The Real Value of EMPs / Hunting for Hangar Space / Lessons in Pressurization

TWIN & TURBINE

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

NOVEMBER 2020 $3.95 US
VOLUME 24 NUMBER 11

PILATUS PC-12 NGX

AN UP-CLOSE LOOK AT THE TECH BEHIND THE TURBOPROP

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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.

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

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NOVEMBER2020 • **VOL. 24, NO. 11**

COVER PHOTO:
Photo Courtesy of Pilatus Aircraft

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Editor's Briefing

by **Rebecca Groom Jacobs**

Almost First-Time Owners

In September we came *this* close to purchasing a Mooney – a story I thought I'd share here. I will turn it over to Jared to summarize the experience, but spoiler alert: the search is still on.

Jared Jacobs: Shortly after Rebecca and I made the call to start our airplane search, a connection of my father-in-law's alerted us of a Mooney M20J coming up for sale. The J-model sits at the top of our wish list, and this particular one was in the process of receiving a brand new Garmin panel *and* overhauled engine. For the price I heard being tossed around, it sounded too good to be true.

I quickly contacted the shop conducting the restoration work and learned the airplane was a "fixer-upper" purchased in 2016. Upon arrival, it had basic avionics and a one-inch crack in the crankcase. The shop bought it for cheap with the vision to overhaul and upgrade the aircraft but soon became swamped with ADS-B upgrades, leaving the M20J to sit for four years. However, with the 2020 ADS-B mandate now behind them, the project was officially underway.

The engine received a new crankcase and a complete overhaul, but the real icing on the cake was the installation of a completely new panel: Garmin G500TXi linked to a G750 and a GFC500 autopilot, all backed up by a G5 standby display. Truly a thing of beauty. But I knew we still needed to get the full picture, so thanks to a good friend who lives nearby (thanks, Zach!), I accessed photos of the maintenance logbooks. And thanks to an A&P friend (thanks, Kyle!), we started dissecting the Mooney's history.

Built in 1979, the aircraft lived in central Texas for most of its life, seemingly maintained above and beyond the minimum standard. Then in 1999, the aircraft was involved in an off-airport landing that resulted in substantial damage. A well-known and respected rebuild shop brought the aircraft back to life over the next two years by completely replacing a left wing section, firewall, belly skins and empennage sections, which were all built new from the Mooney factory. There were also three welds made to the structural cage around the cabin of the aircraft. All of the 337's were thorough, and the work looked to be top-notch. The aircraft went on to fly 15 years without an issue until the crack developed in the crankcase.

Every day for two weeks, the idea of this airplane consumed me. I held daily phone updates with my father-in-law (who is deeply ingrained both in the industry and aircraft sales), in addition to calling numerous other aviation connections to gather all of the opinions and insight I could find. And, of course, I dove deep into forums and internet research. With the exception of the damage history, this Mooney appeared to check all the boxes. Rebecca and I decided to make an offer.

After a long wait over a holiday weekend (probably the longest five days of my life), the owner got back to us with unfortunate news. Instead of negotiating, he had decided to increase the originally quoted price and take the airplane to market at that higher number. This effectively took the airplane out of our budget and out of reach. I was disappointed to say the least.

Since then, I have mentally replayed this "close call" and considered what I could have done differently. I'll be the first to admit that I let myself become too emotionally invested. It is also possible (likely) that my excitement and pressing research off-put the seller. One thing that I know I did right, however, was to let the airplane go when the finances no longer worked for our situation. This was a difficult move, but as I was reminded many times over by pilots much wiser than me, "There will always be another airplane."

As Jared described, it was an emotional roller coaster for a couple of weeks there. But I am confident we made the right call in our thorough research and ultimately staying true to our budget.

So, what is our plan now? We are still on the hunt, keeping an eye on the market listings, but maybe with a little less gusto. As the cold weather sets in (our first snow is falling as I write this), it is likely we will wait until 2021 to amp our search back up. We are also entertaining the idea of a partnership to cut costs and better allow the potential purchase of a Beechcraft Bonanza or Cirrus SR22 – continually the top two aircraft recommended for us.

Thank you again to all who sent in suggestions or shared advice. Hearing your personal ownership stories is valuable insight, and we absolutely welcome them as the quest continues.

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by **Dianne White**

The Hangar Hunt

Northwest Arkansas is known for its backcountry flying experiences with 64 airstrips within an 80-mile ring.

Quick, what's the toughest thing you've ever had to do as a pilot?

Master the NDB approach with a fixed card ADF during your instrument training? Survive your first type rating at FlightSafety? Flight plan a trip into the Northeast corridor without ForeFlight?

Here's mine: Move to a new city and attempt to find suitable hangar space. Packing up my life and moving to a new state was difficult enough, and doing it in the era of COVID added another level of stress. Meanwhile, a top priority was figuring out where my aircraft would call home.

My husband and I relocated to Northwest Arkansas this past summer from Kansas City. We absolutely love it here by the way – it is one of the best-kept secrets in America. (So, keep this to yourself, okay?) The combined cities of Bentonville, Rogers and Fayetteville is one of the most livable areas in the country with a relatively low cost of living, lots of culture and entertainment, and beautiful surrounding terrain. Set in the Ozark Mountains, the area is known for world-class mountain biking, miles of hiking trails, and boating on nearby Beaver Lake – a dream come true for someone who loves being outdoors.

Northwest Arkansas also has a vibrant aviation community. Bentonville-Thaden Field (KVBT) is a growing and popular GA airport, thanks to significant investment in a world-class FBO, restaurant and infrastructure. Dozens of backcountry grass strips dot the Ozarks, making it a pilot's playground for those looking for an adventure off the beaten path. Also nearby are several great airports: Rogers Executive, Springdale Municipal, Northwest Arkansas Regional and Drake Field in Fayetteville.

This leads me back to my original dilemma: finding hangar space at one of these airports. One of our aircraft is used weekly for business travel by my husband or me. The other aircraft – which I have written about on this page before – is a Cessna 172M that my mother bought new in 1975. With only 1,300 total time and in mint condition, it's a special little bird that I have no intent of letting go but posed a challenge as it needed a roof over its head, too.

Very much like every airport in America, hangar space here is at a premium. I did what most aircraft owners do: got my name on every waiting list. I started with the airports in order of preference and then reluctantly worked my way in concentric circles to fields that were further away. Every airport manager I spoke with sheepishly told me the wait time is at least five years.

We all know that those waitlists often contain names of pilots who either already found a hangar or have moved away and didn't take their name off the list. Also, at many airports, hangar lessors who no longer own an airplane often sublease their hangar to their friends, and lax airport officials look the other way. And then you have those who haven't owned an airplane in years and use the space for storage of everything from RVs to lawn furniture. I'm NOT suggesting that is happening here, but I have certainly been the beneficiary of those "secret" sublease opportunities in the past at other airports.

In 2016, the FAA updated its hangar usage policy to clarify compliance requirements for airport sponsors, managers and tenants, as well as state aviation officials and FAA compliance staff. The policy updates are lengthy but essentially disallows any usage of an airport hangar that isn't directly related to aviation. In short, if the airport

accepted grant money from the Feds, they needed to ensure the hangars were being used for airplane storage.

At my former airport home in Olathe, KS (a suburb of Kansas City), a 2017 tornado wiped out numerous hangars. This event, along with the FAA policy change, prompted the local airport authority to clean up its lease act to make access to vacant hangars more equitable. Although not known for being particularly GA-friendly, the airport authority is keeping close tabs on who's in what hangar.

So back to my hangar dilemma. What are the alternatives? Find a suitable plot of land to build a hangar and work through the bureaucracy with local airport and government officials to get the needed approvals for construction. We were willing to consider, but that option was not particularly appealing and looked to be a long-range project. We wanted our planes under roof before winter rolled in. A community hangar, while not ideal, would provide cover. Unfortunately, every FBO in the area had a considerable waitlist.

So, we did what any aircraft owner and aviation enthusiast would do: we injected ourselves into the local aviation community. We worked to get to know many of the interesting and fun people who love flying as much as we do. We were fortunate to meet some incredible people and accomplished pilots who welcomed us with open arms. And you know what's really cool? Pilots love helping other pilots. We soon had a small contingent of aviators who began working the network on our behalf.

Fortunately, we were introduced to a delightful owner of a private executive box hangar who had room for two more aircraft at a reasonable rental rate. Our two birdies now have a warm, well-appointed nest only minutes from our home at the airport that was our first choice. A win-win for all, and we now can call some fantastic pilots our friends.

So, what's still on my "wow, that's hard" list? Shooting an NDB approach using a fixed card ADF is something I learned once and plan never to do again. Flight planning without Foreflight and Garmin Pilot can be done…but why would you? And as I learned, finding hangarage in a new town can be difficult, especially with the scarcity of hangar space. But I'm thankful for the good people who make up our collective aviation communities. They look out for each other, knowing that the freedoms that general aviation enjoy are special and not to be squandered. When I can, I'll pay it forward, so it doesn't have to be on someone's "hard" list. T&T

Dianne White *is the executive director of MMOPA and editor of MMOPA Magazine. For a total of 14 years, she was editor of Twin & Turbine and has worked in the business aviation industry for nearly 30 years. She also serves on the board of directors for Angel Flight Central. An active multi-engine, instrument-rated pilot, Dianne lives in the Kansas City area and can be reached at* **editor@diannewhite.com.**

Are Engine Maintenance Programs Worth the Money?

by **Dale Smith**

Like any kind of "extended coverage" arrangement, engine maintenance programs (EMPs) are polarizing subjects. Some say they're unquestionably worth the value they deliver, while others are just as sure that they're worthless.

What do early color TVs have to do with first-gen turbine aircraft engines? Well, more than you might think. In the early days of "The Wonderful World of Color," you'd be lucky if the old RCA would last through the show. Their cathode-ray and vacuum tubes weren't very reliable, so manufacturers started offering extended coverage plans to help sell their TVs.

That's pretty much the same story with the engines on first-gen business jets. Like the old TVs, many of those early engines had well-earned reputations for being unreliable. It was a coin-toss whether or not you'd get to fly that day.

"It was the unreliability of those early engines that gave birth to the modern-day Power-By-The-Hour programs. In the late 70s and early 80s, corporate jet use was rare, and the Garrett turbine-powered classic jets suffered from high failure ratings, so MSP (Maintenance Service Plan) was introduced," said Jason Zilberbrand, president, VREF Aircraft Value Reference, Appraisal and Litigation Services. "These programs were put in place to give customers a level of protection against unforeseen maintenance events. That bit of extra coverage made it possible to sell airplanes."

Of course, as Zilberbrand explained, those days are long, long gone. Today's turboprop and turbine engines are as "bulletproof" as modern technology can make them. In-flight shutdowns are extremely rare. But, with that being said, engines will be engines, and stuff does happen.

"The engines are the most expensive liability on the airplane today. Major maintenance issues can easily run into the hundreds of thousands of dollars," explained Sean Lynch, program coordinator for Engine Assurance Program (EAP). "The hot section for a Pratt & Whitney PW305 or a CZI on a Honeywell engine can run 700,000 to 800,000 per side. But those are scheduled events you can budget for. The thing about unscheduled events is you never see them coming."

The ABCs of EMPs

While the legendary "Garrett Grenades" are long-gone, today's owner/operators can still find a lot of added confidence and comfort in having their engines enrolled in some kind of engine program.

"One thing to remember is that EMPs are not insurance programs. That's something owners need to understand upfront," Zilberbrand said. "It's a proactive program. Owners are obligated to stay current with the requirements of their program. They need to comply with all the engine manufacturer's required inspections and operate the engines properly."

"For most owners, the fundamental attraction of an engine maintenance plan remains peace-of-mind," stated Alex Youngs, StandardAero's director of sales and marketing, business intelligence, airframes and fleets. "They won't have to worry about unscheduled maintenance events or the major, one-time capital expense of a scheduled hot-section inspection or overhaul."

There's also a secondary benefit that, in the majority of situations, is even more valuable than covering engine maintenance: Enrollment in an engine maintenance plan (EMP) will add value to your aircraft at resale time.

"Most resellers and brokers agree that enrollment in an EMP does benefit the aircraft's value, though the actual percentage will clearly depend on a number of factors including how long the engines have been enrolled on the plan," he says. "According to a former

Rolls-Royce sales executive, the lack of EMP coverage can impact a mid-time, mid-size business jet's value by up to 70 percent."

"Turboprops are much more flexible when it comes to EMP enrollment. Overhauls are expensive, but nothing like jets," Lynch stated. "With jets, short cycled engines are deal killers. Especially on older, lower value airframes. A good engine program basically gives the owner something to sell when the time comes."

As Zilberbrand pointed out, enrollment in an established engine maintenance program doesn't just protect the owner's current and near-term investment; it also benefits any buyer who is going to finance the aircraft's purchase.

"A fringe benefit to an EMP is that banks love them. Financial institutions gain a higher level of comfort knowing that their collateral is protected in the event that the borrower defaults," he says. "Should the bank need to repossess the airplane, they know it's value will be protected because the scheduled maintenance has been accrued for."

Another side benefit to EMPs is buying into a group of experts who know everything about your engine and its components. They have a vested interest in keeping said engine(s) running smoothly.

"Anytime the engine goes in for maintenance, your EMP provider will be watching over everything," Zilberbrand added. "They have an active incentive to help keep your bills down and the engine healthy. This is a huge value that most owners don't think about."

PistonPower Protection

While EMPs for turboprop and turbine engines have been around for decades, they're new to the piston engine market. In fact, there's only one available.

PistonPower is the first and only comprehensive "power-by-the-hour" protection program for piston aircraft engines. Enrollment eliminates the worry of costly overhauls and the ongoing costs of all of your engine's inspections and maintenance.

"Our program was created by aviation professionals that introduced similar programs for turbine engines," stated PistonPower's VP Business Development, Remi Szymanski. "PistonPower brings stability to your maintenance budget and peace of mind to your business and personal flying."

Along with covering all scheduled engine services, including inspections, oil changes and S.O.A.P. tests, PistonPower covers 100-percent parts and labor for all unscheduled maintenance for covered engine components and accessories. There are no out-of-pocket expenses.

"And, like with turboprop and jet aircraft programs, by minimizing the risk and cost of unplanned repairs, the program can significantly increase your aircraft's resale value," he added. "The best part is you can enroll any engine at any time during its life, and the program can be transferred to the next owner, furthering their coverage."

Szymanski explained that the cost to enroll in the program depends

on the engine. There's a zero-dollar fee for new engines on new aircraft that are still under factory warranty. For aircraft that are out of warranty, there is a one-time enrollment fee of $2,500 per engine and required condition inspection.

"Once they're enrolled, the hourly rate for someone flying 100 hours a year on the program including full engine and propeller coverage is around $150 an hour," he said. "It's money the owner should be putting away for maintenance anyway; this is just a more structured way to do it."

Choosing an EMP

Today, between what the engine OEMs offer and what you can find from third-party providers like JSSI, StandardAero, and Engine Assurance Programs (EAP), nearly 40 different EMP programs are available. You can buy coverage for every possible situation from FOD, to ADs, on every LRU in or on the engine. Or you can just buy "end-of-life" coverages for major issues.

"The key is to find a plan that meets the owner's specific needs. For example, will the owner want coverage that includes life-limited parts (LLPs), or mobile repair team (MRT) AOG support, or line labor for engine removal and installation?" Youngs said. "Likewise, does the owner want coverage to include foreign object damage (FOD) repairs or insurance shortfall protection?"

"Even more fundamentally, some low-time operators might want coverage that only addresses unscheduled maintenance events, without the obligation to save for scheduled maintenance events," he added. "It is also important to know that the program will be backed up by a reliable MRO provider, whether it be the OEM or an established independent maintenance provider."

"It can be quite confusing. Every owner/operator's situation and needs are different, so I'd strongly suggest that you get with an experienced appraiser," Zilberbrand said. "You need to know not only what the program will cover now, but what it will actually be worth to the next owner at resale time."

The experts all agreed that while there are a lot of options if an owner/operator wants maximum benefits now and at resale time, their best choice is an EMP that provides 100-percent coverage of the engine and its components.

"Everything else being equal, enrollment in a 100-percent coverage program will get you the full retail value of the aircraft when it comes time to sell," Lynch stated. "Unless you happened to be selling the airplane with freshly overhauled engines and components – and that rarely happens – any other program will require some type of deduction from the current market price."

Is an EMP Right for You?

If you use your aircraft a lot and want to fix your engine maintenance budget and maximize the resale value, the answer is probably yes. But there are caveats. One of the more important bits of EMP "fine print" is a minimum annual utilization requirement.

"For most turboprop and turbine aircraft, there's an hour-per-year minimum, depending on engine type and scheduled events (some turbine engines are calendar inspections, not hourly)," Zilberbrand explained. "That's very important for the owner to understand before they sign up for any EMP."

"If you're only going to fly the minimum or less, you're going to be paying for 'coverage' on all of those hours even if you don't utilize them," he added. "The only other negative is that if you, whatever reason, terminate the program early, then you lose any money accrued in that account. Sometimes it can't be avoided, but it's a shame to lose that money." 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-wining 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.**

PHOTOS COURTESY OF PILATUS AIRCRAFT

PILATUS PC-12 NGX

AN UP-CLOSE LOOK AT THE TECH BEHIND THE TURBOPROP

by **Rich Pickett**

As a follow up to our initial review of Pilatus' PC-12 NGX in our December 2019 issue of Twin & Turbine, Tom Aniello, vice president of marketing, offered us the opportunity to fly the plane at the Pilatus Business Aircraft (a Pilatus Aircraft subsidiary) facility located at Rocky Mountain Regional Airport (KBJC).

Over the years, I have flown the previous PC-12 models for personal, business, charter and disaster relief flights, so I've experienced Pilatus' updates firsthand. Now, with nearly 1,800 PC-12s produced, they have introduced the most extensive upgrade of the PC-12 to date – the NGX. It is the first with Pratt and Whitney Canada's latest PT6, the PT6E-67XP. Developing 1,200 SHP, it is the first production turboprop engine with a dual-channel EPEC (Electronic Propeller and Engine Control), controlling both engine and propeller.

Preflight

When conducting a preflight of the NGX, starting with the engine and its environs, you notice several changes. From the simple, such as re-routing the oil level sensor wiring, to the absence of the traditional propeller governor, to the EPECS and DCTU (Data Collection Transfer Unit) in compartments beneath the engine. The Manual Override lever (MOR) and condition lever are not required since these functions are now managed by the EPECS. The pilot has a single power control lever (PCL).

Externally you can't see the upgraded fuel system of the NGX, but a more effective oil/fuel heat exchanger is incorporated with motive flow jet fuel pumps, improved vents and lines insulated. These changes also eliminate the requirement for anti-icing additives. An important consideration since these additives are not widely available in many parts of the world.

The Brains

EPECS is a complex system of control and sensor components for the engine and propeller – from the engine oil level sensor to the Throttle Quadrant (and PCL) to the Permanent Magnet Alternator (PMA). The electronic engine control (EEC) component of the EPECS monitors over 100 parameters, and in conjunction with the Propeller Control Unit (PCU) and the Fuel Control Unit (FCU), manages the engine and propeller based upon power requirements set by the pilot or autothrottle. Yes – the NGX has a very effective autothrottle!

The start process is automatic, with fuel and ignition now controlled by the EEC, virtually identical to FADECs in many turbine engines. In the event of a hot or hung start, the EEC will not only shut down the engine, it will automatically activate a dry motoring sequence. If the ITT is initially high during a start, such as during a quick turn, the EEC will not activate ignition or add fuel until it is less than 150 degrees Celsius. While pilots always need to monitor for potential issues during the start, this configuration reduces the chances of that occurring.

The DCTU collects the EEC data and transmits via cellular or Wi-Fi to a repository after landing, or it can be downloaded manually. It is also a key component if the operator subscribes to PWC's pay-per-hour platinum ESP maintenance program.

With this combination of components, the engine can be optimized for all phases of operation and service life. This is one reason the TBO intervals are now 43 percent longer at 5,000 hours, HSI only on condition, and other engine maintenance intervals are doubled. This is in addition to a 10 percent increase in power when compared to the PT6-67P engine, equating to faster climbs and higher cruise speeds.

Pilatus has also developed an innovative approach to reduce cabin and overflight noise. When takeoff conditions permit, using the Low Speed Mode button, the pilot can select 1,550 RPM versus 1,700 RPM for the Hartzell 5-composite-blade 105-inch diameter propeller. In fact, you can use the Low Speed Mode in all phases of flight except in known icing or steep approaches. There is probably no technical reason for this restriction, it is in place simply because the Low Speed Mode hasn't been certified under these conditions – yet. The de-icing system for the propeller is intelligent, selecting the appropriate blade heating profile based upon the OAT; nothing could be simpler.

The Cabin

Pilatus took the already-large cabin windows of the PC-12 and made them 10 percent larger. To the passengers, it provides a substantial change in their outside view.

As Pilatus likes to say, the PC-12 series is "designed for those that refuse to travel light." The spacious cabin and cargo area fit that need. The new NGX interior features an improved seat design, allowing seats to fully recline when not against a bulkhead. Multiple cabin configurations are available, from their new air ambulance (which can accommodate two stretchers) to the executive and

Pilatus PC-12 NGX
By the Numbers

Max Speed*	286 KTAS/278 KTAS	FL220/FL300
Fuel Flow Max Speed*	483 PPH/380 PPH	FL220/FL300
Maximum Range (Long Range Cruise, FL300, 225KTAS, NBAA IFR Reserves)		
Maximum Payload (2,236 lbs)	694	nm
6 Passengers (1,200 lbs)	1,568	nm
4 Passengers (800 lbs)	1,803	nm
Max Ramp Wgt	10,495	lbs
MTOW (SL, ISA)	10,450	lbs
Basic Operating Wgt***	6,803	lbs
Useful Load	3,692	lbs
Usable Fuel Capacity	2,704	lbs
Max Fuel Payload**	988	lbs
Base Price	$4.390	M
Typically Equipped	$5.353	M

*Weight 9,000 lbs **Based on Max Ramp Wgt, Single Pilot - 200 lb
***Single Pilot (200 lb), As Flown

commuter designs. Even seat removal is easier with the NGX.

The PC-12 NGX also features a vastly improved air circulation and cooling system, providing 500 CFM of conditioned air through new ducting and a continuous vent along the entire overhead, similar in design to a commercial airliner. This significantly reduces the noise level in comparison with using the flood mode of earlier PC-12s. Couple these changes with redesigned side panels, ample AC and USB power outlets, and passengers will experience a noticeable improvement.

Flight Deck

The flight deck has undergone such a significant upgrade that Pilatus has coined the term "Advanced Cockpit Environment (ACE) powered by Honeywell." It is aptly named.

Overhead you notice a new way to start the engine: two switches – Engine Run/Off and Starter. The lower center console has been simplified with the removal of the MOR and condition levers as mentioned. Progressing from the power quadrant toward the instrument panel the pilots now have a touch panel to control avionics and system functions. In keeping with the ACE concept, other procedures are simplified, with the majority of the cockpit featuring a design that will be familiar with NG pilots.

With the NGX, Pilatus introduced the autothrottle as an option, one that is selected by almost all operators. The pilot selects FMS or Manual Mode to set the speed. FMS mode optimizes the speed for the flight phase, from airspace restricted speeds to selecting the appropriate speed for an IFR or VFR approach. To adjust speed to the desired value, APEX sends a trim signal to the EPECS, which simply moves the Power Control Lever (PCL) to the desired position.

The autothrottle is even active during Emergency Descent Mode (EDM), triggered by a cabin altitude warning above FL200. The plane turns 90 degrees left, descends at V_{mo} /M_{mo} to FL150, then levels at 160 KIAS. While the pilot can control speed without autothrottle, it does simplify the descent.

Flying the NGX

With Brian Mead, Pilatus demonstration pilot, we filed an IFR flight from KBJC to Salida, Colorado (KANK) about an hour away. We did a preflight in their hangar and then moved outside to their ramp on the southwest side of the airport. Our flight plan included the ROCKIES5.DBL departure then direct to Salida.

Setting up the aircraft configuration, including weights, is simple with an intuitive flow. We entered the flight plan into the FMS, which synchronized with the optional second FMS. I found the new touch panel controller improved efficiency. I could select functions on the touch panel while keeping my cursor focus on the MFD display, enabling me to multitask faster.

The checklists are embedded within ACE, easily selected and acknowledged using control yoke switches. Starting was simple. Move engine switch to ON, press the starter. The EEEC determines the optimum N2 speed at

One Year Mark: PC-12 NGX Market Update

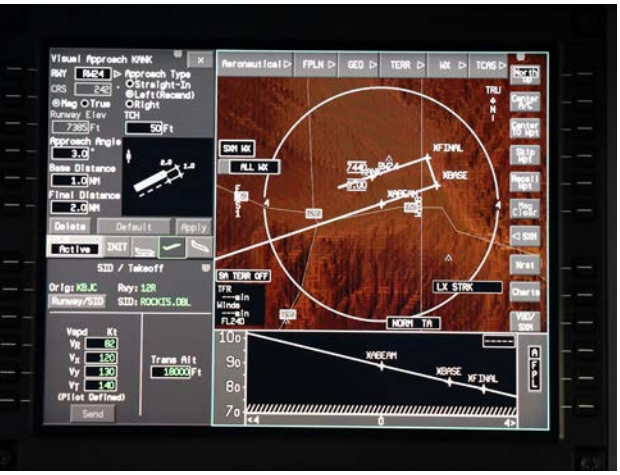
by Pilatus Aircraft

Since unveiling the fully certified PC-12 NGX to the public at the National Business Aviation Association's annual convention on October 21, 2019, the Swiss aircraft manufacturer has enjoyed strong interest and sales for the new model. As the third generation of the venerable PC-12 platform, the new NGX is easily the most significant upgrade since its original introduction in 1994. The new features detailed by Rich Pickett in this article have not gone unnoticed, as many owner-pilots are upgrading to the latest engine and avionics technology in the NGX, citing a dramatic reduction in pilot workload using the new autothrottle system. The all-new passenger seats, larger cabin windows and quiet air distribution system make the new model appealing to passengers.

The first delivery of the PC-12 NGX in the United States went to HP Inc. Director and former CEO, Dion Weisler. Weisler upgraded to the new model from his 2017 model year PC-12 NG, ordering his NGX as soon as Pilatus opened the order book last October. After the first flight in his new PC-12 NGX, Weisler stated, "I really loved my NG, but the NGX takes the PC-12 to an entirely new level. There's something for everyone: passengers enjoy the modern new cabin, and the autothrottle, single-power lever and electronic engine controls are a pilot's dream."

In Europe, the first PC-12 NGX delivery went to Dr. Ulrich Byszio in Germany. Dr. Byszio, a pilot with a passion for all forms of aviation, moved from a popular light jet to his new PC-12 NGX. "The PC-12 NGX is the perfect aircraft for my travels around Europe. The combination of its speed, fuel efficiency, comfort and safety record makes it ideal for both corporations and owner-pilots like myself. It offers an incredible level of versatility that can't be matched by anything else in this class," commented Dr. Byszio after taking delivery of his new NGX.

Following the first PC-12 NGX customer delivery in April of this year, Pilatus delivered 34 units of the new model by the end of October and is targeting a strong finish to 2020 in order to meet customer demand. Pilatus dealers around the world report a solid backlog of retail orders going into 2021 and are actively flying prospects in their demonstrator aircraft.



Top: Flying the RWY 24 visual approach at Salida with autothrottle and autopilot (photo by Tom Aniello).

Right: Simplified controls - new Power Control Lever and Touch Screen Controller (photo by author).

which to activate ignition and inject fuel. If the ITT is too high, it motors the engine a bit longer to lower the initial temperature. If the EEC detects a hot or hung start, it aborts the start and initiates a dry motor – without pilot intervention.

Equipped with SmartRunway and SmartLanding, the NGX provides improved situational awareness by alerting pilots if lined up on a runway different from what was programmed in the FMS for takeoff or landing. It also monitors other potential errors such as excessive approach angles.

Before departure I selected Go-Around (GA) and armed Autothrottle (AT) on the Flight Guidance Panel (FGP). Cleared for departure and advancing the Power Control Lever (PCL) the autothrottle takes control of the PCL just prior to Maximum Continuous Power (MCP) and moves it to takeoff. If Low Speed mode is desired for takeoff, the PCL is set to MCP and AT is not used. In this configuration takeoff roll increases approximately 300 feet.

With three of us in the plane and full fuel, an airport elevation of 5,600 MSL and OAT of 24 degrees Celsius, it was an effortless climb off of Runway 12R, then a climbing left turn with vectors to Red Table (RBL) VOR. Hand flying,

with the AT set to FMS, the EPECS set power to meet the climb profile to our cruising altitude of FL200. The touch panel made easy work of tuning the radios, selecting weather and a host of other functions.

In cruise we experimented with the low and normal prop speed. Pilatus has reported a reduction of 2 to 3 decibels in the cabin while in low speed mode. I could tell we had a frequency change and lower noise level, however, my quick check in the cockpit didn't reveal much of a reduction with a decibel app using both A and Z weightings.

With EPECS, the EEC can fully control the engine for optimization. I noticed during the climb that it set climb power at a lower PSI torque (Pilatus uses PSI for torque measurement) of 34.5 versus 36.95 that I would set on an NG aircraft. This automation resulted in a slight decrease in climb rate but a cooler ITT of 750 degrees Celsius.

In addition to TCAS-II, we also had ADS-B In traffic in this plane. What makes this system unique is when you select the data tag of an aircraft, it will stay displayed so you can continually see the position changes. This TCAS-II Resolution Advisory also provides both climb/descent and turn commands to avoid conflicts.

Time to Land

Many avionics systems in turboprop and turbine aircraft can incorporate a visual approach to any runway with an advisory glide path. But none that I've flown can fly a visual pattern – which is possible with the PC-12 NGX!

It was incredibly easy to program, similar to defining a hold. I selected left pattern with a one-mile crosswind, downwind, base, and final for Runway 24 at Salida (KANK). The FMS determined the best waypoints, calculated the appropriate altitudes and speeds for the approach. The MFD also displays the vertical profile of our projected approach with terrain.

On downwind, I lowered the gear, selected 15 degrees flaps and the autothrottle reduced our speed to 110 KIAS. On base, I selected 30 degrees of flaps and we slowed to 100 KIAS, followed by 40 degrees and 90 KIAS on short final. It was eerie how smooth the automation was in the pattern. Almost to the runway, Brian called out to me, "Autopilot off." I replied, "Why?" and smiled. With the autopilot disconnected and the radar altimeter calling out my altitude in increments of 10 feet, we landed. All we needed was automatic flaring and autoland would have been possible. Maybe that will be the next option.

Rich Pickett and Brian Mead, Pilatus demonstration pilot (photo by Tom Aniello).

Heading Home

After lunch at the Boat House on the banks of the Arkansas River, we took off on a VFR flight back to KBJC. I love hand flying the PC-12s, and the NGX is no exception. Passing Mount Evans on our right and descending over the Front Range, the usual afternoon turbulence was present, and it was an easy right downwind for Runway 12R. I taxied to the Pilatus hangar, set the engine switch to OFF and the EEC did the rest. If the OAT is above 23 degrees Celsius, it will dry motor on the shutdown to keep things cool.

Support

The Pilatus Business Aircraft Ltd facility is also home to their completion and support centers. Pilatus brings "green" PC-12 and PC-24 aircraft to Broomfield to paint, fabricate and install interiors, as well as customize each aircraft to the specifications of their new owners. In fact, 70 percent of the PC-12s worldwide are sold in North and South America, all completed at this facility. Their staff not only installs components, they actually build them, including seats, interior panels, cabinets with the same high quality I've seen at their Stans, Switzerland factory.

All new NGXs include a standard warranty comprised of 7 years/5,000 hours for the airframe, 2 years/2,000 hours for systems, a Honeywell 3-year warranty for the avionics, 5 years/2,500 hours by PWC on the engine, and a 6 years/4,000 hours propeller warranty. PWC is also offering its Platinum Engine Service Program (ESP) exclusively through Pilatus. This program provides virtually total service coverage, including FOD and corrosion, on an hourly basis at a current price of $145/flight hour.

Also based at KBJC is the headquarters for Pilatus' support program. Along with two regional centers in Stans, Switzerland and Adelaide, Australia, they provide 24/7/365 assistance to a global network of Pilatus Authorized Service centers and their satellite support facilities.

Summary

The first flight of the PC-12 NGX was in December 2017, a project that was kept under wraps for some time. Pilatus has come a long way since that first flight, developing an incredible aircraft alongside Pratt & Whitney Canada, Honeywell and other suppliers. From special operations, such as military and air ambulance to executive transport, the PC-12 NGX is a unique aircraft and illustrates Pilatus' continuous innovation. T&T

With 11,000+ hours of piloting more than 100 aircraft models **Rich Pickett** *still has a passion for flying. Rich holds an ATP, CFII SME, SES, glider licenses, and type ratings in the L29, L39, Citation 500/510s/525s, Eclipse 500S, Beechcraft Premier and DA10. His company, Personal Wings, provides training, mentoring and aircraft services. He is also a proud owner of an Eclipse and Cirrus SR22. You can contact Rich at* **rich@personalwings.com**.

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

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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

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Under Pressure
Lessons in Piston Cabin Pressurization

by **Kevin Ware**

The COVID-19 pandemic has had a paradoxical effect on aviation: flying hours are way down while maintenance shops are way busier. I think this is largely due to the reduction in flight hours producing downtime that owners then use to have their airplanes worked on. This has certainly been the case with my own Cessna 340.

Earlier this year, when all the teleconferencing started to replace face-to-face meetings, our customers stopped using the airplane and flying hours dropped. So, I decided it would be an opportune time to fix all the various squawks my airplane accumulated over the past year – one of the biggest being a failure to maintain rated cabin pressure at altitude. Other pilots who fly the airplane dealt with this problem by simply staying below 15,000 feet (providing a 10,000-foot cabin). But with the higher flight level requirements of the approaching winter weather, this became one of the first issues that needed to be fixed. It turns out there has been no easy, quick fix.

Cabin pressurization in piston-powered airplanes is a completely different animal than it is in turbines. The biggest difference is the very limited supply of high-pressure air. Turbine engines have large fans that are huge air pumps, with excess pressurized air available. By comparison, available air in piston engines comes from the engine's turbochargers. They have very small fans driven by exhaust gas, which drives another surprisingly little fan that pressurizes the air. Any change in the amount of exhaust gas, such as a power reduction, will lessen the amount of pressurized air available from the turbochargers.

As altitude increases and the air becomes less dense, the work required by the turbochargers to deliver the same number of oxygen molecules also increases, leaving less available for the folks in the cabin. Generally, even if the cabin is completely sealed, once the airplane's altitude is in the mid-20 flight levels, the amount of air available from the turbochargers is less than required to keep the cabin below 12,000 feet. For this reason they are rarely flown above FL280. Then there is the issue that the air available from the turbochargers drops considerably as power is reduced. If one engine fails on a piston twin in the flight levels, the cabin will quickly go above 12,000 feet simply because of insufficient air input.

Another problem is that most of these piston airframes are decades old, with nearly all of them exhibiting leaks that were not present when they left the factory. In addition, they were designed with a lot of attention to keeping the weight down, making their structures relatively light and more susceptible to pressurization leaks. After thousands of flight hours and many compression cycles (each requiring some slight flexing and expansion of the fuselage), all kinds of small air leaks develop that are very difficult to track down.

To further complicate things, most of these airframes have since had various electronic and other upgrades completed, each requiring additional holes made in the pressure vessel. For example, many piston twins now have JPI engine monitoring systems. This requires a large bundle of wires to be run from the engines through a hole in the pressurized portion of the fuselage near the wing root then up to

the instrument panel. The wire penetration near the wing root is usually sealed off with something like ProSeal. This sticky black material that can eventually dry out and lose its flexibility, resulting in small leaks.

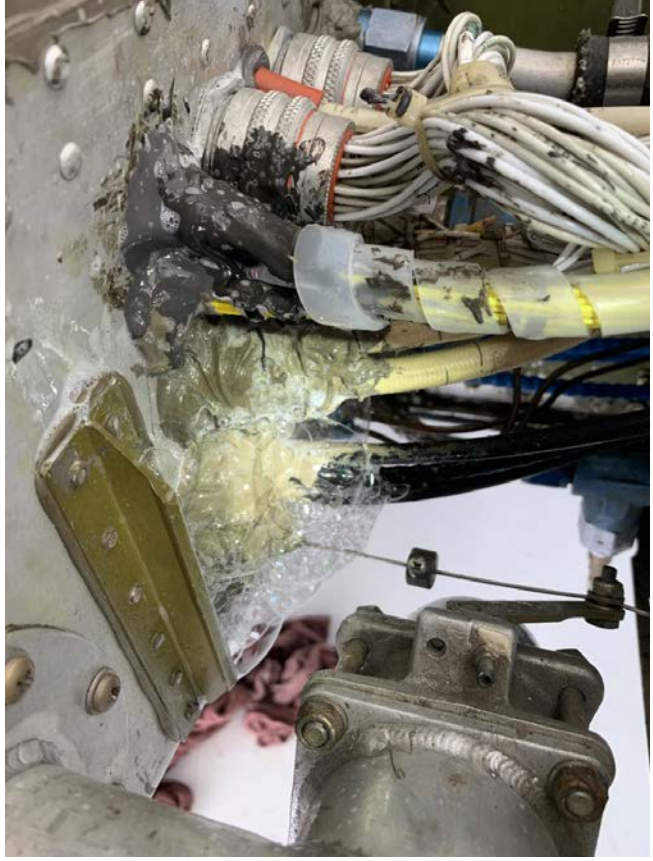
After crawling around the insides of the 340 for the past couple of weeks, I have also come to realize that the design of the pressurization system in these airplanes is really a half-baked affair compared to that in turbines. Some features leave you wondering, "What were they thinking?" For example, on the supply side, the pressurized air comes hot from the turbochargers, runs through an intercooler, then into the cabin. The hoses used to connect the parts and move the air are made up of a flexible material that appears to me like a sewer drain hose in an RV, with hose clamps and all…pretty flimsy stuff.

On further poking around you discover other things that seem wacky. The forward bulkhead for the cabin pressure vessel is just in front of the instrument panel, or immediately aft of the nose baggage compartment and nosewheel well. The bulkhead itself is a flat sheet of aluminum when intuition tells you it should be curved like the end of a propane bottle. But you rationalize that maybe a flat sheet is good enough given the requirement. Then you see there is a large square, flat inspection panel with 90-degree corners attached to the outside of the bulkhead wall, rather than the inside. This means that as pressure increases, the panel is pushed away from its attachments as opposed to into them. To compensate for this design, there are small bolts and nuts every inch or so all the way around it, held together with a substantial amount of ProSeal placed there by the mechanics chasing down leaks. Square corners focus stress on small areas, which is why all the windows and doors on pressurized airplanes have rounded corners. It almost leaves you wondering whether maybe the junior aeronautical engineers were assigned to designing the forward bulkhead while the senior ones worked on more visible designs such as doors and windows.

Design issues aside, just plain age causes another odd problem that can occur after a significant leak is fixed – and it can drive the mechanics nuts with frustration. What happens is, once they fix the cabin to pressurize up to a higher differential than it could before, inevitably, the new higher pressure differential blows out other leaks somewhere in hard to see or access areas. This requires more expensive chasing by the mechanics (most of whom know about this possibility and warn the pilot before any test flight).

In their pursuit of chasing down leaks, one solution the mechanics use to make the leaks more obvious is to "bomb" the airplane. This involves hooking up the outlet side of a vacuum cleaner to the inbound pressure source for the cabin and setting off a special smoke bomb. With all the doors and windows closed, they look for places smoke might be leaking out. Vacuum cleaners actually don't put out that much air, so the cabin pressure usually does not exceed much above 2.0 with this method, and often is not as revealing as was hoped.

The square panel in the forward pressure bulkhead (visible in the wheel well) that left me wondering "What were they thinking?" The black sealant is ProSeal.



Soapy water was sprayed on wiring bundles as the cabin was pressurized via a vacuum cleaner. The bubbles demonstrate leaks not adequately stopped with sealant.

In my airplane the problem started last year when the cabin failed to pressurize to more than a differential of 2.8 (whereas it should be about 4.0). But knowing it was a time-consuming problem to fix, we did not worry about it as long as it didn't need to fly very high. Besides, the mechanics said they would take care of it during the annual in June. They did indeed find a significant leak and fixed it. Once we crossed 4,500 feet during the first flight after, however, a loud sound of leaking air came from somewhere in front of the pilot's seat, and the cabin failed to pressurize much above 3.0. This required a return to the shop, where it was discovered that the boots surrounding the gear extension system were also dried out. Apparently, all it took for them to crack was a cabin to pressurize to 3.0. The boots were fixed and another test flight was made. This time the cabin pressure reached 3.2, but again a loud sound developed, appearing to come from forward of the cockpit. This turned out to be a leak in the heating system hoses.

While all of this work was going on, the airplane was essentially grounded except for test flights. Although I am routinely told flying piston twins without full pressurization is somewhat common in the industry (provided the altitude is kept below 12,000 feet), it still makes me feel a little ill at ease. Maybe this is because in the jets I fly (Learjets in particular), any failure of the cabin pressurization system is a grounding event. Of course, in pressurized piston twins, the airplane not only climbs much slower but also rarely gets to an altitude where a sudden depressurization event would be immediately catastrophic. For example, at FL220, an altitude common for pressurized piston twins, the useful period of consciousness should the pressurization system fail is about 10 minutes. Relatively speaking, there is a lot of time to do something about it. Whereas in a Lear at FL450, you lose consciousness in 10 to 15 seconds if the pressurization goes out. Maybe it is just conservatism that comes with increasing age, but I think despite this knowledge, my own routine use of the 340 will be limited until the failure to pressurize fully is fixed.

The mechanics are a skilled bunch, working assiduously and under pressure to get this airplane problem fixed by the time COVID-19 goes away. Hopefully, both will happen soon. T&T

Kevin Ware *is an ATP who also holds CFI, MEII and helicopter ratings, has more than 10,000 hours and is typed in several different business jets. He has been flying for a living on and off since he was 20, and currently works as a contract pilot for various corporations in the Seattle area. When not working as a pilot he is employed part time as an emergency and urgent care physician. He can be reached at* **kevin.ware2@aol.com**.

by **Kevin R. Dingman**

MAX Effort

Returning the Embattled B-737 MAX to Service

PHOTO COURTESY OF BOEING

Airlines have always been a cyclical industry. And despite assertions several years ago that they would "never lose money again," several unpredictable events resulted in a downturn that is causing a potentially E.L.E. (Extinction Level Event) among some part 121 carriers: The worldwide grounding of the B-737 MAX followed by a cataclysmic drop in load factors due to COVID-19.

These events precipitated massive airline furloughs, personal financial hardships, a huge drop in shareholder value, loss of scheduled air service to domestic and international destinations and collateral damage to related travel/leisure business and industry. Even if (this article was written in late September) another economic relief package arrives, airline employee protections will once again expire – this time in March. And it's anyone's guess if or when business and leisure travel will return to profitable levels post-COVID. The MAX, however, will be slowly returning from its exile as the world's recovery from COVID also slowly unfolds.

What Could *Possibly* Go Wrong!

Perhaps, similar to NASA's previous cultural, project management issues, several high visibility events at Boeing (B-737 MAX flight control and B-787 quality and "tool control") sent Boeing into an inverted flat spin. When engineers observed a tendency for the 737 MAX nose to pitch upward during a specific extreme maneuver, and after other efforts to fix the problem failed, the solution was a piece of software – the Maneuvering Characteristics Augmentation System (MCAS). MCAS adjusts the horizontal stabilizer trim to push the nose down when the aircraft is operating in manual flight, with flaps up, at an elevated AOA.

Boeing originally designed the MCAS as a simple solution with a narrow scope, then altered it late in development to expand its power. Engineers had allowed MCAS to trigger on the input of a single sensor instead of two, as considered in the original design. And pulling back on the control yoke would not override MCAS activation. Boeing calculated the probability of a "hazardous" MCAS malfunction to be very unlikely and that there would be little risk in a runaway MCAS "event" in part because they believed pilots would respond to an unexpected activation as they had been trained for years – with the runaway trim procedure.

What's A Mother (or Airline) To Do

In summary, the following steps had to be taken before any 737 MAX will be allowed to operate revenue flights:

- Installation/Verification of Flight Control Computer

(FCC) Operational Program Software (OPS)

Note: Boeing updated the FCC software to eliminate MCAS reliance on a single AOA sensor signal by using both AOA sensor inputs and changing flight control laws to safeguard against MCAS activation due to a failed or erroneous AOA sensor.

- Airplane Flight Manual (AFM) Revisions
- Minimum Equipment List (MEL) Provisions for Inoperative Flight Control System Functions
- Installation/Verification of MAX Display System (MDS) Software

  Note: Boeing has revised the AOA DISAGREE alert message implementation to achieve the original design intent to be standard on all 737 MAX aircraft.
- Horizontal Stabilizer Trim Wire Bundle Routing Change
- AOA Sensor System Test
- Operational Readiness Flight
- Pilot Ground School and Simulator Training

Returning Pilots to the MAX

As of the 6th of October, the following is a summarized list of pilot training requirements from a NPRM (Notice of Proposed Rule Making – emphasis added by this author):

Multiple flight deck alerts during non-normal conditions, Automatic landings, Enhanced Digital Flight Control System (EDFCS), 737 MAX flight control system: The Elevator Jam Landing Assist system and the Landing Attitude Modifier (LAM), MAX FCC/**MCAS ground training,** HUD, the 737 MAX gear handle. This training can occur in either a full flight simulator (FFS) or airplane. Flight training must ensure appropriate AFM limitations are addressed and complied with.

Stabilizer trim must emphasize the following throughout the airspeed range during manual and electric trim operations:

a) Manufacturer recommended procedures for the proper use of main electric and manual stabilizer trim during normal and non-normal conditions;

b) The different **manual trim** techniques recommended by the manufacturer; and

c) The effects of the **air loads** on the stabilizer and the resulting trim forces in both the nose-up and nose-down directions.

Electric and manual stabilizer trim operation during non-normal conditions training.

Runaway stabilizer. Training must emphasize runaway stabilizer recognition and timely pilot actions required by the Runaway Stabilizer NNC (Non-Normal Checklist). Demonstrate control column functionality and its effect on a runaway stabilizer condition. Emphasize the need to trim out forces on the column **prior to selecting STAB TRIM cutout.** Training must include scenario-based training where a single malfunction results in multiple flight deck alerts that require **timely pilot action** to include recognition and interpretation of the non-normal condition and prioritization of the required pilot actions.

Lord Forgive Me and Knock on Wood

My final "R-9" recurrent training this past September was accomplished in one of my carrier's MAX sims and in one of CAE's, both in DFW. Prior to this training event, I had never been in the cockpit of the MAX aircraft or simulator. We accomplished all of the traditional dial-a-disaster events – most at night, some in ice, strong winds, low visibility and many with system malfunctions or failures. And I've struggled with a way to describe the MAX runaway trim and MCAS scenarios, checklist procedure and aircraft recovery process to our T&T readers without disparaging the reactions, or slow reactions, of the crews' that resulted in two fatal crashes.

For over 45 years, I have experienced or trained in GA, fighters and airliners for approach to a stall, full stalls, spins, flight control malfunctions (like split flaps and rudder hard-overs), low altitude wind shear and high-altitude unusual attitude recoveries and deep stalls in the F-16. And Lord forgive

me for saying, and knock on wood, but of all the aircraft-control training events, the B-737 MAX MCAS failure mode is benign. It's a relatively subtle event, which could make it difficult to recognize in the first three to five seconds, but it progresses slowly, is simple to control once recognized, and the checklist procedure is effective. I will acknowledge, however, if recognized late or the checklist procedure is delayed, executed improperly or out of order, the aircraft can become extremely (I say again, extremely) difficult to handle, even for two pilots.

Return to Service Schedule

Boeing expects a return to service date in the fourth quarter of 2020. Once the aircraft is recertified, the plane maker is planning to deliver its 400-plus stored 737 MAX aircraft within a year. It's estimated that total 737 MAX deliveries for the 2020 to 2023 period will be at least 1,700 aircraft lower than expected at the beginning of 2019. This is a reduction of about 50 percent as compared to previous expectations due to the grounding and the pandemic's effect on the global airline industry as well as world economies. Carriers will bring already-delivered aircraft on-line in the early months of 2021.

Despite the news that my carrier is delaying pilot training in the MAX, they have begun the FAA mandated process of re-training crews via e-mails, crew bulletins and using MAX simulators for recurrent training. They are also scheduling our 1,700 or so B-737 pilots for an extra two-day

MAX-specific training event consisting of several hours of ground school and a two-hour simulator session. This training event, originally scheduled to start in November, will now occur over December, January and February. Currently, my carrier will use the one MAX sim it owns and several from CAE in order to complete this training. The jet is expected to appear on our February 2021 schedule for revenue service.

> "I do not think that there is any other quality so essential to success of any kind as the quality of perseverance. It overcomes almost everything, even nature."
>
> – John D. Rockefeller

Airlines and airplane manufacturers, hotels, the leisure industry, restaurants, bars, gyms, hair salons, schools, municipalities, theme parks and a myriad of both related and unrelated businesses are all suffering. Perhaps the return of the MAX and a vaccine for COVID, both potentially occurring in Q1 of 2021, will be the impetus to give us the hope to persevere in order to overcome and recover from everything, even nature. Mr. Rockefeller thought so. 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**.

Owner's Corner

A section dedicated to the writings and ownership stories of T&T readers.

Cheyenne IIXL:
Up Close and Personal

by **Jeffrey Brausch, Owner-Pilot**

In June 1999, I purchased a 1981 Piper Cheyenne IIXL (N200XL) with freshly overhauled engines, new paint and interior, no damage history and 3,610 hours total time. Not having any turbine experience, my previous aircraft was a Piper Malibu, I headed off to SIMCOM for initial training and simulator work while my Cheyenne went in for a major avionics upgrade. The aging King Gold Crown units were removed and replaced with the latest avionics, including a two-tube EFIS system, dual Garmin 430s, an MFD, Stormscope, Skywatch, upgraded radar, enhanced ground proximity, backup power supplies and more. With N200XL now ready to go, I finished my in-flight training, the insurance company said "good to go," and I began my 21-year and 3,000-plus hour, single-pilot relationship with N200XL.

Load – Range – Comfort

I came to fully appreciate the aircraft's capabilities and nuances as the range of flights expanded from domestic destinations generally under 800 miles to more ambitious trips to Northern Canada and the Arctic Circle, Greenland, Iceland, Central America and the Caribbean.

Cheyenne IIXL aircraft are known for their load-carrying ability. The basic empty weight of N200XL when purchased was 5,850 lbs, which provided a useful load of 3,690 lbs at the maximum ramp weight of 9,540 lbs. With full fuel of 2,506 lbs, the payload available for people and baggage was 1,184 lbs. Assuming six 170-pound adults on board and full fuel, 164 lbs remain available for baggage. The forward baggage compartment holds 300 lbs and the rear 200 lbs. Using Piper's weight and balance visual plotter typically shows a center of gravity near the middle of the envelope. The average number of passengers in my history of flights is not five but two or three. Using my real-world scenario, I can always fill the tanks without having to leave baggage behind and still be well under the maximum takeoff weight of 9,474 lbs.

The Cheyenne IIXL is not your aircraft if you regularly require nonstop flights of 1,000 nm or more. Yes, I have flown trips of 1,100 miles at FL270 with 35-knot tailwinds, good weather at the destination, and landed with over an hour of reserve fuel. But that isn't my usual flight profile. In fact, it's a rarity. On the other hand, I can always count on completing 800 nm flights with 35-knot or less headwinds and good destination weather. When the destination forecast is for poor weather, and there is a reasonable likelihood of going to an alternate, the conservative flight planning range is often reduced to about 600 nm.

Comfort, of course, is highly subjective, but based on many passengers comments and my time in N200XL, this is one comfortable ride. A spacious, quiet, vibration-free interior, with ample headroom, exceptionally large windows, well-designed seats, and a roomy, well-organized flight deck all contribute to a pleasurable experience. The aircraft's air cycle environmental system is an improvement over earlier Cheyenne I and II models. Even on the ground with engines

at idle power, the cabin is cool in hot weather and warm in cold. With a 5.5 pressurization differential, the cabin altitude is 3,800 feet and 8,000 feet at FL180 and FL250, respectively. A high wing loading of 41 lbs/sq. ft. smooths the ride in turbulence.

Power & Performance

The Cheyenne IIXL aircraft is powered by two Pratt & Whitney PT6A-135 750 shaft horsepower engines flat rated at 620 horsepower with a TBO of 3,600 hours. Power management is definitely old school in that the pilot is responsible for managing the start, operation and shutdown of the engines – there are no modern "push-to-start," "set-to-detent," or "exceedance avoidance" automation systems in this genre of turboprops.

During takeoff, I set torque at 1,600 lbs and watch it increase toward the 1,714-pound limit as airspeed builds and drives ram air into the engine intakes. The takeoff, climb, and cruise performance of the Cheyenne IIXL is very respectable with a power loading of 7.6 lbs/shp. At MTOW, the takeoff roll and distance to clear a 50-foot obstacle are 2,100 feet and 3,100 feet, respectively – assuming sea level, no wind and 68 degrees Fahrenheit. The multi-engine climb rate is 1,700 fpm. In the event of a failed engine, the climb rate is 460 fpm (640 fpm at midweight). Of course, at lighter weights, all of the performance figures improve significantly. I prefer a minimum runway length of 4,000 feet but 3,500 works fine, although obviously with less safety margins.

I typically operate N200XL between cruising altitudes of FL180 and FL250 as that seems to be the sweet spot. Using FL200, true airspeed averages 264 KTS at maximum cruise power, maximum weight, and ISA+10°C. Hourly fuel consumption is 544 pph (81 gallons). Reduce the power to maximum range and the numbers are 200 KTS and 356 pph (53 gallons). At midweight, I often see 270 KTS between FL180 and FL200. The single-engine drift down altitudes at maximum and midweight are usually between 15,000 feet and 18,000 feet, respectively. Good comfort in mountainous terrain or staying above icing conditions below.

Flying Qualities

This is also a subjective area, but in my opinion, the flying qualities of the Cheyenne IIXL are truly superb. From stick and rudder hand flying to flight director commanded autopilot control, the aircraft flies beautifully. The flight controls are responsive and neither too light nor heavy for this class of aircraft. Pitch control is rock solid and without oscillation or noticeable lightening of forces anywhere within the weight and balance envelope.

With its additional two feet of length ahead of the wing spar, the Cheyenne IIXL has none of the pitch issues of the earlier, short-bodied Cheyenne models that require a stability augmentation system. Turns are easily coordinated, and steep turns are a joy. Hand flying tight patterns into uncontrolled, smaller airports (including turf and gravel surfaces) can be accomplished safely and is fun. Based in northern Ohio, N200XL has seen its share of Great Lakes icing conditions and strong winter winds. Neither of these

Aging King Gold Crown units were replaced with the latest avionics, including a two-tube EFIS system, dual Garmin 430s, an MFD, Stormscope, Skywatch, upgraded radar, enhanced ground proximity, backup power supplies and more.

adverse conditions has been a problem. The anti- and deicing systems are very capable and, simply put, this is a great airplane in high and gusty winds.

SOPs & Instrument Approaches

It is well recognized that risks are reduced and the safety of flight is enhanced when standard operating procedures are followed. Nowhere is this more important than during instrument approaches. I have found the following SOPs work well in the Cheyenne IIXL.

Transitioning from en route cruise to the approach environment, a power setting between 500 and 700 lbs of torque yields a descent rate between 1,000 and 1,500 fpm. This keeps the airspeed well below maximum operating speed, provides a shallow deck angle for passenger comfort, and acknowledges the possibility of turbulence below. All very comfortable.

For most instrument approaches, I'll target 140 KTS with flaps 15 degrees a couple of miles outside the FAF. If air traffic control needs more speed, it's easy to comply given the Cheyenne's 15-degree maximum flap speed of 181 KTS. The gear goes down (153 KTS max) upon glideslope interception and props to 1900 rpm. At controlled fields, I'll fly a stabilized approach at 140 KTS until going visual and then extend full flaps and slow to 105 KTS over the threshold. For shorter runways, I'll normally fly the final approach at 130 KTS. Smooth and small power changes keep the approach stabilized and avoids induced pitch porpoising on short final.

A note of caution: With only the front seats occupied, the C.G. is near the forward limit. I think it is good practice to flare with firm elevator control rather than setting extreme aft trim. This prevents an out-of-trim condition and resulting sharp pitch up should a go-around or missed approach be required. At midweight, the landing ground roll is less than 1,200 feet with reverse thrust and heavy braking.

Without reverse thrust and using only normal braking, it's about 1,700 feet.

Maintenance & Refurbishment

Because of the complexity of turboprops and the sophistication of their structures, powerplants and systems, it makes sense to have these aircraft cared for by maintenance facilities with extensive experience and deep knowledge in specific aircraft. This is particularly true for the Cheyenne series of aircraft given their age and years out of production. They are well-engineered, capable, strong, generally free of corrosion, and have many years of useful life if cared for by maintainers familiar with this series of turboprops. One such facility, Friend AirCare (formerly Cheyenne Air Service) located on Washington County Airport, PA (KAFJ), has maintained N200XL since my purchase of the aircraft 21 years ago. Their knowledge and experience base, quality of work, schedule adherence, parts inventory, on-going support, and commitment to professionalism have been truly outstanding.

Like many other older but well-regarded twin-engine turboprops manufactured by Beech, Cessna, Piper, Aero Commander, and others, the Cheyenne IIXL can be purchased at a fraction of the cost of a new or late model turboprop, twin or single. In effect, this substantial cost savings provides a generous budget for the extensive refurbishing of a well-maintained aircraft with mid-time airframe and engines. Available STC upgrades for the Cheyenne IIXL include the latest glass panel/avionics, more efficient ram air engine cowlings, four-bladed propellers, new engine instrumentation, the latest PT6-135-A engines, LED lighting systems and more. Complete the process with super soundproofing, custom-designed new paint and interior, and you have an excellent aircraft with even better than new capabilities and safety margins. And, still, a lot of savings left over to buy Jet-A and cover other operating costs for years to come. Worth a look.

Harmony

To my way of thinking, the Cheyenne IIXL is well suited as an entry-level turboprop capable of satisfying a wide range of missions. By entry-level, I mean an aircraft without undesirable characteristics that raise the risk level for a new turbine pilot. This has little to do with the usual way we measure aircraft, such as speed, range and payload – to all of which the Cheyenne IIXL measures up strongly. Simply stated, this aircraft does not have any bad habits that will catch the well-trained transition pilot by surprise. Indeed, as pilot and airplane build time together, so will confidence, respect and learning. As new challenges and encounters present themselves, the depth of character of the Cheyenne IIXL will be revealed. That's the nature of experience. Eventually, a true harmony between airplane and pilot will develop and grow. It's at this level when flight becomes most comfortable and rewarding – and safest. The Cheyenne IIXL offers that opportunity. T&T

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The Fund an Angel Virtual Auction raised significant funds in support of Corporate Angel Network (CAN). Proceeds from the event will ensure CAN is able to continue helping cancer patients, like Scarlett, in critical need during the pandemic and long after. Thank you to all who generously contributed.

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To learn more about Corporate Angel Network and future events, visit corpangelnetwork.org.

by **David Miller**

Strategery

Many people think former President George W. Bush coined this word. In fact, it was first used by comedian Will Ferrell during a Saturday Night Live episode and later used by the President in jest. I thought about the word early on a June morning as I prepared to be strategic for a return flight from Panama City, FL (KECP) to Dallas (KDAL).

The first picture greeted my alarm and showed a growing mass of thunderstorms north of New Orleans. It was moving northeast, right over my intended flight path. SIGMETS were issued to get my attention.

I roused the group at 6 a.m., fifteen minutes earlier than planned.

The departure forecast for ECP was good with scattered offshore thunderstorms building through the area after our scheduled 8 a.m. launch.

"No, we don't have time to stop for breakfast today, just eat the muffins and fruit on the countertop," I urged the family.

We arrived at the airport on time and loaded the bags. I had noticed an intermittent right fuel gauge on the trip down, but as I turned on the battery for this flight, it indicated only slightly less than the left tank. Just to be sure of its contents, I asked the line guy to open the fuel cap so we could see for sure. "I don't see any fuel," came his reply. It took 20 gallons to fill it as did the left side.

That extra 40 gallons would give me some peace of mind if I had to do some extensive detouring along the way home.

Once airborne, the challenge began. As shown in the second picture, the weather had indeed moved directly over my route. That's where the great features of the G1000 and ForeFlight came into play. Individual cells were indicating tops of FL340 with lightning.

"Jax center, three nine six delta mike would like direct Meridian for weather," I said. "Cleared direct Meridian and deviations left or right approved. Advise when direct Dallas Love," came the answer.

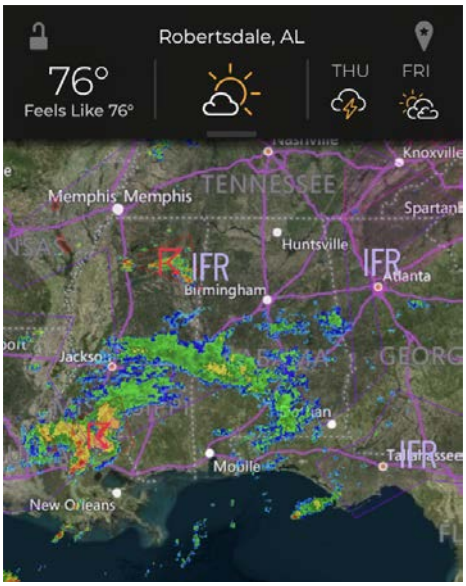
At FL240 in cloud, I had a true airspeed of 260 knots, burning 237 pounds per side. For possible icing, I had everything warmed up: engine inlet, windshield heat, and prop heat along with the standard items. I took a 20 degree right turn to keep things smooth. We never accumulated any ice, and even the passengers remained asleep.

"Atlanta center, Southwest one needs twenty left to avoid a cell over Meridian." "That's approved Southwest one and direct ECP when able," came the immediate reply.

For the next 100 miles or so, we were enveloped in clouds. This from a system that had dumped over five inches of rain in Dallas the day before. I reflected on how many flights I made 40 years ago, where my only weather information was from listening to a flight service guy or lady on a crowded frequency. Or perhaps asking another pilot what the ride was like on 123.45.

We've come a long way, baby.

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**.

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