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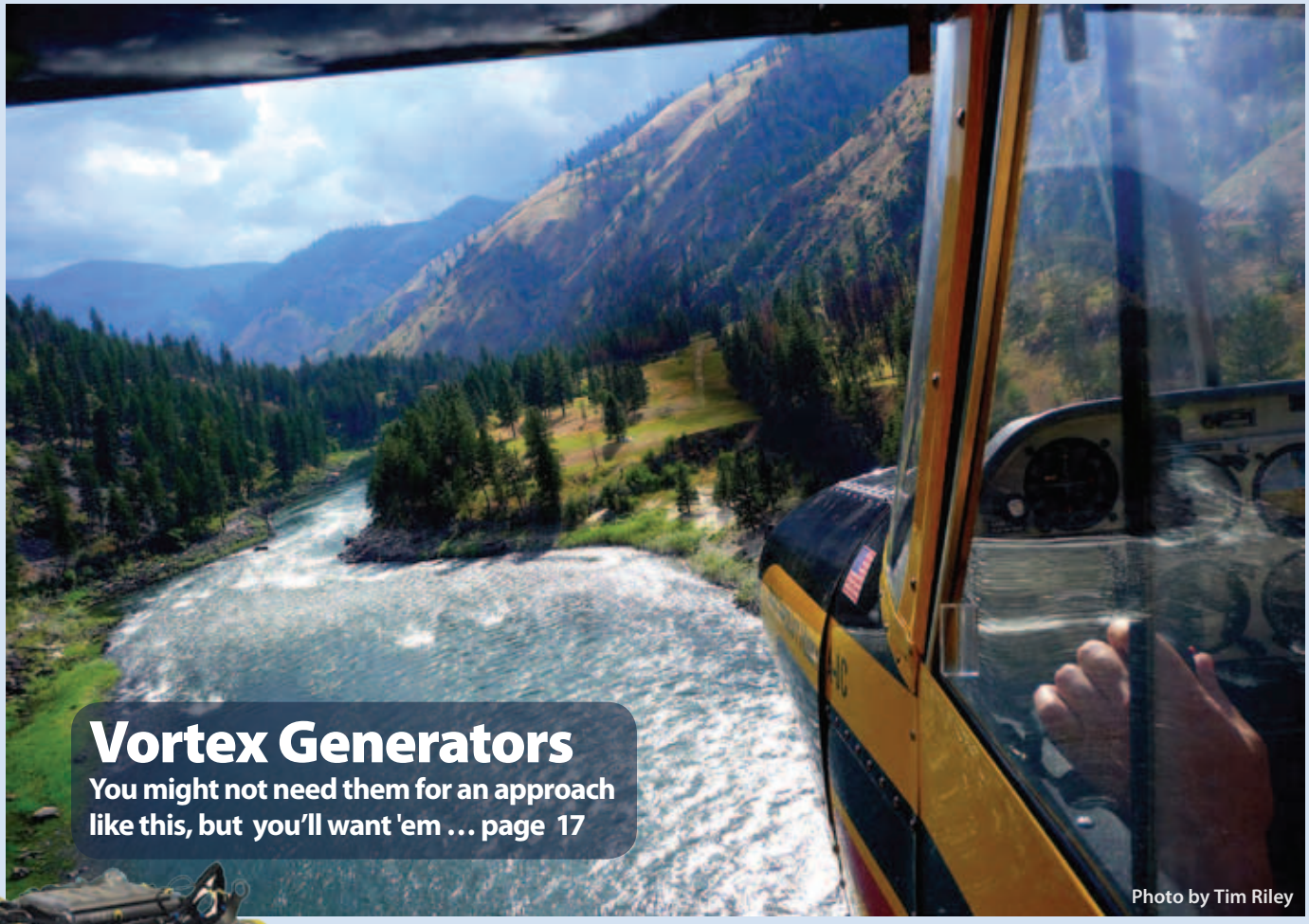

Vortex Generators

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The Aviation Consumer

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The Slow Plod of Diesels

When you put a sharp pencil to the concept, diesel engines should be a slam dunk against gasoline engines. Their fuel specifics are terrific, they have lots of torque and, potentially, they have long overhaul cycles. Modern ECU-based diesels have headroom on both performance and economy, so it's realistic to expect improvements in both.

Yet, the market sort of stumbles along, even with avgas at $6-plus and looking increasingly threatened with extinction in Europe, if not in the U.S. If you add up recent production figures, gasoline aircraft engines continue to outsell diesel options by a wide margin. While it's true that the diesels from Diamond are making inroads, it's also true that Diamond is the only major OEM with a serious diesel program.

When I was on my way to Aero in April, I knew that Cirrus planned a major announcement and given the time and venue, I thought there was a good chance it might be a diesel option for the SR20 or SR22, even if it was just an intent announcement. Obviously, the news turned out to be a funding reveal for the Cirrus Vision jet. I won't say I was disappointed, because I'm glad they're moving forward with the jet—everyone should be. But a second OEM committing to diesel powerplants may be just the thing that this market segment needs to expand more rapidly.

There are several reasons it hasn't thus far, in my view. The big one is lack of horsepower. The Austro AE300 we're covering in this issue is topped out at 180 HP—that's all there is, there ain't no more. That's not enough for a high-performance airplane like the SR22, which really needs at least 100 HP more. If Continental's SMA-based four-cylinder scales up to six cylinders and proves viable, that may be just what's needed. But it hasn't happened yet.

Second, weight. The Austro engines are about 120 pounds heavier than the Thielert engines used in the same Diamond DA42 application. That's nearly 250 pounds total. For a light aircraft with a 3600-pound gross weight, that's 7 percent and it's a big number. That forces an OEM to do one of two things: Certify at a higher weight or put the airframe on a serious weight reduction program. For the new DA42 VI, Diamond did both. This is expensive work and it takes the kind of significant investment that only Diamond, as the diesel leader, seems interested in making in the current market.

Diamond's sister company, Austro GmbH, has invested on a similarly aggressive scale. It's a Mach 1 rabbit to DeltaHawk's or even Thielert's plodding turtle. In my view, what's going on here is that Austro and Diamond are trying to push the market hard with big investments and rapid R&D while the other diesel makers are happy with incremental investments as the market slowly, painfully comes along. Who's right? It's the kind of chicken-and-egg question that has dogged businesses from the dawn of time.

Austro and Diamond seem to be taking the Steve Jobs' customers-don't-know-what-they-want-until-they-see-it approach, while the other engine makers appear to be drifting with perceived market whims or just waiting for the buyers to declare themselves. Austro could have the edge in more advanced products, but it also has the expense of lots of overhead and R&D to earn back in eventual sales.

Another complicating factor is oil prices and trends. If prices collapse again—not impossible, given production and demand trends—where will that leave diesel? My guess is it will still be in the game, but its development will be stunted, meaning the market will continue to be what it has been so far: slow, baby steps forward with a lot of thoughtful pauses. —*Paul Bertorelli*

Strike Finder Sparks

Your article on lightning detectors (see *Aviation Consumer,* April 2012) underplays how good Insight's Strike Finder is and how good a value it is. I cut 'em closer than recommended, but my Strike Finder never steers me wrong.

Your article suggests that downloaded radar images can be 30 minutes old. With most storms going through a 20- to 40-minute cycles from birth to death, I consider this worthless.

I've been trusting my life to Strike Finders since about 1990 for nine years and then a new one in 2002 (with internal gyro stabilizing and the super-bright display) when I got my Arrow. They never steer me wrong and I've never had the slightest problem with either of them.

I went with inexpensive but good shops—Avionics West in Villerica, Georgia—for the second one and never had spurious signals except rare 200 miles away at 3 o'clock and 9 o'clock in the first installation from strobes, which were irrelevant.

Bob Toxen
Atlanta, Georgia

What we said was that NEXRAD returns can be up to 30 minutes old, but they usually arrive reliably in 5-minute cycles. A sferics device is a good companion for a datalink weather, but if you can have only one, we'll go with datalink. It's just more capable and flexible for all weather, not just convective conditions.

AirVan vs. Cessna 207

In your March issue, I read with interest your review of the Gippsland GA8TC and noticed that you compared it with the Cessna 206 (which is smaller) and the Cessna 208 (which is larger), yet made no mention at all of the Cessna 207 (which is just right).

I realize the 207 is no longer in production, but is still very actively flying in places like Alaska, with some planes still going strong, having over 20,000 hours. I felt your review should have included at least some mention of the sturdy and venerable 207, one of which I happen to own. Since the specs are so similar, it seems obvious that the Gippsland was designed to fit into the marketing niche vacuum created when Cessna stopped making the 207 model.

The reason for the GA8TC being slower is probably due to its boxy shape and longer wings. Thanks for having such an interesting and informative magazine.

John McCorkindale
Via-email

LSA Capital Costs

I enjoyed the article comparing the cost of the two aircraft in a flight school scenario. (See *Aviation Consumer,* April 2012.) However, neglecting capital costs isn't very realistic. If in fact U.S. Aviation has a source of no-cost capital, I would like them to sign me up for a couple of million.

Using the same zero-cost capital assumption, my 80-acre tree farm is producing tremendous profits—over the next 60 years I'll probably get $150,000 in timber off it, spending maybe $20,000 for road maintenance, spraying and taxes. With zero capital costs, I could buy another 800 acres and retire on timber income.

In reality, I can't imagine anything less than 4 percent loans on these aircraft, meaning the LSA costs around $3000/year in interest, compared to the 152 being around $1000. If these planes are flown a few thousand hours a year, that isn't all that big a number, but it still represents a whole lot more capital tied up in the LSA aircraft.

I would be interested to see the return on asset numbers on this, but without knowing hours flown per year, interest rates, and percent of aircraft financed, that's not possible. Would U.S. Aviation release this information? I'm not going to compete with them with airstrips on my tree farms.

David T. Chuljian
Port Townsend, Washington

We could have added the capital costs, but the focus of the article was operational costs. As you have, you can figure the capital on the back of an envelope and be close enough. Just plug in the assumptions that make sense for your situation.

MyCast Omission

Gotta love Garmin for providing choices that really are not choices. (See *Aviation Consumer,* April 2012, Droid weather apps.)

I figure I'll keep going with what I have until I decide I need a tablet. Then there will be soul searching about iPad vs. Android. With my Droid serving as a hot spot, I suppose either one could access the Internet without the need for an additional 3G/4G data fee.

I think your article should have at least mentioned MyCast and the transition with a review coming soon.

Abbott de Rahm
Via e-mail

We brought things up to date in the May issue, with a review of Garmin's new Pilot app.

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Austro's Aggressive Play: Fast Track Development

It wants to get the AE300 to a 2000-hour TBO sooner rather than later and at least two higher-horsepower models are percolating in the R&D shop.

by Paul Bertorelli

ENGINE TECHNOLOGY

If new aircraft manufacturing ventures require a degree of faith to succeed, Austro Engine GmbH, grafted on to the side of the Diamond Aircraft factory in Wiener Neustadt, Austria must be the industrial equivalent of the Vatican.

It's not that Austro has no chance of success—the reverse may very well be true—but that it's investing heavily for a future that many in the industry can't yet draw into sharp focus.

The uncertain future of avgas—it seems to be all but dead in Europe and approaching life support in the U.S.—should make diesel engines a natural for strong growth. But with aircraft sales in the tank, that growth has failed to materialize. Gasoline powerplants still outsell diesels by a wide margin and some diesel projects—DeltaHawk, for instance, and Thielert's slow-as-50-weight-oil life extension efforts, have a forever-over-the-horizon quality. The exception is Austro.

This is a company that sprang practically fully formed onto the engine scene in 2008 after Diamond CEO Christian Dries got fed up with customer support and development efforts of Thielert AG, whose Centurion engines Diamond had selected to power its innovative DA42 twin. Given what appeared to be the difficult technical problems Thielert encountered in converting a Daimler-Benz auto diesel for aircraft use, there was no reason to believe Austro would have it any easier.

And it may not have, but during our recent visit to Austro's factory in Wiener Neustadt, we learned that Austro has been the rabbit to Thielert's turtle. In the short space of 30 months, it has invested heavily, improved the engines and recently gained approval for a 1200-hour TBO, up from the 1000 hours it started with.

By the end of this year or early next, it hopes to authorize 1500 hours and eventually 2000 hours. The need for speed is obvious. For as attractive as aerodiesels are, they don't really begin to turn the economic corner until they achieve what diesels are traditionally good at: long service intervals between overhauls.

THE BIG IDEA

Austro came out of the ground in 2007 with quite a start as a result of Diamond Aircraft's frustration with the Thielert 1.7 diesels it originally selected for the DA42 twin. After initial strong sales and good performance, especially in fuel economy, problems surfaced. The Thielerts had a hobbled initial TBO (1000 hours) and required periodic inspection and/or replacement of such critical items as gearboxes, clutches,

CHECKLIST

- Austro AE300s are approved for 1200-hour TBOs and expect 1500 hours within a year.
- ECU tweaking has amped the horsepower to 180, but that's about the limit.
- To offset the engine's considerable weight, a lighter airframe helps.
- Higher horsepower without excessive weight remains elusive. Austro is planning a V-8 diesel.

fuel pumps and alternators.

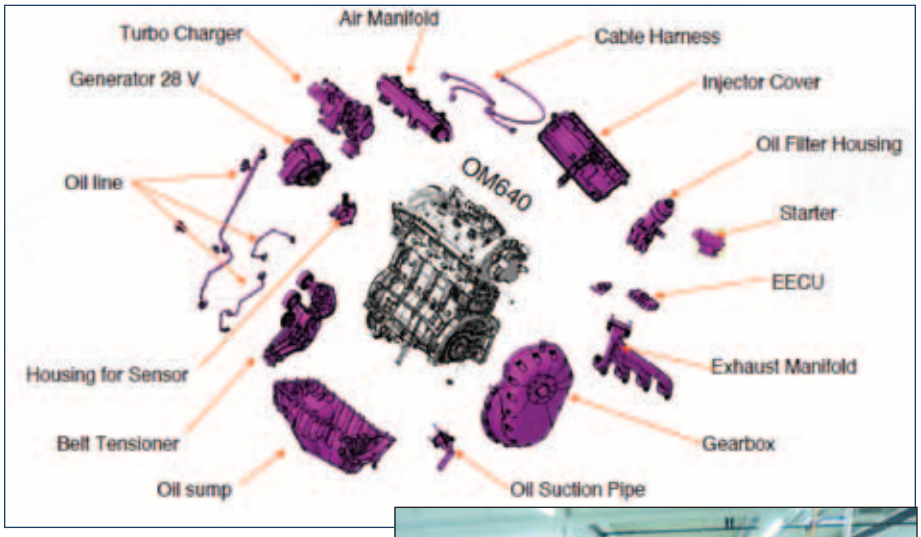
Although owners grudgingly accepted the maintenance load, both Diamond and owners were unhappy when Thielert's support structure proved incapable of quick turnarounds for parts and the engines themselves began to experience faults and failures. In the December 2007 issue of *The Aviation Consumer*, we reported, "Thielert is uniformly criticized for slow support, inefficient warranty and a nonexistent parts chain." At the time, many owners complained that they felt the Thielerts would never be high-TBO engines. (They still aren't.)

In the meantime, Diamond CEO Christian Dries was already working on Plan B, which turned out to be a crash program to develop a new diesel engine to replace the Thielerts. Austro was founded in 2007 in a new building located directly adjacent to Diamond's expanding factory in Wiener Neustadt, south of Vienna. Although the new Austro diesels were to be the primary product, the business, to a degree, was built around the kernel of an existing engine, a small 50-HP rotary now called the AE 50R. Its primary market is for light motorgliders, where it's typically mounted on a stowable mast.

When it turned to the diesel market, Diamond followed Thielert's concept of a "aeroizing" an automotive diesel engine, the Daimler-Benz OM640 that's used in the Mercedes A-class. This vehicle—a kind of a mini-van crossover with luxury features—is seen all over Europe but hasn't been introduced to the U.S. yet. It has been manufactured in the millions, in both gasoline and diesel variants.

That high volume is what attracted both Thielert and Austro to the OM640, for along with high volume comes the kind of high-level statistical process-based quality control that's difficult to achieve in the aviation industry.

Further, Austro retained the OM640's core just as it comes from the factory, including the heavy cast-iron crankcase and head that are common to diesels. Thielert, on the other hand, in an effort to make its engines more aircraft friendly, retooled the block and head in aluminum. During our tour of Austro, Christian Dries pointedly gestured toward the Austro's head and said, "You can't do better than this."



The Daimler OM640, above, and new from the factory at right, serves as the core for the AE300. More than a dozen aviation-specific components are added. New automotive parts stripped off, like the airboxes at lower right, head to the crusher.

OFF WITH THE NEW

When we arrived at Austro's plant on a rainy Austrian morning, we were surprised to find no long assembly lines or the clatter of air tools. It sounded more like a field overhaul shop which, in a way, it somewhat resembles. What we did find were about two dozen fresh-from-the-factory OM640s reposing on pallets—about 20 minutes worth of production for the factory that makes the engines.

The motors were fully dressed and ready for dropping into an A-class chassis. When we asked Austro's director of sales and marketing, Peter Lietz, why Austro couldn't just buy the cores, he said that wasn't an option. By agreement with Daimler, the engines are diverted from the standard automotive assembly line and shipped off to Austro whole. Given how the automotive supply chain works and the fact that quality is

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RUNNING THE NUMBERS

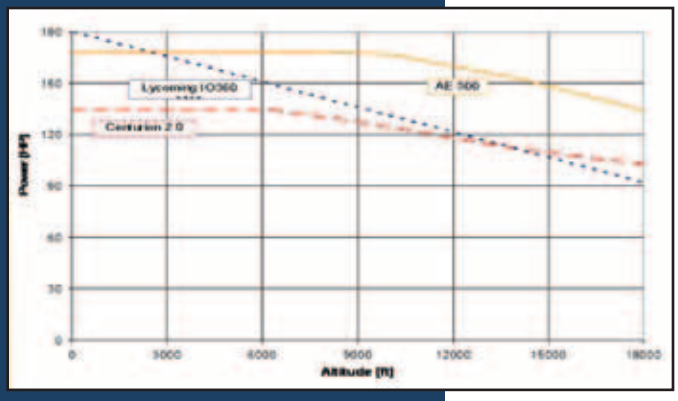
Austro didn't favor us with the exact economics of the AE300, so the best we can do is make some educated guesses. While the conversion of the OM640 can't be cheap, it's conceivable that Austro gets a favorable deal on buying the engines new. The A-class Mercedes sells for about $30,000. If the engine accounts for one-third to half that and allowing for markups, you can begin to see how the $19,400 overhaul cost at least passes the smell test.

A life-cycle calculation using $5.75 Jet A and an average fuel burn of 6.5 GPH yields $37.37 per hour for fuel and $16.16 per hour in engine reserves for a 1200-hour TBO. That's a total, all-in cost of $53.53 per hour, plus the cost of replacement items such as the pumps and alternator, which we don't have numbers for yet.

Compare that to a 180-HP Lycoming IO-360 with a fuel burn of about 9 GPH at $6 per gallon and a $25,000 overhaul at 2000 hours. That's $54 in fuel and $12.50 for the engine reserve for a total of $66.50, not to include the midstream magneto maintenance and possible cylinder work the engine may need. Over the life of the engine, the Austro should cost about $15,500 less to operate than the Lycoming, less however much those replacement parts will cost. It could be close to a wash.

Where the diesel turns the corner is when it gets to 2000 hours TBO or, as Austro suspects might be the case, 2700 hours. At 2000 hours, the Austro drops to $9.70 an hour for engine reserve for a total cost of $47.07 and an operation-to-TBO Delta with the Lycoming of nearly $39,000 over the 2000-hour life of the engine. That ain't chickenfeed.

If Austro actually makes 2700 hours, the hourly reserve drops to $7.18 for a total operational advantage over the Lycoming of about $44,000 during the same 2000-hour TBO run.



Just to throw a little reality-based cold water on the glee here, Austro hasn't yet gotten to these numbers and it doesn't have the data yet to support the long TBO runs. Not much is really known about how a diesel engine fundamentally designed to push a little car down the autobahn at 15 percent power will fare when it's asked to sling a composite prop for 2000 hours at 70 percent power. The Lycoming gasoline engines have done that. Now it's Austro's turn to step up and prove that they can, too.

based on high volume, this makes sense.

Nonetheless, what we saw next was no less startling. From the core OM640, off comes the turbocharger, the fuel injection system, the airbox, the sump, the alternator and a host of smaller parts—all factory-fresh, never-used parts that are sent off to the crusher, according to Austro. It then does its own Cinderella conversion of the core into a certified aircraft engine.

For the critical aircraft components, Austro didn't go it alone but relied on MBtech Powertrain GmbH for the core engine, Hor Technologie GmbH for the gearbox and Bosch General Aviation Technology for the engine control units and fuel injection system.

Two of the most critical components are the gearbox and a dynamic torsional damper, which Austro says is a lifetime part rather than the more traditional clutch used in the Thielert engines. Similarly, the Austro gearbox is a to-TBO part, while the Thielert engines still require gearbox removal and inspection at 600 hours on the way to a 1200-hour TBO.

The conversion is done on a one-by-one basis, starting with stripping and finishing with the build-up of completed engines on the bench, then a trip to the test cell for initial run-in.

LOW VOLUME

Although production is ramping up slowly, Austro's Peter Lietz told us the company has, in 2½ years of production, fielded about 440 AE300s, with a total fleet time of about 120,000 hours. During our coverage of Aero in Friedrichshafen, Austro announced that it had just received EASA approval for a 1200-hour TBO and it hopes to go to 1500 hours by the end of 2012 or early 2013.

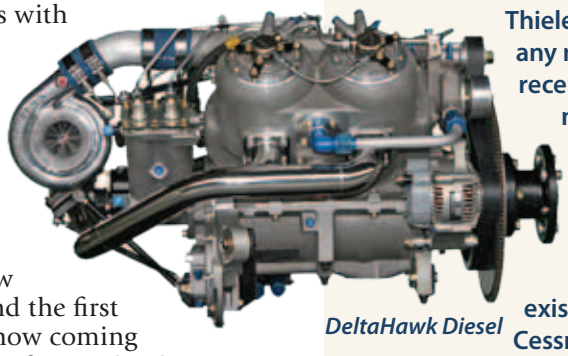
When the AE300 was initially certified, it had a 1000-hour TBO and some parts required periodic replacement or inspection. At 300 hours, the initial engines required an alternator change, a high-pressure fuel pump change and a torque check of the flywheel.

Lietz told us that these items were marked for replacement so Austro could build a statistical matrix for life extension. "There was an exchange program on these parts so customers could send them back and Austro could inspect them for wear," Lietz said. Intervals on these parts have now been increased to 600 hours. Although the gearbox must be removed for the flywheel inspection, the gearbox remains a lifetime component.

Another thing Austro has done is to tease a little more power out of the AE300s. At Aero, Diamond took the wraps off a new model, the expanded-cabin DA52, which the company says can seat five people, or seven in a pinch. This airplane is powered by 180-HP versions of the AE300, which led us to ask about how much power these engines are capable of producing with further

development. Lietz thinks they're about at the limit with a four-cylinder, turbocharged diesel. The additional power comes from a boost in manifold pressure—up to 39 PSI from about 30 PSI—and some additional fueling. "That's the big advantage of an electronic engine. You can control the amount of fuel you use compared to the amount of boost pressure you have," Lietz explained. The piper to be paid, however, is durability.

"You can pull more power out of these engines, but then you reduce the reliability and the safety margins," he adds. The additional power generation has a small impact on peak cylinder pressures, but the power push can go only so far. "We are still in the safety margin of Daimler. We make all of these changes with Daimler because these guys know exactly what we can do with the engines," Lietz says.



DeltaHawk Diesel

With so few fleet hours and the first engines just now coming back to Austro for overhaul, we wondered if either Daimler or Austro has statistical modeling based on what they've seen so far. The answer is yes. Both companies have computer durability modeling predicting engine life cycles, but they need more field data to tell if the models are accurate.

When we visited Austro in March of 2012, the first 1000-hour engines were just coming back for overhaul. These were operated by Ethiopian Airlines as trainers and flown several hours a day every day, according to Lietz. The engines were completely disassembled and all the components were wear checked. "From the outside, they looked dirty. But there were no signs of coolant or oil leaks," Lietz told us.

And what about wear? "Nothing really," Lietz said. The engines would be reassembled with new gaskets and seals and eventually placed back in service. However, for its initial AE300 customers, Austro is

continued on page 32

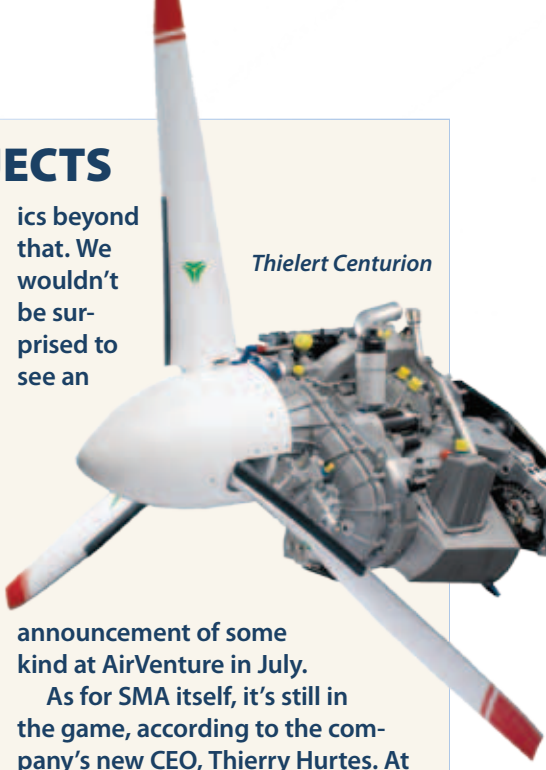
OTHER DIESEL PROJECTS

A survey of the aerodiesel market reveals that it's crawling along, but hardly making the great leaps diesel aficionados have hoped for. Thielert AG was first to the certified market with its Centurion 1.7, followed by the 2.0. But in 2008, it ran into financial trouble, declared bankruptcy and continues to operate from that status.

Still, with 2600 or so engines porduced, Thielert has the largest market share by far, but it's not clear to us if they are expanding that much. Diamond's newly introduced aircraft no longer offer the option of Thielert engines and other than aftermarket conversions, Thielert doesn't have any major OEMs. It recently announced new STCs for the 155-HP Centurion 2.0 for Piper's PA-28 151/161 series and has existing STCs for the Cessna 172 and the Robin. Cessna announced its own Thielert-powered 172 in 2007, but pulled back after the Thielert bankruptcy in 2008.

Further, Thielert has been slow to advance the engine's life extension program. Seven years into the project, the engine is still at a 1500-hour TBR and it must be replaced, not overhauled. Further, it's still hobbled with 600-hour inspection intervals for the gearbox,fuel pump iand clutch. TBR cost is about $42,000.

Two years ago, Continental Motors announced its own diesel project based on technology bought from the French company, SMA. The SR305 is a purpose-designed aviation diesel that has gained very little market traction. Continental said it plans to have its version certified sometime in 2012, but we haven't heard any specifics beyond that. We wouldn't be surprised to see an announcement of some kind at AirVenture in July.



Thielert Centurion

As for SMA itself, it's still in the game, according to the company's new CEO, Thierry Hurtes. At Aero in Friedsrichshafen, he told us the company has been working on SR305 improvements and may have something to announce later in the year. But thus far, as with Thielert, SMA has no major OEMs, although Maule began certification of one of its models with the SR305 as early as 2007.

And what about DeltaHawk? They're still out there and plugging away in what has to be one of the longest engine certification projects in history. The DeltaHawk line—three models from 160 to 200 HP—are unique for being two-cycle V-4s, which gives them a weight and size advantage over other offerings.

DeltaHawk's Dennis Webb told us at Sun 'n Fun that the company is now doing endurance testing and looking for production suppliers rather than R&D suppliers.

Continental Motors diesel

Husky A-1C: Higher Gross, New Gear

The A-1C has 50 pounds of additional payload and clever shock absorbers in the landing gear to take the bounce out of taildragger touchdowns. (Mostly.)

When we speak to companies that build new utility airplanes—CubCrafters, Champion, Maule, Aviat and the like—we're often told that buyers tart the things up with every feature imaginable suitable for jaunts into the bush. But do the owners really fly into remote mountain strips and river sandbars? Some do, but they're just as likely to hangar the things in Houston or Kansas City and use them as fun flyers.

We're sure that comprises at least half of the market for the Aviat Husky A-1C, which comes as close to a new hardcore taildragging bush airplane as we can imagine. Other models from Maule and Champion, for example, have similar appeal, but Husky may reasonably claim the best combination of speed, range, carrying capability and options.

And let's address the perennial complaint we get every time we cover the Husky: It's just an overpriced Super Cub. Perhaps so, but a new certified version of the Super Cub is no longer available, although CubCrafters can sell you a rebuild that they say is as good as new.

But new is new and that's where the Husky lives, with Aviat selling about 30 to 40 airplanes a year, according to the company.

SPORT HERITAGE

Aviat emerged from Christen Industries which, during the 1970s, made a line of accessories for the sport market, including inverted systems, fuel pumps and harnesses. It evolved into experimental airplanes, first with the Christen Eagle, which earned a reputation as being one of the most competent kits available at a time when other kits were anything but.

In 1982, Christen bought the type certificates for the Pitts line and began manufacturing it. The Husky developed because Frank Christen saw a market for a new utility airplane, but came up empty-handed when he tried to buy the rights to the Piper Super Cub, the Champion line and Interstate/Arctic Tern. So he designed and certified his own, which appeared as the Husky in the 1988 model year.

Christen found moderate success with the airplane, given the sharp sales limitations of the day. Over the years, the model has evolved and been steadily improved. The A-1A in 1999 got a 90-pound weight increase to 1890 pounds, while the A-1B was certified at 2000 pounds.

The latest model and what we flew for this flight trial is the A-1C. Although it's essentially the same airframe as the first airplane, there have been changes. In 2005, the model—

CHECKLIST

- New gross weight limit brings the useful load to 900 pounds.
- Aviat has a long options list for the airplane including various tundra tires and floats.
- Although perfect for outback flying, the airplane is also a good fun flyer.
- At $214,000 base, some consider the Husky overpriced, but we think it's a fair value.

The Husky's panel is workmanlike, top, and has enough room for installing equipment for IFR certifications. Fuel system, red switch, right, couldn't be much simpler: It's on or it's off. Flap handle lives on the floor to the pilot's left. Unlike older taildraggers, right, the A1C has modern push-pull throttles that take some getting used to. So does the trim wheel, which requires a bit of backward reach from the front seat.

then still the A-1B—got a new wing and with the C model for 2012, the gross was upped another 50 pounds to 2250. That gives it a useful load of about 900 pounds.

So with full fuel (50 gallons) it can easily carry two heavy people and a lot of stuff—just what's wanted for buyers who like to head into the outback for some fishing and hunting and who don't want to leave the six-person tent and cappuccino machine in the hangar.

Although Frank Christen and his designer/engineer E.H. "Herb" Anderson Jr. created the design, it was carried on when Christen sold the company and it was eventually renamed Aviat. Today, the company makes the A-1C and both the Pitts and Eagle aerobatic biplanes.

TRADITIONAL DESIGN

In a world of slick glass airplanes, the Husky remains a rag-and-tube throwback, albeit a modern one. Like its contemporaries, the fuselage is made of welded 4130 tubing that runs the full length of the airplane, as with a Super Cub. Similarly, the gear legs are of welded tubing and covered in the same synthetic material used in the rest of the airplane.

Taildraggers of this ilk usually have looped bungees around robust steel lugs to help the gear absorb the bumps and while this nicely protects the structure from damage due to hard touchdowns, it also imparts rebound energy to the gear if the touchdown occurs beyond a certain rate of descent. That's why in a three-pointer or a wheelie, the airplane will bounce enthusiastically if the touchdown descent rate isn't near zero. If the touchdown speed is a little too high, the bounce will only get worse.

Aviat tackled this problem by attaching a couple of race car-style shock absorbers at the top of the gear structure oriented to absorb vertical loads. The shocks are inside the belly and thus not visible. They can be accessed from inside the airplane by removing the teak and holly floorboards or by unscrewing a metal belly cover.

Speaking of inside, the A-1C is a bit wider than a Super Cub and certainly more luxuriously appointed than an

A drawback of tandem-seat utility airplanes is that there's not much room for stuff. Aviat addressed the problem with accessible turtledeck storage, left, and a baggage compartment door that make it easier to get cargo behind the seat. Large tires are a popular option, lower left, and peeking under the skin reveals the two shock absorbers on the landing gear legs, lower photo.

Since the cabin is one person wide, the panel is similarly narrow so it has just enough room for sufficient instruments for legal IFR flight, a moving map of some sort and more additional stuff than you might imagine. For instance, the panel can accept a Garmin G500/G600 along with the GNS430 navigator and an RDM-930 large-screen engine monitor. If you've got the budget, you can trick this thing out to be a sublime bush flyer.

Aviat has dosed the options list with a number of utility features including three sizes of Tundra tires up to 31 inches, amphibious or straight floats from Wipaire and PK, fixed and retractable skis and an Airglas belly pod that helps with the fact that you're more likely to bulk the Husky out before you reach its gross weight limit. Another option we like is a removal hatch that allows access to a turtledeck baggage area suitable for long items. It's not big enough for a match set of golf clubs, but tent poles and fishing rods will slide right in.

The A-1C has two engine options, the 180-HP Lycoming O-360-A1P or the 200-HP angle-valve IO-360-A1D6. Prop options include a two-blade 76-inch Hartzell or a two- or three-blade MT composite.

FLYING IT

In flight demoing modern taildraggers, we've noted one thing: They're still taildraggers that require the same technique you'd use in an original Cub. But certain refinements make things easier. Getting in may or may not be one of them. On Tundra tires, the Husky is tall and this requires a butt-across-the-threshold ingress followed by hauling yourself up using the downtubes for purchase. It's a practiced maneuver, but this is certainly no Cirrus. Once you're in, the perch is lofty and comfortable. Soloing is from the front seat and unlike older taildraggers, you can just see over the cowl during taxiing so you might need an S-turn now and then, but not constantly.

The Husky levitates from the runway like an airplane that's either lighter or has more power than it in fact does. It's not CarbonCub-take-off-in-its-own-length performance, but the tail comes up quickly and the lightest tug gets it rotated. With two people aboard and three-quarter fuel, it climbs at 800 to 1000 FPM without heroic effort or a blind deck angle.

Handling is what you'd expect except for the roll rate, which is quite high for a highwing taildragger, the result of the 2005 wing mod that gives

older Cub. The seats are well padded with plenty of legroom in both the front and the back. The seats are fixed, but have different cushions to adjust ride height. The airplane has modern toebrakes and very good ones at that. If you get a little too jiggy, you can lock the wheels and nose it over.

the ailerons longer span and deeper chord. Earlier models had aileron spades, but they are needed now.

The Husky's trim is a bungee tension type via a wheel on the sidewall. Two things about that trim: The wheel is a bit of reach back from the front seat, which we didn't like much, and slight adjustments take big bites of trim, which we did like. The airplane trims up hands off quite readily.

Stalls clean and with flaps, straight and turning revealed nothing unusual. The moment of truth: How does it land with those shock absorbers? Without trying, we bounced the first three-point attempt and expected the usual kangaroo hop with the stick back to arrest the energy. But there was no second bounce. It settled onto the runway with no further drama. Aviat's Larry Schlasinger told us the shocks definitely do tame the bounce, but with no basis of comparison, we have to take him at his word.

For cruise speed, the Husky does about 108 knots on 9 GPH or so, with either the parallel valve or the angle valve. With 50 gallons aboard, it has an easy 4.5 hours of endurance.

CONCLUSION

We think the Husky is what readers have always told it is: An honest airplane, with good flying qualities and a good combination of performance and payload.

It's neither fast nor slow, but in that Goldilocks range of having enough speed to do 300 or 400 miles without torturing the occupants and plenty of fuel to do it comfortably. Ergonomics are good, with decent seats and good ventilation.

Pricewise, compared to other airplanes of its ilk and new airplanes in general, it's a fair value. A late-model Super Cub (early 1990s) costs nearly $100,000 and won't be lavishly equipped. A fully decked-out Husky will invoice for $250,000, but will have more factory features and options, especially for the back country flyer who might want floats or skis.

CONTACTS

Aviat Aircraft Inc.
www.aviataircraft.com
307-885-3151

HUSKY COMPARED

In our reports, we tend to toss around the term "utility aircraft" as if everyone knows what it means. But it means different things to different buyers and it doesn't always mean taildragger, thus you'll see 182s, 206s and even Piper Dakotas doing the utility role.

But let's stay with apples to apples here and take a look at some of the Husky's would-be competitors. And we use the word competitors loosely, because the largest portions of buyers in this market aren't shopping on the most payload, volume or ski mounts. They're just looking for a cool taildragger. All of the airplanes below qualify.

If useful load really is your thing, at 900 pounds, the Husky holds its own, besting the Super Cub, but not the Maules or either of the Cessnas, considering best case. Note too the prices on the used Cessnas, which we extracted from *Aircraft Bluebook Price Digest*. The Cessnas hold their values because they are much in demand by real bush operators. In addition to carrying a lot, they're fairly fast and well supported.

If the Super Cub is the Husky's arch competitor, it has some pros and cons. As a used airplane, it's cheaper and there are a lot of them out there. It has a reputation for ruggedness. But it doesn't carry as much as Husky, although that can be fixed with a weight-increase mod from CubCrafters or Wipaire, to name two.

These boost the Cub's gross weight to 2000 pounds which, depending on the airframe, can yield up to a whopping 1100 pounds of useful load. But these aren't just paperwork increases and both require significant structural mods.

The CubCrafters version requires up to $54,000 in parts, including a new, wider fuselage cage. We wouldn't be surprised if an owner who goes whole hog on this mod, which owners who can afford such things tend to do, could easily drive the invoice toward $200,000. For that princely sum, you'll have as close to a factory-new Super Cub as it's possible to get.

AIRCRAFT	MODEL YEARS AVAILABLE	TYPICAL USEFUL LOAD	CRUISE SPEED	PRICE EXAMPLES
HUSKY A-1C	2012	900 LBS	108 KTS	$240,000 (TYPICAL INVOICE)
HUSKY, A-1,B	1988-2009 (C AVAILABLE 2010)	610 TO 850 LBS	108 KTS	1988 HUSKY:$58,000
				2000 HUSKY A-1B: $95,000
				2008 HUSKY A-1B: $130,000
CESSNA 180	1953-1981	840 TO 1275 LBS	130 KTS	1953 CESSNA 180: $61,000
				1968 CESSNA 180: $76,000
				1981 CESSNA 180: $117,000
CESSNA 185	1961-1985	850 TO 1740 LBS	140 KTS	1961 CESSNA 185: $78,000
				1971 CESSNA 185: $93,000
				1985 CESSNA 185: $179,000
AMERICAN CHAMPION 7GC	1959-2012	500 TO 55O LBS	103 TO 109 KTS	1960 7-GCB: $21,000
				1975 7-GCBC: $33,500
				2011: 7GCBC: $130,000
MAULE M-4,5,6,7 (180 SERIES)	1974-2009	1000 LBS (±)	135 KTS	1970 M-4-180C: $26,000
				1980 M-5-180C: $38,000
				2009 MX-180B: $140,000
PIPER PA-18 SUPER CUB	1961-1994	57O TO 800 LBS	105 KTS	1961 SUPER CUB: $54,000
				1980 SUPER CUB: $70,500
				1994 SUPER CUB: $94,000

AvMap EKP-V: Strong Display, But No Touch

This rugged electronic kneepad GPS offers an impressive display, good terrain warnings and full approach integration, but no touchscreen or wireless.

By Larry Anglisano

We don't envy Italian GPS veteran AvMap in their attempt to compete in today's world of cockpit iPad and with Garmin's well-rounded line of portable navigators. Garmin and Apple all but own the aviation GPS and mapping market. Still, we've been impressed with nearly every model of AvMap navigator we've tested over the years. The company has a knack for offering high-end mapping displays packaged in a case that's convenient and rugged enough to throw around the most hostile cockpit.

And so it goes with the new flagship EKP-V. We were surprised that the latest-generation EKP doesn't have a touchscreen. But the unit's utilitarian capability and brilliant screen take the bite out of this shortcoming. Some might even prefer it.

TACTICAL FOOTPRINT

Our editorial schedule delayed our review of the EKP-V, which gave us several months to live with the unit in our day-to-day flying chores and on several sizeable trips. Its chassis size of 4.3 inches x 6.8 inches x 0.8 inches allowed for easy storage in a flight bag side pocket, on the copilot and back seats, and stashed in our backpack for daily airport commutes on motorcycle.

EKP stands for electronic kneepad, and the 14-ounce unit also proved the perfect size and weight for strapping around our leg with the included Velcro leg strap. The strap attaches to a bracket mount shaped for your upper thigh.

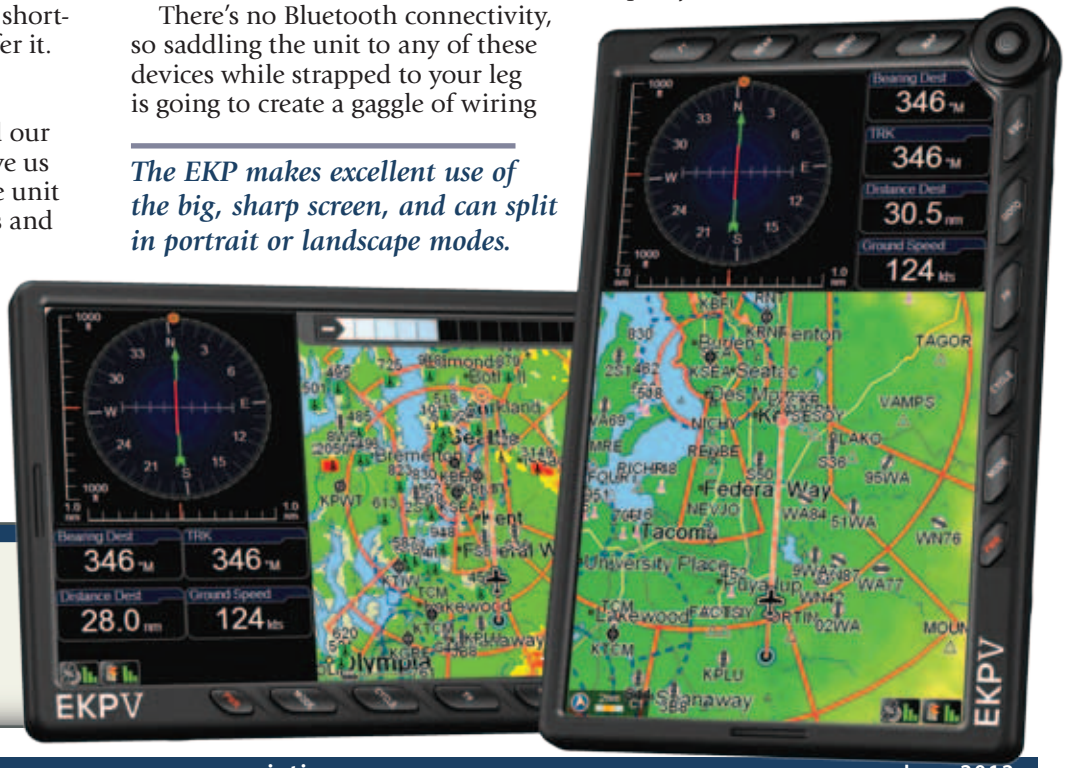
But the unit is also worthy for use as a mini MFD as many LSA and experimental owners have done. The pressure-fit docking station houses two serial data ports, a USB connection, audio/video input and audio output. This connector assembly makes it possible to hardwire the unit to an autopilot for left/right steering commands, Zaon portable for traffic alerts or an XM weather receiver for datalink. Datalink is not built into the unit.

There's no Bluetooth connectivity, so saddling the unit to any of these devices while strapped to your leg is going to create a gaggle of wiring mess that just isn't practical. To us, this is way old school in a day where wireless iPads are a proven and respected cockpit tool.

Battery endurance is roughly four hours. You can squeeze out a bit more juice while in battery saver mode, which automatically dims the display when not in use, but you'll want to plug the EKP in for regular use to take advantage of its terrific display at full brightness. The battery charges while plugged in. You can plug the unit into a USB port using a supplied cable for a slow charge as well.

The EKP-V display, a seven-inch 16,000-color LCD of 800 x 400, proved a crisp read and provided excellent visibility in all lighting conditions including one bright Florida sun-splashed cabin. It was equally comfortable in a dark

The EKP makes excellent use of the big, sharp screen, and can split in portrait or landscape modes.



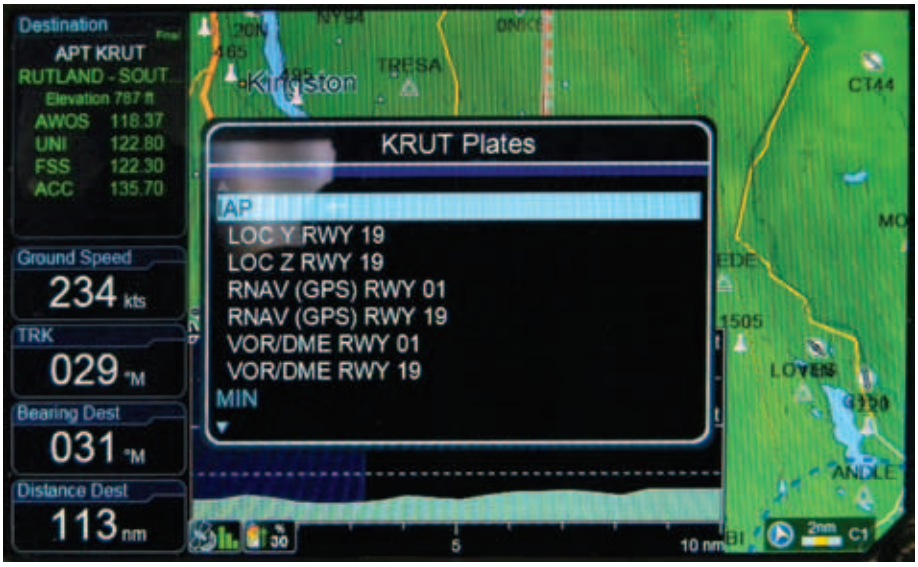
CONTACT

AvMap Navigation
www.avmap.us
800-363-2627

CHECKLIST

- ✚ Convenient size works as knee-mount system
- ✚ Brilliant display for maps and charts
- ✖ Lacks touchscreen and Bluetooth
- ✖ The worst user's manual we've ever read

Approaches can be loaded into the flight plan and charts are an option. Note the profile view of terrain below and behind this menu.



late night cabin, thanks to a linear manual dimming control. A portrait presentation is obviously most practical for kneeboard use. We prefer landscape mode for better use of the map. The EKP-V offers both.

If you come from a Garmin portable, the Avmap's feature set will seem foreign at first, but the controls and overall bezel design are uncluttered and reasonably logical. The EKP-V has 10 mode buttons mounted along the top and down the right side of the face. The enigmatic F1 key is for your most-used functions. For instance, you can customize F1 so it activates the find-airport command, user waypoints or custom checklists—a feature we liked.

A joystick is housed on the upper right corner (or lower right, depending on how you hold the unit) is integral for panning the map display, and serves as an enter key. We think this joystick (more of a fat knob than a stick) should be a tad larger for ease of use. Below the joystick is a thumb wheel that AvMap calls a smart wheel. It's used for zooming the map and navigating the menu structure. These controls have a durable and positive feel, but can be frustrating to use in the bumps. More on that in a bit.

SOLID MAPPING AND GPS

The EKP's WAAS GPS receiver performed well in both high- and low-wing aircraft using the built-in antenna—impressive for a unit that's buried low in the cabin when strapped to your leg. There is an optional remote antenna. Additional data storage (software and mapping data) is via a preloaded Micro SD card.

There's room to store 50 flight plans, but when we tried to build some on the fly, we became frustrated. Instead, we cut to the chase and found ourselves panning the map, placing the cursor on the point we wanted to go and pounding the familiar GOTO button. The position selected from the map now becomes the active destination and you're on your way. This is straight-forward for on-the-fly navigation, but we think some popular iPad apps do better, thanks to touchscreen.

You could also dial in a waypoint by using the GOTO button and dial by identifier using the virtual keyboard (and the smart wheel). At times we found the smart wheel to be a bit too sensitive, blowing past a letter we intended to pluck from the virtual keyboard. AvMap makes the task easier by presenting a list of possible waypoints while you edit. If you want to go to Myrtle Beach, it appears by the time you dial "KMY."

Placing the bulls-eye cursor on top of a map object opens a helpful information window with the objects name, LAT/LON position on the map, bearing and elevation. Push down on the joystick, and you'll get everything you'd want to know about it. For airports that includes runway length, frequencies, fuel service and so on.

The MODE button configures screen overlay, including map data, TAWS, weather and traffic. Speaking of weather, the EKP has the ability to display a host of XM Weather products from third-party wired receivers including Nexrad, Precip, METAR, TAF, TFR and lightning data. We didn't get to try weather on the unit we tested but, given the high-quality display and fast processor, it should work well.

CHARTING AN APPROACH

Loading an approach procedure from an active flight plan is intuitive from the flight plan menu and subsequent flight plan tab, where you have the option for selecting an approach. The legs of the approach are drawn directly on the moving map and drive the EKP's HSI—a real benefit, in our view.

Georeferenced approach plates and airport diagrams for the EKP are provided by Seattle Avionics. Annual subscriptions are $99 and include plates, airport diagrams, arrival and departure procedures. The unit also uses Jeppesen navigational data and

The EKP-V works well as a kneeboard. The bezel buttons keep most of the size available for the screen.

Paradigm Shift

THE END OF THE PORTABLE?

One Baron owner told us the aera796 he dropped several grand on less than a year ago hasn't seen the light of day from his flight bag since his iPad became a permanent fixture on his copilot seat. Are these dedicated devices doomed?

Maybe as a portable resting on your knee, but not as a permanent fixture in your aircraft. There are plenty of pilots flying with both their dedicated portable mounted on the yoke for more GPS-like duties and their iPad for charts.

Capable navigators like the EKP-V and Garmin aera796 are also attractive as budget MFDs—even if it means a major installation effort to get there. The owner of an ancient Piper Cherokee had grand visions, but the big 796 ate up half the radio stack. A second radio stack had to be built where the glove box once lived on the far right side of the panel to relocate the transponder, second comm radio and DME. The install tallied a whopping three grand, which didn't include the cost of the GPS. Still, a true MFD and navigator to drive it would have tripled this investment. The portable turned panel mount made a relative kind of sense.

Hard-mounting the iPad isn't quite as easy, and connecting the unit to an aircraft circuit breaker panel isn't always practical given the unit's demand for current draw. As worthy of a tool as we think an iPad is for the cockpit, we don't see iPads making their way to avionics stacks in the near future.

The iPad's touchscreen and easy wireless connectivity gives it an edge in communicating with the panel, however. Aspen's Connected Panel interface links an iPad, Garmin navigators and Aspen flight displays almost seamlessly.

includes low airways and private airfields plus VFR reporting points.

The easiest way to call up a chart is through the MAP button, where a drop-down list of available charts for the active waypoint appears. We found the EKP to be a fine chart reader that's both easy to work with and read at a glance. To change an approach on the fly, the GOTO button works best. Here you have the option of deleting or changing the approach, resynching the active go-to waypoint or simply changing the active waypoint.

The NEAR key is also an easy way to change an active waypoint and the quick processor breezes through pages of airports, airfields, heliports, VORs, NDBs, intersections, ARTCC, FSS and user waypoints nearest to the existing fix.

NAVIGATING THE TERRAIN

TAWS functionality has dual settings: low separation and high separation with obvious color-coding that's based on the aircraft's separation from the terrain or obstacles. High separation paints obstacles red when they're less than 1000 feet below you. Low separation downgrades this to 500 feet.

Enabling the vertical profile view in conjunction with the TAWS map overlay mode offers sizeable amounts of terrain awareness. Terrain peaks in the profile offer color-coded warnings that we found accurate based on actual terrain.

Waypoint data has the expected choices for bearing, track, distance, ground speed and so forth. There's also a basic, yet effective, HSI with course needle and vertical descent guidance. A split screen works in portrait or landscape mode.

Missing from the EKP is PFD-like flight instrumentation and synthetic vision. We think these may be more buzz than substance on a portable. But a mapping function that AvMap has always nailed is in its accurate terrain depiction and it's carried over into the EKP-V.

CONCLUSION

The EKP-V has a list price of $1998, which closes in on the street pricing for Garmin's aera795. Head to head, we give the EKP-V the slight convenient size advantage given its thinner case, lighter profile and the ability to wear it as a knee board. Still, gadget freaks will likely be drawn to the 795 with its virtual 3D Vision technology, touchscreen feature set and Garmin brand recognition.

We think the EKP-V would be a better product with a touchscreen. That said, AvMap told us they purposely avoided touchscreen because they couldn't find a touch technology with an acceptably high-def screen and that customer feedback hinted that there's still a desire for traditional controls.

For no-nonsense portable navigation that impresses with a brilliant display and excellent mapping, we think the EKP-V is a worthy consideration when shopping the mid-priced GPS market.

Stratus ADS-B Weather: Simple and Seamless

This one-box solution for streaming ADS-B weather and GPS to ForeFlight on the iPad is the most compelling alternative to satellite weather we've seen

by Jeff Van West

In-flight weather for the iPad is nothing new. SkyRadar's ADS-B receiver worked with WingX for well over a year, and Baron's Mobile Link can deliver XM satellite weather to ForeFlight, Global Nav Source, FlightGuide and others.

What is new is some competition. Sporty's Pilot Shop teamed up with ForeFlight and device manufacturer Appareo to offer ADS-B weather on an iPad with the $799 Stratus. Not only has the $799 Stratus' appearance forced a price-drop on competing units, it's also set a new bar for simplicity. Stratus requires no power cords or external antennas for an average flight. The box has all of one button. Turn it on. Go fly.

SEAMLESS INTEGRATION

Stratus is a WiFi basestation, so you connect your iPad to the Stratus the same way you connect to the FBO internet. Once your iPad has memorized the network, it will connect automatically. If you're an über-geek, you can even connect several iOS devices at once, and run ForeFlight with ADS-B weather on all of them. Stratus has an internal GPS and can act as the GPS source for ForeFlight in addition to supplying weather.

ForeFlight treats weather data from Stratus basically the same way it treats data from the internet. METARs, TAFs, winds aloft and NOTAMs are in the airport information pages. PIREPs, AIRMET/SIGMETs and TFRs appear positioned on the map. Tap them and you'll get a pop-up window with details. ADS-B NEXRAD replaces the internet NEXRAD.

So, if you know how to use ForeFlight's weather on the ground, your learning curve for using Stratus is about as steep as central Kansas.

NOT QUITE SATELLITE

There are some operational differences between ADS-B weather and what you'd get from the internet or XM, however. You won't see storm tops or movement. The radar is not animated and is lower fidelity than ForeFlight's internet NEXRAD.

Actually, ADS-B NEXRAD comes in two flavors: high-res and low-res. There's a low-res image for the entire CONUS. (Alaska also has its own ADS-B network, but Stratus will work there, too.) You also get a high-res image for roughly 250 miles around your position. ForeFlight mixes these images into a composite picture (you can see both resolutions in the image on page 16). The local image has five times the refresh rate of the CONUS one, so it can seem a bit out of sync with fast-moving storms, and you only get a general picture of what's going on 400 miles away.

In practice, this radar is ample in detail and refresh speed for tactical decisions. We found the display worked fine even on our iPad 1 with partial transparency. A cool plus of something like ForeFlight is overlaying NEXRAD directly on an en route or sectional chart.

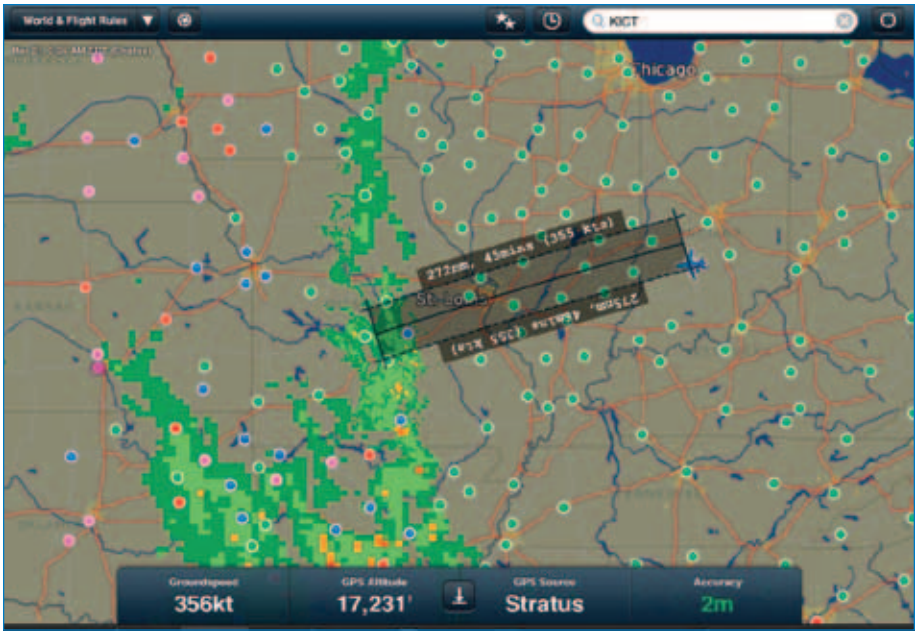
For the record, all the ADS-B data except CONUS NEXRAD is limited radius. Most often you won't get weather more than 500 miles from your current position. It's important to note the source and age of weather data. For instance, a METAR's age appears in green if it's recent, turning amber and red as it gets more out of date. If it's ADS-B-derived weather, it says in parentheses.

You can also see the general age of your weather information at all times on the top left of the map. It's

ForeFlight displays weather data and images the same way whether they came from the internet or ADS-B, which makes using it a snap. The source is noted along with the data's age.

CHECKLIST

- ⊕ Dirt-simple to use, with seamless integration of ADS-B weather and TFRs
- ⊕ A one-time cost of $799 rather than $1100 for XM plus $30/month
- ⊖ Reception altitude is an issue with all ADS-B weather systems.



One thing we really like about an iPad weather solution is the integration with the app. Here's ForeFlight's measure tool in conjunction with both NEXRAD and airport weather conditions.

white for recent data, turning amber and red as it ages. It says "Stratus" in parentheses when the iPad is connected to the Stratus.

For exhaustive detail, there's a pull-down menu showing you all the Stratus stats, including battery life, GPS satellites in view and the error rate for all ADS-B ground stations. This pull-down is also home for general NOTAMs for your area, but not associated with an airport. It's not an obvious place for them, but they're available if you want them.

ForeFlight can display lightning and satellite imagery, but these products aren't included in ADS-B, so nothing appears on the map. Make sure you have the latest update to ForeFlight, because without it there's no warning that the dearth of lightning is "no data" rather than "no lightning." Missing radar data is obvious, as the map shows hash marks over all areas where recent radar is missing.

Future development is factor, too, when looking at ADS-B weather. XM weather products continue to evolve; ADS-B is from the FAA. What you see is what you're going to get for a long time.

Stratus shows ADS-B status by color-coded text on the map and a pop-up window with details.

SPEAKING OF RECEPTION

One universal weakness with all ADS-B weather systems is that, with a few exceptions, you can't receive it on the ground. Much of the U.S. has coverage from about 1500 feet AGL upward, but pilots in mountainous regions, however, may have to travel high and far before they get line-of-sight to an ADS-B ground station.

Where we tested Stratus in Portland, Maine, we normally get ADS-B data climbing through 700 feet, but the unit we had repeatedly lost all contact even at 3000 feet. This is such bad reception, that we suspected a hardware problem.

Sporty's couldn't get us a replacement—Stratus is already backordered with surging sales—so they sent us the optional $60 external antenna. The problem vanished like magic, with reception matching or exceeding the SkyRadar ADS-B box we've flown with in the past. Experimentation in three different airplanes showed the Stratus only misbehaved on the glareshield above the avionics, receiving fine from the backseat.

Given that this was a pre-production unit and we can't find another instance of this despite all the Stratus units flying, we're confident this is an anomaly—a bad box—and most people shouldn't need the external antenna. We did find comments from some people about Stratus units getting too hot up on glareshields and displaying a warning. Be aware the external antenna is ADS-B only. There's no remote antenna for GPS, but using Stratus' internal GPS isn't required.

THE LEADING EDGE

Is Stratus the must-have gadget for 2012? We wouldn't go that far. We're going out a limb and saying this will be the summer of portable ADS-B.

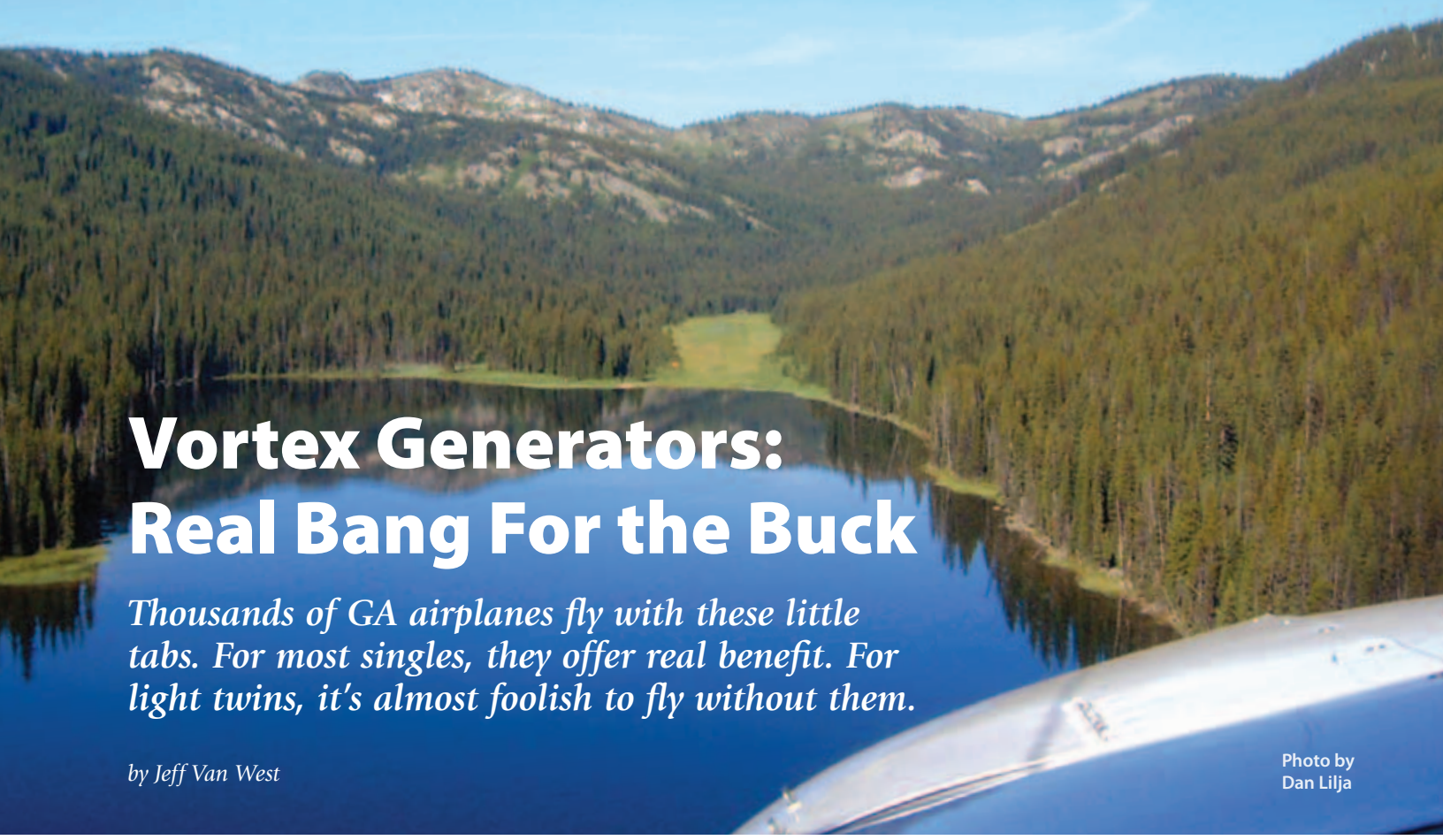
SkyRadar was the only other option, and their prices dropped to $679 when Stratus hit the market. SkyRadar also has the potential for connecting a Zaon traffic system for traffic alerting. FreeFlight Systems has an in-panel solution that will meet the ADS-B mandate and will have a wireless connection for both weather and traffic. We asked Zimmerman of Sporty's if Stratus had latent capability to patch traffic or connect to other systems. He said this box didn't, but future systems certainly might.

All that said, the biggest decider might be what app you like to use. ForeFlight is the weapon of choice for a majority of iPad pilots, and Stratus is the only ADS-B weather option for now. Given that its only limitations are really the limitations of the ADS-B system in general, we expect Stratus units will rightly remain a top seller for months to come.

CONTACTS

ForeFlight
www.foreflight.com

Sporty's Pilot Shop
www.sportys.com/PilotShop
800-776-7897



Vortex Generators: Real Bang For the Buck

Thousands of GA airplanes fly with these little tabs. For most singles, they offer real benefit. For light twins, it's almost foolish to fly without them.

by Jeff Van West

Photo by Dan Lilja

It's one of those aircraft truisms that performance requires compromise. Controllability at low speed means compromising the wing that enjoys high-speed cruise.

That's what makes vortex generators (VGs) seem too good to be true: They claim lower stall speeds in singles and twins without a penalty in cruise speed. Sometimes they bump up the gross weight. For twins, they reduce minimum controllable airspeed (V_{mc}). This is speed below which controlled flight becomes impossible with the critical engine failed and the other engine at full power. Below V_{mc}, there isn't enough rudder and aileron authority to counter the natural yaw and roll of the asymmetrical thrust. Translation: The airplane rolls over and crashes.

Maybe it took this long for VGs to gain acceptance because some aeronautical designers considered them bandaids to make up where a wing design lacked. But from our tests and owner surveys over the years, there's no doubt the little tabs do what they claim. It's quite possible VGs are the most beneficial single safety enhancement you can make for your airplane.

AIRCRAFT MODS

REALISTIC EXPECTATIONS

The gains are different for every airplane. But realistic numbers are four- to eight-knot reductions in stall speed combined with much better low-speed aileron and elevator authority (if elevator VGs are included). Some pilots tell us it's the control authority they appreciate far more than the lowered stall speed. In twins, V_{mc} is often reduced to the point where it's virtually eliminated. This is because the rudder has become so effective that the wing stalls before V_{mc} is reached. Note that many VG kits include a new face for your airspeed indicator to reflect the lowered speeds.

The boost in gross weight for twins is a direct result of the lowered stall speed. Light twins must have a single-engine rate of climb equal to .027 times the square of V_{so}. If stall speed is reduced and low-speed climb is improved, the aircraft now has excess climb, so the gross weight can be bumped up. However, the landing weight remains unchanged, as that's more a factor of aircraft structure. Be sure to burn off enough fuel before you land your twin at the higher weight (or don't tell anyone if you forget). Then again, you don't have to fly heavier. Stick with the original weight and you might actually climb if you lose an engine at rotation.

VG kits usually consist of the metal tabs, adhesive and a template for positioning the VGs on the wing. The template is usually a wide paper strip that matches up with specific rivet lines or structures. The companies tell us that even an A & P with no VG experience should be able to complete an airplane in less than a day.

Placement is critical (see sidebar page 19). It's usually far enough aft that de-ice boots or TKS systems are

CHECKLIST

- ⊕ For many aircraft, they offer performance gain with little or no penalty
- ⊕ One of the most cost-effective upgrades you can buy.
- ~ Not an option for modern, high-performance aircraft like the Cirrus SR22.

Details make the difference. Micro originally had Baron rudder VGs on the fixed surface, but discovered the Baron's rudder design favored VGs on the moving surface. Their RV-9 kit includes a wing root strake that improves elevator authority.

not an issue. Specific kits may also have fatter or curved plates, called strakes, at strategic locations. These are often to ease airflow around engine nacelles or boost elevator authority (even if the strake is forward of the wing).

Icing is a common question with VGs; won't ice accumulate on them? It shouldn't, as they don't extend far enough into the active airflow (see sidebar on page 19). A possible exception could be clear ice with runback. But that may get past your boots and ruin your day no matter what. It is true that VGs make the wing harder to clear of last night's snow, not to mention wash.

VGs can get knocked off. Most kits have an allowable number of missing VGs, below which you must use the original aircraft performance numbers. In some cases, losing too many VGs from one spot may make the aircraft temporarily unairworthy. VG companies all sell replacement VGs.

SELECTING A KIT

Adding VGs is possibly one place where the adage about the weight of the paperwork exceeding the weight of the modification is true. The tabs are really just aluminum (or Lexan for some experimentals) glued to the wings and tail. But this is a major modification that changes aircraft performance, and you'll need a kit STC'd for your airplane.

There are five major sources of VGs for certified birds. Micro Aerodymamics is the goliath leader in terms of STCs, with over 500 models covered. (Reality check: There are technically 32 "models" of Cessna 172 alone.) They're still actively creating STCs, with Luscombe 8s and the King Air C90 just added. Charles White of Micro estimates there are upwards of 8000 aircraft flying with his company's VGs. Micro also supplies the factory VGs shipped on new Maule aircraft and Piper Meridians. Micro kits are available directly from the company and through Aircraft Spruce.

Boundary Layer Research has the next biggest portfolio, focused heavily on piston twins. Many of these were developed by Aeronautical Testing Services, which also developed kits for some Cessna singles (120/140s, 180-185s), Piper tandems (PA-12, -14, -18) and ag aircraft. The Cessna and Piper kits are sold through CubCrafters and the ag kits are sold through Pacific Aero Supply

Installation is more time consuming than complicated. Finding a mechanic willing to let you assist could bring down the labor cost substantially.

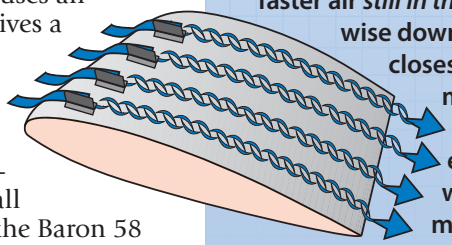
or Mid-Continent Aircraft. RAM aircraft is well known for its upgrades on Cessna twins and offer their own VG kits. Bonanza and Baron experts D'Shannon Aviation offer kits for all models except B36TC, Twin Bonanza and Travel Air.

(If you enjoy soap opera, some digging will show that almost all of these companies are descendants of VG pioneers Paul Robertson, Charles White and Mike Anderson, who ended up at ATS, Micro and BLR, respectively.)

If only one of these companies has a kit for your aircraft, then your decision is made for you. If you have options, then it's time to compare all the numbers. For example, a Cessna 414A owner could get a kit from Micro, BLR or RAM. The RAM kit is far cheaper, at $1650 versus $2950 for BLR or Micro.

But wait, the RAM kit doesn't include the gross- and zero-fuel-weight increases that come with Micro and BLR because RAM has its own weight increases through its other STCs. BLR's kit boosts GW and ZFW by 355 pounds. Micro's kit boost GW by 350 pounds, but ZFW increases only 135 pounds. Micro's kit drops V_S and V_{SO} by 6 knots and 4 knots, respectively. BLR's kit claims only 4 knots and 1 knot. RAM's kit claims depend on whether you're talking about a standard 414A or one combined with other RAM kits, with about 8 knots clean and 4-7 knots dirty. All nearly eliminate V_{MC}.

If you have an A36 Bonanza, Micro's kit for $1450 seems like a much better deal than D'Shannon's kit at $2000, except that the D'Shannon kit includes a 100-pound gross weight bump (as long as you have no other gross weight increase mods). If you don't want the increase, you can just have the VGs for $1000. Micro gives a four- to six-knot reduction is stall speeds. D'Shannon tells us theirs is 7-10 knots. D'Shannon's is also unique in that it uses an L-shaped VG it claims gives a more controlled vortex, and that it places a second row directly in front of the ailerons for better low-speed authority. However, Micro's stall and V_{MC} reductions on the Baron 58 exceed D'Shannon's.



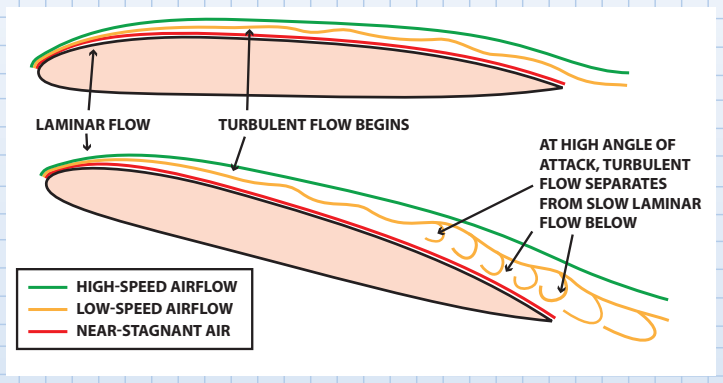
In some other match-ups, how-

Tech Corner

HOW A VG WORKS (ROUGHLY)

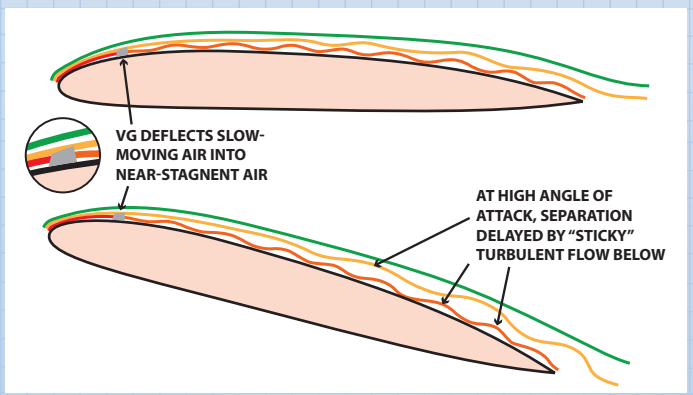
You don't need to know how wings work to make a good landing. Likewise, you don't need to know how boundary-layer devices, a.k.a. VGs, work to use them. But it can help explain how you seem to get something for nothing. We're glossing over some detalis, but you'll get the idea.

We tend to think of airflow rushing over the wing surface uniformly. But that's not quite right at the micro level. The friction of the wing surface slows down the air just above it to essentially a standstill. Air just above that is slowed, but not stopped, by the stopped air below. Air above that is slowed, but not as much, and so on until the air is flowing essentially unimpeded by friction. The depth of air that slowed to some degree is the boundary layer. It's shallowest by the leading edge and thickens further aft on the wing.



For part of the air's journey down the wing, the near-still air, the slow air and the fast air all flow smoothly. That's the low-drag laminar flow we pilots love. But, alas, that middle zone of air begins to deepen and burble into turbulent flow. Turbulent flow is higher-drag, but it's also "stickier." That is, it resists separating and helps keep the airflow overall following the wing surface and earning us our lift.

At higher angles of attack, the boundary layer thickens more dramatically, but the near-stagnant air slows even more *and remains laminar*. Laminar flow separates easily, so flow separates here, close to the wing. That progates up and forward and, bada bing, bada boom, the wing stalls.



VGs are placed near the leading edge of the wing where they are still in laminar flow and can extend high enough into the boundary layer to twist some of the faster air *still in the boundary layer* into pencil-thin vortices running chordwise down the wing. The vortices energize the near-stagnant air closest to the surface of the wing, making it more turbulent and more resistant to separation for a given angle of attack.

Placement is critical. Put a VG too far aft and it can't get enough higher-energy air. Place it too far forward, and it will work great at low speed, but it will hurt cruise performance. Get it just right and what little drag it creates will be balanced by a small drag reduction from a slightly narrower boundary layer in cruise. It's like getting something for nothing.

AIRCRAFT MODEL	MICRO AERODYNAMICS	BOUNDARY LAYER RESEARCH	RAM AIRCRAFT	D'SHANNON AVIATION	CUBCRAFTERS
36 BONANZA	$1450	*	*	$1000 / $2000 G	*
58 BONANZA	$2450	*	*	$1750	*
BEECH DUKE	$2450	$1950 / $3950 G	*	*	*
C90 KING AIR	$3950	*	*	*	*
CESSNA 120	$695	*	*	*	$995
CESSNA 172	$1450	*	*	*	$1495
CESSNA 180	$1450	*	*	*	$1495
CESSNA 340/A	$2950 G	$2950 ZG	$1650	*	*
CESSNA 414A	$2950 ZG	$2950 ZG	$1650	*	*
7AC CHAMP	$695	*	*	*	*
MOONEY M20	$1450	*	*	*	*
LUSCOMBE 8	$695	*	*	*	*
SUPER CUB	$695	*	*	*	$1495
PIPER NAVAJO	*	$4250	*	*	*
SARATOGA	$1450	*	*	*	*
SENECA	$1950 Z	$1950 Z	*	*	*

Chart represents selected popular models and not all kits from all manufacturers are listed. Prices don't include installation or custom paint. "G" indicates a gross weight increase. "Z" indicates a zero-fuel weight increase. Not all VG manufactures claim the same performance gains. Check each manufacturer's website for details.

ever, the only difference we can see is price. Note that custom painting of your VGs to blend in with your paint scheme will cost extra, and it might be tough to tell what color to get until they're actually on the plane if you have a complex paint scheme.

KIT BUILDS, NEW DESIGNS

Micro and ATS both offer kits for some popular experimental aircraft (including Yak-51s and CJ-6s registered as experimental) and generic kits where a homebuilder can add VGs through trial and error. There are also a couple companies catering directly to homebuilders, including Hall Brothers (www.hallwindmeter.com), STOL Speed (www.stolspeed.com), Land Shorter (www.landshorter.com) and Pacific Northwest Aero (www.pnwaero.com).

These kits are a relative bargain at $300-$400. Theoretically, you could add VGs to an LSA with approval from the manufacturer. We're not sure it would be worth it given how much control authority LSAs tend to have and how slowly they can fly before a stall. Pacific Northwest Aero can also ship kits to some Canadian owners maintaining antique birds under the Owner Maintenance Program.

Given how precise the placement must be for VGs, we asked Jerry Lundgren of Pacific Northwest Aero how a homebuilder can do it. It turns out that most wings get maximum benefit at nine- to 11-percent of wing chord. The Pacific Northwest Aero kit is more complete than many others in that it includes tufting material to actually visualize separation and carpet tape to experiment with VG placement. Successes have ranged from better elevator authority on RV-9s to seven- to 10-knot reductions in stall speed on rockets like the Lancair 360. The Lancair owners say it costs maybe a knot in cruise.

Lundgren told us an interesting story about the Lancair IV-P: "We put some VGs on the wing at about 11-percent chord and it wouldn't stall … With full aft stick, it was just descending without a stall break." Lancair IV-P owners sweat if the airspeed drops below 100 knots anywhere before the landing flare, so this looks like the aerodynamic equivalent of raising Lazarus. But it came at a price: "We lost 11 mph at cruise speed," said Lundgren. Positioning the VGs further aft reduced the penalty, but the old stall behavior crept back.

This speaks to the question as to why no VG kits exist for designs like the Cirrus SR22, which has been involved in some high-profile stall-spin accidents. No one we asked could say if they've researched a VG configuration that would complement the existing leading-edge cuffs, which provide similar low-speed aileron authority.

Charles White of Micro said he wouldn't rule out a Cirrus kit if he had an airplane to experiment with for a month. Micro just finished a kit for the Diamond DA-42 that drops Vs by five knots and V_{mc} by nine knots, so there are gains even on newer, already-docile wing designs.

WORTH A LOOK

White says he's most proud of the 71 calls he's gotten from owners saying, "Thanks for saving my life." Two of those were Cessna 340s that had an asymmetrical flap extension—usually the last emergency a 340 pilot will ever experience. They both had enough aileron authority to prevent the rollover and land.

That's a rare event, but when a $700-$2500 investment can give that kind of a controllability gain, we think it's money well spent.

CONTACTS

Aeronautical Testing Svc.
360-435-8859
www.aerotestsvc.com

Boundary Layer Research
425-353-6591
www.blraerospace.com

D'Shannon Aviation
800-291-7616
d-shannon-aviation.com

CubCrafters
509-248-9491
www.cubcrafters.com

Micro Aerodynamics
800-677-2370
www.microaero.com

RAM Aircraft
254-752-8381
www.ramaircraft.com

Trig Avionics TY Radios: Space-Saving Comms

A new comm radio option for tight panels and LSA applications, these units offer big-radio capability with a small footprint and a fair price.

By Larry Anglisano

Most communications radios are designed for installation into a traditional radio stack. That's great for traditional panels, but they can be a non-starter in classic LSA and ultralight craft. The market offers few choices other than Becker Avionics for standalone comm radios that fit in tight spaces. Now UK-based Trig Avionics offers a worthy alternative with the TY-91 and TY-92 transceivers.

SPACE-SAVING FLEXIBILITY

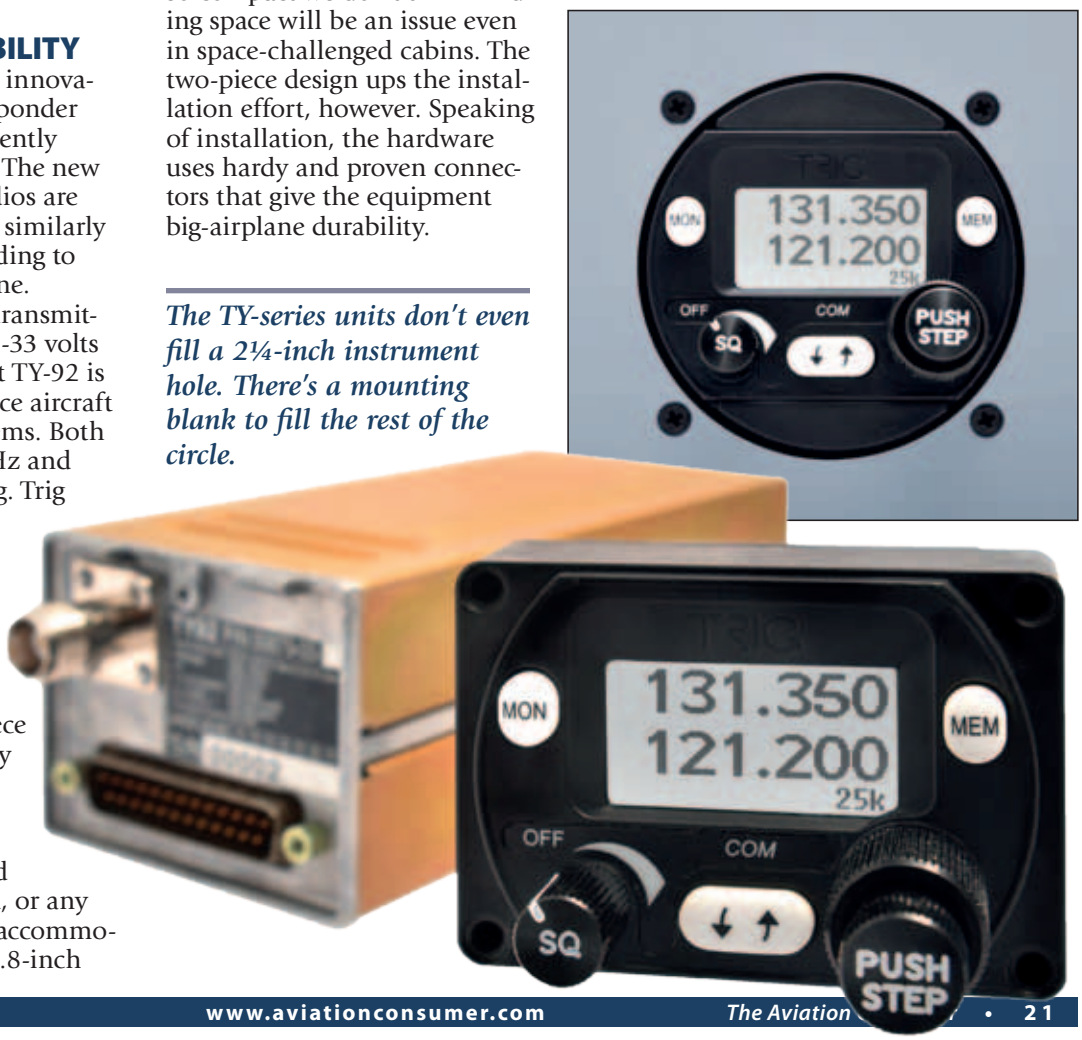
Trig is best known for their innovative and space-saving transponder solutions, including the recently certified TT22 ADS-B unit. The new TY-91 and TY-92 comm radios are pitched to complement the similarly packaged transponders, adding to the growing Trig product line.

The TY91 has a six-watt transmitter and can operate with 11-33 volts of input power. The 16-watt TY-92 is aimed at higher-performance aircraft with 28-volt electrical systems. Both units are certified for 25 kHz and 8.33 kHz frequency spacing. Trig says the TY91 can even be battery operated, making it an option for gliders and other aircraft without power-generating electrical systems.

What makes the TY-series unique is the two-piece design. It utilizes a remotely mounted transceiver channeled by a compact control head. The control head is designed to fit in a standard 2¼-inch instrument cutout, or any area on the panel that can accommodate the 2.4-inch wide by 1.8-inch high chassis case. Better yet is the space saving that's afforded behind the panel with a control head that's only three inches deep. The remote transceiver measures 5.5-inches long and stands 1.7-inches high. Total system weight is roughly one pound.

Multi-component systems save space at the panel, but you still need to find a home for that remote box. But in Trig's case, the remote box is so compact we don't think finding space will be an issue even in space-challenged cabins. The two-piece design ups the installation effort, however. Speaking of installation, the hardware uses hardy and proven connectors that give the equipment big-airplane durability.

The TY-series units don't even fill a 2¼-inch instrument hole. There's a mounting blank to fill the rest of the circle.



CHECKLIST

- ⊕ Designed specifically to fit in traditional instrument holes.
- ⊕ Robust buttons and useful features
- ⊕ Current drag low enough for battery power
- ⊖ Remote mounting requires additional effort

FEATURE-RICH LOGIC

The TY-series bring significant audio capability to starkly equipped aircraft. There's an integrated two-seat intercom and for headset-free operation, the units come equipped with integral speaker amplifier for direct connection to a cabin speaker.

The controls on the radios are straightforward and simple. (Trig even boasts of easy operation while wearing gloves.) There's a volume and squelch knob, frequency tuning

knob and frequency transfer button at the bottom of the radio's bezel. To the left of the LCD display, a frequency-monitoring button allows for monitoring the tuned standby frequency while a memory button commands the nine-frequency memory storage bank.

BUDGET-MINDING PRICE

When released this fall, the six-watt TY91 is expected to list around $2000, while the higher-end TY92 will weigh in around $5000. Installation pricing will be tough to nail but we would expect pricing to be slightly less than a traditional radio since the main avionics stack won't need to be disassembled and restacked. Of course, mounting the remote unit could make up the difference.

TRANSPONDER WITH THAT?

To complement the TY-series comm radios, Trig has also announced the the TT22, which, according to Trig, is the world's smallest Mode-S transponder suitable for GA cockpits.

Like the TY-series radios, the TT22 is a two-piece system with a 250-watt remote unit and a space-saving control head. What we like the most about the TT22 is the integrated altitude encoder—a real space-saver for owners and convenience for technicians. The TT22 is TSO C166b-compliant, which is the ADS-B mandated standard, but will require additional STC. Street price for the TT21 control head-remote combo is just under $2300.

As an aside, Trig also offers the TT31, which is a conventional-design, panel-mount transponder aimed at directly replacing the popular Bendix/King KT76A/78A transponder with something capable of meeting the ADS-B out mandate. The TT31 is around $2800, with the King replacement model around $3300.

In a market dominated by touchscreens and 2.6-million-color LCDs, it's refreshing to see a company addressing the needs of the simple and the small.

CONTACTS

Trig Avionics Limited
44 0 131449 8810
www.trig-avionics.com

LOGBOOK

Reducing Lead Fouling: TCP is Back

After several years of MIA, this lead scavenger is back on the market. Also, a new fuel sampler filters pour-back and tape labels help with misfueling.

After a long period of difficulty obtaining it, TCP has come back on the market in volume and that's a good thing, especially if you own an engine that's susceptible to lead fouling of plugs.

TCP is used to reduce lead deposits on spark plugs, thus reducing fouling. It also helps reduce valve deposits. This means better performance and less need to pull plugs to manually clean them, resulting in money saved and reduced frustration.

Using TCP is simple. It employs a syringe and fluid can arrangement, where TCP is squirted into the aircraft fuel tank at fill-up. One ounce treats 10 gallons, so it adds less than 10 cents a gallon to fuel cost. (A quart of TCP is $35.)

If aircraft engines were all in perfect tune, optimally engineered and professionally flown, perhaps TCP would not be so necessary, but this isn't the case. Moreover, there clearly is extensive owner feedback that certain engines seem more prone to spark plug fouling than others. The Lycoming O-540 in the Cherokee Six comes readily to mind, as does the O-235 used in the Cessna 152.

Inefficient induction systems is why you see the sometimes odd distribution of lead fouling in some engines. Leaded avgas has a potent toxic lead-scavenging compound called ethylene dibromide. In spite of this chemical agent, the tip temperature of the spark plug needs to be in excess of 800 degrees F for the lead scavenger to begin working. Closed throttle idling doesn't normally heat the plugs to this degree, thus promoting deposits.

Further complicating the problems is that tetraethyl lead and ethylene dibromide scavenger chemicals in fuel do not necessarily atomize in the proper proportions from cylinder to cylinder, especially with carbureted engines. It's common for these critical additives to be disproportional among cylinders.

This occurs because of the differences in volatility of these two chemical additives coupled with inefficient (old and simple) induction designs. That's why a multi-point EGT often shows 150 degree-plus EGT differences, even in cruise.

Because of the relatively wide variance in the boiling point of these additives in leaded fuel, fractionalization occurs in the induction system.

Alcor's TCP, right, is worth the expense for engines that lead-foul plugs and valves excessively.

While the ethylene dibromide tends to atomize more evenly, the tetraethyl lead may be badly distributed, resulting in lead fouling in only a few cylinders—or all cylinders in varying degrees if plug tip temperatures are under 800 degrees F. (How the engine is leaned in flight can also contribute to fouling plugs.)

Regular doses of TCP can all but eliminate these problems and is probably worth the minor expense for those engines that need it. Just one fouled plug will require more than $35 worth of effort to clear.

Other things you can do will help with deposits, too. Increasing ground idle RPM a bit and leaning helps. So does raising the temperature of the induction air through judicious carb heat use to promote better atomization. Don't do it on the ground, though, because unfiltered air will enter the induction system. A carb temp gauge can help with this. You don't want to solve one problem and create another—unrecognized carb ice.

Even fuel-injected engines aren't immune from fouling due to primitive induction designs. Again, manual leaning on the ground is helpful. It promotes atomization and higher plug tip temperatures.

Why not add more lead scavenger agent to the fuel? The three reasons are cost, corrosiveness and toxicity. TCP is a little less effective than ethylene dibromide, but much less toxic. If you have chronic lead fouling and other remedies mentioned above aren't helping, TCP is worth a try. However, because of its flammability, it's not supposed to be carried aboard the airplane. For more, see www.alcorinc.com, or call 800-354-7233.

MULTISUMP FUEL TESTER

Fuel samples seems to come and go like the weather. The old standbys remain the cup-and-pin model and the ever-popular test-tube sampler with a screwdriver bit at one end. Wilbur and Orville probably had one.

If the conventional wheel is too boring, now comes a new fuel testing gadget call the MultiSump. This one actually solves that slight problem that many of us have: At an increasing number of airports, it's illegal to pour the sumped fuel on the ramp. (And why would you anyway, with fuel at $6 a gallon.)

As is obvious in the photos—well, maybe not entirely—the Multi-Sump consists of a cup-and-pin type sampler inside a larger container about the size of a medium tumbler. The smaller cup is mounted on a spring stalk inside the larger container.

The idea is that you sample the fuel into the smaller cup, inspect it, then tilt the small cup to drain the sample into the larger cup. Continue with the sampling and when you're done, pour the sampled fuel back into the tanks.

To avoid pouring contaminants, including water, back into the tank, the removable base of the Multi-Sump slides off and acts as a funnel that also has a micron filter. (We noticed even with what appeared to be clean fuel, the filter caught some small black bits we didn't notice in the cup.

The MultiSump is available from Sporty's for $24.95. See www.sportys.com or 800-776-7897.

FUELTAPE

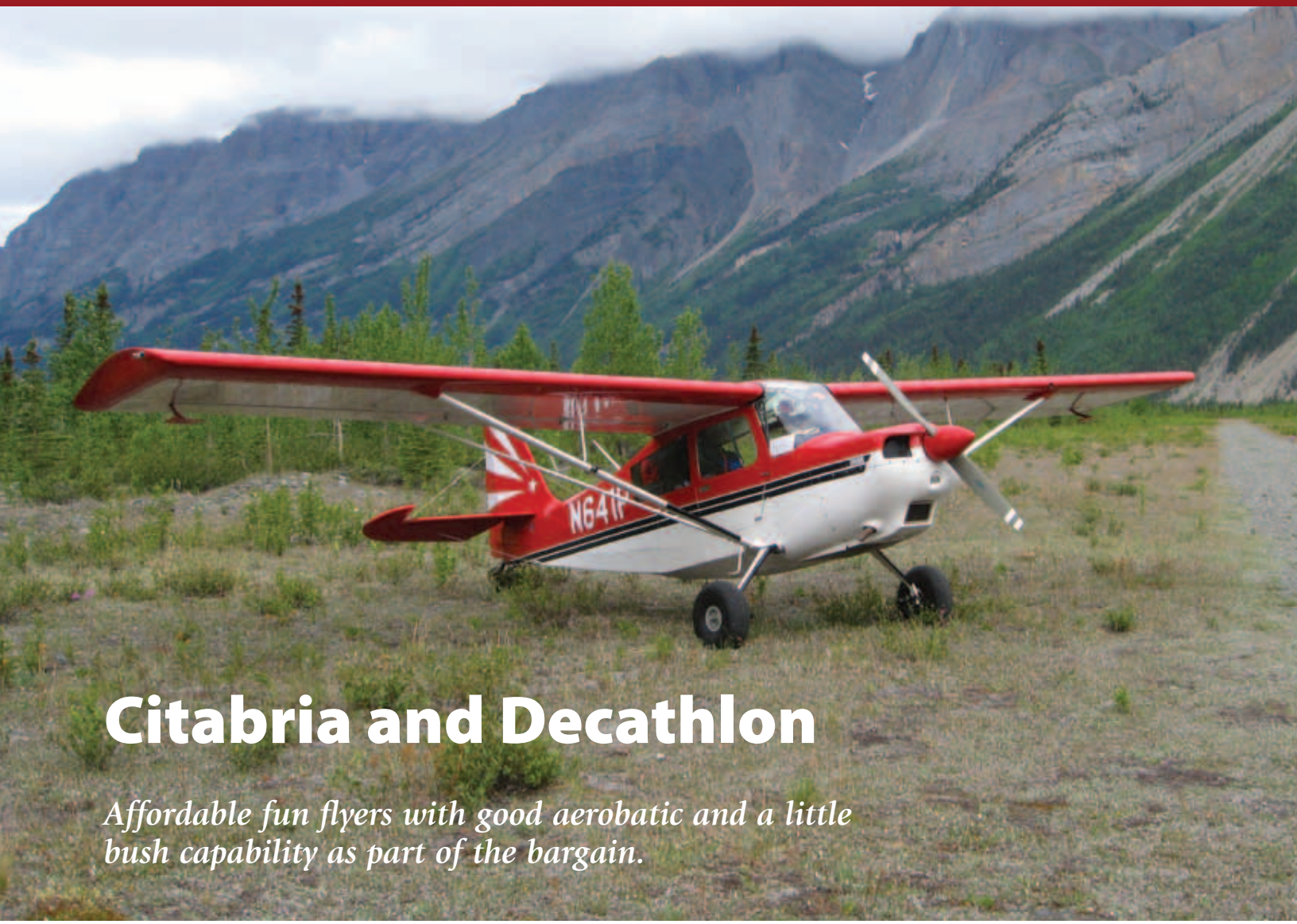
For some reason, misfueling doesn't seem to happen as much as it once did. We're not sure why, but FBO insurers may have something to do with it. Nonetheless, it does occur and if it happens to you, consider yourself lucky if you notice it before you start the engine.

A product called FuelTape aims to help. It's nothing more than adhesive tape labeled with 100LL or Jet A. Place it over the fuel cap and, hopefully, the line guy will notice it.

We tried the product on a Cherokee and we'll say this: It sticks like crazy, so much so that we would be cautious about applying it with too much pressure. A light touch will do to hold it on against the wind or wet weather.

The better guard against misfueling is to stand by the airplane while it's being fueled. But sometimes, you can't, in which case FuelTape might help. It's $7.25 per roll from Aircraft Spruce and Specialty at www.aircraftspruce.com.

The MultiSump, top, allows you to sample several sumps, then tilt the sample cup to dump the fuel into the larger cup. The base slides off and fits into the filler neck to serve as a filter and funnel. Fueltape, below, should get the attention of a clueless fueler who's about to pump kerosene into your Cherokee.



Citabria and Decathlon

Affordable fun flyers with good aerobatic and a little bush capability as part of the bargain.

Owners who fancy a little light aerobatics—or even semi-serious competition—might lust after a Pitts S1 or an Extra 300. But then reality sets in. Those airplanes require no small degree of skill to simply fly safely and that's before we consider the insurance premiums.

And that's why so many owners inevitably gravitate toward the Citabria or the Decathlon, starter aerobatic airplanes that turn out to have much more capability than many realize until they take a close look.

These models have a lot going for them. They aren't expensive to buy or maintain, they don't have any serious gotchas and any pilot of average skill can learn to fly and land them safely. Moreover, they can double as respectable back-country flyers, which is something you're not likely to do in a Pitts or an Extra.

These models have a lot going for them, not the least of which is long production history and good ongoing support.

These airplanes are still in production at American Champion's factory in Rochester, Wisconsin, from whence comes full support for all the models.

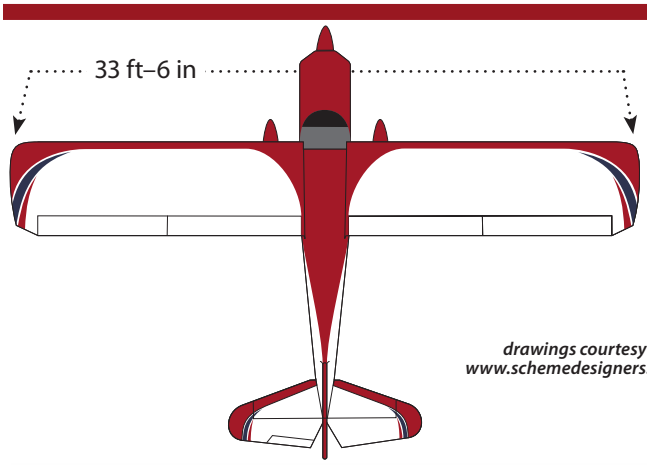
As result, the Citabria is right up at the top of the list for those looking for a simple, fun flying machine capable of most inside positive-G aerobatics. (Citabria is "airbatic" spelled backwards.) Available in several versions, with varying powerplants and equipment, the Citabria and its stablemate, the Decathlon, have a great deal to recommend them to the recreational flyer.

HISTORY

It's fair to say the Citabria goes back a ways—all the way to the beginning, in fact. It's based on the Champion 7-series airframe. The similar, although more

Jim O'Day's 2004 7GCBC, above, has seen some light aerobatics and a trip to Alaska. "The airplane filled the need I was looking for, plus more," he says.

CITABRIA/DECATHLON

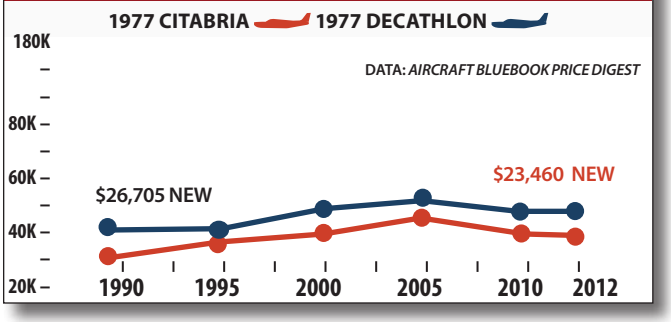


drawings courtesy
www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1967-1975 7KCAB	150-HP-LYC. IO-320-E2A	2000	$21,500	36	500 LBS	112 KTS	±$30,000
1976-1977 7KCAB	150-HP-LYC. AEIO-320-E2B	2000	$25,000	36	500 LBS	112 KTS	±$34,000
1994-1998 7GCBC	160-HP-LYC. O-320-B2B	2000	$21,000	36	500 LBS	110 KTS	±$55,000
1999-2003 7GCBC	160-HP-LYC. O-320-B2B	2000	$21,000	36	500 LBS	110 KTS	±$75,000
2004-2008 7GCBC	160-HP-LYC. O-320-B2B	2000	$21,000	36	500 LBS	110 KTS	±$85,000
1971-1975 8KCAB-150	150-HP-LYC. O-320-E1A	2000	$21,000	40	530 LBS	121 KTS	±$33,000
1976-1978 8KCAB-150	150-HP-LYC. AEIO-320-E1,2B	1600	$25,000	40	530 LBS	121 KTS	±$40,000
1979-1980 8KCAB-150	150-HP-LYC. AEIO-320-E2B	1600	$25,000	40	530 LBS	121 KTS	±$45,000
1981-1984 8KCAB-150	180-HP-LYC. AEIO-320-H1A	1600	$25,000	40	530 LBS	130 KTS	±$55,150
1992-1994 8KCAB-150	150-HP-LYC. AEIO-320-E2B	1600	$25,000	40	530 LBS	131 KTS	±$65,000
1981-1985 8KCAB-180	180-HP-LYC. AEIO-360-H1A	1600	$27,000	40	530 LBS	130 KTS	±$72,000
1995-1998 8KCAB-180	180-HP-LYC. AEIO-360-H1A	1600	$27,000	40	530 LBS	130 KTS	±$72,000

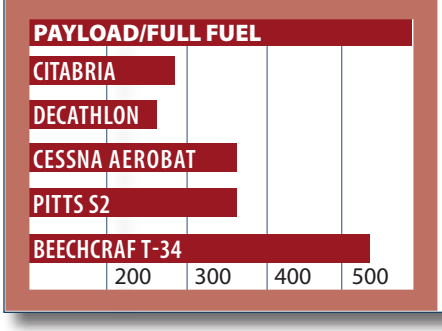
RESALE VALUES

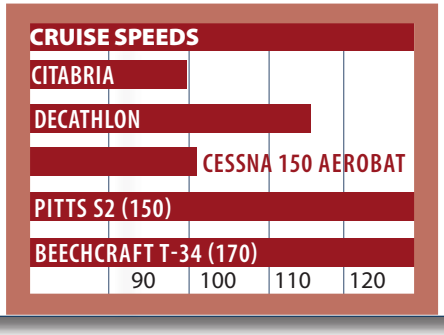


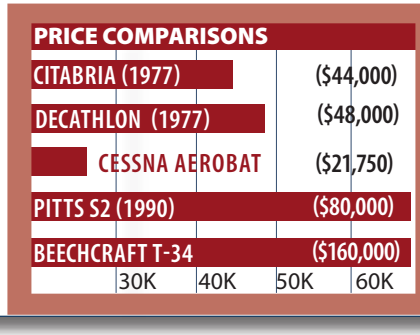
SELECT RECENT ADs

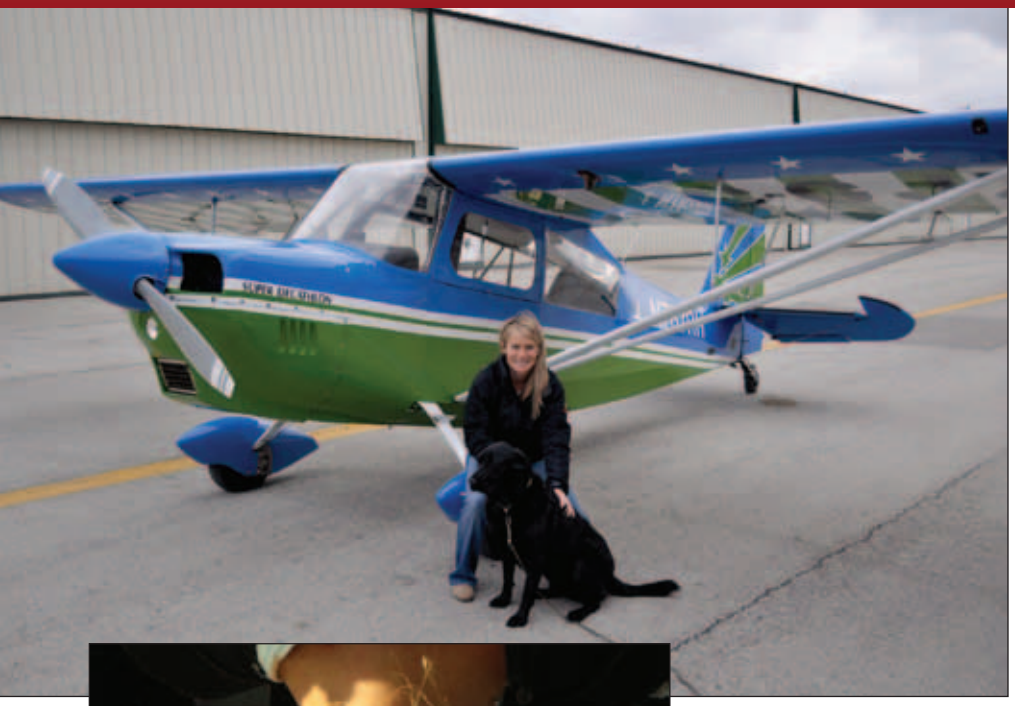
AD 09-22-02	REAR SEAT BACK HINGE
AD-00-25-02	WOODEN SPARS
96-18-02	WING ATTACH FITTINGS
90-15-15	FRONT SPAR STRUT FITTINGS
89-18-06	FOLDING FRONT SEATS

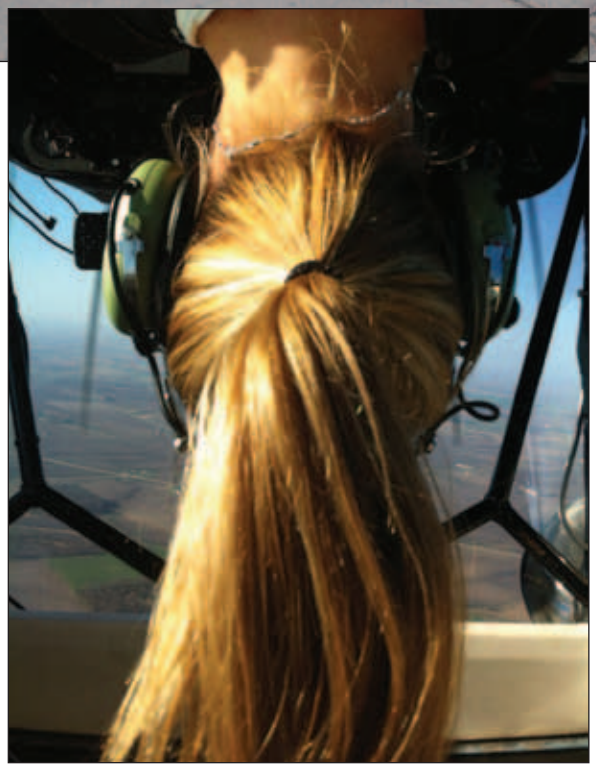
SELECT MODEL COMPARISONS











Cortnie and Lou with Tyson Sampson's Super Decathlon, above. Lower photo shows he uses it for its intended purpose.

rugged, 8 series is used for the Scout bushplane and the more fully aerobatic Decathlon.

There are a few things to watch for when looking for a Citabria, most notably the wooden wing spars found in pre-1990s models. There's also the possibility of strut corrosion, similar to what Piper and Taylorcraft owners have been finding for some years. The good news is that American Champion can retrofit new, all-metal wings onto older airplanes for owners who prefer them, and many Citabrias have undergone the upgrade. In addition, a gross weight boost for the metal-spar versions adds utility.

The Citabria traces its roots back to the Aeronca Champion (which everyone called the Champ), one of the crowd of postwar tailwheel trainers that included the Piper Cub, Cessna 120 and Luscombe. The postwar production boom resulted in tens of thousands of these airplanes, but by 1951 the market was saturated and production ended. The 7EC Champ was returned to production periodically and is now being manufactured for the light sport market by American Champion as the Champ, with a 100-HP Continental O-200 engine. It's the only light sport entry that's also a fully certified airplane. In 1959, the first airplanes that would eventually become Citabrias appeared, dubbed 7GC. In the years that followed, a fistful of airplanes debuted, each called Citabria.

Eventually there were six variants. In some cases, the differences between models are minor, in others more significant. The nomenclature can be confusing, so here's a rundown:

- 7GC—Produced only in the 1959 model year, it had flaps and a 140-HP Lycoming O-290.
- 7GCB—Essentially the same as the 7GC, but with a 150-HP Lycoming O-320; produced from 1960 to 1964.
- 7GCAA—Aerobatic, with the same Lycoming as the 7GCB. No flaps. Introduced in 1966 and in production today as the 7GCAA Citabria Adventure.
- 7GCBC—Aerobatic, same as the 7GCAA, but with slightly longer wings and flaps. Also introduced in 1967 and in production as the 7GCBC Citabria Explorer.
- 7KCAB—Introduced in 1966 as a more capable aerobatic ship, with a fuel-injected 150-HP Lycoming and inverted fuel and oil systems. It was produced through the 1977 model.
- 7ECA— Introduced in 1964 as an aerobatic follow-on to the Champ. Originally, it had a 100-HP Continental O-200, soon replaced by the 115-HP Lycoming O-235. It is in production as the 7ECA Citabria Aurora.

The 8KCAB-150 and -180 appeared in 1971 and 1977, respectively and sported both more power and constant speed props, which are nice for combination aerobat/cruisers.

Most of these airplanes were built by Bellanca, which went under in 1980 at the beginning of the GA slump. A brief attempt was made to revive the line in 1984, but the timing wasn't right and production stopped again. American Champion acquired the Type Certificate in 1988 and started production in 1990.

In 1990, American Champion started delivering Decathlons, followed by the Scout in 1993. 1994 saw the reintroduction of the 7GCBC Citabria, followed by the 7ECA in 1996 and most recently the 7GCAA.

The 7GCBC model has proven the most popular, followed by the 7KCAB. (Not sure about prodcuction numbers; currently the 8KCAB is the most popular, followed by the 8GCBC). The latter, built as a low-end aerobatic airplane capable of inverted flight, did not last largely due to competition from the De-

cathlon. The Decathlon, with its shorter wings and semi-symmetrical airfoil, was a better buy for aerobatics, though the 7KCAB is still a fine airplane.

Today's Citabrias are essentially the same airplanes introduced decades ago (although American Champion offers engines with up to 210 HP), with one significant difference: the wing structure. The Bellanca airplanes had wooden wing spars, which sometimes suffered cracks and were the subject of ADs.

American Champion came up with an all-metal structure and incorporated it into all new aircraft. Owners of earlier models can also have the new wings retrofitted. The cost is steep at (depending on model) $16,000 to $25,000 per set plus $1200 to $1400 installation and $2000 for fabric and paint, but the new wings boost the gross weight, are free of repetitive inspection requirements and certainly increase the resale value of the airplane.

The factory can also supply new, improved front struts for $990 a set and aileron spades for $550. All of these are worthwhile improvements to older aircraft. When shopping for a Citabria, extra consideration should be given to upgraded models.

Offering the upgrades has proven a shrewd business move, affording the factory a source of cash flow that isn't dependent on the sale of new airplanes while simultaneously reducing its liability exposure. Like every other OEM, American Champion has suffered hard times since 2008, cutting its workforce by half. Mods and repairs keep the lights on.

HANDLING

As tailwheel airplanes go, the Citabrias have benign ground handling characteristics, making them excellent transition training airplanes. Nevertheless, pilots with little or no tailwheel experience must remember the fundamental differences between conventional and trigear airplanes. On the ground, tailwheel machines are more prone to swapping ends due to the location of the center of gravity aft of the main landing gear.

This means the pilot absolutely must stay alert to side loading of the landing gear. Staying on the centerline and being unfailingly in

ACCIDENT SCAN: GROUNDLOOPS

When we visited the American Champion factory in Rochester, Wisconsin, recently, we learned that the factory keeps fairly busy fixing airplanes that have been groundlooped, run off runways or otherwise pranged into unyielding objects on the ground. These sometimes include other airplanes, cars and the odd airport fuel pump.

This is not surprising, of course, since the Champion line's accident pattern isn't much different than that of other tailwheel airplanes. It's not that the airplanes are exceptional ditch lovers, but they will bite the unwary. Of 61 accidents we reviewed between 2002 and 2012, more than a third were runway-loss-of-control or R-LOCs.

Interestingly, very few of these occurred in challenging crosswind conditions. Most were in what we consider relatively benign winds—say, 6 to 10 knots, with less than half of that as the crosswind component. But if given the chance, any taildragger will swap ends if the pilot gets lazy on the pedals.

The Champion line also has a higher-than-usual percentage of stall-related accidents, many of which seem to occur in the landings or in the traffic pattern phases of flight. Part of this may be due to how the airplanes are used. Because they have sticks and are aerobatic, pilots and instructors tend to horse the airplanes around at low altitude.

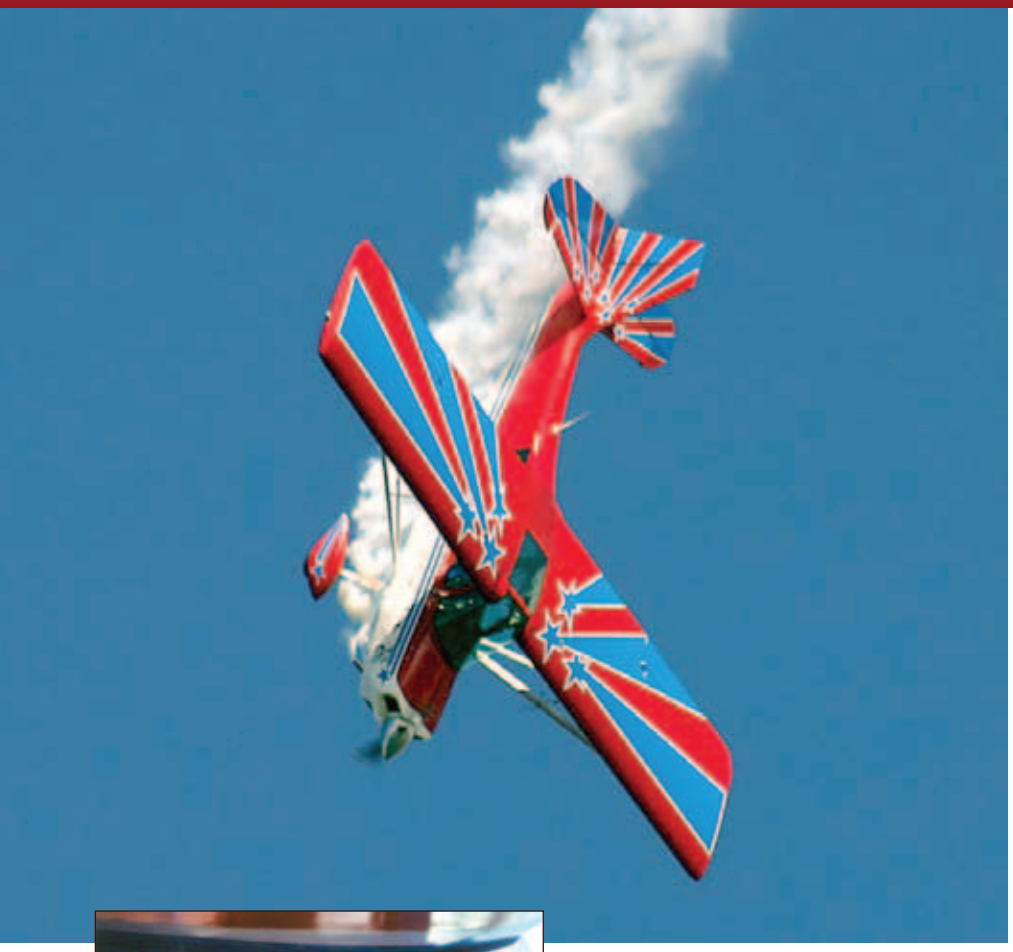
One example of this is the instructor who simulated an engine failure just after takeoff. When the student was too timid with the bank angle while lining up for an engine-out landing, the instructor helpfully wound the thing into a tight turn and an immediate stall. The pair were attempting a runway turnback to a gravel strip in Alaska.

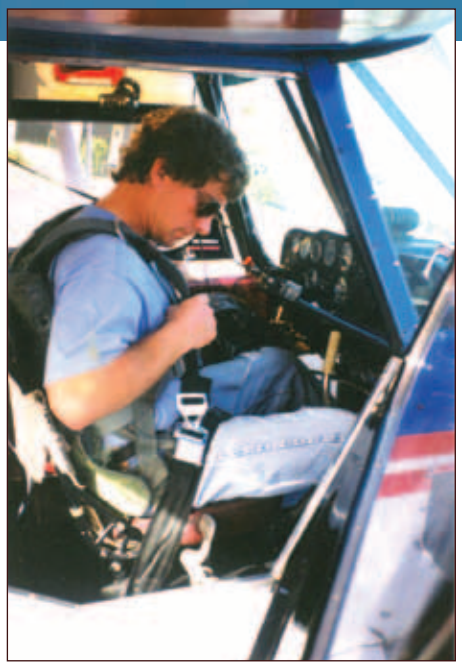
To the airplane's crashworthiness credit, they both survived, one with serious injuries, one with minor injuries. We saw a number of accidents similar to this in which occupants walked away from violent crashes. None were more dramatic than the experience of James Michaels and his daughter Tonie, who sent us the photo below.

"My daughter and I walked away from this without a scratch. We were forced to land in the forest on a Colorado mountainside at 11,000 feet, after we encountered a down draft with a velocity in excess of 9000 FPM. The weather was clear and calm. This was a freak meteorological occurrence that we are trying to understand. We made it home thanks to our Super Decathlon."

Because the airplanes are used in aerobatic flight, they are involved in crashes related to that type of flying. We found three such accidents, two of them fatal. We found a couple more that we term just plain stupid, yet the occupants still survived.

In one, a private pilot with 370 hours decided it would be a good idea to show his passenger what inverted flight at 50 feet would look like in a Decathlon. When he attempted to roll upright, he caught a wingtip and cartwheeled the airplane. Both were injured but survived.





Decathlons are suitable for many aerobatic maneuvers and are used in amateur competition, top. Five-point harnesses are a must for serious acro.

command of the rudder are keys to success. It also means that the ailerons must be properly positioned for the wind when on the ground. If you fail to do that, you can wind up in a ditch during the landing rollout. This is a common Citabria accident scenario.

Once aloft, the Citabria is forgiving in virtually all flight modes, although it is definitely a rudder airplane requiring work to keep the ball centered due to adverse yaw. The elevators and rudder are nicely harmonized while the ailerons are comparatively heavy and less effective. Adding spades corrects this characteristic and are, in our opinion, worth the price.

Stalls are mild, giving aerodynamic warning whether flaps are up or down and stall speeds are as low as about 40 knots for the flap-equipped 7GCBC. Citabrias will spin nicely if the ball is not near the center at the stall. Spin recovery is positive, but requires several hundred feet, even if initiated immediately. Although stressed and certificated for loops and rolls, the Citabria is not a serious competition-level machine. It's ideal for initial acro training and unadulterated fun, but only the 7KCAB has an inverted fuel and oil system. The other variants are generally limited to positive-G or G-neutral maneuvers such as inside loops, barrel rolls and the like.

One potential handling trouble spot is PIO (pilot-induced oscillation) during landings. Although not unique to Champions, the spring-steel main gear can bounce the airplane if the pilot dumps it too hard or if he or she fails to go around. More bounces, a groundloop and/or nose-over and/or prop strike can result. To prevent these, touchdown for a wheel landing should be as close to zero-rate as possible and for three-pointers, as close to the stall as possible, with the stick back. Too fast and like most taildraggers, you'll bounce once, or twice … or more.

PERFORMANCE

The cruising speed of the Citabria is sedate: 100 to 110 knots or so, depending on model, so a number of owners use them for travel. The extra power afforded by the larger Lycoming shows up mostly in greater climb rates. The longer wings of the 7GCBC help; according to Champion, the 7ECA climbs at 740 FPM, while the 7GCAA moves up at 1167 FPM and the 7GCBC climbs at 1130 FPM.

Takeoff and landing performance are impressive, particularly for the wood-spar 7GCBC. According to the Aircraft Bluebook, takeoff ground roll is only 296 feet, and a 50-foot obstacle can be cleared in 457 feet, although in our opinion, those numbers are a tad optimistic. Landing distance over a 50-foot obstacle is also in the 900-foot range, with about a 500-foot ground roll. (Older airplanes with lower gross weights will do somewhat better.)

LOADING, ERGONOMICS

An important thing to note about the new metal wing structure is that it gives the 7GCBC Citabria a gross weight of 1800 pounds, compared to 1650 for the older models. Gross for the 7GCAA and 7ECA was upped in early 2001 to 1750 pounds for metal-spar versions. The Citabrias, especially early versions, are not known for their load-carrying capacity. While the lifting ability varies according to model and equipment. In general, it's not possible to fill the seats and tanks at the same time.

Panels are adequate, if retro. Throttle is on the sidewall, mixture on the panel.

When two large people wearing parachutes consider aerobatics, they may be approaching gross weight even before fuel is added. Owners report that staying within the CG envelope is not a problem.

The cockpit of the Citabrias is laid out so that everything falls easily to hand. Solo is from the front seat and visibility is fair in flight. In the three-point attitude, the nose doesn't block forward visibility. The front stick length gives just the right leverage for the control gearing, especially with aileron spades. The rear stick is short and instructors report that it often takes both hands to get full aileron deflection in a roll in a non-spade aircraft. Each throttle (one for each seat) is where one reaches almost unconsciously with the left hand; the carb heat knob is immediately below.

Most Citabrias have toe brakes, although some of the earliest have that bane of many a pilot's existence—heel brakes. Front seat travel is limited and short pilots may have difficulty getting full rudder throw without using an extra back cushion. Citabrias are some of the better airplanes for tall pilots, especially as the high roofline means not having to bend over to look out the side windows. The seats are surprisingly comfortable and the cushions snap out quickly when it's time for parachutes. The panel is low and slender, making installation of more than basic VFR instruments and radios challenging. Headsets or ear plugs are a must as the cockpit noise level is about on par with the proverbial boiler factory.

The fuel system is utter simplicity, with three sump drains, one direct-reading mechanical gauge in each wing root and a simple fuel selector. Fuel supply is by gravity feed, of course, but as with all Lycomings, there's also a boost pump.

MAINTENANCE

Although maintenance is simple, it pays to seek out a mechanic who's familiar with tube-and-fabric airplanes and, if looking at an airplane with the older wing, who has experience with wood. The covering is Dacron, which is durable, although not good for a lifetime. Owners suggest keeping the airplane out of the sun, since a re-cover job can be costly and time consuming.

Owners and mechanics tell us that aside from making certain the ADs are complied with, especially AD2000-25-02 R1 on wooden spar airplanes, a serious look at all of the fuselage tubes, especially those aft and low, for corrosion and proper inspection of the wooden spars, there are no particular trouble spots

Want skis? Citabrias and Decathlons can have them. Jim O'Day's aircraft, above, was fitted with Trick Air skis.

to watch for when shopping for a used Citabria. Early model wing struts had thinner, .035-inch wall thickness as compared to the more recent .049-inch wall thickness. AD 77-22-5 called for replacement of the old struts, and most if not all airframes should have the heavier struts installed; the presence of a placard limiting speed to 153 MPH is proof of the thinner struts.

Also watch for cracked seat backs. There have been accidents in which the pilot's seat back failed, planting his torso on the aft stick with disastrous results. The landing gear U-bolts can develop cracks, especially in airplanes subjected to rough fields or training.

It's difficult to find a Citabria that has not been groundlooped at some time in its life, simply because they are tailwheel airplanes. A groundloop by itself is not cause for alarm; the trouble arises when the loss of control results in a wingtip and/or prop blade hitting the ground or the landing gear being damaged. Wing damage repair is not always recorded in the logbooks, so inspect any Citabria for wing repairs, especially, as the experts tell us, that most wood spar compression cracks can be traced to an impact event, usually from a groundloop. A full set of service bulletins should be a part of any owner's library, since they can point out areas of weakness.

The new wing structure was developed as the result of cracks in Decathlon wing spars, not those of the Citabrias, so the presence of wood is not necessarily a deal-killer. Nevertheless, years of movement of aluminum ribs against a wood spar means we'd look carefully before buying a wood-spar Citabria.

Students can err and blast right through redline airspeed, so a buyer should assume that an airplane capable of aerobatics has been doing them and that pilots have made mistakes in the process, so inspect the wing and tail carefully.

Fortunately, the Citabria's systems are simple and inexpensive to maintain, so previous owners are more likely to have kept things up to snuff than owners of more complex, expensive and labor-intensive hangar queens.

SUPPORT

Unlike many airplanes, there's a variety of sources for parts. First and foremost, of course, is American Champion. They're located in Rochester, Wisconsin (262-534-6315), or on the web at www.amerchampionaircraft.com. We like the fact that the factory puts a number of its service bulletins and technical information on its website as a free service.

Another source is Santa Paula, California, home of Air Repair (805-525-8616) and Screaming Eagle aircraft (805-525-7121), a pair of shops that specialize in the line. Air Repair can sell you copies of all the factory service bulletins, a worthwhile investment.

For owner support, it appears the Citabria Owner's Group has disappeared, but there's a Bellanca-Champion Club based in Coxackie, New York, with a website at www.bellanca-championclub.com. This site doesn't seem to have a great deal of technical information available, but there is a member forum.

OWNER FEEDBACK

I purchased my 2004 7GCBC Citabria Explorer in 2008 with 100 hours on the tach. I have put 400 hours on the airplane since I bought it. I was not sure what I wanted when I bought this airplane. I was looking for a tailwheel, tandem-seat plane that I could fun fly and something newer so I would not need to work on it. I have a pressurized twin that I fly for my business; it is fun to fly, but a different kind of fun.

I had never flown a tailwheel and I did not have much trouble learning to fly the Citabria. I stayed on the ground when the wind was more than 5 knots until I became more proficient in the airplane. After 50 hours, wind was not a problem. However, if it is blowing 20 knots and gusting, it is a handful on the ground.

I flew some aerobatics in the air plane with Greg Koontz, but after flying in his Decathlon, I learned that the Explorer model is not the best aerobatic plane. It was a good

learning experience, but I have not cared to do any more in my airplane.

I bought Trick Air Skis in 2010 and, living in the north, it opened up a whole new type of flying. Trick Air makes a good package, but because it requires 8.50 tires, when the skis are off, the wheel fairings cannot go back on without a tire change. But the larger tires will handle unpaved strips much better.

Last summer, I flew the airplane to Alaska with another pilot who flew a PA-12. The Explorer performed well against the 150-HP PA-12 as a benchmark. The next trip, I will put bush wheels on. Flying into the back country strips, I found that the standard gear is short even with 8.50 tires. Plus, it was rough and I am sure not all that good for the airframe. I met other pilots with Citabrias and they had bush wheels plus Scout landing gear. The added angle of attack this gives is a plus getting off short and rough fields.

I have added an Air Wolf oil filter kit to the airplane after getting back from Alaska; 25-hour oil change intervals on a long trip was inconvenient. I have VGs on the airplane and that really makes getting slow landing on skis or short fields comfortable. I have an STC for flying with the door off and I usually have the door off all summer unless there is precipitation forecasted.

Having had this airplane for a few years, I am glad I have the GCBC model. If you want to fly in and out of short fields, the flaps are an advantage and 160-HP is needed. The airplane does not have a great useful load, but since I am usually by myself, I don't have any loading problems.

Annuals cost me about $1000, but I am sure I could find a lower price by shopping around. I take it to the same shop that maintains my twin. The only other expense I have had was to replace the battery. The first year I paid $2000 for insurance, and last year it cost me $1400 with the same company for $100,000 hull and $1 million smooth liability. I plan on 6.5 gallons/hour at the power setting I use and the airplane carries 36 gallons. I don't have an autogas STC, but plan to do that.

I bought the airplane looking for something fun to fly after work and on weekends. I can fly a long trip home in my twin and look forward to pulling the Citabria out of the hangar to unwind for an hour. When I bought it, I never thought I would have it on skis in the winter or camping with it on a river in Alaska. The airplane filled the need I was looking for, plus more.

Jim O'Day
Fargo, ND

Owning my Super Decathlon has been a dream come true. Some background: My close friend Bob bought this Decathlon from a Canadian club back in 2009. It had a Canadian registration and was then re-registered with the FAA.

Bob, who is a professional aerobatic pilot, and I ferried this aircraft from Calgary, Alberta, to Bloomington, Indiana. Since May 2009, Bob provided me with superior instruction every time we flew together. I know this Super Decathlon inside and out. When Bob decided to sell this Decathlon, I knew I was the perfect new owner.

Costs to operate is approximately 10 gallons an hour averaging traffic pattern, cruise and acro. Cruise slightly less. Maintenance and annual expense is not out the ordinary. My Decathlon has been meticulously maintained because of the Canadian CAA. The CAA requirements have been transferable to the U.S. requirements, so annual costs are typical.

What's it like to fly? Keep the ball in the center. This is the best trainer in the air. Anyone can loop in an acrobat airplane, but the slow roll in an American Champion is something to be mastered. This is, by far, the best trainer of aerobatics because of its nimbleness. The slightest touch can make the perfect maneuver.

American Champion/Bellanca has a great organization of followers who can support any and all Decathlon owners.

Insurance on a Decathlon is surprisingly inexpensive, provided the owner has the experience in tailwheels as well as time in a Decathlon. The cost is roughly $100 a month, give or take.

Tyson Sampson
Via e-mail

The Aviation Consumer

Austro Engines

(continued from page 7)

offering an exchange engine program. "Right now, those customers are getting new engines because Austro doesn't want them to be delayed and the infrastructure isn't in place for quick field turnarounds," Lietz said, although it will be eventually.

For now, Austro is offering a flat rate on the overhauls: about $19,400 (14,000 Euros). As the volume picks up, Austro will eventually set up field overhaul facilities and prices will become more competitive. We suspect, however, that the quoted flat rate here will eventually be higher, perhaps more in line with gasoline engines of similar horsepower such as the 180-HP Lycoming IO-360s used in the DA420-L360.

On the other hand, if the Austros live up to diesels' reputation for longevity and routinely make overhaul times beyond 2000 hours, the per-hour engine reserve could be lower than that of gasoline engines.

And by the way, in case you're wondering what will happen when Daimler phases out the OM-640, as car companies inevitably do, Austro has made long-term supply arrangements. (Presumably, running the engine line for a couple of extra days could produce a lifetime supply of the engines, although it would require a big investment to buy them.)

MORE POWER

With the Daimler-based OM640 reaching its power limit, what's the next step up? One possibility is what Austro is calling the AE500, which is a variant of the Steyr 275-HP M16 six-cylinder turbodiesel. The engine has some advantages in that it's a monoblock so it can tolerate higher cylinder pressures and output and rather than a common-rail injection system, but an old-school pump injection design. The AE500's major drawback, however, is weight.

At 550 pounds (275 kg), it's heavier than a traditional high-horsepower aircraft gasoline engine, but it currently lacks the power output. (A version of this engine is used in military HUMMVEES and also marine applications.) What's next for Austro is the AE440, a purpose-made V-8 diesel being developed in conjunction with Eurocopter with help from the European Union's Clean Sky project. (Diamond and Austro, if you haven't gathered by now, is big on joint developmental ventures.) In developing the 440, Austro is looking ahead at least a decade and sees in the market a sizeable hole between the highest horsepower gasoline piston engines and the lowest power turbine engines which are light, but fuel hungry.

Because of their exceptional fuel economy, Austro also sees a potential market for its diesels to replace the turbines used in APUs, both ground based and for aircraft.

Austro AE500 may remain a benchtop project. The 275-HP truck engine is too heavy to offer attractive performance.

FEEDBACK WANTED

BEECH 55 BARON

For the September 2012 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Beechcraft 55 Baron, a popular twin. We want to know what it's like to own these airplanes, 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. Photos should be medium or high resolution. We can't publish low-resolution photos.

We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the 55 Baron by July 1, 2012, to:

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