May 2012
Volume XLII
Number 5

The consumer resource for pilots and aircraft owners

The Aviation Consumer®

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The Aviation Consumer

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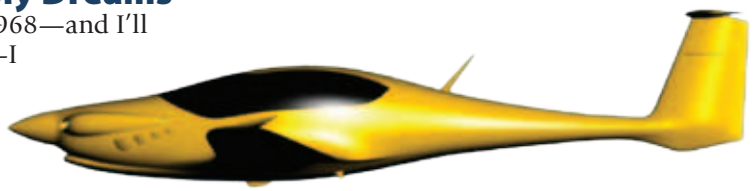
AVIATION CONSUMER (ISSN #0147-9911) is published monthly by Belvoir Aviation Group LLC, an affiliate of Belvoir Media Group, 800 Connecticut Avenue, Norwalk, CT 06854-1631. Robert Englander, Chairman and CEO; Timothy H. Cole, Executive Vice President, Editorial Director; Philip L. Penny, Chief Operating Officer; Greg King, Executive Vice President, Marketing Director; Ron Goldberg, Chief Financial Officer; Tom Canfield, Vice President, Circulation.

Periodicals postage paid at Norwalk, CT, and at additional mailing offices. Revenue Canada GST Account #128044658. Subscriptions: $84 annually; single copies, $10.00. Bulk rate subscriptions for organizations are available.

Postmaster: Send address corrections to AVIATION CONSUMER, P.O. Box 8535, Big Sandy, TX 75755-8535. In Canada, P.O. Box 39 Norwich, ON NOJ1PO, Canada. Publishing Agreement Number #40016479

The Airplane of My Dreams



During the summer of 1968—and I'll date myself here a little—I was putting the finishing touches on my first car. It was a 1956 Chevy rodded up with a 283, fuel-injection pistons, a Duntov cam, a 411 rear—the works. I could never get the fueling right and as was the custom in those days, I kept throwing carburetors at the problem until in a fit of supreme pathetic excess, I borrowed a friend's Edelbrock manifold mounted with three two-barrel Holly carbs. That did it. It also yielded gas mileage of about 8 MPG which, even in the days of 28-cent-a-gallon gas, was unsustainable on my summer-job salary. My next car was a Volkswagen. An economist would call this price elasticity response, but I called it sanity.

Ever since, I've had a taste for economy and efficiency which is why I felt right at home at Pipistrel's factory in Slovenia, where we visited in March. There, when we walked into one of the factory bays, I saw the airplane of my dreams: The Pipistrel Panthera. You'll be able to see it, too, at Aero in April. This comes close to my ideal airplane not because it's sleek—although it is that—or fast—it's that, too—but because it's efficient without giving up performance. At least on paper. The airplane is still in the prototype stage, so I can only judge it based on Ivo Boscarol's estimates. Pipistrel, which is known as a manufacturer of ultralights and light sports, plans to certify this airplane as a full-up Part 23 four-place aircraft, its first such product.

In developing this airplane, Pipistrel is doing something I wish more airplane companies would do but that most have steadfastly resisted. They're putting efficiency and economy as the lead bullet point on the design brief. Not cheap, not fast, not a plush interior, but the most knots for the least gas. In the U.S., we have somehow accepted that to go 200 knots, you have to burn 17 to 20 GPH and a lot more than that if you want to take along a second engine. Diamond challenged this notion with the diesel-powered DA42 and made significant inroads. It's still working the problem. (See page 20.)

If Pipistrel's numbers pan out—they're expecting around 200 knots on 9 GPH from a Lycoming IO-390—they will have raised the bar incrementally, if not by an order of magnitude. It's more of a leap in fuel economy, from 11.6 MPG in the Cirrus to a projected 22 MPG in the Panthera. Pipistrel plans a hybrid and pure electric version, too, but I'll be surprised to see either very soon.

Now anyone in the established certified aircraft industry will say, well, *we* could have done this, but buyers would never go for such a scrunchy little cabin. This raises several questions which I cannot answer. Given the world demand for oil and its price hardness, will airplane buyers finally resonate with the idea of a high-performance airplane optimized for efficiency? Will they be willing to give up something to realize that goal? The give up, as I see it, is cabin size. To achieve these kinds of numbers, you can't haul around a Cirrus-sized cabin and you won't be able to fit a grand piano in the baggage space, although you could carry your smithing anvil, because the airplane will have good useful load (about 1145 pounds).

Further, the seating position is likely to be reclined to keep the frontal area small to reduce drag. These would be give-ups I wouldn't even think twice about trading for fast cruise speed on lower fuel burns. But given the taste for Escalades and Yukons in the U.S., I can't answer for other buyers. Neither can Pipistrel.

As we were departing Slovenia for the Austrian border, I found myself fantasizing about owning an airplane with that kind of efficient performance and also wondering if you could stuff three Holleys onto a O-390. —*Paul Bertorelli*

Real Men Indeed

I enjoyed Coyle Schwab's article about Cessna 195s. I wanted to let you know that real women fly them also and I am one of them.

I learned to fly in a Luscombe 8E in 1980 and have always had a love affair with the 195. I would always ask to have my picture taken in front of beautiful 195s at Oshkosh and Sun 'n Fun. About 17 years ago, my husband

and I finally got our own N9895A. It is truly a part of the family.

Another great thing about the airplane is the 195 community. There is great fellowship and always a helpful hand when you need it. Thanks Coyle!

Tia Robertson
Via e-mail

Out of Focus

I was amused at your comment about overhead electricals in the Gippsland AirVan being too close to read. I experienced the same thing the first time I got into a Tobago. There were many overhead placards. I told the sales rep showing the plane I was too old to fly it as my eyes would no longer focus that close.

I later encountered a professional Sabreliner pilot who had bifocals in the top of his flying glasses so he could see all the overhead important stuff, a solution I would have never thought of.

Unrelated, but same issue: Most fuel totalizers I have installed and flown in many airplanes for many years are usually very accurate if installed with the transducers that came with them. The factories these days do a good job of K-factor matching right out of the box.

I had a Skymaster customer during my Riley days 20 years ago who kept a one-year record of purchases vs displayed used. His accuracy using 5.85 pounds per gallon the avgas company said was real computed out to 0.8 percent error for a year for two engines on a Shadin system. I would much rather have that than a couple of 30-year-old Cessna/Beech/Piper fuel gauges!

Bob Ferguson
Autopilots Central, Inc.

Corrosion and Engines

I had the ACF-50 corrosion treatment applied to my 1978 Piper Seneca II in 1991, and there is still a bit of weeping around rivets to this day. Maybe it was applied too heavily. Had a fuel bladder replaced in 2000, and there were no signs of corrosion in the wing.

I purchased the aircraft brand new in 1978, and it has always been based within 6 miles of salt water and has flown hundreds of hours at or below 1500 feet AGL over salt water as a Coast Guard Auxiliary aircraft, but always hangared.

The only signs of corrosion I've seen have been in the wheel wells and adjacent structures, but this could have been caused when it was temporarily ramped over a weekend at the old Fremont, California, airport, which was inundated with salt water from San Francisco Bay in the mid 1980s.

Regarding bulletproof engines, I'm on my third set of TCM TSIO-360-EB1Bs. The original pair went past the 1800-hour recommended TBO. The second set (factory remans) were replaced by Chevron (with only 250 hours on them) because of the 1994 fuel contamination issue. I had no problems with them. I used the Mobil One synthetic oil in them, but discontinued its use after learning (in your publication, and others) of its lack of lead scavenging qualities.

My current set of TCM factory remans have about 1760 hours on them, with compressions all in the 70s, oil analysis is clean, and they consume one quart of oil (AeroShell 15W-50) each every 50 hours. At every oil change, I also add (to each) one can of AvBlend and one bottle of Lycoming additive. Maybe that's overkill, but they are running sweet. I fly them conservatively, have never had any heating problems and have Merlyn pressure deck controllers. Those devices work as advertised.

Gordon Evans
Via e-mail

In your last issue, I see you really like the Lycoming IO-360-L2A and the Dynon Skyview. It got me thinking—could a person put the Lycoming on an LSA-type airframe like the Arion Lightning LS-1? Any ideas on that? With the 180-HP engine, light airframe, and Dynon Skyview, you could have quite a fast, two-place airplane. Or could you?

Russ Fagg
Billings, Montana

Well, maybe. This is sort of the idea behind the Carbon Cub by CubCrafters. It has a 180-HP CC340 engine, which is an ASTM-approved engine built specifically for the Carbon Cub. There's no horsepower limit for LSA, but larger engines do have a weight penalty and for some airframes, this makes them non-starters.

Then there's the 120-knot indicated speed limitation for light sports, the most roundly ignored number in aviation. In reality, the better way to go is with an experimental. Getting manufacturer approval to swap a 180-HP engine in an airframe designed for 100 HP—if that's what you have in mind—seems unlikely.

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Pipistrel Virus SW: Not Just Another LSA

That's mainly because it's blisteringly fast on very little gas. But it takes some glider pilot skills to fly well.

by Paul Bertorelli

Little white LSAs seem to flow from eastern Europe in such a steady trickle that we'll admit to thinking that one is mostly like another. Indeed, a peek under the cowl reveals the same engine (a Rotax 912) that yields unsurprisingly similar performance. But one that's a standout, at least in speed, in a undistinguished field is Pipistrel's Virus SW.

Pipistrel has gained some note for having run away with the NASA Green Flight Challenge three times with various iterations of its product line, including a purpose-made variant of its Taurus motorglider. All of the Pipistrel airplanes are unique for having evolved from gliders, so they have slender, exceptionally light fuselages, high aspect-ratio wing planforms and low drag.

Currently, there are five powered airplanes in the line, the Sinus 912, the Virus 912 and SW, which is a shorter wing version of the 912 and two versions of the mid-wing Taurus motorglider, one powered by a Rotax 503 and another by an electric motor with a rechargeable battery pack.

Pipistrel has gained note for having run away with the NASA Green Flight Challenge with various iterations of its product line

U.S. PRESENCE

Although it's gained a higher profile through the NASA challenges, Pipistrel hasn't enjoyed wide sales success in the U.S. According to Ivo Boscarol, the company's voluble and energetic founder, this is because Slovenia, where the aircraft are manufactured, lost its bilateral export agreements with the U.S. when the former Yugoslavia dissolved in 1991. Although the European Union countries do have these agreements, Slovenia joined the EU after they were negotiated, leaving the country—and Pipistrel—in a regulatory no-man's land.

"We will address this by opening a factory in Italy," Boscarol told us. For now, the airplanes are manufactured in Ajdovscina, Slovenia, about 20 miles northeast of the Italian city of Trieste. The new factory is expected to be operating sometime in 2015. In the meantime, it is possible to buy a Pipistrel through a third-party arrangement handled through Australia. Contact Pipistrel USA at www.pipistrel-usa.com or 213-984-1237 for the details.

Boscarol told us that Pipistrel benefits from being located in a country

with a long tradition of composite glider manufacture. As a result, it's horizontally integrated, doing all of its design and prototyping in house but relying on out-of-house vendors for major components, especially composite assemblies.

Final assembly and test flight is done at the factory, which is located at an expansive grass field on the edge of Ajdovscina. When we visited in early March, Pipistrel was finishing up installation details and about to fly the Virus SW with Rotax's new 912iS.

And by the way, the airplane's name derives not from some obscure Slovenian word that the company didn't realize had an unintended translation. It's quite intentional and a bit of an inside joke. When it began to find success with its airplanes, the Pipistrel staff would joke that would-be customers came back enthusiastically impressed after test flights and had thus caught the Pipistrel virus. The name stuck.

VERY LSA

Pipistrel aircraft are manufactured to the 600 kilo or 1320-pound light sport standard but are light enough to also qualify under the 475 kilo (1045 pounds) European ultralight standard. As a result, the empty weights of these models are among the lightest we've seen. The version we flew, which was moderately equipped in the European sport style, weighed 655 pounds empty for a useful load of 390 pounds. Under the U.S. limit, useful load would rise to 665 pounds, so yes, it's capable of lifting its own empty weight.

Pipistrel achieves this light weight because it builds its airplanes like gliders. The composite work is no thicker than it needs to be to carry the load and at every turn, components are small and lightened by material removal. Boscarol said Pipistrel counts its weight budget in grams and we can believe it.

When we poked our head into the cockpit, the first thing we thought of was Paul MacCready's Gossamer airplanes. Obviously, the Virus SW isn't quite that light, but it clearly has the feel of being ultra-efficient and minimal with structure. Although the wingspan, at 35.3 feet (10.7 meters) is longish, the cockpit itself is narrow and somewhat short from the seatbacks to the panel. The seats are of the lightest foam material—slings, really—whose rake is adjusted with a pair of straps behind each seat. The baggage compartment is accessible by prying loose some Velcro at the top of the seats and folding the seatbacks forward. Given the airplane's tiny size, these aren't easily accessible in the air, so if you need it during flight, you'd better have it out. The glareshield has some room for charts and maybe a tablet, but is actually a long reach from the seats. It could benefit from a tray or some other fixture to hold stuff. The doors are clear plastic and hinge

As to be expected, the Virus SW cockpit is small and spare. Light foam seat pads are supported by sling-like straps, lower photo. That's the baggage compartment behind the straps. Trim in this version consists of a sliding friction knob (behind throttle, middle photo), but this has been replaced with electric trim.

CHECKLIST

- ⊕ The Virus is flawlessly detailed and polished at every turn.
- ⊕ Speed is exceptional on low fuel flow; the best we've seen in any LSA.
- ⊖ Cabin is tight and the seats aren't the most comfortable we've tried.

The Virus can be fitted with either the 80-or 100-HP Rotax and soon, in the airframe in the background, Rotax's new 912 iS. Full-span flaperons, center and lower photo, can be set to negative 5 degrees to improve cruise speed.

upward, with clips to hold them up for ingress and egress.

As is obvious from the photos, the panel is not large, but is big enough for typical LSA avionics, say a Dynon 180 or Skyview. The Garmin 696 would fit, along with a radio of some sort. Operating under European ultralight rules, the Virus can have a bewildering array of options including something we can't have in the U.S.—a controllable pitch prop. The version we flew had an electrically controllable constant speed prop with a knob to set the RPM, a novel solution.

Rather than conventional ailerons, the Virus has full-span flaperons with two positive settings (9 and 18 degrees) plus one negative setting at 5 degrees. It also has manually deployable spoilers, just as on a glider, but rather than being in the cockpit sidewall, the spoiler control is on the ceiling between the two pilots. Flaperon circuitry is via rods, the elevator and rudder use cables. The rudder pedals are quite small and light, with toe brakes. Although the seats are fixed, the pedals can be repositioned fore and aft.

By the time the Rotax 912iS is shipping, the Virus SW will be available with three powerplant choices—the 80- or 100-HP Rotax 912 and the new 912 iS. Given the airplane's low drag, 80 HP wouldn't be too little power.

After examining the Virus airframe and eyeballing it head on, one thing is clear: The airplane has small frontal area and that's partly how it manages its speed on such low horsepower. And small frontal area means a smallish cockpit and that the Virus has. Getting into it requires a butt-first insertion, following by swinging the legs over the stick into the rudder well. The stick is short enough so that this turns out to be easy. But the door height is limited, so you have to duck in to clear your head. Once in, the seat position is slightly reclined and it's a surprisingly long reach to the glareshield. In fact, you can't reach it if you've got the shoulder harness snugged down. And flying in the Slovenian mountains with a turbulent burya blowing, snug is advisable.

The Virus's 912 requires the usual Rotax warm-up, but in the model we flew with Pipsitrel's Nejc Faganelj—equipped with an electric constant speed prop—you also have to set it to max RPM for takeoff, which is 5800. The takeoff roll is brisk and the initial climb rate is robust, given the light airframe and relatively high power-to-weight ratio. The low drag doesn't help much in climb, but the light weight does. When you level out in cruise, the airplane seems to leap forward all at once.

LOTS OF SPEED

As with all LSAs, the control forces are light, except in roll, which is a little heavier than we're used to. Those full-span flaperons catch a lot of air, but they don't have much deflection so roll isn't as quick as you might expect and the long wings seem to have noticeable inertia. Pitch is very light, but predictable, so we wouldn't call it twitchy. As it should, the pitch force gradient increases with control travel. Slow flight is different. The airplane is so slick that you can idle the engine and have cappuccino and biscotti while you wait for it to slow down.

Once in slow flight, there's not much objectionable adverse yaw to deal with; you can practically fly it feet on the floor. In the stall regime, it will do the usual LSA parachute mode, bobbling along in a high sink rate and not threatening a spin entry unless aggravated. Its spiral stability—the tendency to right itself to wings level in a hands-off banked turn—is quite positive. An excited phugoid seemed to damp back to the trimmed airspeed in less than a cycle, but given the turbulence, we couldn't judge it accurately.

Cruise flight is something else. When the airplane gets going, it sounds fast. The slipstream rushes past those clear plastic doors like you're going 150 knots. And we were close to it. With the Rotax at about

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70 percent power, we saw about 270 KPH indicated, or about 142 knots. Faganelj told us the fuel flow indicator in the airplane was reading too high so with no other confirmation, we couldn't confirm it. Ivo Boscarol says the airplane burns around 3.2 to 3.5 GPH at that power setting and speed and we'll accept that as a fair gauge. It works out to an impressive 40 to 44 NMPG, depending on where you want to put the throttle.

In normal cruise, the flaperons have a -5 degree position, which has the effect of reducing down force on the tailplane and sharply reducing induced drag enough to add several knots to the top cruise speed. Or, you can slide the power back and get just stupid range out of the thing, considering that with 26 gallons aboard, (100 liters) the endurance can be an easy bladder-busting 8 hours. Also back busting. The seats are, unfortunately, not terribly comfortable, in our view. We didn't have time to try the adjustable straps to change the seating position and that might help. Otherwise, two or three hours in the airplane would be plenty, thanks. If we owned the airplane, we would try to do some custom foam pads of some sort.

Throttled back, it's possible to lower the fuel flow to around 2.5 GPH at a speed of 120 to 125 knots or so. That's 10 hours and easily 1000 miles of still-air range. No wonder the Virus's stablemate Sinus airframe holds several long distance records and owners of both airplanes are flying them across major bodies of water as a matter of course.

"This is becoming quite a nice little niche for us," Ivo Boscarol told us. The company has sold about a dozen models that carry up to 250 liters—65 gallons—of fuel for an honest range of 2000 miles. With the new Rotax 912iS and its claimed 20 percent better fuel efficiency, it's possible to imagine one of these airplanes flying non-stop coast-to-coast in the U.S. for $350 in fuel. It might not be luxurious, but doable and luxurious aren't always the same thing.

EFFICIENT AIRPLANES, EFFICIENT FACTORY

When we set off to visit Pipistrel in Slovenia, we had in mind an Eastern European country churning out airplanes thanks to a skill base established by the Soviets during the Cold War. Well, not exactly. In fact, not at all.

Slovenia is the northernmost segment of the former Yugoslavia and is an interestng amalgam of Austria-Hungarian, Italian and Slovene influences. Pipistrel founder Ivo Boscarol jokes that his mother lived in five different countries while occupying the same house.

We're not sure if energy efficiency is historically baked into the culture or is a recent thing, but it's clear that Slovenia is a modern economy with regard to efficiency. It ranks ahead of the U.S. in GDP output for unit of energy, according to the World Bank.

After touring Pipistrel's factory, we can believe it. It's a new building built on the edge of Ajdosnina, adjacent to the town's large grass airport. During our tour, Taja Boscarol showed us features built into the building to make it energy efficient, including passive temperature control and windows oriented to warm the building during the winter and keep it cool during the summer. On the roof is a giant solar array with converters to feed the power back into the local power grid.

Technically, the building is self-sufficient, but the reality is that because many European countries have feed-in laws that require utilities to buy back alternative-source power from customers at subsidized rates, Pipistrel can earn enough credits during the summer to pay for cheaper power from the grid through the rest of year. Ivo Boscarol told us it does make the building efficient, but the investment was considerable and governments throughout the EU are dialing back such subsidies in the face of spiraling debt.

Ivo Boscarol, who has a passion for efficiency, applies that philosophy to his airplane designs. "My philosophy from the beginning was to take care of energy, " he told us. "I'm convinced the airplane must fly without the power of the engine so the needed power is only for takeoff and to climb and to use as less as possible energy for the cruise. This was maybe 20 years ago, not so important. But nowdays, everybody is thinking in the same way. " At Pipistrel, the thinking also extends to extreme light weight. Pipistrel empty weights are as light as any of the LSAs we have seen. Says Boscarol, "In Slovenia, plastic gliders were produced more than 20 years ago. And this know how...now in our factory has a long tradition. We are always using the latest technology to stay ahead of the others."

FLAPS AND SPOILERS

Of course, there's always a second shoe to drop when an airplane goes this fast on so little fuel and it's this: This puppy doesn't want to slow down and come down, either separately or at the same time. Viewed in the pattern from the ground, you can't help but wonder…what the hell is that fast little thing? From inside the cockpit, a typical approach speed of 60 knots (100 KPH) is nothing out of the ordinary for an LSA, but the Virus's glider-like approach profile is flat and if you're not tending to business, this airplane will float down the runway into the next zip code. When it hits ground effect, it skids along like an air hockey puck. So to keep it manageable, you set a drag value with full flaperons—

and that's not much drag—and dirty the thing up more with the top-wing spoilers. The preferred method seems to be to set the power at idle with flaperons full down, then modulate the spoilers to adjust the approach angle. A glider-experienced pilot will feel right at home, save for the fact that the spoiler lever is on the roof instead of the cockpit sidewall.

With just flaperons and no spoilers, the approach is so flat as to be almost alarming. And with neither flaps nor spoilers, you have to be prepared to bleed off speed in ground effect for hundreds of feet, then touch down fast and use the wheel brakes to get it stopped.

The Virus will eat up a lot of runway doing that. It's a fun challenge to fly, but still a challenge. If all that's still a little too boring, you can order the airplane in a taildragger version, too, which has even less drag and, says Taya Boscarol, is also 8 knots faster in cruise.Pipistrel is also developing a trainer version of the Virus called the Alpha Trainer. It will have beefed-up landing gear and other features aimed the training market and will be available later this year.

CONCLUSION

What to make of this thing? At typically equipped prices of $120,000 to $130,000, it's in the mid-price range as far as LSAs go. (The Alpha Trainer will sell for about $82,000 base.) You can spend more and get less performance.

This airplane reminds us of exotic super cars. Fast, nimble, nice to look at, but not high on comfort or luxury. For pilots who derive satisfaction out of squeezing the most knots out of a gallon of gas and actually being able to fly long trips on what amounts to pocket change, the Virus SW is worth considering.

But it'll take a certain mindset. If you could do a week on a motorcycle with your significant other and carry the stuff you need in a pair of saddlebags, you'll be nonplussed by the Virus's cozy cockpit and baggage area. There's room enough to make it work with a little organization. Otherwise, better think about FedExing the luggage.

Rotax 912 iS: So Long, Bing Carbs

With electronic fuel injection and dual-channel ECUs, Rotax claims the new 912 is 20 percent more fuel efficient than like engines.

by Paul Bertorelli

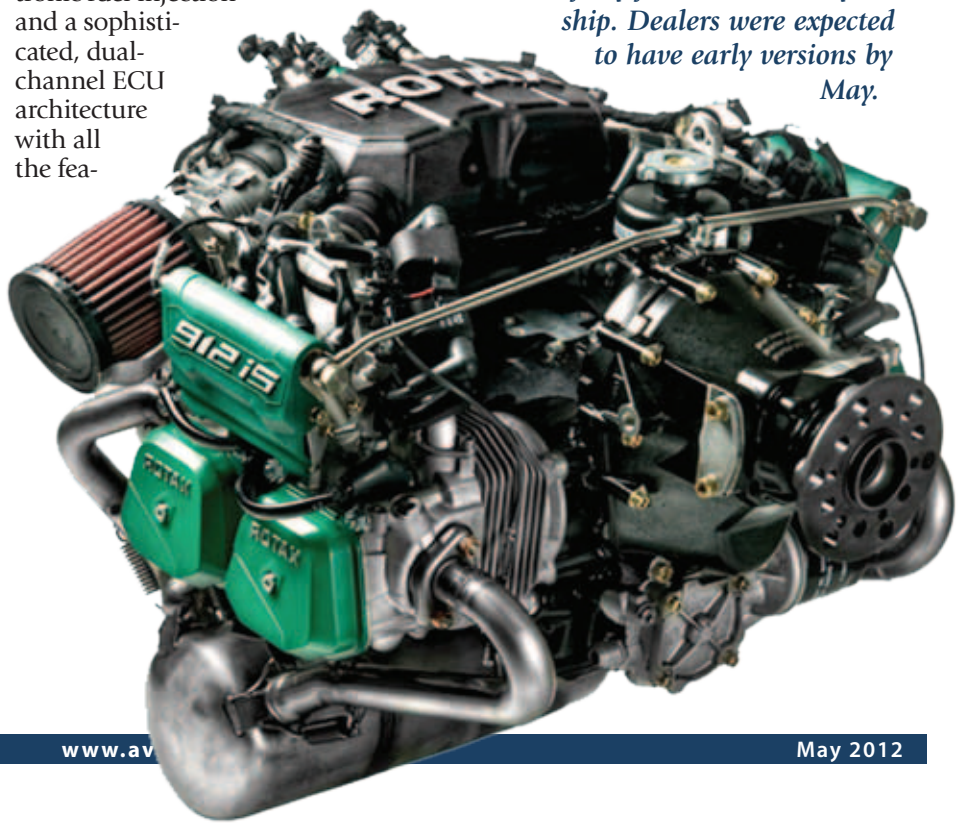
With its 912-series engines, Rotax owns the light sport propulsion market. But even though the 912s are technologically more advanced than the typical Lycoming or Continental engine, buyers have been wondering when Rotax would get around to fuel injection and electronic ignition. In early March, it did just that.

At the company's Gunskirchen, Austria, factory, it rolled out the new 912 iS, an "eco" engine with improved fuel economy, electronic fuel injection and a sophisticated, dual-channel ECU architecture with all the features you'd expect a modern aircraft engine based on automotive technology to have.

And like automotive manufacturers—at least those in Europe—Rotax is worried about the impact of emissions on its core business of producing recreational engines, so the 912 iS is being pitched as having lower CO and CO2 emissions thanks to fuel economy improved by as much as 21 percent.

It was clear during the factory tour that Rotax wasn't launching a trial balloon. The engine emerged fully formed, with the test production line

The 912 iS, below, emerged from Rotax fully formed and ready to ship. Dealers were expected to have early versions by May.



already running and at least a dozen aircraft—LSAs and ultralights—fitted with the new powerplant. The company said they've been flying a prototype for some three years.

A SOLID REP

In introducing the 912 iS, Rotax is building on a solid reputation for the 912/914 series engines, of which about 40,000 are in the field. These engines, in certified, LSA and experimental applications, have delivered good service and we hear very few significant complaints about them. That's not to say they have a pristine record, since Rotax had its own go-around with crankshafts last year. But on balance, the engines have been impressively trouble free.

Rotax resisted the urge—if it had any—to start with a clean sheet on the 912 iS, so it uses the same core four-cylinder, water and oil-cooled core. The cylinder heads have improved cooling flow to provide better leaning and detonation margins, the crankcase has been beefed up some and there's improved oil scavenging. It's the outside of the engine that's changed the most.

Gone are the two Bing altitude-compensating carburetors, replaced by a large plastic airbox that contains a sensor array and routes the induction into four top-down pipes running to each cylinder. The engine has a single mechanical throttle valve located upstream of the airbox.

For fueling, Rotax went with port-type fuel injection rather than direct injection. Although direct injection would have offered the option of precisely tweaking the fuel charge, Rotax evidently thought that the 912's combustion patterns were sufficiently well-shaped as to not benefit much from a redo of the head and cylinders that direct injection might have required. It seems to have taken a "good enough" approach to the engine, which, in our view, makes sense. Why overreach and risk service issues when shorter steps will get almost as far?

But that's not to say Rotax didn't exercise a little creativity. Rather than just one electronic fuel injector per cylinder, it has two, mounted side-by-side on top of each cylinder. Rotax said this was done for redundancy, but we wonder if this system was also engineered to accommodate a larger engine. It's not hard to imagine doubling the scale here and having an economical, sophisticated 200-HP engine to compete with Lycoming's O-360 line.

REDUNDANCY

Since Rotax plans to certify the 912 iS, it has built in the required redundancy in ways consistent with its own philosophy on engine design. The fact that it's using automotive-grade electronic injectors bodes well for reliability, since these components have been refined to the once-in-a-million failure probability.

The injectors are supplied via an automotive-style common rail system pressured at 3 bar (43 PSI) by a pair of electric fuel pumps. Both pumps are in a common metal housing mounted on the firewall. Either of the two pumps is sufficient to operate the engine.

Ignition is provided by two direct-fire type coils per side, with two automotive-type spark plugs per cylinder. The coil outputs are split between cylinders, so either one can run two cylinders on its side of the engine.

The 912 iS has dual ECUs provided by Rockwell Collins. Rotax seems to have used a slightly different strategy in setting up its ECUs. There are two modules—both housed on the same mount—labeled Lane A and Lane B. Lane A is the default, with Lane B running in constant standby and able to run the engine entirely should Lane A fail. The two ECUs are virtually identical, except that Lane B lacks some of the sensor inputs that Lane A has.

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Pipistrel's installation, top, has a water radiator on top of the engine to reduce drag. The 912 iS has an automotive-type common rail fuel injection system, center photo, with two injectors per cylinder. The rail manifold hides behind the green cover. Two electric fuel pumps in a single housing, lower photo, pressurize the system to 3 bar or 43 PSI. Either pump will run the engine.

The comm sticks on this Archer are aftermarket replacements with the same profile as the originals. The pair costs about $800.

Aircraft Antennas: Worth a Close Look

The most thankless system on the aircraft, neglected antennas create a host of problems. Upgrading could pay off with increased performance and styling.

by Larry Anglisano

Geeks to the core, we've always had an odd fascination with aircraft antennas. Maybe it's our ham radio background or the fact that airborne antennas are a critical means of communicating, navigating and reporting our position to the ground. Truth is the average pilot rarely gives these critical antenna systems—fondly slanged "antlers" around the shop—a second thought. That's until the avionics shop suggests a high-cost replacement option or they've deteriorated to the point of creating a system failure.

Antenna work can be an expensive endeavor while fabric and composite aircraft could make the invoice even more shocking. Here's an insider's look at antenna maintenance, tips for upgrading ancient ones and some of the symptoms associated with deficient antennas.

CHECKLIST

- New antennas offer gains in radio performance
- Modern antennas offer cosmetic appeal to older airframes
- Antenna work is expensive and critical to performance

TOUGH LIFE

Antennas live hard lives hanging out in the slipstream and braving the elements. The ones mounted on the bottom of the airframe get additional abuse from exhaust stack grime and vented engine oil. Getting on your back and degreasing these antennas isn't any pilot's idea of a good time, so it rarely happens. Still, it's a critical step in increasing the lifespan of antennas. It's a dirty job but someone needs to do it.

The other problem associated with antenna neglect is the potential for airframe corrosion. As the seal between the antenna's base and the skin of the aircraft breaks down, it's easy for moisture to work its way between the antenna and skin. Before long, corrosion sets in and we all know that's a bad thing. We're finding that removing some antennas to clean the bond between the base and the skin is a worthwhile effort to head off corrosion and to increase performance.

Many new fiberglass antennas are treated with an anti-static coating. This invisible topcoat helps prevent static build up, but it eventually wears off and you might notice the annoying static in the comm radio reception when you fly in certain weather conditions.

You'll know when an antenna has reached the end of its life when the fiberglass' coating wears off, revealing an brownish core and perhaps sizeable cracks and peeling in the fiberglass itself. A symptom common to worn comm antennas is scratchy background noise in the radio receiver. Transmit and receive range performance might suffer as well.

An expensive issue that's common to aged aircraft is antenna signal cable replacement. In many cases, the cabling that attaches the antenna to the radio could be as old as the aircraft and subject to deterioration and wear from years of rattling around. Consider, too, that old coaxial cable is likely non-shielded RG58 (or older) and could be the source of interfering noise that's worked its way into your radios and audio system.

The standard practice these days is to install twin-shielded, low-loss cabling. But cable replacement often requires sizeable teardown of interior components—a chore that's certain to increase the invoice. Still, you'll need to understand that this cabling

is half of the antenna system. Replacing just the antenna might solve half of the problem. When at all possible, replace the cable and the antenna at the same time.

Some installation may require your installer to relocate antennas to respect interference issues. This is common with active traffic systems and for the remote sensor module (RSM) that's part of the Aspen PFD system. Use this as an opportunity to do some antenna upgrading, as the labor you're doing anyway is such a large part of antenna work cost.

COMM, NAV AND WAAS

Contrary to common belief, three items are separate antenna systems. Each comm radio in the aircraft has a dedicated comm antenna. While it is possible for two radios to share a single antenna through a splitter, this is a rare and expensive interface. With the exception of the Beechcraft Flying-V antennas, navigation antennas have nothing to do with communication antennas.

Comm antennas come in different varieties including an inexpensive metal rod whip design to pricey, high-speed, fiberglass models appropriate for turboprops and jets. A proven and popular design for replacing older Cessna OEM applications is the CI121-series antenna made by veteran antenna manufacturer Comant Industries. This is the fiberglass whip antenna you'll see mounted on top of the fuselage of single-engine Cessna models.

For the underbelly mount, it's the CI122. This is a bent-whip antenna with fiberglass base and metal rod element. Expect an invoice of around $800-900 for such replacement, including labor. (Newer Cessnas use similar antennas but with a noticeably fatter and beefier base that retains the classic top of cabin mounting.)

For replacing original equipment comm antennas on Piper models, antenna maker ITT Corp. offers the DM C70-series antennas. These are staggered on the back of the fuselage and maintain a handsome and stock appearance. The replacement cost about the same as the Cessna.

It's common for a single navigational antenna to feed both nav radios in the aircraft through a coaxial splitter. The antenna might be a 'whisker'-type dipole antenna or heavy-duty blade set (see sidebar for more on this upgrade). Nav antennas live especially tough lives since their often installed at the top of the vertical tail in a fairing where they build corrosion. Once these antenna deteriorate you'll notice decreased nav radio sensitivity and the ability to receive a VOR station from a sizeable distance.

Replacement nav dipoles come in all metal or fiberglass coated models and installation effort is often complex when it requires accessing the top of the tail. Ever see that small V design antenna that sits aft of the windshield on some Piper models? That's a glideslope antenna that can be eliminated by going with a dipole tuned for glideslope.

If you haven't yet upgraded your legacy Garmin GNS430 or 530 (or G1000) to WAAS you'll need to pay your shop for antenna installation effort. This can either be minimal or a major blow to your checkbook. While a new WAAS antenna comes

YA NEED SOME METAL ON THAT

Most antennas require a specific ground plane (the ground side of the antenna) and bonding to a metallic surface for proper performance. For example, GPS/WAAS antennas usually require a minimum ground plane radius of 7.5 inches around the radius of the antenna. For any aircraft, that means proper preparation of the area beneath the antenna, as on this Aspen RSM sensor.

Antennas on fabric-covered and composite aircraft need these same ground planes, which poses a unique challenges that can alter performance. Custom fabrication of a ground plane using heavy-duty foil tape or other metallic surface is usually necessary. This and just having enough structure to attach to limits available antenna locations. LSAs can be a real challenge. Here, a new Legend Cub carries a comm antenna, 406 ELT antenna and a GPS antenna in close quarters.

Advanced Aircraft Electronics in Albuquerque markets a unique line of antennas aimed at composite and fabric aircraft that, according to them, don't require ground planes. These antennas are designed to operate with modern radios and the company says they'll last the life of the airframe. Further, one antenna model works for communication, navigation and ELT (you'll still need to install three antennas in the aircraft, but they are all the same design). These antennas will apparently work in metal airframes when a plastic or fiberglass wing tip or similar plastic component has been available to provide the mounting structure. There's no FAA approval on these antennas, so additional approval for certificated aircraft is likely required.

Replacing fragile rod-and-ball transponder antennas with a fiberglass blade is worth the investment.

with the factory upgrade of the GPS unit the shop still needs to access the old GA56 antenna, change the RF connector and install the new antenna. If the old cables aren't twin-shield, low-loss cable, then that needs to change as well.

Performing a WAAS upgrade to the Garmin GNS units in Cirrus could require additional fiberglass work, although some installers are working around this with alternate mounting locations. Still, the antenna placement for WAAS units is critical and a shortchanged installation could yield performance issues that might degrade the WAAS signal when you need it the most.

The good thing about making the transition from a legacy GNS to WAAS GNS is that the GA35 antenna drops in the same mounting holes as the old GA56. Shops leave their cutting tools in the drawer for the project, although the WAAS antenna has a slightly larger footprint.

L-BAND ANTENNAS

Transponders and DME are often referred to as pulse systems. The two systems operate within the same frequency band, so they use the same style (but separate) antennas. You have two options here: the lower-performance and somewhat fragile rod-and-ball antenna, or a more durable and higher-performing fiberglass blade. You want to keep a good eye on these antennas because they're out of sight on the dirty belly of the aircraft.

As with any underbelly antenna, they are easily contaminated with grease and oil. For some that were installed too close to an exhaust stack, they might even melt. Classic is the rod and ball antenna that gets wacked with a washing brush by an unsuspecting line guy—breaking it off the airframe. Suddenly your transponder or DME is inoperative. It pays to remind these folks to be extra careful during belly degreasing and incorporate an antenna check during preflight walk-around.

Unless the antenna is in remarkable condition, we think it's a wise idea to replace the transponder antenna when upgrading to a new transponder. Deteriorated transponder antennas (included cabling) contribute to unreliable transponder

continued on page 31

ACCESSORIZING A HANDHELD IS SIMPLE AND SMART

Adding an external antenna for your portable comm may seem belt-and-suspenders, but it has merit. Most panel-mounted radio, make at least 10 watts of power. Portable radios don't come close to that kind of power output, and a small antenna trapped inside the cockpit further cripples their range. With an external system, you can communicate nearly as far as you would on your panel-mounted radio.

One option is an inexpensive antenna on the belly of the airframe that's dedicated for portable use. The only real cost here is opening the interior to mount the antenna and run coaxial cabling to a convenient location in the cockpit. This could be a panel-mounted antenna jack or just a cable coiled up in a map pocket ready for quick connection. A simple metal element antenna might cost as little as $100 while a higher-performing fiberglass whip costs closer to $200. If you're removing a Loran-C system, it's often easy to use the Loran's antenna position and reuse the coaxial cable for the handheld.

It's also possible to install a splitter in line with one of the existing primary comm antennas. The splitter assembly has a plug-in for the portable that once connected, disables the comm radio in the panel. We're not fans of this practice as it opens the potential for panel-comm failure down the road.

Most modern portable GPS navigators have solid enough receivers that they don't benefit much from an external antenna. If the portable is the only GPS in the aircraft, as you find in many LSA models, you might want to add an external antenna. The Comant ComDat line of GPS antennas are compatible with a wide variety of portable GPSs. Comant also makes a line of dual-purpose combination antennas that serve double-duty as GPS and comm antennas, or GPS and XM.

Angle of Attack: Now Available for Everyone

So long as you don't require flap-position sensing, an AoA system is a minor alteration. But the FAA may relent to significantly more integrated systems soon.

by Jeff Van West

We're told that somewhere there's an Israeli air tactics manual that contains the line, "Speed is life." Good thinking for fighter pilots, but down here in the more mundane world of GA, it's probably more appropriate to say, "Angle of attack is life."

AoA sensors in GA airplanes are as rare as $4 avgas, so we use airspeed as a proxy to get the right angle for approach and landing. One problem with airspeed is that most of us only know the right airspeed for gross weight at sea level on a standard day. If we're light, we tend to come in fast and curse the floating landing that ensues. The other end of the problem is getting too slow, or pulling the plane into a high-g-loading stall far above the wings-level stalling speed. The result when at low altitude can be grisly.

Oddly, there have been at least four companies offering reasonably priced AoA detectors for over 15 years. They're flying in experimental aircraft and plenty of certified birds. Some new interest from the FAA in the safety payoff of AoA indicators may shake things up, even though there hasn't been a policy change yet.

ALPHA SYSTEMS

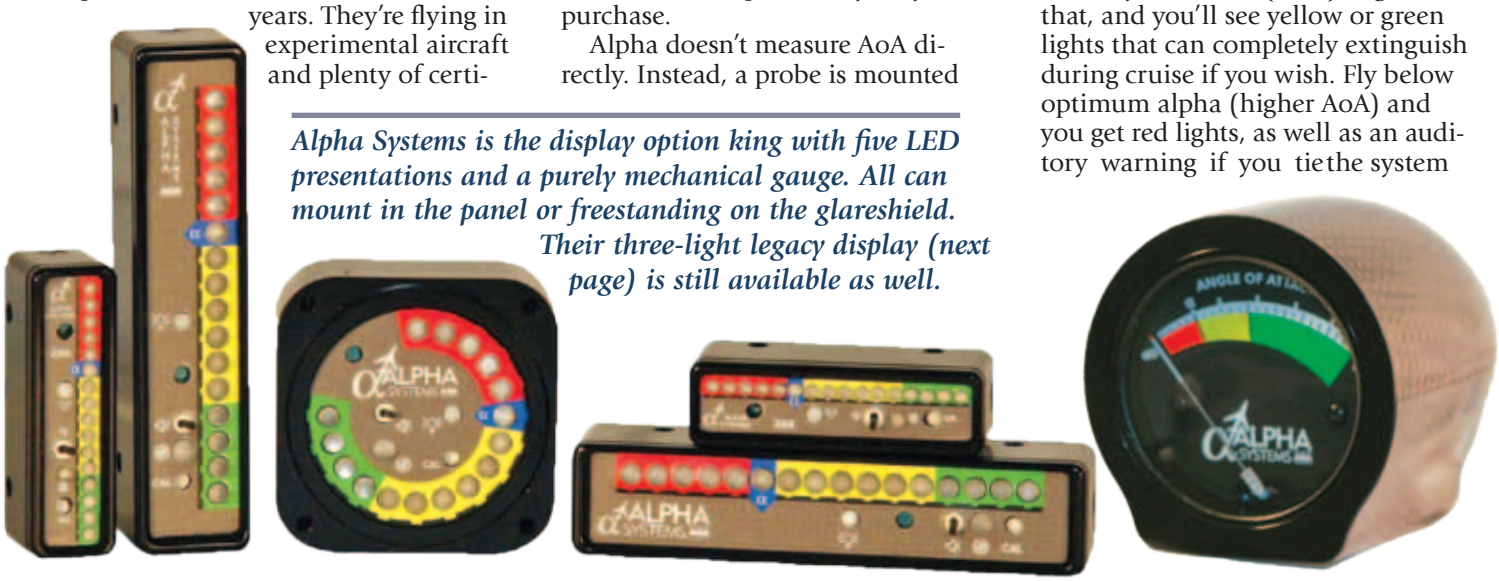
Mark Korin is president of Depot Star, Inc., which operates Alpha Systems to manufacture and sell a wide range of AoA systems. He's not certain how many of his systems are flying in aircraft, but he's confident it's over 3000—about 40 percent of which are in certified aircraft as sophisticated as King Airs.

In December of last year, Alpha received a letter from the FAA stating unequivocally that their system is a minor alteration and can be installed by any willing A&P without STC or 337 form. It's just a logbook entry. This isn't new policy, so much as clarification so no overzealous FSDO demands a field approval. A copy of the letter accompanies any kit you purchase.

Alpha doesn't measure AoA directly. Instead, a probe is mounted at least two feet outside any prop tip and at least six inches behind a wing leading edge. The probe is similar to a pitot tube in that it measures pressure at two points. As AoA changes, these relative pressures change and a relative AoA is computed. Once calibrated, the system can display your relative AoA compared to "optimum alpha," which is essentially L/D_{max}, or your maximum lift potential. (Please no detailed aeronautics letters on this. It's close enough that it works.)

The probe typically mounts in an inspection cover, and the kit comes with a blank to cut and fit for your aircraft. There are also pre-made plates for common sized openings. From the probe, two pneumatic lines run to a transducer, which connects to a cockpit display. Alpha offers these in round, horizontal or vertical presentations that can be mounted in the panel or up on the glareshield to keep them in view during landing. Korin says the glareshield is the most popular option.

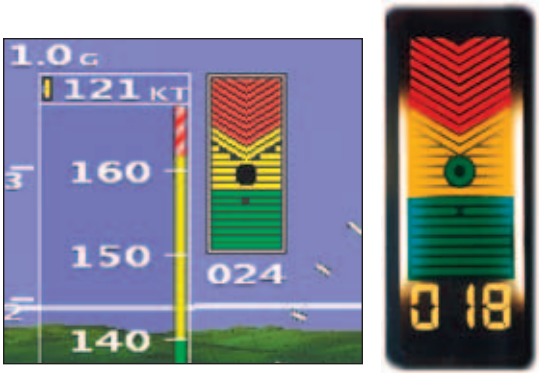
Optimum alpha shows as a blue LED. Fly at a lower (safer) angle that that, and you'll see yellow or green lights that can completely extinguish during cruise if you wish. Fly below optimum alpha (higher AoA) and you get red lights, as well as an auditory warning if you tiethe system



Alpha Systems is the display option king with five LED presentations and a purely mechanical gauge. All can mount in the panel or freestanding on the glareshield. Their three-light legacy display (next page) is still available as well.

CHECKLIST

- Even without flap-position sensing, there's a tangible benefit.
- Simple installs with many options.
- FAA policy may be changing to allow even more integration.



Advanced Flight Systems derives AoA from ports drilled in the top and bottom of the wing. Their Pro and EFIS system display AoA numerically and with color-coded bars. There's also a simple, eight-LED option.

to your audio panel. There are multiple options for how you prefer the light and audio warnings. For those who don't have an electrical system, or don't want AoA to rely on ship's power, there's a purely mechanical option with a needle gauge. You'll forgo any flashing or spoken warnings, however.

The electrical system is also easier to calibrate. Once installed, you push a button while the aircraft is stationary to get a baseline. Once in the air, you'll fly at low RPM and the highest pitch you can maintain that holds level flight—that is, any increase or decrease in AoA yields a descent. If done correctly, this is optimum Alpha regardless of airspeed or power. A final set point is made at cruise. The mechanical system must be flight-tested several times, adjusting the probe angle with each flight to match the correct needle position with optimum alpha in flight.

From there on, you'll see exactly where you sit relative to optimum alpha, which is also roughly 1.3Vs, the ideal approach speed automatically corrected for your current weight, density altitude and so on.

Well, almost. Aircraft with flaps approach at 1.3Vso—flaps out—not 1.3 Vs. The Alpha system earns its minor mod status because it doesn't tie in to the flap system. This means it reads incorrectly with flaps extended. Korin says this is a non-issue because flying at optimum alpha per the gauge means you have a buffer over the flap-out optimum. You can also correct mentally. Fly at the same low-speed, high-angle, no-sink you did during calibration but with flaps out and note how many LEDs into the red you are. This is optimum alpha with flaps extended. It will vary aircraft to aircraft, but always be the same for a given plane.

The Alpha system ranges from $700-$1300, depending on your display, audio and mounting choices. A heated probe is an extra $125. Pressurized-aircraft kits start at $2000, and dual-display options for two-pilot cockpits are available.

The Alpha Systems probe mounts in an inspection cover at least two feet outboard of the prop (below). Another display option is the original, a.k.a. legacy, display (left).

Korin also tells us that the technology to incorporate flap position is there, if the FAA ever lightens up on it. He also says he's in some product discussions he can't disclose just yet. Perhaps an option to display AoA directly on the PFDs of equipped aircraft? We wouldn't be surprised.

ADVANCED FLIGHT SYSTEMS

Rob Hickman's company, Advanced Flight Systems, is a top name in the experimental and LSA world for EFIS (glass-panels). They also make standalone AoA systems, although only a few are in certified mounts. These owners have 337s, and the accompanying scars from battling their local FSDO.

Advanced's system also uses differential pressure, but with two .04-inch holes in the wing at about 20-percent wing cord. These also run to a transducer and can be displayed on a simple, eight-LED bar (Sport model), a sharp LED display with both relative angle and a digital readout of actual angle (Pro model), or directly to one of their PFDs. Hickman says that about 70 percent of their EFIS buyer opt for AoA. "It's a very popular option."

As with the Alpha system, lights extinguish in cruise and illuminate as angle increases. Get past 15 degrees nose up and an audio callout says, "Angle. Angle. Push."

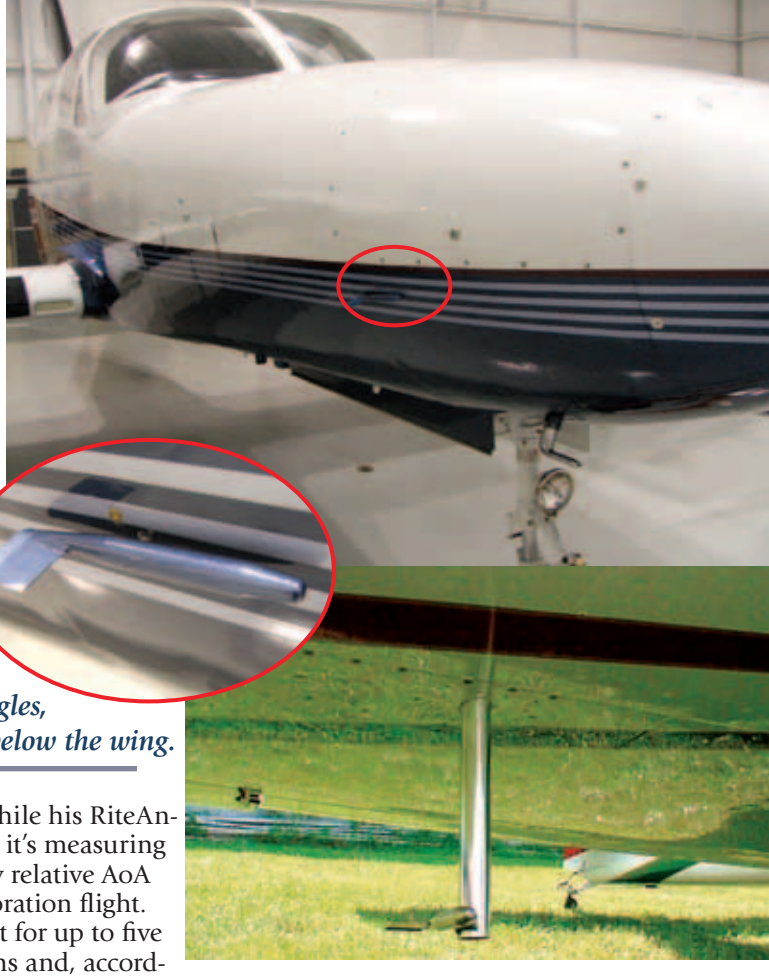
Advanced has a flap sensor, so you calibrate it for both a clean and an approach flap setting. The display then corrects AoA automatically with flap extension. Hickman says that once flaps extend past an approach setting, the resulting AoA change is minimal in most cases. The Pro system also has a gear-warning system built in.

Flap integration makes certification trickier, but Hickman says they are pursuing it with the increased interest in AoA. Hickman told us there are some systems out there in 182s, Caravans and Bonanzas, but "We don't exactly know [how many] as customers try and keep it quiet."

The Advanced system is $1490 for the Pro system and $890 for the Sport. Adding it to their EFIS is $790.

RITEANGLE

Elbie Mendenhal is a retired airline captain and takes the pivoting vane approach to measuring AoA as used on most airliners. While his RiteAngle system looks like it's measuring actual AoA, it's really relative AoA dependent on a calibration flight. RiteAngle can correct for up to five separate flap positions and, according to Mendenhal, can handle speeds up to .78 mach.



RiteAngle uses a free-swinging vane that must sit in clean air. For singles, this means a mast below the wing.

The vane must be mounted in clean air, which means the nose on pushers or twins and at least 13 percent of chord length below any wing. That works out to about seven inches on an RV, but a full foot on a PC-12.

Can you mount it on a PC-12? Well, someone did, but had to take it off when the feds found out. Flap integration was again the issue. RiteAngle has a couple of legitimate (if unusual) STCs, including the Helio Stallion and the Cessna 421. Unfortunately, the original paperwork on the 421 was lost and there's only one flying. There are also a few successful 337s.

Cockpit display for the RiteAngle is a simple LED bar, with the warning lights set for five percent under 1.3 Vs for the current flap position. There's a connection for an external buzzer or audio panel integration. The company website shows four products, but really only two apply to GA. The Buddy system is $400 and has no flap sensor or correction (and is more likely to succeed on a 337). The Elite system is $750 with the flap sensor.

Mendenhal told us he has a system he hopes to get FAA certification for that uses noninvasive ways of sensing both manual and electric flaps. He hopes this will be ready at Oshkosh and will retail for under $1500. Given the history with the FAA on this, we'll reserve comment until we see that complete.

INAIR'S LRI

InAir's Lift Reserve Indicator (LRI) was one of the first AoA options on the market, and is largely similar to Alpha's mechanical system, with a mechanical indicator and no flap position correction. While this basic system hasn't evolved much since its

CONTACTS

Advanced Flight Systems
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Alpha Systems
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InAir Instruments
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www.liftreserve.com

RiteAngle
360-260-0772
www.riteangle.com

creation, its price of $450 makes it a relative bargain.

InAir's owner, Al Mojzisik, tells us he's had a letter from the FAA similar to Alpha for over 10 years, so this system is a minor alteration. He adds that he'll refund any system that gets a kibosh from the local FSDO.

TANGIBLE BENEFITS

We said it back in 2008 when we last examined these products and we'll say it again: It's surprising that there are so many options for what seems like such an esoteric product. Given the options and the fact that it can be a minor install, it's also somewhat surprising that it's not more common. We've heard that an ASTM is in the works for AoA systems. We couldn't find out details by publication time, but this could help pave the way for more integrated systems in certified aircraft.

For certified aircraft, we like what Alpha Systems is offering. The kits are complete and appear to be well-supported. The standard-sized inspection cover mounts and instrument-hole options should make for a simpler install. We also like that the logic in the transducer may allow for flap integration at a later date. For simply a mechanical system, InAir is cheaper, but their gauge won't fit a standard instrument hole if you don't want it on the glareshield.

For LSAs and experimentals, our nod is to Advanced's Pro system for its combination of low-profile installation, a great display and flap/gear integration.

Is the system worth the expense? We think so. There's more to look at here than just some extra protection against becoming a stall-spin statistic or floating a bit on landing—although that may be enough for many pilots.

We had an LRI system in a Mooney for years and routinely had approach speeds lightly loaded that were under stall by the airspeed but with plenty of lift in the bag. Every landing at the right speed and descent rate is that much less wear and tear on brakes, tires and landing gear. If you spend some time, you can get just the right angles for best rate or best angle of climb as well. That's all for an investment of under $1500 for most light aircraft. We think that's a pretty good deal.

PILOT ACCESSORIES

Pilot Logbook Apps: LogTen Pro Does It All

From a frothing sea of options, LogTen Pro easily rises above all other logbook apps. Safelog's app/web combo works well. Owners may want AvConnect or Zululog.

by Jeff Van West

There's nothing wrong with a paper logbook. It's simple, cheap and satisfying to use. But digital logbooks automatically back up, total your time for insurance, an 8710 or duty limits, and, if it's on a mobile device, are always with you.

We were shocked how many options there were for logging via an app, either as a standalone solution or paired with desktop versions. Luckily, a few solutions distinguished themselves from the pack.

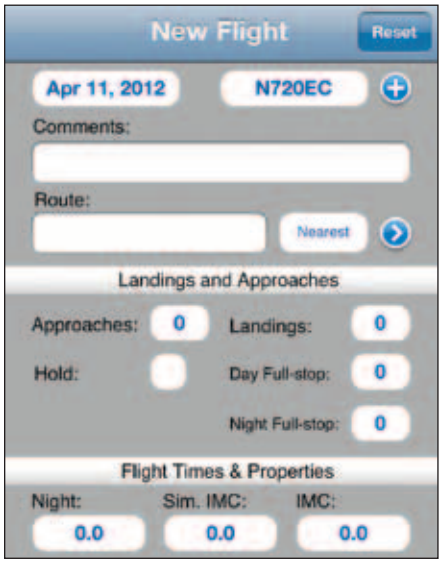
IOS? GO LOGTEN PRO

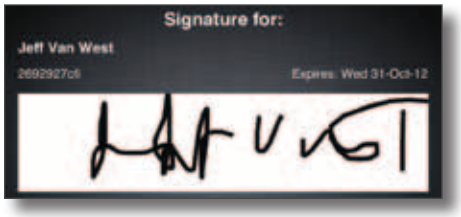
LogTen Pro exists both as an iOS logbook and a desktop program for the Mac. What we found impressive was that the iOS apps are almost as burly as the desktop version—better in some ways. The two obviously can synchronize, but it's not necessary, especially with the big-screen interface of an iPad.

The heart of LogTen Pro is the Radar page with your total times. The Radar is astoundingly customizable. Want a special field for currency in tailwheel, full-stop, night landings in that Beech 18? No problem. For the professional pilot, there's both time remaining for duty limits and predictive warnings for scheduled flights (downloaded from your airline).

Recording flights is sped by favorite aircraft and airports and quick duplication of times to save retyping the same information repeatedly. The flight time list is customizable so you can hide duty times if you don't log it, but add approach types or water landings if they apply. There are also optional business fields for tax purposes.

MyFlightBook offers quite a bit for a free service, with favorite aircraft, flight timers and GPS detection of routes and landings.





What makes the app work as a complete logbook solution, however, is built-in reporting. You can generate tax or time-in-type reports on the iPhone and upload them the company's website. A link pops into your email to download the report on your real computer for printing or filing. To help organize reports, there are options to group flights in specific trips.

The app has the unique feature that after abuse from your local CFI, a signature can be entered right on the iPad or iPhone. Noah Liberman, President of Coradine (which created LogTen) told us these signatures have passed FAA muster for checkrides. In fact, the FAA requested a white paper from Coradine on digital signatures.

The iPhone version is $30; the iPad version is $60. A universal that runs on both is $80, but that's really only useful if the two devices both sync with the desktop software. That software requires Mac OS 10.7 (Lion) and is an additional $99. Coradine can take an existing digital logbook file or spreadsheet, convert it and send it directly to the iPad without the need for desktop software. This mean you really can make the iPad your one and only logbook.

APP ALTERNATIVES

If you don't have an iOS device, or you want an app that pairs with desktop software for Windows, you have three good options: SafeLog, Logbook Pro and mccPilotLog.

In 2008, we picked Safelog as a top choice for logbook software. We're sticking with that, with one caveat. Starting on the app side, Safelog works for multiple platforms with essentially the same interface. The app automatically learns your favorite airports and aircraft and offers them your quick entry. Like LogTen Pro, there is one-tap duplication of times, auto-entry of times and options for detailed recording of IFR work. Currency can be seen at a glance.

Safelog requires a desktop or web-based account and downloads your logbook form there. The desktop software is excellent and is essentially duplicated by the web interface, SafeLogWeb, so you can choose which solution works best for you. Safelog had the slowest syncing of any app we tested, however.

LogTen Pro's Radar page shows almost any filtered view of your time, complete with details. One-tap duplication for times speeds entry, especially on the iPhone. CFIs can sign directly on the screen. (Although this one may make an examiner cringe.)

They also have an odd pricing structure. SafelogWeb is $46/year for web-only access (no app), although the web interface works pretty well even on a little phone screen. Adding the app for iOS or Android, is another $40. You can also get a bundle of desktop version (but no SafelogWeb access) and app for $140, however the desktop is only a three-year license that must be extended after three years for $40/year. So you end up paying about $85/year for app and web/desktop in the long run.

Logbook Pro is powerful desktop software with a dedicated user base. In our opinion, the $70 program is more complex than most pilots need and has a steep learning curve. The company offers an accompanying app for free download that connects to the desktop via the company's servers. There are airline schedule imports for a small fee.

The app is easy to use, with quick view of currency and good shortcuts for fast data entry. It's not quite as clever with favorite aircraft and airports as LogTen Pro or Safelog. It's also only for recording flights while away from your desktop—you won't see the rest of your logbook on the app. After syncing, the flights on the app are erased, although your currency, certificates and total times remain available for viewing.

Belgian company mccPilotLog is a newcomer with elegant desktop software for Windows. A free version of mccPilot is available, but app syncing requires the enterprise version for € 69 (≈ $90). Their app for iOS or Android is limited in exactly what it can record—for example, each flight can only have one associated instrument approach. It also doesn't download all your recorded aircraft and airfield favorites from the desktop, so you must enter them in again on the app. Like Logbook Pro, flights are deleted from the app after syncing, but currency and total times remain.

We found one promising standalone app for the iOS also worth a look. The $10 Premier Logbook is a simple, well-designed app that hits the high notes for smart data entry and viewing currency. It's searchable for time reports and the entire book can be printed to PDF. Its biggest

APP NAME	SUPPORTED DEVICES	DESKTOP COMPANION	APP-ONLY OPTION?	HITS	MISSES	COST
AVCONNECT	IOS, ANDROID	WEB	NO	CURRENCY, ATC AND GPS FLIGHT DOWNLOAD	NO QUICK ENTRY SHORTCUTS, LIMITED DETAIL FOR IFR	FREE APP, BUT REQUIRES $5/MONTH WEB ACCESS [1,2]
LOGBOOK PRO	IOS, ANDROID, KINDLE, NOOK	WINDOWS	NO	FAST-LOG SHORTCUTS, CURRENCY, DETAILED IFR, PROF PILOT AND TAX OPTIONS	NO DOWNLOAD FROM DESKTOP LOGBOOK	FREE APP, BUT REQUIRES $70 DESKTOP SOFTWARE
LOGTEN PRO	IOS	MAC	YES	FAST-LOG SHORTCUTS, DIGITAL SIGNATURES, HIGHLY CUSTOMIZABLE, SEARCHABLE, CURRENCY, DETAILED IFR, PROF/TAX OPTIONS	IOS ONLY, DESKTOP IS MAC OS LION ONLY	$30 IPHONE, $60 IPAD, $80 IOS UNIVERSAL (ADDITIONAL $100 FOR OPTIONAL DESKTOP)
MCCPILOT	IOS, ANDROID	WINDOWS	NO	EASY APP INTERFACE, POWERFUL DESKTOP SOFTWARE	LIMITED LOGGING OPTIONS, NO CURRENCY SCREEN, NO DOWNLOAD FROM DESKTOP	FREE APP, BUT REQUIRES € 69 (≈$90) DESKTOP
PREMIER LOGBOOK	IOS	N/A	YES	FAST-LOG SHORTCUTS, CURRENCY, SEARCHABLE, DETAILED IFR	NO DESKTOP OPTION, NO IMPORT OF OLD LOGBOOK	$10
MYFLIGHTBOOK	IOS, ANDROID	WEB	NO	FLIGHT TIMERS, LANDING DETECTION, CURRENCY SCREEN, IT'S FREE	LIMITED LOGGING OPTIONS, WEB INTERFACE CAN BE CONFUSING	FREE
SAFELOG	IOS, ANDROID, BLACKBERRY, WIN MOBILE, PALM	WINDOWS, WEB	NO	FAST-LOG SHORTCUTS, CURRENCY SCREEN, DETAILED IFR, PROF PILOT AND TAX OPTIONS, SEARCHABLE	COMPLEX PRICING	$40 FOR APP [3], BUT REQUIRES $30-60/YEAR FOR WEB OR $80 FOR DESKTOP [4]
ZULU LOG	IOS, ANDROID	WEB	YES	FLIGHT TIMERS, DETAILED CURRENCY SCREEN, IFR DETAILS, SOME SHORTCUTS, PILOT TOOLS, EXCELLENT WEB COMPANION	INEFFICIENT APP NAVIGATION, ONLY PARTIAL DOWNLOAD FROM DESKTOP (WEB)	FREE APP, $9/MONTH [1] WEB

[1] FREE LIMITED ACCOUNT AVAILABLE, [2] ADDITIONAL AIRCRAFT OWNER TRACKING AVAILABLE. [3] WEB-ACCESS CAN BE DONE WITH IPHONE/ANDROID WEB BROWSER FOR NO EXTRA COST
[4] THREE-YEAR LICENCE FOR DESKTOP, AFTER WHICH YOU MUST RESUBSCRIBE

drawbacks are no way to import earlier logbook data (although you can enter a block of previous hours).

WEB+MOBILE

We found three good combos for web-based logbooks with apps: AvConnect, Zululog and MyFlightbook.

AvConnect and Zululog are similar in that they offer monthly or yearly subscriptions for pilot and aircraft owners and have a solid web interface. We think Zululog's web logbook is easier to use. It also offers some unique features for flight instructors. Both websites offer significant additional tracking for aircraft owners, which might be a deciding factor for some.

The AvConnect and Zululog apps are quite different, however. AvConnect doesn't download your whole logbook, but does show totals and currency. It can create flights manually, by your phone's GPS or even by downloading from ATC post-flight.

Zululog's app shows currency and total times, as well as recent flights, but not an entire logbook. It offers more options for flight details than AvConnect. It also offers flight timers to start and stop, if you can remember to do so, as well as some convenient pilot tools and a place to log squawks.

Syncing to your web account is automatic with either system. The apps are free, and both AvConnect and Zululog offer free accounts, but they are quite limited. Paid accounts for logging pilot time are $5/month and $9/month, respectively. Including aircraft maintenance logging kicks the prices up to $50/month and $25/month, respectively.

Free is good, and that's what MyFlightbook offers. We think their website demonstrates "You get what you pay for" compared to Zululog, but it does the job. The app has some clever options, such as autodetecting your route and landings from your phone's GPS. You can also manually start and stop flight timers. It can download up to your last five years of flight time.

There are no other quick-entry shortcuts, and adding items like instrument approaches to MyFlightbook is cumbersome, in our view. We also think the display of currency works backwards: It shows where you ***are*** current, but if you're out of currency, the information vanishes.

CONCLUSION

If you want a standalone app for your iPad or iPhone, we think LogTen Pro has no rival. If you need web or desktop access and don't use a Mac, it's trickier. We think Safelog's desktop/app or web/app combo best combines ease of use with capability, and MyFlightbook is a winner for getting something useful for nothing spent. We like Zululog and AvConnect, but their bonus value for owners will have to be further explored.

CONTACTS

AvConnect
www.avconnect.net

LogBookPro
www.nc-software.com

LogTen Pro
coradine.com

MCCPilotLog
www.mccpilotlog.net

Premier Logbook
www.inquisitivegraphics.com

MyFlightBook
myflightbook.com

Safelog
www.dauntless-soft.com

Zululog
www.zululog.com

Pilot MyCast Morphs into Garmin Pilot

Garmin redesigned their app for iOS and Android with new navigation and a host of improvements large and small. We think it works well.

by Jeff Van West

Garmin's Pilot MyCast app has been an outlier in the Garmin family. Now it's been revised and rebranded as simply Garmin Pilot. The changes bring some welcome improvements and make navigation similar to other Garmin products.

GO HOME

The core change is in navigation, with a home function that calls up big-button navigation similar to the aera or GTN navigators. Functionally, it's basically the same as Pilot MyCast, but it's simplified and, we think, more intuitive. There's also a dedicated direct-to button, just like other new Garmin navigators.

Press and hold on the map view and you will get something Garmin calls the "radial menu." This is a context-sensitive pop-up offering a ring of three to six large, turbulence-friendly buttons for quick weather, airport or airspace info, flight plan editing or direct-to. Interacting directly with the moving map has been too long missing from Garmin's app.

Another welcome change is with approach charts. MyCast had improved chart access with chart binders, but the new version allows you to open an approach chart and then toggle via the home menu between that chart and the moving map. Switching from map to approach chart is still two taps, whereas ForeFlight is one and WingX or AviationMaps allow simultaneous viewing on split screens, but it's a better implementation than previously. Binders are automatically created for your departure and destination airports, and you can now make custom ones from any airport info page.

Garmin overhauled its trip-planning page to improve the ease of use and better organize the output of a DUATs briefing. The active flight plan has changed from a pop-up window to a dedicated page that has been spiffed up for easier and more flexible editing. Garmin Pilot's download management is also graphically based and works well.

MyCast's display of weather data on the map was always its strongest suit, and Garmin wisely left this largely the same. XM weather is available with Baron's Mobile Link and XM receiver (see February 2012 *Aviation Consumer*), and data age (internet or XM) is easier to see.

We think Garmin Pilot keeps the strongest features of the old MyCast, while cleaning up many of the weaknesses. It's now on par with industry leaders ForeFlight and WingX on iOS and AviationMaps for Android. It also now works as the best quick weather app for Android we know.

Is it better than the others? In some areas, such as weather data presentation, we'd say yes. But it was a first-string player there anyway. In other areas, such as flight planning or app navigation, the judgment of "better" rests mostly on personal preference and which exact feature set works best for you. Competing apps offer more functions, but Garmin Pilot covers all the critical ones.

The two-tap nature of the home screen will infuriate some power users for sure as it now makes lateral navigation around the app impossible. We have a few other quibbles, such as not displaying older, published NOTAMs. Many of us only look on our iPad for NOTAMs now (despite the warnings otherwise) and could get caught by a five-month-old closure still in effect.

Garmin Pilot is free for 30 days after download (without Safetaxi and georeferencing, at least). After that, it's $10/month (or $100/year). Safetaxi diagrams and georeferencing on approach charts are $30 and $50/year, respectively. That pricing is for iOS or Android. Existing iOS users can simply make the switch with an app update. Android users must contact Garmin to get their original fee prorated on the new app.

The biggest changes are the big buttons, both on the new home menu and on a context-sensitive radial menu on the moving map.

TV GARMIN APP

AVweb

snipurl.com/22tawaa

Diamond's DA42 V1: Performance Unmasked

We were skeptical that Diamond could find additional performance in the diesel twin, yet a trial flight revealed faster cruise and better single-engine performance.

by Paul Bertorelli

When Diamond's voluble CEO Christian Dries first flew the prototype diesel-powered twin that eventually became the DA42 in 2002, he said something he would later regret. The airplane would cruise at 200 knots on 10 to 12 GPH. The reality, of course, proved rather less. The DA42 was a strong seller, but a 200-knot cruiser it wasn't. More like about 155 knots on real-world power settings, although the economy was certainly impressive.

A decade later, Dries and Diamond are at it again and this time, to quote another famous CEO, they think they've got the goods. The soon-to-be-introduced DA42 V1 includes a long menu of aerodynamic improvements that seem to substantially improve the aircraft's climb rate, cruise speed and engine-out performance. Although our brief test flight didn't hit the magic 200 knots, we saw speeds approaching that number.

When we visited Diamond's factory in Wiener Neudstadt, Austria, in early March, the company was putting the finishing touches on the V1 and planning to show the certification-ready version at the Aero exposition in Friedrichschafen, Germany, in April. Furthermore, they were assembling yet another twin that will also appear at Aero, the DA52. (See the sidebar on page 23.)

LONG ROAD

Diamond's road to the DA 41 V1 began with the Thielert-powered version announced in 2002 and certified in 2005. The airplane got rave reviews and enjoyed strong sales, but never performed quite up to Dries' hopes. In 2008, the project began to unravel as field service problems with the Thielert diesel emerged and the engine maker filed for insolvency in mid-2008. Diamond had what can generously be described as a tense relationship with Thielert, so it launched its own company, Austro Engines AG, to develop, certify and build aerodiesel and gasoline engines.

This yielded the AE300, which uses the same Mercedes-Benz core engine that Thielert used for its Centurion models but that retains the MB's original cast-iron block rather than the aluminum-block conversion Thielert did. This decision has positives and negatives. The engines are likely to be more durable and are overhaulable, while the Thielerts have a TBR—time between replacement.

Austro stuck with the core block, heads and valve train of the original engine, but it engaged Bosch to set up a dedicated business unit to produce fuel injection systems for the AE300. Further, where the Theilert engines had gearboxes and clutches that proved somewhat tender, the Austro version has a dynamic torsional damper—essentially a couple of gears with a spring in between—to isolate the prop from the engine's powerful torque kicks.

All very nice. But the Austros are quite a bit heavier than the Thielerts, about 112 pounds to be specific. To address that, Diamond simply certified the first airplane to carry the AE300, the DA42 NG, to a 245-pound higher weight, for a 4180-pound (1900 kg) gross weight. They've done the same thing on the new V1 version of this airplane. The original NG is a good performer, climbing at 1200 FPM on both engines at an 86-knot Vy. In cruise, we saw the NG turn in 167 knots TAS on 8.3 GPH per side. Not bad, but far off Dries' 200-knot goal. Dialing it

We flew the DA42 V1 on a blustery Austrian late winter day, left. Certification of the new model was expected by mid-April.

back a little yields 165 knots on 6.6 GPH per side.

While those numbers are certainly credible and they are better than the Thielert-powered airplanes, Diamond still wanted more, since it envisions its twins competing against the 200-knot Cirrus airplanes. Diamond's Dries argues that a second engine is better than a parachute, but so far, the market hasn't taken up that cry with much enthusiasm.

V1

We're not sure why Diamond elected to call the new airplane the V1, given the probability of buzz bomb jokes that might not play well in the UK, but naming airplanes isn't exactly a science. When we toured Diamond's factory in early March, the V1 was in the final phase of testing. Diamond's managing director, Michael Feinig, told us what governed V1 development wasn't "one thing, but one knot." The company made a number of minor aerodynamic changes that appear to add up to substantially higher cruise speed and climb and better engine-out performance, especially at high altitude.

Chief test pilot Ingmar Mayerbuch ran us through the list. If there was low-hanging fruit here, it appears to be nipping a lot of cooling drag. "One big part of the drag reduction was to reduce the cooling drag of the engines," Mayerbuch told us. "We achieved that by rearranging almost every component in the engine compartment. The outer cowling was also modified so, in the end, we had better cooling efficiency of every component." The intercoolers, water and oil coolers and the inlet ducting were all substantially redesigned.

Only a practiced eye would see the differences, but if the airplanes are viewed side by side, they are quite obvious, especially the cowlings. The V1's lower inlets are smaller and reshaped, as is the side inlet. The cowling still has the large bump to accommodate the turbocharger, but the grillwork outlet in the rear has been modified and looks both smaller and less complex than on the previous twin.

The airframe was also modified, with most of the attention given to a redesign of the rudder. The old rudder had a lower counterweight arrangement, but the new one does away with that in favor of a smaller

If there was any low-hanging drag fruit to be nipped, it was probably in the V1's cowls. Components were relocated and redesigned and the inlets were reshaped. The prominent bump on the cowl allows it to clear the turbocharger. The vertical fin, right, and rudder were substantially redesigned. Lower photo shows the horn-style older design.

CHECKLIST

- ⊕ We'll go out on a limb and say that if the DA42 put diesels on the map, the V1 may make sure they stay there.
- ⊕ At the higher power settings, the V1 can easily turn in 190 knots-plus on 16 GPH.
- ⊕ Single-engine performance is considerably improved.
- ⊖ At an estimated $700,000 plus, this isn't a Volksflugzeug.

DA42 V1s will have the Garmin G1000, top. Diamond retained the automated ECU test function, left. Power control is single lever.

rudder hinged on the vertical stab, which has itself been redesigned. The new rudder has no projection below its hinge line and is fit more tightly into the redesigned vertical fin to reduce drag. Belly strakes in front of the rudder have been removed. The landing gear has also been reworked, including the doors, further reducing drag.

Mayerbuch told us the goal of the rudder work was to reduce the takeoff roll and improve engine-out performance. We weren't able to measure it, but Diamond says gross weight takeoff roll has been reduced by about 300 feet over the standard DA42. Minimum controllable airspeed has also been reduced, thanks to the improved tail. Diamond claims an 8-knot reduction to 67 knots at full flaps.

Touring the outside of the airplane, the V1 has numerous other drag clean up features you might not notice unless they were pointed out. For instance, the TKS membranes are much more smoothly faired into the leading edges, there are fairings on the flap hinges and even the angle of incidence of the cabin step has been changed to reduce drag. The balance point of the ailerons was moved inboard to yield a better fit and some 300 screws and fasteners have converted to flush heads.

Much of the improved performance comes from the engines and props. MT designed a new three-blade scimitar profile for the V1 and through improved intercooling to remove temperature limits and the elimination of previous RPM limits (from 2100 to 2300 RPM), the engines have considerably better performance, especially at altitude. (The new single-engine ceiling is 18,000 feet.)

The V1 retains the same gross weight as the NG, namely 4180 pounds with an empty weight of 3146 pounds (1430 kg) for a useful load of 1034 pounds (470 kg). Diamond put the airplane on a two-phase weight reduction program that eliminated up to 66 pounds (30 kg) in composite and interior weight.

DOES IT ALL WORK?

We flew with Ingmar Mayerbuch on an absolutely nasty late winter Austrian day, with gusty winds, a low broken ceiling and light rain. The ceiling was broken enough to find some holes to spiral up through, since the airplane wasn't yet approved for IFR.

Starting the Austros, as with the Thielerts, is automotive like. Just turn on the masters and crank them; there's obviously no mixture to deal with, since the engines are fully managed by FADECs, including the props. For the V1, Diamond retained the auto-test of the ECUs. This involves simply pushing and holding a pair of momentary buttons, which automatically runs the engines and controls through pre-takeoff diagnostics. There are also switches labeled "voter" that allow the pilot to manually select an individual ECU channel to test its function.

What's immediately noticeable about the Austro engines is how perceptively smooth they are. You see and hear them running, but you can't feel them. Diamond's Feinig told us he thinks this is due to the Austro torsional damper and it may very well be. The Thielert engines seem nearly as smooth, but both have far less buzz than the Lycoming engines that are used in the same aircraft.

Prior to our flight, Mayerbuch promised we would see about 300 FPM better climb, about 150 FPM improved single-engine climb rate and a whopping 15 knots of additional cruise speed. Those are tall claims and big improvements for an airplane that essentially has the same

AC TV V1 FLIGHT

AVweb

http://tinyurl.com/6m2wt5q

power as what went before it.

Did it deliver? We'll have to qualify our answer by saying our flight was brief and conditions weren't the best, with turbulence and rain, so we'll reserve our final judgment until we've had an opportunity to take a longer flight in better weather. On initial climbout, we saw between 1300 and 1400 FPM on two engines, which is 200 FPM better than the NG model we flew in 2009. The V1 holds a strong climb rate well into the teens, where it will be quite happy at 16,000 feet. The previous version was more constrained to lower altitudes and thus we didn't see anything like the cruise numbers the V1 appears capable of.

Leveled out in smooth air at 16,000 briefly, we recorded 194 knots TAS on 8.3 GPH per side, which is about 90 percent power. Throttled back to a more realistic 70 percent, the airspeed drops to about 174 knots on around 6 gallons per side. That's where we suspect most owners will operate this airplane, so it's still not quite the 200-knot cruiser once hoped for, although it appears to be at least 15 knots faster than the first Austro-engined version and perhaps 20 to 25 knots faster than the first Thielert-powered airplanes.

Engine-out performance is excellent, especially at high altitude. When we reached 14,000 feet, Mayerbuch shut down the right engine and the V1 had no trouble maintaining a 250-to-300 FPM climb on the right engine, at a weight about 100 pounds below gross.

Of course, all of this comes at a price. The V1's suggested retail price is $770,000, equipped with TKS, the Garmin G1000 and the GFC700 autopilot. It was expected to be certified by mid-April. On a future date, we'll take a closer look at the airplane. For the time being, call us conditionally impressed.

CONTACTS

Diamond Aircraft
www.diamondaircraft.com
519-457-4000

DA52 Decloaks

During our visit to Diamond's factory in Weiner Neudstadt in March, director Michael Feinig led us into a darkened hangar and flipped on the lights. There, propped up on its landing gear, with engines hung but with no wings or interior, was Diamond's new DA52.

CEO Christian Dries off-handedly said the airplane would fly on April 3, which we doubted. But he was right. And he flew it.

The DA52 is essentially the postponed large-cabin DA50 single-engine Superstar with a longer wing and two 180-HP Austros. It's definitely a new airplane, not a variant of the DA42. Think of it as a modern version of Piper's popular Aztec, but with far better fuel economy and speed.

As should be obvious from the photo above, the large-cabin DA52 has gullwing doors similar to the Socata line (or a Mercedes Benz SLS). Seating in the rear is for three and staggered, so the center passenger sits a little to the rear.

The engines aren't standard-issue Austro AE300s, but a model boosted to 180 HP, thanks to a little software tweaking. This leads us to wonder if Austro and Diamond are reaping the benefits of retaining the MB's cast-iron block, thus allowing some cylinder pressure overhead and performance gains.

Diamond's chief test pilot, Ingmar Mayerbuch, said the airplane's first flight was as perfect as any he's seen. There were essentially no squawks and the best speed achieved was about 194 knots, similar performance to the V1. The DA52 will be a five seater (six in a pinch, if the pax are small) and will have a useful load of about 1650 pounds on a gross weight of 4730 pounds. (750 kg/2150 kg, respectively.)

The first flight marked the start of a 14-month planned certification program that's expected to yield a certified airplane sometime in 2013.

Cessna Hawk XP

Most of a 172's best traits mated with a more powerful engine give the XP a niche with those willing to burn a bit more fuel.

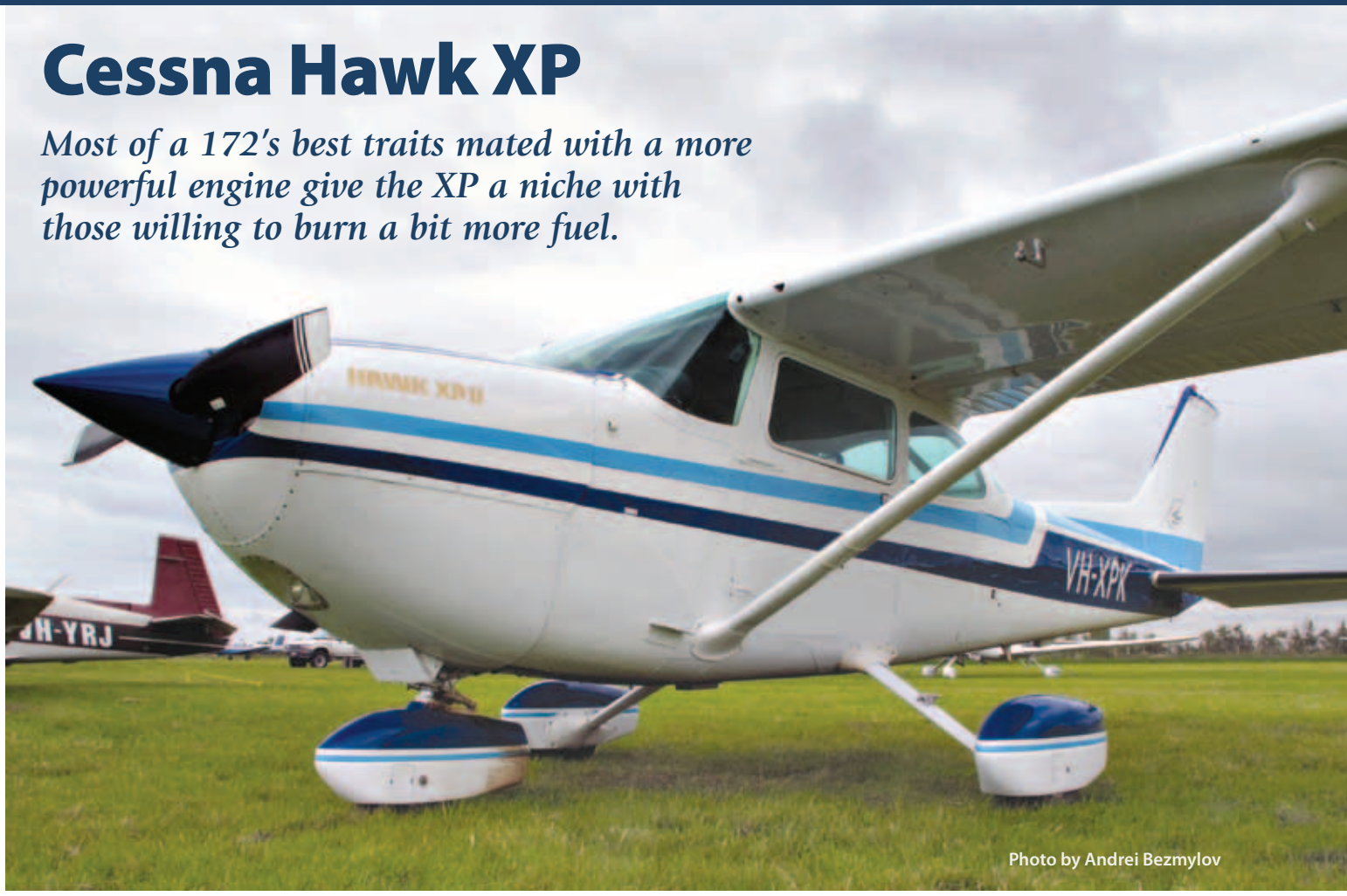


Photo by Andrei Bezmylov

The Cessna Skyhawk has been in near-continuous production for over 50 years and there are over 40,000 of the model out there in the world. There's a reason for that: The design simply works.

That's not to say Cessna hasn't evolved the design and explored variations on the theme. One of these is the Hawk XP, essentially a 195-HP 172 with a constant-speed prop. Some people think of the XP as a Cessna 182 engine in a 172 body. It's not. Others imagine it's an aftermarket upgrade to a stock 172. There is such a thing, but the XP was a factory model.

The Hawk XP is a 172 that carries more, climbs better and cruises a bit faster than standard 172, without giving up the predictable handling or maintenance. For some buyers, that's exactly what they need.

MODEL HISTORY

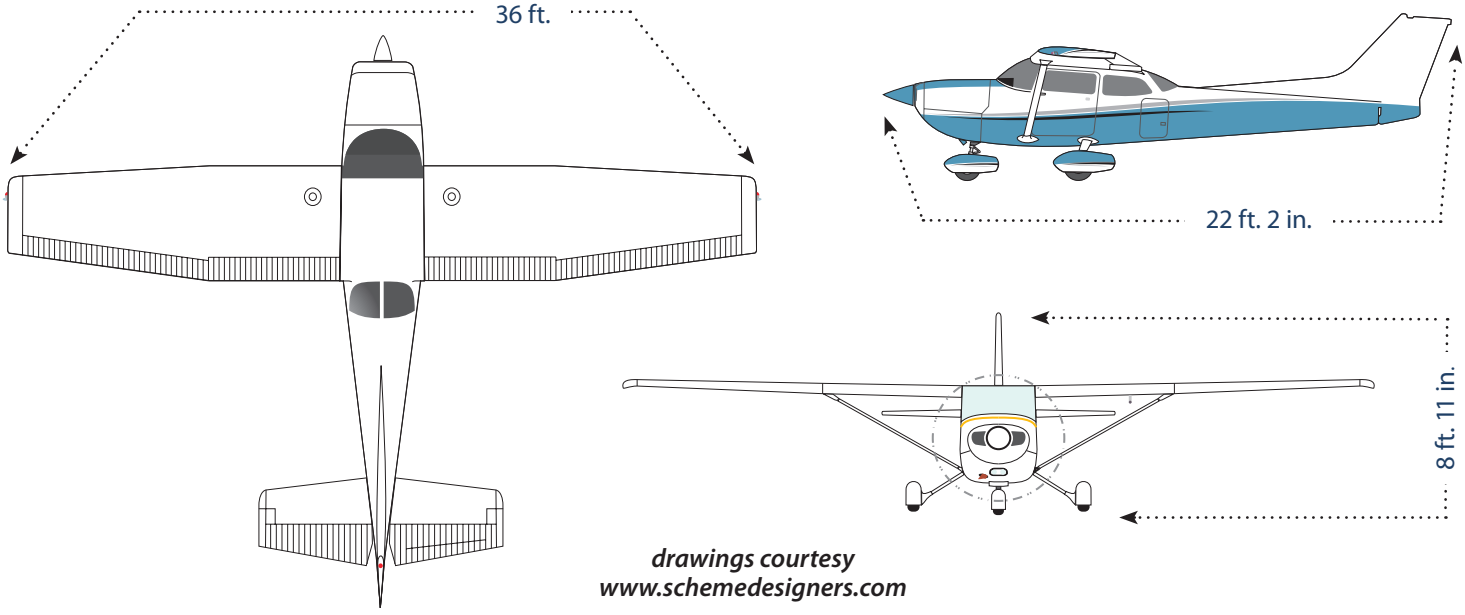
The original 1956 Cessna 172 flew behind a 145-HP, six-cylinder Continental engine. In 1962, engineers hung a 210-HP version on the airframe and began flight testing the combination the next year. It went through certification and was initially sold to the U.S. Air Force as the T-41B in 1967. Known to the FAA and within Cessna as the model R172E, the decision was made to build the civilian Cessna 172 on steroids at Cessna's plant in Reims, France, starting in 1968. There it was called the Reims Rocket and as the FR172E through I series, was one of Cessna's hotter sellers. Air forces throughout the world also bought the aircraft as the T-41B through D.

> *Cessna decided to sell the Reims Rocket in the U.S. under the appellation of Hawk XP, with the XP denoting "extra performance."*

In the U.S., Cessna planned to replace the Cessna 172 with the Cessna 177 Cardinal in the 1968 model year as part of an overall plan to return all of its single-engine airplanes to sleeker, strutless (cantilever) wing designs. (Cessna started manufacturing airplanes in 1927, but didn't put a wing strut on a production airplane until 1946.) It had begun the process with the Cessna 210 in 1967, and the plan was to replace the Cessna 182 with the Cessna 187 following the Cardinal world takeover.

Cessna's attempt to replace the Skyhawk didn't go as planned. The Cessna 177 had a cabin that was larger than the Cessna 182 and carried about 10 gallons more fuel than a 172, but it was also heavier. Pilots predictably overloaded it, and then complained about its performance. Numerous comparison tests proved a Cessna 177 would slightly outclimb and outrun a Cessna 172 when each was loaded at published gross weight, but to no avail.

CESSNA HAWK XP

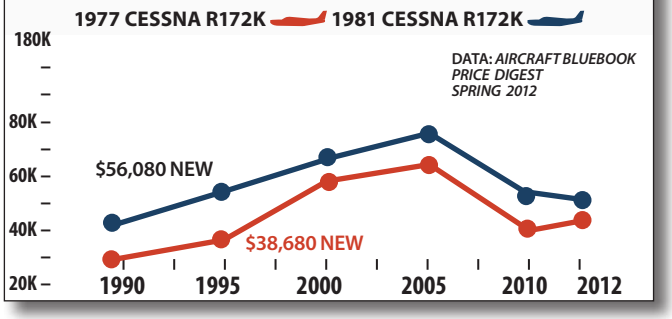


drawings courtesy
www.schemedesigners.com

MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1977-CESSNA R172K II	195-HP CONT IO-360-K	1500	$30,000	68	978 LBS	125 KTS	$43,000
1978-HAWK XP II	195-HP CONT IO-360-K	1500	$30,000	68	978 LBS	125 KTS	$45,000
1979-R172 K II	195-HP CONT IO-360-KB	2000	$30,000	68	978 LBS	125 KTS	$47,000
1980 HAWK XP II	195-HP CONT IO-360-KB	2000	$30,000	68	978 LBS	125 KTS	$49,000
1981-R172 K II	195-HP CONT IO-360-KB	2000	$30,000	68	978 LBS	125 KTS	$51,000

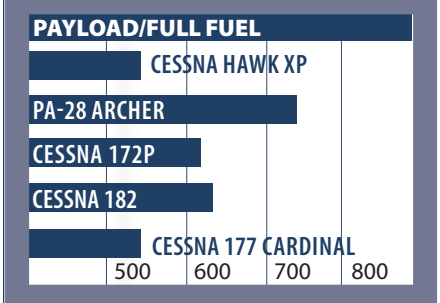
RESALE VALUES

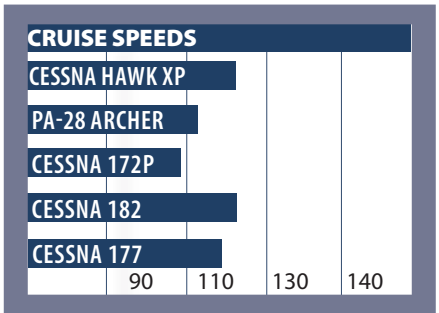


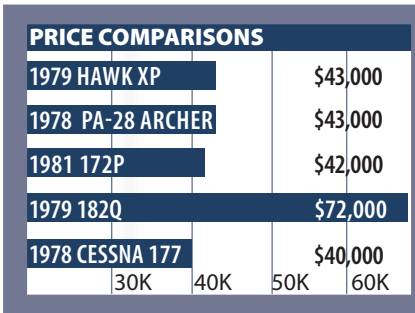
SELECT RECENT ADs

AD 2011-10-09	SEAT TRACK INSPECTIONS
AD 2008-26-10	ALT STATIC SOURCE PORT
AD 2004-19-01	SHOULDER HARNESS ADJUSTERS
AD 2000-13-04	MAGNETO IMPULSE COUPLING
AD 2000-06-01	FUEL STRAINER INSPECTION

SELECT MODEL COMPARISONS







Compounding the problem were control differences. The Cardinal was noticeably more responsive in pitch and roll, leading to overcontrolling by pilots used to the 172. The Cardinal's stabilator was insufficient to stave off some expensive, nose-heavy landings. This was fixed with retrofitted slots, but again, the reputation damage was done.

Cessna quickly realized that the Cardinal was not going to do what had been hoped and used many of the thousands of 150-HP Lycoming O-320-E2D engines it had purchased for the Cardinal to replace the 145-HP Continental O-300-D on the Cessna 172, putting the Skyhawk back into production in the latter portion of the 1968 model year.

In 1969, the Cessna 177 got a 180-HP Lycoming O-360, which remained its powerplant through the end of its production run in 1978. We suspect that Cessna did not initially market the R172 series in the U.S. because its performance was too close to Cardinal 177 and it would have had two airplanes in the same market niche. That may also be why Cessna didn't build the Cardinal in France, yet it did build the Cessna 177RG there.

By the mid-1970s, the handwriting was on the wall for the Cardinal. With all of its compound curves, it was more expensive to build than even the Cessna 182 and sales were dropping steadily. Anticipating the end of production of the Cardinal, Cessna decided to sell the Reims Rocket in the U.S. under the appellation of Hawk XP, with the XP denoting "extra performance."

For 1977, the R172K in both the U.S. and France mounted a six-cylinder Continental IO-360K with a two-blade constant-speed propeller. This powerplant produced 210 HP at 2800 RPM, but Cessna derated the engine to 195 HP at 2550 RPM to meet noise requirements. The gross weight was 2550 pounds, 250 more than the Skyhawk for the same year.

For two years or so, the Skyhawk, Hawk XP and Cardinal were sold side-by-side. Average equipped prices for 1977 were: Skyhawk $30,050; Hawk XP $38,680; Cardinal $39,195. The following year, presumably to avoid direct competition between the Cardinal and Hawk XP, the Cardinal was loaded with avionics, a new name (Cardinal Classic) and had its price cranked up to a hefty $50,760 versus $41,050 for the Hawk XP.

Cessna got the marketing and pricing right with the Hawk XP. In the year of introduction, the company built 724 Hawk XPs, versus only 149 Cardinals. In 1978, another 204 XPs rolled out the factory doors compared with a lackluster 74 Cardinal Classics, although the price hike probably hurt sales more than anything else.

Interestingly, the Hawk XP was one of the first of the Cessna line to succumb to the general aviation decline of the 1980s. Production lasted only through 1981, with a total run of 1450 airplanes, over half of which were built during the first year of sales. Over that short span, the Hawk XP gained a 28-volt electrical system, flap speeds were increased, the IO-360KB engine was used with an increase in TBO (from a mediocre 1500 hours to a respectable 2000), an oil filter was added and it got an improved avionics rack with a cooling fan.

The company didn't abandon the idea of an uprated Skyhawk, however. In 1977, the standard Skyhawk received a 160-HP Lycoming engine that was better able to swallow 100LL avgas. In 1980, Cessna brought out the Cutlass RG, a retractable Skyhawk with a 180-HP Lycoming and constant-speed prop intended to be a trainer for complex aircraft operations.

In 1983, two years after the Hawk XP ended production, the 172Q Cutlass appeared—a fixed-gear version of the Cutlass RG—which lasted for two model years and 390 units. When Cessna restarted production of the 172 in the 1990s, it again produced the 160- and 180-HP versions of the Skyhawk. Today, only the 180-HP Skyhawk SP remains in production.

Adding a bit more power to 172 ease and stability makes for a good IFR platform on a reasonable budget. Upgrading the late-70s panel with capable, but modest, avionics makes good sense in these craft. (Before and after photos by Barry McCabe.)

CARDINAL COMPARISONS

When the Hawk XP was introduced, *The Aviation Consumer* did a side-by-side comparison of the new airplane and the Cardinal. We found that the Cardinal was, on the whole, a better airplane. It offered better handling, better visibility, a much larger cabin,

Barry McCabe's Hawk XP got an interior facelift as well. The interior dimensions are still a Cessna 172, which is to say cozy for two front-seaters.

less noise, lower maintenance costs and almost identical performance and load-carrying capacity. The more aerodynamic Cardinal was a bit faster on 15 fewer HP, could carry more and could take off and land a bit shorter. On the other side of the balance sheet, the Hawk XP could fly higher and farther. Despite the lack of a clear-cut advantage for the Hawk XP, it trounced the Cardinal in sales in 1977 and 1978. Such is the power of marketing and reputation as well as a much lower price.

Current prices on both models have declined considerably since we last examined this XP in 2007. Hawk XPs with average equipment sell for $43,000 to $51,000 for the latest model year, the 1981 model. By comparison, fixed gear Cardinals of relatively the same vintage sell for about $43,000. Straight-leg Skyhawks of this vintage retail in the high 30s and low 40s, with average equipment. The fixed-gear version of the Cutlass—a very rare model—retails in the $45,000 range.

CLIMB, YES. SPEED, NO.

The Hawk XP isn't a speed demon. Those struts and broad frontal area for upright seating mean the XP cruises at a rather lethargic 125-130 knots despite pumping nearly 200 HP. The Mooney 231, also equipped with a Continental IO-360 (albeit turbocharged and producing the full 210 HP) flies along at 165 or so.

The impact of a draggy airframe is perhaps more clearly seen by comparing the 195-HP Hawk XP to a contemporary 165-HP Skyhawk, where the 35 extra horses only generated eight knots or so more speed in cruise.

Gross-weight climb according to the book is 870 FPM, a tad better than the Cardinal or the Skyhawk of the same vintage and about the same as the Skylane. Gross-weight takeoff performance is virtually identical to the Skyhawk. Of course, the XP's numbers come at a higher gross weight, but 150 pounds of that is taken up by the heavier engine and prop. The real payload difference is only 100 pounds.

XP pilots rave about real-world performance. One perhaps optimistic fellow swears he gets 1500 FPM at moderate weights, even in warm weather. "Has near-STOL characteristics," reports another. Something more like 1000 FPM at moderate weights is a more common report. But that's no surprise as the basic 172 has good short-field performance thanks to its low stall speed. The XP's extra power can only help.

Useful load for a basic-IFR XP runs around 900 to 950 pounds. One owner of a lavishly equipped XP reports 879 pounds. With the standard 49-gallon tanks filled, the cabin load is about 600 to 650 pounds: three people and some luggage. Subtract 100 pounds if the optional 66-gallon tanks are filled.

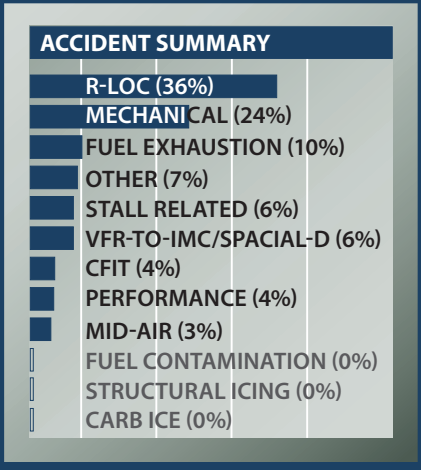
At max cruise, the XP slurps north of 11 GPH, but most pilots throttle back to 10 or less. At moderate power, four hours and 450 miles is about as long as you'd want to fly one. The optional tanks stretch the range to 650 miles. If these numbers appeal, consider that the XP's immediate successor, the Cutlass, has the

ACCIDENT SCAN: R-LOCS AND OIL ISSUES

The exemplary accident record of the Cessna 172 generally applies to the R172K Hawk XP. It's a simple and strong airframe with good crashworthiness. Want some anecdotal proof? From one of the reports: "During the landing roll, the airplane came to the end of the field, nosed over the edge of a 50-foot cliff, and came to rest on the beach below." Result: one minor injury and one uninjured.

Our hit parade leader on accidents is almost always runway loss of control (R-LOC). The Hawk XP is typical, with about 36 percent of the accidents falling into this category. The Hawk seems to have an exceptionally high number of nose-heavy and hard landings, however. Perhaps this is the result of pilots transitioning up from a "normal" 172 and not compensating for the heavier engine over the nosewheel. It's possible some of these pilots are flying beyond their abilities or common sense, like the one who landed downwind with winds at 23 gusting to 38. They are also low-altitude drop-ins, where the pilot mushed or outright stalled on short final.

Mechanical problems are a bit above average for the Hawk XP. A surprising near one-in-five of these involve the oil pump and the common shaft driving the oil pump and tachometer. It's hard to fault the airplane, however, when an attentive owner might have avoided the problem. One oil-starved airplane showed unmistakable warning signs in oil analysis for 61 hours before the final engine seizure. It's no good sending in the oil tests if you don't read the reports that come back. Another notable failure was overheated or burned cylinders from pre-ignition or detonation, perhaps from overleaning. The ranking of fuel exhaustion supports this idea that Hawk XP pilots tend to push their mount a bit further than it can really go.



Higher is an issue, too, with failure-to-climb accidents in loaded airplanes not outclimbing canyon walls at density altitudes over 10,000 feet. The Hawk has more power than a regular 172, but it has its limits.

same airframe and gross weight, but 180-HP Lycoming engine. It weighs 100 pounds less empty and burns 1.5 GPH less fuel.

HANDLING

Since the Hawk XP is essentially a Skyhawk, it's no surprise that it handles like one—steady and sedate. Although, we heard from one pilot who taught himself aerobatics in a T-41B, the aforementioned military version of the XP.

Roll response is fairly ponderous and pitch control is heavier than the Skyhawk, due to the extra weight of the engine. A new elevator introduced in 1981 reduced pitch forces. The XP's handling characteristics may not set your hair on fire, but snappy handling is exactly what you don't want in an IFR platform.

As with all Cessnas, the huge flaps cause some pitch changes and they're so draggy in the 40-degree position that gross weight go-arounds require some finesse. Flap travel was reduced to 30 degrees in later models to improve handling when slipping with full flaps.

On the ground, the nosewheel steering is rather heavy. And the high-wing design makes the XP susceptible to winds on the ground if the pilot doesn't properly position the ailerons when taxiing. Again, typical Cessna.

In short, the handling is exactly what you'd expect from an airplane based on the Skyhawk. Predictable, stable, docile and offering no surprises. These characteristics meet the design mission well and contribute to its historically good safety record.

ACCOMMODATIONS

The interior of the Hawk XP is fairly comfortable. Like the Skyhawk, the panel is relatively tall and the seating position upright. Cessna offered articulated seats with height adjustment, a valuable option, in our opinion, as they fit a wide variety of pilot frames. The seats are subject to the famous Cessna seat-track AD, recently updated but largely unchanged.

Access is easy due to the double doors and getting into the back seats is easier than on low-wing designs. It's easier to step up into a cabin than it is to lower yourself down into a pit. Ventilation on the ground is good thanks to windows that open. There's adequate head- and legroom for all four seats.

Visibility is the classic tradeoff of high- versus low-wing aircraft. One particular caveat with Cessnas is that the top of the door window is only a few inches above the level of the top of the glareshield. So there's some obstruction to the side when the seat is raised to improve forward visibility.

The panel is well laid out for airplanes of its vintage, with standard vernier controls and conventional instrument placement. The cockpit gripes applicable to the Hawk XP should come as no surprise to Cessna owners: Royalite panels that yellow and crack, vent tubes that can pop open at high speeds. You might still find one with the infamous ARC electronics. These were destined for paperweight status when they left the factory, so don't expect much from them now.

The baggage compartment is of reasonable size, with a fairly large door. It can be accessed in flight. The size of the door is a welcome thing should it be necessary to get out of the airplane through it after a crash.

MAINTENANCE

The heart of the XP's performance—and problems—is the six-cylinder Continental IO-360-K and -KB engine. It's expensive to overhaul and has a mediocre reliability record. The engine's main problem seems to

be that it's tough on cylinders. Low compression and/or high oil consumption are not unusual.

Not everyone has cylinder problems—we had owner reports of 1800-plus hours of trouble-free operation—but cylinder cracks, along with piston, ring and valve troubles, seem more common than in similar Lycoming engines. One owner, for example, reported he had to replace two cylinders in the first 600 hours, and then had a cracked piston that allowed most of the oil to leak out. Scans of SDRs show that cylinder cracking is fairly common.

There have also been crankshaft failures. The -KB engine with its 2000-hour TBO was a result of Continental beefing up the crank in 1979. Given the cost of overhaul, anything to make the engines last longer is a plus.

Judging from owner reports, the XP is easy to maintain; not surprising, since it has the same airframe as the familiar Skyhawk. Surprisingly, despite the extra weight up front, we have found no real problems with the nose gear or its attachment at the firewall. Typically, airplanes with heavier engines are more likely to suffer hard-landing damage from pilots slamming the nose down. Still, we recommend a close look at the area.

Unfortunately, most XPs were made during 1977 and 1978, the years in which Cessna let its quality control slip badly as it struggled to meet a huge demand for its airplanes. Virtually all single-engine Cessnas made at this time had improperly performed paint jobs because Cessna ignored DuPont's specifications and used a cheap, quick primer under the paint. The result was persistent filiform corrosion that affected hundreds (if not thousands) of aircraft, particularly those based in warm, humid climates. By now, most if not all of these aircraft have been repainted, but a check should be part of the pre-buy inspection.

There are no particularly onerous ongoing ADs on the Hawk XP. Naturally, several of those that apply to the 172 also apply to the XP, but for the most part they're one-time modifications that should have been done long ago.

Recent directives include 2011-10-09, updating the requirements for recurring seat-track inspections, 2008-26-10, for an inspection to ensure the alternate static source port isn't blocked by its ID placard, 2006-03-08, for Aero Advantage vacuum pumps, 2004-19-01, for inspection of upper shoulder harness adjusters; 2002-13-04, inspection of the magneto impulse coupling; 2000-23-21, a one-time sampling of the metallurgy of the crankshaft and possible replacement; 2000-06-01, inspection of the fuel strainer assembly; 97-1-13, a Cessna-specific "shotgun" AD that mandates replacement of hoses; 97-26-17, which calls for ultrasonic inspection of the crankshaft and possible replacement if defects are found; and 95-11-8, inspection of the prop blade clamp screws.

One advantage of buying a Cessna single is that it's very easy to find parts and maintenance expertise. The Hawk XP is no exception. The airframe holds no surprises, and it's not different enough from the standard Skyhawk to cause any trouble for mechanics.

MODS, CLUBS

STCs are available to bump the power of the derated IO-360 back up to the full 210 HP (Isham, Inc., www.PlaneTools.com) by increasing the maximum RPM. Hartzell (www.hartzellprop.com) offers one of its three-blade, Scimitar blended airfoil conversion "Top Props" for the Hawk XP which, in our experience with other airplanes, improves rate of climb and reduces vibration without hurting cruise speed

There's also the usual selection of flap, aileron and elevator gap seals, go-fast fairings and so forth. It's a safe bet that any company that makes mods for the Skyhawk has a version available for the Hawk XP. The owner's club to join is the Cessna Pilots Association (www.cessna.org, 805-922-2580), which offers a magazine, insurance discounts and technical help.

OWNER FEEDBACK

The Cessna R172K, or more commonly called the 172XP, is a great platform.

Ours was a 1977 and the true airspeed was 120 knots running it at 24 by 24. I always planned for 12 GPH, but as soon as we reached altitude, it was easily leaned to 10 GPH using the EDM 700. We had an IO-360 with the Isham conversion bringing it up to 210 HP. Having the KB heavy case is important as the K case is too light.

I flew it to Alaska four times and I never had a problem. It had a great instrument package that was not exorbitant, but very efficient. We had a Garmin 430 with WAAS, a 496 with the XM Weather and an STEC 50 autopilot. I feel having the weather available in an airplane the same as I do an instrument rating—everyone should have it.

The insurance last year for liability only was $500. Adding hull cover-

The XP's extra power makes it a natural for backcountry and float use where climb rate is priority one. (Photo by Fred Seggie.)

age brought it up to $1700. We put extra hull insurance on when traveling when we couldn't guarantee we could put it in a hangar on a regular basis. The annual normally runs around $1200, plus any discrepancies.

Mary Build
Naples, Maine

Valley Flyers was organized in New Hampshire in 1988 to purchase our 1977 R172K. There are five owners. We've had eight different owners since we started; I am one of two original owners.

The plane was purchased just prior to TBO and we had a major overhaul done on the 195-HP IO-360-K engine and the propeller, which is constant speed. In 2001, the engine was replaced with a factory-remanufactured, 2000-hour TBO IO-360-KB. The engine is fuel injected and has performed flawlessly since then. There have been no problems starting the engine even when hot.

Most performance numbers are similar to other 172 models with the exception of climb, which is often 1000-1500 feet per minute. Maximum gross weight is 2550 pounds and our useful load is 900 pounds. The wings hold 49 gallons of fuel. We flight plan for 115 knots and 8-9 gallons per hour.

In 2002, we gave serious thought to trading the plane for something newer. The plane had originally been located in Arizona and the paint and interior plastic suffered as result. Everyone agreed that they really wanted to keep the XP platform and we began a program to seriously upgrade the plane. These upgrades included a Garmin 340 audio panel, 327 transponder and 430 GPS with new Garmin CDI, as well as two new comm antennas and marker antenna. The 430 was later upgraded to WAAS. The plane was then repainted and the interior was completely replaced. In 2004, we added an STEC 30 autopilot with GPSS.

We bill our owners two ways. Everybody pays a monthly fee to cover all of our fixed expenses, currently $155. Each time an owner uses the plane, they pay $20/hour and their own fuel costs. The most recent annual inspection for the plane was $1700 and the IFR certifications were $468. Our most recent annual insurance renewal was $2234.

Our Hawk XP is great to fly, a solid platform in the air and does really well in IFR conditions.

Barry McCabe
West Hartford, Vermont

My 1977 XP was delivered from the factory with a seaplane kit installed, which includes extra bracing for the wings and corrosion protection. The airplane received a new factory remanufactured IO-360-KB engine in 2003 when cracks were found in the heads of the original engine. The airframe has about 2200 hours on it. The current engine has about 900 hours on it.

Since purchasing the airplane I have flown it about 30 hours, much of this time has been on cross-country trips. During this time, I am averaging 10.7 GPH fuel consumption and about one quart of oil per 10 hours. Although I have read that many XP owners get a true airspeed of 130 knots, I am only seeing about 125 knots. I have not put the wheel pants on yet, so this may improve cruise a bit.

This is the first airplane I have owned (even though I have about 1900 hours total time as a pilot). I was a military pilot back in the 70s and early 80s, and mostly flew C-123 and C-130 aircraft. But I did not fly at all for about 28 years. When I purchased this airplane, I wanted to be conservative so I went for a fixed-gear airplane. I also wanted a bit more power than the average 172. The XP seems to fit the bill pretty well. I am still learning the finer points of this airplane.

Mike Sachse
via email

From the outside, the tip-offs that it's a Hawk XP are the constant-speed prop and the lettering on the nose cowl.

Antenna Replacement

(continued from page 12)

performance. Frequency drift and power output problems are common symptoms for aged antennas. You can often tell a lot about the unit's health by eyeballing the antenna. Plan on spending around $400 for a decent blade antenna installation plus whatever labor it takes to run new cabling.

Some traffic systems like the Avidyne TAS, Garmin GTS and Honeywell KTA-series use top and bottom L-Band antennas including one directional twin-blade antenna. Don't be surprised if your shop needs to do some serious antenna shuffling to make these systems work properly without interference.

CONCLUSION

Aside from system performance antenna upgrades benefit cosmetics, convenience and perceived speed. A fresh paint job will make old ratty antennas stand out like a sore thumb. If you've had a new paint job recently, will they match the paint? Speaking of paint, make sure your paint shop doesn't paint your antennas. While this sounds trivial, it does happen at sloppy paint shops and it's an easy way to trash a pricey antenna.

When venturing on a major avionics project, don't assume your shop will replace the antennas although good shops will make recommendations based on their condition. Ask your shop if they plan to remove the antennas associated with removed systems, and if they will do the associated skin patch work. Cleaning up drag-inducing antennas from the top of a cabin makes dealing with a cabin cover easier.

Lastly, don't underestimate the costs associated with quality antenna work. The performance of all those critical and eye-catching avionics counts on this major system—which doesn't get nearly the respect it deserves.

The classic Bonanza "Flying V" antenna screams nostalgia, but also means poor reception and drag. Comant's high quality fiberglass nav blade cleans up the airframe and, if installed properly, offers excellent performance. You'll need a new separate comm antenna, however.

The Aviation Consumer

Rotax 912 iS

(continued from page 9)

Speaking of sensors, there are a lot sprinkled around this engine. It has MAP and temperature sensors, EGT sensors for each cylinder, an external pressure sensor and even acoustic knock sensing, which Rotax says is installed but not yet programmed. That will come later, after more field experience. There are presently no CHT sensors, although that may come later, too. The primary performance feedback for the ECUs is EGT and power is calculated through a combination of throttle position sensing and MAP.

Unlike most modern cars, the 912 iS doesn't use mass airflow sensing because, according to Wolfgang Wukisiewitsch, Rotax's VP of product development, the induction runs are too short to provide the zonal airflow mass air sensing needs to be accurate. "Throttle position is accurate enough, and it's more robust," Wukisiewitsch said.

Obviously, the 912 iS is an electric engine and requires about 15 amps to operate the pumps and ECUs. It gets that power from two permanent magnet alternators mounted on the flywheel—or more accurately, the magnets are on the flywheel and the coils are fixed, immersed in oil for cooling. Alternator A has a 16-amp capacity and normally runs the pumps and ECU. It runs entirely independent of the ship's electrical system and will generate voltage as long as the flywheel is turning.

If it fails, a second 30-amp alternator (Alternator B) comes on line automatically, switched by a smart fusebox or load center that's part of the engine package. The fusebox also provides DC output to power ship's systems. If more power is needed, there's an optional 42-amp external alternator. Rotax also recommends installing a switch to connect the starting battery directly to the fusebox for tertiary backup if both alternators fail.

ECONOMY

In the U.S., we tend to think in terms of rich- or lean-of-peak operations, but Rotax prefers the technical engineering term, Lambda. In eco mode, the 912 iS will operate close to Lambda 1, which is a stoichiometric 14.7 to 1 air-to-fuel ratio. Rotax was cagey on precise fuel scheduling, but allowed as how Lambda 1.3 (leaner) might be possible in some operating environments.

The iS has two modes, power and eco. At about 77 percent power and lower, the engine transitions automatically to eco mode. In power mode, the 912 iS will run closer to Lambda .8 or .9. The 912iS is approved for 91 AKI mogas, but Rotax, in including future knock-sensing ability, may be anticipating lower-octane fuels or it just wants more detonation margin. Or both.

Beside's lower emissions, Rotax is also selling better fuel economy, which the engine will need to deliver because it's going to be more expensive. At press time, we didn't yet have precise numbers on this, but Rotech Research, the Canadian company that oversees certified sales for the Americas, estimates the 912 iS will have about a 16 percent price premium over the standard 912.

In the LSA market, this will translate into a higher price for the airplane itself. For the Pipistrel Virus, for instance, the base price with the 912 iS engine will be $113,294 versus $102,685 with the standard 912. And speaking of standard, will the 912 iS become that for the LSA world? At Pipistrel, founder Ivo Boscarol told us he thought it would, but then Pipistrel plies the efficiency market. At Gunskirchen, sentiment among the LSA makers we spoke to seemed mixed.

"It depends," said Colin Alexander, director of a company that maintains Rotax engines in New Zealand. "I want to see if it delivers the fuel savings Rotax says it will." We'll know more about that soon enough, we suspect. In the meantime, what the 912 iS looks like at this juncture is progress.

FEEDBACK WANTED

CESSNA 185

For the August 2012 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Cessna 185, a favorite utility aircraft. We want to know what it's like to own these heavy haulers, 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 Cessna 185 by June 1, 2012, to:

Aviation Consumer
e-mail at:
avconsumer@comcast.net