November/December 2019

FAA Safety BRIEFING

THREAT AND ERROR MANAGEMENT

Federal Aviation Administration

U.S. Department
of Transportation

**Federal Aviation
Administration**

ISSN: 1057-9648
FAA Safety Briefing
November/December 2019
Volume 59/Number 5

Published six times a year, *FAA Safety Briefing*, formerly *FAA Aviation News*, promotes aviation safety by discussing current technical, regulatory, and procedural aspects affecting the safe operation and maintenance of aircraft. Although based on current FAA policy and rule interpretations, all material is advisory or informational in nature and should not be construed to have regulatory effect. Certain details of accidents described herein may have been altered to protect the privacy of those involved.

The Office of Management and Budget has approved the use of public funds for printing *FAA Safety Briefing*.

ABOUT THIS ISSUE ...

The November/December 2019 issue of FAA Safety Briefing *focuses on the concept of resource management and error mitigation techniques in the aviation environment. Feature articles focus on threat and error management and highlight the importance of sound crew and single pilot resource management. We'll also look at ways flight data monitoring can help you steer clear of errors and learn from your mistakes.*

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The magazine is available on the internet at:
www.faa.gov/news/safety_briefing

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FAA Safety BRIEFING

The FAA safety policy voice of non-commercial general aviation

DEPARTMENTS

TO ERR IS HUMAN

In the last issue of *FAA Safety Briefing*, we focused on preventing aviation emergencies whenever possible and effectively handling those we couldn't — or didn't — manage to prevent. While mechanical failures do sometimes occur, advances in airframe, powerplant, and avionics technologies have substantially reduced the number of accidents attributable to the machine. The fact remains that human error is all too often either a primary cause or a strong contributing factor in GA accidents and incidents.

Past issues of this magazine have also explored human factors, risk management and, more recently, overall safety culture (July/August 2019). The development and evolution of these topics is a response to the simple truth: human beings make mistakes. We make them every day, and in every aspect of our personal and professional lives. Some are scarcely noticeable; others are painfully obvious. Still others — to include the human mistakes and errors that occur in the aviation context — can have dangerous, and sometimes deadly, consequences.

Never Waste a Mistake

For this reason, both the FAA and the aviation community are constantly looking for ways to eliminate these problems entirely wherever possible. That's the context for work that the FAA does in our CAST (Civil Aviation Safety Team) and GAJSC (General Aviation Joint Steering Committee) partnerships with the aviation community. It is also a fundamental premise of the FAA's Compliance Program, which recognizes that we should never "waste a mistake" by punishing people who are trying to comply with regulations and risk management principles. Rather, the Compliance Program seeks to enable both the FAA and the aviation community to use unintentional deviations to learn what went wrong, identify the root cause, and develop a sustainable fix that makes the entire National Airspace System (NAS) safer.

> **LIKE CRM, TEM HAS PLENTY OF RELEVANCE AND APPLICABILITY TO GA PILOTS AND MECHANICS.**

Manage to Mitigate

Recognizing, though, that human beings are fallible, and that mistakes and errors *will* occur, has led to a branch of research and practice that we'll broadly categorize as "management" since its products all include that word. You've probably heard of CRM, which started as "Cockpit Resource Management" but soon broadened into overall "Crew Resource Management." We'll take a closer look at CRM in this issue, because many of its principles and concepts are useful and applicable to GA pilots and mechanics.

I suspect you have also heard of SRM, which is a slightly awkward abbreviation for "Single Pilot Resource Management." While SRM shares many of the underlying ideas of CRM, both its name and its specific techniques have been adapted and optimized for use in the incredibly broad world of GA operations and airworthiness.

The term "TEM" — Threat and Error Management" — might be new to you. By some definitions, TEM is the latest and greatest iteration of CRM, but our lead article in this issue of *FAA Safety Briefing* makes the point that TEM is really a distinct complement to CRM. Like CRM, TEM originated in the air carrier world. But also like CRM, TEM has plenty of relevance and applicability to GA pilots and mechanics. It's a worthy addition to your safety toolbox.

As you read through TEM, CRM, and SRM, and other articles in this issue, I think you will find that several key ideas recur, either explicitly or implicitly. First is the importance of developing and maintaining situational awareness. It is sometimes said that 90 percent of life is about showing up; the rest is about paying attention. Situational awareness is precisely about paying attention, and the TEM/CRM/SRM disciplines provide tools to help you do that.

Second is the importance of teamwork. Even a single pilot is never truly alone. TEM/CRM/SRM all stress the importance of knowing that you always have a crew, and that effective teamwork is one of the keys to safety. Read on!

AVIATION NEWS ROUNDUP

Report All Wildlife Strikes

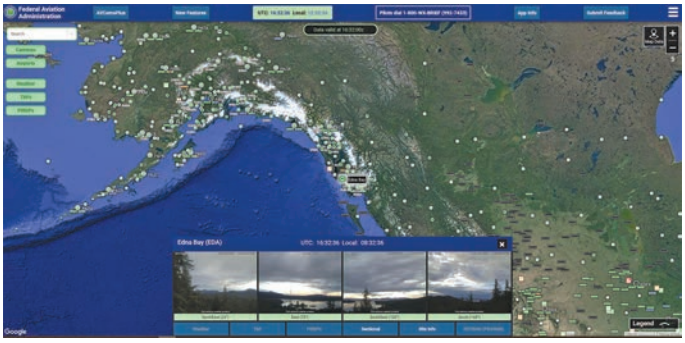
For more than two decades, the FAA and the U.S. Department of Agriculture have worked together to collect accurate data on wildlife strikes to better understand the scope and nature of the problem and build a foundation for management programs to mitigate risk. A major part of collecting the data is providing the general public with an easy way to submit strike reports in a consistent format.

The number of wildlife strikes reported per year to the FAA increased steadily from about 1,800 in 1990 to 16,000 in 2018. Expanding wildlife populations, increases in the number of aircraft movements, a trend toward faster and quieter aircraft, and outreach to the aviation community all have contributed to the observed increase in strike reports. As a result of the increase, there has been a greater emphasis on wildlife strike hazard research and airfield wildlife management.

If you experience a wildlife strike, please contribute to this effort by making a report at ***Wildlife.FAA.gov.***

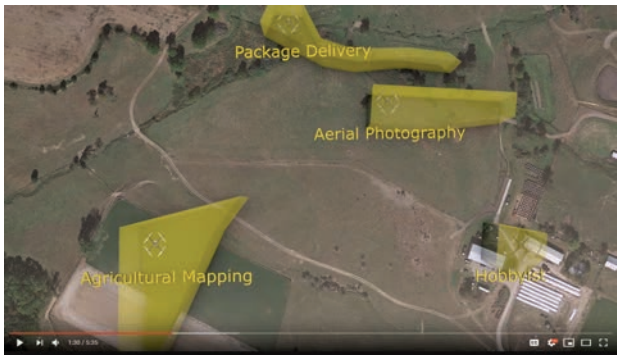
Flight Service Welcomes Aviation Weather Camera Program

The Aviation Weather Camera Program is increasingly popular in Alaska as a primary source for pilots to obtain preflight weather. The goal is to reduce weather-related aviation accidents and flight disruptions by making images available free to the public on the weather camera websites. The images allow pilots to see real-time weather between the point of departure and arrival at 230 locations throughout Alaska and 178 in Canada. The program recently moved to the FAA's Flight Service.



Weather cameras provide a means to look before you fly versus flying out to take a look, which gives pilots the data to make better decisions. Since the program began in 2007, there has been a reduction in the number of weather-related aviation accidents in Alaska. See ***AvCams.FAA.gov*** to view the camera network.

The weather cameras are considered advisory and the team is looking at ways to enhance the website to incorporate additional data and give a more comprehensive picture. The experimental enhanced website includes both official weather information such as Meteorological Aerodrome Reports (METARs) and Terminal Aerodrome Forecasts (TAFs), and advisory weather information that comes from sensors installed at various locations in Alaska. See ***AvCamsPlus.FAA.gov*** to see the new website.



The FAA, NASA, and industry partners successfully demonstrated how the Unmanned Traffic Management (UTM) system will help advance the safe integration of drones through the UTM Pilot Program (UPP). Watch the video here: youtu.be/zpc4aoJKefA.

Successful Demos of Drone Traffic Management Completed

The FAA, NASA, and their partners, in a pilot program that is laying the groundwork for an Unmanned Aircraft System (UAS) traffic management (UTM) system, successfully demonstrated over the summer how such a system can work in the future.

The demonstrations, conducted at three separate test sites selected by the FAA for the UTM Pilot Program (UPP), showed that multiple, beyond visual line of sight (BVLOS) drone operations can be safely conducted at low altitudes (below 400 feet) in airspace where FAA air traffic services are not provided.

As demand for low altitude drone use increases, the FAA, NASA and the UPP partners are working together to accommodate these operations safely and efficiently.

The UPP was established in April 2017 as an important component for identifying the initial set of industry and FAA capabilities required to support UTM operations. The results

from the UPP will provide a proof of concept for UTM capabilities currently in research and development, and will provide the basis for initial deployment of UTM capabilities.

Civil Aviation Registry CARES Initiative

Have you heard about the modernization of the Civil Aviation Registry? The Civil Aviation Registry Electronic Services (CARES) initiative is a set of e-services that fully maximizes the use of automation and technology to accomplish registering an aircraft or acquiring an airman certificate. Envision an online portal with mobile accessibility, user authentication, automatic electronic notifications, and more. You can learn more about CARES at ***FAA.gov/go/CARES.*** If you have questions or feedback, send an email to ***9-FAA-CARESGroup@faa.gov.***

SAFETY ENHANCEMENT TOPICS

Please visit **bit.ly/GAFactSheets** for more information on these and other topics.

NOVEMBER

Controlled Flight Into Terrain

Learn about how overreliance on automation technology can inhibit terrain awareness.

DECEMBER

Aircraft Performance Calculations

A review of best practices for determining and predicting aircraft performance.

CANCER, HEART DISEASE, AND FLYING

While cancer and heart disease remain the leading causes of death in the United States, remarkable advances in treatment have occurred in recent years. Many conditions that were previously permanently disqualifying for pilots can now be safely waived after treatment and evaluation.

MANY CONDITIONS THAT WERE PREVIOUSLY PERMANENTLY DISQUALIFYING FOR PILOTS CAN NOW BE SAFELY WAIVED AFTER TREATMENT AND EVALUATION.

Cancer

Cancer and the treatment of cancer can both cause cognitive impairment. When mild, it may not be noticeable without specific testing. However, couple this fact with an aircraft emergency, other stress (financial, work, family, etc.), or hypoxia, and what had been manageable could become incapacitating.

The most serious aviation hazard arising from cancer is a seizure. Sometimes this is the initial event for a primary brain cancer. More often, this is a consequence of metastatic disease (spread to the brain from somewhere else). It renders an individual unable to pilot a plane and can even interfere with someone else controlling the aircraft. There are medications which reduce the likelihood of a seizure, but the side effects of these medications are not compatible with flying. Pay attention to the warning signs for cancer which include unexplained weight loss, a change in bowel habits, cough (especially with bloody phlegm), unexplained pain, or a changing "mole" on the skin. Comply with recommended screenings. Having a colonoscopy at the recommended intervals (50 years of age) should almost eliminate the chance of developing colon cancer at a later date.

Melanoma can often be cured if caught early enough. For all screenings, discuss your particular risk factors (such as family history, smoking, etc.) with your physician. See our July/August 2019 Condition Inspection (p.6) for more information on melanoma.

Cardiovascular Disease

There are a number of risk factors for heart disease and strokes. Most can now be managed if not entirely eliminated. Keep your weight down, follow a good diet, exercise, and don't smoke. If you have high blood pressure, blood sugar, and/or cholesterol, get them treated. While the FAA has a robust program to mitigate aeromedical risk in those with known heart disease, the airman is ultimately responsible to heed the warning signs, whether cardiovascular disease has been diagnosed or not. Symptoms of cardiac disease may include chest pain with exercise, pain that radiates to the jaw or shoulder, nausea, and/or a crushing sensation in the chest. These should always be evaluated prior to flying. Remember though, cardiac disease can present without any warning signs, so it is best to discuss your particular situation with your primary care physician or your AME.

Strokes can be devastating. For some, there are symptoms prior to a debilitating stroke. Temporary losses of function, called transient ischemic attacks (TIAs), are similar to strokes but last 24 hours or less with resolution of symptoms. Get evaluated prior to permanent damage. Should stroke symptoms present in flight, land as soon as possible.

What should I do to prevent an inflight emergency from a medical condition?

Prevention is the best strategy. Follow a healthy lifestyle and get treatment for underlying conditions. Follow the recommended screening schedule. If you have any of the symptoms discussed, do not ignore them. Talk with your physician or AME before you return to flying. If further testing is recommended, complete the evaluation. The FAA routinely allows pilots to fly with these conditions after proper evaluation and risk mitigation. Get treated; don't risk permanent impairment.

Dr. Michael Berry received an M.D. from the University of Texas Southwestern Medical School, and a master's in preventive medicine from Ohio State University. He is certified by the American Board of Preventive Medicine in aerospace medicine. He served as an FAA senior aviation medical examiner and vice-president of Preventive and Aerospace Medicine Consultants for 25 years before joining the FAA. He also served as both a U.S. Air Force and NASA flight surgeon.

LEO M. HATTRUP, M.D.

THE COMMON COLD

Why Should I Be Concerned About a Common Cold?

The "common cold" comes from a virus (typically a rhinovirus). It usually begins 1-3 days after exposure and lasts 7-10 days. Keep this timing in mind when planning a flight. You may feel okay at the onset or near resolution of a cold while on the ground, but you may not be fit for flight. Recall that pressure changes with altitude and that spatial disorientation can be an issue even when healthy.

That "stuffy" feeling commonly found with a cold is more dangerous than you might think. The Eustachian tubes allow air in the middle ears to equalize with pressure changes. Sinus passages serve the same purpose. Mucous membrane swelling caused by a cold can block both. While this is an inconvenience on the ground, it can be dangerous in the air. Gas expands in the middle ear and sinuses on ascent, and clearing is generally not an issue. However, the membranes can collapse on themselves when pressure increases during descent. This can create a one-way valve resistant to a Valsalva maneuver (gently exhaling with your mouth closed and your nostrils pinched shut), with potentially incapacitating pain.

Vertigo, a sensation of spinning, can also occur during a cold due to inflammation of the balance system and/or surrounding soft tissue. Most of us have experienced vertigo after being on a merry-go-round. Imagine trying to fly in that condition. It would be challenging even while flying with visual references and devastating on instruments.

What Should I Know About Cold Medication?

Sometimes medicine used to treat a cold can be as bad as, or worse than, the cold itself. Accident investigations indicate an alarming number of mishap pilots fly with cold medications in their system. The effects of these medications, along with the underlying illnesses, are frequently implicated in these mishaps. Some of these accidents might not have occurred had the pilot waited another day or two.

> SOMETIMES MEDICINE USED TO TREAT A COLD CAN BE AS BAD AS, OR WORSE THAN, THE COLD ITSELF.

Please see the July/August 2019 *FAA Safety Briefing* for an expanded discussion on medications. While medications have known typical side effects, almost any medication can produce almost any side effect in the right person. You may have any, all, or none of the listed side effects. Even if you are taking a medication which is typically acceptable, you should try any new medication for at least 48 hours on the ground before flying with it. If you have an adverse reaction, do not fly for five dosing intervals after the last dose. For example, if directed to take one dose every 4-6 hours, wait 30 hours before flight (always choose the longer time). Look at warning labels for all medications you use and *avoid* those with cautions about drowsiness, dizziness, operating heavy equipment, etc. The doses of diphenhydramine (Benadryl©) found in many cold medications and over the counter sleep aids can cause more impairment than alcohol.

What's My Best Course of Action If I Have a Cold?

Wait until you have been asymptomatic for a few days. While patience can be difficult, please recognize that you are accepting increased risk if you do fly. It's best to be off of all medicines for a cold before flying. If this is not feasible, at least ensure that you would be safe to fly without these medications and that you have been on them long enough to ensure that the medication itself will not cause problems. For upper respiratory symptoms, carry a bottle of a nasal decongestant (such as Afrin©) to use as an emergency "get-me-down." As with a fuel reserve, though, there should be no expectation that you will actually need to use it.

Leo M. Hattrup, M.D., received a bachelor's degree from Wichita State University, a master's in public health from Harvard University, and a doctorate from Vanderbilt University. He is retired from the U.S. Air Force in which he spent the majority of his career in aerospace medicine. He is board certified in aerospace and occupational medicine. He is a certificated flight instructor and enjoys flying airplanes, helicopters, and gliders.

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Public ADS-B Performance Report

ICAO: A5BEC0 (51337300) **Tail Number:** N47 **Last Flight Id:** N47
Period: 03-23-2018 13:11:20 to 03-23-2018 13:59:29

Operation Analysis Overview

	Analysis
Airborne 1090	☑
Surface 1090	☐
Surface RWY/Taxi 1090	☐
Airborne UAT	☐
Surface UAT	☐
Surface RWY/Taxi UAT	☐

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Federal Aviation Administration

GOOD DECISIONS ON THE FLY

NASA photo

Pilots can easily get caught up in the "Vortex of Error" where threats lead to errors, which can lead you down the hole to an undesired aircraft state.

Putting TEM on Your Safety Team

By Paul Preidecker

If I told you that you had only had five minutes to buy a new car, would you make the right decision? I definitely would not. I would need to take my time, do some research, maybe create a database of information, analyze, and compare. Only then would I feel ready to make that kind of decision. Put another way, most of us do not make good decisions under time pressure.

As pilots, though, we make dozens of decisions … literally on the fly, without the luxury of time. Most often, we manage decisions concerning our flight with relative ease. Our experiences have helped build an internal database of answers. We have a host of flight planning resources available, and technology such as ADS-B to help make the right decisions en route.

Effective risk management is essential to safe operations, so the well-known mantra of aviate, navigate, and communicate has evolved to add mitigate. But in order to mitigate risk, we have to know, or at last anticipate, what

those risks are. The risk management section of the Airman Certification Standards (ACS) can help, but let me offer an additional idea. GA pilots can also mitigate risk by using a model borrowed from the airlines: Threat and Error Management (TEM).

The goal of TEM is simply to identify and recognize threats, reduce errors, and prevent undesired aircraft states. TEM acknowledges that there is no such thing as a perfect flight, that we operate in a complex environment, and that we will make mistakes.

TEM further recognizes that accidents rarely occur due to a single event or error; rather, they result from a chain or series of events or errors. Breaking the chain can stop an accident, and the best approach is to break the chain at the earliest point. That means you must become aware of threats and errors that constitute the beginning of the accident chain. So, the TEM approach is designed to help pilots recognize and prevent those mistakes from escalating into operational errors.

TEM Terms

In the parlance of TEM, a ***threat*** is an event or situation that occurs outside the pilot's ability to influence, increases the operational complexity of a flight, and requires attention/management to maintain safety margins. For example, dealing with adverse meteorological conditions, airports surrounded by high mountains, congested airspace, aircraft malfunctions, and errors committed by other people outside of the cockpit, such as air traffic controllers, flight attendants, or maintenance workers. Threats can be classified into three categories: *operational threats* (e.g., equipment malfunctions or taxiway closures); *environmental threats* (e.g., weather and ATC); and *mismanaged threats* (e.g., stepping on the wrong rudder in an engine out situation.) The threat in this example starts as an engine out. Stepping on the correct rudder helps mitigate the threat of the engine out. Stepping on the wrong rudder (mismanaged) is an error that now induces another threat, loss of control. It's important to know that threats are not just observable events or situations; they can also arise from the decisions we make about those situations. The all-too-familiar visual meteorological conditions (VMC) into instrument meteorological conditions (IMC) scenario is just one example.

An ***error*** is a pilot action or inaction that leads to a deviation from intentions or expectations, reduces safety margins, and increases the probability of adverse operational events on the ground or during flight. Errors also come in three categories: *aircraft handling errors* (e.g., speed, configuration, or automation); *procedural errors* (e.g., intentional or unintentional deviation from regulations or aircraft operating limitations); and *communication errors* (e.g., misunderstanding between you and ATC). Note that errors do not always arise from threats. Selecting flaps above published flap operating speed is an error that may not be associated with any threat.

Although what I have described above is not an all-inclusive description of the typical TEM model, here's a simple way to distinguish between threats and errors: threats come *at* you; errors come *from* you.

How Do CRM/SRM Play with TEM?

CRM and SRM are both valuable players on the safety team. As you will read in other articles, CRM — now generally known as crew resource management (CRM) — is about leveraging all available resources to help you manage a flight. Adapted from CRM, single pilot resource management (SRM) is a tool that individual pilots can use for this purpose. When I fly for the airlines, I have the benefit of fellow crew members, ATC, dispatchers, gate agents, and others. When I fly GA, I view ATC and flight service as part of my crew. GA pilots also have flight planning tools, maybe a pilot partner, and technology such as GPS and ADS-B.

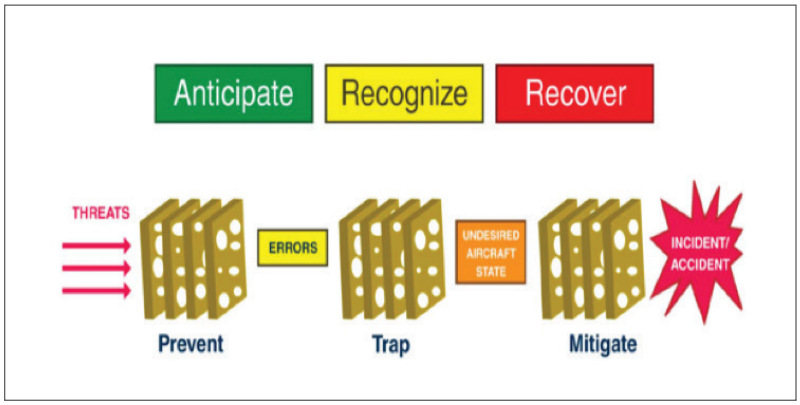
> **Threats come at you; errors come from you.**

Here's the distinction: CRM/SRM is about managing resources, and TEM is about managing threats.

Setting the Trap

Most threats, and the errors that may arise from them, increase the complexity of a flight. Typically, they require time or action to manage. Therefore, workload increases. Increasing workload is in fact a threat. The sooner we manage threats and break the chain, the more effective we will be at maintaining safety. Left unmanaged, threats can compound creating a multiplying effect of errors.

In the language of TEM, we talk about trapping errors. A trapped error is the first step in breaking the chain of events that may lead to trouble. Here's an example: ATC



Applying the Swiss Cheese model to TEM.

Modern avionics have not eliminated the potential for malfunctions.

clears you to a new altitude while you are listening to ATIS. You are not certain you heard the assigned altitude. Rather than changing to the altitude you thought you heard, you request clarification.

An un-trapped error is just that: You make an error and you fail to recognize it. Un-trapped errors may or may not have associated safety consequences. For example, suppose you are flying an instrument approach and you do not set or brief the missed approach altitude. If you land without incident, there is no safety consequence. But if you miss the approach and fail to climb to the appropriate altitude, there's an obvious safety problem.

So here's another definition: The result of not effectively managing threats and trapping errors is the ***undesired aircraft state*** (UAS). An undesired aircraft state is an aircraft position, speed, altitude, or configuration that results from pilot error, actions, or inactions. It clearly reduces safety margins. It can result from something as simple as flying an incorrect heading or crossing a hold short line without a clearance.

We Are the Problem, and We Are the Solution

Human beings are most often the problem in that we fail to recognize our errors or the errors of others. Fortunately, we are also the solution. Through training and practicing TEM, we can adopt strategies and countermeasures to effectively mitigate risks.

The TEM approach starts with *anticipation*. Anticipation is recognizing that something is likely to go wrong, even if we do not know exactly what or when. Anticipation thus leads to vigilance, which means following the discipline of always being on guard, even on the most routine flight. The next step is *recognizing* a problem, and after recognition comes *recovery*, correcting the situation before it leads to an error or unintended aircraft state.

> **CRM/SRM is about managing resources, and TEM is about managing threats.**

	THREATS	MITIGATION
PERSONAL	• Have not flown in a few months. • Documentation: manual error, chart error. • Fatigued.	• Fly with instructor to regain proficiency. • Use IMSAFE checklist in preflight planning.
AIRCRAFT	• Rent aircraft with different avionics and equipment. • Aircraft malfunction: one of two radios inoperative, maintenance event/error.	• Take time before flight to learn differences. Take a class or course to familiarize yourself with new avionics. • Have a backup radio. Postpone until fixed.
ENVIRONMENT	• Taxiway closures. • ATC: error, language difficulty, runway change, similar call signs, etc. • Airport: runway contamination, birds, ground handling event, etc. • Terrain: high ground, slope. • Unexpected weather. • Flying to unfamiliar airport.	• Have airport diagram visible prior to taxi. Mark route on chart. • Consider alternate airports during flight planning. Remember that "direct to" may not always be the best route. • Review airport diagram, traffic pattern details, available services.
EXTERNAL PRESSURES	• Friends or family waiting to pick you up.	• Arrange to call them after you arrive.

Examples of threats and possible mitigation strategies.

Even minor incidents can lead to taxiway, runway, and even airport closures for an extended period of time.

Recognition and recovery are both countermeasures. There are many other countermeasures we can use to prevent threats from turning into errors. For example:

Technology (e.g., flight planning tools, GPS, and ADS-B) can help provide increased situational awareness and information both prior to, and after departure. However, keep in mind that technology can be a threat if it is a distraction. Don't forget to look outside and know your equipment well.

Briefings are essential in a crew environment, as they create a shared mental model. In GA, though, you can brief yourself. Some pilots like to brief an approach out loud. Proper pre-flight planning requires getting a weather briefing from a qualified briefer or from flight planning programs.

Checklists and procedures that you consistently follow are also safeguards. Creating and following standard operating procedures on every flight will help you become a more reliable pilot, especially if you are tired, distracted, or dealing with unexpected weather or a mechanical issue.

> **Through training and practicing TEM, we can adopt strategies and countermeasures to effectively mitigate risks.**

As PIC, you are the last line of defense. As final authority, it is your responsibility to mitigate risk and manage safety. You trust your mechanic, but it is up to you to thoroughly preflight your aircraft and make sure paperwork is in order. You trust the fuel handler, but always check to make sure you received fuel. You trust ATC, but it's up to you to embrace the meaning of PIC.

The PAVE model can be a starting point to help you apply TEM strategy.

Paul J. Preidecker (paul@flightdeckinsights.com) is a pilot and check airman for a regional airline. He is active in GA and seeks to improve training by developing best practices and standard operating procedures for GA pilots.

CRM: THE MAGIC OF USING ALL AVAILABLE RESOURCES

(And the Misery of Trying to Go It Alone)

By Susan Parson

Early in my FAA career, I was scheduled for an "initial CRM" training course at the Mike Monroney Aeronautical Center in Oklahoma City. I love learning new things and, as friends and relatives have wryly observed, connecting anything to aviation will always get my attention and usually sustain my interest. Even so, I confess I wasn't expecting a lot from the course; formal training in organizational settings can sometimes be … dry.

That three-day course turned out to be anything but dull. On the contrary, it was an eye-opening session that still ranks high on my list of most interesting/effective courses. Right from the start, we found that the excellent instructors had designed a nice mix of guided discussion and hands-on sessions in the facility's flight training device (FTD). Most of us were anxious to get to the FTD part of the course. Having endured way too many courses with way too many of those contrived "table team" exercises, my group was also groaning (almost, but not quite, out loud) when we were herded into teams for one of "those" activities.

The. Best. Exercise. Ever.

As it happens, that event was probably the thing I remember most vividly, and I often recount it even now as among the best of the best. Here's how it unfolded.

The instructors gave each person a sheet of paper with a story about some event. We each got a second piece of paper with some questions about what we had just read. On the surface, the task seemed like second-grade stuff and, since everybody's narrative was the same, why did we have to do the table-team thing? Being a speed reader, I zipped through part one and dove into the questions in part two. The first three were a snap. The fourth … hmm. I guess I need to reread the narrative. But — and you see what's coming, right? — nothing in the paper I held offered anything that would let me answer that question. I got question five, but questions six through eight were like the fourth … I didn't have that information.

By this time, the table was populated by puzzled people restlessly fidgeting with those sheets of paper. Given our ages, it was clear that all of us had been thoroughly schooled in the fading (I hope) "do-your-own-work/asking-others-is-cheating" exhortation we constantly heard from our primary school teachers. We all suffered in silence until one of our group tentatively asked whether anyone else had found the name of the city. The floodgates opened. We realized that while the narratives all looked identical at first glance, each one contained subtle differences — nuggets of information not given to any other person in the group. No single individual had the full story, so it was impossible to complete this simple assignment without contributions from each and every person on the team.

> **Both tradition and regulation give full authority to the pilot in command, who must understand and accept that questions and observations are not a threat to his or her final authority.**

There wasn't any need for an extensive debriefing on this exercise, because the lessons were so obvious. It emphatically and unforgettably brought one of the fundamental concepts of CRM to life: no single human being has the full picture, and every single person has something useful to contribute to developing it. Working with other people to assemble a complete picture is not cheating; on the contrary, you cheat yourself if you fail to take advantage of all available information needed for safe operation.

Rising from the Ashes

The necessity of good CRM for pilots and mechanics also seems perfectly obvious, but it wasn't always so. Books (e.g., Robert Gandt's *Skygods;* Arthur Hailey's *Airport*) and movies (e.g., *The High and the Mighty*) set in the so-called golden age of commercial aviation are replete with vignettes about the all-powerful "skygod" captains of the day. The role of the first officer — then more commonly called the co-pilot — was to obey the captain's "gear up and shut up" commands without question. The role of the cabin crew was to bring coffee and meals to the flight deck. No one dared contravene the captain's dictates, even to provide essential safety information. The predictable result: lots of smoldering wreckage and far too many lost lives.

The phoenix of CRM first began rising from those ashes in the 1950s, when British RAF and BOAC pilot David Beaty wrote a book called *The Human Factor in Aircraft Accidents*. But it wasn't until the late 1970s — and yet another tragic accident — when the principles Beaty espoused found their way into an NTSB recommendation. In that same timeframe, NASA psychologist John Lauber, an expert in cockpit communication processes, first used the term "cockpit resource management." The essence of the initial CRM approach was to encourage first officers to question their captains if they had concerns about some aspect of the flight.

Sadly, it took one of history's most fiery crashes, the 1977 Tenerife disaster, to raise CRM from a mostly unpracticed principle to a full-fledged program. United Airlines became the first air carrier to provide CRM to its flight deck crews in 1981, a concept expanded to flight attendants a few years later. CRM — by then known as "crew resource management" — had become the global standard by the 1990s, not just for pilots and flight attendants but also for air traffic control and maintenance. Recognizing that the core concepts and practices of CRM are applicable and beneficial well beyond aviation, other sectors (e.g., maritime, firefighting, medicine) have also adopted forms of CRM.

Making It Fly for You

Descriptions vary, but most formal definitions of CRM include the following:

- CRM is a system that uses all available resources to promote safety.
- CRM is concerned with the cognitive and interpersonal skills needed to manage resources within an organized system, not with technical knowledge and skills.
- CRM aims to foster a climate or culture where authority may be respectfully questioned.
- CRM training thus emphasizes communications, situational awareness, problem solving, decision making, and effective teamwork.

It can be challenging to master these skills, which may require significant changes in personal habits, interpersonal dynamics, and organizational culture. This challenge is especially acute in hierarchical sectors such as aviation. Both tradition and regulation give full authority to the pilot in command, who must be trained to understand and accept that questions and observations are not a threat to his or her final authority.

This necessity is no less true when two GA pilots are flying together. Regular readers might recall a Postflight department article called "Pilot[2]" in the March/April 2018 issue of this magazine. I recounted the story of flying with a pilot friend who had a dismaying habit of "helping" me by, for example, changing trim or flap settings without even telling — much less asking — me first. A presentation by John and Martha King helped greatly by offering tips on how two GA pilots can peacefully co-exist and, as appropriate, share duties in the confined space of the cockpit. The fundamental idea is that the pilot in the right seat always addresses the pilot in the left seat as captain and provides objective information with no personal pronouns. For example, "you're getting too slow!" is forbidden. Instead, the right seat occupant might say, "Captain, airspeed is decreasing." The captain similarly avoids personal pronouns with a response such as, "Noted; correcting." If the situation isn't resolved, the next transmission might be something like, "No correction noted."

While developing the initial version of the Civil Air Patrol's National Check Pilot Standardization Course a few years ago, I came across another CRM technique that can work well in a GA setting. A CRM expert named Todd Bishop developed a five-step process that uses assertive statements encompassing both inquiry and advocacy:

1. **Get attention** — Address the individual by name or title.
2. **State your concern** — State what you see in a direct manner while owning your emotions about it. "I'm concerned that we are low on fuel."
3. **State the problem as you see it** — "I don't think we have enough fuel to fly around this storm."
4. **Suggest a solution** — "Let's divert to another airport and refuel."
5. **Obtain agreement (or buy-in)** — "Does that sound good to you?"

Perhaps the single most important CRM step you can take in GA is the first one: a thorough pre-flight discussion that clearly establishes roles (e.g., who is PIC), responsibilities, and expectations. Knowing who has that role is very important if something goes wrong, but the more fundamental reason is safety. So, if you are the PIC, state that before you go to the airplane. Tell your pilot companion what kind of assistance you do (and do not) want. If you are the guest of the PIC, make no assumptions. Ask whether and how you can assist. Stick to terms you establish but make it clear to the PIC that you will use one (or both) of the techniques presented here to communicate any concerns and help ensure a safe flight.

Susan 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.

You Never Roam Alone!

PUTTING SINGLE PILOT RESOURCE MANAGEMENT TO WORK

By Susan Parson

Aviation never fails to deliver a powerful "not so fast" lesson any time we think we've got something nailed.

Like many GA pilots, I got accustomed to being the sole pilot on board. Most of my flying involved being alone in the airplane or serving as pilot and flight attendant to my non-flying passengers. I figured I was pretty adept at "single pilot resource management" (SRM).

My moment of reckoning with the true challenges of single-pilot operations came just after Thanksgiving one year. I had flown to coastal North Carolina to spend some quality time with family and, since the weather forecast for the return trip looked grim, I moved my departure time up by several hours.

What could possibly go wrong?

First, I was in instrument meteorological conditions (IMC) shortly after takeoff, but I figured I'd soon be on top. In fact, I was in the soup for the entire flight.

The ETA conditions at my destination were forecast to be marginal VFR. But Mother Nature doesn't read forecasts. There were many clues that this system was not behaving as expected, but I still didn't expect to hear a pilot ahead report missing the approach to my airport. Things got very busy, starting with the controller's request for me to "say intentions." There was no copilot or autopilot to help with basic flying tasks while I sorted through charts and options. There was no GPS, except for the tiny first-generation handheld I had recently acquired. I had never flown any of the approaches to Dulles, which was my only viable option. I had never flown a holding pattern "for real," but I had just copied instructions for holding in no-kidding IMC. The workload was intense, and I knew it would take a lot of focus and concentration.

When I was eventually cleared for the approach, I flew with every bit of concentration and precision I could muster. I broke out of the clouds around 300 feet above ground

level and experienced the incredible "there-it-is!" relief when I saw the brightly lit runway.

In the most basic terms, I passed the SRM test: I flew single-pilot, single-engine IFR in IMC and landed without bending metal or rules. In the broader sense, though, there was plenty of room for improvement.

SRM Defined

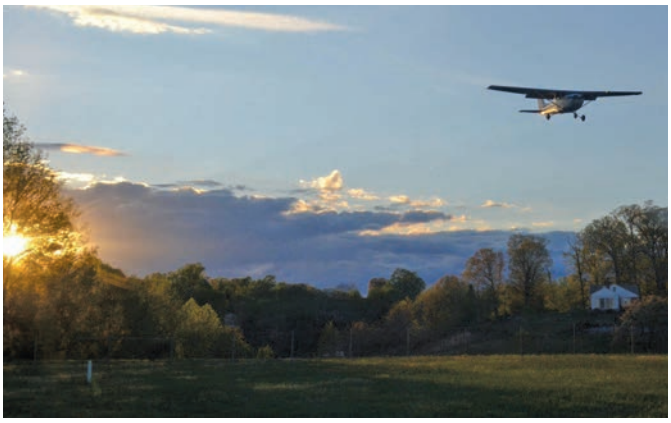
The FAA *Risk Management Handbook* (FAA-H-8083-2) calls SRM the art of managing all the resources, both those onboard and those from outside sources, to ensure a successful flight. It is about how to gather information, analyze it, and make decisions. The pilot must be able to competently perform a number of mental tasks in addition to the physical task of basic aircraft control. These include:

- Situational awareness
- Task management
- Automation management
- Risk management
- The aeronautical decision-making (ADM) process
- CFIT (controlled-flight-into-terrain) awareness

The *Risk Management Handbook* also offers an observation that became very real to me:

Learning how to identify problems, analyze the information, and make informed and timely decisions is not as straightforward as the training involved in learning specific maneuvers. Learning how to judge a situation and "how to think" in the endless variety of situations encountered while flying out in the "real world" is more difficult. There is no one right answer in ADM; rather each pilot is expected to analyze each situation in light of experience level, personal minimums, and current physical and mental readiness level, and make his or her own decision.

That is no small challenge, especially for GA pilots whose aeronautical experience may be limited. In my flight, which involved an airplane with no automation, solid training provided a firm foundation for task management and situational awareness. But I would have been much safer with a structured approach for gathering and analyzing information for both preflight and en route decision making.



FAA photo by Anders Croft

SRM in Action

One of the most important things I lacked at the time was a set of personal minimums that, given the soupy conditions at my departure airport, would have kept me on the ground that day.

But let's say that you launch, like I did. The most valuable resources I had that day were external. I had been monitoring weather via an Automated Weather Observing System (AWOS), but the pilot ahead of me on the approach provided real-time information that made my divert-to-Dulles decision pretty easy. While I didn't need any special assistance from air traffic control (ATC), it was comforting to know that all the resources they offer were just one transmission away.

If you have passengers with you, they can assist by reading checklist items, watching for traffic, and listening to ATC radio calls. You might also teach regular passengers to assist with switching radio frequencies and basic programming for moving map and multifunction displays. Internal resources also include checklists and verbal briefings.

> **In basic terms, I passed the SRM test: I flew single-pilot, single-engine IFR in IMC and landed without bending metal or rules. But there was plenty of room for improvement.**

Onboard equipment constitutes another important resource. Today's technology offers an incredible range of information to assist with overall situational awareness, navigation, weather information, and much more. The key is to know what information is available and how to access it without diverting your attention from essential aircraft control duties.

To apply the tenets of SRM in a structured way, the *Risk Management Handbook* suggests regular evaluation of:

- Plan
- Plane
- Pilot
- Passengers
- Programming

The point of the 5P approach is not to memorize yet another aviation acronym. Instead, you might simply write these words on your kneeboard, or add a 5P reference to your checklist for key decision points during the flight. Items to consider include:

Plan: Basic elements of cross-country planning: weather, route, fuel, current publications, etc. Since any of these

FAA photo by Anders Croft

factors can change at any time, review and update the plan at regular intervals.

Plane: Be proficient with all installed equipment, and familiar with performance characteristics and limitations. Monitor systems and instruments in order to detect any abnormal indications at the earliest opportunity.

Pilot: The "IMSAFE" checklist is a handy tool for identifying hazards to your fitness for flight.

Passengers: Passengers can be a great help by performing tasks such as those listed above. Be mindful, though, that passenger needs — e.g., physiological discomfort, anxiety, or desire to reach the destination — can create potentially dangerous distractions.

Programming: Electronic displays, moving map navigators, and autopilots can reduce workload and increase situational awareness. However, be mindful that the task of programming or operating this equipment can create a dangerous distraction.

Whatever SRM approach you choose, use it consistently and remember that solid SRM skills can significantly enhance the safety of "crew of you" flights.

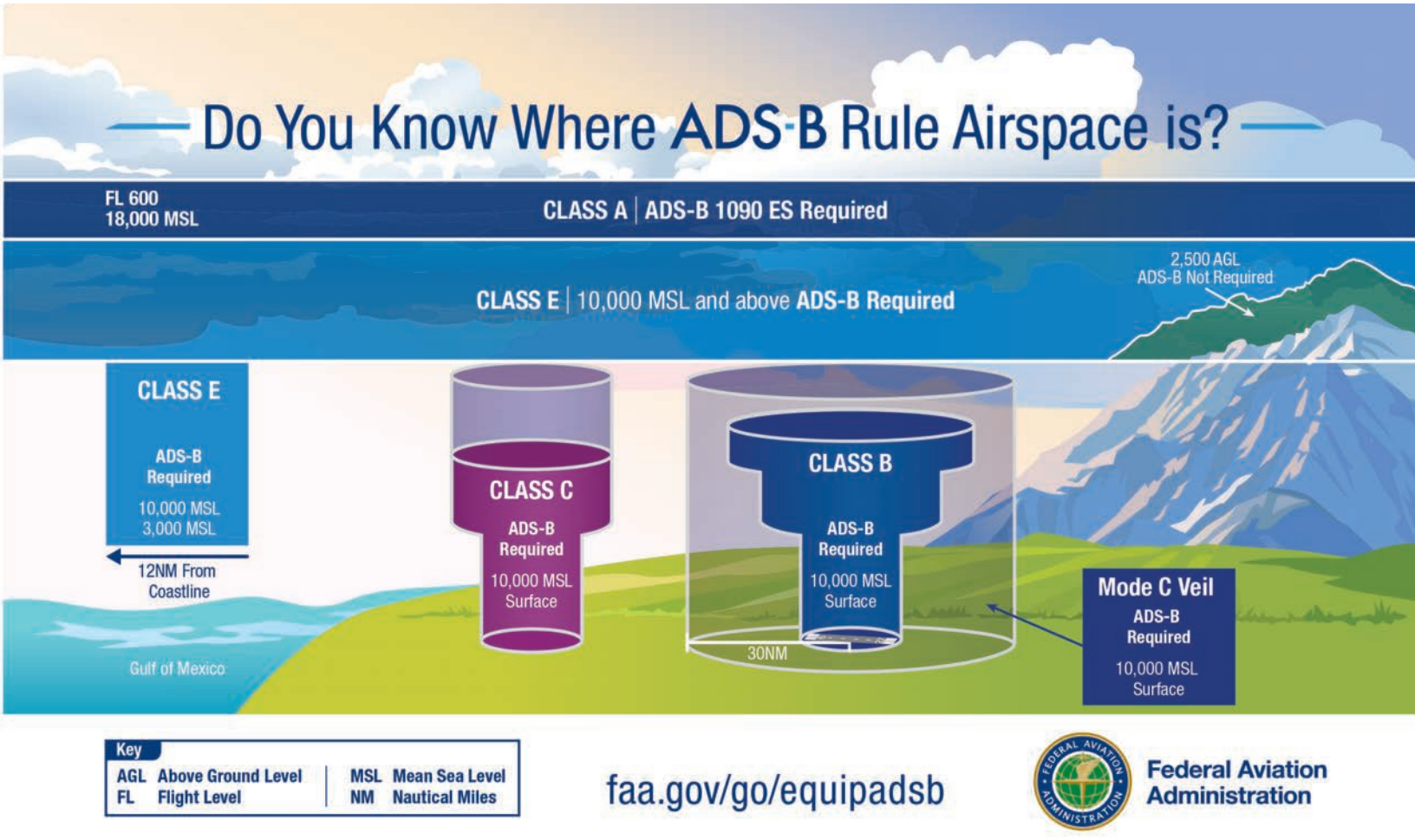
Susan Parson (susan.parson@faa.gov) is editor of *FAA Safety Briefing* and a Special Assistant in the FAA's Flight Standards Service. She is a general aviation pilot and flight instructor.

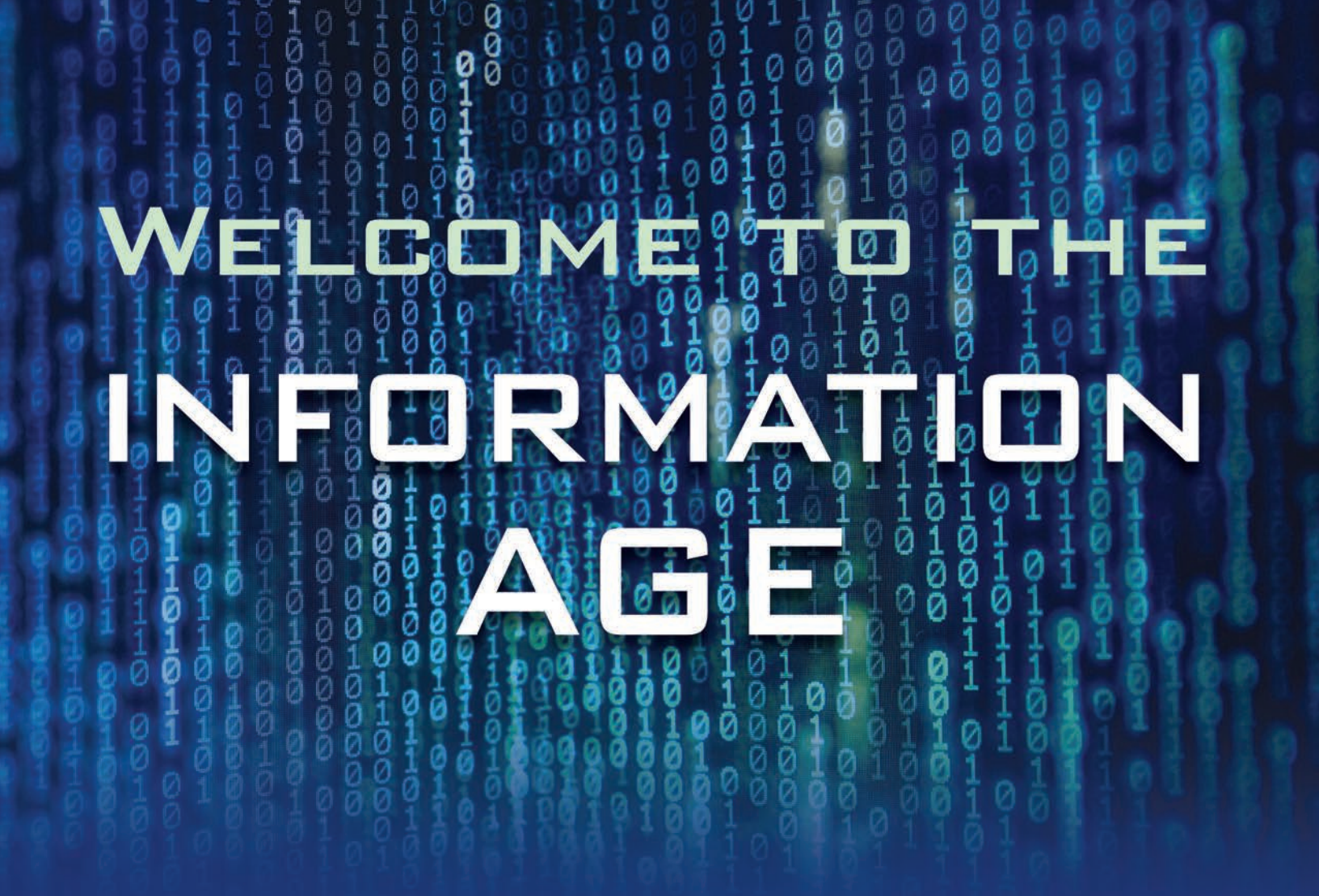
LEARN MORE

FAA *Risk Management Handbook* (FAA-H-8083-2)
bit.ly/2kuuDSn

FAA Safety Briefing, Sep/Oct 2019 (Checklist)
adobe.ly/2ZuWKnd

"Your Safety Reserve," *FAA Safety Briefing*, Mar/Apr 2015
go.usa.gov/xV8bG





WELCOME TO THE INFORMATION AGE

General Aviation Enters the Next Era

By James Williams

In history, the three-age system is a way to classify historical periods into groups of three, each building on the others. The Stone, Bronze, and Iron Ages are the best-known examples. But we could apply the concept to any other historical segment.

So let me propose that the Coal Age, Oil Age, and Information Age constitute our latest tripartite era. Coal was the fuel that fed the Industrial Revolution and the railroads. This age kicked off in the early 19th century and began declining in the early 20th, when oil began to rise in economic and strategic value. The automobile and its practical internal combustion engine allowed aviation to take off, so to speak. The Oil Age has slowly transitioned to the Information Age, with data increasingly being the central "fuel" of our modern lives. How many times a day do you hear "data-driven" as a descriptor for everything from strategic plans to morning commutes?

In an Age Gone By

Until the last decade or so, one could argue that general aviation still resides in the Oil Age. That has begun to change in the last two decades. To one degree or another, composite materials, modern engines, and glass cockpits have become part of the general aviation ecosystem. As discussed in "How I Learned to Stop Worrying and Love the Singularity" in the May/June 2018 issue of *FAA Safety Briefing* (p.25), modern avionics opened the door for Flight Data Monitoring (FDM). Flashy screens with modern graphical interfaces sold these new avionics, but their digital architecture made the FDM breakthrough possible. Data capture became an easy task and data storage became a function of allocating memory already on board. The stage was set for GA to advance into the Information Age.

Data Versus Information

While many people consider data and information synonymous, they are different, albeit interconnected terms. The simplest way to distinguish the two is to recognize that data is a fact, while information is a fact (or facts) with some level of context or analysis. For example, a reading of your 50-knot airspeed is data. Information on the other hand would be: airspeed is 50 knots while in a climb. That context is meaningful and makes the information much more useful than the data.

FDM uses data to build information that can be useful for many purposes, from improving your flying skills to managing your maintenance practices. While useful at the individual pilot level, FDM is best used on a broader basis, since collective programs offer a larger data pool that can help detect problems more quickly. Think of it this way: if you had to learn every life lesson through personal experience, it probably wouldn't go well (e.g., don't touch a hot stove, look both ways before crossing the street, etc.). Our ability to learn from the experience of others is a key driver of safety in aviation.

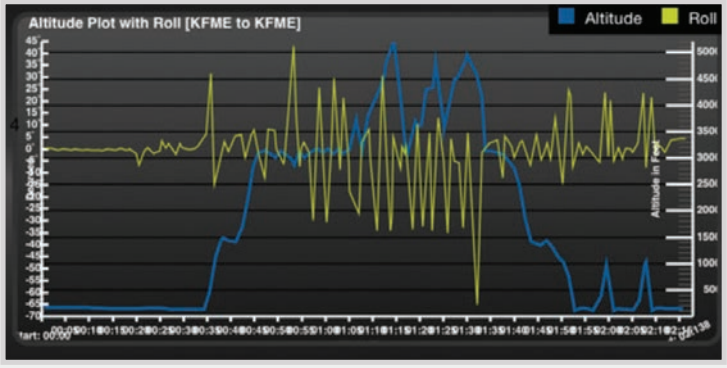
GAARDing Data

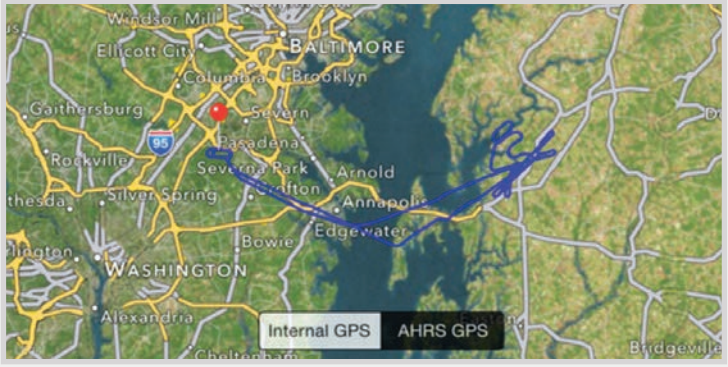
FDM has been very beneficial to commercial aviation safety. The stumbling block for GA has always been scale. As noted in our previous FDM article, now there's an app for that.

First a bit of background. The FAA uses a collection of databases to monitor aviation safety and these have been integrated into a single access point in the Aviation Safety Information Analysis and Sharing (ASIAS) system that allows users to query across all these separate systems. One big hole in ASIAS was always GA data. The National General Aviation Flight Information Database (NGAFID) fills that gap by providing a structured data collection system.

To help ramp up data collection, an early innovation of the NGAFID was the introduction of the General Aviation Airborne Recording Device (GAARD) App for iOS and Android devices. GAARD allows these devices to record and submit data into NGAFID, thus dramatically increasing the total possible user base. While the data might not have the same fidelity of that derived from more advanced avionics systems, it has a much lower entry cost.

"Flight schools are quickly realizing the benefits," says Operations Research Analyst Corey Stephens with the FAA's Office of Accident Investigation and Prevention. "The more all of us work together, the better off we'll all be." Stephens hopes to see similar safety improvements to the ones seen following the implementation of FDM in the commercial world. The General Aviation Joint Steering Committee (GAJSC) is working to spread the word on the benefits of NGAFID and ASIAS and has signed up 13 universities and 97 corporate flight departments in addition to many individual GA pilots. In total, more than 1,000,000 hours of





The NGAFID allows you to review your own flight data to target improvement. You can overlay multiple data plots to analyze your flight in greater detail.

flight data have been collected in the light GA community alone.

Analysis Paralysis

Data collection is only part of the equation; it needs context to create useful information. The GAJSC is hard at work in this area, but another organization is also on the case. The Partnership to Enhance General Aviation Safety, Accessibility, and Sustainability (PEGASAS) is a joint FAA/Academic Center of Excellence program designed to focus research on specific projects in the GA world. As you might recall from the previous FDM article, the PEGASAS team's Safety Analysis for General Aviation project is intended to provide tools to GA that would normally come from a corporate or commercial carrier safety program.

> **Our ability to learn from the experience of others is a key driver of safety in aviation.**

In its current phase, project researchers are learning to enhance the low resolution data provided by smartphones and tablets used as Electronic Flight Bags (EFBs). This work includes trying to "recover" data that didn't originally exist (e.g., flap position). Such enhancement may provide higher resolution data without needing to increase the parameters on GA recorders. The team has demonstrated this capability on the Cessna 172 and Piper *Archer*. They have also developed algorithms to identify phases of flight in the Cessna 172 and Cirrus SR20, as well as prototype algorithms to detect hazardous states from flight recorder data. This kind of analysis turns interesting data into useful information.

Modern advanced avionics feature native digital flight information, which makes data collection a breeze.

Classic panels make data collection a significant task.

Welcome to the Future

GA's rapid ascension into the Information Age leaves us with some questions. Some might ask: can't this data be used against me? The short answer is no. There are a number of firewalls that make any data submitted to NGAFID off limits to enforcement (and remember that under the FAA's Compliance Program, enforcement is a tool reserved for willful failure to comply with safety regulations). Remember too that voluntary reporting has a long and successful track record in both commercial aviation and, through the NASA Aviation Safety Reporting System, in GA. The FAA fully understands that such systems require trust, which has been a hallmark of the safety reporting programs the agency has sponsored.

Others might ask the famous WIIFM (what's in it for me) question. The most immediate benefit is that solutions like the NGAFID allow you to analyze your own performance and catch small errors before they become big ones. You can also detect changes in your flying. I remember one particularly frustrating session with touch-and-go landings when I just couldn't figure out why it went so poorly. I eventually determined that I was too fast on approach. FDM would have made it far easier to see the problem. FDM also means that by working together we can limit not only personal frustration, but also more dangerous outcomes.

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

LEARN MORE

National General Aviation Flight Information Database
ngafid.org

PEGASAS Project 05 – Safety Analysis for General Aviation
bit.ly/2kRFbLJ

ON COURSE FOR SAFETY

Resource management is the umbrella theme for the topics featured in this issue of *FAA Safety Briefing* magazine and, as regular readers probably know, the primary purpose of this department is to raise awareness of resources that the FAA provides for the aviation community.

In that spirit, let me invite you to take a fresh look at the ***www.FAASafety.gov*** application, and check out some of the latest additions to the Learning Center Course Catalog (bit.ly/2khRQHE). If it's been awhile since you last visited, you might be surprised to see how many courses have been added to the roster. I hope you'll browse extensively, but here are "VFR Direct" pointers to just a few of the many no-cost items that align with this issue's focus area.

One important note: even though some of these courses might appear to be targeted to pilots or mechanics, the concepts are valid for all!

- **ALC-28 — The Art of Aeronautical Decision Making and ALC-82 — Do the Right Thing: Decision Making for Pilots (presented by AOPA)**: Both of these courses provide tips on a critical skill (bit.ly/2kl3VeX and bit.ly/2m6Cwhh).
- **ALC-174 — Fatigue Countermeasures Training**: This four-segment course presents the basics about fatigue, sleep, and fatigue risk management. This fast-paced, action-packed presentation first explores how fatigue can impact your family, your health, and your job. It then covers fatigue basics and hazards, sleep basics, and methods you can use to effectively prevent or combat fatigue (bit.ly/2kuxevN).
- **ALC-258 — Human Factors Primer for Aviation Mechanics**: The objective of this course is to lead an AMT technician through human factors definitions and to provide tangible ways to use that knowledge about human factors in the maintenance hangar. The course introduces two basic types of human error: unintentional and intentional. It includes several videos, exploration of the "Dirty Dozen," a hangar safety scenario, and discussion about the importance of safety nets (bit.ly/2lygWCl).
- **ALC-448 — Surprise, Surprise!**: This course addresses the startle response, distraction, interruption, lack of systems knowledge, pilot proficiency, and aircraft owner/mechanic teamwork. It follows the Threat and Error Management philosophy where threats poorly managed lead to errors and ultimately to an undesired aircraft state (bit.ly/2lUZaJw).
- **ALC-474 — NAFI PDP Distraction Management and Cockpit Techniques**: An experienced flight instructor and pilot shares techniques for managing inevitable distractions (bit.ly/2lvtbzB).
- **ALC-514 — Challenge / Response — Practical Flight Deck Insights for GA**: GA flying is different, diverse and, in many ways, a lot more challenging than airline operations. This presentation focuses on using Standard Operating Procedures (SOPs) to Plan, Brief, Do, Review, and Renew (bit.ly/2lwYLwK).
- **ALC-534 — The Buck Stops with Me**: Failing to follow procedures (FFP) continues to be one of the leading safety issues in aviation maintenance. This course helps aviation maintenance personnel better understand and appreciate how an organization's culture affects safety with respect to FFP (bit.ly/2ktU3zz).
- **ALC-556 — Adapting Threat and Error Management to General Aviation**: Threat and Error Management training recognizes that pilots operate in a complex and highly dynamic environment, one in which every action taken can be critical. This course offers tools you can use to manage them before they become a second link in the accident chain (bit.ly/2ksYESK).

I can't resist closing with a pitch for another batch of new additions to the Learning Center Course Catalog. Look for the "*FAA Safety Briefing* Live" courses that introduce and discuss topics from each issue of this publication, starting with the March/April 2018 edition.

IF IT'S BEEN AWHILE SINCE YOU LAST VISITED, YOU MIGHT BE SURPRISED TO SEE HOW MANY COURSES HAVE BEEN ADDED TO THE ROSTER AT WWW.FAASAFETY.GOV.

Susan 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.

CRM FOR DRONES

People and Technologies Working Together

Deputies Chris Delima and Anthony Pagliari search for a shooting suspect with a UAS. (Photo used by permission of the Alameda County, CA Sheriff's Department)

Crew Resource Management (CRM) is as important to the safety and efficiency of unmanned aircraft systems (UAS) operations as it is to manned operations. Effective UAS CRM can improve a flight crew's ability to perform work using complex systems, like UAS ground control stations, while maintaining overall situational awareness to create a safe environment for flying.

With more and more public safety agencies using UAS as part of their response to hazardous events, Deputy Fire Chief Chris Sadler of the York County, Virginia Fire Department notes that "It is critical for personnel to utilize CRM practices during these missions to ensure that everyone is working together as a team." The added stressors of the emergency operation require public safety flight crews to strictly adhere to good CRM processes so they are not distracted and can remain focused on maintaining the safety of the flight.

UAS CRM involves good communication among the respective crew members; clear and concise processes; initial and recurrent training both for normal and abnormal operations (loss of control, lost link, de-confliction with manned aircraft); and managing individual and overall workloads while always keeping the safety of the National Airspace (NAS) as the highest priority.

As with any other component in a safe system, CRM doesn't just happen. A foundational element is selecting the right combination of people with the proper initial and recurrent training. Lieutenant Neal Landfield of the Arlington, Texas Police Department states, "Crew resource management is critical for complex UAS operations. To provide safe service to our communities, we have to select the best pilot/crew for the job and determine relevant mitigations for environmental stressors."

Just as in manned operations, the crew's ability to communicate effectively is key. However, this communication must occur in an operational environment that differs significantly from that of manned operations. In most UAS operations, the remote-pilot-in-command's (RPIC) attention is usually on the flight controls and the UAS camera monitor. The crew is operating not in a closed cockpit, but outdoors where they are subject to weather conditions and possible distractions from observers and management while they operate. Without a 'sterile' cockpit, the UAS flight crew experiences more distractions that could affect CRM and ultimately decrease the safety and efficiency of the operation. For this reason, UAS crews need to train in the same conditions and environments in which they are likely to operate.

Captain Mike Brown, a B787 airline pilot with more than 20,000 flight hours, is also a reserve deputy with the Alameda County Sheriff's Office who flies both manned and unmanned aircraft. Because he firmly believes that CRM plays an important role in unmanned operations, Captain Brown teaches a CRM course to the Alameda County deputies who fly UAS. He stresses that, "In any endeavor where people are involved, human error will occur. CRM reduces the chance that the consequences of an error will be catastrophic." So, whether you hold an Airline Transport Pilot or Remote Pilot Certificate, or both, CRM is a proven method to help you reduce risk and increase the safety and efficiency of your operation.

Mike O'Shea works with government agencies as a resource on public unmanned aircraft operations and has more than 30 years of experience working in public safety. He can be contacted at michael.oshea@faa.gov.

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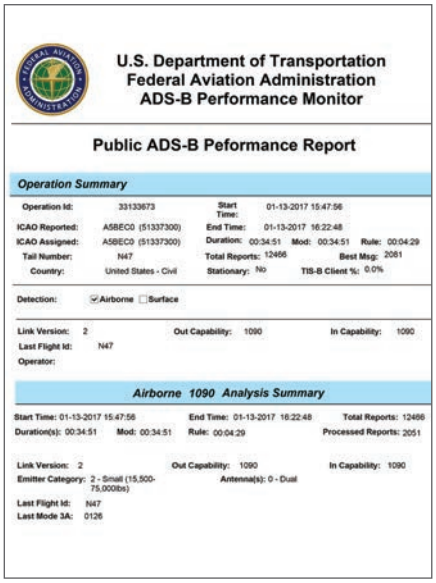
JENNIFER CARON

ADS-B OUT INSTALLATION TIP: RUN A PAPR REPORT



U.S. Department of Transportation
Federal Aviation Administration
ADS-B Performance Monitor

Public ADS-B Peformance Report

Operation Summary

Operation Id:	33133673	Start Time:	01-13-2017 15:47:56
ICAO Reported:	A5BEC0 (51337300)	End Time:	01-13-2017 16:22:48
ICAO Assigned:	A5BEC0 (51337300)	Duration:	00:34:51 Mod: 00:34:51 Rule: 00:04:29
Tail Number:	N47	Total Reports:	12466 Best Msg: 2081
Country:	United States - Civil	Stationary:	No TIS-B Client %: 0.0%

Detection: ☑ Airborne ☐ Surface

Link Version: 2 Out Capability: 1090 In Capability: 1090
Last Flight Id: N47
Operator:

Airborne 1090 Analysis Summary

Start Time: 01-13-2017 15:47:56 End Time: 01-13-2017 16:22:48 Total Reports: 12466
Duration(s): 00:34:51 Mod: 00:34:51 Rule: 00:04:29 Processed Reports: 2051

Link Version: 2 Out Capability: 1090 In Capability: 1090
Emitter Category: 2 - Small (15,500-75,000lbs) Antenna(s): 0 - Dual
Last Flight Id: N47
Last Mode 3A: 0126

If you're an avionics installer, there's no question that you're handling an overwhelming demand for installations of ADS-B Out. The good news is that for many units, the install can often be straightforward, your typical installation time is just a few days, and there's even a handy ADS-B installation job aid from the FAA at ***bit.ly/2NA4spF.***

But bear in mind that before you can return the aircraft back to the owner, it is your responsibility to verify that the ADS-B Out system complies with both the configuration and the performance requirements of 14 CFR section 91.227. Here's a breakdown of those requirements.

Configuration

The configuration (or broadcast elements) of section 91.227 includes the aircraft's assigned ICAO 24-bit address, emitter category, flight identification, and several other identifiable parameters to convey an aircraft's location on the ground and in the air. "Most ADS-B equipment manufacturers provide checkout tools that you can use to edit and view the system configuration," says James Marks, ADS-B Focus Team Lead in the FAA's Flight Standards Service. "Many ADS-B equipped aircraft are not fully compliant with the performance requirements for the equipment, and the majority of ADS-B compliance failures result from improper configuration of the equipment at installation," Marks explains. During installation, pay particular attention to the emitter (or aircraft) category, the flight ID (aircraft call sign), and the 24-bit ICAO address code (also known as the Mode S code) settings to ensure that you have entered them correctly. Test equipment is often limited to verifying that the configuration information you entered is present in the avionics but lacks the capability to determine whether it is correct.

Performance

Performance aspects of 91.227 requirements include the Navigation Integrity Category (NIC), and the Navigation Accuracy Category for Position and Velocity (NACp and NACv). You'll find the avionics standards for outputting NIC, NACp, and NACv in Technical Standard Order (TSO)-C166b (1090 MHz) and TSO-C154c (978 MHz).

PAPR

After your installation is complete, you must test the system per the manufacturer's installation guidance. The FAA recommends that you perform both a ground check and a postflight check to verify that the system configuration and performance are working correctly. Use ramp test equipment or other system interface tools to confirm data transmitted by the ADS-B system is correct. Next, run a Public ADS-B Performance Report (PAPR) to verify the system complies with 91.227 requirements.

PAPR is a sure-fire way to verify that you have installed and configured the system hardware correctly. The report shows any equipment configuration or performance errors in highlighted red. And best of all, the PAPR service is free, online, and takes just 15 minutes to receive so you can run as many reports as you need to resolve any issues and help keep your installs error free. You'll find a user's guide at ***bit.ly/31Yk0aY***, but in a nutshell here's how it works.

After the owner completes a post-installation validation flight in airspace that supports ADS-B Out, go online to ***bitly.com/PAPRequest***, fill out the required information, and submit. In 15 minutes, you'll get an email with a PAPR showing all the configuration and performance details for the ADS-B equipment you just installed.

Run a PAPR after all your ADS-B Out installations. It's quick, it's easy, and lets you know right away if your install was a success.

Jennifer Caron is *FAA Safety Briefing's* copy editor and quality assurance lead. She is a certified technical writer-editor in aviation safety and flight standards.

LEARN MORE

14 CFR section 91.227, ADS-B Out Equipment Performance Requirements
bit.ly/2HrC8Sk

DON'T BOTHER ME, I'M FLYING!

You're zooming down the highway — more like crawling if you're in Washington, DC! — when your phone chirps with the familiar sound of an incoming text message. Oh, and did I mention it's late in the day, you've got a lot on your mind, and your phone is in the passenger seat? Do you pick it up and read the message? It could be an important follow up from a potential employer. Or, it could also be one of those incessant BOGO offers from your favorite burger chain (both could be important, no judging here). Despite knowing that thousands of people die each year from distracted driving incidents (3,166 fatalities in 2017 alone according to the National Highway Traffic Safety Administration), many people will still try to read that message. We've probably all been similarly tempted.

The justification some give for diverting attention to an emoji-laden text is that they know their vehicle and feel confident they can maintain a sufficient margin of safety. But just because you've been lucky in the past doesn't make it a safe thing to do. The time you divert to the text is time when you are unaware of actions taking place outside the vehicle. The delayed reaction to a suddenly stopped car or a pop-up construction zone often causes an accident.

The same issue applies to pilots. Distraction is a dangerous threat to safety, so pilots must learn to manage distractions during every flight. To see the deadly effects of distraction in aviation, have a look at the National Transportation Safety Board (NTSB) accident report for the August 26, 2011 crash of an EMS helicopter flight in Mosby, Missouri (***go.usa.gov/xVTWQ***). In this accident, personal texting while flying was at least partly responsible for the crash that killed the pilot, a nurse, a paramedic, and the patient.

In another accident, a Cessna 150 pilot and his passenger were killed when their plane crashed into a wheat field in Watkins, Colorado (***go.usa.gov/xVTBY***). Contributing to the accident was the pilot's distraction due to cell phone use while maneuvering at low altitude. A Go-Pro camera found near the wreckage revealed footage of the pilot and his passengers taking mobile phone "selfies" during takeoff, climb, and in the pattern just before the accident flight. Investigators believe the pilot's focus on his cell phone, coupled with the flash function of his camera, contributed to the development of spatial disorientation and consequent loss of control.

But distraction in the cockpit doesn't always involve such a blatant diversion from primary flying duties. It is often more insidious, like fixating on a cockpit warning or trying to troubleshoot an avionics display issue. With the ADS-B Out mandate just around the corner, many pilots now have the capability to display weather and traffic information with ADS-B In equipment. This technology can certainly enhance situational awareness and decision making, but it's absolutely critical to know how your system operates, to include its limitations, before you fly so they don't become a dangerous distraction. Remember too that ADS-B equipment is a supplemental tool; it does not relieve you of see-and-avoid responsibilities.

> **SINCE 2008, THERE HAVE BEEN 22 FATALITIES IN GA AND PART 135 CRASHES THAT INVOLVED PILOTS DISTRACTED BY NONOPERATIONAL ACTIVITIES.**

To emphasize the importance of eliminating distractions, the NTSB has added this topic to its 2019-2020 Most Wanted List of Transportation Safety Improvements. According to its *Eliminate Distractions* fact sheet for aviation (***go.usa.gov/xVTkg***), since 2008 there have been 22 fatalities in GA and part 135 crashes that involved pilots distracted by nonoperational activities. The NTSB urges pilots to keep mobile phones off and out of the environment to avoid the temptation of answering. Also, although there are no regulations on sterile cockpit procedures for part 91, avoidance of all nonessential conversations is an excellent point to brief with passengers. It goes over a lot better than having to yell, "Don't bother me, I'm flying!"

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

WHERE EVERYBODY KNOWS YOUR NAME

Type Clubs for the Rotorcraft Community

Photo courtesy of Whirly-Girls

Just like Norm and the other patrons of *Cheers*, the famous neighborhood bar of the 80s and 90s sitcom, many of us enjoy places where everybody knows our name. Luckily, for helicopter pilots, there are dozens of clubs and associations where you can share your interests with other like-minded pilots and which cater to almost every niche in the helicopter community.

Are you a veteran? Active duty military? Think about joining the Vietnam Helicopter Pilots Association, the Combat Helicopter Pilots Association, the Ancient Order of the Pterodactyl (Coast Guard Aviation Association), the Naval Helicopter Association, or the U.S. Air Force Helicopter Pilot Association.

Would you prefer a group close to home? Try the New England Helicopter Council, the Midwest Helicopter Association, or the Eastern Region Helicopter Council.

How about a group that caters to your job? The National Agricultural Aviation Association, the Professional Helicopter Pilots Association, or the Airborne Public Safety Association for police officers, firefighters, and anyone else interested in aviation-related public safety might be a great club for you.

The International Women Helicopter Pilots' Whirly-Girls is a group where female helicopter pilots from the U.S. and around the world can share their experiences and find camaraderie.

Fans of homebuilt helicopters can check out the Popular Rotorcraft Association.

The Survivors Network Air Medical Community helps those who have survived a helicopter accident, and the friends and family who have lost a loved one in a helicopter accident, deal with pain, grief, and anxiety.

The flagship group for helicopter pilots is the Helicopter Association International (HAI). This Virginia-based group is well known for its annual Heli-Expo, the country's largest helicopter conference, but the group also sponsors smaller forums and training sessions.

Most of these organizations welcome new members.

"We're always looking for people who want to help us keep the passion going for vertical flight," said Joni Schultz, Whirly-Girls board member and past president. When the group was founded in 1955 by Jean Ross Howard Phelan, Phelan could find only a dozen female-rated helicopter pilots worldwide to join the organization. According to Schultz, the group now has about 2,100 members around the world.

"We're a smaller group," Schultz says. "We're small enough to get to know you. We have quite the camaraderie going."

The Indiana-based Popular Rotorcraft Association has about 1,000 members with chapters worldwide, says John Rountree, the group's general business manager. Membership dues include an electronic copy of the magazine, *Powered Sport Flying*.

The group also provides webinars, seminars, and events.

"We're really just here to support the community," says Rountree, which includes helping members get their aircraft evaluated by experts in the field. "We'll have experts come down and look at your ride, or you can bring it to the chapter and we'll have them check it out and tell you how to fix it."

FAA inspectors or Designated Airworthiness Representatives must approve these homebuilts before they can be flown.

HAI has about 3,000 members, but that number is a bit misleading. Some members are part of a corporate membership which could include thousands of people, says Dan Sweet, HAI director of public relations and communications.

Savor the joys and challenges of working with and piloting helicopters with one — or a few — of the communities of folks who share your interests and passion, and you can enjoy getting together where everybody knows your name.

THERE ARE DOZENS OF CLUBS AND ASSOCIATIONS THAT CATER TO ALMOST EVERY NICHE IN THE HELICOPTER COMMUNITY.

Gene Trainor is a communications specialist in Fort Worth, Texas. He previously worked as a technical writer for the Rotorcraft Standards Branch.

Here's a handy tip and some feedback from members of our new GA Safety Facebook Group!

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 (NAS) safer.

Get Vital WX Info FAST!

Text the word "METAR" add a space, and then add in all caps your four letter airport identifier (for example: METAR KDCA) to the number 358782. You'll get the current weather conditions at your chosen airport. For private-use airports, text METAR and the two-letter, two-number identifier (e.g., METAR GE99), and for public-use landing facilities, text the one-letter, two-number identifier (e.g., METAR W94). For more information, visit bit.ly/2kHOrlx.
— David

What's Your Type Club?

A type club offers an excellent way of leveraging other people's experience and expertise to improve your own. Learn more at: ***adobe.ly/329EZbo.***

Very happy that the FAA wrote a piece about type clubs, and also included our @EAA Type Club Coalition's efforts in the article! Type clubs are important for a safe and vibrant general aviation culture and EAA is committed to supporting them!
— Kyle

Can You Take a Hint?

Pay attention to the subtle comments you get from your fellow pilots. Those comments and suggestions may be a polite way of helping you avoid dangerous decisions in your own flying. Get more tips here: ***adobe.ly/2G31CVC.***

Holy cow, FAA! Best dang thing I've read in ages. It's a shame we can't retroactively taser basic humility, coachability, and airmanship into those who'll run from this article like a kid avoiding vegetables. Thanks for a great one; widely circulating this one already; provocative, timely, and very appreciated.
— Roland

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* ***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.

ADS-B EQUIP NOW!

2 MONTHS

2 Months Left to make the ADS-B Out Deadline!

Starting January 1, 2020, you must be equipped with **ADS-B Out** to fly in most controlled airspace.

Q: I keep hearing the deadline will be extended. Will the January 1, 2020 deadline be moved?
A: The January 1, 2020 deadline will not move. The FAA encourages owners to equip as soon as possible to capture the benefits of ADS-B and to ensure they will be able to access all available airspace once the mandate becomes effective in 2020.

Q: What will happen if I wait until after the deadline to equip?
A: The ADS-B Out rule allows a mechanism for pilots/operators without ADS-B Out equipment installed to request ATC authorization to deviate from the rule to access ADS-B Out rule airspace. The FAA published a policy in 2019 with guidance on how controllers will handle these aircraft (see bit.ly/2zcFNiF). The policy is clear that unequipped aircraft cannot expect uninterrupted access to ADS-B airspace.

INFINITE DIVERSITY IN INFINITE COMBINATIONS

I've always loved behind-the-scenes stories. That means I almost always buy the "special features" version of movies and, in my youth, I made quick work of books like Arthur Hailey's 1960s classics *Hotel* and (of course) *Airport*. These days, I relish hearing the stories that my significant other, a part 121 airline captain, dishes out from his workday in the pointy end of the airliner. There are never names — I wouldn't remember them anyway — but he has a knack for painting vividly colorful word portraits of the astonishing range of humanity he encounters in airports and airplanes. I regard it as more evidence of what I call the "ubiquity of uniquity," an alliterative restatement of Star Trek science officer Spock's Vulcan IDIC philosophy.

The Not-So-Secret Sauce

But just like the super-diverse Star Trek crews, the airline crewmembers I hear about combine their strengths and their unique characteristics to form a single, smooth-operating team. That doesn't happen by accident or by magic. A well-known team-development sequence describes the progression from "forming" to "storming," "norming," and (finally) "performing." Flight crews skip the "storming" part entirely. Carefully developed Standard Operating Procedures, or SOPs, are the not-so-secret sauce, the norms that enable total strangers to meet at the airport, form themselves into a crew, and use the norms to perform smoothly from the get-go.

The recent passing of Captain Al Haynes has put those SOPs, which broadly include some of the resource management topics we've explored in this issue, back in the news at the time of this writing. Even if you weren't yet on the planet in July 1989, you have undoubtedly heard the story — and perhaps seen some of the YouTube videos and animated recreations — of United 232's fiery arrival in Sioux City after a catastrophic engine failure left the DC-10 with no hydraulics. It might have been the first time many people heard of Crew Resource Management (CRM), which by then had been airline SOP for less than a decade. I was privileged to hear Captain Haynes give his behind-the-scenes perspective on two occasions, and he never failed to talk about the vital role that effective CRM played in saving many lives that day. It wasn't just the flight deck crew, augmented by an off-duty United check airman who offered assistance. It was also the way the cabin crew, air traffic controllers, and well-trained airport first responders worked smoothly together to minimize loss of life in a seemingly impossible situation.

The more recent story of Cactus 1549 — aka "Miracle on the Hudson" — is yet another famous example of CRM in action. As with United 232, the Cactus 1549 team included not just the now-famous flight deck crew, but also flight attendants, ATC, and first responders.

> **AS A GA PILOT, I AM GRATEFUL FOR THE WAY THAT SO MANY OF THESE PRACTICES HAVE BEEN ADAPTED FOR PILOTS WHO FLY IN LESS CAPABLE AIRPLANES AND WITHOUT THE HELP OF AN ON-BOARD CREW.**

Both United 232 and Cactus 1549 are a long way from the earliest days of aviation, when daredevils and lone eagle flights were celebrated, and airline SOP was the gear-up-and-shut-up crew culture of the so-called "skygod" era. As a frequent airline passenger, I am extremely grateful to benefit from the development of better and safer practices. As a GA pilot, I am also extremely grateful for the way that so many of these practices have been adapted for, and adopted by, pilots who fly in less capable airplanes and without the help of an on-board crew.

As we have explored in this issue, there is infinite diversity in infinite combinations of pilots, airplanes, environmental conditions, and crews. But may we all resolve always to come together on the team for safety.

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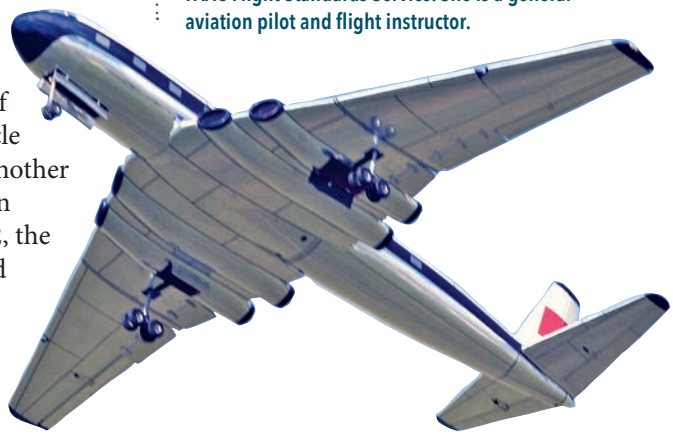

SABRINA WOODS

Aviation Accident and Incident Analyst, Accident Investigation Division

How does an English and secondary education undergrad become engulfed in aviation? That would be due to the United States Air Force and its so-called "infinite wisdom!" As a second lieutenant, Sabrina Woods was assigned to aircraft maintenance.

"It turned out to be serendipitous because I loved it, and I was very good at my job," she explains. "I have been hooked on aviation ever since."

For 12 years, Sabrina served as an Air Force maintenance officer on mostly fighter aircraft. She also trained as a military aircraft accident investigator. Her first fatal accident investigation changed her career trajectory from active duty to pursuing a master's degree in aviation safety and human factors from Embry-Riddle Aeronautical University.

"Watching the response of my peers upon seeing the final safety board conclusion of '*pilot error*' with no other explanations turned me towards human factors," she notes. "I always knew there was much more than just '*he or she screwed up*' in each accident or incident, so I decided to learn more on my own about what causes a person to make a mistake or commit an error."

Sabrina was exposed to the civilian world of general aviation when the FAA hired her as a technical writer for the *FAA Safety Briefing* magazine. She wrote many articles about human factors for the aviation community.

She believes the future of aviation safety involves a better understanding of human behavior and human error, so when the FAA's Air Traffic Organization wanted to address human factors in this area, Sabrina altered course and officially became a human factors scientist. Her primary task in the new position was to refine the crew resource management concept to be more applicable to air traffic controllers. The July 2017 attempted taxiway landing by Air Canada Flight 759 was one of her most notable investigations.

"Each pilot needs to have a better understanding and appreciation of their own limitations. My goal is to help give our flying community the tools needed to be able to self-identify when things aren't at optimum and when they are at an increased risk of committing an error," explains Sabrina.

Sabrina's position in the Air Traffic Organization gave her the opportunity to work alongside the Office of Accident Investigation and Prevention's Accident Investigation Division, and that led to her joining that division as its human factors and safety analyst. During a significant accident or incident, Sabrina evaluates the findings and analyzes the data to develop and implement safety actions. The Accident Investigation Division is the principal organization in the FAA that investigates aircraft accidents and collaborates with the National Transportation Safety Board (NTSB). Their mission is to make air travel safer through investigation, data collection, risk analysis, and information sharing. "Since the NTSB has no regulatory authority, our team is responsible for ensuring that anything that needs to be addressed gets the attention it warrants," explains Sabrina.

SABRINA BELIEVES THE FUTURE OF AVIATION SAFETY INVOLVES A BETTER UNDERSTANDING OF HUMAN BEHAVIOR AND HUMAN ERROR.

Sabrina also serves as the liaison between the Accident Investigation Division and other FAA offices on safety risk assessments, safety issue identification, proposed safety recommendation assessments, and accident data analysis.

"I truly believe that if each person knowns their own limits, why or how they exceed beyond those limits, and the factors that can lead to accidents or incidents, then we will slowly start to bring down the accident rates that are directly attributable to human error," explains Sabrina.

Paul Cianciolo is an associate editor and the social media lead for *FAA Safety Briefing*. He is a U.S. Air Force veteran, and a rated aircrew member and volunteer public affairs officer with Civil Air Patrol.

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