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The Aviation Consumer

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RESALE MATTERS: FACTORY VS. FIELD ENGINES

A colleague faced with an engine swap on his Baron recently asked me a tough one: Will a factory remanufactured engine—as opposed to a quality field overhaul done by a respected shop—greatly influence the resale value of the aircraft? Moreover, will the Baron be more difficult to sell without factory engines? The quotes he got showed almost a $10,000 delta, per engine, between a field overhaul using new cylinders and a Continental reman. Before hitting the pavement and asking several industry pros to weigh in, we threw the question out on sister publication AVweb.com to see what readers would do. The results were predictable.

Roughly 51 percent (328) of the respondents said they didn't think a factory engine would matter to a buyer as long as the overhauled one is well within the TBO and has thorough logbooks. Still, 20 percent of the respondents were more concerned about the perceived support and quality than about resale value and said they would spring for a factory engine. Nearly 10 percent weren't prepared for the possibility of an engine replacement or overhaul and said they would sell the aircraft before doing anything. I once helped a friend sell his Baron with runout engines and props. Boy, talk about the proverbial giveaway.

To see how it might counsel its members faced with such dilemmas, I asked the American Bonanza and Baron Society. According to Thomas Turner, the executive director of the ABS Air Safety Foundation, a factory engine on a Baron or Bonanza "generally contributes to a higher resale value than a field overhaul," he said. Turner acknowledged, however, something we know from prior *Aviation Consumer* engine shop surveys: There are wide variations in standards, quality and customer service from one shop to the next. A top shop that turns out a quality overhaul with excellent documentation of whatever it included in the job should carry more value than a field overhaul with lesser documentation from a one-man shop. Make no mistake, this isn't to say that many small shops don't turn out seriously high-quality engine overhauls. But I think name recognition has a lot to do with perceived quality—or lack of—and can affect the buying decision. Still, there's more to the decision than where you source the engine.

Consider that a factory reman is a zero-time engine with new logbooks and a new serial number. The engine is essentially indistinguishable from a new one, except the reman engine may include some used parts as long as they meet as-new tolerances. But pistons and crankshafts, for example, generally won't be used in a factory engine regardless of specs. Accessories like mags, alternators and prop governors are remanufactured to zero-time tolerances. A point to understand is that while a field overhaul resets the time since major overhaul clock, it will never erase the used engine's total time in service. Additionally, the overhaul may not include any work to the accessories.

As for real-world resale prices, every airplane sales professional I spoke with felt that while a low-time factory engine is certainly desirable to many buyers and could outsell a similar aircraft with a field overhaul, few buyers are willing to pay a premium for it in the current market. Fred Ahles, president of the respected Premier Aircraft Sales in Fort Lauderdale, Florida, said that while a factory reman engine might have a wider target audience, his firm has no problem selling aircraft with engines overhauled by "big name" engine shops (he specifically mentioned Certified Aircraft Engines in Opa Locka, Florida) that use factory-new cylinders—often an upcharge from the basic overhaul price. Another shop that consistently came up was Zephyr Aircraft Engines in Zephyrhills, Florida—a top-ranking shop in our prior surveys.

In the end, you may not care at all about perceived resale value, but more about downtime. In many cases it will be quicker to get a factory engine back on the aircraft than sending yours out for a field overhaul. For some, the sizable price premium to get back in the air sooner is worth it.—*Larry Anglisano*

DOCS ON BASICMED

I read Larry Anglisano's commentary about BasicMed's altitude restriction in the April 2017 *Aviation Consumer*. I can only think that restricting BasicMed pilots to altitudes below 18,000 feet is related to limiting them to less complicated aircraft and not the altitude itself.

Perhaps the FAA just doesn't want jet pilots flying around with BasicMed certification and while I don't agree, I think we are lucky to have gotten what we did.

It reminds me of the original EAA/AOPA petition about restricting IFR flight. No one has ever shown that IFR flying was medically more stressful than flying VFR.

The more suitable restriction would have been if your aircraft is over 3000 pounds, you must have a tug to pull it out of the hangar if you are over 60 years old!

Brent Blue, MD
via email

While I can't disagree with your point that a heart attack at 18,001 feet is no more serious than one at 17,999, the 18,000-foot limit is probably the least important issue to find fault with in the BasicMed rule. Prior denials, the exclusion of safety pilots and especially the physician attestation signature will be bigger problems for many pilots. But the FAA isn't the culprit.

The FAA pretty much followed the legislative language verbatim, and it was Congress—several senators in particular—whether out of ignorance, sloppy wording, outright malice or a desire to reward the trial lawyers, who wrote into federal law most of what is disappointing about BasicMed.

Still, BasicMed is more than even EAA and AOPA dared asked for in the exemption petition. The ability to fly high-performance singles and twins, with five passengers, day or night, VFR or IFR, up to if not in the flight levels—without a Third Class medical certificate—will be an enormous improvement for a lot of pilots.

Almost every benefit has a cutoff somewhere, often arbitrary, and leaves someone feeling left out, but the altitude limitation will not be much of an inconvenience to very many people.

Stephen Leonard, Senior AME
Boise, Idaho

CIRRUS REVIEW

As a longtime subscriber, I enjoyed the thorough flight evaluation of the G6 Cirrus SR22T in your April 2017 issue. However, even the base SR22 is priced out of reach for our growing flying club, which currently has an aging Arrow and a Cessna Cutlass. I heard rumors that Cirrus put a new engine in the entry-level SR20 and I'd like to pitch it to our club. Any chance you can write a report on it? Thanks for your good work.

Stephen Mitchell
Oakland, California

It's not a rumor, Stephen. Cirrus re-engined the entry-level SR20 with a four-cylinder Lycoming IO-390, an engine that replaces the six-cylinder Continental IO-360 used on the SR20 for years. The Lycoming IO-390 has 215 horsepower and the G6 SR20 has a useful load increase of 150 pounds.

We flew the new SR20 and plan to publish a review in an upcoming issue of Aviation Consumer.

HOW MUCH FOR THOSE NEW FUEL SENDERS?

I enjoyed reading the article on fuel gauge upkeep in the March 2017 *Aviation Consumer*. While we appreciated being included in the choices for keeping your aircraft's fuel quantity system airworthy, the cost of an upgrade to a digital fuel quantity system is not uniform across the board or a blanket $5000.

The component and installation cost is related to the number of fuel senders onboard an aircraft and the ease to which wiring can be added.

For example, upgrading a Cessna 182 or 206 (where there are only two senders located at the wing root on either side of the cabin) to digital senders is not any different in price and installation than a McFarland FAA-PMA solution. Both McFarland and CIES individual fuel sender prices are under $400. In this case the only difference is running a power wire to the aircraft bus for the digital CIES sender.

Where installation of digital senders becomes difficult and expensive (as in the $5000 example you state) is in aircraft like the Cirrus, where the molded composite wing makes it difficult to easily add or modify the existing fuel sender wiring.

Many shops report that the most troublesome aspect of installing a new digital fuel gauge or engine MFD is the fuel quantity system. Utilizing current fuel senders as was suggested in the article may not always be a time-saving option.

Scott Philliben
CIES Inc.

CORRECTION

In the crankcase overhaul article in the April 2017 *Aviation Consumer* we incorrectly stated Penn Yan Aero's engine warranty. It's three years or unlimited hours to TBO, not five years as we wrote.

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L-3 NGT9000 ADS-B: Expanded Capabilities

L-3 upgrades its multifunction ADS-B transponder with better traffic alerting, Stormscope interface and TerrainVision.

by Larry Anglisano and Paul Bertorelli

CHECKLIST

- Arguably the most feature-rich ADS-B system on the market.
- Color multifunction touchscreen breathes new life into older panels.
- But the compromise is a lot of data on a small screen. Buy two to spread it out among four displays.

When L-3 introduced the Lynx NGT9000 multifunction ADS-B transponder in 2015, we nearly dismissed it for all but the highest-end applications. With a starting price that put it well north of ten grand, the NGT9000 seemed like a questionable investment for buyers looking for an affordable path to ADS-B compliance.

The NGT9000 still isn't budget priced, but thanks to a growing and competitive market, L-3 dropped the price, making it a serious player in an ADS-B market dominated by Garmin's new transponders.

L-3 continues to advance the product with new software that provides sizable enhancements, which in turn makes it the most equipped ADS-B solution on the market. Here's a look.

RIGHT FORM FACTOR

We covered the NGT9000 in other reports (see the April 2015 issue of *Aviation Consumer* for starters) so we won't start from scratch here. But to recap, the device has a built-in WAAS GPS receiver, a dual-band ADS-B receiver and it has 1090ES ADS-B output.

L-3 never liked to call the NGT9000 a transponder because it does a lot more, but at its core that's what it is—a Mode S Class A1/A1S transponder. The new term is smart transponder, with wireless connection to tablets and smartphones.

The NGT9000 fits in a standard 6-inch-wide radio stack and measures just under 2 inches high. It has a footprint similar to most other stack-mounted transponders.

Since ADS-B retrofits and transponder upgrades often go hand in hand, the two-for upgrade strategy is partly why Garmin has enjoyed huge success with its GTX345 series wireless ADS-B transponder.

We think transponder-based ADS-B solutions make the most sense, particularly for a simpler installation, but keep in mind this is a major retrofit that could require antenna work. This may require additional pricey approval on pressurized aircraft.

Are remote UAT systems nearing extinction? We think not, but compare installation quotes. Remote-mount installations (this includes remote transponders, too) may require interior teardown to route interface wires through the cabin. They also require a dedicated display.

The advantage the NGT9000 has over all competitors is a self-contained MFD. For lightly equipped panels—particularly those without multifunction displays and mandate-approved WAAS GPS systems—the touchscreen-equipped NGT9000 packs a punch.

One appeal is the overlay of traffic, FIS-B weather, terrain and Stormscope on the RGB color display. It's not an easy task cramming all of that functionality on a small screen. But the data is divided among two drag-and-swipe touchscreens and yes, at under 2 inches tall, the NGT9000's display may not be the best way to view all that data. Think utility.

Spoiled after eyeballing data on large MFDs and on a tablet computer? The NGT9000 will seem small by comparison. But it does have wireless capability for interfacing with a variety of third-part tablet apps, including ForeFlight, WingX Pro and the Seattle Avionics FlyQ. No, it doesn't work with Garmin Pilot, and an external GPS WAAS can't be used to feed the NGT9000 the position source; the internal WAAS GPS must be used.

The saving grace is that the GPS signal can be split from an existing WAAS antenna. So if you have a GNS or GTN navigator, for example, the shop doesn't have to install a WAAS antenna dedicated to the NGT9000. The GPS Networking LDCBS series (roughly $350) is one approved splitter covered in the AML-STC.

ATAS AURAL ALERTING

The latest software, version 2.1, allows for five new capabilities on new and existing NGT9000s. While the software is free (shop labor isn't),

L-3 nails the traffic display feature set on the NGT9000, thanks to tech that trickles down from Skywatch TAS/TCAS systems. It's intuitive, uses familiar symbology and now has aural callouts.

WHAT'S ALL THAT GOING TO COST?

As is often the case with avionics installations, more external interconnection means more teardown and more time on the hangar floor. That results in a bigger invoice. To take advantage of the NGT9000's new functions, plan on all of the above.

If you want the $667 ATAS aural alerting (a feature we think is worth the effort to hook up), you could find yourself biting the bullet and finally buying a new audio system. New ones have plenty of unswitched audio inputs for accommodating the alerting. If you already have an audio panel that will work, you might spend a few hours of shop labor to hook it up. Round numbers, plan on $500 extra for typical radio stacks, according to two shops we talked to. Pulling the trigger on a new audio panel installation—especially in aircraft that haven't seen an avionics upgrade in years—could mean spending a few thousand dollars for a modern one with intercom stations.

As for the new Stormscope interface, your shop could need to add or swap around the wiring because the NGT9000 has to be the main and controlling display in a multi-display setup. Add roughly another $500 if the wires are accessible. All in, a new base-model NGT9000 retrofit could approach or even crack $10,000.

some of the new capabilities will require additional wiring, plus an upcharge to gain the features through a software unlock. See the sidebar above for what you might expect for costs and installation effort. One major upgrade is ATAS, for ADS-B aural and traffic alerting system.

ATAS surveys and issues traffic alerts for airborne traffic targets at all altitudes, making it especially useful in the traffic pattern. Frequency congestion results in nuisance alerts, so some TAS and TCAS systems won't scan for traffic below 500 feet unless they're connected to external mode sensors like landing gear squat switches and airspeed sensors. With its ATAS, the NGT9000 self-filters terminal area traffic and gives collision alerts down to ground level.

Worth noting is a distinct advantage to ADS-B traffic minders compared to TAS simply because of a more complete picture of the traffic threat. Using predictive algorithms, the NGT9000 knows where the threat aircraft is turning, what its exact WAAS GPS position is and precisely where it's going to be in relation to the host.

The system has two sensitivity levels. In the terminal mode (below 2000 feet AGL) you'll get traffic alerts within 12.5 seconds prior to what's called the closest point of approach (CPA) within 750 feet horizontally and 300 feet vertically. Enroute (above 2000 feet), the vertical sensitivity increases to 500 feet. If the CPA is greater than two miles or greater than 850 feet vertically, it won't issue an alert.

L-3 has gone as far as earning FAA certification (TSO-C195B) for its ATAS function, plus the NGT9000 now has aural alerting that helps put your eyeballs on the traffic. During a traffic alert, you'll hear "Traffic, five o' clock, one-half mile," for example. There's also a mute button on the screen to manually silence the callout.

If you're used to flying with TAS or even TIS traffic alerting, avoid the trap of ignoring traffic alerts when flying with ATAS. L-3 made it clear that an ATAS alert means the traffic threat is real and close.

If ADS-B traffic isn't enough for belt-and-suspender types, the flagship NGT9000 has a built-in active TAS system. Based on transponder interrogation, it emulates L-3's Skywatch technology, a TAS/TCAS product it sold off.

Since the NGT9000 has a dual-

The NGT9000 adds sizable utility to federated radio stacks like the one in the Cessna at the top. It can also be mounted outside of the stack, middle photo. That's an ADS-B traffic tag at the bottom.

band receiver, alerts generated directly from ADS-B data (both 1090 and UAT) have priority, while active TAS is second and TIS-B uplink is third.

L-3 says the combination of active TAS (you'll have to buy the $8000 TAS-equipped unit to get it) combined with ADS-B traffic alerting provides the best traffic alerting of any ADS-B system on the market. It certainly is the most complete.

If you already have an L-3 Skywatch installed, the existing NY164 directional antenna can be used to complete a diversity (dual antenna) interface, which helps eliminate shadowing.

TERRAIN AND STORMSCOPE

Just when we thought lightning detectors were headed for retirement (they're overshadowed by SiriusXM and ADS-B weather systems, plus they're expensive to repair), L-3 adds Stormscope display capability to the NGT9000.

While there are many Stormscope models still in service (there were over 60,000 built), only the L-3 WX500 will work with the NGT9000. This is the two-piece remote system (processor and antenna) that connects with a variety of panel displays. We doubt new WX500s will be flying off shelves because of this new interface, but we also think having the capability adds another tactical resource to FIS-B ADS-B radar, especially when you consider the resolution limitations.

The Stormscope is controlled and displayed on a dedicated page in the NGT9000. You can view cell mode or strike mode, overlay lightning data on the map page, plus control the 200-mile range. Since the WX500 can drive two displays via its twin serial output ports, you can still keep it connected to an existing system.

If you have a Garmin navigator, GMX200 or Avidyne MFD, to name a couple among a long list of compatible systems, they can be used as secondary, non-controlling displays. The WX500 can also provide a magnetic heading source to the NGT9000 if the Stormscope is wired for synchro magnetic heading.

There are now two options for terrain alerting on the NGT9000 and both trickle down from L-3's LandMark TAWS-B system. For turbine-category aircraft that have to have a mandate-compliant Class B TAWS system, L-3 offers the $4000 eTAWS option. One of the requirements of TAWS-B is aural and visual alerting during CFIT conditions.

But you don't always need TAWS-B in pistons. For that crowd, L-3 added TerrainVision. This is an $893 option that doesn't have the aural alerting or forward-looking predictive capabilities of a full-up TAWS-B system, but it does have the same terrain color/altitude clearance display. When enabled, TerrainVision appears on the NGT9000's right display.

SMART IMPROVEMENTS

Software 2.1 also has some subtle enhancements, including the ability to more efficiently use dual NGT9000s in one panel (one acts as a primary MFD, while the other handles transponder and ADS-B Out functions, for example).

Additionally, L-3 said many NGT9000 customers who operate in the SFRA and ADIZ zones requested to disable the single-button VFR squawk mode to guard against inadvertently squawking 1200 when flying in those areas, so it added the capability in the new software.

The base price of the NGT9000 is $6170, but the ATAS and TerrainVision capability bumps the price to $7730. With built-in TAS, it's $11,750 including antenna. You can add ATAS and TerrainVision to existing NGT9000s for $667 and $893, respectively.

For buyers looking for a cheap ADS-B upgrade, the NGT9000 probably isn't the system. But for panels that don't have an MFD and are begging for a transponder upgrade, we think the NGT9000 makes sense.

Contact www.l-3lynx.com.

YouTube See a video about the NGT9000 at http://tinyurl.com/j95ht2a

IT'S TIME TO RELAX THE ADS-B TSO

Last month, Seattle Avionics began marketing a new portable dual-band ADS-B In product from uAvionix. It's called the pingBuddy2 and sells for the eye-opening price of $149.

The pingBuddy2 is significant for a couple of reasons. One is the utterly disruptive price. Heretofore, the dual-band portables have sold for nearly 10 times as much. We're thinking here of the Stratus 2S, the Sagetech Clarity and the Levil Technology iLevil 3 SW. To be sure, these aren't exact comparisons because the more expensive products include onboard GPS and AHARS that put some backup gyro capability on a tablet. One version of the iLevil even has pitot-static input. By comparison, the pingBuddy2 has just ADS-B In for TIS-B and FIS-B access. You're on your own to provide it with GPS position data.

The bigger picture is that uAvionix, looking forward, is leveraging volume in the drone market to effect some interesting economy of scale. At this point, it's somewhat aspirational volume because the requirement for ADS-B on drones hasn't materialized yet. Our guess is it will, but it will take a while. But uAvionix, with its full line of miniature avionics, is betting on that future.

The plus for GA owners and pilots is that even though uAvionix's market is overwhelmingly in the UAS space, it sees some opportunity to disrupt ADS-B prices for manned aircraft. As we go to press, the company announced several ADS-B products for the experimental and LSA market. As with other non-certified ADS-B products, there's a significant price break compared to TSO'd equipment. Could that eventually result in significantly cheaper ADS-B Out solutions for owners still balking about equipping? Maybe.

But "significant" is in the eye of the beholder and the trick part here is will the vastly larger demand for UAS ADS-B materialize before the 2020 mandate deadline? Our guess is it won't, because the FAA hasn't even settled on regulations for the larger drones that will fly in the airspace with manned aircraft, much less figured out how and when to require ADS-B for Part 107 operations.

The argument for those little drones having ADS-B—and you equipping your airplane—is compelling. The low-power systems uAvionix is producing don't need to ping ground stations or pipe data into TIS-B or be engaged with ADS-R. They need a simple ADS-B Out pulse so you can see them in your equipped airplane. If you're really worried about the risk of colliding with a small drone, that's the argument for equipping both aircraft with ADS-B.

As a point of public policy, the FAA should now look at the potential of volume-driven ADS-B equipage and how it could reach its goal of full participation. Despite all the positive spin you may have heard, the rate of equipage is still lagging. Whether that's related to cost or other factors is anyone's guess. Vastly cheaper ADS-B Out solutions can't hurt the effort and may ignite the torrent of demand the FAA so desperately wants.

The $1100 SkyVision Salus-3 is one product that's positioned to do just that. It's a portable that has ADS-B Out and In, WAAS GPS, a transponder control module for keeping the Mode A codes in sync with the ADS-B data, plus it has an external ADS-B antenna input in addition to the integral stick antenna. That's the current Salus-3 in the main photo.

While the device supposedly meets all of the performance specs of TSO 154C, company founder Harry Sanders told us the FAA won't issue it a TSO because it's convinced portable units aren't reliable. Still, FAA ADS-B performance reports gathered by existing owners prove the Salus-3 is just as reliable and accurate as any TSO'd ADS-B system. We flew with a Salus-3 for a report in the June 2015 *Aviation Consumer* and it worked, but had limited third-party app interface.

Aside from a low price and avoiding a pricey teardown installation, the idea of a portable ADS-B Out device is the ability to carry it from one aircraft to another. This can save struggling flight schools a small fortune in upgrades. Simply program the aircraft-specific ADS-B data in the tablet app before starting the engine (that's what we did with the Salus-3 when we rented a Cherokee for the flight evaluation) and away you go.

To achieve widespread equipage, we think the agency needs to relax—or even eliminate—the TSO requirement for certified ADS-B. It's lunacy and utterly counterproductive that an experimental RV-8 can run around in the same airspace that a Skyhawk can, but the latter requires a more expensive certified ADS-B receiver. This is at the core of the squabble NavWorx is having with the FAA, which insists that the company's GPS solution for its low-cost ADS-B boxes doesn't meet the TSO requirement, even though it meets the TSO performance specs. The FAA is just making it that much more difficult and expensive to equip over what we think is an inconsequential technical fine point.

Removing the TSO and certification hoops would make it much more likely that a company like uAvionix could bring cheaper ADS-B to the market. Could we see an under $1000 solution suitable for certified airplanes? uAvionix thinks so, especially if the drone demand it sees over the horizon materializes. But it may not be in time to meet the 2020 witching hour. Still, better late than never.

And while we're at it, why not just reconsider the entire idea of TSOs? It's an idea whose time may be done.

MANDATE-COMPLIANT, PANEL ADS-B PRODUCTS

PRODUCT	ADS-B SPECS	DISPLAY INTERFACES	PRICE	COMMENTS
APPAREO				
STRATUS ESG	1090ES ADS-B TRANSPONDER	N/A	$3490	Has internal WAAS GPS, interfaces with Stratus portable
ASPEN AVIONICS				
ATX100	978 UAT OUT, 978 UAT IN	EVOLUTION MFD	$2645	Requires external GPS
ATX100G	978 UAT OUT, 978 UAT IN	EVOLUTION MFD	$3495	Has internal WAAS GPS, ADS-B In and Out
AVIDYNE				
AXP340	1090ES ADS-B TRANPONDER	N/A	$3995	Partial plug-and-play with some existing BendixKing transponders. AXP322 is remote version.
SKYTRAX100	978 UAT IN	IFD540/IFD440	$2199	Compatible with Avidyne's IFD540 navigator
BENDIXKING				
KT74	1090ES ADS-B TRANSPONDER	N/A	$2999	Partial plug-and-play with KT76A/C, KT78A transponders, requires WAAS GPS input
KGX130	978 UAT IN	IOS TABLET MFD TRAFFIC ONLY	$1489	ADS-B In only, for use with 1090ES transponder
KGX150 (G)	978 UAT OUT, 978 UAT IN	IOS TABLET MFD TRAFFIC ONLY	$4069	Has internal WAAS GPS
KGX150	978 UAT OUT, UAT IN	IOS TABLET MFD TRAFFIC ONLY	$3489	Version without internal WAAS GPS
FREEFLIGHT SYSTEMS				
FDL-978-TX	978 UAT OUT	N/A	$2995	Has Diversity, includes control head
FDL-978-XVR	978 UAT OUT, 978 UAT IN	IOS, ANDROID MFD TRAFFIC	$3695	Has Diversity, includes control head and Wi-Fi module
FDL-978-XVR	978 UAT OUT, 978 UAT IN	IOS TABLET MFD TRAFFIC	$4495	Internal WAAS GPS, includes Wi-Fi module for tablet use
FDL-978-TX/L	978 UAT OUT	N/A	$1995	Lite version, no ARINC card, upgradeable to ADS-B In
FDL-1090-TX	1090ES ADS-B TRANSPONDER	N/A	$4495	Remote control head/processor design, requires WAAS GPS input
GARMIN				
GTX335	1090ES ADS-B TRANSPONDER	N/A	$3295	Internal WAAS $3795
GTX345	1090ES ADS-B TRANSPONDER	GTN/GNS/G1000/TAB	$4995	Internal WAAS $5795, GTX345-R LRU priced the same
GDL84	978 UAT OUT, DUAL-BAND IN	IOS, ANDROID TABLETS	$3995*	Standalone ADS-B Out and In, wireless Bluetooth connectivity with Flight Stream 110/210. Requires Garmin Pilot, ForeFlight tablet app. *$4495 with Flight Stream 210 (built-in AHRS)
GDL88	978 UAT OUT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$3995	Requires WAAS GPS input, tablet interface requires Flight Stream wireless Bluetooth module, Garmin Pilot or ForeFlight app
GDL88-W	978 UAT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$5143	Has built-in WAAS GPS receiver, tablet interface requires Flight Stream wireless Bluetooth, Garmin Pilot or ForeFlight app
GDL88-D	978 UAT, DUAL-BAND IN	GNS530W/430W G600/500 GTN750/650 *IOS/ANDROID	$4495	Diversity model (requires top and bottom antenna installation), requires WAAS GPS input, tablet interface requires Flight Stream wireless Bluetooth module, ForeFlight or Garmin Pilot app
GDL88-WD	978 UAT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$5643	Has built-in WAAS GPS receiver, Diversity (requires top and bottom antenna installation), tablet interface requires Flight Stream wireless Bluetooth module, ForeFlight or Garmin Pilot app
L-3 AVIATION LYNX				
NGT-9000D+	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	SELF-CONTAINED, GARMIN MX20	$11,557	Rack-mounted, internal WAAS, TAS, comes with NY164 directional antenna. Aural alert $667 option on all
NGT-9000+	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	SELF-CONTAINED, GARMIN MX20	$7923	Version with internal TAS, but doesn't come with a NY164 directional antenna. TerrainVision is $893 on all

MANDATE-COMPLIANT, PANEL ADS-B PRODUCTS (CONTINUED)

PRODUCT	ADS-B SPECS	INTERFACES	PRICE	COMMENTS
NGT-9000+	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	SELF-CONTAINED, GARMIN MX20	$7923	Has internal TAS, but no Diversity. Aural alert $667
NGT-9000	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	SELF-CONTAINED, GARMIN MX20	$6170	No Diversity, no internal TAS. Aural alert $667
NGT-2500	978 UAT OUT, 978 UAT IN	MX20, TABLET	$3890	iOS, Android tablet interface requires $270 optional Wi-Fi module, $973 control panel may be required
NGT-2000	978 UAT OUT, 978 UAT IN	TABLET	$3590	Requires $270 Wi-Fi module, built-in WAAS GPS, could require $973 optional control panel
NGT-1000	978 UAT OUT	N/A	$2310	Basic mandate-compliance, built-in WAAS GPS, could require control panel installation
NAVWORX				
ADS600	978 UAT IN	Garmin MX20, GMX200 *GNS430/530/G500/600	$1499	*Garmin display interface will overlay traffic only. $2399 version with internal GPS can interface to 1090ES transponders
ADS600-B	978 UAT IN, 978 UAT OUT	Garmin MX20, GMX200 *GNS430/530/G500/600	$2020	Has non-certified built-in WAAS GPS for aircraft that don't need to comply with ADS-B mandate
ADS600-EXP	978 UAT IN, 978 UAT OUT	Garmin MX20, GMX200 *GNS430/530/G500/600	$1599	ADS-B Out and ADS-B In UAT for installation in experimental and LSA.
SEATTLE AVIONICS/UVIONIX				
PINGBUDDY2	978 UAT IN	INTERNAL	$129	Mode A/C transponder with integral ADS-B In/Out
TRIG AVIONICS				
TT31	1090ES TRANSPONDER	N/A	$2568	Requires external WAAS GPS input, KT76A/C replacement
TT22	1090ES TRANSPONDER	N/A	$2595	Remote control head and processor

NON-CERTIFIED PORTABLE ADS-B PRODUCTS

PRODUCT	PRICE	SIZE	ADS-B SPECS	BATTERY LIFE	MAJOR APPS SUPPORTED	COMMENTS
DUAL XGPS170	$549	4.3 X 2.7 X 0.8	978 MHZ	5 HOURS	WINGX PRO, FLTPLAN.COM, SEATTLE AVIONICS FLYQ, ADVENTURE PILOT IFLY	Convenient chassis design with nonskid base
SAGETECH CLARITY	$1150	2.5 X 2.5 X 1.5	978 MHZ 1090 MHZ	6 TO 8 HOURS	WINGX, ADVENTURE PILOT IFLY, GLOBAL NAV SOURCE, IPAD EFB, SKYVISION EXTREME	ADS-B only; no AHRS, dual band
SAGETECH CLARITY SV	$1400	2.5 X 2.5 X 1.5	978 MHZ 1090 MHZ	6 TO 8 HOURS	WINGX, ADVENTURE PILOT IFLY, GLOBAL NAV SOURCE, IPAD EFB, SKYVISION EXTREME	Top overall performer for GPS, ADS-B and EFIS; smallest physical size; runs HOT
ILEVIL AW	$1395	4 X 2.5 X 1.0	978 MHZ	5 HOURS	WINGX, FLYQ, ADVENTURE PILOT, AHRS UTILITY, XAVION, AVNAV EFB, AVARE	Can be be hardwired, pressure transducer interface for airspeed/altitude
ILEVIL 2SW	$1195	4 X 2.5 X 1.0	978 MHZ	5 HOURS	WINGX, FLYQ, ADVENTURE PILOT IFLY, AHRS UTILITY, XAVION, AVNAV EFB, AVARE	Good performer, solar charging, now has dual frequency ADS-B
STRATUS II	$899	6 X 2.6 X 1.25	978 MHZ 1090 MHZ	8 HOURS	FOREFLIGHT ONLY	Good overall value; runs coolest; requires toggling to separate app to use EFIS
STRATUS I	$499	5.75 X 4.25 X 1.0	978 MHZ	8 HOURS	FOREFLIGHT ONLY	First-generation model, no AHRS, single-band receiver
GARMIN GDL39	$599 $699 W/ BATTERY	3.5 X 1.9 X 6.0	978 MHZ 1090MHZ	4 HOURS	GARMIN PILOT FOR IOS AND FOR ANDROID, GARMIN GPS396/496/696/AERA500 VIA CABLE, GARMIN 796	Bulky footprint, especially with optional battery installed
GARMIN GDL39 3D	$849 $899 W/ BATTERY	3.5 X 1.9 X 6.0	978 MHZ 1090 MHZ	4 HOURS	GARMIN PILOT FOR IOS AND FOR ANDROID, GARMIN GPS396/496/696/AERA500 VIA CABLE, GARMIN 796	Has AHRS output for driving Garmin Pilot attitude and synthetic vision display
SKYVISION SALUS-3 978UAT/1090ES	$1099	8.0 X 3.0 X 2.0	978 MHZ 1090ES	EXTERNAL VOLTAGE	XTREME VISION, WINGX PRO, SKYRADAR, ADVENTURE PILOT, XAVION	First portable solution attempting to meet ADS-B mandate certification
STRATUX	FROM $100	VARIES WITH CASE OPTION	978 MHZ 1090ES	EXTERNAL VOLTAGE	FOREFLIGHT, WINGX, FLYQ, OTHERS	Assemble your own receiver and play the ADS-B data on a variety of apps

Continental's Big Play: A New Engine Factory

Despite an anemic market, Continental's Chinese parent has loosened up $40 million for a new plant. It's aggressive about gaining market share.

by Paul Bertorelli

Touring either Lycoming's factory in Williamsport or Continental's in Mobile is like a stroll through time. Cheek by jowl with ancient hand-operated machine tools are modern CNC machining centers that would be at home in a Ford or GM plant. In late March, Continental revealed that it's ready to scrap the old stuff for good.

In a surprise announcement, the company unveiled plans to build a new factory on fresh ground in Mobile, investing some $40 million in new machine tools and production processes that Continental hopes will improve efficiency and make it more competitive in what it sees as an increasingly global market.

Since robust growth in aviation is but a pipe dream, Continental's overarching business plan is to gain market share from existing players and to eke out sales with new products whose development is paid for by money saved through more efficient production.

AVIC GOES BIG(ISH)

The Chinese state-owned company AVIC bought Continental from Teledyne in 2010 and has shown an acquisitive bent since. In 2013, it bought the bankrupt assets of German diesel maker Thielert Aircraft Engines and in 2015, it scooped up Danbury Aerospace/ECI, a major producer of PMA parts and the budding Titan engine line. Those purchases were in keeping with a business plan that expands the company's reach without necessarily growing the overall market much.

The March announcement, envisioning some $70 million in total investment in Mobile, includes a new, clean-sheet factory, a revised global customer service network and an expanded presence in China with a design and engineering center aimed at expanding the Asian market.

In Mobile, $30 million will go into a new 225,000-square-foot factory to be built by an outside investor and leased by Continental. An additional $40 million will buy new, state-of-the-art production machinery better suited to the low-volume, high-mix product stream that both major engine manufacturers survive on.

Although Continental's factory has its share of vintage machine tools, it has benefitted from incremental investments in new equipment, even when it was owned by Teledyne. But CEO Rhett Ross says the average age of equipment in the plant is 17 years and isn't nearly flexible enough to handle the plant's highly varied output.

"We're going to consolidate our Mobile factory from 11 buildings, to two buildings. In doing this, we're going to remove a lot of inefficiencies," Ross told me when I toured the plant in March. "We're going to bring in a lot of new manufacturing equipment based on heavy benchmarking that we've done at places like Harley Davidson, some of the big auto plants, Rotax even. We need to come into this century," he adds.

That Continental's parent, AVIC, is bullish on the investment return is obvious from the size of it. As industrial investments go, $40 million is relatively modest and is but a fraction of what a major aircraft certification project costs. But heretofore, investments in Continental and Lycoming have been on the order of a million here or a million there, with the occasional cash injection totaling up to $10 million over several years.

What's unique about the March announcement is both the larger scale and short timeline. Continental says the factory will be producing things by 2018 and will be fully operational by 2019.

Continental moved from Michigan to Mobile in 1966. It now occupies 11 World War II-era buildings and spends more than a million dollars a year just on building maintenance.

MODERN MACHINERY

Despite the presence of some modern machining centers in the plant, there are huge production efficiency gains to be had, says Michael Skolnik, who overseas manufacturing operations in both Mobile and the company's Germany-based diesel engine plant.

The signs of this are everywhere. Already in place in Mobile is a large automated machining center for crankcases. Before it was installed, Continental told customers they would have to wait for some parts until the company could justify machining the minimum number, which might be 50 units. "Now," says Continental's Mike Gifford, "the minimum is one." That means it's practical to fill a single order for a crankcase the company might not have in inventory. And following lean manufacturing principles, inventory is always kept to the bare minimum.

On the camshaft line, Skolnik showed me a part that once required nearly 12 hours of setup time but now requires under 10 minutes. Still, Skolnik says by automotive standards, the factory is not very flexible.

"With our business, we're very low volume and very high mix. We have to be flexible. Our systems today are not very flexible, which adds a lot of waste, a lot of waiting and a lot of work in progress. That drives inventory costs. That goes away to a certain extent with flexible manufacturing," says Skolnik. These days, flexible manufacturing often means five-axis machining centers that require fewer setup steps and deliver part cycle times two-thirds faster than with older three-axis equipment.

As part of its benchmarking, Continental looked at other engine and manufacturing plants, including cutting-edge factories like Rotax. With high volume, such factories have robotic assembly and fleets of autonomous guide vehicles that scurry around the plant delivering parts and picking up finished assemblies.

Chances are, you won't see much of that at Continental. "We can go to automation at some level. It doesn't always make sense due to our volume. We are investigating a couple of circumstances [for automation] not so much from the economic standpoint, but for safety and ergonomics," Skolnik says. For example, some parts—crankcases and crankshafts—are heavy enough to benefit from being handled by machinery rather than raw muscle power. But there's not enough volume to justify major investments in the sort of robotics that are routine in auto plants. It's unlikely there ever will be.

Incremental investments have placed some modern machining cells on the floor, right, but they aren't as flexible as new equipment. Cylinder assembly, middle photo, is still a hand operation, as is picking parts for an engine assembly kit, lower photo. A new factory will contain more automation, but minimal robotics.

And that gets us to the workforce. It will inevitably be smaller because when one machine replaces 20, fewer guys are required. Ross told us the local governments pitched in to help with the new factory development and in return, Continental has committed to maintaining a workforce in Mobile no smaller than 300. It's currently at about 400. Moreover, that workforce will require skills the factory doesn't currently have in abundance, so it'll have to create them with a lot of retraining.

WHAT'S IT ALL FOR?

Any bean counter worthy of the name would look at general aviation sales across the board, consider a $40M investment and then ask: Why? What's the possible return here? Ross has a ready answer. "The efficiency we gain out of this more than justifies the investment and it will help free up money that we will put back into the industry. We intend to accelerate our research and development for new products," Ross says.

Given the history of innovation in the piston market, the outlook is not particularly encouraging, in my view. Ross said Continental would like to revisit the electronic ignition idea after its first foray, the Aerosance system that morphed into the PowerLink FADEC, found little traction in the market, despite significant investment. Technology has leapt forward in the nearly quarter century since that system was conceived.

continued on page 32

Bristell NG5 Another LSA Speedster

Four times the fuel economy and a fifth the price of a new Cirrus. If you want to go places, the Bristell will get you there.

by Paul Bertorelli

CHECKLIST

- With six hours of endurance and 120-knot cruise, the NG5 impresses.
- So do the avionics, which include envelope protection.
- Control forces are lighter than we'd like, requiring accommodation.

Is there a value proposition in an airplane that cruises two-thirds as fast as a near million-dollar Cirrus, uses only one-quarter the fuel and costs one-fifth as much? The Bristell LSA, an Eastern European import we're examining here, certainly tests the notion.

Like the Tecnam Astore we reviewed in the January 2017 issue, the Bristell NG5 stretches the slow-simple-cheap ethos of the light sport airplane to the breaking point. Given its sophisticated avionics, high cruising speed and attention to interior and baggage space, the Bristell is clearly conceived as a high-end traveling machine, not a bump-around-the-pattern flivver.

The airplane is available in three variants: the tri-gear version we flew for this review, a tailwheel model (the TD) and even a retractable gear version that's unlikely to ever see the light of day in the U.S., except as an experimental. Base price is $126,900, but more realistically, the invoices hover around $180,000 and up.

AFTER THE FALL

It's fair to say that the Bristell springs from the rich tradition of aircraft manufacturing left behind in the Eastern Bloc countries after the fall of the Soviet Union. By our count, there are at least nine extant sport aircraft manufacturers in the Czech Republic and, if not thriving, they appear to be holding their own.

The Bristell is the creation of designer Milan Bristela and if the airplane bears a resemblance to the Czech Sport Aircraft SportCruiser, which Piper introduced briefly as the PiperSport, it's no coincidence. Bristela was involved in the design of that aircraft, too.

Both the Bristell and the SportCruiser are all-metal—or at least mostly metal—low-wing aircraft with bubble canopies and a low-slung sporty look. They look enough alike to be mistaken for the same aircraft, but they're actually considerably different, according to Lou Mancuso, a veteran Long Island FBO who's now importing the aircraft to the U.S. through the Lancaster, Pennsylvania-based Bristell Aircraft.

The Bristell NG5 has a shorter wingspan—26.8 feet vs. 28.2 feet for the SportCruiser—a wider cabin and is slightly shorter than the Cruiser. But the biggest difference is in comparative weight and useful load. At 675 pounds, best case, the Bristell is one of the lightest LSAs on the market and is much lighter than the 855-pound SportCruiser. (The version flown for this flight trial weighed 777 pounds.) Consider the useful load against the standard 1320-pound LSA max gross weight. The airplane I flew had a 543-pound useful load compared to about 465 pounds for the SportCruiser. Throw in full fuel (32 gallons) and the Bristell has 351 pounds of payload left—two people if they aren't too heavy. If the occupants are broad shouldered, they'll have a bunch more lateral room than they would expect in a Cessna 150. With a 51-inch cabin width and a console in between, there's no bumping of shoulders. Legroom, while adequate, is less impressive. Anyone much over six feet may feel cramped. Adjustments are handled via sliding rudder pedals and shuffling the seat cushions.

A LITTLE TRAVELING MUSIC

One thing is obvious about the Bristell: While it may be cheap to fly and suitable for 30-mile breakfast flights, the designer appears to have more ambitious flying in mind. For one thing, the airplane is fast. Without trying very hard, I easily pushed it up to 120 knots true and suspect with prop adjustments, it has more in it. The airplane was equipped with a

ground-adjustable three-blade Fiti composite prop. Available as an option is an electrical ground-adjustable prop, but it's not adjustable in flight.

Second, the Bristell has far more sophisticated avionics than most LSAs (more on that in a moment) and storage space galore. There's a large rear baggage compartment with a shelf and 33 pounds of capacity plus two wing lockers just inboard of the ailerons that each hold 44 pounds. Bristell offers custom-made bag liners that fit these wing lockers. That's a lot more space than you need to meet your buddies on a Saturday morning breakfast flight so clearly, this airplane is meant to go places. With 32 gallons of fuel for six hours of endurance, it's got the legs to get there.

The airplane I flew was equipped with the 100-HP Rotax 912 iS, but the 115-HP turbocharged 914 is also an option, as is the 100-HP 912 ULS. Mancuso told us that customers have been split between the iS and ULS options. The 912 iS is a $10,000 upgrade and burns a little less fuel, but at under 5 GPH in cruise, typically, the Bristell is already miserly on gas. With the right winds, says Mancuso, he's made it nonstop from Florida to the northeast.

Now, back to the avionics. The version I flew was equipped with the Garmin G3X Touch, which includes an autopilot with envelope protection options. If this package is less sophisticated than what's found in a modern Cirrus or Cessna, it's not much so. The airplane had a pair of 10.6-inch displays that can have independent ADAHRs and a backup battery on the pilot's side good for 20 to 30 minutes of operation. (The airplane itself also has a backup battery for the 912 iS FADEC system.) Although it's not approved for IFR, the airplane I flew had backup gauges nonetheless, a trio of pitot-static instruments under the eyebrow and above the center display. No standby gyro, however.

Manufacturers building to the ASTM light sport standard are allowed to approve their aircraft for flight under IFR but not in IMC—Tecnam does this. Bristell hasn't followed, but Mancuso says it's in the works. Further, the company is exploring an E-LSA variant that would be operable in IMC under IFR. Given the reliability and sophistication of the avionics, I wouldn't hesitate to use an airplane like this for cautious IFR in IMC. Cautious means avoiding even a hint of icing and giving thunderstorms a wide berth.

Bristell offers avionics packages other than the Garmin G3X Touch, top photo. But buyers go for the Touch. Expansive canopy, top photo, provides stunning visibility.

NO SIMPLE AIRPLANE

If the FAA (and the industry) intended light sports to be modern iterations of the Piper J-3, Bristell didn't get the memo. Neither did Tecnam and a few others. The Bristell is not a simple airplane to operate, although it's easy enough to fly. After my second flight in the airplane, I observed to Mancuso that LSA or not, the Bristell is a true TAA—technologically advanced aircraft. He compared it to checking out in a Piper Arrow, albeit one with a glass panel.

The airplane has a longish pre-start and pre-takeoff checklist and I'd say a pilot shouldn't gloss over it. There are checks for the backup batteries and the two lanes for the Rotax's ignition system, plus some semi-involved step-throughs on the G3X Touch and a check that the autopilot servos can be overpowered by muscle. The Rotax has that peculiar requirement to warm up before the power can be advanced to taxi, something Lycoming operators rarely bother with.

As far as the Touch is concerned, anyone familiar with the Garmin GPSMap 396 and forward or the GTN-series navigators will adapt to its top-level functions relatively easily. It responds to random button pushing and if you know a few basics like touching tabs to bring up deeper menus, it's not hard to drive it. High-level functions, such as flight planning and configuration setups, will require some training or manual review. A couple of hours ought to do it. It's much easier than a G1000. The autopilot is broadly similar to the GFC 700 and, indeed, has some of the same functions, including Electronic Stability and Protection, which Garmin calls ESP-X for the Touch. Whether the autopilot is engaged or not, ESP kicks in when bank and pitch angles are out of bounds and it exerts increasing corrective control force until the exceedance is resolved. It can be manually disabled and that's something you'd want to do when doing steep turns or stalls. The system also has the blue level button that seems to be standard these days.

As installed in experimentals and LSAs, the G3X Touch autopilot offers the choice of control solely through the touchscreens or the screens and a GMC 305 control panel. In the Bristell, it's mounted below the center display just above the console where it's easy to get at. I think it's an addition worth the extra space and weight. The G3X version I flew had two 10.6-inch displays but there's the option of 7-inch displays too or combinations. The Bristell's panel is so large that it easily accommodates the two

Landing gear, left, is an LSA weak point. Bristell claims to have reinforced its gear and the nosegear is steerable. Each wing, lower photo, has a unique baggage locker with a 44-pound capacity.

larger displays. Ground handling of the Bristell is superb, thanks to a steerable nosewheel. Bristell must have gotten the geometry just right because the airplane does tight taxi turns effortlessly, something many other LSAs can't quite do. The nosegear is equipped with a dual shock absorber and the main gear legs have been beefed up to forestall landing damage.

Once past the G3X, the Rotax and autopilot complexity, the Bristell is just your standard stick-and-rudder airplane. One note: Like so many LSAs, the Bristell has light control forces, albeit probably not as light as the SportCruiser. This is a mixed bag and I prefer control forces more akin to certified aircraft because they auto damp any pilot tendency to over control. The Bristell's forces are not so light to excite a PIO on takeoff or landing, which is definitely the case for a pilot new to the SportCruiser.

Thanks to an unrestricted bubble canopy, visibility out, up and down is terrific—almost as though there's no canopy there at all. The top of the bubble is shaded with a composite material and panel-mount vents provide gales of air, so the cockpit didn't seem hot on a 75-degree Florida day. The canopy itself seems improved over the SportCruiser style. You simply pull it down and a couple of overcenter latches engage two pins. To release it, there's a lever at the aft end of the console. Unfortunately, canopy openings in flight are a prominent occurrence in the SportCruiser accident pattern. Although the airplane is flyable and controllable with the canopy open, pilots have been so distracted by an open canopy in flight that they've lost control of the aircraft and crashed as a result. I found only a couple of accidents involving Bristell aircraft (not this model) and no canopy openings in flight.

Slow flight and stalls in the Bristell are the usual. I didn't notice much pitch change on flap deployment and the airplane will easily slow to a comfortable minimum of 55 knots indicated for a max-performance landing. I did notice that the nose drops through rather vigorously if the stall is aggravated to a full break. Mancuso said this won't occur if the wings are kept level, but I didn't notice any bank when I tried the stalls. If I were flying the airplane regularly, I'd explore this more in depth. The published stall speed in landing configuration is 39 knots. You could probably fly approaches at 50 knots and have adequate margin.

The airplane likes to get up and go. It accelerates briskly, even with two aboard, but needs to gather itself up a little before launching into a brisk climb of 800 to 900 FPM. The POH promised only 700 FPM, but I saw better than that, suggesting that this data may have been developed with a cruise setting on the prop.

Speaking of cruise, the airplane accelerates and settles down to 118 knots at about 4.5 GPH. Pushed a little harder, it will do 120 knots TAS and likely better than that at high altitude with the turbocharged 914. Mancuso says Bristell is looking at Rotax's new 135-HP 915 iS and may offer it when it becomes available later this year or early next year.

That engine, although heavier, should dent the airplane's useful load slightly, but in exchange for even better climb rate and cruise at altitude. It's expected to have similar fuel economy as the 914.

Although the Bristell hasn't been a hot seller in the U.S. yet, it's doing well in Europe and the company reports build volume of about 80 aircraft a year. So now the question is: Do buyers want this kind of performance to fly places or just to hang around the pattern doing landings? If the former, Bristell ought to find a niche larger than the one they have now, especially since no one blinks at a $200,000 LSA.

YouTube **See a video about the Bristell at http://tinyurl.com/j95ht2a**

CONTACTS...

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717-735-1600
www.bristellaircraft.com

The CFI Rating: Getting It, Using It

The flying part of the CFI rating is secondary; what's important is learning how to teach. ASA, Gleim and King schools are top choices for prep materials.

by Rick Durden

We've been following the debate over the existence of a pilot shortage with some interest. We think that one piece of evidence has shoved the needle to the "Yep, there is one" side of the scale so definitively that the debate is over: Flight schools are actively recruiting flight instructors and paying them a living wage. In some cases flight schools are also offering hiring bonuses.

Because the jobs new commercially rated pilots traditionally got to build time so they could eventually get hired by the airlines—night freight and check hauling—have dried up, currently the most popular way for low-time pilots to build time is to flight instruct. That being the case, we decided to take a fresh look at what is involved in obtaining the flight instructor rating—primarily time and cost factors.

We'll start by referencing a conversation we had with the chief flight instructor, Manpreet "Prince" Singh, at the CFI Academy (www.cfiacademy.com) in Lodi, California, the only flight school we know of that focuses exclusively on training CFIs. Singh pointed out that getting the CFI rating will be an experience unlike obtaining any rating the pilot already has. For the first time the pilot will not merely be facing a completion standard of demonstrating "satisfactory knowledge" of a task or flight operation—he or she will be required to demonstrate what the FAA refers to as "instructional knowledge" of that task or flight operation. To become an instructor a pilot must know the why or how of a flight operation, not just have enough understanding to get by.

Singh went on to say that for a pilot to pass the CFI practical exam she or he will have to know the material and be able to explain it clearly at a very basic level and be able to demonstrate the ability to modify his or her teaching method to meet the learning method of the individual student. Good communication skills are a must.

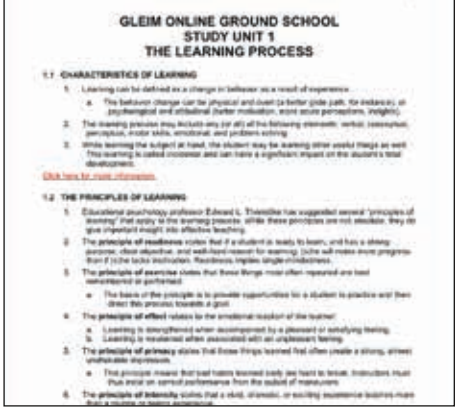
We agree with Singh's observations and recommend to any pilot who is seeking to become a CFI that he or she understand going in that it will be hard work, the vast majority of the time spent will be on the ground—because she or he should already know how to fly—and that there are no shortcuts to the rating. The FAA considers flight instructors as its conduits to general aviation pilots—current and to be—and therefore demands a great deal of those who want to become instructors. That is reflected in a far higher first-time failure rate for the CFI practical test—we were told that it was as high as 70 percent in some areas.

There are three CFI ratings for airplanes—airplane single-engine, airplane multi-engine and instrument airplane—and to keep this article to a reasonable length, it's limited to airplane CFI ratings. One of the conclusions we reached while researching this article was that if at all possible from a time and finances position, if a person wants to get more than one of the airplane CFI ratings (pilots almost invariably obtain the CFI airplane single-engine first), to do them one after another, especially airplane single-engine and then instrument airplane. Once you've gotten up to speed to pass one practical exam it's far easier to get ready for the others right away.

THE WRITTEN EXAMS

There are three FAA written examinations applicable to the various flight instructor airplane ratings. The first is Fundamentals of Instruction (FOI), which must be successfully completed by anyone seeking any of the CFI airplane ratings unless the pilot meets one of the requirements set out in 61.185(b) to be exempted from completing the test—by already holding a flight or ground instructor certificate or being a teacher or college professor at the level set out in the reg. The second is Flight Instructor Airplane (FIA). The third is

The CFI rating is probably the toughest to obtain, but changes in employment prospects for new CFIs are making it not only a good stepping stone to other professional flying jobs but a potential career in itself. Photo: Embry Riddle Aeronautical University.



Ground school and written test prep is offered by a number of what we consider to be high-quality providers including, clockwise from top left, ASA, Gleim, Dauntless and King.

Flight Instructor Instrument Airplane (FIIA).

A person seeking a CFI Airplane rating must pass the FOI and FIA exams. To then become an instrument instructor the applicant has to pass the FIIA exam. To add on the multi-engine flight instructor rating to an existing flight instructor airplane rating, the applicant does not have to take a written examination.

STUDY MATERIALS

We weren't kidding about the hard work involved with obtaining a flight instructor rating—and it starts with the volume of material a pilot has to master. At the most basic level, an applicant must be familiar with all the references in the Flight Instructor Practical Test Standards (PTS)—soon to be Airman Certification Standards (ACS)—and those in the Private Pilot ACS, Commercial Pilot PTS and, if going to become an instrument instructor, Instrument Rating ACS.

The good news is that all of the references are FAA publications and are available free on www.faa.gov. They include *The Airplane Flying Handbook, Pilot's Handbook of Aeronautical Knowledge, Aviation Instructors Handbook, Instrument Procedures Handbook, Aeronautical Information Manual, the Federal Aviation Regulations* and the PTS/ACS for the private, commercial, instrument and flight instructor ratings.

Enterprising aeronautical publishers also sell the FAA publications in hard copy and electronic form. We found prices for the electronic books under $5 while hard copy prices ranged in the mid-teens. We also found a number of books in electronic and hard copy form written for the prospective flight instructor, enough that we cannot even try to list them in an article of a reasonable length. Our cursory review did not reveal any that were of poor quality. We do recommend one book, *The Advanced Pilot's Flight Manual*, by William K. and William C. Kershner, for a prospective flight instructor because of its concise and clear explanation of aerodynamics and aeronautical concepts. We found copies available for as low as $6.

WRITTEN TEST PREP

We looked at five providers of courses for the flight instructor written and/or practical tests. It is a competitive field and we liked the quality of all the materials we saw.

Sheppard Air. Sheppard Air's test prep courses (www.sheppardair.com) are offered via downloadable software that is unabashedly designed to teach the student just what is necessary to pass the FAA written.

Studying starts with going through the questions with only the correct answer displayed. The student can click on an explanation box and get a brief explanation of the correct answer. The student is then to go through the questions again with all the answers showing while learning to recognize the correct answer.

Price for the FOI course is $30, for the FIA $40 and the FIIA is also $40. Sheppard Air has instructors on duty 24 hours a day to answer questions that come up while studying.

Gleim. We've long liked Gleim's (www.gleim.com) "just the facts, Ma'am" approach to training. It offers an online ground school for the FOI for $49.95, the FIA for $99.95 and a kit that combines the two and adds several hard copy publications and a flight bag for $189.95.

The courses are semi-structured in that the student first reads from an e-book and then takes practice quizzes. It concludes with what we consider very realistic practice tests. There are no videos. Once in the question bank, in study mode, the student can call up all or some of the questions for a particular topic. Clicking on an answer provides instant feedback as to whether the answer is correct or not, in impressive detail. It keeps a running tab of questions missed and presents that data in a progress review section. Once the student has answered all of the required questions in the test prep correctly, he or she may request and obtain an endorsement to take the FAA knowledge test.

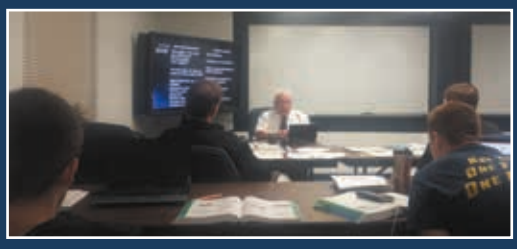
Dauntless. For more than 15 years Dauntless (www.dauntless-soft.com) has offered "active learning by doing" and "learning by simulated testing" downloadable software for FAA computerized knowledge test preparation courses. The student selects one of the knowledge areas within the particular test prep and starts with "test/study" mode. It introduces the student to the material with FAA-style test questions, the correct answer and an extensive explanation, often with high-quality graphics.

The student then repeats the knowledge area in "learning and practice" mode, answering questions and getting immediate feedback. Finally the student takes FAA-style tests that simulate the real thing. Dauntless advertises that, like the FAA, it discourages rote memoriza-

ONE PILOT'S CFI TRAINING EXPERIENCE AT AMERICAN FLYERS

I took the knowledge tests for CFI/I 15 or 20 years ago but then didn't follow through with the rest of the training. I was in a busy law practice that required 24/7 availability on short notice, and the bulk of initial CFI candidates failed their practical tests reputedly as a way of building character. Nobody has time for that. I put the CFI idea on hold with the Advanced Ground and Instrument Ground Instructor certificates as consolation prizes.

I knew I wanted to instruct part-time as I approached retirement at the end of 2015. I did some research and developed two principal criteria in looking for concentrated training: I wanted a program that would maximize my chances of avoiding the quasi-obligatory first-time fail, and I wanted substantial practice teaching experience in a group setting. The training location had to have almost guaranteed flyable weather.



There are a number of choices for CFI training around the country. The larger programs seemed to better satisfy my criteria. I heard some good things about American Flyers in Pompano Beach, Florida, and in particular the head instructor in that program, Patrick Connell (photo above). He had been teaching instructors for decades with a strong track record.

I signed up for a February 2016 CFI airplane and instrument class cycle in Pompano. In preparation for class, I took the knowledge tests. I spent roughly eight hours every day for six weeks before class studying and drafting plans for private, commercial and instrument lessons. I flew with a local instructor to hone the commercial maneuvers that I hadn't practiced recently.

The pace is vigorous. It is a 30-day program, seven days a week and at least eight hours a day (plus two to four hours of daily homework). Practical tests come after the program is concluded. Most days were split between lectures and discussions about teaching techniques, and practice teaching in front of classmates. At least once a week, our practice teaching was critiqued in detail by Connell. Only about 10 hours was devoted to flying. We had unlimited sim (BATD) time.

We had a very cohesive and diverse group of motivated people in our class. We worked hard together and helped each other with teaching skills as well as instrument skills for those who were not current. Not all of the instructors we had for the class training were as experienced or effective as Patrick, who taught about 80 percent of the time. Patrick is a superb teacher; I found after starting work as an instructor that his training and techniques put me way ahead of where I would have been otherwise.

Takeaways: The program met my criteria. Those who hadn't done initial lesson plans before class had to work extra hard. Those who had not taken the knowledge tests had extra work and stress. Those not current in flying the necessary maneuvers (instrument and visual) needed extra time and effort.

This isn't a beach vacation. My only visit to the beach during the entirety of the course was on the afternoon after my second practical test. Otherwise, while the weather was nice in Florida and the palm trees attractive, I might as well have been in Kansas.

—J. Scott Dyer

tion and encourages understanding of knowledge areas; however, it also advertises that it provides just the materials to learn what is necessary to pass the knowledge test and nothing more.

Dauntless test preps for the FOI, FIA and FIIA are $49.99 for new users ($44.99 for returning customers) and they will bundle any three test banks for $104.99.

King Schools. Long a heavyweight in the pilot training video world, Martha and John King (www.king-schools.com) advertise, and our observation of their courses confirms, that their courses seek to help turn out well-rounded pilots who understand and can teach the concepts involved in aviation.

The courses are organized into a recommended flow through the major subject areas with them broken into digestible bits. Review questions then appear with immediate feedback and a report card of success on the questions is generated.

King packages its video courses in a number of ways, from the FIA/FOI ground school and test prep for $279 through a "Flight Instructor Get It All Kit" for the FOI, FIA, advanced ground instructor written and CFI checkride oral and written prep as well as a number of hard copy publications for $599.

ASA. Known for its high-quality aviation textbooks and test prep books, ASA (www.asa2fly.com) offers its Virtual Test Prep series and Prepware designed to prepare the student to take the FOI and FIA knowledge exams. The Virtual Test Prep consists of a number of videos—we counted 10, priced at $9.95 each, on specific knowledge areas. They can be purchased as a bundle for $79.95.

ASA's Prepware series is offered on multiple platforms for the FOI and FIA written exams at $49.95 each. We consider ASA's CFI materials to be test prep rather than ground school for the CFI rating. As test prep, they live up to ASA's usual high standards with high-quality graphics and explanation of answers.

THE PRACTICAL EXAM

As we said, the majority of the work a pilot goes through to get ready for the CFI practical exam is done on the ground. That should include practice teaching in a classroom

environment and one-on-one. The flying portion generally consists of getting used to flying from the right seat while learning to teach while demonstrating the maneuvers. We were told by a number of sources that a pilot who has the maneuvers down cold from the left seat can make the transition in 10 hours.

From our informal survey, it appears that more CFI candidates currently go a formal program at one of the larger flight schools as opposed to flying with a local flight school. We were told by Kathryn Robine, an instructor with the Michigan Flyers in Ann Arbor, Michigan, that a primary reason for not getting the rating locally is a scarcity of complex airplanes—which are required for the practical test—to rent. She had to go to four FBOs before she could find a suitable complex airplane for her most recent CFI student to fly—two airplanes had serious mechanical problems requiring extended downtime and one was in such lousy shape she wouldn't dare send the student for a checkride.

Nevertheless, Ed Pataky, a new instructor in the Houston area, told us he kept the cost of the rating down by working with an instructor he respected and reading everything he could get his hands on to make sure he had the broadest possible knowledge base. Pataky did as much of his training, including spins, in a Cessna 150, and only finishing up and taking the test in a Cherokee Arrow.

FORMAL PROGRAMS

Because of the high failure rate for initial CFI practical tests, we recommend going through some form of formal CFI training program that includes extensive ground training and critiqued classroom instruction time. Such programs, in our opinion, are geared to successfully turning out well-rounded CFIs. We also think formal programs help fight one of the dirty secrets in the industry—the FAA has drastically reduced the number of Designated Pilot Examiners (DPEs), so there can be delays of up to three months in getting a checkride scheduled and because of the reduced number of DPEs, they get away with charging $700 to $900 for a CFI checkride. We heard of rates as high as $1500—highway robbery, in our opinion. The FAA is supposed to give initial CFI checkrides (it's free when an FAA inspector gives the ride), but farms most out to DPEs. Major flight schools seem to be able to schedule checkrides more efficiently than local instructors because they are sending out a steady stream of applicants.

Our survey of flight schools revealed that for the CFI airplane rating most offered 40 to 60 hours of ground instruction and up to 10 hours of dual in a complex aircraft. Most were intensive 15-day programs at the flight school, which means the student pays for lodging (we saw everything from tent camping to expensive motels offered). We saw prices from $3195 to $5000, which did not include the DPE fee. We did see some five- and seven-day programs but did not consider them to include adequate ground training time to prepare a student for the practical exam.

A number of schools offered instrument flight instructor training as an adjunct to the airplane instructor training for a surprisingly modest additional fee and another 15 days of time. For example, American Flyers (www.americanflyers.net) charges

The regs require that a CFI applicant demonstrate "instructional proficiency" in "spin entry, spins and spin recovery procedures."

$3195 for its 15-day course for the CFI-A and $3,995 for its 30-day CFI-A and CFI-I combination course.

Of the schools we surveyed, most required that the incoming student have successfully completed the appropriate FAA knowledge tests and have the spin endorsement. Some of the schools offered extra instruction for those students who had not completed such prerequisites.

New instructor J. Scott Dyer completed the 30-day American Flyers course for his airplane and instrument CFI (sidebar page 17). He was emphatic that if he had not arrived current and comfortable on instruments and with the private and commercial maneuvers, it would have been difficult to complete the class in the time allotted.

A NEW CFI

Prince Singh of the CFI Academy told us that he gets two to three calls a week from flight schools seeking CFI graduates to come work for them but that some 90 percent of the students who come through his program already have jobs lined up.

Even a cursory internet search reveals several training programs that are seeking flight instructors with signing bonuses and an annual income as high as $35,000, although we still take such claims with a certain grain of salt.

New instructors who were working part time for local flight schools and FBOs reported being paid between $20 and $40 per hour (for flight or ground instruction).

We did speak with instructors who were hired by commuter airlines upon hitting the magic 1500 hour mark, making it an excellent stepping stone to an airline or corporate career. Finally, we also spoke with instructors who were coming into professional aviation as a part-time, second or even retirement career and found that they enjoyed it so much that they were going to going to stick with it for the foreseeable future.

Garmin inReach: Mapping, SMS-Capable

Garmin acquired the Iridium-based DeLorme inReach portable satcomms and stepped up the utility with its Pilot app interface. Warts are data cost and speed.

by Larry Anglisano

CHECKLIST

- Shallow icon-driven menu structure makes the inReach easy to use.
- The right size for use in and out of the cockpit, plus it has Bluetooth for Garmin Pilot app connect.
- Don't expect smartphone-like performance. Data speed is limited by the aging Iridium network.

In February 2016, Garmin purchased Maine-based DeLorme—the maker of topo maps and the inReach portable two-way Iridium-based satcomm navigator. The inReach tech was a good score for Garmin because it has a place in multiple markets including aviation, outdoor and marine.

Moreover, the future of Iridium-based communicators looks bright. Iridium is in the process of replacing its aging Block 1 circuit-based satellite infrastructure with the data-centric Iridium-NEXT IP-based satellites, which will eventually mean lower data costs and faster data speeds, with a focus on messaging and web browsing.

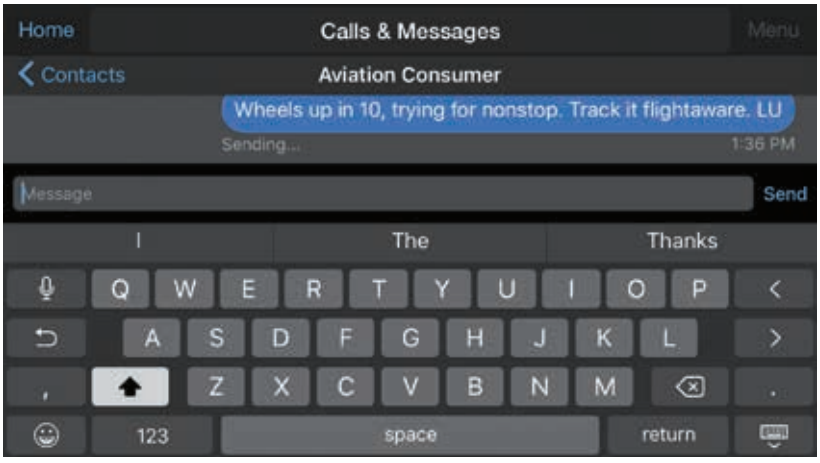
In the interim, Garmin released the first branded inReach devices: the Explorer+ and SE+. We've been using the flagship Explorer+ with the latest version of Garmin's compatible Pilot app in the air and on the ground. Herewith is an overview.

TWO MODELS

Garmin sells two versions of the inReach satellite communicator. The $399 inReach SE+ and $499 inReach Explorer+ both do real-time tracking (location sharing through the web-based MapShare portal), two-way text messaging, can trigger interactive SOS calls to the GEOS International Emergency Rescue Coordination Center (IERCC) and have built-in Bluetooth for wireless connection with Garmin's Pilot tablet app. They also work with Garmin's Earthmate map for downloading topo maps and NOAA charts. The models differ in that the flagship Explorer+ comes with preloaded DeLorme topographical maps with onscreen GPS-based routing. Additionally, the Explorer+ has a built-in digital compass, a barometric altimeter, plus an accelerometer. We think the features are worth the extra $100 for ground use, but not air use.

Both models share the same physical dimensions. They weigh 7.5 ounces and measure 2.7 by 6.5 by 1.5 inches and have a built-in GPS and Iridium satellite antenna. We found that the inReach is the perfect size for stashing in a jacket pocket and in the map pocket of the airplane or attaching to a backpack or flight bag, thanks to the standard carabiner clip.

The inReach runs on a rechargeable lithium-ion that proved to have impressive endurance. They have to



Messaging with the inReach SE+ and Explorer+ is easy with Garmin's Pilot app, which enables texting from your smartphone. Just don't be in a hurry—message delivery can be slow.

INREACH CONTROL SET

because remember, the inReach is a tracking device that might actually get you rescued. Officially, the specs call for 100 hours of life at the default 10-minute tracking mode, up to 75 hours at 10-minute tracking with one-second logging and up to 30 days in power-save mode, which reduces the tracking interval to every 30 minutes. Powered off, the batteries are said to last three years.

The inReach is powered with a Micro-B connection, but we wish it used a Mini-B because that's what the majority of our devices use. The power port is protected with a rubber weather cap, plus the entire unit has an IPX7 water-resistant rating. You can't swim with it, but it will survive splashes, exposure to rain and snow and incidental exposure to one meter of water for up to 30 minutes.

The inReach doesn't have a touchscreen, but instead has a straightforward UI interface where you move around menus with a bezel rocker pad and six function keys. We were able to start using the device without hitting the users manual—a good thing.

Another good thing is the display. It's a transflective color TFT with 200- by 265-pixel resolution that performed well in direct sunlight, plus it has adjustments for backlighting. But, the font is relatively small and there's a lot of data on the 2.31-inch screen.

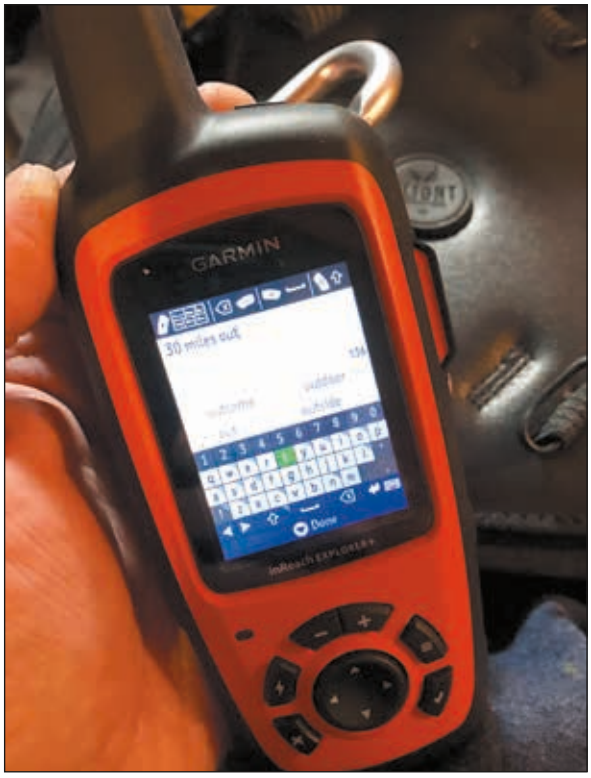
The screen has basic icons (spread out among two pages) for various menu functions like map, messages, routes and waypoints, to name a few major ones. There are also status icons at the top of the screen for showing the status of the internal GPS, Bluetooth connection, unread text messages and battery status. The status LED on the bezel flashes green if you have a new message, flashes red if the receiver doesn't have a clear view of the sky (it also flashes red if the battery is below 10 percent), plus it alternates red and green when you trigger an SOS.

USING IT

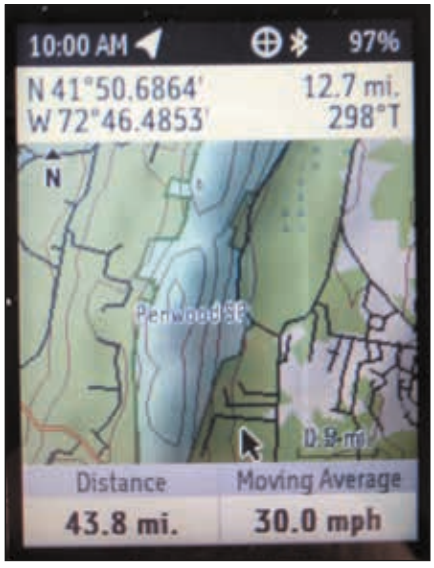
Whether in the aircraft or on the ground, one common function you might use is tracking. When you start the tracking, the inReach simply logs the initial location and also updates the track line on the map display at the set tracking interval. The device then periodically (again, at preset rates) transmits the position over the Iridium satellite network. Iridium offers full pole-to-pole global coverage.

Your followers can track you on the MapShare web-based portal (they can also ping the inReach to see the current position and send a message), plus you can embed MapShare data on social media, including Facebook.

The inReach has a smart SOS function that helps conserve battery life, plus an SOS key that's protected by a cap to guard against inadvertent activation. Simply hold the key down and a default emergency message is sent (you can edit custom SOS messages from the SOS page) along with your current position. For the first 10 minutes, location updates are transmitted every minute. After the first 10 minutes, location updates are sent every 10 minutes. If you remain



The built-in Messaging app has an onscreen QWERTY keypad that we found easy to text with, top. That's a preloaded DeLorme topo map in navigation mode, bottom.



stationary, position updates are sent every 30 minutes. You can also reply to the confirmation message from the emergency responders. If you want to cancel the rescue service, hold the SOS key and press Cancel.

The customizable Map page shows your current location, sent and received messages, stored waypoints, plus a colored track line that connects your track points. The flagship Explorer+ takes the mapping interface one step further and shows street-level detail, points of interest and topographical data.

Since the inReach is also a handheld GPS, you can navigate directly from the map by scrolling/selecting a point as a destination. In our trials, the receiver locked on quickly even in dense forest and in valley areas.

Before a trip, you can preload routes from your MapShare account, while others can see your progress, waypoints and destinations. You can also request basic, premium or marine weather forecasts. Be prepared for data charges.

There's also an onscreen compass (standard on the Explorer+ only) that serves double duty as a navigation display. A heading pointer indicates the direction you're going, while a bearing pointer points to the loaded destination. There are also speed and distance data fields. Compared to aviation navigators, it's a pretty basic feature set, but it's an effective ground navigator, which also shows roads.

MESSAGING

Aside from the SOS utility, the real value of the inReach devices is their two-way communication capability. Unless you're at low altitude, you can't rely on cellular service, so the inReach is another way to communicate via SMS messaging.

You can use the inReach as a standalone communicator through the built-in Messages application much like you do on a smartphone, although without the convenience of a touchscreen. Instead, you type with the four-way rocker pad and the Enter key. It's really not as awkward as we expected.

What helps (or hurts, depending on how you feel about a device choosing your words) is that the messaging app uses predictive text. You likely won't be sending long-winded messages with the device; think quick utilitarian communication, for which it works quite well.

When you initiate an SMS, it starts by asking who you want to communicate with. You can enter the phone number directly or select contacts that you've added. Type the messages, hit Send and off it goes. But not at blistering speed, that's for sure.

In general, we waited several minutes (one time nearly 15) for short messages to send, which is confirmed with an audible chirp. There's also the familiar spinning wheel next to the message that shows the send is in process.

CHOOSE YOUR PLAN

There are two categories of subscription plans: annual and monthly. On the Monthly Freedom plan (geared toward seasonal or occasional use) you pay for airtime only when you need it and you can move up and down a plan at no charge. There's a minimum 30-day commitment, which allows you to suspend the service. All plans include unlimited SOS service and preset messaging.

The Extreme subscription plan is $99.95 per month under the Freedom program or $79.95 per month under an annual contract. This gives you unlimited text messages with no charge for each text you send or receive, plus unlimited location pings and tracking points. Standard is two-minute tracking intervals.

On the other end of the spectrum is the Safety plan for $14.95 per month under the Freedom program. It includes 10 text messages, but you're charged 50 cents for each additional message, plus 10 cents per tracking point and location ping. The plan that may make the most sense is Recreation. It's $34.95 per month and includes 40 text messages and unlimited tracking, at 10-minute intervals. Each plan has a $19.95 activation fee.

We think the flagship Explorer+ delivers a lot of utility, but only for times when a cellphone doesn't work. The SOS function is a bonus and the inReach is easy to use. If ground maps and navigation aren't important, but reliable cabin messaging is, save $100 and get the SE+.

Contact www.garmin.com, 800-800-1020.

Autopilot STC Update: TruTrak, Trio Are Close

Both manufacturers are neck-to-neck in the race to win an AML-STC for experimental autopilots. Third-party interface potential is still unknown.

by Larry Anglisano

If you've been waiting for a cheaper FAA-approved retrofit autopilot you might not have to wait much longer. In fact, you can even have your shop begin the installation. This past April, both TruTrak Flight Systems and Trio Avionics came to Sun 'n Fun with STC approvals on the installation hardware and wiring harnesses for experimental autopilots.

As we reported in the February 2017 *Aviation Consumer*, Trio is working with an outside engineering firm to secure an STC for its Pro Pilot flight control system for Cessna 182 and 172 models. It has competition.

TruTrak—a dominant name in the experimental autopilot market—is nearing final STC approval for its Vizion system for 172 and 177 models and is already selling install kits. It says AML-STC certification (AML is an approved model list that covers multiple aircraft) could come by AirVenture later this summer, and could also include more aircraft models. Unknown at this juncture is which third-party certified systems the FAA will allow the autopilot to be interfaced with under the current PMA.

SCALABLE PMA

TruTrak has partnered with the Experimental Aircraft Association (EAA) for earning the Vizion STC and PMA approvals. Recall that EAA was instrumental in the STC for the Dynon D10A experimental EFIS display (it owns the STC) announced last summer. The milestone win paved the way for Garmin's STC for the experimental G5 electronic flight display.

Fresh off the Dynon project, we think EAA has the right regulatory momentum to win autopilot STCs. On the other hand, autopilot approval under a blanket STC is uncharted territory that comes with technical challenges. Control forces, airframe structural design (which plays a part in servo mounting location, for example) and wiring considerations complicate matters—at least when it comes to convincing the FAA that a one-size-fits-all autopilot can actually work.

But TruTrak is being aggressive. It doesn't intend to limit the Vizion STC to just the Cessna Skyhawk and Cardinal, even for the initial approval. It's looking to include Mooney and Piper. But there are other challenges. Our sense is that across-the-board approval could come at the expense of interface limitations, similar to STC'd experimental EFIS systems—which can't legally be connected with an autopilot.

But risk-based or scalable PMA could offer flexibility, which follows the FAA's non-required safety-enhancing equipment (NORSEE) policy. Autopilots fall under NORSEE's definition of equipment intended to measurably increase safety, but aren't required by FAA regulations. In the official policy, the FAA goes as far as encouraging the installation of non-required equipment to improve safety.

Design approvals under NORSEE are based on risk—i.e., the particular safety impact in case of failure. Plus, production authorization requires far less FAA oversight than traditional approval methods. An important aspect of getting an autopilot approved under the more logical NORSEE policy is the final cost of the product. There's no sense in getting an experimental autopilot that sells for $2100 (the current price of the non-certified Vizion) approved when you'd have to sell it for ten times the price to recoup the high cost of certification.

SIMPLIFIED INSTALLATION

Both manufacturers have an advantage because they have existing products with proven success in experimental aircraft. Like Trio's Pro Pilot system, the TruTrak Vizion isn't a clean-sheet design. It's been in the company's lineup for a few years and is based heavily on the Digiflight II—a system that dates back to 2003.

The digital Vizion autopilot's

The TruTrak Vizion autopilot STC is EAA's next regulatory project. At Sun 'n Fun 2017, TruTrak's Cessna 172 test bed was front and center at EAA's show headquarters.

feature set is advanced, compared to analog systems, but this includes the features we think buyers expect in a modern system. This includes selectable track, altitude hold (and altitude preselect), vertical speed command, plus the ability to track GPS courses. In line with the intent of the NORSEE policy, a selling point from a certification standpoint is the system's basic envelope protection via an emergency leveling mode. As with other more advanced certified systems, a single button push returns the aircraft to wings-level flight.

We looked closely at the TruTrak installation and liked what we saw in terms of simplicity For example, in the Cessna 172, the Vizion's pitch servo mounts up front between the two sets of rudder pedals rather than in the tail section. Plus, the servo drives the elevator control directly instead of using bridle cables. Not only does that make it easier to install, but it also makes it easier to maintain. If you've ever climbed in the tail to remove or install a servo you know precisely what we mean. If you haven't, you've likely paid the high-priced invoice for someone else to do it.

The Vizion's roll servo for the Cessna mounts in the right wing and in close proximity to an existing inspection plate, where the servo drives the aileron bellcrank directly. The servo installation is based on pushrods. Again, no bridle cables that have to be precisely torqued before installation and as part of routine maintenance.

As for the Vizion's control panel, TruTrak will offer it in several form factors. There is one for standard 3-inch instrument hole mounting, one for mounting in a 2-inch instrument hole (think the size of a clock), and also a 2-inch by 4-inch rectangular flat-pack version.

THIRD-PARTY INTERFACING

In the experimental world, the Vizion interfaces with just about any avionics suite designed for GA aircraft and technically it should work with certified systems, too. This includes legacy and current-production Garmin, Avidyne and BendixKing radios. But the FAA will have the final say.

"For the certified version, we're still discussing with the FAA exactly what amount of interfacing will exist at the lowest level of the PMA," TruTrak's CEO Andrew Barker told us this past April. It may actually turn out that TruTrak will step up to a higher level in the scalable PMA to be able to interface with more mainstream products.

According to Barker, the Vizion will interface with nearly any portable GPS navigator, but interface ability with panel navigators like the Garmin GTN and Avidyne IFD series is still unknown. The company is looking for as much feedback as it can get when it comes to interface demand. "If we need to put more energy into interface potentials, we'll do so," Barker said. You can bet it will be a demanding market and one that will expect the autopilot to legally interface with newly certified EFIS displays to include the Garmin G5 and Dynon D10A—neither of which are approved for autopilot interface.

At Sun 'n Fun, Garmin released the electronic directional gyro feature for the G5 (the instrument connects to an external magnetometer for heading display), plus an electronic HSI for displaying lateral and vertical course guidance from Garmin navigators and navcomms. But notably missing is simple autopilot heading command, although the G5 does have a heading bug that does little else than marking a heading for reminder. We weren't the only ones to ask Garmin if it has plans to pursue approval for a G5/autopilot interface, especially since the capability exists with the non-certified version.

It said it hears the market demand loud and clear and plans to tackle the approval. We asked TruTrak's Barker about these kinds of limitations and he hinted at some changes coming soon that will loosen up the interface approval snags.

As for price, TruTrak estimates 16 hours of install labor for the Vizion in a 172, and ballparks the autopilot to sell for around $4000. Contact the company at www.trutrakap.com.

That's the 3-inch round version of the TruTrak Vizion autopilot in the top photo. The middle photo is the Vizion's pitch (altitude hold) servo behind the center pedestal in a Cessna 172. At the bottom is Trio's Pro Pilot autopilot.

Ercoupe/Cadet

These classic two-placers are affordable, stall/spin-resistant and impressively capable in crosswinds.

Back in the day—as in 1939—the Ercoupe was designed to be exceptionally safe by making it resistant to stalls and spins. But the airplane racked up a number of firsts, including being the first successful production GA airplane that had a nosewheel, plus a fully cowled engine. This contributed to more speed than most of its counterparts had. Better yet, an Ercoupe can handle a crosswind of twice the velocity that can be dealt with by almost any other airplane.

These days, by nature of its design, the Ercoupe/Aircoupe doesn't come across as having an abundance of testosterone, so what may be the funkiest two-place airplane from the 1940s is a bit of a sleeper on the used market. We think it's overlooked by potential buyers who don't understand its capabilities. Owners seem to love their Ercoupes for a variety of reasons.

Moreover, the venerable 'coupe remains one of the cheapest ways to get in the air. A nicely kept up early Ercoupe retails for around $14,000, although a pristine restored model may sell for much more. Some can be had for as low as $10,000, but prospective buyers should watch out for basket cases in that price range.

Surprisingly, 20-year-newer (1968-1970) Mooney Cadets—Ercoupes with a single tail and rudder pedals—might also sell for under $20,000.

The C model, the only model that has a low enough gross weight to qualify under Light Sport, is quietly becoming an in-demand airplane. Its referenced value in the *Aircraft Bluebook* may be behind the times.

After a crabbed touchdown, the airplane immediately turns to point in the direction it is traveling.

If you find a decent Ercoupe, you get a fun airplane suitable for Saturday afternoon joyrides on nice days or modest cross-country trips. You can fly along with the canopy open, your elbow out in the breeze, and pass the folks in their two-place Pipers and Aeroncas. Those cost more and have the engine cylinders dragging along in the breeze.

MODEL HISTORY

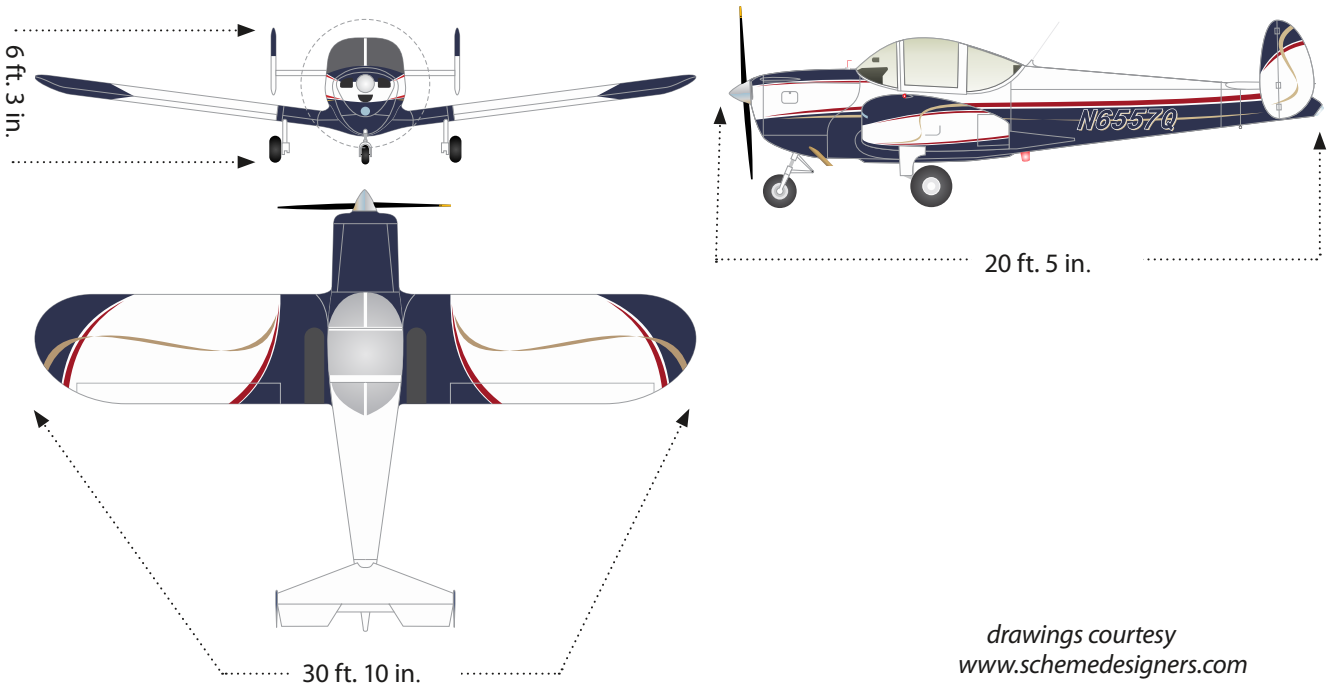
First of all, is it Aircoupe or Ercoupe or Cadet? It depends on who you talk to and really the year of manufacture. The airplane has a long, complex history with on-again, off-again production dating back prior to World War II and then the brief, but intense, postwar boom.

The first model appeared in 1939, and was manufactured by the Engineering Research Corp. (ERCO), which was the source of the "ER" in Ercoupe. It was designed by Fred Weick, very much an aeronautical genius, who went on to design the first truly crashworthy ag-plane, which became the Piper Pawnee, and to collaborate on the design of the Piper Cherokee line. As a National Advisory Committee for Aeronautics (predecessor of NASA) engineer, Weick had designed the Weick W-1 in response to a call for an airplane that could not be stalled.

Back then, the W-1's design was a very big deal because stalls were even worse killers than they are today. They weren't well understood, and the small engines available for GA meant shaky performance and a rela-

That's Tom Murrell flying his polished 1946 Ercoupe 415-D in the lead photo.

ERCOUPE/AIRCOUPE/CADET

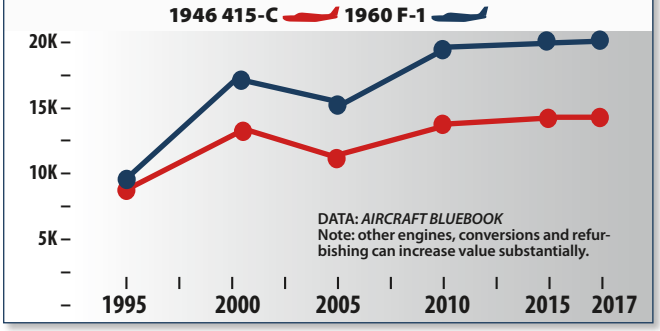


drawings courtesy
www.schemedesigners.com

ERCOUPE/AIRCOUPE/CADET SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1946 415-C	75-HP CONTINENTAL C-75-12	1800	$20,000	24 GAL	440 LBS	90 KTS	±$14,000
1949 415-G	85-HP CONTINENTAL C-85-12	1800	$20,000	24 GAL	480 LBS	100 KTS	±$17,000
1960 F-1	90-HP CONTINENTAL C-90-12F	1800	$20,000	24 GAL	480 LBS	100 KTS	±$20,000
1969 M 10	90-HP CONTINENTAL C-90-16F	1800	$20,000	24 GAL	460 LBS	100 KTS	±$15,750

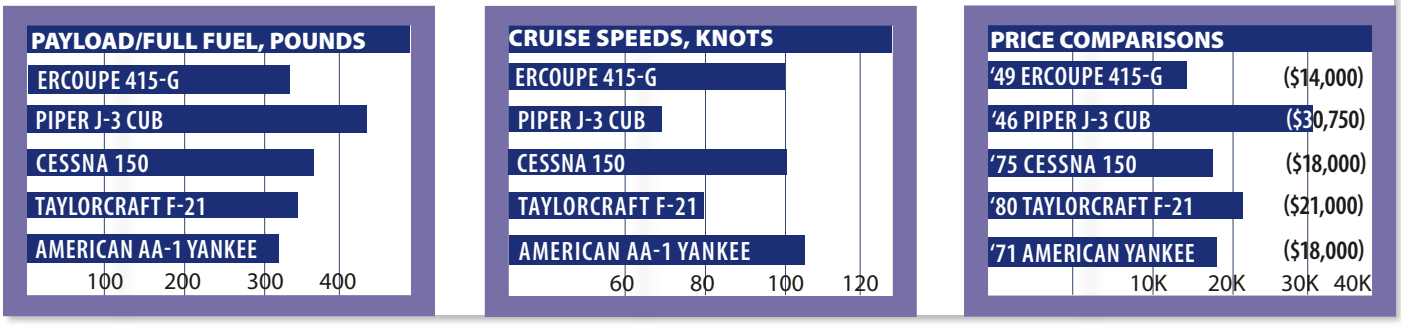
RESALE VALUES



SELECT RECENT ADs

AD 2012-08-06	INSPECT AILERON AND AILERON BALANCE ASSEMBLY FOR CRACKS
AD 2003-21-01	INSPECT WING OUTER PANEL FOR CORROSION
AD 2002-26-02	INSPECT WING CENTER SECTION FOR CORROSION
AD 2002-16-04	INSPECT/REPLACE FUEL LINE NIPPLE FITTING
AD 59-05-04	REAR SPAR INSPECTION/ REINFORCEMENT

SELECT MODEL COMPARISONS



It's rare to find an Ercoupe sporting an original instrument panel, top, but they're out there. The one at the bottom has been modded. Notice anything missing? Few have rudder pedals.

tively small envelope between cruise and stall speeds.

Weick went to work for ERCO and used many of the techniques he'd developed with the high-wing W-1, including limiting up-elevator travel for stall resistance, for the low-wing Ercoupe.

Production continued on the original Ercoupe through 1941, when the attack on Pearl Harbor brought all U.S. civil aircraft manufacturing to a standstill. Some 112 were built before the war.

Postwar, ERCO got in high gear and pumped out more than 4000 75-HP 'coupes in 1946, an impressive volume second only to Mr. Piper's Cub. These models are known as the 415-C and they have a four-cylinder Continental C-75-12. (Many have been converted to C-85-12 engines.)

The Model C and CD, with a 1260-pound gross weight, are the only Ercoupes that qualify for Light Sport.

Production of the 415-C, D, E and G models continued until 1950. Model changes in the C and D were minimal, but the D model got a weight increase to 1400 pounds by further limiting up-elevator travel. The C and D had 75-HP engines while the E and G had 85-HP powerplants. The E and G models also had split elevators.

The postwar boom evaporated by 1947, hitting the two-place market hard. ERCO soldiered on until 1950, eventually building about 5000 airplanes. It then sold the Ercoupe type certificates to Univair. Univair didn't build any complete airplanes, but did support the line with new parts.

In 1958, a company called Forney took over production rights and introduced a spruced-up model called the Fornair F-1 Aircoupe. The F-1 'coupe had a 90-HP Continental C-90-12F, but otherwise retained most of the design features that ERCO had developed. Forney built a couple hundred airframes before retiring production.

Rights to the airplane were eventually purchased by Alon Inc., which built 245 airplanes between 1962 and 1967. Alons have a bubble canopy rather than the sliding windows found in the earlier models.

Surprisingly, the line was then sold to Mooney—yes, Mooney—which made major modifications to the airframe, including a single tail in place of the original's Lockheed-like twin-fin design, and retained the rudder pedals, which Alon had added when it took over the design. (You can add pedals to any Ercoupe via a kit sold through Univair—www.univair.com—for about $1400.)

Mooney had in mind a basic trainer and called the revised model the Cadet. But it wasn't much of a seller. Only 118 airplanes were made between 1967 and 1970.

By 1973, rights were sold back to Univair, the same company that had bought the design from ERCO. As before—and still—Univair supported the airplane with new parts production. All told, nearly 5800 'coupes were built, with the last one coming out of the Mooney plant in 1970. For all practical purposes, however, the majority of Ercoupes were built between 1945 and 1952.

NOTABLE DESIGN

At a time when most civil aircraft were covered in fabric stretched over welded tubular frames, the 'coupe was an all-metal, riveted design but with fabric-covered wings on early models, later changed to all metal.

The Ercoupe had a pair of vertical fins on a single tail boom, a design that had become popular with Lockheed and Beech twins in the 1930s. And although the Ercoupe had rudders, it had no rudder pedals. The cockpit floor has but one pedal, for the brakes, helping with legroom for tall pilots. The twin tails put the rudders outside the twisting propwash, designing out some, but not all, of

the left-turning tendency in a climb. The airplane still needs right wheel during a climb.

Weick set out to confront two safety issues of the day: stall/spins and groundloops. That meant the Ercoupe was one of the first civil aircraft to take advantage of what was being learned about the stability of a nosewheel versus a tailwheel for control on takeoff and landing. It took the rest of the industry another decade to adopt this visionary idea.

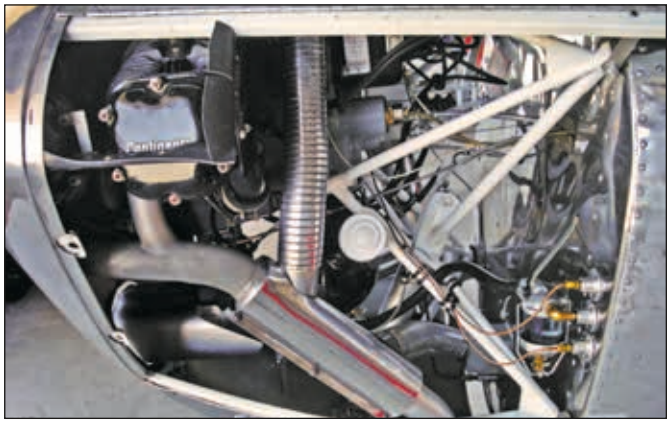
Further, the Ercoupe had a collar on the control column that limited elevator up travel—if you can't reach the critical angle of attack, you can't stall the airplane. And if you can't cross control—remember, no rudder pedals—you can't spin it, either. The airplane has rudder control, but it is automatically coordinated with the ailerons through a mechanical linkage (only the rudder on the inside of a turn deflects).

The no-stall, no-spin philosophy drove the design entirely. The restricted elevator travel required a nearly constant CG so the Ercoupe had side-by-side seating. The lack of rudder controls presented a theoretical problem on crosswind landings, so Weick's solution was a rugged trailing-beam gear design that allowed the airplane to be plunked down in crosswinds, without the usual side-slip correction.

Owners say the gear is more than beefy enough to stand the load of landing in a crab, and control authority is sufficient to keep the airplane tracking correctly once it's on the pavement. You can do a bad landing in an Ercoupe, but it takes effort to damage the gear.

It's not, as some think, a castering crosswind gear as in some versions of the Cessna 190/195. After a crabbed touchdown, the airplane immediately turns to point in the direction it is traveling, so you feel the sideload on touchdown. You then steer the airplane with the control wheel during rollout, turning slightly away from the wind to counteract the tendency of the airplane to weathervane.

Rudder purists sneered, but the Ercoupe was successfully tested in crosswinds up to 40 MPH—far beyond the capability of almost any aircraft, then or now. True, it took nerve to drive the thing on in a stiff crosswind, but the gear proved up to the task. With the landing gear properly adjusted and the top of the tails 75 inches above the ground, the wing sits at a zero-degree angle of attack when the airplane is on the ground. This allows landings to be performed at speeds up to an incredible 110 MPH, although owners we spoke with were not willing to try such a speed.



One of the joys of flying an Ercoupe is sliding the canopy back, top photo by B. Easly. Full-opening cowling halves make access to the little four-cylinder Continental easy, bottom.

When Boeing came along with its Dash 80, the 707/717/KC-135 prototype, it used the lowly Ercoupe to train pilots to land the new airplane. Because of its low-slung engine pods, the new jetliner couldn't be slipped to a landing. Pilots had to learn to land it in a crab and ride out the rudder-induced correction.

And, in fact, the initial design was good enough not to require much meaningful fiddling. Rudder pedals were made available as an option in 1949, mostly as a psychological crutch to entice pilots who thought a "real" airplane had to have pedals.

In most Ercoupe models, fuel capacity is 24 gallons, in two 9-nine-gallon wing tanks and a 6-gallon header tank between the panel and the engine. An engine-driven pump sends fuel from the wing tanks to the header tank, from where it gravity feeds to the carburetor.

There is a float with a wire sticking out of the header tank. Once it starts down, either because all of the fuel in the wing tanks is depleted or the engine-driven fuel pump has failed, you have about an hour before it gets quiet up front. As with some Cessnas, there's no fuel tank selection, just a simple on/off switch located on the cockpit sidewall.

From a crashworthiness standpoint, the fuel system design is grim. The wing fuel tanks are in front of the spar, unprotected on impact. The header tank, as with too many of the Ercoupe's contemporaries, is between the occupants and the engine.

ERCOUPE ERRORS: MAINTENANCE

The Ercoupe series of airplanes evolved from a design competition to create the safest possible airplane—one that was incapable of stalling—and that was as easy to fly as possible. It met those design criteria. When elevator travel is properly adjusted and the airplane is within CG limits, it cannot be stalled, and the two-control version is extraordinarily easy to fly (and, in our opinion, a lot of fun).

There is no free lunch in aviation. While an Ercoupe cannot be stalled, it can establish a heroic rate of sink when the yoke is full aft (generating about 60 MPH). That means a risk of hard landings or hitting obstructions short of the runway. The two-control arrangement means that when climbing at a speed below 75 MPH, the degree of aileron deflection to overcome P-factor generates so much drag that the rate of climb may simply disappear—creating an increased risk of hitting obstructions on takeoff for pilots who are casual about speed control.

Finally, we've informally observed over the years that airplanes that are easy to fly or designed to be "safe" have a certain attraction for pilots who will let their skill level diminish to the point that they rely on the design of the airplane to protect them from themselves—not necessarily a wise idea.

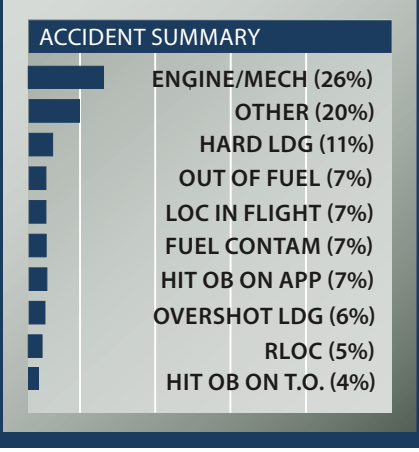
Our review of the 100 most recent Ercoupe accidents confirmed our concerns regarding the trade-off for safety versus controllability although, surprisingly, there were seven loss of control (LOC) inflight events, only one of which appeared to be a stall. The remaining six involved very high sink rates, in some cases shortly after takeoff. Even though there were seven accidents involving hitting obstructions on landing and 11 hard landings, there were only a total of 29 landing-related accidents, a number that we considerer better than average. There were only five runway loss of control (RLOC) events—an usually low number. Flown on speed, an Ercoupe is amazingly easy to land and take off, even in strong crosswinds.

A major concern was an apparent willingness of Ercoupe owners to forgo or skimp on maintenance. Twenty-six accidents were due to engine maintenance issues, several involving the failure of parts that were still on the engine 50 years after the airplane rolled out of the factory. It may be a safe airplane, but stuff does wear out. On top of that, there were seven fuel contamination accidents—in all cases the contamination included foreign material such as rust in addition to water.

The fuel system requires attention because fuel valves have to be on and a fuel pump working to transfer fuel from the wing tanks to the fuselage header tank. Once the cork float fuel gauge starts going down on the header tank you're either out of fuel in the wing tanks or the fuel isn't transferring. Six pilots didn't figure that out and things got quiet while there was fuel in the wing tanks.

Two pilots decided to do aerobatics in their Ercoupes and pulled them apart inflight. Seven pilots hit obstructions after takeoff, one after an intersection takeoff—an Ercoupe is not a short-field machine.

A father and son with zero flight experience were given permission by the owner—hey, it's easy to fly—to fly his Ercoupe. They got 250 feet up before losing control and diving into the ground.



The airplane developed somewhat of a "not a real" image for its lack of rudder pedals. The 'coupe was too easy to fly, suggesting that anyone who would own one didn't have the right stuff at a time when the phrase hadn't even been coined yet. This is an absurd state of affairs, of course, and one that seems to dog every radical safety idea, from seat belts up to and including ballistic parachutes.

After a series of minor engineering changes, the Forney airplanes got all-metal wings. To this day, there are debates as to whether this was an improvement. Alon added a sliding canopy, replacing the earlier slide-up/down windows.

Reverting to high-testosterone thinking, Mooney, calling it the M-10 Cadet, revamped the Ercoupe's image by installing a single tail—complete with the trademark "backward" vertical leading edge and angled trailing edge. The Cadet also had standard rudder pedals, with enough elevator authority to actually stall briskly and even stall strips, so the airplane would stall like a "real airplane."

PERFORMANCE

With its twin tails and somewhat sleek design, the Ercoupe looks fast to some eyes, and it does OK. Despite having a fat, low-aspect ratio wing that's excellent for slow speed and stall characteristics but middling for climb and cruise, a 90-HP Ercoupe will run with a Cessna 150 or Luscombe.

A 75-HP 'coupe will struggle climbing above 4000 feet on a warm day with two people aboard; solo, it's not bad. One owner said his 85-HP model with a climb prop "loves the ground." He noted that if you put two people and some baggage aboard, you know you're really carrying a major load. "They claim 500 FPM for the first five minutes, but mine never does that well."

An Ercoupe is not a short-field machine—it also uses much more runway departing than it does landing. The twin tail design did not eliminate all left-turning tendency—P-factor is still there—so allowing the speed to get much below 75 MPH in a climb means there will be so much drag from aileron and rudder deflection that the climb rate can be frighteningly low when trying to clear an obstacle.

Like other airplanes of the day, such as the J-3 Cub and Champion,

While the Ercoupe's all-aluminum structure might hold up well in a crash, consider the placement of the fuel tanks: forward of the spar and unprotected in a frontal impact.

the Ercoupe is not an all-purpose machine, performance wise. The 75-HP models will be zippy enough for solo flying but if you want to do much two-person flying, try to find a 90-HP Alon model or, at the least, an 85-HP version with a climb prop.

Then again, among the postwar designs, Ercoupes hold their own, and then some. Plan on around 100 MPH in 75- and 85-HP models and perhaps 110 MPH in the 90-HP models.

By comparison, you'd be lucky to see 80 MPH in an early Cub, and even late-model Cessna 150s struggle to make 110 MPH.

A 'coupe really will handle strong crosswinds. Owners reported landing in direct crosswinds of more than 30 MPH. Folks at the Ercoupe Owners Club confirmed the ability of the airplanes to land in very strong crosswinds, but noted that one place where Ercoupe pilots do get into trouble is attempting to take off in very strong crosswinds.

FLYING QUALITIES

So what's it like to fly an airplane with no rudder pedals, a canopy/windows you can open in flight and systems straight out of the 1940s? Different, to say the least. Then again, that's what attracts owners to the Ercoupe in the first place.

It's never going to be accused of being your average spam can. Generally, the 'coupe is a good flyer with appealing handling characteristics. It has full-span ailerons—no flaps—so roll response is far snappier than other airplanes of the same era. Properly rigged, it will not stall—the up-elevator restriction means the airplane has a "minimum speed" in 1 G flight. It won't go any slower—power off, it simply descends under full control.

The downside is that the sink rate can become eye-watering. Our accident survey found several 'coupe accidents on landing were due to the pilot failing to arrest a high sink rate after getting slow. This was consistent with comments to us that besides trying to take off in a stiff crosswind, the second area where Ercoupe pilots get into trouble is with allowing a high sink rate to develop.

Also, in a steep turn, you may reach full aft wheel and full power but be unable to maintain altitude—potentially developing a stunning rate of descent. The only way to stop the sink is to roll out of the turn. It may be necessary to fly level to accelerate to a speed at which the airplane will begin to climb.

The rapid rate of descent allows for precise and impressive short-field landings but if you're not careful, the same trait can and will put you in the weeds short of the approach end of the runway.

Once a 'coupe has been slowed to its minimum speed on final, it will not flare without adding a lot of power because the yoke is already

David Abrams' 1946 Ercoupe is parked next to the 1947 Chrysler that was used in the opening scene of "Driving Miss Daisy," top. That's Chuck Rosenfeld and Maynard Smith departing AirVenture in formation, middle. The Mooney M-10 Cadet in the bottom photo (recognize the tail?) was the final iteration of the Ercoupe series.

fully aft. In reality, an Ercoupe is quite easy to land. The trailing beam gear is forgiving, usually soaking up the too-high arrival rate of a ham-fisted pilot. In a bouncy crosswind, just crab the airplane into the wind and touch down as you would with no crosswind.

The airplane will reliably right itself on the runway and the rest is easy, although you do have to steer away from the crosswind—counterintuitive for aileron positioning for pilots who fly three-control airplanes.

Luddites who insist on having rudder pedals can find a model so equipped, but one owner of a pedal-equipped Ercoupe says he crabs it onto the runway anyway.

Another owner who contacted us thinks the rudder pedal mod is actually dangerous because it's not connected to the nosewheel and may confuse pilots about ground handling. On the ground, you drive the Ercoupe like a car, steering with the control yoke, not the pedals.

MAINTENANCE, PARTS

A top concern for anyone buying a nearly 70-year-old airplane is parts availability. Fortunately, any model that was built in the thousands—as the Ercoupe was—is usually still around in sufficient quantity to represent a profitable market for parts makers. For Ercoupe owners, the best source of parts continues to be Univair (www.univair.com), which holds the type certificate for the airplane and makes most structural parts.

Another company, Skyport Services (www.ercoupeparts.com), specializes in Ercoupe parts, STCs and accessories and is a cornucopia of 'coupe-iana, including an STC for gross weight increase.

Owners highly recommended the Ercoupe Owners Club (www.ercoupe.org), said it is passionate about the care and feeding of the marque and has a good website and newsletter for all thing 'coupe.

As with any older aircraft, the largest area of concern with an Ercoupe is corrosion. There have been two ADs calling for inspection for corrosion in the wings, AD 2002-26-02 and AD 2003-21-01. Buy the wrong airframe and you could face potentially uneconomic repair costs. Since many Ercoupes have and continue to live outdoors, water incursion is a worry.

Water tends to leak into the fuselage and corrode the belly skins. The tail cone and wing spar lower caps are also corrosion-prone areas. Mice can also be destructive.

It should go without saying that on a prebuy, the inspecting mechanic should check the airplane carefully for corrosion. The Ercoupe Owners Club website has a good pre-purchase examination checklist.

Another common problem in the Ercoupe is the nosewheel, especially the single-fork models on the earlier airplanes. Decades of landings and abuse and side loading due to crabbed landings in crosswinds will take a toll. Shimmy can be a problem due to loose or worn nosewheel linkages.

Look for the double-fork nosewheel and check the linkage. Some Ercoupes have been converted from the single fork design. If that hasn't been done, it may be worth considering, although some owners say the single fork is fine.

Main gear struts can also be a problem, again due to years of pounding. The shock struts can seize up if they're too low on fluid, and

landing forces are transmitted directly to the wing spar center section. Check it for damage and look for a reinforcement gusset that has been retrofitted to many airplanes.

Check for unrepaired damage. One accident was triggered by wingtip damage that had simply been Bondoed over. As older airplanes go, the Ercoupe isn't overburdened with a huge number of ADs but one to check for is AD 59-05-04, which calls for beefing up the rear spar where the outer wing panel attaches. Noncompliance with this AD can be a killer.

There are a number of mods for the series; the 100-HP Continental O-200 engine upgrade is popular.

REALISTIC EXPECTATIONS

Owners tell us the Ercoupe is what it is: a fun, easy-to-fly airplane with few bad habits that's a good choice for a starter airplane.

On the other hand, a prospective buyer shouldn't go into the deal looking for a steal.

Of all the Ercoupe models to choose from, we think the later Alon and Forney models may be the better values, even if they cost a little more.

The early airplanes had fabric wings—a plus for inspections—but the later models with metal wings have been equipped with inspection panels, so hidden corrosion is less of a worry. It can be found, if you look.

Last, don't expect too much of an Ercoupe. If you have places to be and things to do and serious cross-country is on your list of desires, the Ercoupe is not a good choice. But it's an eminently affordable and maintainable weekend fun flyer with a certain 1940s classic panache.

OWNER COMMENTS

I have owned three 415-C Ercoupes. They have been efficient, docile and quite low-cost to fly and maintain. The parts availability is outstanding for a classic.

Due to a maintenance error, I was forced to make a deadstick landing in badlands after the prop came off in cruise flight. The all-aluminum structure was exceptionally energy-absorbing, and although the aircraft was destroyed, I walked away without injury.

Chuck Rosenfeld, Region 3 Director
Ercoupe Owners Club

That's Patrick Oltmanns' 1959 Forney F-1 Aircoupe in the photo above.

I have flown and greatly enjoyed my 1959 Forney F-1 Aircoupe over the last three years. Flying open cockpit as a couple is a new flying experience for us and we have been amazed by the attention the aircraft gets everywhere we go. It has been more than once that we have been greeted at fly-ins with a tongue-in-cheek remark, "Have you ordered your rudder pedals yet?" and I usually respond: "No, those are for beginners!" It just never gets old.

Our favorite destination is the annual Triple-Tree fly-in and as it turns out the Aircoupe makes for a better camping plane than expected. The baggage compartment is sufficient for lightweight camping gear for two and a martini shaker for our favorite after-flight drink. Hence the name "Martini Girl."

Patrick Oltmanns
Charlotte, North Carolina

My Ercoupe interest began with a 1943 *Popular Mechanics* article. Eventually, one came up for sale at my local field—I sold my share in a Cherokee and became an Ercoupe owner. I don't understand how some people can sneer at 'coupes because they are, to me, really flying. The Cherokee was somehow all closed in and insulated, like an old station wagon. Much of the year I fly the Ercoupe with the top down; it's wonderful.

Even repowered with a C-85 (which is an improvement over the C-75), it burns below 4 GPH a lot of the time. As for speed, it will exceed 114 MPH. Plus, people like to come up and talk about the airplane.

It's an honest and straightforward airplane to fly—a reasonable crosswind is no problem at all. It is a trifle chilly in January. I have no plans to "move up"—I'm there.

Parts and repair? Skyport has good, helpful people. Best may be the Ercoupe Owners Club. It has online offerings about what to look for and questions to ask. When learning the ins and outs of my airplane, online conversations eased the way and brought me into the community.

Fred Weick's work of all those years ago certainly bore some wonderful fruit. For me, the Ercoupe is the most fun flying I've had.

Steve McNew
via email

Once the pilot understands the peculiarities of the plane, about the only thing he or she can't do in it are slip and spin. I've landed my Ercoupe in a 28-knot direct crosswind with no problem. At a fly-in, I watched four Ercoupes and a Grumman Tiger land in a gusty crosswind—only the Tiger had to go around.

Obviously, both takeoffs and landings in a crosswind are handled differently from a three-control airplane. Also, on the ground, the wing has no angle of attack and will not fly at any speed until the nose is raised. This allows the airplane to gain flying speed with the nosewheel safely on the ground. Then the airplane can be popped into the air and a turn made into the wind to set up

The Aviation Consumer

Continental

(continued from page 11)

Presumably, v2 of electronic ignition could be smaller, lighter and simpler. Cheaper? Not too likely.

Continental also plans to complete cert work on its CD300 six-cylinder diesel, yet another attempt to get a high-output Jet-A piston engine into the OEM mix. Continental's last effort at this remains mired.

Recall that it bought technology rights to SMA's four-cylinder SR305 engine in 2013 and soon rechristened it the CD200. Four years later, it still has no certified engine. Just as an illustration of how engine development timelines get telescoped, SMA brought the engine out in 1998. Nearly 20 years later, it has a certified engine, but no market presence worth considering. In 2012, Cessna said it would offer the engine in the 182, but four years later, the project remains undone, with an indeterminate time schedule. Continental doesn't seem to be having much better luck; the SMA-based CD200 is still not certified.

The six-cylinder CD300 is undergoing cert work at the company's St. Egidien, Germany, diesel manufacturing center. It's always been assumed that a high-horsepower diesel would break the market open because it would be suitable for Cirrus-type aircraft. Continental is betting on that and it's no coincidence, perhaps, that the engine is also being tested in an SR22.

Although Lycoming and Continental have competed directly only in the sense that they've vied for OEM business, Continental's acquisition of the Titan product line from ECI may change that. The Titan line includes a significant catalog of PMA parts, but also the Titan Lycoming-style engine that's finding some sales success in the light sport and experimental market.

Ross says Continental would like to certify this engine, opening up both OEM and conversion potential that could generate more sales. Furthermore, if Continental's new manufacturing is as flexible as the company hopes, it could expand the PMA parts business considerably.

While this would increase competition, it also has a downside, which we heard about from engine shops. When Continental rejiggered its distribution through Aviall, shops complained about marginally higher prices. Ross said these weren't instigated by Continental, but by Aviall. But shops still have to pay the higher prices, making them less competitive against factory overhauls and remans.

Also, if Continental grabs increasing share via overhauls, its parts manufacturing gives it strong competitive leverage, further stressing field shops struggling to compete. The fewer that survive, the fewer the choices for customers. As overall market activity declines, there's likely to be more pressure on price escalation, not less.

Lycoming may also feel the heat, both in competition on parts and through certified engines similar to what they sell. The Titan line gives Continental much stronger presence in the four-cylinder segment, something it has always lacked.

Despite the potential for an unhealthy competitive environment in the long term, no one can reasonably expect Continental not to invest to gain both share and competitive advantage. Buyers may eventually lose something on price competition, but gain on new product choices, customer service and flexibility.

FEEDBACK WANTED

DIAMOND DA40

For an upcoming issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Diamond DA40. We want to know what it's like to own these aircraft, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs **(full-size, high-resolution please)** you'd like to share to the email below. We welcome information on mods, operating expenses or any other comments. Send correspondence by June 1, 2017, to:

Aviation Consumer
Email at:
ConsumerEditor@hotmail.com

ERCOUPE

(continued from page 31)

the appropriate crab for climbout.

Crosswind landings are made crabbed; the trailing link gear will swing the nose forward as soon as the main gear are on the ground.

There are a number of mods for the Ercoupe; four that come to mind are: enlarged baggage compartment, alternator conversion, master relay at the battery (providing more safety for the electrical system) and Cleveland wheels and brakes.

Larry Snyder
via email