Deck Out Your Office / Managing Pandemic Fatigue / Loss of Control Safety

TWIN & TURBINE

FOR THE PILOTS OF OWNER-FLOWN, CABIN-CLASS AIRCRAFT

DECEMBER 2020 $3.95 US
VOLUME 24 NUMBER 12

AVIONICS UPGRADES

STRATEGIES TO MAXIMIZE YOUR ROI

BOSE

AVIATION

HOLIDAY PROMOTION

Get a free set of Bose Alto or Rondo audio sunglasses when you purchase a Bose aviation headset.

Order between Nov 22 - Jan 9 to receive your free Frames.

Exclusive Bose Open Ear Audio™ technology lets you listen to music or take a phone call with sound you'd never expect from your sunglasses. Get a free set of Bose Alto or Rondo Frames – an up to $199.95 USD ($249.99 CAD) value – when you purchase a Bose A20 or ProFlight Series 2 Aviation Headset. Get 10% off each additional A20 or ProFlight Series 2 headset purchased.

ORDER YOURS AT BOSE.COM/AVIATION

Connect with us @BoseAviation

Offer valid 11/22/20-01/09/21. Offer not to be combined with other offers or applied to previous purchases, and is subject to change without notice. 10% discount offer only valid for purchases made as part of the same transaction. Discount to be applied to the aviation headset with the lower AMRP. Only one Bose Frame (Alto or Rondo) per transaction. Promotion redemption may be subject to account registration with Bose. Delivery is subject to product availability. Purchases must be made from Bose or from a Bose authorized dealer at full retail price. Offer is valid in the U.S. and Canada only, and a U.S. or Canada shipping address is required.

TWIN & TURBINE

EDITOR
Rebecca Groom Jacobs
rebecca@twinandturbine.com

EDITORIAL OFFICE
2779 Aero Park Drive
Traverse City, MI 49686
Phone: (231) 946-7770

PUBLISHER
Dave Moore

PRESIDENT
Dave Moore

CFO
Rebecca Mead

PRODUCTION MANAGER
Mike Revard

PUBLICATIONS DIRECTOR
Jake Smith

GRAPHIC DESIGNER
Marci Moon

TWIN & TURBINE WEBSITE
www.twinandturbine.com

ADVERTISING
Jenna Reid
1-800-773-7798
Jenna.Reid@VPDCS.com

ADVERTISING COORDINATOR
Betsy Beaudoin
1-800-773-7798
betsybeaudoin@villagepress.com

GENERAL AVIATION ADVERTISING INFORMATION
Aviation.Publications@VPDCS.com

SUBSCRIBER SERVICES
Rhonda Kelly
Kelly Adamson
Jessica Meek
Jamie Wilson
P.O. Box 968
Traverse City, MI 49685
1-800-447-7367

To change mailing address, email *rhonda.kelly@vpdcs.com*

Twin & Turbine (ISSN 1945-6514), USPS 24432 is published monthly by Village Press, Inc. with advertising offices located at 2779 Aero Park Drive, Traverse City, Michigan 49686. Telephone (231) 946-3712. Printed in the United States of America. Periodical Postage Paid at Traverse City, MI.

SUBSCRIPTIONS: *Twin & Turbine* is distributed at no charge to all registered owners of cabin-class aircraft. The mailing list is updated monthly. All others may subscribe by writing to: *Twin & Turbine,* P.O. Box 968, Traverse City, MI 49685, or by calling 1-800-447-7367. Rates for the United States and its possessions follow: one year $15.00; two years $29.00. Canadian subscriptions are one year $24.00; two years $46.00, including GST tax. Overseas subscriptions are one year $52.00; two years $99.00, U.S. funds. Single copies $6.50.

ADVERTISING: Advertising in *Twin & Turbine* does not necessarily imply endorsement. Queries, questions, and requests for media kits should be directed to the Advertising Director, *Twin & Turbine,* P.O. Box 968, Traverse City, Michigan 49685. Telephone 1-800-773-7798. Website: *www.twinandturbine.com*.

MANUSCRIPTS: *Twin & Turbine* assumes no responsibility for unsolicited manuscripts, photographs, or art work. While unsolicited submissions are welcome, it is best to query first and ask for our Writer's Guidelines. All unassigned submissions must be accompanied by return postage. Address queries and requests for Writer's Guidelines to the editor.

POSTMASTER: Send address changes and inquiries to Twin & Turbine, Village Press, Inc., P.O. Box 968, Traverse City, MI 49685.

Contents

DECEMBER2020 • **VOL. 24, NO. 12**

COVER PHOTO:
Photo Courtesy of Garmin

Issues of Twin & Turbine are available for free *www.twinandturbine.com*

Editor's Briefing

by **Rebecca Groom Jacobs**

Fit for Flight

> "In times like this, it's easy to feel like everything is a threat when the reality is…you're probably doing okay. 'Managing the story' is being mindful of the present moment – not letting your mind run into the future." – Matt McNeil, LiftAffect

The inspiration for this month's briefing comes from NBAA's recently published "Pandemic Playbook: Lessons Learned from COVID-19," found in their November/December issue of "Business Aviation Insider."

The piece dives into business aviation's many examples of adaptability during the 2020 pandemic, including FAA extensions and temporary rules, navigation of travel restrictions, new aircraft sanitation practices, expanded digital outreach, etc. The article as a whole is an amazing testament to the industry's resilience.

One particular section struck me as especially relevant to highlight on this page:

Keeping Crews Mentally Fit

Being 'fit to fly' is more than just a physical condition; it's also a mental one. Business aviation professionals are not immune to the mental health issues affecting the overall population, many of which have been heightened by the effects of COVID-19.

This requires aviation managers – many of whom are already confronted with idled aircraft and flight crews – to consider the pandemic's potential impact on the mental health of their employees and themselves.

"Because of collective anxiety and uncertainty, we as pilots need to be extra vigilant in self-monitoring symptoms," said Matt McNeil, a licensed professional counselor and founder of LiftAffect, who noted that pandemic-induced physical and mental impacts, such as increased irritability and trouble sleeping, could increase risks for errors on the flight deck.

Though I am not a professional pilot, I am married to one and surrounded by numerous others. Conversations around reduced flying hours, job security concerns and heightened health risks have become more commonplace in our day-to-day lives. It can be difficult to leave those emotions and distractions at the aircraft door.

Our own contributor and airline pilot, Kevin Dingman, also discusses the mental toll of COVID-19 in his article on page 22: "We're all familiar with the IMSAFE aviation mnemonic. By triggering three of its six components: S-stress, F-fatigue and E-Emotion, the pandemic has inserted itself in our preflight planning not only regarding quarantine restrictions and availability of services but in our very fitness to fly the airplane – and we should not underestimate its effect… just as we do in the cockpit, analyze the situation, manage problems as they arise and take the appropriate action."

So, whether you fly professionally or privately, I encourage you to consider whether or not you, or your flight department, should be taking steps to address the topic of mental health. One potential resource is LiftAffect – quoted in this article. LiftAffect specializes in helping professional pilots with depression, anxiety, acute/chronic stress, complex trauma, performance issues, etc. (You can learn more at liftaffect.com).

2020 has delivered one challenge after another, but let's do all we can to ensure safety remains at the forefront. Here's to a healthier and happier 2021.

rebecca@twinandturbine.com

Beechcraft

BY TEXTRON AVIATION

THE NEXT KING RISES

THE KING AIR 360 TURBOPROP

UPDATED AIRFRAME | STANDARD AUTOTHROTTLE | STUNNING NEW INTERIORS

When facing adversity—we persevere.
When confronting new challenges—we push ahead.
When the obstacles, barriers and uncertainties mount...

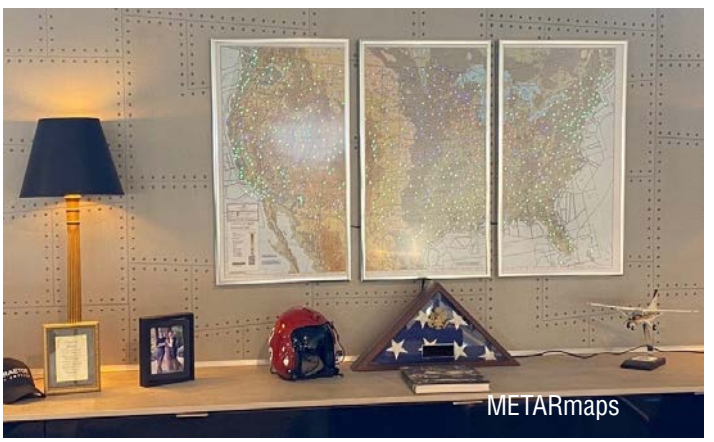
We rise above.

BEECHCRAFT.COM/HEIR-OF-EXCELLENCE

Deck Out Your Office

by **Grant Boyd**

Tin Tail Numbers


METARmaps


Phighter Images

An interesting side effect of the coronavirus pandemic and resulting lockdowns is the significant spike in business occurring over the internet. This transition has included a heavy reliance upon video calls in an attempt to conduct "business as usual" from home to which we are now digitally viewing colleagues' and clients' backyards, kitchens, living rooms and home offices.

With this extra attention upon your home space, perhaps you are looking to freshen or add aviation décor – or maybe you are just in need of holiday gift ideas. We have collected a few unique options for you to consider.

Repurposed Furniture

Today, you can find several companies bringing scrap aircraft parts back to life as functional pieces of furniture. These one-of-a-kind pieces are commonly showcased in restaurants, homes and FBOs.

Phighter Images is one example of those upcycling custom-made aviation furniture, gifts and history display items. Kurt Eldrup is the company's founder and sole craftsman. As a veteran, many of Eldrup's pieces are constructed out of military aircraft pieces, but his work has also included pieces from twin and turbine general aviation aircraft.

Eldrup has been making av-centric furniture pieces for decades, something he started several years after becoming an A&P mechanic. Through his education in aviation maintenance education and experiences, he has a strong penchant for what must be done to an upcycled part for it to be structurally sound as well as visually appealing.

A key portion of his business comes from tables and desks, many of which are constructed out of cloth-covered wood wing pieces. A stickler for detail, Eldrup pays special attention to ensure that the finished product maintains its aircraft roots while being both functional and aesthetically pleasing.

Wall Art

Everyone knows that pictures are worth a thousand words, with drawings and photos being one of the most common touches in an aviation-themed space.

A quick visit to the **International Society of Aviation Photographers'** website *(aviationphoto.org)*, and you can view a large list of ISAP members (and their galleries) who capture aviation moments on film. Larry Grace, the organization's president and avid photographer, notes that creativity plays a heavy role in the digital artist's success.

"A good photographer has to have an idea for the images they wish to create, or it's just a photo."

Scrolling through the organization's member portfolios, the amount of practice, preparation, shooting and processing is apparent. Whether it's a Piaggio Avanti rotating off a runway with a mountainous background, or two TBM's flying formation over tropical waters, photographers showcase aircraft in seemingly limitless fashion.

Or maybe you want a commissioned piece of your Epic E1000 in formation with Blue Angel 7 and a Cessna 150. Or a recreation of a tattered and worn Polaroid from your first solo flight. Member artists of the **American Society of Aviation Artists (**ASAA) can take seemingly nothing, such as pen and paper, and turn it into just about anything. In a New York Times interview, aviation artist Keith Ferris once noted the advantages that artists have, saying, "I can take nothing and turn it into something as opposed to the photographer."

Another wall décor option comes from **Tin Tail Numbers,** which produces signs replicating airplane tail numbers. The company requires only a picture of your airplane, and they send a "piece" of your airplane in return. Mitch Osowski, owner of a sheet metal fabrication company, created the product to help one of his friends remember his aircraft that did not survive after making an emergency landing.

Measuring 16 by 30 inches, the curved piece sits slightly raised from the wall and is typically constructed out of metal overlain with high-quality vinyl (but can also be made from composite to match Cirrus and other aircraft built from that material). The sign is also built with hand-punched rivets if applicable, with "extreme attention to detail used to match the exact paint scheme, colors and font." The company has even duplicated weathering and damage on the product to match that on the aircraft itself.

METARmaps presents a unique way of showcasing airport-related weather data and the cleanness of a standard navigation map. This "real-time weather wall art" allows one to instantly, without opening an app or the internet, see current conditions at airports (including the ability to denote favorites and home bases) across a state, region or the entire country.

Richard Freilich, the product's creator, notes that the map's data is controlled by a tiny WIFI-connected computer located within the map's one-inch thick frame. The individually addressable LEDs, which sit atop the airport identifiers, light up in the same color as a METAR would indicate (green for VFR, yellow for MVFR, red for IFR, and magenta for LIFR).

Freilich notes that the full United States map is the most popular, followed by the East and West Coast segment maps. Other available options range from The Virginias to Alaska to the Gulf Coast. METARmaps can also meet customers' requirements for a custom range and airport inclusion and include a logo on the map itself.

Aircraft Models

Certainly, a common centerpiece found in an aviation enthusiast's office is an aircraft model or models. To make it more personalized, pilots can customize their current aircraft or replicate their first airplane, favorite trainer or even their dream bird.

Aviator Gear, which has been making custom-built models for more than 15 years, constructs an array of aircraft out of mahogany. Cory Bower, the company's director of sales, described the one-off build process that occurs on each model:

Customers first search the company's selection of past-built models or submit their own aircraft type. From there, the team takes all requested details and creates a custom order form. If all is correct, the 10-week production process begins. After completion, photos of the model are sent to the customer for approval. The typical model size is 16 to 18 inches long with markings and colors based exactly upon customer-provided pictures. Larger models are also available upon request.

Factory Direct Models (FDM) also hand builds custom-made models, from desktop to full-size. The company references customers' aircraft photos throughout the build process so that the model is delivered with an identical paint scheme, logos, registration number, antennas and "all the details that make your airplane unique."

Aviator Gear

A popular add-on option is a fully customized interior which replaces the opaque window outline with a transparent plastic material. This allows one to view their replica seats, instrument panel and other interior details from headsets to fire extinguishers. Most custom builds take about 14 to 16 weeks for delivery, but FDM notes to ask about rush delivery options.

FDM has been pilot-owned and operated for more than 25 years and currently supplies models to 50-plus aircraft manufacturers and hundreds of other aerospace companies in 68 countries. You can find a showroom of their custom model options at the Phoenix-Mesa Gateway Airport (IWA) or view hundreds of photos on their website.

So, whether you are tackling quarantine projects or simply wish to redecorate your home office with fresh pieces, now is a great time to showcase your aviation identity. Perhaps the new pieces will become a conversation point during your next video call.

Note: Neither the author nor anyone affiliated with Twin & Turbine was compensated by any of the companies or individuals noted in this article. T&T

Grant Boyd *is a recent MBA graduate of Wichita State University. A private pilot, Boyd is currently working toward his instrument rating, with the ultimate goal of combining his love of business and aviation with a career at a general aviation manufacturer. You can contact Grant at* **grantboyd2015@gmail.com**

Lessons in Leadership

by **Stan Dunn**

Exactly one month into the new millennium, Alaska Air flight 261 crashed into the Pacific Ocean off the coast of Los Angeles. It was a scheduled international flight from Puerto Vallarta, Mexico, to Seattle-Tacoma Airport in Washington. There were two pilots, three cabin crew members and 83 passengers on board. There were no survivors.

The primary cause of the accident was the failure of a jackscrew nut, which controlled the pitch trim for the MD-83 aircraft. Ultimately investigators would be convinced that the jackscrew in question had not been greased during at least two consecutive maintenance events. The NTSB would also fault significantly extended maintenance intervals on the jackscrew (which had been increased from 500 hours to 2,550 hours over an eight-year period), and point the finger at the FAA for lax oversight of Alaska Airline's maintenance procedures.

> “A common trait in effective leaders is the ability to be decisive. Imperfect decisions made decisively almost always produce better results.

These two issues would be joined by a third: End play checks indicated unusually rapid wear to the accident aircraft's jackscrew more than a year prior to the crash. The mechanic who performed the end play check stated that he had never witnessed a jackscrew in such a worn state. As a result, he submitted a work order to replace the component. This was where – a year later – the NTSB would become perturbed with Alaska Airlines. A graveyard shift mechanic would cross out the work order to replace the jackscrew and instead remeasure the end play five separate times to verify it was within minimum wear limits (it had .007 inches to spare). The aircraft was unceremoniously returned to service.

Only a Matter of Time

Hidden in the tail of the aircraft was a rather large screw spinning through an unlubricated nut. Every second of horizontal trim chafed another millionth of an inch of thread. By the time of the accident, the pitch trim system had been a ticking time bomb for weeks. The initial failure occurred in the climb with the autopilot on. Eventually, elevator forces would cause the autopilot to disconnect. The crew would continue the climb for the next seven minutes through sheer endurance – up to 50 pounds of elevator force was required to maintain pitch attitude.

The cockpit voice recorder only captured the final 31 minutes of the flight, so there is no record of what the crew was doing while they were over Mexico. Undoubtedly, they ran the “Stabilizer Inoperative” checklist. They paused at an

intermediate altitude for crossing traffic. Once they leveled off at 31,000 feet, the pulling force on the flight controls decreased to 30 pounds. Eventually, the crew sorted out that they could reduce the control forces if they increased airspeed. The aircraft subsequently accelerated from 280 KIAS to 301 KIAS, and the control force decreased to 10 pounds. The Stabilizer Inoperative checklist did not explicitly direct the crew to land at the nearest suitable airport, and so the flight continued for the next two hours towards Southern California.

It is easy to sift decisions through the hindsight of tragic fatalities. It is obvious now that an immediate return to Puerto Vallarta would have greatly increased the chances of a safe landing. For every second that the crew failed to make a decision, Los Angeles beckoned (there are very few landing alternates between Puerto Vallarta and LA). Flying in international airspace produces a complexity for an aircrew in a stressful situation. The California coast likely brought great comfort.

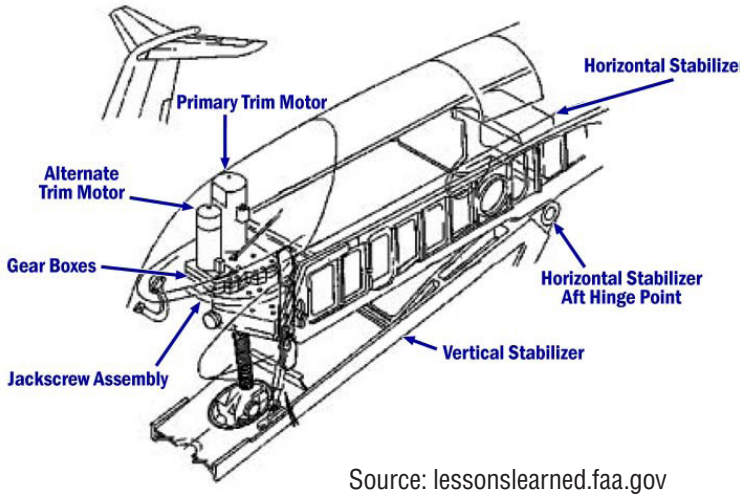
The cockpit voice recorder begins in the middle of a conversation between the captain of Flight 261 and Alaska Airlines maintenance controllers in Seattle. Within the first minute, a mechanic queries the captain, "Understand you're requesting diversion to LA…is there a specific reason you prefer LA over San Francisco?"

This was a question with in-between-the-lines implications. Alaska Airlines 261 was originally scheduled from Puerto Vallarta to Seattle with a scheduled stop in San Francisco. The mechanic was advocating the captain to continue the flight to its intermediate destination. The captain would haltingly equivocate that he favored the weather in LA. He would later admit that he was concerned about the ability to safely land the aircraft: "I'm concerned about overflying suitable airports."

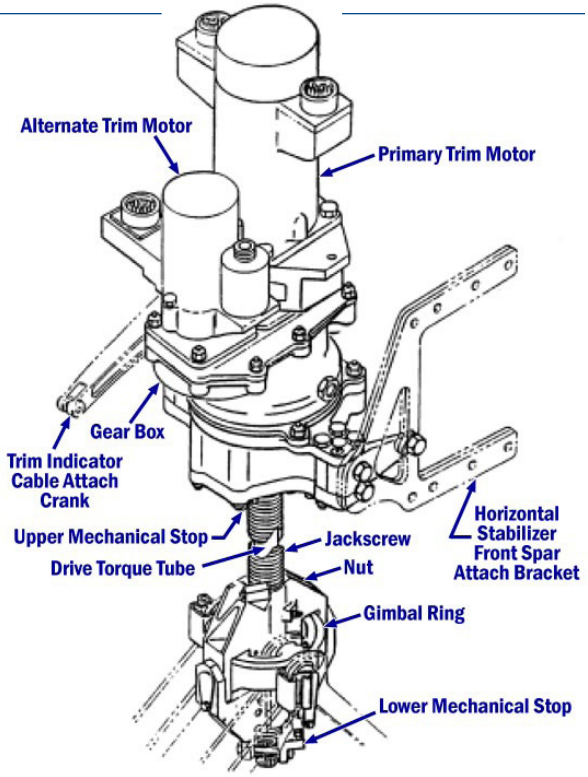
The maintenance controller would not give up: "[Will the] added fuel that you're gonna have in LA be a complication or an advantage?" This point actually had some merit. A lighter aircraft is generally preferable for an abnormal landing. Burning off fuel was already reducing the amount of control force that the crew was encountering (the crew had reselected the autopilot on as a result – even though this was contrary to guidance found in the Stabilizer Inoperative checklist). In truth, the destination was not going to have a direct bearing on the final outcome of the flight.

The flight's dispatcher would immediately apply additional pressure: "If we land in LA, we'll be looking at probably… an hour and a half [delay, ATC has] a major flow program going…in San Francisco." The captain would feebly respond: "Boy…you put me in a spot here." Airline personnel at LAX would pile on: "Be advised we have to get landing rights…I have to clear it all through customs first." The captain responded more assertively: "Better start that 'cause we are coming to you."

A few minutes later, the captain requested an update on San Francisco weather, clearly succumbing to a bout of second-guessing. A station mechanic at LAX would contact the crew asking, "Did you try the suitcase handle and the



Source: lessonslearned.faa.gov



pickle switches?" Suitcase handle was a colloquialism for a mechanism on the pedestal that commanded the electric trim motor. Pickle switches performed the same function on the yoke. The mechanic was wondering if a switch had failed.

The captain told the mechanic: "[Pitch trim] appears to be jammed…the whole thing." This innocuous exchange would result in a befuddling sequence of events. Without communicating with the first officer (who was the pilot flying), the captain apparently decided to try the trim one last time. The only record of this moment – which occurred four seconds following his conversation with the LAX mechanic – was the captain muttering (apparently to himself): "Let's do that." This was followed by the sound of a click, then a clunk, then two faint thumps, and then an expletive as the aircraft pitched aggressively down. The first officer would ask in alarm, "What are you doing?"

In the following two minutes, the aircraft descended from 31,000 feet to 23,000 feet. Twenty-five seconds after the dive began, the captain informed ATC, "We've lost vertical control of our airplane." There was limited communication with ATC for the next minute. It is likely that the controller identified Flight 261 as an emergency aircraft at this point. Only once in the transcript does the crew explicitly declare an emergency – and it was the first officer, one minute prior to the crash, who exclaimed, "Mayday" (he never actually transmitted the phrase over the radio – it was captured on internal microphones).

The aircraft would recover for several minutes at 24,000 feet. The threads in the jackscrew nut had completely failed, resulting in the horizontal stabilizer moving to its nose-down mechanical stop (the nut threads would later be found tangled around the jackscrew). The crew managed to maintain basic control for the next nine minutes. During this period, the captain once again communicated with a mechanic on the ground at LAX, explaining that the trim had ran away full nose down. The mechanic inquired as to whether the crew had attempted to trim the nose back to a neutral state. The captain responded: "I'm afraid to try it again…"

Thirty seconds later, the captain asked the first officer, "You wanna try [the trim] or not?" The first officer responded: "Boy, I don't know." The captain would demure: "It's up to you, man." The first officer suggested proceeding to LAX. He also suggested briefing the passengers. The captain would do so and then descend once again, this time intentionally.

The captain decided to test the flaps at 17,000 feet. He noted that the configuration helped stabilize the aircraft. Then – for unknown reasons – he directed that the flaps be retracted again. The aircraft accelerated from 248 knots to 270 knots following retraction and once again became difficult to control. A minute later, the CVR recorded a sound similar to the movement of the slat/flap handle. Four seconds later, the aircraft would enter its final, fatal dive. The horizontal stabilizer, abnormally stressed due to elevator loads (exacerbated by the second selection of flaps at relatively high speed), finally failed completely – the structure connecting it to the vertical spar crumpled, resulting in an uncontrollable condition.

The captain's flying skills would prove unusually sharp at this point. Recognizing the danger of the nose down pitch, he would apparently decide to roll the aircraft inverted. He would exclaim: "Push and roll, push and roll. Ok, we are inverted…at least upside down, we're flying."

The aircraft was doomed at this point. The elevator did not have the control authority needed to compensate for the failed horizontal stabilizer. Compressor stalls were soon heard on the CVR due to the negative angle of attack on the inverted engines. Just before impact, the captain uttered his final words: "Ah, here we go." Unquestionably this comment was made by an individual who knew that he was about to die. The captain never gave up, fighting to the very end. His final moments proved to be ones of courage.

Command Authority

The NTSB blamed the crash on a combination of Alaska Airlines maintenance and insufficient FAA oversight (Alaska Airlines has maintained an impeccable safety record since). The accident report notes the catastrophic failure of a jackscrew was an abnormality for which the crew had no training or experience to assist in their decision-making efforts. It would be unfair to blame the crew for their confused response to a befuddling mechanical failure. Still, there are lessons to be learned here.

Within sight of Los Angeles, the captain became stuck in a neverland between the desire to maintain the schedule and the gnawing concern that something very serious was wrong. In the midst of this he briefly abdicated his command authority. His initial decision to execute a precautionary landing at LAX was unambiguous, yet he apparently became persuaded by outside sources to attempt to salvage the flight. It is easy to understand the desire to be a team player and instructive to qualify when that desire should be cast off.

The fact that the captain was concerned enough regarding the aircraft's handling characteristics to prefer the runway at LAX was a clear indication that a critical state existed. The fact that he had flown for a couple of hours in that condition likely made him reluctant to declare an emergency once he was with Los Angeles controllers, but it was the proper course of action to take. His failure to unequivocally declare an emergency produced a blasé response from personnel on the ground, and it was this blasé response that ultimately incited the final, deadly decision.

The declaration of an emergency is not an admission of failure. It merely informs air traffic control that an aircraft requires priority handling. It also puts the pilot in a mental state where their focus can shift from the mission (getting to the destination) to executing a safe landing. Lingering uncertainties will collapse, and the focus of all the available resources can be directed towards a safe resolution to the crisis.

A common trait in effective leaders is the ability to be decisive. This is true in nearly any endeavor – flying an airplane, running a business, or raising a family. Command authority does not exist for the sake of hubris: it exists to eliminate useless committee deadlock. Consensus building has its place, but it also has its dangers. Imperfect decisions made decisively almost always produce better results. Perfection is impossible, chasing after it pointless – particularly when lives are hanging in the balance. T&T

Stan Dunn *is an airline captain and check airman. He has 7,000 hours in turbine powered aircraft, with type ratings in the BE-1900, EMB-120, EMB-145, ERJ-170, and ERJ-190. Stan has been a professional pilot for 14 years, and has been flying for two decades. You can contact Stan at* **Stan@flyingformoney.com.**

Upgrade for Collins Pro Line 4 System – Carpenter Avionics.

Citation XLS G5000 Install – Stevens Aerospace & Defense

AVIONICS UPGRADES

HOW NEW AVIONICS AFFECT AIRCRAFT VALUE

by **Dale Smith**

As much as we'd like to believe they are value-adding, the fact is, many variables impact just how much your new avionics will positively impact the bottom line when it comes time to sell.

I can tell you from many years of personal experience; new avionics have a nearly hypnotic effect on aircraft owners. When they see a shiny new gizmo of any type, their eyes glaze over, and the desire to add it to their aircraft's panel becomes overwhelming. Even with purchase and installation costs often running well into the five-figure range, owners will attempt to justify the upgrade to themselves and their significant other by saying, "It'll add value to my airplane."

Well, if your definition of "value" means more money, then you might and probably won't recoup a good percentage of said upgrade. The truth of the matter is that the "added value" that comes with a particular upgrade means something different to every owner. Yes, to some, it's more money at closing. To others, increased value comes from adding a piece of equipment that makes them a better, safer pilot. And there are a lot of grey areas in between.

So, let's look at the two types of owners and their goals: The "keeper," who wants improved aircraft usefulness/safety, and the "seller," who's obviously looking for a higher selling price.

Upgrades for the Long Run

"The first thing to do, no matter what your goal is, would be to fix whatever issues you have with inoperative instruments or avionics that are in the aircraft now," stated Mark Lee, president, Carpenter Avionics. "A cover plate is much better than an inoperative box. Any prospective buyer will assume the worst with regards to how much it will cost to replace that unit."

"Once those issues are addressed, if the owner is planning on keeping the aircraft for a long time, then their avionics upgrade should be driven by equipment that will make their typical flight safer and more enjoyable," he added. "To them, whatever that upgrade is, it's adding value."

Too true. Even with software upgrades, avionics technologies and capabilities are advancing so quickly that once the unit is in the panel for any length of time, it will probably have little to no value uptick at sales time. Lee said that to maximize the ROI of your avionics upgrade, it needs to fulfill an immediate need or goal. The upgrade can be as simple as adding a couple of USB outlets into the panel to power your iPad (an addition any pilot would value) or as complex as adding a touchscreen PFD or new autopilot. If the upgrade fulfills an immediate need or desire, then it's adding value to you.

No matter your direction, Lee stressed that you need to be strategic in your thinking regarding your upgrade plan. It's a big mistake to start adding components into the panel without clear short- and long-term goals in mind.

For example, let's say you want to improve your IFR skills by adding one of the amazing new touchscreen GPS navigator units from Garmin or Avidyne. Which one is your best choice? Your knee-jerk reaction may be just to say Garmin. (Isn't it the solution to everything?) But, depending on your situation, brand-G may not be your best course of action.

"The Garmin GTN TXi is a stellar GPS navigator, and its interoperability is best when it's working with other Garmin units. Mixing it with avionics from other vendors can be done, and it is done, though it may not interop functions with the other gear that it has with other Garmin units," Lee says. "If you plan to change more of your avionics to Garmin, then it's a great foundation unit."

"If you have a panel of solid avionics units now that aren't Garmin, and you don't have the plan or budget to do a full-on upgrade, then the Avidyne IFD may well be your better solution," he continued. "It has a great flight management system, and it's very compatible with many different kinds of avionics and autopilots. It will deliver its full array of capabilities without having to remake your panel totally."

Lee said that with all of the variables regarding installing and integrating new-generation avionics with legacy systems, the best first step is to contact an established avionics dealer and get their professional guidance.

Like anything, though, do your homework, make sure the shop is established and has a level of experience with the various brands of avionics and your aircraft's make and model. There may be installation or integration issues that an inexperienced shop has

> "Regarding King Airs and Citation Excels, in my opinion, the best avionics modification one can perform is a G1000 install in a King Air or a G5000 in a Citation Excel. There is a much better return on investment on these types of installs as opposed to partial panel modifications."
>
> – Gary Brown, avionics/operations manager, Stevens Aerospace and Defense

PHOTO COURTESY OF STEVENS AEROSPACE & DEFENSE

not seen. That can have a huge impact – and not always a good one – on how your avionics upgrade turns out.

Upgrades to Boost the Bottom Line

Approaching an avionics upgrade to maximize your aircraft's selling price is a whole different challenge. It's like putting down a new carpet before you list your house. Maybe the new owner doesn't like green shag…

Anyway, the first step to a successful outcome is determining exactly what upgrades you need to make to bring your aircraft up to par with others currently on the market. This is no time for emotional attachments. Everyone's airplane is a "10." So the most reliable source of this kind of impartial and objective market information is an accredited aircraft appraiser.

"Although upgrades will always add value to an aircraft, exactly how much that increases the selling price will depend on how it impacts functionality and capabilities," explained George Kleros, senior VP strategic event management and fleet support, Jet Support Services, Inc. (JSSI). "The appraiser can determine fair market value by using the sales comparison approach know as 'comps,' which are recognized by the American Society of Appraisers and accepted by all aviation financial institutions."

"The owner would like to know what the value of their aircraft would be before and after an avionics upgrade," he added. "Remember that asking price and market price are two different things. Especially in today's world."

No doubt knowing where your aircraft stands in the market is a valuable piece of information that could save you tens of thousands of dollars in not doing an upgrade you may have thought was necessary. Many owners have done an extensive upgrade thinking that they were making the right move only to learn that they wasted their time and money. So, starting with solid data can be a life-saver. Of course, this kind of information does come at a price.

"We offer a basic 'desktop' evaluation option. We look at this airplane compared with airplanes with comparable equipage, age, paint, hours, with or without an engine program, and all," Kleros stated. "There are a lot of variables, but we can come up with a basic number."

"If the owner wants an on-site appraisal, we will grade each component in the cockpit, the interior, paint, engines, and airframe. It gives us a very accurate estimate of the market value," he says. "It's not for everyone, but it can pay off in the right situations."

Best Bang for Your Bucks?

Well, isn't that the proverbial $100,000 question. Unfortunately, there's no easy answer. It depends on your airplane and what the next owner is looking for. Step one is any current or soon-to-be-obsolete equipment, like CRT displays or LORAN units, need to be replaced ASAP. And if there's not an


PHOTO COURTESY OF CARPENTER AVIONICS

easy upgrade, then expect the value of the airplane to be way below market. Also, if your airplane isn't yet ADS-B Out compliant, get it done before you list it for sale.

"For the most part, we are past the ADS-B [Out] mandate and the bulk of the work in that area is done. But, there are still planes flying today and many sitting on the ground that are not ADS-B compliant," explained Phil Stearns, director of sales and marketing, Stevens Aerospace and Defense Systems. "There are options out there, and many that have been installed and working just fine, that divert from the OEM suite – meaning stand-alone ADS-B solutions. These meet the ADSB mandate and are fully STC'd solutions."

"That said, if a new owner wanted full WAAS/LPV capability, for example, it might require that they remove the newly installed stand-alone components (GPS, transponders, etc.) and repurchase upgraded OEM components to have the latest and greatest features and capabilities," he continued. "Both paths and options are clearly valid, but owners should consider the future path they or the new owner will have to take in order to fly as they wish or even comply with future mandates and OEM software changes."

But, if you're currently operating an aircraft that's still in production, you'll want to take a hard look at what features and functions are available from the factory.

"Regarding King Airs and Citation Excels, in my opinion, the best avionics modification one can perform is a G1000 install in a King Air or a G5000 in a Citation Excel. There is a much better return on investment on these types of installs as opposed to partial panel modifications," stated Gary Brown, avionics/operations manager, Stevens Aerospace and Defense, Nashville, TN. "Brokers and owners will often spruce up an aircraft panel prior to selling by installing some updated flight or communication components to make it more attractive to sell, which in fact these do add important features and benefits, but add little ongoing significant value overall to the airplane."

"If we were to use a 20-year-old Piper Mirage as an example, you can buy them all day long for $450,000. But you're buying 20-year-old avionics that won't deliver the capabilities today's units do," explained Fred Ahles, founder, Premier Aircraft Sales, Inc., "Buyers want to purchase an airplane that is as close to what they ultimately want now. No one wants to buy an airplane only to have to put it in the avionics shop for three months while it's upgraded."

"So, the closer you can come to delivering their solution, the better chances you have of a fast sale at maximum value," he added.

Ahles cautioned, though, that the one thing you don't want to do is to get too "creative" with your avionics upgrade. For example, putting a low-cost digital PFD solution like Aspen in a lower cost airplane, like a 210 or older Bonanza, may reap some good ROI. But, not so on a more expensive/newer aircraft.

"Once you get into the $300,000 and up price range, if you try to cut corners, you are limiting the next owner's ability to easily upgrade later on. That will definitely hurt the resale value," he said. "But, there's also danger if you decide to go all-in with the upgrade. Many times, there's more to upgrading avionics than just what you see in the panel."

And, when it comes to upgrading your aircraft's avionics to today's standards, it's not just the cockpit that needs your attention.

"Take a hard look at connectivity options in some form. By and large, people want to be able to stay connected in the air like they do on the ground," said Tony Raines, large cabin aircraft sales manager, Stevens Aerospace and Defense Systems. "There are options from simple text-only type solutions to systems fully capable of streaming anything you want, when you want it, and with many people doing it at the same time."

"Your airplane may be 'capable of being upgraded' but a similar aircraft that is 'already upgraded and capable right now' will most likely get looked at first and possibly purchased, and your plane may not ever be considered," he added.

To Upgrade or Not. That is the Question

If you've read this far, the answer is solid: It depends. Like everything in aviation, there are variables and compromises to whether or not your new GPS navigator, touchscreen EFIS, or autopilot will net you a gain.

Of course, there is an option we haven't discussed yet: You can do nothing. That's right, if you're looking to sell in the next few months, all of our experts agreed that your best solution is to just leave the panel alone – albeit fix whatever is broken – and let the buyer install the avionics they want. There's a risk in whatever you decide to do. To minimize stress, the best thing you can do is to approach it logically and talk to an experienced avionics installer or aircraft appraiser. Their insights may well help you set a course of action that will help you make informed decisions.

So, to answer the ultimate question: Will an avionics upgrade help increase your aircraft's selling price? The truth is, you won't know that until the buyer hands you the check. T&T

Dale Smith *has been a commercial, private and business aviation marketing and media communications specialist for nearly 40 years. He is an award-winning aviation journalist and aviation artist. Dale has been a licensed pilot since 1974 and has flown more than 40 different types of aircraft. Contact Dale at* **dalesmith206@comcast.net.**

Speed Cowl™ Increases DBO by 34,000* Miles!

Almost everyone involved in the care and feeding of an airplane, knows that TBO is the shorthand designation for time between overhaul. We have no quarrel with the TBO designation: but it falls a bit short of telling the whole story. We think our term DBO (Distance Between Overhaul) is much better because it relates more specifically to the cost-conscious aircraft owner. When the numbers are honestly developed and fairly presented, Increased DBO becomes one impartial index to determine the value of an aircraft improvement. Here's what we mean by value: Speed Cowl™ increases your aircraft's DBO by 34,000*miles. That equates to more than sixty-five 500 nm. trips at little to no additional operating costs to you! The inescapable conclusion: Speed Cowl™ figures to give you much more useful time in the air, miles traveled, before you have to shell out for a hot section inspection or major overhaul. That's Value!

Order your Speed Cowl™ today, and start logging extra miles, every hour you fly!

AMERICAN AVIATION®

Advanced Technology for Proven Aircraft

www.AmericanAviationInc.com

800-423-0476

**Distance will vary depending upon aircraft condition, operating procedures, altitude and atmospheric conditions.*

The Worldwide General Aviatio

owner/operators and chief pilots of these air

100%

TOTAL MARKET COVERAGE

JETS - 17,806

CHIEF PILOTS & OWNERS

COUNT	AIRCRAFT
36	AIRBUS ACJ319
30	ASTRA 1125
32	ASTRA 1125SP
57	ASTRA 1125SPX
29	BEECHJET 400
266	BEECHJET 400A
195	BOEING BBJ
503	CHALLENGER 300
40	CHALLENGER 600
26	CHALLENGER 601-1A
121	CHALLENGER 601-3A
54	CHALLENGER 601-3R
325	CHALLENGER 604
7	CHALLENGER 800
148	CITATION 500
340	CITATION 525
318	CITATION BRAVO
187	CITATION CJ1
96	CITATION CJ1+
240	CITATION CJ2
225	CITATION CJ2+
476	CITATION CJ3
174	CITATION CJ3+
368	CITATION CJ4
189	CITATION ENCORE
74	CITATION ENCORE+
392	CITATION EXCEL
14	CITATION I
280	CITATION I/SP
445	CITATION II
54	CITATION II/SP
155	CITATION III
124	CITATION LATITUDE
247	CITATION M2
467	CITATION MUSTANG
130	CITATION S/II
323	CITATION SOVEREIGN
105	CITATION SOVEREIGN+
310	CITATION ULTRA
285	CITATION V
31	CITATION VI
122	CITATION VII
329	CITATION X
38	CITATION X+
253	CITATION XLS
301	CITATION XLS+
1	DIAMOND I
32	DIAMOND IA
16	DORNIER ENVOY 3
304	ECLIPSE EA500
75	EMBRAER LEGACY 500
100	EMBRAER LEGACY 600
53	EMBRAER LEGACY 650
247	EMBRAER PHENOM 100
328	EMBRAER PHENOM 300
80	FALCON 10
22	FALCON 100
16	FALCON 200
242	FALCON 2000
27	FALCON 2000EX
34	FALCON 20C
15	FALCON 20C-5
17	FALCON 20D
1	FALCON 20D-5
10	FALCON 20E
49	FALCON 20F
75	FALCON 20F-5
197	FALCON 50
8	FALCON 50-40
118	FALCON 50EX
178	FALCON 900
24	FALCON 900C
116	FALCON 900EX
156	GLOBAL 5000
123	GLOBAL EXPRESS
25	GULFSTREAM G-100
239	GULFSTREAM G-200
14	GULFSTREAM G-300
24	GULFSTREAM G-400
313	GULFSTREAM G-450
11	GULFSTREAM G-500
602	GULFSTREAM G-550
27	GULFSTREAM G-II
12	GULFSTREAM G-IIB
111	GULFSTREAM G-III
175	GULFSTREAM G-IV
338	GULFSTREAM G-IVSP
204	GULFSTREAM G-V
38	HAWKER 1000A
2	HAWKER 125-1A
2	HAWKER 125-1AS
12	HAWKER 125-400AS
2	HAWKER 125-600A
1	HAWKER 125-600AS
61	HAWKER 125-700A
72	HAWKER 4000
223	HAWKER 400XP
44	HAWKER 750
153	HAWKER 800A
14	HAWKER 800B
398	HAWKER 800XP
42	HAWKER 800XPI
88	HAWKER 850XP
187	HAWKER 900XP
2	JET COMMANDER 1121
2	JET COMMANDER 1121B
2	JETSTAR 731
4	LEARJET 23
12	LEARJET 24
2	LEARJET 24A
7	LEARJET 24B
20	LEARJET 24D
8	LEARJET 24E
6	LEARJET 24F
4	LEARJET 25
19	LEARJET 25B
4	LEARJET 25C
45	LEARJET 25D
4	LEARJET 28
32	LEARJET 31
182	LEARJET 31A
26	LEARJET 35
398	LEARJET 35A
21	LEARJET 36
33	LEARJET 36A
32	LEARJET 40
243	LEARJET 45
225	LEARJET 45XR
92	LEARJET 55
6	LEARJET 55B
8	LEARJET 55C
307	LEARJET 60
623	PILATUS PC-12/45
149	PREMIER I
1	SABRELINER 40
7	SABRELINER 40A
2	SABRELINER 40EL
2	SABRELINER 40R
4	SABRELINER 60
5	SABRELINER 60ELXM
68	SABRELINER 65
7	SABRELINER 80
1	SABRELINER 80SC
67	WESTWIND 1
1	WESTWIND 1123
14	WESTWIND 1124
50	WESTWIND 2

TURBOPROPS - 12,801

CHIEF PILOTS & OWNERS

COUNT	AIRCRAFT
403	CARAVAN 208
1,523	CARAVAN 208B
155	CHEYENNE I
16	CHEYENNE IA
206	CHEYENNE II
56	CHEYENNE III
38	CHEYENNE IIIA
57	CHEYENNE IIXL
35	CHEYENNE IV
235	CONQUEST I
291	CONQUEST II
38	JETSTREAM 31
63	JETSTREAM 32
52	JETSTREAM 41
37	KING AIR 100
450	KING AIR 200
17	KING AIR 200C

PHOTO BY JESSICA AMBATS

n & Business Aviation Markets

craft *ALL RECEIVE* Twin & Turbine every month

Do you want your marketing message to reach these key decision makers?

ADVERTISE IN TWIN & TURBINE

COUNT	AIRCRAFT
16	KING AIR 200T
229	KING AIR 250
182	KING AIR 300
14	KING AIR 300LW
617	KING AIR 350
62	KING AIR 350C
8	KING AIR 350ER
387	KING AIR 350I
4	KING AIR 350IER
8	KING AIR 90
6	KING AIR A/B90
76	KING AIR A100
184	KING AIR A200
34	KING AIR A90
197	KING AIR A90-1
105	KING AIR B100
1,038	KING AIR B200
107	KING AIR B200C
99	KING AIR B200GT
5	KING AIR B200SE
8	KING AIR B200T
47	KING AIR B90
302	KING AIR C90
38	KING AIR C90-1
186	KING AIR C90A
378	KING AIR C90B
76	KING AIR C90GT
88	KING AIR C90GTI
150	KING AIR C90GTX
13	KING AIR C90SE
258	KING AIR E90
173	KING AIR F90
28	KING AIR F90-1
5	MERLIN 300
13	MERLIN IIB
8	MERLIN III
22	MERLIN IIIA
44	MERLIN IIIB
14	MERLIN IIIC
3	MERLIN IV
11	MERLIN IV-A
101	MITSUBISHI MARQUISE
18	MITSUBISHI MU-2F
1	MITSUBISHI MU-2G
15	MITSUBISHI MU-2J
37	MITSUBISHI MU-2K
12	MITSUBISHI MU-2L
25	MITSUBISHI MU-2M
24	MITSUBISHI MU-2N
29	MITSUBISHI MU-2P
47	MITSUBISHI SOLITAIRE
796	PILATUS PC-12 NG
197	PILATUS PC-12/47
296	PIPER JETPROP
74	PIPER M500
92	PIPER M600
602	PIPER MERIDIAN
198	QUEST KODIAK 100
2	ROCKWELL 680T TURBO
5	ROCKWELL 680V TURBO II
4	ROCKWELL 680W TURBO II
4	ROCKWELL 681 HAWK
85	SOCATA TBM-700A
90	SOCATA TBM-700B
381	SOCATA TBM-850
121	SOCATA TBM-900
38	SOCATA TBM910
136	SOCATA TBM930
6	STARSHIP 2000A
50	TURBO COMMANDER 1000
22	TURBO COMMANDER 690
131	TURBO COMMANDER 690A
135	TURBO COMMANDER 690B
73	TURBO COMMANDER 840
20	TURBO COMMANDER 900
19	TURBO COMMANDER 980

TWIN PISTON - 6,872 OWNERS

COUNT	AIRCRAFT
35	BARON 56 TC
1,566	BARON 58
446	BARON 58P
118	BARON 58TC
3	BARON A56TC
335	BARON G58
158	BEECH DUKE B60
150	CESSNA 340
480	CESSNA 340A
49	CESSNA 402B BUSINESS LINER
110	CESSNA 402C
20	CESSNA 404 TITAN
312	CESSNA 414
430	CESSNA 414A CHANCELLOR
36	CESSNA 421
30	CESSNA 421A
335	CESSNA 421B
713	CESSNA 421C
38	CESSNA T303
100	DIAMOND D42
65	PIPER 600 AEROSTAR
3	PIPER 600A AEROSTAR
44	PIPER 601 AEROSTAR
4	PIPER 601B AEROSTAR
182	PIPER 601P AEROSTAR
21	PIPER 602P AEROSTAR
509	PIPER CHIEFTAIN
20	PIPER MOJAVE
280	PIPER NAVAJO
196	PIPER SENECA
13	ROCKWELL 520 COMMANDER
3	ROCKWELL 560 COMMANDER
11	ROCKWELL 560A COMMANDER
7	ROCKWELL 560E COMMANDER
6	ROCKWELL 560F COMMANDER
12	ROCKWELL 680 SUPER
3	ROCKWELL 680E
14	ROCKWELL 680F COMMANDER
11	ROCKWELL 680FL GRAND COMMANDER
4	ROCKWELL 680FLP GRAND LINER

HIGH PERFORMANCE MOVE-UP SINGLES - 5,726 OWNERS

COUNT	AIRCRAFT
200	BEECH BONANZA
435	CESSNA 182
52	CESSNA 206
373	CESSNA P210N
21	CESSNA P210R
54	CESSNA T182
790	CIRRUS SR20
2,875	CIRRUS SR22
26	MOONEY ACCLAIM ULTRA
11	MOONEY OVATION ULTRA
271	PIPER MALIBU
93	PIPER MATRIX
525	PIPER MIRAGE

TWIN & TURBINE

Jenna Reid, Advertising
316.409.7033 • Jenna.Reid@vpdcs.com
www.twinandturbine.com

Loss of Control:
Latest FAA Guidance

by **Ed Verville**

In-flight loss of control (LOC-I) is the leading cause of fatal accidents for both commercial and general aviation accidents. The FAA recently provided new guidance for stall prevention and recovery as well as modifications of Full Flight Simulators (FFS) to provide Extended Envelope Training (EET) – higher fidelity beyond the current limitations.

Some of the requirements went into effect in March 2019, with the remaining provisions going into effect in March 2020. The regulatory requirements are currently only directed toward FAR Part 121 airline training programs, but the FAA recommends that all air carriers, airplane operators, pilot schools and training centers follow the new guidance.

The Years Leading Up

In addition to the Federal Aviation Administration (FAA), the International Air Transport Association (IATA), the National Transportation Board (NTSB) and AOPA's Joseph T. Nall Report all state that stall/loss of control in-flight is the most frequent category of fatal accidents. Three of the most discussed accidents are Pinnacle Airlines Flight 3701 (October 2004), Colgan Air Flight 3407 (February 2009) and Air France Flight 447 (June 2009).

In response, the FAA changed how jet aircraft recover from stalls. Rather than powering out of the stall while attempting to maintain altitude, as previously taught, the new procedure was to reduce the angle of attack (as we had always done in general aviation airplanes and military fighter jets) and also to "annunciate stall." This was to share information in the cockpit. For example, if one crew member was aware of a stall, they were required to share that information with others by stating they were stalling. Sounds like good CRM. This requirement was put into effect in 2012 with the implementation of Change 4 of the FAA ATP Practical Test Standards.

The new guidance in 2012 seemed promising, but pilots continue to stall and crash airplanes. A recent example occurred in March of 2018 when a Challenger jet departed to Dubai. While flying near the Persian Gulf climbing to Flight Level 380, the jet experienced a problem with the pitot tubes and Air Data Computer. The pilot's and co-pilot's airspeed indicators subsequently began to diverge. An EFIS COMP MON caution message (Comparator Monitor) appeared, and the pilot's airspeed went above .85, past MMO. This also resulted in an audible "clacker" indicating an overspeed situation – a situation not very

likely while climbing at this altitude. The captain pulled the thrust levers to idle and pitched up, stalling the airplane. This resulted in crashing the airplane and killing all 11 people on board. Another fatal accident that appears to be loss of control comes from Atlas Air Flight 3591. Atlas Air lost a Boeing 767 freighter near Houston, Texas on February 23, 2019 when a pilot, who became disoriented in IMC and turbulence, pitched the aircraft to 50 degrees nose down and exceeded 400 knots.

The Latest Guidance

The new guidance implemented by the FAA in March 2019 and March 2020 via AC 120-109A now requires all Part 121 Air Carriers to receive "instructor-guided, hands-on experience" in stall recognition and recovery. The ground training must include a review of stall factors such as weight, G loading, CG, bank angle, altitude, icing effects, inadequate monitoring of autoflight modes, airplane specific knowledge, and malfunctioning equipment. Simulator or flight training must include maneuvering without automation (autopilot and autothrottles), slow flight, climbs, descents, impending stalls, full stalls, upset recovery, airspeed and other malfunctions, task-based training, and scenario-based training. While airline pilots certainly had stall recovery training prior to the changes, the new requirements replicate training seen at a university flight school in a Cessna or Cirrus more so than an airline training program.

The FAA has also changed the stall recovery procedure. Rather than doing everything simultaneously, the FAA now directs the recovery to be done in sequence, with emphasis on reducing the airplane's angle of attack (AOA). This is a drastic change from training before 2012 when we would "power out of a stall" in jets with minimal altitude loss.

Here is the new recovery procedure (2-5. RECOVERY PROCEDURES. AC 120-109A):

- Disconnecting the autopilot and autothrottle/autothrust systems;
- Reducing the airplane's AOA immediately;
- Controlling roll after reducing the airplane AOA;
- Managing thrust appropriately; and
- Returning the airplane to the desired flight path.

Table 1 and "Notes" in the appendix of the AC provide the "associated rationale" for each step of the procedure. For example, reducing the angle of attack prior to rolling the wings level will allow the wing to return to flying, ailerons to become effective, and enable the airplane to roll to level in coordinated flight. This will also help avoid uncoordinated flight or a secondary stall. The AC repeatedly states: "Reduction of AOA must be paramount in all stall prevention and recovery procedures." Some airlines have attempted to simplify the process by using the mnemonic:

- Automation off;
- Push (reduce AOA);
- Roll (wings level);
- Thrust (manage thrust);
- Stabilize (return to a desired state of flight).

Be a student of stalls and loss of control. Seek some basic spin and aerobatic training.

How to Improve LOC Safety

- Eliminate risky behavior.
- Buzzing: Don't do it.
- Distractions: Minimize.
- Impulsivity: Slow down.
- Panic: "Always Fly the Airplane." Confidence comes from training.
- Do not deviate from standards: SOPs, AFM, AOM, FARs.

In his book "Redefining Airmanship," Tony Kern states, "Flight discipline is the cornerstone of airmanship. 1) Violations of flight discipline have an insidious creeping effect on an aviator's good judgment. 2) Flight discipline violations are contagious. 3) The best defense is a personal standard of zero tolerance for violations of flight discipline in any form."

Steps for GA Pilots

Step 1: Be a student of stalls and loss of control.

- Read and follow the guidance in FAA Aviation Circular, AC 120-109A.
- Study the book "Stick and Rudder" by Wolfgang Langewiesche.
- Practice stalls with a CFI.
- Learn new stalls.

CFI candidates must learn a variety of stalls (power on, power off, takeoff/landing, cross control, accelerated, secondary, banking, etc.) Even if you are not training to become a CFI, you may seek the same advanced stall training as a CFI candidate to become more knowledgeable and proficient.

Step 2: Seek some basic spin training.

My local university flight school has a Super Decathlon that they use for spin training. The first spin I ever did as a CFI candidate years ago was a blur. But even after my third spin that day, I was no longer disoriented during a spin, and the recovery became simple.

Step 3: Seek aerobatic training.

If you really want to study this topic, seek some professional but basic aerobatic training. I have done this on more than one occasion and have always been amazed at what I learned in a short week of training.

Steps for Corporate Pilots

When you schedule your next recurrent training program, advise the training center that you would like to follow the FAA's recommended training in AC 120-109A. I know that flight simulator instructors have many required tasks to complete during an FAR 61.58 PIC progressive training cycle, but they should be able to build in many of the FAAs Part 121 maneuvers during your next recurrent training. T&T

Ed Verville *is a TCE, DPE, Contract Check Airman with more than 14,000 flight hours in 90 different makes and models. He holds type ratings in the CL-65, CL-30, CL-604 and B-747. Ed has conducted 3,000-plus check rides in general aviation airplanes, CRJs and Challengers. He also instructs the FAA's new stall recognition and recovery program to FAR Part 121 Air Carrier pilots.*

CAN'T-MISS TRIP?
CASP℠ HAS YOU COVERED.

A simple, cost-effective way to keep your aircraft ready to fly

The Collins Avionics Service Program (CASP℠) helps you avoid unplanned maintenance disruptions on your aircraft. Covering Collins Aerospace avionics and cabin equipment, CASP contracts are simple, fully transferable and effective the same day you sign. No pre-inspection or buy-in fees required. Contact your Collins Aerospace dealer to see how CASP ensures you get where you need to go and don't break the bank getting there.

collinsaerospace.com/CASP

COLLINS AVIONICS SERVICE PROGRAM

- Simple, predictable contract with immediate coverage
- Predictable cost and performance
- No pre-inspection or buy-in fees
- Trusted – nine out of 10 operators renew their CASP contract

Collins Aerospace

by **Kevin R. Dingman**

Lines in the Sand

Pandemic fatigue, airline furloughs, a 2021 mulligan

The past year has presented significant challenges to us all, with current events often feeling like the sword of Damocles hanging over our head. COVID still haunts us; "peaceful protests" have caused many to consider the cost/benefits of city life; the world economy and politics feel as if they're on a precipice; the airlines are in desperate trouble, and personally, I'm in the last year of my airline career.

Drawing a line in the sand is an expression used to describe a decisional point beyond which you will proceed no further or a moment in which you reach a physical or mental inflection. It means to put a limit on what we will do or allow without incurring a consequence. In the United States, it's a reference to the action of William Travis. While commanding the defenders of the Alamo and contemplating a demand for surrender, he drew a line in the sand and asked those willing to remain and defend the Alamo to their deaths to step across. Perhaps it's time we drew a "line-in-the-sand" indicating our decision to take a mulligan and start afresh in 2021 (for non-golfers, I'll explain mulligan in a bit).

Monsters and Threat Perception

The word monster conjures up figures from gothic horrors like Frankenstein, Dracula or The Swamp Creature – classical images of exotic entities with no heads or grotesquely exaggerated features. Pilots also use it metaphorically: the engine failure monster, cabin fire monster, maintenance monster or the check ride monster. Our modern-day microbe monster, COVID-19, has wreaked havoc on not only aviation but all segments of society, conjuring both fear and fatigue.

Neuroscientist Dr. David Rock observed that during this pandemic, almost the entire world is reacting neurologically to higher levels of threat perception than normal. We all share fear, a sense of a loss of control, anxiety, pain and frustration. Collective exhaustion – "pandemic fatigue" – has emerged as a formidable adversary. And authorities

say it can fuel a vicious cycle. A tired and frustrated public tends to let its guard down, triggering more infections and restrictions that in turn compounds the fatigue.

We're all familiar with the IMSAFE aviation mnemonic. By triggering three of its six components: S-stress, F-fatigue and E-Emotion, the pandemic has inserted itself in our preflight planning not only regarding quarantine restrictions and availability of services but in our very fitness to fly the airplane – and we should not underestimate its effect. In a combined industry effort, NASA has prepared a series of surveys to better understand how COVID influences pilots both directly and indirectly due to the effects of the pandemic. In addition to emotions, fatigue and stress, another monster faces those of us paid to pilot planes professionally: the furlough monster.

You're Fired!

The stock market's 57 percent plunge from October 9, 2007 to March 9, 2009 (1929 was 83 percent) was a stark reminder that a modern-day stock market crash is still possible. And does this sound familiar: "Over the next several years, consumer spending and investment dropped, causing steep declines in industrial output and employment as failing companies laid off workers." That was an internet search response to "what happened during The Great Depression of 1929." The follow-on government protectionist strategy of the Smoot-Hawley Tariff and rapidly growing trade restrictions then generated a worldwide depression.

Fast forward to 2020: About 15 million people were employed in restaurants as waiters and cooks and other staff; half of them saw their jobs disappear. Similar losses struck other industries: hotels, entertainment, the conference industry, car rentals and the airline industry. Air travel stalled out last March and has improved slightly, but passenger volumes remain down by more than 65 percent. Without additional government funding, carriers have moved ahead with massive layoffs: American Airlines furloughed 17,500 workers on October 1 and will lay off another 1,500 soon. United Airlines began to furlough nearly 16,400 workers at the start of October. Delta said it planned to furlough 1,721 pilots, and Southwest Airlines has said that it will not cut jobs through the end of the year. The reason to avoid pilot furloughs is largely one of logistics.

The process of bringing back pilots can take 15 months due to the industry's extensive and intricate training system, according to Dennis Tajer, a spokesman for the AA pilot union. Paraphrasing Tajer: "It's a very large ship, and when you stop it, it takes a lot of energy to get it back up and running. Pilots are assigned to an aircraft and a seat position. When we furlough, we furlough from the bottom, so all of our junior first officers, mostly on narrow-body aircraft, are removed. That causes a trickle down of training that has to happen in order to maintain the system, even a greatly reduced system. We're a vaccine industry. We're a vaccine country right now," Tajer added. "We've got to have this financial bridge extended across the turbulent river, or we're going to be walking right into the middle of the river, and the repercussions will be long term."

Despite the challenges, there is a dim light at the end of the tunnel as the MAX takes flight once again, orders for business aircraft may be turning around, and a COVID vaccine should accelerate the return to a new normal. Authorities warn, however, that an overall societal recovery will not be V-shaped. And while this economic forecast does not bode well for those paid to pilot planes (nor anyone else), many pilots have retired or taken varying amounts of leave to mitigate total disaster. Soon this will include me.

Being a pilot is not what I do; Being a pilot is what I am.

On my birthday in September of 1990, I voluntarily abandoned the mantle of fighter pilot. And 30 years later, this past September, I completed my final recurrent training event at my Part 121 carrier (in the B-737 MAX simulator – see last month's story "MAX Effort"). After 49-plus years of flying, with over 30 of them at the airlines, at midnight on August 31 next year, I will lose the admirations of men, women, children and supermodels as I'm stripped of the Airline Captain title. The prospect is daunting. Although my psyche must suffer this psychological slap in the face, it's not the most distressing part. The Social Security Administration forecasts me to live 18.8 years past retirement, but they don't factor in the airline pilot "qualifier."

According to friends that have recently retired from airline flying, the first couple of post-retirement years are traumatic. And statistics indicate that the probability of death is higher among recently retired airline pilots than that of the general population. About 25 years ago, as determined by pocket-protector wearing geeks (no malice intended if this was you) that calculate and compile mortality tables, about 78 percent of male, non-smoking airline pilots died by age 67 – seven years past the old, and two years past the new, mandatory retirement age. Fortunately, said geeks and our society's healthy lifestyle changes coupled with medical advancements have calculated a new number for male, non-smoking airline pilots: 72 years old.

Coincidentally, seven years past retirement. Seven used to be my lucky number – not so much anymore. Ups and downs in the airline industry have been the only constant during my career, and 2020 has proven to be especially challenging. And just in case the pocket-protector's actuarial forecast for male, non-smoking airline pilots is too optimistic, or if you hunger for my flying career anthology, I offer this semi-chronological compilation. You can find them at twinandturbine.com or, if your fellow readers don't swamp me, I can email you a few:

"A Pilot's Mom." T&T May 2016. "There was just one student in our little town known for flying little airplanes, and everyone, including the Sheriff, knew that it was one of the Dingman boys."

"Paper Airplanes." T&T May 2011. "Looking out of the gold-tinted F-16 canopy, I watch as the airport drops below me at over 50,000 fpm."

"Passing Gas." T&T January 2011. "Once we get close to the European continent, the second tanker departs and we fly the rest of the way to Italy as a twelve-ship formation."

"The Van Ride." T&T March 2014. "You've never been ribbed properly until you've been ribbed by a bar full of fighter pilots."

"Issues." T&T September 2010. "If we could see the chain of events often talked about in an accident scenario, wouldn't we intervene? Do we not see the chain – or is it simply not there?"

"Mad Dog." T&T June 2016. "I tell detractors that the Super-80 is one of the last real airliners. One that needs a pilot as badly as the pilot needs it."

"Abducted." T&T October 2016. "We were debriefing, CIA-style, after our once-in-a-career flight to this nefarious base. One thing was certain: our jet would never leave this place."

"Retire Me Not." T&T September 2016. "If you love the flying you do, and if you have a choice, don't change a thing – enjoy what you have."

"Guppy School." T&T January 2017. "Learning the B737-800 NG; Getting over a painful experience is much like crossing monkey bars. You have to let go at some point in order to move forward."

"In The Groove." T&T June 2017. "Flight Attendant's in-flight miles are like McDonald's hamburgers: they're in the billions. So, their experience-based critiques have legs. But take heed, they can be silky smooth or harsh and hairy."

"All The Leaves Are Brown." T&T November 2019. "As you evaluate and monitor your own flying ability and proficiency, remember that there is a balance between our overachiever obsessions with accuracy and efficiency and the emotional gratification of the art."

A 2021 Mulligan

This is not the end. It is not even the beginning of the end.
It is, perhaps, the beginning of the beginning.

– Winston Churchill

According to the USGA (United States Golf Association), golfer David Bernard Mulligan hit a poor drive off the first tee and then simply re-teed and hit another. Ever since, if your drive from the first tee ends up off the fairway in the water, the woods or a prickly desert, the player who elects to take a mulligan avoids a two-stroke penalty and the negative effect on their confidence. They say that confidence is what you feel inside and arrogance is what others perceive. The fearlessness given off by a pilot is projected onto others because we are entirely confident in our decisions, especially in an emergency. Whether it's in the cockpit of a

commercial airliner or a C-152, arrogance (confidence) can be the difference between life and death.

A 2004 NASA study found psychological commonality among pilots: aviators scored higher in being conscientious, competent, dutiful, self-disciplined, and assertive while generally keeping emotion out of the cockpit. Of all the evaluated traits, assertiveness rated the highest among all personality traits. Other high scorers were the traits of dominance, forcefulness and of being socially ascendant. Properly implemented, these are valuable qualities. In addition to drawing a line in the sand, perhaps we should assertively take a mulligan to start 2021.

Who'll Stop The Rain

– Creedence Clearwater Revival, 1970

In a time of crisis, we are fortunate as pilots to possess the above traits, and I believe they can help us navigate these troubled times. While CDC recommendations and a vaccine may soon arrest the pandemic, this is a moment when leaders (like you) want to be able to share good news; to be able to tell stakeholders that things are under control and that there is a plan to return to normalcy. So, just as we do in the cockpit, analyze the situation, manage problems as they arise and take the appropriate action. Merry Christmas, my fellow aviators – 2021 is just around the corner. T&T

Kevin Dingman *has been flying for more than 40 years. He's an ATP typed in the B737 and DC9 with 24,000 hours in his logbook. A retired Air Force major, he flew the F-16 and later performed as an USAF Civil Air Patrol Liaison Officer. He flies volunteer missions for the Christian organiz tion Wings of Mercy, is employed by a major airline, and owns and operates a Beechcraft Duke.Contact Kevin at* **dinger10d@gmail.com**.

CJ2 Avionics Upgrade

by **John Brantigan, Owner-Pilot**

When my wife Carolyn and I purchased our Citation CJ2 brand new from Cessna in December 2002, we specified dual Garmin 530s in place of the Collins Nav-Com units normally a part of the Collins ProLine 21 system. This was new for Cessna because so many buyers were immediately replacing the Collins Nav-Coms with the Garmin units everyone loved. Fast forward to 2013 when WAAS became available and was necessary to fly LPV approaches. I had the upgrade completed at the San Antonio Citation Service Center. I really like the folks at San Antonio and have most of our major service done there. However, this turned out to be an unhappy experience.

Before departing KSAT, the tower allowed me to practice LPV approaches to Runway 12R (now 13R). On three consecutive attempts, I had to perform emergency climbs at Hasdo because of pop-up traffic from Boerne Stage Airport (5C1). Boerne Stage is a non-towered airfield almost exactly on the direct path to KSAT 13R. Virtually all KSAT traffic passes directly over 5C1 at 3,500 to 4,000 feet. Yet, there is no airspace restriction keeping 5C1 traffic below 3,000 ft., and worse, there is frequent sailplane activity. Sailplanes don't require transponders, and they frequently circle the airport to gain altitude. Everyone knows about this hazard, yet the FAA does not address it and frequent near misses and emergency maneuvers occur daily.

Giving up on practice approaches, I departed single-pilot for Eagle-Vail (KEGE), where Carolyn was visiting daughter Scoie. I was in weather with constant moderate turbulence the entire flight and could not access METARs or NEXRAD. I had not been informed that the method of accessing them had changed. At RLG, I asked Denver Center if anyone was having trouble getting into KEGE, expecting turbulence to increase while descending in the mountains. Center replied that they hadn't had any complaints. After a wild ride, the folks at Vail Valley Jet Center told me that I was the only one who had landed that afternoon. Are we having fun yet?

Later I studied publication 525AFM-S59 describing the operation of the system along with documents provided by Garmin. To fly an LPV approach, you needed to begin with the autopilot in heading mode (HDG), then select "activate vectors to final (VTF)." Next, select approach (APPR) – but only after the snowflake GlidePath (GP) switches to a diamond symbol, indicating that the 530 had switched from linear deviation mode to angular deviation, and you saw on the PFD scoreboard the white symbols "APPR GLC()" and "GP," indicating that the LPV approach had been armed. When the lateral and vertical paths were captured, the respective symbols turned green. In

actual practice, the approach frequently didn't get armed. And if armed, the autopilot failed to capture.

There were some things that I did like about the installation. The WAAS 530 flew the autopilot much more smoothly than before. It flew automatic approach course reversals, holding patterns, missed approach procedures and missed approach holding patterns, which it did not do before. But I needed an upgrade.

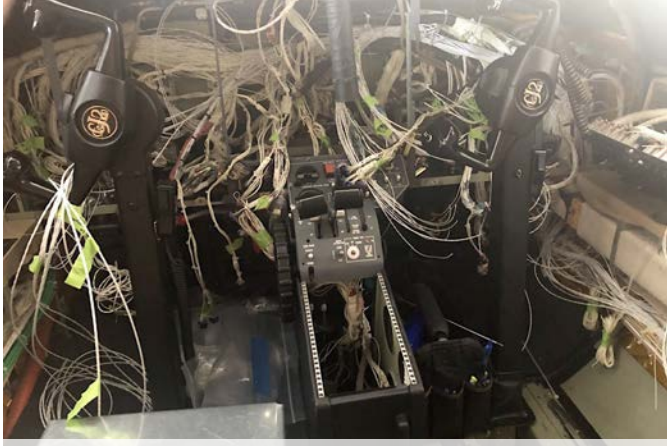
Collins Aerospace has a new system, the ProLine Fusion, at an installation cost of $400,000, but it is not available for a CJ2. And based on airport gossip, the ProLine Fusion system requires a full week of classroom training and is described as difficult. We occasionally need to engage a professional pilot from Corporate Air Center at KBVS. They fly the Lear 40 and 45, a G150 on domestic and international flights, a Pilatus PC-12, numerous helicopters, and a Lear 35, recently sold. A few years ago, I provided my CJ2 for three of their pilots to receive the C525 type rating (T&T contributor Kevin Ware was one and wrote about his experience in this magazine). They all know the ProLine 21 system and other avionics installations, but they do not know the ProLine Fusion.

You might ask why we don't just trade our CJ2 for a CJ2+ with newer avionics. That would be fine but at a differential of $1 million. We have had a total of three overnight mechanical delays over 18 years and 2,000 hours of operation in our CJ2. This airplane has been reliable and does everything we want it to do.

In January 2017, Carolyn and I purchased a 2009 B407 from Bell Helicopter in Ft. Worth, Texas. It was outfitted with a G500 display, a GTN750 GPS and a HeliSAS autopilot. Because the 750 was new to us, we engaged long-arm Lewis – the protagonist in many fables of Kevin Ware published in these pages – to fly with us from Ft. Worth to KBVS. Flying VFR in January, you want to cross the mountains in the south rather than attempting a direct route. The GTN750 has been easy to learn, very intuitive, and flies a better coupled LPV approach than our 530-equipped Citation.

I then learned (I don't recall where) that Garmin International, Inc. operates a CJ2 with dual GTN750's based on an STC developed by JetTech. I contacted the company, and Rob Irwin of JetTech quoted us a price for the installation of dual GTN750Xi's with GMA 35 Audio Panel and voice-activated intercom, including autopilot coupled WAAS LPV and GTX 335/345 ADS B (In and Out), and traffic display on both GTN's. The installation included Flight Stream 510, GDL69A Satellite weather and radio and AIS 380 digital fuel flow with the replacement of all instrument panels. A key to fitting dual 750's was the replacement of existing standby ADI and altimeter dials with a Garmin GI 275 standby instrument that displays attitude, altitude and airspeed.

We delivered the CJ2 to JetTech at KBJC in July. The projected three to four-week installation time was achieved despite a week delay due to



Avionics brain surgery in progress.

The completed installation – clean and attractive.

an unexpected need to replace two cables on the traffic system. I spent the downtime reading the GTN750 manual and using the Garmin Trainer, an iPad app that simulates the GTN function. I believe anyone familiar with the Garmin 430/530 will find the GTN750 very intuitive, yet there are a lot of advanced features as well. The panel is much cleaner. You don't see audio panels or transponders, which are controlled by the 750s.

When we picked up the airplane, JetTech already had the databases loaded. Rob spent about two hours with us in the cockpit reviewing the operation of the systems, and we departed KBJC for Lincoln, NE that afternoon to visit daughter Matel. We felt no need for an instructional flight.

What do I like about the system? Everything (well, almost). LPV approaches are reliable, and there are no surprises. But once established on final, you still need to select autopilot "heading," then "activate vectors to final," then autopilot "approach" in order to couple the glide path. The GTN750Xi adds some features beyond the basic GTN750. One is Connext, a Bluetooth data link between the panel units and portable electronic devices such as an iPad running ForeFlight. This allows automatic transfer of flight plans, FIS-B weather, ADS-B traffic and other data. Imagine how much easier the helicopter flight would have been if we could have transferred all those user data points instead of entering the lat-lon coordinates manually. The Stratus unit that we previously had in the cockpit is no longer necessary.

Another terrific feature is the Telligence Voice Command. You press and hold the Push-to-Command (PTC) switch while you make one of many voice commands, such as "Show Approaches Page," "Say distance to destination," or "Tune destination tower."

In the basic CJ2, if both generators are off-line and the battery is the only source of electrical power, the full system will run for only 10 minutes. With battery in EMER, the emergency bus will be powered for 30 minutes. The GI275 has an internal AHRS and Air Data Computer and internal battery that powers the unit for a minimum of 75 minutes, a significant improvement over the original standby instruments.

In conclusion, this is the system that I wanted for a long time. All professional pilots that I use for backup know the system without training. I am totally happy with the system and excellent work completed by JetTech. T&T

Ad Index

ADVERTISING, JENNA REID
1-800-773-7798 • Email: **Jenna.Reid@VPDCS.com**

"DANKE, STEVENS!"

On time. On budget. Exceptional work. That's how you earn respect from around the world. This spring, working with a German customer, Stevens performed the pre-buy for this King Air 90, then installed a G-1000 avionics suite, MT 5-bladed props, winglets, strakes, as well as custom interior refurbishment and partial paint. Seventy years ago, we began building a reputation for technical expertise and personal engagement. Airplanes have changed since 1950, but the Stevens commitment to a great customer experience remains the same.

STEVENS AEROSPACE AND DEFENSE SYSTEMS
EST.1950

SOAR WITH THE LEADER

www.stevensaerospace.com | 1-800-513-9164 | Greenville SC | Macon GA | Nashville TN | Dayton OH

Go/No-Go

"Gunnison Crested Butte Regional Airport, automated weather observation one three zero seven Zulu, wind calm, visibility one zero, sky conditions 600 scattered, overcast 4,400, temperature one-two Celsius, dewpoint one-one Celsius, altimeter three zero four one, remarks, density altitude 8,400."

I listened to the automated Gunnison AWOS with more than usual interest as I drove from Crested Butte, Colorado on an early Saturday morning in late July. I was headed to Dallas (KDAL) with precious cargo, my family. The "monsoon season" had just begun, creating a vast wet weather pattern throughout the Rockies. Most of the mountain peaks were shrouded in cloud as light mist covered my rental car windshield.

I squirmed a little in my seat.

My personal minimums for departing Gunnison's uncontrolled airport are 5,000 and 5, which offers me a safety margin in case I need an immediate return. The nearest alternate is Montrose about 50 miles away, requiring a climb over mountainous terrain.

I arrived 45 minutes before the family to pre-flight and look closely at the weather. The heavier precipitation was just west of Gunnison and stationary. Weather on our departure route was better, skies clearing east of the front range. I had no idea about the tops or icing reports this early in the morning.

The airport, normally bustling on a summer weekend, was eerily quiet.

Our C90A, with an increased gross weight mod, would allow a non-stop flight to Dallas with a full passenger load. But departing at close to gross weight would not be safe. Our climb performance in the event of an engine failure after takeoff would be marginal. And given that our climb would be in solid IMC conditions, I wanted optimum performance. A fuel stop in Amarillo (KAMA) was the safest option.

I noticed a TBM land after an ILS approach to runway six. As the passengers deplaned, I asked who the pilot was. "I am," the youngest one said. "Any icing on the approach?" I questioned. "I got light icing above FL240 but nothing below 18,000," he responded.

Now I had a little more knowledge. Enough to make the go/no-go decision.

Passengers boarded, Patty reading the checklist and holding short of runway zero six, I called Denver Center. "November three niner six delta mike, I have a King Air on the approach to Gunnison. You are cleared as filed, climb and maintain one-six thousand, contact me on one two four point five after departure, hold for release," came the clearance.

The B200 King Air crossed high over the threshold and used all of the 9,000-foot runway. Released for takeoff, I had the obstacle departure programmed into the Garmin G1000 flight plan, including a right turn after takeoff and a climb in the hold at Blue Mesa VOR. We were enveloped in the clouds within 2,000 feet. This is probably the highest workload environment in a multi-engine turboprop – power management, checks for icing, airspeed control, communicating and navigating, all simultaneously.

The Pratt -135 engines on the airplane had us climbing at 1,600 feet per minute through thick moisture-laden clouds. Prior to the hold, we were already passing 15,000. "Center, three niner six delta mike requesting direct Alamosa," I said. "Six delta mike, you are cleared direct destination."

We broke out at FL230 into beautiful skies and headed home.

Fly safe. T&T

David Miller *has owned and flown a variety of aircraft from light twins to midsize jets for more than 50 years. With 6,000 plus hours in his logbook, David is the Director of Programs and Safety Education for the Citation Jet Pilot's Safety Foundation. You can contact David at* **davidmiller1@sbcglobal.net**.

ice shield PSA™
de-icing systems

PRESSURE SENSITIVE ADHESIVE (PSA) WING BOOTS HAVE ARRIVED!

Visit IceShield.com/PSA or contact an Authorized Ice Shield Distributor for more information

Ice Shield is pleased to offer Pressure Sensitive Adhesive (PSA) wing boots. Simialar to the FASTboot®, Ice Shield PSA allows minimal aircraft downtime and easy installation. Contact an authorized distributor to purchase today.

Ice Shield & Ice Shield PSA products are available for sale worldwide!

IceShield.com/PSA • 800-767-6899 • info@iceshield.com

WHEN YOU REALLY HAVE TO TRUST YOUR AUTOPILOT TRUST THE EXPERTS

Now Approved
King Air 90, 100, & 200 Series, & Piper PA-31 Series!

THE GENESYS AEROSYSTEMS S-TEC 3100

The S-TEC 3100: The next generation of autopilot technology and capability, from the leading name in autopilots. You can now be confident of precise digital control for every phase of flight with the safety of an advanced digital autopilot.

Learn more at stec3100.genesys-aerosystems.com/tt

*Additional equipment may be required depending on configuration

GENESYS AEROSYSTEMS

S-TEC 3100
PRECISE PERFORMANCE.
PROVEN EXPERIENCE.
PERSONALIZED ATTENTION.