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The Aviation Consumer[®]



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EDITOR

Paul Bertorelli

MANAGING EDITOR

Jeff Van West

CONTRIBUTING EDITORS

Jonathan Doolittle

Rick Durden

Larry Anglisano

SUBSCRIPTION DEPARTMENT

P.O. Box 420235

Palm Coast, FL 32142-0235

800-829-9081

www.aviationconsumer.com/cs

FOR CANADA

Subscription Services

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London, ON SW1

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FIRST WORD

SHOULD GOVERNMENT PRIME THE FUEL PUMP?

"Government's view of the economy," wrote the oft-missed Ronald Reagan, "could be summed up in a few short phrases: If it moves, tax it. If it keeps moving, regulate it. And if it stops moving, subsidize it." The last nugget of that quote, government subsidies, accurately encapsulates the alternative fuel industry and especially ethanol. Yet it was Reagan, that stalwart of small government and free enterprise, who signed bills extending loan guarantees for the then-nascent ethanol industry. What does this have to do with aviation? We may be about to do it again in the name of preventing aviation from fouling the air with carbon dioxide and turning the planet into a hot house that will melt the polar icecaps.

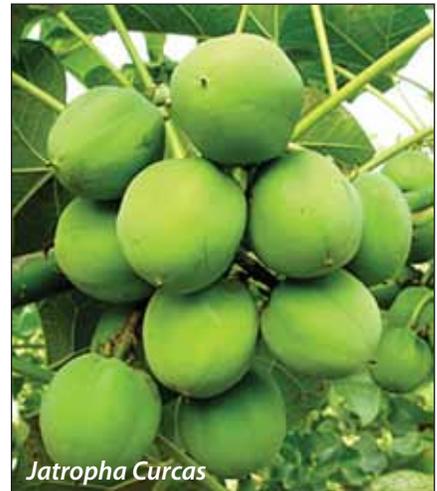
A little history: The ethanol industry traces its roots to the Nixon administration, whose agriculture department pushed for more corn production and propped up the inevitable price collapses with government subsidies. When technology emerged to convert corn into high-fructose sugar and, eventually, ethanol, the farm lobby struck gold. It engineered Congressional loan guarantees, price subsidies and even tariffs to protect the industry against cheaper foreign competition. The ostensible cover for politicians voting for these programs was that ethanol would help the U.S. achieve energy independence which was then as it is now, preposterous. (Recall that in 1982, the Arab oil embargo was still fresh in the memory of many, as was the second oil supply shock of 1979.)

Yet the subsidies remain. Although voters are wising up—there was a bipartisan effort to kill the subsidies and tariffs in late 2010—ethanol industry tax support was extended for at least another year as part of the president's tax deal. But there's growing market rejection of ethanol and it may yet be forced to stand on its own economically.

Meanwhile, aviation is leading the charge for the next round of potential juicy subsidies: so-called advanced biofuels. These include a range of technologies including cellulosic (rather than distilled corn) ethanol, hydro-treated renewable jet fuel from various feedstocks and Fischer-Tropsch-derived synthetic kerosenes. This time, the fear factor cudgel is climate change. These fuels are seen as greener, emitting less carbon dioxide than traditional petroleum-derived fuel. As an added pot sweetener, the military is solidly behind these programs, both because of climate change considerations and strategic supply concerns. Military testing has lent early credibility that the ethanol industry never enjoyed. Moreover, there's a lot of government money circulating to support this development and despite budget cutbacks, more is likely coming.

None of this means that advanced biofuels will prove remotely economically sustainable unless the price of oil hits some unknown tipping point. (It could.) Similar rosy predictions were promised for ethanol and 30 years later, they've failed to materialize. The danger is that we evolve into a fuel economy with continuing subsidies for ethanol and more and larger ones for advanced biofuels, hoping against hope that they too will eventually turn the economic corner as ethanol never did.

So as an aviator, you definitely have a dog in this fight, even if you fly a piston airplane. Swift Fuels is the highest visibility player in the piston aviation biofuels game and what happens on the larger stage will affect its fortunes. Thus far, the technology isn't evolved—or at least proven—



Jatropha Curcas

continued on page 32

Sunglasses Reflections

Sunglasses (see December 2010 *Aviation Consumer*) are always a great subject. I purchased Veldalo Titanium sunglasses a few years ago after reading about them in *Aviation Consumer*. This was my first encounter with copper-rose (Blue Blockers) sunglasses and I loved them. They worked best at twilight, amplifying contrast. A problem I had was my glass cockpit displays, which had a washed-out look.

I got a pair of free glasses at the last Consumer Electronics show in Las Vegas. While the glasses look funky to my friends, they work great, are comfortable and let me view my glass panel with no problems.

I still use the Veldalo glasses for driving and skiing. Not only do they cut glare and enhance contrast, they are very comfortable and look great. Customer service is also excellent. When a hinge broke over a year after I purchased them, Veldalo replaced them at no cost.

Frank Singer
Huntington Beach, California

Spider Comments

Thanks very much for your very fair comparison between Spidertracks and SPOT in the last issue. You got to the nub of the issue—we are more expensive but you really do get what you pay for.

However, there were a couple of things you may not have realized, which I felt compelled to point out.

The key thing is that we are much more than just a personal locator-type system.

For example, the active monitoring watch mode can be set to turn on automatically when the aircraft takes off and we send the SOS messages automatically when the

system loses contact with the Spider. It also makes the system pilot-proof, because they don't have to turn it on and crash-proof because the alert is sent by the system, automatically and within minutes, without the pilot having to do a thing.

While we do offer this active monitoring as a pilot-activated option during flight, the S3 model, designed specifically for GA/recreational-type pilots comes with Spiderwatch active monitoring turned on as standard.

This puts us squarely in the category as a potential replacement for an ELT, rather than just another tracking system and to us this is pretty important. As I'm sure you are well aware, ELTs have a very poor track record. The 121.5 MHz ELTs failed to transmit in over 75 percent of accidents in the U.S. during the 1990s. From our experience in New Zealand, 406 MHz ELTs have no better success rate.

You're right, we don't claim we operate like an ELT. We claim ELT technology is redundant and fourth generation tracking-based location systems like ours are the future for locating downed aircraft.

A couple of other key points which can make all the difference to the pilot are: We're two way, so the user can see the message has gotten through, which makes a big difference if you're in the middle of nowhere and have no other way of knowing whether your SOS has been sent.

You picked up on the importance of the two-minute versus the 10-minute update rate—crucial if you are flying at 100 knots or more if you want a small defined search area.

And another key feature we offer is the automatic texts or e-mails that can be sent to the pilot's nominated recipients automatically when

the aircraft accelerates through 40 knots with Spiderwatch activated and when the airplane lands and/or Spiderwatch is turned off.

This additional feature turns the system into an automatic flight following system for those who don't have an operations manager doing their dedicated flight following.

Rachel Donald
Marketing and Communications
Spidertracks

Where Are Trends?

I've been reading your reviews of various advanced instrumentation for aircraft, like the "Glass for LSAs" in the November 2010 issue and have yet to see any mention of a feature I've been expecting, but never seen in aircraft instrumentation: Display of values varying over time to allow easy identification of adverse trends.

In a prior career, I worked in a nuclear power plant and before that on Navy submarines. For various critical parameters (such as oil pressure supplied to the turbines) we had an instrument which had a pen connected to the display, so that not only was the current value displayed, but we could also look at a paper chart that spooled by under the pen, to see how the value had changed over time.

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CONTACT US

Editorial Office
941-929-1693
E-mail: avconsumer@comcast.net

Subscription Department
P.O. Box 420235
Palm Coast, FL 32142-0235
800-829-9081

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Portable Traffic Alerters: Zaon + Garmin Works

Portables won't catch all traffic, but for lower budgets, it's the only option. We think a Zaon XRX and a Garmin portable is the best solution.

by Larry Anglisano

There may not be widespread midairs out there, but we wiggle in our seats in busy airspace and non-controlled fields. If you fly a glider, rental or don't have 10 grand in your budget for a traffic alerting system (TAS) install, a portable traffic system can fill the gap.

But these aren't active systems like TAS. Portable systems are passive, simply listening for 1090 MHz transponder transmissions of other aircraft. Some designs suffer from pulse suppression issues. The result is nuisance alerts that might have you reaching for the power switch in busy airspace. In a traffic-rich environment position accuracy is also a concern.

Interpreting the data on a small screen—especially when it's on top of the glareshield in a sun-splashed cockpit—is tough. Tying it to a portable GPS map screen solves this issue, but with added wiring clutter.

Given that rules vary for LSAs and certified aircraft, we tested several configurations: Some connected to external L-Band antennas, some installed in the panel

and some plopped on the glareshield (which became a projectile in turbulence). We tested in high-wing, low-wing and a helicopter. We also tested on the ground, evaluating effectiveness for spotting targets in the pattern before takeoff. We compared the units to on-board TIS and TAS systems for yet more drama.

Our testing grounds was a slice of central Connecticut Class D airspace sandwiched between New York's Class B and Hartford's busy Class C. Finding threat targets to paint in any direction was not a problem. We admit to some tension.

ZAON PCAS MODELS

PCAS stands for Portable Collision Alert System, and the PCAS XRX Onyx (used to be SureCheck) is the flagship offering with a street price just south of \$1500. It did the best at spotting traffic of any in the test group and has the most features.

The XRX can play its traffic on everything from the Honeywell AV8OR or later-generation Garmin portables to Anywhere Map software. It also interfaces with LSA/experimental

CHECKLIST

-  Reasonable alternative to high-priced TAS, especially the Zaon MRX.
-  Connection to portable GPS improve utility.
-  Flagship Zaon XRX can be a handful of wires and bulk in the cockpit.

cockpit displays from Grand Rapids, Advanced Flight and others. The XRX is unique with display of target bearing and two configurable screen options, including a top-down, 3-D quadrant view. It has a serial port and an audio interface on the rear of the case (rugged power/data cable optional). Speaking of audio, the XRX offers tone or voice alerts that can be routed through headsets with a plug-in adapter which Zaon calls Headset Direct. It worked well with our Bose headsets when the extra wires weren't getting in the way.

We think the XRX traffic presentation and azimuth function is the most detailed of any of the portables. The unit detects and paints up to three target aircraft and bearing data is depicted with on-screen arrows. It also has intuitive menus for setting range—either one, three or six nautical miles as well as relative altitude window of ± 500 , 1500 or 2500 feet. You can even configure whether the host aircraft is a high- or low-wing. An optional ground mode won't show traffic less than 200 feet above. For traffic resolution, the system uses integral altimeter, compass and turn and bank, and thermal sensors. As a result, there's display of local squawk code, altitude, bank angle, bearing and temperature offering some critical and useful flight data. It even works in a pressurized cabin.

If you are looking for a low-profile and inconspicuous model, the XRX

The budget Zaon MRX is small and effective. It has the potential for panel mounting as well.



Placement of the XRX is critical to performance and the XRX can be awkward to find a home for. It created significant mag compass error in one of our test aircraft. The MRX is much easier to slap and go.

has a small footprint but there's an awkward signal amplitude/phase cancellation antenna protruding from the top of the case. In fact, we struggled to find a good way to keep the XRX in place and forward facing when jumping from aircraft to aircraft. Proper placement on the glareshield is critical to bearing resolution and you need to be careful mounting the unit too close to the structure. Zacon warns of potential aft-shadowing in metal airplanes—up to 60 percent in some cases. In the XRX's defense, we didn't use the included Velcro mounting dots or silicon feet during our testing.

Despite its awkward shape, the XRX stamps a small footprint. Its intuitive, back-lit LCD display is unfortunately difficult to view in direct sunlight. Connecting to a portable map display would be worthwhile.

Operating on and around a traffic-packed instrument approach in a Skylane, the unit was busy calling other targets above and below coinciding with the onboard TIS datalink transponder. It missed a Regional Jet that was smoking along and quickly catching up to us on the localizer. We assume it was that aft-shadowing Zacon warns of.

For a shirt-pocket option, we like the Zacon MRX. The MRX is about the size of a deck of cards and its shape makes it possible for in-panel mounting, unlike the XRX. It also only costs about \$500. You can operate the MRX on a couple of AA batteries or plug into ship's power. The MRX won't work in pressurized cabins since it uses an integral altimeter to determine the local altimeter setting.

The tiny MRX had a high-quality feel, and we were impressed with the portable antenna and right-angle RF connector. We flew the unit stand-alone and in a Piper that had a dedicated L-Band blade-style antenna, affording the best potential performance. There were some limitations and the unit offered some head-scratching bogus call-outs. We



wondered if it was our own pulse it was calling. ATC confirmed there was no traffic in our vicinity.

MONROY ATD-300

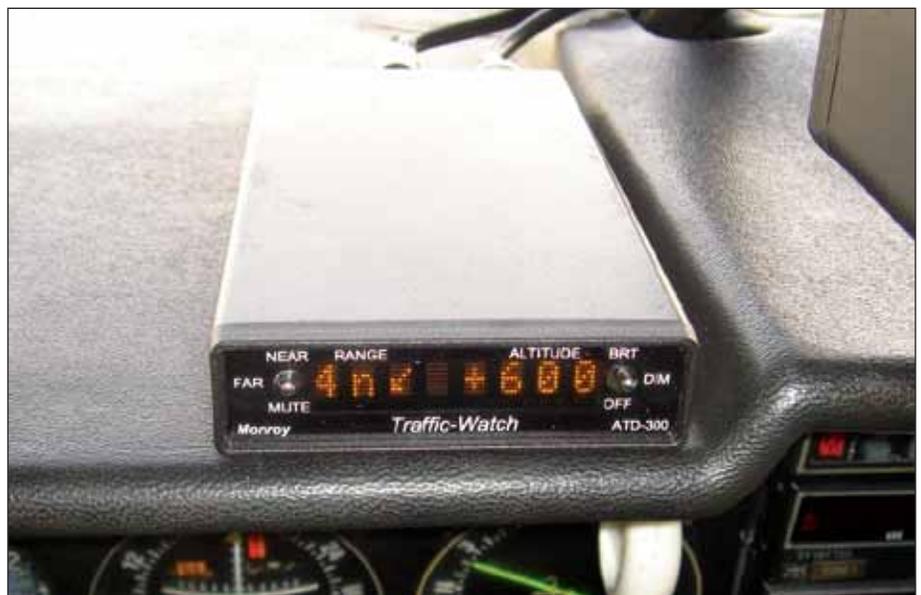
A pioneer in portable traffic devices, the Monroy ATD-200 was the first low-cost semi-portable. The product has matured into the \$795 ATD-300 Traffic Watch+, which is a similar design that has PMA and STC approval. For existing ATD-200 setups, you can easily drop in the newer ATD-300.

There are two versions of the ATD-300. The Plug-and-Fly kit simply plugs into the cigarette lighter plug and uses a portable antenna. Plug and Fly is limited to calling transponder replies and distance only and has a range of five nautical miles. For directional information on the traffic, Monroy offers the ANT-300 external L-Band fiberglass antenna.

The small ATD-300 resembles an automotive radar detector. It's simple to operate with a simple display that tracks one threat at a time. We like the easy-to-interpret high-vis display of the Monroy, but were less impressed with the unit's performance. The unit we sampled was panel-mounted and interfaced with an external antenna.

As with the earlier ATD-200, the unit seemed to pick up host transponder replies even when connected with a Comant blade-style external antenna. To be fair, there wasn't much separation between the traffic antenna and the transponder antenna and neither had shielded low-loss coax. These are important points with a permanent installation.

The Monroy ATD-300 shows range, altitude and direction when connected to an external directional antenna.



CONTACTS

Monroy Aerospace 954-294-9006 www.monroyaero.com	Proxalert, Inc. 602-992-3120 www.proxalert.com
NavWorx Inc. 888-628-9679 www.navworx.com	Zaon Flight Systems 800-496-9430 www.zaon.aero

The ATD-300 provides distinctive female voice warnings for traffic at different ranges. For instance, when the unit is set in the far mode, targets at three miles and ± 1000 feet is announced as "Traffic." When set in the near mode, only traffic within one mile and 500 feet is announced as "Traffic nearby." When there is no traffic activity, the ATD-300 automatically displays the onboard Mode C altitude data and bus voltage monitor. The ATD-300 can display on panel-mounts, such as Garmin 430/530s and Aspen PFD/MFDs.

PROXALERT R5

We tested the R5 in our last portable review back in 2007. It performed well and was rich with functions, such as an altitude-deviation alerter. It's designed for mounting on top of the glareshield and uses a portable L-band antenna. Aircraft Spruce sells it for \$795.

But we couldn't get through with the company for a fresh sample or get updated information. No matter

how good a product may be, it's nothing without prompt factory support when needed. Caveat emptor.

NAVWORX PADS600

We covered the NavWorx PADS600 in our ADS-B roundup in the October 2010 issue. The \$1495 PADS600 receives TIS-B broadcast traffic and displays the targets on a variety of third-party displays, including Garmin portable GPS units. NavWorx told us, however, they aren't focused on portable ADS-B but instead on fully TSO'd, mandate-compliant systems. This has us contemplating the longevity of the PADS600.

PANEL MOUNTING?

To avoid lugging the system around, and to potentially improve performance, permanently mounting one of these systems is tempting. This is seldom easy or inexpensive and might not be legal.

The PMA-approved Monroy ATD-300 has an STC for limited applications, which may help. But ultimately, it's up to the installing shop whether any installation requires official approval. Interestingly, the Non-TSO/Non-STCd Zaon MRX has a complete section in its installation guidelines offering advice on return-to-service approval options. It makes no promises, but Zaon offer an impressive bundle of install hardware to get the physical job done.

As we noted, the best performance comes from connecting the portable to an external antenna. If your aircraft has an abandoned transponder or DME antenna system remaining on the airframe, you might be in luck as long as the system doesn't have any defects. Otherwise, the install cost will depend on how much interior must come out.

CONCLUSION

We thank Sporty's for supplying some of our test units. They told us sales of the Zaon XRX system with the optional Garmin interface cable is way up and we can see why. We found the XRX and smaller MRX to be solid performers.

None of the portables perform as well as a real TAS or TCAS system. You can't expect them to. However, a portable can be better than a TIS datalink system at times due to coverage holes. A portable also works on the ground.

We think the Zaon XRX coupled to a third-party display is the best the portable market has to offer. But it's also the priciest and has the most cabling to deal with. Best case is the XRX connected to the GPS that's in a Gizmo dock where you can hide all those wires behind the panel. Worse case is putting both units on top of the glareshield while creatively routing the wires. If that's more cost or trouble than you want, our advice is a stand-alone MRX. It should get the job done for little money.

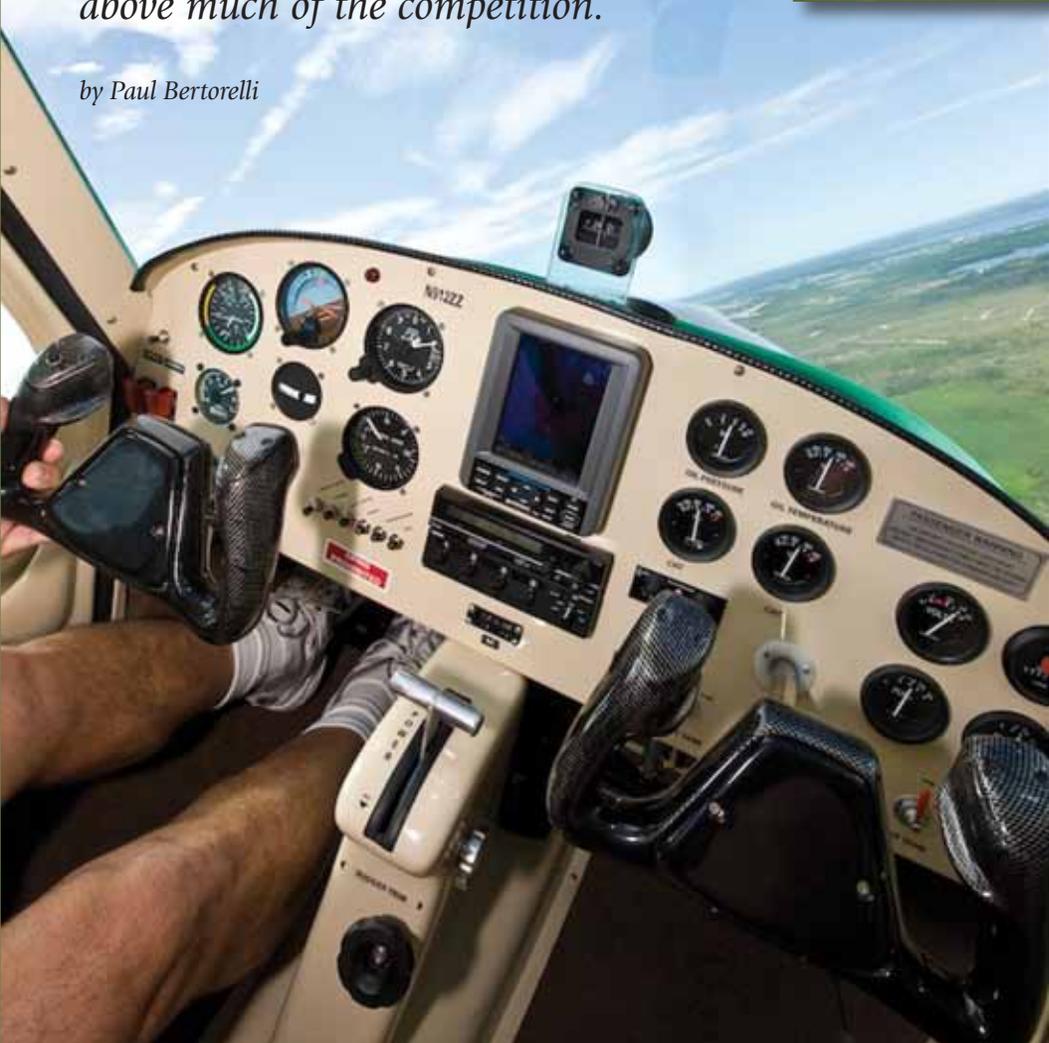
	PRICE	SIZE	EXTERNAL INTEGRATION	COMMENTS
ZAON XRX	\$1,495	3.9 W X 2.7H X 3.6D	WIDE VARIETY PORTABLE GPS, MAPPING AND EXPERIMENTAL MFD (BLUETOOTH OPTIONAL)	3-D PRESENTATION AND RICH THIRD-PARTY INTERFACING, ADVANCED DESIGN
ZAON MRX	\$549	2.5 W X .6 H X 4.2D	NONE	EXCELLENT PERFORMER EVEN WITHOUT EXTERNAL ANTENNA, CONVENIENT SIZE
MONROY ATD-300 PLUG & FLY *	\$795	2.8W X 0.8H X 5.0D	ARINC429 TO GNS400/500, ASPEN, HONEYWELL	EASY TO PANEL MOUNT, LIMITED TARGET TRACKING AND DISPLAY, HAS PMA/STC
PROXALERT R5	\$795	5W X 1.8 H X 4.7D	NONE. SOFTWARE LOADED THROUGH SERIAL PORT	GOOD PERFORMER IN PRIOR TESTING, ALTITUDE ALERTER, SUPPORT QUESTIONABLE
NAVWORX PADS600	\$1,495	6.1W X 1.5H X 5.4 D	WIDE VARIETY PORTABLE AND PANEL MOUNT, BLUETOOTH	LOW-COST WAY TO PLAY IN ADS-B (TIS-B) DATALINK WORLD

* ATD-300 PANEL KIT ADDS PANEL-MOUNTING HARDWARE AND EXTERNAL BLADE L-BAND ANTENNA FOR \$1295

Paradise P1 Lexus in Waiting?

Designed as a heavier airplane, the P1 flies like one, too. Its interior is a cut above much of the competition.

by Paul Bertorelli



CHECKLIST



Originally designed with a 1650-pound gross weight, the P1 loafs as an LSA.



Big airplane touches such as sliding seats, rudder trim and visors are welcome.



Interior detailing is superb throughout and the airplane is quiet in flight.



Paradise isn't geared up for volume yet and the company may not be able to deliver for awhile.

place. It was conceived originally intended as a small, inexpensive utility airplane for the Brazilian outback. It first flew in 1999 and more than 130 are flying in Brazil.

In the world of LSAs, this makes it an odd duck: It was originally designed with a maximum gross weight of 1650 pounds, so it theoretically has a useful load of about 800 pounds. Since the LSA limit is 1320 pounds, its real useful load is about the same as everything else, around 500 pounds, depending on equipment.

But at the higher weight in its original form, it has the weight and rough size of a Cessna 150. (The wingspan is 31 feet, compared to the 150's 33 feet and it's about 3 feet shorter than the Cessna.) But the P1 kills the Cessna in overall performance, cruising at 110 to 115 knots and out climbing the 150 by a couple of hundred feet a minute. That puts it in the same league as many of the other LSAs—faster than some, slower than others. But what it gives up in speed, it makes up in range. The P1 sports a prodigious 38

LIGHT SPORT FLIGHT TEST

Buyers of light sport airplanes say they want cheap, basic models, but when the check is to be written, what they really buy are upscale airframes with glass panels and whatever creature comforts can be gotten into the airplane. That's why the top LSA sellers aren't the lowest priced models, but nearer the highest.

The Paradise P1 fits this mold, more or less living up to what the company's sales manager, Chris Regis, calls the Lexus of LSAs. He's not far off the

mark, given the airplane's detailing, price point and the degree to which you can customize the panel. But we would make another comparison: It's a modern Cessna 150. We'll get to why in a moment.

BRAZILIAN ROOTS

Like the majority of current LSAs, the P1 is an import, but from south of the border, not Europe. The airplane emerges from Brazil's lively aircraft market and was designed before the ASTM light sport rules were put in



The P1 is available with three engine options, including the 100-HP Rotax 912UULS, top. The Warp Drive prop is ground adjustable, but a Kiev prop is also an option. Paradise's Chris Regis, left, reclines in the P1's large baggage compartment. The right seat is easily removable to allow access.



The right seat is easily removable to allow access.

gallons of gas capacity, giving it seven hours of endurance, depending on engine choice and power setting. Even if you don't plan long cross countries in an LSA—and many owners don't—this gives you the option of either tankering cheap fuel where you find it, or just not having to worry about refueling after every couple of flights.

The P1 is equipped with integral metal wing tanks—one on each side, with a left/right/off valve—and it's approved to burn E10 autogas in any of the Rotax engines available as options. These include the 80-HP 912, the 100-HP 912 ULS and the 115-HP 914. All of the engines have a three-blade Warp Drive composite prop, but a Kevlar/glass Kiev prop is an option.

Although the Rotax seems to be

happy with E10, this fuel has obvious drawbacks. As we reported in the January 2011 issue of *Aviation Consumer*, the fuel is hydrophilic and owners who use it report that it can absorb moisture both during flight and in storage. To reduce the risk, either fly a lot or stick with 100LL.

Although the Rotax engines don't like 100LL, they can operate on it without substantially raising maintenance costs. Operating on unleaded fuel, Rotax engines can run for 100 hours on a single oil change. With leaded fuel, the interval is cut in half.

LUXURY CABIN

The P1's construction is reminiscent of the Symphony SA160, although it's obviously smaller. Like the Symphony, the P1 is constructed of welded steel tubing skinned with composite from the cabin section rearward. The doors, wingtips and cowling are glass, but everything else is riveted aluminum.

To minimize vibration and noise, the skins on both are bonded with Sikaflex and riveted. The control system is conventional cables, with a manual and optional electric trim system operating a moveable tab. It

also has adjustable rudder trim, which is unusual for an LSA.

Rather than a stick, the airplane has a yoke, giving it a larger-airplane feel and representing a departure for the majority of LSAs, which have center sticks. The airplane's flaps can be either manual or electric, at the option of the customer. The manual flaps are controlled by a Johnson bar between the seats. The P1 also has another unique option: The airplane can be equipped from the factory with hand-only controls for operation by a paraplegic pilot. While that's obviously a niche market, it's in keeping with Paradise's philosophy to innovate and respond to customer requirements.

As for options, the P1 may have the most extensive list of add-ons in the LSA field, especially with regard to avionics. There are four basic packages, ranging from a round-gauge panel all the way to a full-up a dual-display Dynon Skyview package. The base price is \$117,312 while the dual-screen Dynon version is priced at \$139,312.

Where the P1 distinguishes itself is in interior accommodations which are, by any standard, quite commodious. The seats are large and comfortable and, as with heavier airplanes, adjustable via sliding rails. Moreover, there's a quick removal option that allows the seats to be popped out easily, without tools. This is a plus for any airplane used for utility purposes. The standard seats don't recline, but there's an option to add this capability.

With sliding seats, there's no contorting yourself to reach a rudder adjustment control or putting up with having your knees in your chest for lack of leg room. In the airplane

AC TV



For a video demonstration of the Paradise P1, log onto www.avweb.com and select the video index in the upper right home page. Scroll down directly to the Paradise video.

we flew, the seats were nicely detailed in Brazilian leather, with three-point harnesses and headrests.

The interior detailing might be thought of as a modernized version of Cessna's mid-1970s motif. No, not Royalite, but molded plastic and carbon fiber parts that give the airplane a decidedly automotive (and quiet) feel. The panel is flat metal, finished in a customer-specified color. Side panels and a center console are molded plastic—also available in different colors.

The console even has a pair of cup holders, something usually overlooked in even top-end airplanes. There are generous sun visors, another detail many LSAs skip. LSAs tend to have generous baggage areas, although getting stuff into and out of them isn't necessarily easy. The P1's baggage area is 30 cubic feet, with a stated capacity of 70 pounds. In the Brazilian version, the weight limit is 330 pounds. It's accessible by tilting the seats forward, giving what is average access for the class. With one seat removed, it's possible to recline in the airplane and use it as a makeshift camper. A rear skylight provides enough light to find things in the very far reaches of the baggage compartment.

The cabin is well ventilated, with both panel vents and cabin-window mounted blast vents. Since Rotax engines are water cooled, the heater uses an automotive-style core with a blower, thus reducing if not entirely eliminating worries about carbon monoxide in the cabin.

FLYING IT

If we have any significant complaint about the P1, it would be getting into and out of it. The cabin itself is large enough, but it's not very tall, meaning headroom is limited and due to structural considerations, there's a top sill right below the lower surface of the wing. This means you have to duck down to squeeze yourself into the seats. It's not exactly painful, but doing it gracefully requires practice.

Once you're in, the headroom is adequate, but not generous. Although we were comfortable, those long of torso might scrape a headset band on the headliner from time to time.

Cockpit visibility is excellent forward and out the side windows, although it's somewhat restricted by the door posts, requiring a little head craning to pick up the runway on the



Compared to other LSAs, the P1 lacks cabin height so getting in requires a duck, above. Seats are adjustable on rails, as in Cessnas, and have a quick-release option for removal, right. Big airplane features, such as rudder trim and console cup holders, lower right, are a nice touch.



turn from base to final. This is the typical tradeoff between high-wing LSAs and low-wing designs, which generally have unrestricted bubble canopies. On the other hand, the bubbles have proven oven-like during the summer.

There's nothing exceptional about the operation of the P1. It's typical Rotax. Turn the key, start it up, warm it up and take off. However, the airplane is equipped with a pair of covered toggle switches for the ignition systems, rather than the traditional left/right key positions.

One pleasant surprise in flying the P1 is its handling. Because of their light weight and size, almost all of the LSAs we've flown have a less-than-pleasant twitchy feel, especially in pitch. For pilots used to heavier certified airplanes—that's most of us—these airplanes require accommodation. And in our view, the neutral or near-neutral stability some of them have may not meet ASTM standards.

In contrast, the P1 flies and feels like...a Cessna 150 or even a 172. Right at rotation, we noticed the pitch forces are just heavy enough to prevent over pitching, but not so heavy as to require a grunt to coax the thing off the runway. Many pilots who fly



LSAs are surprised at how difficult they are to rotate smoothly, but the P1 is the exception. It also has what we could call conventional stability. If aggressively displaced in pitch, it oscillates two or three times and finds the trimmed airspeed, while a few LSAs we've flown simply hold the pitch while the airspeed decays.

Roll forces are on the light side, again, much like the Cessna 150. The airplane isn't trim hungry, but rather than a trim wheel, it has a small T-lever mounted on the console between the two seats. This requires a

WHAT'S SELLING? NOT MUCH

If 2009 was a dismal year for LSA sales, 2010 wasn't much better. In fact, according to Dan Johnson, it was a little worse, although some manufacturers did much better, especially Piper. Johnson keeps track of all things LSA and posts data on his Web site, www.bydanjohnson.com.

The chart at lower right shows his top 10 sales data ending in November 2010. Johnson's data shows 218 new registrations for 2010, down 4 percent from 2009, which was itself a dismal year. That leads Johnson to believe that 2011 may be stronger, since demand is known to be out there, credit is available and buyers say they're on the verge.

Even though sales were off for 2010, there were winners, according to Johnson. Piper made major gains with its PiperSport accounting for 24 percent of all registrations during 2010.

While that's a respectable showing, it doesn't necessarily reflect actual sales activity, since Piper may retain some of those airplanes in inventory. After months of delays, Cessna is also gaining a little traction with its Skycatcher, although

it's a long way to filling its backlog of orders. Johnson said 29 Skycatchers appeared on the registry, accounting for 16 percent of 2010 registrations.

In terms of overall market share, the chart below shows the ranking. With its early start and well-respected brand, Flight Designs continues to dominate the field, with 320 airplanes registered, amounting to 16 percent of the market, the largest single share. Paradise is ranked number 20, with 15 airplanes registered.

AIRCRAFT	MODEL	NUMBER	MARKET
FLIGHT DESIGN	CTLS	320	16.7%
AMERICAN LEGEND	LEGEND CUB	157	8.2%
CZECH SPORT	PIPER SPORT	148	7.7%
CUB CRAFTERS	SPORT CUB	148	7.6%
TECNAM	P2008, MULTIPLE	138	7.2%
REMOS	GX, MULTIPLE	120	6.3%
JABIRU USA	J-250, MULTIPLE	96	5.0%
EVEKTOR	SPORTSTAR	92	4.8%
SPORTAIR	STING S3, MULTIPLE	73	3.8%
EASTMAN	CH-650XL	73	3.8%

little getting used to, because aircraft as light as the P1 require trim in small doses—a quarter turn on a trim wheel translates to a miniscule movement of a lever. We found nothing unusual in slow flight or stalls, so the airplane should be an excellent trainer.

It's also a respectable cruiser. On an empty weight of about 815 pounds, a single pilot could top the tanks and still have room for 70 pounds of baggage. That translates to six hours of endurance with a generous one-hour fuel reserve. In still air, that's about

650 miles of range. Not bad for an LSA. Cruise speeds are claimed as 110 knots at 75 percent power and that's about what we recorded, more or less, making the airplane suitable for modest cross-country flying.

COMPANY PROFILE

The Paradise line was started in the late 1990s by Brazilian businessman Noe de Oliveira S. Filho, a self-taught aeronautical engineer. It remains privately owned and mostly self-financed, although Chris Regis told

us the company will seek financing to expand its U.S. facilities.

Currently, the Brazilian factory has a nominal capacity of 120 aircraft a year, but because of labor shortages, it's building half that number. The current downturn has definitely not hobbled Brazil. Brazil's economy has been expanding at a red-hot 9 percent and only slowed to 6 percent in 2010.

According to Regis, this has resulted in a problem other manufacturers might like to have: The factory can't keep up with demand and is struggling to expand. As we go to press with this issue, Paradise is moving from its Sebring, Florida, location to larger quarters once occupied by Piper at Lakeland, Florida. Regis told us the company will likely expand that facility to include at least an assembly if not a fabrication factory.

When we visited Sebring, the company was assembling finished aircraft from parts fabricated in Brazil, but Regis said the Brazilian capacity isn't sufficient to meet even domestic demand. Regis showed us a modest inventory of P1 parts, so we suspect the airplane would be well-supported. Also, Lockwood Aviation is widely known for its expert support of the Rotax line and it's located at Sebring.

CONCLUSION

Like every other LSA out there, the P1 has to live or die in a veritable ocean of competition. At present, it's a relative unknown and, according to Dan Johnson's LSA market reports, Paradise has only 15 sales in the U.S., representing less than 1 percent of the market as of late 2010.

Normally, that would cause us to be cautious of this airplane, but the fact that it's coming out of a South American country with a booming economy suggests that the company might have staying power. Our impression is that it's appropriately lean, but also properly stocked with support parts and infrastructure. That makes it worth watching and that's what we intend to do next time we do an LSA comparison report.

CONTACT

Paradise Aircraft
www.paradiseaircraft.us
863-655-0179

In-The-Ear Headsets: Halo is a Top Value

A headset based upon earplugs isn't for every head or every mission, but the Halo offers comfort and versatility. Lightspeed's Mach 1 is the best performer.

by Jeff Van West

After a couple of hours, most people are ready to get out of a traditional, skull-clamping headset. Go eight hours in a sweaty cockpit, and wearing even a top-of-the-line Bose A20 or Lightspeed Zulu gets old.

The alternative is an in-the-ear (ITE) headset, which is fundamentally a pair of earplugs with speakers and a mic. Don't knock earplugs. When inserted correctly, they offer noise reduction comparable to all but the best ANR headsets (We tried. It's true.) They don't clamp down on your head or cause sweat to bead up around your ears, either.

Still, they aren't for everyone. They require more practice and patience than a headset you can just toss on. They aren't for pilots who jump in and out of aircraft all day. ITE headsets are small and light, but the thin

cords and tubes are more susceptible to tangling or breakage. And then there's earwax. It will get on the earplug tips (call them eartips) and require keeping a bag of them on hand to replace as needed.

The eartip material of choice is foam, which must be inserted into the ear canal and held there as it expands to fit. When we tried ITEs during a mid-Atlantic summer a few years back, we had to be quick to get the compressed foam in the ear before it expanded. This time it was during a Maine winter and we had to wait until our body heat warmed the things before they expanded at all. All vendors offer silicone tips that simply slide in as an alternative, but we think their noise attenuation is too poor to recommend.

QUIET TECH HALO

Quiet Technologies has been at the ITE headset game for a while with several product variants. Their Halo is the current offering and is the lowest price of any of the ITE options at \$349. Replacement eartips are \$1.50 a pair. We also found it to be the most comfortable with three options for wearing: over the

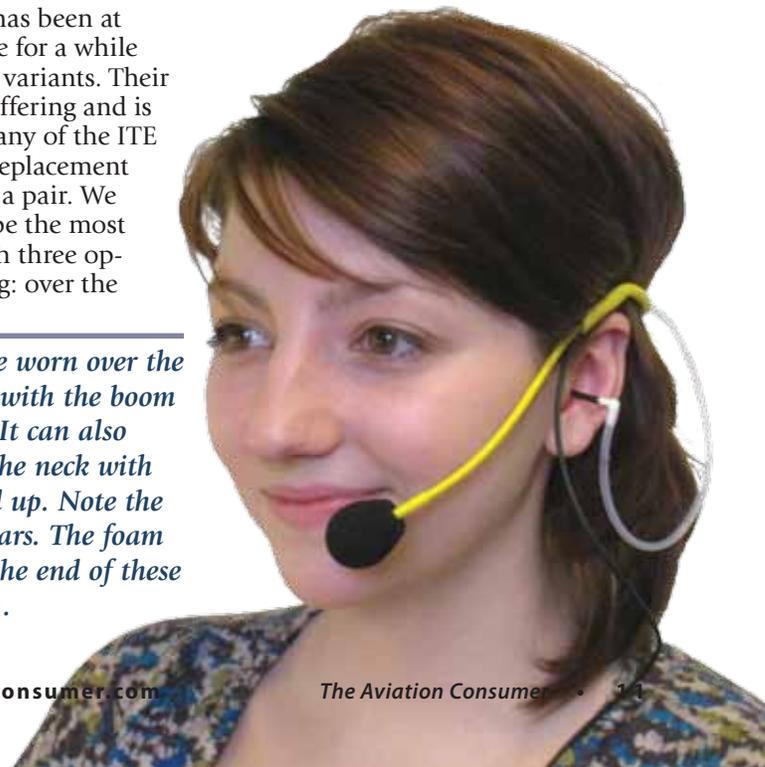
The Halo can be worn over the head or behind, with the boom switching sides. It can also be draped over the neck with the boom pointed up. Note the long tubes to the ears. The foam eartips press on to the end of these tubes (upper right).

CHECKLIST

-  Excellent choice for long trips or if irked by traditional headsets.
-  Noise reduction similar to most ANR without batteries.
-  More complicated to use than a "toss it on, toss it off" headset.

head like a headband, behind the head and over the ears (like glasses worn backwards) and loosely resting on the shoulders behind the neck.

Headband and behind the head were equally comfortable and worked well with glasses and hats. The metal band is wrapped in a soft plastic sleeve. The band can be shaped to fit the head better and offers a tighter or looser fit. It was easy to get enough pressure to keep the boom mic in place but keep it light enough to forget we were wearing it. The over-the-shoulder orientation



ATTACH STYLE		HITS	MISSSES	PRICE
CLARITY ALOFT STANDARD	OVER THE EAR, BAND BEHIND THE HEAD	SOLIDLY BUILT, SECURE MIC PLACEMENT, HEAD BAND ADJUSTMENT, MUSIC INPUT	COMFORT OVER TOPS OF EARS AN ISSUE FOR SOME PEOPLE	\$525
CLARITY ALOFT PRO	OVER THE EAR, BAND BEHIND THE HEAD	TSO'D, SOLIDLY BUILT, SECURE MIC PLACEMENT, MUSIC INPUT	COMFORT OVER TOPS OF EARS AN ISSUE FOR SOME PEOPLE	\$695
LIGHTSPEED MACH 1	IN THE EAR, LOOP OVER THE EAR	EASIEST TO DON/REMOVE, CELL/MUSIC INPUT, MOST COMPACT, BEST MUSIC CLARITY, CUSTOM MOLD OPTION*	LEAST SECURE MIC WITH FOAM EARTIPS, CELL/MUSIC REQUIRES BATTERY POWER	\$425
QUIET TECH HALO	OVER THE HEAD, BEHIND THE HEAD OR ON SHOULDERS	MANY WEARING OPTIONS, "NATURAL" SOUND QUALITY, BEST PRICE	SOUND TUBES CAN SNAG ON ITEMS, LEAST ROBUST CONSTRUCTION, NO MUSIC INPUT	\$359
* ADDS ABOUT \$300				

would be fine for a passenger who was just listening, but the mic doesn't move with the head, so it's not for someone regularly talking.

The Halo had excellent clarity of sound, especially for voice. ATC transmissions sounded more like live speech than radio when tried side-by-side with other ITEs in the same aircraft. We kept turning the volume down as the foam further expanded and sealed. Music, while still quite pleasant, seemed a bit clipped at the high and bass ends of the spectrum

unless we adjusted the input to boost those. Music is only through the intercom as the Halo has no integral music input.

The sound tubes on the Halo are long and easy to get caught under the headband or snag on a seatbelt. We learned to insert the eartips such that the tubes curled and lay close to the head to prevent this. Phil McCandless of Quiet Tech says these tubes can be shortened an inch with minimal audio effect (in fact, it boosts the treble a bit).

The Halo was the most critical ITE in getting the earsel complete. Having a tube pulled out of even one ear made the radio unintelligible. Attaching fresh eartips is also a more delicate maneuver with the Halo than the competition. While not fragile, it's clear a Halo wouldn't hold up to the abuse you could level on something like a David Clark. That said, Quiet Tech is a small company with excellent support and the Halo has a two-year warranty.

LIGHTSPEED MACH 1

The Mach 1 is the most feature-rich offering, with a jack for music or cell phone connectivity (no Bluetooth, sorry), auto muting of music and intercom isolation. Isolation is for a passenger using the Mach 1 who doesn't his phone call shared with the entire cabin. The Mach 1 also has no headband. It fits over the left ear like a cell phone headset. That alone is a big selling point for some.

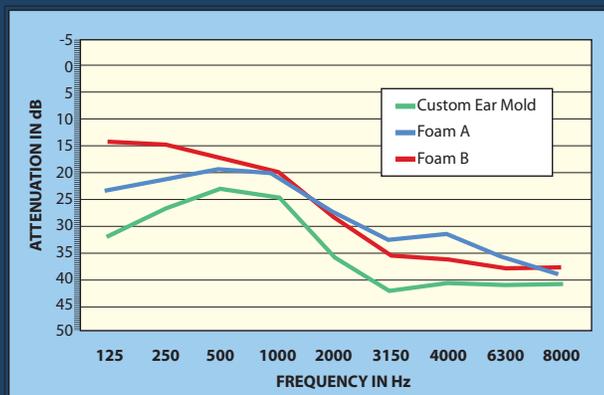
Unlike the Halo or Clarity Aloft, which use tubes to carry the sound partway to the ear, the Mach 1 has speakers directly at the eartips. This gave the Mach 1 excellent sound overall and the best sound for music. It also had the best sounding mic—as good as any headset we've tried, in fact. The volume controller is about the size of a deck of cards and has a jack for connecting a music player or a cell phone (cables included), but these functions (and only these functions) require an internal battery. Lightspeed says the round CR2032 battery lasts 100 hours.

BUILT CUSTOM FOR YOUR EARS

Don't like the idea of rolling foam, sticking it in your ears and waiting for it to expand? Well, you can hop down to your local audiologist and get him to make a custom mold of your ear canal and send that in to Lightspeed. They'll make custom earpieces that fit you and you alone. No waiting for foam to expand (but you still have to clean off the earwax).

Custom earpieces should provide even better seal than foam and better attenuation. Most report that this is the case, however, Phil McCandless of

Quiet Technologies (an audiologist himself) disagrees. He notes that the hard plastic mold must be a perfect fit for this. Any leakage will ruin the noise-damping effect. He also says the plastic can cause sweaty or sore points in some people's ears.





Lightspeed's Mach 1 fits over the ear on the left and is just a wire to an earplug/speaker on the right. Some testers found the mic boom would swing away from the mouth with too much head motion. The controller is the big, but its aux jack accepts both music and cell inputs.

Lightspeed touts their no-roll foam that makes donning the headset simpler. While true, we felt this was a distinction without a difference once we got the knack of the other headsets. What we didn't like about the Mach 1 was that it was hard to get the earpiece to stay put on some heads. It would move just enough to put the mic too far away to pick up speech. Working with an instrument student with a head swiveling between aircraft traffic and watching their scan was the worst. No amount of repositioning the earpiece or the clip to hold the wire running to the controller would fix the problem.

For pilots who don't have this problem, the Mach 1 is probably the best ITE not requiring custom earmolds (see sidebar). But for those who do, the Mach 1 is a non-starter. The problem might be fixed by ordering custom ear molds, but that adds about \$300 (\$100 for the trip to the audiologist and \$200 for the installation from Lightspeed.) for the Mach 1's \$450 price. Replacement foam eartips are \$15 for six.

CLARITY ALOFT

There are two versions of the Clarity Aloft ITE. We tried their \$525 standard version, which differs only from the Pro version in the material for the headband, the fact that the Pro is TSO'd and that the Pro costs \$695. But if your cockpit re-

quires a TSO'd headset, the Pro is your only choice. Eartips for either are \$25 for a pack of 12.

The Clarity Aloft headband is worn behind the head and over the ears only. You can bend the frame as needed to better fit your head, and there is an optional adjustment band that can put some clamping pressure on the band if you want it, or it can be slid forward to better grip the back of a smaller head. The eartips screw on to short tubes that don't snag or tangle easily. Overall the unit feels robust. Clarity Aloft must agree as they have a three-year warranty.

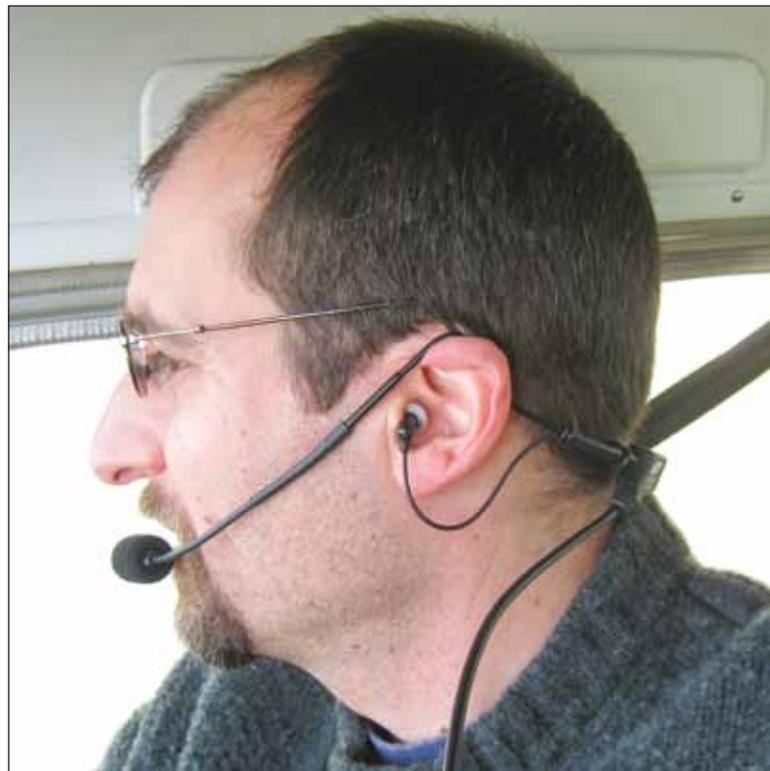
There is a music input on the volume controller, but it doesn't auto mute. Instead, it's set so music input is always at a fraction of the radio

Clarity Aloft offered the most secure fit, but we had to be careful not to pinch the top of the ear where it meets the head, as shown here.



intercom volume. This worked OK in practice, but it limits the volume-setting flexibility. Sound quality was good, but we think the Halo has clearer voice and the Mach 1 richer music.

Some testers reported the over-the-ear portion of the Clarity Aloft was uncomfortable or "heavy-feeling." One had to remove it after two hours



ALURA'S BUDGET ANR: WOW

We got the press release and the photo for the new Alura ANR headset and shook our heads. It looked like your average David Clark copy, and with a price point of \$299 we started writing the polite review about a headset that might be useful for passengers you like OK, but maybe not so much you're going to splurge on their ears.

Then we got the headset and had to throw that draft away.

The Alura has the classic headset build, right down to the green earcups. The fit is snug, but comfortable enough for multi-hour legs. We didn't get to try it on really long trips, but imagine it would become a bit of a skull squeezer after a while. Sound quality was well above average for voice and music, but in no way a threat to Bose or Lightspeed's flagship models. For 300 bucks, though, we don't expect it to be.

The ANR, however, exceeded our expectations. We were trying these in-the-ear headsets at the same time and switched back and forth. They were about equal. The Bose X that was on board could keep its smug expression, but more for comfort than total quiet. Alura claims a total of 47 dB of noise reduction, 24 dB passive (helpful if the batteries die, but still pretty loud).

In the "why didn't I think of that" category is Alura's smart ANR activation. It automatically turns on the ANR when it senses the headset is plugged in to an active intercom, audio system or radio. It turns the ANR off when you pull out the jacks or kill the master. There isn't even an on/off switch on the battery box. There's only a light to tell you the system is on or the 9-volt battery is getting low. The battery box has a stereo-mono switch and a PTT input. Considering a budget headset may be a choice for a budget aircraft with no integral audio system; the latter was a thoughtful touch. We'd like to see a music input on the controller for the same reason. Cub pilots like to hear their tunes, too.

The Alura mic is more sensitive to system squelch than average. In a plane with a manual setting, it was tough to get a spot where it consistently picked up speech without setting it so sensitive the com stayed open from cockpit noise. On an high-end auto squelch system, the mic had to be right at the lips to get reliable results. Franco Valentino of Alura says this is by choice as it makes for a clearer outbound transmission and over headset noise cancelling.

The Alura comes with a 30-day money-back guaranty one-year warranty. For pilots without the budget for top-end ANR and all the extras, we think the Alura is worthy as a primary headset. It would also be a good choice for passengers you really do like. Their website is www.aluraheadsets.com.



as it was too uncomfortable. We asked Clarity Aloft about this and they agreed some users experienced this, and a few had fashioned their own sleeves for the headband to fix it. Jo Abbott of Clarity Aloft pointed out their 30-day money-back guaranty that allowed people to test this for themselves.

WORTH A TRY

Actually, all three of these manufacturers offer 30-day trials, which is a real plus as ITEs are a different paradigm and take some getting used to. (You can keep the used eartips; no charge.) We think the perfect ITE candidate is someone who flies long legs where clamping pressure is an issue and ease of donning isn't—and who don't require the all-encompassing quiet and clarity of a Bose A20 or a Lightspeed Zulu. The ITEs still aren't quite there, but they offer equal or better noise reduction than the most mid-level or lower ANR headsets.

A passenger who just doesn't like headsets is another candidate, so long as they understand how to put the eartips in. Children, who don't fit well in traditional headsets, are a third. The author's eight- and ten-year-olds strongly favored the Halo using the included small/pediatric eartips. Too bad he can't keep the test units.

For sometime passengers or kids, the Halo is squarely our top pick for an ITE headset. For pilots, or a passenger who must have private music or phone, we'd lean to the Mach 1—if that person can get a good fit on the left earpiece. But even as a primary headset for pilots, we still think the Halo is a great value.

CONTACTS

Clarity Aloft
612-747-3197
www.clarityaloft.com

Lightspeed Aviation
800-332-2421
www.lightspeedaviation.com

Quiet Technologies
866-784-3883
www.quiettechnologies.com



The Navy's Green Hornet testbed, left, was successfully fueled by a 50/50 blend of refined camelina oil (below) and conventional JP-8.



FUTURE FUELS

Biofuels Take Flight: But It's No Slam Dunk

Military demand has ignited a flurry of R&D and investment in turbine biofuels, but clear-eyed skeptics say the economics haven't been proven.

by Paul Bertorelli

While the world of piston general aviation wrings its collective hands over an unleaded replacement for 100LL, the turbine market is caught up in a vast, breaking wave of biofuel activity.

Even though heavily subsidized biodiesel is already finding a niche market, it looks like demand from the airlines, but especially from the military, is driving an explosion of so-called advanced biofuels development. As we reported in the December 2010 issue of *Aviation Consumer*, the ASTM approvals for bio-derived turbine fuels are already in place or soon will be.

But that's not the same as having a ready and robust industry that can refine meaningful volumes of biofuels for aviation use at affordable prices. While research projects and startups number in the hundreds, no one has

yet demonstrated convincing real-world economics that would allow biofuels to compete with petroleum-based fuels. And for every biofuel believer, there's a show-me skeptic who notes that thus far, biofuels haven't achieved a glorious history.

Although turbine fuels are getting the big research dollars, there may be a minor spinoff that dribbles some crumbs to the piston side: Swift Enterprises continues its work on what is essentially an octane-proven 100LL replacement and a burgeoning biofuel industry can only help its efforts by establishing a wider technology base and, intriguingly, possibly benefitting from refining unwanted biofuel co-products into high-octane avgas.

THE BIG DRIVER

As has often been the case with other aviation technologies, the hard push

for biofuels is coming from the military. The Air Force and Navy want to have half of their turbine fuel—and for the Navy, half of its ship propulsion fuel—coming from biomass sources by or before 2020. Both services will mix conventional fuels 50/50 with advanced biofuels in order to blend drop-in replacements that require no modifications to engines or distribution and

storage systems.

Rick Kamin, the Navy's lead researcher for fuels, told us that this means an F-18 pilot launching on a mission with a blend of refined camelina oil and JP-8 won't know the difference. "To the fleet, it's a straight drop-in solution. They won't have to make any changes," he said.

Testing has proven the point. Both the Air Force and Navy have done extensive testing on their proposed biofuels blends—including engine ground tests and flight tests—and found no surprises that required changes in fuel formulation. The Navy did its tests at Patuxent River, Maryland, in an F-18 it expansively called "The Green Hornet."

Heat contents and weights of these fuels are similar enough to require no performance table changes for aircraft. Kamin told us that seals, gaskets and O-rings in military aircraft do require a certain percentage of aromatic compounds to swell and seal correctly, but that's provided by the conventional petroleum portion of the mix. "That really is the main reason we're going with a 50/50 blend," Kamin told us.

Although both services burn a bunch of JP-8 jet fuel, the military as a whole accounts for only about 2 percent of U.S. fuel consumption and the Navy only has a small portion of that. (Interestingly, by 2020, the half of its fuel consumption projected to come from biofuels is about 330 million gallons, only a bit more than general



Aviation biofuel is already being pursued on a global scale. Finnish oil refiner Neste has committed to supplying Lufthansa with a 50/50 blend for commercial use on revenue flights.

independence and some downside protection against petroleum price spikes. "Our goal in pursuing alternative and advanced biofuels really gets down to enhancing our energy security position, and having more independence as relates to the sources of our fuel. Today, we get our fuel from all over the globe and we want to have more sources of homegrown fuel to power the fleet," Hicks told us. Worries about emissions are also a factor. In considering future fuel purchases, the services have to demonstrate that what they buy will have the equivalent or lower life-cycle carbon emissions than conventional fuels do.

WHAT IS THIS STUFF?

For aviation use, advanced biofuels consist of several processes and a number of feedstocks, not all of them necessarily biomass. The term hydrotreated renewable jet fuel (HRJ)—sometimes also called synjet—can refer to fuels produced using a variety of processes. Hydrotreating, which is routinely done in conventional oil refineries, refers to exposing a hydrocarbon to heat and pressure in the presence of a catalyst to remove sulfur and other impurities. For HRJs, it is a principle part of going from raw oil to finished fuel.

Feedstocks for HRJs vary but the two most promising seem to be camelina, an oilseed crop often grown in rotation with wheat and jatropha, a seed crop with a high oil yield. Because these crops yield oil directly which can be further processed, they are fundamentally different than corn-based ethanol, which requires water-intensive fermentation and

distillation. The Navy's Green Hornet test was fueled by hydrotreated camelina oil made by UOP, a Honeywell company.

Other processes are also on the table, including pyrolysis and liquefaction of feedstocks and some fermentation-based technology. One technology that gets a lot of press is the Fischer Tropsch process, which was developed in Germany toward the end of World War I and was used during World War II to synthesize liquid fuel from coal. But it can be applied to other feedstocks, including municipal wastes and even natural gas. Although Sasol, a South African company, uses F-T to produce liquid fuels from coal and natural gas, the Navy's Rick Kamin told us the services haven't been interested in this process because it doesn't meet the requirement to reduce carbon dioxide emissions. For the services and the airlines, the focus remains more sharply on crop-based HRJs.

NOT SO FAST

Given the volume of coverage and activity in the HRJ and biofuels fields, it's tempting to assume the industry is on its way to being a player. After all, why would all these companies, not to mention the U.S. government, invest so widely without promise of success? For the same reason that in the late 1970s, Congress sold ethanol as the gateway to energy independence. It looked good on paper and it wasn't imported from the middle east. But there were skeptics then and there are skeptics now.

One of them is John Hofmeister, Shell Oil's former CEO who, in retirement, has formed Citizens for Affordable Energy, a non-profit education and promotional organization. Hofmeister got the mainstream media's attention last fall when he declared that autogas in the U.S. would reach \$5 by late 2011 or sometime in 2012, which could translate to \$7 avgas. He says the demand curves are unmistakable as the world economy slowly begins to shake off the deep downturn of 2008.

"We are already at the demand levels of 2007 and 2008," Hofmeister told us. "Asian demand is already exceeding those levels," he adds. Following BP's Macondo oil spill in the

aviation's current leaded avgas consumption.) Although that's a tiny drop compared to the 30 billion gallons of Jet A used in the U.S., the hitch is that the industry doesn't exist to make even that much turbine biofuel, nor are the technologies and economies anything like well proven. The Navy's purchase of a 40,000-gallon test batch cost the service \$67 a gallon.

Nonetheless, the services are undaunted. "We are very engaged with industry. We've talked to private equity, we've talked to venture capital, we've talked to the firms in this area," says Thomas Hicks, the Navy's deputy secretary for energy. "We are confident that they're going to be able to meet those demands and do so in the quantities we need at the price points we need," he adds.

The Navy's schedule is aggressive, to say the least. By 2012, it plans to have all of its aircraft and ships certified to operate on 50/50 biofuel and by 2016, it plans to put an entire strike group to sea—the so-called "Green Fleet"—fueled by biofuel blends.

What's pushing the Navy's conversion is what's always pushed alternative fuels: The promise of energy

continued on page 18

A NEW FUEL SPEC: 100VLL

If the industry can't eliminate tetraethyl lead from avgas all at once, how about just reducing the amount of TEL used in avgas? That's the idea behind a new fuel specification called 100VLL, which the ASTM initially approved in December with final approval likely to be considered in a few months. This fuel would contain about 81 percent of the maximum lead allowed under ASTM D910, although in actual practice, it could contain even less lead.

This new specification was developed at the request of a coalition of industry groups, including AOPA, EAA, GAMA, NATA and others in response to unique pressures some airports (and states) face because of emerging National Ambient Air Quality Standards that will reduce the amount of allowable airborne lead emissions by tenfold by 2017. The EPA already has a long list of certain so-called non-attainment areas which have been identified as exceeding the stated standards.

Some of these areas contain airports, some don't, but the worry is that as states are forced by the EPA to throttle down lead, they may try to reduce operations at some airports or even close them down. A lower lead fuel—100VLL—might give these airports and states an option in responding to EPA requirements. It's a time-buyer against a longer-term drop-in replacement for 100LL emerging. Even though EPA has been warm to the VLL idea, it's not known if they'll stay that way.

Interestingly, research done by the Coordinating Research Council in support of the VLL proposal found that some avgas currently on the market already meets or even exceeds the proposed lower lead threshold. The reason? Although ASTM's D910 spec for avgas requires certain performance requirements—and limited compositional limits—real world avgas varies widely in its actual formulation. We've seen

test results, for instance, in which some fuels have as much as 30 percent of the aromatic toluene by volume, while others have virtually none. Yet both samples meet the D910 requirement.

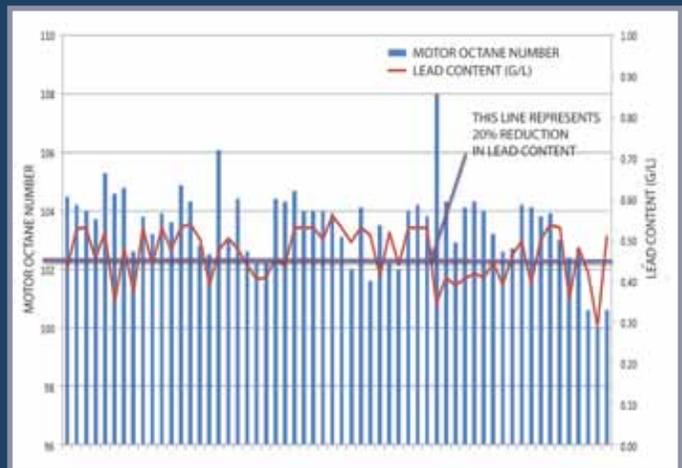
D910 specifies a minimum motor octane of 99.6 for 100LL, although the typical FBO fuel is usually at least 101 octane and some test at as much as 108

octane. The spec allows a maximum of TEL content of .56 g/L or 2 mL per gallon of gas. D910 doesn't specify a minimum amount of TEL; the refiner can use as much or as little as required to hit the octane requirements. Some get by with less lead—a lot less—because their basic alkylation technology yields higher-octane blend streams. For those with lesser alkylation, lead is a cheap way to bring the octane up.

For its baseline research, CRC discovered something interesting and that many in the industry probably knew already: Lead content varies widely. The research analyzed more than 90 avgas samples and found lead content as low as .3 g/L all the way to near the maximum allowable .56g/L.

There's a loose correlation between lead content and octane, but it's not a perfect fit because of variations in refining blendstreams and technology. For instance, the highest MON noted—a deliriously generous 108 octane—also had one of the lowest lead values. On the other hand, the sample with the lowest lead content (.3 g/L) also had the lowest octane, a bare 100, just above the minimum spec.

This raises critical questions about 100VLL. Will enough refineries want to or be able to make it and even if



The chart above was adapted from the CRC VLL research. The vertical blue lines represent individual fuel samples with octane values on the left and lead content on the right.

they do, can they maintain the octane margins? If 100VLL was adopted as a widespread interim spec on the way to an unleaded fuel, would some refiners be unable to make it and thus simply exit the business?

On the first question, the CRC report demurs. "Unfortunately, it's beyond the scope of the data and this report to comment on that risk." The report noted that a primary supplier representing 24 percent of the samples tested couldn't meet the VLL specs and still maintain octane.

As for the octane overhead issue, CRC took a stab at that by noting that if one third of the samples they tested are already at the proposed VLL level and octane shortfalls were an issue, it should show up in service difficulty reports of detonation events.

Although this is an imprecise way of detecting a problem since the variables of each event aren't entirely known and it's further not known how many such incidents might not be reported at all, an SDR review should reveal any significant detonation damage patterns.

It did not. The researchers found of 31 incidents involving burned pistons that might signal detonation, none cited fuel quality as a potential cause.

SWIFT CONNECTION

So is Swift Fuel a biofuel or not? Well, it sort of can be, but it depends. When Swift burst upon the scene three years ago, company co-founder John Rusek said this: "Not only can our fuel seamlessly replace the aviation industry's standard petroleum fuel [100LL], it can outperform it. Our fuel should not be confused with first-generation biofuels like E-85, which don't compete with petroleum."

Rusek said Swift's technology could produce the 1.8 million gallons per day of fuel used by GA in the U.S. by using just 5 percent of the existing biofuel plant infrastructure.

Thus far, this remains unproven. At the time of its introduction, Swift led us to believe it would be produced by biomass such as switchgrass or sorghum. But the reality is that Swift has concentrated not on the biomass generation of its primary feedstock, acetone, but on refining the process of converting the acetone itself into fuel.

The company's Jon Ziulkowski recently told us that Swift is increasingly looking at a model that might be a bolt-on processing unit to an existing plant already producing acetone from biomass or other sources. Swift has asked companies doing this work for proposals to meet acetone prices that will make its fuel competitive with petroleum-derived avgas.

And this is where a wider biofuels industry could swing things Swift's way. On the long list of potential biofuels is bio-butanol, an alcohol with superior qualities to ethanol. Historically, butanol was a byproduct of acetone produced for explosives manufacture. But the fuels market has flipped that; butanol is now the star and acetone the unwanted coproduct.

And nothing says cheap like an unwanted coproduct and that could give Swift the cheap acetone it needs to make Swift Fuel fly.

Gulf of Mexico, offshore exploration permits have been sharply restricted, which Hofmeister says will deny world markets the stabilizing influence of one to three million barrels of crude a day from the Gulf. Unless demand relents, which Hofmeister doesn't expect, oil prices well above \$100—and probably closer to \$150—may be sustainable.

We asked Hofmeister why this isn't the perfect climate to launch a new biofuels industry. Maybe it is and maybe it isn't, he says, because although biofuel processes are relatively straightforward to prove, the economics are anything but.

"When I was at Shell, I was involved in five different biofuels projects," Hofmeister said. "Each one of them was promising, but as you go through these technical projects you set up gates that you have to go through. There was more of a tendency to move the gate than there was to achieve it."

Hofmeister says he hasn't given up and thinks projects like purpose-grown algae for biofuels will have payback, but "that journey is long and torturous." He says he'll be surprised if the military services manage their ambitious goals. "The military has been at this for a decade. This is not something that started in the last two or three years. And they have essentially an unlimited pool of money to do things that are essentially non-commercial. If you look at the airlines or owners of private aircraft, they're not going to be able to afford the kinds of things that the military is working on," says Hofmeister.

The inflection point will be scalability, which everyone on both sides of the biofuels fence agrees is the next hurdle to overcome. Despite dozens of companies plying the field, Hofmeister thinks the industry is five to 10 years from having the knowledge—not the ability, the knowledge—to put large-scale, competitively priced biofuel production in place.

The rule of thumb is that harvesting and transporting the feedstock crop accounts for 80 percent of the production cost of biofuels. But unlike crude oil, which can be pipelined or tankered halfway round the globe without change or degradation, biofuel crops cannot, meaning that biofuel processing plants have to be placed near where the crops are grown. And

there have to be a lot of them.

"A 65-million-gallon biofuel plant will need about 15 football fields a day of switchgrass to operate," says Norman Smit, of the Biofuels Center of North Carolina, one of the few state-funded R&D shops for biofuels. Looking forward, North Carolina sees its tobacco crops losing value and it's seeking replacements. Moreover, it has several major military bases that might represent a ready, local market for a regional biofuels industry.

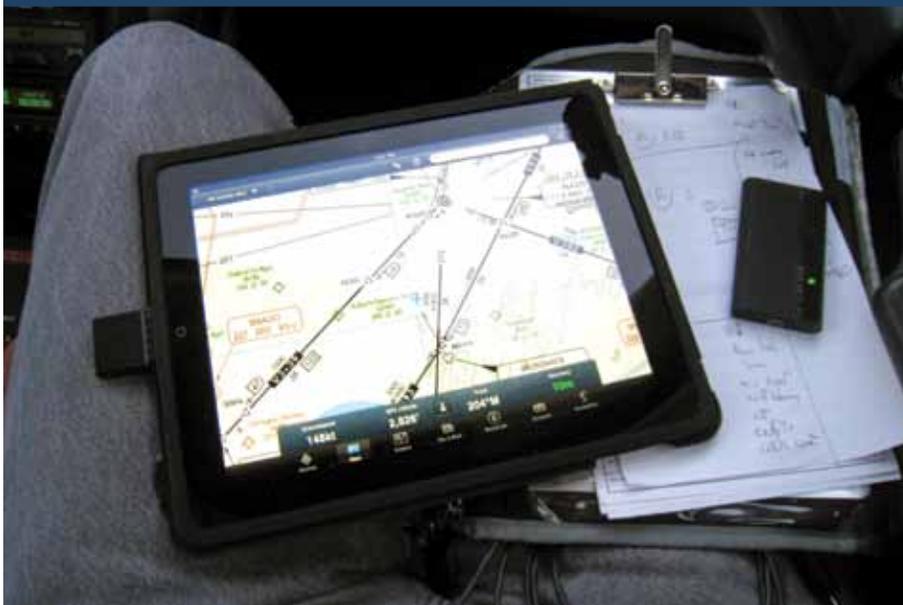
"You obviously can't afford to transport the crop very far," he adds. And the comparison to the established economies of ethanol production is an imperfect fit.

"With ethanol, you had the Midwest corn infrastructure already in place. The transportation was there, the railways and the elevators...you don't have that with energy grasses," says Smit, who adds that largest challenge the industry may face is demonstrating the economics well enough to attract funding.

"A bank can look at proposed numbers for a new ethanol plant and look at the ethanol market to see if the claims add up. That's difficult to do with these new technologies," Smit says. That's why Smit says he's encouraged by the Department of Defense work, which might at least result in loan guarantees to leverage financing for new biofuel plants. The total market capital requirements are considerable because although there are about 150 oil refineries in the U.S., the non-transportable nature of fuel crops means that there may be several hundred if not several thousand biofuels facilities. The industry will require additional infrastructure that doesn't now exist.

A sustained oil price higher than \$100 a barrel might ignite a flight of capital into the biofuels sector, but Hofmeister says that knife cuts both ways and has. "You reach a competitive price level where biofuels become affordable relative to crude oil, but then crude oil has proven over time that what comes up, will come down. The higher the crude oil price, the greater the political pressure to produce more crude oil." He says the oil is out there and can be produced.

When and if that happens, says Hofmeister, biofuels are back where they started from: a bride looking for a groom.



Add-on GPS modules for the iPad and iPhone

The iPad's built-in GPS has been a weak point from day one, and non-3G models didn't have GPS at all. Now there are two excellent alternatives.

by Jeff Van West

After flying with iPads and iPhones ourselves and talking to many pilots who also do, we've concluded there are those who've had the internal GPS lose its location—and those who will.

The issue isn't accuracy, so much as reliability. Some apps purposely don't offer items like georeferenced approach plates because they don't trust the GPS.

But that may all change. There are add-on GPS units for the

iPad/iPhone hitting the market. Two of the first are the plug-in Bad Elf and the Bluetooth GNS 5870 MFI.

Short story: They're both far more reliable than the built-in GPS. In our testing, we never saw a loss of GPS position with the GNS 5780 and we only saw a loss with the Bad Elf after repeatedly switching apps while flying. The Bad Elf can be reset in the air by unplugging and replugging the unit into the bottom of the iPad. It reacquired satellites within

three minutes.

Because the iPad/iPhone GPS is aided by the cell network it sometimes won't reset at all in the air.

The Bad Elf (a name arrived at after "sufficient quantities of German beer")

The units are tiny and charge with a USB connection. The Bad Elf plugs in to the 30-pin dock and can double as a charge/sync cable.

is the simpler of the two systems. It plugs into the 30-pin dock on the bottom of the iPad or iPhone and prompts you to download a free app to configure it. After that, plugging in the Bad Elf makes any GPS-enabled app use the Bad Elf position. The app can also deliver firmware updates to the GPS module.

There's a micro-USB plug on the Bad Elf that can be used to charge the attached iPad. Because the GPS isn't much bigger than the stock 30-pin plug, the iPad or iPhone will still fit in most docks you might have. The Bad Elf gets power from the phone (or USB) so it will run down your phone/pad faster than with no GPS. However, it lets you switch your phone to airplane mode and keep GPS. This saves phone power if not plugged in and can prevent interference with panel-mount GPSs or audio systems (both of which we've seen or heard of).

Our only concern about the Bad Elf is the inherent flimsiness of the 30-pin connector, especially with an iPad that's more likely to be loose in your lap rather than in a mount. Luckily, it seems easier to knock it out than break it off (don't ask). A future connection, for ADS-B weather for instance, might need that same 30-pin connector, which could be a problem. The status light on the Bad Elf is also hard to see in bright daylight.

The GNS 5870 MFI is a Bluetooth GPS that charges via a USB cable but we never recharged it in 10 hours of flight time. When paired to the iPad or iPhone, any apps needing GPS use

continued on page 31

CONTACTS

Bad Elf
sales@bad-elf.com
www.bad-elf.com

Global Navigation System (GNS)
+ 49 - (0) 24 05 - 41 48-0
www.mfi.gns-gmbh.com



COCKPIT ACCESSORIES

Top-Value CO Detectors: BW GasAlert, SafeTest

In a market choked with choices and price points, we think it makes sense to consider a CO detector. CO Guardian's panel mounts are also good performers.

by Paul Bertorelli

If you're absolutely determined to kill yourself in an airplane, you'll have to find a better way to do it than gassing yourself with carbon monoxide. The world is so awash with CO detectors across a range of prices and capabilities that we can't imagine many owners haven't at least considered these gadgets.

And the good news is that all of them work quite well, even, you might be surprised to know, the \$4 cheapie stick-on detectors that all your friends tell

you are a joke. (They aren't.) How real is the risk of your exhaust or a perforated heater doing you in? It's real enough, although not the level of risk that should keep you awake at night. On the other hand, given the choices in detector technology, there's no reason you can't eliminate the risk entirely or at least tamp it down.

We were surprised to learn that the market has shifted quite a bit since we last examined detectors five years ago. There are many more small portable units and even a couple of panel mounts. We didn't attempt to try them all, but in this review, we're examining some of the more prominent offerings, which offer more than enough choices.

THREE CATEGORIES
The gadgets sort into three basic cat-

CHECKLIST

- + The detector market has mushroomed since we last surveyed it.
- + All of the products perform well, but not all do low-level sensing.
- + CO Guardian has upped its game to include products that interface with EFIS and MFDs.
- Two of the units, CO Guardian's 152WD and the Mannix DCO1002, proved dead on arrival.

egories: The familiar stick-on patch detectors that have been around since dirt was invented, sophisticated and sensitive portables and a line of panel mount devices dominated by a company called CO Guardian.

We obtained samples of each type and tried them in a shop-built gas chamber which we charged with low

From left to right, top, CO Guardian 452 and 455, with 55 display unit; CO Experts; Mannix DCO1002; SafeTest 90; BW GasAlertExtreme (also at left) and CO Guardian 152WD. Foreground: Pocket CO 300.

levels of CO from a laboratory-grade cylinder. We were able to expose the detectors to various levels of CO from under 100 PPM to several hundred PPM.

The important performance expectation is low-level sensing. Although the EPA says that acceptable levels of exposure in the workplace can be up to 50 PPM over an eight-hour period, as a certification requirement, the FAA requires that the cockpit have levels no higher than 50 PPM.

Yet at levels as low as 10 to 40 PPM, it's possible to suffer symptoms of CO poisoning such as headache, blurred vision and impaired judgment. That last item is the main worry. Ten PPM isn't much CO, but, like hypoxia, a mild case of CO exposure could lull you into a critical misjudgment or result in poor decision making that you're not even aware of. It could be aggravated by hypoxia and while having oxygen aboard will help with that problem, it won't cure or prevent CO poisoning in a cockpit where exhaust is encroaching or the heater is compromised.

Thus, low-level detection (below 50 PPM) is preferred, as is an effective alarm or annunciation system. Although a display of the actual CO level is nice, it's not a must, as long as the detector alarms below 50 PPM.

QUEST SAFETEST 90

This compact portable has been our go-to detector for a number of years and it still is. Unfortunately, the company is discontinuing this model, but Sporty's told us it still has a number in stock at \$379.

The SafeTest is a proper gas detector, meant for industrial and scientific use and built accordingly, all housed in a robust plastic case. The price has gone up \$84 since we last reviewed it, but we think it's still a good value.

It uses an electrochemical sensor that's capable of detection down to 1 PPM, which it displays on a backlit LCD digital display. It will calculate time-weighted averages and short-term exposure limits, and will also record peak values.

The detector has a loud, warbling alarm and flashing red lights that are impossible to miss. It's so accurate, that we have used it as the benchmark to test the other detectors. But the others have upped their game so

much that they all seem to agree on CO levels within a few dozen points.

Interestingly, time to first response is similar among all the units, which is to say they light up quickly when CO climbs above 50 PPM, but most pick up far lower levels, too.

BW INSTRUMENTS

As Quest Technology exits the CO market, BW Technologies arrives, marketing a line of compact, sophisticated single-gas detectors, which include carbon monoxide. These replace the Honeywell Lumidor line, which has been discontinued. These were carried by Aircraft Spruce and we suspect they'll pick up the BW line as a replacement.

The company has two models, the GasAlertClip (about \$200) and The GasAlertExtreme (about \$240.) The Clip is intended as a disposable that operates continuously for two (or three) years once activated while the Extreme is switchable, with a field-replaceable 3-volt battery.

The GasAlertExtreme is about half the size of the SafeTest 90, with a small front-mounted digital display and a robust belt clip and hanging loop. The instrument is housed in a shockproof and immersible protective case.

The GasAlertExtreme reads CO values directly and also has low, high and weighted-average exposure calculations. They're also capable of datalogging through an optional cable. The detector's alarm limits are factory set at 35 PPM as a time-weighted average, but they can be reset in the field. In any case, the unit reads lower levels directly and

To test the detectors, we exposed them to minute puffs of laboratory grade CO, top, CO Guardian 455, center and lower, includes a pulse oximeter and can output data to an MFD, EFIS or a dedicated display.





The first, best defense against carbon monoxide is not to let it get into the cabin in the first place. Poorly maintained joints in the exhaust system, muffler and heater are common leakage points. But even with a perfectly maintained exhaust system, CO can swirl into vent inlets, gear door openings and at through-firewall fittings.



alarms above 35 PPM. The alarm consists of flashing red LEDs and a beeper that is, in our view, a bit too low in volume to penetrate headset attenuation, so it's important to keep the detector in the pilot's or passengers' view. It also has a vibrator feature.

CO EXPERTS

For a number of years, aeromedix.com has sold the CO Experts unit (\$179 retail) for aircraft, even though it's intended for home or commercial building use. But the CO Experts detector has an important advantage over cheap hardware store detectors: It does low-level detection—as low

as 7 PPM. Between 7 and 24 PPM, it emits a series of beeps once a minute, escalating to a beep series every 20 seconds, then every 10 seconds above 50 PPM.

These annunciations are piercing and impossible to miss, meaning that the detector can be placed out of sight, if desired. Since it's not intended for cockpit use, the best location for it might be on the cabin floor or a seat where it can't get kicked or damaged.

We noticed that this detector is extremely sensitive. It detected minute traces of CO from across the shop when we used a fan to clear small puffs of CO from our test chamber.

AC TV



For a video demonstration of CO detectors in action, log onto our sister publication, www.avweb.com, and click on the video tab in the upper right homepage. Scroll down to the CO Detector video.

POCKET CO

At \$129 from aeromedix.com and \$125 from Aircraft Spruce, the Pocket CO 300 is the smallest of the portables—it's literally a keychain device. Yet even so, it doesn't give up much to the higher-priced models, except for lack of low-level alerting. (It does sense and display below 50 PPM, but it doesn't alarm until above that level.) Like the other sophisticated portables, the Pocket CO calculates time-weighted averages and will warn if the average exceeds 25 PPM over an eight-hour period.

This detector has three alarm types: a vibrator, a buzzer and a tone-type alarm that we found to be moderately loud. It also has flashing alarm lights, so if it's kept in sight,

you won't miss its warning. The 50 PPM alarm can be set on or off, but the value can't be changed. It's powered by a CR2450 coin-cell, which can be field replaced.

CO GUARDIAN

CO Guardian offers a full line of detectors with a focus on panel-mount devices. The closest thing it has to a portable is the Aero 152WD, a self-contained detector that plugs into an accessory cigarette lighter socket and remains constantly energized.

CO Guardian also provided us with two other representative models from its line, the Aero 452 panel mount and a newer product called the Aero 455, which uniquely combines a pulse oximeter with CO sensing and can output the data to a dedicated display (Aero 55) or to select MFDs through an RS232 data stream. These include the Garmin line, Electronics International's MVP-50 engine monitor and others.

The low end of the CO Guardian line is the plug-in 152WD at \$149. It can operate on 12 or 28 volts. These units have two stages of alarms, flashing a yellow light when exposed to traces of CO (below 70 PPM) and red above 70 PPM. The detector's green light remains on if CO is below 50 PPM. There's also an audible buzzer that we would call moderately loud. It's noticeable, but not as attention getting as the SafeTest 90 or the CO Experts.

Our trials of the Aero 455 and 452

CONTACTS

aeromedix.com
888-362-7123

Aircraft Spruce and Specialty
877-477-7823
www.aircraftspruce.com

BW Technologies
888-749-8878
www.gasmonitors.com

CO Guardian
800-639-7139
www.coguardian.com

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

proved impressive. At \$459, the Aero 452 is a compact unit (1.5 by 1.3 by 3 inches). It will operate on 12 or 28 volts and has a self-test feature. It alarms in five minutes or less—a lot less in our test—when the CO level reaches 50 PPM, at which point it flashes an amber light and emits a conspicuous tone. CO Guardian provides drawings and data for installation approvals in certified aircraft. Most of these, we suspect, will be field approvals.

A companion product, the Aero 455, is available in several variations. The version we tried consists of one module that houses the pulse oximeter and a second discrete unit (the Aero 55) that contains an LCD digital display. The display alternately shows pulse oximetry data (pulse and SPO₂ oxygen saturation, plus CO level).

The 455's output can also be piped into the aforementioned MFDs, eliminating the requirement for the 55 display unit. If the display is

needed, it costs \$250, while the 455 sells for \$895.

This product proved sensitive at detecting low levels of CO. It displays values above 10 PPM and alarms within three minutes above 50 PPM. The alarm is an impossible-to-miss piercing beep. We did notice that it didn't agree with the SafeTest 90 at high levels (above 500 PPM) of CO.

CO Guardian says its detectors are relatively maintenance free with a lifespan of five to seven years under ideal conditions. They recommend recalibration every five years, which costs \$499 for the 455 and a flat \$99 for the 152 and the Aero 452.

CONCLUSION

We're not convinced a CO detector is must-have equipment, but on the other hand, for not much money, you can protect yourself against the risk. Repeating the results of our last trial of these products, the SafeTest 90 is still our top pick. Sporty's has a few left before it's discontinued,

so act quickly. Quest Technologies (a 3M company) told us it would continue to support these products, including calibration, so we're not worried about it being orphaned.

So our new top choice in portables is the \$240 BW Instruments GasAlertExtreme. It's comparable to the SafeTest 90 and it's robust and easy to use. We were impressed with both the quality and performance of this instrument.

The Pocket CO 300 from Spruce and aeromedix.com isn't a bad choice at \$125, but we think the superior alarming features of either the CO Experts or the GasAlert are worth a little extra money.

CO Guardian's panel devices are good performers and our first choice is the Aero 452 at \$459. Although it doesn't alarm at low levels, its simple, always-on monitoring is, in our view, sufficient to reduce the CO risk substantially, which is all you can really expect of a carbon monoxide detector.

DEATH PATCHES? WE THINK NOT

The butt of many a hangar joke, CO detection patches have been around for years. What can be more depressing than one of these things stuck to the sun-bleached panel of a 40-year-old Cherokee? But let's give a little credit where it's due, please.

We've always been surprised by how well these things actually work when squirted with a little CO. After a few minutes, the sand-colored patch slowly darkens to the color of charcoal, con-

firming the presence of carbon monoxide.

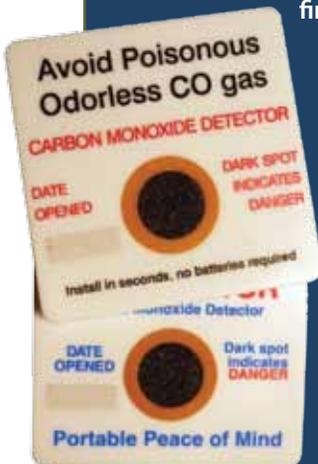
So at less than \$5 each, what's the problem? Several, actually. For one, the patches go stale. The manufacturers recommend a replacement cycle of 90

days, which few owners seem to do. (Quantum Eye (\$9.95) recommends an 18-month cycle.) Periodic replacement is good advice. We once tested a patch that was more than 10 years old and despite being exposed to deadly levels of CO, it didn't seem to change color.

Second, the patches aren't necessarily good at detecting low levels of CO. You could have symptoms at 15 to 20 PPM and probably not see much color change. Third, slight darkening is a problem, because you can't tell what the patch looked like when it was fresh.

The Quantum Eye, lower right, addresses this by placing a small detector pill inside a plastic housing that's surrounded by a color key. Normal is the sand color, caution is green and the danger zone is black. We found that the detector card has the color key exactly right. About 100 PPM turned the pill the exact shade of green shown on the card. The other two detectors, the CO-Detector from ASA (\$3.95) and the Aircraft Spruce detector, reacted faster than

the Quantum Eye did, turning a dark black within 90 seconds of being exposed to 90 PPM. To preserve their effectiveness, patches shouldn't be exposed to organic solvents. The same advice applies to most (but not all) electronic detectors. Solvents damage the sensitivity of the compounds used for detection.



Cessna 340/340A

A fast, pressurized cabin-class twin that's still one of the best step-ups from a high performance single.

Although airplanes are often sold as business and transportation tools, the reality of ownership falls short of the ideal. While either lack the range, the carrying capacity or the ability to deal with real-world weather, thus an airline or a charter outfit gets the call.

A serious business airplane needs a decent cabin, credible speed and the ability to hack it when there's ice or thunder in the forecast. Pressurization is nice since clients don't want to spend several hours with a plastic hose stuck up their noses. Family members aren't that keen on it, either.

Enter the Cessna 340. Although not without its shortcomings, most notably certain loading limitations and an overly complex fuel system, the 340 is an impressive, flexible and capable airplane.

MODEL HISTORY

The 340 owes its existence to the boom days of general aviation during the late 1960s and early 1970s when the twin market was stratified and still developing. At the entry level, you had Twin Comanches, Apaches, Aztecs, Baron and the Cessna 310. At the upper end, the ritzy cabin-class Cessna 421,

Beech Duke and Piper Navajo met the needs of well-heeled owners who could afford megabucks for an airplane.

The 340 arrived in 1972 to fill niche in between: a modest cabin class with an affordable price tag. It was a lower-cost alternative to the Cessna 414, which had arrived in 1970.

Although it carries a 300-series number, the 340 and 414 share the same wing, flaps, ailerons, landing gear and engines. The 340 has an air-stair door, thus you don't need a ladder to get into it, as some have jokingly complained about the long-legged Cessna 310. The 340 carries less than the 414, but it's faster on the same fuel burn.

From 1972 through 1975 the engines were Continental TSIO-520Ks, which produce 285 HP at 33 inches manifold pressure from sea level to 16,000 feet. However, most of the K engines in early 340s have been converted to Js or Ns.

The TSIO-520J engine, used on early 414s, produces 310 HP at 36 inches manifold pressure. The N engine, installed on later 414s and 340As, produces 310 HP at 38 inches.

The major difference between the K engine and the J and N variants is that the latter are equipped with intercoolers, which wash the heat out of the induction air as it flows to the cylinders. This yields better power and efficiency without stressing the jugs, something that's good for longevity.

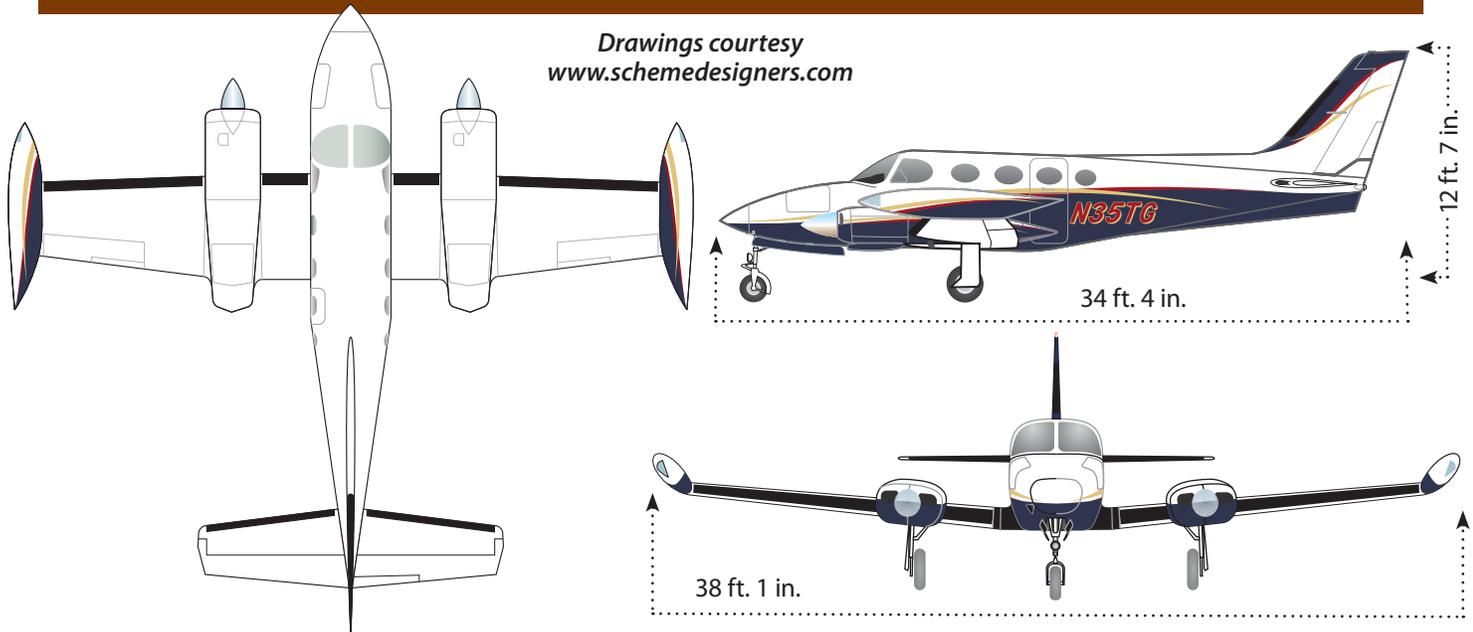
The N engines produce their rated 310 HP up to 20,000 feet and provide higher cruise speeds and better climb and single-engine performance. Three-blade McCauley propellers, formerly an option, also became standard equipment in 1976; earlier 340s came with two-blade McCauleys.

Cessna 340s are prized for being all-weather machines but aircraft



Photo courtesy of Remy Blanchaert Jr.

CESSNA 340

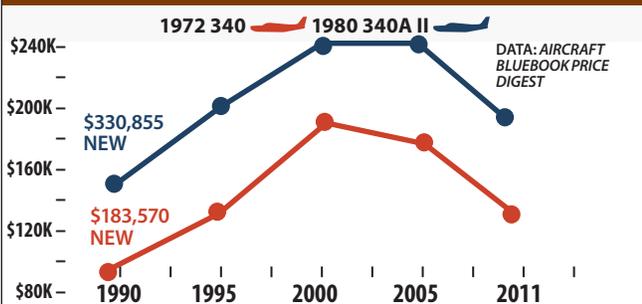


SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1972-73 CESSNA 340	CONT. 310-HP TSIO-520-N	1400	\$40,000	102/207	2200 LBS	210 KTS	±\$120,000
1974-75 CESSNA 340 II	CONT. 310-HP TSIO-520-N	1400	\$40,000	102/207	1800 LBS	229 KTS	±\$132,000
1976-78 CESSNA 340A II	CONT. 310-HP TSIO-520-N	1400	\$40,000	102/207	1800 LBS	229 KTS	±\$200,000
1979-80 CESSNA 340A II	CONT. 310-HP TSIO-520-NB	1600	\$40,000	102/107	1800 LBS	229 KTS	±\$190,000
1981-82 CESSNA 340A II	CONT. 310-HP TSIO-520-NB	1600	\$40,000	102/107	1800 LBS	229 KTS	±\$202,000
1983-84 CESSNA 340A II*	CONT. 310-HP TSIO-520-NB	1600	\$40,000	102/107	1800 LBS	229 KTS	±\$205,000

*NONE DELIVERED IN 1983

RESALE VALUES

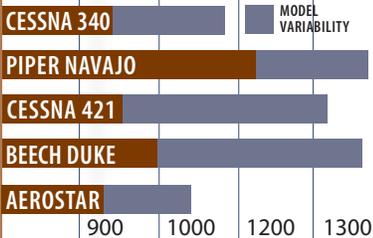


SELECT ADS

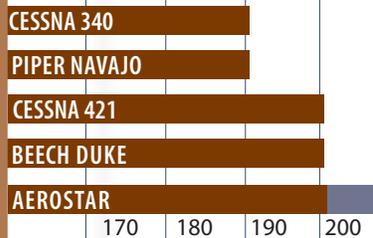
- AD 00-01-06** EXHAUST SYSTEM REPAIR
- AD 98-24-14** EXHAUST SYSTEM COMPONENTS
- AD 97-01-13** FUEL, OIL, HYDRAULIC HOSES
- AD-87-21-02** FUEL FILLER OPENINGS
- AD 82-26-05** RUDDER BALANCE WEIGHT RIB

SELECT MODEL COMPARISONS

PAYLOAD/FULL FUEL



CRUISE SPEEDS



PRICE COMPARISONS

1980 340A II	(\$195,000)
1980 PIPER NAVAJO	(\$195,000)
1980 CESSNA 421	(\$325,000)
1980 BEECH DUKE	(\$190,000)
1980 AEROSTAR	(\$145,000)

\$100K \$150K \$200K \$250K

certified for flight into known icing conditions, when properly equipped, came only in 1977. The following year, a maximum ramp weight of 6025 pounds was approved, and max weight for takeoff and landing was set at 5990 pounds for the 340A, compared with 5975 pounds for the 340. The last significant change in the line came in 1979, with the switch to TSIO-520NB engines (the B denotes a heavier crankshaft). Subsequent modification of cylinders, valve lifters and piston pins by

The 340's airliner-like cockpit and all-weather mission make it worthy of serious avionics, and some even sport aftermarket glass. Systems complexity is a big jump for many upgrading pilots.

Continental increased TBO of the NB engines from 1400 to 1600 hours in 1983.

But Cessna didn't build any 340As (or much of anything else) that year and after putting together a scant 17 of the airplanes in 1984, production was terminated for good, with a total of about 1297 aircraft made. Some 872 are still registered.

SYSTEMS

The pressurization system is the same as those found in Cessna's 400-series twins, with a maximum differential of 4.2 PSI providing an 8000-foot cabin up to 20,000 feet. Above that, the cabin climbs with the airplane.

Cessna offered an automatic pressurization control, which activates and deactivates while climbing or descending through 8000 feet, but

more buyers opted for the variable-control system. The variable system maintains a sea-level cabin up to 9000 feet, then delivers the pilot-selected cabin altitude until a 4.2 PSI differential is reached.

As pressurization goes, the 340 is relatively

easy, requiring just a quick check and set for each flight. The pilot merely dials in field elevation plus 500 feet before takeoff and landing and selects desired cruise cabin altitude on initial climb. The rest is simply monitoring the system to make sure it's delivering as commanded.

While the pressurization is easy, the same can't be said for the fuel system. Start with the 100-gallon-usable tip tanks which are the mains in this airplane. Add up to four auxiliary wing tanks, two holding 40 gallons, the other two holding 23 gallons. Throw in locker tanks, which add another 40 gallons. That's up to 203 gallons in tanks peppered throughout the length of the wings.

Where things get tricky for the uninitiated is which tank to use when. Use the mains, alone, for takeoff and landing. The engines can feed directly from the auxiliary tanks, but fuel in the lockers has to be transferred to the mains, which are the tip tanks. You have to make room in the mains first, otherwise you'll vent the pumped fuel over the side.

And if you have only one locker tank (common on 340s), remember to use crossfeed; dump all 120 pounds from a locker into one tip tank, and the imbalance will be enough to upset even your autopilot. Unfortunately, Cessna never got around to simplifying the fuel systems in its 300-series twins (Cru-sader excepted) as it did in most of



Photo by
Brant Aero



The intercooler is visible below the nacelle in this photo. There are five possible engines on the 340, and several prop options.

the 400s. Calling the tip tanks mains has its own issues. Ramp attendants have filled the wrong tanks ("Just top off the mains"). Transitioning pilots have switched to the aux tanks thinking they were drawing from the tips, and vice versa.

Despite this, the 340 hasn't suffered an inordinate number of fuel-related accidents. Jerry Temple, an aircraft dealer specializing in the 340, says, "The fuel system is no big deal. I prove it twice a month to new twin Cessna owners. It can be mastered in one 3½ hour cross country.

While known ice certification came in 1977 and up, the majority of 340s have what is called full deice. This usually mean boots on the wing and tail (with the exception of the wing stubs), heated props and alcohol spray for both sides of the windshield. This is adequate for many 340 owners. The few 340s out there with hot props only are tough to sell, but can be ideal for owners warmer locations.

Air conditioning might be the factory system, which requires the right engine be running to get cool air. Parts for this system can be challenging to get. The Keith System, also called JB Air by many, is electric and can be powered by a ground APU, although in the real world of FBOs, a 340 rarely gets the APU. Support for the Keith system is good.

PERFORMANCE

The 340 is a high flyer, with a service ceiling of nearly 30,000 feet. But most owners wisely operate in the high teens to mid-20s, where the airplane can be expected to true between 190 and 205 knots on about 30 gallons per hour at 65 percent power, and 200 to 217 knots on 32 to 34 GPH using 75 percent power.

Rate of climb at sea level is a respectable 1650 FPM, but climb performance tapers above 20,000 feet to a dawdling 300 to 400 FPM in the

The 340's engines work hard in a harsh environment. We think modern engine monitoring is a must.



mid-20s. Not bad as twins go, but no turboprop, either.

The 340's claimed single-engine rate of climb is 315 FPM, better than the 414 (290 FPM), Beech P58 Baron (270) and the Piper 601P (240) and 602P (302) Aerostars. Single-engine minimum control speed is 82 knots. Stall speeds are 79 knots, clean, and 71 knots in landing configuration.

Not all twins of the 340's days have accelerate-stop and accelerate-go performance tables but, to Cessna's credit, the 340 does. Under standard conditions, a 340 that loses an engine at lift-off speed (91 knots) can be brought to a full stop within 3000 feet of brake release. The POH also indicates that should a pilot

decide to fly after losing one on lift-off, the airplane will clear a 50-foot obstacle after traveling less than 4000 feet over the ground after brake release (assuming the pilot does everything right).

The performance figures above are for 340s with 310-HP engines. Those that still have 285-HP K engines (if any) are nearly 20 knots slower in cruise, use roughly 200 feet more runway for takeoff and climb 1500 FPM on both engines, 250 FPM on one.

HANDLING AND PAYLOAD

Cessna's big twins have a reputation for being comfortable and easy to handle and the 340 fits that mold,





It's cabin class, complete with fold-out tables. There's far more space for cargo than gross weight allows, which makes the weight boost from a VG kit almost a must.

although not entirely without warts. The airplane owes its speed to a relatively slick airframe and because it has flap and gear operating speeds that are on the low side, it can be a handful to go down and slow down at the same time.

For example, flaps can be extended 15 degrees at 160 knots (the limit is 156 knots for the first 300 airplanes built) to help slow the airplane to max gear-extension speed, a pitiable 140 knots. But slowing the airplane to 160 knots without stressing the engines can be a problem, if you believe in the shock cooling genie. Owners say descents and approaches require planning and occasional persistence with ATC if a slam dunk is in the offing.

Once the airplane is slowed down with gear and flaps deployed, however, it tends to sink like a rock,

and some power must be maintained right into the flare. This is due in part to the split flaps, which are great for drag, but not so good for lift.

Entering the airplane through the luxurious airstair door gives a big-iron feel. But for the pilots, that wears off quickly when they have to squeeze through a narrow (seven-inch) opening to their seats. Once you're seated,

the cabin is quite comfortable up front. The 340's cabin is 46.5 inches wide and 49 inches high, about the same size as an Aerostar's and 4.5 inches wider than a P-Baron's.

If owners have any consistent complaints about the 340 line, they relate to lack of payload. Load enough gas for a 4.5-hour flight with reserves and you can take along only two passengers and their bags. Fill the seats with 170-pound FAA clones and pack away their regulation 30 pounds of baggage each and you can carry enough fuel for less than two hours of flying.

Considering the payload limitations, the baggage space in the 340 seems a cruel joke. Among the cabin, nose and locker compartments, there's a cavernous 53 cubic feet of space in which a maximum of 930 pounds can be crammed. That is, however, the maximum. Most 340s have at least one fuel tank occupying a locker, and nose baggage compartment space typically is compromised by avionics gear.

The installation of vortex generators, however, brings a 300-pound

gross weight bump. Considering an entire VG kit weighs about as much as the air in your tires, it's about as close to a free lunch as you can get. If you're considering a 340, by all means consider vortex generators.

MAINTENANCE

Like any high-performance airplane, a 340 won't tolerate skimpy maintenance. If rebuilt engine prices in the \$45,000 range (times two), annual inspections at several thousand dollars and operating expenses of \$400-550 an hour curl your toes (as they do ours), the 340 is not the aircraft for you. While some owners reported annuals in the \$5000-dollar range, Jerry Temple tells prospective buyers to expect \$10,000 to \$15,000 for annual inspections.

Owners we spoke with overwhelmingly agree the annual must be done by a shop with twin Cessna expertise. TAS aviation in Defiance, Ohio, was singled out by a few owners.

But those with the budget should get their money's worth out of this airplane. Some things to watch out for: First, there are the TSIO-520 crankcases, which have a history of cracking. In mid-1976, Continental switched to heavier cases, which helped a bit but certainly provided no panacea. A couple of knowledgeable sources estimated that about two-thirds of the engines flying in 340s right now probably are cracked in one place or another.

But not all cracks are critical and there's a general sense that catastrophic engine failures caused by crankcase cracks are on the decline. All big-bore Continentals have a

modest predilection for cracked cylinders and heads.

Cracked and blown-out cockpit windows were the subject of several reports, as were cracked Bendix mag housings and distributor blocks, loose horizontal and vertical stabilizer attach bolts, and cracked waste gate couplings.

As far as ADs go, the 340 is neither the best nor the worst. AD 2000-01-16 requires repetitive inspection, repair or replacement of exhaust components in a range of Cessna twins, not just the 340. This AD was issued in response to cracks/failures that led to catastrophic fires. AD-97-0-13 requires replacement of certain hydraulic, oil and fuel hoses while another, 88-03-07, requires inspection of fuel crossfeed lines for chafing and modification of firewall stiffener flanges and fuel lines. AD 87-23-08 calls for ultrasonic inspection of the crankshafts, as does 97-26-17. Speaking of crankshafts, some 340s were involved in the Continental crankshaft recall of 2000. The logbooks should reflect this as AD 2000-08-51.

AD 96-20-7 calls for repetitive inspections of the Janitrol cabin heater while 96-12-22 requires repetitive inspections of the oil filter adapters. 95-24-5 deals with repetitive prop inspections and 90-2-13, a type-specific directive, called for replacement of the main landing gear inner barrel bearings.

One important directive to check for is 82-26-05, which requires visual checks for cracks in the rudder balance weight rib every 100 hours until a new rib is installed. Such cracks have been the subject of numerous service difficulty reports.

INSURANCE

Temple says his typical buyer has a few hundred hours in high performance singles, but insurance is usually obtainable at a reasonable price. The typical requirement is 25 hours dual in the aircraft and attendance at an insurance-approved school, usually with simulators and insurance-approved instructors, such as SimCom. Annual recurrent training is usually required.

Low-time owners also might not get more than \$1M with per-seat limits of \$100,000 until they have accumulated more 340 time.

Temple also says that now is a good time to be a 340 buyer as prices are at all-time low. The savings can pay for more dual instruction for a low-time pilot, or allow for expensive avionics upgrades. However, Cessna 340 prices are slowly climbing.

MODS, OWNER GROUPS

The 340 fleet has been a popular model for engine modifications performed by RAM Aircraft Corp. Their mods increase the number of powerplant options to five: the standard TSIO520-NBs (310 HP), the RAM Series IV (325 HP), the RAM Series VI and VII (335 HP each) and the stock 310-HP engine with American Aviation Intercoolers. This last combo provides performance similar to the 325-HP RAM IV. RAM packages include a seventh stud on crankcase cylinder pads, which reduces the stresses in these areas that often cause cracks. (Contact RAM at www.ramaircraft.com or 254-752-8381.)

Improved turbocharger intercooling systems are available from American Aviation and are highly recommended by owners. The installation includes ram-air inlet ducts under the engine nacelles and more efficient (American says 28- to 70-percent more efficient) heat exchanger cores. The company says its system cuts the temperature of air entering the engine from about 170 degrees to 80 degrees, improving rate of climb by up to 300 FPM and adding up to 15 knots in cruise. (Contact American at: www.americanaviationinc.com or 800-423-0476.)

A STOL mod for 340s was offered by Sierra Industries, and included installation of Robertson-designed Fowler flaps and a trim spring that precludes the need to retrim the elevators when the flaps are raised or lowered. Sierra says the mod decreases accelerate-stop distances by 40 percent and improves short-field performance about 15 percent. Although still supported, the mod isn't available for new installations. Contact Sierra at www.sijet.com or 888-835-9377.

Precise Flight makes speed brakes for the Cessna 340. They're of novel design and project into the airstream from a snug enclosure at the aft end of the engine nacelles. Contact Precise Flight at www.preciseflight.com or 800-547-2558.

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ACCIDENT SCAN: TERRAIN ENCOUNTERS, GEAR FAILURES AND R-LOC

When we scanned 15 years of C340 wrecks we fully expected to find pages of entries detailing weather-related augers. Instead, we found a high number of landing gear failures, either the result of improper maintenance or unexpected linkage failure. There were also some hard landings that didn't help the seemingly finicky landing gear on the 340. We found plenty of over-runs and drop-shorts proving that nailing approach speeds in this speedy twin is imperative.

As we would expect with most high-performance and pressurized aircraft, there were plenty of terrain encounters where pilots mismanaged altitude while toying with mountains. As is common in twin Cessnas, mismanaging the fuel can also lead to a trip into the NTSB reports. Still, there was no defining smoking gun when it came to the accident history and crash patterns associ-

ated with this airplane. But out of the 70 wrecks that we sampled, there were 76 fatalities, often with multiple fatalities in a given crash. This tells us that whether it's flying for business or pleasure, the 340 is a people hauler. We got the impression that some pilots don't do a good job of flying the airplane on a single engine, as there were several precautionary shutdowns that ended in fatalities as pilots lost control while maneuvering to land. And when things go amiss on takeoff, some pilots struggle with proper abort procedures with a handful of fatalities occurring on aborted takeoffs. In the end, our research shows that flying a C340 requires solid training and bringing your A-game to the cockpit.

ACCIDENT SUMMARY

TERRAIN	(27%)
LANDING GEAR	(16%)
R-LOC	(15%)
STALL RELATED	(13%)
ENGINE FAIL	(13%)
FUEL RELATED	(6%)
ICING	(4%)
VFR IN IMC	(4%)
WILDLIFE	(2%)



Cessna 340 owner Philip Mattison told us of his switch to four-blade MT composite props that increased climb rates by 200 FPM and cruise speeds by seven knots as well as giving cooler CHTs and smoother operation. (He also says he'll cut anyone a deal on a nice set of used Q-Tip Hartzell props for a 340 or a 414.)

It's rare to find a 340 without the aforementioned vortex generators, which essentially eliminate Vmc, give great control at low airspeeds and add 300 pounds to the gross weight. If you do find one, VGs are available from Micro Aerodynamics, Pacific Northwest Aero LLC, through RAM, as part of the company's speed mod kits and through Boundary Layer Research. Micro Aerodynamics is at www.microaero.com and 800-677-2370; Pacific Northwest is at www.pnwaero.com and 541-388-9902; Boundary Layer Research is at www.blrvgs.com and 800-257-4847. Robertson STOL kits are still avail-

able, but the installation cost is usually prohibitive. If you need this, find a 340 with it already installed.

As for owner groups, there are two: the Twin Cessna Flyer at www.twinessna.org and the Cessna Pilot's Association at www.cessna.org or 805-922-2580. TCF also offers operations seminars that are highly regarded by owners. According to Jerry Temple, the TCF \$65 dues is "the best dinner bill you will ever spend."

OWNER COMMENTS

I have owned two 340As in the past 20 years, interspersed with a variety of Beech Barons. I have enjoyed the speed and flexibility of flying a turbocharged, pressurized twin Cessna for a total of 10 years.

Operating costs averaged \$224/hour for the first airplane (owned in the 90s) and \$493/hour for the second (currently owned). This doesn't include additional major expenses of an engine replacement (about

\$30,000), a VG kit (\$4617) or Flight Safety initial training (\$4350).

Flying was a lot cheaper in the 90s, partly because the fuel cost averaged \$74/hour versus \$145/hour. Also, despite now having 4000 hours total time, 1100 in 340s, my insurance costs doubled. My yearly flight time is also less, which drives up that hourly cost.

Eugene C Fletcher
Louisville, KY

I've been flying a 1980 340A with Ram VI engines and Robertson STOL for about nine years and over 2000 hours. It's comfortable and with properly syncrophased engines it's quiet enough that headsets aren't required, though they are nice.

We typically don't carry more than five and then only with little baggage. With only two you can fill the tanks (183 gal) and go from Southern California to Florida with one fuel stop. It typically takes two stops

for the return trip. We have carried six with a light fuel load, but don't plan on flying more than a couple hours or taking much baggage.

We typically plan 207 knots with a 35-36 GPH fuel burn at 17,500 feet. You can add about 1.8 knots for each 1000 feet above that. The 340 with STOL at standard conditions needs about 1300 feet to land over a 50-foot fence and about 1800 feet to take off over the same fence. So it comfortably operates out of 2600-foot fields, but about 3200 feet is a balanced field.

With the Ram VI and STOL, the 340 picks up an additional 400 pounds of payload, so a typically equipped 340 with 183 gallons of fuel could carry about 750-800 pounds of payload.

Greg H.
Reno, Nevada

I have owned a 1979 Cessna 340A for the past 11 years, and it has worked out so well I have yet to come up with a reason to change to a different airplane. The two aircraft I owned prior to the 340 were a Cessna 425 (Conquest I), and a Cessna 303 (Crusader), each of which I owned for a lesser period of time.

The RSTOL conversion with RAM VGs drops VMC speed down well below a stall, and opens up just about any airport where you would feel comfortable operating a stock Cessna 206. The only disadvantage of the RSTOL modification is that it precludes aftermarket speed brakes.

The RAM VI version that came with my airplane produced about 210 knots at FL200 burning 38-40 GPH total. The RAM VII conversion I installed at TBO runs about 30 degrees cooler and is 10-15 knots faster on the same fuel.

One of the frequently overlooked advantages of a pressurized piston airplane, compared to a turbine aircraft, is the ability to fly at lower altitudes, when headwinds dictate, with only a modest difference in TAS, and actually a slight decrease in fuel burn. When winds at altitude are not favorable, I generally plan on 180 knots in the 8000- to 10,000-foot range with about 36 GPH fuel flow.

The airplane best fits pilots and passengers who are well under 200 pounds, and less than 6 feet tall. If I

was larger than that, I would probably buy a 414 instead of a 340 and just fly 15-20 knots slower.

Kevin E. Ware
Mount Vernon, Washington

The Twin Cessna Flyer has represented 340 owners since 1988. The airplane has never been a better value as it's a buyer's market and bargains abound.

One reservation people have in switching from, say, a five-year-old Cirrus to a 35-year-old 340 is maintenance cost and downtime. A well-maintained older airplane can be every bit as reliable as a newer airplane. The 340 will definitely cost more to maintain. But one in tip-top shape can be as reliable as any airplane on the market—new or old.

On the other hand, a "bargain" airplane can be a financial nightmare. Corrosion is a big concern. The buyer who thought he had the perfect airplane gets hit with a bill of 25 percent of the value of his airplane on the first annual. These airplanes simply must be maintained by a knowledgeable shop. When buying, a pre-buy by a shop that specializes in twin Cessnas is a must.

The electro-mechanical landing gear on the 340 must be maintained strictly according to Cessna's instructions. That means re-rigging it every year or 200-hours whichever comes first. It's an eight-hour job start to finish and many shops don't do it. This is asking for trouble.

Insurance companies will typically require initial training at SimCom or FlightSafety plus 25 to 50 hours with a safety pilot in the right seat. Thereafter, annual simulator sessions are usually required. We have had members with as little as 400 hours total time transition to a cabin-class twin Cessna. It can be done if the owner is sufficiently motivated.

What we hear most often from the new owners is how much they love the pressurization. They no longer have to cajole their family to wear oxygen cannulas. They now routinely fly in the flight levels where the airplane is faster, the airspace less crowded and it's easier to circumnavigate the weather. It's a new world for them.

The two long-term concerns for 340 owners are Cessna's Supplemen-

tal Inspection Document program (SIDs) and fuel availability, given the likely phase-out of 100 LL. SIDs are the industry's way of addressing the aging GA aircraft fleet and will likely affect all legacy GA aircraft, not just twin Cessnas. No one has a crystal ball, but the conventional wisdom is that the FAA will continue to address specific safety concerns via ADs and not resort to the broad-brush approach of mandatory SIDs.

The 340 can fly four to six people at up to 200 knots for 800 miles with the security of a second engine—for a purchase price of \$300,000 or less. For many people, the 340 is the perfect airplane for their mission.

Bob Thomason (President TCF)
Charlotte, North Carolina

Special thanks to Jerry Temple for his background information for this article, and Remy Blanchaert Jr. for his photos.

iPad Aux GPS

(continued from page 19)

the remote system. Performance was flawless. Lights on the face show GPS signal lock, Bluetooth status and low battery.

Bluetooth means you don't have to worry about snapping off the 30-pin connector. But Bluetooth also draws down iPhone/iPad power and our impression is our iPhone discharged slower using the Bad Elf. The iPad allows you to turn cellular and wi-fi off while leaving Bluetooth on, so airplane mode is a non-issue.

Our only beef with the GNS 5870 was turning it on and off. It has no switch; instead you slide your finger up or down the side as needed. Sometimes we had to slide 10 times to turn it on and gave up trying to turn it off. After 15 minutes unpaired it turns itself off.

The Bad Elf is \$99 and the GNS 5870 is \$99.95, but there's \$60 shipping from Germany on the latter from the company. We have seen it online for \$129 with free shipping and Sporty's will carry them soon.

For overall simplicity and airplane-mode use on an iPhone, we like the Bad Elf. For an iPad that was moving around the cockpit, we'd go with the GNS 5870 MFI.

Letters

(continued from page 3)

This made a slow change in the value much more apparent; one did not have to memorize the current value for current conditions, but could just look for adverse trends, allowing attention to be given even if the value of the parameter had not yet changed to an alarm set point.

Certainly, on many flights, there are parameters which never settle down to a steady state value, due to rapid changes in engine speed, altitude and so on.

However, there are other flights where parameters do settle down to a steady state value and an inflection in a trend line is a much-easier-to-see warning of an incipient problem than a change of a value from near the top of allowable values to near the bottom of allowable values over the course of several panel scans.

Such a feature could be easily implemented in a video display, but I am unaware of any offerings in this regard. The closest I've seen is the ability to download historical information from some instruments after a flight and display it graphically on a computer.

Are you aware of any instrumentation with this capability for general aviation aircraft?

Allen Inks
Via e-mail

Actually, some glass systems do have trend lines. For example, some of the systems include in their tape displays for variables such as altitude and airspeed, a magenta secondary tape that shows

directionality and vector of the trend. Furthermore, path or vector indicators are becoming more common and these are also a form of trend indicator in that they show where the aircraft is flying irrespective of which direction it's pointed. We agree that engine trends would be a nice-to-have, but we don't know of any system that displays this in real time.

iPad Letter of the Month

Your thoughts about the iPad were right on. (See November and December 2010 *Aviation Consumer*.) I learned through experience that the brightness can be adjusted... turned to full bright, the iPad is easy to read in a sunny cockpit, but pros tell me that reduces battery life by about 25 percent.

But then, as you pointed out, cheap charging cords running off 24- or 12-volt outlets are the answer. I suspect that turning down the brightness would be great at night, although I haven't yet tried it. I love my iPad and Foreflight!

Paul Larsen
Via e-mail

Government and Fuel

(continued from page 2)

to the point that it can demonstrate its economic viability. Or fail to. But that day is coming.

Meanwhile, do you think the government has a role? I actually think that it does. Well-structured and intelligent government grants can serve to prime the pump in ways that private enterprise can't (or won't) do on its own. Want an example? On the world market,

FEEDBACK WANTED

AEROSTAR



For the May 2011 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Aerostar, a cabin class twin famed for its speed. We want to know what it's like to own these aircraft, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs 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 Aerostar by March 1, 2011, to:

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the U.S. ranks 16th in internet access penetration behind many countries in which government-enterprise partnerships have accelerated the development of this vital utility. Driven purely by profit goals for the next quarter, private enterprise hasn't delivered because so few companies are willing to invest for the long haul.

Unfortunately, as Ronald Reagan might have said, well-structured and intelligent don't belong in the same sentence as government. So the challenge for us is not to figure out if Jatropa can be made into a workable fuel—we already know that it can—but to let free market forces decide if we want to pay what it really costs.