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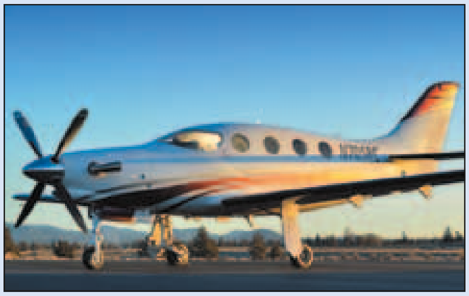
Garmin G3X Touch

A new touschscreen avionics suite that out-features the G1000...page 8



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The Aviation Consumer

EDITOR
Larry Anglisano

SENIOR EDITOR
Rick Durden

EDITORIAL DIRECTOR
Paul Bertorelli

CONTRIBUTING EDITOR
Jim Cavanagh

SUBSCRIPTION DEPARTMENT
P.O. Box 8535
Big Sandy, TX 75755-8535
800-829-9081
www.aviationconsumer.com/cs

FOR CANADA
Subscription Services
Box 7820 STN Main
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BUILDING FOR A NEW FAR 23

You've probably heard about the ARC's (Aviation Rule Making Committee) proposal to the FAA that could relax the stringent certification process for small aircraft. I think we can all agree that it's time to change the certification standards that exist in FAR 23 regulations, particularly when it comes to avionics. This was obvious as I looked at two new integrated avionics suites that were introduced at the annual Sun 'n Fun show this past April.

Garmin brought its latest generation G3X—the G3X Touch. It's been redesigned from the ground up and is available in a variety of configurations. As the name implies, it has a touchscreen feature set, plus a long list of standard and optional features that you might expect in a newly designed avionics system. You can read all about it starting on page 8 of this issue.

The other attention-getter was Dynon Avionics' reworked Skyview, relabeled the Skyview Touch. It too has a new touchscreen feature set, along with a major software improvement that finally enables more integration with popular IFR navigators, including the GNS530/430 and GTN750/650. But as impressive as both of these systems are (including the price point—both systems start at under $6000), you can't legally install them in a certified aircraft and that's unfortunate for a market that's struggling to afford avionics upgrades.

Uncertified avionics isn't unchartered territory and these new systems from Garmin and Dynon could help support a Part 23 rewrite. For years, Dynon has served the experimental aircraft market and more recently, the light sport market, with uncertified avionics that have features and a price point that puts many certified systems to shame. I've been involved in enough experimental avionics retrofits to know that there's no shortage of failsafe that exists in the wiring interconnection between components and the electrical bus (a major concern the FAA has for avionics in certified aircraft). In many cases, these systems have more failsafe than certified interfaces, and it's not uncommon for many experimental avionics suites to have several layers of backup.

One airplane manufacturer that's making a sizable contribution to the Part 23 ARC technical and regulatory committee is Flight Design, the maker of the CT-series LSA. Flight Design is well along in the development of its C4, a four-place composite single that will be powered by the Continental IO-360AF alternate fuel engine, will have a whole-airplane parachute, an impressive 1320-pound useful load and an 80-gallon fuel capacity. The picture above is the C4's cockpit.

But the big news from Flight Design is its selection of Garmin's non-certified G3X Touch avionics. This is a bold step because the C4 is intended to be an IFR-approved airplane that will be certified under FAA Part 23. An integral part of that IFR capability is the presence of Garmin's certified GTN750 IFR navigator and GNC255 navcomm. Flight Design could have selected the certified G1000 integrated avionics, but that would have driven up the cost of the airplane that's expected to sell for around $250,000 with the G3X Touch as standard.

Flight Design says it can use the uncertified G3X Touch avionics in a certified C4 because the proposed Part 23 rewrite has a provision for non-TSO approved equipment when blanketed under the aircraft's type certificate. It may seem like Flight Design is taking a huge gamble by banking on the distant changes to FAR 23, but the fallback in the C4—should the Part 23 rewrite or G3X Touch fail—is the backup flight instruments, along with the certified GTN750 that sits in the middle of the instrument panel. That's a smart and affordable approach to new airplane certification. —*Larry Anglisano*

SAFETY REFURBS

As an emergency physician with a background in epidemiology and public health, I would like to thank Rick Durden and *Aviation Consumer* for the article on Safety Refurbs in the March 2014 issue. Although it was very well done and quite helpful, I'd like to add two caveats.

It is difficult to calculate overall effectiveness of safety equipment because flying is actually pretty safe and there are always unintended consequences of adding equipment. Like anti-lock brakes in cars, I'm sure that parachutes save some individuals. But some pilots would have been better off spending the money on training, better instruments or replacing the parachute with fuel. Anti-lock brakes might induce complacency and increase risk-taking by drivers, which makes up for their overall benefit. I suspect that parachutes are a good idea, and I'd never do acro without one, but suspicion is not proof.

Either airbags or belts are essential equipment. Both are about equally good at keeping you and the panel from merging. Each has some minor theoretical advantages, but at least in ground vehicles, the benefits are not additive. If you were to use the three-point harness in your car, the airbags probably add nothing. The NTSB seems to like the integrated systems (on the basis of very weak evidence) and maybe they are worth the cost, but I'd be happy with a good set of four—or five-point belts.

Mark Hauswald
via email

You overlooked one simple, inexpensive method of improving restraints in aircraft without shoulder harnesses. The Quickie from Hooker Harnesses anchors to the seat belts in the seat behind the occupant. The rear seats in my 1967 T210 lacked harnesses for the main (middle row) passenger seats. I added on by using two Hooker Quickies. These belts (available in a choice of two colors) consist of a two-inch V-type harness that has large loops on either end. It uses the rear seat belts of a four-place aircraft to anchor the shoulder harness for the front seat occupants. The front seat belts are then threaded through the loops on the opposite end. The length adjustments are made with conventional adjusters. Basic positioning is done by adjusting the rear seatbelts.

I anchored them to the belts for the third row kids' seats. They aren't as effective as real harnesses with proper geometry (as Hooker mentions in its own discussion), but they certainly would reduce the flail. All of this without complicated paperwork, additional approvals or tools.

Art Friedman
Santa Paula, California

ASPEN'S VFR PFD

I read the article in your April issue on Aspen's new Evolution VFR PFD. I'm struggling to understand what's VFR-only about it.

If an airplane has navcomm radios with dedicated CDIs, the PFD is an ideal unit to replace the vacuum-driven AI and DG. There's nothing VFR about it. My Garmin GNS530 fulfills all the IFR navigation I'll need, plus my backup King KX170 works fine. Is this just a marketing angle that Aspen is using to convince VFR pilots to upgrade?

Mike Meadows
via email

We think there's steam behind that marketing angle and the model's entry-level price. The Evolution VFR won't display localizer and glideslope guidance from the GNS530 or any nav/GPS system. This lack of approach guidance limits the instrument to VFR approaches, something Aspen says fits a VFR-only mission.

RENTER'S INSURANCE

Jon Doolittle's March 2014 article, "Renter's Insurance: Know the Exclusions," was very timely for me. I was planning to check out in the Cirrus SR20 at SRQ Aviation in Sarasota, Florida, but they wanted me to sign a form agreeing to be "liable for any expenses incurred for damages inflicted upon the aircraft while rented to me."

I checked with three insurance brokers (Avemco, AOPA Insurance Services and Reba Aviation Insurance). All of them told me it would only pay if I was at fault. If I had signed the SRQ Aviation form, I could (and would) have been forced to pay out of my own pocket for damage that was not my fault. There's no way would I sign their form.

The sad postscript is that SRQ Aviation refused to modify its form, so I'm not flying its Cirrus. I wonder if other renters at SRQ know what they signed. Perhaps they are young with few financial assets or old with very well-hidden assets.

David Ansley
via email

AIRGUIDE FLIGHT GUIDE

I've been a happy customer of Air-Guide, the publisher of Flight Guide, for 30 years. It looks to me like Air-Guide is in the midst of failing and

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CONTACT US

Editorial Office
860-614-1987
E-mail: consumereditor@hotmail.com

Subscription Department
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Epic E1000: Big Power and Speed

Starting with a successful kit-built hotrod, Epic Aviation seeks to certificate a 1200-HP personal traveling machine with jet-like performance.

by Rick Durden

To date, the single-engine turboprop market has been a classic economic model of independent niches—the players don't compete directly. The Pilatus PC-12, Daher-Socata TBMs, Cessna Caravans, Quest Kodiak and Piper Meridian target different mission and load needs; there's not much to encourage price competition, although the TBMs are so fast they do go head to head with some jets.

This could change in 18 months—when Epic Aviation hopes to finish certification and start delivery of its 1200-HP E1000 to compete directly with the new TBM 900. Epic offers an amazingly slippery-looking, hell-for-stout carbon-fiber machine with a larger cabin, more payload, max cruise speed within measurement error and slightly shorter legs than the TBM.

With an initial $2.75 million price tag for the E1000—we wonder if Socata will drop its $3.4 million-equipped price to compete. To make it more interesting, the FAR Part 23 certificated airplane Epic is developing started life as an Experimental category, kitbuilt aircraft.

HISTORY

In 2004, Epic Aircraft began selling the LT, a 320-knot, composite, single-engine turboprop, as a kit. Buyers would spend several weeks at Epic's facility, working under supervision, as they complied with the 51 percent owner-built rules for the basic airplane. Once past that hurdle, they were free to contract with Epic for the company to build the rest of the airplane and add on various options.

In 2009, a combination of management shenanigans forced Epic Aircraft into bankruptcy. It was sold at auction in 2010. The new owners started selling kits again. In 2012, the company was again sold, this time to Engineering, L.L.C., a Russian company. It appears to be well-financed and has announced its determination to build a certificated airplane based on the LT—the E1000. Putting skin in the game, the new Epic Aircraft also purchased the old Lancair Columbia/Cessna Corvalis factory on the Bend, Oregon, airport. During our visit to the 200,000 square-foot facility, we saw the last few LT kit-built airplanes being finished up in one building while work was going forward on the molds to build conforming parts for the E1000 in another.

Epic has forecast FAA Part 23 certification of the E1000 in 2015; given all that goes into that process and its requirement for the regular infusion of cubic money—we think there's a pretty good chance it will happen if world sanctions imposed on Russia for its behavior in the Crimea don't shut off the tap. Epic has been hiring engineers and has built and tested some parts of what are to be the conforming prototype airplanes (two are planned and are to be completed this year).

NO CHANGES

We were told that Epic management decreed that the E1000 would simply be a production version of the LT—there were to be minimal changes to the airplane. While that approach sounds good and is intended to keep costs down, the reality is never that simple. Although, having what might be considered to be over 50 "proof of concept" airplanes providing feedback from the field doesn't hurt.

Nevertheless, there will have to be some expensive changes. For example: The seats will have to meet crashworthiness requirements—that's a million bucks just getting the first ones designed and built. Max stall speed under Part 23 is 61 knots, the LT we flew stalled at 63, even with its long, double-slotted flaps. A stall speed above 61 knots generates changes in crashworthiness requirements that can be prohibitively expensive and heavy. We were told VGs are being considered to reduce stall speed and that a stick pusher system may be installed as well.

Because no production-conforming prototype E1000 exists, we flew two different Epic LTs, one only recently completed and one from the middle of serial number range. We were satisfied from our meeting with chief pilot Rich Finley and VP of marketing, Mike Schrader, that the production airplane will have handling and performance at least on a par with the LT. Because handling,

CHECKLIST

- (+) 1200 HP gives a 4000-FPM initial climb and a margin of takeoff safety.
- (+) Experience with years of kit versions gives Epic a leg up on certification.
- (~) Meeting Part 23 requirements is rough; nothing is guaranteed.

stability and control for the LT are close to what will be required for certification, one we flew had weights installed for flight tests for aft CG handling.

AIRFRAME

The LT is, and the E1000 will be, constructed of carbon fiber—at the high end of the spectrum of strength-to-weight ratios of composites. The wing is a one-piece unit that has been tested to over 10G, as has, we were told, the conforming ailerons. On one hand, building to such a load factor means the structure is too heavy, especially given the very conservative FARs on composite structure strength. However, it also gives a great deal of room for the airplane to grow.

The fit and finish of the LTs we looked at was first rate—one of the benefits of composites. The absolutely smooth, clean skin is formed into a number of compound curves that help with both high- and low-speed performance and would be unreasonably expensive to attempt on a metal airplane. The windshield appears to simply be a transparent section of the overall airframe, so smoothly is it faired. The wing leading edge has an unusual curved taper—we learned it was purely for esthetics, not performance. We were a little surprised at the modest size and shape of the winglets and can't help but wonder if they will be tweaked in the future as Pilatus has now done a few times on the PC-12.

POWER

The engine is a Pratt & Whitney PT-6-67A with a 1825-ESHP thermodynamic limit, derated to 1200 SHP. TBO is 3500 hours. It swings a four-blade prop; we couldn't help but wonder if a five-blade isn't somewhere on the drawing board, although with a 4000-FPM initial rate of climb, the extra weight may not be worth any incremental performance gain.

The dual buss electrical system is powered by a starter/generator and backup alternator—outputs to be defined. There will be two batteries, mounted on the firewall. The hydraulic landing gear has an emergency nitrogen blow-down backup. A total of 288 gallons of fuel can be carried in the two tanks—a maximum of 400 pounds of fuel imbalance is acceptable. It is anticipated that a device to automatically switch tanks will be installed—the LT requires that it be done manually. Max pressurization differential is 6.5 PSI.

Long span, double-slotted flaps have maximum travel of 40 degrees, above. Main landing gear is trailing-beam design, right.

De-icing will be provided by leading edge boots. Known icing certification will probably require some form of windshield anti- or de-icing. We were told that the windscreen is so highly raked that simply using defrost has been adequate per owners in the field. Schrader and Finley said that bleed air will probably be used.

WEIGHT

Gross weight is to be 7500 pounds, with an empty weight of 4400 pounds targeted—Epic wants a full-fuel payload of over 1100 pounds so it can be a fill the seats and fill the tanks machine, besting the TBM by more than 300 pounds. The reality of certification usually means empty weight creep; we'll be watching to see how effective Epic's engineers fight that battle.

INSIDE

The cabin door is aft of the wing, just ahead of the rear seats. There are two seats in the cockpit, and four in the cabin. There is space for baggage behind the rear seats. Currently 500 pounds is allowed.

THE IMPOSSIBLE TURN

No matter how low the risk of an engine failure is for a turboprop engine, the fact that there's only one attached to the airframe invariably raises "What do I do if...?" We have not been able to find any positive correlation between phase of flight or power changes with engine failures on turboprop engines—so the smart money says it's most likely to happen in cruise because that's where the engine spends most of its time.

With a 17.5-to-1 glide ratio and 700-800 FPM rate of descent, the Epic LT and upcoming E1000 have quite a radius of action should something go wrong at FL280—as well as a fair amount of time to troubleshoot and see if usable power is available.

However, power loss in cruise just isn't what elevates a pilot's pulse rate—it's the loud silence just after takeoff and the question of whether to land straight ahead or attempt "the impossible turn" back to the airport. After flying the Epic, we think that the sheer power and acceleration of this airplane modifies the dynamics of the engine failure on takeoff decision equation. Simply put, the airplane has so much energy within 30 seconds of breaking ground that there's a good chance of making a safe landing following a power loss on takeoff.

To start with, 1200 HP on a clean, 7500-pound airplane means fast acceleration. The book says it will get out and over a 50-foot obstacle in under 2000 feet.

Takeoff procedure is to lift the nosewheel at 80 knots, retract the gear as soon as the airplane begins to climb and raise the flaps when the gear hits the wells while accelerating to 160 knots. On our flights, that speed was reached in less than 30 seconds after breaking ground and the rate of climb was going through 3000 FPM.

Epic Aviation's Chief Pilot Rich Finley demonstrated to us that once 160 knots is achieved, the airplane has plenty of energy to return to the departure runway should the engine fail. The procedure is pull the power lever to idle, the prop to feather and enter a modified Lazy-8: the nose is already high, but pitch is increased and then a turn is initiated. Max pitch, about 25 degrees up, is reached at 45 degrees of turn and the nose starts down—it will get down to the horizon at 90 degrees of turn. Bank is increased through the first 90 degrees of turn, targeting 45-60 degrees.

At 90 degrees of turn, the speed is about 110 knots and the first notch of flaps is selected. The airplane has gained about 500-700 feet since the engine quit. Bank is maintained and the nose drops as needed to hold 110 knots. There's plenty of altitude and energy to get the airplane turned back (a runway return requires more than a simple 180-degree turnaround). The gear is extended and flaps used as needed.

We tried Finley's turn at altitude—it worked. The combination of enough power to generate a lot of altitude in a short time and the low-drag airframe provides a post-takeoff safety margin we've never experienced in a single. The turn will have to be practiced; a pilot who hasn't done Lazy-8s and experienced the constantly changing control forces and complex pitch/bank relationship will need dual.

Finley has also developed what we think is an effective one-size-fits-all procedure for engine power loss in the Epic. It is simply: power to idle, prop feathered and turn toward the nearest airport. We worked through a power loss flow chart he created—up high you have time to troubleshoot, down low you land—and found that it works.

While an engine failure when ATC has you at 4000 feet 30 miles out over Lake Michigan means getting wet, we think the power of the Epic reduces the risk of a bad result during the critical time after takeoff.

Getting into the cockpit seats was pleasantly easy compared to a number of airplanes of this size—there is no console to step over. Visibility is generally good, although the low "eyebrow" of the windshield caused us to think that it was going to be difficult to see into turns—that did not prove to be the case.

The production airplane will have either a Garmin G1000 or G950 panel—the final decision has not been made. An LT will be going to Garmin shortly for the work leading to the integrated glass panel that will appear on the E1000.

FLYING IT

Taxiing is sure-footed and solid. The nosewheel will unlock and castor, allowing the airplane to pivot on one wheel—unexpected and welcome for maneuvering a 43-foot wingspan on tight ramps.

At the risk of getting carried away and waxing rhapsodic, acceleration on takeoff goes beyond "oh wow" and well into the "addictive" arc on one's personal "holy smokes" indicator. 1200 HP pulling 7500 pounds of clean airplane results in a scorchingly short takeoff run (1700 feet over a 50-foot obstacle). The rudder trim (coolie hat on the yoke) is set at full right prior to launch, so the rudder input needed is low. The rudder is nicely sensitive, and we suspect that experience would erase the weaving we demonstrated on takeoff.

The downside to all that power is setting it on takeoff. The 80-knot rotation speed comes up in seconds—trying to get the power lever to the proper torque while keeping the airplane straight is challenging, especially on a narrow runway. Too much torque, and you risk damaging the engine; too little and you don't clear the obstructions. With the computerization available today, having to set power on takeoff on a turboprop is not acceptable. On a hot, single-pilot airplane, automation should keep the workload as low as possible—in our opinion, setting power for takeoff ought to be as it is on a jet; just push it up to where it clicks.

At 80 knots, raising the nose five degrees quickly results in a positive rate of climb; which means it's time to suck the gear up (max retraction speed is currently 135 knots) and then retract the flaps and transition

Composite structure allows exceptionally clean lines and compound curves for maximum cabin size and minimum drag, top. Cabin door is cut from the finished cabin after molding, giving a tight fit, middle. Current mockup of E1000 panel with angle-of-attack indicators up high, bottom.

to a 160-knot climb while watching the rate of climb notch up over 4000 FPM. Additionally, 160 knots is the magic number after takeoff as it gives enough energy to allow a return to a runway behind you if the engine takes the day off.

Time to climb to FL340, max certificated altitude for the E1000, is currently published at 15 minutes. We suspect that is going to prove accurate as we saw over 3000 FPM during climbs through the teens.

CRUISE

A max cruise speed of 325 knots at FL 280, burning 62 GPH, with a VFR range of 1385 NM is forecast for the E1000—it should be easily obtainable as the LT will do that now and Epic is reworking the engine air intake to make it more efficient. Slowing to a cruise speed of 260 knots, fuel flow is forecast to be 40 GPH, which will give a range, with VFR reserves, of 1650 NM. We did not go above 17,500 on our flights—there, at high cruise, we saw 312 KTAS, at a fuel-sucking 82 GPH.

We flew the LT through its full speed range from stall (some warning buffet, a minor bobble marked the break) to Vne (280 KIAS). Controls are moderately heavy, as one expects in a turbine, and remained responsive at all speeds. As might be expected with the kind of power up front, any speed or power change requires retrimming the rudder. It's not a big deal, just something to keep in mind.

Handling in the pattern was solid, although the LT is akin to a jet in that speed changes are not felt—you have to pay attention to speed on approach as there's no sensory indication. 120 knots is used on an instrument approach, with 10 degrees (first detent) of flaps. Close in, slow to 95 KIAS with full flaps and about 15 percent torque to generate a three-degree glideslope. The combination of long-span, double-slotted flaps and the ability to use the prop as a speed brake allows fine-tuning an approach and getting in and stopped easily in under 2000 feet.

Finley advised that thus far, testing of the LT is showing a demonstrated crosswind velocity of 37 knots. With the control authority we observed at low speed, we're not surprised.

PERFORMANCE

Epic advertises the performance of a Cessna Citation 500 on less than half the fuel burn—that's probably about right. The idea is to make the prospective owner pilot think twice about buying a jet.

Another advantage to the turboprop is that the new owner doesn't have to spend two weeks getting a type rating and then a week to 10 days renewing it. Epic's initial training program for the LT, and probably for the E1000, is targeted at 10 hours in the airplane over the course of four to five days—training to proficiency. Recurrent training includes five hours in the airplane and usually takes place over two days—a distinct value for the person who has to take time off from making the money to afford an airplane for training.

CONCLUSION

As a kit-built hotrod, the Epic LT has enjoyed success. We are the first to recognize that it's a huge step to go from experimental to certificated airplane—some companies that have tried have hemorrhaged money until admitting defeat. If Epic's reports of adequate funding are correct, we think Epic has a good chance of pulling off Part 23 certification.

Epic has a potentially powerful alternative to the TBM 900. We'll certainly be watching the competition with interest.

The dual-screen G3X Touch will be the standard avionics package in the Flight Design C4, left photo. The Garmin GTN750 in the center console makes the system capable for IFR.

Garmin G3X Touch: Tops G1000 Features

Garmin makes an aggressive run at the LSA and experimental markets with the redesigned G3X Touch. We think it's more advanced than the aging G1000.

by Larry Anglisano

It's hard to believe that Garmin's current G3X Touch integrated avionics suite was born from the company's GPSMAP696 portable GPS. The original G3X utilized the 696 portable GPS control set and display, but was connected to a remote ADAHRS system.

When LSA models first hit the market, the early G3X panel was an option to the stark avionics arrangement that was standard in many aircraft. The industry marveled at the G3X in the Legend Aircraft Cub, among other models.

Still, Garmin's G3X never gained traction in the LSA and experimental market dominated by Dynon Avionics, a company that remains on the cutting edge with affordable avionics that are easy to use, easy to install and have generous cross-brand compatibility. In our estimation, Dynon still dominates today, reinforcing its mainstay in the LSA and experimental market with its recently introduced Skyview Touch integrated suite.

But Garmin, with its third-generation G3X Touch, attracted a lot of attention at this year's Sun 'n Fun. The system was chosen by five light sport manufacturers—encompassing 13 aircraft models—that are offering the G3X Touch as standard or optional equipment. If Garmin is setting out to dominate the LSA and experimental avionics market with its new G3X Touch, we'd say it's off to a tremendous start.

GROUND-UP REDESIGN

When Garmin assembled Team X last year (that's the forward-looking engineering group that focuses primarily on designing products for experimental and LSA applications) its first project was to redesign the first-gen G3X. Improvements included a new digital autopilot interface, a redesigned ADAHRS and an advanced engine instrument interface, to name a few. The G3X redesign was a huge boost to the system and to Garmin's position in the experimental and LSA market.

While the new G3X Touch uses many of the same components found in the last version of the G3X (known as LRUs, for line replaceable units), the outgoing display and control set is replaced with a larger one with a touchscreen feature set.

The new face of the G3X Touch is the GDU46X—a 10.6-inch high-resolution touchscreen color display. The suite can be configured with one, two or three displays, which house WAAS GPS receivers, in addition to an optional SiriusXM receiver.

Garmin designed the system with an open architecture, at least when it comes to interfacing with its own certified equipment. There's the option of connecting the displays with the GTN750 or GTN650 navigator, in addition to older GNS-series navigators. This gives the G3X Touch full IFR capability.

With a basic single display configuration, there's a split PFD and MFD presentation, but multiple displays are configured for dedicated PFD, MFD or a combination of split screens on all. In a multi-screen configuration, it's easy to compare the system to a G1000 or the G900-series for experimental aircraft.

The new displays are compatible with previous G3X air data and AHRS computers. This makes the G3X Touch a plug-and-play upgrade for second-generation G3X systems. There are new components, too,

CHECKLIST

+ Starting at $5495, the well-equipped G3X Touch is affordable.
+ The latest GX3X Touch is plug-and-play with earlier G3X components.
~ Dynon's Skyview Touch has more buttons for the touchscreen challenged.

Clockwise from upper left: The GDU46X display primarily uses a touchscreen user interface, but four dedicated bezel keys and two rotary function knobs supplement some of the onscreen commands. Engine instrumentation—via the EIS engine instrumentation module—can be displayed in a split-screen view with the PFD. There's an optional lean assist mode that works in conjunction with a fuel totalizer. The integral digital flight control/autopilot system can be commanded directly from a dedicated page on the MFD and with the GMC305 external autopilot control console.

including the GSU73, an ADAHRS LRU that also provides for an engine/airframe data interface, plus an ARINC429 data hub for connecting the GTN navigators. It also connects with the pitot and static system for computing flight instrument data.

There's also a remote magnetometer for heading resolution, a temperature probe and the GAP26—a pitot tube that senses AOA (angle of attack). If it sounds like the G3X Touch is a complex system with many subsystems, it is. In many respects, it follows the lead of the G1000, which also uses multiple LRUs.

SUPPORTING SYSTEMS

Unless you want IFR capability, you don't have to use the G3X Touch with a GTN or GNS navigator. Earlier comm radios including the SL40 and SL30 transceivers can be utilized as standalone radios. But for integrated communications, the GTR20 is a 10-watt comm LRU that's tuned in a dedicated window on the GDU46X display. Like the panel-mounted GTR200 transceiver, the GTR20 has standby frequency monitoring, frequency storage and a Find function for searching frequencies for nearest airports, based on GPS position.

The G3X Touch is capable of channeling several remote transponders, including the GTX23ES ADS-B transponder. The transponder control window is in the main data bar at the top of the display, logically located next to the radio tuning window. Transponder tuning for panel-mount transponders, including the popular GTX327 Mode C and GTX330/ES (for TIS-B and ADS-B traffic) is also supported.

FEATURE SET

While primarily a touchscreen feature set, the G3X Touch also has dedicated control keys for performing common functions, including direct-to navigation, finding nearest waypoints and accessing a main menu. Two rotary knobs—one on each side of the bezel—can be used for frequency tuning, scrolling and a variety of other functions.

The G3X Touch data card slot on the lower portion of the bezel accepts standard SD cards. The SD card can be used for a variety of functions, including software updates, storing checklist files, flight data logging, exporting track logs and user waypoints and importing/exporting flight plans.

Like other Garmin navigators and the G1000, the system has a page navigation bar displayed on the lower portion of the MFD. You can touch the desired page on the page navigation bar or turn the large knob associated with the MFD to cycle through the pages. Main pages that are accessed on the MFD include the map, electronic charts, waypoint information, active flight plan, optional SiriusXM weather, terrain, traffic and optional engine data, which we'll get to in a minute.

You can enter a waypoint identi-

Video feed from Garmin's VIRB Elite action camera can be displayed in a dedicated window on the MFD, upper left photo. Cub Crafters chose the single-screen G3X Touch, GMC305 autopilot and GTR radio for the panel of its Carbon Cub, upper right.

fier on a dedicated onscreen data entry keypad and simply press the OK checkmark on the screen to activate it. We found simple navigation chores to be straight-forward and the touchscreen performance was flawless. Like the GTN touschsreen navigators, the G3X Touch uses a capacitive touschscreen.

There's an interactive audio alerting system, including a pilot-adjustable audio output setup for adjusting the volume of warning messages, including "approaching airspace" and "arriving at waypoint," for example. There's also audible altitude alerting that interfaces with the flight instruments on the PFD, plus a fuel tank reminder alarm for switching tanks.

REAL-DEAL PFD

The PFD (primary flight display) can be viewed in a full-screen presentation or split screen. As you would expect, the PFD is full-featured and includes configurable Vspeeds on the airspeed tape display and at the bottom of the airspeed indicator.

We like the interactive glidepath presentation. For instance, the VDI (vertical deviation indicator) appears to the left of the altimeter during an GPS approach. The glidepath display is analogous to the glideslope for GPS approaches supporting WAAS vertical guidance, including Garmin's LNAV+V, in addition to L/VNAV and LPV guidance. The glidepath indicator appears on the PFD as a magenta diamond. If the approach type downgrades past the final approach fix, a "NO GP" message is annunciated.

The system has a full EHSI (electronic HSI) with the ability to display two bearing pointers for traditional nav and GPS sources, plus bearing to the nearest airport. When a bearing pointer is displayed, its associated information is displayed in a bearing data window at the lower side of the HSI. This takes the guess-work out of figuring out which nav source is associated with a given bearing pointer.

The system will automatically slew the localizer course pointer to the correct final approach course when an ILS, localizer, back course, LDA, or SDF approach is active in the external navigator. Once inside the final approach fix on an approach, the course pointer will change from magenta to green and the course pointer will slew to the appropriate final approach course as received from the external GPS.

The HSI may be configured to provide directional information in either magnetic heading or automatic track-up modes. Heading mode orients the HSI to display aircraft heading in a conventional manner, with the current heading value shown at the top of the compass card as indicated by the lubber line. In automatic track-up mode, the aircraft symbol and lubber line move to indicate heading and wind correction, while the current ground track is shown at the top of the compass card. That's smart and provides useful data that's also customizable.

Speaking of smart, whenever the G load on the airplane goes above +2.1G or below -0.5G, the HSI is temporarily replaced with a large graphical G-meter. You can acknowledge the condition and remove the G-meter by pressing the Clear key. Regardless of the current G load, the HSI can be replaced with a G-meter by changing this setting from the PFD setup page.

You can also display the optional trim and flap position sensor to the left of the EHSI. This shows the current position of the elevator, aileron and rudder trim, if equipped, in addition to current flap position.

Other windows for display on the PFD include outside air temperature, wind data—including direction and speed—or the headwind and crosswind component.

There's also an AOA (angle of attack) display. The AOA functionality is defined in the system setup. For instance, when the AOA is below the calibrated minimum visible AOA threshold, the angle of attack gauge is not displayed on the PFD. When AOA exceeds the calibrated caution alert threshold, an intermittent audible tone will be heard. The tone will increase in frequency until the stall warning AOA is reached, where it sounds continuously. There's also the GI260 AOA indicator that's mounted on top of the aircraft glareshield—where it should be—for referencing during the approach to landing.

ENGINE, AUTOPILOT

A major add-on to the G3X Touch is Garmin's flight control system. The integrated autopilot brings many of the advanced features found in the certified GFC700 and utilizes the compact GSA28 digital servos that Garmin calls a "smart servo."

The GSA28 servo is considered smart because it contains the software drive logic and doesn't rely on a remote computer for roll and pitch commands. Weighing only 1.4 pounds, Garmin says it is more than 40 percent lighter than most autopilot servos for experimental and light sport applications. Unlike other brands, the servos are made of die-cast, machined metal components—not plastic.

It's available in single or dual axis and the autopilot is commanded through and annunciated on the G3X Touch display. It also works with the optional GMC305 autopilot control panel. The autopilot offers envelope protection, with a Level mode, to help restore the aircraft to straight-and-level flight.

Another major option is the GEA24 EIS engine interface module. The module enables aircraft-specific customizing of system data input for display of engine gauges and color bands, alerts, fuel data, flap and trim position and other primary and secondary sensor data for overlay on the G3X display. The GEA24 EIS interfaces with most popular engine models, including the Rotax 912-series, although interface kits are available for other popular engines.

TRICK VIDEO, ADS-B

The G3X Touch has a video composite input channel that's compatible with Garmin's $500 VIRB Elite HD action camera. Aside from displaying real-time video in a dedicated window on the MFD, the interface allows you to start and stop the camera's recording directly from the G3X Touch.

The G3X Touch is compatible with Garmin's GDL39R remote ADS-B receiver. This was born from the portable GDL39 and enables Garmin's TargetTrend relative motion traffic technology on the screen. It's also a source for receiving FIS-B weather.

For subscription-based broadcast satellite weather, Garmin offers a version of the G3X Touch display that has an integrated SiriusXM receiver, which also provides entertainment input to the system. It's a $500 option.

BUILD YOUR SUITE

A single-screen G3X Touch starts at $5499 and includes the GSU25 ADAHRS, GMU22 magnetometer and GTP59 temperature sensor. A dual-display system is $9399 and the triple-screen suite is $13,699. The GEA24 engine indication system is an additional $600 for all configurations.

There's also the $995 GTR20 comm transceiver, $2199 GTX23ES transponder and $249 GI260 AOA indicator. Garmin's SVX synthetic vision is standard on all systems, in addition to VFR sectional and IFR enroute charting.

If you want to connect a GNS or GTN-series IFR navigator, you'll need the $425 GAD29 IFR navigation adapter.

None of the systems include the autopilot interface as standard. The roll axis interface that uses a single GSA28 servo is $750, or $1500 for dual-axis roll and pitch. The GMC305 remote autopilot control panel is $750. There's also the heated AOA probe, at $299.

If you add all of that up, a dual-screen G3X Touch suite—with autopilot—tricks out at $15,421. That's an entire glass cockpit that's priced less than one Garmin GTN750 touchscreen navigator. It arguably has more features than the G1000 suite.

The major snag is the lack of certification, making the system off limits for installation in Part 23 certified aircraft. But that could change. As we explain in the First Word commentary on page 2, proposed changes to the regulation could eventually allow the installation of non-certified equipment in certified aircraft.

If that happens—and we have no idea if and when it will—the G3X Touch could well be the inexpensive mass-retrofit glass cockpit of the future. Contact www.garmin.com, 800-800-1020.

DYNON: STILL THE MARKET LEADER

Garmin's G3X Touch isn't the only new touschscreen avionics system for the LSA and experimental markets. While Garmin's Touch announcement was attracting attention at this year's Sun 'n Fun, the Dynon Avionics booth was packed with customers fingering its new Skyview Touch integrated avionics suite.

Dynon's marketing manager Michael Schofield made it clear that Skyview Touch was announced before the G3X Touch and that Dynon is the market leader in light sport and experimental avionics. According to Schofield, the first-gen Skyview is installed in thousands of aircraft, making it the best-selling glass for experimental and light sport piston singles. Quite frankly, we like to see this type of healthy competition.

The Skyview Touch retains many of the same major features of the older Skyview, but gets a hybrid interface that has more soft keys than the G3X Touch. That's advantageous to folks that aren't sold on a full-up touch feature set. A single 10-inch display setup starts at $3995, which is $395 more than the older Skyview. Existing SV-D1000 Skyview customers can easily upgrade to the Touch version for $795. The upgrade is seamless because much of the existing Dynon wiring and remote components can be utilized with the Touch.

Also new with Skyview Touch is an onscreen six-pack flight instrument display. These familiar round instruments can be displayed with a synthetic vision background or on a plain screen. Skyview Touch supports full electronic charting, including airport diagrams and georeferenced procedure charts. There's also a multi-screen option. Look for a full report on the Skyview Touch in an upcoming issue of *Aviation Consumer*.

Aftermarket Plastic: Betters OEM In Price

There are plenty of options for replacing old plastic components. Save money and install them yourself, but don't expect a fit that's exactly like an OEM part.

by Jim Cavanagh

Because of design, certification and insurance costs, the OEM industry is hobbled with a rather arcane system of pricing replacement parts. When it comes to interior plastic parts—like a window molding, hinge cover or a glove box overlay, for example—a couple of dollars' worth of plastic becomes a $400 part simply because of its unique shape and application.

Fortunately, there are several smaller companies that can design, fabricate and sell certified parts for much less than an OEM. In fact, it's not uncommon for an OEM to buy parts from these replacement shops.

We covered certified fiberglass replacement parts in the February 2014 issue of *Aviation Consumer* and found that fiberglass costs more than plastic, it's more resistant to damage and is easier to repair than plastic.

But don't think that plastic parts are old technology and no longer viable. In most cases, plastic will get the job done and when used in areas that aren't subjected to temperature, sunlight or heavy usage, can be a viable long-term option. But replacing plastic components won't come without some challenges. Here's a look at the market and what to expect in your search.

PLASTICS 101

For the most part, plastic will be ABS or Kydex. Kydex—a combination of acrylic and PVC plastics—was developed in 1965 purely for the intent of making aircraft interior parts. Kydex is highly flame retardant and might

AIRCRAFT REFURBISHMENT

be required by an OEM for initial installation. Kydex has different finished textures and comes in colors. It's also expensive, so most aftermarket shops keep the price down by using other forms of sheet goods.

PVC or Poly-vinyl Chloride is a tough material. This toughness, combined with the flexibility and malleability of Acrylic lends itself to the thermal forming of complex parts, both large and small. PVC is resistant to a number of chemicals, can be finished with different textures and colored with paints that use a flex agent. PVC is made in Bloomsburg, Pennsylvania, and comes in sheets in a number of colors and thickness. Few parts are made with PVC, but it can be found.

The most popular interior plastic is ABS, or Acrylonitrile Butadiene Styrene. ABS is an extremely tough, formable plastic and it gets a high gloss when worked at the right temperature. Available in a few colors, Cessna and Piper originally used all ABS for its trims and fairings. When painted and ultraviolet-protected, it can last for 15-20 years. While resilient, ABS will support flame under high temperatures.

CHECKLIST

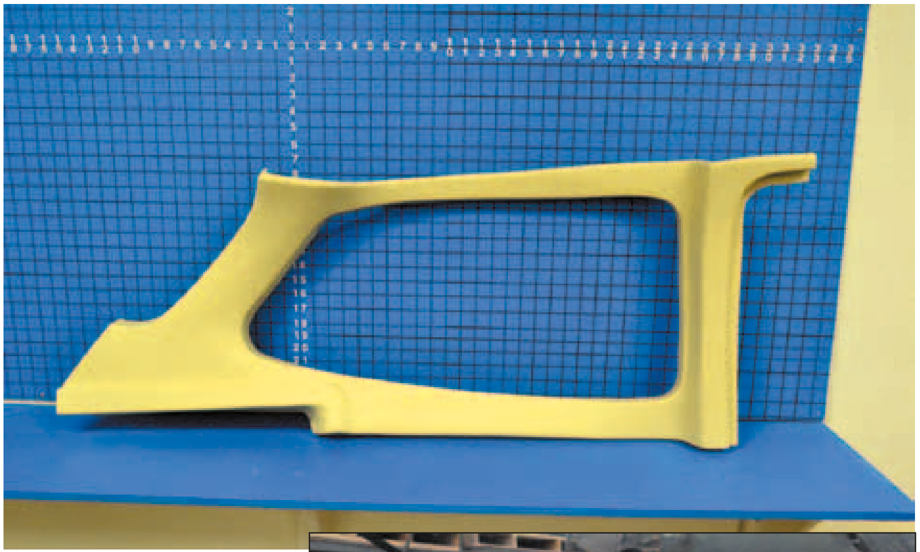
- + Aftermarket plastic parts are generally much cheaper than OEM parts.
- + Major suppliers should have a sizable inventory of plastic parts in stock.
- ~ Plastic instrument panel overlays aren't exactly modern enhancements.

BIG DOGS

There are three main producers of aftermarket plastic parts, plus a few smaller shops around the country that make a limited number of items for less popular models. We will present overviews of the major providers and their pedigrees so you'll know where to start in your search.

If you must have an OEM original, Preferred Airparts sells new surplus Cessna parts for a slight discount over factory new prices. Speaking of OEM parts, it's not uncommon to pay a 50 percent price premium for them over aftermarket replacements. The advantage, however, is OEM parts should provide a perfect fit without trimming or drilling mounting holes. But you'll likely face

That's an older Skyhawk with new plastic in the lead photo. It's a lot of work to install replacement plastic over switches, knobs and other accessories.



Will it fit or give you fits? A window trim, top photo, has complex curves and precise dimensions that complicate installation. A worker at Plane Plastic, middle, loads molds onto the vacuum table where it's sucked down for a precise fit. You'll want ultraviolet protection on plastic that's in direct sunlight, bottom.

long lead times because OEM parts are generally made in batches, with intervals between production runs.

A couple of outfits claim to specialized in interior plastic components for certain aircraft makes. Two of these are PAST, a major supplier of Piper replacement parts, and Texas Aeroplastics, specialize in Cessna applications.

PAST, which used to be Heinol and Associates, was run by Al Heinol, a guy with a rich background in tool and die manufacturing for the automotive industry. Many of the older plastic steering wheels on American-made cars were produced on the tooling developed by Al Heinol. Heinol was known to make parts that had an accurate and quality fit. The Heinol parts catalogue focused on a wide variety of Piper applications, including the Aerostar and Navajo. The plastics manufacturing community has countless stories of Heinol's love/hate relationship with the FAA (he loved to hate them, we're told). In early 2013, the company was purchased by Alva, Oklahoma-based Premier Aerospace Service and Technology (PAST) and is becoming one of the major players in the aircraft interior parts business.

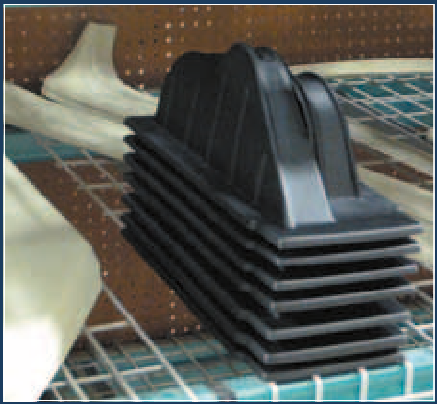
Scott Brown, PAST's president, was once the president of Vantage Plane Plastics before aggressively pursuing the parts vending for the OEM industry and today supplies a number of parts to major manufacturers. The purchase of Heinol is an effort to keep the crew working between aftermarket supply and production runs for Cessna. At the same time, the company is building a larger inventory of Cessna replacement parts.

The Heinol buyout was typical of a company that wants to be aggressive, wants to enter a market with proven products and importantly, reap the benefits of having the legwork already in place. Consider that Heinol owned the tooling and inventory for scores of Piper parts, and more importantly, the paperwork that made them legal to install in aircraft. That's a huge benefit for the consumer in terms of availability and costs.

The FAA requires sizable hoop-jumping when it comes to PMA parts and the STC that permits a legal installation. The PMA and the STC are treated separately, each with its own set of requirements and each handled in a different office. This creates an interim during which only completed, certified parts can be sold by the new company. PAST was surprised to find out that only a few of the 235 part numbers Heinol offered were actually legal. These days, along with making OEM parts for Cessna, PAST is busy acquiring certification for over 700 part numbers (in batches), developing its own manuals, storage, inventory and manufacturing areas, materials and techniques for the PMA approval. Interestingly, OEM manufacturing entails no FAA involvement or inspections.

Founded in 1981 by Jerry Evans, Texas AeroPlastics has been building Cessna interior parts for 33 years. While the company has downsized to a skeleton crew and moved to a smaller shop on the Northwest Regional Airport in Roanoke, Texas, the operation is efficient. As the name implies, Evans focuses on aftermarket Cessna parts and has partnered with different shops over the years to share information and better the fit and quality of the parts. The company fabricates its parts exclusively with ABS plastic and most parts are

SAMPLE PRICING (CESSNA 172M)



OEM PART NUMBER	DESCRIPTION	OEM	VANTAGE PLANE PLASTICS	TEXAS AERO PLASTIC
0413484-18	CESSNA PASSENGER DOOR POST WITH VENT HOLE	$638	$122.02	$98.21
052001-100	ELEVATOR TIP	$235.80	$99.88	$94.10
0522150-1	LOWER STRUT COVER	$278.10	$61.95	$72.91
0723200-5	CESSNA WING TIP	$524.17	$294	$284
0500233-12	CENTER PEDESTAL	$1407.60	$246.65	$194.86

Pricing for individual plastic parts will vary between suppliers, but no one aftermarket supplier stands out for substantially lower pricing. In general, different manufacturing techniques and individual shop setup will create slightly different prices for the same part number. If you shop around, you may be able to buy one part for a bit less than any other provider. If you replace an entire set of interior plastic, or most of it, nearly all vendors will likely be within a few dollars of one another.

painted for UV protection. Besides the inventory of certified parts, the company sells maintenance items, lighting products and a leading-edge STOL kit.

Alva, Oklahoma-based Vantage Plane Plastics originated in 1961 as Kinzie Products. As a Hughes helicopter repair station, it began manufacturing its own parts—and learning the tricks of certification—when certain helicopter parts were unobtainable.

In the early 1980s, the company bought a Cessna 207 and found there were limited sources for aircraft interior parts, so it began building them itself. It accumulated a parts inventory of 3500 interior and exterior parts and is still growing. The plastic division of the company began in 1999 as Plane Plastics. Needing more technical and financial resources, it was sold to Vantage in November 2000. In 2005, the company built a new facility in San Diego, California.

Vantage builds parts for Boeing and other major airframe manufacturers, in addition to the U.S. military. The Vantage division of Plane Plastics is autonomous and managed by Mark Severs, a lifelong manufacturing expert, and Dale Logsdon, an A&P mechanic with IA privileges. The company employs only 18 people and 15 of them work in production.

It's said that Plane Plastics is the big dog in the aircraft plastics yard because it can produce replacement plastic for nearly every general aviation aircraft out there. It continues to acquire pieces that will eventually make it into the inventory. To date, the Plane Plastics catalog has roughly 3500 parts and there are another 350 parts currently submitted for PMA and STC certification.

The company has a vast mold inventory. When we visited the facility, we saw row after row of 20-foot-tall shelving that's dedicated to housing an inventory of 200 most popular replacement plastic parts. To better maintain stock, each part is barcoded and a computer automatically schedules a production run when the supply gets low.

Plane Plastics offers its parts in three colors and the parts themselves are made of thicker plastic than the plastic material used by an OEM, but there's a tradeoff.

Thicker plastic can create a tight fit during the installation process, but the parts seem more robust and sturdy. The primary material used is ABS, but some parts are made of Kydex. The company website has a section showing how to measure and duplicate holes and is a good source for searching part numbers.

It's important to note that color choices will be limited for most aftermarket plastic components. That's a problem if you are trying to match the rest of the plastic or interior coloring of vintage aircraft. This means you'll be faced with the additional task of painting the parts. Several suppliers told us the best long-term option is to apply vinyl dye to white or almond-colored parts. The soaking dye lasts longer and won't dull the plastic finish.

INHERENT VARIATIONS

Many parts will require placards that you'll need to source on your own. We noted that Plane Plastics includes placards on a Cessna pedestal/trim

CONTACTS

Plane Plastics
866-307-5263
www.planeplastics.com

Texas Aeroplastics
817-430-3651
www.buyplaneparts.com

PAST, Inc.
866-865-1262
www.premieraerostore.com

Preferred Airparts
800-433-0814
www.preferredairparts.com

DITCHING PANEL PLASTIC FOR METAL

by Larry Anglisano

Maybe you've upgraded to a modern interior and the latest avionics, but even the best-looking Royalite plastic panel overlay will ooze 1970s. It's not just about looking fly. There are advantages for ditching plastic panel trim in favor of a custom metal panel. With the right paint work, you could gain improved night lighting and sharper instrument visibility. There's a reason why the instrument panel in most military aircraft are painted gray.

Another reason for investing money and time in a new panel is to obtain a better instrument and avionics layout. If you're upgrading to a large PFD like Garmin's G500, you'll have no choice but to pay for panel fabrication. The upside is that you'll be able to locate backup instruments and switches in a more custom layout. The downside is cost and downtime. Some of that has to do with FAA certification.

In general, when shops rip out the Royalite and starts fresh with aftermarket panels and subpanels for the instruments, radio rails, switches and the major equipment certificated for the aircraft, they're into a major modification that could require FAA field approval. The regulatory process can be curtailed if the replacement panel kit has STC approval. There are companies that specialize in type-specific panel fabrication. It's up to the shop to sign off the installation, but ultimately it's up to you to ensure any modifications come with adequate paperwork to support its airworthiness.

Panel building has become the norm for avionics projects. In our view, shops that can't offer the service in-house—at an affordable price—are at a big disadvantage. What's affordable? That depends on the complexity of the aircraft, but a basic panel build can approach or top $10,000.

housing. Of the parts we looked at, some are thin and some are made of thicker plastic sheets. When a thickness is chosen, it is based on the so-called draw, or how much the materiel will have to stretch when vacuum-formed over a mold.

A minimum thickness is important for both appearance and longevity. While thicker parts seem more robust, an entire interior replaced with the thickest sheeting can weigh up to 25 pounds more than the original parts. Cessna was notorious for producing extremely thin parts, but that helped with achieving a more favorable useful load. We suggest revising the aircraft weight and balance data after replacing all or most of the interior plastic. In some cases, it's a good idea to have the aircraft weighed.

We discovered an interesting tidbit during our research. Mark Severs, who worked at Boeing, explained the discrepancies in part sizes that often lead to warranty work. A 747, if built to maximum tolerance in the fixtures, will have an extra row of seats compared to the same plane built to minimum tolerances. That's a three-foot difference in cabin size. Severs explained that scaled down, it is not unusual for a Cessna or a Piper to be a half-inch longer or shorter. This can often be a problem when fitting aftermarket plastic parts.

To keep tabs on the fitment of its parts, Plane Plastics has a few airplanes in its hangar that it will randomly fit parts on to make sure the molds aren't changing dimension. In addition, they'll perform a factory installation at the owner's request. Other shops have other ways of ensuring proper fit, often rebuilding parts while having the ill-fitting part in hand.

At most shops, a lot of time is spent repairing or upgrading molds. Different materials and resins have been used to make molds and while some hold up, others do not. In the old days, wood was used, but over time it expands and contracts with temperatures and ultimately cracks. Plaster was another medium, but it's quite heavy and can shrink .

Some molds were made of aluminum, but when a hot part contacts cold aluminum, it immediately cools, deforming the part. New resins eliminate much of this and hopefully the repairs that become necessary for a proper fit during installation.

CERTIFICATION MATTERS

Occasionally, a shop will have a part that is pending FAA certification and will sell this as a so-called owner-supplied part, while noting that the certification is missing. It's up to the owner to install the part or a mechanic to note it's an owner-provided part—an avenue taken by all of the plastic suppliers. Al Heinol used it like a magic wand. Despite having a non-certificated status, many of Heinol's parts were arguably the nicest in the industry thanks to his tooling background.

This brings to question the necessity of requiring certification on cosmetic parts, save for burn testing. Many argue that cosmetic parts are as detrimental to an aircraft's airworthiness as a headset is. Thankfully, a farsighted FAA has allowed for out-of-production parts to be used without certification if the owner provides instructions for making the part, proves its fit and function and signs off the installation in the aircraft logbook. Sending the old part to a manufacturer for use as a pattern qualifies the fit and function process.

Of the shops we visited, we think Plane Plastics is the size and volume leader, plus it has a resourceful website. PAST is growing into the number two slot for parts availability. All of the suppliers said that if they don't have a part, they know who does and will lead customers to the source. That's a welcomed gesture.

Garmin GXM42: Newer SiriusXM

Garmin's GXM42 receives new WSI weather packages from SiriusXM Aviation, but it only works with the aera796 portable GPS.

by Larry Anglisano

CHECKLIST

- (+) SiriusXM includes advanced weather products at a lower cost.
- (~) Pay-for weather may not be worth it for some as FIS-B gains momentum.
- (–) None of the first-gen XM receivers can work with the new data format.

The way we see it, portable and affordable ADS-B receivers are threatening—if not putting a sizable dent—in the once-dominant satellite broadcast weather market.

Even though the FAA's free, ground-based FIS-B weather information stream isn't exactly a match for XMWX products, many users we talk with are tired of paying the increasing costs of XM subscriptions. With pricing options that range from $35 to $100 per month, it's easy to see the appeal of free ADS-B weather if you can accept some compromises, including the lack of reception while on the ground and the lower resolution of FIS-B radar.

Perhaps recognizing ADS-B as real competition, SiriusXM is now offering more for less by creating three new subscription tiers, bundling what used to be price-premium weather products in a lower priced package. It's also reduced the price of activating a new receiver. To take advantage of the savings, you'll need Garmin's new GXM42 weather receiver.

MORE BANDWIDTH

The merging of Sirius Satellite Radio and XM Radio afforded a higher broadcast bandwidth because the new SiriusXM has two sets of satellites to work with. This expanded bandwidth increases the broadcast capacity of the system, enabling SiriusXM to deliver more entertainment channels (150 channels, up from 135), plus expanded aviation weather. That's good news for new subscribers, but a letdown for existing customers with older weather receivers because the older hardware isn't compatible with the new broadcast format.

There are a lot of early-gen receivers out there, partly because Garmin saturated the market with the GXM-series. That's the hockey puck-like portable receiver module that plugs into XM-compatible portable GPS units.

Garmin's portable XM interface came to the market back in 2002 as a standard accessory to the GPSMAP396 and continues with the current aera796 portable. The GPSMAP696 and aera500-series touchscreen GPS also work with the older GXM40 XM receiver. Then there's the GDL69—the permanently mounted XM receiver that interfaces with Garmin panel displays.

Don't throw your old receiver away—yet. While the GXM40 and GDL69 aren't compatible with the new SiriusXM signal format, these older receivers will continue to work

Garmin's GXM42 portable SiriusXM receiver, inset, retains the same puck-like design as the old GXM40 receiver. We wish it communicated via Bluetooth instead of with a wired interface. For now, the receiver only works with the Garmin aera796 portable GPS, left photo.

with the older XMWX data stream, at least for the foreseeable future, although SiriusXM wouldn't give us a definitive timeframe for continued compatibility.

The company told us the new receiver won't receive the old data stream, but made it clear that older receivers and subscriptions continue to work, despite rumors that the company has abandoned the old data stream in favor of the newer signal.

The GXM42 next generation receiver shares the same footprint and connectivity as the older receiver and has a list price of $599. The fee to activate the receiver is reduced to $25 and SiriusXM is offering a $300 rebate for new purchases with a qualifying subscription.

In a world where Bluetooth connectivity is the norm rather than the exception, we wish the new receiver was available in a wireless version, especially since the aera796 has Bluetooth capability. Instead, it connects with the aera796 with a mini USB cable. You'll want to mount the receiver on top of the glare shield so it has an unobstructed view of the sky. This means a wire draped over the panel, unless you can drill a hole and run the wire under the panel.

SIRIUSXM AVIATION SERVICE LEVELS

PACKAGE CONTENTS	Pilot Express $34.99 month	Pilot Preferred $54.99 month	Pilot Pro $99.99 month
Radar	✔	✔	✔
NEXRAD storm cell attributes	✔	✔	✔
Radar coverage map	✔	✔	✔
Observed lightning strikes	✔	✔	✔
Temporary flight restrictions (TFRs)	✔	✔	✔
Winds aloft (including graphical depiction)	✔	✔	✔
AIRMETs/SIGMETs/PIREPs	✔	✔	✔
Temperatures aloft	✔	✔	✔
Standard forecast winds	0 hours	0-24 hours	0-48 hours
High resolution forecast winds	0 hours	0-3 hours	0-24 hours
METAR, TAFs CONUS	✔	✔	✔
METARs, TAFs non-CONUS		✔	✔
Wind shear		✔	✔
Cloud top imaging		✔	✔
Surface visibility forecast		0-1 hours	0-3 hours
Graphical turbulence guidance			✔
Freezing level/forecasting time		0-1 hours	0-3 hours
Icing NOWcast			✔
Convective outlook			✔
SiriusXM Radio programming	Optional	Optional	Optional
One-year prepaid subscription	$384.89	$604.89	$1099.89
Two-year prepaid subscription	$734.79	$1154.79	$2099.79

SIRIUSXM AVIATION

That's the name of the new weather packages offered under the new SiriusXM data stream. Boston area-based WSI (Weather Service International) is the new weather provider of SiriusXM Aviation products. For years, XMWX products were packaged and provided by Huntsville, Alabama-based Baron Services, through the company's WxWorx division.

We attempted to contact WSI to get more information on the weather packages and specific details on its weather products, but multiple calls to several people in WSI's aviation division were unreturned before we went to press. When we asked SiriusXM's Craig Correa about the new data, he said that "weather presentations can vary by product and sometimes between models from the same brand."

From what we can tell, many of WSI's core weather products—including radar imagery—look similar to Baron's data. Under the new stream, there are more weather products available in the basic, lower price package. Also, since many of the old weather products are trademarked under Baron Services, some products were given new names.

For example, what's called SCIT attributes (storm cell identification and tracking) in the XMWX product is now named storm cell attributes in the new SiriusXM Aviation lineup. Both products contain specific information about a storm cell, including speed and direction, but they're just named differently. What is different is that SiriusXM Aviation bundles more products together.

For instance, in addition to high-resolution radar images, the new SiriusXM's $34.99 Pilot Express base subscription package includes cloud-to-cloud and cloud-to-ground lightning data. Under the package delivered by Baron Services, light-

For free-for-all FIS-B weather, the Garmin aera796 can be ordered with the GDL39 ADS-B receiver, right. Radar imagery has lower resolution than the SiriusXM-delivered radar.

These are screen grabs of a Garmin aera796 displaying SiriusXM weather from the GXM42. From left to right: Temperatures aloft are standard in the Pilot Express package, and the aera796 feature set enables you to select temperatures for a desired altitude. Nexrad images and frontal boundaries can be displayed on a dedicated weather map page or overlaid on the navigation map. The surface pressure feature displays isobar and pressure centers on a dedicated page.

ning data is limited to cloud-to-ground strikes. Pilot Express also includes AIRMETS, SIGMETs and TFRs as standard.

Under the older XMWX's pricing, none of these products are included in the $34.99 Aviator LT base subscription. Instead, you have to step up to the $54.99 Aviator package.

One of the big selling points of the higher priced Aviator package in the XMWX subscription was winds aloft data. Under the new data stream, it's included in the lower priced basic Pilot Express plan. The chart on page 17 shows the major products that the GMX42 will receive.

THE FUTURE

The Garmin aera796 retails for $1699 and doesn't come standard with a weather receiver. Customers have the option of buying the $599 GXM42 or the $599 GDL39 ADS-B receiver. There's also the GDL39 3D, which has built-in AHARS and synthetic vision. It works with Garmin's Pilot app on iOS and Android tablets. We covered it in the March 2014 issue of *Aviation Consumer.*

Garmin told us that it's working on an interface that can make the GXM42 compatible with existing current production portable navigators, including the GPSMAP696 and aera500-series units. It's also working on a future panel-mount interface that can receive the new data.

We asked SiriusXM if the updated weather packages has anything to do with losing customers to free ADS-B weather services. "We are aware of the capabilities and shortcomings of ADS-B, and we place our focus on delivering SiriusXM's unique value to the consumer completely independent of ADS-B," it said. As for the timeline for continuing the XMWX weather stream, "SiriusXM does not have changes to the XMWX broadcast to announce at this time; we will communicate changes as soon as they are known," the company said.

We also asked what it plans to do about the frustration that some users experience when dealing with end-user customer support. According to SiriusXM's Correa, it deployed a new customer care team that's based in North America. This team (855-796-9847) specializes in the new SiriusXM Aviation products.

FIS-B delivers regional and continental U.S. Nexrad radar, AIRMETs, SIGMETs, METARs, winds aloft data, TFRs, TAFs and PIREPs, to name a handful of free services. With receivers priced in the same range as the new GXM42, we're not so sure fee-based cockpit weather has the longevity that SiriusXM hopes for. While buyers that invested in pricey panel-mounted satellite receivers might be stuck paying for subscriptions, we think new adopters with lighter missions might choose FIS-B.

CONTACTS

Garmin
800-800-1020
www.garmin.com

SiriusXM Aviation
855-796-9847
www.siriusxm.com/sxmaviation

Airplains Inpulse ADI: Mogas for Big Engines

Methanol/water injection definitely tames detonation, but it may take a larger avgas-to-mogas price difference to make the numbers work.

by Paul Bertorelli

In the world of internal combustion engines, technology has declared war on octane. Thanks to sophisticated engine control units and knock detection, ever fewer modern cars require high-octane fuel. Aircraft engines, naturally, have been left behind, stranded on their own little island of octane neediness. And so the perverse problem of finding a replacement for leaded 100-octane avgas.

But what if there's just enough octane in the automotive gas pool to make it work in aircraft engines that had a little detonation control? That's the idea behind Airplains' resurrection of ADI or anti-detonation injection, a simple, proven technology that employs a light spray of methanol and water into the induction pipes to quench potential detonation, making it possible to burn lower-octane fuels in high-compression engines.

With a replacement avgas far from resolved, Airplains is betting that ADI will find some traction among owners who might be attracted to the mogas option if they own engines that require 100-octane but who would prefer to pay less for fuel. (Who wouldn't?) In fact, even though it remains an underused option, most engines in the U.S. general aviation fleet can burn lower-octane mogas with nothing but an STC. But those that can't burn mogas consume the majority of avgas sold and Airplains thinks some of those owners will like the idea of saving $12 to $20 an hour on fuel costs, even if they have to invest $12,000 to do it.

SLOW BURN

ADI is well-proven technology that simply fell out of favor for lack of need. In the heyday of high-performance piston engines during World War II, fighter aircraft were commonly equipped with ADI, despite the availability of higher-octane fuels than are produced today. ADI was typically used intermittently in tactical situations where a pilot needed every bit of horsepower the engine could produce for brief bursts. The injection could be controlled manually or automatically by a switch that activated at high throttle settings. ADI also found application on some civil airliners, including Lockheed's famed Constellation, the DC-4 and the Martin 404. When piston fighters and airliners faded, so did ADI, although it actually found some use in jets, too, including the B-52.

Airplains' iteration of ADI is a revisitation of technology originally developed by Todd Petersen in the 1980s as part of his larger program to market STCs for mogas. Market acceptance at the time, says Petersen, was anemic because the system wasn't cheap and the price difference between avgas and mogas was only about 50 cents. "In those days, there was no hurry to get rid of 100 octane. Nobody thought it was just around

The Inpulse system, right, is approved for Barons and the Cessna 210. Airplains used an IO-520 Cessna 180 as a test bed. The system control unit, upper photo, mounts in the panel.

ADI fluid is stored in a five-gallon, baggage compartment-mounted tank, top photo. Fluid flows at 6 GPH through two nozzles mounted in an induction circuit plate, lower photo.

the corner. We thought it was further down the road," Petersen says. Leaded avgas's demise is still not just around the corner, but it's generally agreed we can see the end of it within five years or so.

Insufficient octane causes the flame front in engine cylinders to propagate too rapidly, leading to what is essentially an explosion with rapid pressure spikes and locally severe heating on the tops of pistons and in valves. ADI addresses this in two ways. First, it lowers the temperature and increases the density of the incoming induction charge, removing or at least lessening the conditions for detonation to begin. Second, the ADI blend provides enough cooling of combustion chambers and valve surfaces to suppress the rapid flame front advance that would otherwise lead to detonation.

Why a methanol/water blend? Would water or methanol alone suffice? Either would, but Petersen, in mining research done for ADI systems 70 years ago, found that a 60/40 ratio of methanol and water works best. (There's also a dose of water-soluble oil in the fluid to reduce the corrosive effects of methanol. Owners can mix the stuff themselves.)

The methanol adds heat to the combustion charge, which isn't produced by water alone, and it also provides freeze protection down to minus 40 degrees C. Straight methanol, on the other hand, has a low boiling point and could get vapor locked inside a hot engine compartment.

A report Petersen did describing his research revealed that during World War II, the Royal Aircraft Establishment referred to ADI as a "dual-fuel system." Low octane was found satisfactory for cruise, but ADI resolved the octane deficiency for high-output takeoff or high cylinder-head temperatures. And that's exactly how the Airplains Inpulse system works.

PLUMBING

Airplains' Mike Kelley and Rafael Soldan described the Inpulse system as simple or, to use Kelley's descriptor, "dumb." There's not much to it. The basic plumbing consists of a five-gallon tank in the rear of the aircraft—at least in the Cessna 180 we flew—plus ¼-inch lines running forward to the engine bay, where they're routed into a pair of nozzles. The nozzles are threaded into a custom plate that's mounted in the induction system either upstream or downstream of the throttle plate, variable with aircraft and engine. A solenoid valve toggles the fluid flow—it's either on or off, and it's not on much.

The system is low pressure, driven by a pair of pumps—one primary and one backup—at about 6 PSI, As shown in the photo above, the pumps are tiny and live on mounts at the base of the tank structure. The tank itself is double-walled aluminum as a safety measure against the ADI fluid's flammability and it has a filler nozzle outside the aircraft behind the baggage compartment.

The "dumb" part, says Kelley, comes in the control of the system. It's sensor spare, needing only to know when manifold pressure is higher than 25 inches or CHTs are above 400 degrees F. That sensing is done by a 2¼-inch panel-mount computer with a pair of switches. One turns it on and tests the system; the second allows overriding the computer's commands to run the backup pump and flow ADI fluid continuously, independent of MAP and CHT. Total installed weight of the Inpulse, including fluid, is about 65 pounds. Not a huge hit against payload, but not trivial either.

The system flows 6 GPH of fluid through the two nozzles, which are pointed at each other in the throat of the induction plate. That sounds like a lot of fluid for a single engine to gulp and it is. But because ADI is mostly about addressing octane shortfall during takeoff, it doesn't flow much fluid on a typical flight. A high-horsepower, normally aspirated aircraft usually climbs briskly and in under five minutes, it's likely to be below 25 inches MAP, if the pilot hasn't reduced power in a lower level off. So on a typical takeoff, you'd consume about a pint of fluid, although a takeoff heavily loaded on a hot day might require double that if CHTs remain high during the climb. Soldan told us that on a trip from Kansas to Georgia and back, he used about a quart of fluid.

Then why carry five gallons of it, which contributes mightily to system weight? It's a tradeoff, explains Petersen. To guard against running out of fluid and getting stranded where you can't find any, you need to carry enough to last for awhile. Carrying jugs of it in the baggage compartment probably isn't practical, since you're still hauling the weight without the protection of the double-walled tank.

The cost of the fluid, by the way, isn't much of a factor. In bulk, methanol costs about $2.50 a gallon and the soluble oil, the same type used for machine cutting tools, is readily available. Stashing a small drum of methanol in the hangar and mixing it as needed would be practical.

FLYING IT

To sample the system's performance, we departed from Wellington, Kansas, in Airplains' Cessna 180. Having Inpulse aboard doesn't add much workload for the pilot, other than requir ing a pre-takeoff check to see if the system has fluid and is flowing it. That involves running the pumps manually and watching for indications that the induction is digesting the water.

Interestingly, the effect of the water is not instantaneous. With the 180's IO-520 at run-up power, there's not enough MAP to switch on the fluid, so you do it manually and watch for a slight decrease in indicated MAP. But the decrease is indeed slight and it's surprisingly slow in coming—several seconds. Switching off the injection had the reverse effect; a slower-than-expected rise in manifold pressure.

Todd Petersen told us that his developmental research indicated that quenching detonation in a cylinder is more or less instantaneous when the fluid stabilizes the flame front but without knock sensing, you're unlikely to notice it through any physical manifestations. Test data Soldan reviewed with us confirms this.

Because of the thermal mass of cylinder heads, CHT indicators are slow to respond after post-quench detonation. Once injection is applied, it takes fully 30 seconds to even measure a CHT effect and more than a minute before the temperatures cool significantly. Soldan said cooling is on the order of about 20 degrees and although that doesn't sound like much, it's sufficient because detonation tends to have a sharp temperature/pressure threshold and reducing CHT by that amount is quite likely to snuff it out.

Because we flew on a cold, late-winter day in an airplane without good CHT sensing, we're accepting Airplains' test data, backed up by Petersen's experience and that of Inpulse user John Otte. In our view, there's no argument that the system works; the challenge is economic, not technical.

CONCLUSION

Airplains' Mike Kelley recognizes that Inpulse's appeal is neither universal nor a cinch for those owners who could use it. How, he asks, are you going to convince a Baron owner who's running a split fuel system—avgas for takeoff, mogas for cruise—without the bother of an STC to buy an expensive system that carves into payload? On the other hand, Airplains is getting nibbles from non-U.S. customers where mogas is both more available than in the U.S. and sold at a much higher price Delta. Typically, in the U.S., mogas is $1 to $1.50 less than avgas, but it can be more. Even at $1, that's as much as $18 an hour in fuel savings for large displacement engines. If you flew but 50 hours a year, you'll save $900 in fuel. Not bad, but against a $12,000 investment, that's a long payback. But if the avgas/mogas price difference rises to $2, which it very well could once 100LL is gone and replaced by an unleaded fuel, and you flew 120 hours, the savings would be $3600 a year. In our view, that looks more attractive.

Still, Airplains will need a lot more engine and airframe STCs to gain much market penetration and these are expensive to develop individually. The company is hoping to make deals with interested owners and we can only hope that in the meantime, mogas finds wider distribution. Right now, only about 115 U.S. airports carry it.

To us, Inpulse looks like a long-term play that may find buyers after the 100LL crisis is resolved. Nothing will quite focus owner attention on mogas like $7 or $8 avgas. It's already gaining some notice in offshore markets.

HOW THE NUMBERS CRUNCH

Whether ADI makes economic sense depends on three variables: the cost difference between avgas and mogas, yearly flight activity and how available mogas is. We spoke to South Dakota ag operator John Otte, whose experiences have shown both the problem and promise of Inpulse ADI.

Otte operates a pair of Cessna 188 Agwagons in a busy application business in the north plains. One is equipped with an IO-520 and Inpulse, the other with an IO-550, which isn't approved for the system yet. Otte told us he flew the 520 Agwagon about 100 hours last year, but his primary aircraft, the 550-powered model, flew more than 300 hours. Even so, Otte figures his fuel cost savings at $1 a gallon and the airplane will burn up to 100 gallons on a busy day. So for a 100-hour year, Otte figured he saved about $1800 in fuel costs. But if he had the system on his main aircraft, the savings would be more than $5000, paying off the Inpulse investment in under three years. His savings are actually higher because he'll be getting a non-road use tax refund on his mogas purchases.

Otte says the payback is definitely worth the investment and he'd install it again. Otte says when the system is fully charged, the airplane feels a little tail heavy, but not so much that he thinks it needs to be addressed. It may be possible to install the fluid tank forward, behind the firewall. Loss of payload is not significant, but the airplane does feel different, Otte told us.

"As far as operating it, the way it works, it has worked superbly. There are a few preflight checks, but it's pretty much automatic," Otte says.

The economics for an owner-flown personal or business airplane are no different than Otte's. According to AirNav's data, mogas, on average, is $1.35 cheaper than avgas and is available at about 110 U.S. airports. It's widely available through the upper Midwest and can be found at at least one airport in most states. A not-too-determined owner could probably find mogas without much trouble. The chart at left shows the economics based on various assumptions.

AVGAS/MOGAS PRICE DELTA	HOURS PER YEAR	YEARLY SAVINGS
$1.25	50	$875
	100	$1750
	150	$2625
$1.50	50	$1050
	100	$2100
	150	$3150
$2.00	50	$1400
	100	$2800
	150	$4200

Assumptions: 6-cylinder mogas-approved engine, burning 14 GPH block-to-block

CONTACT

Airplains
800-752-8481
www.airplains.com

Avidyne IFD540: Closer to Certification

Avidyne's slide-and-fly replacement for Garmin's GNS530W nears certification. We flew with it and liked the FMS and hybrid controls.

by Larry Anglisano

Avidyne and its IFD-series GPS navigator project has taken a beating from both customers and the dealer network. It's no secret that the company has slipped several times on its IFD certification and delivery projections. Worse, Avidyne offered a pre-delivery sales incentive that required early adopters to pay a refundable deposit in exchange for a sizable discount on the cost of the IFD540 or IFD440 unit. Some of those customers have received or are requesting refunds because of undelivered product.

But not all buyers are disgruntled over Avidyne's certification delays. We've heard from position holders that remain patient as Avidyne continues to endure the rigors of the FAA certification process, and postings on Avidyne's online project update forum, avidynelive.com, has more than one counterpoint from positive buyers who feel that waiting for the IFD is a better option than buying from the competition. That competition is Garmin, of course. There's also Bendix King's KSN770, a touchscreen navigator that's years overdue and currently stalled in the certification process.

To see the IFD540 in the real world, we recently went flying with the uncertified unit in Avidyne's Cessna 182 test bed—disproving the conspiracy theory that the IFD doesn't really exist.

WHILE YOU WAIT

The first thing Avidyne's IFD project director Steve Jacobson showed was how easy the installation is when replacing an existing Garmin GNS530W. That's one of the main reasons some buyers are holding out for the IFD540 because it requires no panel work or rewiring. Simply unlock the GNS530W from its tray, pull it out and slide the IFD540 in its place. As promised, it really is a while-you-wait effort.

If it seems like there's a lot of data on the IFD540 screen, left, there is. That's because the FMS in the navigator is straight out of the large R9 integrated avionics suite. As a result, the 5.7-inch screen can be busy.

Technicians should be familiar with the system setup and configuration process because Avidyne mimicked the setup menu of the Garmin GNS navigators. This is where interface parameter such as RS232 and ARINC429 databus, bezel lighting and external sensors are set.

While it's recommended that shops conduct it, given the level of interface that will exist between other systems in the aircraft, Avidyne said that flight testing isn't required after installing a slide-in IFD. Not counting a flight test, the entire installation might take an hour or two of shop labor, with paperwork.

As long as the existing Garmin GNS is a WAAS version, the IFD540 will work with the existing WAAS-GPS antenna. In fact, Avidyne said the IFD540 will work with all of the same accessories that the GNS530W does. This includes CDIs, HSIs, autopilots and external mode annunciators.

COMPATIBILITY

The latest controversy surrounding the IFD project is the unit won't be entirely functional with some Garmin systems, including the GMX200 MFD. When connected with a GNS530W, approach charts in the GMX200 are automatically loaded when you select an approach, eliminating the additional step of manually selecting the chart from the GMX200. Avidyne said it figured out a way to replicate the MAPMX serial data label that's required for automatic chart loading between the two systems. For some, the lack of this functionality would have been a deal-breaker, but that's been addressed and Avidyne said it will work.

Whether you're starting from scratch with a new installation or sliding the IFD into an existing GNS installation, there's a wide variety of compatible interfaces. Aspen's

EFD1000 PFD, along with vintage Bendix/King KI525-series analog HSI systems are fully compatible. If you don't have an HSI or PFD, Garmin's GI106A CDI works, as will resolver-equipped Bendix King indicators.

The IFD is compatible with both the Garmin GDL69/69A XM satellite weather and entertainment receiver, in addition to Avidyne's MLB700 satellite weather receiver. For lightning overlay, L-3's WX500 will work, as will Avidyne's TWX760 lightning detection system.

For traffic system interface, there's Mode S TIS—including Garmin's GTX330, L-3's SKY497 Skywatch, plus Avidyne's TAS600-series active traffic alert system.

The aircraft we flew had Avidyne's new AXP340 ADS-B transponder. This is a slide-in replacement for Bendix King KT76A/78A transponder and has 1090ES ADS-B output. Avidyne says the IFD navigators will serve as an approved GPS source for satisfying the ADS-B out mandate.

If you fly a turbine aircraft that requires a TAWS-B terrain system, a version of the IFD540 has integral Class B TAWS for an additional $7995. Standard is a full-featured terrain awareness system that has both visual and audible terrain alerting. We went sniffing for towers and obstructions on the flight demonstration and the IFD accurately displayed the threats.

MULTI-TOUCH SCREEN

We've operated the IFD540 in demo stands, but this was our first crack at fingering the so-called hybrid interface in flight. A hybrid user interface means that any function you can accomplish with the touchscreen can also be accomplished using mechanical knobs and buttons. In our view, the hybrid feature set on the IFD540 should satisfy a wide variety of users because there's enough familiar menu commands that are brought over from the GNS530W. Users should be familiar the Procedure command that's used for loading approaches, departure and arrival procedures, for example. But the FMS wasn't born from the GNS530. Instead, it trickles down from Avidyne's R9 integrated cockpit. For that reason, we think Avidyne should offer structured factory training the way Garmin does with its GTN-series navigators. We suspect there will be a sizable learning curve that tags along with an IFD upgrade. As easy as the installation is, it's unrealistic to think you can fly away with the same level of proficiency you perhaps had with your old GNS530W. In our view, the Geofill FMS on the IFD is worlds ahead of the GNS530.

That's a Garmin GNS530W below the IFD540, top photo. The two share the same chassis size and wiring, lending to an installation that literally takes seconds to complete. We think that dual IFDs, bottom, help to spread the data out. The smaller IFD440 is the size of GNS430.

While Avidyne's Jacobson was flicking his fingers primarily on the touchscreen, our fingers went straight for the buttons and knobs when loading an approach in the bumpy Florida skies. Despite the touchscreen, we went straight for the bezel buttons—especially the familiar PROC key—a command we've been using for years on the Garmin GNS navigator. Because the menu structure on the IFD was foreign to us, having the familiar keys was reassuring, and we suspect many users will be glad those keys exist. Still, we had some nits.

TV IFD540 VIDEO

www.avweb.com

First, we think the onscreen touch labels are a bit too small. Chubby fingers might miss them on the first press, as we did while flying in the bumps. Jacobson experimented with different types of gloves to determine which work best, but he told us most of the gloves he tried—including Nomex—are workable. Don't underestimate this utility. If you fly in cold climates, a capacitive touchscreen has to work with gloves.

The IFD supports multi-touch touchscreen technology, meaning that features such as the two-fingered pinch zoom for changing map and chart range is fully enabled.

Navigating the IFD is fairly straight-forward, thanks to what Avidyne calls a Page and Tab user interface. That's because most of the major functions revolve around the three-page function keys at the bottom of the IFD bezel. Each of the three function pages has associated tabs and the buttons serve as left and right rocker keys to navigate the tabs.

continued on page 32

Brian Spurr

Cherokee 235/Dakota

Piper's familiar airframe mated with a big engine offers healthy amounts of utility and simplicity.

When Fred Weick and John Thorp set out to design a less expensive alternative to Piper's Comanche, it's unlikely they thought the resulting PA-28 series would become so popular, so durable or so varied. Since introducing the Cherokee 150 and Cherokee 160 (PA-28-150 and PA-28-160, respectively) in 1961, Piper has stretched, T-tailed, turbocharged and reproduced that basic airframe tens of thousands of times.

Its original Hershey-bar wings eventually gave way to a longer, semi-tapered design, the landing gear has been folded and many different powerplants have been fitted. While much has changed, the design's basic utility, systems, handling and reliability have remained. Three models remain in production—four, if you count the twin-engine PA-44-180 Seminole—almost 50 years later.

While PA-28 Cherokees came in many flavors, the most powerful of them—the Dakota—isn't the fastest but is perhaps the most flexible. It and earlier 235-HP Cherokees take advantage of the market's affinity toward muscular four-place singles, a natural attraction proven popular enough to support two significant entries for many years: the Cessna 182 Skylane and the Piper PA-28-235/236. The 182 came first and outlasted the 235/236. By any measure, it's been a success. Like the Piper, it features a good combination of utility, roominess and performance. Piper's version, however, never matched the 182's popularity, even though it combines the Skylane's chief attributes: decent performance, simplicity and common, proven components. If your needs include a big dose of horsepower pulling a simple airframe, the most powerful PA-28 Cherokee is a very solid candidate.

If you're looking for a low-wing, four-seat load-hauler with simple systems and a bulletproof engine, you've come to the right place.

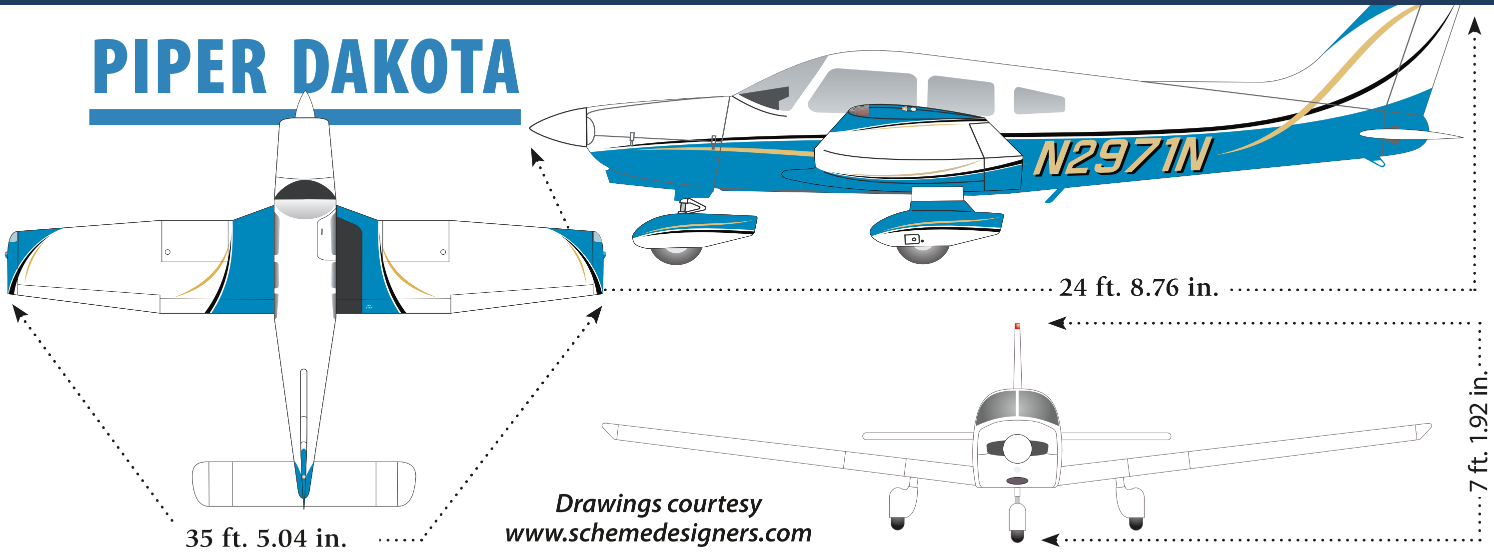
HISTORY

Even before the 1960s began, Piper proved to be a master of taking a single design and turning it into a variety of airplanes. The company's PA-24 series—precursor to the Cherokee line and first available with 180 HP—eventually was offered with 250, 260 and a whopping 400 HP, plus a popular twin-engine version. Carrying that theme forward, the company's PA-28 Cherokee started life as a basic four-place, fixed-gear single with 160 HP, positioned opposite the Cessna Skyhawk. Before all was said and done, the PA-28 had mutated into everything from the two-seat Cherokee 140 to the T-tailed Turbo Arrow IV, plus a twin-engine version, the PA-44 Seminole.

Then and now, the Cherokee 235 represented the top end of the PA-28 line, with a derated Lycoming O-540 engine mated to the basic Cherokee airframe. It was brought to market as a 1964 model, only three years after the original Cherokee hit the scene. Aside from the engine, the only significant difference between the Cherokee 235 and its less-powerful siblings was an extra two feet of wingspan. The extended wingtips housed fuel tanks needed by the thirstier engine, boosting total fuel capacity to 84 gallons.

The original 1964-65 model came equipped with a fixed-pitch two-blade propeller mated to a 235-HP Lycoming O-540-B2B5 engine having a TBO of only 1200 hours. Plane

PIPER DAKOTA

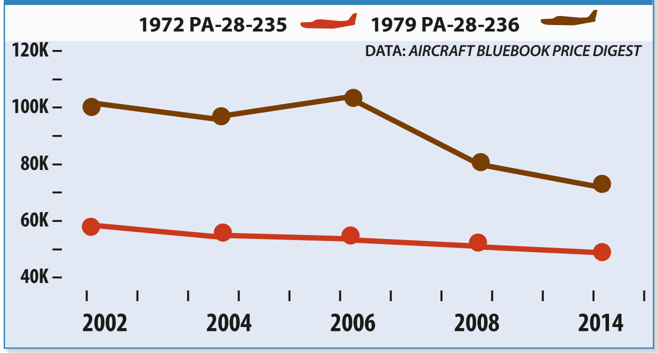


Drawings courtesy www.schemedesigners.com

PIPER CHEROKEE 235/DAKOTA MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1964 PA-28-235 CHEROKEE 235	LYCOMING O-540-B4B5	2000	$30,000	80	1465 LBS	136 KTS	±$42,000
1968 PA-28-235 CHEROKEE 235C	LYCOMING O-540-B4B5	2000	$30,000	84	1433 LBS	136 KTS	±$50,000
1972 PA-28-235 CHEROKEE 235 F	LYCOMING O-540-B4B5	2000	$30,000	84	1433 LBS	136 KTS	±$54,000
1973 PA-28-235 CHARGER	LYCOMING O-540-B4B5	2000	$30,000	84	1250 LBS	132 KTS	±$59,000
1977 PA-28-235 PATHFINDER	LYCOMING O-540-B4B5	2000	$30,000	62	1408 LBS	126 KTS	±$64,000
1979 PA-28-201T TURBO DAKOTA	CONTINENTAL TSIO-360-FB	1800	$40,000	72	1321 LBS	154 KTS	±$70,000
1979 PA-28-236 DAKOTA	LYCOMING O-540-J3A5D	2000	$30,000	72	1392 LBS	143 KTS	±$75,000
1986 PA-28-236 DAKOTA	LYCOMING O-540-J3A5D	2000	$30,000	72	1392 LBS	143 KTS	±$120,000
1994 PA-28-236 DAKOTA	LYCOMING O-540-J3A5D	2000	$30,000	72	1392 LBS	143 KTS	±$140,000

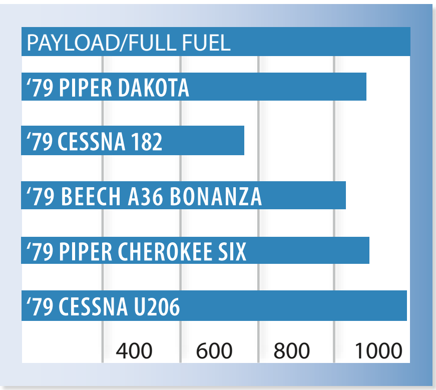
PIPER DAKOTA RESALE VALUE

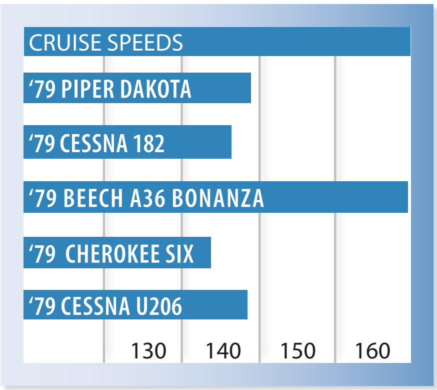


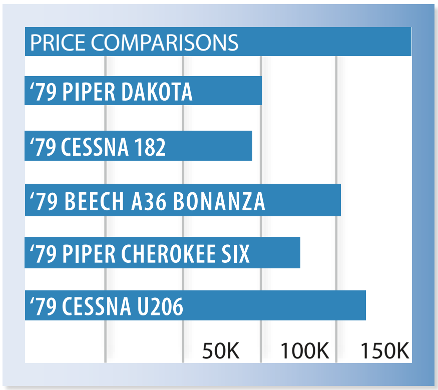
SELECT RECENT ADs

AD 2006-20-09	REPLACE ENGINE CRANKSHAFT AT OVERHAUL OR AFTER 12 YEARS
AD 2007-04-19	REPLACE CERTAIN SUPERIOR AIR PARTS CYLINDER ASSEMBLIES
AD 2010-15-10	INSPECT CONTROL WHEEL SHAFTS FOR CORRECT ASSEMBLY
AD 2013-02-13	INSPECT STABILIZER CONTROL SYSTEM AND REPLACE PARTS AS NEEDED

SELECT LATE-MODEL COMPARISONS







Lycoming's six-cylinder O-540 basically loafs along in the 235-HP version installed in Piper's most powerful PA-28. Getting maintenance access to it requires removing numerous screws and separating the upper and lower cowling halves.

spotters can identify this, along with the follow-on B model, by only two side windows. The B model also had an optional constant-speed propeller. It was produced from 1966-68. The 1968 model boasted an increased TBO of 2000 hours. The improvement was retrofittable and by now there should be none of the 1200-hour engines left in service.

The 1969 C model boasted a third side window, new instrument panel and power controls. Few other significant changes were made for this, the D, E or F models. This first PA-28-235 series finished up in 1972, with the F.

The 235's second generation began with the 1973-74 Charger and ended with the Pathfinder model, produced from 1975-1978. Both were still PA-28s, but with enough differences to be significant. Examples include a five-inch fuselage stretch coupled with a 100-pound boost in takeoff weight and a corresponding 59-pound increase in empty weight. There were other minor alterations, like standard shoulder harnesses for the front seats and a stall horn to replace the stall light. And the constant-speed prop at last was made standard.

The final variant, the PA-28-236 Dakota, was introduced in 1979. It boasted the new semi-tapered wing planform first available on the Warrior in 1975 and by then common across all PA-28 models. The Dakota was larger in critical dimensions, with another fuselage stretch of 7.5 inches and a span increase of 3.4 feet.

Also new was a different engine variant, the Lycoming O-540-J3A5D, still with 235 HP. It offered better fuel efficiency and less noise and vibration. It also was designed to use 100/130 avgas instead of 80 octane. The Dakota sported a new cowling, plus Piper's new-style wheel pants and, along with the new wing came new ailerons and a new fuel system, reducing capacity from 84 to 77 gallons (73 usable). Despite the drop in fuel capacity, range didn't suffer as much as one might expect. This can be attributed to better engine efficiency and improved aerodynamics, thanks to the long, semi-tapered wing.

By the time the Dakota came out, general aviation sales were beginning to drop dramatically. Few changes were made to the model, and production slowed to a trickle. The last Cherokee model came off the assembly line in 1994.

TURBO

We did leave out one Dakota from the history detailed above. This is not a mistake—it's intentional—because it's really a different airplane, the PA-28-201T Turbo Dakota, with a turbocharged 200-HP Continental TSIO-360-FB powerplant. Aside from the questionable move of putting a significantly less powerful engine into an airplane people buy for horsepower, the execution left a great deal to be desired in the areas of induction, cooling and exhaust air flow.

The result—essentially a fixed-gear, Turbo Arrow III—was a bundle of mechanical trouble. The 201T has proven to be less reliable than the more powerful, normally aspirated Dakotas, with trouble and accident rates four times higher than one would expect, based on the proportion of them in the population. (It's impossible to be precise, since the FAA lumps together all PA-28s in the activity surveys.) An unusually large percentage of accidents, incidents and SDRs have been directly related to the powerplant and accessories.

The "non-Dakota" Dakota was made for one year, 1979, and only 91 were built. Some of these were sold as 1980 models. In a previous look at Dakotas, we had this to say about the Turbo: "Suffice it to say everybody makes mistakes, and this was one of Piper's big ones. Oddly enough, some owners love them." One such owner sent in his comments, below, indicating few problems with his aircraft

If you just can't resist a Turbo Dakota, be certain you get a solid-gold pre-purchase inspection, including documentation of meticulous maintenance before you consider purchasing it. For us, lack of an aftermarket wastegate and engine monitor with regular data retention would be a deal-breaker.

MARKETPLACE

The market long ago decreed the big Cherokee of choice to be the PA-28-236 Dakota. Enhanced performance from the new wing makes a real difference, and it's reflected in the prices they bring. According to a recent *Aircraft Bluebook Price Digest*, the latest Dakota retails for $140,000, versus $42,000 for a 1964 235. As a side note, a 1979 Turbo Dakota goes for $70,000—that's $5000 less than the same year normally aspirated Dakota. This may reflect its rarity as the only turbocharged, fixed-gear

Cherokee; perhaps it also reflects many mods available to improve the Turbo Arrow , which also can be fitted to the Turbo Dakota.

Meanwhile, Cessna's 182—which formerly enjoyed much higher prices in the marketplace—has taken a hit. A 1979 model currently fetches $72,000, or just a couple grand less than the Dakota. This is a reversal from previous times we looked at the two models; the Cessna product usually commanded a premium. It still does for some model years—earlier Skylanes can fetch a tad more than the same-year Cherokee 235, for example, according to the Bluebook—but the 182's historical higher price disappears when compared to the 236.

This reversal is probably the result of two phenomena. First, Skylanes are still being made, deflating prices for older ones. The same can't be said for Dakotas; when they're gone, they're gone. Second—and without rekindling a low-wing versus high debate—the Dakota's strutless, cleaner design usually appears more modern.

If we were in the market for a big Piper, we'd opt for the nicest Dakota we could find. If money is more of an issue, there's an interesting trade-off that can be made. As noted below, the pre-Charger and Pathfinder PA-28-235s actually perform better than the Charger/Pathfinder do, though not as well as the Dakota. The trade-off comes in the extra useful load and interior space available with the Charger and Pathfinder. As noted above, it's wise to avoid the Turbo Dakota unless you're absolutely sure it's right for you.

HANDLING

Most PA-28s handle about the same, and the 235/236 is no exception. There's more difference between early Hershey-bar models and later, taper-wing versions than there is between the different models with the same wing. The Hershey-bar-equipped versions are quite stable in all but the most turbulent air—at which point they become very high workload—if you want to fight rather than accommodate conditions. Many pilots term them truck-like. The taper-wing Dakota is more responsive and demands less effort.

The respectable and stable PA-28

DAKOTA DEBACLES: RLOC, OTHER

Our examination of the 100 most recent accidents involving Piper Dakotas and Cherokee 235s confirmed one suspicion we had—that the wide-track landing gear meant there were fewer than average runway loss of control (RLOC) accidents that involved running off the side of the runway—and three were on icy or slush-covered runways. Unfortunately, that advantage was pretty much negated by the number of RLOC accidents that involved coming down final too fast, touching down long and running off the end of the runway. Sometimes it seems that no matter how well an airplane is designed, pilots find ways to break it.

The engine/mechanical accidents were a little disconcerting, as almost half were engine stoppages for reasons unknown, while most of the others were due to poorly performed maintenance or owners not understanding the concept that an engine just might need a little TLC over the years. One owner had never removed the oil filter—it and the engine were full of metal shavings from parts that eventually self-destructed in flight.

Fuel-related mishaps ran from pilot-induced to mechanical. Four involved worn-out fuel selectors that allowed mispositioning of the valve, three were due to selecting the wrong tank, three came from pilots running completely out of gas and one from water contamination so bad and persistent that many of the fuel system components were rusted.

Fully 10 percent of the accidents were a result of irrationally optimistic VFR pilots trying to either launch in instrument weather or press on in deteriorating conditions. Seven hit the ground before the airplane broke up; three did not.

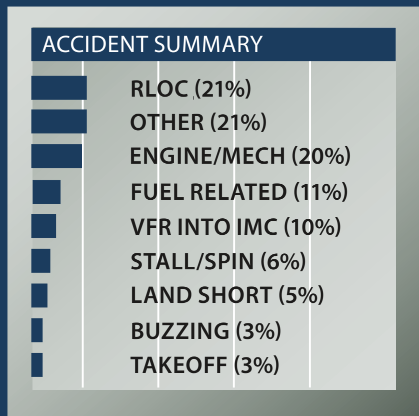
The stall/spin accidents were all immediately after takeoff from short fields—and the three takeoff accidents involved hitting obstructions while trying to launch from a short runway. One can speculate that the generally enthusiastic takeoff and climb rate of the airplanes may have caused pilots to try to obtain performance from them that was never built in.

One of the three buzzing accidents saw a pilot try a low pass over his friend's moving car, misjudge and leave the left main gear in the car, seriously injuring his friend.

Five pilots tore up their airplanes by landing short of the runway, an unusually high rate, we think.

The 21 accidents in the "other" category were truly a mixed bag of events. There were four taxi accidents in which the pilot misjudged the wingspan and hit something—in one it was a fence and the tip tank opened up, causing a fire. One pilot was incapacitated by carbon monoxide poisoning. There were two deer strikes, one bird strike and two mid-airs; one with a high-wing and one with a low-wing airplane. One pilot sensibly diverted when concerned about fuel, but landed on a closed runway and tore up his airplane when he hit junk left on it.

Our favorite involved a pilot who decided that the three airplanes using one runway for touch and goes didn't know what they were doing, so he launched from an intersecting runway while communicating with them—apparently in a derogatory fashion. He hit one at the intersection. Included as one of the causes of the crash was the pilot's "ostentatious display." Good grief.



That's Sean Sullivan's 1964 Cherokee 235 panel, left, reworked with a custom panel overlay. The single radio stack in older 235 models can accommodate modern avionics, but flight instruments are spread out and still retain a basic T layout.

handling is also present in the 235/236 and results from the nose gear not being a self-centering design. Instead, it's connected full time to the rudder pedals and, when the rudder is deflected in flight, the nose gear is, too. The effect is compounded with larger fairings and wheel pants. Having trouble maintaining desired heading when cruising in a PA-28? See if you are inadvertently putting some pressure on one of the rudder pedals, or kick the pedals left and right to see if the nosewheel is centered.

There's an obvious hazard if the pilot has deflected the rudder when the nosewheel touches down. It's not really a problem, but is something new Cherokee pilots should know about. Still, for all the years these characteristics have been known, the long-term damage caused by improper stress, loss of control and gear collapse accidents occur with high frequency.

A particular handling quirk found in this biggest of Cherokees won't be found in a less-powerful version like the Warrior, however. That big engine weighs a lot and it affects the way the airplane handles in the landing flare. The 235/236 otherwise is an easy-flying airplane and many owners praise its stability in IFR operations, but the greater weight of the engine/propeller combination out front—while contributing to a generous CG envelope—increases the design's tendency to under-flare in landing and even during takeoff.

Lightly loaded, the 235/236 can be difficult to flare properly during landing, especially if speed control is not good, airspeed is high and full flaps are used. The same trick that works so well in PA-32s and PA-34s—using only the first or, at most, second notch of flaps—helps the pilot to hold the nose gear off. Notably, Skylanes and other big-bore, tricycle-gear Cessnas can suffer from the same lack of pitch authority in the flare.

PERFORMANCE

Unlike some airplanes, early Cherokee 235s performed better than later models. This is due, in part, to the fact that many designs start out underpowered; not so the 235, which had plenty of ponies from the outset. Cruise speed, rate of climb, range, service ceiling and poor altitude performance of the Charger/Pathfinder can be attributed to the same engine hauling around more airplane. Even the official figures reflect this. Late-model 235s with constant-speed props have a service ceiling of 14,500 feet. The Charger's official top is a dismal 12,000 feet, and even getting to 10,000 feet in the summer is a trial.

The new, longer wing on the Dakota brought much better performance to the design. The service ceiling went up to a very respectable 17,500 feet, assuring adequate density-altitude performance and ability to cruise with relative efficiency in the teens. Only takeoff ground run performance declines when compared to the Charger (886 to 800 feet), although performance to cross a 50-foot barrier improves (1216 versus 1260 feet).

Climb performance in the Dakota is also markedly improved, again because of the longer wing. These are the characteristics attracting people to big-engined singles—an airplane with a smaller engine simply can't hold its own in a hot-high-heavy situation the way a Dakota can. In its own way, the Dakota shows what aircraft development within a model line should be, but rarely is: improved utility and performance.

The Dakota's wing also pays off in improved roll response, due to the taper and new aileron design.

SYSTEMS

There are a few things to be aware of about the PA-28-235/236's systems, some of which are potential problems for the uninitiated.

The brakes come in for routine castigation. Especially in the later models, pilots complain there is too little braking power available and pedal feel is too spongy. This may be a perception rather than a fact. Braking force directly relates to the airplane's performance and wheel/tire size, along with the discs and pads. Too much brake power puts the expense elsewhere, in replacing flat-spotted tires.

The fuel system in earlier airplanes deserves mention as well. The original four-tank fuel supply requires constant attention to fuel management. Accidents continue to occur from failing to switch tanks or because a tank with no or low fuel is selected. This occurs despite the location of the fuel gauges and selector on the 235s in the center of the cockpit, below the engine controls.

The Dakota's system is simpler, but the selector is in the usual out-of-sight, out-of-mind PA-28 position on the left side wall.

Another potential problem area is the pitot and static system design. With the pitot tube (or blade in this case) mounted on the bottom of the port wing, the system is quite susceptible to water contamination and bug blockage. It's nearly impossible to inspect properly and frequently the only indication is the lack of or clearly erratic indication of airspeed during the takeoff run. Pitot and static leaks could require fuel tank removal to access decayed lines.

Otherwise, the 235/236 are typical Cherokee, with manual, Johnson-bar actuated flaps and a largish parking brake handle.

INTERIOR

In later models, with more seat adjustments in both the front and rear, and better attention to seat shape, the 235 is better than the average light plane over long stage lengths. A number of owners have commented on seat design as a plus. We agree, and not only for comfort reasons. Piper is one of the only manufacturers to pay attention to crashworthiness of its seats. The S-shaped seat frame deforms on impact, absorbing energy.

Especially after the fuselage stretch introduced in 1972, the 235 series provides reasonable comfort for four people. Many owners report the front-seat passenger actually has an easier time keeping out of the pilot's way than in a Bonanza. The Dakota is roomier still.

Otherwise, the 235/236 is typical Piper, including a single cabin door and a baggage compartment accessible from the rear seats. Panel layout also is carried forward from other and earlier PA-28s, which is to say it's good with the exception of the engine instruments.

Early 235s had these two gauges on the upper right side of the panel. While there is a certain logic to putting the tachometer and manifold pressure gauge near the throttle, as with later models, we prefer to see the critical powerplant information up high and near the pilot's line of sight. To us, the late-model Bonanza is about as good as it gets in a single. Of course these days, digital engine instruments can fix a nagging layout. You can also cut a new panel.

The center avionics stack is rather short when compared to other manufacturers, so Piper generally relocated the autopilot to above the pilot's left knee and left room for a short stack to the right. Some earlier panels may have sacrificed the glovebox, too, and recent attempts to install the latest and greatest avionics have run into issues regarding available depth behind the panel, especially at the top of the center stack.

The 236s and later 235s have a row of rocker switches above the power quadrant. Circuit breakers are mounted low and on the right half of the panel. Earlier models used fuses and toggle switches, which often got spread across both halves of the panel. With many 235s at or beyond 45 years in service, some panels may appear very dated; others may have been totally revamped.

MAINTENANCE

The 235/236 has a huge advantage going for it when it comes to maintenance: reliability. That said, the engine is relatively inaccessible, requiring removal of at least the cowling's top half for anything other than routine preflight oil checking.

The O-540 is significantly derated compared to some variants of the same engine, like the 350-HP versions in the Navajo. That means stresses are low and service reports verify that the 235-HP version is nearly bulletproof. With the core engine still in production and tens of thousands in the field, support has not been a problem. With parts and service widely available, proper maintenance does not require a guru.

Because it's a PA-28, parts and service for the airframe are quite easy to come by. As these things go, it's an easy airplane to live with.

These observations, of course, do not apply to the Turbo Dakota. The powerplant and accessory problems it suffers are legion by comparison. Still, many of the same aftermarket mods that tamed the Turbo Arrow models—intercoolers, for instance, and improved wastegates—can be fitted to the Turbo Dakota. As noted above, we'd consider these aftermarket items mandatory.

MODS, TYPE CLUB

Any airplane in service for almost 50 years will develop a vibrant aftermarket for replacement parts and modifications. Not only does the PA-28 series fit this mold, it may lead the pack since so much of its design remains constant from model to model and year to year. Thus, a basic part or modification initially developed for, say, the PA-28-140 could easily be used on a -235, subject only to obtaining the necessary approvals.

Among the modifications available are aileron and flap gap seals, more efficient wingtips, stabilator tips and fairings, wheelpants, vortex generators, retrofit shoulder harnesses, HID lighting and much more. Many replacement parts—especially for plastic interior and exterior items—are available from aftermarket third parties and are vastly superior to the originals (which may or may not remain available from the factory).

Having once absorbed the Cherokee Pilots Association, the Piper Owner Society (www.piperowner.org, 866-697-4737) is the type club serving 235/236 owners. Services include a monthly four-color magazine, online forums, insurance discounts and more, including technical support.

OWNER COMMENTS

I am a member of the Flying 20 Club in Danbury, Connecticut, that owns a 1979 PA-28-236 Piper Dakota with about 6000 hours total time. It serves primarily as the club's traveling aircraft, but also gets a fair amount of use on shorter flights, where additional payload is needed. With nearly 1200 pounds of available payload, it is a true four-place aircraft—one of the great benefits of owning a Dakota.

Two modifications that the club made to the aircraft were replacing the stock Lycoming O-540-J3A5D engine with a Lycoming O-540-J3A5 when it came time for an overhaul, plus replacing the two-blade prop with a three-blade Hartzell Top Prop. I personally consider the engine swap almost mandatory, since it replaces the dubiously certified dual magneto with two independent magnetos. Everything else on the engine is identical, except for a slightly higher weight. The replacement of the two-blade prop for the three-blade prop has resulted in a dramatic increase in climb rate, better management of left-turning tendencies on takeoff and a negligible decrease in cruise performance.

Our members typically average 13-15 GPH fuel burns with a true airspeed around 130 KTS at 65-70 percent power. This is good for about 4.5 hour legs with reserve. On one flight, I was able to fly from Danbury, Connecticut, to Appleton, Wisconsin—navigating around the lakes—with only one fuel stop and still land with about an hour of fuel remaining.

Climb rates typically range from 800 FPM at maximum gross weight on a hot day to as high as 1800 FPM with a light load on a cold day. Average climb rates work out to about 1000-1200 FPM all the way to 8000 feet MSL.

The only persistent problem we have had with the Dakota is a nosewheel shimmy on landing when the nose wheel pant is installed. This unfortunately required an expensive repair of the rudder skin due to cracking when it was landed too fast with the nose wheel on the ground. However, with the nose wheel pant off and holding the nose wheel off as long as possible, we haven't had any problems in the two years since the repair. Typical annual inspections cost about $4000.

Gary Baluha
President, Flying 20 Club, Inc.

I was tired of hearing "please expedite your climb" from ATC when flying IFR in the Northeast in my Warrior and decided that a Dakota would solve that problem. As a result, I've owned a 1979 PA-28-236 for nine years now, and the climb performance has always been great. Lightly loaded in cool weather, it's easy to pin the VSI at 2000 FPM in a 100-knot climb. Even under the worst conditions, it will easily climb 500 FPM at any altitude.

Stepping up to the Dakota will be a non-issue for anyone who has flown a Cherokee. Except for the constant-speed prop and the better performance, it was essentially the same airplane as my Warrior. In fact, by setting the power at 55 percent you have Warrior performance; at 65 percent it becomes an Archer; and at 75 percent (or even 85 at low altitudes) it comes into its own.

Of course, fuel consumption is much higher than its lower-powered siblings. Annuals have cost about the same as the Warrior—typically about $1500, owner-assisted. Insurance cost went up only a bit, to about $1200 per year.

The airplane has had relatively few maintenance issues, with a couple of exceptions. I have learned to treat the number one exhaust riser as a consumable. I get about 200 hours out of each pipe. Often they can be repaired and I keep a usable replacement in the baggage compartment. The pipe usually cracks at the weld at the cylinder flange, but at least one has cracked across the flange. I make a simple check by pinging the exhaust components with my finger during preflight and this usually reveals the cracked piece.

Alternators only lasted a couple of years, with either the alternator mounting tab breaking (completely off, in one case), or cracking the attach bar. I replaced the stock Chrysler alternator with a Plane Power AL12-C60 and it has been fine now for about 100 hours. The Plane Power is lighter, too. Same thing with the starter. When it hung up, I replaced it with a Sky-Tec, saving a few more pounds up front.

My Dakota leaks oil—only a few drops between flights—but this has persisted despite many attempts to locate the leak, including performing a complete overhaul. Oil consumption is pretty high on my engine, at about a quart every five hours. This didn't change after the engine was overhauled.

Handling is typical Cherokee, but since the Dakota has a much greater useful load, you do need to adjust landing speeds a bit depending on weight. Previous reviews have suggested the Dakota is nose-heavy, but I found it actually seems to have more elevator authority in the flare than my Warrior.

The Dakota is legendary for its ability to carry four people and full fuel and it's difficult to overload it.

D.W. Fearn
West Chester, Pennsylvania

I was a new private pilot when I bought my Dakota a few months after earning my certificate. I bought the Dakota to transport my family of four between our permanent home in Iowa to our lake place in Arkansas, which is 400 nautical miles. The trip now takes around three hours versus the nine it used to take driving.

I am happy with the plane so far and have not had to do anything to it except oil changes, so I can't offer much cost information other than it averages about 13 GPH for me. I'm sure I'm conservative with my leaning compared to more experienced pilots. Insurance is only about $1400 per year, while fixed-gear Cherokee Sixes I was looking at were going to cost around $4500 annually to insure.

Mike Hawbaker
Via e-mail

Two days after I successfully passed the private checkride, my partner and I took ownership of a 1979 PA-28-201T. One of 91 built, the Turbo Dakota, as it's more commonly known, is the so-called red-headed stepchild of the Dakota family, mostly because of its rather troublesome engine, the Continental TSIO-360FB with the fixed wastegate.

We were looking for an airplane without the complexity of retractable gear to initiate and complete my instrument training. Plus, it had to be capable of hauling four people and luggage. To say the least, it's been an interesting ride.

Previous owners had upgraded the panel with a Garmin GNS430, Garmin GMA340 audio panel, Garmin GTX327 transponder, KCS 55A slaved HSI system, plus an Insight Strikefinder and engine monitor. Under the cowl, a Merlyn automatic wastegate controller was also installed, along with an Aero Safe standby vacuum system.

The airplane has more than 1200 pounds of useful load and, with the long tapered wing, it's a very stable platform. I usually plan for 140 knots at 12 GPH, but usually get a little better. Fly it higher into thinner air and it obviously does much better.

The engine had about 600 hours before TBO when we purchased it. Approximately 300 hours later, a crankcase bolt sheared while on short final for landing, spewing engine oil onto the belly and windshield. We decided to replace the engine with an overhauled one, at which time the prop was sent out for an overhaul. We also got a new spinner to replace the original cracked unit. A little over two months and $40,000 later, we were back in the air. The new engine made a huge difference. Oil consumption is almost nil, the airplane climbs better and goes faster (8-10 KTAS across the board).

I would not even consider owning a Turbo Dakota or any other aircraft with the Continental TSIO-360 without the Merlyn controller installed. The factory fixed waste gate system is a joke. The turbo spins at full speed all the time, even at lower altitudes when you do not need it, resulting in excess turbo, cylinder head and oil temperatures. With the Merlyn installed, most of the exhaust gas is bypassed away from the turbo when not needed at lower altitudes, resulting in lower temperatures across the board. A slight increase in speed at the same power setting also results.

After more than 200 hours since the new engine was installed, and except for an alternator drive bushing failure in IMC, at night (which ended well, by the way) it's been a trouble-free ride.

Would I buy another Turbo Dakota? You bet. It's easy to fly, easy to maintain, relatively inexpensive to insure at $1300 annually for two instrument-rated pilots. Plus, the turbocharged engine is nice for reaching the smooth, cool air at higher altitudes where speed and fuel efficiency increase. Between Piper and the aftermarket, finding parts has not been a problem.

There are faster airplanes burning less fuel, and there are singles that will carry more, but not many at a fuel burn of 12 GPH. I think the Dakota and Turbo Dakota represent a good compromise between speed and utility.

Michael Sena
Towanda, Pennsylvania

After owning a 1979 Piper T-tail Turbo Arrow for a few years, I purchased a 1979 Dakota in 1984 with 115 hours total time because I wanted an airplane with better load capability and fixed gear. The useful load with full fuel is close to 790 pounds and, filled to the tabs, is a little over 900 pounds I have flown to Canada over 20 times on fishing trips with friends and grown sons, plus equipment and baggage. Weight, CG and fuel is not an issue. Over the years, I have added a two-axis autopilot, a graphic engine monitor, a Tanis block heater (for Chicago winters), a Strikefinder, Quiet Flite intercom with voice-activated mics and stereo headsets, a standby vacuum system that runs off the manifold and a panel-mounted Bendix King GPS.

In 1995 the airplane was brought up to date with new paint and interior by Central Aviation in Watertown, Wisconsin. This was approximately $10,500. A burled walnut overlay was installed to replace the plastic panel overlay. Speed mods by Knots 2U were also added. There was a noticable difference at slow speeds with better aileron control. Since I retired 10 years ago, I have kept the airplane in Scottsdale, Arizona, for half of the year and the Dakota's extra horsepower helps a lot at high temperatures and elevations.

In 2007 the engine was overhauled by Poplar Grove Airmotive with 2009 hours. I joined a group (the Flying Samaritans) that flies medical missions to a clinic on the Pacific side of the Baja, which means there are a lot of flights over the Sea of Cortez, mountains and remote areas. While there were no issues with the 28-year-old engine, I thought it would be appropriate for an overhaul.

I typically fly at 65 percent power, 50 degrees rich of peak and flight plan for 15 GPH and 135 KTS. In cruise, the fuel flow is approximately 13.5 to 14 GPH.

Insurance is about $1400 per year, with $1 million smooth and $80,000 hull coverage. Annual inspections are between $2400-$3200. When owner assisted, it's around $1300-$1500.

I fly between 80-110 hours per year and change the oil every 35-45 hours. Other than occasionally replacing starters, alternators and batteries, the engine is bullet proof. Parts and service are not a problem around the country.

I have never regretted buying this airplane. It is a delight to fly and comfortable for the pilot and passengers on long trips.

Ted Lipinski
via Email

The Aviation Consumer

LETTERS

(continued from page 3)

the company is still taking customer money. Why do I think something is wrong at AirGuide Publications?

AirGuide doesn't respond to emails sent to airguide@flightguide.com, which is the address listed on their website. I wrote to them about a customer service issue and it took several weeks to get a less-than-satisfactory reply. I sent another email in response and they never replied.

In January I ordered additional Flight Guide volumes via its website, and AirGuide charged my credit card for the purchase, in addition to $18.15 for shipping. The guides never came and the company never returned my calls or emails. The customer service phone number (800-359-3591) went straight to voicemail every time I called and now it doesn't work at all.

I've called my credit card company to dispute the charge, since there seems to be no other recourse.

If AirGuide Publications has collected money for orders that aren't being filled, you might want to warn *Aviation Consumer* readers.

Dave Touretzky
via email

They're warned now, David. You're not the only one trying to reach them. We couldn't get through using AirGuide's last published phone number and email address. We contacted several AirGuide distributors, including Chief Aircraft. None of these companies have current stock of Flight Guide products or know what happened to AirGuide.

Avidyne IFD540

(continued from page 23)

We'll cover the full user interface in an in-depth review once the IFD is certified. However, based on our short flight with the IFD, we think the interface is best served with dual IFD navigators because a single screen can get busy in a hurry. For instance, a second IFD can be used to program procedures, using it as a keypad. The second unit—perhaps the smaller IFD440—helps spread out some of the data that tends to clutter up a single screen. Remember, the IFD is a powerful FMS that originated from large integrated cockpit screens and is repackaged to fit on the IFD's single 5.7-inch screen. We think the data will be even more cramped on the smaller IFD440, a unit that replaces the Garmin GNS430W.

Speaking of screens, we can say that the IFD's full VGA screen with 640-by-480 pixel count is extremely sunlight readable. The cockpit in the 182 we flew was splashed with bright Florida sun and the display never washed out. The unit also ran surprisingly cool. Avidyne built several fans into the unit and it's obviously an effective means of keeping the box reasonably cool.

WORTH THE WAIT?

Despite the rocky start Avidyne had with the deposit thing, we believe that the IFD will be worth the wait for many users that want an alternative to Garmin's GTN-series. Those units are built around a feature set that's almost entirely touchscreen, with a few exceptions.

Moreover, the IFD is a huge money and time saver when it comes to installation. Garmin's GTN750 can require sizable amounts of panel reconfiguration, which means teardown, downtime and expense.

Avidyne's Tom Harper hopes that the IFD540 will begin shipping in June of this year. "We're in the home stretch of the final certification and if all goes as planned, we'll be shipping during the later part of June," he said at Sun 'n Fun 2014.

The IFD540 currently has a list price of $16995. The version with a 16-watt comm radio is an additional $4995. The smaller IFD440 has a list price of $14,995, but Avidyne is currently offering the unit for $9300.

To keep tabs on the status of the IFD program, visit the IFD forum at www.avidynelive.com.

FEEDBACK WANTED

PIPER AEROSTAR

For the August 2014 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Ted Smith/Piper PA-60 Aerostar, the speedy cabin-class twin. We want to know what it's like to own these planes, 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 photos you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Aerostar by June 1, 2014, to:

Aviation Consumer
e-mail at:
ConsumerEditor@hotmail.com