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The Aviation Consumer®

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The Aviation Consumer

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ASTM's Minimal Oversight: Does It Work?

When I travel around and visit various aviation businesses, a common complaint is how difficult—and expensive—it is to move a certification project of any kind through the FAA. The smaller the company is, the more stressful the process is because major companies like Garmin and Cessna cast a darker shadow and have the staff who can spend time doing nothing but jumping through FAA hoops. Small companies can't afford that.

When light sport came along, the idea was to spur innovation by getting the FAA out of the loop and letting manufacturers do their own approvals with loose oversight by ASTM International.

But has it worked? I'm beginning to think it has. First of all, I don't hear any bitching about ASTM's oversight, nor do I hear complaints about the FAA meddling where it agreed not to. There are two reasons for the latter, I think. One is that surprising as it might seem, some people in the FAA actually believe in the LSA idea and want it to succeed on the terms originally agreed to. The other reason is that light sport isn't much of a career path for an ambitious FAAer. The really committed apparatchiks gravitate to the multi-million dollar three-letter programs whose length stretches directly to retirement.

So that leaves the LSA industry to flourish or die on its own merits and I think it is doing just that. In this month's issue, we're looking at the Renegade Falcon, a nice, sleek and fast design. But what I found most interesting is how one little company, of its own accord and without much money, jollied along Lycoming and Precision Airmotive to come up with a fuel injection system for the IO-233. It remains to be seen if this powerplant will give Rotax serious competition, but it's nice to see someone trying.

The development was done over a series of months, free of FAA oversight that would have telescoped the time to years and cost something in the high six figures. Instead, the project just perked along and was flying before any of us realized it was even underway.

Let's hear it for free enterprise and competition, unhindered by the heavy hand of government. Having said this, I have heard two complaints about the ASTM process. One is that the companies involved are putting the system at risk by not taking the required production recordkeeping seriously and that some of the models are bending the rules.

Well, maybe. But I'm not getting my pants snagged on this and I don't think anyone else should, either. For example, like a lot of LSAs, the Falcon has a placard that limits its level flight speed to 120 knots indicated. But with the right prop—one that's readily available from the manufacturer—it will probably easily exceed that. I ride a motorcycle that will do 155 MPH, but I don't ride that fast. That's my decision and it's the same deal with a slightly too-fast LSA. The limit is a nice guideline, but it's arbitrary and up to the pilot to observe. Or not. That's as it should be.

Similarly, Renegade's Doc Bailey favors LSAs being used for IFR and as a manufacturer under ASTM, he has all the authority he needs to make that happen by POH amendment. That's as it should be, too.

The only worry here is that this heady freedom will get out of hand or lead to abuses that result in accidents serious enough to either have the FAA intervene or to result in regulation by the plaintiff's bar. Or both. For the time being, I think there's little risk of either. The market may be anemic and demand for LSAs may never boom quite the way some figured it would, but the underlying idea seems to do what was intended and if that's all it does, I'll take it.—*Paul Bertorelli*

The Data Dilemma

I read your synopsis on our data in the cockpit; how discouraging. (See *Aviation Consumer*, December 2011.) May I ask a question and make a comment? First, I think I vaguely remember reading some time ago that a portion of the aviation fuel tax had been set aside and saved up to fund the NextGen system, and that these funds were diverted to other uses not even within aviation. Am I correct or mistaken on this, or did something similar to this happen?

I don't so much mind paying for what I use, but the current taxing and accounting practices in place don't seem to allow for this. If what I presented above is true, I'm mad as hell.

In comment, I was ready to put in a G500 glass panel in my homebuilt, but after reading this article, I'm seriously considering going back to putting in steam gauges. And please make note, I plan to fly more not less.

If or when the government oversight or involvement in my flying becomes too onerous (it is getting very close), I will continue flying, but without paying attention to their rules. My airplane relies on physics to fly, not the permission or oversight of any government.

Larry E. James
Via e-mail

We're not sure about the original funding intent for NextGen, but we are sure that at some point, the FAA decided it prudent to foist the cost off on users.

421 Fine Points

I enjoyed your article on the Cessna 421. Having flown and managed one for nine years, I have some experience in the 421B. At the time, I was also flying a Beech E-90 for another firm. Initial investment aside, the Beech is 15 to 20 percent more expensive to operate on an hourly basis.

My two employers never met or even spoke on the phone, but they would borrow each other's aircraft if one was down for maintenance. The swap was nm vs sm and each paid for his own fuel. No complicated contracts or bookkeeping, just a simple understanding between gentlemen.

As for the 421, when I took over the operation, one engine had 200 hours and the other had 300 hours. My most frequent destinations were small towns in Colorado all above 6000 feet MSL. We never changed a cylinder starter or turbocharger. It is all in the operation.

The best cruising altitude for a Golden Eagle is 1000 feet above the turbulence. Why waste time climbing unless the additional altitude is going to put you in a very good tailwind? Do not work the engines hard needlessly.

Cool the engines slowly. Plan your descent so that you reduce power one inch every two minutes. If ATC asks for a slam dunk, just say "unable." Most will understand.

If you have a quick turn, point the aircraft into the wind and open the oil filler doors to let the heat out. Even better, open the outside cowl doors. It does not take more than three minutes. Don't forget to close them.

Respect your starters. If the engine does not start after 15 seconds, it is not going to start. Let it cool for three to five minutes before trying again. After several attempts, let it cool for 30 minutes. I can think of few things worse than a scorched starter on a Sunday afternoon.

All in all, if you have five passengers and their baggage and 90 percent of your trips are 400 miles or less, the 421 is an excellent, reliable aircraft. We took those engines 200 and 300 hours past recommended TBO and they were still in very good condition.

Juan L. Brito
El Paso, Texas

Kudos to Us...

Not long ago, I took you to task a bit on the lack of coverage of "backside charges" for using GPS-based cockpit boxes. You even published my letter in the December issue.

So thanks is deserved for the second half of the features/costs matrix in that same issue when discussing

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CORRECTION

In our January 2012 article on Cirrus safety, we said the Diamond DA40 had one incident of post-crash fire. The actual accident, non-fatal, involved a DA20, not a DA40. The DA40 has zero incidence of post-crash fire.

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Renegade Falcon: Lycoming on the LSA Map

Sleek, fast and sexy, the Falcon is the first of several O-233 LSAs and the first to sport fuel injection.

by Paul Bertorelli

AIRCRAFT FLIGHT TRIAL

If there's anything surprising about light sport airplanes, it's that there isn't much surprising about light sport airplanes. Bolt a 100-HP Rotax to a 750-pound airframe and you get something that climbs about 500 FPM, cruises about 110 knots and ranges to 500 miles. Will that be high wing or low wing?

Amidst this calm sea of sameness, does opportunity lurk? Renegade Aircraft, a small startup you've probably never heard of, thinks so. Renegade is marketing an upscale, sporty LSA that represents the sharp wedge of handful of LSAs powered not by Rotax, but by Lycoming's new O-233 engine. The supposed market appeal here is higher performance and a "real" aircraft engine, this despite the fact that Rotax has made itself the largest manufacturer of aircraft engines by becoming the LSA standard.

Can Lycoming muscle in? Renegade's Doc Bailey thinks so, especially for those customers who just don't like Rotax's high-revving whine and who are more interested in performance than low price. There's little question that Lycoming, despite its higher weight, has the performance potential, even in a light airframe. And if Renegade has proven anything, it's that an ambitious manufacturer can capitalize on ASTM's relaxed oversight to fast-track development.

On its own and working with Precision Airmotive, Renegade encouraged developments of a fuel injection system for the O-233, thus, the IO-233. And get this: It's considered a FADEC version and has supported Lycoming to develop the AEIO-233, a fully aerobatic version of the engine to suit the Renegade Falcon's aerobatic airframe. All three of these taken together could give Lycoming a significant competitive advantage, at least in a small slice of the LSA market.

OUT OF THE SHADOWS

Renegade's Falcon may be the sleekest LSA that you've never heard of. The company had two of them parked in the Lycoming booth at AirVenture last summer and we walked right past them without registering what they were. They are, to a degree, early casualties of the LSA wars, built by a Hungarian company called Corvus and sold under the nameplate

Like many LSAs, the Falcon's panel can be customized with about any avionics. This version has a Dynon Skyview.

Corone. It first appeared in the U.S. in 2007 and later that year, a new variant called the Corvus Corone Phantom appeared at Friedrichshaven, powered by a Rotax 912. The following year, a version of the Phantom with a Lycoming O-235 was produced in the U.S. Renegade's Bailey told us there are about 140 airframes flying in Europe.

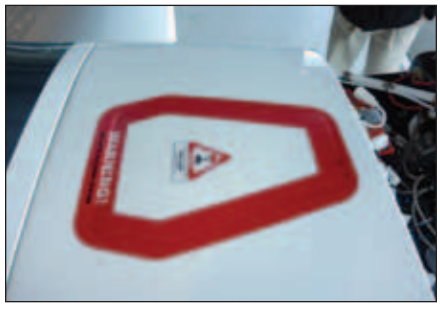
In 2010, Corvus got sideways with the Hungarian government over matching loan guarantees and went bankrupt as a Hungarian entity. The Corvus nameplate still exists in Italy and France as dealer entities.

Bailey's involvement began as a sales agent for T&T Aviation, which was importing the line from Europe, but not making much of a splash. When Corvus was restructured in 2010, he acquired intellectual property and manufacturing rights for the U.S., but no tooling or production equipment. At that point, the Corvus Phantom—powered by either the 100-HP Rotax 912 or the Lycoming O-235—became the Renegade Falcon and the company turned to building it with Lycoming's emerging O-233.

Bailey sees his primary market as what are often called full-circle pilots between the ages of 55 and 65. They may be previous aircraft owners or always-wanted-to-be pilots who see in LSA an opportunity to fly and own an airplane unthreatened by the loss of a medical. Bailey told us he sees this older demographic as the sustaining force for sales, with a timeline extending at least 10 years or more. And after that? Clearly, the company will have to court younger buyers.

Full-circle pilots, according to Bailey, have a definite taste for conventional aircraft engines, if not an aversion for the Rotax, which they tend to view as a converted snowmobile engine—or worse. Evidently, they also like the idea of fuel injection. "I haven't talked to a single buyer who asked for a carbureted version of the Lycoming engine," Bailey told us.

Unfortunately, in competing against Rotax, both Lycoming and Continental have the same problem: weight. Rotax installations typically total about 170 pounds all in, with all the plumbing and associated hardware. In an airplane with a 1320-pound gross weight and useful loads a little less than 500 pounds, if that, every ounce matters. Bailey says the Lycoming is heavier, at about 211 pounds, plus another 22 pounds for the prop, fuel injection and the tuned cross-tube exhaust Renegade is using.



The view out the front and side of the Falcon LS is spectacular, top. An optional BRS system goes between the engine and the cabin, center photo. A center console contains the fuel tank switch (15 gallons per side) but CBs are a long reach from the seats.

But he insists the Falcon airframe, which is built using vacuum-formed Kevlar and carbon fiber, is light enough to accommodate the heavier engine. The Falcon demo model we flew had a claimed empty weight of 826 pounds for a useful load of 484 pounds. With full fuel (30 gallons), it will carry 324 pounds—not quite two people or two small people and a paper sack for baggage.

That's comparable to an O-200-equipped Skycatcher, but heavier than a Flight Designs CTLS and way heavier than a Remos GX. Both of those airplanes also use carbon construction, but the lighter Rotax engines give them a weight advantage.

Renegade's hope is to build a small LSA manufacturing base—both its own Falcon models and other manufacturers—based on Lycoming power. "Our ambition is to build an all U.S.-made LSA and provide about 20 jobs," Bailey says. However, he concedes that Lycoming's penetration into LSA will be necessarily limited. "A lot of LSA airframes can't use the 233. They're just too heavy," he says.

Given the construction, don't expect a downmarket price from Renegade. The base price is $129,000 with a Dynon Skyview, a comm radio and electronic ignition (see sidebar.) But the options lists is essentially

WHO ARE THESE GUYS?

"If you told me five years ago that I'd be in the business of manufacturing airplanes, I'd have thought you were an idiot," says Chris "Doc" Bailey when asked how and why he got into the LSA business with Renegade. And make no mistake, Bailey is Renegade. The company is largely a one-man show, self-financed with sales and through a small FBO and flight training operation at Lee's Summit, Missouri, not far from Kansas City. He has a small manufacturing and support staff.

Bailey says he got into LSA for the same reason many people do: fear of losing flying privileges for lack of a medical. Like it or not, Bailey says this continues to drive the market, at least for his buyers. Because Rotax so dominates the LSA sector, Bailey sees a dual opportunity to produce both a U.S.-made LSA and to serve as a focal point for a Lycoming-centered LSA industry.

Given the low labor rates in Eastern Europe, the U.S-made aspect of the plan may be the most challenging. But Bailey insists he's got it wired. He has contracted with a company called VX Aerospace in Morganton, North Carolina to build the composite airframe components. The parts will then be shipped to Lee's Summit and assembled in an off-airport finishing shop, to include paint and avionics. Bailey said Renegade expects to be receiving composite components by about March of 2012. He told us he has gotten exceptional support from the Lee's Summit Airport and community and from a staff willing to work to maintain a low overhead. "They want to see this go," Bailey told us.

Bailey's flight career extends to 1977. After he graduated from Central Missouri State University's aviation program, Bailey spent more than a decade as an Army aviator and flight instructor and has experience in Part 135 work and aerial application.

He recognizes that sustaining an LSA company will be challenging but believes it can be successful at a production rate of around 50 airplanes a year, with a peak of 100. In addition to the U.S.-built Falcon, Renegade plans to market the Polish-built FK12 Comet light sport aerobatic biplane. Recall that before Cirrus bailed on the LSA idea, FK signed up to produce its Polaris model under the Cirrus nameplate.

unlimited, or at least limited only by weight, so invoices in the $150,000 to $170,000 range might be more the norm. However, with Cessna's recent announcement that the Skycatcher will sell for about $150,000, the Falcon may suddenly be more in the mainstream with regard to price.

Since acquiring the design from Corvus, Renegade has undertaken some modifications and intends more. We were shown a polished aluminum gear leg, for example, which replaces a failure-prone composite part Corvus originally used. We also saw a sexy taildragger version, which Bailey expects to be a bit faster than the tri-gear model and one that will retain the capability of being converted between the two gear styles. The wings have an overlapping spar arrangement with quick disconnect pins that aren't intended for routine de-winging, but are meant to be handy for occasional trailering or seasonal garage storage.

Control circuitry is push-pull tubes for the elevator and ailerons and cables for the rudder. The Falcon has a conventional trim tab—electric only—that occupies about a third of the elevator's trailing edge, centered on its span. We decowled the engine to have a look at its installation and found it clean and easily accessible. The IO-233's accessory case has been redesigned to accommodate only one accessory pad, for either a conventional magneto or the Champion PMA-based electronic ignition Lycoming offers.

The version we flew had a conventional magneto and a Light Speed solid state CDI ignition, but as an option, it can have two Light Speed systems. A nice maintenance touch is that the oil filter is easily accessible and mounted vertically, so it can be changed without making an oily mess.

Most noticeable in the engine room are two large carbon-fiber plenums to route cooling air in lieu of the traditional sheet metal baffling and seals, which never seem to fit quite right. The cowl itself has two large downstream ports at the back to improve cooling air flow, giving the impression of gills on a fish.

FLYING IT

But first, you have to get in and this can prove a challenge. In profile view, the Falcon is radically sleek with a long nose that's every bit as rakish as the CTLS is pug-nosed. This results in a seat pitch angle more akin to an F1 racer than an airplane, so getting in requires stepping on the seats and shoving your legs down a long tunnel to the rudder pedals. The seats adjust and sliding them forward also moves them higher.

The canopy is huge and pivots, Diamond DA40-style, at the front of the cabin. But unlike the Diamond, the Falcon lacks hand grips so you have find what purchase you can to lower yourself into the seats. (Renegade plans to add glareshield grips.) Once you're in, the seating position is comfortable and the view outside is stunning. We flew on a cold winter day, so insolation through the canopy was welcome. It would be less so on a summer day, but you can taxi

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LYCOMING'S IO-233 ARRIVES

Rotax was ideally positioned to become the engine of choice for light sport aircraft. It has decades of experience in ultralight engines, and the 912 was a natural step up to airframes suited for 100 HP. Further, Rotax is well established in Europe, where ultralights and what we now know as light sport aircraft have been flourishing.

Against that backdrop, Continental and Lycoming have a problem. Both have small four-cylinder powerplants—Continental the O-200, Lycoming the O-235—but both designs are dated and, more significantly, heavier than the Rotax by a considerable margin. Accurate installed weight estimates vary, but Rotax weights are typically in the 150- to 165-pound range, while Continental's O-200-D, which is its LSA lightened version, weighs about 200 pounds dry. Similarly, the Lycoming O-235 weighs about 215 pounds.

Realizing it had an opportunity to make at least some inroads into the LSA market, it set about lightening the O-235 to produce a new variant called the O-233. However, as with Continental's O-200, the O-235's lightening has proven only so effective, with dry weight of about 200 pounds. It's still not a viable choice for an LSA with a heavier airframe.

Lycoming reduced weight by nibbling at the edges. The cylinder fins have been shaved, the accessory case redesigned and lightweight starters and alternators are used. When it first appeared as a prototype in 2008, the O-233 had a simple throttle-body injector, but it can also be equipped with an M4 carburetor.

As Lycoming envisioned the engine, conventional magnetos were to be displaced by a dual electronic ignition system housed in a single unit on the engine's only accessory pad. Developed by Champion for Lycoming, the electronic ignition operates via both ship's battery power and its own internal permanent magnet alternator. Although it requires ship's power to start the engine, once it's running, the PMA generates power to fire a pair of coil packs providing sufficient spark for the traditional two plugs per cylinder.

For its part, Renegade has used this as a jumping-off point for additional options. Buyers can have the Champion system, a conventional magneto along with a Light Speed Engineering ignition system or two Light Speed systems. The Light Speed Plasma system is well proven and popular among homebuilders. It's a capacitive discharge design that uses a direct crank sensor to index engine timing.

A magnet is installed in the flywheel and a Hall effect sensor detects crank rotational position. On four-cylinder Lycomings, the crank sensing can also be done at the accessory case pad, or both can be used to provide redundancy, which is what Renegade plans for customers who order dual Light Speed systems. Otherwise, a magneto lives on the O-233's accessory pad.

The Plasma system produces a highly energetic spark that improves starting performance. It's also capable of ignition advances of as much as 38 degrees BTDC, which helps with fuel economy. Because it has no rotational parts of its own, the Plasma system relies on external power, so if two are installed, Renegade provides a backup battery in addition to the ship's starting battery.

Renegade has also expanded the Lycoming envelope with regard to fueling. Lycoming's throttle-body injection idea is rudimentary and perhaps simpler than a carburetor, but Renegade's fuel injection initiative ups the game. Says Renegade's Doc Bailey, Lycoming didn't have fuel injection on its immediate horizon, so he pursued the idea with Precision Airmotive, which manufactures the traditional Bendix RSA fuel injection system used by Lycoming for years.

The unsurprising result is that the fuel injection system for the O-233 is a standard Bendix RSA shrunk down to the size of a M4 carburetor. It bolts to the same pad and fuel is delivered through individual nozzles from a flow divider on top of the engine. Fuel is sprayed through a nozzle behind the intake valve. The Bendix system is a continuous flow design, not a timed direct-injection system found in most cars. (You can have that if you want, however. Precision Airmotive has developed a closed-loop FADEC for ASTM and experimental engines.)

Precision's Alan Jesmer is adamant about one thing: The fuel injection system doesn't increase power much, if at all. Its benefits are primarily better fuel distribution for starting, smoother operation and leaning, so when combined with high ignition advance settings, it's potentially more efficient.

The IO-233 in the Renegade uses carbon fiber plenums to improve cylinder cooling. Injection is handled by a scaled down Bendix RSA servo.

Compass Replacement: Two Viable Options

Precision's proven PAI-700 offers an easy-to-steer presentation. The drawback is the finicky installation where a mistake can render it useless.

by Larry Anglisano

INSTRUMENT UPGRADES

Mag compasses live hard lives. They bake in the sun-splashed heat of the windscreen. They sustain endless amounts of airframe vibration, which not only makes them a challenge to read with accuracy but also contributes to ultimate failure.

You probably don't think much about the compass in your aircraft until it spews its fluid all over the instrument panel and you realize FAR 91.205 requires you to fix it. Replacement options are slim and while a vertical card model is considered a step above the traditional whiskey design, installation technique is critical, and surprisingly expensive.

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SIRS Navigation
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www.sirs.co.uk

NOT A SIMPLE UPGRADE

The whiskey compass got its name because it's filled with alcohol. When the seals and gaskets in the compass housing become brittle and it leaks. Rebuilding them is possible, but that is becoming a thing of the past. Many shops simply replace the entire instrument.

Compasses can be mounted in a variety of configurations that can alter price and installation effort. Some hang from a mount on the windshield center post, some sit on top of the glareshield, and others mount in the instrument panel.

If you set out to replace one yourself, be sure to order the exact replacement because chances are, ordering a drop-in replacement from a catalogue based on looks will result in a model that doesn't fit the existing mount. They also come in specific lighting voltages and in northern- and southern-hemisphere configurations.

THE ONE AND ONLY

Precision Aviation enjoys sole proprietorship of the TSO'd vertical card compass with the $280 PAI-700. Company principal John Coskey proudly told us there are over 77,000 PAI-700 units in the field stemming from over 30 years of manufacturing. The PAI-700 is offered in serious iron the likes of Canadair Challengers, Lear 45s and a variety of helicopters.

Much of this success is from design appeal. The PAI-700 mimics the presentation of a heading indicator, which takes the guesswork out of compass turns. Precision doesn't solve all the problems inherent with old-school mag compasses because the magnet drive is subject to lead and lag effect, but Precision maintains that the beauty of vertical card design is the absence of pendulosity.

Further, the design is inherently stable due to eddy-current damping (no kerosene required). Precision's design is unique with a high-powered, north-sniffing magnet mounted to a bearing and shaft assembly. Unlike a floating wet compass de-

The PAI-700 (opposite) is hugely popular. But the SIRS Navigator (right) is a less-finicky alternative without the vertical presentation.

sign, the magnet's horizontal axis of movement is converted to the vertical using a set of transmission-like gears. The face of the compass is then mounted vertically on a shaft and bearing assembly. While turbulence will still have an effect on a vertical card model, you can expect it to recover itself significantly faster than the floating card type—if it's mounted properly.

As high-quality as the PAI-700 is, the snag is getting it mounted in a way to keep it moving freely with as little interference as possible. The install kit includes a foam isolator that's used to smooth out vibration. From there, it's up to the technician to install the mount in the position that keeps the compass level in flight. It's more difficult using the deck or glareshield mount and if they don't get it right, it's easy for the compass card to hang up or stick. It can also make calibration the proverbial bear.

Our experience has proven that a hanging mount yields better results than a deck mount. Also, that foam isolator is known to dry out over time and good preventive maintenance is having your shop replace it.

The unit comes with a choice of 28-, 14- or 5-volt lighting and is available in clear, blue or red. There's also a variety of mounting brackets to accommodate the unit in nearly all aircraft.

SIRS NAVIGATOR COMPASS

In our view, a worthy alternative to a vertical card design is the SIRS Navigator. The Navigator is made in the UK but has TSO certification and sells for $272 through Aircraft Spruce. The navigator modernizes the traditional whiskey compass, building in some modern designs including blue LED backlighting and fluorescent yellow legend.

The silicone damping design seems to eliminate the classic bobbling motion of the floating compass card that's inherent with other wet compasses. Our experience flying with and calibrating this compass has been favorable. If you buy one, don't lose the special adjustment tool that fits the adjustment points; it's unique to the unit.

Falcon Gauge markets the MCVC-2L-A, which is a vertical card compass. This is a non-TSO'd unit aimed at the experimental market. We have no experience with the quality or performance, other than it appears to mimic Precision's compass. If you have any experience with this unit, we'd like to hear about it.

CONCLUSION

We're fond of the easy-to-steer presentation of the vertical card design of the PAI-700. However, the finicky installation often yields disappointing performance, which is no fault of the unit. Take it to the pros for installation and brace for a hefty invoice.

If you are convinced that your only means of navigating a main system failure will be with a mag compass, the PAI-700 vertical card unit is probably for you. Otherwise, we would go with the modern SIRS Navigator or a proven Airpath traditional compass. Let's face reality: You're probably only using the real compass to set your DG on the ground or double check the groundtrack you get from your GPS.

IT TAKES TWEAKING TO GET IT RIGHT

Having accomplished our fair share of compass calibrations (they should be part of every major avionics installation), we know how the process can snowball the final invoice. In some cases, we're talking a full day of work.

A compass swing is a two-technician process (unless a fixed compass rose is used), which takes a steady hand and sharp eye on the calibrated sight compass, plus a smooth driver behind the controls. Another snag can be finding an interference-free area on the airfield to obtain accurate readings. Underground cabling for airfield lighting, buildings and other taxiing aircraft in the vicinity can affect the compass reading. The key is to simulate cruise conditions, with all systems turned on just as they would be in flight and engine power as high as practical. Some aircraft pose additional challenges by design. Magnetizing of the steel cage Mooneys is one dreaded example where it's nearly impossible to zero in an accurate calibration.

No matter the application, calibration is a major part of the installation labor cost. PFD-equipped aircraft can actually make things easier. Their highly accurate, self-aligning magnetometers can be used as a master heading reference for aligning the compass, making the hair-pulling compass swing ritual a bit easier.

Datalink WX for iPad: ADS-B is a Better Deal

Baron's Mobile Link system for XM weather offers more feature-wise, but ADS-B gives you all the critical stuff for less cash and complexity.

by Jeff Van West

The iPad cockpit revolution has been slow to incorporate datalink weather. Many iPad fliers take their downloaded weather from the FBO and work with that, what 3G they can get in the air and calls to Flight Service.

Datalink weather for the iPad via ADS-B has actually been around for a while ("Portable ADS-B WX," May 2011 *Aviation Consumer*), but limited coverage and limited pilot acceptance has mean limited equipage. Now that Baron Services, who supplies the XM weather service to XM/Sirius, has entered the iPad age with their Mobile Link will datalink sweep the iPad universe?

We don't think so. The Mobile Link system works well, and is a smart choice for a select group of users. But we think ADS-B solutions are a better choice for the majority. Which group you're in depends on your exact situation, and possibly, which iPad app you prefer.

FROM SATELLITE TO IPAD

Datalink weather for the iPad is a two-part solution. There's new hardware to download the weather data and get it to the iPad and then the app you're using to view that weather data. For XM weather downlinked from the XM satellite system, there's only one hardware option: Baron's Mobile Link coupled to an XM portable receiver.

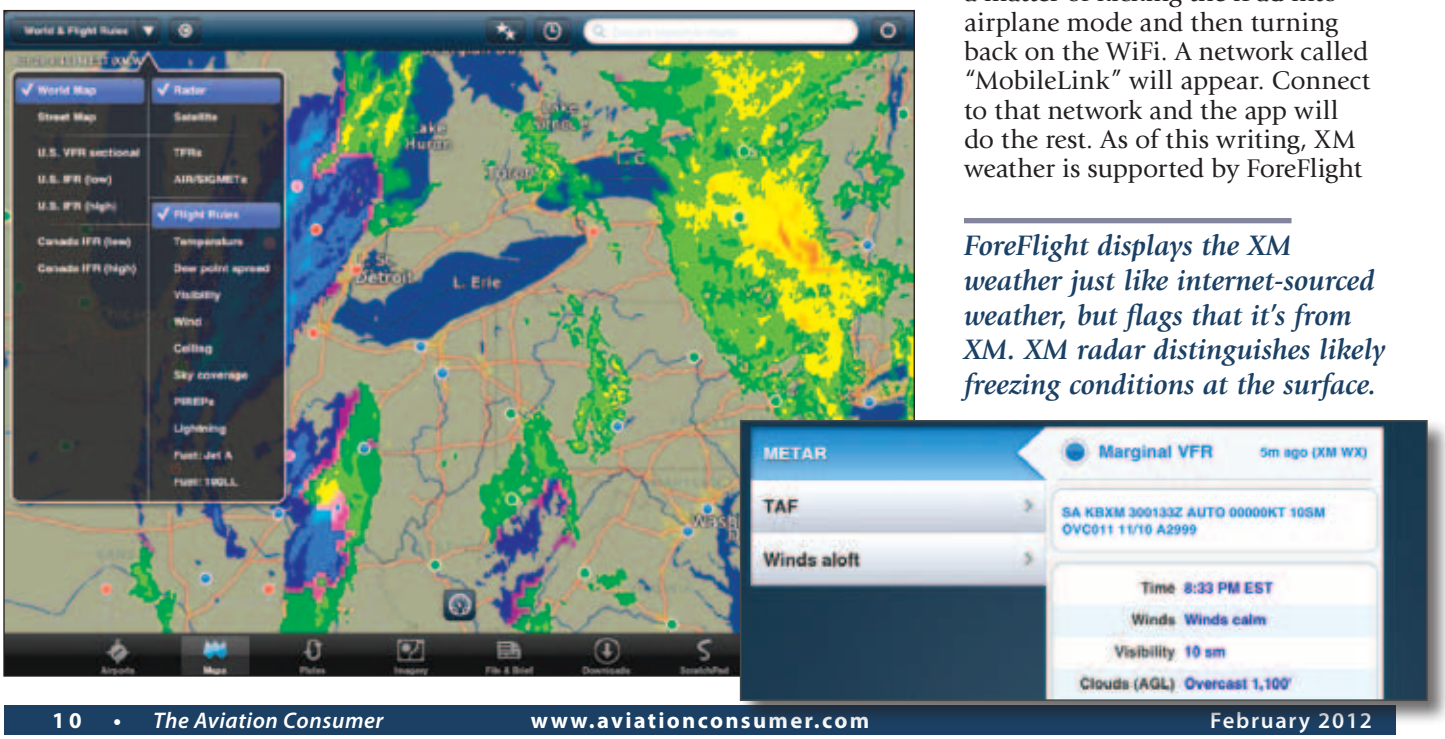
Baron has long had a portable XM weather solution that has been used to push weather to various laptop computer systems and portable GPS units such as the Bendix-King AV8OR series. The Mobil Link is actually a second black box that takes the signal from that XM receiver and broadcasts it on WiFi to connect to the iPad. This means the complete hardware solution is two boxes (connected by a cable), two remote antennas (one for GPS position and one for reception of the XM satellite signal and a power cable (one cable can power both units).

This strains the definition of the term "portable" and probably isn't practical if you're jumping between different aircraft. However, because the iPad connects via WiFi, the whole system can be buried in the baggage area or under a seat so long as the antennas can get to a window and power can reach the cigarette plug. The supplied cables were amply long to do this in our test aircraft.

Once the system is running, it's a matter of kicking the iPad into airplane mode and then turning back on the WiFi. A network called "MobileLink" will appear. Connect to that network and the app will do the rest. As of this writing, XM weather is supported by ForeFlight

CHECKLIST

- ⊕ Both systems work reliably, and are well integrated into iPad apps.
- ⊕ WiFi to the iPad hides the wiring chaos.
- ~ XM costs more, but offers more weather products, and works where ADS-B coverage is poor.



ForeFlight displays the XM weather just like internet-sourced weather, but flags that it's from XM. XM radar distinguishes likely freezing conditions at the surface.

and Global Nav Source. WingX and Flight Guide's iEFB should have XM support in the first quarter of this year.

The app is an important part of the equation. For example, ForeFlight, which we used for most of our testing, currently supports XM METARs, TAFs, PIREPs, TFRs, winds aloft, AIRMET/SIGMETs, NEXRAD and satellite images. This includes Canada if your XM subscription includes it. Other data in the XM stream, like datalink lightning and Current Icing Potential, are available, but ForeFlight doesn't yet support them. There's also no XM radio streaming. Oddly, the XM receiver has WAAS GPS position but doesn't pass this to the iPad. You're stuck with the iPad's internal GPS or a separate GPS receiver for your moving map.

ForeFlight does an excellent job of seamlessly weaving the XM information into its existing user interface. It's long offered radar overlaid on a map, but now it will use XM NEXRAD whenever it's available. The same is true for METAR/TAFs. If XM is available, you'll get XM data. If not, you'll see the most recent internet data. Either way, the source and timestamp is available so you know where it came from and when. A nice recent addition to ForeFlight has been PIREPs on the moving map. These work with both internet and XM PIREPs.

One thing we found disconcerting is that if you're in flight and try to display XM NEXRAD when the data isn't available, ForeFlight blanks out the entire map. While you won't mistakenly think there's no rain when there's actually no data, we think that notification is a bit extreme.

ForeFlight provides a good interface to check XM reception status and data latency. This can be handy on certain headings where the antenna can get blanked by a wing or seat. The XM satellites are both in the southern sky for U.S. users. It can be a bit persnickety if you change apps in flight, but we were always able to get it to reconnect with some futzing.

The complete system of a XM receiver for portables and the Mobil Link to drive that data to the iPad is $1124. If you already have an XM receiver for portables, you can buy the Mobile Link Wi-Fi box for $200 to add on. You'll also have the XM subscription, which starts at about $40/month.

XM Mobile link requires two black boxes with four snaking wires between them (top). However, most of it can be stashed in the back as the connection to the iPad is via WiFi (middle). SkyRadar's ADS-B solution is less gear (bottom), although you may need a wired, remote antenna for good reception.

FAA WEATHER

Part of the ADS-B system that lies at the heart of NextGen is broadcast weather and other flight information (such as NOTAMs). As of this writing, we think the best supported ADS-B weather on the iPad is in WingX, which uses the SkyRadar ADS-B receiver from Radenna LLC. We've spoken to other vendors, such as ForeFlight, who plan to offer ADS-B support this year.

SkyRadar is a one-box solution with two fixed antennas for WiFi and ADS-B reception of flight information, as well as a wired GPS receiver and power supply. The box can be stashed in the back like the XM units, however, the small ADS-B receiver might not be able to pick up a signal from the broadcasting ground stations if it's too buried. We found in our testing that the SkyRadar box didn't need to be in a window to receive, but it couldn't be more than a couple feet from one. There's an optional remote antenna for ADS-B you can hang in a better (inside the aircraft) location.

Reception is a weak point for ADS-B versus XM. XM is usually fully downloaded from the satellites by the time you're done with a runup. ADS-B is broadcast from the ground and isn't available for much of the U.S. until 1800 feet AGL or so. In the

ADS-B NEXRAD doesn't distinguish freezing, but a look at the associated METAR gives you a clue. WingX flags the ADS-B METARs, PIREPs, etc. If NEXRAD is set for on, it shows a lightened chart anywhere radar data is missing, as in a few areas shown here.

mountain west, it can be more like 10,000 feet AGL.

Like XM on ForeFlight, the ADS-B information on WingX is woven right into the airport and map just like weather downloaded from the internet, but they implement a bit differently. METARs, TAFs, NOTAMs and PIREPSs, as well as forecast winds and temperatures aloft, appear in the airport information for specific airports. It'll take you a couple taps to drill down to it. However, you can get color-coded METAR circles on any moving map.

AIRMETs, SIGMETs, TFRs and NEXRAD get overlaid on moving maps. If NEXRAD isn't available, the chart will appear washed out so you can still use the chart while waiting for the image to download. Because ADS-B is a service of the FAA, it's only available in the U.S. However, it is available in parts of Alaska where XM is not.

Also because it's an FAA service, there are no perks like the Current Icing Potential. Given the FAA's budget woes, it's unlikely these will be added any time before GA includes flying saucers. AIM 7-1-11 (d) lists all the information available, as well as the coverage radii. Unlike XM, which broadcasts all weather for the U.S. and Canada to all aircraft, ADS-B broadcasts in for a range around each ground stations, so NOTAMs and TFRs may only show within 100 miles of your aircraft, only to later pop up as you get in range of another ground station. NEXRAD is broadcast at low-res for the CONUS and high-res for the local 250 miles.

One nice plus of the SkyRadar system is that it allows up to four WiFi connections and will stream ADS-B to all of them. It also passes on GPS position to the iPad.

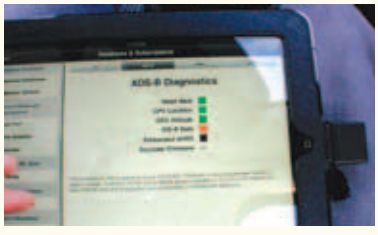
SkyRadar's ADS-B receiver is $950. A remote antenna is an extra $50. This is cheaper than XM to start and the weather is subscription free. SkyRadar also has some traffic information solutions in the works. FreeFlight systems has an installed system in development that will both meet the ADS-B equipage mandate (for $5000-$7000) but will offer a $75 add-on to transmit both weather and traffic to a portable like the iPad.

BUYING IN

If you're only in one aircraft and your flying profile needs things only XM can deliver—Canadian weather, data in the mountains, detailed icing information—then we wouldn't hesitate to give a thumbs up to the Mobile Link system.

But for the wide part of the curve looking for the most economical way to get datalink weather onto an iPad, we think ADS-B is the way to go. The limitations seem a fair trade for subscription-free payoff. Not to mention the more of us who use it, the less likely some bureaucrat is to pull the plug to try and save a few bucks.

AC TV



To see the ADS-B/WingX and XM/ForeFlight systems in action on the iPad, log on to www.avweb.com and select the video index. Or, to go directly to http://tinyurl.com/7djol22.

CONTACTS

Baron Services (XM Mobile Link)
256-881-8811
www.baronservices.com

Radenna, LLC (SkyRadar ADS-B)
888-759-2372
www.skyradar.net

AIRCRAFT UPGRADES

Turbine Step Ups: What's Involved?

Lots of money, of course, but kerosene burners also introduce decision making challenges you might not have considered.

by Paul Bertorelli

For the moment, let's set aside the vulgar discussion of money and consider whether turbine aircraft are all they're claimed to be. Well, of course they are. Case closed. Turbines are faster than piston-engine aircraft, fly higher and since all the engines' moving parts are always rotating in the same direction, they're generally more reliable.

Moreover, the owner of a turbine aircraft is untroubled by that pesky problem of whether a high-octane fuel will be available and what it will cost. There's no argument that Jet A is the world fuel of the future and it's available in parts of the world where high-octane avgas has long since disappeared.

For owners looking to ditch their piston aircraft in favor of a kerosene burner, there are more choices than ever. Older twin turbines like the King Air can be had for a song and there are turbine conversions of piston airframes (Mirage Bonanza, Cessna P210) and high-performing new single-engine turbines such as the Piper Meridian, the Pilatus PC-12 and Aerospatiale TBM series. The would-be buyer hardly lacks for choice.

Having dispensed with the I-must-have-it phase of the discussion, the reality of turbine ownership pivots not so much on which one or whether it should be a single or a twin, but how much will it cost or, more broadly, what you might expect to spend a year on turbine ownership. It's obviously going to be more, but how much more?

CHECKLIST

- ⊕ It's a buyer's market for some twin turbines such as the MU-2, early King Airs and Twin Commanders.
- ⊕ The most accessible turbine step up is O&N's Silver Eagle conversion.
- ⊕ Operating costs for singles such as the TBM and Meridian are lower than a twin, but many twins are cheaper to buy.
- ⊖ Beware of low-cost, older turbine twins. They can be money pits.

Want to fly fast for a low entry price? MU-2s, right, that sold for more than $1 million new, can be had for less than half that on the used market. Socata's early TBM 200s, top, still command more than $1 million.

TURBINE OPTIONS/SINGLE ENGINE

MODEL	TYPICAL PRICE RANGE[1]	ENGINE	TBO/HOT	MAX WEIGHT	USEFUL LOAD	CRUISE SPEEDS	ESTIMATED HOURLY COST[2]
SILVER EAGLE P210	$600,000 TO $1M	ROLLS 250-B17/F/2	3500/1700	4000 LBS	1530 LBS	190-210 KTS	$225 TO $270
TRADEWINDS BONANZA[3]	$400,000 TO $650,000	ROLLS 250-B17/F/2	3500/1700	3850 LBS	1200 LBS	200-220 KTS	$225 TO $270
JETPROP DLX	$700,000 TO $1.1M	P&W PT6A-34	3600/VARIES	4300 LBS	1358 LBS	260 KTS	$280 TO $325
PIPER MERIDIAN	$750,000 TO $2M	P&W PT6A-42	3600/VARIES	4850 LBS	1489 LBS	260 KTS	$400 TO $450
SOCATA TBM 700	$1.1M TO $1.9M	P&W PT6A-64	3500/VARIES	6250 LBS	2554 LBS	280 KTS	$500 TO $585
PILATUS PC-12	$1.3M TO $4.3M	P&W PT6A-67B	3600/1750	9920 LBS	4188 LBS	270 KTS	$590 TO $650

[1] Prices given are early to late-model used aircraft estimated from *Aircraft Bluebook Digest* and seller asking prices.
[2] Hourly costs are estimated from owner reports, www.planequest.com and other sources.
[3] Tradewinds Turbines still exists as an entity.

WHAT'S THIS GONNA COST?

If you budget, say, $35,000 a year for a high-performance single or twin, a turbine could easily be twice that and it goes up from there. Even though purchase prices on some turbines are reasonable if not rock bottom, they burn more fuel—sometimes a lot more—and although the maintenance invoices may come less frequently, they tend to be much larger when they do come. For instance, the overhaul cost on Continental TSIO-550 is around $38,000. A Pratt PT6A will be four times that, if everything goes well. To be fair, the Pratt—depending on the variant—has a 3600-hour TBO, but the wise owner won't budget as though that number is written in stone.

New turbine owners don't blink at insurance bills totaling $25,000 a year and some have to take recurrency training twice a year to get that. An annual on a piston airplane invoicing at $15,000 would cause the owner to think twice about keeping the old dog, but that's chickenfeed in turbine land.

There are exceptions, however, and some turbine owners tell us it's possible to get into the world of Jet A without mortgaging everything you own. Just don't expect to enter into turbine ownership on the cheap with a factory-new Meridian or PC12.

The graphics above and on page 17 give a broad sense of what turbine airplanes are available, what they cost and how they perform. All of the owners we interviewed told us it makes the most sense to match the mission to the budget and then pick the airplane that meets both.

"For me, the MU-2 was a complete no-brainer compared to the King Air," said owner Dennis Wolf, who went from a Cessna 421 to the MU-2. "The King Air is 40 to 50 knots slower and burns 30 to 40 percent more gas," he added. That's another way of saying don't buy a turbine just because it's cheap. Spending more to match the mission with regard to speed, range and payload may make more sense.

And so will spending more on a particular airplane rather than pick-

Nathan Thompson, left, with his Commander 690B: "I should have spent $100,000 more and purchased a better maintained airplane. More money up front translates to less money over time."

ing up a hangar queen on the cheap. Twin Commander owner Nathan Thompson told us he carefully analyzed all the aircraft options—MU-2, King Air, Conquest—before stepping from his Cessna P337.

"And that's when I started making mistakes. I put a little too much emphasis on purchase price. I should have spent $100,000 more and purchased a better maintained airplane. More money up front translates to less money over time," he says.

WHAT YOU GET

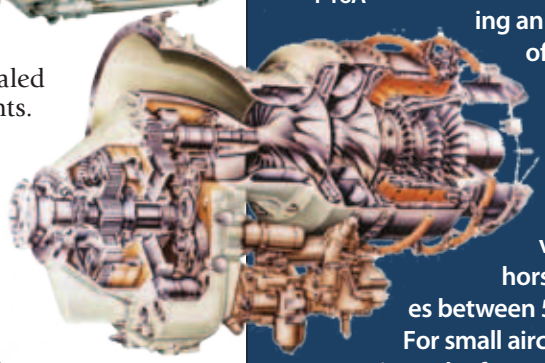
Our interviews with owners and operators of turbine aircraft revealed a number of constants. Obviously, they are definitely more expensive. Second, turbine aircraft have a reputation for dispatch reliability and this doesn't seem overstated. Third, a turbine-powered aircraft will in some cases, but not all, completely change the mission possibilities with regard to weather and distance. Owners say they can make trips in a turbine that wouldn't have been possible in a piston airplane.

Fourth, while turbines are easier to fly, they are more demanding to flight plan for reasons of fuel burn and weather encounters. Fifth, by dint of insurance requirements, the training load may be much higher and for some owners, that's as much a question of time as it is money.

Our impression of the easiest step-up turbine route is either of the two conversions powered by the Allison/Rolls 250. One is the Tradewinds Bonanza conversion, the other O & N's Cessna P and T210 conversion. Tradewinds is no longer converting, but O&N is and you can budget just short of $1 million for the job, or buy one used for anywhere from about $500,000 to $800,000, depending on engine state.

Owners tell us performance is just a bit better than a turbocharged piston would be, but runway perfor-

PT6A



TPE331

THREE ENGINE CHOICES

We're mainly focusing on turboprops here and that means three engine choices: Pratt & Whitney's ubiquitous PT6A, the Honeywell TPE331 and the Rolls (formerly Allison) 250-B17/F/2 used in two conversions, the Tradewinds Bonanza and O & N's Silver Eagle conversion of the Cessna P210. (See September 2010 *Aviation Consumer* for a review.)

The PT6A first appeared in 1963 and gets credit for igniting an entire market of turboprop aircraft and conversions. The engine is available in a number of variants with horsepower ranges between 580 and 1700. For small aircraft applications, the free-turbine version is used, meaning a gas generator flows high velocity combustion gas over a turbine to produce power into a gearbox or power section; there's no direct link between the gas generator and the gearbox/prop. However, the PT6B is a turboshaft engine available in higher power.

The PT6A is considered reliable and easy to maintain. Stated TBO is between 3000 and 3600 hours, with a typical overhaul cost of $150,000. The engine is modular, with a gas generator section and power section that can be split and serviced separately. Hot section inspections are required at about half TBO. The PT6A is found in the Piper Meridian, the TBM series , the JetProp conversion of the Piper Mirage and in King Airs.

A different animal entirely is the TPE331, which is called either the Garrett or the Honeywell engine by turbine cognoscenti. This engine is a turboshaft design and was developed by Garrett AirResearch before being taken over by Honeywell in 1999. Like the PT6A, it's available in a number of variants ranging from about 600 to 1650 SHP. The TPE331 is a contemporary of the PT6A, having appeared at the same time, but it has only a fraction of the market share enjoyed by the PT6A. The 331 has a 5400-hour TBO interval with a typical overhaul cost between $120,000 and $140,000. It typically requires a hot section inspection at 1800 hours, a hot section and gearbox inspection at 3600 hours, then the full overhaul at 5400 hours. But these intervals may vary by model and maintenance program. The 331 is found in the MU-2, the Twin Commander and the Cessna Conquest.

The Rolls 250-B17/F/2 is found mainly in GA singles, although we know of one emerging twin-engine conversion. Like the 331, the 250 is a turboshaft design and like the PT6A, it also uses reverse airflow. The 250 was developed by Allison about the same time that Pratt and Garrett introduced the PT6A and 331. Allison intended the engine as a helicopter power plant and there are a couple of dozen variants in powers ranging from 380 to 650 HP.

In 1995, Rolls Royce acquired the line from Allison and still builds it. At 200 pounds installed, it's a definite contender as a direct piston-engine replacement. The 250 has a 3500-hour TBO with an overhaul cost of about $120,000. Hot section inspections are required at mid-time and cost between $25,000 and $30,000.

250/B7/F/2

Bob Mittelstaedt's Silver Eagle-converted P210, above and left: "I'm averaging only about 23 gallons an hour. The Meridian idles at that."

mance is vastly improved, especially for the Silver Eagle mod, which has reverse thrust for stopping on short or contaminated runways.

"Basically, you've got 450 HP compared to 300 HP so there isn't any field you can't get in or out of," says Tradewinds Bonanza owner Dave Cooper. "Then you can climb out at 3000 feet per minute at 70 knots; that's the max climb. The big thing is stopping. You can stop in a couple of hundred feet. It's kind of made me a worse pilot, it's so easy to fly," he adds.

For the Tradewinds conversion, because of the higher fuel consumption, Cooper says range is a problem. It's less so for the Silver Eagle 210, which carries more fuel.

"The big thing that kept me away from the Meridian is that the fuel burn is dramatically more. I'm averaging only about 23 gallons an hour. The Meridian idles at that," says Bob Mittelstaedt, who converted a P210 to the O&N Silver Eagle four years ago. Overall, he says, his fuel costs are close to the same for about a 20 percent increase in cruise speed with similar maintenance costs to the piston P210, but a much greater confidence level in the engine. "The reliability has been just fabulous," he told us. The biggest cost hit is the capital tied up in the airplane—roughly $1 million. At even 3 percent a year, that's $30,000—three times the cost of his insurance. On the other hand, some turbine twins such as early Twin Commanders, MU-2s and King Airs can be had for under $300,000. But unless you need the second engine, the operating costs may offset the capital savings. But some owners do want the second engine.

Raul Segredo's Citation cabin, below: "There's satisfaction in having my family in the safety and comfort of a turbine."

TWINS

Commander owner Glenn Kautt told us he has been flying since 1964 with the typical layoffs that most of us have experienced. "When I came back, my wife said I could fly anything I wanted as long as it has two motors. That was the call to action," Kautt says.

That led him to a Cessna 310, a 414 and eventually a TPE331-powered Twin Commander. Like all of the owners we spoke to, Kautt, who is a financial planner, ran the numbers for several aircraft and arrived at the Commander as representing the best combination of purchase price, performance and operating costs even against less expensive airplanes to operate such as the JetProp conversion or the Meridian.

Kautt told us a tale we heard several times. The financial meltdown in 2008 tanked aircraft values, especially twins, and many would-be turbine buyers were sufficiently hedged to be able to make exceptionally high-value purchases on both turboprops and jets. As a result, we suspect there's a small turbine ownership bump between 2008 and 2010, when prices started to recover slightly.

The single-versus-twin equation for turbines runs in parallel to the same discussion framed for piston airplanes. However, there are some subtle differences. For one, insurers may not require much recurrent training for a modest piston twin, but they may for a turbine. Second, in most circumstances, twin turbines deliver on second-engine redundancy in ways that piston twins don't.

In a Cessna 310 loaded to the gunwales, you'll need to be on your game to eke out a 300 FPM climb. But in a turbine, with the bad engine properly caged, 1000 FPM is more the norm. But it's a mistake to assume a turbine twin is therefore more bulletproof.

"There is a regime in the MU-2 if you lose an engine from the time you rotated until you have 125 knots, you're landing straight ahead. End of discussion," says Dennis Wolf, who upgraded from a Cessna 421 to an MU-2 and who instructs in that airplane.

He says that anyone looking to move into a twin turbine needs to shuffle the performance numbers across a range of considerations to include how the airplane will per-

TURBINE OPTIONS/TWIN ENGINE							
MODEL	TYPICAL PRICE RANGE[1]	ENGINE	TBO/HOT	MAX WEIGHT	USEFUL LOAD	CRUISE SPEEDS	ESTIMATED HOURLY COST[2]
CESSNA 441 CONQUEST II	$1 TO $1.4M	TPE331-8-401S	5000/1800	9850 LBS	4168 LBS	280 KTS	$650 TO $700
CESSNA 425 CORSAIR	$725,000 TO $925,000	P&W PT6A-112	3500/1700	8600 LBS	3652 LBS	260 KTS	$400 TO $475
TWIN COMMANDER 690A[3]	$385,000 TO $485,000	TPE331-5-251K	5400/1800	10,290 LBS	4025 LBS	280 KTS	$675 TO $725
TWIN COMMANDER 690B	$475,000 TO $600,000	TPE331-5-251K	5400/1800	10,325 LBS	3592 LBS	280 KTS	$675 TO $725
MITSUBISHI MU-2J	$250,000 TO $270,000	TPE331-6-251M	5400/1800	10,800 LBS	4000 LBS	265 KTS	$680 TO $725
MITSUBISHI MU-2B-60	$550,000 TO $600,000	TPE331-10-501M	5400/1800	8930 LBS	3200 LBS	270 KTS	$660 TO $725
PIPER CHEYENNE I	$360,000 TO $500,000	P&W PT6A-11	3500/1700	8700 LBS	3743 LBS	236 KTS	$600 TO $650
PIPER CHEYENNE II	$360,000 TO $500,000	P&W PT6A-11	3500/1700	9000 LBS	3980 LBS	269 KTS	$650 TO $700
BEECH 90, A-90 KINGAIR	$200,000 TO $260,000	P&W PT6A-20	3600/1700	9000-9300 LBS	3320-3620 LBS	216-235 KTS	$660 TO $700
BEECH C90 KINGAIR	$340,000 TO $600,00	P&W PT6A-20	3500/1700	9650 LBS	3965 LBS	220 KTS	$670 TO $700

[1] Prices given are early to late-model used aircraft estimated from *Aircraft Bluebook Digest* and seller asking prices.
[2] Hourly costs are estimated from owner reports, www.planequest.com and other sources.
[3] Other models of most of the aircraft aren't listed, but are also possibilities. Choices are representive options.

form on a single-engine after takeoff, in cruise and especially over mountainous terrain where driftdown could be a factor. Furthermore, stepping up to a turbine of any kind, says Wolf, requires more training, experience and situational awareness than meets the eye.

"Flight planning is a big one: You've got to know about weather in the flight levels, you've got to know about winds and you have to be used to fuel burns in the 100-gallon-an-hour range rather than 20 gallons. It's a whole different ball game," he says.

The warning about fuel management was echoed by other owners, some of whom said they were shocked at how fast the fuel goes away in a turbine. And into winter winds, a turbine's otherwise impressive range might easily shrink to piston performance and the wise owner will learn not to push it.

STRAIGHT TO A JET?

Interestingly, because of the aforementioned financial crisis, some owners found themselves in a position to step directly from a piston airplane into a jet whose selling price was substantially marked down post-2008. Miami-based Raul Segredo told us he did exactly this, after his position on a new Eclipse EA-500 was lost in the company's bankruptcy in 2008. At the time, he had been flying a Bonanza for use in his avionics business, which sells into an international market at the air transport level. Prior to Eclipse's demise, Segredo had earned a type rating in the company's simulator. But when he bought a Cessna Citation 501SP, he did the training in the airplane. And he told us something curious.

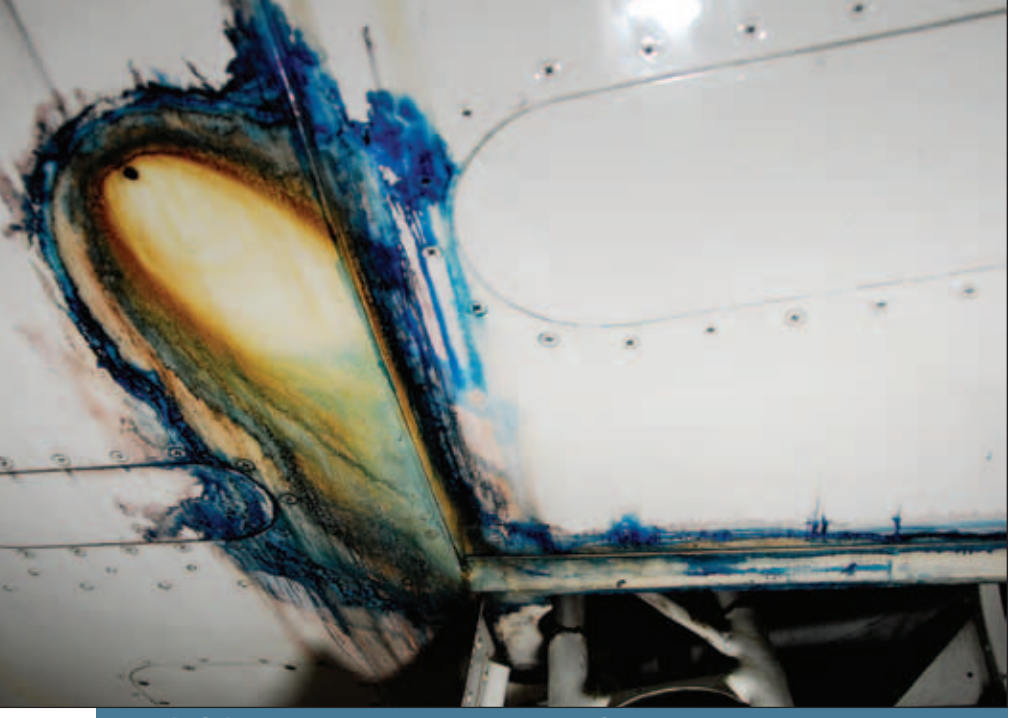
"Having the perspective of having done both the simulator training and the in-the-aircraft training, I would say that the airplane is far more beneficial if you can afford it," he said. Speaking of which, we asked how he was able to get insurance in stepping directly to the Citation. His insurer didn't balk, but did require a full-year of flying with a type-rated co-pilot. "With the benefit of hindsight, I think a year's worth of supervised operation was well advised," Segredo said.

And speaking of insurance, although the premiums aren't cheap, none of the owners we spoke to said they were insurance-limited in any way, including high limits on smooth coverage. One owner based in Europe told us a European carrier wrote $8 million in liability on his Silver Eagle conversion.

As far as the jet cost compared to the piston, Segredo said it's a huge leap from the Bonanza. "It's five times more per mile. Ten times more per hour," he said. (Call it about $1300 an hour.)

But for Segredo, the payoff is more productivity for business appointments. "I can now actually get out and back from trips I would just otherwise not take in the Bonanza," he told us.

He says there's no reason to believe that with the right training, a pilot should expect to have to do a stint in a turboprop before stepping up to a jet, at least one as simple as the Citation is to fly. And besides, he repeated a sentiment we heard from many other owners. "There's no better way to get a big grin than to light up a couple of turbines and make a lot of noise."



Is that as bad as tank weepage gets, left? No, it can get worse and will if it's not fixed with spot repairs or a reseal. (Photo: Paul Beck.)

AIRCRAFT MAINTENANCE

Fuel Tank Reseal: Thankless, Expensive

Not many shops will agree to tackle this job, so the skill base is eroding. But there are still choices when tank weepage gets out of control.

One of the unfortunate side effects of slow aircraft sales has been an erosion in the maintenance base. Many smaller shops have disappeared and some of those that remain are either losing the ability to do some kinds of work or are just declining to accept it.

One maintenance procedure on the chopping block has been the resealing or repair of wet wing fuel tanks, especially in Mooneys, but in a few other models as well. At best, repairing weeping wet-wing tanks is a dark art, at worst, it's something some owners say they have to have done several times to stop the leaks, if even the leaks can be stopped.

There are a few solutions. One is to find a shop that can spot repair otherwise sound tanks and back up the work, another is to strip the tanks back to bare metal and reseal them and a third is simply line the wet wing bays with neoprene bladders. Each approach has its merits.

SHOPS

Although not many shops take on tank work, two that do are Weep No More LLC in Minnesota and Florida Flight Maintenance, in Venice, Florida. Weep No More is an outgrowth of Willmar Air Service in Willmar, Minnesota, a long-established and respected Mooney dealer and service center. Florida Flight is also a well-known Mooney center based on an airport with a long Mooney connection. (Either shop can handle any kind of wet wing tank work.)

Weep No More's Paul Beck developed his tank sealing process while working for Willmar, but now has established his own business. He's also able to travel to the customer—world wide—to repair spot leaks, but full resealing has to be done in his Minnesota shop. Florida Flight does all of its tank work in Venice.

Depending on who you talk to (and how much they've recently spent on tank work), wet wings are either the worst idea in aviation design or not nearly as bad as everyone thinks. Mooney has traditionally used them because they're light and relatively accessible in the design's single-piece wings. Other models, such as Piper's Cherokee, have split wings and/or the fuel cells are accessible and can thus be removable aluminum or bladder-type tanks.

Wet wings usually fail somewhat gracefully, beginning with a slight odor of fuel around the airplane or in the cabin and evidence of blue stains caused by weeping. The condition only grows worse with time.

The main failure mode seems to be deterioration of the sealant caused by aging and, at least in Mooneys, hard landings. The landing gear is attached to the spar in the area of the tanks and the rubber donuts Mooney gear legs have don't offer much damping. Years of landings, with a few hard ones thrown in, can flex the structure enough to loosen old sealant, kicking off the leak process. (You'll sometimes see bits of sealer when sumping the fuel.)

Mooney tanks also develop leaks toward the front of the cells, producing staining visible from inside the gear wells.

Minor leaks can be repaired, but after one or two attempts, a reseal may be the best option. "I usually base it on the age of the sealant," says Paul Beck, of Weep No More. "It's pretty much back to the J-model. If you're back in that vintage, you might want to think about a reseal. If you're newer than that, you might not need it," Beck says.

Both Florida Flight and Weep No More use a similar strategy to track down leaks. It involves drawing a vacuum in the tank, noting where air bubbles appear, then spot sealing that area. The tank has to be drained to complete the repair.

FULL RESEAL

Even well-known Mooney shops like Don Maxwell Aviation in Longview, Texas, won't tackle reseal work, which Maxwell describes as the worst job

in aviation. All of the work has to be done through small access panels, requiring the flexibility of a contortionist and the patience of a saint. Maxwell does a couple of tank repairs a week, but sends reseal work to Paul Beck at Weep No More.

"You just have to find that special guy to do it and I just haven't found him yet. It's hard on a fat boy to get in those positions anymore," Maxwell jokes.

The reseal job requires taking the tank interior down to shiny bare metal then applying fresh sealer, which is itself a three-part process with a day of curing for each step. It can't be rushed and haphazard work will bring the airplane right back for a fix. (All the shops offer warranties of their work.)

While he was at Willmar, Beck developed a clever process that sprays a stripper called PolyGone into the tank cells. PolyGone is a non-corrosive, water-soluble solvent specifically designed for polysulfide sealers.

LOTS OF STRIPPER

Beck's process uses hardware sort of like a purpose-built lawn sprinkler to douse the inside of the tank with Polygone. Drains at the bottom of the fuel cells collect the stripper and loosened sealer and a pump re-circulates the stripper. Tank stripping can thus be largely completed automatically in a day or a little longer for tanks that have accreted years of patches.

Other methods include mechanically scraping the old sealer out or using a combination of both methods, which is what Florida Flight does.

CONTACTS

Don Maxwell Aviation Services
www.donmaxwell.com
903-643-9920

Florida Flight Maintenance
www.mooneyservice.com
941-485-1149

O&N Aircraft Modifications
www.onaircraft.com
570-945-3769

Weep No More LLC
www.weepnomorellc.com
320-295-1671

It's ugly in there. Center photo shows the mess inside a 32-year-old Mooney with original sealant being cleaned by Florida Flight. Access is through top and bottom wing panels and it's slow, tedious work. Bottom photo shows a freshly completed tank seal from Paul Beck's Weep No More shop.

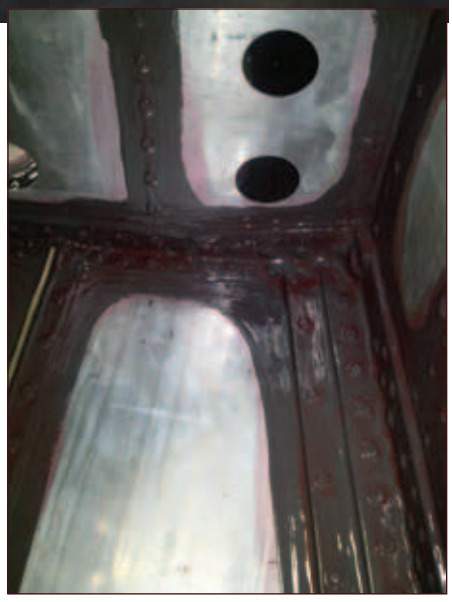
Whichever method is used, the cost will be similar—a range of $6500 to $8000, again, depending on the condition of the old sealer.

BLADDERS

What's involved with bladders? Essentially abandoning the wet wing tanks and stuffing vulcanized neoprene bladders through the access panels. For the Mooney, these are available up through the J-model and although they used to exact penalties in both reduced fuel and higher empty weight, a new system from O&N Aircraft Modification retains the J-model's original 64-gallon capacity at weight penalty of about 30 pounds. This requires eight bags, total, and lists for $8000. However, Don Maxwell says he advises customers that bladders and a reseal come out in about the same place pricewise. One good thing is that old systems limited to 54 gallons can get the 10-gallon upgrade for $2650 list, plus the labor.

Maxwell has done the bladders, but doesn't push them. "I usually recommend that a strip and reseal is best. They used to have a price advantage over strip and reseal, but now they're about the same price. Some people want the bladders so their local mechanic can take one out and get it fixed if it leaks. Everyone is used to bladders," says Maxwell, who is one of 10 shops that do the O&N bladders.

Our view is that bladders make sense only if you're not weight critical—in other words, you don't need much payload with full fuel—and you simply don't trust a resealed wet wing. Otherwise, if you're going to keep the airplane, a properly done reseal will enhance the airplane's value and probably last as long as you own it. You can keep the 30 pounds of payload.



The other side of the same coin is that a 30-year-old airplane that hasn't been resealed but whose logs show evidence of leak fixes should be viewed somewhat warily in the pre-buy. Factor in the cost of a reseal or bladders because at that vintage, the tanks are holding fuel on borrowed time.

LSA Finance Woes: Crippling the Industry

If the brand is listed in Vref or Bluebook, credit is usually available at reasonable rates. Want a loan for an odd make or commercial use? Fugetaboutit.

by Jeff Van West

The light sport aircraft market was hyped up with so much promise, but still struggles to deliver real payoff. It's not that the aircraft aren't selling—they are, as much as anything is selling. But market has been primarily one of cash, not credit. While credit is tight in all economic sectors today, LSAs have some specific issues that make them a tougher sell to the bean counters at the bank.

CREDIT IS AVAILABLE

The credit picture hasn't changed much since we last looked at this issue about a year and half ago. Financing is available for LSAs and experimentals right up through jets so long as the borrower has the right stats. Those are generally credit scores north of 700 and debt-to-income (DTI) ratios in the low 40s, including the aircraft loan. Lenders tell us that if there's been any movement on what a bank wants to see, it's that the weight of a good DTI has more play than it did two years ago and the credit score is a bit less important.

What has changed, however, is the number of transactions. Jim Blessing, VP of AirFleet Capital, says they saw an 18 percent increase in transactions in 2010 versus the pits of 2009. The rate of approvals is up about 30 percent. Given that the requirements haven't changed significantly, the logical conclusion is this represents reluctant borrowers now feeling secure enough to apply for loans. The majority of the uptick seems to be in used aircraft sales.

Rates are generally what we've seen for the past two years. Common terms are 20 percent down with 20-year terms at five to six percent. Big loans for big iron can dip below five and loans under $75,000 for used piston singles may be north of six percent. Again, that's for the right borrower. Fall outside of the standards and it's unlikely a higher rate will make up for it. The answer will simply be, "No."

Photo by Mary Grady

LSAS: CASH DEALS

LSA guru Dan Johnson estimates that LSA sales are now between 20 and 25 percent of GA propeller aircraft sales. Yet brokers and banks tell us that LSAs represent about five percent of their aircraft transactions (that's transactions, not total volume where these low-cost aircraft would be an even smaller share).

Digging deeper, we found this is not evenly distributed across LSA manufacturers. For example, the popular Flight Design series had a good 2010 by LSA standards, with 32 airplanes sold for about $4 million. Financed deals accounted for about

Kappa who? Banks rightly worry that a product from an unknown might be orphaned. Little or no sales volume makes value assessment a blindfolded dart throw.

CHECKLIST

- ⊕ The total number of financed deals across aviation is on the rise.
- ⊕ Financing is available for some LSAs for qualified buyers.
- ⊖ No financing is available for commercial operations or little-known makes.
- ⊖ Even known makes may not be valued highly enough by the bank.

35 percent of those. Flight Design President Tom Peghiny tells us he thinks only about half the deals that required financing were ultimately approved. Pete Krotje of Jabiru told us that he sold eight airplanes this year and one was financed, but historically it's been about 20 percent.

These LSAs appeal to a wide range of buyers, so it makes sense they're seeing a wide range of financial situations. For some of the more specialized designs, it's almost entirely a cash business. Cub Crafters sold 44 of their light Sport Cub S2 designs last year, 42 of which were the 180-HP, performance hot rod Carbon Cub SS model—a $165,000 airplane. Exactly zero were financed.

Randy Lervold of Cub Crafters describes the aircraft market as having three parts: the enthusiastic tire-kickers, the middle section who might buy with financing in secure financial times and the upper third who simply write a check. His market right now is completely that upper third.

Low-production and new designs in LSAs are the other models that see little or no financing. But in this case it's because the lenders won't go there. Jim Blessing says of the LSA market, "It took us a while to get our hands around it. Some the aircraft that came back to us lost over 50 percent of their value. They didn't hold value compared to certified aircraft."

The ones that plunged the most were due to manufacturers dropping out of the game. Another issue was simply a low demand for used LSAs. High wear and tear on the lightweight interiors and parts, and the breakneck advances in installed avionics compound the problem for selling a used LSA.

"Some the aircraft that came back to us lost over 50 percent of their value. They didn't hold value compared to certified aircraft."

So while the credit terms may be similar for LSAs and certified piston singles, the criteria for qualifying aircraft are not. If the LSA isn't a big enough name to be listed in *Bluebook* or *Vref*, then it's highly unlikely you'll get financing. Even if it is listed, there's no guarantee the bank will agree the LSA of your dreams is worth what you want to borrow.

"I agree with some of what I see in *Bluebook* and *Vref* and disagree with some of what I see," says Mike Jacobs, Director at First Pryority, a top bank for loans on single-engine pistons. "Valuation is a modification with my biases and prejudices. You could ask 10 different people what an aircraft is worth and you'll get 10 different answers."

Financing an LSA for use in a flight school is prohibitively expensive or outright impossible—except for a Skycatcher, which can be financed directly through Cessna.

Ron Herold of airplane-appraiser.com points out that low volume makes the valuation highly subjective. "Fair market value requires transactions, and it has to be a fairly current market." Herold also points out that different appraisers factor in variables differently. He notes that the Rotax engine on many LSAs is only warranted for 18 months from delivery to the manufacturer. If that's a European company and it takes nine months for the aircraft to be built, shipped and then sold in the U.S., this "new" aircraft only has nine months on its engine warranty and he'll account for that in his appraisal.

The vast majority of the top LSA names—Flight Design, Remos, Tecnam, Evektor—are built in Europe also run into an exchange-rate issue. Prices were pegged during a stronger Euro that's since fallen over 20 percent. But the prices have not come down. Potentially there's fat to trim in those LSA prices, but doing so would devalue the used market in the U.S. and further complicate the picture. So the models remain essentially overpriced compared to U.S.-built designs.

FLIGHT SCHOOL SORROWS

Phil Soloman, CEO of Tecnam North America, isn't thrilled with the nine LSAs Tecnam sold this year, none of which were financed. "We would have sold double that number if financing was available. Our target market is flight schools. There is simply no financing for flight schools outside the Cessnas," said Soloman. Tecnam also sells a fully certified, Rotax-powered twin that is pitched at flight schools, so the financing issue strikes beyond just LSA sales.

Our talks with lenders and LSA manufacturers were uniform in this regard; no one is financing LSAs for commercial use. Krojte of Jabiru says it costs him about four sales a year—which would be a 50-percent increase in sales for that company. "The ones in flight schools on a loan were against some other asset or cash deals. They can't even finance 50 percent of it."

Technically, the money can be had from a few banks, but the rates are not favorable. Blessing of AirFleet

FALLOUT OF GOOD INTENTIONS

Perhaps by the time you read this, AOPA and EAA will have made their latest bid to relax the third-class medical requirements. The proposal is that pilots doing day-VFR flights, in fixed-gear airplanes of 180 HP or less, and carrying no more than one passenger can fly without a medical. A current driver's license will suffice.

The limitations for daytime, 180 HP and passengers come from existing Recreational Pilot limitations, according to Kristine Hartzell, Manager of Regulatory Affairs for AOPA. But the kind of operation and the fact that it can happen without a medical hits home for LSA manufacturers. Hartzell said that there was initial backlash from the industry but, "Most people we've been speaking with see this as an effort for the whole aviation community. So everyone will benefit."

Photo by Mary Grady

Our conversations came up a bit differently. Tom Peghiny of Flight Design said, "I can't see how AOPA's bid will help. But I can certainly understand their motivation. I'm also sensitive to how general aviation is struggling." Peghiny's comments were the tamest we heard when asking this question of LSA manufacturers. Smaller vendors pretty uniformly said: "It'll kill us." Pete Krojtie of Jabiru told us that simply the announcement of the proposal last fall killed three prospects. "What they said is they have a year to go on their medical, so they'll wait. They'll continue to fly their beloved 172 or Cherokee."

Dick Knapinski, speaking on behalf of EAA, says their organization feels it's a net gain as a GAMA study says this exemption could keep 50,000 pilots in GA. "I can appreciate the concerns," says Knapinski, "but let's play this out and see." He also points out that the no-medical Sport pilot was really a side benefit of LSA, which started as a way to legalize "fat" ultralights. "There's also powered parachute and weight-shift that's part of LSA." Peghiny of Flight Design agrees that, "Light sport has a lot more to offer than just flying without a medical."

Randy Lervold of Cub Crafters says this wouldn't change his marketing approach one bit. "We make the highest performance, best quality aircraft we can. We get many buyers that compare Carbon Cub to certified aircraft."

While it's horribly impolitic to say it, we think that a relaxed medical requirement causing several players in LSA to drop out may be a good thing in the long run. It could just be a way to speed up evolution, leaving behind only the designs and companies strong enough to survive on their merits as aircraft, rather than just a way to keep flying without a signoff from the doctor.

AC TV

Podcast: Proposed Medical Changes -- The Impact on LSA

File Size 9.8 MB / Running Time 10:40

By Mary Grady, Contributing Editor

For a more in-depth discussion of this issue, log on to www.avweb.com and select the podcast index. Or go directly to http://snipurl.com/21mf5z5.

Capital says a minimum would be 30 percent down and a 10-year term with a high rate. He says that the primary issue is that LSAs depreciate extra quickly on the flight line. The loans are upside down in no time.

FLY CESSNA

It's a completely different picture at Cessna. Skycatchers can be financed through Cessna Finance directly. Terms are generally good, but they wouldn't commit to exact figures for us. In general, they only ask 15 percent down, but like shorter terms of 10 or 12 years. They also wouldn't commit to borrower criteria—minimum credit scores, DTI ratios, etc.—saying instead that "We do a full analysis on the individual and make loans based on the individual.

Cessna Finance will fund a Skycatcher for commercial use. A lot of them, in fact. Three out of four loans on Skycatchers are for commercial use, almost entirely at flight schools. Cessna wasn't able to give us numbers on what percentage of all Skycatcher purchases were financed by press time, but as so many were bound for flight schools, the feeling was it was a high number.

NO FUTURE SANS FUNDS

The LSA industry is stuck in a Catch-22 where low volume of sales hinders financing, but the impediments to financing limit sales volume. For the biggest names this isn't a crippling issue, but for smaller brands or for the commercial market, it's devastating.

If someone could figure out how to run a privately funded LSA finance company, they'd get a bunch of customers. If they could figure out how to structure it so they didn't end up with a bunch of crumped, used, underwater, repo'd LSAs, they might even make money.

Soloman of Tecnam put it pretty well: "Financing is a fact with any high capital value asset. Until then, the LSA market will be restricted to rich, older individuals."

Renegade Falcon

(continued from page 6)

with the canopy held open by its gas springs. Starting the Lycoming is like starting an O-235, and it's immediately obvious that this isn't a Rotax. The Lyc shakes and rattles the airframe and settles down to an idle that's a little more bumpy than a purr. Run-up involves checking the mag and Light Speed system for proper function. All of the vital signs are clearly depicted on the Dynon Skyview.

The airplane has a steerable nosewheel, so ground handling is precise, especially tight turns. However, the airplane we flew needed brake tweaking. We had to rely on demo pilot Chas Perkins in the right seat to get the airplane stopped. Part of this has to do with the reclined seating, making it more difficult to gain good purchase on the toe brakes. Adjusting the seat forward would have helped.

The takeoff roll is also un-Rotax-like; rather than an urgent gathering up speed, the Falcon actually seems to push you back into the seat a little. We didn't measure the takeoff roll, but the climb rate was impressive—about 1450 feet on a 45-degree day from Lee's Summit, Missouri, where Renegade is based. The airplane reached pattern altitude by about the middle of the crosswind leg, but it can do it by the end of the runway if pushed.

The clear canopy is so large that the sight picture takes some getting used to, especially on landing. That long snout gives the impression of a tail-dragger in the flare and the tendency is to round out too high. Thump. It's easier once you know what to expect. On speed is a must. The airframe looks and is slick. Cross the numbers at 70 knots indicated and the Falcon will punish you with a long float.

We would place the handling in the upper strata of LSAs. Pitch is light, but just this side of twitchy and roll forces feel more like a certified airplane, say the Diamond DA20. Dynamic stability is good and so is roll stability. The airplane has massive Fowler flaps that extend to 40 degrees, but the slowest stall speed seems to come at the 30-degree setting. There's lots of buffet and a real break, not a pronounced parachute mode. But it takes holding the stick to the stop to get it.

Instructors will likely like this airplane for two reasons. As noted, it climbs like crazy, so a one-hour flight lesson can include a lot of circuits and bumps. It's also a quick cruiser. The two-blade Prince prop on our trial airplane delivered about 119 knots true, flat out at 4000 feet burning a little over 8 GPH. Bailey told us with cruise-trimmed props, the Falcon will push toward 130 knots cruise, although we couldn't confirm this. (LSAs are legally limited to 120 knots indicated in cruise flight.)

Ergonomically speaking, we didn't find much to complain about. The panel, which sits relatively high due to the reclined seating position, places everything easily to hand and the stick rides high between your knees. There's a set of circuit breakers on a console under the panel, which is quite a stretch to reach. We would prefer these on the main panel.

Chas Perkins told us Renegade is working to improve the canopy seal system and they'll need to, because it was quite drafty, with a noticeable cold flow from the front and breeze on the back of the neck. That would be welcome in the summer, but not on a cold winter day.

CONCLUSION

We would deem the Falcon to be as competent as any LSA we've examined. It performs at the top tier, out-climbing and out-cruising most of the other airplanes we've tried. With a choice of props, a buyer can tilt toward brisker climb for faster cruise or split the difference. That might be a strong selling point for Renegade.

But will the IO-233 draw buyers as well? Possibly, but in our view prejudices against the Rotax 912 being a chainsaw engine are on the wane as these powerplants continue to prove themselves. On the other hand, we like the idea of fuel injection in place of the Rotax's carburetors and there's little question that the IO-233's slightly higher power output (115 HP) gives the Falcon excellent performance.

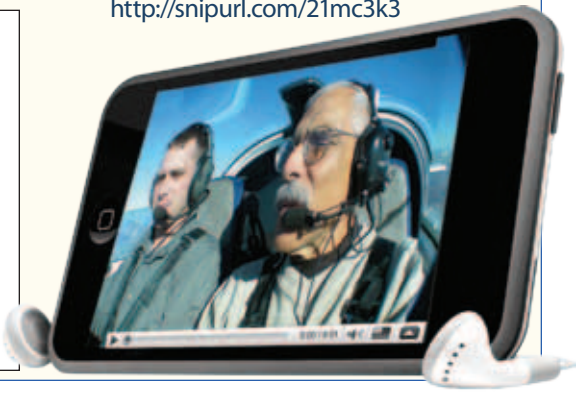
What most impressed us about Renegade, however, is Doc Bailey's willingness to take full advantage of the flexibility offered by ASTM oversight. Eliminating the FAA's burdensome certification rules was supposed to spur innovation and rapidly shorten product development time. In Renegade's case, this is exactly what happened. In our view, it's unlikely that anyone would have pursued fuel injection for the O-233 if doing so involved an expensive and lengthy certification process. On that alone, Renegade deserves recognition.

CHECKLIST

- ⊕ With 115 HP, climb and cruise performance is excellent.
- ⊕ Cockpit visibility, ergonomics and handling are good.
- ⊕ Fuel injection is a plus and so is electronic ignition. Engine is autogas approved.
- ⊖ Canopy seals need work. The cockpit proved drafty in cold weather.

AC TV

For a video report on the Renegade Falcon and a tour of the Lycoming IO-233, scan the tag below with a mobile app or log onto www.avweb.com and scroll down to the Renegade and IO-233 video. The direct URL is http://snipurl.com/21mc3k3



Piper Seneca

If there's such a thing as everyman's twin, the Seneca certainly qualifies.

Most piston twins have carved themselves a market share for a few years, then vanished as market conditions changed. Piper's Twin Comanche and Aztec are examples and so is the Beech Travel Air, Duke and Duchess. On the other hand, for various reasons, some twins have endured and Piper builds two of them, the Seminole and the Seneca. Both have endured for various reasons, although neither is made in much volume these days.

It's easy to see why the Seneca has endured. It does nothing exceedingly well—it's not fast, nor a joy to fly nor will it turn heads on the ramp—but it does a lot well enough.

It's affordable to buy and maintain, carries a good load and flies without any nasty habits. There are plenty of used examples on the market and airplane remains popular as a multi-engine trainer, but it's not the sort of airplane anyone who learned in will want to immediately ditch in favor of something sexier.

In short, it's an entirely reasonable airplane. That, more than anything, may explain why the Seneca endures in Piper's line. It's one of only four twins still in production—the others being the Baron, Piper's own Seminole and new-age Diamond Twin Star.

THE HISTORY

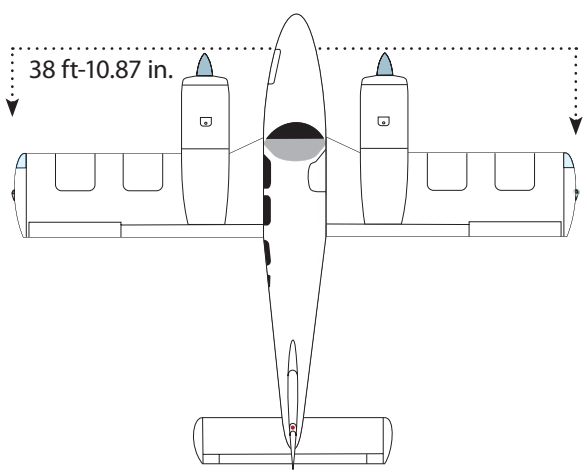
All modern manufacturers are known for so-called "parts bin" engineering—stretching the parts and pieces of one model into another, something that makes perfect sense. But few have been as good at it as Piper has. The Cherokee line begat the Cherokee Six, the Six the Saratoga and the Saratoga the Seneca. Saw off the wings of a Seneca and a Cherokee Six and you couldn't tell the two apart. The Seneca first appeared in 1971, when GA was still a going industry and there was actually headroom for new twins. At the time, the Aztec—a good seller for Piper—and the Comanche were growing long in the tooth and Piper needed something new. The Seneca had counter-rotating Lycoming IO-360C1E6 engines producing 200 HP each and at its introduction, it cost about the same as the Twin Comanche C/R, but had larger engines, higher gross weight and a roomier cabin with a rear door that the Twinkie lacked. In other words, it was cabin class comfort for about $63,000 equipped.

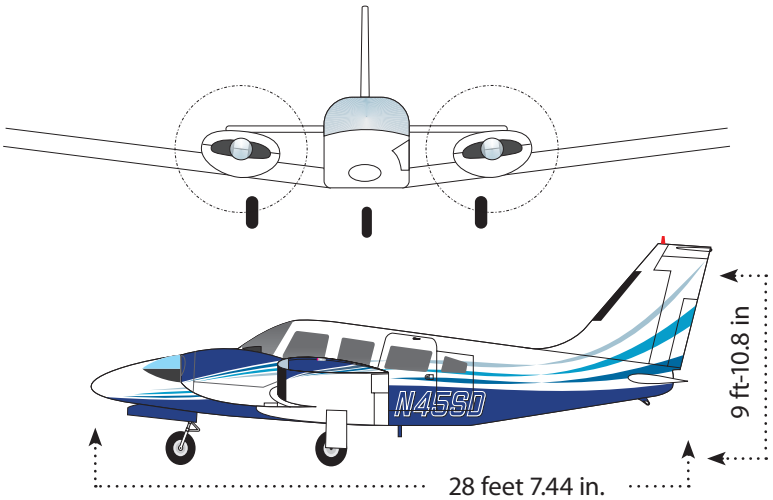
The Seneca isn't really exceptional at any one thing. But it's affordable, reasonable to maintain and not demanding to fly.

Both the Seneca and the Twin Comanche were built in 1972 but when Tropical Storm Agnes pushed the Susquehanna River into Piper's Lock Haven works, the Twin Comanche drowned with it and the Seneca was moved to Piper's new Florida operation. Piper built 360 Senecas that year, a good start in the twin market where the competition was the Cessna Skymaster, which sold poorly in 1972. In three years, Piper sold 933 Seneca I's, dramatically outdoing the Aztec and Comanche.

Part of this was due, no doubt, to Piper's decision to modernize the airframe. It dumped the Comanche's Byzantine plumbing, favoring a fuel system with only three positions: on, off and crossfeed. Since the airplane had counter-rotating props, there was no worry about critical engines,

PIPER SENECA



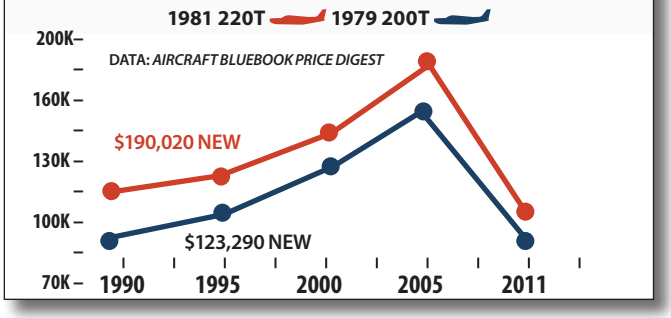


drawings courtesy www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1972-1974 PA-34-200 SENECA I	200-HP-LYC. IO-360-C1E6	2000	$28,000	100	1414 LBS	163 KTS	±$50,000
1975-1980 PA-34-200T SENECA II	200-HP-CONT. TSIO-360-E	1400	$30,000	93	1340 LBS	177 KTS	±$72,000
1981-1990 PA-34-220T SENECA III	220-HP-CONT. TSIO-360-KB	1800	$35,000	93/123	1800 LBS	178 KTS	±$150,600
1991-1993 PA-34-220T SENECA III	220-HP-CONT. TSIO-360-KB	1800	$35,000	93/123	1800 LBS	178 KTS	±$210,000
1994-1996 PA-34-220T SENECA IV	220-HP-CONT. TSIO-360-KB	1800	$32,000	123	1800 LBS	178 KTS	±$195,000
1997-2007 PA-34-220T SENECA V	220-HP-CONT. L/TSIO-360-RB	1800	$45,000	122	1350 LBS	178 KTS	±$350,000
2008 PA34-220T SENECA V	220-HP-CONT. L/TSIO-360-RB	1800	$45,000	122	1350 LBS	178 KTS	$585,000
2011 PA-34 220T SENECA V	220-HP-CONT. L/TSIO-360-RB	1800	$45,000	122	1376 LBS	197 KTS	$899,000

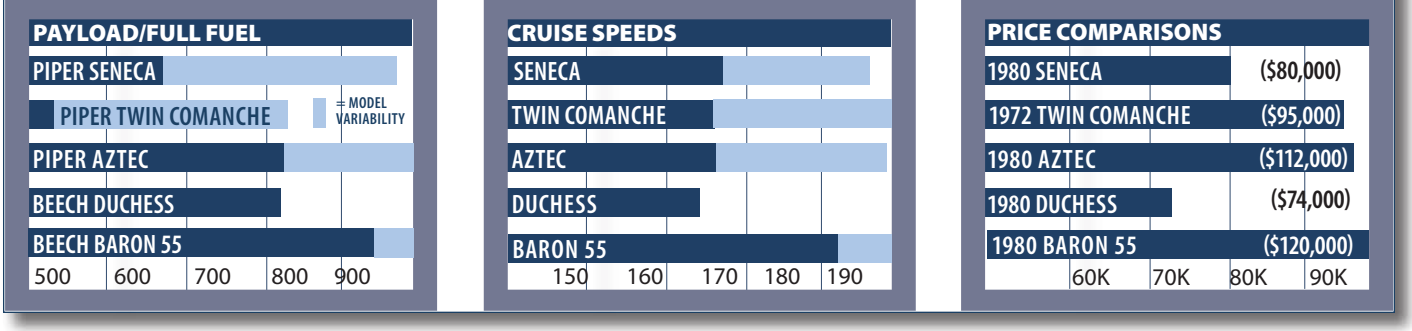
RESALE VALUES



SELECT RECENT ADs

AD 10-15-10	CONTROL WHEELSHAFT INSPECTION, REPLACEMENT
AD 05-15-10	COMBUSTION HEATER INPECTION
AD 2005-13-16	NOSE LANDING GEAR BOLT
AD 97-01-01	MAIN GEAR SIDEBRACE
AD 94-13-11	MAIN LANDING GEAR TRUNION

SELECT MODEL COMPARISONS



Senecas don't come immediately to mind as short or rough field airplanes, but flown properly, they can deliver passable performance at both. (Photo: Rafael Carelli.)

either. The Seneca was based on the wildly successful PA-32 series with a long and wide cabin, true seating for six, a big aft door on the left and a cockpit door on the right. Since passengers don't like climbing over wings, this design proved a favorite among charter operators and for owners with big families. It still does. And despite its boxy shape, Piper applied some styling touches to make the aircraft fairly attractive. Early interiors, apart from that unfortunate Velour upholstery, were also a step up from early efforts. The modern Seneca V has dropped one of the seats in favor of an optional entertainment/refreshment center.

The original Seneca I was a good start, but it was lacking, too. Pitch stability wasn't the best and the controls were on the heavy side—Bonanza pilots wouldn't like it much. The airplane also had noticeable Dutch roll in turbulence, which would tax the stomachs of the backseat pax. There were design and production issues, too, that led to a lot of ADs. Records indicate that the original Seneca is subject to 47 ADs, counting the shotgun ADs that apply to most airplanes; a dubious record.

To its credit, Piper didn't sit still. It corrected the Seneca's handling and noise/vibration shortcomings. The ailerons were changed to a modified Frise design and made larger. The engine mounts were changed and soundproofing was added. Piper also changed some of the weights to give pilots the option of carrying more weight or more fuel. Gross was increased from 4000 to 4200 pounds. The increase carried with it a price, of course. Single-engine performance at the higher gross weight was marginal, at best. Single-engine rate of climb sank from 230 FPM to 190 FPM and single-engine ceiling from 5200 feet to 3650 feet. Piper also introduced a new limitation: a zero-fuel weight of 4000 pounds, meaning that any weight over 4000 pounds had to be in fuel, not payload.

SENECA II

With a strong if not a hot seller on its hands, Piper continued to improve the Seneca with the PA-34-200T Seneca II. More changes were made to the control system to improve handling. The aileron/rudder interconnect was removed and with it went some control heaviness.

The rudder gained an anti-servo tab and the stabilator was changed with the addition of a bobweight. The ailerons were increased in span and balanced for lighter effort. This time, the changes worked and no major alterations were made after that.

But the big performance change for the Seneca II came in the powerplants, with the four-banger Lycs giving way to six-cylinder turbocharged

One selling point of Senecas is the seating, which is club-style in most models. There's adequate if not surplus room for passengers and two baggage compartments for their stuff.

Continental TSIO-360-E engines with fixed waste gates. Rated at the same 200 HP at sea level, they produced 215 HP at 12,000 feet. Flying high and fast is nice, of course, but twin drivers worry more about high-altitude engine-out performance. Here, the Seneca II was a different beast entirely.

Single-engine climb rate improved to 235 FPM and single-engine ceiling more than tripled to 13,400 feet. Initial recommended TBO was the same 1400 hours. In 1977, this was increased to 1800 hours and owners report that with careful operation and maintenance, this is realistic.

The airplane got a higher gross weight, too, increasing by 370 pounds to 4570 pounds. However, the zero-fuel weight stayed at 4000 pounds, so the benefit was a mixed blessing. And another limiting weight was introduced: a maximum landing weight of 4342 pounds. Once again pilots were given more flexibility and more ways to get into trouble if the loading limits weren't obeyed.

With the improved controls and engines, the Seneca II also got optional extended-range fuel tanks that increased usable fuel from 93 to 123 gallons. The campaign against noise and vibration continued with the addition of a three-blade prop option, which weighed 46 pounds.

The popular club seating option was also introduced, as was a Janitrol heater and optional fan to move heated or ambient air through the cabin. In later years, some system changes and options were added, such as a priming system to make engine start easier, optional more powerful brakes, modifications to the instrument panel and air conditioning. In 1980, a built-in oxygen system was offered.

From the Seneca II forward, Piper used Continental TSIO-360s in nacelles that provide plenty of working room for mechanics. The stock turbo system doesn't have a conventional wastegate and benefits from a Merlyn deck controller.

SENECA III

By the late 1970s, with sales still strong, Piper began overhauling its entire model line, introducing the tapered wings and had a fling with T-tails in Arrows and Lances. The 1981 Seneca III was supposed to have the same T-tail and tapered wing as the Lance, but Piper found that the flying qualities weren't as good as the company had hoped. The configuration was left unchanged. There were still significant changes to the Seneca III, however. A different variant of the Continentals was used, with 220 HP each. These engines had a higher RPM limit (2800 vs. 2575 RPM). This, combined with fuel scheduling, resulted in maximum power of 220 HP, albeit time-limited to only five minutes.

Continuous rated power was still 200 HP. Single-engine rate of climb improved marginally to 240 FPM and all-engine rate of climb went from 1340 to 1400 FPM. However, most other performance figures, such as runway required, declined somewhat due to a further increase in allowable weights, the unavoidable bugaboo of every manufacturer.

The new weight limits were made possible by reinforced structure. This time, the zero-fuel and landing weights were raised as well. Maximum takeoff weight was now 4750 pounds, zero-fuel weight 4470 pounds and max landing weight 4513 pounds. The pneumatic system (for air-driven instruments and optional de-ice system power) was changed from a pressure to a vacuum system in 1981. According to Piper, this improved mean time between pump failures from an average of 400 hours to more than 700 hours. Owners say that in the field, the pressure pumps last about the same as vacuum pumps.

Other changes to the Seneca III included a new panel, one-piece windshield and a switch to electric flaps. We've always been fans of manual flaps: They're simple, positive and hard to break. The move to elec-

ACCIDENT SCAN: LANDING BIFFS

Instructors transitioning new pilots to the Seneca often brief their charges by saying the airplane flies just like a Saratoga. They might just as well add that it crashes like one, too. As shown in the graphic here, runway prangs lead the list of why Senecas come to grief.

That's not unusual for airplanes in general, but it is somewhat unusual for twins which, by dint of insurance company requirements, tend to be flown by more experienced and better-trained pilots. In the Seneca's case, however, they still bend the airplane on the runway about as often as pilots of singles do.

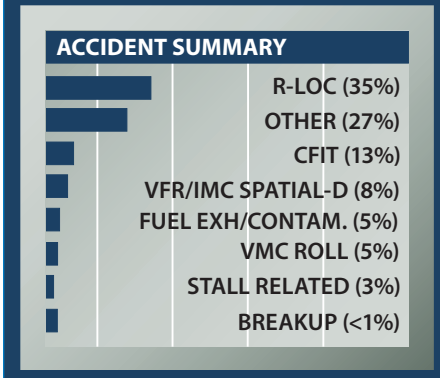
The "other" category listed in our graphic below describes a multitude of sins so diverse that we can't break the numbers down into any meaningful patterns. There were, for example, a couple of inflight fires, one due to a heater malfunction, another an improperly maintained fuel fitting. We also found two propeller blade separations which rendered the airplanes unable to maintain level flight. Both crashed off field, albeit with survivors.

More troubling were at least five VMC roll incidents of one sort or another. Given improvements in training, we don't see these much anymore, although they used to be common 30 or 40 years ago. At least two occurred in actual engine-out scenarios, not training incidents. One was an attempted single-engine go-around with five occupants in the airplane. Not too surprisingly, there were no survivors.

This, unfortunately, illuminates both the advantages of a six-place twin and its potential for a lethal siren song. In one accident, the non-instrument-rated pilot filled the seats with five people, took off overgross and crashed after encountering weather en route. All aboard perished.

Nothing in the accident pattern suggests the airplane has any outstanding gotchas. Although it's not hard to land, it does have marked control heaviness and if not trimmed correctly, the nose can slam down on landing. The Seneca is not known as a crow hopper after a hard landing, but we found a couple of such incidents that escalated to the point of collapsing the gear.

On the plus side, there were fewer inadvertent gear-ups and fuel exhaustion incidents than we would normally expect to see. This may be due to the Seneca's simple fuel system, which has only mains and no aux tanks to confuse things.



tric flaps was required because of a change to larger flaps, which resulted in high actuation forces. Amazingly, the Seneca never went out of production, even during Piper's troubled times in the late 1980s and early 1990s. Admittedly, production was down to a trickle (four were built in 1992), but it stayed on the price lists. And it's still there.

As part of Piper's transformation into New Piper, the Seneca was revamped yet again, being redubbed the Seneca IV and lately, the V. Relatively few changes were made, the most notable being new cowlings that result in higher speeds. Also, the interiors have been markedly improved in recent models. Along with these improvements come much higher prices: When the Seneca IV was introduced in 1994, it sold for about $425,000. A new Seneca V retails in the $899,000 range, with Garmin's G600 glass panel.

PERFORMANCE, LOADING

All of the Senecas offer fairly good short-field performance and sea-level fields of 3000 feet or so are no problem as long as both engines are turning. As noted above, however, later versions are better once airborne. Of all the light twins, the Seneca is among the most benign in the runway environment.

It's not a fast airplane, however. The normally aspirated early models cruise in the 160- to 170-knot range at 65 percent and 10,000 feet. Limiting speeds are low: 129 to 130 knots for gear extension; 138, 121 and 107 knots for 10-, 25- and 40-degrees flaps, respectively. One owner we spoke to highly recommends that speed brakes be fitted. The turbocharged models are, of course, quite a bit faster, especially when taken high. Owners report cruise speeds in the 180-knot or faster range in the high teens and low flight levels on typical fuel flows of 24 to 28 GPH.

The later Senecas are decent haulers. Loading the Seneca is about as easy as it gets. The fuselage is low to the ground, allowing rear passengers to climb on board easily and the rear seats are easy to remove. The two baggage compartments have weight limits of 100 pounds apiece. The generous CG range permits flexibility in seat selection and the later models were equipped with a clever visual slide-rule type CG computer, which makes loading a snap.

Owners tells us that early Senecas have useful loads in the 1200- to 1300-pound range while the Seneca II averages closer to 1500 pounds, with its higher gross weight of 4570 pounds. The latest iteration, the Seneca V, has regressed due to higher empty weight, with useful loads in the 1300- to 1400-pound range.

CABIN AND COMFORT

With its four-foot-wide cabin, adequate seating for all but the biggest of six people, and ample windows, the Seneca is long on comfort in comparison to most other piston-powered airplanes in this class. Although the club seating often yields a tangle of legs in the rear cabin, it's still appreciated by passengers, according to owners who have contacted us. Given its payload, the Seneca is a good five-person airplane with some baggage or a four-person airplane with a lot of baggage, stowed in either the nose compartment or behind the rear seats in the cabin.

Flight visibility from the cabin is adequate but not exceptional. The big windows are nice but up front, the large engine nacelles extend forward of the wing leading edge,

Seneca instrument panels have come a long way in 30 years. The originals, top, were basically the same as Cherokee Six/Saratoga panels, with lots of room for dual stacks and very busy. Compare that to the modern Seneca V panel, lower photo. The Garmin G600 suite leaves very little else on the panel, save for the mapcomms necessary to drive the displays.

blocking horizontal and downward visibility.

This, coupled with the wide-chord wing, makes spotting traffic below the airplane difficult. Heating and ventilation are typical Piper, with overhead and floor vents that provide enough air in most circumstances. Seats are also typical Piper, which is to say reasonably comfortable but with a tendency to sag and wear with use. Most owners recommend overhauling them.

MODS, OWNER GROUPS

Senecas, beginning with the II, came with fixed wastegate turbochargers. These are relatively simple and inexpensive to manufacture, but at the cost of efficiency as well as longevity and a tendency to overboost due to sensitive throttle response. Owners say a must-have mod is to fit the engines with Merlyn automatic upper deck air controllers. We've heard good reports about these mods and other owners tell us intercoolers can also help. (Contact www.merlyn-products.com or 509-838-7500.)

Due to the low speed restrictions, speedbrakes are a good investment, particularly in heavy traffic areas. Precise Flight makes a set for $4995. Contact: 800-547-2558. For Seneca I

Thanks to the much-appreciated rear door, loading a Seneca cabin is easy. The door sill is low to the ground and the door is large enough for cargo and passengers. A step stool is helpful for some pax.

owners who want turbocharging, the old Rajay is found on used models but no longer installed. TradeWind Turbines (806-852-7232) may have parts.

Seneca II and III owners can improve their turbos with Turboplus intercoolers in kit form. Contact www.turboplus.com or 888-514-4514. Although the takeoff and landing numbers on the Seneca are decent, those who want better performance can invest in Sierra Industries' R/STOL kit. Call for pricing and expect a long lead time. Contact: 888-835-9377 or www.sijet.com for more information.

Hartzell Propeller had an aggressive program to install three-blade propellers on the Seneca II and III. The STCs can replace either two-blade Hartzell or three-blade McCauley propellers. The three-blades offer better takeoff and initial climb and also eliminate the RPM/MP restriction applicable to the two-blade propellers. Contact Hartzell at www.hartzellprop.com or 937-778-4200. Although the props are still available, the deals may not be. Check with Hartzell to find out.

The Piper Owner Society supports Seneca buying and ownership and is a good general resource for Pipers of all sorts. Contact 866-697-4737 or www.piperowner.org. Another group is the Piper Flyer Association at www.piperflyer.org or 800-493-7450.

OWNER FEEDBACK

I have owned a Seneca II since 1978, when I purchased it new. It now has 3445 hours on the airframe and it runs great. The factory reman TCM TSIO-360 engines (TBO 1800) have 1405 hours on them, the compressions are still OK and they burn one to two quarts of oil every 50 hours.

At every oil/filter change, I add a can of AvBlend and a bottle of Lycoming additive. Oil analysis at each change reveals all to be normal. I'm the only pilot and there is no deferred maintenance—all SBs have been complied with except for replacing the aluminum battery cables with copper ones.

Annuals run $4200, unless there's a surprise. The most recent annual cost $5316. Aside from oil changes and repetitive ADs, unscheduled maintenance can easily run $3000 to $5000 a year. For example, I just had the wing rib SB done for about $3600. Hangar rental at Napa, California, runs $242 per month. Annual insurance for a hull value of $145,000 and $2 million smooth is $6464.

The panel is pretty much stock Collins Micro-Line, with the exception of a VFR Magellan SkyNav 5000 GPS and a marine radio. Airframe mods include nacelle-mounted recognition/taxi/landing lights and a full Robertson STOL kit. This STC replaces the manual flaps with full-span semi-Fowler electric flaps, spoilers (vs. the stock ailerons) and extended/drooped wingtips. It lowers the VMC and stall speeds by at least 12 knots and dramatically improves the short-field and single-engine capabilities. I installed Merlyn Black Magic upper-deck pressure controllers and they work as advertised, with five percent more power or five percent less fuel flow.

The cabin is quiet enough inside for normal conversation, but I installed a PS Engineering 1000 ICS in 1994 to improve things for my aging ears. I have only two gripes about the airplane itself: The landing gear extension speed is 129 knots indicated, mostly due to the flimsy gear doors and the prop clearance with stock two-blade McCauleys is only 10½ inches. The newer replacement three-blade props have the same 76-inch diameter, so there's no help there.

Although it's a good load-hauler, I'll drive my truck or pay somebody to transport bulky items. I am seriously considering getting a partner or trading the airplane for a recent manufacture high-powered composite fixed-gear single that has modern avionics and costs less to maintain and insure.

However, if the Draconian user fees go into effect as proposed, I may just say to hell with flying altogether. I just turned 60, have been flying for almost 40 years, 5000-plus hours, USMC, Vietnam FAC and so on, but I'm not that big of a curmudgeon. Still, it's no wonder that the numbers of active and student pilots continue to decline.

Gordon Evans
Via e-mail

As an MEI and former owner of a Seneca V, I have a lot of familiarity with the model. I purchased my

Although the Cherokees eventually got Piper's tapered wing, the Seneca did not and retains the slab-like original. (Photo: Peter Unmuth.)

1997 Seneca V in 2003 and sold it in 2006. My discussion encompasses only older Seneca Vs before the recent upgrade to Avidyne glass cockpits.

Expenses during that time amounted to approximately $64,000 in repairs, inspections and parts. Based upon the hours flown, this amounted to $80 per hour. Keep in mind that these expenditures were more than average due to the fact that the rental/training operation required 100-hour inspections in addition to annuals. Fuel amounted to about 25 gallons/hour. At $4.50 per gallon, this comes to an additional $112 per hour. Add to this the cost of engine, prop, paint and avionics reserve of about $50 per hour and the total direct operating costs were about $240 per hour.

The aircraft is very dependable and I was just about never grounded. There is the occasional failure of a magneto, alternator or vacuum pump. The aircraft is quite capable of operating on a single vacuum pump or alternator (VFR) as there is no lack of vacuum nor loss of electric.

The POH book speeds for Seneca Vs are fairly reliable as these aircraft are not that old. Due to turbocharging, the higher you fly, the faster you go. Many Seneca Vs have built-in oxygen. For me, flying in the highest non-oxygen levels (10,000 to 12,000 feet) resulted in about 185 knots at high-speed cruise on 13 to 14 gallons per side. Most people fly at lower settings for more economical fuel. You can substantially increase the range by using the long-range economy setting of 25 inches MAP/2200 RPM. This results in a fuel burn of only 9 to 10 gallons with a speed of about 155 knots.

Loading varies a lot on Seneca Vs, and the worst are those with boots, air-conditioning and deice. Generally, the aircraft are capable of flying three to four people with full fuel. Seneca III's have significantly higher useful loads—about 200 pounds on average.

Many of the older Senecas have club seating in the cabin. If you are redoing the interior and it is not currently club seating, you can modify it to that configuration with any Seneca model, except perhaps in a Seneca I.

There's no doubt that the Seneca is a very comfortable and reliable aircraft. Some of the drawbacks are lack of payload, range and space. Although it seats six, it is not comfortable with six adults. It's more like four adults and two children at most.

Jeffrey Feldman
www.daystarair.net

Letters

(continued from page 3)

the 795/6 vs. iPad apps. Also, those same subscription categories could be useful when reviewing the next latest and greatest box, portable or otherwise.

Good job...and thank you.

Jack Tyler
Jacksonville, Florida

...On the Other Hand

I have always respected what you do for us at *Aviation Consumer* and all it does for GA. But I was surprised after purchasing the Garmin 796, based in part on your video, of all the shortcomings you failed to mention.

Garmin clearly missed the boat on making this unit portable with the huge clunky cable that can't be unplugged. What was the point of having a battery if you can't mount the unit without the bracket and an enormous six-foot-long cable?

All of the mounting hardware is huge, bulky and hard to live with in a cockpit. The screen still is not big enough to view an entire approach plate, yet the unit footprint is similar in size.

The last issue is the unit does not tell you when the battery is completely charged and it takes a long time to charge a battery; this is very annoying. I will say that the resolution, functionality and ease of use are better than anything I have ever seen.

I hope you will mention some of the shortcomings of this new product so Garmin will make an attempt at fixing them. I am not particularly sorry I bought it, but I sure thought it would be a portable unit similar to the GPSmap 496, but with a larger screen. Garmin is almost there…

Chris Galloway
Via e-mail

Electroair Beef

Usually, I'm impressed by your publication's knowledge and reviewing capability. However, you had one statement in your review of the Electroair electronic ignition that is incorrect. (See October 2011 *Aviation Consumer*.)

The last paragraph in the "Bolt It On" section states that it's called a "wasted spark" system because it gains an efficiency advantage from advanced timing. While it is absolutely true that the electronic ignitions (such as Emagair, Electroair and Light Speed) gain efficiency due to variable timing, that has exactly zero to do with the definition of "lost spark" or "wasted spark."

These terms come from the fact that the system fires two plugs at the same time, one on the compression stroke and one on the exhaust stroke. Since firing a plug into the exhaust stroke accomplishes exactly nothing, it's called a "lost spark." It does, however, make the system easier to design and manufacture, and costs little in the way of electricity.

Full disclosure: I have a Light Speed EI and a Pmag EI on my homebuilt COZY MKIV with an O-360A2A and an Airflow Performance fuel injection system.

Keep up the good work.

Marc J. Zeitlin
Via e-mail

Good point. The Electroair system allows for advance settings up to about 38 degrees BTDC, so it fires before the conventional magneto does…meaning that the mag doesn't fire into the exhaust stroke, but it does fire into a fuel/air charge that's already well into combustion. It should therefore help with fuel economy.

FEEDBACK WANTED

CESSNA HAWK XP

For the May 2012 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Cessna 172 Hawk XP. We want to know what it's like to own these high-power 172s, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs 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 Hawk XP by March 1, 2012 to:

Aviation Consumer
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