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The Aviation Consumer

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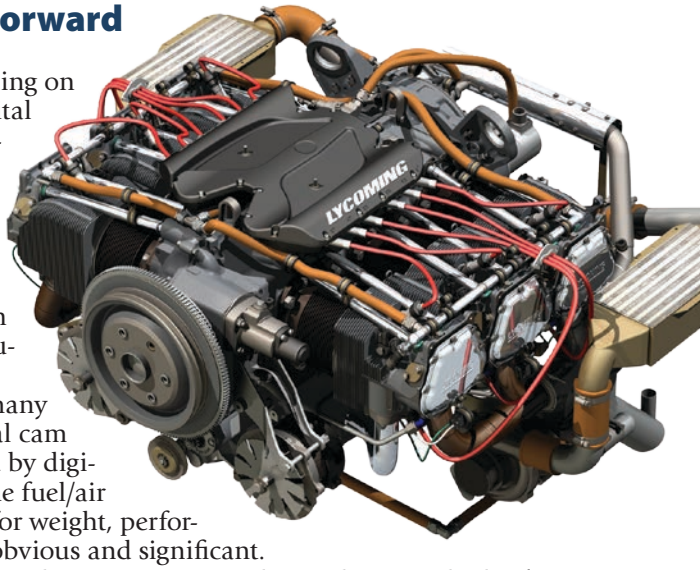
Lycoming's Step Forward



I've been doing some reading on the rapid evolution of digital and electric drive technology in the automotive segment and was not too surprised to learn that the typical car's build budget now allows more for integrated circuits than it does for steel. This evolution is accelerating to the point that it may not be many years before the traditional cam and valve train is replaced by digital actuators to manage the fuel/air charge. The implications for weight, performance and economy are obvious and significant.

Just as obvious is how much aviation engines lag in this regard. They're not just incrementally behind, but generationally behind. The reasons for this are several fold. I don't think legal liability or lack of imagination are the big drivers; the market is simply small and insular and won't support the investment required to push such projects through certification.

Against this backdrop comes Lycoming's new IE2 project which can best be thought of as an incremental advance, not a great leap forward. In that sense, it's appropriate to what buyers might reasonably be expected to want and pay for. Based on a detailed review of the project I did with engineers at Lycoming for a report that begins on page 5 of this issue, the design and execution of this system looks promising. Just as important, Lycoming isn't overpromising it as a fix-all for producing high horsepower on low-octane fuel. What a refreshingly different kind of honesty that is.

So what's it good for then? Good question. Lycoming sees the market interest mainly in ease of use and workload reduction for the pilot, plus an incremental improvement in operating economy. It also has protective algorithms against overtemping and overboosting. It's a single-lever system with full authority control of boost and prop RPM, with automotive-style sequential common rail fuel injection and direct-fire coils for ignition, with variable timing. In principle, it's not much different than TCM's long-established PowerLink, although the execution looks to be several beats more sophisticated by dint of technology that's nearly a decade advanced from Continental's pioneering FADEC.

I don't know if this will be enough to kick up sales for the IE2. My gut feel is that it will be a factor, but the larger one is timing. Avionics advances have so far outstripped engine electronics that even buyers are sensing a vast mismatch. A dumb magneto can't tell your EFIS much about engine health, but a sophisticated FADEC with its finger on temperatures, mass airflow, ignition and fueling certainly can. Think of the EFIS/FADEC interface as a really smart check engine light. Even so, the informational interface is just an incremental improvement over the most sophisticated engine monitors already available, but it's an improvement nonetheless.

So at this point, it looks to me like Lycoming's incremental approach has it about right. My prediction is that it will find some market traction in just the same way—incrementally. I'll be surprised if the IE2 engine isn't an option on at least two established OEM aircraft within two years. If it is, others will follow. I'd be willing to put $10 on that bet. —*Paul Bertorelli*

iJoy, iGrief...I Am

I enjoyed your article on the iPad. I had been planning to write to tell you how good it is for an approach plate solution. If you buy the SkyCharts Pro app for $20 per year, you can wirelessly download all the enroute, sectional, terminal area charts and approach plates, along with STARs, SIDs and AFD.


COCKPIT ACCESSORIES

Aviation Apps for iPad: A Cut Above Phones

Were not wetting our pants with excitement, but the iPad definitely has EFB aspirations, with dozens of useful apps. But GPS navigation isn't one of them.

by Paul Bertorelli

Just fpr fun, I'm writing this articel on the virtual keyboard of Apple's vauned iPad and, as you can see, it,s not going that we;. Switching back to a real keyboard, I can now explain that despite the hype, the iPad for general use and for aviation use will do a lot of things adequately, but only a handful of things well. Composing text isn't one of them.

By early June 2010, there were more than 300 aviation apps for the iPad, but the number is technically less because some of those are iPhone apps that will run on the larger device and some are just variations on the same program, such as multiple checklists or POHs.

The iPad may be many things to many people, but there are several things it is not: a moving map, a good navigator or a datalink weather display. I doubt if Garmin will even feel a minor nick in sales from iPad competition. The iPad is, however,

iPad in actual size. Clip here and tape to panel. (If you can find room.)

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Current charts seamlessly delivered for $20 per year and you get an iPad for free, if you figure the cost of the Jepp or NOS subscription that you save will pay for it. Do your flight planning on DUATs or some other Website.

Couple this with a Garmin aera 560 with XM WX weather and you are done. Put up with the cables in the cockpit and you have an extremely versatile, easy-to-use solution which is inexpensive, has the reliability of satellite data inflight and which can be updated in three years when the next new thing comes out, unlike a panel mount.

If you want to have a backup for the paperless approach plates, which my FSDO told me they want, then simply put another version of SkyCharts on your Touch or iPhone and you have two complete copies of all the maps and charts at flight time. It's a small screen, but it would work in an emergency.

Robert Grace
Via e-mail

I think you understated how bad the iPad's GPS receiver is. I tried using it with SkyCharts Pro and it had no clue where I was unless I was on the ground. This was on a round-trip flight ABQ-CNM-ABQ at altitudes of up to 12,500 MSL. Speaking of SkyCharts Pro, I did not see it mentioned in your review of apps. I really like the ability to pan and zoom the charts. It was even usable in turbulence, which surprised me. I was disappointed that they claim it cannot legally replace paper charts—this was one of the primary reasons I bought an iPad. I am tired of spending hundreds of dollars on paper every year. Are there any iPad apps that can legally replace paper?

Kenneth Ingham
Albuquerque, New Mexico

Glider IFR

Read the article on the Diamond HK36 with interest. I'm an SEL private pilot who recently got a glider rating with self-launch endorsement. I also have an instrument airplane rating.

I noted that you indicated that the HK36 can be equipped with a GNS430. My questions are: Can the HK36 be IFR certified? Are you aware of any currently available motor gliders in which a properly rated pilot can fly up through a solid overcast, for example?

It seems that at least some gliders are IFR certified, since there are special instrument currency maintenance rules for gliders.

Allen Inks
Via e-mail

No, the HK36 cannot be instrument certified. Its limitations call for day or night VFR, if you've got the necessary lights. Recall that for lack of required lightning protection, Diamond's DA20 is also not certifiable for IFR.

You Tell 'Em

Excellent thoughts in the Tyranny of One More Thing in the June 2010 First Word column. I'm struck by the growing risk adversity that seems rampant in our country.

Burt Rutan talks about it in terms of NASA's approach to experimentation. How are we to achieve anything in space without trying a lot of approaches? No one wants astronauts to fail or worse, to die, but how else is there experimentation? (That's me, paraphrasing, not Burt specifically.)

Congressmen (eager for their moment in the limelight) effectively talk to it in critiquing BP. How are we to get at oil reserves if we don't have someone willing to take the risk to drill at 5000 feet of depth? S$#^ happens! Doesn't mean that BP couldn't have done a better job or there weren't mistakes made, but how do we find out what works if we don't try?

Compare all this to the golden age of aviation—1903 to 1943 to cite some dates. From 0 to P-51s (or thereabouts) in that time. From 0 to over 500 MPH in that time. Did we

continued on page 32

CORRECTION

In our May 2010 report on the Cessna 310, we somehow managed to report that Larry A. Ball was deceased. He is, in fact, alive and well and we are the ones who are mortified at our error. Our apologies.

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Lycoming IE2: Incremental Technology

It's as close to a clean-sheet engine as you're likely to see in the current market. But what it really does is adapt mainstream auto technology to airplane engines.

by Paul Bertorelli

The modern car engine—even a cheap one—is such a marvel that you can turn the key without thinking about its once-in-a-million failure-rate ECU, its direct-fire coils and fuel injectors that can paint the Mona Lisa in 93-octane pulses. Oh, and if you can't get 93 octane, no worries, the ECU will adjust the timing to burn 91.

Were it so simple with aircraft engines. And not that Lycoming and Continental haven't tried to make it that simple and they are still trying. Lycoming's latest and most sophisticated attempt is the new IE2 for integrated electronic engine. Integrated means electronically customized for the airframe and dancing cheek to cheek with the airplane's EFIS and it also means full-bore electronic control of nearly everything. Lycoming has been at this awhile, some three years, but the project only recently came out of the ground in Lancair's new flagship Evolution, a behemoth of a pressurized 230-knot kit airplane. The IE2 will be the Evo's centerpiece and Lycoming plans to move smartly forward with certification for other aircraft requiring high-horsepower engines. It's not impossible to imagine this engine in certified form in a year to 18 months and we wouldn't be surprised to see Piper offer it on the Mirage or some other manufacturer to offer an airframe molded around the IE2. The timing on that just feels right.

The IE2 will be the Evo's centerpiece and Lycoming plans to move smartly forward with certification for other aircraft requiring high-horsepower engines.

It's not that the IE2 is such a spectacular leap forward in aircraft propulsion. It isn't. What it is is a thorough application of automotive-type technology to yield an evolutionary improvement in the pilot's ease of use and measurable improvements in performance and economy. Lycoming is not rewriting the laws of physics here, but simply bringing aircraft internal combustion into the 21st century. Lycoming is betting that the market timing is right, what with the high-octane fuel worry overhanging the sales like the grim reaper's scythe and with more owners plainly saying that they want engines that are easier to operate and more economical. (Then again, they've always said that.)

Maintenance reliability plays into the marketing attraction, too. Theoretically, with the engine's built-in protective algorithms against overtemping and overrevving, the engine won't be subjected to abuse by a ham-fisted pilot. Further, the ECUs are sucking up and storing a lot of data, transmitting some directly to the cockpit for the pilot's real-time analysis and storing a lot more for use by techs to diagnose maintenance issues, using a code-type system similar to modern cars.

NO MAGIC BULLET

While the IE2 promises to be several things, it is not a panacea for the lack of 100-octane fuel. As we reported in the July issue of

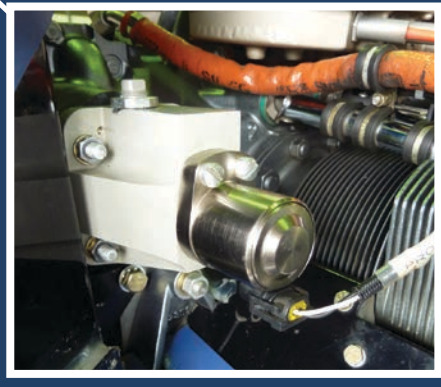
Lancair's high-flying, pressurized Evolution kit aircraft is the launch customer for the IE2. Testing is proceeding full bore. Photo by Richard VanderMeulen, courtesy KITPLANES.

E2 single wastegate is fully electronically controlled. It can be configured with dual wastegates.

Each cylinder has a pair of plugs fired by individual direct-fire coils housed atop the engine. (Note: this isn't production hardware.)

A first for mainstream aircraft engines, the IE2 has acoustic knock sensing on each cylinder.

Sequential pulsed fuel injectiion fed by a common rail is routine in cars.



Prop governor uses a small electric stepping motor to control oil pressure to set prop pitch.

Aviation Consumer, Lycoming general manager Michael Kraft is clear about one thing: No matter how clever or how effective, electronic controls won't address the loss of six to nine octane points. As far as octane management, FADEC-type controls are adequate around the margins, but in Lycoming's view, they won't allow a 350-HP engine to run on 94-octane unleaded fuel.

While this idea was a prime mover for Teledyne Continental's work on its own FADEC, the PowerLink system, Lycoming says it has a different agenda for the IE2. Specifically, it sees the octane issue as part of the picture, but the IE2 is intended to be core technology to make Lycoming's entire line of engines easier for pilots to fly, more economical to operate while taking weight and cost out of the airframe.

We get the weight part, but does Lycoming really think electronic controls will be less expensive than iron magnetos? It does. Recurrent maintenance on magnetos and traditional fuel systems—mostly the mags—piles up the bucks on the way to TBO. The electronics, although more expensive to install, are expected to lower to-TBO mainteance costs, plus provide some fuel economy. Lycoming views the IE2 not as a bolt-on FADEC, but a leap beyond first-gen piston electronics. True clean-sheet engines don't come often from either Lycoming or Continental, but the IE2 may very well be a practical example of just that.

NO SURPRISES

When we pored over the IE2 at Lycoming's test hangar in Williamsport recently, we saw more or less exactly what we expected to see: an iteration of state-of-the-art automotive electronic technology adapted to a 350-HP TIO-540 to morph into the TEO-540. But it's not an off-the-shelf 540. The crankcase and cylinders are purpose-made for the electronic controls and the accessory case and gearing would be unrecognizable to a mechanic who's wrenched a 540.

By automotive standards, the IE2 is about on par sensor wise. But it doesn't need the oxygen sensor circuit nor the transmission conrols found on modern cars to improve fuel economy. The basic inputs are venturi pressure and temperature for mass airflow calculation, MAP, induction temperature, CHT, TIT and RPM. For crankshaft and top dead center reference, the IE2 has two magnetic position sensors, one on the crank and one on the cam. They sense crank position by magnetically detecting a missing tooth in the gear train, but unlike Hall-effect sensors, they aren't powered, thus eliminating at least one failure point.

Speaking of power, it's delivered to the engine via a dedicated dual-channel power box that can run the engine either from the aircraft bus or from the default position—a dedicated permanent magnet alternator installed on the accessory case. The engine is designed to run independently of aircraft electrics, although it doesn't have to. It has provisions for an additional alternators on the accessory case or via front-belt drive.

Starting with the air, gone is the traditional Bendix RSA throttle body

The IE2 is all about the evolving megatrend in transportation electrification. Primary power comes from a robust permanent magnet alternator, top, and the engine can deliver prodigious aircraft power via additional alternators on the accessory case or via belt drive forward. Power is managed by a dual channel power box and the engine is controlled by a dual-channel ECU, center photo.

and injector system. In its place is a throttle body that still has hard linkage to the power lever, but one that's equipped to measure mass airflow and temperature, with redundant temperature sensing capability, since air density and flow is such an important player in power setting. The engine control unit is housed in a single box the size of a thick netbook and is dual channel—either channel can run the engine. The ECUs use sensed throttle position as a target reference for the pilot's power command, then the mass airflow data is used to fuel the engine accordingly by referring to a customizable look-up table and fine tuning that according to a feedback loop with programmed limits and protections.

The IE2 uses electronic pulse injectors whose reliability in automobile use has been raised to nearly failure-proof levels. These run from a common rail at a pressure of 3 bars or about 43 PSI.

This fueling option adds a measure of reliability because the engine is set up to run each cylinder as an individual power unit—if one fails, either due to fuel or ignition, the other five will continue running as smoothly as the software can make them. The system is configured with return lines which circulate fuel as a hedge against vapor lock.

Ignition still terminates in two plugs per cylinder, but rather than mags or remote spark generation, each plug has its own direct-fire coil similar to the high-reliability type found on modern motorcycles. In automotive and motorcycle apps, direct-fire coils usually attach to the plug, but on the IE2, there's no room for that. All of the coils—12 total—live in an array mounted on top of the engine where the fuel injection spider would otherwise be found. As you'd expect, the ECU channels cross control, so if one fails, the other can still fire at least one plug in each cylinder.

MECHANICALLY DIFFERENT

Although the engine's overall dimensions and its bore and stroke and combustion chambers haven't changed, the IE2 gets its own purpose-manufactured cylinders, crankcase and accessory case design. The cylinders have been modified to accept both the pulse injectors and acoustic knock sensors, so these represent new production parts. Further, the crank and cam are fitted with magnetic position sensors and the accessory case has completely revised gearing, eliminating the mag drives entirely and providing space for the PMA and the fuel pump for the injector system.

When Continental pioneered its FADEC 15 years ago, it took baby steps—leaving prop governing and wastegate controls for future iterations. It used largish, remote ignition modules installed behind the engine. But Lycoming isn't doing any of this, since its goal is simple, single-lever operation for the pilot right out of the box. The prop control is on the front of the engine and is an electro-hydraulic design controlled entirely by the ECUs. So is the wastegate, a single unit in the IE2 version we looked at. The engine has dual turbochargers.

OPERATION

When we probed about the IE2 operating strategy, we learned that Lycoming wants to change the conversation about lean-of-peak versus rich-of-peak operation, preferring instead to say that the IE2 runs at the best efficiency for whatever power level the pilot has commanded. In a nutshell, that means it fuels

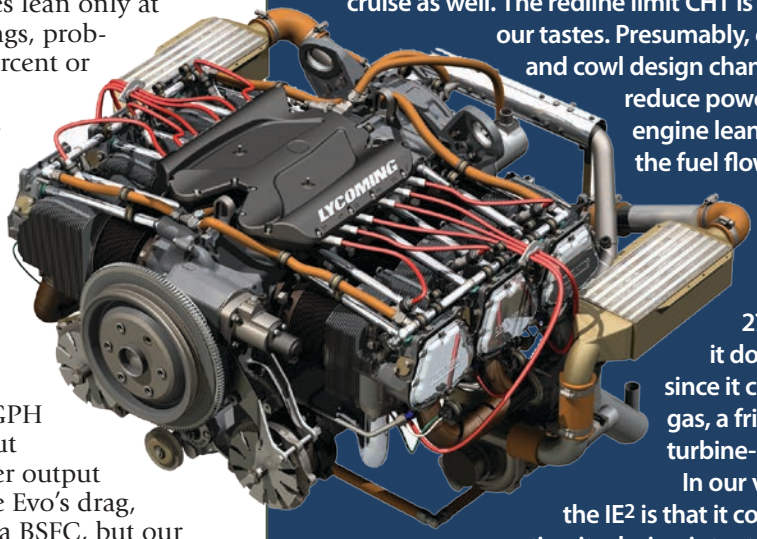
AC TV

For a video tour and interview with Lycoming's Jim Morris, log onto our sister publication, www.avweb.com, and click the video button in the upper right corner of the homepage. Scroll down to Lycoming IE2 video.

heavily for takeoff and climb, backs that off in high-power cruise and runs lean of peak when it senses the pilot has pulled the throttle back to improve economy.

We didn't get a detailed look at the fueling map, but engineer Jim Morris explained that the fueling schedule—as least the version developed thus far—is designed to compromise between the best efficiency and acceptable temperatures. At high-power cruise, it appears to be running rich of peak, based on the fuel flows we were quoted. But when the pilot pulls the throttle back, the ECU smoothly adjusts RPM and fuel accordingly until, at some point, it fuels around the peak CHT spike just rich of peak and transitions to lean of peak operation. The prop RPM change is a smooth enough ramp not to be noticed by the pilot, although the fueling happens almost instantaneously. But unlike the Cirrus approach of running Continental engines lean of peak at high power, the IE2 goes lean only at lower power settings, probably around 65 percent or lower.

Morris declined to say what brake specific fuel consumption Lycoming is expecting with the IE2, but he noted that initial data shows that the Evolution can run at nearly 200 knots on 12 GPH at altitude. Without knowing the power output or much about the Evo's drag, we can't calculate a BSFC, but our bluesky guess is around .4 to .41, which is an efficiency improvement over the typical 540-series engine.



FLIGHT TRIAL: SIMPLE, FAST, SMOOTH

Lycoming's stated goals for the IE2 engine are chiefly simplified operation, less workload for the pilot and better fuel efficiency. Add on to that improved reliability thanks to the electronics and you round out the package.

Does it deliver? It's too soon to judge it but Doug Rozendaal flew the Lancair Evolution for our sister publication, *KITPLANES*, and here are some of his impressions. First, startup: "The checklist is basically this. Boost pump: Auto. Ignition switch: On. Starter switch: Push. No priming, no mixture lever and no concern about hot starts—the TEO-540 starts like a car." We'll call that a definite improvement over the usual Chinese fire drill of mixture-lean-throttle-full-boost-reverse-it-and-try-to-catch it on the fifth blade.

For runup, there's something called a PFA button for pre-flight actions. Push this and the system does the full preflight routine, including cycling the prop, checking the mags—ooops, no mags—fault checking the ECUs. If it finds a serious fault, it will illuminate a no-takeoff lamp. Other less serious faults are warned and/or store for download and analysis.

Rozendaal reports that the single-lever works as advertised. "No need to worry about mixture and the engine protects the turbo from shock cooling by leaning aggressively when it senses rapid power reductions…this protects the engine and turbocharger from major and rapid temperature changes."

With 350 HP in a light airframe, the Evo climbs well—1050 FPM at 140 knots on 34.5 GPH. CHTs tended toward the warm side—413 to 446 degrees—something we think will need attention as this engine goes forward into certified airplanes. These high temperatures were seen in high-power cruise as well. The redline limit CHT is 450 degrees F, which is too warm for our tastes. Presumably, cooling can be improved with inlet and cowl design changes. One option, of course, is to reduce power and allow the software to run the engine leaner. The tradeoff is a speed hit, but the fuel flow drops back into the teens.

Speaking of speed, Rozendaal's report revealed that the Evo has plenty of that. At 21,000 feet, the Evo zips along at 235 knots true on 27.2 GPH. If the fuel flow seems high, it doesn't stunt the airplane's range, since it can carry a whopping 146 gallons of gas, a fringe benefit of having begun life as a turbine-powered aircraft.

In our view, what's most appealing about the IE2 is that it comes out of the gate more or less meeting its design intent and that it can be significantly customizable for whatever airframe it happens to be in. The industry has been talking about this for awhile. It looks like it's starting to deliver.

LIMITS AND PROTECTIONS

Following the automotive paradigm, the IE2 has various limits and protections built into it. Obviously, traditional aircraft engines limit revs through the prop governor, albeit somewhat crudely. The IE2 has a hard electronic rev limiter, just like a car does. This value can presumably be set by the engine installer or OEM for different engine setup, but if the engine gets outside the governor's range, it backs off the fuel first, then interrupts the ignition. The pilot would notice this a brief burble, if it were noticed at all.

CHT is also an automatic operational limitation. The upper end limit is 450 degrees F, but normal operation is allowed up to 420 degrees F. When the limit is reached, the ECU adjusts first with fueling—richer or leaner, presumably based on throttle position—followed by slightly retarded timing. For starting, by the way, the IE2 retards to 5 degrees BTDC from its base advance of 23 degrees BTDC. This results in reliable, car-like starting whether the engine is hot or cold. It also figures out starting fueling based on engine temperature.

In our view, the most intriguing aspect of the IE2 is its individual acoustic knock sensors. These are obviously a play toward allowing lower octane or, as Lycoming says,

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Standalone Intercoms: PS Engineering Rocks

Integrated audio panels still rule, but there's a place for the stand alone intercom. PS Engineering excels in quality and high-noise applications.

by Larry Anglisano

Modern aircraft audio systems are self-contained control boxes and can handle nearly every aspect of cockpit and cabin communications. They command the radios in the avionics stack, provide seat-to-seat intercom function and even offer high-fidelity music and telephone capability. But for basic aircraft, like the many LSAs and older tailwheel tandems on the ramps, a basic standalone intercom might get the job done for a lower cost while still providing high-quality audio and a decent level of functionality. These systems don't control the radios, so if you have a couple of coms and navs in the stack, you'll need an audio switching panel.

Here's a review of available intercoms and as you'll see, not all units and installations are created equal.

GET SOUND WIRING

Installation costs should be pretty close among all the systems, except that a pre-fabricated wiring harness could save a few hundred dollars. Still, invoices that top two grand aren't uncommon for two-seat jobs. Four-seaters cost more due to removing interior to route new wiring.

Using old and existing non-shielded wiring is a sure way to induce unwanted noise into the audio so every new intercom installation should include new wiring. It's just too critical an area to skimp on.

Electrical noise can be tough to avoid and it isn't always the fault of the installer. Weak charging systems, alternator whine, faulty strobe light power supplies and even a single bad cell in the aircraft battery can induce noise. Entertainment input circuits are also common noise culprits. The older Garmin GPS396 XM Radio interface is known to require a ground loop isolator.

A few other key points: Put the microphone and headphone jacks in sidewalls, not the floor where dirt and debris can fall in, and passengers can step on the plugs. Place those jacks so the headphone plugs are recessed into the housing rather than sticking out at a 90-degree

INTERCOM MODEL	SEATS	MUSIC INPUT	PRICE	COMMENTS
PS ENGINEERING				
PM501	4	SINGLE	$299	ENTRY-LEVEL INTERCOM WITH NO FRILLS
PM1000II	4	DUAL	$367	PROVEN UNIT WITH INDEPENDENT VOLUME AND SQUELCH
PM3000A	4 OR 6	DUAL	$493/629	TWO AUX INPUTS FOR ON-BOARD WARNING SYSTEMS, STEREO
PM1200	2	SINGLE	$499	EXCELLENT IN HIGH NOISE APPS. HAS BASIC AUDIO SWITCHING
SIGTRONICS				
SPA400/400N	4	WITH RMS UNIT	$216/237	N MODEL FOR HIGH-NOISE ENVIRONMENTS
SPA600/600N	6	WITH RMS UNIT	$252/288	MUSIC INPUT OR CREW MODE REQUIRES OPTIONAL HARDWARE
SAS440/640	4 OR 6	WITH RMS UNIT	$324/360	SMART AUTOSQUELCH FUNCTION
SPORT200/200S	2	SINGLE	$199/279	S VERSION IS STEREO
FLIGHTCOM				
MODEL 403	6	SINGLE	$269	SWITCHABLE TO MONO TO ACCOMMODATE MONO HEADPHONES
MODEL 403MC	4	SINGLE	$179	SMALLEST INTERCOM ON THE MARKET
MODEL 403LSA	2	SINGLE	$199	LOW COST STEREO FOCUSED TOWARD LSA MARKET
NORTHERN AIRBORNE TECHNOLOGIES (NAT)				
AA83	6	SINGLE	$ 931/995	STEREO UNIT WITH WIDE RANGE OF AUDIO ADJUSTMENTS
DAVID CLARK				
ISOCOM	6	NONE	$345	LACKS MUSIC INPUT, EASY MOUNT IN 2" CUTOUT
GULF COAST AVIONICS				
GCA-400A	4	SINGLE	$139	LOW COST, HORIZONTAL OR VERTICAL MOUNT

angle. We'd avoid drilling yokes that don't already have push-to-talk switches. Get a high-quality switch that straps on.

PS ENGINEERING

The hugely popular PM1000-series intercom put PS-Engineering on the map years ago and the TSO'd PM1000II four-place intercom remains in the lineup. This unit has nearly all of the smart yet basic functions one could want in a stand-alone intercom including pilot isolate mode, independent volume and squelch controls for pilot and copilot, entertainment input and optional crew isolation, which isolates the front seats from the rear passengers.

If you want stereo sound you'll need to step up to the PM3000 series, which is a six-seat model. It doesn't have the independent volume and squelch control that we like in the PM1000-series but it does have the same high-quality audio.

Spun off from the PM1000 is the PM1200 for high-noise cockpits. We've used the PM1200 in an open-cockpit warbird and find it to be a flawless performer. It can be wired for voice activation or push-to-talk.

FLIGHTCOM

Well known for their Denali line of ANR headsets, Flightcom also makes intercom systems. In fact, the company has roots in intercom design after the founder struggled to hear his flight instructor while taking lessons during the 1980s. His portable design won our Product of the Year back in 1986. The modern no-frills units are designed for utility on a budget, and have a generous two-year warranty.

The model 403 stereo intercom can be interfaced for six seats and has pilot isolation and entertainment input. One feature we like a lot is the mono/stereo selection switch at each intercom station. This means installers can use stereo jacks all around but users won't need to worry about plugging in a mono headset that doesn't have a mono/stereo switch. The systems sell for $269.

The Flightcom model 403LSA is a two-place stereo and voice-activated intercom based on the same platform as Flightcom's flagship model 403 but pitched at LSAs. It has auxiliary music input with auto-muting and, for tight panels, there's an optional faceplate for mounting in a 2.25-inch instrument hole. An optional 15-foot prewired harness simplifies the connection. The 403LSA was recently marked down to $199.

The model 403MC is marketed toward space-limited panels and own-

NOT MUCH TO SEE UP FRONT

The thing about intercoms is that most of the important stuff doesn't show on the outside. That said, PS Engineering's PM1000 II shows off several nice features, such as independent volume and squelch as well as an isolate mode. Going stereo with the PM3000 means sacrificing a few of these niceties—but not the great audio quality.

The Flightcom line comes with an alternate faceplate for easy mounting in an existing 2.25-inch instrument hole as well as the super-small 403mc unit for really tight panels.

If there's one reason we'd choose for upgrading a basic intercom, it would be for music input. XM Satellite Radio's iClassic Vinyl saved our sanity on a recent Northeast-Florida round trip.

Portable GPS systems can often drive XM Radio into an intercom system. Remote XM and SIRIUS systems from Avidyne and Garmin can be programmed in the cabin with a remote control. If a portable GPS is mounted in an Air Gizmo docking station mounted in the panel, the shop can wire the XM Radio output directly to the intercom—no patch cables. If you want to have the flexibility of using an external music device or the XM, the shop can install a music source select switch on the panel. Options are only limited by your imagination and, of course, your budget.

CONTACTS

David Clark Company 508-751-5800 www.davidclark.com	Northern Airborne Technology 888-763-2232 www.northernairborne.com
Flightcom Corporation 800-432-4342 www.flightcom.net	PS Engineering, Inc 800-427-2376 www.ps-engineering.com
Gulf Coast Avionics 800-474-9714 www.gca.aero	Sigtronics 909-305-9399 www.sigtronics.com

ers on a budget with its $179 price. It could be the smallest intercom on the market measuring 2.6 by 2.3 by 1 inch high with the ability to mount vertical or horizontal in the panel. There are no bells and whistles, but it has pilot isolation, auxiliary input and failsafe circuitry design.

SIGTRONICS

Sigtronics has achieved success with the four-place SPA-400 and six-place SPA-600 intercom systems that date back to the early 1970s. There are a ton of these basic units still in service and you can buy them new. The SPA-400N/600N models are designed for high-noise cockpits.

SPA owners complain that there's no entertainment input. But now they can add stereo capability (and crew isolation) to an existing SPA-400/600 intercom installation with the RES-401/601. The RES is an add-on system that won't require a major rewire of the old intercom, accepts input from nearly any remote device (iPod, MP3, etc.) and provides muting when a com radio is transmitting or receiving, or when the ICS squelch is opened. There's also a karaoke mode for passengers.

The new two-place Sport 200 and Sport 200 S (stereo) intercoms are designed specifically for LSAs, ultralight and helicopters. Aimed at high-noise environments, the company claims they're tested at ambient noise levels of up to 120 decibels. They can be used in either voice activation mode or push-to-talk intercom mode. These units are small, requiring 2.5-inches wide by one inch of vertical panel space.

The SAS-440 and six-seat SAS-640 are four- and six-place models that have a one-touch button to set the squelch threshold for a given environment, pilot isolation and multiple mounting schemes.

The SCI-series intercoms offer dual volume and squelch control and are a drop-in upgrade to an existing SPA400 or SPA600. The four-place SCI-4 and six-place SCI-6 offer dual volume and squelch control and three modes of operation: all, pilot isolate and crew isolate.

Sigtronics supports their claim that their units are RFI and EMI immune, even saying shielded wiring isn't needed. We're skeptics on that, but applaud the company for designing intercoms to battle the sources of audio noise. We also like their five-year warranty on parts and labor.

NAT, GCA AND DC

Northern Airborne Technologies (NAT) in Canada has perfected audio control for helicopter, special mission and airborne law enforcement applications. The AA-80 series intercom for general aviation applications is built to the same higher standard.

The unit comes with dual volume and squelch control plus entertainment input circuits The controls on NAT's general aviation products are as rugged as they are in NAT's higher-end products and are offered in various configurations and mounting schemes.

We've found NAT audio quality to be excellent and reliable with squelch circuits that open and close nearly perfectly. We haven't seen many NAT intercom failures, either.

Continued on page 32

INTEGRATED AUDIO PANELS FOR LSAS AND EXPS

A step above the standalone intercom is a lower-end audio panel with integral intercom. Some designs available for the regulation-light LSA market challenge a decision to go with a stark intercom.

Garmin's GMA240 is aimed at the LSA and experimental market and it extensively focuses on entertainment input. It doesn't have marker beacon input and some of the other radio source switching functions. But it does have dual stereo input, a front panel music volume control with music on/off button and dedicated controls for customizing music mute functions. If connecting a GPSMAP 396/496 or aera to the GMA 240, you can adjust the XM music volume directly from the GMA 240. It has a list price of $895.

PS Engineering recently introduced the PMA5000EX. It has an integral four-place stereo intercom, split mode for dual audio capability, pilot and crew isolation, multiple music inputs, dedicated music volume controls and an advanced Intellivox circuit for high-noise cockpits. PS Engineering strategically designed the PMA5000EX as a direct slide-in replacement for the Garmin GMA240. It's priced at $995.

While these panels are considerably more money than a standalone intercom, they push cockpit entertainment to a whole new level. Think of them as music controllers that also command radio and warning system functions.

Unleaded AvGas: What's This Gonna Cost?

With no lead, future avgas should be cheaper, right? Maybe yes, maybe no. Lead is less the cost driver than low volume and lack of competition.

by Paul Bertorelli

CHECKLIST

- The two 100-octane candidates easily meet detonation requirements.
- Both Swift's 100SF and GAMI's G100UL are producible from conventional petroleum sources.
- While 94UL is the most readily certifiable and producible, it's unlikely to be cheaper than 100LL and lacks detonation margin.

Not 10 seconds after Wilbur cracked up the Flyer that cold December morning at Kitty Hawk, Orville must have asked, "what's this gonna cost me?" And we've been asking ever since, never more so than now as the future of 100LL hangs in the uncertain balance between readily available and extinction.

As potential replacements loom hazily on the horizon—and frankly, there aren't many of them—it's fair to start asking what they might cost. Or to cynically turn the question on its head: Does anyone have the first clue?

NO ONE'S ASKING

At this stage, we're aware of no industry wide economic analysis of what we view as the top three contenders, 94UL, Swift's 100SF and GAMI's G100UL. One reason for this is that the find-a-new-fuel effort has been biased toward the regulation and approval process at the expense of probing the refinery economics. Second, the two 100-octane options are works in progress, so making cost estimates is a smell test at best. Third, predicting future fuel prices of any kind is a black art governed by market forces with potentially wild variables.

Nonetheless, we think it's worth asking so that owners can begin to form the kind of opinions that will eventually gel into genuine demand for one product or another. The overall outlook? At the moment, all three contenders seem within range of cost economics of current 100LL. But "in-range" is a slippery term.

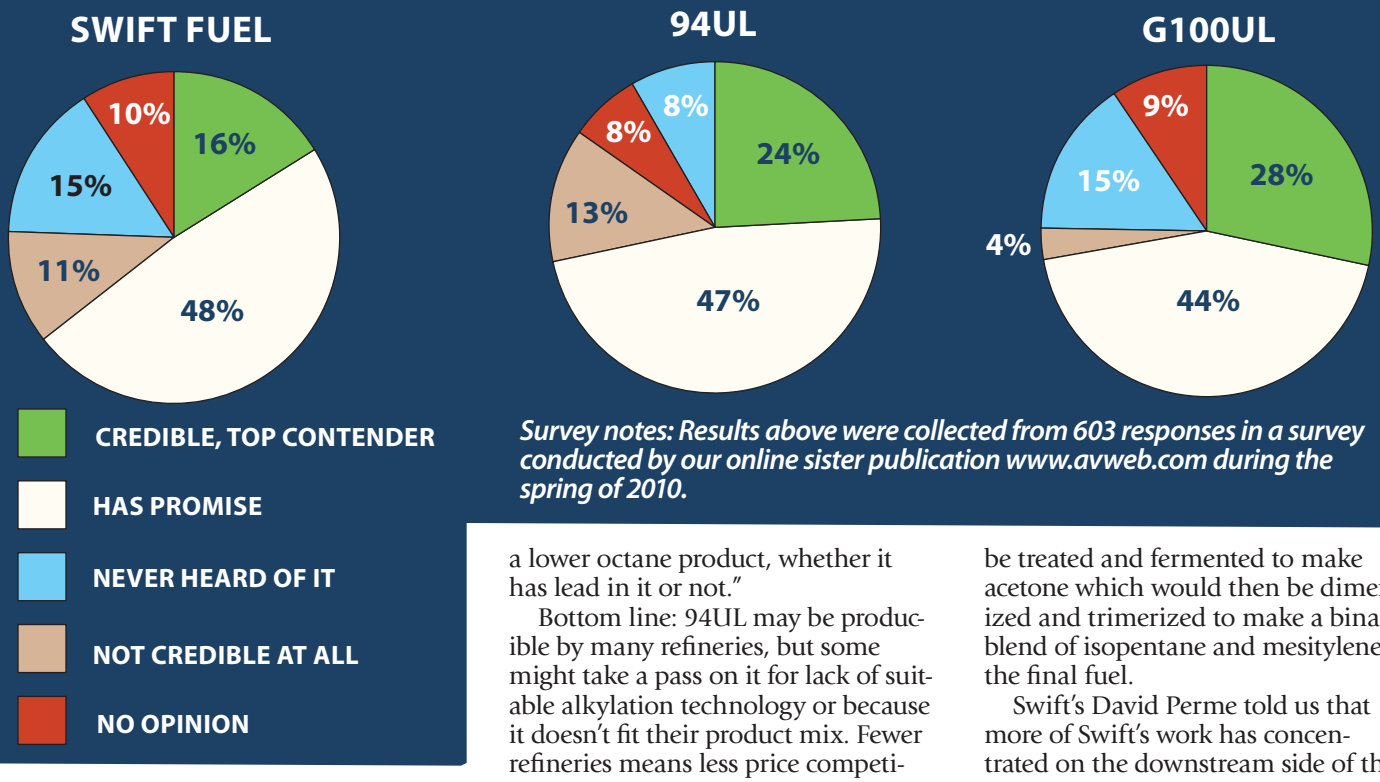
94UL

Ignoring the argument over required octane for a moment, 94UL would seem to be the simplest solution. It's just 100LL without the lead; basically juiced up mogas, right? Unfortunately, no. As with all fuels, refineries make their 100LL octane numbers in various ways, depending on how they're physically configured and what their economics are. Some refiners dose their avgas heavily with aromatic hydrocarbons—toluene, usually—while others use little or none. Lead concentrations vary, too. Typically, avgas blends are primarily made with alkylates—a branched hydrocarbon chain, isoparaffinic material, made by combining straight-chain light hydrocarbons with isobutane in the presence of liquid acidic catalysts. Alkylates are typically of high-octane and they represent the top-of-the-line components that refiners have available when making any kind of gasoline. But not all alkylation is created equal. Some refineries yield higher octane alkylates than others and/or what they produce is cheaper.

So knock the lead out of one avgas and you might be left with something close to 94UL, but take it out of another whose alkylation is of lower octane and you have something less. And therein lies the cost crunch.

WHAT READERS THINK

In your view, how credible is each of the following as an avgas replacement?



Survey notes: Results above were collected from 603 responses in a survey conducted by our online sister publication www.avweb.com during the spring of 2010.

A refiner with a lot of capacity for good quality alkylate might be able to blend avgas without the lead, adjust the aromatics and deliver a 94UL without sweating, while its competitor either won't be able to match it or will chose not to because the margin's not worth the effort.

If you're thinking just removing the lead alone will lower the price, you'd hardly notice. Tetraethyl lead isn't exactly gold; we're told that only about a nickel's worth—a couple of grams—goes into every gallon. Shell's Rob Midgley told us that from Shell's perspective and with current technology, a 94UL fuel would cost it a little more to produce than 100LL, because of additional processing for the base gasoline. For other refiners, it might cost the same or a little less.

What about transportation? We've been told avgas is expensive to transport and store because its lead content (and low volume) prevents it from moving by pipeline and it requires dedicated truck, rail and barge transport. Wouldn't eliminating the lead make things simpler? Maybe, but simpler is not always cheaper. "To tell you the truth," said one major avgas wholesaler we know, "we'll still use dedicated trucks because we don't want to risk contaminating avgas with a lower octane product, whether it has lead in it or not."

Bottom line: 94UL may be producible by many refineries, but some might take a pass on it for lack of suitable alkylation technology or because it doesn't fit their product mix. Fewer refineries means less price competition so the best guess is 94UL would cost about what 100LL does now, but could actually cost a little more. Transportation (and storage) doesn't appear to be a compelling factor.

SWIFT 100SF

Behind door two is Swift Enterprise's 100SF, which the company now says will meet a $5 to $6 per gallon retail price. That's between 30 cents and $1.30 higher than the current national average avgas price of about $4.70. That's up quite a bit from Swift's initial estimates of around $2 (refinery cost, we presume) when it was first announced in 2007, but down from the $10 we were given as the latest estimate at Sun 'n Fun 2010.

What changed? We haven't been able to pin down the details precisely, but we think Swift's initial numbers did not include all the capital recovery costs. The most highly visible change for Swift is that it now believes 100SF will be competitive if made from traditional hydrocarbon sources, namely the propylene that's a byproduct of refinery and chemical plant cracking processes, rather than from biomass. When Swift first appeared, it was described as being a renewable fuel made from cellulosic biomass such as switchgrass or sorghum. Those materials would be treated and fermented to make acetone which would then be dimerized and trimerized to make a binary blend of isopentane and mesitylene, the final fuel.

Swift's David Perme told us that more of Swift's work has concentrated on the downstream side of the acetone rather than the upstream, biomass side. Does this mean that Swift thinks it's more economical to make 100SF from industrially sourced acetone than from biomass? Perme stopped short of saying that, but insists that having both a petrochemical and biomass option for the acetone feedstock gives Swift flexibility.

The capital requirements for Swift may be lower if it buys acetone on the open market rather than funding the machinery to build it from biomass. Perme says Swift's research reveals that the acetone conversion process itself can be done by many conventional refineries without major capital or infrastructure investments.

If this is true, the key will be the cost of acetone, about three gallons of which will be required to make a single gallon of mesitylene. Avgas currently comes out of the refinery at about $2.25 to $2.50 a gallon, add another buck and change and you get the current typical wholesale price of about $3.50. We find bulk acetone prices in just that range—about $3.40 or so, variable with market demand. To meet its $5 to $6 target and allow for the retail markup, Swift's major challenge will be finding acetone cheap enough to meet a refinery-out price between $3 and $3.50.

Ramping up to capacity will also

be daunting for *any* of the new fuels. Depending on the source quoted, U.S. avgas demand is between 200 and 300 million gallons a year. Perme estimates it would take about a year to scale up to that volume, using primarily petroleum feedstock.

On the plus side, the FAA's initial testing of Swift Fuel reveals that it has excellent knock resistance characteristics and thus far, no component incompatibly issues have been discovered, despite its high aromatic content.

G100UL

The newest visible entrant in the fuels sweepstakes is G100UL, which emerged in a hurry late last year, the research product of General Aviation Modifications, Inc. in Ada, Oklahoma. The company hasn't revealed the G100UL formulation yet but says it's made of conventional alkylate basestock with additional components that include some aromatics. The FAA hasn't run detonation tests on G100UL in its Atlantic City tech center, but we've seen GAMI's own test runs which seem to confirm that it performs about equally to 100-plus octane leaded avgas.

As GAMI has pushed its research forward, it now says that there are various ways to make the fuel to a minimum spec and the blends are definitely variable in price. GAMI's George Braly told us that the fuel can be made in conventional refineries with "materials found inside the fence of any refinery." He notes that G100UL is a component blending approach, not an additive approach, meaning its performance lies in getting the component ratios exactly right. Unlike other fuels research, because it has a test cell, GAMI's work has been based on full-scale engine testing, not motor octane tests.

In an interview in July, Braly told us he currently estimates that G100UL could be produced by refineries at price within 50 cents, plus or minus, of current avgas prices, so we take that to be between $4 and $5. How confident are we of this price? Not very, because we can't yet run the blend components past independent sources. We expect to be able to do that before the end of the year.

As far as scaling up to make G100UL for refineries that have the basic alkylation capacity, Braly says the additional components could be shipped in from other sources and simply blended or refined on site by the refinery. Its production doesn't seem as complex as Swift's catalytically converted acetone. But yields for both processes are unknown.

Cessna CEO Jack Pelton visited GAMI's Ada test cell in July and after a demo said, "G100LL looks to be a fuel that can be refined and distributed within the existing infrastructure we have here in the states. I would guess it could be produced in many other international locations also."

CONCLUSION

At best, price estimates on the two 100-octane contenders are informed stabs in the dark. At this point, we don't see anything so wildly out of whack economically that would suggest they aren't worth pursuing further. It's simply too soon to put sharp price numbers on these products.

In a way, 94UL, once thought to be the easy go-to backup fuel, is the outlier. It would cost at least as much as 100LL and maybe a little more while delivering less octane. Although Continental favors this fuel, it concedes that adopting it will require engine modifications for some owners and/or operating restrictions. No one knows how the market will take to this.

Lycoming, on the other hand, believes the market won't support engine mods and will have little tolerance for performance restrictions and the recertifications these may require. Clarity awaits.

WHAT EVER HAPPENED TO MOGAS?

Ethanol more or less tanked it, that's what. But the larger economic driver may be that the price difference between mogas and avgas narrowed substantially by the mid-1990s and the hassle of hauling mogas yourself or putting a pump in at the airport lost its luster.

With 100LL on the ropes, could mogas make a comeback? Maybe, but it will be a struggle, says Todd Petersen, whose business, Petersen Aviation, pioneered the idea of mogas STCs during the 1980s. The original demand was sparked in part by cost, but also because 100LL caused lead fouling of spark plugs in some engines and owners simply wanted a way around it.

With price Deltas of more than $2 a gallon in some cases, owners found it worth it to haul their own gas to the airport, but as avgas and mogas prices converged, this became less attractive. Some airports installed mogas facilities and just over 100 still have these. But now, says Petersen, finding avgas not blended with ethanol—so called E0—is iffy and supplies of it can come and go.

Thanks to corn state politics, the ethanol lobby has held enough sway over Congress (and state and local governments) to keep strong ethanol mandates and incentives in place. Five years ago, the ethanol refinery boom reached a frenzy and now there's a billion-gallon idle capacity—a lot of ethanol looking for less gasoline because of slow economic activity.

But, says Petersen and Kent Misegades, who we spoke to about a couple of coalitions pushing for a mogas resurgence, there's hope. There's an emerging market for "recreational fuel" for boats, classic cars and other engines that perform poorly on E10. Although it's not available everywhere all the time, E0 can be found with a diligent search.

Three Web sites can help: www.flyunleaded.com, www.e0pc.com and www.pure-gas.org. Among the three, there's plenty of information to track down E0 and even suggestions on how to get pumps at the airport. Petersen's STCs are still active, too, at www.autofuelstcs.com.

photo courtesy U-fuel Inc.

Composite Versus Metal: No Relief in Cost to Own

If anything, long-term ownership costs for plastic aircraft are greater than traditional metal construction. Exact numbers depend as much on luck as design.

by Jeff Van West

Back when fiberglass airframes were first coming to the piston-single market, one of the sales brochure bullet points was that they would be cheaper to maintain: no corrosion, patching or fill for minor dings, simpler structures with less to inspect on the annual.

Unfortunately, that's not what we're seeing in the real world. It appears that composite designs, like the Cirrus or Diamond, have traded one set of airframe issues for another and the costs have come out a wash or in favor of metal—at least looking globally.

The caveat is important because we saw greater variability in ownership costs within a given design than between designs. The average cost of ownership for two similar-vintage Cirrus SR22s could vary more than comparing an SR22 and a Mooney Ovation of similar model years.

That said, some trends emerged and some not-so-obvious gotchas appeared as we looked at people's actual experiences owning glass airplanes.

> ***"I bought a new Cirrus so I wouldn't have to worry about ongoing maintenance issues. Boy, was I in for a shock and an expensive education."***

FIXING BROKEN GLASS

By far the most common gripe was the cost of repairing the composites themselves. Cost number one might be just finding someone to do the repair. Any A&P should be able to deal with a dented Piper wing. You may have to fly the plane some distance to find a competent soul to fix your Corvallis—or even to judge what needs to be repaired. Now total the complexity of the job, shop hours, curing time for the repair and travel back to get your airplane to you see how this adds up. If AOG time is an expense for you, you'd better add that in, too.

The complexity of composite repair shouldn't be underestimated. Not all dings are equal, and two small dents that look identical to you might be vastly different beneath the skin. Randy Lambeth, a Cirrus SR22 owner in Atlanta, told us of a dent from an item being dropped on the wing. He'd seen a similar dent on his previous Mooney M20J fixed for $150. The Cirrus fix was over $1000.

Big damage will always cost big money. Steve Blonstein is the chief pilot for the large West Valley Flying Club with three locations around San Francisco. He also leases back an SR22 to the club that happened to strike a goose with its left wing. The only visible damage was a significant crack on the leading edge. The actual repair required the replacement of four square feet of wing and cost $35,000. Even an entire replacement wing (used) for a Cessna 182 wouldn't cost that much.

An important detail here is that part of the repair cost was paying Cirrus Aircraft to design an approved repair. That's not uncommon with a major composites job. It does mean that Blonstein's repair should drop the cost for the next Cirrus owner who takes out a *Branta canadensis*.

That's not to say that all composite repairs are expensive. Blonstein pointed out that touch-ups to the Cirrus paint were easy and cheap. We

CHECKLIST

- Composite repairs are often far more expensive than equivalent metal work.
- Some design elements, such as lightning-protection mesh, can create new maintenance issues.
- Many early issues with composite designs and advanced avionics are now resolved.

also noted in our December 2009 report on painting composite aircraft that some designs had thick enough top coats at the factory (particularly Diamond aircraft) that dull paint could be polished back to a new-looking shine.

Full repaint jobs for composite aircraft use 10- to 25-percent more labor on prep due to the care and limitations of removing the old paint before painting, but the taping and painting itself can be simpler and cheaper, so our December 2009 report found the total job not that much more expensive that comparable metal jobs.

Since West Valley operates several Cirri in a busy rental environment, we asked Blonstein how the fiberglass airplanes fared overall compared to the metal aircraft on the flight line beside them. Exact comparisons were difficult because all West Valley aircraft are leasebacks and maintenance varies at the discretion of the owner, but he felt that overall, they were a wash. He did note that repairing cracked wheel pants and replacing the vinyl striping on the Cirrus is an above-average cost that crops up often. He added, however, that most maintenance differences have smoothed out in recent years as what were new systems have been revised and redesigned.

We heard this echoed by several Cirrus owners. Still, the average annuals reported by the Cirrus owners we talked to came in $2000-$3000 higher than like-vintage Cessna 182s. However, getting Cirrus-like performance in metal would require something like a Mooney, which has the added expense of maintaining the retractable gear.

NO CORROSION? NOT

One savings in composite aircraft should be that corrosion is a non-issue. That pays off in an absence of repairs to a corroded airframe, as well as skipping the $1000 or so every four years to reapply corrosion proofing if you live near the sea.

But it's not that simple. While the composite might not corrode, hinges, bell cranks and other hardware are still susceptible. Jeff Soules of U.S. Aviation picked up a Florida-based Diamond DA40 to bring back to his Texas flight school that operates several Diamonds. The detailed inspection turned up 51 squawks on this relatively new aircraft. Many were corrosion related, including corrosion inside the wing where screws carried moisture to the lightning-protection mesh and broke the required electrical continuity. Total cost for all the repairs: $29,000.

The wing corrosion was discovered because the DA40 had 1000 hours on it and was due for the mandatory 1000-hour structural inspection that involves removing the wings. Missed the memo on that inspection? It's less daunting than you might think, due to the design of the Diamond, but Soules estimates it costs $2500 for the labor alone. He's found this same mesh corrosion issue on other inspections that have doubled the cost of the job.

An analogous "surprise" cost for some Cirrus owners is the parachute repack that must be done every 10 years. For older Cirrus aircraft built without an access panel for the parachute, this maintenance could cost over $9000. We also found in our research that leaking rear windows seems to be a common issue cropping up now in the Cirrus fleet.

This goose collision was gory on the outside and on the inside. The final repair required replacing four square feet of wing and rang up at $35,000. But, on the plus side, the limited damage to the airfoil meant the plane returned and landed without any control problems.

As much as we like to think of composite aircraft as corrosion proof, that's just not true. Hinges, bell cranks and even lightning protection mesh can corrode if the design provides a path for moisture. Fewer inspection panels can make these issues harder to find and repair.

Soules says the annuals on his Diamonds (DA20s, DA40s and DA42s) are cheaper than comparable Cessna 152s, Cessna 172s and Piper Senecas in his fleet, but that the minor savings is lost to the wing inspections, and that overall maintenance costs for at least the piston singles are close to equal. We find his an interesting perspective because he's operating seven Diamonds, 23 Cessnas and six Pipers logging a combined 3000 to 4000 hours a month in the same training environment and using the same maintenance program.

Soules believes that a private owner of a composite aircraft would actually fare better because some of the expensive repairs are a direct result of the rigors of a training environment.

CAN'T GET AT THE PARTS

Checking with shops, we found that avionics and interior work can be an issue with some of the fiberglass designs. They usually have fewer inspection panels and interiors are often built with more single-piece assemblies, such as a one-piece headliner. One shop told us that getting to a remote system such as a bad flux gate (digital compass) or pulling the interior to add a new antenna (say, for a WAAS upgrade) can take twice the labor of a comparable metal aircraft. But that varies widely with what needs to be accessed in what airframe.

Adding antennas to any fiberglass aircraft can be tricky, but manufacturers and shops seem to have built the skill that this is less of an issue than it used to be. On the plus side, the fiberglass aircraft often ship from the factory with most every gadget you could want. It will be interesting to see if ADS-B upgrades are generally more expensive for fiberglass designs than for metal ones.

Upgrades sometimes introduce unexpected consequences. Perhaps the most notable one was the electric de-ice STC for Columbias that turned out to be a fire hazard, but only after several owners paid to have them installed.

An issue that seems to be getting better with time is parts availability. Mechanics used to being able to get any part, any time for a Cessna had been frustrated with how long it could take to get a part from some of the newer companies. We see the same thing happening now with new LSA companies and think it's endemic of young companies rather than the newer aircraft designs.

STILL WORTH IT?

Jeff Harris told us, "I owned a 1978 182 for almost three years and sold it to buy a new Cirrus back in November of 2002 so I wouldn't have to worry about ongoing maintenance issues. Boy, was I in for a shock and an expensive education." The next four years of bills and maintenance frustrations almost led him to selling the airplane. Why didn't he sell it?

"I love my Cirrus when it works," he told us. "For the last couple of years it has been a champ. All I want is a dependable aircraft that I can maintain and does what it's supposed to do. After four years of squawks it seems to be doing that."

It's hard to find the combination of performance, interior space and sophisticated systems you get in a Cirrus or a Corvallis in anything built using aluminum. Owners wanting that triumvirate are willing to put up with some level of additional maintenance load to get it.

How much of an additional load it is, we don't have enough data to say. Collecting a big enough sample of aircraft operated and maintained to the same standards is tough. And there are no 10,000-hour composite airframes to tell us what the super-long-term viability is going to be. We also recognize that our results may be skewed by the early learning curve the industry has weathered in creating both the composite designs and the expensive systems inside them.

We wouldn't shy away from any of the composite aircraft strictly because of a potential for higher maintenance costs. What is clear, however, is that anyone expecting some relief from the maintenance burden by buying a fiberglass design—or, perhaps, even just a new airplane—is in for a harsh disappointment.

iFly 700: A Big, Yet Basic, GPS for a Great Price

The iFly 700 makes basic viewing of sectionals, en route charts or approach plates a snap. It falls short on advanced features and ease of update.

by Jeff Van West

CHECKLIST

- Reasonable price for hardware and data subscription.
- Software is simple but this makes some navigation cumbersome.
- No internal battery for backup.

There is no perfect cockpit GPS. Some folks want a big screen; others need portability. Some want all the frills and some just need the essentials.

The iFly 700 by Adventure Pilot is targeted at the big-screen and essentials crowd. The unit boasts a seven-inch screen in a package that's only 7 1/4 x 4 1/2 x 3/4 inches and a diminutive 0.8 pounds. But that's partly because it has no internal battery. More on that in a minute.

A SOLID CHART VIEWER

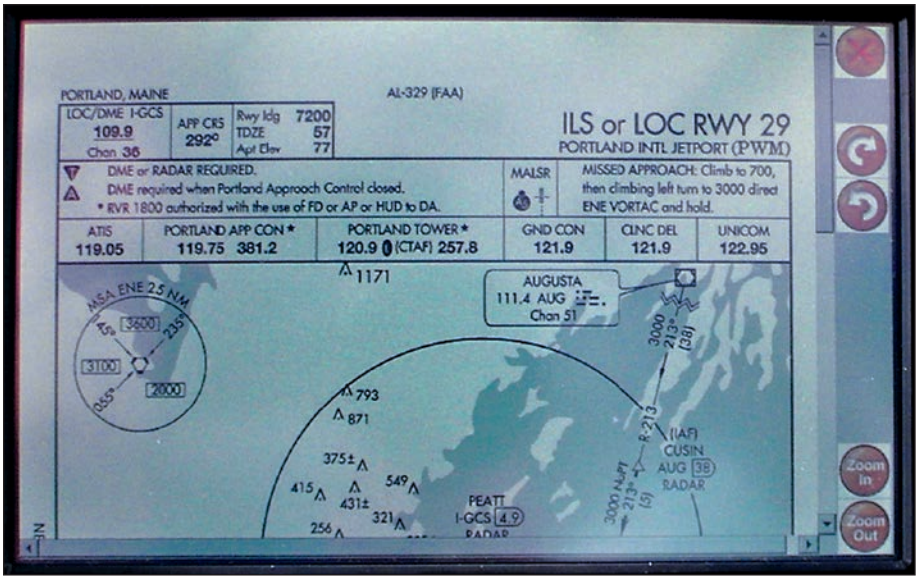
What the iFly does best is what it does right after startup: display scanned charts. The screen is crisp and readable and the charts can be zoomed in and out by on-screen buttons. It renders charts quickly enough to avoid annoyance. The aircraft position is superimposed, as well as any flight plan. As these are scanned charts, they are only presented north-up. Panning the charts is a matter of sliding your finger on the touchscreen in style of an iPhone/iPad. The hardware has a good feel under the fingers and we rarely saw a screen touch misunderstood by the system.

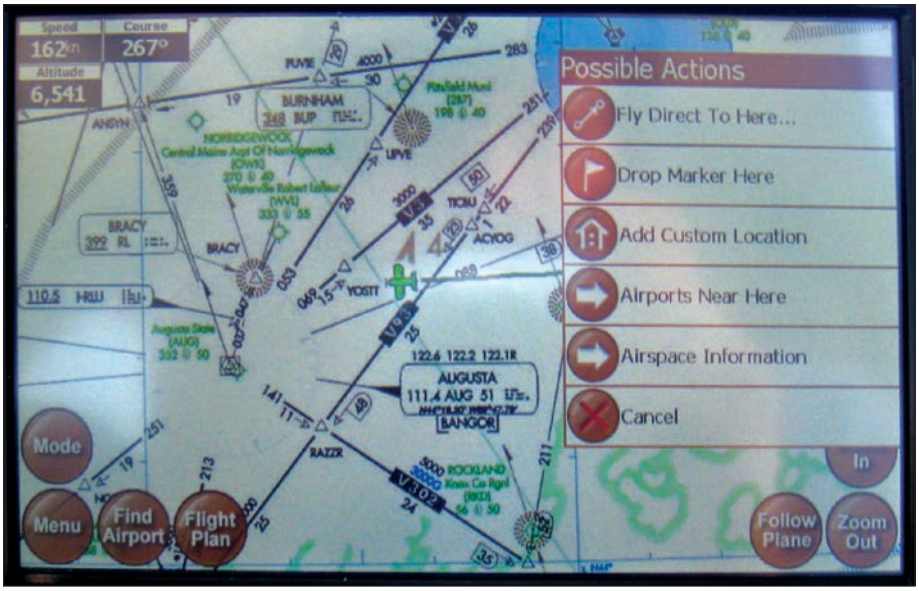
Changing charts is equally simple. Tap the Mode on-screen button and choose from sectional or low en route charts, as well as three versions of a vector (computer-generated) maps. We found these vector maps of almost no utility as they display less data than the scanned sectionals without taking advantage of the display options of vector charts, like track-up viewing or the options to customize how data is layered.

On-screen buttons tastefully dim when not in use. There are also user-configurable data blocks for things like altitude and groundspeed, as well as a nice heading tape at the top of the screen. The iFly has descent flight plan management with an on-screen keyboard for easy waypoint entry. You can't enter Victor airways, however.

Getting to detailed data is both a strong and a weak point of the iFly. It's strong in that it's simple. To get details about an airport, hold down your finger generally near the airport on the chart and choose "Airports Near Here" from the pop-up menu. Then select the airport you want. To add a waypoint to your flight plan, hold down your finger where the fix is, select "Add Waypoint Here," and select fix or lat-long from the next menu. (Flight plans can also be edited by dragging your courseline on the screen.) To get details on air-

The iFly screen is big, sunlight-readable and touch sensitive. It has no internal batteries, so it must plug in to ship's power or the included battery pack (above).





space, hold down your finger … you get the idea.

While easy, this menu-driven system is tiresome after a while. Nowhere did we find this more frustrating than when loading instrument approach plates. The iFly offers NACO approach charts and airport diagrams, which are viewed from the airport information page. Getting to a specific plate means a minimum of five screen taps.

That wouldn't be too bad except that if after looking at the RNAV Rwy 07 you want to see the ILS Rwy 25 for the same airport, you'll have to start the process again. There is a history button that lets you quickly view a chart once you've called it up the first time. History also makes a functional way to toggle between a plate and the en route chart.

The screen is amply wide to view the approach plate full width and scroll top to bottom. But the plates are not geo-referenced, so you won't see your position on them. The version we tested also lacked the NACO takeoff and alternate text information that doesn't appear on dedicated plates. Adventure Pilot says these will be added this summer.

BATTERIES AND UPDATES

Since the iFly has no internal battery, it must be connected to ship's power or the included battery pack (actually a USB power supply). This connection can be done in series on 12-volt systems (cig lighter to power pack to iFly), but it's either-or on 24-volt systems. We think this undermines the iFly's utility as a backup during complete electrical failure. Battery life is good at four hours off a full charge.

Approach plates are easy to read with finger scrolling. However, getting airport information or loading approach plates, required repeatedly stepping through menus.

We also have issues with iFly's data update system. Owners of the iFly get login and password to the iFly website where they can create an update package to download. This package includes current TFRs and METARs for the U.S., as well as any software updates. No issue there. The problem is that the user must also check off each sectional and en route chart they want updated, as well as each state they want for approach plates. VFR Sectionals have a filter to at least show what's new, but there's no such convenience with the IFR publications.

That might be fine for a local flier downloading one IFR chart and one state's plates. But for our tests in the Northeast, this resulted in finding and checking a dozen boxes (scattered about the alphabetical listing from Connecticut to Vermont) and a download that was 1.7 GB. There is a map to help select charts, but it's not clickable to select items. It's only there for reference. The system could seriously benefit from a smart download manager. Once downloaded, the package is put on a USB stick that connects to the iFly. The update installs relatively quickly on the GPS.

One thing we can't complain about is the iFly's price: $499 + $69/year for all data updates. There's also a 30-day money-back guarantee.

It's hard to peg a competitor for the iFly as nothing quite hits the iFly's big size plus its stripped-down feature set. The AV8OR Ace is similar in scale, but far more sophisticated, with dozens more features like terrain awareness and datalink weather. It's also almost four times as expensive. If your perfect GPS is big, yet simple, the iFly 700 is worth a look.

CONTACTS

Adventure Pilot, LLC
888-200-5129
ifly.adventurepilot.com

Headsets Inc. and DRE: Decent ANR on a Budget

You can add the zen peacefulness of noise canceling to your favorite headset or helmet for a bargain price. Or you can buy one ready to go. Some restrictions apply.

by Jeff Van West

CHECKLIST

- ANR add-in module is cheap, effective and fairly simple to install.
- Child's headset with ANR is a great option if your fly regularly with kids.
- The EM-1 and 6001 are plenty rugged, but are middle-of-the-pack on comfort, sound and price.

The world of noise-canceling headsets is largely ruled by the high-end units like the Bose X and Lightspeed Zulu. If pilots baby their ears, it seems they go for the best they can buy. But there's still a place for good deal on ANR, be it for backseat passengers or just to stretch your own flying dollar.

Headsets Inc. offers a drop-in module that fits a wide range of existing headsets and helmets. OK, it's not quite "drop in." Some wire clipping and soldering is involved. The company also sells complete headsets with their ANR installed headset, and they revived the DRE Communications line of headsets, which includes one with ANR.

DO IT YOURSELF ANR

The most spendthrift way to go is to upgrade your existing headset yourself with one of the kits from Headsets, Inc. They've been selling these same basic kits for about 15 years, with periodic improvements over time. For example, the latest kits use a new foam that both improves the passive noise reduction of the headset (i.e., how much it blocks with the noise canceling off) and removes the need for the adhesive to hold the new ANR modules in place.

When you order, you'll have to tell them which model you have and they'll put the right parts in. The base price is $169, which includes everything you need short of wire clippers and a soldering iron (even the solder is included). Some Peltor headsets and helmets require a special kit that's $189.

Options may ratchet the price up a bit. The auto-shutoff battery box is a $10 upgrade to the kit price. New mic and audio cables that have the power supply to the battery built in (the AMP cable it's called) is an extra $19. We had both of these add-ons and would recommend them as a good value for ease of the install and lifetime of the headset's 9-volt battery. Alkaline 9-volts last about 15 hours of use in the unit, which isn't terrific as ANR systems go. But one user told us he gets over 100 hours of use from a lithium 9-volt in his system. And the lithium 9-volt is lighter ('course it also costs $7 a battery). There is also an option for panel-mount power.

The results of the upgrade flat-out won't match the performance of a purpose-designed ANR headset—you can't turn your old David Clark 10-40 into a Bose X. But you can get significant relief from cockpit noise with minimal loss audio quality. In fact, for many old headsets, it's probably a gain. The sound in the unit we tested was the tinniest of any of the ANR units we've used. If you're an audiophile who likes Brahms while cruising, we'd suggest elsewhere. It's

The Headsets Inc., kit comes clearly labeled and complete with all parts you'll need including solder and shrink wrap.

The red color and "velvet top" of the child's headset may be a hit with the young wearer, but the more salient features are the smaller headband, shorter mic and the single, large volume knob. If your child's head is big enough, the earcups on an adult headset don't drop below the jaw line and the mic can be positioned in front of the lips, then they don't need the child's version.

fine for normal cockpit communications, however. The company claims 20 dB of canceling at the key frequencies.

Because the 10-13.4 we tested used the older foam, its passive noise-reduction is now terrible, so the headset is functional with a dead battery but not remotely quiet. The mic quality and headset fit will be whatever you started with. That means the upgrade makes more sense if you've already invested in better earseals and a comfortable headband than if you still have the $99 special you got right after your first ride in a Cessna 150 and haven't used in 10 years.

The system comes with a three-year warranty. We found the company quick to respond to inquiries and helpful during the install. If you like the idea of the upgrade but don't relish the job of installing it, the company will do the job for an additional $50 ($75 for a helmet).

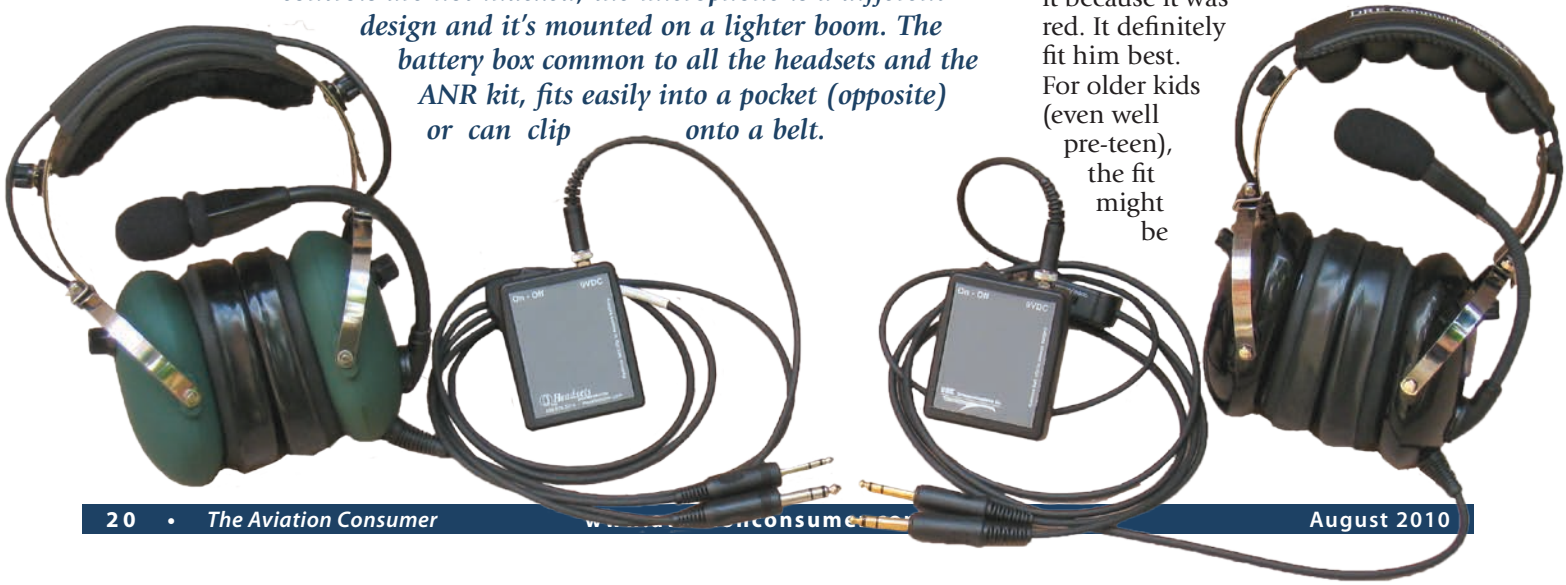
FOR THE KIDS

A rather gaping hole in the headset market has been an ANR headset for children. Headsets Inc. jumped into that gap by taking an AvComm child's headset and adding their ANR to it, as well as a few of their popular upgrades, such as the ComfortTop headband (which one of our child testers dubbed "the nice velvet top").

The two key features of a child's headset are a smaller headband, so the earcups don't fall below the jaw, and a shorter boom on the mic. Most full-size headsets require bending the mic boom partway back on itself to get consistent results (sort of important when a little voice in the back says quietly, "I'm not feeling so good."). The headset also has only one volume control with a really big knob. Experience has taught us that complex volume controls and young kids are a bad mix.

We got some actual children who are used to flying with scrunched up adult headsets and asked for their opinion. The small-headed in our group said the kids' headset was the most comfortable, hands-down. But he might have also liked it because it was red. It definitely fit him best. For older kids (even well pre-teen), the fit might be

The Headsets, Inc. EM-1 (left) and the DRE 6001 (right) share the same ANR and battery box. The 6001 has a wider steel headband, the volume controls are not indexed, the microphone is a different design and it's mounted on a lighter boom. The battery box common to all the headsets and the ANR kit, fits easily into a pocket (opposite) or can clip onto a belt.



CONTACTS

DRE Communications
877-987-9977
www.drecommunications.com

Headsets Inc.
800-876-3374
www.headsetsinc.com

too tight. So it's a matter of how many years you'll be flying with the kids to judge the investment. The complete unit is $349. You can also buy the original headset for $100 and upgrade it yourself if you're so inclined. Headsets Inc. is working on a new kids' model due this fall.

READY-MADE OPTIONS

The company sells its own headset with ANR, branded as the EM-1, for $399. They also took over the formerly-defunct DRE line of headsets. The DRE-6001 is the flagship model, and the only one with ANR. It sells for $462.95.

The EM-1 and 6001 use the same speaker system you would get with a kit so they're rated at the same 20 dB. The real differences between the two units are that the 6001 has a wider steel headband (so the Comfort-fit top isn't an option), different earcup designs, the volume controls on the earcups are not indexed and that it has a different microphone on a lighter weight boom. Both headsets use a rugged, steel-band top and beefy cables that we expect would stand up to the abuse of non-savvy passengers.

We tested both these headsets

on the ground and in flight, but we didn't have access to a full lab like we have been able to secure for some other reviews. That means we have more anecdotal data than objective. Both headsets performed roughly the same, but we thought the DRE 6001 seemed to have a better mic but worse passive noise canceling. The DRE headband pad we also found uncomfortable after long periods of wearing it. We also don't like the separate volume controls on each earcup as it requires switching hands around to set the volumes. However, it is easier to reach up to your head than fumble down the cord for the volume sliders on some headsets.

Given that these two headsets are so close in design, we question why someone would spend an extra $50 for the DRE model. But carrying that logic further, we have to consider budget ANR models like the GCA ANR-II, which sells for $249 and is really the old Lightspeed QFR-X/Cc model rebranded. We've found these to be excellent headsets with features like cellphone/music input and good total noise reduction. They have less active noise canceling than the EM-1 or 6001, but more passive. That might be a plus with a backup/passenger headset that you pull out only to find a dead battery.

Those super-budget ANR headsets aren't as rugged as the EM-1 or 6001, however. They wouldn't be the right choice for daily use. And the EM-1 is still half the cost of a Lightspeed Zulu or two-thirds the cost of the new Lightspeed Sierra. And the ANR kit added your existing headset is half of that again. So there's certainly a place for these units in the full headset spectrum. If you're looking for ANR that's rugged, or fits into the headset you've loved for years, these products are worth a look.

HOW HARD IS IT TO INSTALL?

If you're the kind of person who drops your car off at the shop to get the wiper blades changed or have the coolant checked, then don't bother ordering the ANR conversion kit from Headset's Inc. Putting in the unit requires some basic aptitude in soldering and a willingness to cut wires and pull out internal parts.

That said, it's not rocket science and with about 85,000 kits sold (yes, you read that right) to civilians and the military, the company has worked out most of the bugs. Our install in a 19-year-old David Clark 10-13.4 headset turned up a few quirks. For instance, the DC headset used a shielded cables and the ANR kit did not. This left us wondering what to do with that sheild. Cut it free? Connect it to the common ground? The instructions were of no help. Also, we were (correctly) sent the older pink foam system needed to fit the tight 10-13.4 earcup, but not the correct instructions for installing it. The instructions did warn how tough it can be getting the ANR in the right earcup of a 10-13.4.

Headsets Inc., is quick to reply to your e-mail or phone query, however, and the installation video on the website showed how the pink foam was used. The kit came with enough extra solder, wire and shrink wrap that we could redo the two errors we made. The visual wiring diagram is enough to do the whole job if you're already familiar with wiring.

It's probably a testimony to the simplicity of the job that when we fit it all back together it worked on the first shot. And it says something for the robustness that after some rough handling and intensional dropping, it still works fine.

AC TV

For a more complete look at the steps and missteps one editor endured while installing the Headsets Inc. ANR, log on to www.avweb.com and select the video index.

Lock and Key Navajo: Updated Classic

Piper's big twin is still a standout load hauler and fast cruiser. This mod essentially remanufactures the airframe to near new standards.

For anyone who needs to haul a lot of stuff and fly fast while doing it, the choices are limited. Unless you have a million-dollar -plus turbine budget, legacy piston twins are the top contenders.

And in that group, Piper's Navajo will survive to the short list and that's why it remains a brisk seller on the used market, despite the cratered economy. Aircraft dealer and modifier Mike Jones, a Navajo specialist, gets that and thus: the Lock and Key Navajo. This mod treads ground

The Navajo's panel is rebuilt, with GNS430/530 combination and an Avidyne MFD as standard.

Yes, it really carries all that stuff and more. We actually flew the airplane with Mike Jones' Sun 'n Fun booth stuffed in the back.

that's been broken before, which is essentially to pick a reliable, robust airframe and remanufacture it to new standards, tossing in some state-of-the-art technology where appropriate. Given that the last Navajo was built in 1984, these airplanes are ideal candidates for the sort of upgrades Jones offers on the model.

Remanufacture may be too strong, but Jones' basic idea is to put

CHECKLIST

- ⊕ The Navajo enjoys an almost unassailable market niche.
- ⊕ Workmanship on the mod is superb. It even smells new.
- ~ Investment required is high and some owners may want to shop turbines before committing.

Navajos have variable seating configuration, but the most popular is a four-seat club configuration, top. Many also have a potty seat, lower photo. Swing-up cargo door eases access to rear baggage space. The airplane can carry up to 700 pounds of baggage.

the airframe into the same shape it was when it was new, but with more modern equipment making it basically a better airplane.

MODEL HISTORY

The Navajo represented a departure for Piper, a clean-sheet twin aimed at a market segment that Cessna essentially owned. The model first appeared in 1967 but really hit its stride when the PA-31-350 Chieftain was introduced in 1973. The fuselage was stretched two feet and the airplane got a nice cargo door behind the airstair door.

The airplane hit the sweet spot of payload and cruise speed, some able to carry a whopping 1000 pounds (or more) with full fuel, making them the rare corporate or big-family piston twin that can not only walk the walk, but can do it for great distances.

In the Lock and Key mod, Jones builds on this pedigree by essentially reworking the airplane from the bare metal stage out. At a standard price of $795,000, not including the airplane itself, this is not a cheap mod. Because of their unique capabilities, the Chieftains have retained their value and a good one still sells for $300,000. There seem to be plenty on the market.

LIKE NEW

The Lock and Key mod—which Jones launched seven years ago—takes about four to five months to complete and is essentially an extensive renovation. The goal is to have everything down to the smallest light bulb working like factory new. (Jones had in mind the "turnkey" concept, but thought that would be mistaken for "turkey," thus he went with Lock and Key.)

Various packages are available. The standard avionics setup, for example, is the Garmin GNS530/430 combination, a GMA340 audio panel and an Avidyne MFD. The Garmin G600 is also an available option.

The old interior and paint are stripped and premium replacements are installed. The demo we flew had a tasteful gray leather interior and state-the-art metal panel.

Original Chieftains had the Lycoming TIO-540-J2BD engines with the ill-starred Bendix dual mag. The Lock and Key changes that to the J2B variant, which has conventional separate mags. (See the June 2010 issue for a report on the demise of the Bendix D-mag.) The engines get four-blade props with Q-tips and winglets, which Jones says helps with the climb rate.

Jones says the business is geared to buy a candidate Navajo and proceed with the mod from there, but it will also accept a customer's aircraft that's in good shape.

Jones is big on customer satisfaction so before delivery, he has the airplane flown for 15 to 30 hours to iron out any squawks. Warranties on individual components are extensive, including a year on avionics and instruments, two years on factory engines, four years on a new Janitrol heater and seven years on fuel tanks.

AC TV

For a video tour and interview with Mike Jones on the Lock and Key Navajo mod, log onto our sister publication, www.avweb.com, and click the video button in the upper right corner of the homepage. Scroll down to Lock and Key video. Here's the direct link: http://snipurl.com/yzqyn

CONTACTS

Mike Jones Aircraft Sales
615-390-0915
www.mikejonesaircraftsale.com

Bellanca Viking: Quirky But Cool

The wood wing Vike is of another age, but it holds its own with the best modern airframes.

photo courtesy Frank Holbert

In an era when the state-of-the-art aircraft have to be baked in an oven after being laid up in plastic sheets squished together in vacuum bags, it's hard to imagine that a wood and fabric wonder like the Bellanca Viking still exists. But it does. And although there aren't great squadrons of them around, the Viking retains a loyal, almost cultish following.

Why? Because there's nothing quite like it, that's why. The Viking's performance isn't stellar, but it's credible with most of its contemporaries, the aircraft handles well with few gotchas and it's so strongly built that owners still delight in showing the famous factory picture of a dozen cheerleaders standing on the wings. "Try that with an aluminum airplane," goes the advertising tag line.

The Viking is nothing if not sturdy. Inside the wing are two laminated wood spars running the length of the wing, connected by a system of ribs. Inside the fuselage is a lattice work of stout steel tubes that form the engine mount, then carry through the fuselage to form the tail. Add laminated spruce forming one axis and a steel roll cage forming the other and you've got a very sturdy airframe with better occupant protection than many modern designs can claim.

MODEL HISTORY

The Viking's family tree (sorry) traces its roots back to the Bellanca Cruisaire, a triple-tailed retractable taildragger design reminiscent of aviation pioneer Giuseppe Bellanca's early designs. The first Model 17 Viking appeared in 1967, powered by a 300-HP Continental IO-520-D.

> ***Owners still delight in showing the famous factory photo with a dozen cheerleaders standing on the wings.***

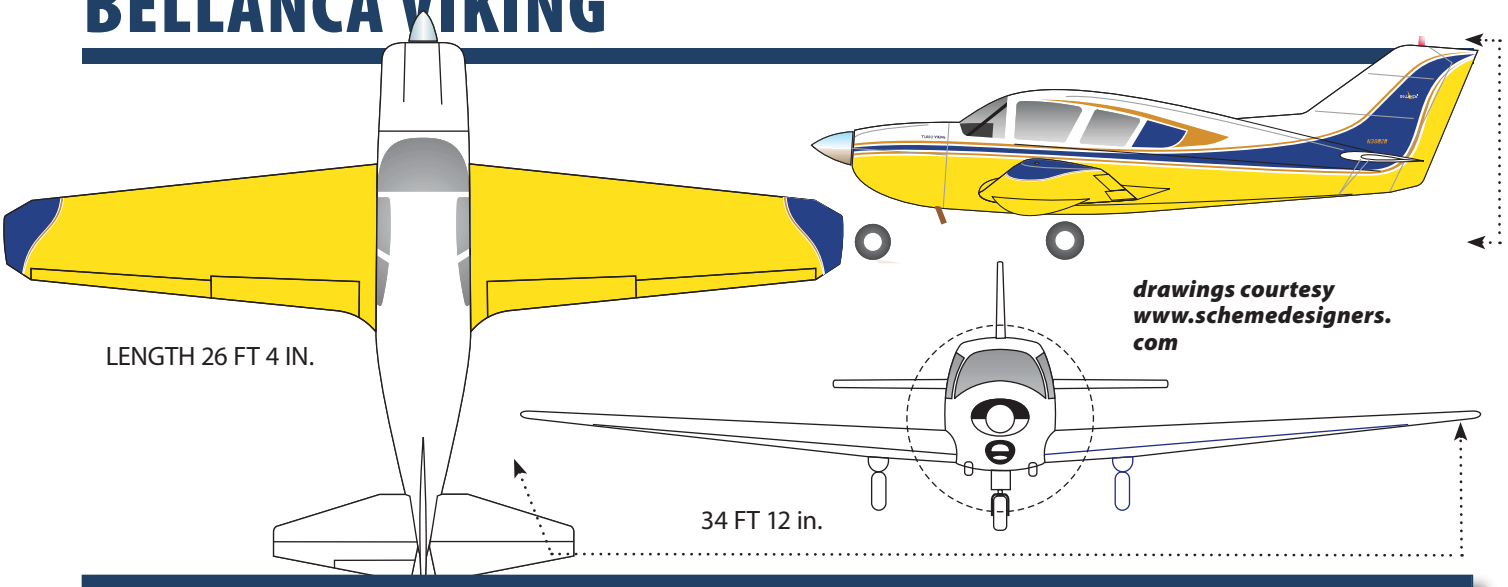
The model evolved gradually, but other than the engine, there were few major changes. The Continental-powered Viking was called the 17-30, while the 17-31, introduced in 1969, was powered by a 290-HP (later 300-HP) Lycoming IO-540, either normally aspirated or turbocharged. Either engine was available for much of the early production run; the 17-31 was discontinued after 1979 and in 1996, the Continental IO-550 was made available as an option. Some earlier airplanes have been retrofitted. The original hydraulic gear and flap actuation system was redesigned midway through the 1968 model year with the introduction of electric flaps.

The original fuel system—five tanks, two fuel selectors, eight possible combinations of selector settings and several sometimes incomprehensible gauges—was simplified to a left, right and aux system in 1974. After that mod, the fuel mismanagement accident rate for Vikings dropped dramatically. Production continued at a modest rate—in the peak production year, 1973, just under 200 were built—significant volume by modern standards, but a trickle for that era.

Bellanca Aircraft Corp. went bankrupt in 1980, the year things turned sour for the entire industry. In 1984, the company got back on its feet and started building Vikings again on a limited, custom-order basis. Only nine were built in 1984 and 1985 and none in 1986. About 38 were produced between 1984 and 2005.

In 2001, Bellanca went bankrupt again. In 2002, a group of six Bel-

BELLANCA VIKING

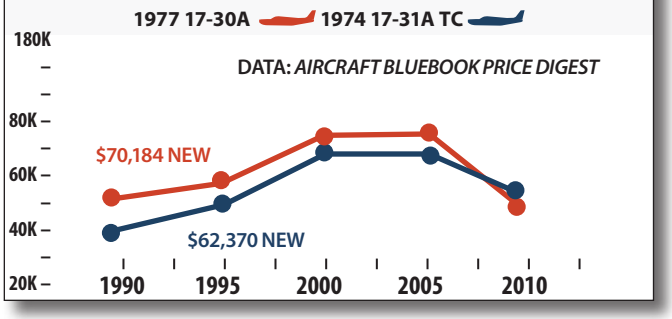


drawings courtesy www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1967-1970 VIKING 17-30	CONT. 300-HP IO-520-D	1700	$30,000	60	1078 LBS	170 KTS	±$30,000
1969 VIKING 17-31TC	LYC 250-HP IO-540-GIE5	1600	$40,000	72	1190 LBS	190 KTS	$39,000
1969 VIKING 17-31	LYC 290-HP IO-540-GIE5	1600	$40,000	72/92	1108 LBS	190 KTS	$30,000
1970-1974 VIKING 17-30A	CONT. 300-HP IO-520-D (K)	1700	$30,000	92	1108 LBS	170 KTS	±$33,000
1970-1974 VIKING 17-31ATC	LYC 290-HP IO-540-GIE5	1700	$40,000	72	1190 LBS	190 KTS	±$42,000
1975-1980 VIKING 17-30 300A	CONT. 300-HP IO-520-K	1700	$30,000	92	1140 LBS	170 KTS	±$52,000
1975-1978 VIKING 17-31A-300	LYC 300-HP IO-540-K1E5	2000	$40,000	92	1140 LBS	190 KTS	±$50,000
1980-1990 VIKING 17-30A	CONT. 300-HP IO-520-K	1700	$30,000	92	1108 LBS	170 KTS	±$78,000
1991-1997 VIKING 17-30A	CONT. 300-HP IO-520-K	1700	$30,000	92	1108 LBS	170 KTS	±$155,000
1998-2001 VIKING 17-30A	CONT. 300-HP IO-520-K	1700	$30,000	92	1108 LBS	170 KTS	±$190,000

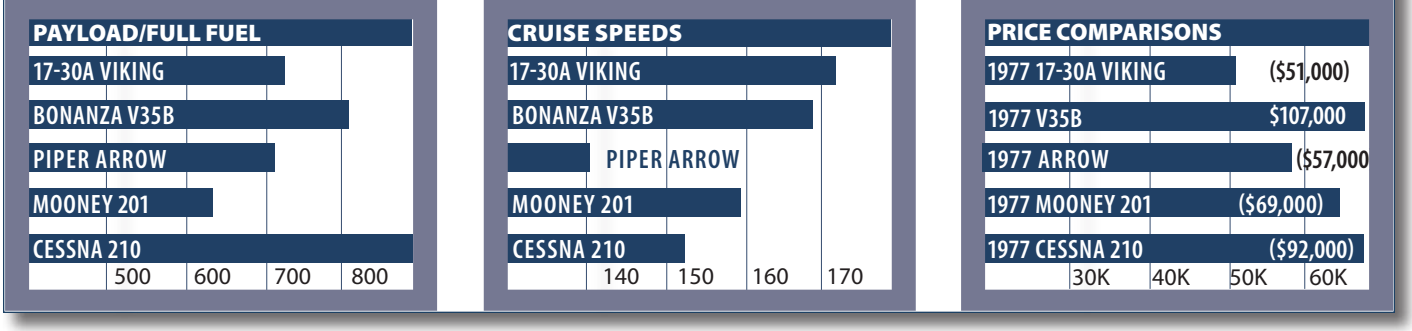
RESALE VALUES



SELECT RECENT ADs

AD 08-05-11	MUFFLER AND TAILPIPE CRACKS
AD 96-18-07	NOSE GEAR BRACKETS
AD 90-02-17	LANDING GEAR FITTING ASSEMBLIES
AD 86-25-06	MAIN AND AUX TANK INSPECTION
AD 76-08-04	WOOD DETERIORATION CHECKS

SELECT MODEL COMPARISONS



Owners describe Vikings as comfortable, but not overly roomy—more Arrow than Mooney. David Pile's aircraft, above, is typical of the attention to detail the airplanes boast, especially the nicely upholstered seats. Note the steel down tubes in the upper photo. Occupants sit inside a stout welded steel cage, providing exceptional crash protection. And our thanks to Pile for his assistance in preparing this article.

lanca enthusiasts bought the company from the state of Minnesota and established Alexandria Aircraft Co. LLC. Their immediate goals were to provide technical support and parts to owners and A&Ps in the field. The owners of AALLC also reduced parts prices substantially and rewrote the type certificate for Continental-powered Vikings, which helped prospective buyers looking to replace a run-out 520 with a 550. By early 2010, however, market conditions no longer supported this enterprise and the assets of the factory were put up for auction. There are about 1360 or so Vikings in the fleet, most of which are Continental-powered.

MARKET SCAN

And there are enough Vikings on the market to offer buyers a good choice at remarkably good prices. According to the *Aircraft Bluebook Digest*, early Continental-powered 17-30s hover around $30,000 while mid-1970s Vikings are in the high $40s. The latest models, which the *Bluebook* shows as 2001, are valued at $218,000. We found at least 17 for sale in *Trade-A-Plane* online. All things considered, these prices represent a good value, but one owner told prices have dropped recently.

Look for one that has flown regularly and, above all, been hangared or at least sheltered. Moisture in the wings is the biggest threat to the value and the airworthiness of the airplane and drying them out at 160 knots is the best thing for them, owners tell us.

PERFORMANCE, PAYLOAD

By modern standards, the Viking is a credible but not exceptional performer. Normally aspirated models cruise at around 160 knots, 10 knots slower than heavy singles like the Cessna 210 and A36 Bonanza. The turbo helps, of course. Haul the airplane up to FL200 and you'll see 190 knots. On the other hand, a Viking will outclimb a 210 or an A36.

The book claims 1210 FPM and owners report similar numbers. For all its power, the Viking's useful load is typically 1000 pounds or so and even less with a lot of equipment on board. That's in the range of an average 200-HP retractable, such as a Mooney or Arrow. On top of this, the big engine requires a lot of fuel, which further limits the

cabin load.

Fuel capacity is either 60 or 75 gallons, but owners say there don't appear to be many 60-gallon versions. In fact, aux tanks in early models bring the total to 90 gallons. "With full fuel, my 1973 Viking will carry three passengers, or two passengers and baggage," one owner told us. This payload is typical of all aircraft of this era. Commented another about his turbo: "Lycoming engine, heavier than the Continental, plus two turbos, equals a pathetic full-fuel legal load of two adults plus bags." Compare that to a Cessna 210, which has a useful load pushing 1400 pounds in some cases and can typically haul 90 gallons and four people plus baggage.

But the Viking has always been more sports car than pick-up truck. With all four seats occupied by FAA-standard humans and 100 pounds of baggage, the airplane can ship maybe 40 gallons of avgas—enough to fly 250 miles with IFR reserves. However, most owners of post-1973 Vikings comment that they're content with a choice of full seats or full tanks and insist that their bladders usually give out before the fuel does.

HANDLING

The Viking is almost universally praised for its light, smooth aileron control. "The Viking is a very stable aircraft in turbulence and IMC conditions with no Dutch roll due to the very ample vertical stabilizer. It rolls and handles like a sports car—not like a station wagon," reports owner David Alger. "My Viking has the same empty weight as the Lance I used to fly, about 2225 pounds. But the control feel and harmony are just wonderful. Low speed control on the Viking is excellent and makes short field operations easy, and the stall is very mild. It's is also a very good IFR platform, not twitchy and pleasantly light on the controls," says Mark Sellers.

Landing can be tricky, however. Power off, with gear and flaps out, the Viking has an awesome sink rate that owners liken to Steinway pianos. The steep descent angle, however, does allow a skilled Viking pilot to make short landings and the excellent climb rate enables the airplane to depart from short fields just as well.

The Viking's cabin dimensions are modest at best, a reflection of its 1930s design heritage. "The cabin is small for two guys my size," reports a 210-pound Viking pilot. Even a rabid pro-Viking zealot admitted that the cabin is "not roomy." Not as tight as a Mooney, maybe, but no 210, either.

Interior appointments draw raves. Many Vikings have a leather or crushed-velour upholstery that puts the chintzy interiors of Pipers and Cessnas to shame. Cabin noise, on the other hand, is high, although some owners tell us it's no worse than other aircraft. "A Viking is certainly no louder than any other single engine GA aircraft of similar vintage. Anyone flying any single-engine GA airplane without ANR won't be able to hear much after a while anyway," says Craig Gifford.

We don't think there's much to differentiate the two normally aspirated engines from an ownership point of view. The turbo is another matter. Prospective buyers should carefully consider whether the extra acquisition cost, complexity, fuel consumption and potential overheating problems are worth the benefits of turbocharging. Since it's a turbo normalized system—you get full power all the way to the flight

ACCIDENT SCAN : FUEL RANKS HIGH

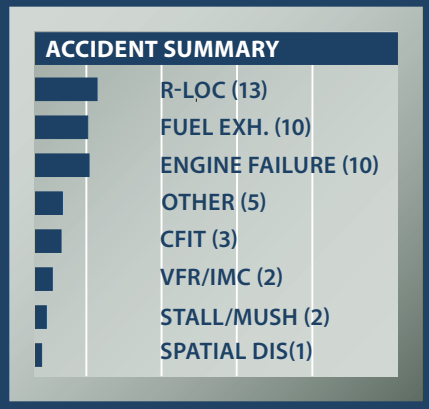
In a small population aircraft such as the Viking, identifying accident trends and concluding much about the aircraft is problematical. Nonetheless, our review of 20 years worth of NTSB accident reports reveals some patterns.

The surprise, if there was one, is that fuel exhaustion and fuel mismanagement incidents ranked number two on our scale. (The chart at right shows actual numbers, not percentages.)

This is somewhat unusual as these things go because most models, if they have a fuel exhaustion profile, tend to show far fewer of such incidents than they do the number one favorite cause of wrecks: R-LOC or runway loss of control.

Two things account for this, in our view. One is that the airplane has a relatively large, thirsty engine and carries just an adequate amount of fuel. The second is that any aircraft with aux tanks that require special fueling or inflight management techniques is automatically more likely to have a fuel exhaustion or mismanagement pattern.

Indeed, one of the accidents resulted because a pilot ran a tank dry with plenty of fuel in the aux tanks and another was the result of confusion by line personnel over how much fuel to put where.



Engine failures also ranked fairly high, at 10. All but one of these were Continental-powered 17-30 models. The other was a turbocharged Lycoming version.

The low number of fatal accidents—only 21 percent of the total—seems to confirm the Viking's crashworthiness reputation. So does the photo below, provided to us by Frank Holbert. It occurred in Mexico and took out two trucks. The aircraft occupants walked away.

It's not quite the famous cheerleader photo, but you get the idea. That's at least 600 pounds standing on the Viking's exceptionally strong wing. A factory film made during the 1970s shows an impressive aerobatic routine with the airplane.

levels rather than an extra boost on the ground—in most cases (outside the Rockies, at least) the answer is probably not.

One reader who owned both advised against the turbo version. The gear system is robust, but there's apparently some confusion in the field about exactly how to adjust the limit microswitches to make the system work well. The emergency gear extension in a Viking is two-thirds foolproof and one-third tricky. When the mains retract, they fold forward and are held there under pressure, so dumping pressure causes them to fall into the slipstream and lock.

Step one of the emergency extension procedure is to slow the airplane to 90 knots, so the overcenter spring can push the nosegear through the slipstream and let it lock. No cranking or huffing and puffing necessary—just slow the airplane down.

HANGAR IT

Owners were all but unanimous in emphasizing the need to hangar a Viking. "Absolutely imperative!" said one. "A crucial necessity," echoed another, although one reader insisted a shade hangar in a dry climate is good enough. "I keep my Viking inside. But I would keep any airplane I fly IFR inside. Wood deterioration is a function of moisture content. Keep your wood dry and rot can't happen. Simple as that. That said, I often fly in rain and leave the plane outside on trips," reports Mark Sellers.

The primary reason is to prevent the accumulation of moisture that can trigger wood rot in the wing, but it's also a good idea to protect the fuselage fabric from ultraviolet radiation and moisture. The "lifetime" Dacron covering will last a long time in a hangar, but owners report the need to recover in as little as six years if the airplane is left outside.

Factory support for the model is, well, iffy. Still, owners say parts are generally available from Alexandria Aircraft LLC and the Web site is still up at www.bellanca-aircraft.com. Furthermore, the airplane's rag, tube and wood construction mean that experienced mechanics can fix about anything on the airplane.

"I personally don't worry about AALLC because it's really the shops at Rocket, Weber, Witmer and MARS (nicely covering all parts of the U.S.) that keep these airplanes flying. The future of 100LL poses a far greater risk to the Viking future than the status of the factory being for sale," says Craig Gifford.

OWNER COMMENTS

I bought my first Viking in 1969. Since then I have had a total of five Vikings and have over 6000 hours in them. I suppose this in itself would be a good testimonial. My current model is a 1998 Viking with an IO-550 engine and one of the last ones built.

The Viking is a pleasure to fly. Its systems are very simple, making repairs much less expensive than the "iron" aircraft. I often fly with very heavy loads finding that the performance is not diminished significantly. I have inadvertently gotten into icing situations several times in the past 40 years and on one occasion accumulated a large amount of rime ice at 12,000 feet. I knew I could get down to an altitude where the temperature was above freezing, so I just kept going to see what the airplane would do. Of course, the airspeed dropped significantly, but I was able to maintain altitude with no problem. I think the relatively "thick" wing has a significant advantage in that respect.

With the IO-550, I run lean of peak all the time and true 170 knots, saving 2 GPH. Running ROP adds about 7 knots. I find the IO-550 about 10 knots faster than the IO-520 and I think most people have experienced the same. Annuals run about $3000 depending on how much extra stuff I want to have done. Rocket Aviation in Plainview, Texas, does all the major repairs and they are never more than a phone call away.

I keep the airplane hangared all the time (except when traveling) and have never had a problem with the wood. Think about it. There are 200-year-old homes made of wood and amazingly they are still standing. I plan to fly the Viking until I quit flying.

David Alger
Lago Vista, Texas

I began my "affair" with Vikings when I was in high school in Plainview, Texas, back in the early 1990s. At Miller's Flying Service (a legend among Bellanca drivers), I learned to fly in a Cherokee 140 and with 54 hours in my logbook, less than a week after my private checkride, I began my checkout in the Viking at the ripe age of 17.

In my flying career, I have flown many types of Piper, Cessna, Mooney, Beech, Cirrus and Diamond aircraft. However, I found myself coming back to the Viking as I shopped. I found a 1989 model that had been meticulously maintained and I bought it in August of 2007.

I could not find another airplane that I could purchase in the mid-$150,000 range that had this performance. Bonanzas are twice as expensive in the same vintage and they are slower, but larger inside.

Operating costs are about the same as any other airplane in the category.

I generally let Rocket Aviation (formerly Miller's) do my annuals. This is simply because they know the airplane inside and out and are experts on how to detect issues early and fix them efficiently. All my other maintenance is at a local shop. There's nothing really tricky to maintaining a Viking other than keeping it relatively dry.

An annual generally runs me $2000 to $3000 out the door and I always fix everything that even remotely looks like trouble. Insurance runs me around $2300 annually for a $160,000 value.

I can only knock the Viking on two things. One, the baggage area is small. We have to pack in duffle bags and think about everything we take. My wife misses the space our 182 had, but the extra 30 knots in speed is worth it to me! That's the other knock. The gear speed is pretty slow and this slick airplane

David Alger's 1998 model, above, is one of the last Vikings built and has a factory IO-550 engine. A handful of airplanes have been field converted to the same engine.

Says Ty Flippin of his Viking, below: "I can cruise a minimum of 180 KTAS at 6000 feet burning around 17.5 to 18 GPH running rich of peak, but more regularly fly LOP at around 170 to 172 KTAS on 13.5 GPH."

can be a challenge to slow down. A speed brake mod would be nice.

Overall, I could not be any happier with my Viking. Everywhere I go, I get comments on it. It has ramp appeal that a 182 or even a Cirrus just cannot have. It is in the same category of efficiency with a Mooney, but has slightly more interior space. It costs half as much as a Bonanza to purchase. It's a simple airplane to fly. Everything feels natural. It's one of those airplanes that you sort of feel guilty for turning on the autopilot.

Ty Flippin
Via e-mail

I have owned a 1985 Viking for six years and let me say at the outset I like my airplane a lot. For the money spent, it is an outstanding value. Other four-seat aircraft may outperform the Viking in some parameters, but when you add it all up and divide by the dollars spent, the Viking is an extraordinary deal. Here are a few data points:

I outran a friend in his SR22 on identical IFR flight plans from Chatham, Massachusetts, to Philadelphia. Same power settings and altitudes, same routing. I departed seven minutes before he did and arrived 11 minutes before he did. I routinely cruise in the low 170-knot range. My airplane is one of about a dozen Vikings that either came from the factory with the IO-550 or has been retrofitted in the field.

I had six square feet of sheet metal on the belly of a Piper Lance replaced for about $6000. I had twice that much fabric on the belly of my Viking replaced and a flap re-taped and painted as well, for under $2000. Fabric is easy to patch and repair.

My friend with the SR22 would never consider taking his plane into a grass field. He'd trash the wheel pants. I routinely land at unimproved fields. The Viking's wood wing delivers excellent short field performance without cuffs, VGs or sheet metal pyramids riveted to the leading edge.

Fabric covering: Every technology has its limitations and life span. After 25 years of being kept inside, my Viking looks great and has good gloss retention on the original paint. But the paint has begun to embrittle and I am starting to see a little surface cracking. I'm planning on recovering in a few years, and I'll spend a lot of money doing it.

Wood wings: Flying the airplane regularly and circulating air through the wings should prevent any issues. Wood deterioration happens over time, just like corrosion in a metal airplane. A good pre-purchase inspection is the best way to avoid the problem. The guy in the hangar next to me flies aerobatics in a Stearman with many thousands of hours total time and wooden spars. This is completely unremarkable. Would you do the same thing in a sheet metal airplane from 1942? Doubt it.

Maintenance: I am fortunate to live 15 minutes from the top Viking shop on the East Coast, Witmer's Aircraft Service in Pottstown, Pennsylvania. Tom Witmer is easy to deal with and his product knowledge is unsurpassed. Vikings seems to be afflicted with a lot of shade-tree maintenance, perhaps because the systems on the airplane are so simple owners and mechanics don't look at the manual.

When I got my airplane, it was out of rig and a couple of systems had been buggered up. After getting over that initial hump, my maintenance expenditures have been tolerable' dispatch reliability has been excellent. The gear, which is the most complicated system in the airplane, uses the same power pack as the Piper Arrow.

The negatives: The airplane is not big inside. Getting in and out, especially for the copilot, is not graceful. On the other hand, I am 6-feet 2 inches and once I'm in and settled down, it's quite comfortable.

I have good headroom and the lack of a center console below the panel permits me to spread my legs all the way across the airplane if I'm by myself. The back seats actually have more room than the front.

In the later model Vikings, the cockpit lighting, fuel controls, environmental controls and flap settings are, in my opinion, just right. Vikings came with a ski tube that easily accommodates a golf bag. Little things like that can make a real contribution to the experience of flying a plane. I wish

the airplane held more fuel. I have 75 gallons usable, which is merely adequate. But 15 gallons of that is in an aux tank behind the rear seat and this permits significant CG adjustment when flying fatties or carrying a lot of baggage. Like I said, for the money spent, my airplane is a great value.

Mark Sellers
Philadelphia, Pennsylvania

I first flew the Bellanca Super Viking in the late 1970's when I worked as a rent-a-pilot. On my first flight, before the gear was even up, I knew I was flying something special. I logged about 100 hours in the BSV in the 1970s and enjoyed every one of them. The Super Viking is like an American muscle car compared to the European imports; it does with horsepower what the others try to do with finesse.

In 2004 I was looking to buy a fast plane for cross-country flights and the BSV made the list with some more common aluminum models. I researched speed, features and prices for a month and the BSV rose to the top of my list. Since owning N4201B I average about 125 hours a year. I typically fly it on trips exceeding 200 miles primarily for pleasure. Here are some comments:

Pro:

- The BSV is cheap to purchase. I saved about $75,000 over similar performance aircraft.
- Most parts are readily accessible since very few are proprietary. I had to replace a rudder (metal corrosion) and found one at salvage for $250.
- Very smooth in turbulence. The wing gives much like the 787.
- High rate of climb gets one to cruise speed much sooner.
- Very few ADs to comply with.
- Little if any repairs between annuals.
- Very strong airplane in an accident. The cockpit is enclosed in a steel roll cage. An accident in Mexico destroyed two trucks but the pilot and pax walked away.
- Overall, a very fun aircraft to fly. Quick on the controls and very solid in an IMC environment. Some say the elevator is heavy but I would call that a stable IFR platform. Trim for 100 knots on a radar base and there it stays.

Con:

- Tricky for the novice pilot to land. A BSV can be ground looped and one needs to hold the nosewheel off as long as possible.
- Snug cockpit. Not as tight as a Mooney, but it's not made for four large men, either. I rarely fly with anyone in back, so this
- Needs to be stored in a hangar. No issues with leaving it out on trips but it should be hangared at home. The sun degrades fabric faster than aluminum.
- Pre-buy and maintenance needs to be done by someone who knows the BSV. You can spend a lot of money teaching a Cessna mechanic the quirks of the BSV.

Frank Holbert
Via e-mail

Standalone Intercom

(continued from page 10)

This always bodes well, in our view. We wouldn't have any problem putting a NAT audio product in our aircraft based on quality and performance alone. However, at $931 for the mono system and $955 for the stereo system, we're not surprised that they aren't big sellers in the GA market.

The $139 GCA-400A from Gulf Coast Avionics is a budget intercom that supports four seats and has pilot isolation and entertainment input. The unit can be mounted vertical or horizontal and comes with mic and phone jacks. Like the Sigtronics SCS, the folks at Gulf Coast warranty the GCA-400A for five years. We've found the service at Gulf Coast to be exceptional.

David Clark's Isocom has been around for a long time and still remains in the headset-maker's product line. It's bare-bones and is popular for yanking out of the panel to make room for something more modern. It doesn't have entertainment input or crew isolation. About the only thing we admire about the Isocom is its longevity (which usually says something positive about a product) and its ability to mount in a two-inch instrument cutout.

CONCLUSION

Before deciding on a standalone intercom, price a full audio panel installation, such as Garmin's GMA 340 or the PS Engineering PMA8000 series. The additional capability of a full-up audio console may mean a better value—especially if advanced entertainment is part of your plan. These sophisticated audio controllers also offer room to grow if you add more radios or entertainment sources to the aircraft.

Keep in mind, however, that the radios in the main stack need to be interfaced, which will complicate the installation and add to the cost. But for aircraft that have original audio wiring left over from the '70s, this is likely the best plan. But for others with otherwise good audio wiring, a standalone intercom upgrade might be a good value.

The Aviation Consumer

Lycoming IE2

(continued from page 7)

to make the engine not limited to 100LL. But that doesn't mean mogas and it doesn't mean 94UL. It does mean a few octane points under 100. Lycoming's corporate view is that the industry needs to move toward a 100-octane solution to the loss of 100LL.

Acoustic knock detection has been a difficult nut to crack for air-cooled aircraft engines because their inherent vibration signatures make pinging difficult to extract from the hash of background noise. But knock sensors have gotten better and there's more processing horsepower available to separate the wheat of pinging from the chaff of banging valve trains and the whirr of gears. In any case, with individual cylinder knock detection, the IE2 suppresses detonation the same way it handles high CHTs—first with fueling, then with timing adjustments.

CONCLUSION

If you were hoping Lycoming would produce a radical, watercooled and super-efficient engine that would turn the aircraft industry on its ear, the IE2 is not that. In our view, if Lycoming had launched such a project, we would view it as running off a cliff. Such an engine would require vastly more investment than the IE2 will, OEMs don't seem to be clamoring for it and even if they were, we doubt if it would ignite sufficient demand to justify the cost of developing it in the current market. In a few years, maybe.

Lycoming (and Continental) have to be mindful of the 100,000-plus engines each of it continues to support in the legacy fleet. While those engines represent a millstone of sorts, they also represent a profitable installed base. New airframes—including TAA models like the Cirrus—still tilt toward conventional powerplants that don't require liquid cooling systems and heavy investment in a retooled service network.

In this context, we like what we see thus far in the IE2. It appears to be a logical, well-engineered incremental step toward improved performance and economy on what are, in the end, relatively efficient and reliable base engines.

Some years ago, a watercooled engine Continental developed for Dick Rutan's Voyager project became known as the Voyager engine. If the IE2 is successful and becomes known as the Evolution engine, we think Lycoming will have hit just the resonant note it seems to be aiming for.

Letters

(continued from page 3)

lose anyone? You can bet your bippy we did. Did we want to lose anyone? Of course not. What is the cost of advancement? Answer: Mistakes along the way. The list goes on. You can think of five other instances as demonstration, I'm sure.

Ed Story
Via e-mail

LSA Right On

It's about time someone dared tell the truth about LSAs. Ed Fogle (Letters, July 2010) is correct. The biggest problem isn't cost, it's utility. The 1320-pound weight limit doesn't allow for a durable airframe, two average guys and enough fuel to go anywhere.

The Kitfox, for example, has a design gross weight of 1550 pounds. As the LSA Kitfox Sport, it has to leave behind more than 200 pounds of useful load. That's the passenger or fuel that would make it a useful airplane.

Let's just admit that 1320 pounds was a foolish mistake, fix it and release Light Sport to realize its potential. Until that happens, for most of us, they're not worth the money.

Gary Miedema
Via e-mail

FEEDBACK WANTED

BONANZA 35

For the November 2010 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Bonanza 35 series. We want to know what it's like to own these high performance singles, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the 35s by September 1, 2010, to:

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