the air carrier world.

Early systems relied on radar-like sensors to detect ground and later used highly detailed terrain databases. These systems provided more warning time to the crew; they have thus been required in the air carrier world for decades. The rise of GPS as the staple navigation aid in GA, along with copious storage, meant that all the pieces were in place to make this superpower available to GA. These systems use the precise GPS location information combined with highly accurate terrain and obstacle databases and can provide aural and visual warning of impending danger depending on aircraft equipment configuration.

In the generic sense, TAWS capability is available from many avionics systems with the required components. Some systems can even be optioned with officially sanctioned TAWS. The difference between TAWS and the more generic systems is similar to that between EVS and EFVS. The certified TAWS system has to meet specific regulatory requirements in terms of equipment, installation, and database fidelity while the generic does not. The generic terrain systems can offer significant assistance to a pilot but do not



meet the technical requirements of a certified TAWS. For the average GA user, though, even the basic terrain/obstacle avoidance technology is a huge win.

Just Another Rather Very Intelligent Assistant



No doubt you've seen movies featuring Robert Downey Jr. as Iron-man, rapidly issuing commands to his AI assistant, Jarvis (an acronym for Just Another Rather Very Intelligent System), or later Friday, and thought it sure would be nice to have an assistant like that on my flights. Well, you might soon be in luck.

Like the competition for super-capable AI assistants in smartphones and home assistants, this idea is also gaining steam in the GA world. Research by the MITRE Corporation led to a software system called digital copilot, created to run on tablet type devices, which will give the pilot timely information and alerts. It works by monitoring a large set of aviation databases and flight progress. According to MITRE, "This prototype technology may be applied to airspace awareness, clearance conformance, approach briefing automation, surface safety, holding pattern depiction and traffic pattern entry, and other tasks." MITRE's goal wasn't to bring an actual product to market, but rather to prove the concept and let others develop the idea.

That's what has happened. Apps like ForeFlight and Garmin Pilot have added functionality to adopt some of the digital copilot concepts. These apps can do things like assist with preflight briefings and flight plans, provide notification of changing conditions on your route of flight,

and pull up geographically relevant charts and procedures. As you would expect, there are differences between each implementation and some will be of greater benefit than others. All will improve over time as more experience leads to better systems. But the goal is clear: shift workload from the pilot to the digital copilot and provide another set of eyes to alert the pilot to potential problems.

Super Powers in Your Pocket

So you're probably wondering where this leaves you if you don't own or have a say in your airplane's equipment. I have good news: you're not left powerless. Some of the shiny new superpowers are available in portable devices. When combined with a portable ADS-B receiver/AHRS (Attitude and Heading Reference System) they can offer amazing capability. Some concepts like the digital copilot are designed for such devices while others can be adapted. In fact, with the addition of ADS-B/AHRS units, or if your aircraft has a compatible system, you can gain terrain/obstacle awareness and warnings and even SVS.

Great powers come with great responsibility.

Yes, there are limitations. Much depends on the devices you have and how they play together. Not all providers offer their product on all mobile platforms. As with anything at the intersection of technology and aviation, you need to know before you go — check what works before relying on any of these superpowers.

You also need to consider inflight power usage. If the aircraft you are flying doesn't have a way to provide continuous charging, it's a good idea to have an alternative power



Photo courtesy of Avidyne.

source. Keeping the screen on, particularly at higher brightness settings, can drain the battery pretty quickly. The last thing you want is to line up for an approach and watch the approach plate disappear because your battery just died.

Some of the shiny new superpowers are available in portable devices.

Notwithstanding the limitations, the portable revolution gives you a great set of tools for avoiding CFIT — tools that were unimaginable not so long ago. Most of these apps will allow free download at least for trial purposes. If you're starting from scratch, make sure you have compatibility with all platforms and accessories you intend to use.

Check with friends and fellow pilots for advice on what to buy. You may be able to save a bit by opting for a slightly older model without sacrificing too much performance. You should also be sure to ask what accessories you will need. In terms of capability gained per dollar spent, these superpowers are some of the best deals in GA.

As stated earlier, great powers come with great responsibility. You have to know the limitations. Remember that most are for advisory use. It might be tempting to use that shiny new EVS to sneak below minimums on the approach. But that's where the responsibility comes in. Pushing these powers too far could put you in exactly the situation they were intended to avoid.

James Williams is *FAA Safety Briefing's* associate editor and photo editor. He is also a pilot and ground instructor.



Image courtesy of ForeFlight.

PILOTS



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Are We There Yet?

Exploring External Pressures

By Paul Cianciolo

Editor's Note: The following article appeared in the Jan/Feb 2017 issue of FAA Safety Briefing. After a comprehensive analysis of controlled flight into terrain (CFIT) accidents, the General Aviation Joint Steering Committee determined that "external pressure to complete a mission" was a key causal factor. Many of the concepts discussed in this article support these findings and mirror the underlying causes of CFIT accidents.

If you won't put up with a backseat driver, why would you be influenced by a backseat flyer? The external or social pressures associated with completing a flight have been associated with a number of general aviation (GA) accidents. There is almost always pressure on the pilot to launch, and pressure to continue. Even the drive to the airport can create pressure to avoid wasted time.

The "E" in PAVE

When you fly with non-pilot passengers, prepare yourself. They may not say it, but they are thinking it. *Are we there yet? Are we there yet? Are we there yet?* If you just rolled your eyes at those words, you were affected by the "E" in PAVE (the risk assessment checklist of *Pilot, Aircraft, Environment, and External Pressures*). The "E" here is the external pressure of "get-there-itis" — or "get-home-itis" depending on the destination.

"Simply put, get-there-itis is a pilot killer," observes Allan Kash, an aviation safety inspector (ASI) in the FAA's General Aviation and Commercial Division. "It's a classic behavioral trap, which is an accident-inducing, operational pitfall a pilot may encounter as a result of poor decision making." (For more about this topic, check out "Get-Home-Itis" in the March/April 2013 issue of this magazine.) Get-there-itis is often a result of the influence of your passengers. They tend not to understand the intricacies of GA flying.

"The biggest external pressures that I've experienced are non-pilot passengers," notes Kevin Clover, an ASI and the FAA's national FAA Safety Team (FAASTeam) operations lead. "Their general expectation is that an airplane ride is going to go like a car ride. They can become irritated and even bored by all the things that have to be done or considered to get the airplane in the air."

What else is one to do without cell service or WiFi, right? Some people can't handle the pressure of being away from their internet connection, and that pressure can migrate to an unwary pilot. This doesn't just apply to kids or spouses either. High-powered business types used to making decisions and taking risks can create a pressure on the pilot to complete the flight. "When you tell them there is a safety issue, they still want to make the decision to go," explains Clover, who is a former part 135 charter pilot. "They can't seem to separate making a business decision



that involves the loss of money to that of a flight decision that could involve the loss of life.”

You’re the pilot-in-command, so the responsibility of a safe flight rests with you, not your passengers. Motivation to meet a set schedule not under the pilot’s control will cause pressure on the pilot, even if flying solo. Significant family events like family reunions, weddings, funerals, graduations, athletic events, connecting travel arrangements, and vacations can cause the perfect internal storm that pushes you out of your comfort zone. “In this scenario, pilots can be compelled to take unnecessary flight risks when making the go, no-go, decision for that particular flight,” states Marcel Bernard, an ASI and FAA aviation training device national program manager. “An example would be departing on a flight in marginal, or forecast marginal weather conditions when they would otherwise not go.” Bernard has personally experienced pressure from his family (passengers) to get home during a trip. “I resisted and found a hotel room for the night. Making the no-go decision was the right thing to do.”

Mission Mentality

With family it can be easier to say “it’s a no-go” because it’s not your job to get to the destination. Your job is to keep your family safe. However, helicopter emergency medical service (HEMS) pilots have a unique external pressure due to the critical nature of their overall operation. The pilot is driven by the goal — to get a critically ill patient to the hospital. In order to reduce the effect of this pressure, HEMS operators do not notify the pilot of the patient’s condition. This narrows the pilot’s decision making role to one ques-

tion: “Can the pickup and transportation to the medical care center be made safely?” Risking the life of the entire HEMS aircrew in an attempt to save one life is not a safe practice.

If you have made the technology leap and are using a new *skysharing* app to legally rideshare in the skies, you have another external pressure to think about. The goal here is to complete the flight to make money, which is why a commercial pilot certificate is required. It provides an added level of safety to counter external pressures among other things. (*For more about this topic, check out the article “Can I Air-Share with My Airplane?” at bit.ly/3hYyX57.*)

Flying for nonprofits can also influence your risk-based decision making. Flying to save a dog, transport a veteran, or search for a missing person puts the pilot in a mission-first mentality. Civil Air Patrol (CAP) has recognized this risk to pilots, which is why the organization requires the completion of an “Operational Risk Management Matrix” worksheet before every mission flight. This paper-based flight risk analysis tool, or FRAT worksheet, assigns a point value for each hazard that corresponds to its risk factor. A low risk flight has a worksheet total of 75 points or less. As the risk value increases, the flight can be released only by a higher-level officer in the chain-of-command, which is a valuable control to prevent accidents. The CAP worksheet doesn’t strictly follow the PAVE checklist — the external pressures are the *Mission* broken down into two hazards.

1. Operations Tempo: The more aircraft involved, the greater the chance for collision.
2. Search Complexity: High workload caused by unfamiliar tasks can add to distractions.

More than four aircraft in the search area is considered high risk and carries a 20-point value. The combination of complex tasks for the aircrew to perform and the use of technology not routinely used by the aircrew is also considered high risk, and similarly carries a 20-point value. If everything else on the worksheet is low risk and these two high risk items are at 40 points, the flight is still within the low risk threshold of 75 points.

If you won't put up with a backseat driver, why would you be influenced by a backseat flyer? The external or social pressures associated with completing a flight have been associated with a number of GA accidents.

Pressure Popping Principles

Now that you understand what can cause external pressures and influence a pilot's decision making skills, let's look at how to mitigate those risks. The use of personal standard operating procedures (SOPs) is a way to manage it whereas a FRAT worksheet helps you make the go, no-go decision. According to the FAA's *Risk Management Handbook* (bit.ly/2kuuDSn), the goal with an SOP is to supply a release for the external pressures with procedures that can include, but are not limited to the following:

- Allow time on a trip for an extra fuel stop or to make an unexpected landing because of weather.
- Have alternate plans for a late arrival or make backup airline reservations for the must-be-there trips.
- For really important trips, plan to leave early enough so that there would still be time to drive to the destination.
- Advise those who are waiting at the destination that the arrival may be delayed. Know how to notify them when delays are encountered.
- Manage passenger expectations. Ensure passengers know that they might not arrive on a firm schedule, and if they must arrive by a certain time, they should make alternate plans.
- Eliminate pressure to return home, even on a casual day flight, by carrying a small overnight kit containing prescriptions, contact lens solutions, toiletries, or other necessities on every flight.

The key to managing external pressure is to be ready to accept delays. As Bernard puts it: "What good is it if you die trying to get there?" Clover notes that the "key is to reset your passengers' expectations early." Let them know



it will take some time to get the preflight done. Let them know that you may not get to your intended destination today if the weather changes. "I mitigate the pressure from my family and friends through education," explains Bernard. "I explain the limitations of flights accomplished in GA aircraft in advance. — *I'm not the airlines, and the aircraft I fly have significant limitations compared to the major air carriers using turbojet aircraft.* — By educating potential passengers in advance, much of the pressure disappears."

Above all, remember this: management of external pressure is the single most important key to risk management, because it is the one risk factor that can cause a pilot to ignore all others. It places time-related pressure on the pilot and figures into a majority of loss of control accidents, especially on base to final. So manage your "E" before you take off.

Paul Cianciolo is an associate editor and the social media lead for *FAA Safety Briefing*. He is a U.S. Air Force veteran, and an auxiliary airman with Civil Air Patrol.

LEARN MORE

"Your Safety Reserve" – FAA Safety Briefing, Mar/Apr 2015
bit.ly/FAASB-Arc

"Voice of Reason" – FAA Safety Briefing, Jul/Aug 2014
bit.ly/FAASB-Arc



(DON'T) HIT THE DIRT!

Tips for Terrain Avoidance

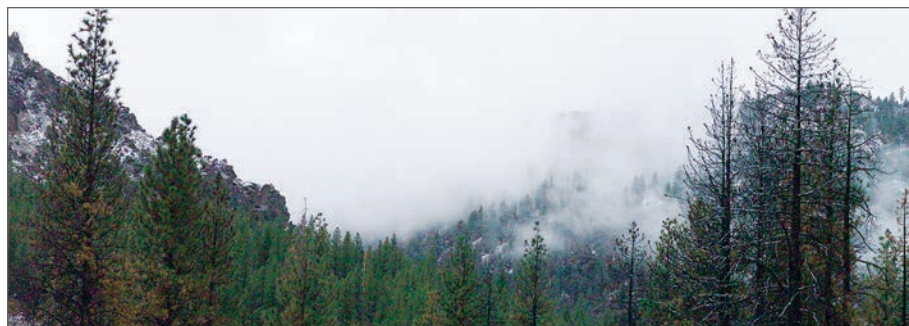
Let's face it. Some kinds of accidents are just more baffling than others. Many — maybe all — of us are tempted to spout the usual “I-would-never-do-that!” mantra when we hear about pilot-induced mishaps. In the privacy of our own thoughts, though, we can sorta kinda understand how stuff happens when pilots press their luck a little too far with, say, fuel. But it's a lot harder to understand controlled flight into terrain (CFIT) accidents, because the idea of flying an aircraft that is under your control into terrain is unfathomable. Even so, it keeps happening, possibly because we don't know enough to recognize the danger signs soon enough to stay out of the trees.

To that end, both the FAA and the aviation community have developed a number of resources to help fill any gaps in your knowledge of common CFIT causes and how to avoid them.

See the AC

One readily available resource is the FAA's Advisory Circular (AC) 61-134, *General Aviation Controlled Flight into Terrain Awareness*. Don't let the 2003 issuance date lead you into thinking it's out of date — sadly, things haven't changed enough to merit its withdrawal. This particular AC identifies some of the risks associated with general aviation (GA) CFIT accidents, and provides recommendations and strategies to combat the scourge of CFIT in GA.

Here's a preview. The AC looks at GA CFIT in terms of three broad categories. One focuses on VFR pilots without an instrument rating who operate in marginal VFR weather conditions (MVFR), visual meteorological conditions (VMC), and what is known as “scud running” in



instrument meteorological conditions (IMC). The second category looks at GA IFR operations in IMC conditions on an IFR flight. The third category addresses low-flying aircraft operating in VMC. A common thread is the idea that the pilot is always responsible for ensuring that he or she is well trained, qualified for the intended flight, in compliance with all regulatory requirements for the flight, and has the self-discipline to follow safety procedures that can minimize CFIT type accidents.

The AC also has a list of safety recommendations keyed to the types of operation described above, some of which apply directly to pilots and others that are broader cultural changes that we as a community still need to make. Being a fan of checklists, I especially like the way the AC includes a copy of the Flight Safety Foundation's (FSF) CFIT risk-assessment safety tool.

While some of its material is directed to corporate or crewed operations, the basic concepts are both scalable and applicable to individual GA pilots. Part I, CFIT Risk Assessment, is about calculating the level of CFIT risk for each flight, sector, or leg. Part II looks at CFIT Risk-Reduction Factors, Company Culture, Flight Standards, Hazard Awareness and Training, and Aircraft Equipment

Factors. In Part III: Your CFIT Risk, you combine the totals and determine your CFIT Risk Score.

Take Ten (or Just Nine ...)

There is no shortage of YouTube videos on a variety of aviation safety topics, including CFIT avoidance. The FAA's 2016 offering, “CFIT — What More Can We Do?” — takes just under nine minutes to watch. Once you are in YouTube's CFIT search neighborhood, you're likely to find plenty of others to watch as well. Set in Alaska, the FAA video features some fabulous scenery — the kind best viewed from a safe altitude. Check it out and do your part to make CFIT accidents a relic.

Susan K. Parson (susan.parson@faa.gov) is editor of *FAA Safety Briefing* and a Special Assistant in the FAA's Flight Standards Service. She is a general aviation pilot and flight instructor.

LEARN MORE

Advisory Circular 61-134, GA CFIT Awareness
[bit.ly/AC61-134](https://www.faa.gov/regulatory/policy/rulings/61-134)

CFIT Video – What More Can We Do?
[Youtu.be/JBxg6hgbAr8](https://www.youtube.com/watch?v=JBxg6hgbAr8)

CFIT/Automation Overreliance
[bit.ly/CFITAutomation](https://www.faa.gov/regulatory/policy/rulings/CFITAutomation)

MOTION PARALLAX EFFECTS IN UAS AERIAL VIDEOGRAPHY

Controlled flight into terrain (CFIT), trees, or towers is a prime concern of mine every time I fly. I fly a three-pound quadcopter to take aerial images at low altitudes and there are so many obstacles to avoid.

Before takeoff, I consider distance estimation and depth perception factors to avoid a CFIT. The FAA's *Pilot's Handbook of Aeronautical Knowledge* (PHAK) explains these factors and identifies them as both monocular and binocular in nature.

Monocular cues include motion parallax, geometric perspective, and aerial perspective. Binocular cues are dependent upon the viewing angle difference between each eye to the object. These visual illusions can be dreadful for flying; however, they are very useful for composing aerial images.

PHAK defines various monocular cues and explains that motion parallax is an *"apparent motion of stationary objects as viewed by an observer moving across the landscape."* For example, take driving on the highway — when you look out the window, fences and electrical poles close to the road zoom past, while trees in the distance appear to move at a slower rate. The PHAK further explains that geometric perspective occurs when an object appears to have a different shape when viewed from varying perspectives and distances. It also states that aerial perspective refers to the effect the atmosphere has on the appearance of an object when viewed from a distance; the object has fewer details and its color will become less saturated with blue tones (at daylight) or red/orange tones (during the golden hour).

To prevent CFIT, I take several steps before liftoff to counteract monocular cues, in addition to using the quad-



©2020 JW Reinhardt

copter's obstacle avoidance system. The first step is to plan the operation to determine the operation's objective, airspace, weather, and flight path. Second, I conduct a site survey to identify ground and air risks. Third, I establish a geo-fence and an altitude hard deck that clears all obstacles. I fly low and slow (or hover) to frame and compose the image, adjust camera settings, and track the subject. Flying within visual line of sight, I use the quadcopter's camera to view a different perspective and ensure I'm clear of any obstacles.

To exploit monocular cues in the digital images, especially the motion parallax effect, I use the camera's settings and design specific flight sequences. It is extremely rewarding to capture images that show these effects. To record video showcasing the parallax effect, I fly the quadcopter using two different flight sequences:

1. For the first sequence, I fly really low on top of the ground or water and rapidly move forward toward the skyline. The video captured in this sequence shows the foreground moving faster than the skyline.
2. The second sequence uses the quadcopter's ActiveTrack function

and is flown laterally. This captures the parallax effect — trees or other static structures in the foreground — that presents the motion difference between the foreground and the skyline. As the quadcopter flies laterally, it also yaws to maintain focus on a tagged object in the skyline. The video captured in this sequence will show the foreground moving faster than the background with a slight yaw.

The other visual cues can also be exploited using frame composition and camera settings to create interesting aerial images.

Understanding both of these concepts will allow you, as a UAS pilot videographer, to better frame the images you desire while maintaining the highest level of safety. Learning to use monocular cues while flying drones can save costs and may inspire you to use different approaches to videography, creating more interesting images.

John Reinhardt is a program manager in the UAS Integration Office's Operational Program Branch. He currently manages the FAA's UAS Test Sites Program.



SAFETY WIRE ... IT CAN SAVE YOUR LIFE

Photo by James Lewis.



Loose hardware or components have led to accidents, many of them fatal. Properly secure aircraft components with safety wire, ensure that hardware locking mechanisms are correctly installed on your aircraft, and check them often to confirm they are taut and ready for flight.

Fasteners, Wires, and Fast Facts

Safety wiring, or positive wire locking, is a type of locking device used to secure (“safety”) cap screws, nuts, bolt heads, and turnbuckle barrels, which cannot be safetied by any other practical means. Safety wire is necessary in areas where vibration could loosen a bolt. Any tendency of the hardware to loosen is counteracted by the tightening of the wire. Used properly, it will lock so that the wire remains taut and prevents further movement.

Keep it Locked

While there are several methods of safetying aircraft parts, two other basic methods include cotter pins and self-locking nuts.

- Cotter pins: used for securing bolts, screws, nuts, and pins on aircraft

and engine controls, landing gear, and tailwheel assemblies, or any other point where a turning or actuating movement takes place. They should not be re-used.

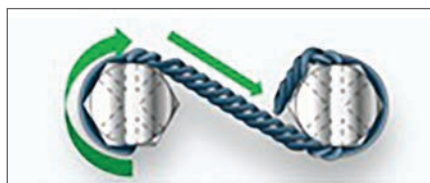
- Self-locking nuts: a type of nut that resists loosening when exposed to vibrations and torque, used in applications where they will not be removed often. Replace them when they’re no longer maintaining minimum prevailing torque, since repeated removal and installation will cause the self-locking nut to lose its locking feature.

Tips to Keep Things Tight:

- If there is a hole in a bolt ... it likely requires a cotter pin or safety wire in it. Be sure to ask.



- When installing or inspecting safety wire, ask yourself, does it pass the “Righty-Tighty” test (i.e., ensure that the safety wire is applied so that it is in tension in the tightening direction — the direction that would cause the bolt to “Tighty”).



Here the bolt tightens to the right. If one bolt tries to loosen through vibration, it will tighten the other bolt and vice versa.

- Safety wire should be tight and maintain a light tension when secured. You should notice about six to eight twists per inch with a good safety wire job. Safety wire is not intended to take the place of the proper installation of fasteners. Always make sure that the fasteners or components are tightened to the proper torque first, then install the safety wire. Always remove all old safety wire before installing new.
- When inspecting fiber or nylon locknuts, make sure the bolt or stud extends at least the full round or chamfer through the nut. Flat end bolts, studs, or screws should extend at least 1/32 inch (or 1 and 1/2 threads) through the nut.
- Castle nuts require a cotter pin or safety wire to lock them down. Turnbuckles should either have safety clips or safety wire.

If you’re doing owner-performed maintenance, make sure that you know what you’re doing, and get a second set of eyes to look at your work after you’re done. If you have any doubts, ask your mechanic, get some advice from your Experimental Aircraft Association (EAA) Chapter, or talk to your local FAA Flight Standards District Office inspectors — they are more than willing to help.

There are many other parts that require safety wire or other means of locking. **FAA Advisory Circular AC 43.13-1B** outlines the various locking methods and the proper safety wiring procedures.

Jennifer Caron is FAA Safety Briefing's copy editor and quality assurance lead. She is a certified technical writer-editor in the FAA's Flight Standards Service.

SEEING FIT TO END CFIT

After reconvening in 2011, the General Aviation Joint Steering Committee (GAJSC) set its sights on ways to more effectively address the leading causes of general aviation (GA) accidents. After analyzing accident data on several hundred accidents and ranking the resulting causal factors, the GAJSC formed working groups to tackle these leading issues one by one. First up were loss of control working groups (WG) for takeoff and landing and maneuvering, followed by the system component failure — powerplant group.

Controlled flight into terrain (CFIT) was next with a 20-plus government/industry member WG convening in 2017. In line with a set of tried-and-true methods and practices employed with the previous WGs, the CFIT group pored over a set of CFIT accidents from 2008-2018 in search of ways to prevent reoccurrences. They operated by scoring a set of intervention strategies derived from the data and deemed to have broad-based applicability. After a final consensus, the CFIT WG issued these strategies in the form of Safety Enhancements (SEs). SEs are essentially plans containing one or more intervention strategies to prevent or mitigate a problem associated with the cause of an accident. Although the initial SE list was much larger, the following seven SEs have been approved and are currently being implemented. Expect to see and hear more about these topics (and possible additions) in the near future.

Safety Enhancement 12: *Weather Technology*

This safety enhancement investigates and deploys cost-effective technologies that can provide real-time weather information (including

actual conditions as viewed through a remote camera) at airports, similar to what is being done in other parts of the United States, such as Alaska. *Note: The FAA recently announced an effort underway in Colorado where weather cameras were installed at 13 locations with additional sites under consideration. Additionally, there are plans to install 23 new camera facilities in Hawaii beginning in late 2020.*

Safety Enhancement 51: *Augmented Visual Technology for GA*

Encourage GA pilots and operators to equip and utilize Enhanced Vision System (EVS) / Synthetic Vision System (SVS) technology to enhance situational awareness with respect to surrounding terrain.

Safety Enhancement 52: *WINGS Program Overhaul*

FAA to overhaul and develop a plan for continual improvement of the FAA Pilot Proficiency Program (WINGS) to make it more user-friendly and dynamic. In addition, the WG recommends reviewing/updating the program's training content to ensure it is all up to date and includes CFIT-specific information from the CFIT WG's efforts. *Note: The FAA Safety Team has already convened a WINGS enhancement committee and is looking to integrate changes in 2021 in concert with the ongoing FAASafety.gov overhaul.*

Safety Enhancement 53: *Pressure to Complete a Mission*

To identify opportunities for improving awareness of the need to mitigate mission completion pressure on piloting, including sources and types of pressures, and the impact on decision-making. The SE recommends conducting a

review of existing measures intended to address pressure to complete a flight, and identifying new opportunities for improved education and outreach to the flying community on the importance of managing pressure.

Safety Enhancement 54: *Terrain Awareness Warning Systems (TAWS) for GA, Addressing Time-Limited Inhibit, and Future Auto Ground Collision Avoidance*

Improve TAWS capabilities and algorithms to better protect pilots operating in areas with challenging terrain, and develop additional safety protections to prevent the permanent inhibition of nuisance TAWS alerts during a terrain-critical flight.

Safety Enhancement 56: *UIMC Escape Response*

Review data on unintended flight into IMC (UIMC) escape to understand if better training on UIMC escape maneuvers and situational awareness is needed to reduce CFIT and loss of control accidents that result from UIMC.

Safety Enhancement 58: *Approach Guidance in Night/Mountainous VFR*

To further prevent CFIT accidents, the FAA along with pilot organizations, flight instructor refresher course (FIRC) providers, and training providers should conduct an education campaign and/or develop learning modules educating the instrument-current pilot community of the safety benefits of backing up a nighttime VFR approach with lateral and vertical navigation guidance, particularly in mountainous terrain.

Tom Hoffman is the managing editor of *FAA Safety Briefing*. He is a commercial pilot and holds an A&P certificate.



THE INVISIBLE THREAT

Avoiding Wire Strikes in Rotorcraft Operations

A defining characteristic of helicopter operations is the distinct ability of rotorcraft to conduct a variety of low-level operations, and to perform unique and invaluable tasks that have become essential to our everyday lives — everything from lifesaving emergency medical response, to wildfire suppression, to electrical and gas utility support.

But as these types of helicopter operations have expanded, so have the number of wire strike accidents. Sadly, wire strikes remain one of the leading fatal accident causes in low-level helicopter operations. Many pilots mistakenly believe that just watching for wires will provide sufficient reaction time. Statistics show that all pilots flying low are susceptible to a strike, regardless of experience and ability. Several capable and experienced pilots who have survived a wire strike say the same things: “I just didn’t see it.” “The wires just appeared.” “There was no time to think or react.”

What and Where is the Wire Environment?

According to the U.S. Energy Information Administration, there are nearly 200,000 miles of high voltage transmission lines with literally millions of miles of low voltage distribution lines throughout the United States. Wire strike hazards can exist almost anywhere a flight profile demands operations below 500 feet above ground level. This environment has an inherent risk of wire strikes, and flight crews must be properly trained to assess the environment and verify the presence of wires without relying solely on “see and avoid,” since wires can be completely invisible in some weather or environmental conditions.



What is the Solution?

Power utilities have been expanding training programs to educate both pilots and utility crews in proper techniques to mitigate the risk of wire strikes. Modified low-level crew resource management (CRM) procedures, which incorporate linemen and patrol personnel into active crew roles and responsibilities, as well as enhanced pilot understanding of power line structures and hardware, have had a significant impact in reducing the number of wire strike incidents related to power line patrols. Achieving a broad reduction and/or elimination of wire strike incidents lies in training and education on what this hazard actually looks like, and in training pilots to include wire threat assessments in pre-operation planning. A proactive plan to use all available tools and follow proper communication and responsibility protocols is key.

Here are some tips on wire hazard mitigation:

- Avoid low-level flight whenever it is not essential to the operation.
- Become familiar with all known hazards in the operations area prior to low-level flight.
- Brief all crew and passengers to speak up and be specific if they see power lines, towers, or other obstacles.

- Look for all indicators of a power line (e.g., right of way clearing or support structures).
- Always cross transmission lines at the point of the supporting structure.
- Be prepared to climb out of the wire environment if any distraction or confusion occurs (e.g., irrelevant crew conversation, radio call, etc.).
- Assume that wires are always present in any unfamiliar operations area until proper high reconnaissance confirms otherwise.

Organizations exposed to low-level flight should consider an enhanced training program that provides specific tools and awareness of low-level hazards. Here are two examples:

- *Wire Environment Training* provides a basic knowledge of low-level CRM, utility rights of way, structures, and hardware that can provide early indicators on the possible presence of wires, as well as indicators on direction of the wire and other hazards.
- *Human Performance Improvement (HPI)* is essential training to help crews recognize personal biases that may interfere with effective CRM and risk assessment. This training also shows how human errors can occur and provides effective mitigation tools.

Ron Stewart is the director of helicopter operations at Wilson Construction Company and has been involved in helicopter utility operations for over 25 years.

LEARN MORE

Surviving the Wires Environment Video
[Youtu.be/9ccxc6S4aWI](https://youtu.be/9ccxc6S4aWI)



Here's an example of GA Safety Facebook Group members supporting and helping each other.

Check out our GA Safety Facebook page at [Facebook.com/groups/GASafety](https://www.facebook.com/groups/GASafety)

If you're not a member, we encourage you to join in on the discussions and post relevant GA content that makes the National Airspace System safer.

How Do You Maintain Your Pilot Skills?

This question was posted to our GA Safety Facebook page by Heather Metzler, FAA Safety Team Program Manager and WINGS Pro. Here are some of your replies.

By Using Them. Hopping into the aircraft and doing the flying to some extent is like riding a bike — it comes back quickly. The stuff leading up to flying, though, rusts much quicker. Continue preflight planning. Practice preparation for certain scenarios. Mix things up with different density altitudes, different payloads, flight planning over different terrain. Keep the mind sharp by continuously asking what's out there that could change your decision making regarding routes, alternates, and go/no-go decision making.

— TJ

Best way is to fly as frequently as time and money permits. Second best is to use a simple simulator at home (don't go crazy) to learn the

knobology. Finally, anytime the weather changes I "plan" for a couple trips from my home airport and test my decision making skills.

— Srinivas

Logon to [FAASafety.gov](https://www.faa.gov/safety) and enroll in WINGS Courses for pilots and the WINGS Pilot Proficiency Program.

— Paul

Here's the FAA Safety Team's response from Heather Metzler:

Very interesting and wide range of answers to what seems like a very simple question, when indeed it is an extremely important question when it comes to aviation safety. For me, I try to fly at least every quarter, which is not nearly enough to maintain proficiency, so I normally try to go with an instructor once a quarter and do a WINGS flight. If an instructor is not available (I fly a Champ most of the time and tailwheel instructors are in short supply at times) then I will go solo and practice. Please keep sharing. There have been some great ways to answer how you maintain your pilot skills, and you never know who you may help by sharing your techniques.

Roger That, Romeo

Your comms article, "The Sound of (Microphone) Music" in the Checklist department of the May/June 2020 issue (bit.ly/One-Two-TREE), was a great bit of history. Drives me crazy when I hear folks mess it up!!

— Skip

Thanks for the note and the feedback; glad you enjoyed the piece. It was fun to research and write. I chuckle to imagine how it would be if "Romeo" had been used in lieu of "Roger" in the early days; we might all be saying "Romeo" on the frequency for "received and understood."

M Here's some more feedback about NOTAMs from our new blog on Medium. Check it out at medium.com/FAA.

Thank you for the great information at bit.ly/yesNOTAM. I have wondered when the NOTAM system was going to change. When I was flying for the airlines, we would get 10 or 20 pages of NOTAMs for a one leg flight. Still that way now. Glad it's finally changing. Good article.

— Mark

The FAA is working towards producing a single, filterable, machine-readable, internet accessible NOTAM database so that pilots can prioritize critical safety information. We expect the new NOTAM system to be in place by 2022, but you won't have to wait until then to see a big difference. We're making incremental improvements right now. To learn more, check out the video of the Aeronautical Information Optimization Summit, Session 1: NOTAM modernization, on the FAA's YouTube channel at youtu.be/WJpLQPsRu8I.

CORRECTION: The Sep/Oct 2020 issue misidentified Danielle Corbett as the author of Drone Debrief, Data-Based Decision Making. In fact, that article was written by Alina George, Business and Planning Analyst in the FAA's UAS Integration Office.

Let us hear from you! Send your comments, suggestions, and questions to SafetyBriefing@faa.gov. You can also reach us on Twitter @FAASafetyBrief or on Facebook at [facebook.com/FAA](https://www.facebook.com/FAA). We may edit letters for style and/or length. Due to our publishing schedule, responses may not appear for several issues. While we do not print anonymous letters, we will withhold names or send personal replies upon request. If you have a concern with an immediate FAA operational issue, contact your local Flight Standards Office or air traffic facility.



AUTOMATION À LA MODE

Keeping “George” on Task and on Track

As you have read, the government/industry General Aviation Joint Steering Committee (GAJSC) established a working group to review controlled flight into terrain (CFIT) events, figure out why pilots keep driving perfectly good airplanes into the dirt, and suggest safety enhancements to prevent such accidents.

The group’s findings included many things you might expect, in the variety of conditions discussed in this issue’s feature articles. There were accidents arising from (sigh) continued VFR flight into instrument meteorological conditions (IMC), and from procedural mistakes in IFR flight (e.g., flight below minimum en route altitude, descent below MDA). There were incidents traced to unrealistic aircraft performance expectations (e.g., high density altitude, tailwinds on approach). There were wire strikes, and not just those involving rotorcraft or agricultural application operations. More than half of the wire strike CFIT events occurred in other kinds of flying — and they usually occurred in the neighborhood at or below 200 feet above ground level (AGL).

Staying in Pilot Mode

The GAJSC working group also found cases in which reliance on automation was a precursor to CFIT events. As we have previously explored in this magazine, technological advances offer an unprecedented level of situational awareness that can reduce CFIT accidents. Even if your aircraft panel still sports the classic “six pack” of round dials (also known to some as “steam gauges”), chances are good that you have some kind of portable gadget that can offer an impressive array of information about terrain and



Image courtesy of Garmin.

human-constructed obstacles. Many — including the kind I use myself — even offer verbal warnings about everything from entering the runway to airborne traffic and terrain. All you have to do is to pay enough attention to read (or hear) and heed your electronic helpers.

Too often, though, we humans let ourselves slide from the proper mode of alert Pilot-in-Command to the perilous demeanor of relaxed Passenger-in-Comfort. It is truly ironic that the advent of at-a-glance position awareness capability has sharply diminished the “where-am-I-now” discipline that was the hallmark of being in the loop. When you don’t have to put any mental effort into ascertaining positional awareness, it’s easy to stop paying attention, until (as the saying goes) the ground rises to smite you.

Who’s Minding the Store?

Loss of situational awareness can be especially prevalent when you have an autopilot (aka “George”) along to help. George can do a lot, and most autopilots manage basic flight functions better than most pilots do. For instance, most GA autopilots will easily hold heading and altitude. Many will also follow a desired navigation track. But since artificial intelligence hasn’t advanced enough to give autopilots the ability to think, these features have led to surprises when the pilot steps out of the loop. In terms of the

CFIT topic explored in this issue, it’s important for pilots to understand that many GA autopilots lack the ability to integrate aircraft position and terrain information. That means that it’s on the pilot to think that through and manage the automation so as to maintain adequate terrain and obstruction clearance. Avoiding this potential technology pitfall means finding ways to keep yourself continuously in the loop, and constantly aware of automation modes in use. Here are a few ways to accomplish this important goal:

- Use callouts to maintain positional awareness of position, course, and altitude.
- Verbally announce changes to heading, altitude, and frequency.
- Record changes in writing. The act of speaking and writing bolsters awareness.
- Verbally announce any change to navigation source and autopilot modes.
- Read each item on the autopilot status display aloud every time there is a change, stating which modes are armed and which modes are engaged.

Flying is all about being *in* the sky and looking *at* the ground. Let’s all do our part to stay in that mode and keep our electronic helpers in a mode to do their part as well.

CHAD BREWER

Operational Safety Analyst, FAA Integrated Safety Teams Branch

When he was a child, Chad Brewer



considered walking through the airport and getting to fly in an airplane for his family's annual trek to Daytona Beach, Fla., the best part of the vacation.

In high school, Chad had a physics teacher who loved to talk about aviation. That teacher was a former Air Force pilot who also taught an aviation course in school, which sparked Chad's interest in becoming a professional pilot. Chad went on to graduate from Embry-Riddle Aeronautical University — the other “best part” of Daytona Beach.

During his flight training, Chad was lucky enough to find a mentor through a family friend who happened to be the director of the FAA's Flight Standards Service. The mentor encouraged Chad to apply to the FAA after graduating, which he did. Now, Chad's passion for safety has a home in the Integrated Safety Teams Branch under the FAA's Office of Accident Investigation and Prevention.

Chad and his team provide technical expertise and input to government/industry collaborative efforts including the Commercial Aviation Safety Team (CAST), the General Aviation Joint Steering Committee (GAJSC), and the

Aviation Safety Information Analysis and Sharing (ASIAS) program. This job includes working with industry stakeholders like the Aircraft Owners and Pilots Association (AOPA), the National Business Aviation Association (NBAA), the Experimental Aircraft Association (EAA), and the General Aviation Manufacturer's Association (GAMA).

One of his team's accomplishments was achieving the GAJSC goal to reduce the general aviation (GA) fatal accident rate by 10-percent from 2009-2018. Another was surpassing the 100-mark of GA stakeholders providing voluntary flight-safety data into the ASIAS program, which has now amassed more than one million flight hours of recorded data.

Chad's branch, along with other FAA and industry experts, recently finished developing safety enhancements to prevent controlled flight into terrain (CFIT). These include augmented visual technology for GA pilots, steps to overhaul the FAA's WINGS Pilot Proficiency Program, awareness of pressure to complete the mission, improvements to terrain awareness and warning systems, and navigation guidance for nighttime VFR approach in mountainous terrain for instrument-current pilots.

Chad strongly encourages all pilots to take a CFIT-related course through FAASafety.gov or from the aviation community. It is critical to be familiar with the causes of unintended flight in Instrument Meteorological Conditions (IMC) and use best practices to mitigate the risk.

When it comes to challenges in information sharing and preventing accidents, Chad explains that the GA safety culture and myths surrounding flight data monitoring are on the top of his list.

“With a large number of GA pilots, their safety learning stops after they receive their airmen certificate — they don't attend safety webinars, work-

shops, or take advantage of the latest technology,” he said. “Many GA pilots also think that it is too costly or overly complicated to analyze their own flight data, when in fact the aviation industry has come a long way in making this accessible to everyone.”

Chad is excited to be a part of that solution and looks forward to new ways of sharing and leveraging data to benefit the aviation community.

Last but not least, Chad reminds pilots that if they witness or hear of a fellow pilot unintentionally behaving in a way that may put themselves in danger, they shouldn't be afraid to say something. Be an active safety mentor, and you could save a life.

Paul Ciano is an associate editor and the social media lead for *FAA Safety Briefing*. He is a U.S. Air Force veteran, and an auxiliary airman with Civil Air Patrol.





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