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ABOUT THIS ISSUE ...

The July/August 2020 issue of FAA Safety Briefing *focuses on the importance of human factors in aviation. Feature articles and departments address stress, fatigue, decision making, cognitive bias, and more. We also take a closer look at the humans behind the FAA's Human Factors team to see how their work is helping improve aviation safety.*

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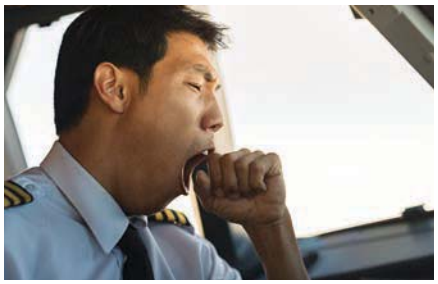
FAA Safety BRIEFING

The FAA Safety Policy Voice of Non-commercial General Aviation

25

To "B" or Not to "B" ... Why Equipping with ADS-B Makes Sense



DEPARTMENTS

16

THE HUMAN FACTOR

It's almost axiomatic to say that human factors are somehow involved in every aviation incident or accident. That includes drone accidents. While officially known as "unmanned aircraft systems," most drones still have pilots — and the remote pilot of a drone is as human as any other pilot. The very nature of human beings carries the inevitability of mistakes. Even though designers and engineers have worked very hard over the years to design machines that are immune to, or at least tolerant of, mistakes by those who fly and fix them, human beings have a remarkable way of finding new ways to make errors. We all know that those errors can be deadly in aviation.

That's where human factors research comes in. In the United States, the more formal discipline of human factors started during the World War II era. The combination of mechanical and procedural advances has dramatically reduced the ugly numbers that were almost viewed in that era as a "cost of doing business." But even one accident is too many, and so the work aimed at reducing both mechanical and human factors causes continues. That's also why the team is devoting this issue of *FAA Safety Briefing* to a fresh look at the discipline of human factors.

The Abstraction Distraction

If you think the term "human factors" sounds very abstract, I agree with you. Some may even regard it as a largely meaningless cliché. It's neither an abstraction nor a cliché! So, before we go any further, let's nail down what we mean by "human factors" and why this branch of science merits your attention.

HUMAN FACTORS PLAY A BIG ROLE IN AVIATION SAFETY, NOT ONLY FOR THOSE WHO PILOT AIRCRAFT, BUT ALSO FOR THOSE WHO DESIGN, MANUFACTURE, AND MAINTAIN THEM.

A traffic accident investigator named William Messerschmidt deftly describes it as "the way people interact with the human-made or influenced environment." Specifically:

> *(P)eople make things, others interact with those things, and we're curious as to how those interactions are likely to end up. (…) We're often asking how we can make those interactions safer, more efficient, or better in some way.*

A more formal definition calls human factors "the study of how humans behave physically and psychologically in relation to particular environments, products, or services." The same source goes on to note that "factors of humans" (emphasis mine) include attention, detection, perception, memory, judgment, reasoning, and decision-making. All these factors play a role in aviation safety, not only for those who pilot aircraft, but also for those who design, manufacture, and maintain them.

A Look Ahead

Here's a preview of the magazine team's take on this crucial topic. At the time of this writing, stress is quite literally a global condition arising from the pandemic coronavirus health emergency. So, we'll launch with a look at stress, which the *FAA Safety Briefing* editor characterizes as the "ultimate" human factor. Magazine alum Sabrina Woods, whose passion for human factors science led to her recently earned Ph.D. in this topic, leads a discussion of bias and its potential for behavior adverse to safety. We devote another feature to the "humans behind human factors" research and application in the FAA, whose work is even more important in light of issues that contributed to the B-737 MAX accidents. You will meet one of the FAA's leading "humans in human factors," Dr. Kathy Abbott, in this issue's FAA Faces department. Other topics include fatigue, workload and task management, and much more.

If you are among the many whose aviation activities have been sidelined by the pandemic, we hope you will use any stay-at-home time that remains to join us for this deep dive into the multifaceted world of human factors — and, once released for normal activities, that you will take the time to ensure that you are ready for a safe return to the sky.

AVIATION NEWS ROUNDUP

FAASafety.gov to Get Modern Makeover

To meet industry demand, a major effort to replace the FAASafety.gov website is underway.

The FAA Safety Team (FAASTeam) is collaborating with Delaney Technologies, Inc., to build a brand new mobile-friendly system using a Salesforce, Inc., platform. This is the first step in the process to transform the current website into a strategic tool designed to meet the needs of all users — from all airmen to volunteer FAASTeam Representatives and FAASTeam Program Managers (FPMs) in the Flight Standards District Offices to FAA managers and executives.

The next step will incorporate the latest technology, including artificial intelligence (AI), and will leverage FAA and other government data systems to reinforce the FAASTeam's data-driven approach to aviation safety, education, and outreach. Tools will be added to make everyday tasks easier. As the website is developed, interviews with industry partners, volunteer representatives, managers, and team leads will help to ensure the tools are accurate and comprehensive.

Avoid Illegal Air Charter Operations

Illegal air charter operations pose a serious safety hazard to the traveling public. The FAA works aggressively to identify and shut down rogue operators and to help passengers ensure the company they hire is legitimate.

Air charter operations — also known as commuter and on demand operations — require a higher level of FAA pilot training and certification, aircraft maintenance procedures, and operational safety rules, than pilots who may take family or friends for an airplane ride. FAA inspectors perform more frequent periodic checks on air charter pilots, crew, and aircraft than they do on private pilot operations. A passenger has the right to see the Operator's Air Carrier or Operating Certificate to validate that the aircraft has authorization for charter use.

As a legitimate air charter operator, if you suspect that a client is moving to or using an illegal system, articulate to him or her the safety-based differences between you and a part 91 operator (pilot experience, training and oversight, maintenance programs, equipment, background/drug checks, etc.).

As an aircraft owner, ensure you fully understand the requirements for legitimate leases as explained in Advisory Circular 91-37B, *Truth in Leasing* (bit.ly/AC91-37B). If you consider placing your aircraft in a "leasing pool" or "leasing program," conduct an independent exam of the system to ensure you are not engaging in a disguised illegal charter system.

The following red flags may indicate an illegitimate charter operation:

- The company provides the aircraft and at least one crewmember, yet attempts to transfer operational control to a consumer via any document.
- A lack of federal excise tax charged to the consumer. Legitimate operators have to charge this. If the price is too good to be true, it probably is.
- A lack of a safety briefing or passenger briefing cards.
- Any evasiveness to questions or concerns. Legitimate operators should be transparent and helpful.
- The pilot or someone associated with the company coaches passengers on what to say or do if an FAA aviation safety inspector meets the aircraft at its destination.

If you suspect an illegal air charter operation, report it. You can call the Illegal Charter Hotline at (888) 750-3581, or fill out the online form at hotline.faa.gov, or fill out the online form from the National Air Transportation Association (NATA) at AvoidIllegalCharter.com.

Scenario-Based Helicopter Training Improves Aviation Decision Making

The U.S. Helicopter Safety Team (USHST.org) released an extensive recommended practice document, which suggests training scenarios to mitigate risk and improve aviation

decision making. The training lesson plans identify and describe numerous fatal helicopter accidents that involve some aspect of a lack of sound aviation decision making that placed the aircraft in an "at risk" situation.

The situation was either caused by, or was a contributing factor to, the fatal accident including:

- Loss of rotor RPM in autorotation
- Loss of tail rotor effectiveness
- Spatial disorientation
- Unintended flight in IMC
- Low altitude wire strike
- Low altitude engine failure

Simulator training providers in evidence based training or other syllabi may use these scenario guidelines as the basis to improve aviation decision making. Each year, the U.S. helicopter industry safely flies more than 3.2 million flight hours. Working together, we can build on that safe record and eliminate the small number of accidents that do occur.

The recommended practice document and its five annex documents with crash scenarios are online at ushst.org/ENHANCED-TRAINING.

Changes Coming to Flight Service in the CONUS, Puerto Rico, and Hawaii

Since pilots are using mobile apps and online resources to receive regulatory compliant briefings, work is underway to update messaging and guidance on self-briefing without the need to also contact a Flight Service specialist. Throughout the summer, Leidos Flight Service will make some changes to their phone system to provide pilots with additional services and capabilities.

These new capabilities will interact with online platforms to allow specialists to provide quicker, more streamlined services and let the phone system perform some simple actions when calling from a phone number contained in a registered profile. Changes include new messaging and menu options associated with the number you are calling from, priority in the phone system with a linked account, and self-service options on 1800wxbrief.com.

Also in the account menu, pilots will be able to opt-out of certain required statements routinely delivered during a specialist-provided briefing. This will notify the specialist that you are familiar with and aware of the requirements and preclude them from providing these details during future calls.

Specialists will also have the ability to view an actual update briefing and provide only the information that changed since the last standard weather brief obtained from 1800wxbrief.com, from a specialist, or from a commercial provider that links to your account when a regulatory compliant briefing product is used. This eliminates the need to repeat unnecessary information.

Go to 1800wxbrief.com to learn more.

Weather Cameras Test Visibility Sensors

In March 2020, the FAA's Weather Camera (WCAM) program successfully downloaded a new edge detection algorithm, known as Visibility Estimation through Image Analytics (VEIA), onto its cloud servers. The FAA's NextGen Weather program and MIT Lincoln Laboratory developed VEIA to extract visibility estimates and turn the weather cameras into visibility sensors.

The feature is now operational on the WCAM developmental website, providing visibility estimates for the images from the Palmer Airport (PAAQ) camera site in Alaska. Further testing and analysis will help to perfect operations as the algorithm learns its environment to improve accuracy. The algorithm determines visibility over a 10-day period by looking for stationary edges or landmarks of known distances from an airfield, such as a tower or mountaintop and interprets how well they can see each marker as compared to a clear, sunny day.

In the future, this new technical capability will verify the operational accuracy of VFR Visual Weather Observing System ceilings and visibility sensors. The FAA is working with the National Weather Service to add the information to the existing data feed used to send images and weather data. Another capability may monitor and report physical camera-view status and verify ceiling sensor outputs. In addition, it could estimate visibility and ceiling conditions at airports where an Automated Weather Observing System or Automated Surface Observing Station does not exist. The goal is to improve aviation weather industry-wide to enhance weather observations and prediction forecasts.

If you're interested in learning more about the AvCams program, please check out https://avcams.faa.gov, or https://avcamsplus.faa.gov.

GETTING TO A "NEW NORMAL"

As the nation cautiously begins moving towards the "new normal" amid the current public health emergency of COVID-19, aircrew members need to be especially cautious. Aviation is less forgiving than most other occupations and pursuits. While we all face life challenges from time to time, such as the loss of loved ones, financial issues, divorce, illness, etc., the current situation is unprecedented in its impact on so many general aviation (GA) pilots simultaneously. Many pilots, especially those who rent the aircraft they fly, have limited their flying or stopped altogether for months. At some point, many will return to the skies.

Take Your Time!

Eagerness is understandable, but "take your time" needs to be step one in the new normal. Here are a few considerations.

Human factors: Think about how the emergency has affected you personally, and use the IMSAFE checklist (Illness, Medication, Stress, Alcohol, Fatigue, and Eating/Emotion). Are you or a family member in a high-risk group? Have you experienced economic or financial distress? Will these issues distract you from safe flight? Is your best option to wait a bit longer?

Health risk: A second consideration is the potential health risk of sharing an aircraft. Cleaning and disinfecting surfaces between flights will take extra time; factor it into your schedule and do not rush pre-flight planning or aircraft inspection. There is a growing body of information on proper use of disinfectants on various surfaces, but don't forget ventilation. Freshly swabbed surfaces need time to dry, both for effectiveness of the disinfectant used and to minimize the

potentially adverse impact of strong in-flight odors.

If you decide to take a passenger, you will need to manage the risks of inadvertent transmission of this highly contagious virus in the confines of a typical GA aircraft cockpit. That raises questions on using personal protective equipment (PPE) during flight. Masks can interfere with placement of a boom mike. Gloves reduce tactile perception and may impede use of today's ubiquitous touch screens.

If you do use a mask, remember that its major benefit is to protect others, but it does trap particles on both sides. If you touch the mask and then touch your face, you lose any personal benefit. The same applies to the use of gloves. Headsets are another issue: if you do not have a personal headset, now is a good time to consider making that investment.

Plane and Pilot: You also need to allow time to verify that both the plane and the pilot are in a condition for safe flight. Many aircraft have been sitting idle for extended periods. Verify that maintenance is current. Take extra time with preflight inspection and look for any sign of animal infestation.

Pilots grounded for long periods of time also need extra preflight time. Having long experience working with pilots who have been grounded for an extended period, the military and air carriers have formal plans to enable safe return to flying. GA organizations offer similar programs. It's a good time to check these out. While the FAA extended currency timelines for many aviation activities, proficiency is up to the pilot. In addition to hitting the books and flying with an instructor, consider chair flying as an approach to re-establishing dormant habit patterns — to include diligence in using checklists.

Proper planning is always important, but the effects of the COVID-19 public health emergency creates an extra dimension. As you brief on weather, fuel, and other usual things, check as well on airport and Air Traffic Control (ATC) status and hours of operation, as well as any public health measures in place at your points of arrival and departure and any intermediate stops. Note that airport overflow parking may have resulted in runway closures and/or changes to taxi procedures. Plan, and allow extra pre-flight time in case you encounter anything unexpected.

While it may not be the first time you have returned to flying after a hiatus, this situation is unique in scale and scope for pilots, aircraft, air traffic controllers, and public health authorities. Respect this reality, and take the time needed to ensure that your return to the skies is a safe one.

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., FAA MEDICAL OFFICER

A PRIMER ON MEDICAL TESTING

As with many hot topics, "medical testing" is a deceptively simple term for a complex process. This particular subject owes its current notoriety to the COVID-19 public health emergency, but medical testing will be with us long after the pandemic ends. Since you will need to discuss medical testing with your physician at some point, you might find a better understanding of the terms helpful.

Accuracy — It's Complicated!

Ideally, testing would definitively establish whether one is sick, immune, or contagious. Perfect tests would be 100-percent *sensitive* (everyone with the disease/condition tests positive) and 100-percent *specific* (everyone without the disease/condition tests negative).

Sadly, we do not live in this ideal world of yes/no binary outcomes. Even with good tests, it is possible to get a false positive (i.e., positive result even in the absence of the disease or condition) or a false negative (i.e., a negative result even when the disease or condition is present). Both outcomes are problematic. In clinical medicine, a false positive can lead to additional testing and, possibly, unnecessary treatment. A false negative test can delay proper treatment.

In public health, these outcomes can result in unnecessary restrictions on those free of disease or inappropriate clearance for those with disease. To put this issue in perspective, if a test has 95-percent sensitivity and 95-percent specificity, 5-percent of those with the disease or condition will test negative and 5-percent of those without will test positive. If we test 10 million people, one million tests total will be incorrect.

In addition to sensitivity and specificity, *prevalence* (the number who actually have the disease/condition) has a huge impact. Succinctly put, the more common something is, the more likely a positive test is a true positive (positive predictive value) and the less common it is, the more likely a negative test is a true negative (negative predictive value).

Screening

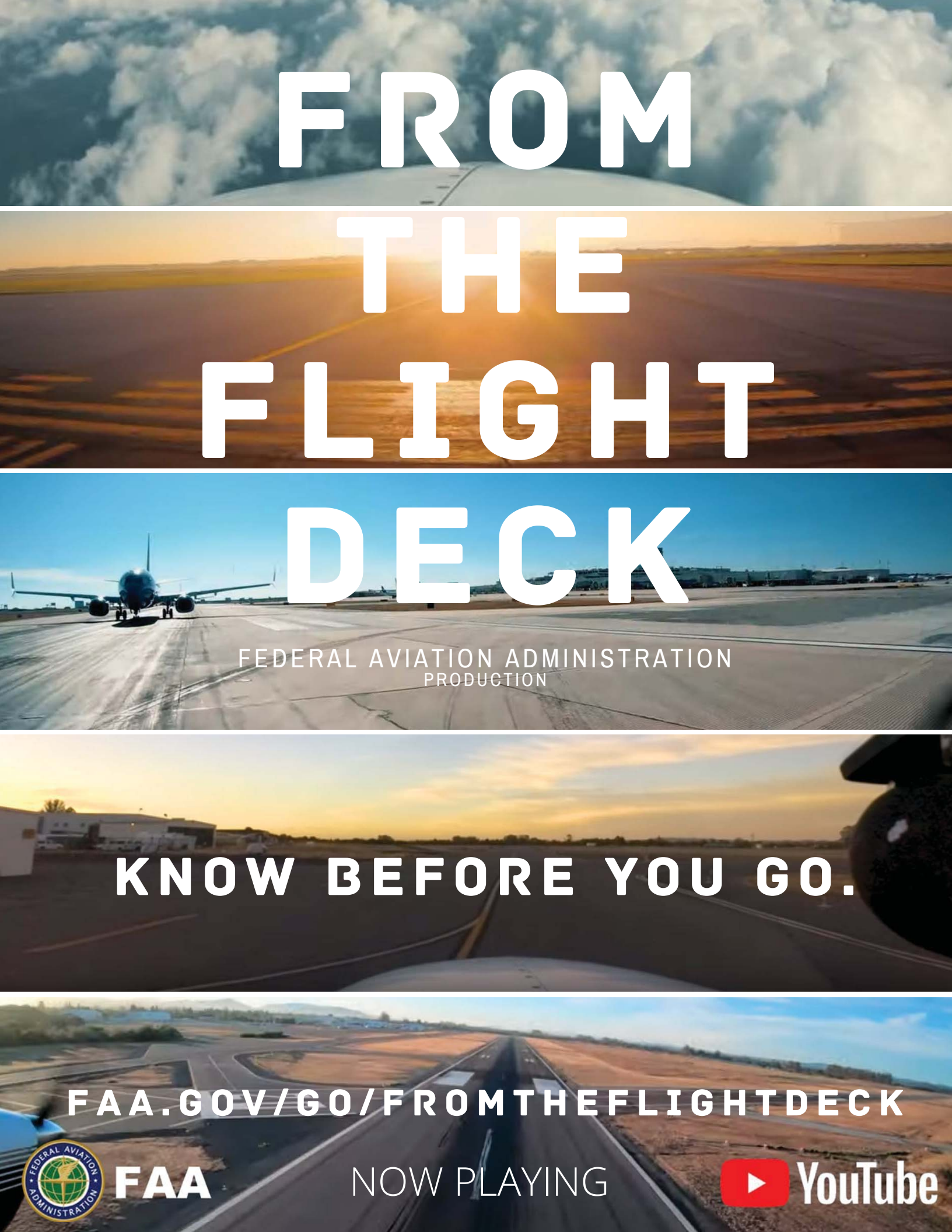
Both in clinical medicine and public health, health care workers use predictive values to develop clinical guidelines that define who needs to be screened and when. A common clinical example is mammography for women. Start too soon and many tests will show false positives resulting in the risk of unnecessary procedures, scarring, infections, and worry for women and their families. Start too late and you are less likely to detect breast cancer at an early stage when treatment is more likely to be effective and the disease potentially curable. This is why doctors discuss when to begin testing for many conditions on an individual basis. For other conditions, such as high blood pressure, where there is no real risk from screening and treatment options are safe, these tests are universal.

We often hear now that more testing for COVID-19 will accelerate the return to normal. It will, but testing is complex and we need to talk about what this really means.

Testing for a virus falls into one of two basic categories: tests for antibodies (proteins the body produces to fight infections) and tests for antigens (proteins produced by an infectious agent). At the time of this writing, the sensitivity and specificity for many COVID-19 tests (unfortunately, this is not uncommon) have been sub-optimal for both the virus (antigen) and antibodies. Further complicating the issue is "cross-reactivity." Antigen tests may detect an antigen from a related infectious agent, making test interpretation more difficult. In addition, antigen tests vary widely in accuracy and can remain positive even after someone is no longer infectious. Antibody tests suffer similar problems. A positive antibody test for an infectious virus may indicate an immune response to prior infection or a similar virus, but not current immunity. In other words, the presence of antibodies does not guarantee protection against reinfection. Moreover, antibodies may be detectable early in an infection while the individual remains infectious.

There has been rapid progress, but many questions remain to be answered. Meanwhile, I hope this primer has provided a better idea of the challenges that policy makers, the public health officials who advise them, and your physician face when it comes to medical testing. In addition, you should be equipped to make a more informed decision the next time your physician advises medical testing.

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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Passing the STRESS Test

Keep the Dark Side of Stress at Bay

By Susan K. Parson

Human beings are amazingly diverse, but the discipline of human factors tells us that we have certain "factors *of* humans" in common. These include cognitive functions such as attention, detection, perception, memory, judgment/reasoning, and decision making. Such factors play a role in how we react, both physically and psychologically, with respect to a given environment, product, or experience.

When one or more of these encounters poses a challenge or demand, the universal human reaction involves some level of emotional or physical tension that we call "stress." For that reason and a few more presented below, I tend to characterize stress as the ultimate human factor.

The Two Faces of Stress

According to Roman mythology, Janus was the god of duality, among other things. The Greek comedy and tragedy faces used to symbolize theatre are sometimes called Janus masks, presumably for this reason.

Like Janus, stress is a creature of duality. Depending on the situation, the person, and even minute things like the time of day, stress can motivate, or it can debilitate. It can stimulate a helpful hyper-focus, a harmful fixation, or an equally dangerous lack of focus. It can be positive when it pushes a person to positive activities or outcomes. On the flip side, it can be negative when it causes anger, frustration, or high tension.

Another duality is that stress can take two forms. You "host" the acute version when, for example, you quickly maneuver to avoid conflicting traffic or find yourself in instrument meteorological conditions (IMC) on a VFR flight. Acute stress leapt into my life on several memorable occasions, including the first time I got holding instructions while flying single-pilot IFR in no-kidding solid IMC. Handled properly — more on that in a moment — acute stress can help you safely navigate potentially dangerous situations.

Chronic stress is a peskier and more insidious visitor — kind of like a lingering houseguest who eats all your food, ransacks your belongings, and occupies all your favorite spots. Just as with the overstaying houseguest, chronic stress may leave you seething in silence, trying to pretend all is well. Meanwhile, your blood pressure soars, you sleep poorly, and you feel like you are carrying lead weights. Unmanaged, chronic stress can do permanent damage.

> **The four As of stress management are: Avoid, Alter, Adapt, or Accept.**

Having been there and done that, I cannot overemphasize the importance of promptly recognizing and dealing with chronic stress. Needless to say, the dark side of stress doesn't play nicely on the flight deck if you are the pilot of an aircraft, or in the maintenance hangar if your job is fixing flying machines. But managing stress is just as important for your overall quality of life.

Figure 1: Some of the warning signs of stress.

Emotional	Psychological	Behavioral	Physical
• Tearful • Irritable • Mood swings • Extra sensitive to criticism • Defensive • Feeling out of control • Lack of motivation • Angry • Frustrated • Lack of confidence • Lack of self-esteem	• No concentration • Indecision • Memory lapses • Easily distracted • Less intuitive • Less creative • Worrying • Negative thinking • Depression • Anxiety	• No time for relaxation or pleasurable activities • Forgetfulness • Reliance on alcohol, smoking, drugs • Workaholic • Poor time management • Absenteeism • Self-neglect • Social withdrawal • Insomnia • Aggressive/anger • Nervous	• Aches/pains • Muscle tension • Grinding teeth • Frequent colds/ infections • Allergies • Rashes/skin irritations • Gastrointestinal discomfort • Weight loss or gain • Indigestion/ heartburn/ulcers • Hyperventilating • Dizziness/palpitations • Panic attacks/nausea • Physical tiredness • Heart problems • High blood pressure

Identify — Friend or Foe?

You have probably heard the term IFF, the abbreviation for Identification Friend or Foe. Briefly, IFF is an identification system that lets military and civilian ATC interrogation systems identify aircraft, vehicles, or forces as friendly. It also determines bearing and range from the interrogator. In order to manage stress so as to get the benefits of its better half while keeping its dark side at bay, you need to develop an internal IFF system to help you spot signs of stress. See figure 1 for a few things to look for.

Playing the "A" Game

I've written in previous issues that the "aviate" part of the familiar Aviate-Navigate-Communicate mantra means managing attitude, airspeed, altitude, and avionics. Because it's easy to remember, an article on the four As of managing stress resonated strongly with me and could be helpful to you as well.

The four As of stress management are: ***Avoid***, ***Alter***, ***Adapt***, or ***Accept***.

Avoid sources of stress. Say "no" to taking on more than you can handle, whether in personal or professional situations. Limit the time you spend with people who cause stress in your life. Stop doing things that make you tense.

Alter the situation. Create a balanced schedule. Be willing to compromise. Learn to be appropriately assertive by expressing feelings and needs in an open and respectful way.

Adapt to the situation. Learn to reframe problems (e.g., a mistake is an opportunity to learn; bad weather offers time to refresh aviation knowledge). Put issues in perspective (e.g., will I remember this a month from now?). Set reasonable standards. Practice an attitude of gratitude.

Accept what you can't change. Focus on what you can do, and don't obsess about things you can't control. Frame challenges as opportunities for growth and learning. Let go of anger and resentments. Confide in a trusted friend, family member, colleague, or professional.

This Too Shall Pass!

Even normal life offers myriad daily opportunities to practice stress management. At the time of this writing, though, the pandemic coronavirus health emergency continues to disrupt virtually every aspect of what we knew as "normal life." I find it can be a challenge to manage stress in this utterly unprecedented time, and perhaps that is true for you as well. Let's jointly resolve to put the four As of stress management into daily use, and remember that this too shall pass.

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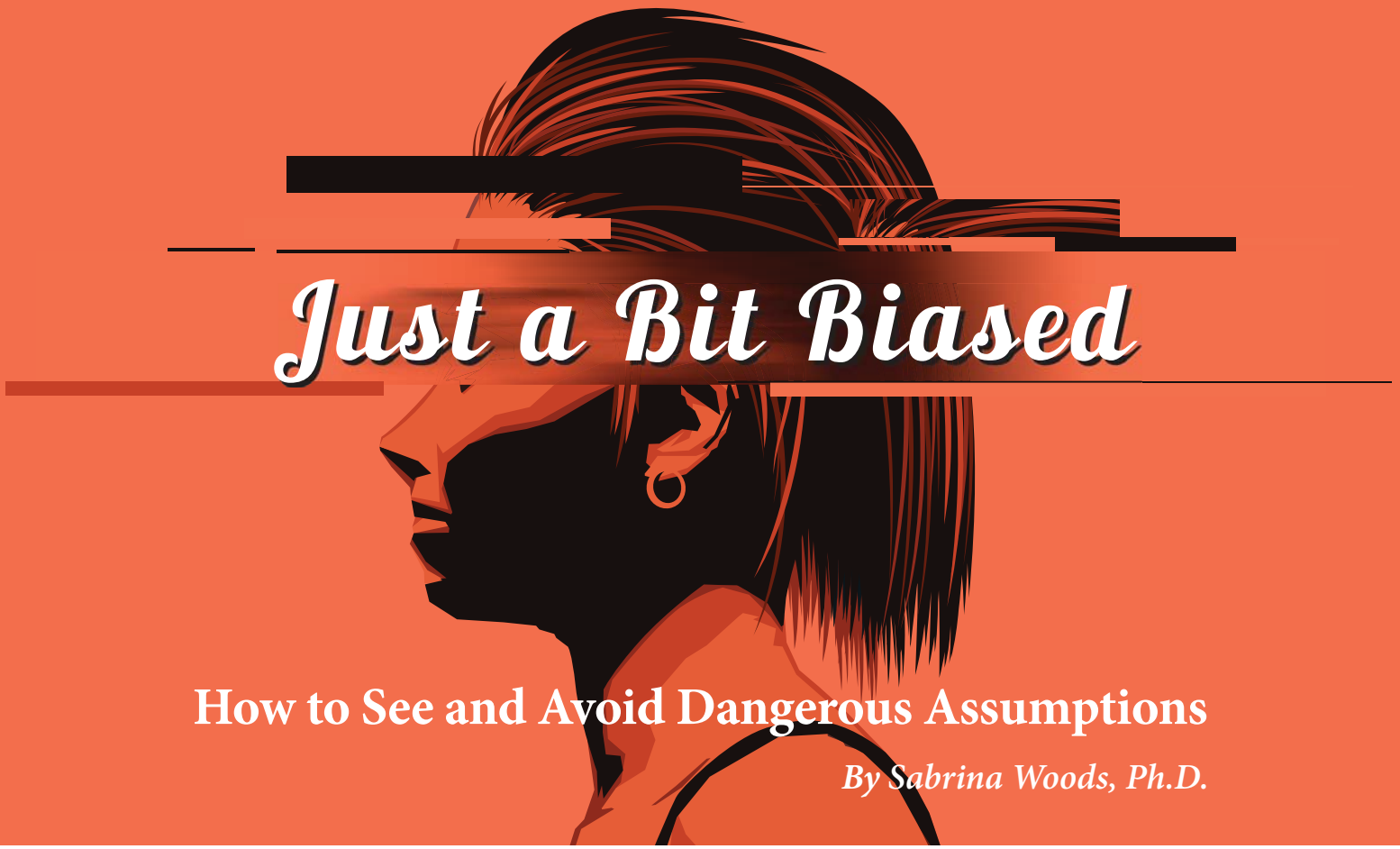


Just a Bit Biased

How to See and Avoid Dangerous Assumptions

By Sabrina Woods, Ph.D.

Hello again readers! I enjoy every edition of the magazine immensely, but I am particularly excited about *this* edition of *FAA Safety Briefing*. This is because it highlights what some of my human factors contemporaries are doing across the FAA to ensure safe aviation everywhere. The field of human factors is broken into so many different sub-disciplines and within the FAA we have people who are subject matter experts in engineering/airworthiness, ergonomics, and design; flight deck design and testing; human physiological response; human-in-the-loop and user interfaces; and my own specialty — perception, cognition, and decision-making, to name a few. The work human factors engineers, practitioners, and scientists do is essential to attaining and maintaining a high level of human performance and in keeping the NAS safe from the risks associated with human error. But I might be just a bit biased.

Bias Defined

If you have ever read up on human factors and human error, you have likely heard a story or two of how a pilot was affected by a cognitive bias. Cognitive biases are mental adaptations that occur when a person's prior knowledge, or his or her expected outcome, influence their resulting perceptions, interpretations, and decisions. But not all bias is bad. Biases result from cognitive heuristics, also known as "shortcuts," that we mentally make to aid in the decision-making process.

Think about it this way: when you have to make a judgment or decision about the world around you, there might literally be a thousand things to consider in that environment. Perfectly rational decisions would involve weighing ALL of the factors individually; potential costs versus possible benefits, negatives versus positives, before coming to a conclusion. In the irreverent words of a certain viral meme out there: ain't nobody got time for that! Our attention is a limited resource so we have to be a bit selective in what we can pay attention to and use for our decision making. Cognitive biases are often a result of your brain's attempt to simplify that information processing and speed up problem solving.

Sometimes though, the biases trip us up, leading to poor decisions and bad judgments. There are many different types of bias, but all have similar causes, risks, and mitigations. The most important tool to countering biases is to know they exist, and to understand when you might be most susceptible.

When Bias Goes Bad

Working in the FAA's Office of Accident Investigation and Prevention, I get to see firsthand how bias can get the better of us. While heuristics are often a good thing and help us navigate life quickly, they become an issue of biases gone bad when they lead to perceptual distortion, such as misidentifying the designated runway/taxiway; inaccurate

judgment, such as over/underestimating how close/far convective weather is; distraction, like being too busy chatting with a passenger to effectively monitor flight progress; fixation, like only looking at the cockpit array rather than looking out the window; and complacency, such as assuming a controller will advise you of traffic instead of actively looking for it.

Some of the more common biases that affect pilots are expectation bias, confirmation bias, plan continuation error, automation bias, and automaticity.

It's To Be Expected

Expectation bias is when we have a strong belief or mindset towards something we expect to see or hear, and act according to those beliefs. For example, a pilot contacts the tower and indicates he or she is ready for an intersection take-off. The controller clears the pilot for runway 10, however he or she departs from 28 because that is what the pilot was expecting and where he or she has typically departed from in the past.

Some of the more common biases that affect pilots are expectation bias, confirmation bias, plan continuation error, automation bias, and automaticity.

Other things play into the expectation such as routine or familiarity. We humans tend to be creatures of habit. If a person is used to doing things a certain way (such as taking off from runway 28) and doesn't expect the runway change due to winds, that person might simply proceed as though nothing has changed. This might even be despite acknowledging the actual assigned runway from ATC. Sound familiar? Perhaps it has even happened to you or someone you know?

Looking for Confirmation in all the Wrong Places

Next is confirmation bias. This is when we only look for, listen to, or acknowledge information that confirms our own preconceptions. We tend not to seek out or pay attention to evidence that could disconfirm the belief. I see this a lot in VFR into IMC incidents and accidents where there is often evidence of the pilot's natural inclination to look for positive information that will allow him or her to complete the flight even as he or she ignores or downplays information that could lead away from achieving that goal.

Confirmation bias is a perfect segue into plan continuation error — more colloquially known as get-there-itis — and the two often go hand-in-hand. Plan continuation is the unconscious cognitive bias to continue with the original plan in spite of changing conditions. The closer to the destination, the worse the bias gets. Our decisions are further influenced by the emotional, financial, and time investments that have already been made in accomplishing the goal. This is all despite the fact that the hazard is constant and the risk of a worse-case scenario (crashing and dying) is more profound.

In one example, a non-instrument-rated private pilot departed from a remote lake in Alaska with his son, anxious to get home. The airplane's flight path was heading over mountainous terrain in an area that frequently had low ceilings and reduced visibility due to rain, fog, and mist. The pilot queried Flight Service who advised of bad weather moving into the area. Rather than staying put, the pilot risked taking off in an attempt to outrace the weather and get home. Several weeks later the wreckage was finally found in an extremely wooded area several miles from the lake. There were no survivors. The National Transportation Safety Board stated that contributing to the accident was the pilot's self-induced pressure to complete the flight.

What the Heck is it DOING?

Technological advancements in the cockpit are a wonderful thing but their use can lead to unintended consequences. Automation bias is when we over-rely on automated aids and decision support systems, or become complacent in assuming the technology is always correct. We subsequently fail to monitor or question the technology sufficiently. As a result, manual flying time dramatically decreases, we can get distracted, and the automated information replaces personal vigilance which leads to complacency. The problem arises when the human is left "out of loop" and no longer knows just what the heck the automation is actually doing when it comes time to step in.

Air France 447 serves as a tragic air carrier example of what happens when a whole crew was outside the automa-

tion loop and was unable to determine "what it is doing" in time to prevent the accident. The aircraft entered a stall and fell from the sky into the Atlantic Ocean taking all 228 souls on board with her.

Yes, Dear

Last, there is automaticity or what I call the "yes, dear" response. I am sure anyone who has a significant other, children, parents, close friends, etc., can relate to what I mean by this.

It is when routine tasks lead to an automatic response without any real consideration to what is being said or done. We just kind of mentally tap out and rote memory response takes over for a moment. We register that something is being said and automatically respond, but we don't actually process what is being asked of us. In physical automaticity, the brain is no longer "conscious" enough to stop the automatic response of well-trained muscles, aka "muscle memory."

One example of this is responding "roger" to a hold short, runway, or altitude change without actually processing what the new instructions were. Acknowledgement of an instruction does not always ensure understanding. A physical example would be in shutting down the engines instead of setting the parking brake when stopping in accordance with a line up and wait instruction (true story!).

I Get Bias (With a Little Help from My Friends)

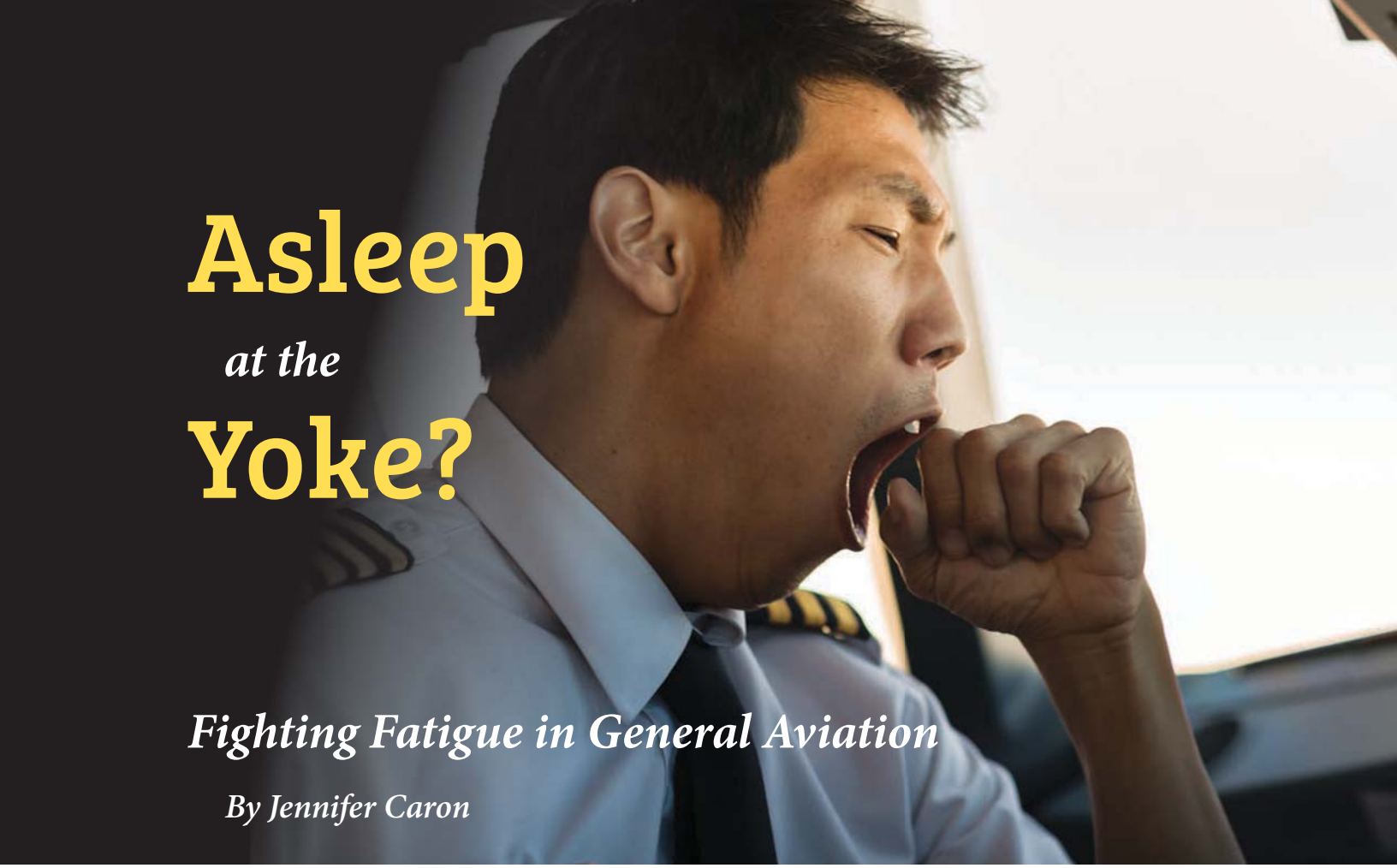
One of my favorite quotes of all time is from Douglas Wiegmann and Scott Shappell, two preeminent Human Factors (HF) researchers in the industry and in academia. They said that *human beings by their very nature make mistakes; therefore, it is unreasonable to expect error-free human performance.* It is a concept that my fellow HF contemporaries and I have taken to heart. For us, understanding how bias is likely to affect pilots helps us see the bigger picture better and helps us to create mitigations that prevent the inevitable human error from becoming an accident.

For you, mitigating cognitive bias can come down to exercising just a few best practices:

1. *Perform a Self-Assessment:* Understand that you ARE human and therefore CAN become biased. Know thyself and understand what stressors or fatigues may increase your own personal potential to be biased.
2. *Make a Backup Plan:* Don't expect the standard strategy to always work. Have alternative plans. Think about what would happen if the "go to" option is no longer available.
3. *Active Listening:* Especially when communicating with ATC! Active listening is a way of listening and responding to another person that ensures mutual understanding. It requires each person in the conversation to fully concentrate on and understand the intent of what is being said.
4. *Look for Disconfirming Evidence:* Test out your assumptions by trying to actively disprove them.

One of the most important things in aviation we can do is work so that our own human nature doesn't get the better of us. But again, I might be just a bit biased.

Dr. Sabrina Woods is a guest writer for the *FAA Safety Briefing*. She is a human factors analyst for the Office of Accident Investigation and Prevention. She spent 12 years as an aircraft maintenance officer and an aviation mishap investigator in the Air Force.



Asleep at the Yoke?

Fighting Fatigue in General Aviation

By Jennifer Caron

"There is no sunrise so beautiful that it is worth waking me up to see it!"

— Mindy Kaling

Who doesn't love a good night's sleep? For me, a spur-of-the-moment nap on a lazy Saturday afternoon curled up under a soft, warm blanket is heavenly bliss. Sleep is, in fact, as necessary as food and water. Without it, we experience significant physical and psychological problems.

If you've ever been a new parent, a graveyard shift worker, or burdened by an untreated sleep disorder such as insomnia or sleep apnea, you know what it's like to try and get through the day without enough sleep. You're tired and out of sorts, it only takes a feather to push your buttons, and caffeine and sugar are your two best friends. It's easy to rationalize and tell ourselves we don't need sleep but if we don't get enough of it, or if our sleep is interrupted, we will suffer from fatigue.

What is Fatigue?

We know it when we feel it. Fatigue is that drowsy, weary, sleepy feeling you get when you haven't had enough rest. It's an all too common part of our workaholic American culture, which is known for too much of the wrong food, too little of the right exercise, and insufficient or poor quality sleep.

But fatigue is not unique to our culture. It is a human condition that affects each and every one of us. No profession, activity, or gender is immune to its effects. Whether you're a pilot, a truck driver, or a paramedic, if you're sleep deprived you will experience the same physical and mental limitations across the board. What causes the fatigue is less important than the negative impact it has on your ability to perform tasks. Like drugs or alcohol, fatigue slows reaction time, decreases awareness, and impairs judgment.

> **Fatigue poses the highest risk during the task-critical taxi, takeoff, and landing phases.**

For most, fatigue can easily be resolved with a nap or by "sleeping in" the next day, without any adverse effects. But if you are involved in safety-related aviation activities such as air traffic control, or piloting or maintaining an aircraft, the consequences of fatigue can be disastrous.

How Does Fatigue Affect GA?

While commercial pilots are more prone to the occupational fatigue that results from long duty days, schedule changes, or multiple time zones, GA pilots can develop fatigue too. The risk of accidents is higher due to the challenges of single-pilot operations and the relatively higher individual workload. Also, GA pilots don't usually have the benefit of a second pilot to share tasks or to help judge fit-

ness for flight. Research shows that humans are poor judges of their own fatigue level. Family, friends, and crew are a lot more honest — sometimes brutally! — and won't hesitate to tell you how tired or ill you really look.

> **Fatigue impairs performance and has a negative impact on basic piloting skills.**

"You are probably more fatigued than you think, and you pose a bigger threat to your safety than you realize," says Dr. Katrina Avers, a research scientist in the Human Factors Research Division at the FAA's Civil Aerospace Medical Institute (CAMI). Her research focuses on fatigue education and fatigue risk management programs for flight crew, cabin crew, and maintenance technicians.

"We think that if we just push through and focus hard enough then we can overcome it, or if we drink enough caffeine then our performance levels will improve. But that's just not true," says Dr. Avers. In the end, you're still fatigued and your performance still suffers.

Motivation, caffeine, physical activity, and environmental stimulation can mask fatigue and possibly enable you to ignore the symptoms for a while. But they will not eliminate unavoidable physical effects. Coordination and alertness decline. Performance falls off, judgment and decision making become impaired, and you might take unwarranted risks. Even the most experienced pilots make mistakes when they're flying fatigued and no amount of masking can overcome its effects.

"It's much easier for us to look for risk factors in our flight environment than it is to look for those same risk factors in ourselves, but we have to be self-aware and recognize how impaired we really are to avoid flying fatigued," Dr. Avers explains.

A particularly insidious fatigue risk takes the form of short sleep attacks, also known as micro-sleeps. These are brief periods of sleep where you nod off suddenly and without warning. According to a 2001 study of in-flight brain activity, "pilot micro-sleeps occurred most frequently during the middle-to-late segments of cruise flight. They were over nine times more likely during night flights. Despite strong motivation to be alert during the final stages of flight, micro-events were also found to occur during the period from top-of-descent to landing." None of these are good things for a pilot, especially if there is no one else in the aircraft to help keep the pilot alert.

Flying Fatigued

Fatigue is not only a risk during the lull of cruise flight. It poses the highest risk during the task-critical taxi, takeoff, and landing phases. Reported fatigue-related events have included procedural errors, unstable approaches, lining up with the wrong runway, runway incursions, landing without clearances, and poor decision making.

"Fatigue impairs your performance and can have a negative impact on even fundamental skills," explains Dr. Avers. It compromises your ability to react quickly and communicate effectively. It adversely affects your memory and eye-hand coordination, so much so that after 17 hours without sleep, your ability to control, guide, and direct your hands closely resembles someone with a blood alcohol content of 0.05 to 0.08-percent.

To see the relationship between sleep and performance levels, take a look at the sleep restriction study in Figure 1. Results show that there's an increase in your level of impairment when sleep is reduced below seven hours per night. "Simply put, as your sleep decreases, your risk of incidents and accidents increases," says Dr. Avers. "The impacts of fatigue aren't just when we pull an all-nighter," she continues. "An individual that gets six hours of sleep per night

Figure 1: The consequences of sleep deprivation. *Van Dongen, et al. 2003*

Like drugs or alcohol, fatigue slows reaction time, decreases awareness, and impairs judgment.

over two weeks can have the same level of elevated fatigue as someone that has been awake for 24 hours straight."

If you're flying fatigued, another risk is how you will react to an in-flight emergency or any unexpected situation that causes intense periods of stress. One way to think about the role of fatigue in accident risk is to know that fatigue causes random episodes of *inattention* just when you need *all* of your attention to avoid an accident.

Consider the example of an in-flight engine failure. Your first priority is to remain calm, run through memory and checklist items, and look for a safe place to land. But here's what could happen if you're flying on an empty sleep tank. Reaction time slows, you're not focused, and panic mounts as you waste precious time and altitude trying to make decisions. Your thinking is fuzzy, memory items fade, eye-hand coordination is off, situational awareness is affected, and you're more likely to make errors and engage in risky behavior. As listening and communication skills diminish, it gets harder to find the right words for the mic. Any of these scenarios could greatly reduce the chances for a successful outcome.

Fatigue is of particular concern to aviation shift workers, including ATC and maintenance. It is a common belief that shift workers adapt over time and don't experience fatigue. Not so. Shifted schedules require working against the body's internal clock (circadian rhythm). Naturally regulated by light, the circadian rhythm tells you to be awake when it's light and to go to sleep when it's dark. Under these conditions, you are more vulnerable to fatigue because your sleep/wake cycle is out of sync. The result: degraded performance, increased errors, decreased morale, and other safety risks. Companies can regulate shift work and time off, but there is also an individual responsibility to monitor and control sleep habits.

So How Can You Combat Fatigue?

"The best way to combat fatigue is to improve your understanding of what causes it, know the risks associated with it, and apply effective countermeasures," says Dr. Avers. You can take the FAA's free fatigue training course on FAASafety.gov. Created by the FAA's Human Factors Research Division and the FAA Safety Team (FAASTeam), over 500,000 pilots and mechanics have taken the course. Here's a link to get you started: bit.ly/FAAFatigueTraining. To learn more about managing fatigue and to try out the fatigue risk assessment tool visit bit.ly/FatigueMgmt. Here's

a fact sheet that shows how the FAA is addressing some fatigue issues called out by the National Transportation Safety Board: bit.ly/FAAFactSheet.

A few more tips:

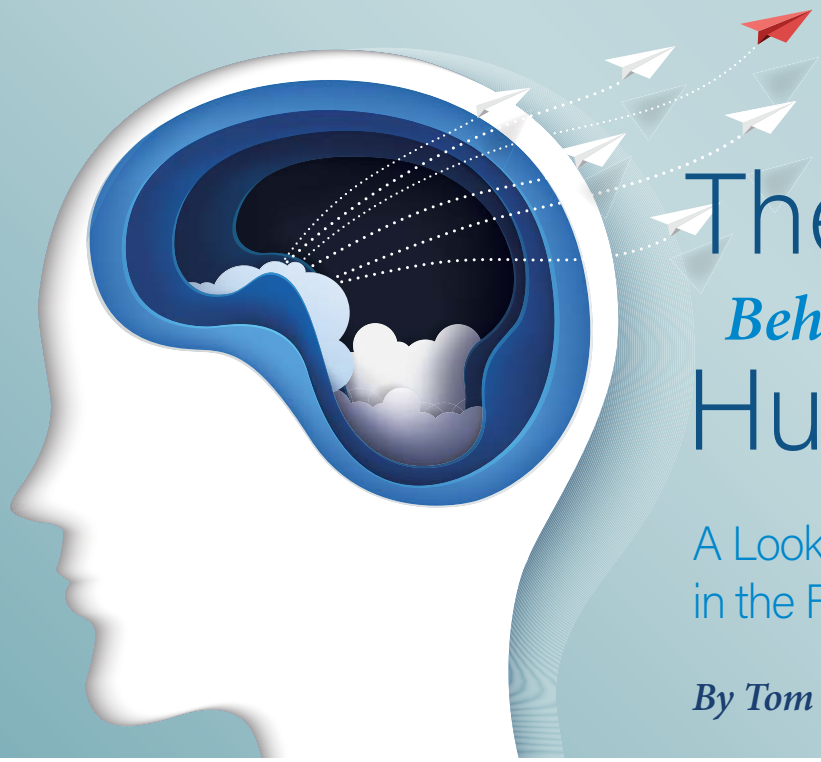
1. *Identify Fatigue:* If you feel the urge to doze every time you sit down, you are likely fatigued. Look for these symptoms: yawning, nodding off, attention lapses, difficulty concentrating, and irritability. Use the IMSAFE checklist to check your health before engaging in any aviation-related activities.
2. *Manage Fatigue:* If you feel fatigued, ground yourself until you can get sufficient rest. Remember that caffeine only masks fatigue and is not a substitute for sleep! Nap strategically; some sleep is better than none. Even a 10-minute nap can help, but do not use cat naps to replace a good night's sleep.
3. *Prevent Fatigue:* Establish good sleeping habits and stick to the routine. You can find a sleep log to track your sleep, and many more fatigue countermeasures, at mxfatigue.com.

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

FAA Grounded video
bit.ly/FAAGrounded

Fatigue in Aviation video
bit.ly/FAAFatigueTV



The Humans *Behind* Human Factors

A Look at the People and Resources in the FAA's Human Factors Team

By Tom Hoffmann and James Williams

Since the earliest days of aviation, scientists have labored over how to successfully factor the human into the vast world of aeronautical parts and procedures. From cockpit ergonomics, to maintenance procedures, to air traffic workloads, all have critical "human in the loop" components that must be considered for optimum performance, efficiency, and safety. As science and technology have matured over the years, so too has our ability to measure, analyze, and enhance the human condition in aviation; whether it's related to pilots, maintenance technicians, controllers, or the whole host of supporting roles in this ever-evolving industry.

> **For decades, the FAA has been at the forefront of aviation human factors research, development, and practical application.**

For decades, the FAA has championed efforts in this field and has been at the forefront of aviation human factors research, development, and practical application. While not always obvious to the average aviation consumer, this work is absolutely critical to preventing human-induced error and improving the safety of the NAS. For example, you may not readily think about why a particular cockpit control or indicator is colored, shaped, or placed where it is, or why certain checklist items are sequenced the way they are. But more often than not, there are human factors at play in determining how these things are deliberately designed or planned.

In this multi-part review, we aim to shed some light on the FAA men and women who work diligently to advance aviation human factors. Thanks to their efforts, stemming from multiple disciplines and areas within the agency, we've been able to peel back the curtain on the human condition — exploring what makes us tick, what makes us react in unexpected ways, and what helps us to perform at our best. That knowledge allows the FAA to implement standards, policies, and procedures that better account for the human condition across all aviation domains and advance safety in the NAS, both domestically and globally.

A Home for Human Factors

FAA human factors personnel currently reside in several organizations including the FAA's Office of Aviation Safety (AVS), the Air Traffic Organization (ATO), and the Office of NextGen (ANG). These organizations maintain sponsorship, collaboration, and oversight relationships depending on the requirements, resources, and expertise needed to complete projects and activities. This article will focus on the AVS-oriented human factors efforts as this area is more directly involved with projects that affect aircraft and airmen certification.

A particularly useful approach to leveraging the collective brainpower within AVS has been with the formation of an AVS Human Factors Coordination Team (HFCT). Triannual HFCT meetings bring together all the pertinent parties to discuss ongoing projects and requests, and to see where assistance and/or resources may be reallocated or where they could overlap. Chief Scientific and Technical Advisor for Flight Deck Human Factors, Dr. Kathy Abbott, chairs the AVS HFCT. *You can read more on Dr. Abbott in this issue's FAA Faces department.*

Let's take a closer look at what the people in each area of AVS bring to the table and how they contribute collectively to advancing human factors application within Aviation Safety.

Aircraft Certification (AIR)

One of the larger groups of human factors support is in the FAA's Aircraft Certification Service (AIR). The primary role of AIR human factors specialists is to develop human factors regulations and guidance on aircraft systems and to support certification projects. Also, they serve as subject matter experts on projects involving human factors issues with a new flight deck system, a new aircraft, or an alteration to an existing aircraft. Human factors specialists often focus on flight deck systems, but may also address other aspects of an aircraft, such as identifying human factors issues with flight controls and aircraft handling characteristics. A key reference is the *Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls V 2.0* (bit.ly/HFCFDD), a one-stop-shop for human factors-related regulatory and guidance material for aircraft certification.

Complementing some of this technology and certification-driven research is AIR's current focus on leveraging data, specifically how certain data sources can shed light on many of the more positive aspects of pilot behavior. "When we look at safety data, we often focus on pilot error or what went wrong with the flight," says Human Factors Scientific and Technical Advisor Michelle Yeh. "The truth is, there are a lot of incidents that have been avoided due to pilots doing the right thing." Yeh and her human factors colleagues look forward to finding ways to better describe what pilots do well and leveraging sources that provide data on this pilot behavior. This will help inform decision making that involves automation integration, another important human factors focus area for AIR.

"There are many human factors issues related to certification projects and automation technology," says flight test pilot David Sizoo. "These issues are sometimes subjective and relate to pilot workload in accomplishing a task." Sizoo, who specializes in helping bring advanced technology to the general aviation (GA) market, uses an example of a prototype touchscreen navigation system to make this case. "Part of our job is to determine how intuitive the design is and whether or not a pilot can properly interact with it during turbulence. We then work with other test pilots to quantitatively assess the workload of tasks and the usability of the system with respect to its intended function," he continues. AIR conducts these human factors assessments both on the ground and in the air in order to assess the suitability of a system, whether it's a component, or a whole aircraft.

Sizoo's current project portfolio includes something along those very lines — the EZ Fly for GA. The concept entails integrating an automation platform that reduces pilot workload through a smartphone-like interface, while also providing full and seamless envelope protection. Sizoo partnered with industry and academia to develop and fly this system in a Navion airplane, which incidentally was not certifiable to fly with existing regulations. Sizoo acknowledges how that is a major part of the project — to identify gaps in the regulations so the agency can update the standards to enable this safety-improving technology.

AIR human factors specialists are also working together with scientists at the FAA Civil Aerospace Medical Institute (CAMI), NASA, industry, and universities on a number of research projects, including how to integrate control interface technologies that improve the human-machine team concept in other novel ways. One example is exploring autopilot system technology that does not require the pilot to take corrective action during a failure, but rather uses run-time assurance algorithms that "step in" to help the pilot. Another study aims to research the human factors of reduced crew operations (i.e., using a digital co-pilot).

Flight Level Engineering, LLC.

The EZ Fly concept being tested in a Navion airplane.

Flight Standards (FS)

While human factors specialists in AIR are involved with aircraft certification issues, Flight Standards (FS) focuses more on the operational side of things. Among other things, FS human factors specialists:

- Develop and update FAA regulations, policy, and guidance about human factors issues for aircraft operations and procedures, aircraft maintenance, pilot training, and other functions;
- Support projects that involve human factors assessments of aircraft operations, procedures, and maintenance;
- Develop decision-making tools to assist the FAA Flight Standards Service; and
- Sponsor and supervise human factors research to support Flight Standards.

An FS employee on the frontline of human factors research is Engineering Psychologist Mark Reisweber, who

FAA Engineering Psychologist Mark Reisweber stands in front of an End-Around Taxiway masking screen at DFW.

works in the Flight Research and Analysis Group in Oklahoma City. His research is specifically geared towards testing and analyzing information that enables others to make decisions that affect the NAS. "I deal in new or re-designed procedures, including those that involve the integration of new equipment and designs," says Reisweber. "Based on our testing, we can then say, under these certain conditions, pilots can't deal with this situation, or if they can, here are the thresholds to do it safely."

> **It's our job to test all the elements of human-machine/system interaction, whether under good, bad, hard, or stressful scenarios, to ensure humans are safely up to the task.**

An important part of FS' human factors research capabilities are two highly configurable Level-D full motion flight simulators located at the FAA's Mike Monroney Aeronautical Center. "A lot of times we get tasked with testing procedures or configurations that don't yet exist, so our engineers, technicians, and pilots have to create them and/or modify our cockpits in the simulators," says Reisweber. This flexibility makes these devices a tremendous asset to the FAA, which can provide 150-200 lines of data, including such indices as vertical descent rate, aileron deflection, airspeed, etc. The simulators proved helpful in a recent angle of attack study that measured the efficacy of a new AOA display gauge and how pilots might interpret its indications under varying flight conditions.

Human factors testing and research for FS goes beyond the simulator. An example of a more "in-the-field" study occurred when Reisweber teamed up with a diverse group of researchers from Flight Standards, Bell Helicopter, the University of Oklahoma, and a Des Moines-based emergency medical services operator to test a unique flight procedure in a Bell 429 helicopter. The project tested whether air ambulance helicopters could alter their routine and safely fly to specific nodes around the city instead of higher-risk areas when responding to an emergency.

Another example is the End Around Taxiway (EAT) Project. This study aimed to address a phenomena which would occur at Dallas Fort Worth Airport when using proposed taxiways that extended beyond the pre-existing runway/taxiway structure. In simulation, pilots experienced some unorthodox reactions when landing or taking off with aircraft on the "new" end-around taxiways, which appeared to be incurring in front of them. "This was very much a human perception issue that required a human factors solution," says Reisweber. "When you're seeing an aircraft crossing in front of you, large or small, it's hard to judge its distance because the retinal image on your eyeball says it's the same size." The study determined that pilots did some "pretty strange things" about 25-percent of the time while observing what appeared to be an aircraft obstructing their flight path. The rather simple solution was to erect a 20-foot tall by several hundred foot wide barrier with standard orange and white markings that masks the taxiing aircraft. The FAA later determined this solution has the potential to apply to similar situations at other airports, even GA airports.

Reisweber is proud of the work he and his human factors colleagues have done and how much their testing capabilities have evolved. He's also a firm believer that more is not always better when it comes to technology and automation. "You have to test the human in the loop, whether it's a controller sitting in front of a scope, a single pilot flying a 172, or the flight crew of a 787. It's our job to test all the elements of human-machine/system interaction, whether under good, bad, hard, or stressful scenarios, to ensure humans are safely up to the task."

UAS Integration Office (AUS)

It's not uncommon to think of an unmanned aircraft system (UAS) — by virtue of being "unmanned" — as not requiring much attention in terms of human factors issues. However, human factors are very much at play with UAS operations. They just may not be as obvious as you might expect. For example, a UAS pilot works without the normal visual, auditory, or sensual cues that a pilot would experience during flight, and that can be challenging. "You don't think about these more subtle factors, but they are important feedback channels your body uses during flight," says human factors specialist Stephen Plishka. "If you increase power but don't experience a corresponding vibration and noise, it's easy to think something's not right."

An example of a flight deck style control station with multiple displays that would be operated with a menu structure.

It's these limitations that have Plishka's research focused heavily on UAS control station design, in particular, screen size limitations. "What critical information do we want displayed at all times and that cannot be masked or minimized? How do we factor in the remaining information with reconfigurable windows that make sense to the operator?" When it comes to menu design, Plishka stresses having a "shallow, but wide" approach. "You never want to be more than two button presses away from anything you need," he states. "Beyond that, it's difficult to remember where that function resides." This is also an area of research that can be leveraged for both UAS and more traditional manned aircraft designs.

Mission duration is another integral human factors component for UAS. Some operations last minutes or hours; others could "drone on" for days, weeks, or even months. Fatigue becomes a real issue in extended operations and raises questions about duty day limitations, breaks, relief crews, and shift change protocols. There's also a need to give pilots a sufficient level of stimulation throughout a long flight. A unique aspect of UAS operations that can help is the ability to stagger time zones for control stations. This helps UAS pilots avoid the dreaded night shift when the body wants to be sleeping.

Another unique challenge for UAS is the lack of aviation expertise among some manufacturers. Plishka makes it a priority to help educate and inform these companies about the standards and resources that apply to aid in their design process. "For example, we want to make sure they're using the color red [for emergencies] appropriately before they bring a system to certify with the FAA," says Plishka. One document he likes to share is the *Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls V 2.0* (noted in the AIR section) since much of it applies to UAS.

Aviation Maintenance

The goal of Aviation Maintenance human factors research is to identify and optimize the factors that affect human performance in maintenance and inspection. Example areas of attention include training, motivation, fitness for duty, worker/workplace safety, tool and system design for maintainability, and more. From a broad perspective maintenance human factors pays attention to the people who do the work, the environment in which they work, the actions they perform, and the resources to complete safe work.

"For the last 15 years, we've tried hard to capitalize on good solid scientific research to create practical guidance" says Chief Scientific and Technical Advisor for Maintenance Human Factors Dr. Bill Johnson, who leads research in this area for the FAA. "Our human factors work has evolved to stress demonstrated actions and attitudes rather than just pure science on the human condition." What Dr. Johnson dubs Maintenance Human Factors 2.0 emphasizes programs and concepts that lean more towards the application of prior research, e.g., safety culture, safety management systems, and information-sharing. "Going forward, we need to focus more on organizational psychology," says Dr. Johnson.

The "The Buck Stops with Me" course helps aviation maintenance personnel understand that 100-percent procedural compliance relies on a healthy safety culture.

Some recent projects that support that effort are the development of a new safety culture assessment tool and updated tools and methods for reducing failure to follow procedure (FFP) events, both discussed further in this issue. Dr. Johnson also helped develop an FAA Safety Team course on FFP entitled "The Buck Stops with Me" at bit.ly/FFPTheBuck. This course helps aviation maintenance personnel better understand and appreciate how an organization's culture affects safety with respect to FFP. The course has logged an estimated 14,000 completions to date, evidence of Dr. Johnson's flair for creating high quality and engaging products for the maintenance community. "It's less of a training program and more of a way to get maintenance technicians to think culturally about taking responsibility for their actions."

Dr. Johnson also works closely with the DOT Transportation Safety Institute to deliver a three-day maintenance human factors course to all Airworthiness Aviation Safety Inspectors (ASI). According to Dr. Johnson, "Our ASIs receive more HF training than any other inspector workforce in the world. They are able to understand and add value to any HF initiatives that they oversee."

You can find more maintenance-related human factors content at HumanFactorsInfo.com as well as dozens of courses on FAASafety.gov. Dr. Johnson stresses both sites as important resources for brushing up on the fundamentals, especially as workers transition back to a more routine work schedule in the coming weeks/months.

Office of Accident Investigation and Prevention (AVP)

"Data are just summaries of thousands of stories — tell a few of those stories to help make the data meaningful."

— Chip and Dan Heath, authors of "Made to Stick"

As part of his investigation duties, Air Safety Investigator Patrick Lusch looks for how human performance may contribute to aviation accidents.

Although vastly understated, the Heath quote does provide a fairly accurate account of the Office of Accident Investigation and Prevention's role in aviation safety and human factors research. AVP's overall mission: make air travel safer through investigation, data collection, risk analysis, and information sharing. They essentially tell the story of what the data is indicating to better inform how and where both the agency and industry make improvements. This includes identifying any potential human factors issues. More specifically in this regard, AVP investigators:

- Determine how breakdowns in human performance may have caused or contributed to an occurrence.
- Identify safety hazards related to limitations in human performance.
- Identify ways to eliminate or reduce the consequences of faulty human actions or decisions.

As part of these efforts, AVP investigators and analysts work closely with other divisions and offices within the FAA, as well as with groups like the Commercial Aviation Safety Team and the General Aviation Joint Steering Committee to inform them on what accident data is saying. Depending on how severe or pervasive the issue may be, requests for further support or research can be made, typically via the AVS HFCT. See this issue's Checklist department for more information on AVP's role in human factors investigations.

Office of Aerospace Medicine (AAM)

Tucked neatly into the windswept Great Plains is Will Rogers International Airport (OKC) in Oklahoma City. On the grounds of OKC sits the previously mentioned Mike Monroney Aeronautical Center, a federal campus that houses CAMI among other various offices.

Under CAMI is the Aerospace Human Factors Division of the Office of Aerospace Medicine managed by Dr. Carla Hackworth. The division is the home of two labs: the Flight Deck Human Factors Research Lab managed by Dr. Katrina Avers, and the NAS Human Factors Safety Research Lab managed by Dr. Jennifer Myers. The division is staffed by 37 employees comprised of research psychologists, research technicians, statisticians, engineers, and computer specialists. Let's take a closer look.

Flight Deck Human Factors Research Laboratory

The Flight Deck Human Factors laboratory conducts a broad-based program of applied human factors research on causal factors associated with aviation accidents and issues involving the design, operation, and maintenance of flight deck equipment in the NAS.

One employee behind this research is Dr. Dennis Beringer, a research engineering psychologist with over 45 years of aviation psychology/human factors experience and more than 25 years with the Flight Deck Human Factors Research Lab. "When I arrived we had no flight sims, but within two years, with the help of other principal investigators in the branch, we had two," explained Beringer. "I got my private pilot certificate in 1969 while I was a psych/math major at UCLA," he added. "So that got me interested in seeing if I could apply some of the psychology I was learning to aviation related issues." After a decade and a half in the university environment teaching graduate and undergraduate students and conducting applied research in Human Fac-

tors, Beringer eventually found his way to CAMI where he was brought on to help write a specification for the new general aviation flight simulator.

When asked which projects give him the greatest pride, Beringer recalls a study conducted in response to several otherwise inexplicable Piper Malibu accidents. "On one of the accidents, they were able to reconstruct some parts of the terminal phase through radar data. The aircraft had entered a steep and rapid descent and had broken up in the air," said Beringer. "We started looking at possible explanations. Through experimentation with pilots, we determined that the probable cause was pilots misunderstanding what the 'big red autopilot disconnect button' really did ... it disconnects the autopilot, but it only interrupts the electric elevator trim," he further explains. "In a runaway-pitch-trim incident with autopilot engaged, you can't just press the button and release it; the autopilot will disengage, but the trim will continue to run."

Beringer later presented his findings at the annual Malibu Mirage Owners and Pilots Association meeting. "They were very grateful to hear about it," recalls Beringer, "and I was thrilled that we had uncovered something that would help them remain safe."

When asked about the future of human factors research, Beringer reflects on some of the new, or in some cases, "revisited" control schemes that make it easier for the pilot to control the aircraft with less training, and more intuitive displays. The key is the ability to leverage an average person's talents to see and understand the information being displayed, and then use it to fly/navigate an aircraft. Beringer adds that this can be done with the addition of reliable "helper" systems onboard to take care of some of the tasks, whether they be autopilots, envelope-protection systems, or software-enabled sensors/displays. "This, I think, is where the most interesting parts of future human factors efforts in the aerospace field will be."

National Airspace System (NAS) Human Factors Safety Research Laboratory

Another important facet of the human factors research at the FAA is the air traffic control (ATC) workforce. Enter Dr. Jerry Crutchfield, an engineering research psychologist in the NAS Human Factors Safety Research Lab, a facility where research is focused on improving the person-job fit through hiring, training, and technology. "I have been interested in science my whole life," says Crutchfield, "but it wasn't until I started working as a graduate student at the FAA's Aerospace Human Factors division that I learned how meaningful and rewarding the applied side of psychology could be."

Crutchfield's primary focus is managing the ATC Advanced Research Radar Simulator and ATC Advanced Research Tower Simulator labs. He uses these simulators, sometimes in concert with other tools like electroencephalography (EEG) and eye tracking, to measure human performance and conduct research in the ATC world. With these tools, Crutchfield's team was able to develop a large (and free) set of standardized ATC simulation scenarios to assess new technologies and procedures for either en route or terminal area applications. Crutchfield's research also extends to the tower. "We have a Tower Simulation Based Performance Measure (TSBPM) that we have validated against over 300 tower controllers," he continues. The TSBPM could be used to rate controllers and for training or selection purposes."

Dr. Dennis Beringer tests out some eye tracking equipment in a simulator.

Looking forward, Crutchfield's research is having some interesting applications. "Four years ago I started a line of research about how controllers visually scan the air traffic environment, in order to teach novice controllers as well as experts to scan," he explains. "The scanning research led to my recent involvement in identifying visual requirements for remote tower systems." Crutchfield is excited about the prospect for this work to improve both the design of remote tower systems and the training of controllers in all types of air traffic environments.

We only scratched the surface here of what CAMI has to offer in the realm of human factors research. Some of the other facilities include the altitude chamber, the biodynamics impact sled, and the spatial disorientation simulators. For a more detailed look at the CAMI team and research lab facilities, go to bit.ly/FAACAMI.

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

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

LEARN MORE

AVS Human Factors
www.faa.gov/aircraft/air_cert/design_approvals/human_factors

Tool Time

Beta-Testing a Maintenance Safety Culture Assessment Toolkit

By Kylie Key, Ph.D., Inchul Choi, Ph.D., and Justin Durham

There are benefits to having a positive safety culture — but how do you know whether you have an adequate safety culture, and how to improve? Helping the aviation industry answer these questions is a goal of researchers at the FAA's Civil Aerospace Medical Institute (CAMI).

What is a Safety Culture?

Safety culture can be defined as employees' perceptions of how much safety is valued in their organization and the extent to which risk-taking behaviors are viewed as necessary to ensure timely completion of tasks. The level of safety culture in the workplace is typically measured with a survey of employees' commitment to safety. But it's not just an employee's commitment to safety — after all, employees don't work in a vacuum. Safety culture is shaped by the work environment. While there are many surveys available, they can be expensive and may require trained researchers or consultants to analyze and interpret the data, making them out of reach for smaller organizations. Major airlines may be able to afford these costs, but smaller organizations usually cannot.

FAA Maintenance Safety Culture Assessment Toolkit

Researchers at CAMI are working to provide a stand-alone process for organizations to have full ownership of their culture assessment and associated proprietary data. The FAA Maintenance Safety Culture Assessment Toolkit is designed to include everything needed for a DIY culture assessment and improvement effort that will allow organizations control of the process by providing the survey instrument, data analysis tools, and educational/guidance materials for safety culture promotion.

This toolkit goes beyond simple measurement of employee commitment to safety, which is the focus of most culture surveys. It measures environmental factors from the work environment, such as the job resources available and the demands that are faced to complete a task. Together, job resources and demands form the foundation of culture, in turn influencing an employee's outcomes (e.g., job satisfaction, risk-taking behavior) and the organization's bottom line (e.g., errors, accidents/injuries, productivity).

Whether you have a workforce of two or two thousand, job resources and demands are drivers of safety culture and should be included in any culture assessment. Although the toolkit is currently in development, we urge you to honestly assess yourself and your organization using sample items in Table 1, considering ways that you may be able to allocate additional job resources and reduce demands.

As noted, the toolkit is under development and the instrument is being refined. The current version has about

Table 1

Job Resources	Job Demands
• Is there a strong commitment to safety at all levels (from senior executives to new hires)? • Does management devote sufficient effort to managing safety? • Is there a clear policy for Just Culture? • Do employees feel comfortable reporting hazards and safety events? • Are there sufficient equipment, tools, and parts/consumables to perform tasks? • Are the technical manuals/job cards accurate and usable? • Is training carried out at appropriate intervals?	• Are there mixed messages communicated to employees (e.g., leaders say they care most about safety, but their actions speak more towards productivity or profit)? • Is there unrealistic time pressure or are deadlines unachievable? • Is there an unmanageably high workload? • Are there inadequate personnel to complete work tasks safely? • Do employees have to cover for underperforming colleagues? • Is there pressure to work long hours or overtime? • Do job requirements put pressure on employees' personal lives?

180 items, but takes only 20-30 minutes to complete, and is administered via an anonymous online survey link. The data analysis tool plots the distribution of participant responses, along with the goal set by the organization, to pinpoint opportunities for improvement.

Lessons Learned from Beta-Testing

Before publicly releasing this toolkit, we are beta-testing to ensure it meets the needs of the aviation industry. So far, we are in various beta-testing stages with three organizations, each with 50-plus employees: a large part 145 maintenance operator, a rotorcraft maintenance organization, and a group of pilots. Some key lessons learned and next steps are:

1. Each organization faces different operational challenges, necessitating tailored survey content. A future goal is to empower users to tailor the survey to their operations without needing our help.
2. Some organizations cannot spare 20 minutes for every employee to complete the full survey, but they still want a quick pulse of their culture. A future goal is to create a "short form" of the survey, perhaps by expanding Table 1. This short form would include only the top safety culture items that apply to every organization, large or small.
3. Without ensured anonymity, no amount of incentives or advertising for the survey will result in an adequate participation rate. Protecting anonymity is key, no matter how many (or few) respondents there are.

The aviation industry has an appetite for the toolkit and has encouraged us to expand our efforts to other operations types (e.g., cabin crew, ground handling). We have also been asked to make a scaled-down version of the toolkit for smaller operations such as general aviation (GA).

The most critical challenge to a successful GA toolkit is protecting employee anonymity to ensure an adequate participation rate and sincere responses.

Culture Assessment in GA

The most critical challenge to a successful GA toolkit is protecting employee anonymity to ensure an adequate participation rate and sincere responses. Our tentative plan is to: a) create a customizable anonymous survey administered online, so that responses are de-identifiable, b) prevent managers from seeing individual responses by aggregating the data into a centralized database, and c) create an automatically generated report with an overall picture of the organization's safety culture, but not disclose detailed information that could identify participants (such as job role or scheduled shift).

Additionally, if the number of the respondents is very small, we could average the data across multiple similar organizations with similar size and scope of operations. Each organization could then receive the same report about industry on average, revealing general trends and plausible

issues that they may have.

This is one potential method for making the toolkit work for GA, but we need smaller organizations to provide expert feedback to help us improve the survey and the process. We need to better understand the unique operational challenges in the GA environment, what we are missing, and how we can make a better tool for smaller organizations. To make this toolkit work — we need you. If you are interested in testing the survey or have suggestions, please contact Dr. Kylie Key at kylie.n.key@faa.gov. We continually look for ways to improve and look forward to hearing your feedback!

The authors thank the research funding source, the FAA's Human Factors Division (ANG-C1), and collaborators Dr. Bill Johnson, Dr. David J. Schroeder, and Blake L. Nesmith for their contributions to this project.

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Justin Durham, M.A., is a Human Factors Researcher for Cherokee Nation 3S at the FAA's CAMI. He is currently pursuing a Ph.D. in Cognitive Psychology at the University of Oklahoma.

LEARN MORE

"Safety culture: Where do we stand?" March 2019 FAA Aviation Mx Human Factors Quarterly, page 5
bit.ly/FAAHFMar2019 (PDF)

"Safety Culture Promotion in an Example Mx Organization" June 2019 FAA Aviation Mx Human Factors Quarterly, page 4
bit.ly/FAAHFJun2019 (PDF)

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To "B", or Not to "B"...

Why Equipping with ADS-B Makes Sense, Even in Places It's not Required

By Tom Hoffmann

At precisely 12:01 am (0001Z) on January 02, 2020, the FAA's mandate for Automatic Dependent Surveillance-Broadcast (ADS-B) Out took effect, requiring most National Airspace System (NAS) users in designated rule airspace to be equipped with this next generation surveillance technology. No, no airplanes dropped out of the sky, nor did radar screens across the country go black. Instead, thousands of pilots quietly went about the business of flying, but with an entirely new system of situational awareness and safety working in their favor.

This historic milestone capped off over a decade of hard work and coordination among regulators, manufacturers, educators, and industry stakeholders. That's not to mention the thousands of pilots who, since the requirements were first laid out in 2009, have weighed the pros and cons of different ADS-B options and worked diligently with repair stations to have these systems properly installed in time.

As the FAA initially communicated during the ADS-B launch, equipage was not an across-the-board requirement. The FAA carefully weighed the cost-benefit of installation and decided that ADS-B Out would be mandated only for those aircraft that operate in or transit through "rule airspace," essentially anywhere a transponder is required. For pilots who operate in or around major cities or metropolitan areas, equipping was a given. However, for those who

fly in some of the more rural swaths of the country, it was a more calculated decision. Would the expense of equipage and inconvenience of aircraft down time be worthwhile? That's a question many faced, and perhaps still face today. Allow me to share some information that might help inform your decision and explain why ADS-B matters, even when it's not required.

The Art of B'ing

Let's start with a quick refresher. ADS-B is a foundational NextGen technology that uses GPS to track aircraft in real time and improve situational awareness. There are both Out and In components that serve distinctly different purposes.

With the now-required ADS-B Out system, Air Traffic Control (ATC) can get an exact latitude-longitude position for an aircraft about every second. It also allows ATC to see and provide services to aircraft near mountains and rough terrain, over bodies of water, and at lower altitudes where line-of-sight radar struggles.

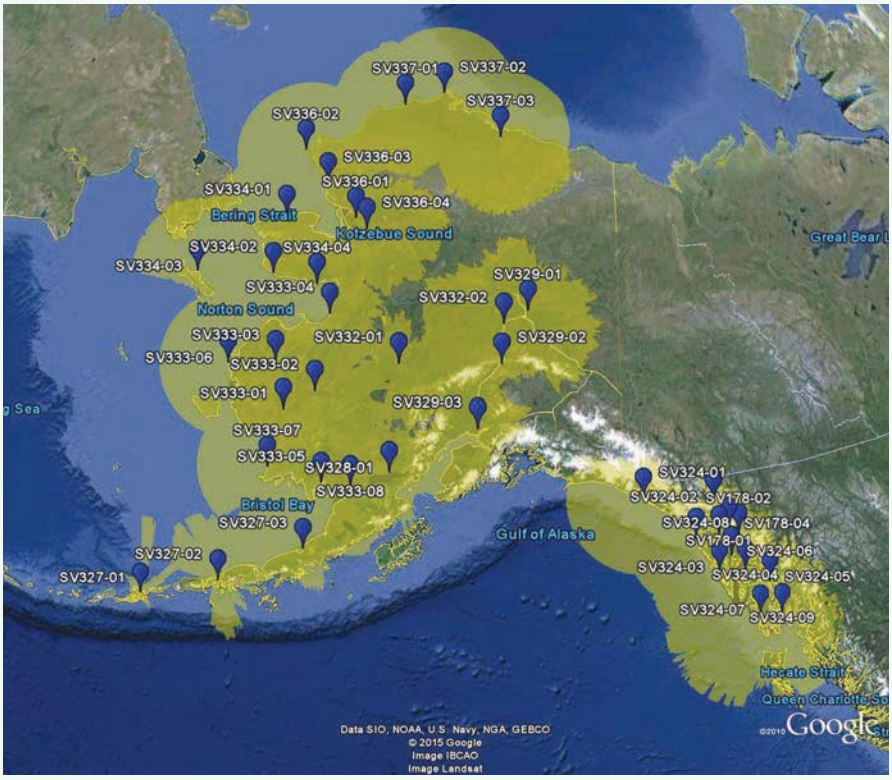
ADS-B In systems give appropriately equipped aircraft the ability to receive traffic and weather information in a variety of display formats (panel mounted, portable tablet). These services, known as Traffic Information Services-Broadcast (TIS-B) and Flight Information Services-Broadcast (FIS-B), offer pilots critical surveillance information on surrounding traffic as well as a host of weather and aeronautical information products.

Under the mandate, ADS-B Out is required to operate in most controlled airspace in the United States. If you fly where a transponder is required, you need ADS-B Out. However, there's still a lot of aerial real estate where that doesn't apply. For example, in Alaska, where all airspace below 18,000 feet (outside the Class C at Ted Stevens Anchorage International Airport) remains outside rule airspace. It's natural to see how some might be opposed to equipping with ADS-B Out, especially when an operator may only sporadically need to access ADS-B Out rule airspace.

According to FAA Contractor and Leidos Senior Systems Engineer Jim Wright, there's still tremendous value in having just an ADS-B Out solution. "ADS-B Out allows other aircraft who have ADS-B In to see and avoid you, significantly reducing the risk of mid-air collisions," says Wright. With ADS-B Out, your aircraft creates a "hockey puck" shaped zone of about 30 miles in diameter around your aircraft (with a 3,500-foot buffer above and below) that allows other ADS-B Out/In equipped aircraft in that vicinity to pick up your location.

> **Having an aircraft equipped with ADS-B Out increases the likelihood of a successful search and rescue mission.**

Also, due to the significantly better coverage with ADS-B, having an aircraft equipped with ADS-B Out increases the likelihood of a successful search and rescue mission. In places like Alaska where radar coverage is minimal, this feature is significantly more relevant. Just ask Wright, who would have benefitted greatly with having the position accuracy and speedier recovery action of ADS-B after a tragic accident in Alaska in 1994. Caught in a blinding snowstorm, Wright's Cessna 206 crashed on a beach and hurtled into a grove of spruce trees. Rescuers lost precious time searching for the crash site along a 25 mile route based on Wright's last known position. With ADS-B Out data, the crash site could have been narrowed to a 1,000-foot perimeter. "Even if the aircraft operates outside a coverage area," he continues, "the route can be tracked to the point where coverage is lost." Wright wound up losing part of his leg after that accident, but he lives to tell the tale of how ADS-B is a true life-saver.



A snapshot of ADS-B coverage in Alaska at 10,000 feet along with the locations of the states' 42 ground stations.

It's the "In" Thing

The benefits of ADS-B Out are a strong incentive to equip, but those benefits go to the "next level" with ADS-B In.

The benefits of ADS-B Out alone are a strong incentive to equip, but where those benefits go to the "next level" is with adding ADS-B In. Equipping with both gives pilots the full package of situational awareness with traffic and weather information at a relatively modest price point. Since it's not required, pilots also have more flexibility in adopting an ADS-B In solution, including the popular and cost-effective BYOD (bring your own device) option. There are now 19 FIS-B products available with more on the way. Some of the more recent products include cloud top reports, icing forecasts, and turbulence information.

The FAA is also working on a plan to beef up the FIS-B reception range in Alaska to help pilots pick up information on developing weather further out. "Boosting signal power will allow you to maximize your situational awareness and plan for conditions that you see forming before you find yourself in trouble," says FAA's Alaska ADS-B Expansion Lead Jamal Wilson. The project is still in the beginning stages, but Wilson is optimistic with it moving forward very soon.

An important side note here: FIS-B and TIS-B information is strictly advisory in nature and should never be used in place of see-and-avoid practices.

See and "B" Seen

Having both ADS-B Out and In has another distinct advantage, especially in areas like Alaska where ADS-B ground station coverage is limited or lacking. Aircraft that have ADS-B Out (either a 1090 ES or 978 MHz unit) and a dual band ADS-B In receiver, can "talk" to each other and swap position information without the need of a ground station. When within range of a ground station, ADS-B In/Out equipped aircraft have a more complete traffic picture and can even detect other non-ADS-B targets that have a transponder.

Alaska currently has 42 ground stations covering some of the more highly trafficked areas, but there are gaps the FAA is working to address. According to Wilson, the FAA is taking a phased approach at improving ADS-B coverage in Alaska, aiming to add ground station infrastructure at 12 locations in the near future. "These additional ground stations could go a long way toward filling out the coverage in the center of the state, and between Anchorage and Yakutat which includes Cordova," adds Wright. The expansion efforts respond to requests from aviation stakeholder groups and reinforce action on some of the key takeaways from the NTSB's 2019 roundtable discussion on part 135 operations in Alaska. See the NTSB Chairman's blog post on the subject here: bit.ly/NTSB135.

But Maybe I Don't Want to "B" Seen

Privacy is a concern with some operators who may have issues with their real-time position and information being made public. The FAA has implemented the Privacy ICAO Address (PIA) program to address these concerns. PIA enables interested and eligible aircraft owners to request an alternate, temporary ICAO address, which will not be assigned to the owner in the Civil Aviation Registry. The program will be implemented in two phases, with the FAA maintaining initial control. A second phase will transition PIA control to a third party service provider. For more on PIA and how to submit a request, see faa.gov/nextgen/equipadsb/privacy. Aircraft owners concerned with privacy should also look into the anonymous mode available on a majority of UAT/978MHz ADS-B systems.

"B" Part of the Solution

The reasons and rationales for equipping with ADS-B are numerous. But none can be more compelling than its potential to save lives. A recent FAA safety analysis concluded that Alaska air taxis with ADS-B In experienced an overall accident rate that was 55-percent less than those unequipped. The same study also looked at the effect of ADS-B In on certain types of accidents in the lower 48 and noted a similar 50-percent average rate reduction for equipped aircraft, with a cut in the fatal accident rate of about 90-percent. These numbers, along with countless pilot testimonials on how it saves lives, speak volumes in support of a decision to equip with ADS-B, whether it's required or not.

"The main challenge is getting people to equip," says Jens Hennig, VP of Operations at the General Aviation Manufacturers Association. "Yes, you may only enter rule airspace once or twice in a state like Alaska, but having everybody on the same frequency will improve safety and operations. This is the future, not just a milestone. This is the surveillance technology we're going to use for the 21st century."

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

LEARN MORE

"Better with ADS-B – The Proof is In" – July/Aug 2019 issue
https://adobe.ly/2JqKxal

The 2020 National GA Award Honorees

For more than 50 years, the General Aviation Awards program and the FAA have recognized aviation professionals each year for their contributions to GA in the fields of flight instruction, aviation maintenance/avionics, and safety.

The FAA and the General Aviation Awards Committee usually presents individual plaques to the recipients at EAA AirVenture in Oshkosh, Wisconsin, and provides an all-expenses-paid trip to this event. Since the COVID-19 public health emergency forced cancelation of AirVenture 2020, the awards will be presented at another time. Names of the honorees will be added to the permanent plaque in the lobby of the EAA AirVenture Museum.

To learn more about the honorees' contributions to the aviation industry and hear some of their top safety tips, check out this recorded presentation held last May: GAA-live.com/2020.html.

Nominations and applications for the 2021 General Aviation Awards will be accepted starting July 1, 2020. If you know of a flight instructor, AMT, or FAASTeam Rep whom you think is deserving of an award at the local, regional, or national level, we encourage you to nominate him or her. If you are an aviation professional with a distinguished career in one of these categories, we encourage you to apply. For more information about nominating or applying, please go to GeneralAviationAwards.com/Nominations.

2020 National Flight Instructor of the Year

Dr. Catherine Cavagnaro of Sewanee, Tennessee, is a mathematician by training, earning her bachelor's degree in mathematics from Santa Clara University in 1987, and her doctorate in mathematics from the University of Illinois in 1995. She is a Professor of Mathematics at Sewanee: The University of the South, where she developed and implemented courses in aerodynamics, differential equations, and mathematical modeling. Aviation provides a treasure trove of real-world examples for her mathematics courses.

Catherine owns and operates Ace Aerobatic School, where she is widely known as an expert on spin recovery and avoidance, as well as recoveries from unusual attitudes. She draws rave reviews for the videos she makes to help pilots understand the complex aerodynamics of spins and unusual attitudes. One example shows that recovery is the same for a 60-turn spin in her Cessna Aerobat as it is for a three-turn spin.

Catherine has also served as a test pilot, spin demonstration pilot, researcher, and visiting professor of aviation systems at the University of Tennessee Space Institute. While there, she served on the icing team that modeled the longitudinal stability characteristics of NASA's *Twin Otter* in various icing configurations, and she configured the variable-stability *Navion* to duplicate these characteristics. Catherine was inducted into the Tennessee Aviation Hall of Fame in 2018.

When she isn't teaching aviation or mathematics, Catherine loves exploring with her sons, Jack and Pete, in their acrobatic Beechcraft *Bonanza*.
(catherine@aceaerobaticschool.com)

2020 Aviation Technician of the Year

Dennis Wolter of Cincinnati, Ohio, has been fascinated with airplanes since an early age. When he was 11, an uncle gave him his old Army Air Corps training manuals to explore. At age 15, he started an airplane washing business to support his private pilot certificate training. When he wasn't washing airplanes, Dennis assisted an airport mechanic doing repairs on both metal and fabric airplanes.

He spent the 1960s working on airplanes, serving as a line-boy, on-call copilot on freight runs, unpaid ferry pilot, avionics installer, interior apprentice, and sheet metal technician.

Dennis graduated from the University of Cincinnati in 1969 with a bachelor's degree in industrial design. After graduation, he taught engineering and aviation maintenance at Cincinnati State Technical College. He earned his mechanic airframe rating in 1972, his powerplant rating in 1984, and inspection authorization in 1999.

In 1973, Dennis founded Air Mod with the goal of designing, fabricating, and installing general aviation piston aircraft interiors. His company became known throughout the country as a premier aircraft renovation facility, bringing old-school craftsmanship and innovative design to every project. State of the art interiors, custom instrument panels, improved soundproofing, ventilation and lighting upgrades, ergonomic comfort, safety enhancements, and other modifications are all executed to the highest standards.

Dennis holds a supplemental type certificate (STC) and numerous FAA field approvals involving seat improvements, cabin ventilation, instrument lighting, cabin upholstery, windshield and window modifications, and passenger restraints.

Dennis also served on the board of the Great Oaks career and technical education school system's aviation program development committee in Wilmington, Ohio. Over four decades, he has presented seminars about interior renovation, corrosion, aging aircraft issues, and compliance with FAA regulations at EAA AirVenture Oshkosh and at Sun 'n Fun. He has given similar presentations to the Aircraft Owners and Pilots Association (AOPA) and American Bonanza Society (ABS) conventions and at Cessna Pilots Association (CPA) fly-ins.

In 2019, at the request of the ABS Air Safety Foundation, Dennis gave a three-hour presentation about aging aircraft issues. It is now on the ABS website as a tool to educate Beechcraft owners about how to keep their airplanes in airworthy condition.

Dennis has written nearly 100 articles for the ABS and CPA magazines and served as a technical representative for both associations, fielding hundreds of phone calls and emails from aircraft owners. He currently writes monthly articles for *Cessna Flyer* and *Piper Flyer* magazines.

Dennis has also served as a consultant to both Cessna and Beechcraft regarding technical and design matters. He has worked with AmSafe on airbag passenger restraint installations and with Skandia on the development of superior soundproofing materials for piston GA airplanes. (drwolter@airmod.com)

2020 National FAA Safety Team Representative of the Year

Gary Brossett of Midland, Georgia, joined the FAA Safety Team (FAASTeam) in 2005 as a Georgia Accident Prevention Counselor and subsequently as a FAASTeam Representative and Lead Representative. Gary has distinguished himself in devoting his time, attention, talent, and expertise in managing and mitigating GA accidents, incidents, pilot deviations, and runway incursions using the FAASTeam core strategy of training, outreach, and education. In the past five years he has hosted more than 84 local aviation training events.

Gary served in the U.S. Air Force from 1980 to 2005 as a mechanic, engine shop supervisor, lead engine mechanic, engine maintenance supervisor, aircraft maintenance supervisor, and technical school administrator and instructor. He then joined Pratt & Whitney (P&W) where he currently serves as a senior quality engineer and maintenance instructor at P&W's Engine Center in Columbus, Georgia. Gary holds master's degrees in aviation/aerospace education from Embry-Riddle Aeronautical University and in quality management from Eastern Michigan University.

Gary is a life member of the Experimental Aircraft Association, the Air Force Association, and the Aircraft Engine Historical Society. He is also a member of the Vintage Aircraft Association, AOPA, the American Society for Quality, and the Balloon Federation of America (BFA).

Gary is passionate about ballooning. In addition to being an FAA-certificated private balloon pilot, he has earned BFA certification as a basic aeronaut and master crew chief, and in 2019 was honored by BFA as National Crew Member of the Year. (brossettg@gmail.com)

SUSAN K. PARSON

BUT WHAT DO YOU ACTUALLY *DO*?

As one of my former bosses often observed, for many years the global approach to aviation accident investigation was find, fix, and fly. This approach was primarily directed to issues with the machine and/or the weather, two pieces of what turns out to be a three-part puzzle. It's pretty easy to find and fix problems with the machine. Technology (e.g., radar, stormscope) and rules (e.g., stay away from thunderstorms!) could fix — sort of — accidents involving weather. The third piece, the human being, was not exactly ignored. But because it's a lot harder even to see, much less understand, the reasons for certain human actions and behaviors, the vague "pilot error" term was a catch-all.

The more we learn, though, the more we know how much we still need to learn about pilot error. It may be easy to see what the pilot actually did, but the *why* and the *how* are key to prevention. That's where the human factors (HF) discipline comes in.

Investigating HF

To learn more about what these specialists do, we queried Dr. Sabrina Woods, a frequent *FAA Safety Briefing* contributor who now works as a Human Factors Analyst in the Accident Investigation Division of the FAA's Office of Accident Investigation and Prevention (AVP).

"The International Civil Aviation Organization's Manual of Aircraft Accident and Incident Investigation details how human factors issues should be investigated post-accident," she noted. The manual lists the objectives of human factors investigation as: (1) determining how breakdowns in human performance may have caused or contributed to an occurrence; (2) identifying safety hazards related to limitations in human performance; and (3) identifying ways to eliminate or reduce the consequences of faulty human actions or decisions.

HF work encompasses the "domains" of human, machine, and environment — the standard ingredients in the recipe for any accident or incident. Any human performance investigation must consider six different fields, keeping in mind that, like a kaleidoscope, these factors interact and combine in myriad ways. The elements that create any given situation include:

- Behavioral: 72-hour history, operator's behavior, life habit patterns, and life events.
- Medical: general health, sensory acuity, drug/alcohol ingestion, and fatigue.
- Operational: training, experience, habit patterns, operational procedures, company policies, culture.
- Task: information, perception, task components, workload, saturation, stimulus, time.
- Equipment Design: workspace, man-machine interface, instrument display/design, controls layout and design, seat design/configuration, alerting systems.
- Environmental: external conditions, internal conditions, illumination, noise, vibration.

At the Scene

By law, the National Transportation Safety Board (NTSB) is responsible for determining probable cause for any accident or incident in the United States. Also by law, the FAA participates in the investigation. The FAA team includes HF experts like Sabrina. "My primary job is to help the lead FAA investigator determine and analyze the human factors issues in the accident or incident," she notes. "I might launch with the 'go team,' or help with transcriptions and witness interviews."

The bulk of the work occurs after the on-site investigation concludes. "HF experts develop a human performance assessment so as to improve the safety risk management and mitigation process," says Sabrina. Other duties include providing subject matter expertise on HF-related safety recommendations, and leading human performance/human factors data analysis.

"Strong communication skills are a must," she adds, to be an effective interface with fellow HF specialists not just in the FAA, but also in the NTSB, with major industry stakeholders, and global counterparts in the HF discipline.

We all benefit from the work that dedicated Human Factors Investigators do to improve aviation safety.

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.

DRONES DOING DIRTY WORK TO KEEP HUMANS SAFE

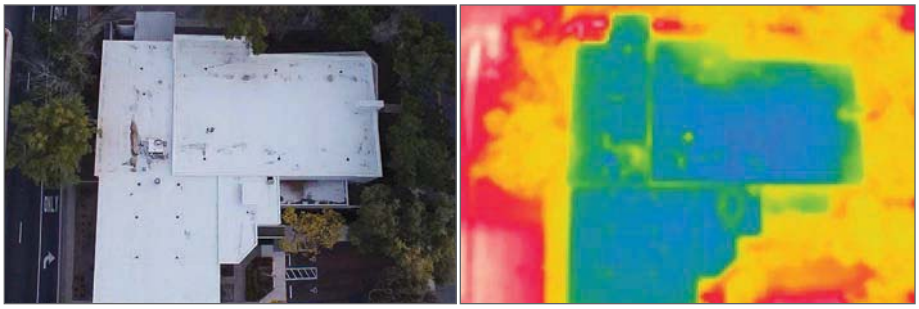
Have you ever watched the "Dirty Jobs" television show? It takes a behind-the-scenes look at how difficult and strange some occupations can be. Jobs vital for public safety and health can be physically demanding, dirty, and even dangerous. General industry, utility companies, and state and local governments are discovering that drones can do much of this work more safely and efficiently.

The Occupational Safety and Health Administration (OSHA) was established to ensure safe and healthful working conditions. The agency has been keeping records of on-the-job accidents and fatalities for decades. OSHA is now using drones to inspect facilities following accidents at worksites considered too dangerous for OSHA inspectors to enter. Examples include an oil drilling rig fire, a building collapse, a combustible dust blast, an accident on a television tower, and a chemical plant explosion. Such environments greatly increase accident risk.

Keeping Humans in Their (Safe) Place

An estimated 80- to 90-percent of accidents in the workplace are attributed to human factors. In 2018, there were 4,500 preventable work injury deaths. The number of injuries included workers in construction, agriculture and forestry, utilities, transportation, and government. Accordingly, the goal of human factors is to reduce human error, enhance safety, and increase productivity.

Consistent with that aim, drones have practical applications in many situations that might expose a worker to environmental hazards. If a poisonous gas is leaking from an unknown source inside a large factory, a drone could navigate along the pipes to find the problem. Drones recently captured aerial views of a forest fire in the exclusion zone around the shuttered Chernobyl nuclear power plant (site of a 1986 reactor explosion that released massive amounts of radiation into the area). The goal was to get the current fire under control before it reached the site of the reactor. Thermal cameras on the drones helped authorities see hot spots through the smoke, while limiting radiation exposure and other risks to personnel. Drones also have been used to survey areas that have become unsafe for workers following a hurricane or an earthquake.



A visual image and infrared image taken from a drone conducting an inspection.

Inspection is another area where drones shine. Traditional inspection methods for utility pole, roof, and buildings are time-consuming and often require bringing in qualified inspectors. This work can be expensive and risky when it requires carrying heavy equipment while climbing to access certain areas. Roofs can have unusual, complex designs or they may be many stories high. Hazards can vary from heat exposure, insect bites, collapsing roofs, and falls. Using a thermal camera-equipped drone for roof inspections can eliminate many risks and also obviate the need to comply with regulations required for human health and safety.

Conventional procedures for work can become mundane, boring and yes, dull. Boredom increases the potential for complacency — a common contributor to injuries — during cell tower, utility pole, and wind turbine inspections. When workers get extremely comfortable with a procedure, they may unintentionally minimize the amount of risk involved. Because drones don't get bored, they can enable safer and more efficient performance of this type of work.

The current pandemic offers yet another example of how drone use keeps humans safe. For example, the Chula Vista Police Department has been able to use a loudspeaker on a drone to effectively and safely communicate information about the pandemic to homeless encampments while maintaining a safe distance. Drones have also been used to provide prescriptions to a retirement community of more than 135,000 residents, allowing them to shelter in place.

Given all the great ways drones can keep us clean, healthy, and safe, maybe Mike Rowe should consider using one for his next "Dirty Job."

Diana Robinson is a project specialist in the Programs and Data Management Branch of the UAS Integration Office. She has an MBA and a B.S. in Alternative and Renewable Energy Management.

BILL JOHNSON, PH.D., AND KYLIE KEY, PH.D.

ADDRESSING THE CHALLENGE OF FAILURE TO FOLLOW PROCEDURES

Most aviation maintenance workers and their managers know the importance of procedures. They know that procedures are often based on regulations and they know how to follow them. Even so, a very high percentage of safety lapses are triggered by a failure to follow procedures (FFP).

That's why the FAA launched a three-year research and development project to investigate FFP events and develop a web-based training program to prevent them. The online training program is based on lessons learned from approximately 150, 90-minute interviews with Aviation Maintenance Technicians (AMTs), supervisors, and procedure writers. Researchers asked interviewees to describe a FFP event and its contributing factors, and/or rate the effectiveness of good practices for reducing FFPs.

> **A VERY HIGH PERCENTAGE OF NEGATIVE SAFETY EVENTS ARE TRIGGERED BY A FAILURE TO FOLLOW PROCEDURES (FFP).**

An important finding from the interviews was that FFPs don't usually arise from a lack of knowledge or from poor quality in procedural documents. Mechanics know the regulations and the importance of using the written technical procedures. Procedure writers also know how to do their job. So knowledge is not enough to stop FFPs.

FFP events we studied frequently arose from task familiarity, interruptions and distractions, time pressure and competing priorities, and group norms of deviating from procedures. In short, FFPs are largely driven by an industry culture of completing perceived safe and quality work, as quickly as possible, to the neglect of strict procedural compliance. Consequently, the best way to address FFPs is to address the general industry culture regarding the design and use of procedures.

Figure 1. Safety Champion Attributes

So Now What?

The practical products from this research project were designed to change daily attitudes and behaviors about explicit use of procedures. To accelerate this culture change, the researchers launched a free, 30-45 minute training course called "FFP: The Buck Stops with Me." This course emphasizes the message that since FFP is everyone's problem, each of us should take responsibility for ensuring procedural compliance. No more passing the buck! The training introduces 11 Attributes of Safety Champions (see Figure 1), and concludes with an invitation for trainees to sign a Safety Champion pledge.

The course also comes with Before-and-After Procedure Following Task Cards for AMTs, supervisors, and procedure writers. Companies can print and promote the Before-and-After Procedure Following Task Cards to be worn on employee badge lanyards. You can find all printing specifications at www.humanfactorsinfo.com under the "Training & Tools" tab.

We launched the course in October 2018, and it has already attracted nearly 14,000 users. Some companies have adopted it as their recurrent training program, and we expect more to follow suit. If you haven't already checked it out, we strongly encourage you and your colleagues to take the course at bit.ly/FFPTheBuck.

Small investments can lead to big changes in the long run. Monetary commitment is not enough. Training and task cards are only the beginning. Now, industry must re-energize its commitment to following procedures. Everyone from senior management, organized labor units, individual workers, and government must commit to addressing the FFP challenge. Inadequate procedures, regardless of the reason, must be reported and revised in a timely manner. If FFP is everyone's problem, then it is everyone's opportunity to improve. Please do your part!

DECISIONS, DECISIONS

Life is full of day-to-day decisions. Which shirt do I wear today? Should I take the freeway or the back roads? Or, maybe like most folks these days, there's the taxing decision on whether to "eat out" in the living room or the dining room. These are just some of the daily choices we make, usually without much thought or consequence.

External factors, such as time, money, and emotional state can all play important roles in how we make our decisions. Personal experience and habits also factor into the process and, based on how well you apply lessons learned, that can either be a good *or* bad thing. While the consequences of some common decisions may only result in being late for an appointment, decision-making skills in the flying world can render more serious consequences and unexpected results. Consider the following scenario.

> **AS CAN BE EXPECTED – AND BY ALL MEANS IT SHOULD – NOT ALL THINGS GO ACCORDING TO PLAN.**

Gone Fishin'

It's Friday night and after a grueling week at work you look forward to flying out for a weekend fishing trip with friends. The forecast calls for "severe clear" and light winds in the morning, with the possibility of storms later that afternoon. Sounds like a good plan for an early flight. However, as can be expected — and by all means it should — not all things go according to plan.

That grueling work week triggered several consecutive restless nights

Enhanced taxiway centerlines are designed to reduce pilot deviations.

with at best 25 hours of sleep for the week. You decide to make up for it and hit the hay early. However, sleep doesn't come easy as you begin to feel congested and your throat seems a tad scratchy. You pop an aspirin to help.

Waking up late the next morning, your plans for a good breakfast and a detailed weather briefing are disrupted. Instead, you grab some coffee, a banana, a package of tissues for your worsening cold symptoms, and perform a quick overhead scan only to see miles of brilliant blue. You head off and hope not to keep your friends waiting too long.

Arriving at the airport, you discover the stormy front is expected to move through sooner than planned. Instead of calling it a day, you press on, hoping to still squeeze in a couple hours of fishing.

Throwing your flight bag and tackle box in the back of the plane, you complete your pre-flight, scratch down the ATIS, and request taxi clearance. Within seconds the controller responds, "Cirrus 123, taxi to runway 18R." You begin your taxi as you blaze through remaining checklist items, set frequencies, and ponder how a fresh fish dinner will taste.

During this flurry of last-minute activity, as well as a brief fit of sneezing, you neglect to hear an unexpected instruction from ATC to hold short of the parallel runway 18L for landing traffic. Luckily, your eyes catch the traffic on final, but only seconds before your plane reaches the hold-short lines. You narrowly escape what could have been a deadly runway incursion.

Stop and Read the Signs

Before this pilot even left home, we can see a trail of bad decisions. Stress, fatigue, illness, and get-there-itis all played a part. All too often pilots overlook perilous signs. Individually, they may not seem bad, but in concert, they can be deadly. Nearly 80-percent of all aviation accidents are human factors related, with many stemming from bad decisions.

Complacency and carelessness have a way of creeping up on pilots, so it takes a concentrated effort to steer yourself in the right direction. Throw in some distractions and unexpected events and you have all the ingredients for disaster. That's why recognizing the consequences of your decisions *before* you take action is so important.

The pilot in the example had several clues that it was not the best day to fly. Using available resources is one way to break that chain and help mitigate the risk to you and your passengers. These resources range from your own knowledge and personal piloting skills, to ATC and flight service station personnel. By tapping these resources, in addition to heeding the warning signs that impede good judgment, you'll be well on your way to making more good decisions.

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

AVOIDING INFORMATION OVERLOAD

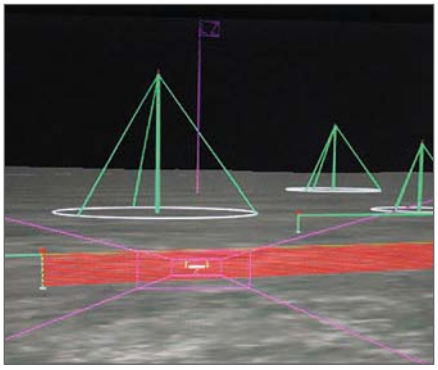
For years, the FAA's Civil Aerospace Medical Institute (CAMI) in Oklahoma City has been studying pilot performance and aeronautics with the goal of making flying safer. As CAMI researchers have discovered, sometimes adding simple visual cues can make a huge difference in safety.

In a series of CAMI-led flight simulator studies, helicopter air ambulance pilots were asked to fly and land a helicopter to transport an injured patient in a remote area. Along their route, the pilots had to navigate past a mix of television broadcast towers and power lines.

As the pilots flew from a simulated Amarillo (Texas) airport, they were guided by a see-through head-mounted display showing a computer-generated image of obstructions (towers, known wires) that they were supposed to avoid to get to their landing spot. The study sought to evaluate how realistic a representation has to be for pilots to understand what they were seeing and take the appropriate actions. In this study, researchers studied complex "realistic" towers versus simplified ones.

The pilots preferred the simple towers because they created less clutter in the see-through display and could not be confused with guidance lines (highways in the sky). The pilots were less likely to recognize the simple towers and wires for what they were than the more complex ones. The simple display had a green wire as the pilots approached their designated landing spot.

"With some of the pilots having power-line inspection experience, more than half the pilots flew under the simple wire, creating a potentially dangerous situation," said Dr. Dennis Beringer, a CAMI engineering research psychologist who led the experiments.



An image of the powerline "curtain" warning displayed in a helicopter simulator.

When the researchers displayed a red "curtain" from the top of the power lines to the ground as the pilots approached their landing area, none of the pilots flew under the wire. "They avoided it and successfully landed at the site," Dr. Beringer said. The additional warning "curtain" allowed pilots to more easily interpret the hazard despite having a decluttered display.

This study falls under the umbrella of human factors, which covers a wide range of areas that include pilot workload and task performance. Determining how to assist pilots to process and interpret information can be crucial when they face an unsafe situation. That includes wire strikes, a major cause of helicopter accidents.

If the brain can interpret the meaning of a spatially relevant red curtain as a hazard indicator even in a simplified display, that can be useful information to a manufacturer developing hazard warning systems.

During flight, helicopter pilots have to process all sorts of information and stimuli simultaneously. The danger is when pilots hit a point of information overload. FAA researchers look for technology, methods, and processes that can reduce or eliminate that condition.

For example, Automatic Dependent Surveillance-Broadcast (ADS-B), helicopter terrain awareness and warning systems (HTAWS), and autopilot technologies have made flying easier and safer. The drawback is that these systems require concentration when quick decisions are needed.

"There's a sweet spot where you provide enough functions and enough capabilities to achieve some of these tasks a little more easily than if you didn't have the stuff at all," Dr. Beringer said. "But then you don't want to go past that point and make things so complicated that the system becomes difficult for the pilot to use, because there are too many variants for the pilot to remember."

While technology can help, training pilots to recognize their susceptibility to information overload or task saturation is also important, experts say. If a pilot is handling an emergency and reaches information overload, the first priority is keeping the helicopter operating safely in the air or finding a safe place to land. "Rehearsing repeatedly what to do in dangerous situations, such as engine failure, is crucial," says Dr. Bruce Wright, Medical Education Division, team lead, airman education. "Everything else can be put off. You don't have to answer the radio. You don't need to mess with the electronics. You've got a crisis on your hands."

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

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

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.

What Not to Say on the Radio

Can anybody tell me where in the books it says — when [you] enter the pattern at non-towered airports, [you should] say, "any traffic in the pattern, please advise?" It doesn't! So why do we hear this nuisance call so much? — Jerry

Making this call is kind of like walking into a room full of 50 people and shouting "I'm Brett, what's your name?" Check out Advisory Circular 90-66B, Non-Towered Airport Flight Operations at go.usa.gov/xv6eP. There's good reason not to broadcast a blind request for everyone on frequency to talk all at once. It does nothing for situational awareness or safety but rather the opposite since most likely everyone within radio range will only hear the screech of simultaneous transmissions and reach for the volume knob to turn down the squeal. Most CTAF frequencies are shared by multiple airports, and on a busy day, even those you can't hear may be able to hear you. Minimizing pointless radio calls is in everyone's best interest to allow for maximizing communication. — Brett

Here's an excerpt from author Susan K. Parson's feature, "No-Go on the Radio, What Not to Say" in the May/Jun 2020 issue: Don't copy the audio mistakes of other pilots, such as "any traffic in the area (to) please advise." [This is] the audio equivalent of tossing litter out the window of your car. It is the incoming pilot's responsibility to listen, build a mental picture of other traffic, and transmit intentions.

For more on how to improve your "plane" English, check out the entire May/Jun 2020 issue at www.faa.gov/news/safety_briefing.

The Way to Go? Aspect Ratio

I just read "The Wing's the Thing" in the Jan/Feb 2020 issue, and I thoroughly enjoyed it. You are very knowledgeable and your article addresses my concerns with aircraft owners about the purchasing decisions that they make when considering a new aircraft. Aspect ratio is everything. One gets tired of taking cross countries on flights better suited to higher aspect ratio winged craft. Altitude and speed equals comfort. Thank you for your enlightening treatise on wings. — Gary

Thank you for the lovely note and feedback. You make a great point about the importance of aspect ratio, and you are absolutely correct — altitude and speed equals comfort!

Calling All Aviators

I read your article "CRM: The Magic of Using All Available Resources" in the Nov/Dec 2019 issue. I thought it was a very good explanation of how GA pilots can use Crew Resource Management. I liked the exercise that you had to perform. What other exercises can I share with my fellow aviation students to make us better pilots? — Luis

Thanks very much for taking the time to write and letting us know you found the article useful. We don't have the actual story used in the exercise, but you could probably replicate by writing a one-page "master" story, ideally about something relevant to the training group. Next, develop the list of questions you want the participants to answer on the basis of the complete "master" story. Finally, depending on how many participants might be in each table group, remove a different piece of information needed to respond to the questions from each of the 4-6 copies. It works best if the items deleted are somewhere in the middle of the document. It's probably best to make the first and last paragraphs of each copy identical – it allows participants to assume they all have exactly the same information.

Good luck in your studies!

***Readers:** If you have any CRM exercises that you'd like to share, please send them to our FAA Safety Briefing mailbox at SafetyBriefing@faa.gov.*

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*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**. 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.*

ON STAYING GROUNDED

Early this morning, a friend sent yet another link to one of the sad and shocking videos making the rounds right now. With haunting music in the background, the camera sweeps across row after row after row of airliners parked nose to tail in every available space. It seems to go on forever. It's not just one airport. The video tours most major world airports, airports normally full of planes that are moving rather than moored. It is we who are unmoored in this time of unprecedented disruption.

While COVID-19 has devastated the air carrier industry and kept more than a few GA pilots and planes on the ground, personal aviation is in other ways more accessible than ever. For example, another YouTube video documents the heretofore impossible trifecta: a GA pilot gets ATC authorization to do "low and go" approaches at — get this — EWR, LGA, and JFK. When the pilot/videographer initially makes this request, the controller laughs, but not the way he would have guffawed just a few weeks ago. "Well, why not?" is the bemused controller's accommodating answer. I'm not sure which is more amazing: watching the pilot of a light GA airplane skim over the runways at these airports or seeing how eerily quiet and empty they are.

Disruption and Distraction

The COVID-19 public health emergency that has caused such incredible things had already begun to disrupt daily life when the magazine team met — virtually, by the way — to start planning this issue of *FAA Safety Briefing*. We agreed that our long-planned focus on human factors was very appropriate. We didn't know then (or now) how long it would take for "normal" to return, but we adjusted the plan to include topics like stress. In "Passing the Stress Test," I wrote about the Janus-like duality of stress, with its capacity to both motivate and debilitate. In thinking more on this topic — hard to do otherwise when stress surrounds us like a thick layer of persistent stratus — I pondered the idea of the choices we can make. No pilot willingly chooses to be grounded in the aeronautical sense, but all of us can choose to stay grounded in terms of outlook. As phrased on a motivational plaque I once had, we rarely get to choose what happens to us. But we can always choose how we deal with it.

> NO PILOT WILLINGLY CHOOSES TO BE GROUNDED IN THE AERONAUTICAL SENSE, BUT ALL OF US CAN CHOOSE TO STAY GROUNDED IN TERMS OF OUTLOOK.

Fight/Flight, or Freeze

The "fight or flight" dichotomy is one of the most basic choices wired into the human brain. When stress sends a batch of hormones careening around the brain like so many loose marbles, impulse sometimes pushes us into combat. Other times it commands evasion. A third wired-in reaction is the frozen I-can't-believe-my-engine-just-quit pause.

React or Respond

For a given situation, any of the three reactions described above could help or hinder a good outcome. Much

depends not so much on the immediate reaction, but on what happens next or, put another way, how you *respond* after you have made it through the initial *reaction*.

Fixate or Fix

There are many ways to respond to a stressful situation or event, but the two I want to note are "fixate" vs "fix." When things go awry, whether on the global scale of the pandemic or the personal scale of confinement, it's easy to fixate on what's wrong. Just as in instrument flying, though, fixation is not a helpful approach. It may not be possible to fix the source of the stress. But, as proper instrument flying procedure teaches, we can choose to stop fixating. Only by looking around is it possible to get a solid fix on an attitude that puts you back in control, and a bearing that allows you to safely navigate through the turbulence.

Stay healthy and choose to stay grounded in serenity … this too shall pass.

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.

DR. KATHY ABBOTT

Chief Scientific and Technical Advisor, FAA Flight Deck Human Factors

Kathy Abbott didn't start out with the intention of making aviation safety a career, but NASA had other plans for her. After working as a waitress and later a computer programmer to help pay for her bachelor's degree in information science, math, and a minor in psychology, she was offered a job as a contractor at NASA's Langley Research Center after graduation.

Kathy's first project was to write a digital simulation of a Boeing 737 to support research studies that compared instrument landing systems to microwave landing systems.

"I didn't know anything about aviation at the time," she explained, "so I was really thrown in the deep end!"

That didn't stop Kathy from excelling at her job. A few years later, NASA hired her as a researcher for flight deck design and operations. While employed at NASA, she completed both a master's degree and doctoral degree, including courses in aeronautical and mechanical engineering, cognitive psychology, human factors, and artificial intelligence. After all that schoolwork, Kathy finally had time for flight training and earned her private pilot certificate at the Felker Army Airfield Flying Club at Ft. Eustis, Virginia.

Kathy has since piloted Cessna, Grumman American, Champion, Beechcraft, Sabreliner, Boeing, and Extra Flugzeugbau airplanes. She also has simulator time in Airbus, Boeing, and McDonnell Douglas airliners.

In 1993, Kathy was temporarily assigned to the FAA to help develop a plan to certificate the next supersonic transport aircraft, which built on her high speed civil transport research program at NASA. After the assignment ended, she became a co-chair for an FAA human factors team on interfaces between flightcrews and modern flight deck systems. That report was published in 1996. It made several recommendations to the FAA; the agency then hired Kathy to help implement those recommendations.

"That was 24 years ago, and we have accomplished quite a bit together," she notes of her career with the FAA.

One of those accomplishments came in 2013 with the publication of Section 25.1302 of Title 14, Code of Federal Regulations, which covers installed systems and equipment for use by flightcrews. It requires manufacturers to look at equipment design from the perspective of whether the design encourages pilot error.

"The human factors specialists in the FAA's Aircraft Certification Service have been working on this since the late 90s," Kathy said. "It's a very big deal."

New technology, new airspace operations, and many other complexities are bringing change to general aviation (GA). Helping industry to manage change safely is an important challenge that Kathy and her team are working on continuously. Kathy stresses that it's equally important for GA pilots to know their aircraft and its systems, and to be aware of their personal fitness for flight. She notes that new technologies will continue to be introduced along with many benefits and potential risks as well. However, the pilot is always ultimately responsible for the safety of his/her flight.

"Consciously manage the risk associated with flying," reminds Kathy. "Never stop learning from other pilots, especially learning what to do and also what not to do."

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.

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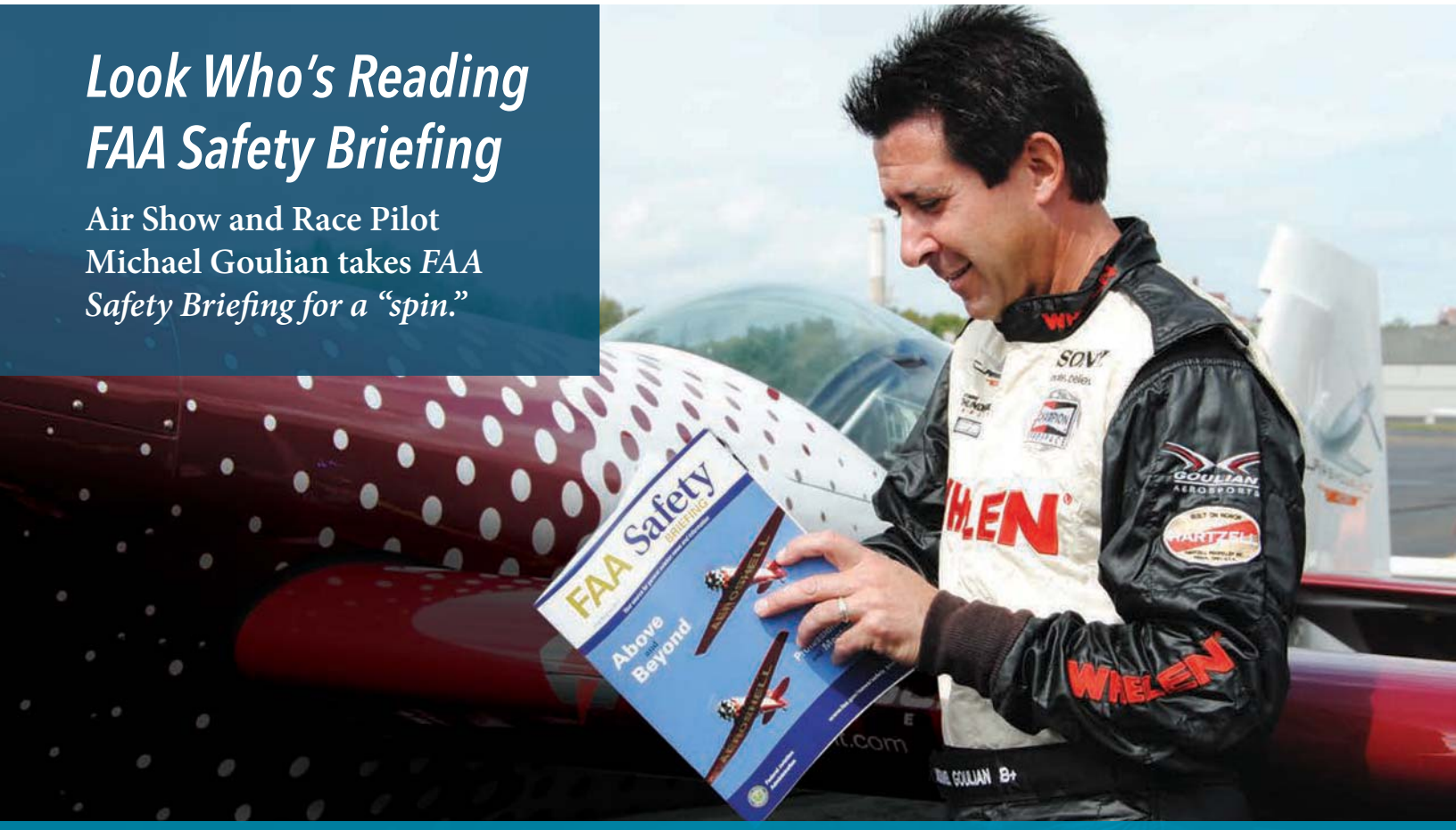
Look Who's Reading FAA Safety Briefing

Air Show and Race Pilot Michael Goulian takes *FAA Safety Briefing* for a "spin."



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