

FORMATION FLYING, INC.

Last year the FAA established a new requirement for non-aerobatic formation flight in waived airspace at airshows. Any pilot now wishing to participate in such activities must possess a valid industry formation training and evaluation credential acceptable to the FAA. Two organizations, FAST and ICAS, have received FAA approval to issue non-aerobatic formation cards. FAST, however, is for warbirds only and ICAS' emphasis is on the professional airshow pilot. That left a large group of competent formation flyers who like to support their local airshows with formation flybys without an agency to issue cards.

That situation is about to change. Stu McCurdy, who led the 25-ship formation at Oshkosh '97 for Van's Aircraft 25th Anniversary, has been searching for alternatives to resolve the problem. Discussions with EAA, FAST, FAA and formation groups around the country, led to forming a corporation dedicated to formation flying. The corporation, called Formation Flying, Inc., will parallel FAST, use

similar formation manuals, videos, evaluation guides and forms, appoint a limited number of formation check pilots around the country, evaluate formation knowledge and proficiency skills, issue formation cards and maintain the requisite database. EAA will become a signatory organization to this corporation and assist in certain administrative requirements. This corporation will go a long way toward standardizing formation flying across the country. Once formed, with procedures and documents in place, the corporation will seek FAA's acceptance of its credentials for flying non-aerobatic formation in waived airspace.

Stu McCurdy now needs to hear from formation flying groups around the country who would like to become members of and support this corporation. If you or your formation group would like to be in on the ground floor of this developing corporation, send your name, address, telephone number, e-mail address, name of the formation, number and types of aircraft and a summary of formation experience to: Stu McCurdy, 3509 Gattis School Road, Round Rock, TX 78664.



Lancair



flying *new* types

IT'S ALL ABOUT THE BASICS

BY BUDD DAVISSON

AVIATION *has a problem.*

This time it's not money. It's not politics. It's not regulations. What it is, is an overall, insidious degradation of basic flying skills.



IT HAS BEEN HAPPENING FOR A LONG TIME, *and it's hurting sport aviation.*

HOW DO I KNOW THAT? Because over the course of nearly 8,000 hours' dual given, I've been checking out pilots to fly all manner of sport aircraft, Cubs to Pitts to Midget Mustangs to whatever is out there. Almost all of my "students" are certificated pilots seeking to make the leap from "normal" general aviation aircraft to those "sport" type aircraft that camp under the EAA banner. And, almost regardless of these pilots' flying background, their basic flying skills are such that some sport aviation airplanes will present a larger challenge than they'd have to meet within the general aviation population. That's not necessarily because their instruction is subpar. It's just that a Katana, 172, or anything similar isn't going to prepare a pilot for many of the aircraft that are the basis of sport aviation.

WHY SPECIALIZED TRAINING?

For the purposes of this discussion we're defining "sport aircraft" as those which fall under the EAA umbrella: homebuilt and vintage, which has the subcategories of antique, classic, and contemporary. And the question being asked is, if "normal" flight training isn't adequate by itself to fly some sport aircraft, and the basic skills of many pilots have eroded, is flight training available to prepare pilots to safely fly those birds that fall into each of these categories? The answer is yes. And no.

For some of the homebuilts, the RVs for instance, there are specialty instructors available who do their training in RVs. For aircraft like Stardusters and Thorps, this usually isn't the case. For classics like Cubs, Champs, and their ilk, yes, there are those who do that kind of training. For the antiques, say a Waco QDC or Pitts, you'll have to dig to find a qualified instructor. For the contemporaries, most of which are similar to modern aircraft, you would think adequate training would be available, but in some instances, that may not be the case.

One of the strongest arguments for specialized training for sport aircraft is that "normal" FAA-blessed flight schools don't offer that kind of training. That's not their purpose. In fact, it could be argued that, while the pilots coming out of those schools are safe to fly modern aircraft similar to those they trained in, they are babes in the woods when it comes to some types of sport aircraft. This is because modern certified aircraft, especially trainers, are known quantities: The FAA certification process makes them that way. When a pilot climbs into a Cessna/Piper/Beech/Diamond/Cirrus, although each has its own idiosyncrasies, within certain limits they still fly essentially the same. More than that, their designs are such that pilots' basic skills can be weak, and they'll still be safe because the airplane will try to take care of them. However, homebuilts, antiques, the classics, and even some of the older contemporaries are different breeds. Even a flight instructor with 1,000 hours in something like a Katana or Cirrus is unlikely to have the skill set to safely fly something like an RV (even a nose-wheel version), Cub, or Staggerwing. And a tailwheel endorsement won't make up the difference.

THE PROBLEM IS OFTEN THE BASICS, NOT THE HARDWARE

The laws of physics don't change for anyone. Not for Burt Rutan, Beechcraft, or NASA. However, aircraft to aircraft the interpretations of those laws do change, and the handling characteristics can vary wildly. At the same time, however, the very basic, rudimentary piloting skills involved in flying still apply, regardless of the airplane. In some cases, that's where the problem lies. It is very difficult, for instance, to teach the need for rudders in controlling adverse yaw or P-factor in aircraft where the engineers have designed most of those effects out of the aircraft in favor of ease of handling.

In the vast majority of sport aviation-type aircraft there has been little or no attempt to eliminate any of the aerodynamic gotchas that every propeller-driven airplane includes. It is the rare vintage or homebuilt airplane, for instance, for which the aerodynamics have been dumbed down to minimize such things as adverse yaw or P-factor. It is an eye-opening experience for someone with only Cessna or Katana flight time to do nothing more than make a turn in an Aeronca Chief (the king of adverse yaw), or perform a full-power climb-out in a Pitts and try to keep the ball centered. Basic skills are required across the board regardless of airplane type, but the newer and more "normal" the aircraft, the less that is so. And it shows.

NO, WHAT IS MISSING?

Excuse me if I indulge in a purely personal observation, but in looking back over hundreds, maybe thousands, of past students, almost all of whom were certificated pilots, I can easily see a distinct commonality of those skill nuances that they're missing. For some pilots, all of the areas listed below are weak, while most pilots are weak in at least a few of them. It is true that only a few of these skill lapses are truly troublesome in flying general aviation aircraft, but in some sport aircraft, they can cause serious heartburn.

Don't Truly Understand What the Rudder Is for. This is a super-common problem evidenced by pilots holding rudder or aileron while established in a turn or while climbing/gliding with the ball well off-center, thereby compromising efficiency and directional control.

Looking at the Nose Without Actually Seeing It. This is another way of saying their attitude control is approximate, rather than precise, because they don't see the small changes in the nose's position relative to the horizon so speed control becomes a continuously moving game of tag.

General Lack of Precision. For many pilots, everything that is quantifiable, from pattern altitude to approach speed, is approximate with no effort at holding exact numbers. This is a mindset, a general outlook, and not a skill. It affects every aspect of flying.

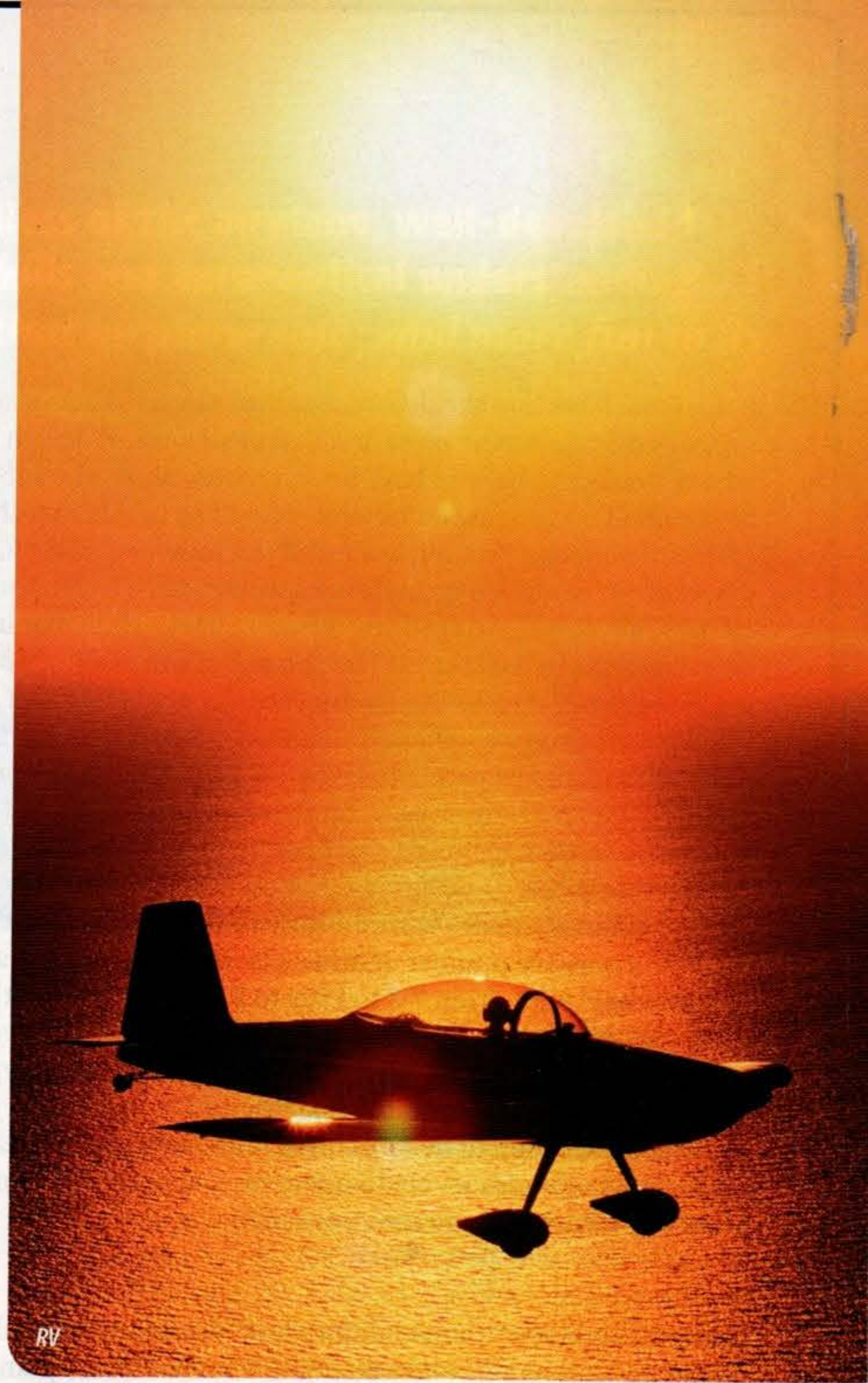
A General Lack of Aerodynamic Understanding. Such things as the buildup of drag with increased lift of any kind for any reason is not part of some pilot's thought patterns. There is also often a lack of understanding of the speed/g relationships that can breed unsafe situations at either the high, or low, speed ranges. So many aerodynamic basics aren't truly understood.

A Lack of "Feel" for the Airplane. Too often an airplane is viewed as a mechanical device, rather than being an art form that uses nothing more than invisible air to add a third dimension to our lives. If an airplane is seen and treated only as a machine, the pilot will never experience the wonderful feeling of being one with flight. They'll simply be a lever puller. A button pusher.

Limited Planning Ahead. The old platitude that says "Never let your airplane go anywhere your brain didn't arrive at first" is at the core of aviation safety. To get where you're going, you need to visualize where that is and what it takes to get there. It makes no difference whether it is over the horizon or on the other end of final approach.

Total Dependence on the Engine for Approach. You can always count on your dog, but the same can't be said of your airplane's engine. Yet, pilots will habitually set up a long, power-on approach knowing that if the engine fails, they are in deep guano. Pilots who don't do enough power-off landings (assuming they can be done in their airplane) to have developed the judgement this kind of landing engenders will be nothing more than passengers when the engine actually quits. And they do quit!

No Overall Sense of Awareness. There is an entire world outside of the cockpit. Yet, some pilots act as if their world is defined by their instrument panel. A continual scan of the world outside, from behind one wingtip to behind the other catching the panel on the way and noting as many details as practical, makes pilots aware of their place and progress.



'NORMAL' VS. SPORT AVIATION

Exactly what differentiates "normal" general aviation airplanes from sport-oriented types, and why do I say the basics are more important in the sport arena? That's difficult to answer concisely because the world of the sport airplane is not only huge but different airplanes in different parts of that world will have differing levels of "differentness." In addition, those differences may affect different parts of the pilot's skill package at differing times. Is that different enough for you? So, we'll divide and conquer by wading through the various EAA classifications (homebuilt, vintage, etc.), pointing out the differences to be expected and the types of training that may be needed.

Basic skills are required across the board regardless of airplane type, but the newer and more "normal" the aircraft, the less that is so. And it shows.



FIRST: ABOUT THOSE PESKY TAILWHEELS

Before we delve into the different categories and aircraft types, let's spend a few minutes discussing the most dreaded of all aircraft design features: the tail-wheel. Books can be, and have been, written about the subject, but they can all be summed up in a few quick sentences. The first is that there is a huge amount of misinformation floating around about tailwheels. In fact, no one viewed tail-wheel airplanes as being anything special until early in the 1950s because almost *all* prior airplanes had the little wheel in back. Then manufacturers saw the nose wheel as a way to sell the "If you can drive, you can fly" concept. It is worth noting that the majority of the landing accidents in tailwheel aircraft can be traced back to a crooked or drifting touchdown, which sets a series of events in action that are then poorly handled. If the CG is on the line of travel and there is no crosswind, there is no reason for the taildragger to turn. This, however, comes back to basic airmanship. It's difficult to make a square, no-drift touchdown if the pilot lacks the coordination to fly a clean approach.

Yes, taildraggers do require a little more training but it's well worth the effort because a massive number of otherwise unavailable aircraft become available to the tailwheel pilot, from J-3 to Pitts to P-51. Fortunately, there are a number of flight schools that specialize in tailwheel training. However, make sure you go to one that will give you a well-rounded experience on all types of runways in all kinds of conditions. The experience should be more than just what is needed to get you safe enough to fly on calm or wind-on-the-nose days. A few extra hours in challenging winds on challenging runways are well worth the time and money. It's the best insurance you can buy.

HOMEBUILTS

As soon as you say "homebuilt airplane" some people quake in their boots, but others nod knowingly and ask, "Which homebuilt airplane?" The latter are those who understand that the world of homebuilt airplanes is at least as wide and varied as the general aviation community itself. Maybe more so. They range from super slow (Pietenpols) to super fast (Glasair III). The big difference between homebuilts and others is that there is no guarantee how any one of them will compare to civilian airplanes because they weren't designed to the same specification template, FAR Part 23.

Something that can be said about many of the newer generation homebuilts (RVs, GlaStars, Lancairs, Bearhawks, Zeniths, etc.) is that their designers, being professionals, do pay homage to the FAR standards in making their designs suitable for public consumption. However, most include a strong flavoring that adds just a little "bite" (read that as "fun") to the recipe. Few homebuilts can be considered our granddad's Buick Roadmaster, which can easily be said of many general aviation airplanes. Many homebuilts can be seen as Corvettes (or Ferraris), and it's this sports car attitude that can come as a surprise to some folks.

Any RV, for instance, is a superb handling airplane, but its quicker (delightfully so!) control response and much smaller size will initially challenge a Piper or Cessna pilot. It'll take only a few training flights with an experienced instructor for any strangeness to disappear. However, without that training the possibility of over-controlling at a critical juncture exists. And there's no excuse not to get that kind of training because the new homebuilt rules allow giving training in non-certified aircraft. Plus, almost all major kit manufacturers can hook a builder up with an instructor or two who specialize in their airplane. The best training of this type, however, doesn't focus only on the way to fly that particular airplane. Hopefully, the check pilots make the flights a form of flight review in which the pilot's basic skills are sharpened and then applied to the airplane in question.

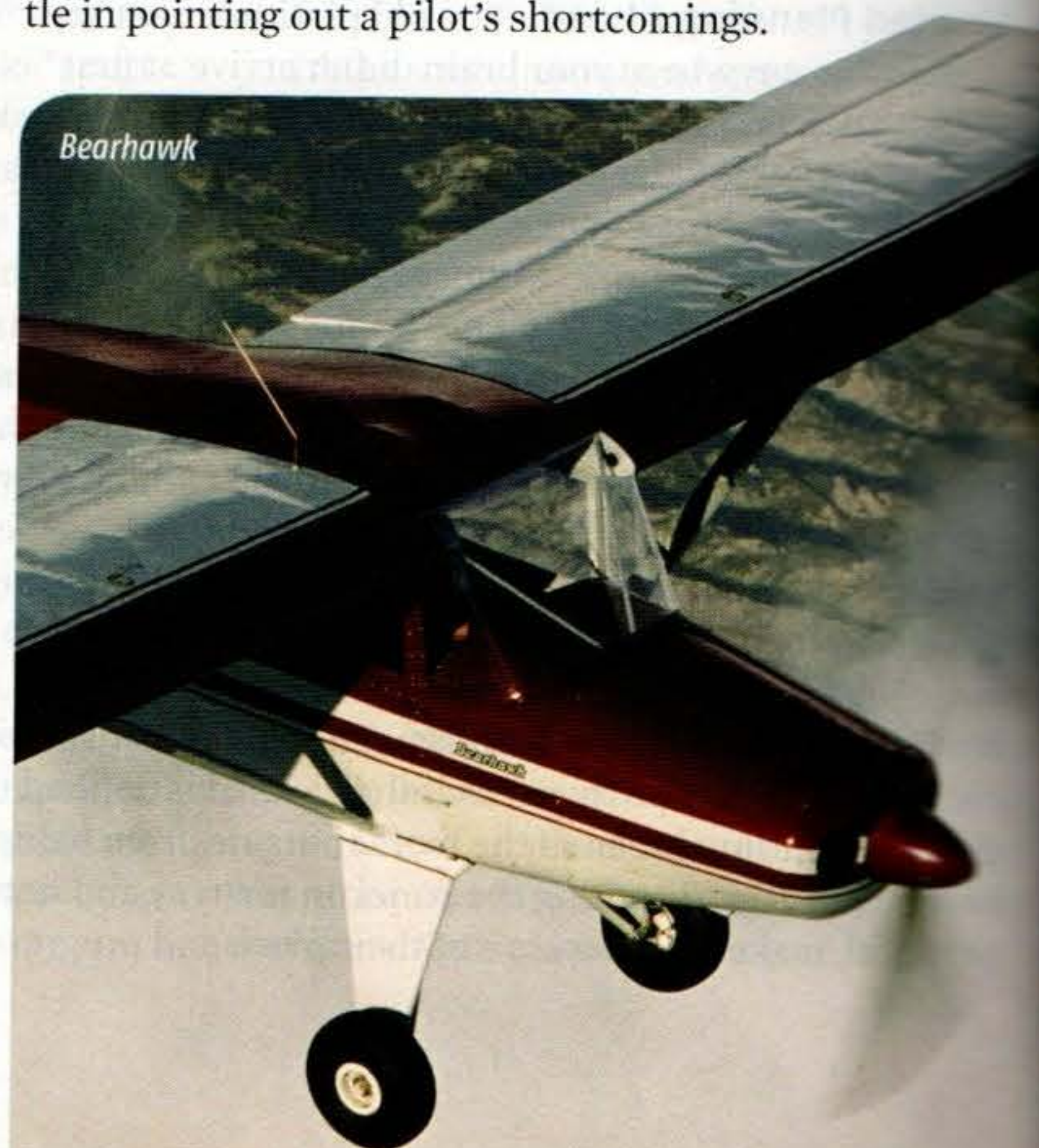
'EQUIVALENT TRAINERS'

For the less numerous homebuilt designs for which there is no factory training support, there are civilian aircraft that can give a similar experience, and a good instructor can translate what the student is seeing in the trainer to what they can expect in their own airplane.

The old Grumman AA-1 Yankee series of aircraft handle very much like RVs, Thorps, and most of the other quicker monoplanes. They are responsive and nearly duplicate the steeper-than-average power-off glide slope of the homebuilts. Unfortunately, it's hard to find a training school actually using them.

At the opposite end of the performance curve are the low and slow designs like the Pietenpol/Baby Ace, etc. The good news here is that Cubs, Champs, and even Citabrias, which are operated by any number of flight schools nationwide, will give the new slow-motion homebuilt pilot a good basis to build on.

For fast-moving taildraggers, the two-place Pitts Specials are readily available just about everywhere in the country for meeting that oft-feared moment when they have to be landed. This is another of those old wives' tales. Airplanes like Midget Mustangs, Pitts, Skybolts, Stardusters, etc. are not the terrorizing experience the homebuilt pundits say they are. They do, however, absolutely demand training, and the two-place Pitts, combined with the right instructor, is the perfect trainer. It gives ground-handling experience as well as acclimating a pilot to a lack of visibility over the nose and, when compared to most homebuilts, produces a pilot that is over-trained. Come close to being able to land a Pitts and the other types are easy. At the same time, the basics of aviating will become abundantly clear to the newbie because the S-2 Pitts is anything but subtle in pointing out a pilot's shortcomings.



Regardless of the airplane, well-developed basic skills and aeronautical understanding make that airplane safer and more fun to fly.



Zenith

VINTAGE

When talking about vintage aircraft (antique, classics, and contemporary), we're actually talking about everything from the dawn of aeronautical time to what amounts to yesterday (1970). During that 60 years, certification standards changed dramatically, and more importantly, the market's idea of what is acceptable changed. For that reason, while there is little difference between a contemporary aircraft of 1970 (think C-172) and today's aircraft, comparing a 1920s antique aircraft to a 1960s contemporary is a study in aeronautical progress. While the basic skills apply across the entire spectrum, the further back to antiquity we go, the more noticeable the absence of basic skills will become and the more likely a detailed checkout will be required.

ANTIQUE — DECEMBER 17, 1903, THROUGH AUGUST 31, 1945

There are actually at least four generations of "antique" aircraft, and the handling of each is different. The aircraft of the "teens," like a Jenny, have handling that can only be described as leisurely and rudimentary. During that time, the concepts we take for granted, like ailerons, powerplants, and overall control balance, were under development, and there is a gross difference between a 1910 Curtiss, a 1917 Curtiss Jenny, and a 1920 anything. Little about their stability and control requirements will be recognized by a modern-trained pilot. 1920s aircraft, on the other hand, would be more familiar, although still very demanding of stick and rudder skills. 1930s aircraft show the thought and development that makes them still viable in today's world, and they include newborns like the Luscombe, Cub, Taylorcraft, and Ercoupe that survived World War II to become postwar classics.

CLASSIC — SEPTEMBER 1, 1945, THROUGH DECEMBER 31, 1955

The decade right after WWII saw the continuation of some prewar designs, but the 1946-48 over-production of new light aircraft designs (C-120/140, PA-16/17, Swift, Champ, etc., most of which took years to sell) form the basis for much of on-homebuilt sport aviation today. The classics, through the 1950s Tri-Pacers and C-170s, outnumber just about any other segment of the sport aircraft population, although RVs may now outnumber them.

The new postwar designs all feature improvements in handling and design refinements, but they still demand that basic stick and rudder flight skills be applied. Keeping the ball centered in the interest of improved controllability and

safety asks that the pilot knows when, and how, to use the rudder. Then there is that tailwheel thing, which calls upon those same feet to handle two-directional control in variable conditions. The tailwheel classics (120/140, PA-16/17, C-170, etc.) are far from being difficult to land but encourage a pilot to pay attention in the touchdown phase of the landing. The basics apply. The nosewheel classics (Ercoupe, Tri Pacer, etc.) will let the pilot survive less-than-wonderful touchdowns but would still reward the pilot for good basic skills in the air.

CONTEMPORARY — JANUARY 1, 1956, THROUGH DECEMBER 31, 1970

The contemporaries bridge the gap between old and new. This group includes C-172s, Cherokees, Bonanzas, and so many others that are still stage center on the general aviation scene. In only a few instances do they present challenges that modern pilots can't handle with their present skills with a detailed checkout. Also, most of the marques are represented by type clubs in through which specialized instructors are readily available.

THE BOTTOM LINE IS 'BASICS'

Regardless of the airplane, well-developed basic skills and aeronautical understanding make that airplane safer and more fun to fly. The next time you're in the air, be your own toughest critic and see exactly what you're doing right and what you're doing wrong. Just that little bit of introspection will make you a better, safer pilot. And it's free! **EAA**

Budd Davisson is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of *Flight Journal* magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on www.AirBum.com.



ROBERT N. ROSSIER
COMMENTARY / STICK AND RUDDER



What's So Dangerous About That?

The unknown hazards we carry onboard
BY ROBERT N. ROSSIER

MOST PEOPLE GIVE PRECIOUS little thought to the potential hazards of common products we find and use in our homes, garages, and basements. But as pilots we need to give these things some thought, especially when it comes to what we carry onboard our aircraft. What might be a mere mishap in an earthbound setting could easily spell disaster in the air. And sometimes it's the things we least suspect that pose the greatest danger.

HOUSEHOLD PRODUCTS

Most pilots have an acute awareness of hazardous materials that pose a threat when carried aboard aircraft. Among the many substances we concern ourselves with are products such as motor oil, bleach, brake fluid, propane tanks, oil-based paints, spray paint, charcoal lighter fluid, paint thinner, alcohol, butane lighters, cleaning supplies, and batteries. While the average person off the street might wonder what's so dangerous about these items, the answer is clear in the numerous reports that have been collected over the years regarding issues that have occurred in flight. Noxious fumes from solvents, lubricants, and fuels are one problem; chemical burns

are yet another. Just imagine what we might be splashed in should we make an otherwise survivable off-field landing. And then there's the long-term issue of what the corrosive effects to the airframe, various mechanisms, or wiring might be if a spill is not properly cleaned up.

MEDICAL EQUIPMENT

Whether we fly commercially or bring family and friends on trips with us, one hazard we might not recognize comes in the form of certain medical equipment. Certainly, we must take precautions whenever oxygen bottles are carried aboard, but other items can be of concern as well. These days, portable oxygen concentrators are common for those suffering from various breathing conditions, and the safety of

these devices for use on aircraft has been called into question. For commercial operations, FAR 135.91 — *Oxygen and Portable Oxygen Concentrators for Medical Use by Passengers* — lays out a strict set of criteria and operational guidelines that those of us flying under Part 91 should at least consider for our safety as well.

BATTERIES AND CONSUMER ELECTRONICS

One recurrent theme in air safety over the years has revolved around batteries. Generally, the types of batteries we are concerned with are of the automotive lead-acid variety, with their highly corrosive liquid electrolytes that can cause severe burns when spilled. Those are bad news, but they aren't the only batteries we need to worry about. Even some of the most innocuous batteries can present a hazard. Years ago I read about an incident that occurred when a person loading a bag into an aircraft noticed it was beginning to smolder. On closer inspection it was found that a 9-volt transistor battery had been packed in the bag, and the two terminals had shorted out across the metal zipper. The shorted battery quickly heated up, and the surrounding materials were approaching ignition temperature. Had the developing issue not been noticed on the ground, it might have become a serious problem in the air.

What might be a mere mishap in an earthbound setting could easily spell disaster in the air. And sometimes it's the things we least suspect that pose the greatest danger.

Similar occurrences have been documented with other high-energy battery-powered items such as the high-powered lights used by scuba divers. As it turns out, the heat generated when these devices are left on can be enough to ignite a blaze. More modern dive lights typically use LED (light-emitting diode) technology that generates a fraction of the heat of older incandescent devices, but the power source is still there, and still potent.

These days, due to their high-energy density, lithium-ion batteries are favored for everything from wheelchairs and toys to electronic entertainment and cellphones. But they don't enjoy a perfect safety record.

Back in April, a woman from Wisconsin claimed that her Fitbit Flex 2 fitness tracker exploded on her wrist, leaving bits of melted plastic for doctors to pick out of the second-degree burns the incident caused. Fortunately, she wasn't on an airplane. But consider the Australian woman on a commercial flight from Beijing to Melbourne who got a shocking surprise when the headphones she was wearing suddenly and inexplicably began to sizzle and burn. She tore them off and tried desperately to stomp out the blaze. A fast-acting flight attendant found a bucket of water in which to douse the defective headgear. Imagine the chaos that could cause in a four-seat aircraft. And while these incidents appear to be isolated, there have been numerous instances of so-called hoverboards that have spontaneously combusted. Most carriers no longer allow them to be shipped by air, and that should be a warning to us all. And then there are the Samsung Galaxy Note 7 cellphones that have been banned from commercial flights due to their fiery personalities.

The common thread running through all these incidents seems to be the lithium-ion batteries that power the devices. The organic (meaning carbon-based) electrolyte inside lithium-ion batteries is typically quite volatile and flammable. An internal electrical short, whether it's caused by external damage or a manufacturing defect, can result in rapid overheating, a pressure build-up as gases are produced inside the battery, and eventual explosion and/or ignition of the fluid vapors. With millions of these devices being produced, even an extremely low rate of manufacturing defects can spell occasional disaster.

IMAGINING THE WORST

If our concern is over the flammability of materials in the cockpit, we might think the regulations have our back. The FAA is pretty cautious when it comes to the materials that can be used in the cabin of an aircraft and requires fabrics to meet "flame-resistant" criteria. So maybe we take solace in the FARs and feel like we have some measure of protection. But how about the items we bring aboard?

How about the cellphone that was stashed in a duffel bag and thrown in the baggage area behind the passenger seats?

The issue surrounding how we might extinguish a fire in the cockpit was driven home to me one day when a fellow pilot accidentally made a partial discharge of a chemical fire extinguisher in our yearly ground school classroom. This was a pretty big room — huge when compared to an aircraft cockpit — yet the products of that extinguisher made it impossible to breathe. Eyes stinging and choking breath, we had to evacuate the room. Now imagine trying to extinguish a burning duffel bag in the back of the airplane. This probably isn't going to end well. In fact, my attitude is that chemical extinguishers should be considered only for dealing with fires while on the ground. In the air, the only viable option might be a halon extinguisher. Or a parachute.

OTHER ELECTRONICS ISSUES

With the multitude of electronics in our daily lives, we might ponder their safe use in an aircraft. One area of concern is the potential for portable electronic devices (PEDs) to interfere with navigation and communication systems in the cockpit. Operations under FAR Part 135 and 121 prohibit the use of PEDs with certain exceptions such as pacemakers and hearing aids, and those of us flying under Part 91 might want to consider the potential risk to our operating safety as well. The regulations do permit the use of specified PEDs and other devices that the operator of the aircraft has determined will not interfere with the safe operation of that aircraft — at least from the navigation and communication perspective. How we power those devices and the risks they pose is another matter entirely — and perhaps one worthy of consideration.

The dangers associated with hazardous materials may not be a problem on every flight, but they do come up from time to time. If we pay close attention to what we bring on board our aircraft, we can likely avoid the worst case scenario. *EAA*

Robert N. Rossier, EAA 472091, has been flying for more than 30 years and has worked as a flight instructor, commercial pilot, chief pilot, and FAA flight check airman.

MEDICAL REFORM



IS REAL

BASICMED RULE PUBLISHED IN JANUARY,
TO TAKE EFFECT IN MAY

YEARS OF EFFORT BY EAA AND AOPA

culminated in January when the FAA published its updated regulations, known as BasicMed, which will implement the aeromedical reform law passed last July. The regulations will take effect on May 1, 2017. Because it is final, the rule was not released for a typical public comment period. The FAA also published an advisory circular, AC 68-1, describing the rule's implementation.

The details of the rule are laid out in the sidebars, but what it boils down to is this: As long as you've had an FAA medical within the last 10 years, you can fly recreationally using a valid driver's license in lieu of a medical certificate. To stay legal, you'll need to take a free online medical education course every two years, and see any state-licensed doctor every four years. That doctor will have to run through and sign a checklist that you'll keep in your logbook until your next visit is due.

"This is the moment we've been waiting for, as the provisions of aeromedical reform become something that pilots can now use," said Jack J. Pelton, EAA CEO and chairman. "EAA and AOPA worked to make this a reality through legislation in July, and since then the most common question from our members has been, 'When will the rule come out?' We now have the text and will work to educate members, pilots, and physicians about the specifics in the regulations."

During EAA AirVenture Oshkosh 2016, Sen. James Inhofe (R-Oklahoma), the author of the Pilot's Bill of Rights 2 legislation that evolved into the aeromedical reform law we have today, praised EAA's advocacy efforts. "I am grateful for the strong and consistent voice of EAA members who shared why third-class medical reform is necessary," he said. "I want to thank Jack Pelton, CEO and chairman of the Experimental Aircraft Association, and his team for their leadership and support from the beginning and all their work to educate my colleagues in Congress on issues that affect pilots."



WHAT AND WHERE CAN I FLY?

- Aircraft not more than 6,000 pounds max takeoff weight.
- No more than five passengers.
- For recreation, not for compensation or hire, though flight instruction is allowed.
- Within the United States, at less than 250 knots and at or below 18,000 feet MSL, VFR or IFR, day or night.



WHAT DO I HAVE TO DO?

- Hold a valid U.S. driver's license.
- Carry your driver's license with you when you fly.
- Have a medical certificate issued by the FAA at any point after July 15, 2006.
- Answer questions on the Comprehensive Medical Examination Checklist (CMEC).
- See any state-licensed physician once every four years, and have him or her complete the CMEC.
- Complete a free online medical course every two years.

MARCH 2012

EAA and AOPA petition the FAA to give pilots who fly recreationally the option of getting a third-class medical or, instead, participating in a recurrent online education program that will teach them how to self-assess their fitness to fly.

DECEMBER 2013

Rep. Todd Rokita (R-Indiana) introduces the General Aviation Pilot Protection Act (GAPPA), which includes third-class medical certification reform language. A companion measure was subsequently introduced in the Senate.

AUGUST 2014

FAA Administrator Michael Huerta announces at EAA AirVenture Oshkosh that more than 16,000 comments were received regarding the EAA/AOPA petition and a rule would be released for public comment by fall 2014.

JUNE 2012

The FAA opens the petition for public comment for three months, through mid-September 2012.

JUNE 2015

Sen. Joe Manchin (D-West Virginia) and Sen. John Boozman (R-Arkansas) offer a third-class medical certification reform amendment to a Senate transportation bill.

JULY 2015

At AirVenture, Huerta announces that the EAA/AOPA petition is still awaiting final action from the Department of Transportation to advance to the rulemaking process. EAA also fires back at the Air Line Pilots Association (ALPA) regarding a letter opposing aeromedical reform, which ALPA sent to all senators.

SEPTEMBER 2015

The Pilot's Bill of Rights 2 gains a Senate supermajority, surpassing 60 Senate co-sponsors.

FEBRUARY 2016

House Transportation and Infrastructure Committee Chairman Bill Shuster (R-Pennsylvania) introduces the House version of an FAA reauthorization bill that includes medical reform language similar to that contained in GAPPA. The bill passes out of committee but never makes it to a floor vote.

FEBRUARY 2015

Sen. Jim Inhofe (R-Oklahoma) introduces the Pilot's Bill of Rights 2 in the U.S. Senate, which includes third-class medical reform language similar to previous GAPPA bills and more extensive than that requested in the EAA/AOPA petition for exemption.

JULY 2016

With FAA authorization set to expire, the House and Senate agree to a 14-month authorization extension with some broadly agreed-to policy implementation, including medical reforms contained within the Pilot's Bill of Rights 2.

APRIL 2016

Inhofe includes Pilot's Bill of Rights 2 provisions in the Senate's FAA reauthorization bill, which passes the Senate 95-3.

JULY 11, 2016

The House passes the FAA extension and medical reform.

JULY 13, 2016

The Senate passes the FAA extension and medical reform.

DECEMBER 2015

The U.S. Senate passes the Pilot's Bill of Rights 2 on a bipartisan vote after extensive negotiation with Commerce, Science, and Transportation Committee members and Senate leaders over third-class medical certification reform. The bill is sent to the House.

JULY 15, 2016

President Obama signs the FAA Extension, Safety, and Security Act of 2016, making medical reform law.

MAY 1, 2017

BasicMed to go into effect.

JANUARY 10, 2017

The FAA publishes its final rule, announcing changes to Medical Certification of Small Aircraft Pilots, known as BasicMed.

TIMELINE

SIMPLICITY

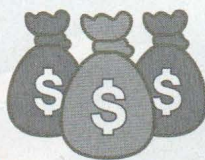
Thanks to third-class medical reform, many pilots who have held a valid medical certificate in the past 10 years will never have to see an AME or hassle with FAA paperwork again.



EAA
GETS IT
DONE

SAVINGS

By removing the need for constant medical and special issuance renewals, third-class medical reform saves pilots significant time and expense.



Additionally, many EAA members have reached out to share their enthusiasm. Steve Engelking, EAA 244968, of Longmont, Colorado, wrote, "Thank you so much to Jim Inhofe for getting this through Congress and passed into law. Three cheers for this heroic effort!"

Stewart Barnes, EAA 761379, of Anchorage, Alaska, is also celebrating BasicMed, calling it "Simpler, cheaper, more efficient." He went on to say that, "The FAA third-class and [special issuance] never did anything to make me safer, healthier, or a better pilot. It had zero value yet it cost me money and my doctor's time to jump through the hoops. Not anymore!"

January's publication finalized the highly anticipated measure that was signed into law in July of 2016 as part of an FAA funding bill. That was the ultimate success of a long effort by EAA and AOPA to bring significant aeromedical reform to pilots flying recreationally and eliminate the time and expense burdens on those holding third-class medical certificates.

The law guaranteed that pilots who held a valid third-class medical certificate during the period after July 15, 2006, will be eligible to fly under the new rules. New pilots and pilots whose most recent medical expired prior to July 15, 2006, will be required to get a one-time third-class exam from an FAA-designated aviation medical examiner.

The FAA was required to implement the law within 180 days of its signing, a deadline that it met with one day to spare. Despite the release of the regulations as a final rule, EAA is reviewing the language carefully to ensure it fully reflects the language and intent of the law.

Aeromedical reform has been a top advocacy priority of EAA members for a number of years, and led to EAA and AOPA initially petitioning the FAA for changes in the third-class medical certification process. The goal was to reduce the unnecessary regulatory and expense barriers that pushed aviators out of recreational flying and kept prospective pilots from entering the aviation community.

EAA has updated its online FAQs and will continue to update them to provide the latest information on aeromedical reform. EAA is also working with its aeromedical and legal advisory councils to provide resources that will help members and their personal doctors understand the provisions of the new regulations. **EAA**

SAFETY

Third-class medical reform will allow pilots to treat underlying medical conditions with their personal physicians and continue to fly the type of aircraft in which they are most experienced.

ADVOCACY

EAA could not have pushed medical reform through Congress without your continued support. Thousands of EAA man hours and ongoing relationship building went into getting this done. Your membership, and our community, makes a difference.

THE COMPREHENSIVE MEDICAL EXAMINATION CHECKLIST (CMEC)

The CMEC will have two parts: questions to be answered by the pilot in advance of the exam and a list of items for your doctor, any state-licensed physician, to include in the examination. The questions will include basic identifying information like name and address, date of birth, a short medical history and list of current medications, and information about whether you've ever had an FAA medical certificate denied, suspended, or revoked.

The list of items for the doctor to cover in the examination are now part of the third-class medical exam and are typical to those found in any routine physical. These items include:

- Head, face, neck, scalp
- Nose, sinuses, mouth, throat
- Ears and eardrums
- Eyes
- Lungs and chest
- Heart
- Vascular system

- Abdomen and viscera
- Anus
- Skin
- Genitourinary system
- Upper and lower extremities
- Spine, other musculoskeletal
- Body marks, scars, tattoos
- Lymphatics
- Neurologic
- Psychiatric
- General systemic
- Hearing
- Vision
- Blood pressure and pulse

And anything else the physician in his or her medical judgment considers necessary. The doctor will have to indicate that he or she has made the necessary checks, and both the pilot and doctor will need to sign the form. Then you put the form in a safe place and get back to flying.

Formation Flight Safety

Part 2

BY CHARLIE PRECOURT, SAFETY COMMITTEE CHAIRMAN, EAA BOARD OF DIRECTORS

WE KICKED OFF OUR Formation Flight Safety series last month with a focus on the challenges of the lead position, as well as situational awareness and key collision risk factors. Flying well as a formation leader can be more challenging than flying the wing, and it's important to emphasize that you shouldn't try to tackle the lead position until you have mastered flying on the wing. Even if it's easier than leading, flying wing is still a new skill.

I can still remember my first formation training flight, back in the fall of 1977 (how time flies!). I remember it because I was surprised by my instructor's demonstration of the wing position. We briefed a basic two-ship formation skills mission, with me flying wing. We performed an interval takeoff with about five seconds of spacing behind the lead aircraft, and my instructor demonstrated the takeoff and join-up straight ahead. But it was his technique of flying in close formation ("fingertip" in Air Force lingo) that really surprised me. He was jockeying the throttle back and forth constantly, plus and minus an inch at a pretty high frequency (maybe two cycles per second!), and the same was true with the control stick. He was "stirring" it constantly. Since we were in the old T-37, side-by-side, jet trainer, I had a perfect view of his inputs and resulting position. But what I couldn't figure out was how his inputs were affecting our position on the leader.

I later discovered that I couldn't figure it out because those inputs were not having much if any effect on his position! "Inside" some of those stirring motions were a few inputs that mattered; I just couldn't see which ones they were! After all, the leader was not moving his throttle, and was only moving the stick when he needed to initiate a roll or pitch maneuver. So we probably didn't need to be moving the controls so vigorously! Bottom line, if you're flying the wing well, you'll be making smooth deliberate inputs to maintain position. My instructor was what is known as a "high gain" pilot, one who is constantly moving things, even if the movements don't really matter. His input in one direction was immediately canceled by an input in the other direction—the net result was zero change.

Having said that, flying the wing position does indeed involve making constant corrections back to the "perfect" position relative to lead. But the corrections you make should be small and timely. This requires an ability to anticipate. If you wait too long to make a correction, you will end up farther out of position, necessitating a large correction, which takes longer to have effect, which means another correction will follow, and before long you're oscillating in large variations around the desired position. To learn to anticipate

corrections, and get ahead of them, you need good reference points on the lead aircraft that allow you to "triangulate" your correct position, both laterally and fore-aft. The three legs of the triangle are:

- Your view up the "wing line" toward your leader's head.
- The leader's fuselage line from his cockpit back toward his tail.
- Your view directly abeam, at his tail.

On the ground prior to flight (as we discussed last month) set the two aircraft on the ramp in a desired close formation position. From your wing aircraft cockpit position, look up the wing line of the lead aircraft and find something on the fuselage or cockpit directly behind an item on the wing. For example, does the wingtip light superimpose the canopy leading edge? If so, remember that; it creates your "wing-line" reference. Then look abeam at the tail of the lead aircraft, where are you relative to the rudder hinge, for example. These are your "null" (good) references. All corrections in flight with the stick and throttle are meant to return you to this position. We're looking for our two aircraft to have wingtips about 3 feet apart laterally, and a wingman "stagger" aft of the lead about 30-45 degrees; in other words our cockpit is that angular amount from a perfect side-by-side line.

So on my first formation flight, the instructor gave me the aircraft after his "demonstration," and I had no idea how to make the required corrections. I ended up in that proverbial "yo-yo" adding too much power and overshooting, then pulling off too much and getting behind, banking into lead and getting too close, then banking away too much and getting too far away. Eventually, though, I discovered a very interesting relationship in the "triangulation" necessary

for the correct position, one that you can explore with a simple exercise. The objective of the exercise is for you to learn to recognize when a power change is required to correct back to position versus a bank angle change. Believe it or not these two inputs, power and bank, are very closely coupled in achieving that perfect, stable wing position.

Start out with your instructor stabilizing your aircraft in the proper wing position in wing-level flight on the leader. Then make a very slight bank angle input away from the leader (2-3 degrees of heading change). What you will notice first is an apparent lag behind the leader. If you are not closely monitoring your "triangulation reference," it will appear that you are drifting behind. Your instinct will be to add power. In fact, what has happened is you have increased your lateral spacing on lead, because of the heading change. Since you are on a 30-45 degree staggered wing-line reference, any

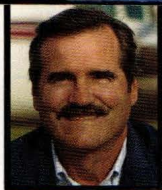
move outward along this line also appears to be a move aft. Your intuition is to add power. But all you really need to do is bank back into the leader, and you will come right back up the wing line to the original correct position. Perform this exercise until you instinctively know that you are wide and need to bank toward lead, or that you are truly aft and need to add power. Until you master this "perception" issue, you inevitably find yourself in the power yo-yo moving back and forth about the desired position in large oscillations.

Another common error for pilots learning to fly formation in the close position is their over-fixation on the triangulation references. If you look at only those two reference lines we defined, you miss the big picture. Once you get comfortable, those references will become second nature, and you'll be looking at the whole lead aircraft and seeing movements in relative position at the inch level instead of the foot level. In other words, see the big

picture of where you are relative to lead, and make the correct correction (power or bank) immediately, when it's a matter of a few inches instead of a few feet.

Once you have mastered this concept, then other positions take on the same relative demand. If you want to do a cross-under to move from the right side of leader to the left, reduce power slightly, step back to get to a place where your nose clears leader's tail, then add power to stabilize. Then add a small bank change to the left to move laterally across to the left side. Then once on the left side, add power to move forward to the wingtip position. This maneuver uses all the principles I discussed above.

Spend some time on the basics above and you'll get really comfortable with relative positioning on your leader. Once your corrections are instinctive, you're ready to move to more advanced maneuvers like rejoins and trail formations. A topic for next month! Fly safely out there. *EAA*



J. MAC MCCLELLAN

COMMENTARY / LEFT SEAT

Traffic Pattern Tactics

What's allowed near a runway, and what works best

BY J. MAC MCCLELLAN

SOME SAFETY EXPERTS have recently recommended that pilots consider flying a steady turn from downwind to final in the traffic pattern. The theory is that a constant turn is easier to fly than a squared-off downwind to base followed by another squared base to final turn.

That's not a new idea. In fact, it's old. But for many pilots the traffic pattern is a rectangle around the runway, and any deviation from that three- or four-leg pattern is probably illegal, or at least unsafe. That's not true.

Jeff Skiles took on the traffic pattern in his Contrails column in the March issue. Clearly Jeff is in the big majority that backs the rectangular pattern most of us think of as "standard." But I think the issue is not as standardized as one may think.

First, let's consider the rules that require us to fly a standard, or any, traffic pattern: There aren't any.

Under FAR 91, the rules that govern overall flight operations, there is no definition of what a traffic pattern is, or any requirement to fly a traffic pattern when approaching an airport to land.

The only FAR that comes close to requiring a traffic pattern is 91.126 that says pilots approaching to land at an airport without an operating control tower must make all turns in the vicinity of the airport to the left. If the markings on the airport — segmented circle and such — indicate a right traffic pattern, all turns must be made to the right.


The rule doesn't say we must fly a downwind, or base, or any other component of a traffic pattern. The rule doesn't even say we have to turn at all when approaching to land so straight-in approaches from any distance are legal. Even more confusing, the

rule uses the word "vicinity" of the airport without defining what that means. Is "vicinity" the 4-nm radius around an airport under which we must establish radio contact if there is an operating control tower? I don't think so. Is "vicinity" a mile, or half mile, or maybe a few hundred yards? It depends, I guess.

The FAR Part 91 rules do, however, give right of way to an airplane on final approach to land over other airplanes in the area and airplanes waiting to take off. If two airplanes are approaching at the same time, the lower altitude airplane has right of way over the higher altitude airplane. That's pretty much it for regulatory traffic pattern flying.

What we think of as the standard traffic pattern is described in the *Aeronautical Information Manual (AIM)*. For pilots as old as me that's the book we used to call the *Airman's Information Manual*.

The AIM is not strictly a regulatory document, but it does describe what the FAA believes are best practices. You can't be busted for not following a recommendation in the AIM, but if you ignore its advice and come to grief, your defense will be more difficult, at least.



I'll be the first to say we need traffic patterns at both towered and nontowered airports. The most obvious reason for traffic patterns is to standardize traffic flow making it more likely we will see and avoid other traffic. The other reason is the traffic pattern helps us orient ourselves and prepare for a safe landing.

In the *AIM* is the description and diagrams of the standard pattern with entry, downwind, base, final, upwind, crosswind, and departure legs. It's all very tidy on the page with nice square turns from one leg to another. Altitudes for the traffic pattern are proscribed by the airport operator, but the distance of the downwind from the runway, for example, is not.

One thing that always makes me chuckle when looking at the standard traffic pattern is the recommended entry leg onto the downwind. So, according to the chart in the *AIM*, how do you join the left downwind leg when approaching the airport? Turn right. So, to fly the recommended pattern we break the only pattern rule, which is to make all turns to the left. Just one more example of why using words like all, never, always, and other exclusives is so problematic.

All of that aside, I'll be the first to say we need traffic patterns at both towered and nontowered airports. The most obvious reason for traffic patterns is to standardize

traffic flow making it more likely we will see and avoid other traffic. The other reason is the traffic pattern helps us orient ourselves and prepare for a safe landing.

At towered airports we need a traffic pattern, and pilots need to know what it is, because that's how controllers issue instructions. When a controller tells you to "report the left downwind" for the active runway, you need to know what that means. No matter what the FARs say about the requirement for flying a traffic pattern, an instruction from a controller is a requirement unless some emergency situation demands that we deviate from that instruction.

TRAFFIC PATTERN AS KEY

The military emphasizes the standard traffic pattern less and "key" positions more. I think that makes sense.

In military flying parlance the "key" positions, such as high key or low key, help to standardize an approach and landing, particularly in high-performance airplanes.

The key position is a location over or near the airport at which the pilot knows he should be at a specific altitude and airspeed, and configuration in terms of flaps and landing gear.

By flying to the key position at the specified altitude and airspeed, a pilot can know with very good precision what power setting, flap setting, bank angle in the turn, and so on will put the airplane on final approach at the proper altitude, speed, and configuration.

It's the same for civilian pilots, especially pilots just learning to fly, or transitioning to a new type. If we just wandered onto final approach from some random distance from the airport, judging when to slow down, when to extend flaps, and what power setting to use would all be difficult, at least until you had hundreds or more likely thousands of hours of experience in that airplane.

But by entering a downwind leg our situation looks familiar. We quickly learn what power setting is going to yield the target

airspeeds for base leg to arrive on the desired glide path and airspeed for final. Instructors or pilots checking you out in a new type know and can recommend the power setting and configurations that work from downwind, while that would be very hard to do if every approach was a random run to final.

The other common military flying technique I like and think works well is the overhead break, which calls for the pilot to fly directly over the runway and then "break" into a turn to downwind and continuing the turn onto final.

When approaching a nontowered airport — particularly one I'm not familiar with — I find that flying directly over the runway works great. Overhead you can look for markings and the windsock on the airport. You can see traffic in all directions. And other airplanes are most likely to be below you taking off or landing, and others on a downwind or upwind pattern leg are crossing in front of you. When you announce on

UNICOM that you are overhead the runway, everybody on the frequency knows where to look.

DRAGGING IT IN

I learned to fly more than 45 years ago at a tiny airport east of Cleveland — Concord Airpark — where the single runway is barely more than 2,000 feet long and there are trees all around and a big hump in the middle of the strip. Because the runway was short and the trees were tall, the airplanes there were nearly all basic singles. A Bonanza was an exotic machine, and its pilot who took on the challenge was clearly an ace to be admired.

The mantra at Concord and thousands of other small airports around the country back then was to always be in a position to make the runway if the engine quit suddenly while flying the pattern. That meant that you stayed close on downwind, turned a short final, and usually had to employ some slipping on short final to get rid of the extra altitude you carried just in case.

For whatever reason, we don't seem to have the same fear of engines quitting that dominated years ago. And in my Cessna 140 I did have the engine quit a few times in the pattern during the winter. You couldn't get that light-wing-loaded Cessna down in the dense air of winter with power anything above idle. But at idle the carburetor and induction tubes hanging down in the cold below the barely warm Continental C85 engine would simply stop providing a useful fuel mixture, even with carb heat on, and the engine would quit.

I learned to blip the power every 15 or 20 seconds on those cold days to keep the engine turning. Better still I learned that duct tape over about half the cowling cooling air inlets, and two other openings just below the prop hub, kept the engine warm enough to run virtually every time.

Any pilot who strayed too far away from the runway, out of engine-out glide distance, was "dragging it in." In those days dragging it in was a mark of poor airmanship and much scorn from the local experts who gathered at the airport routinely to critique all approaches and landings.

Today we call dragging it in a stabilized approach. Traffic patterns at airports with even modest amounts of activity stretch out over miles making it unlikely any pilot who loses power suddenly while in the pattern can glide to the runway. But except for old-timers — who now have to be older than me to have earned the title — I don't hear a lot of concern about the size of a traffic pattern or even much worry about an engine quitting.

What's happened is that a stabilized approach in larger airplanes at a distance from the runway is essential for safety. A pilot rolling onto a quarter-mile final in a jet would be drummed out of the corps. So at airports with a mix of traffic the pattern must expand to accommodate heavier and faster airplanes that require a stabilized final approach at least for the last 1,000 feet or more of descent to landing.

So sometimes at some airports we will all be dragging it in, no matter what we fly. But when you have the airport to yourself, I still think staying close enough to make the runway if you suddenly lose power makes sense.

SQUARE TURN?

Back to the original question — would a curved more or less steady turn from downwind to final approach be safer? I believe the answer is yes. When you make square turns you have to level the wings, and that means you need to lower the nose or add power to maintain airspeed. When a pilot is distracted by traffic or wind or whatever the record shows we don't always do that, and a stall and spin is the too-often tragic result.

For all the reasons I discussed, and more, we don't always have control of how we fly the traffic pattern. Making a continuous turn to final in a low-wing airplane blocks your view of other traffic that may already be on final. That means there is no simple solution to the stall-spin loss of control in the pattern. All we can do is work on our basic airmanship, fly turning patterns when we can, and be ready for whatever surprises the traffic pattern may hold. **EAA**



J. MAC MCCLELLAN

COMMENTARY / LEFT SEAT



The FBO Problem

It's high costs for everyone involved

BY J. MAC MCCLELLAN

IF YOU WANT TO raise the blood pressure of pilots, bring up fuel costs. If you want to put that same group into orbit, mention ramp and handling fees. There is no hotter topic among pilots. That is, unless you talk to a pilot who just landed at an airport with nobody around where what passes for an FBO is locked up, and he and his passengers can't find a restroom, much less a rental car or a way through the fence. That pilot, at the moment, isn't thinking about fuel prices.

I wouldn't say the FBO business is in crisis, but it certainly is under stress. At busy airports you find gleaming facilities with every amenity pilots and passengers could wish for. At thousands of smaller fields there isn't enough business to support much more than self-service fuel and limited hours of staffing.

We're flying in a bifurcated world of busy FBOs that must recover the high costs of their operations through high fuel prices and ramp fees, and the other half that has so little business that the cost of staying open is higher than the meager income. And pilots are caught in the middle. Without a reliable network of FBOs our airplanes are nearly worthless as traveling machines.

Until the 1980s most FBOs relied on income streams from new airplane sale maintenance, hangar rent, flight training, airplane rental, at least some charter, and fuel sales. For all sorts of reasons those business segments evaporated leaving pretty much only fuel sales to fund the entire operation.

That's old news that we've all chewed for years. But there are other more recent developments that have added to FBO operating costs that must be recovered from pilots who stop there.

One of the big impacts most of us see and think about is the fallout of the 9/11 terrorist attacks. In the wake of that disaster every airplane and every airport became a suspect in the public's and politicians'

J. MAC MCCLELLAN

It didn't matter that the terrible damage was done by "heavy" airline jets; after the attack every airplane of any size was lumped into the threat category.

At airports with airline service, the reaction was immediate and uniform. Control of ramp access and identification of everyone on the airport side became a requirement. Fences were made more robust, gates more secure, and requirements for tracking all personnel on the "airside" more stringent.

Even at airports without scheduled airline service the rules for fencing and access and identification all increased if that facility wanted to receive government funding.

I was based at White Plains, New York, at the time, and we airplane owners all had to go through a TSA identification and screening process just to get to our airplanes. As I remember it, there were three different rounds of photos, fingerprints, and biometric data identification processes we submitted to as new and "improved" techniques were introduced.

While most of us general aviation airplane owners believe the security measures enforced after the attack were all an overreaction, that doesn't matter. The security forces — and more importantly the public — believe our airplanes can be a threat, and we're not going to win that argument.

Guess who got to pick up the costs of enforcing the new security procedures for GA? The FBO, that's who. The line crew and the rest

of the staff had to go through identification procedures, control access to the ramp, and often escort, or at least observe, pilots and passengers as they come and go to their airplanes.

The result is higher costs for the FBO with no added income. And the security apparatus has created a huge inconvenience for pilots because the airport becomes essentially unusable when the FBO is closed. I was talking the other day to a crew who forgot to call the FBO to ask for “late staffing” for their after-hours landing to drop passengers. Taxiing to the ramp, no problem. But they couldn’t get through the fence. They could see their cars parked on the other side, but with the FBO closed, they had no route through the fence, and it’s tall and topped with barbed wire.

Finally an airport maintenance guy came by in a pickup and agreed to ferry the people around to their cars. But he couldn’t use the gate at the FBO because it wasn’t authorized, or locked shut, or something, so he had to drive to a far corner of the airport to a

We’re flying in a bifurcated world of busy FBOs that must recover the high costs of their operations through high fuel prices and ramp fees, and the other half that has so little business that the cost of staying open is higher than the meager income. And pilots are caught in the middle. Without a reliable network of FBOs our airplanes are nearly worthless as traveling machines.

gate he was authorized to use. It took several trips to drive the passengers to their cars that were mere yards away on the other side of the fence.

The FBO would have kept staff at the facility — for a hefty but probably still unprofitable fee — if the pilots had remembered to call. But my point is that the cone of security that has dropped over our airports costs us all, and the best an FBO can do is pass on the costs to break even.

The other development that has helped blow up the fuel sales income stream for many FBOs is the large and continuous improvement in jet engine efficiency. Years ago you couldn’t fly a business jet very far without needing to take on fuel. But more recent designs are not only much more efficient, but they also have higher maximum landing weights, so pilots can carry fuel on multistop hops, which is convenient and often cost saving but deprives FBOs along the way of income.

Another cost-driving issue is rising expectations for what is an acceptable level of amenities at an FBO. Airport authorities who grant leases to FBO operators want, and often demand, a stylish, modern, roomy, and even plush facility. After all, the FBO is the first impression passengers will have of a city when they arrive, and nobody wants to yield any prestige to a city or state next door or across the country. And if there is more than one FBO on the field, they all have to compete to impress pilots and passengers with their service and accommodations. It's really easy to see where the high costs come from, and you get one guess who gets to pay.

While I'm listing cost burdens on many busy airport FBOs, it's also worth mentioning private fuel farms. Some airports, over the years, gave permission for locally based airplane owners to install their own fuel facility. That's great for the operator, but there goes one more source of income for the FBO leaving the visiting pilot — or one not big

enough to have his own fuel farm — to pick up the tab for fuel sales income the FBO lost out on.

My memory is too foggy to recall exactly when the first ramp fees were introduced, but it was in response to the cost impacts I've listed, plus more. With costs piling up and pilots being able to "tanker" more fuel, FBOs decided a ramp fee was the only way to recover the costs. If you buy a minimum number of gallons based on your airplane size, the fee is waived. We've all worked the numbers, and if you buy the minimum fuel at the big FBO, the cost difference between that fuel bill and the lower cost small airport nearby is about equal to the ramp fee. No surprise there.

At first, only the biggest FBOs at the largest airports charged ramp fees. Now fees are the norm at even modest FBOs at not very busy airports. There are a few busy FBOs that have managed to continue without handling fees, but the number is dwindling. And with or without ramp fees the fuel prices at the big

FBOs have to be higher than the smaller airport no matter what to cover costs.

It would seem that competition would bring down FBO fuel prices and ramp fees, but not always. The problem is traffic volume. The operating costs of an FBO are not going to be cut in half just because there is another FBO on the field. If there isn't sufficient traffic, the income from each FBO goes down while the costs remain the same. And if one FBO really excels in getting the big majority of the traffic, the other loses money and goes out of business, anyway.

In my experience the small FBO has posted a name and phone number to call if you have problems. And friendly people have always been there to help me, give me a lift to a restaurant or motel, open the hangar door, and whatever else I asked. These are people like us who love airplanes and want to be around them and to help fellow pilots. Theirs is a labor of love, but it still has to pay the rent and put food on the table, and I worry that there isn't enough flying to assure that can go on forever.

Having said all of that, and understanding and even sympathizing with the challenges of the FBO business, I do believe some FBO fees and charges border on gouging. Having spent most of my career living and flying in the New York City area I like to think I'm immune to sticker shock. But when I encounter a \$400-plus ramp fee for a King Air at a modest-sized airport in the middle of the country, I sure think that's chutzpah if not actual gouging.

The problem is I have no way of knowing what requirements and cost burdens the airport authority has put on that FBO. The FBO has a beautiful new building that it may have been required to build, and who knows what the airport is charging for the lease. But the FAA can find out. One of the requirements of FBOs and other businesses on airports receiving federal funds is that they charge fair prices that can be justified based on operating costs. And that's oversight I hope the FAA is taking seriously.

The other half of the FBO problem is at hundreds, even thousands of airports in smaller communities there simply isn't enough traffic to support more than minimum services. The cost of running a small FBO isn't high compared to the busy airports, but when the top line of income is tiny, any cost can be too much.

The great salvation for small FBOs and VOA airplane owners who use them has been self-service fuel. But in my experience the credit card readers on the self-serve pumps are finicky and not terribly reliable. Maybe it's because the card reader device is often exposed to the weather or the dollar volumes being charged are much higher than at a car gas station, but I've frequently had problems getting the system to operate.

But in my experience the small FBO has posted a name and phone number to call if you have problems. And friendly people have always been there to help me, give me a lift to a restaurant or motel, open the hangar door, and whatever else I asked. These are people like us who love airplanes and want to be around them and to help fellow pilots. Theirs is a labor of love, but it still has to pay the rent and put food on the table, and I worry that there isn't enough flying to assure that can go on forever.

Whether it is a glossy and swank FBO at a busy airport or a modest downhome operation in the country, we need them all. FBOs have been hit with repeated high-cost body blows over the past 20 and 30 years, and I admire those who remain. They have found various avenues to deliver the service we need and expect at the many kinds of airports that make this country's aviation system the best in the world. So the next time I launch into a tirade about FBOs I'm going to pause to remember where I would be without them. *EAA*

J. Mac McClellan, EAA 747337, has been a pilot for more than 40 years, holds an ATP certificate, and owns a Beechcraft Baron.

Retractable Gear Article Comments

The following was taken from a letter to me from James Foster (IL)

I was disappointed by the comments regarding J. D. Newman. There is no place for repeating hearsay and conjecture in an article weighing the merits of RG systems (if anywhere). Unsubstantiated statements that undermine the entrepreneurs in our sport do all of us a disservice. We should encourage new designs and then let the market decide if the developer correctly interpreted its desires.

Lets work toward elevating the science, and art of the canard pusher designs. Criticism is fine, but keep it constructive and fair.

Fly Canards

EZ Retractable Main Gear, Another View

In the January issue David Orr's article, EZ Retracts, contained statements that stimulated reply from a CSA member and a non-member. The member's comments are printed in the article on the left. The other letter presents J.D.Newman of Infinity Aerospace views of the situation.

Mr. Newman's very detailed letter stated, "I hope and believe there is space for this letter to be published in its entirety, or it will lose it's informative value and purpose." He further offered to pay to have the 3 page double-sided letter placed in the newsletter.

Among other things, the letter refutes: the reason for the law suit against the Long-EZ owner, time period of the agreement, reason for

the crash, negative statement that his retract system is not insurable or held in low esteem by the insurance investigator, safety concerns, and offers history of his company and an update on Infinity progress.

Past newsletter policy has been to make extended articles available to the membership. To obtain such articles members have been directed to send a SASE and request the desired information. It has also been policy to not accept any paid material for publishing.

In light of that policy, and not wishing to paraphrase Mr. Newman's information, I have decided to make the letter available through the usual extended article method.

Long-EZ For Sale

O-320 Long-EZ, low time.
Call Estol Harp (412) 482-2555

I SCREWED UP

Looking isn't the same as seeing

BY BUDD DAVISSON

SHOW ME A BUILDER who has never made a mistake, and I'll show you a builder who has never actually built anything. Mistakes are part of life, and in any situation, be it mechanical or social, the very first thing to say or do when something goes wrong is to admit right up front that you really screwed that up. This brings the situation to a close, ready to be worked upon. The second thing is asking how you can fix it. While saying those things to ourselves, we need to do so while asking ourselves what we learned from that mistake. In this Shop Talk I'm doing all three. This is a mea culpa and a discourse on mistakes rolled into one.

The email that prompted all of this came from Todd Tracy, EAA 1272355, of Pompano Beach, Florida. It read, "The June 2019 article Shop Talk 'Confessions of a Knot Nerd' has incorrect photos for Steps 2, 3, 4 and 5!" and he goes on to explain what is wrong. Nice catch, Todd. Thanks! And you're right.

When I received that email, I thought, "What the ...?" and immediately grabbed some rope. Giving it little to no thought, I tied the taut-line hitch as I have done hundreds, maybe thousands, of times in my life. Another "What the ...?" The knot came out just the way Todd described it and the way I thought it should be. So, what did I do in the photos? This is where, when we're building stuff, whether it's the Station 4.1 Fuselage Framus or taking a photo of a knot, we need to actually *see* the part, not just look at it.

There's a profound difference between seeing and looking. The latter means our eyes are the only organ involved while the former has our brain conducting the exercise, not just our eyes. The result is that, when seeing, we're actually analyzing what our eyes are looking at and drawing useful data from the image. When I was shooting those photos, I was doing a lot of looking and very little seeing. I was, as we so often do, seeing what I wanted to see. I was thinking more about exposure, framing, etc. than what the picture said.

What I was looking at and not seeing was that between step one and step two, I must have turned the rope over or something because I misidentified which line was going from the ground to the airplane. The one that's on the left in the first photo is on the right in the second one. Another "What the ...?" I was tying the knot around the wrong piece of rope and going the wrong direction! Fundamentally, the series of half-hitches go around the main rope and put it in a

slight bind, and the harder you pull on it, the tighter it gets. I looked at it with my eyes, but my brain was somewhere else and didn't see the mistake.

There's a profound difference between seeing and looking. The latter means our eyes are the only organ involved while the former has our brain conducting the exercise, not just our eyes.

That's a pretty basic mistake. How could I not have seen that? I didn't see it the same way a close friend and highly experienced airplane builder didn't when I walked into his shop and found a mistake. He was building a 450-hp replica of a 1930s racer. I immediately pointed out a deep nick, almost through the tubing, in the stabilizer spar from a cut-off saw. It was obvious to me because I was "seeing" but invisible to him because he was so close to it that he was always "looking" and saw only what he expected to see. We all do that. Every one of us. That's why an extra set of eyes going over our work is always needed. It's the same way that our spouses do a better job

Radio Antennas

Dave Black (VA) - In addition to being a Velocity builder I hold Commercial and Amateur Radio licenses. To speed up the building process I had my wings with internal Nav and Com antennas built for me. I *assumed* the antennas were fine until I tested them.

Antennas are as important to radio receivers as propellers are to engines. There is a fair amount of "black magic" in antenna design but the idea is to radiate as much signal as possible. Fortunately that is easy to test. The general health of an antenna may be determined by checking its *Standing Wave Ratio* (SWR) across the frequency band. SWR is the ratio of maximum voltage to minimum voltage on the transmission line, and indicates what portion of the signal is reflecting back instead of radiating. If no signal is reflected back, you have a perfect SWR of 1:1. As an antenna works more poorly, more signal bounces back without radiating and the measured SWR increases. An SWR of 2:1 is often considered the acceptable maximum. It is important to note that a high SWR adversely affects receive just as it affects transmit functions.

I checked my antennas with an SWR analyzer. The results made me sick. I discovered my nav antennas have an SWR ranging from a low of 2:1 to 4:1. My com antennas range from nearly 1:1 to over 8:1, higher than my meter will read! At 8:1 SWR nearly 2/3 of all power reflects right back to damage the transmitter. Not good. If I was grading these antennas, the navs would get D+ while the coms would get D-.

The SWR vs frequency plot for each of my nav and com antennas shows the SWR changes a lot with change in frequency. (see plots on next page) The curves have sharp bottoms and the traces go into the stratosphere! My built in antennas were not even correctly tuned for their band. As installed, my nav antennas would work well only above 116 Mhz. The coms would work

acceptably below 122 Mhz, rendering most of the com band useless.

Much better antennas are available. The Sportcraft 008 com antenna is an inexpensive commercially available antenna designed for composite aircraft. Its plot lies relatively flat across the whole com band, never reaching as high as 2:1. This is how an SWR curve should look. That antenna gets an A.

I opened up my winglets to see if I could salvage the installation. It was impractical to fix the many installation errors: failure to use Baluns for matching co-ax to antennas, locating the antenna near a carbon-fiber lay-up, routing co-ax directly along an antenna element, use of cheap co-ax with solid center conductor and open weave braid, antennas cut to wrong length, and failure to verify antenna performance during installation.

As a result of my experiences, I have been asked to evaluate antennas in other canard airplanes.

I have found: a Long-EZ with antennas installed in the usual way (with no balun). It had an SWR ranging from 1.5:1 up to 3:1. The antenna worked reasonably well. A Long-EZ project with antennas supposedly built into the winglets were so poor I could not detect any antennas at all! A Vari-Eze with SWR ranging from 3.5:1 to 6:1. It's SWR was poor and the com antenna was polarized almost horizontally. The owner reported difficulty transmitting and receiving. Another Velocity owner had SWR numbers identical to mine. That was not surprising, since the antennas were installed by the same factory as mine.

In talking with builders I get the sense that most would rather not concern themselves too deeply with antennas. It's much easier to just build it as shown in the manual or as a friend did it. Builders may be lulled into a false sense that their antennas are fine based on nothing more substantial than they seem to work. Builders

should remember that *any* piece of wire will work as an antenna. Only if you test the antenna can you determine how well it is working. How well the antenna works makes the difference between a transmit range of 100 miles or only 5 miles.

Antennas must be constructed using proper technique and that it be confirmed by testing prior to glassing them permanently in place. All antennas, whether of good or bad design, are position sensitive. Where you put them and how you install them makes a tremendous difference. Well designed antennas can be installed to work poorly. Poorly designed antennas can be installed to work acceptably. The trouble is you will never know which you have - or how best to position your antennas, unless you test them.

To test them, take the wings outside, well clear of electrically conductive objects and people. Place them as high above the ground as practical. A wooden picnic table could be used for support. Run an SWR sweep, using an SWR analyzer or com transmitter plus SWR meter. Plot SWR values every 1 or 2 Mhz. Reposition the antennas and feed lines as necessary until you achieve the lowest, flattest possible SWR curve within the frequency band of interest. If the SWR curve goes up too high at the low end of the band, as my nav antennas did, the antenna elements should be longer. Conversely, if the SWR curve goes too high at the top end of the band, the elements should be shortened. Make adjustments 1/2" at a time with an effort toward centering the SWR curve on the band of interest.

If you have not built your antennas, take the time to do it properly. The extra time and few dollars spent on a well designed antenna installation will provide superior radio performance for the life of your plane and may well prevent an unexpected trip to the radio repair shop. If antennas are already installed, check them anyway and decide a course of action.

In my case I determined the antennas

**Step 1:**

Half hitches around the main line. In some versions the second half hitch crosses over the first one but exits in the same place

of finding something we've lost than we do. I don't know how many times I'll be running around the house looking for something, and my wife will point it out sitting right in front of me. Looking not seeing. That's how mistakes are made. And we all make them.

One of the really aggravating aspects of making a mistake while building an airplane is that a big one at the wrong time means taking many steps backward to set it right. That's hard to do psychologically. We always want to be moving forward and hate to take steps back. It's at that point, while sitting in the shop looking at a bugged piece and trying to make up our minds whether we should back up and do it over or not, that we should remember what it is that we're building. If something fails, we can't coast over to the curb and call our spouse to come get us. The call to them may not

be from us, and it may not be pleasant. So, if something needs fixing, be 100 percent safe, back up, and do it over.

Looking not seeing. That's how mistakes are made. And we all make them.

One of the few attributes of growing a little older is that our patience seems to increase. I know I'm now perfectly willing to redo a piece two or three times just to get it as right as I can get it. Don't confuse that for the ravings of a perfectionist. I'm anything but. However, I very much value my own hide and the happiness of my loved ones, so cutting corners to save time is something I outgrew decades ago. This is a highly recommended trait for builders.



Step 2: *In some versions the third half hitch goes over the top of the main line, rather than under, and curls under.*

However, there are mistakes and then there are *mistakes*. Some are cosmetic and visually irritating while others introduce flight safety issues. If a rivet set leaves a string of smiley faces across part of a panel, the airplane's structure is unaffected. Do the same thing with a screwdriver, plowing a deep gouge across the same panel, and it's a different story. The safety is affected and a repair needs to be considered. Undercutting a weld at the end of a cross tube at the rear of the fuselage is less worrisome than the same thing on a landing gear or wing fitting. Then cutting and splicing is sometimes called for.

It is seldom we don't recognize the correct solution for a mistake the instant it is discovered. We almost always automatically know what "should" be done. We know when a panel should be replaced or a weld redone or spliced. Or the paint



Step 3:

This is the tautline hitch as seen on most knot tying websites. However, there are variations on the tautline theme.

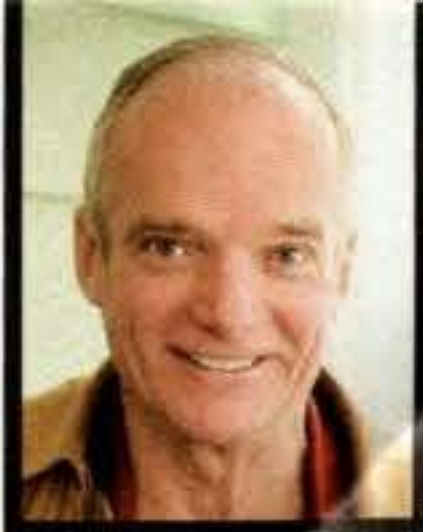
Far too many times we try workarounds that look easier in the short term, but almost never work out in the long run.

stripped and done over. However, it is seldom that we give in and say to ourselves, "We screwed up so let's cut to the bottom line and do it right." Far too many times we try workarounds that look easier in the short term, but almost never work out in the long run. We know that, but we try them anyway and almost always regret it. Most of the time, giving in to what we know deep inside is the correct solution is the right thing to do—regardless of the time involved. And that brings us back to that stupid knot.

Having made the mistake about the not last time around, the right thing to do is to start over. So, I will. Here are the steps to doing it right. The line going

from the ground to the airplane is on the right. Sorry I screwed up! Incidentally, in rectifying my stupidity, I Googled taut-line hitch and found at least four variations on a theme. Most having to do with whether the last half-hitch goes over or under the main line. Todd's version runs the second half-hitch over top of the first one. Try them all and see what works best for you. **EAA**

Budd Davisson, EAA 22483, is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of *Flight Journal* magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on www.AirBum.com.



CHARLIE PRECOURT

COMMENTARY / FLIGHT TEST

Revisiting Engine Failure Training

Building proficiency in handling the unexpected

BY CHARLIE PRECOURT

REACHING A RUNWAY in an engine-out training scenario has always been one of my favorite training exercises. Obviously, we can't achieve a runway landing in every scenario, so a big part of this training is also meant to build judgment for when to go for a runway and when to find an off-field alternative. When you think about it, engine failure, especially in a single-engine aircraft, is among the most serious emergencies we might face. Yet we can anticipate and train for this eventuality and increase our chances for success. The challenge comes with the endless number of circumstances we might confront — takeoff, climb-out, cruise, in the weather, on approach, or in the pattern. It really boils down to a math

problem, knowing the numbers for your aircraft and following the primary rule — fly the airplane first.

What does it mean to know the numbers? In short, knowing how much performance you can extract from your aircraft when you are engine-out. What are the glide speed and glide ratio? How much altitude do you lose in a 360-degree turn at max glide speed (both in cruise and in landing configuration)? How far can you glide from a given altitude? In the space shuttle (obvi-

ously an engine-out scenario), we lost 12,000 feet of altitude for every 90 degrees of turn in the arrival phase prior to rolling out on final — yikes! In the MiG-21, we needed 6,000 feet from a high base position to make a turn of 180 degrees to the runway. In the L-39 jet trainer, I could achieve a full 360-degree overhead turn to touchdown from only 1,000 feet above the runway. What do you need for your aircraft?

If you don't really know what to expect of your aircraft, you can easily learn in a controlled manner. For the takeoff phase, go to a safe altitude in your practice area, say 3,000 feet above the ground, and fly a simulated takeoff climb, at climb speed, and chop the power and perform a 180-degree turn. Measure how much altitude you lost. Then add 50 percent to that and make it your minimum altitude to attempt a return to the runway if you ever lose an engine on takeoff. Why add the 50 percent? Because if you perform a 180-degree turn, you'll be offset by your turning radius from the runway centerline requiring you to turn further than 180 degrees to angle back to centerline for landing. Reduce the offset by planning this turn into the crosswind. So a simple 180-degree reversal maneuver ends up closer to 270 degrees of turning in the return-to-the-runway scenario. If you don't account for this, you can end up in the dreaded stall-spin crash attempting to get to the runway. If the engine fails below your minimum turnaround point, fly straight ahead or make minimum turns to pick the best off-field spot. And fly the airplane all the way to a stop!

Now for the takeoff phase, you have some math that works for you — a minimum turnaround altitude. Bank angle matters, too. Do a turn at 30 degrees of bank and another at 45 degrees; you will be surprised at the difference in altitude loss. The absolute minimum altitude loss for a turn reversal occurs at pretty steep bank angles — but that's not a place to be when you're close to the ground. Make sure you always maintain best glide speed or slightly higher.



For cruise scenarios, we add some more math. How far away from a runway can you be and make it if you lose the engine? If your glide ratio is 12-to-1 (lift-to-drag ratio max is 12), then for every nautical mile high you are (6,000 feet altitude), you can glide 12 nm distance. Obviously, this is without wind, so you'll need some margin for that, too. Here's where knowing how much altitude you lose in a 360-degree turn really helps. If you have enough margin to glide to a runway and still perform a 360-degree turn over the field, then you are in pretty good shape. That extra altitude will allow you to align with the best runway for landing. If you have ForeFlight, you can use the Glide Advisor feature to help you with this math (see "New Tools for Max Glide," Flight Test, July 2017).

Engine failure, especially in a single-engine aircraft, is among the most serious emergencies we might face. Yet we can anticipate and train for this eventuality and increase our chances for success.

My favorite exercise is to go to a nontowered field when there's no traffic, pick various starting altitudes and distances, pull the power to idle, and perform a glide to the runway. Go to 6,000 feet at 12 miles out, as in the 12-to-1 glide ratio airplane example above, and see what you can do. Enter from a variety of angles. Use the math for your airplane's glide ratio and speed. Each time you set up the exercise, go through the pilot's operating handbook engine failure procedure, maintain best glide speed, aim for the center of the airport until you get close enough to determine whether you can achieve a particular runway, and then execute the close-in procedure. What's that? The close-in procedure is establishing check altitudes at key points in the pattern to your chosen runway, such as 1,500 feet midfield downwind, 800 feet turning base, and 300 feet rolling out on a half-mile final. These key checkpoints, which are repeatable and reliable for the performance of your aircraft, are what you should develop in your own training. My numbers are only a generic example. The goal is to take any initial condition at a distance from the airport and manage your glide and energy to arrive at a known point relative to a landing runway that provides you the "numbers" you need to reach the runway. So, as you fly these approaches, you should get very familiar with what it takes from midfield downwind, abeam the numbers, and turning final. In the military, we called these "key positions." Being at or a bit above the key numbers is the goal. Always keep a little money in the bank. Initially, aim for a touchdown one-third of the way down the runway, and carry 5-10 knots above best glide speed on final. Glider pilots usually use half spoilers on base and final, allowing them to extend the glide if they misjudge the glide on final. Remember, you are going from a tailwind on downwind to a headwind on final.

CHARLIE PRECOURT

Once the runway is made, you can always dump extra energy by adding flaps, performing a slip, or extending a base to final turn. Go out and try a number of these. If you can't make the runway, go around and make note of that initial condition and try again from a bit closer-in condition. Over time you will gain a really good feel for what's achievable. The more situations you practice, the better you'll be at handling the real thing.

Remember, too, that your goals include optimizing performance by establishing best glide speed immediately upon losing the engine (simulated or real) and holding it all the way into where you know you can reach the runway. If you can't reach the runway, find a suitable off-field alternative and fly your key positions to that chosen location. Get the checklist down pat — it enables you to potentially recover power and get you back to a field if there's time to troubleshoot. The most important thing in all of this, though, is to maintain aircraft control. Fly the aircraft first!

Your goals include optimizing performance by establishing best glide speed immediately upon losing the engine (simulated or real) and holding it all the way into where you know you can reach the runway.

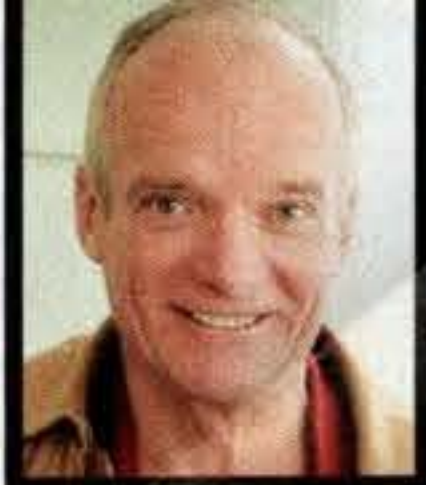
This proficiency exercise is a good one for all of us in single-engine aircraft, but it is particularly important if you are preparing to enter Phase I flight testing of a new home-built. As we roll out our new *EAA Flight Test Manual* to help builders execute Phase I flight testing, it is worth noting that we recommend building proficiency in the same or a very similar aircraft prior to testing your new aircraft. We also recommend that you remain within gliding distance of a suitable runway until you have confidence in your engine. The NTSB identified engine failure and subsequent loss of control as one of the

most common accidents in Phase I. That's why we've been pursuing initiatives like the Additional Pilot Program and publishing the *EAA Flight Test Manual*.

So, go out and have some fun and learn what your aircraft can do if you ever lose power in flight. You'll be glad you did come the day you get surprised.

Fly safe. *EAA*

Charlie Precourt, EAA 150237, is a former NASA chief astronaut, space shuttle commander, and Air Force test pilot. He built a VariEze, owns a Piper JetPROP, and is a member of the EAA board of directors.



CHARLIE PRECOURT

COMMENTARY / FLIGHT TEST

Engine Out by the Numbers

Practice leads to preparedness

BY CHARLIE PRECOURT AND CHRIS GLAESER

LAST MONTH, I DISCUSSED some good techniques for “when the engine goes quiet,” and I want to continue the discussion regarding some additional tests that you can accomplish with your own aircraft. Chris Glaeser, a test pilot colleague and volunteer on our safety committee, provided some thoughts from his experience flying U.S. Air Force F-16s. Over to you, Chris.

FROM CHRIS GLAESER

According to industry safety expert Ron Wanttaja, EAA 275698, a study of nearly 450 experimental amateur-built (E-AB) engine failure accidents between 2008 and 2018 showed that 42 percent occurred during takeoff or initial climb, 43 percent were en route, and 12 percent happened in the traffic pattern.

Before takeoff, I like to review four things:

- Abort criteria.
- Where I'll land following an engine failure below 500 feet.
- Planned actions for engine issues above 500 feet.
- Immediate actions for a thrust loss.

I always compute my takeoff distance at maximum gross weight, then add about 30 percent more distance to determine an abort point and make sure I have plenty of runway remaining for the abort. If I haven't lifted off before that point, the takeoff is aborted. The *EAA Flight Test Manual* flight test card 10 discusses how to test for takeoff performance. Many of the E-AB accidents in Ron's database are partial power failures, and a failure to be airborne when expected is all you need to know to abort.

Once power is set, I target specific parameters to verify if the engine and propeller combination are performing properly. These parameters can be rpm, manifold pressure, and both fuel flow and fuel pressure. All it takes is a targeted look at those parameters in the initial part of the takeoff roll. If your avionics are programmable, the airplane will provide a caution or warning if you set the limits of these key parameters and will alert you if a parameter is out of limits subsequent to your targeted look.

Once airborne, I maintain runway heading, which results in the aircraft drifting with the crosswind. This will reduce the turn radius necessary for an emergency 180 back to the runway, and any turn

Any delay in lowering the nose following a loss of power on takeoff will result in a very slow airspeed.

following engine failure should be made into the wind. Maintain V_y (best rate of climb speed) to maximize your climb rate, while reducing your distance from the runway. Below 300 feet AGL, an emergency landing should be made with only 15-30 degrees of heading change maximum. This heading change can be increased at altitudes above 300 feet AGL. I always turn crosswind at 400 feet in the traffic pattern to minimize my distance from the runway. By 500 feet on crosswind, I am pretty much assured of being able to accomplish a downwind landing, having already achieved a 90-degree heading change. Don't forget to preplan for the use of crosswind runways, if one is available.

If your engine fails during initial climb, your “first responsibility is to maintain flying speed. The pilot must immediately lower the nose to achieve the proper pitch attitude necessary to maintain the appropriate approach airspeed. Make the initial turn into the wind.” That quote is directly stated in the FAA's *Glider Flying Handbook* to help pilots in the event the towrope breaks during the initial part of the climb. It stresses an immediate nose-down move to maintain adequate airspeed.

Here is a test you should do to understand how your particular airplane performs in a similar event. For safety, do this test at or above 3,000 feet AGL:

- Stabilize at V_Y at takeoff power and takeoff configuration.
- Note the pitch attitude (it will be a few degrees higher during actual takeoffs).
- Retard the power over 3-4 seconds, simulating an engine failure.
- Immediately lower the nose to achieve V_G (best glide speed) and record the necessary pitch attitude.

A typical takeoff attitude is around 6-9 degrees nose up for a C-172, and a typical glide attitude is approximately 2 degrees nose down. Note that V_Y in a C-172 is approximately 72 knots, while V_G is approximately 68 knots. Any delay in

lowering the nose following a loss of power on takeoff will result in a very slow airspeed. Note the difference between the climb pitch attitude and the required pitch attitude for best glide is at least 8 degrees nose down. This critical maneuver is rarely practiced.

Repeat this test at or above 3,000 feet AGL with one change: delay your initial pitch-down movement for 3-4 seconds, simulating the shock of an unexpected engine failure and a delayed response. Be sure to prepare for and avoid a stall. Be certain to note how fast the aircraft decelerates.

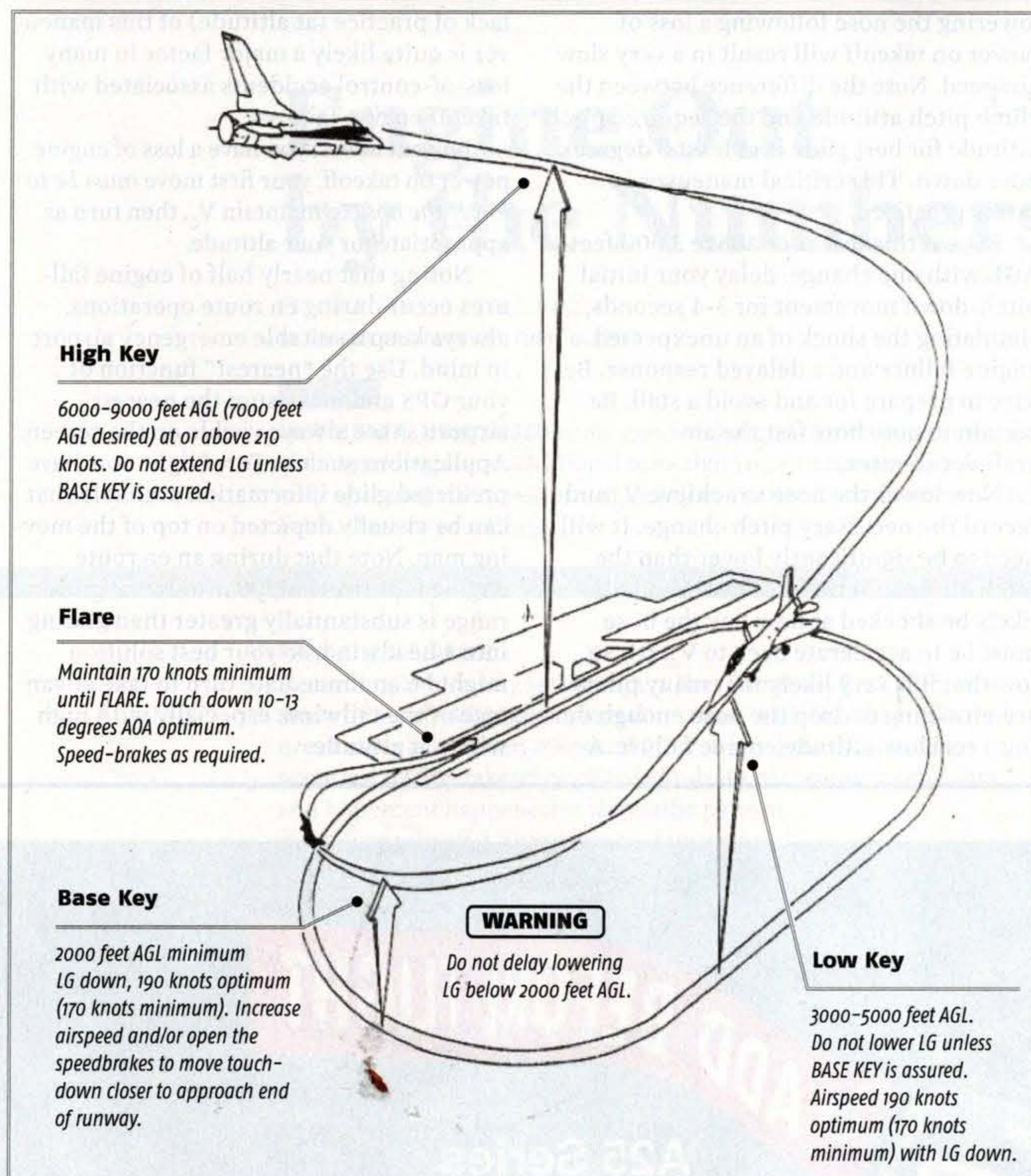
Now lower the nose to achieve V_G and record the necessary pitch change. It will need to be significantly lower than the pitch attitude in the first test. You will likely be shocked at how low the nose must be to accelerate back to V_G . It's so low that it is very likely that many pilots are unwilling to drop the nose enough during a real low-altitude engine failure. A

lack of practice (at altitude) of this maneuver is quite likely a major factor in many loss-of-control accidents associated with takeoff engine failures.

Bottom line: If you have a loss of engine power on takeoff, your first move *must be to lower the nose* to maintain V_G , then turn as appropriate for your altitude.

Noting that nearly half of engine failures occur during en route operations, always keep a suitable emergency airport in mind. Use the "nearest" function of your GPS and make sure the nearest airport(s) are always visible on the screen. Applications such as ForeFlight now have predicted glide information available that can be visually depicted on top of the moving map. Note that during an en route engine failure event, your tailwind glide range is substantially greater than gliding into a headwind, so your best solution might be an immediate turn to take advantage of the tailwind, especially with high winds at altitude.

FLAMEOUT LANDING PATTERN



When I was a U.S. Air Force F-16 test pilot, we were required to routinely demonstrate proficiency in flameout landings. In addition, we always practiced simulated flameout landings at the beginning of test flights that were engine test flights or loss of control (high AOA) test flights because risk of an engine flameout was more likely. Many engine test flights involved an intentional engine shutdown for relight tests. On one occasion, I needed to perform an actual flameout approach after multiple unsuccessful restart attempts.

Note that there are three notes in this F-16 diagram regarding a minimum speed of 170 knots (slightly above V_G). V_G was considered an absolute minimum speed at all times.

I personally fly V_G plus 10 knots during all engine-out approaches in my RV-7A to keep a little bit of energy "in the bank." Going below V_G at any time is a really, really bad idea because regaining V_G will require you to lower the nose significantly. If you are short of the runway on final and below V_G , you have zero options for stretching your glide, while V_G plus 10 knots allows you to extend your glide slightly. In strong winds, it's difficult to judge the winds accurately going from a tailwind at "low key" to a headwind on final, and I therefore like to aim a little long and fly a little fast until I can accurately judge the final glide angle.

You should perform glide tests at altitude to determine your altitude loss in a 360-degree

turn ("high key"), and a 180-degree turn "low key" using the EAA FTM flight test card eight. Knowing your own aircraft's performance is essential in intercepting this flameout landing pattern. Charlie's aircraft lost 925 feet in a power-off 360 in a 30-degree bank turn and 825 feet in a 45-degree turn. You should be comfortable in this maneuver in any case as the Airman Certification Standards requires an emergency descent between 30-45 degrees of bank. To achieve a final approach rollout altitude of 300 feet, Charlie could use a high key of 1,200 feet, low key of 800 feet, and "base key" of 500 feet (all based on a 30-degree bank). You might need an extra 360 turn if you arrive at high key with too much altitude, or you may need to otherwise modify the pattern to lose energy. In any case, it's better to widen the downwind, S-turn, or sideslip than to extend final beyond your normal pattern. Practicing a flameout pattern from pattern altitude (1,000 feet AGL) works well if abeam the numbers and using this point as your low key. Charlie also suggested aiming one-third down the runway to provide a pad for stronger-than-expected headwinds or errors in your approach. Perform S-turns or slips on final to bleed excess energy, but don't extend flaps until you are certain you have the runway made.

Also note that F-16 pilots do not extend the landing gear until they have intercepted the flameout pattern (unless they are below 2,000 feet). If you have an aircraft with retractable gear, it's good to know how the gear affects your descent rate and how long it takes to fully extend and then take both into consideration. Redo FTM flight test card eight with the gear up and the gear down (honoring maximum gear speeds) to see how this affects your descent rate.

After you've completed these tests, put an engine failure overhead diagram in your pilot's operating handbook, and make a habit of practicing these approaches from different setups such as high key, low key, or longer range during cruise flight.

Fly safe! EAA

Charlie Precourt, EAA 150237, is a former NASA chief astronaut, space shuttle commander, and Air Force test pilot. He built a VariEze, owns a Piper JetPROP, and is a member of the EAA board of directors.

Chris Glaeser, EAA Lifetime 552070, is a former United States Air Force F-16 test pilot, has over 500 glider flights, and is a member of the EAA board of directors' safety committee. He is also a flight advisor for EAA Chapter 878 in Maple Lake, Minnesota, and owns an RV-7A.