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The Aviation Consumer

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ICON FLIGHT CENTERS: FLY BEFORE YOU BUY

Unless you own a seaplane, the buzzkill after earning the seaplane rating comes when you try to rent one, or at least it was for me. With the ink still wet on the certificate and my chest puffed with confidence, I was ready to ditch the shirt and go splashing in the central Florida lakes, but couldn't go solo because Brown's Seaplane Base in Winterhaven, Florida, doesn't rent its training fleet. I totally get it; Brown's fleet of J3 floatplanes are too valuable to day-to-day cash flow to risk getting crunched and grounded, plus the insurance is off-the-charts expensive. If Michigan is a destination, Northwoods Aviation in Cadillac might let you rent its SuperCub on floats (skis, in the winter) after 10 hours of type experience and a signoff. Bring your own seaplane insurance—it isn't included.

Faced with such dilemmas, the attention getter was Icon Aircraft's recent announcement that it will rent a growing fleet (16 currently) of A5 S-LSA amphibs at Icon flight centers in Tampa, Florida, Vacaville, California, and soon a location in Texas.

Consider that less than a year ago, Icon announced delivery/production delays and production-worker layoffs shortly after the A5 earned certification. But making the aircraft accessible to delivery position holders, potential buyers and just about anyone else who wants to fly them seems a good test of the waters, while maintaining exposure. Recall Icon's early vision of capturing a new market segment—particularly non-pilots who are active in power and other adventure sports. Icon's spinoff business is a lot of things. It's a dues-collecting flying club, a place to get a seaplane rating and rent one of the most modern and controversial seaplanes at market. It's also a means for deposit-paying A5 future owners to get flying hands on the investment money.

Can't afford to buy an A5? You can still experience the aircraft by biting off as much as you can afford. You can earn the LSA seaplane rating, complete a checkout for rental or simply fly with an instructor. Icon isn't apologetic for the cost structure. The SFI (sport flying introduction) includes one 1.5-hour flight for $595. The ISS (initial sport solo) is $300 for the airplane, $95 per hour for the instructor, $400 for ground school and $299 for books and materials. Icon estimates a beginner pilot could require 10 hours of dual instruction before soloing.

The SPL (sport pilot license) includes endorsement for LSA-ASES. That could take 27 hours total and roughly $12,000. Already have a seaplane rating? You can transition to the A5 in an estimated 4.5 hours, plus a checkride. Doing the math, that might cost $2200, including ground school. Deposit holders pay $50 monthly dues, which covers A5 renter's insurance, $250 per hour for the aircraft and can schedule the A5 up to 45 days in advance. Non-position holders pay a $500 initiation fee, $50 dues for insurance coverage, $300 per hour for the aircraft and can schedule the rental up to 30 days in advance.

For as action-packed and glamorous as flying an A5 seaplane may seem to aviation outsiders, insiders understand the risk—seaplane flying is edgy stuff. Since Icon president Kirk Hawkins and several other staff members are former military pilots, the company takes a military-type approach to training. Hawkins faces the risk reality head-on. He learned a lot by taking some of the better training that's offered in other high-risk activities. This includes the Keith Code California Superbike school, Skip Barber racing school and aerobatic courses taught by winning air racers, to name a few. Can Icon make a successful business case for offering up the A5 in a training and rental environment? I believe it already has.

Hawkins made it clear that while its main focus is producing and selling aircraft, Icon recognizes the normal recreational consumer behavior of trying before buying. He's also well aware of the high dropout rate in the dismal training market and says he knows how to fix it. According to him, "The consumer has never really been given an appropriate offering around aviation that is safe, easy, fun and relatively affordable. The Icon flight center is our thesis."—*Larry Anglisano*

MORE ON FERRY PERMITS

The November 2016 article in *Aviation Consumer* on ferry permits was right on! In my 44 years working in the engine business, I dealt with numerous different FSDOs and GADOs. Each had its own set of rules governing ferry permits, and within each office there were different interpretations of the rules, depending on the inspector.

Early on, it was simple and few if any questions were asked. But, some offices would not issue permits, while others would. It becomes a big deal not being able to ferry if the aircraft is stuck out in the boondocks away from practical maintenance. The most recent and biggest headache came a few years ago when the Miami, Florida, FSDO changed the jurisdiction for the Bahamas to an international office. For a while, it stopped issuing permits to move the aircraft out of the Bahamas.

As for flying the aircraft after a prop strike, in my involvement with somewhere north of 1000 prop strikes, I recall only one failure 21 hours after the strike. One Cessna 185 came close to losing the prop 14 hours after the prop strike.

A Beech Baron that had a brake failure and ran off the runway and onto the beach on St. Barths Island. The pilot beat the props with a hammer thinking he was going to straighten the tips that were bent 90 degrees. I cut about 3.5 inches off the three tips, dressed them out and painted the tips, but the French government wouldn't let it fly without a ferry permit.

A local pilot going to San Juan, Puerto Rico, took my handwritten note describing the repair and its authorities gave us a ferry permit to fly from St. Barths to Sensenich Propeller Service in Lancaster, Pennsylvania. I watched the departure with crossed fingers. The pilot said it was perfectly smooth, but he had to reduce manifold on one engine by 2 inches to keep it flying straight.

Charlie Melot
via email

Charlie Melot has seen it all while running Zephyr Aircraft Engines in Zephyrhills, Florida. He recently sold the business to a longtime employee and says the operation will continue just as it has for the last 44 years.

NAVWORX ADS-B

I read with interest your report on the NavWorx ADS-B AD in the January 2017 issue because I have a system I planned to install in my Van's RV kit. Does the FAA enforcement have jurisdiction over experimentals?

Peter Livingston
via email

That's a good point that was just filed via official comments to the FAA by both AOPA and EAA. Aside from asking the FAA to provide more information about the ADS-B system's reported deficiencies, the groups also question why the AD applies to units installed in both certified and experimental aircraft.

Logically, it's argued that an airworthiness directive is not appropriate for a part that was never intended for installation in a type-certificated aircraft. EAA asked the FAA to withdraw the AD for the ADS600-EXP (the system you likely have for your RV) and communicate safety concerns through non-regulatory special airworthiness information bulletins (SAIBs) or safety alerts for operators (SAFOs), which is the usual procedure.

We'll keep reporting on the issue, which takes a new twist every few weeks.

TERRESTRIAL RADIOS

Do you guys know if anyone makes an AM/FM stereo radio that is approved for installation in certified aircraft? I can't seem to find any.

Jeff Faught
Bismarck, North Dakota

There are two models that we know of. There is the Avionics Innovations AICD-III, which has an AM/FM stereo tuner, a CD/MP3/WMA player, digital tuning and display, plus it can connect to a SiriusXM satellite receiver.

It weighs 3.5 pounds, operates on 11 to 33 volts DC and is FAA and PMA approved. You can find a used system for roughly $900 or less.

If you want an old-school radio—complete with analog mechanical tuning and a cassette deck—we spotted an Avionics West EC-100 on eBay for $50. Rock on.

BUDGET EFIS DEAL BREAKER

I enjoyed your thorough review of the Dynon D10A and Garmin G5 low-cost EFIS displays in the January 2017 issue of *Aviation Consumer.* It sounds like we're finally seeing progress on FAA regulation reform that should have come years ago. But, are we really there yet? As you pointed out in the article, you still need to retain backup instruments, plus they won't drive an autopilot.

I was ready to go with the Garmin G5 for my Mooney, but it would mean keeping my ancient KI256 flight director gyro to drive the KFC150 autopilot. That's a huge limitation and deal breaker for me—as I suspect it will be for others, too.

Gregory R. Mathews
via email

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Garmin G1000 NXi: Faster, Brighter

The latest-gen G1000 NXi gets a faster processor, brighter screens and wireless connectivity, but no touchscreen.

by: Larry Anglisano

In avionics life, 13 years is an impressive production run. That's roughly the time Garmin's G1000 has spent at the top of the integrated avionics market. While Garmin has been making incremental upgrades to the system—some major and some minor—it says the latest update, the G1000 NXi, is the most major one to date.

AVIONICS FLIGHT TEST

To see just what the next-generation G1000 NXi brings to the table, we went flying with the system in Garmin's King Air 350, where it will replace the current G1000 for future King Air retrofits. The G1000 NXi could be the new standard for OEM equipage in a wide variety of airframes. Cirrus has already adopted the system, calling it the Perspective+ .

EVOLUTION ONLY

Before diving into the next-gen G1000 NXi, it's worth reviewing the G1000's evolution because the NXi isn't revolutionary. When the screens are dark, it's practically identical to the older system, save for the modern corporate logo on the bezel. How that will resonate with buyers and OEMs expecting a total facelift of the G1000 remains to be seen. On the other hand, if the system is reliable and capable—and in our view the G1000 certainly is—why change it?

In an interview conducted last year, we asked Garmin why it hasn't made design changes to the aging hardware as it did with the GTN-series touch navigators. Garmin said the G1000 to this day continues to serve its original intentions: to offer a weight-saving, high-tech, integrated glass cockpit that rescues a market long stuck in the age of steam gauges. Well, that might have been the market then, but that's not exactly today's standard. A recent change in regulation has opened the floodgates for low-cost electronic flight instruments—including Garmin's own certified G5 EFIS—which we think will ultimately pull the plug on iron gyros.

While the GAMA aircraft sales reports continued to show declining new sales of turboprops and jets (yes, pistons, too), the aging iron-gyro-equipped turboprop and light jet refurb market seems brisk—perhaps even lucrative.

Garmin has enjoyed sizable success in that market with its G1000 King Air retrofit program for the 90/200/300/350-series King Airs. As of late 2016, Garmin distributor and service center Elliott Aviation has installed over 450 G1000 systems—more G1000 King Air retrofits than all other dealers in the world combined. It has the process down, proven by its 15-day and $3000 penalty per-day downtime guarantee. In many older King Airs, the project yields a 250-pound weight savings. This includes the new GFC700 flight control system, which Garmin released in 2005.

Back then, the GFC700 integrated autopilot was initially certified on the Beech Bonanza and eventually on all platforms. It is since been updated with stability control, plus envelope protection, and is a major subsystem in the G1000 NXi, capable of coupled go-arounds and automatic emergency descent.

We're awed at the precision with which the GFC700 flies—on all ends of the airframe spectrum. It's no easy task to make an autopilot fly just as well in a Skyhawk as it does in a beefy 350 King Air. The G1000 NXi retrofit includes complete removal of the old autopilot system and many trash bins of old wiring. Got an old King Air with the primitive AC inverter system? That all comes out, simplifying the electrical bus and overall reliability.

Depending on the aircraft, the

In the King Air, the G1000 NXi is a three-screen suite, with a 15-inch MFD and dual 10-inch PFDs, lead photo.

user input for the autopilot is either on the PFD or on a dedicated GFC700 control panel. In the King Air retrofit, the panel is placed up near the center of the glareshield so both pilots can reach it. There is also a keypad/joystick FMS panel. In the King Air, it's in the deep center pedestal—not the best location, in our view—because fingering it does result in some heads-down time. We spotted a better location just forward of the throttles and under the MFD, but the space is occupied by a modern annunciator panel for CAS alerting. While this isn't a Garmin component, it further modernizes the panel.

Somewhere around 2007, the system got weather radar capability and TAWS-B terrain alerting, electronic charts, Garmin's SafeTaxi and WAAS GPS. The new NXi supports Garmin's solid-state GWX70 Doppler-capable weather radar, which also has turbulence detection and ground clutter suppression. Garmin's GWX radar technology, which started with the GWX68, has put Garmin at the top of the weather radar market, but we thought the presentation could be tweaked and on the G1000 NXi it has.

On big-airplane interfaces from Collins and Honeywell, to name two, the weather radar imagery is overlaid where you want it to be when shooting approaches—on the PFD. This function is finally available on the G1000 NXi PFD as a configurable weather source on the new HSI Map feature. More on that in a minute.

Garmin's ESV (3D synthetic vision) and a 1090ES extended squitter ADS-B transponder came in 2008. Oddly, ESV is optional on the G1000 NXi, enabled through an electronic unlock process. Garmin sells the option as part of upgrade bundle packages. New pricing hasn't been set yet, but by itself, ESV software is priced at nearly $5000 on the older G1000. Standard is Garmin's electronic charting or optional Jeppesen data; both have georeferencing, as do the new VFR sectional and enroute charts.

TCAS and TAS active traffic alerting came to the G1000 in 2011, but the G1000 seemed to be at an ADS-B In roadblock. A thorny issue for G1000 owners has been the system's inability to display ADS-B weather and traffic, but that's solved in the G1000 NXi (and in many legacy systems) with the GTX345R ADS-B In/Out transponder. Additionally, the weather and traffic can be streamed (via Bluetooth) to tablet computers running the Garmin Pilot app for iOS and Android devices, wireless-equipped Garmin portable GPS systems and the ForeFlight Mobile app for iOS devices. This is accomplished with the Flight Stream 510 MMC-driven wireless module, which also acts a database concierge utility for updating the system's navigation data, plus two-way tablet/panel flight plan transferring. With a single Flight Stream database stream, the G1000 NXi will synchronize the data between all of the displays in the suite, and database uploads can be done inflight—a time-saving convenience.

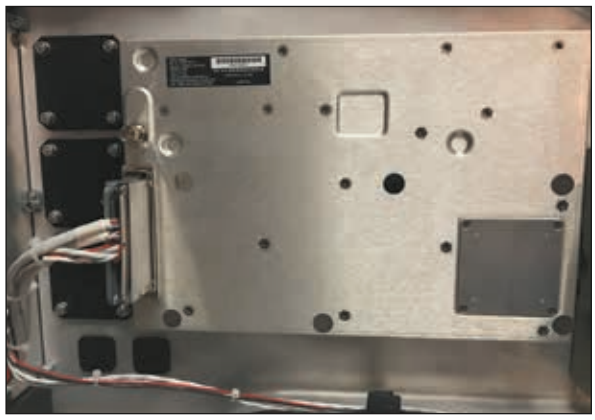
MORE HORSEPOWER, BETTER DISPLAYS

The major change in the G1000 NXi is the processing power. Switching from a single to a dual-core proces

CHECKLIST

- ⊕ Dual core processor and more memory gives the system a much needed performance boost.
- ⊕ Embedded GFC700 autopilot is a flawless performer.
- ~ In a world where touchscreen is the modern standard, it still doesn't exist in the G1000 NXi.

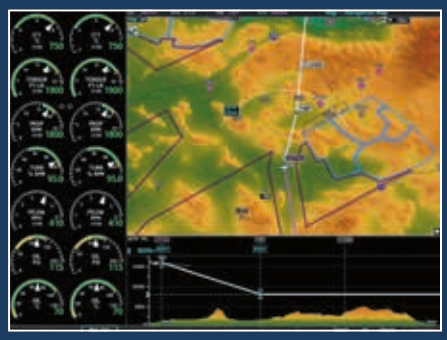
The GFC700 flight control system, top, is a major subsystem in the G1000 NXi. The optional SurfaceWatch software monitors the runway you are setting up for and displays it on the PFD, middle. Upgrading to the G1000 NXi requires a display swap, which is easy enough to accomplish in a day or less, thanks to plug-and-play drop-in.



G1000 NXi FEATURES AT A GLANCE

The NXi's displays are substantially brighter than the older G1000 thanks to LED backlighting. The font is heavier and more crisp, while text boxes have modern rounded borders.

The HSI Map is a thumbnail topo map display at the bottom of the PFD. You can configure it for a traditional EHSI or magenta course line, plus overlay ship's radar, SXM and FIS-B weather, traffic and terrain.



The electronic engine gauges are easier to read thanks to bolder graphics. When an approach is loaded, the VSD (vertical situation display) on the MFD draws a pictorial glideslope relative to the terrain and your location.

A text box under the comm radio frequency display shows the facility name associated with the tuned channel—no more forgetting who you're talking to.

The G1000 NXi gets Wi-Fi and Bluetooth wireless capability with the Flight Stream 510 MMC card. Upload databases from the tablet (inflight and on ground) with Wi-Fi and push flight plans to and from the system with Bluetooth.

sor makes the system zip along at nearly twice the speed of the old one. This is obvious a few seconds after you switch on the power. In the old G1000, you wait what seems to be an eternity for the boot cycle to complete before you can access frequencies, listen to the ATIS, enter flight plans and all the other stuff you want to do quickly. We counted less than 10 seconds for the NXi to come alive and be ready for user inputs.

The other benefit of the newer processor is map performance. You won't have to wait for slow redraws and map refreshes, especially when you pan out long distances. And moving around the map is made much easier with a redesigned cursor-control (CCD) joystick. The action on the old joystick system has 90-degree positions, but the new one is responsive throughout 360 degrees of travel. This speeds data entry and makes it easier to pan the map. We think the new joystick just feels less awkward than the old CCD.

The massive 15-inch MFD that's standard in the King Air retrofit dwarfs the two 10-inch PFDs and it's notably brighter and more crisp than the old system. In lesser aircraft, the G1000 NXi will have dual screens and some OEMs might offer 10-inch and 12-inch versions. In general, it's uncommon for buyers to settle for the smaller displays when given the option, but that could change with the G1000 NXi because the screens are much brighter, thanks to LED backlighting. Garmin also modernized the overall appearance, albeit in a subtle way. The electronic engine gauges are easier to read because they are bolder, plus the various onscreen text boxes are easier on the eyes, thanks to rounded borders.

We especially like the redesigned softkey labels. On the older G1000, activated softkey functions used a grey background, which wasn't exactly intuitive, in our view. Now their status is better represented with text that's annunciated in green when a function is active, rather than grey.

Speaking of colors, the MFD and PFD get three-color terrain shadowing, using green, yellow and red contouring to advise how high the aircraft is above the terrain. Green is 2000 feet, yellow is 1000 feet and red is 100 feet AGL in relation to the terrain. That seems more standard.

There is also a new vertical situation display (VSD) on the MFD, which is a customized terrain profile pictorial based on the active flight plan and current winds. As the aircraft cruises along, the terrain below it is depicted in a vertical profile view.

SURFACE WATCH, CONFIGURABLE HSI

Garmin's terminal safety software technology originated with SafeTaxi, which is a suite of georeferenced surface charts that display runways, taxiways, FBOs and hangars relative to the aircraft's location on the field. Hot spots identifying confusing or complex taxiway and runway intersections, as well as hold short lines, are overlaid on the MFD. This isn't anything new. But the optional SurfaceWatch software takes awareness to a higher level because it creates a backstop against runway and taxiway incursions. It's also a safeguard against taking off on a runway that's too short, or taking off or landing on the wrong one altogether.

Arming the feature is accomplished by entering the departing runway while building a flight plan or setting a departure procedure. The system also references the data entered for takeoff and landing performance. In our demo staged out of Bradley International Airport in Connecticut, we set Runway 33 as the departure runway—more than enough pavement to launch the King Air.

But in the event we lined up on a different runway—or one that was too short for our entered performance profile—the system would annunciate a "check runway" or "runway too short" aural alert and visual message on the PFD. SurfaceWatch comes alive as soon as you roll out of the chocks, advising which taxiway you're on.

SurfaceWatch also works in the background during the takeoff (and landing) roll and displays the runway distance remaining as you haul along. It even monitors your final approach to the runway and advises which one you're lining up to. Of course, you'll need to enter the correct data to begin with, but we think the feature can be an effective tool for avoiding overruns. Even if you don't enter the takeoff and landing performance parameters (you wouldn't in smaller aircraft, but in jets and turboprops it's a way of life), you can still manually enter the minimum runway length you can accept and SurfaceWatch will keep tabs on your position.

The new HSI Map function on the PFD transforms the traditional electronic HSI presentation into a pictorial of what you might see on the big MFD. To be honest, initially we weren't feeling its useful utility, but warmed to it once we went flying.

If you're a pilot who likes a decluttered display, or are easily overwhelmed by onscreen data, the HSI Map feature might take some getting used to. On the other hand, it's easily and quickly decluttered—or turned off completely—with "map options" softkeys dedicated to the inlay's setup.

For example, if you're flying an ILS or LPV approach, you might want to display a traditional and familiar electronic HSI, which is a clean and straightforward presentation. But, you can also overlay a lot of data. This includes traffic targets from the ADS-B system or from an active TAS/TCAS, plus ADS-B FIS-B Nexrad and METAR

That's the 15-inch MFD that's used in King Air retrofits, top photo. We were pleased with the increased speed of map panning and redraws on the G1000 NXi. In place of a touch interface, the G1000 NXi uses a keypad with a redesigned joystick for cursor control and navigating the screen, middle. We half expected to see the touchscreen FMS controller like the ones used in the G3000, bottom, but Garmin said it's being sensitive to price.

YouTube See our video of the G1000 NXi at http://tinyurl.com/j95ht2a

VISUAL APPROACH GUIDANCE

Garmin says one of the most requested features by professional flight crews is GPS guidance for shooting visual approaches. Whether for avoiding an embarrassing setup (or worse, a landing) to the wrong airfield, or for backstop when flying published VFR procedures, we think the visual approach guidance is perhaps the NXi's most useful new utility.

From the NXi's database, you load a visual approach procedure just as you would any instrument procedure. Once activated, the PFD shows lateral and vertical deviation, plus flight director command bar cues. And, of course, the visual guidance couples to the GFC700 autopilot, where it flies it to the threshold. How does the system compute it?

The VFR guidance you're flying is an extended centerline from the runway you're landing on. That's nothing new; the feature has been in portable GPS systems for years. But you're also flying FMS VNAV guidance, which on a published visual approach ultimately dumps you into a 3-degree path and on the VASI. You have the option of loading a Straight or Vectored procedure. Again, just like an instrument approach. The Straight transition creates an initial approach waypoint that's automatically inserted into an active flight plan. The Vectors option is just that—vectors to the straight-in visual. The Straight fix altitude is based below the glidepath intercept altitude for that fix, so the airplane is in a position to capture the glide path somewhere between the Straight and Final fixes.

Also rolling in the background is Garmin's Surface Watch, which crosschecks the correct runway and annunciates it on the PFD. The Surface Watch communication box lives directly to the left of the airspeed tape.

As we slid down the visual approach to Runway 24 at Bradley International in Connecticut, there was a 2-NM callout and textual "approaching RWY24" alert. Of course, with the SVT synthetic vision option, you're already looking at a 3D image of the runway environment, and of course the real view outside the windshield.

data. You can also display the new relative terrain data, ship's weather radar and lightning data. There is a lot of data that closely surrounds the HSI's map inset, including the current magnetic heading, the bugged heading , a lateral CDI and a data box with wind direction and speed. If the system has SVT synthetic vision, the inset is overlaid on it. Like we said—it can get busy.

WISH LIST

Naturally, it's easy to be greedy when a major avionics manufacturer touts a system as dominant and major as the G1000 NXi as "next-generation." As much as we complain that integrated avionics are layers deep, we think buyers want more—even if they don't use half of it.

Noticeably missing on the G1000 NXi we flew is Angle of Attack data. It's available on the older G1000 (in Cirrus Perspective applications, to name one) as a third-party input from Safe Flight. A twin turboprop should have it, too. And yes, we think younger buyers might expect a touchscreen interface simply because it's the new standard in pretty much any piece of electronics. Saying that, we think Garmin has improved the user interface enough—particularly the reworked 360-degree joystick/cursor control and the favorable performance of a faster processor—to say that a touch interface isn't necessary. But that's preference.

A good compromise, in our view, would be to replace the mechanical keypad with the touch-controlled FMS used on the G3000 system.

Garmin's Scott Frye, the sales manager for the integrated flight deck retrofit programs, made it clear that in reworking the system, Garmin was mindful of the $400,000 sweet spot. A from-scratch redesign means costly FAA approval, which gets passed on to the consumer. Because of aging airframes, the King Air retrofit market is less tolerant of higher prices than some may think. There's also competition from the Collins Pro Line Fusion retrofit program for the King Air—a system with a touch interface. We'll look at it in an upcoming report.

As we go to press, Garmin is finalizing the NXi's pricing structure. It estimates that a G1000 NXi step-up from existing G1000s (these owners already likely spent roughly $350,000 for the retrofit) will be around $50,000, with a one-day downtime and new two-year warranty.

Upgrading existing G1000s in other aircraft to the G1000 NXi are up to the OEMs. We suspect that a modern replacement for the aging G500/600 could offer them (and buyers) more options, especially if it displayed engine data.

The G1000's ADS-B In problems are solved with the GTX345R 1090ES transponder LRU, left. It has Bluetooth connectivity for tablets and is wired for G1000 NXi ADS-B traffic and weather overlay.

Retrofit De-Icing: ThermaWing Impresses

If you want an aftermarket de-icing system, the chances are good there's one available. We particularly like ThermaWing for price and simplicity.

by Rick Durden

If life were fair, no pilot would ever have to fly in conditions in which airframe icing becomes a reality. But life isn't fair and any pilot who flies IFR in the winter or at high altitude faces the very real possibility of decorating the airplane with ice no matter how carefully she or he plans, plots and schemes.

For pilots who regularly use their airplanes to travel, having ice protection beyond a heated pitot tube often goes from the "nice to have" column to the "I really need it" column when considering upgrades to the family machine—especially if there's recently been a pucker-inducing encounter. We did a survey of what's available for retrofit and found, to our surprise and pleasure, that some form of retrofit de-icing system is available for just about any high-performance piston single or twin.

Before we run through what we found, we'll note that the retrofit systems come in one of two flavors, "non-hazard" and FIKI. Non-hazard systems are designed (and certified) simply to buy time for pilots to get out of ice, not linger in it. They are not certified for flight into known icing conditions. Non-hazard icing certification only requires that the system perform its intended function—shed some ice—and that the system does not affect stall performance, controllability, stability and trim. The performance testing is done in dry air—there is no performance testing in icing conditions. Testing for ice-shedding in icing conditions is limited.

A FIKI-certified system—flight into known icing—goes through rigorous testing designed to show that the airplane can deal with most, not all, icing conditions for a period of 45 minutes. A FIKI system generally has to have two sources of power, an ice-inspection light, a heated stall-warning vane and heated static source(s). Getting FIKI certification is a big deal; nevertheless, a FIKI airplane will *not* handle severe icing conditions—such as freezing rain—for any length of time. FIKI certification does not make an airplane into a go anywhere, anytime machine.

TKS

Evolved from a system used by the Royal Air Force in the icy skies above Europe in World War II, CAV Ice Protection's (www.caviceprotection.com) TKS ice protection system exudes an ethylene glycol-based fluid from thousands of laser-drilled holes in titanium panels on the leading edges of an airplane's wings and tail. A slinger ring dispenses the fluid onto the prop and the windshield is protected by a fluid dispenser.

TKS works as a freezing point depressant—the fluid has a freezing point of -60 degrees C and mixes with the supercooled water in the cloud through which the airplane is flying and allows the resulting mixture to flow off of the airframe without freezing.

TKS is designed to act as an anti-

The TKS system retrofitted on this Cessna T210, main photo, uses Titanium leading edges. The drill is to bring along jugs of extra TKS fluid to avoid having to buy fluid while away from home base.

Full Ice Shield de-ice boot retrofit kit on a Bonanza—the kit includes tail boots, top. TKS in use on a Bonanza wing, middle, and windshield, bottom.

icing agent and, at a higher flow rate, as a de-icer. The fluid chemically breaks down the bond that has formed between the ice and the airframe. The relative wind then carries away the ice. Once the ice has departed, the flow rate often can be reduced so that the system functions in the anti-ice mode.

0.0025-inch diameter holes are laser-drilled at a rate of 800 per square inch into 0.7 to 1.2 mm thick titanium panels, which either replace the existing leading edge or are attached over an existing leading edge. Fluid is supplied to the propeller slinger ring, windshield spray bar and the wing and tail panels by a positive displacement, constant volume metering pump after passing through a microfilter that removes contaminants. A system of nylon tubing carries the fluid to proportioning units that divide the flow into volumetric requirements for each portion of the system. Depending on the aircraft, the pump is either a 14- or 28-volt unit and draws a maximum of two amps at its maximum operating speed. There are two versions of TKS available, FIKI approved and non-hazard.

Joel Jackson, sales and marketing administrator for CAV Ice Protection, the largest manufacturer of TKS systems, told us that CAV's system is now being installed on seven different types of aircraft by six OEMs and it holds STCs for retrofit onto more than 30 different aircraft models, including Cessna, Cirrus, Beechcraft, Diamond, Mooney and Piper. The company's website gives a full listing of the aircraft that can be retrofitted with TKS non-hazard and FIKI systems. There are additional TKS system STCs owned by Air Net II (www.airnet.com) and one, for the Aero Commander 500, owned by Central Air Southwest (www.centralairsouthwest.com).

Because the components of a TKS system vary based on the installed equipment on a given airplane, pricing requires that a buyer provide detail about the airplane to the provider and get a quote for the system appropriate for that airplane. We were told by CAV that its systems range in price from $23,000 to $50,000 for piston singles plus installation.

Installation is performed at one of three approved centers in the U.S.—or one in Europe—and typically takes 120 hours. System weight is 40 to 50 pounds, depending on the aircraft. Users have told us that there was a speed penalty for the system of 5-10 knots for long-wing Mooneys, 3-5 knots for the Cirrus line and none for the Cessna 206 or 210.

Early on there were reports of corrosion on some airplanes; however, the fluid is not corrosive and we have not received recent reports. Our working hypothesis is that the reported corrosion was installation-related.

CAV told us that the service life of its TKS system is infinite so long as the filter and pump brushes are serviced periodically and standard preventive maintenance is conducted.

TKS fluid weighs 9 pounds per gallon and costs $10 to $20 per gallon, although we have heard of FBOs charging upward of $50 per gallon. Cessna T210 owner Scott Dyer told us that the least expensive way to buy the fluid is in 55-gallon drums. It is hazmat, so plan on paying a surcharge for shipping. Dyer and others told us they carry a few gallons in jugs when they travel so that they don't have to buy fluid on the road. He said that he flight plans for use of TKS fluid. He figures on two hours of endurance on the ant-icing setting and one hour on the high or de-ice setting. CAV's sales manager, Jeff Holden, told us that one to two hours is generally accurate for endurance but it can be as long as 3.5 hours or as short as a half hour depending on the type of aircraft and the operating mode.

A TKS system has to be kept "wet"—which means using it at least once a month. Owners also told us that they run the system on the ground for about five minutes if they think they are going to encounter ice soon after takeoff. The fluid is messy and slimy—one of the reasons ice doesn't adhere to the airframe. It means that you will have to clean your hangar floor regularly as it tends to seep out for a while after use in flight and you'll need to warn line personnel working around your airplane that the area in front of the wings and tail may be slippery.

SLD GUARD

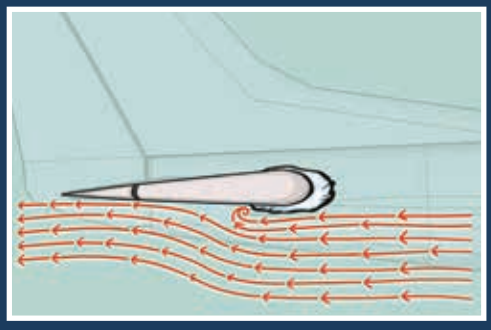
We are watching a new product from CAV, SLD Guard. It is designed for dealing with the most dangerous type of moisture in the icing world, supercooled large droplets (freezing rain) and to meet the FAA's evolving

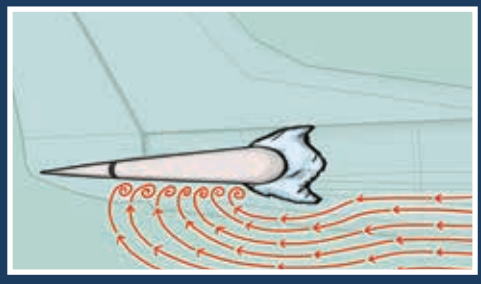
TAILPLANE ICING AND TAIL STALLS

Every year structural icing claims a small but steady number of airplanes and many pilots have reported narrow escapes. Many of the accidents are on approach in conditions in which the airplane is no longer collecting ice. As the means of reconstructing icing-related accidents has gotten more sophisticated, we've learned that tail stalls, rather than wing stalls, may be the culprit in the descent or approach phase of flight. That matters because pilots have been taught how to recover from wing stalls (lower the nose, add power) but not from tail stalls, and the recovery from tail stalls is precisely the opposite (raise the nose, raise the flaps, reduce power).

The smaller the radius of the curve of a leading edge, the faster and wider the ice buildup is. Therefore, even with only a half inch of ice on the wing there may be an inch or more of ice on the tail.

The shape of the ice is the reason it's a problem. When there is ice on the front of the airfoil, the airflow across the lifting surface (the top of the wing, the *bottom* of the tail) is no longer attached to the surface because it has had to cross an ice berm. Aft of the berm there is airflow separation creating a sort of rotor or vortex of disturbed air in the area of flow separation. (Top figure. Figures are courtesy of our sister publication *IFR* magazine.)





The reverse airflow means that a portion of the tail's airfoil is stalled. If the area of disturbed airflow gets large enough, the tail stalls. This becomes important because the tail of an airplane is usually lifting downward to overcome the nose-down pitching moment of the wing.

In cruising flight icing is not as much of a concern for the tail because it is at a low angle of attack. That changes on approach: As the airplane slows and flaps are extended, the angle of attack of the tail increases, increasing the risk of a stall if ice is disturbing the airflow.

Flap extension does two things to an ice-contaminated horizontal stabilizer, both bad. It changes the airflow aft of the wings, deflecting it downward, which causes increased downwash over the tail, increasing its angle of attack, whether it is a high- or low-wing airplane. (Middle figure.)

With an increased angle of attack and an ice buildup on the leading edge, the flow separation on the underside of the tail, the lifting part, is made worse, and the rotor, the area of disturbed air, gets bigger and moves aft.

Flap deflection has the second effect of moving the center of lift of the wing aft, farther away from the center of gravity. This causes an increase in nose-down pitching force. To compensate, the tail must exert greater lift downward, thus increasing its angle of attack still more and causing it to work nearer to its performance limit. Eventually, the tail can stall. (Bottom figure.)

The common scenario for a tailplane stall event is that the airplane is picking up ice. As the pilot begins the approach, she selects approach flaps and notices that it's difficult to trim the airplane and the elevator feels lighter than usual. The control wheel will move forward very easily but it's difficult to pull it back. Often some mild PIO (pilot induced oscillation) begins and the pilot can't damp it out entirely.

At some point the pilot selects full flaps and the airplane pitches down 45 degrees, the pilot tries to pull back on the yoke, but it's immovable and the airplane crashes.

The recovery technique requires reducing the angle of attack of the horizontal stabilizer. That means raising the flaps—at least to the previous position. It also means physically pulling the elevator away from the area of flow separation by pulling back on the wheel. There are reports that on some commuter turboprops the force necessary to pull the wheel back and get the nose up to the horizon may be as high as 400 pounds. The more realistic load for smaller aircraft is as high as the 100 to 125 pound range.

If the pitch control gets "lighter," particularly if it becomes easier to push forward on the yoke than it is to pull aft, be suspicious. It may become difficult—if not impossible—to trim the airplane and you may enter PIO. Further warning is given via buffeting in the control wheel itself, not buffeting of the airframe. If you have any amount of flap deployed and you experience shaking in the control wheel, it's a good bet that it's the tail that's at risk of stalling.

The bottom line: If you have ice on the airplane, leave the flaps up on the approach and landing. If the POH has a speed for approaching with ice contamination, use it. Otherwise, fly fast and do not close the throttle until the wheels are rolling on the ground (if you reduce power in the flare you may go from being above the power-on stalling speed with ice to below the power-off stalling speed with ice—a wing stall problem).

The ThermaWing system installed on a Cirrus SR22, top. Since the laminant that attaches to the leading edges is so thin, it won't affect cruise speeds. That's an installation underway on a Columbia 400, bottom.

FIKI standards. Supercooled large droplets create a special hazard as they are so big that they remain liquid and "run back" behind leading edge de-icing systems before freezing, often creating a dam that plays havoc with airflow over the wing (particularly the ailerons) or tail.

SLD guard consists of thin titanium strips installed on the wing upper surface in front of the ailerons and on the upper and lower surfaces of the tail, behind the existing de-icing system. The strips exude TKS fluid to rid the surface of any run-back ice from supercooled liquid droplets. Wind tunnel video on CAV's website of SLD Guard in use is impressive. We've seen video of ice dam buildup aft of de-icing boots on horizontal stabilizers and think SLD Guard has great potential for protection against tail stalls in ice. According to CAV's Joel Jackson, SLD Guard can be installed on airplanes that have any type of de-icing system. He said it was not currently available for retrofit but that may change.

BOOTS

Pneumatic de-icing boots were first installed on an airplane in 1932 and have been in use ever since—because they work. However, the technology has improved substantially. The system consists of inflatable rubber boots attached to the leading edge of the wings, tail and sometimes wing struts. When ice begins to form on the leading edges, the tubes within the boots are inflated. (Don't wait for ice to build—use the boots right away—the need to wait is an aviation myth that needs to be killed off.) Boots crack ice by creating fracture and shear stresses. The airstream carries the broken ice away.

De-icing boots have aerodynamically smooth polyurethane surfaces designed to enhance ice removal and resist erosion and UV damage. Kept clean and occasionally treated with commercially available products for their care, an owner who hangars a boot-equipped airplane can expect a set to last 20 years. We covered de-icing boot replacement in the December 2012 issue of *Aviation Consumer*.

Almost all de-icing boots are installed by the aircraft manufacturer; however, if you have one of several models of the Piper Saratoga or conventional tail Beech Bonanza lines, a full, non-hazard pneumatic de-icing boot system can be purchased from B/E Aerospace (www.iceshield.com). Its full Ice Shield kit consists of wing and tail boots, prop boot, heated windshield panel and ice-viewing light. A buyer may choose to purchase just some portions of the kit.

The prices for the full kits vary slightly by the type of aircraft, but figure on $45,000 to $50,000 installed. Installation is performed by Tiffin Aire in Tiffin, Ohio, and, according to Kristian Barnett, marketing specialist for B/E Aerospace, it takes 80 hours. Depending on the type of airplane, the full kit weighs on the order of 50 pounds.

The good thing about de-icing boots is that a user doesn't have to cart fluid around; the bad thing is that they have a lot of moving parts, although users tell us that they tend to be reliable and rarely need parts replaced. Plan on spending $12,000 to replace a set of boots.

THERMAWING

Originally developed by Kelly Aerospace (www.kellyaerospace.com) in conjunction with a project to de-ice the gigantic blades of wind turbines, ThermaWing is an electric de-icing system that uses a graphite foil laminate attached to the leading edges of the wings and tail to heat up and break the bond between ice and the foil, allowing the airflow to carry the ice away. The outer layer of the foil is made up of Tedlar, an ice phobic/nonstick, polyvinal fluoride film developed by DuPont.

The system has a number of heating zones and is further broken up into leading edge and shed zones. The leading or impingement area of the wings and tail is kept warm continually so that it "runs wet"; moisture striking it remains liquid. The liquid water runs aft onto the shed zone, which is normally kept cold so that water will freeze there and not further aft.

During the de-ice cycle, the voltage to the shed zone is increased, causing it to heat up, releasing the ice bond and allowing the airflow to carry the ice away. The voltage is then reduced; the shed zone cools off and ice forms again, to be shed during the next cycle.

The pilot arms the system should ice be expected. Once the OAT drops to 41 degrees F, the de-icing cycle begins automatically. Each cycle is 60 seconds, with the entire aircraft being de-iced in 33 seconds. The system is designed to heat each zone to 40 degrees F very rapidly—as company owner Todd Bates said, "We want a pop!" The heating/cooling curve for each section is very steep.

Price for the non-hazard system is $30,000 installed. ThermaWing is in the process of transition from ownership by Kelly Aerospace to Deice Technologies Inc., run by Todd Bates. Installations are still being performed by Kelly Aerospace and take one week. The installation includes adding a 70-volt, 150-amp Hartzell alternator to the aircraft to power the system. The laminate attached to the leading edges of the wings and tail is so thin that it should not affect cruise performance. Installed weight is 40-50 pounds.

ThermaWing is a non-hazard system and is currently STC'd on the Cessna Corvalis 350 and 400 and the Columbia 300, 350 and 400. Bates told us that an STC for the Cirrus SR22 series is pending. The company is seeking FIKI certification for the Cirrus and Cessna aircraft.

CONCLUSION

We were surprised at the number of types of aircraft for which aftermarket de-icing systems were available. For the owner who regularly flies in parts of the country where the potential for icing is high, a de-icing system can increase the utility of his or her airplane and provide more peace of mind. We also think that retrofitting a de-icing system is worth considering as part of a refurb an owner may be considering.

Going forward, we are particularly interested in watching to see if more STCs are obtained for the Therma Wing system as it looks to us as the next logical step in de-icing technology, especially at a price that appears to be well below that of retrofit boots or TKS.

Trio Autopilot STC: Testing New FAA Policy

Trio Avionics joins the STC race with its Pro Pilot experimental autopilot. The initial focus is the Cessna 182/172 at a price that's below $10 grand.

by Larry Anglisano

The way we see it, if the Trio Avionics Pro Pilot autopilot is proven in experimentals like the Van's RV series, it's ready for duty in Cessna Skyhawks and Skylanes.

If the ongoing certification process falls into place, California-based Trio Avionics plans to bring an STC-approved version of the Pro Pilot to AirVenture 2017. With a post-installation price that's targeted below $10,000, we think the market would embrace it as an alternative to an S-Tec system.

Can more sensible FAA policies and the right engineering approach make it happen? We think so.

THE RIGHT TECH

At first blush, the Trio dual-axis Pro Pilot has the form and function we would expect in a modern retrofit autopilot. Not insignificant with any new autopilot is the installation complexity. To keep bottom-line costs down, a reasonable downtime might be less than one shop week, but we're told the Pro Pilot can be installed in a Cessna Skyhawk in one day. Having had our hands in autopilot installs, we think that's enthusiastic, frankly.

The backbone of any autopilot retrofit is the actuator installation, which is a sizable effort. The Pro Pilot has two servos: roll and pitch. Servo installation is traditional: attaching the pushrod to an aileron or elevator bell crank. In a Cessna 182/172 application, the roll servo is installed in the wing, while the pitch servo is in the tail.

However, in 182 applications, one of the goals is to mount the pitch servo behind the cockpit center pedestal, making it more accessible for installation and servicing. Earlier airframes have limited tail section access from the outside, which means

The Trio Pro Pilot autopilot control head fits in a standard 3-inch instrument cutout and has a bright display.

The microprocessor-controlled Pro Pilot servo, left, has a slip-clutch for manual control override, plus automatic disconnect on takeoff.

you climb in and work while lying on the stomach. It's not a task most techs look forward to.

Missing is a trim servo, but the system is smart enough to send signal commands to an existing pitch trim motor to balance the elevator forces when the altitude hold and climb/descent modes are engaged.

The Pro Pilot control head fits a 3-inch instrument cutout, weighs 12 ounces and houses all controls and sensors. This is a completely digital system that uses an internal solid-state inertial rate sensor, plus the inputs from an external GPS for navigation, including digital steering.

The GPS monitors the inertial sensor's performance, providing automatic corrections to the sensor data to correct for drift due to thermal shifts, inherent sensor drift and noise errors.

A fully digital interface is welcomed, but the reality of retrofits is having to deal with older analog equipment—including connection with the BendixKing KX155 and other vintage radios. Trio is engineering this analog-to-digital interface as it moves toward certification.

The Pro Pilot has what we think every new system should—airspeed capture and hold, plus lateral and vertical approach capturing. It also has altitude preselect, vertical climb and descents, plus stall and overspeed protection using servo feedback circuitry. There is also an automatic 180-degree turn feature to back away from inadvertent IMC. With a digital GPS input, the Pro Pilot's display shows navigation status, including track, distance, estimated time enroute, plus fuel endurance data.

The kicker? The uncertified Pro Pilot currently sells for $2995.

TAKE IT TO THE FAA

How do you keep autopilot technology like this from the panels of certified aircraft? Make the STC process so expensive and time-consuming that small companies like Trio Avionics want no part of the certified market. But when the effort includes an outside STC firm, aircraft owners and veteran aircraft engineers, it could be the most efficient way to work with an FAA that seems to be more forward thinking than ever. That's where The STC Group—the company tasked with earning the initial STC, PMA and ISO 9000 certification for the system in the Cessna 182/172—comes in. The STC Group was founded by Paul Odum, an IT executive and aircraft owner from California.

We think Odum's group has several feathers in its certification cap. First, it's relying in part on new FAA policy, including Policy Statement PS-AIR-21.8-1602. The idea of the policy is to improve safety with a new approval process allowing the installation of NORSEE (non-required safety enhancing equipment) "that is determined to be a minor change to type design and whose failure condition is minor." Previously, autopilot retrofits were considered major alterations. In the policy statement, the FAA specifically includes "stability and control (such as an autopilot or stability augmentation system)" in the NORSEE equipment category.

Trio Avionics isn't alone in the autopilot STC race. TruTrak has been flying its experimental Vizion system, shown at left, in a Cessna 172.

It's important to stress that NORSEE approval under this policy is not an approval for installation on the aircraft. The equipment becomes eligible for installation on the aircraft after approval. If the equipment is deemed to be a major change to the aircraft's original type design, an STC must be pursued. But, experience counts.

The STC Group's Mark Sullivan told us there is more than one Pro Pilot currently flying in Cessna 182 aircraft in the United States and in South America. The Trio installation in the U.S. registered aircraft was—get this—awarded an FAA field approval. While a field approval is a one-time STC, it is previously approved FAA data that might be useful.

The company isn't only relying on seemingly more lenient FAA policy. In its pursuit of the Pro Pilot STC, it is utilizing engineering power that has extensive experience at Cessna Aircraft to construct the detailed technical drawings required for approval. In our view, these are the right people for the job because they understand how the autopilot installation hardware should adapt to a variety of Cessna airframes. Remember, Cessna at one time did autopilots in-house, using the Sperry/ARC line. The STC Group—which will own the STC—has also hired some of the best avionics field installation talent, and has gained AOPA lobbying efforts.

As for Trio Avionics, it started in the experimental market around the year 2000 and has close to 3000 autopilots flying in a variety of aircraft, including the Van's RV and in EZ models.

The final price hasn't been established and this will depend on the certification effort. There's also the cost of product liability. The STC Group's Sullivan—a longtime attorney and aircraft owner—isn't concerned. He believes the goal of bringing an approved Pro Pilot to market just below the $10,000 mark, including installation, is achievable. We think it's imperative.

Contact www.trioavionics.com.

Blackhawk Caravan: New Vigor For Old 208s

The XP140 delivers the same or better performance as factory-new airplanes at a fraction of the cost. Rapid climbs are the sweetener.

by Paul Bertorelli

Military pilots are trained for and thus accustomed to flying airplanes with thrust enough to slap the eyeballs back into their sockets. Blackhawk's new XP140 conversion for the staid Cessna Caravan doesn't quite deliver that kind of punch, but there's a hint of it from the lofty left seat.

Blackhawk has had great success in plying the niche of Pratt & Whitney PT6A-powered airplanes that the factory just didn't get quite right for lack of available power or just marketing considerations.

Blackhawk's latest project replaces the OEM PT6A-114 or -114A (600 or 675 HP respectively) with a -140 free turbine rated at 867 HP. While the conversion isn't cheap, Blackhawk is selling into a market where the airplanes earn their keep with revenue flights and the additional performance rings the cash register.

THE UPGRADE MARKET

Engine mods and upgrades have been mainstays of the GA aftermarket since shortly after Charlie Taylor built the last Flyer engine. As the piston market cooled in the 1990s, the turbine aftermarket heated up with several companies offering mods to popular airplanes like the King Air series, Cessna's turbine twins, Piper's Cheyennes and more recently, the Cessna 208 Caravan.

Waco, Texas-based Blackhawk came into the market in 1999 and now offers PT6A upgrades for the Beechcraft King Air 90 and 200 series, the Conquest I and the Piper Cheyenne. When we visited Waco last December, Blackhawk was working on a PT6A-67A mod for the King Air 350.

For the Caravan, Blackhawk offers two options, both available for the 208A and 208B models. Its first foray was the XP42A, which swaps the airplane's existing -114 or -114A for the 850-HP PT6A-42A. Because that engine is larger and has a different footprint than the powerplant it replaces, the XP42A conversion gets a new fiberglass cowling as part of the conversion kit. It also gets a new four-blade Hartzell prop, a new mount and engine exhaust outlets.

The follow-on product, which achieved STC approval last year, is the XP140, which includes a slightly more powerful engine, but one which will easily fit into the existing cowl with minimal modifications to the airplanes.

"No modification is really a bolt-up, but this one comes as close as any I've seen," said Bob Kromer, Blackhawk's senior vice present for engineering. The XP140 retains the original cowling and requires only a single exhaust. Rather than a four-blade prop, it gets a new three-blade model.

EXCHANGE MOTORS

Kromer told us that with more than 2500 Caravans flying, there are many hundreds motoring around

The XP140 conversion applies to all extant Caravans except those equipped from the factory with Garmin G1000s. The test article we flew had the baggage pod removed, bottom photo. New three-blade Hartzell props are included, right, and these yield cruise speed gains.

The 867-HP PT6A-140, left, is the same physical size as the engine it replaces. The package includes Howell instruments, center photo, which are combination digital/analog displays. Blackhawk's previous mod, the XP42A, requires a new cowl and a four-blade prop.

with tired PT6A-114/114A engines in need of overhaul. Since these are almost universally working airplanes, Blackhawk's pitch to these owners is why spend money on an overhaul to get the same performance when you can spend a little more and improve performance dramatically.

"A little more" is relative. Caravans on the used market vary widely in price. A 15-year-old airframe with a run-out engine in presentable condition retails for between $600,000 and $700,000. The XP140 engine kit, all inclusive, sells for $604,000, plus another $25,000 in labor to install it.

To sweeten the deal, buyers are offered a $50-per-hour credit for engine cores that are below the 3600-hour TBO. The 600-HP -114 gets $34 per hour in credit. "If you flew your engine to 3600 hours, there are no credits for your exchange and that's built into the price. If you've got an engine with 500 hours on it, it's worth money as a credit," Kromer said. (The cores go back to Pratt for overhaul.)

Kromer tells owners that adding another $200,000 for paint and avionics upgrades will bring the total to about $1.4 to $1.5 million, or a million less than a factory-new equivalent.

Cessna currently offers two versions of the 208, the Caravan and the Grand Caravan EX. The Caravan is the smaller of the two, at 37 ft. 7 in. in length with a gross takeoff weight of 8000 pounds. It uses the 675-HP PT6A-114A Cessna switched to in 1990 from the 600-HP -114. The Grand Caravan EX is 41 ft. 7 in. long with a max takeoff weight of 8807 pounds. The Grand Caravan EX, which became available in 2013, has the same PT6A-140 Blackhawk uses.

Blackhawk's secret sales sauce is that its conversion applies to all of the Caravan models, including both the 600- and 675-HP variants.

"Obviously, the guys upgrading from the 600-HP airplanes will notice the biggest performance difference," Kromer told us. Not that the step up from the 675-HP engine is exactly a slug, as we learned on our flight trial. Blackhawk can modify *all* of the Caravan models except those equipped with factory-installed Garmin G1000 suites; Cessna retains a lock on the software for those models and Blackhawk can't tap into them for the engine instruments.

FIELD INSTALLS

Blackhawk's Waco shop is primarily a skunk works, so most of the installs are done in the field by businesses Blackhawk has trained or overseen. The kit includes the new engine, exhaust system, new prop, a 325-amp Ametek starter/generator, a larger-capacity oil cooler and new engine instruments from Howell Instruments.

Kromer told us the typical installation requires two technicians and an electrical specialist and requires about 10 working days. Many customers add paint and avionics work to extend the schedule. The engine carries the standard Pratt & Whitney new-engine warranty.

Although the airplane retains its

CONTACTS...

Blackhawk Modifications
254-755-6711
www.blackhawk.aero

YouTube See a video review of the XP140 at http://tinyurl.com/j95ht2a

original weight and payload numbers, it's approved for floats and given the additional horsepower, we suspect the performance on high-density altitude lakes and rivers is much improved over the original, especially when the starting point is the -114 engine. The props are equipped with zero locks (and Beta range) so the only residual thrust at idle is from the exhaust.

AIRCRAFT	ENGINE/HP	GROSS WEIGHT	TORQUE	FUEL FLOW	KTAS
CESSNA 208B	PT6A-114/ 600 HP	8750 LBS	1658 FT/LBS	373 LBS/HR	170
CESSNA 208B	PT6A-114A/ 675 HP	8750 LBS	1865 FT/LBS	394 LBS/HR	175
XP140 208B	PT6A-140/ 867 HP	8750 LBS	2184 FT/LBS	452 LBS/HR	187

Data above is based on performance at 10,000 feet in cruising configuration. Our flight trial results were similar. Time to climb to 10,000 feet was 9:35 with -114 setting and 6:25 with -140 engine. The chart shows 208B data, but STCs apply to all Caravan models.

FLYING IT

We demo'd the XP140 test article at Blackhawk's Waco headquarters on a foggy fall day. It's easy to compare the takeoff and climb performance by simply setting the new engine's torque values to those of the PT6A-114A it replaces. The Howell gauges are a combination analog/digital display that makes both coarse power setting and tweaking doable on the fly.

For the first flight, we took off from Waco and climbed unrestricted through an overcast to 10,000 feet. At a mid weight, the Caravan accelerated briskly on the runway and after rotation, we held the climb at 110 knots indicated.

According to the timer, we reached 10,000 feet in 9:35. Leveling out, we calculated the true airspeed to be 171 knots on a fuel flow of 329 pounds or 47.7 GPH. The max ITT was 765 degrees for a torque value of 1865 pounds. This performance matches the OEM -114A engine.

For the second flight, we repeated the same profile, albeit at a slightly lighter weight due to reduced fuel. Runway performance was dramatically improved and we felt the propwash pulsing in the rudder pedals. With the additional power, it takes effort to hold the 110-knot best climb speed because the deck angle is noticeably higher.

And, of course, so are the torque and fuel flows. Max torque was 2397 pounds and fuel flow in cruise was 434 pounds (65 GPH). Although most engine power upgrades don't produce much additional speed, the XP140 does, by dint of the optimized prop.

Cruise speed at 10,000 feet was 180 knots TAS and we reached that altitude in 6:25. It would have been a little quicker if it hadn't been so challenging to hold 110 knots in the climb. From brake release, the XP140 averaged 1550 FPM in climb, against 1047 FPM for the OEM engine.

To extend their utility, many Caravans have cargo pods installed, but the test article we flew did not. Based on Blackhawk's claimed performance data for the two engines, the numbers we saw were in line with the claims. In addition to the faster climb, the takeoff performance is also better.

Blackhawk documentation claims a 3086-foot takeoff run over a 50-foot obstacle (1602-foot ground run) on an ISA -10 day at 8300 pounds total aircraft weight. That's for a baggage pod-equipped airplane. The OEM engine in the 208B delivers 3650 feet over the obstacle for a ground roll of 1965 feet in the same conditions. Overall weight and balance remains unchanged from the original aircraft.

However, what Pratt giveth, Pratt also taketh away, albeit not much. More speed and power translate to higher fuel flow. We asked Blackhawk's Kromer if owners of these mods take advantage of the ability to throttle them back to lower power settings to save fuel. He said owners tend not to. If they're buying that power, they want to use it. Fuel consumption is a secondary concern. At max cruise power, the XP140 mod has a still-air range of 825 miles at 12,000 feet while the OEM -114A it replaces will stretch to 900 miles. This is not likely to be much of a factor for most operators because they're buying the conversion for its rapid climb rate and improved short field performance, not long legs. In a pinch, the -140 can be pulled back to extend range.

Which get us to the principal market for the XP140: skydiving operations. With the faster climb rate, drop zone operators can do nearly two extra revenue loads per hour, which translates to higher earnings and makes the considerable investment more attractive.

In our view, by investing as much as it has in the XP140, Blackhawk has positioned itself in a unique niche, giving it the ability to match and even exceed new factory airplane performance at a fraction of the cost. We see this as yet another datapoint in a trend of more refurb and mod projects as new aircraft prices escalate and sales volumes decline.

XP140's runway acceleration, below, was dramatically faster than the OEM engine provides.

Landing Gear Checks: Know Thy System

If you want to avoid a nasty inflight surprise, get down on all fours and inspect the gear the right way. Take your time and understand what you're looking at.

Staff Report

While there are plenty of items that can be easily inspected to help prevent a landing gear malfunction, we're convinced that too many pilots simply don't spend the time to do so.

As we sift through the NTSB accident reports each month, we're consistently finding landing gear mishaps that might have been avoided if the pilot spent a little extra time inspecting the gear during the preflight, or simply knew how to recognize potential problems areas before launching.

In this article, we'll look at the things you and your mechanic should be inspecting—including items on fixed landing gear—in hopes that you won't join the ranks of "those who have" landed gear up.

GET JACKED UP

We're not suggesting you learn how to completely disassemble and reassemble the landing gear on the aircraft you fly, but instead, knowing what the system looks like when it's stowed in the wheel wells and fully extended will give you a better mental picture and help you spot something that's out of place during your preflight.

Since landing gear designs are all over the board—from stone simple to incredibly complex—it pays to spend some money on shop labor and have your mechanic put the aircraft on jacks so you can observe a gear retraction and extension. You know what it sounds like, but do you know what it looks like? Spend some time in the service manual looking at the component breakdown and be familiar with any ADs that apply to your system. Some aircraft have landing gear gotchas that are ready to happen.

For example, Piper Seneca operators should be familiar with AD 2005-13-16, which affects the nosegear/retract rod and bolt. Also, take a close look at the nosegear shimmy dampener bolt. Even though it looks like it's installed upside-down (with the head facing down), knowing that's the way it's supposed to be can prevent a nosegear-retracted landing if found the other way around.

Fly a Beech Bonanza? A broken uplock cable can result in a gear-up landing, but it's an easy check on the ground. Savvy Mooney owners make it a habit to look at the nosegear trunnion. Any dents indicating over-travel of the nosegear steering linkage are red flags, since this can lead to a gear collapse.

Pilots aren't the only nuts behind the wheel. One thing every landing gear has in common is a critical nut (or nuts) for holding the wheel on. Considering the neglect wheel nuts receive, it's amazing that it doesn't rain rubber as wheels fall off. They deserve a hard look; perhaps not before every flight, but on a scheduled basis.

Keep a rag handy (wheel nuts are pretty greasy) and grab hold of it to see if you can turn it by hand. You shouldn't be able to. If the nut is so dirty it's hard to see, use that rag to wipe the dirt clean. Dirt should equate with excess wear in anyone's mind, so keep that nut and the area around it clean. Cleaning will also allow you to check the condition of the cotter pin.

One of the most neglected bolts is the one that goes through the scissors, also called the torque link. It's easy to overlook, even for mechanics. You should be looking for signs of wear around the head of the bolt and the nut on the other side.

Another critical nut-bolt combo

Aircraft that sit for an extended period require careful attention to the landing gear. We spotted a neglected Mooney with tires so flat the main landing gear doors were bent and driven into the pavement, left photo.

is the one holding the shimmy dampener in place on the nosegear. These bolts are notorious for snapping, which in turn could cause the nosegear to fold from excessive shimmy—or you can lose control during takeoff or landing. The shimmy dampener bolts should be checked for signs of wear and excessive free play.

Grip the nosegear tire and give it a gentle wobble or have someone in the cockpit walk the rudder pedals back and forth. There should be no obvious free play, and the dampener should resist a wobbling motion. Beyond wobbling the gear side to side, try it fore and aft as well. Often, the actual attachment of the gear can start to work loose. Caught early, this can be relatively inexpensive to fix (relative to the cost when it pulls free entirely, that is). Try this on both the nose and main landing gear.

While you're shaking things up, be sure to give the brakes a shake, too. Grab the caliper and see if it's just slightly loose. If you don't have either Cleveland or McCauley brakes, any looseness could mean trouble. Parker brakes should feel rock solid, so if they wiggle, look for loose bolts.

If you do have Clevelands or McCauleys, they should feel slightly loose. This shows that the calipers are still free to slide on the anchor pins, meaning both sides of the brakes are working. Also, be sure the anchor pins themselves are clean and free of rust (if not, make a note to clean them up). Hit those pins with a shot of LPS-1 or dry silicone lubricant. You want to use a dry lubricant so it doesn't attract dirt, which WD-40 or plain oil will.

LANDING GEAR DOORS

Like the landing gear itself, gear doors can be simple or complex. Regardless, they can tell you a lot about the health of the gear. This is particularly true of clamshell-type doors that are typically found on the nosegear, but may also be used on the mains.

You should be looking at the edges of the doors for scrape marks (possible misalignment of the doors), chafing or rubbing as indicated by bare metal (possible loose doors), crimped or crinkled door edges (again, misalignment) and whether the door as a whole seems true and fair. Try giving it a little wiggle to check for excess slop or looseness.

Whether you've got an electric retractable gear system, hydraulic system or manual system, they're all actuated. In electric and manual systems, this will be by means of pushrods and bell cranks. Hydraulic actuators use a powerful electric motor to power the hydraulic pump.

Pushrods are easy enough to check. You're looking for bending or breakage here. Breakage will usually be self-evident, but bending may not be. Here's where having a good mental picture of what things are supposed to look like pays off. The pushrods in some aircrat take convoluted shapes to work around other gear components. You'll either have to dive into the manual or know by memory what you're looking at.

Hydraulic actuators all share some common problems, not least of which is leakage. Obviously, if you find one spewing hydraulic fluid, you've got a problem, but knowing where to look can be a challenge. Depending on the type of actuator you've got (single-acting or double-acting), it can leak from several places.

On some models, it's easy to check the hydraulic fluid level, such as on the Cessna 172RG. On others, like the Piper Aztec, it's impossible to check hydraulic fluid level because the airplane has to be on jacks and the gear has to be retracted.

Double-acting actuators, which are fairly common in hydraulic landing gear systems, have three possible leak points: the actuating rod and the two hydraulic lines attached to the cylinder. Run a finger around each line attach point and see what comes back. Also, make sure the rod is clean and not covered with grit or dirt, which may lead to later leaks. And while you've got your head up there, take a look at the hydraulic lines and fittings. Flexible lines should not be twisted or kinked (this can indicate improper installation and, eventually, could break).

There are many items to check on a Bonanza's complex gear, top photo. It's worth having a mechanic show you what to look for when it's disassembled. While you're preflighting the landing gear, look closely at the brakes, bottom photo, for leaking and loose hardware.

A landing gear failure on roll-out in a Cessna Centurion, top photo, can be especially ugly because of the side load it can create on the nosegear. Use caution when maneuvering the aircraft with a tug and inspect it carefully after ground crews move it. Exceeding tow limits can easily damage the linkage, bottom.

Solid lines should be smooth and free of dents. While you're looking at all this stuff, pay attention to electrical components including limit switches, squat switches and indicator switches. You might be surprised to find kinked or frayed wires. These require immediate attention. We once caught an unsecured squat switch floating in the wheel well after the aircraft was released from annual inspection.

Baron and Bonanza owners should also take this opportunity to check the condition of the indicator cables that run along the top of the wheel well. Make sure they're free and straight, have no cuts or dents, and are at least reasonably clean. Now is also a good time to check the condition of the uplock rollers and cable. Give it a spin (it should turn easily), look for signs of wear or gouging and that it's lubricated. Make sure the protective boots are in good shape.

DOWN AND LOCKED FOREVER

Even if you enjoy the simplicity of an airplane with fixed landing gear, there are some things you should be doing to avoid problems. One thing is to check for the early warning signs of corrosion. On Cessnas, closely examine the main gear leg itself for the telltale blistering or bumpiness in the finish that shows corrosion. For the Pipers and Beeches, check the tops of the fairings for the same, as well as excessive aluminum oxide buildup. Of course, make sure the scissors are free to move and not rusted. A careful look at the junction of the gear leg and the fuselage can detect evidence of looseness and excess play.

Bolts that hold the Cherokee gear to the wing protrude through the wing structure (usually slot-head bolts). Look specifically at these bolt heads as viewed from the top of the wing. They should not be "smoking" or show any evidence of working. Bends or wrinkles in the upper wing surface may indicate a hard landing.

Don't forget the brakes. Check for even wear fore and aft on the pads. Wear mostly on one pad usually means the pads are not sliding free on the pins due to corrosion, lack of lubrication or bent pins. You also want to look for leaking brake fluid.

REAL-WORLD GOTCHAS

We remember a time when gear collapses on some models were common occurrences, including an issue on the Cessna 310 that was created on the maintenance floor. Cessna finally got the word out that you could not rig just one leg of the gear system as it will screw up the others. To rig the electromechanical gear on Cessna twins you have to follow the maintenance manual (which is very well illustrated), start in the center of the system and work outward progressively.

It takes two people who know what they're doing about eight hours. In the mid-1970s Cessna built a full-size working mockup of that gear in a structure that could be disassembled and wheeled through a doorway. Back when Cessna dealers sent mechanics to Cessna for classes, that gear mockup was in constant use for training. The word finally got around that you had to maintain that gear by the book.

The Cessna single-engine gear system went through a bunch of iterations—three distinct ones on the Cardinal RG—and Cessna finally got it right on the third one. Those have to be maintained assertively. It's always a little spooky to watch a gear swing because they've got to jack the airplane up high enough to allow for the mains to descend about 18 inches in the retraction cycle.

We mentioned the system on a Piper Aztec and the importance of checking the fluid level with the gear up. We remember when a shop checked the fluid level on one while it was standing on its gear. Of course it read low, so the tech filled it up. We took off, retracted the gear and flew 10 minutes to home base, landed and taxied in. When we got out of the airplane, we saw that most of the lower half was covered with hydraulic fluid. We don't remember if any seals were blown out, but it sure was a mess to clean up.

Speaking of messes, even the best maintenance practices and most through preflight inspections won't always fight off landing gear failure. Be ready for them by knowing the exact procedures for manually extending the gear in the airplane you fly. Have you ever tried to manually crank the gear down? Do it.

Last, don't let a landing gear failure distract you from the most important task of all, which is flying the aircraft to a safe landing.

Financing an Aircraft: Using a Broker Helps

Interest rates are near historic lows, as are insurance premiums—it's a good time to buy. We recommend using an aircraft finance broker to get the best loan.

by Rick Durden

As this is being written the stock market is in record territory, aircraft insurance rates are at record lows, the Fed has just started to raise interest rates out of the basement, the economy is at full employment and the incoming administration is promising to cut taxes while spending massive amounts on economic stimulus. Is this a great time to finance an airplane or what?

Our crystal ball is foggy; we don't know if promised financial deregulation will spur the economy or blow it up via the savings and loan debacle or Wall Street monetizing mortgages. What we do know is that aircraft loan rates are still at historic lows, aircraft prices have been stable and banks that make aircraft loans are competing for your business.

Our survey of the aircraft finance market turned up lots of optimism. Bob Howe, president of Dorr Aviation Credit Corporation (www.dorraviation.com) said that since the election their phones have been ringing constantly. Dan Garzelloni, principal of Mile High Financial Corporation (www.milehighmoney.com) told us that even though he's seeing a slow increase in interest rates, they will have to increase substantially before they adversely affect aircraft sales.

The bottom line is that right now a person interested in buying a piston single or twin should be able to get a 20-year fixed rate loan with an interest rate of under 5.5 percent with a 15 percent down payment. Rates for turbine equipment are in the 4 to 5 percent range, with 15 to 20 percent down.

WHERE DO I START?

You just had another lousy experience with a rental airplane and decided it's time to quit renting. You're ready to buy. You're going to need to finance the purchase, but the bank where you got your mortgage and car loans doesn't know a Piper from a Pilatus and won't touch aircraft loans. Where do you go to get a loan at the best interest rate?

We do not recommend that you simply start contacting banks that advertise aircraft loans. In order to find out what rate you'll get from a particular bank, you'll probably have to go through the application process. That means the bank will "pull" your credit—do its due diligence and get your credit report. Every time your credit is "pulled," your credit rating takes a small hit—it may be as much as five points. If you apply to four banks, the jolt to your credit rating can be noticeable.

We recommend that rather than shopping for the right bank that you shop for the right aircraft finance broker. An aircraft finance broker is a financial professional who knows the aircraft world (and is almost always a pilot). His or her company works with a number of banks—usually between three and six—that specialize in aircraft loans. The broker will learn about you (and you about the broker) and will be able to tell you pretty accurately what kind of deal you can make before you apply. We also recommend that you tell a broker that you are also speaking with other brokers—you want them competing for your business.

Once you decide on a broker, he or she pulls your credit just once even though the broker may be talking to several banks to get you the best deal—so your credit rating only gets one nudge.

There is a broker's fee; however, it's paid by the lender, not you.

The application process is more

Before you find the airplane of your dreams, we recommend that you contact an aircraft finance broker and get your financing approved so you can move fast when you locate the ideal machine.

CHECKLIST

- Early approval can lock in a loan rate while you find an airplane.
- Aircraft finance brokers and bankers will compete for your business.
- Loan rates of under 5 percent are available, but that may change soon.

FINANCIAL STATEMENT AND APPLICATION – SECTION I

Borrower: _____
Co-Borrower: _____
Address: _____
City: _____ **State:** _____ **Zip:** _____
Number Years this address: _____
Previous Address if less than 3 Years at current address.
Address: _____
City: _____ **State:** _____ **Zip:** _____
Phone Number: _____ **Email:** _____
Social Security # and Tax ID if self employed: _____

Employer: _____
Employer Address: _____
City: _____ **State:** _____ **Zip:** _____
Phone Number: _____
Position or Occupation: _____ **Years In Position:** _____

Salary (Include Bonus and or Commissions):	**$_____**
Dividends:	$_____
Rental Income:	$_____
Other Income: (Specify)	$_____
Total Income:	$_____
Total Last Year Income:	$_____
Are you obligated to pay alimony or child support: __Yes __No Amount:	$_____
Income Tax Settled through:	$_____

Have You ever Declared Bankruptcy: ___ Yes __ No
Are you a defendant in any legal actions: ___ Yes ___No

Assets:		**Liabilities:**	
Bank Accounts:	$_____	Notes payable to Banks and others:	$_____
Government and marketable Securities:	$_____	Mortgage(s) payable:	$_____
Privately Owned Companies:	$_____	Unpaid Income Tax State:	$_____
Partial Interest in Real estate:	$_____	Federal:	$_____
Real estate Owned:	$_____		
Cash Surrender Value of Life Insurance:	$_____	Credit Card or Charge accounts:	$_____
Personal Property:	$_____	Installment Debt:	$_____
Other Assets: (List)		Other Debt: (List)	
_____	$_____	_____	$_____
_____	$_____	_____	$_____
_____	$_____	_____	$_____

Total Assets: **$_____** **Total Liabilities:** **$_____**

Total Assets less Liabilities: $ _____

Do you have any contingent liabilities or a co-maker on any loans: ___ Yes __ No
If yes explain: _____

Aircraft loan applications are standardized—this is page one of what you should expect to fill out.

involved than buying a car, but less than a house. From what we've seen, the application form is standardized. You'll be required to disclose assets and liabilities in full. Plan on providing your income/earnings information (all sources of income), several months of bank statements and at least two years of tax returns.

Give everything to the broker in one package—one of the best ways to mess up an aircraft loan application is to provide information piecemeal.

Steve Smestad, owner of Airfleet Capital Inc. (www.airfleetcapital.com) said applicants should "fully disclose" on the application. He said that from time to time he'll have an applicant "pencil whip" the application and not disclose all assets. When the bank does its due diligence it often finds those assets and may get suspicious as to what else the applicant has hidden, especially if it's any liabilities—and it can result in denial of the application. Post-2008, there has been a lot more pressure on lenders to know their customers and actually perform their due diligence before approving a loan.

ADVICE

One of the positive side effects, in our opinion, of working with an aircraft finance broker is that he or she usually knows the market well and can advise you on everything from how to effectively present yourself on the loan application to what kind of airplanes banks like to make loans on. For example, Bob Howe said that it's extremely difficult to get a loan on an airplane that is an orphan—where there is no factory support—such as a Bellanca Viking or the Aero Commander 112 and 114 series.

On the other hand, Howe told us that the bread and butter airplanes for the banks—the ones they prefer—are high-performance piston singles such as Cessna 210s and 400s, Piper Saratogas and Malibus, Cirrus SR22s and the Beech Bonanza line as well as all piston twins.

Brokers also told us that one of the best things a prospective owner can do is to get financing approved before picking out an airplane. That way the buyer knows the precise limits of his or her budget and can negotiate accordingly as well as move fast once finding the right airplane—assuming it passes a rigorous pre-purchase examination.

Steve Smestad also told us that the type of flying the owner plans to do will affect the interest rate and term of an aircraft loan. If you are buying an airplane you're going to fly 150 hours a year, you'll be looking at the low end of the interest rates, a 15 percent down payment and a full 20-year amortization. If you're going to lease the airplane back to a flight school where it will fly 100 hours a month, you'll be probably pay near the high end of the interest spectrum, probably have to put 20 percent down and will have a less than 20-year amortization period.

Plan on being able to finance no more than 85 percent of the Vref/*Blue Book* value or the agreed purchase price, whichever is lower. We note that some lenders will make an exception for recently refurbished airplanes. Knowing that you won't be able to finance more than 85 percent of book value gives you leverage in negotiating with a seller who argues that "book values are too low."

CONCLUSION

We think that even though interest rates are slowly creeping up that it's a good time to buy. We recommend arranging your financing through an aircraft finance broker and getting your financing approved before you make a decision as to which airplane to buy.

Flashlight Update: S&W, Streamlight Impress

The Sporty's Captain's light by Smith & Wesson and Streamlight Night Com win our long-term flashlight trial. But, the Fenix UC30 is worth a try.

by Larry Anglisano

In the December 2015 issue of *Aviation Consumer*, we declared the Smith & Wesson Captain's light (by Sporty's) and the Classic Maglite the top dogs among LED flashlights for the cockpit. Still, we weren't going to let them walk away with the trophy that easily.

The real test would be using them long term—and we weren't gentle. We're pleased to report that all eight of the lights that were among our favorites survived a year of hard use inside the flight pack, in the cockpit and around the aircraft for preflighting and light maintenance chores. Since we think flashlights should serve double duty, we kept them handy around the garage and during rugged outdoor activities.

None of the lights needed battery replacement, but since our use was spread out among several lights, we didn't expect to. We continued to like the S&W's intuitive and simple buttons, plus the ability to conserve power by shutting down LEDs (three dual-mode LEDs and 10 single-mode LEDs). For a AAA-powered light, we think the $39.95 price (with holster) is a solid buy. Worth mentioning is the model used in our January 2011 review recently suffered a broken switch.

Replacing the Maglite LED, our new second favorite is the law enforcement-endorsed Streamlight Night Com. While we like the anodized aluminum body and long battery life (28 hours via two 123-series lithium cells), we couldn't warm up to the small rotary knob that's difficult to use with gloves.

But, the "safety" mode to guard against inadvertent power-up was a saving grace. If the $59.95 price is an issue, we'd go for the cheaper Sporty's/S&W.

FENIX UC30

The $60 UC30 shines 960 lumens and runs on either a single 18650 USB rechargeable li-ion battery or two CR123A batteries. You'll only get 1.5 hours endurance at full brightness, but over 30 at 50 lumens. At 5 inches long and 1 inch wide, the impact- and water-resistant UC30 is the right size for the cockpit. The light has five outputs, including an instant strobe mode. We use Lone Tree, Colorado-based Fenix cycling lights with good results, plus the company is easy to reach and talk with. For more, visit www.fenix-lighting.com.

Reader Peter VerLee turned us on to the rechargeable Fenix UC30, middle image. That's the S&W Captain's light, lower right. The Streamlight Night Com, top of page, is a close second to the S&W.

Cessna 210 Centurion

A Cessna 210 won't be cheap to maintain, but it pays back in load hauling, speed and cabin comfort.

A six-seat retractable single can be a logical and compelling. step-up aircraft. Some are as fast as many twins, can carry sizable payloads, can accommodate plenty of modern avionics and generally are straightforward to fly. A single engine avoids a twin's upkeep costs, while most systems (with landing gear being a notable exception) aren't overly complex to work on. So which model do you buy?

Despite all the appeal, the market isn't littered with obvious choices. There is the 36-series Bonanza, Piper's Lance/Saratoga and Cessna's 210 Centurion. There is also the non-pressurized, cabin-class Piper Matrix, but its price point may not make many prospective purchasers' lists. If fixed landing gear is more to your liking, then Piper, Cirrus and Cessna have other offerings making the cut.

Still, a six-seat retractable offers a good mix of the things pilots with a need to go places and carry more than two people often look for. This includes good range/endurance, loading flexibility, enough cruise speed (so that inevitable headwinds won't prolong the agony that much) and the ability to mix easily with the airliner flow at larger airports.Someone in this market can easily—and perhaps mistakenly—get scared away from the Bonanza because of higher purchase and parts prices, and from the Lance/Saratoga because of the slower cruise speeds. Often the winning solution is the Cessna 210 Centurion. Got substantial flight time in a 100-series Cessna? That could make a 210 step-up more appealing. But there's no free lunch.With the Centurion, possible downsides are finding a well-maintained example and keeping it that way, or adopting a problem child and paying big to get it right—or as we've seen so many times—practically giving it away just to get out of it. Centurion maintenance is not trivial, especially the landing gear. If too many items are deferred, the airplane may have annoyingly bad dispatch reliability. Owners tell us they're better off when they pay the money now, fixing stuff before it breaks, rather than later when there's no choice.

When all-out payload and speed are important, the 210 is hard to beat.

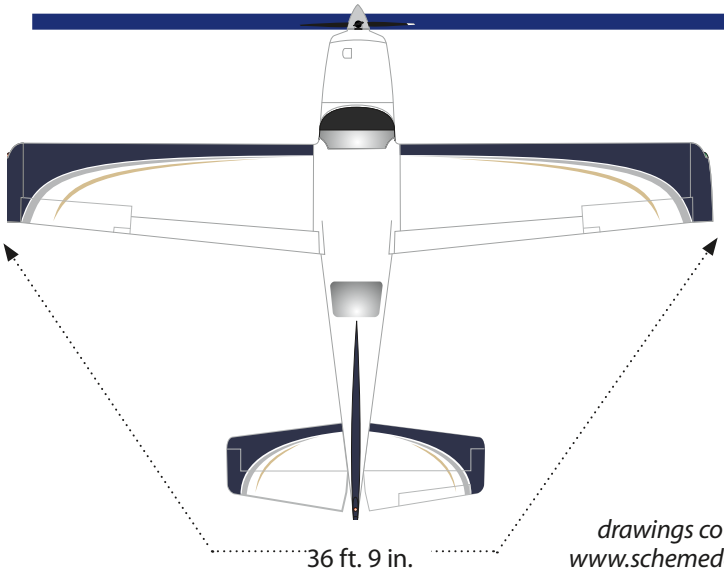
Cruise speeds of about 170 KTAS can be routine and equipped useful loads easily exceeding a half ton are common. Fuel capacities vary between model, but there should be enough to traverse a third of the U.S. without stopping, while carrying at least three adults and lots of bags.

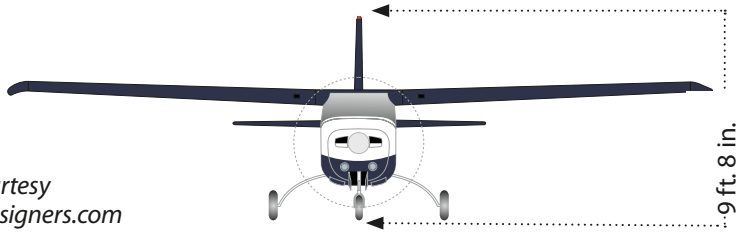
MODEL EVOLUTION

By almost any measure, the Cessna 210 is a flexible, successful airplane. Although early models were little more than retractable 182s, it eventually evolved into a sophisticated, sought-after series of three basic types, each with their

The 210 came in turbocharged and normally aspirated versions. That's a 1982 T210N in the main photo above. Notice the missing aft landing gear doors.

CESSNA 210 CENTURION



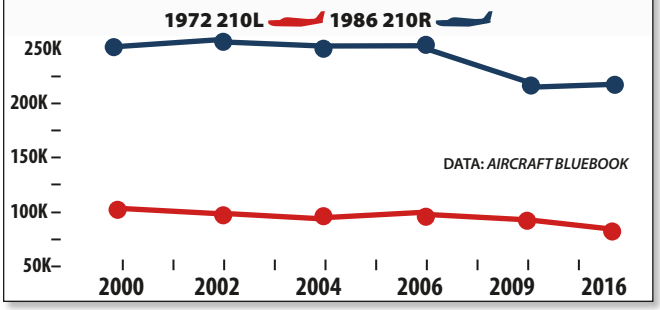


drawings courtesy
www.schemedesigners.com

CESSNA 210 SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1960 210	CONTINENTAL IO-470-E	1500	$30,000	65	1160 LBS	165 KTS	±$35,000
1964 210D	CONTINENTAL IO-520-A	1700	$30,000	65	1240 LBS	166 KTS	±$44,000
1967 210G	CONTINENTAL IO-520-A	1700	$30,000	90	1440 LBS	167 KTS	±$50,000
1967 T210G	CONTINENTAL TSIO-520-C	1400	$35,000	89	1350 LBS	170 KTS	±$60,000
1972 210L CENTURION II	CONTINENTAL IO-520-L	1700	$30,000	90	1440 LBS	170 KTS	±$75,000
1972 TURBO 210L CENTURION II	CONTINENTAL TSIO-520-H	1400	$35,000	90	1580 LBS	180 KTS	± $82,000
1979 210N CENTURION II	CONTINENTAL IO-520-L	1700	$30,000	90	1600 LBS	170 KTS	± $117,000
1979 T210N CENTURION II	CONTINENTAL TSIO-520-R	1600	$35,000	90	1697 LBS	180 KTS	±$126,000
1986 210R CENTURION II	CONTINENTAL IO-520-L	1700	$30,000	87/115	1630 LBS	180 KTS	±$215,000
1986 T210R CENTURION II	CONTINENTAL TSIO-520-CE	1600	$35,000	87/115	1630 LBS	189 KTS	±$230,000

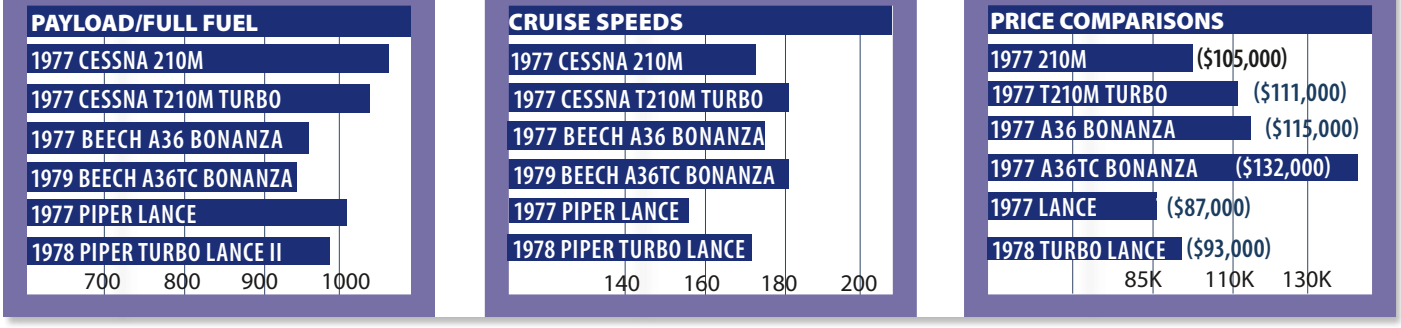
RESALE VALUES



SELECT RECENT ADs

AD 2002-07-01	REPLACE LEFT AND RIGHT STABILIZER ATTACHMENT BRACKETS
AD 2004-08-10	INSPECT/REPLACE CERTAIN ECI CYLINDERS ON IO-520 ENGINES
AD 2004-19-01	INSPECT UPPER SHOULDER HARNESS ADJUSTER
AD 2005-24-09	REPLACE VARIOUS MCCAULEY PROPELLER HUBS

SELECT MODEL COMPARISONS



That's a wing-mounted radome, top, and a T210M's retrofitted panel, photo courtesy of Scott Dyer.

own characteristics, including the normally aspirated 210, the turbocharged version and the pressurized Centurion, which we covered in a separate report in the March 2015 issue of *Aviation Consumer*.

The 210's lineage extends back to the late 1950s, when tricycle landing gear—much less a retractable—signified a newly designed airplane. First certified in 1959 and marketed as a 1960 model, the original 210 and 210A were 2900-pound airplanes powered by a Continental IO-470-E of 260 HP, a fuel-injected version of the 182's engine. Also belying its 182 roots were a strut-braced wing and seating for four. Still, there were major differences.

Chief among them: Cessna engineers had to devise a way to hide its landing gear in the belly. They succeeded, but no one would call the results elegant. Hangar flyers throughout the world still remark on the "twist and tuck" gear retraction design first developed for the 210 and later extended to all high-wing retractable Cessnas. Early models relied on an engine-driven hydraulic pump, which was later upgraded to an electrohydraulic system.

Before that, though, Cessna made minor improvements in 1961, bringing out the 210A, still powered by the IO-470-E with a 1500-hour TBO. A slightly larger cabin, a 100-pound gross weight increase and a different engine (IO-470-S) resulted in the 210B. Big news came in 1964, with the 210D, which received not only Continental's IO-520-A, but a 1700-hour TBO and another 100-pound gross weight increase. Child seats in the baggage compartment were optional.

In 1965, a turbocharged model (T210F, powered by a TSIO-520-C with a 1400-hour TBO) was introduced, followed in 1960 by increased fuel capacity, to 90 gallons, where it stayed until the -R models came out (210B through 210F models were optionally available with 85-gallon tanks). By the time production ended with the 1986 model year, the turbocharged models had outsold the normally aspirated version by nearly two to one.

In 1967, Cessna made a major change in the look of the airplane when it replaced the strut-braced wing with a cantilevered design. While it was later determined that airframe break-up rate of the cantilever models was the same as the faster strutted ones, some critics question the wisdom of this redesign. In about half of the accidents, the tail broke before the wing did, which is pretty common for inflight breakups. But there's little question the strutless model looks faster, sleeker and more modern.

By the time the 1970 model 210K arrived, Cessna had added extra baggage space, two additional seats and a 3400-pound gross weight. A year later, the 210 got a boost in takeoff horsepower, to 300 HP, still using the tried and true IO-520-L. In 1977, the 210M came out, with a 3800-pound gross weight, to be followed in 1979 by removing the gear doors for the 210N. Ninety gallons of fuel was standard tankage on 210G through -N models.

But the peak had been reached. Only one additional model—the 210R, with the same IO-520-L and a 3850-pound gross—would come out before production ended as Cessna extracted itself from the piston-powered airplane business. The turbocharged models were also retired with the 1986 T210R, by then sporting a 325-HP TSIO-520-CE with a 1600-hour TBO and a 4100-pound gross. Both -R models came with 87-gallon fuel tanks as standard and were optionally equipped at the factory for 115 gallons.

Along the way, in 1972, Cessna reworked the gear system. While still hydraulic, it no longer relied on an engine-driven pump. Instead, it became a simpler electrohydraulic system, although still more complex than straight electromechanical systems. Seven years later, in

1979, Cessna introduced another simplification by eliminating the main gear doors. This ridded the airframe of actuators, linkages and various switches, yielding a system with fewer failure points. It was also lighter and less expensive to build. Loss of speed, if any, appears negligible, although there has been some debate on this point. (Owners of older models can have their gear doors removed through an STC.)

Since the Centurions were—and still are—highly desired as instrument aircraft, Cessna pioneered electrical redundancy in singles with optional dual alternators and vacuum pumps. The dual pumps became standard with 1983 models as the turbo versions were offered with certification for flight into known icing conditions. Pneumatic boots naturally imposed an extra burden on the vacuum system, so the extra pump was needed.

PERFORMANCE, COMFORT

Light on the controls, sports car-like handling, delightfully well-balanced are all adjectives used to describe how airplanes handle. None of them apply to the Cessna 210. The Centurion is, at best, a truck. Pitch forces are relatively heavy and although roll rate is adequate, the controls are not well harmonized when compared to, say, the 36-series Bonanzas.

Some owners tell us the 210 "is nice and stable. Put it somewhere and it stays there." Others have told us if you don't learn to trim precisely, hitting the airplane's target speeds for approach and landing will be like a workout in the gym, which is more in line with our own experience flying the 210. But set the power and trim correctly and it's child's play. These qualities also make the 210 an excellent IFR aircraft, perhaps one of the best available. Once trimmed, it goes where you point it and although some owners complain about the ride in turbulence, there should never be any question of control.

Thanks to limited elevator travel, the Centurion is tough to wrangle into a full-stall break, so there's nothing particularly nasty about them. Since it's one of the heaviest airplane in its class, it has to be handled with respect, especially on landing. It's not difficult to land, mind you—especially when there's some weight in the back—but it suffers its share of hard landings, swerves, runway overruns and gear collapses. Again, if trimmed on speed, the 210 can be landed with no undue strain.

Strutless 210s, top, have predictable handling if you trim correctly. The Continental TSIO-550 is tightly packed in the cowling, middle. Egress and ingress is easy, thanks to wide cabin doors.

Speed is the 210's true forte. Owners tell us that real-world cruise speeds lie in the 160- to 170-knot range, with climb rates of about 750 FPM at 120 knots indicated, although many do cruise climbs of 500 FPM all the way to altitude for better speed and cooling.

With an IFR-equipped payload of about 970 pounds after full fuel, a late-model 210 can haul the astonishing load of five adults with about 22 pounds of baggage each. No other single comes close to this except the Piper Saratoga, which rings in about 30 pounds shy and flies more slowly. Furthermore, the Centurions have an unusually long center of gravity envelope (the longest in class) that tolerates loading extremes that would make other models in this class virtually unflyable, namely the Bonanza. When all-out payload and speed are important, the 210 is hard to beat.

Although most Cessnas have an excellent reputation for short-field operation, an unmodified 210 doesn't shine in this category when compared with its peers. Minimum runway required to clear a 50-foot obstacle is a little over 2000 feet, which is close to the figure given for the A36 Bonanza, but

CENTURION CRUNCHES: FUEL, GEAR

Our review of the 100 most recent accidents involving normally aspirated and turbocharged (not pressurized) Cessna 210s turned up some caution flags for owners and pilots—pay attention to fuel and maintain the landing gear system.

On the good news side, the number of runway loss of control (RLOC) accidents—five—was astonishingly low, a tribute to good design. Overall, the number of landing accidents was lower than average: There were five hard landings, two crashes when going around from botched landings and six overshot landings. A 210 needs to be flown on-speed on approach: It will float a long ways if the approach is fast. One pilot who went off the end of the runway and tore up his airplane said that he'd come down final at 110 knots—some 30 knots fast—because of "tall trees in the approach path." Huh?

On the bad news side were 20 fuel-related accidents. Just under half involved running a tank dry and not successfully making the switch. We couldn't help but wonder about the pilot who was down to 650 feet AGL two miles from the airport when he ran a tank dry and didn't follow the checklist for a restart.

Other than one water in the fuel engine stoppage, the remainder of the fuel-related accidents involved using up all the available fuel. Most were pilots who had taken off with reduced fuel to start with, including a non-certificated pilot who decided to take a friend for a night joyride.

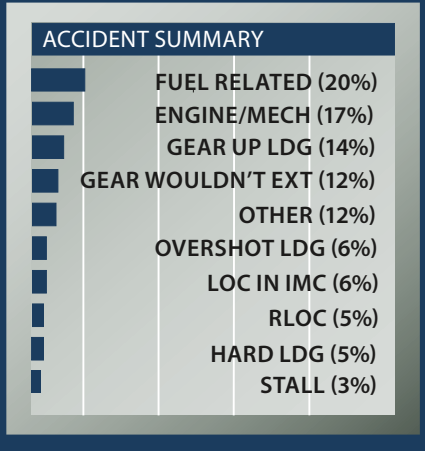
We note that cantilever-wing 210s have long, skinny fuel tanks and the wings have little dihedral, so the airplane must be parked wings level to assure the tanks can be completely filled. Cessna has published warnings to that effect. It's not kidding. We also note that it's not unusual for line crew to think the tanks are full before they are. Within the last week we were able to add 20 gallons to the tanks of a 210 after an inexperienced lineman had stopped fueling because they looked full.

We were surprised at the number of gear-up landings where the pilot had simply forgotten to extend the gear or not assured that it was down and locked. Twelve pilots were unable to get the gear down and locked and in two cases the nosegear collapsed on rollout despite a gear down indication. In each of those events, some component in the gear system had failed or the hydraulic fluid had leaked out—in our opinion the 210 gear system should be maintained assertively and any problem fixed immediately, not deferred.

We observed that no one was injured in the gear up landings—even when the landing gear was partially extended.

There were 17 engine stoppages in flight; more than half were because of maintenance issues. The remainder were unexplained. We note that some models of the T210 can be at risk of vapor lock. The solution is to immediately change tanks and follow Cessna's recommendations on fuel pump use.

Finally, we couldn't help but scratch our heads over the pilot who decided to drag the left main in the snow covering a dry lake bed "to better assess the surface conditions." Unfortunately, "drag rapidly increased and sucked the aircraft down." Full power didn't help—the airplane sunk into the snow and nosed up.



longer by several hundred feet than those posted by the other Bonanzas and Piper's PA-32R.

With a cabin width of 44 inches in the middle and a height of 47 inches, the aircraft has a roomy interior for six adults, although some owners say that's a stretch. Still, we used to put six adults in a T210 pretty regularly, with the smallest people in the far aft seat. You could carry full fuel, six 170-pounders and about 10 pounds of baggage. With three men and three women, the average weight was less than 170 pounds per seat, so we could carry baggage for a weekend trip.

Ventilation and heating are generally good except for the rear of the cabin. The trick? With the heat on full, add in some outside air. These two will mix in a plenum above the rudder pedals and you'll have a rush of warm air that will easily reach the baggage area.

In general, fit and finish in many Cessnas is not the best and the 210 is no exception: Poorly fitting doors and aging seals occasionally lead to drafty cabins. Owners also complain of water and air leaks, and Royalite interior panels that crack and come apart with age.

MAINTENANCE

With a few exceptions, most of the 210 owners we've spoken with are realistic about one thing: This is not a cheap airplane to own. Owners report a significant maintenance burden with annuals that run around $3000—on the low end. Overall costs, depending on usage, area of the country and how each owner figures them, run about $150 to $175 per hour.

Although production of 210s ended in 1986, owners report good parts availability, albeit with high prices. Used parts are sometimes an option, given the relatively high population of 210s.

The main gear doors on 210s have been an ongoing problem for years. One of the more popular mods has been to simply remove them, a step eventually taken by the factory as noted above.

The service difficulty report (SDR) database shows many gear-related problems in the 210. Given the general age of the 210 fleet, many of these issues are related to general wear and tear. Many of them, too, are related

to the system's general complexity. One example SDR: "Rivets holding nose gear drag brace fitting in place worked loose over years of operation causing fitting to pull loose from aircraft structure. This, in turn, caused nose gear to retract on ground."

Various components get blamed for gear problems but the overall issue is sheer complexity: There's a lot going on when the gear is cycled. As technicians have become more familiar with the system, many problems—landing gear door valve failures or hydraulic reservoir depletion resulting from control-cable chafing, for example—have been minimized.

These days, however, it seems long-term service of basic components like rod ends and other mechanical parts is exacting a toll. Read another SDR entry: "Nose landing gear failed to extend. Nose gear uplock actuator clevis assembly failed, causing nose gear assembly to stay in up and locked position. Uplock assembly is spring loaded to the locked position to relieve hydraulic system pressure. Submitter recommends every 100 hours check clevis assembly for security of cotter key in clevis assy for locking effectiveness."

Too, the historic nemesis of older Centurions—fatigue cracks in landing gear saddles—has apparently not abated completely. While a repetitive AD from 1976 addresses the issue, it still crops up from time to time in the SDRs. All 210s built from 1960 to 1969 live under the shadow of this problem. With luck, the cracks are found during annual inspections and are fixed in any airplanes now on the market. If for some reason they're missed, the saddles eventually break and the pilot finds out when one landing gear leg hangs up in the halfway position.

Saddle replacement was required for 1960 and 1961 models. But even they must be replaced every 1000 hours. Buyers should check the saddles and replacement times on these aircraft. Some owners simply replace them whether they're cracked or not. Later, 1968 and 1969 models came with improved saddles as original equipment, but they must be inspected at 1200 hours and annually thereafter and still run the risk of eventual cracking. The landing gear system was redesigned in 1970, thus apparently ridding the line of the problem once and for all.

Fueling a 210 when it isn't sitting level makes it difficult to fill with accuracy, but fuel management is simple.

Potential buyers should also take care to check the horizontal tail for a variety of problems, including stabilizer and bracket cracking. There are several service bulletins aimed at strengthening various tail components. And make sure the elevator skin itself has not become corroded thanks to water absorption by the foam filler, especially in older 210s. Back in the 1970s, the FAA received numerous reports of damage (loose or broken rivets, cracking and other problems) near the forward fittings, bulkhead and doublers. The problem is confined to fuselage station 209 and Cessna has kits to repair the problems or prevent them from happening.

Cessna has issued service bulletins dealing with cracks in the lower forward doorpost and strut fitting, which affects other Cessna singles as well; if any are found, a mod must be done. If not, repetitive inspections at 1000-hour intervals are called for. Some notable ADs include: AD 91-22-1, which calls for replacing cracked and chafing wires in the nosegear tunnel on all 210s; AD 94-12-8, regarding calibration and labeling of the fuel system; and AD 93-13-9, concerning replacement of the air induction hose on T210s. We've seen plenty that are chewed up.

There's one more thing to be aware of about the 210, a trait that could bring the pilot who pushes the limits of range to grief. The position of the fuel caps on top of the wing, as designed, places them at the high point of the tanks. It's entirely possible that, if the airplane is not level or if the nose strut is not properly inflated, the tanks can't be fully topped. Given the dismal accuracy to be expected from aircraft fuel gauges, this potential mismatch between what the pilot thinks is on board and what is actually there poses a possible hazard. When flying to maximum range, be diligent in getting the tanks topped correctly.

MODS, CLUBS

Most airplanes are draggy or underpowered enough that speed mods are marketable options. It's a testament to the 210's basic good performance that this is not the case. Still, like any high-performance single, the 210 can benefit from the installation of speedbrakes. Both Precise Flight (800-547-2558, www.preciseflight.com) and Knots 2U (262-763-5100, www. knots2u.net) offer electric-actuated speedbrakes that work well and are a good value. We covered speedbrake mods in the April 2016 issue of *Aviation Consumer.*

Also of interest is an IO-550 engine upgrade, which is generally done in conjunction with a prop up-

For a well-maintained 1980 210N like Peter VerLee's shown in the top photo, plan on $5000 annual inspections—if all goes smoothly. Got bags? A 210 is best in class for loading them in.

grade. TruAtlantic—formerly Atlantic Aero—(844-309-6548, www.truatlantic.com) and Texas Skyways (800-899-7597, www.txskyways.com) offer upgrades to the TCM 550-series engine. There's also the aforementioned gear door elimination mod from Sierra Industries (888-835-9377, www.sijet.com). Sierra also makes STOL kits, as does Horton (620-326-2241, www.hortonstolcraft.com).

There's also the Vitatoe turbonormalized IO-550 mod (www.vitatoeaviation.com), enabling impressive climb rates while keeping engine temperatures cool.

As an invaluable source of wisdom and support, 210 owners should join the Cessna Pilots Association (805-934-0493, www.cessna.org). CPA has an excellent buyer's guide on the 210. Another group is the Cessna Owner Organization at 888-692-3776 or www.cessnaowner.org.

For tips on flying any 210, we recommend *Flying the Cessna 210—The Secrets Unlocked* by Chuck McGill, www.safeflightintl.com.

OWNER FEEDBACK

The T210 Centurion is an airplane with incredible capabilities for a single-engine piston, but is not for the "faint of wallet." I've flown my Centurion 3000 hours since January 2000. Stepping up from a Piper Dakota, I considered the 210, Bonanza and a Saratoga. The Bonanza lacked the payload and loading flexibility, and the Saratoga was slower than either. Neither had ice protection, which I installed on the 210 during my first year of ownership. Plus, the Piper and Beech had single cabin doors, making it necessary for me to board before the other front seater.

It is said of the Centurion that if you can close the doors it will fly. This is almost always true. I can load 5.5 hours of fuel, 2.5 hours of deicing fluid and 900 pounds in the plane and fly within the weight and balance limitations. The 5.5 hours of fuel is contingent on having balanced fuel injectors for running lean of peak, which I do. The 2.5 hours of deicing is with the system running on the anti-ice setting. On deice mode, the fluid will last just over an hour.

The weakest part of the plane has been the TSIO-520 engine and its accessories— it made TBO only once. Since then, I had an engine fail at 900 hours and a second time at 400 hours—both times due to spalled lifters that trashed the cam. The first time I went for a full overhaul to new limits. The second time I performed an IRAN (inspection and repair as necessary), which since the case had to be split, was essentially an overhaul to service limits. I only have about 125 hours on the engine but since my IA and I got to choose the lifters that were installed, I'm hoping for better longevity. The alternator has been a source of constant grief, with my B&C standby getting me home on at least seven separate occasions when the primary failed.

Annual inspections (if the engine doesn't have issues) run about $5000. This is a complex airplane and there will always be some squawks. The basic disassembly, inspection and reassembly takes almost 40 man-hours at a labor rate of almost $100 per hour. I upgraded the panel in 2009 with a Garmin GNS530W, Aspen PFD, Garmin 330 transponder and a PS Engineering audio panel. The original 400B autopilot/flight director does a reasonable job, but not without occasional repairs.

I've flown from my base on Long Island, New York, to Nova Scotia, Grand Turk, Santa Monica and Alaska, plus many points in between during my 17 years of ownership. When she gives me mechanical grief I could cry. But, when she's working right, there's no airplane like a Turbo 210.

Michael Harbater
Far Rockaway, New York

I purchased N732AV, a 1976 C210L, in the fall of 1981. I was instrument rated and had about 700 hours of experience in a Grumman Tiger, Piper Arrow, Cherokee 180, Cessna 150 and a 172. My typical mission was to fly from Groton, Connecticut, to Clintonville, Wisconsin,

then to Sioux City, Iowa, and back to Connecticut on long weekends. The normally aspirated 210L turned out to be perfect for that mission. Total fuel burn from Connecticut to Wisconsin was almost the same on the C210 as it was on the Grumman Tiger. Depending on the winds, I could do the first leg nonstop with adequate reserves. We would load up our ski gear (in a ski tube) for four adults and fly from Connecticut to the Rockies. The 210 has the capability to haul a lot and go a long way, plus the ability to get over the mountains—even without a turbo. Whatever would fit in the car would fit in the 210 and we would always be within weight and balance limits.

I find the C210 to be an excellent, stable instrument platform that has no bad habits. It came with King radios, which were trouble-free right up to the time I replaced them with a Garmin stack with ADS-B. The 300A autopilot was trouble-free and working great right up to the time it was replaced with a STEC 50. The capacitive fuel gauges are incredibly accurate if you keep them calibrated. The OEM 1970-vintage wire-wound potentiometers in the gauge control unit are susceptible to corrosion, which can lead to erratic readings. They are also vulnerable to ham-fisted mechanics damaging them. Replacing them with modern sealed pots solves this problem.

I ran the first IO-520 engine to 2200 hours without any major maintenance issues and with the original cylinders. It was running great when we installed a factory re-manufactured IO-520 in 1994. I was so disappointed that after spending close to $30,000 on a new engine the plane flew no differently than it had on the old engine. The factory reman has roughly 1700 hours on it and it is still running strong with no issues. It normally burns a quart of oil every five hours. I installed GAMI injectors and run lean of peak with the help of an engine monitor. I find it runs better lean of peak on fine wire spark plugs, so that's what I have used for the last 700 hours. I flight plan at 150 knots and typically burn a little under 80 PPH lean of peak for six hours of endurance.

Typical straightforward annuals run about $5000. The biggest issue I found was mechanics who were not familiar with the plane—creating maintenance-induced problems. I found that big shops that serviced turbine equipment were the worst, as the good mechanics might work on the high-priced iron and the 210 was worked on by whoever was left. A good thorough preflight after an annual is essential. In the 2700 hours I have flown the plane, there were only two instances where the plane was not ready to support the mission due to mechanical issues. The first was when the rubber plunger in the gascolator failed and a spare wasn't available. The second was when a gear door actuator blew apart because of incorrect assembly by an incompetent mechanic. I do as much maintenance as FAR 43 App A, part C allows. I just completed the installation of a new Airtex interior—a huge job when done correctly.

I did the Sierra mod to remove the gear doors on the main gear. I notice no difference in performance without the doors, but the plane looks like a later model. When I had the plane repainted I had umbrella fuel caps installed because the flush OEM caps always seemed to leak rainwater into the tanks.

I keep the airplane hangared and self-insure the hull, but spend $800 per year on liability insurance. The Cessna Pilots Association is a great asset for Cessna owners. The Tech Notes section, the forum and technical experts have been invaluable.

Wayne Romberg
Forked River, New Jersey

I have owned a Cessna 210 with three partners for 12 years, three engines, three propellers and two airframes. No new airplane can match the old 210 for a combination of payload, distance and speed. I flight plan for 155 knots, hauling 90 gallons of fuel and burning 12.5 GPH lean of peak. Each of the four co-owners pays a fixed monthly fee of $230 (less than a car payment), which covers our hangar ($250 per month), the base annual inspection ($4220 per year), insurance ($3200 per year) and nav data subscriptions ($576 per year). We pay $36 per hour for engine and prop overhaul. We currently own a 1976 Cessna 210L—our second Cessna 210—purchased in 2016 for $105,000. The first one

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CESSNA 210

(continued from page 31)

suffered a landing gear failure. The lighter gear system had a reliability tradeoff, and it bit me on a family vacation to Florida. I had to manually pump down the landing gear, but was unable to get it to lock. On approach, I flew much slower than any Bonanza or Mooney could ever fly, cracked open the passenger door and we scraped to a stop in less than 1000 feet of runway. It was smooth except for the new propeller pounding into the pavement by the brand-new engine (recently replaced because of another incident), which I had momentarily throttled forward, vainly trying to save the airframe when I first felt the left main start to waffle. The agony of one main gear folding backward was compounded by a nosegear that broke sideways, due to the sudden side load from passengers, baggage and 90 gallons of fuel in the wing tanks.

We flew our previous engine to 600 hours beyond TBO. It performed with great power and reliability right up until it seized in flight and left my co-owner and his wife gliding to a successful deadstick landing on a nearby runway, frantically hand-pumping the gear down.

Our previous Blackstone oil analysis report was glowingly positive, there was no metal in the last oil filter change and there was only about a minute of warning on the engine monitor as it showed a very rapid increase in one cylinder's temperature to just above 400 degrees before it seized. Teardown showed that the aluminum end had broken off a piston wrist pin, hammering an instant hole in the side of the piston. When I asked Continental how common it was for the end to break off of a wrist pin, they answered me with studied silence.

We bought the scimitar-shaped Hartzell J3F (with spinner for $10,300), which has become the de facto standard propeller for this airframe. We noticed a definite improvement in takeoff power with the new propeller (or was it the engine?), until it ate a runway in Florida.

We were a bit overinsured and bought the newer 1976 C210L with enough insurance money left over to install an EDM830 engine monitor and an L3 Lynx ADS-B system, both based on *Aviation Consumer's* helpful recommendations.

With two doors, a spacious cabin for six (or five, plus a furry friend) and a wide CG envelope, a Cessna Centurion is a good family traveler.

I have learned many things about the 210 in the last 12 years. Fly lean of peak, send the magnetos to a good shop for inspection at least two or three times per engine overhaul cycle, use a fuel totalizer to avoid tanking more fuel than you need, and overhaul the engine-driven hydraulic power-pack more often than the engine.

Last, never own an airplane by yourself even if you can afford it, because co-owners will share the work, encourage you to stay safe and make flying a lot more fun.

Michael Magnell
Dallas, Texas

FEEDBACK WANTED

GRUMMAN CHEETAH

For the April 2017 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Grumman AA-5 Traveler and AA-5A Cheetah. We want to know what it's like to own these aircraft, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs **(full-size, high-resolution please)** you'd like to share to the email below. We welcome information on mods, operating expenses or any other comments. Send correspondence on the Cheetah/Traveler by March 1, 2017, to:

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