Aviation Human Factors Industry News

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FAA Aviation Mx Human Factors Quarterly - March 2019

https://www.faa.gov/about/initiatives/maintenance_hf/fatigue/publications/

What the Experts Want to Know

By Bill Johnson: FAA Chief Scientific and Technical Advisor for Human Factors in Aircraft Maintenance Systems.

The average aviation work experience for the February 2019 class was 35 years. They want a short review followed by information that they can use in their job to be able to explain human factors to othersThe Department of Transportation (DOT) Safety Institute (TSI) offers a three-day maintenance human factors class about four times per year. The course is available to industry and government participants as part of an advanced certificate program for safety officers and accident investigators. The primary customer is FAA Flight Standards. This article is about a recent class and about content trends in today's human factors courses.

This course was offered at a unique time, when most of the class just resumed work after the January furlough. Spirits were especially high since everyone was glad to be back on the job. Of course, there were the inevitable discussions about the backlog of scheduled inspections, correspondence, certifications, and more. Inspectors wanted the flying public to not only be safe but also to have the security of regulatory oversight. There was the general perception: that airline flight and maintenance had been proceeding safely during the furlough. That is attributable to an overall industry safety focus that is reinforced not only for commercial reasons but also due to many FAA-mandated programs. That includes continuing analysis and surveillance efforts. Programs like the Aviation Safety Action Program (ASAP) are greatly enhanced and require FAA inspector presence. A safe system does not necessarily mean that safety stops the moment FAA is not physically present. Safely was not compromised. FAA is back to cooperate with industry to reinforce safety programs.

January/February is a traditional time to look back at the previous year's international safety statistics. The average, from 2010-2017 is 16.1 fatal events/year. The fatal large jet accident number went from 12 in 2017 to 14 in 2018. While four of the 14 had only one fatality, there were two large losses including, the Lion Air 737 , with 181 fatalities, and the Cubana 737, with 112 souls lost. Over half of the events had a human factors component with both flight and/or maintenance contributing factors. Therefore, 2018 was a reversal of recent annual trends.

An Evolving Curriculum

We started the 2019 class by asking the inspectors what they expected to learn. The average aviation work experience for the February 2019 class was 35 years. Such experienced participants have already had many HF classes. They seldom want more fundamental scientific information. Instead, they want a short review followed by information that they can use in their job. Inspectors want to be able to explain human factors to others. Thus, we had the explicit instructional goals shown in Table 1.

This course will empower you to:

• Add value to the HF programs that you oversee

• Strengthen your ability and spirit to speak about human factors to maintenance audiences

• Identify HF performance challenges and to offer solutions

• Assess the quality of the maintenance safety culture

• Renew commitment to your inspector role in HF-related safety

Table 1. Training goals

Advanced HF training does not have to have the traditional kinds of declarative knowledge where learners are measured by their ability to define human factors or recite a list of human errors. Instead, advanced training goals should strive to affect the learner's ability and attitude to apply principles and add value to the fundamentals.

From a training perspective, new human factors training must consider sources like Bloom's Taxonomy, an educational structure from the '50s. That means that the training must range from the easy stuff, like remembering and recalling facts, to higher goals like applying the learning to the work environment. Learners must be able to create new ideas and concepts based on not only new knowledge but also their life and aviation work experience.

The class started with a review of methods for considering human factors in maintenance. Each of the methods are shown in Figure 1. I always refer to this graphic as "my one page to consider human factors." The methods included: SHELL, Swiss Cheese, Dirty Dozen, Probability-Severity Matrix, Bow Tie, Threat and Error Model (not pictured), and PEAR. The class used the PEAR Model (People-Environment-Action-Resources) as a guideline/framework to structure discussion about many human-factors related events.

Adult learners thrive on relevant stories. Therefore, with the PEAR structure the class reviewed many events/accidents. We always take a moment to acknowledge that this technical discussion of accidents respects the heart-breaking loss of family and friends. Table 2 lists the PEAR categories with examples. Our class has about four example events related to each letter in PEAR. Inspectors often add stories as part of the class discussion.

People Examples

2015, German Wings, French Alps, Pilot mental fitness for duty, personnel selection, and more

2018, US-Bangla, Kathmandu, Captain's demeanor with crew and ATC

Environment Examples (including corporate communications)

2000, Alaska, California, Horizontal stabilizer jackscrew failure and more

2018, Lion Air, Indonesia, Corporate communications failure at multiple levels

Actions Examples

2008, XL, France, Failed AOA during post lease flight test and more

2013, British Airways, UK, Failure to secure A320 cowling. 50 such incidents since 1992

2014, Virgin Atlantic, UK, Installation error on B747 Landing gear actuator

Resources Example

2003, Air Midwest, Charlotte, Training, supervision, procedures, crew rest, and more

2011, Airtours, Nevada, Scheduling, available personnel, reused locking device, and procedures.

Table 2: Example of PEAR Categories for Events

Today's Topics for Discussion

Our aviation safety inspectors class has three to five structured discussions listed in Table 3. For discussions we use the format of small group discussion and problem solving. Then, there is a full class discussion, with a reporter from each group. The discussions seem to be a favorite part of the class for all participants, including the instructors. The talks always reinforce, to me, that the aviation safety inspectors are truly dedicated to their safety mission. As an HF instructor I certainly recognize that I am the student during the discussion segments of the class.

Identifying the Top Five Maintenance Human Factors Challenges

Assessing Safety Culture in a Maintenance Organization

Competencies for a Maintenance HF Trainer and for an Airworthiness Inspector

Voluntary Reporting, Just Culture, and Compliance Process

Relationship Between Safety Management and Human Factors

Table 3. Topics for Class Discussion

One of the course goals is to empower and invigorate the learners to make human factors presentations to others. Therefore we do have content-centered topics. Examples are: worker fatigue, communications, and the criticality of following procedures. Of course, learners are given editable copies of all presentation materials and related media. During 2019, we will promote the Follow Procedure topic. That includes an hour-long web-based training program available on the FAA Safety Team website (www.faasafety.gov).

Final Comments about Human Factors Training

I have been delivering human factors training for nearly 40 years. Most of it has been related to maintenance and engineering. Most has been in aviation maintenance domains. I am certain that such training is as important today as it was when I began. I am quite sure that my enthusiasm for the topic has not diminished as I have written many papers like this one.

All maintenance human factors training must be matched to the audience. A fundamental class must be aligned with regulatory guidance. Recurrent training must align with the evolved human performance and technical challenges.

The Joint Aviation Authority, the European Aviation Safety Agency, and other National Aviation Authorities established regulations and guidelines in the mid-'90s. Groups like the International Civil Aviation Organization, Transport Canada, and the UK CAA published significant training documents. At the same time, companies like Lufthansa Technical Training created significant HF training materials, including computer-based training that was used by at least 200,000 engineers and mechanics worldwide. Many other companies followed the Lufthansa lead. International consultants established companies to meet the training demand. The FAA started a maintenance human factors research program in 1988. Those early efforts were excellent. The fundamental HF training contents and ideas remain relevant albeit worn out in format. However, the necessary and oft-regulated recurrent training presents an opportunity to update the aging fundamental materials and match them to HF challenges that may not have been present in the past 30 to 40 years.

Many readers have heard me light-heartedly say that “there is good job security in addressing human error.” It is as true today as well as when I started training maintenance human factors. Nevertheless, keep trying.

Need more information?

You can find 10 years worth of “Dr. Bill” wisdom published in the *AMT* magazine archives at AviationPros.com. Products from the FAA Maintenance Human Factors Research program are at https://www.hf.faa.gov/

Inadequate maintenance fatal for Piper pilot

The airplane owner and a mechanic completed the Piper PA-28-140’s annual inspection the morning of the accident. The mechanic did no work, but returned the airplane to service with an endorsement that the annual inspection/airworthiness requirements had been met based on his determination that the engine run-up was satisfactory.The airplane departed but returned to the airport in Stonewall, Texas, shortly after the departure. During the return, a witness said the plane was “way too high,” and its approach was “pretty steep.”

The airplane touched down about halfway down the short grass runway and was “going way too fast.” The airplane overran the end of the runway and into a pond where it became submerged. The pilot died in the crash.

Post-accident examination of the runway revealed the presence of skid marks from the airplane main landing gear wheels along the last 300′ of the runway. The propeller exhibited rotational signatures but with some loss of torque.

Post-accident examination of the airplane revealed numerous unairworthy maintenance items and/or lack of maintenance to the engine and accessories. Additionally, the engine and various accessories surpassed their manufacturers' recommended time for overhaul/replacement.

The exhaust manifold was blocked with internal fractured pieces that would have resulted in power loss. The condition of these pieces was consistent with a failure that had been preexisting.

The induction hose to the carburetor was the wrong part for the installation. The hose was collapsed and would have restricted airflow into the carburetor resulting in power loss.

Both magnetos were no longer serviceable and would have produced minimal ignition. The engine timing was not set to the engine manufacturer's specification.

Had the mechanic conducted a proper annual inspection, he would have identified many of the issues found during the airplane's post-accident examination.

Based on the evidence, the pilot likely returned to the airport due to a loss of engine power. It could not be determined which of the many discrepancies led to the loss of engine power. Further, the pilot did not attain a power-off approach glideslope that would have led to a proper touchdown point near the approach end of the runway.

Probable cause: The pilot's failure to attain a proper touchdown point following a loss of engine power and his inability to stop the airplane on the short, soft runway. Contributing to the accident was the inadequate maintenance of the airplane by the owner and the mechanic and the improper annual inspection by the mechanic.

NTSB Identification: CEN17FA139

This March 2017 accident report is provided by the National Transportation Safety Board. Published as an educational tool, it is intended to help pilots learn from the misfortunes of others.

Where are the Supervisors? Supervision and Accountability (U.S. Navy).

All commands are required by the Navy and Marine Corps Mishap and Safety Investigation, Reporting and Record Keeping Manual (OPNAVINST 5102.1D/MCO P5102.1B) to report all mishaps, hazards and near misses.

In addition to reporting, they're supposed to be investigated to determine what happened and how to prevent the incident from happening again.

Personnel from the Naval Safety Center review all Web Enabled Safety System and a majority of the Enterprise Safety Application Management System reports.Over time,we've learned both military and civilian personnel know how to get injured. There are no new ways to get injured. Most of the time a generic write-up can be used and all that's required is to change the name.

Why is this occurring? The words that come to mind are **SUPERVISION** and **ACCOUNTABILITY**.

Supervisors own the process and employees are accountable to follow the process. If an employee is not performing a defined process properly, why is the process not being followed? What should be done to ensure the process is followed? Did the supervisor or another employee witness a violation and not correct the action? The majority of injuries can be categorized as compliancy, but what is the cause?

Here is an example of improper supervision and improper personal accountability: An employee is using a 6-foot ladder when an 8-foot ladder is necessary. The employee stands on the top rung. Not authorized. The thought process is "I'm only going to do this one time." A supervisor or another employee witnessed the employee not following the process. Nothing was said. The employee did not fall; no injury.

Behavioral science would show this as a sure certain positive. If an individual accomplishes a task without regards to personal safety and does not get injured, the individual has convinced him/herself that this behavior is satisfactory. The more the task is accomplished without regards to safety, the higher the chance of a mishap.

The supervisor or employee who witnessed the violation should have stopped the job on the spot. The process should be reviewed and the proper ladder brought to the job site. What usually happens is finish the job and try to remember to bring the proper ladder next time. Did the employee using the ladder know the top two rungs should not be used to stand on? If properly trained he/she should know. Did the supervisor or other employee know? The supervisor should know, the other employee may or may not know. If the process looks unsafe it usually is.

How are dilemmas like this solved? Supervisors are not always around and when the job needs to get accomplished and personal accountability sometimes falters when the job needs to be done now.

If the employee's lack of accountability caused a personal injury what else is counted besides the injured employee? Depending on the injury, a trip to the hospital is required. If during working hours, another employee may take them (more lost time) or emergency services are called. Either way the project is stopped. Time is lost.

If the proper ladder was brought or the project delayed until the proper ladder arrived, the chance of an injury is greatly reduced. Time was delayed, not lost.

During this time of fiscal restraint employees may hear "you need to do more with less." No such luck. With less, what is going to be sacrificed?

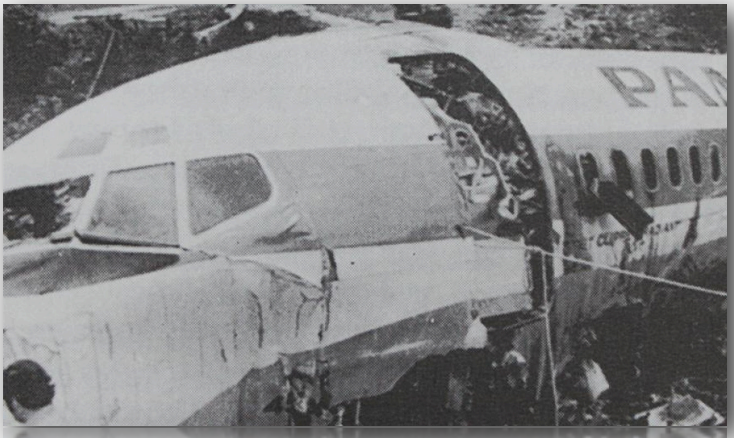
Is safety culture needed? Yes, safety should always be included into the command culture or command climate. Make it common practice to stop an unsafe evolution and properly train employees or shipmates.

When using operational risk management (ORM), you must decide whether the risk overrides the benefit. There are very few results in everyday tasks were the risk overrides the benefits.

Everyone who sees a safety violation should say something. If you think it is unsafe most likely it is. Bottom line, supervisors should supervise and review processes. Employees should be accountable to report processes that are not working or outdated.

How three deadly Pan Am plane crashes in nine months changed airline's safety culture

Faulted by the FAA for its substandard airmen and inadequate training after spate of 1970s disasters in Pacific, Pan Am made sweeping changes



The April 22, 1974 departure – a Boeing 707-321B – crashed into a mountain on its approach to Bali's Ngurah Rai International Airport. All 107 passengers and crew – mostly Japanese, American and Australian – were killed. Earlier that year, on January 30, another Pan Am Boeing 707-321B had crashed, on the approach to American Samoa's Pago Pago International Airport, killing 97 of the 101 people on board.Six months before that, on July 22, 1973, a Pan Am Boeing 707-321B had plunged into the sea just seconds after taking off from Tahiti International Airport, killing 78 of 79 passengers and crew.

A Federal Aviation Administration report blamed not Boeing but Pan Am and its "substandard airmen", inadequate training and "a host of operational items" for the fact that "Pan Am was littering the islands of the Pacific with the hulks of Boeing jetliners", according to Robert Gandt, in *Skygods: The Fall of Pan Am* (1995).

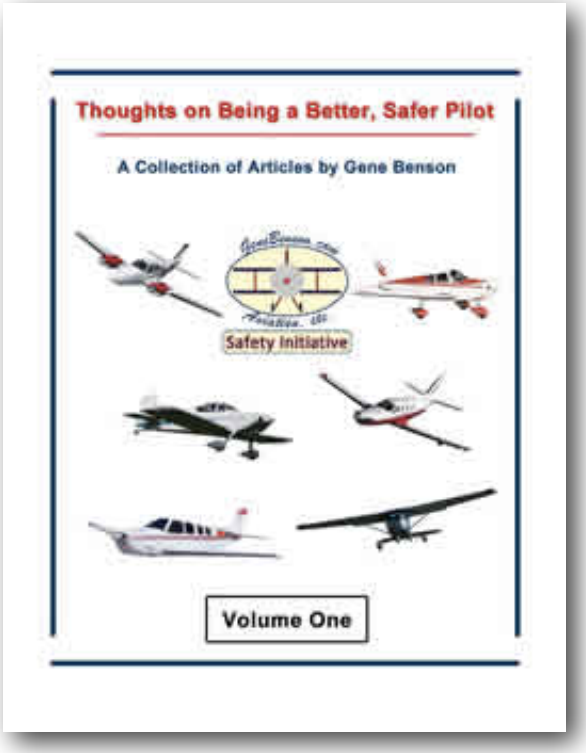
Pan Am made swift and sweeping changes; it never lost another Boeing 707 and its safety record improved dramatically. But the Bali, American Samoa and Tahiti crashes – which claimed 282 lives in nine months – remain by far the worst to have occurred in each of those places.

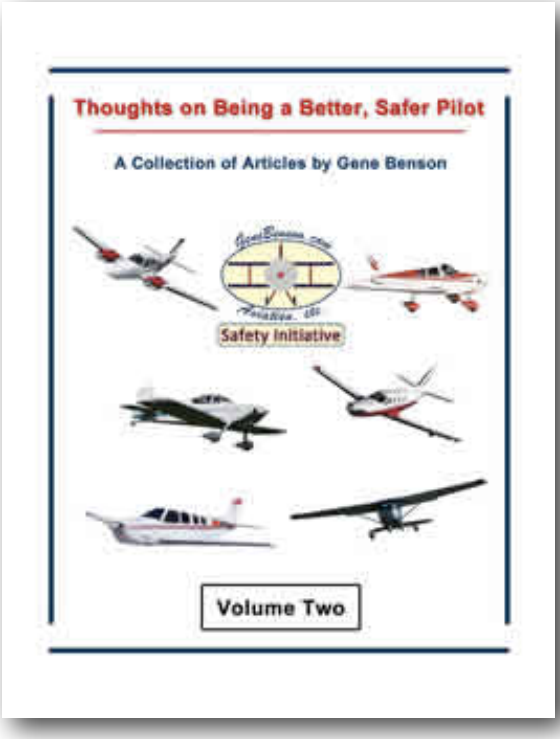
BOOK SALES

I am still diligently working on a book summarizing some of the things I have learned in my more than fifty years of flying. Every time I think it is just about finished, I recall something else that I want to include. I will probably trim it down a bit before final publishing because I don't want the print version to be so heavy that it overloads a small GA airplane. I am hoping to have it finished by the end of March or early in April.

Meanwhile, I have published two shorter e-books that are reprints of some of the articles I have written over the years. They are available on Amazon.

All proceeds from book sales are used to help support the Safety Initiative.





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Flying Is Safer Than Eating

The Federal Aviation Administration's (FAA) decision to ground Boeing's 737 MAX 8 passenger jet in the wake of two crashes has raised questions about the safety of today's airplane technology and led to some exaggerated reactions. "Can pilots trust Boeing with any of its other [planes]?" demanded one retired pilot on CNN. A more balanced assessment was offered by Atlantic journalist James Fallows. "The astonishingly good safety record of the world's commercial air-travel system," he suggests, "has earned most of the system's members the benefit of the doubt on safety judgments." Quoting another pilot, Fallows concludes that "airline accidents have become so rare I'm not sure what is still acceptable to the flying public."

The safety of modern airline travel is indeed a wonder. For the near-decade between February 2009 and April 2018, there wasn't a single fatality on a commercial flight in the United States. Considering that during that time, Americans flew something on the order of sixty million miles per month-akin to flying to the moon and back every day for four years-that's an astonishing degree of safety.

It's a cliché that driving to the airport is more dangerous than flying, but putting it that way may actually overstate the risk of plane travel. A 2006 report calculated the odds of dying in a crash at 1 in 11 million-and that was before the decade-long zero-fatalities streak. Driving is vastly more dangerous. In 2017, Americans drove more than 3 billion miles at the cost of 37,133 lives. In the entire decade before that, American air carriers suffered 67 fatalities (none in the U.S.), while flying 7.8 billion miles worldwide. According to other sources, seven people die for every billion miles traveled by car, whereas for plane travel, that figure is 0.07.

That's such a tiny number that it's little exaggeration to say that flying is safer than doing anything else. Hiking, biking, and eating are literally thousands of times more deadly.

About three hundred people die annually from falling off ladders; more than twice that many from toaster fires. About five thousand die from choking on food. The proverbial lightning strike is a virtual epidemic in comparison to airline fatalities. Lightning killed twenty-seven Americans in 2017-a record low, far below the seventy-five per year average before 2000. A person is four times more likely to be killed by a shark than by a passenger plane. To cite a more optimistic number, the odds of getting five cherries on a slot machine are one in 3,125-meaning you're more likely to win two jackpots in a row than to die in a plane crash.

There is a risk of non-fatal injury on commercial jets. But even there, the industry's safety record is extraordinary. Only about forty people are hurt by turbulence each year. By comparison, nearly two thousand people per year suffer serious knife wounds while cutting bagels.

This isn't to minimize the tragedy of airline fatalities but to celebrate the engineering achievements that lie behind this remarkable safety record. That record is the result of painstaking precautions and meticulous learning from mistakes in the years since September 17, 1908, when Thomas Selfridge became the first person killed in a plane crash. (His pilot that day was Orville Wright, who never fully recovered from his own injuries.)

The degree to which airplane science has advanced since then is shocking. Only after two de Havilland Comets crashed in 1954 did engineers realize that the square shape of the windows was concentrating stress at the corners, resulting in structural failure. Airplane portholes have been oval ever since. Two years later, two planes collided over the Grand Canyon, killing 128 people, due in part to obsolete air traffic control rules that gave different agencies conflicting authority over guiding planes from the ground. Things improved when the FAA was given the responsibility, ending such confusion (though safety could improve far more if private companies were allowed to compete for the job).

Perhaps the greatest recent innovation is satellite-guided navigation, which in the past two decades has not only reduced the risks of air travel even further but has provided other benefits as well. Investigators were alerted to the possible link between the two MAX 8 crashes, for example, by information on both flights recorded by satellite trackers. This data will help to ensure that the already breathtaking safety margins of today's flying are improved still further.

The commercial airliner is one of the most complicated machines ever built, an awe-inspiring masterpiece of scientific and technological ingenuity. And considering all the factors involved in sending an eighty-ton machine through the sky at five hundred miles per hour, it boggles the mind to think how far we've advanced. Nothing will ever be entirely risk-free-but we owe a debt of gratitude to the countless engineers and pilots who have managed to make air travel among the safest things that human beings do.

Into the Storm

What makes an otherwise safe pilot believe he or she can pick through the cells of a thunderstorm? In this episode, Wilson Khors and his copilot become so transfixed on making it through a tiny hole in a line of convective weather over San Juan, Puerto Rico, they simply disregard the option of turning around. They're not alone. Even some of the most experienced pilots have done it. In part, they're using weather depiction tactically rather than strategically. But is that really wise?

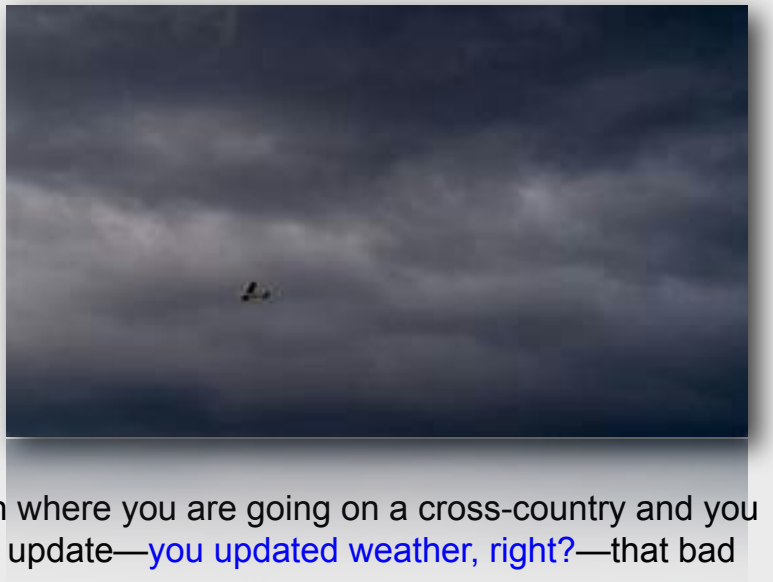
Topics the episode will cover:

The hazards of trying to fly through rather than around convective weather.
How weather depiction varies tremendously based on who and where you are.
The advantages of using weather depiction strategically to avoid storms rather than tactically to pick a path through them.

LISTEN TO THE EPISODE

TRAINING TIP: 'BLACK CLOUDS WERE VISIBLE'

What's the best way to outrun a thunderstorm? Hint: It's a trick question.



There's no good way to outrun a thunderstorm, but people keep wearing out the bad ways. If you find yourself in a situation that creates temptation to confront convection, there are things you can do to avoid going over to the dark side.

One sketchy situation for a student arises after you've gotten where you are going on a cross-country and you discover in your weather-briefing update—you updated weather, right?—that bad stuff is heading your way. Meanwhile the fuel truck hasn't shown up at your aircraft yet and another renter needs the airplane at 5 p.m.; next time you'll place the fuel order before you go inside the airport's famous restaurant for lunch.

At times like this you might also want to phone your fixed-base operator and let them know that the 5 p.m. renter might be out of luck. With that pressure off your mind, contact your flight instructor and discuss the weather, or, if you already have the information you need to opt to stay put, go ahead and tell the CFI of your no-go decision (I'll back you up if anybody complains).

You will know that the Dark Side of the Force is eating away at your resistance if you feel an overwhelming urge to jump in the airplane without even a walkaround glance, forget about the the top-off and the runup, and blast on out of there.

That's a recipe that cooks up nothing but trouble—and not just for student pilots who don't want to make waves.

When a flight instructor and student in a Cessna 172 learned from an internet weather check that bad weather was approaching the Tennessee airport where they had stopped on a cross-country, they took off and immediately ran into trouble as airspeed proved erratic, apparently the result of a low-level wind shear encounter. Loss of control into trees followed. An official **report** of the accident highlighted the CFI's decision to initiate flight into thunderstorm activity, noting another pilot's report that "black clouds were visible in the distance."

When studying aviation weather, trainees learn that dangerous effects of thunderstorms—hail, lightning, extreme winds—can extend unpredictably far from the visible storm area.

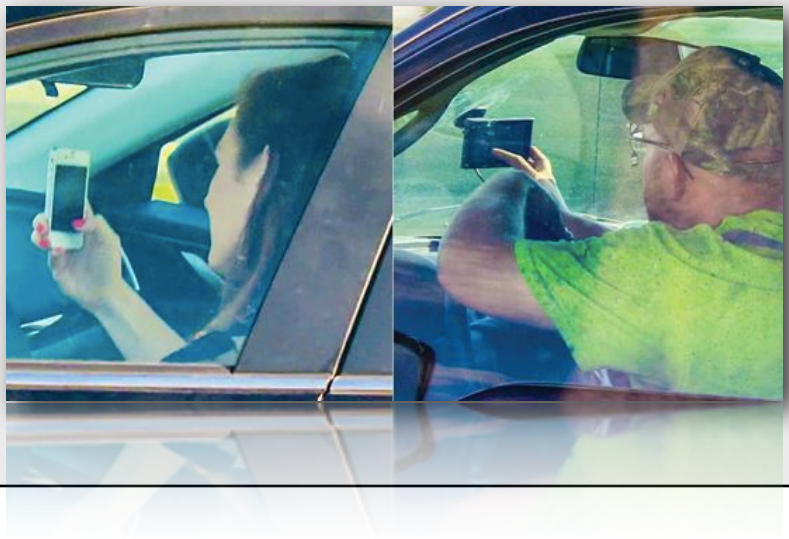
Looking at it another way, if incoming convective weather makes you want to make a run for it, it's probably already too late to do so.

https://app.ntsb.gov/pdfgenerator/ReportGeneratorFile.ashx?

EventID=20040616X00808&AKey=1&RType=Final&IType=CA

IIHS Estimates More Than 800 Traffic Deaths in 2017 Linked to Cellphone Manipulation

IIHS noted that a 2018 national survey by the AAA Foundation for Traffic Safety found that 64 percent of respondents consider distracted driving a much bigger problem now than it was three years ago.



Manipulating a cellphone was a contributing factor in more than 800 crash deaths on U.S. roads during 2017 amid a marked increase in the percentage of drivers observed interacting with cellphones, according to new research from the Insurance Institute for Highway Safety (IIHS). The estimate is based on the number of Virginia drivers observed in a 2018 IIHS roadside survey; 57 percent were more likely to be manipulating a cellphone than drivers in a 2014 survey. The percentage of drivers observed manipulating a phone rose from 2.3 percent in 2014 to 3.4 percent in 2018.

However, drivers were less likely to be seen simply holding a cellphone or talking on a hand-held phone than in the prior survey. The finding is consistent with research indicating that drivers are talking on hand-held phones less and fiddling with them more often than in recent years, according to IIHS.

IIHS noted that a 2018 national survey by the AAA Foundation for Traffic Safety found that 64 percent of respondents consider distracted driving a much bigger problem now than it was three years ago.

"About 37,000 people died in motor vehicle crashes in 2017, the most recent year of data available. Assuming the prevalence of phone manipulation nationwide rose as it did in Northern Virginia to 3.4 percent, and assuming, based on the latest research, that fatal crash risk is 66 percent higher when manipulating a phone, then more than 800 of the estimated crash deaths in 2017 could be attributed to phone manipulation," IIHS reported.

"The latest data suggest that drivers are using their phones in riskier ways," said David Kidd, who co-authored the study and is a senior research scientist with the Highway Loss Data Institute. "The observed shift in phone use is concerning because studies consistently link manipulating a cellphone while driving to increased crash risk."

"When people talk about distracted driving, most often cellphones are the focus, but drivers are distracted by other secondary behaviors more often than cellphones," he added. "Things as simple as drinking coffee or talking to your kids can take your attention away from the road."

https://www.iihs.org/iihs/news/desktopnews/distracted-driving-cellphone-manipulations-up-57-percent-over-prior-survey