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*The consumer resource for pilots and aircraft owners*

# The Aviation Consumer®


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The Aviation Consumer

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# CONFIDENCE MEN

It's a good thing I don't own a TV because I'd huck a brick at it the next time I heard the words "economic recovery." As of five minutes ago, productivity is up, help wanted is down, inflation is in stasis and the consumer confidence index is … actually, I don't know what the consumer confidence index means, really.

But I do have a gut feeling what simple "consumer confidence" is, and that's why I'm thinking about sending CEO of Cessna, Jack Pelton, a big box of heart-shaped chocolates. Cessna unveiled at Sun 'n Fun their new Corvalis TTX, sporting a Euro-touring sedan interior and the latest Garmin G2000 avionics suite customized for the Corvalis. That's a pretty bold move considering Corvalis sales over the previous two years probably constituted a little more than a rounding error on Cessna's balance sheets.

The crazy-like-a-fox payoff for this bravado was that Cessna sold 16 of the $733,000 beasts. That's just shy of $12M total for those of you keeping score at home. Tack on the 13 high-wing piston-singles and the Caravan they sold, and I think they've got the tornado damage to their display booth covered.

Call it a wake-up call that the buyers are out there, doing what we've been suspecting: Sitting on purchase decisions as much from uncertainty as austerity. Cessna made a statement, announcing they believed in the market, were willing to invest real skin in a quality product and would sell it for a fair price. The confident seller inspired confident buyers who put down real money. It happened with the SkyCatcher and the Mustang in much the same way. Do we see a trend here?

On my 2011 sweets list as well is Aspen Avionics CEO John Uczekaj. Aspen already did the industry a big service in offering a stepping-stone approach to panel upgrades. Now they've partnered with Honeywell to bring some much-needed competition to the GPS/nav/com space that's been Garmin's monopoly ever since Garmin swallowed UPSAT. Honeywell's KSN 770 GPS/nav/com has been stalled for years. So long, in fact, that Garmin has since raised the bar immensely with their new KTN series. But Aspen has a track record of hitting their niche with that right combination of product, price and support. Buyers believe in them and, well, buy.

Aspen also partnered with Avidyne to fill the gaping need for an aftermarket autopilot whose capabilities justify the installation cost. The idea is paring the Aspen digital gyros and GPS/nav integration with Avidyne's digital autopilot. All that's missing from this picture are some digital servos, and your 30-year-old Bonanza can thumb its spinner at gusty crosswinds all the way down a GPS glidepath. Will people buy? Uczekaj says they're lining up.

Confidence, or lack thereof, is probably at the heart of the LSA market stumbling. How can a buyer be confident he or she made the right choice when there are over 100 companies to choose from? Some buyers do their best and take the leap, others just go with what they know (Did I say "SkyCatcher" earlier?) and the rest just wait.

The twin markets of new aircraft sales and reasonable revitalization of existing aircraft are the springs that feed aviation's economic tributary. Kudos to the bold souls working on the first count. The second is a tougher nut. We need engines, interiors, exteriors and avionics at all price points to keep the extant fleet viable and attractive. This may take regulatory reform, such as an ASTM process for parts similar to the LSA market. Will this hurt new sales? I don't see the Lexus dealership suffering from Monty's used car emporium across the street.

Economic recovery? Save it for the talk shows. I like the camp intoning, "The Economy is dead! Long live the Economy!" We make a lot more progress by just getting on with the business of good business. A free box of chocolates to anyone else out there who's ready to bring it on. —*Jeff Van West*

## A Bum Rap

Your thorough reports provide a very valuable service to your readers. Unfortunately for your readers, the March 2011 report on private pilot test prep was not up to your usual high standards, in my view.


For example, regarding King Schools, your reporter had two major complaints. First was the price. But that's because you compared the King Schools price for six courses with everyone else's price for a single course.

King Schools offers a special price for purchasing both the Knowledge Test Course and Practical Test Course of $398. When a customer purchases both courses at the same time, they also receive four Take-Off Courses of their choice. These courses are designed to get customers over particular flight training hurdles they may be having trouble with. Courses include "Take-Offs and Landings Made Easy," "VFR Cross-Country Flying," "Communications," "Surviving Your Most Feared Emergencies," "Night Flying" and many others.

For an apples-to-apples comparison, your reporter should have listed our single-course price for the Private Pilot Knowledge Test Course as $279. It is a bit higher than the prices for the other courses, but that reflects the higher value in terms of informational content and instructional value. We go to a lot of work to make our courses clear, simple, and fun to take—and our customers' results show it.

The second complaint regarding King Schools was that the course requires note-taking. Your reporter must not have viewed our "Click Here to Start" segment—otherwise he would have known that we provide very thorough, yet succinct, notes that our customers tell us they find invaluable. You also mention that our courses are not as "tech savvy"—whatever that means. This is a bum rap. King Schools goes to a lot of effort to use technology to make our courses intuitive and easy to navigate, and to serve up questions related to what the customer just studied right after each segment. To me that is what "tech savvy" is all about.

The problem with this review is that the things King does well—making things so clear that the subject seems easy, and making the course intuitive and easy to navigate—aren't apparent without a little deeper investigation. That depth of investigation does not appear to have occurred in this case.

I know it is difficult to review five separate courses well, but your readers are entitled to a better review than the one provided in this instance. Thanks for giving me the opportunity to level the playing field.

John King
King Schools

## Misleading Letter

I'm afraid to say I find the space you gave the letter by Eric Neeb regarding the Cirrus unfortunate. (See April 2011 Letters) Mr. Neeb is extremely dishonest, in my view, in not disclosing that he is a Cessna dealer.

Thomas Borchert
via-mail

*Neeb did not disclose to us that he is a Cessna dealer but, frankly, we should have checked. A little Googling would have fixed this. Next time we will. His company is www.propelaircraft.com.*

## LightSPEED Fan

I did a bit or research before buying the LightSPEED Mach I. I originally didn't plan on buying the molded earpieces, but using it and having the mic droop and/or flop around (as you experienced) and then discussing the problem with the customer service reps, it was strongly recommended that I buy the molded ear piece and try them.

They were very nice and offered to refund my money if I wasn't pleased with them. The first pair I got were generation one and very satisfactory. They did the job nicely. It has a very thin metal tube from the headset that would either hold the foam ear tips or go into the silicone molded earpiece.

They lasted about three years when, because of the less than optimal design, they tore. The new design has the back of the silicone earpiece completely enveloping the headset body on each side. It is stable and strong with no need for the over-the-ear loop. They have it exactly right now.

My suggestion to them would be to sell the Mach I with the molded earpiece as the standard product. With the molded earpieces in properly, the noise attenuation is absolutely wonderful. I have a pair of LightSPEED 3Gs and a Telex ANR-1D, both of which are very good, but the Mach I bests them both for noise attenuation. The

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# Choosing Retrofit Glass Aspen Takes the Prize

*The Aspen Evolution and Garmin G500 both offer a powerhouse upgrade owners rave about. We favor the Aspen for its scalability and value.*

*by Larry Anglisano*

If you're committed to the account-draining task of a major avionics upgrade, your sights are likely set on either of the two most sought-after systems for the aftermarket: Garmin's G500 and the Aspen EFD1000-series.

We think buyers go into the decision-making process smitten by the G500's bigger size, and for bigger, more valuable airplanes, it's easy to label the G500 a logical fit. But our experience is that Aspen wins the install bid more often than Garmin. Why? It's the install complexity that ultimately rules the decision even when a buyer's heart is set on the G500 from the get-go.

## AVIONICS SMACKDOWN

That said, keep in mind that to compare apples to apples, you need two Aspens to equal a single G500.

### BIGGER, BUT BETTER?

Aircraft in the 6000- to 12,500-pound category have only one choice: Garmin's $30-grand G600 system. The G600's software is certified for this class and the system is sold soup-to-nuts with little in the way of add-on options. Aspen's EFD1000C3 flavor is aimed at Class III applications. The a-la-cart G500 is aimed at the lighter stuff and owners can add charting, SVT synthetic vision and other options as needed to keep the total cost a bit more in check.

The G500 stands out in the marketing propaganda because it looks bigger—and it is. The Garmin has dual screens (PFD and MFD) housed in a single bezel. Each color LCD screen measures 6.5-inch diagonal with 640x480 VGA resolutions, displaying 65,536 colors. Some owners react that the machine looks smaller in the panel than they envisioned after eyeing the brochures. This could be an illusion for large panels. But, on a small panel like in a Mooney or Skylane, the G500 is dominant.

Aspen's PFD is a single 760x400 32,768-color LCD screen design that measures six inches. The bezel width is such that it fits dead center in the middle of the six-pack, slid-


ing through the existing three-inch instrument cutouts and secures to a rectangular, surface-mounted bracket. There's a flush-mount option, but it requires chopping of metal—just like the G500. An optional second or third screen, the 1000- and 500-series MFD, can occupy the space to the left or right. A dual screen setup is called the Evolution 2000.

The Aspen display has data bars that split it into a top and bottom half. Measure the total viewable area above that data bar (which contains horizon and airspeed and altimeter tapes) and you get an area that's roughly 2.50 inches high and 2.75 inches wide. The G500 is clearly wider at four inches. Thanks to that extra screen space, the G500 on-screen nomenclature is stamped in a larger font that buyers are, not-surprisingly, drawn to. The size also makes the G500 PFD screen look less busy than the Aspen.

Aspen's latest software (2.3.3) increases font size for airspeed, altitude bug, tape and drum values, baro setting, selected heading and course while also increasing the size of the values in the data bar. This is a big improvement, even for our 40-something-year-old eyes. On the topic of software, both systems have software platforms that are easily upgradeable in the field, in most cases.

## INSTALLATION REALITY

Many of the systems flight-critical electronics live inside the EFD1000 display, which saves critical space and installation effort. It includes the AHRS and a digital air data computer that has pitot and static fittings on the back of the display chassis, an input-output processor (IOP) and of course a main system processor. A configuration module stores installation, aircraft-specific calibration, and user data settings so swapping out a display requires no reconfiguration. Housed in the rear of the display is a cooling fan and backup battery that has enough juice for 30 minutes of display life. A remote sensor module (RSM) containing a magnetometer, OAT sensor and GPS receiver is mounted on the airframe.

A complete G500 is composed of the GDU620 display and remote units: a GRS77 AHRS, GDC74A air data computer, a temperature probe and GMU44 magnetometer. There's no backup battery.

The single-screen Aspen weighs roughly three pounds, while the G500 is closer to 15 pounds, including the huge wiring bundles (some of which is Ethernet) routed between all of those remote boxes.

Aspen understood early on that radio stacks have a smorgasbord of equipment and designed to play with the crowd.

**CHECKLIST**

| ASPEN | | GARMIN |
|---|---|---|
| ~ | SIZE AND CLARITY | + |
| + | SYSTEM FLEXIBILITY | ~ |
| ~ | SYSTEM REDUNDANCY | − |
| ~ | INSTALL COMPLEXITY | − |
| + | CUSTOMER SUPPORT | + |

## CONTACTS

Aspen Avionics
888-992-7736
www.aspenavionics.com

Garmin International
800-800-1020
www.garmin.com

The mysterious remote analog converter unit (ACU) converts analog signals to digital format, allowing vintage nav radios to play on the Aspen electronic HSI.

G500 is snobbish in comparison, accepting input from the world-conquering GNS-series (and now GTN700 and 600 systems) and the Garmin-AT SL30 Nav. Have a KX155 you want to feed the G500? It won't work, so you'll need to retain it stand-alone or buy a 430. For some buyers this is a deal-breaker.

On autopilot interconnects, both systems are liberal. Garmin was the first to offer a digital autopilot emulator with the GAD43 that can replace Bendix/King and some Collins autopilot gyros. Aspen joined the party with the EA100 emulator, which at this time only has Bendix/King emulation. Aspen said it's working on a Century and ARC interface. S-TEC interfacing would require turn-coordinator emulation and isn't in the plans for either system. The G500 can command the S-Tec the remote altitude preselector with a $2995 enablement card. The Aspen cannot. In our trials, both the EA100 and GAD43 work flawlessly and jump-start older analog autopilots while increasing reliability.

Both systems include integrated GPS roll steering (GPSS), which is a dollar saver since you won't need to buy the $3000+ GPSS upgrade for your existing autopilot. Aspen makes GPSS more seamless, however, with on-screen control. The G500 requires an external switch, increasing the install effort and operational complexity.

On the topic of GPSS, one function we like in the Aspen GPSS is the wings-level mode. If the GPSS is active and the GPS source is lost (not unheard of and often unrecognized by the pilot) the GPSS mode automatically switches to wings level and alerts the pilot to select another means of tracking.

The G500 accepts oodles of remote inputs including the GDL69 XM receiver, a wide variety of traffic systems, the L-3 WX500 and Avi-

## ASPEN'S SYSTEM MAKES FOR A "SIMPLER" INSTALL

Installing either of these systems in any aircraft is a major job. If someone brags that the Aspen is a drop-in system they simply mean the chassis of the display drops through the existing horizon and DG instrument holes. That's where the simplicity ends.

Over the years, we've learned to judge install complexity by length of the installation manual. The G500 has several manuals, broken down into electrical, physical and the configuration process. Expect a shocking instrument panel gut-job.

For the G500, it's either the replacement of the entire pilot's instrument panel or creative sheet-metal artistry that includes painting the entire instrument to match.


With an Aspen, the paint cans and cutting wheels stay in the storage cabinet because the holes are already cut, and seldom does the instrument panel even need to be removed from the aircraft. There's some shifting around of supporting instruments and perhaps some relocation of toggle switches and annunciator panels, but that's about it.

The techy buzz word in a G500 suite is LRU for Line Replaceable Units. These sub-units are modular in design and are mounted either wherever there's room and appropriate environment for each particular sensor. Big work. Garmin says this design eases troubleshooting and maintenance by easy replacement of a remote box. But the install is time-consuming and complex, and it's not uncommon to relocate and rewire systems that might cause interference—like strobe lighting and power supplies and collocated coax cables.

Aspen's remote sensor module (RSM) can be an issue. It's the size of a GPS antenna and attaches on the rear of the fuselage in a magnetically clean area. This can be especially tricky on composite aircraft. There's an option for mounting the RSM internally, but that requires additional approvals and disables the OAT, winds aloft and TAS data.

Configuration and setup of either system is an important and lengthy portion of the job, but our experience is that Aspen's setup is easier. If you're installing autopilot gyro emulators, expect sizeable amounts of flight testing. That's more time off the calendar and on the final invoice.

dyne TWX-series sferics systems, as well as TAWS terrain input. Aspen plays XM with the EWR50 Evolution Weather Receiver or Heads Up XMD76. Garmin's GDL69 won't work.

## TRULY À LA CARTE

A huge selling point for Aspen is the incremental upgrade potential. Simply add a second or third screen as budget allows. Like the right half of a G5000, the second screen is for playing weather, terrain and georeferenced NACO charts but the wider screen area on the Garmin makes for a nicer chart presentation, in our view. There's also traffic overlay that can play on a single EFD (as can XM weather) with appropriate software. It takes two Aspens to challenge a G500.

But pairing Aspen displays also provides redundant backup and flight data integrity cross-checking with dual-AHRS. There's also split-screen data capability. The reward for this extra cost and install effort is a regulatory green-light for removing all of the backup flight instruments except the attitude gyro. Note that you'll need the 1000MFD and remote battery for this. The lower-end 500-series MFD won't allow reversion to function as a backup PFD.

A single G500 offers little in the way of single-point display failure redundancy. If the screen fails, you're now on the steam gauge backup instruments.

But that's not the whole story. The Evolution system's Achilles heel is pitot-static blockage. Loss of either pitot or static data will not only remove the airspeed and altitude, it will remove heading and attitude on all Evolution displays because its reliability may be in question. It will also take down the autopilot if you're using the EA100 to drive it. Good thing you still have that retained attitude gyro.

Aspen told us certification without traditional horizon gyro is on the doorstep, and the new software won't remove the attitude data. It may still be unreliable, however. The G500 will still provide attitude data without airspeed input.

While we're talking about dependent systems, flying IFR with an Evolution requires an IFR GPS is installed and working.

We think the G500 MFD capability exceeds the Aspen, if simply because it is that much bigger. It can also overlay ship radar. The G500 has FliteCharts (NACO approach charts) and SafeTaxi standard. The pricey Jeppesen ChartView is optional. Aspen offers NACO charts only, but they are georeferenced (your position is shown on the chart) where FliteCharts are not. An annual FliteChart subscription for the Garmin is $395. For the Aspen, it's $299, and is supplied by Seattle Avionics.

Aspen should soon offer synthetic vision for $2995. For multi-screen setups, the syn vision cross-feeds among displays. Garmin's SVT is wonderful on the G500 and worth the $4995 option. We'll have to fly it on the Aspen to see if the extra visual information overloads the already-busy display.

We don't care much for the Aspen's rate of turn indicator, a curved white line on either side of the heading, with tick marks for full and half-standard rate turns. We're not fans of the Aspen's small and

*continued on page 23*



*Here is a G500 and a two-screen Evolution system reproduced at one-half actual size. Garmin's on-screen text is noticeably bigger. Both systems rely on softkeys that are about the same size. The G500 relies more on multi-step menus than the Evolution. You can also see how two backup instruments or a third Aspen display could be added in the space occupied by this text.*

# Great Lakes Revival: Docile and Glass Smooth

*We're not big on the nostalgia thing, but the Lakes' handling rivals any modern airplane we've flown. And Waco Classic is taking orders.*

*by Paul Bertorelli*

**CHECKLIST**

- Overall size and weight is just right, making it easy to muscle around a hangar.
- Several engine options up to 210 HP are available.
- Handling is probably as pleasant as anything flying, with few bad habits.

There aren't many airplanes that feel precise and balanced in flight without being twitchy and solid without being heavy. The Bonanza 33/35 series qualifies and some say the Cirrus line is close. We recently discovered one that has the middle of this lane nailed down. Improbably, it's the Great Lakes classic biplane, which Waco Classic is now reintroducing as a sport aircraft. (Not light sport, but certified, mind you.)

**AIRCRAFT FLIGHT TRIAL**

Just as improbably, it filled up its order book with at least a year's backlog at the Sun 'n Fun show in April and the year is barely a quarter old. What the heck is the appeal of a 80-year-old open cockpit throwback to the Depression era? If you have to ask, you can't possibly understand, but we'll try to explain it.

The Great Lakes was first developed in the late 1920s as a trainer and personal fun airplane. Market timing was right because the post-World War I flying boom was sustained by the Curtis JN-4, which was difficult to handle and getting long in the tooth servicewise.

Great Lakes enjoyed a flood of initial orders, but before the factory could fill them, the onset of the Great Depression in 1929 gutted the market. The factory survived in reduced circumstances, but only 264 of the original Model 2T were built.

Although designed for a Warner radial, it never had that engine line but the American Cirrus Ace engine instead. Great Lakes production survived on and off long enough to see the airplane get a Lycoming O-320 and an AEIO-360 with the last of the original—albeit much improved—line. Waco is certifying a new engine for the airplane, the 210-HP IO-390 and AEIO-390.

In 1931, when the Lakes was still in its heyday, despite the Depression, it sold for a rather pricey $2985, the equivalent of about $42,000 today or the price of a Lexus IS350 luxury sedan.

Waco Classic, which builds various versions of the big-brute Waco YMF-5D at its Battle Creek, Michigan, factory, will put the Lakes into production later this year, on customer-order basis. Two models will be offered, the $219,000 Touring model with a 180-HP Lycoming IO-360 and the Sport model at $239,000 powered by a Lycoming AEIO-360, also at 180 HP. (Both are aerobatic.) Waco says it will certify a new engine for the Lakes, the 210-HP IO- and AEIO-360.

Who are the buyers? Peter Bowers of Waco Classic told us these are owners who want a docile, medium-performance aerobatic airplane without setting their hair on fire in a Pitts or an Extra. Some of them may be buyers who would consider a Decathlon, but realize for not much more money, they can live the dream of 1930s Golden Age flying.

## SMALLISH

Part of the appeal of the Lakes is its size. Think of it as a three-quarter scale version of the Waco. It's 20 feet 4 inches long, with a wingspan of only 26 feet 8 inches, but a wing area of 187 square feet, making the wing loading about 9.6 pounds per square foot. With the 180-HP Lycoming, power loading is exactly .1 HP/lb. This results in a respectable, if not spectacular, climb rate and cruise

speeds in the 120 MPH range, or about what the typical LSA does. Stall speed is a lazy 59 MPH.

We flew Lakes expert John Duncan who told us the airplane we trialed had an empty weight of about 1000 pounds on a max gross of 1800 pounds. It carries 26 gallons of fuel in top-wing tanks, so practical endurance is three hours, making a 300-mile trip easily doable.

## IMPROVING IT

Waco Classic plans to adhere to the original construction, but with some significant changes. It will get some structural attention to handle the IO-390 and instead of the airplane's original Doug Fir spar, the new models will have an aluminum spar build-up. That will move the gross weight up to 1900 pounds. In addition, instead of the original heel brakes, the new models will get modern toe brakes. That will be a mixed blessing for those not accustomed to light braking in a taildragger, for modern brakes have more than enough grip to put an airplane like this on its nose.

The Lakes emerged from the industry just after Lindbergh flew the Atlantic so, in a sense, it's a "Gen II" biplane, with more use of riveted aluminum on various structures and a newer oleo strut landing gear that, as John Duncan told us, "makes a mediocre pilot look good."

## FLYING IT

One thing Waco can't modernize is egress into the front hole. It's smallish and the top wing traverses the center of its diameter. It requires an awkward, backward swing to get in the first time. The second time, we suspect muscle memory will make you look less spastic. The harnesses are Hooker four-points, but need to be tighter because the front cockpit combing is barely six inches away from your nose. That could hurt in a roll over. Bowers said this will be addressed.

Visibility over the nose from the front is decent, although shallow S-turns are required. You really sit deep in the fuselage, so wind protection with the stub windshield is good, albeit with a deafening noise level that will require a good high-noise intercom and mics to overcome. Bowers told us a higher windshield is planned, but we're not sure it needs it. With the engine heat, the front cockpit was quite comfortable on a cool, humid morning.

Takeoff is standard taildragger stuff. The tail comes up with a moderate push and then the Great Lakes' handling qualities immediately reveal themselves. It has glass-like smoothness in response to

*Pilots sit low in the front and rear cockpits, with good wind protection. Panel is spare and small; no room here for fancy glass, upper right. The long-travel oleos, right, make for the smoothest landings among any taildraggers.*

**AC TV**

For a video tour of the Great Lakes and an interview with Peter Bowers, log onto to our sister publication www.avweb.com and click on the video button, or use this direct URL: http://snipurl.com/27qnnj

all control inputs and because there's no evidence of twitchiness, the forces feel very linear. The roll rate is not Pitts quick and it comes with moderate force, but the entire airplane feels like it's on a ball-bearing mounted longitudal shaft. Like most older designs, it has some adverse yaw, but it only takes touches of rudder to correct this.

The power control is similarly precise, with a lot of travel required to make power changes. "Jerky" just isn't in the Lakes' vocabulary. The trim mechanism is similar to a Piper Cub in principle, but different in execution. A jackscrew adjusts the leading edge of the horizontal stabilizer to trim off pitch forces, but rather than a crank, you just grab a tightly strung chord threaded through a steel sleeve in each cockpit. Move it forward for nose down, aft for nose up. Effective, simple and intuitive; we liked it better than the Cub's crank.

But the landing was the real eye opener. We're quite tailwheel current, thanks, yet when we fly tailwheel LSAs for trials, we expect to be a little humbled on the first try or two. All tailwheel airplanes have their minor quirks.

Not so much in the Great Lakes. Thanks to those bump-eating oleos, our first wheelie attempt was a greaser. John Duncan said that three-pointers are similarly easy to achieve if you just hold the attitude. "It doesn't matter if you start that from a few inches or a few feet, it will just settle in," he told us. That said, the Lakes is still a taildragger and it will bite and head for the ditch if you let it. So like any other tailwheel airplane, staying ahead of it on the rudders is a must.

Considering its size, power and wing loading and superb handling, the Lakes strikes us as one of those near-perfect compromise airplanes that no one knows about. But as the sport aviation industry matures, that just may be about to change, if Waco Classic has anything to say about it.

## CONTACTS

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269-565-1000
www.wacoclassic.com



# Lakeland Tiedown Test: What Worked?

*A surprise tornado roared through Sun 'n Fun in March, testing the mettle of both commercial and homemade tiedown solutions.*

*by Paul Bertorelli*

Sun 'n Fun 2011 may very well go down as the year of The Claw, the ubiquitous yellow three-leg tiedown system that dominates the portable tiedown market. When an F1 tornado roared through the airport, The Claw got its supreme test. Did it pass? It generally appeared to perform well and the company wasted no time getting testimonials up on its Web site. But there were dramatic failures of all the tiedown systems, including The Claw. Although The Claw staff told us no portable tiedown system could hold in the kind of winds that struck Sun 'n Fun, we think there are methods to tiedown that will survive those kinds of winds.

## WALKING THE LINE

After the storm abated, we walked the line and examined and talked to various

owners about their tiedown strategies. The Claw was the most widely used. It has been aggressively marketed and with its unique, stake-and-leg design, it's easy and quick to install. Based on our tests, its performance is highly variable depending on soil type and conditions. (Too dry is as bad as too wet.) Our tests have revealed pull resistance between 200 pounds and 600 pounds, but never the 1200 pounds the company claims.

Nonetheless, it appears that The Claw probably held fast more often than it gave way and many owners approached the Hunting Solutions booth lavishing praise on the product. The company promised to replace any broken anchors and handed out at least two sets while we were there.

"I'd use them again in a heartbeat," said Dan Mercurio of Van Bortel Aircraft. "They held great." Mercurio had a Cessna 182 secured outside the main hangar area. On the other hand, in the American Legend booth, Dave Graham's experience wasn't so positive. One of Legend's Cubs blew into the tent after the Claws securing it pulled out.

As shown in the photo, one of the anchors failed in a way we saw repeated several times, including in our own tests. When the anchor begins to pull out, it rotates, side loading one leg and snapping it near the center mount. (Here's a video showing the physics: http://snipurl.com/27qrg5)

We know Hunting Solutions has seen this before, so we asked if they plan a fix. The answer appears to be no, since owners say they want a light, easy-to-carry tiedown system that fits into a small bag. The company's Bill Alexander told us they have experimented with larger, heavier hardware for The Claw, but the market simply isn't interested in either paying more or carrying the additional weight.

Alexander said the product has been beefed up since we last tested it, but it will still fail if the winds are high enough or the soil is weak or wet. Before marketing it, Alexander said the company actually tested the product at Lakeland and achieved pull resistance of about 750 pounds. However, Alexander says when the soil is saturated, as it was at Lakeland in March, pull resistance will be far less.

*Most Claws (right) seemed to hold against the wind, but not for the up-ended Super Cub, above. (See inset.) In the Legend booth, one Claw failed in a characteristic way, allowing the airplane to blow back into the vendor tent. We saw several such failures. The best all-around tiedown system was Diamond's, lower photo. It's a 3/4-inch steel T-rod driven into the ground at a 45-degree angle.*

## K-9 AUGERS

In our previous tests, the so-called doggie or K-9 augers that show organizers sell as a in-a-pinch solution have yielded mixed results, with pull resistance ranging from 200 pounds to more than 500 pounds. These products vary widely in quality and in the 10 years we've been testing them, we've noticed a troubling trend. Most are manufactured in China and the metal quality seems to have worsened.

If you use a pry bar or long screwdriver as a lever to screw the auger into the ground to its hilt, you're likely to fatigue the metal where it bends to form the triangular anchor point, weakening it or breaking it outright. We experienced this during our tests.

*The nosed-over Zenith, upper left, was tied down with doggie augers that pulled out. (See inset.) The amphib Husky, lower photo, appears to have been secured with lightweight, rod type ties.*

In the real-world tests at Lakeland, we didn't see any failed K-9 anchors, but we saw pull outs from saturated or weak soil, or from anchors simply not driven deep enough. But we also saw many that held just fine. According to our tests, both The Claw and the K-9 anchors provide more pull resistance if situated under the tiedown ring, rather than at an angle. For rope, use ½-inch Dacron instead.

## BEST CHOICE

We're sticking with our recommendation that The Claw is the all-around best and most practical *commercial* system. If fits in a bag, comes with a hammer and straps and is easy to use. Better yet, if it breaks, the company will replace it. Still, there's there's a better solution, in our view, and that's the homemade heavy tiedown anchors used by Diamond Aircraft, JAARs and others in their display booths.

These variously consist of ¾-inch steel rod or rebar with a T or eyelet welded at the top. They're between 18 and 24 inches long and will penetrate beyond any rain-soaked and mushy layer of top soil. With a shear point ground on one end, they're easy enough to drive into the ground with a medium-sized maul and are extractable, but with effort.

The JAARs system uses three of these stakes driven into an inverted cone pattern at each tiedown point and joined with a chain. Think of it as a giant, heavy duty Claw. We suspect they'll hold in any wind. Diamond's version, pictured on page 11, is driven in at a 45-degree angle to the horizontal, toward and outboard of the tiedown ring. In other words, the tiedown rope pulls perpendicular to the axis the rod is driven on. You see this type of stake used to anchor large commercial display tents. It's sometimes driven right through pavement.

Diamond used heavy cordage to snug their airplanes down and none of them budged, even as Rans' LSAs were being ripped out of the ground like kites. The downside of this system is weight and cost. We would estimate the total weight at 10 to 12 pounds for the Diamond-type design and at least 30 pounds for the JAARs version, compared to about 3 pounds for The Claw. But the tradeoff is greater holding power, which JAAR's Darryl Neidlinger told us easily resisted the Lakeland blow.

FUTURE FUEL

# 100-Octane Cost Data: Sharpening the Pencil

*For Swift, holding the pump price down will hinge on finding cheap acetone. GAMI's G100 may be cheaper, but will oil companies balk at a proprietary formula?*

*by Paul Bertorelli*

The two leading contenders to replace 100LL with an unleaded equivalent, Swift Enterprises' Swift Fuel and General Aviation Modification Inc.'s G100UL, both say their fuel will cost more than 100LL. But how much more? We took our own run at it based on what we've been able to glean about these fuels from patent filings and information from the two companies.

According to its patent filings and published FAA test data, Swift is a binary blend of mesitylene (also known as trimethylbenzene) and isopentane. Mesitylene is a bit of an exotic, used for specialized solvents and industrial processes. It's a terrific octane enhancer, but so rare in industy that no commodity prices are available. One supplier we contacted sells it for $53 a gallon, a price that's obviously unsustainable for fuel use.

Isopentane is a low boiling point hydrocarbon that's produced as a light fraction during initial refining. Some refiners break it down for other uses and it's also a constituent in cosmetics. According to the FAA's report, Swift Fuel contains 85 percent mesitylene and 15 percent isopentane, although that ratio may vary.

GAMI's G100UL is more complex and variable, consisting of a high-grade aviation alkylate that's similar to the base of 100LL avgas before it's dosed with lead and aromatics like tolulene. G100 has been blended in a number of variants, one of which includes mesitylene. More promising economically, however, are G100 blends that include various types of xenols, including para-, meta- or ortho-xylene. These materials are cheaper than mesitylene and traded on chemical commodity markets, thus they're more widely available. Still, pinning down prices is slippery because like all commodities, these materials have dynamic price swings depending on demand for plastics, chemicals, paints and solvents, in which they are used.

Although G100UL lacks the motor octane of either Swift Fuel or typical FBO 100LL, GAMI says it performs equivalently in full-scale engine tests and better than min-spec 100LL, which, according to ASTM D910, can be 99.5 octane. To provide a little margin, refiners typically deliver 101 to 103 octane. To beat the mesitylene price challenge, Swift proposes to make its own from acetone and the core of its research work is to refine that process and—the critical part—to find cheap acetone.

## SWIFT'S NUMBERS

Our run at the math works out like this: The world market price for acetone is currently about 50 cents a pound or about $3.25 a gallon. A refinery source we checked with told us acetone will convert to mesitylene at a 1.6 ratio, meaning 1.6 gallons of acetone will be required to make a gallon of mesitylene for about $5.20, just in materials. This appears to be supported in Swift's patents.

Make room for the isopentane, which costs about $1 a gallon, variable with season, and our stab at the finished price at the refinery gate is about $4.40. But that number includes no capital costs, no transportation, no storage and no processing, which could bring it closer to $5 out the re-

finery gate. Adding up the the wholesale margin, transportation costs and FBO flowage, it totals just under $7 retail. It could be higher, however, if capital costs prove greater than estimated for a small volume. On the other hand, saleable co-products from the acetone conversion process may reduce that a little.

It also matters where the acetone comes from because what's good about acetone is also bad. It can be—and has been—a lot cheaper than 50 cents a pound. But it's also recently sold for as much as 90 cents a pound, which would make for the $8 or $9 price you worry about. Swift's challenge is to find cheap, stable sources of acetone. Acetone prices are tied to propylene, a chemical intermediate that's a byproduct of refining. but also an acetone feedstock. In our estimation, in order to compete directly with 100LL, which exits the refinery for between $2 and $2.25, Swift will need 20- to 25-cent acetone. Conceptually, acetone can be produced through biomass sources, but Swift hasn't proven the economics nor taken the bio process end-to-end at large scales.

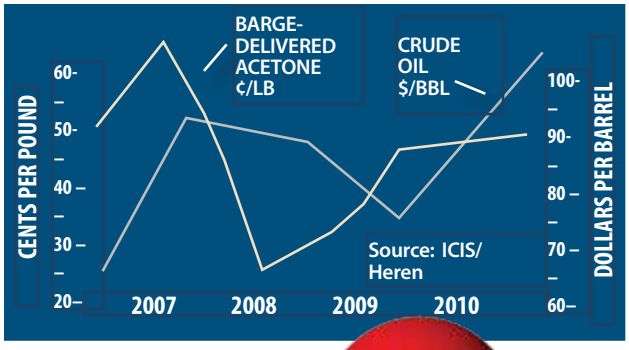
## G100UL

G100UL has its own challenges. Although it's more closely related to traditional refining than is Swift fuel, refiners may balk at producing proprietary compositional blends for which they'd pay a royalty. Swift's binary blend also departs routine refining and would require dedicated or perhaps converted infrastructure, such as a modified ethanol plant.

Although the xylols are cheaper than mesitylene—like acetone, about 50 cents a pound, but sometimes less—they also don't provide the motor octane numbers. And like acetone, their prices flucuate even more than crude oil does because of volatile demand for plastics and other goods.

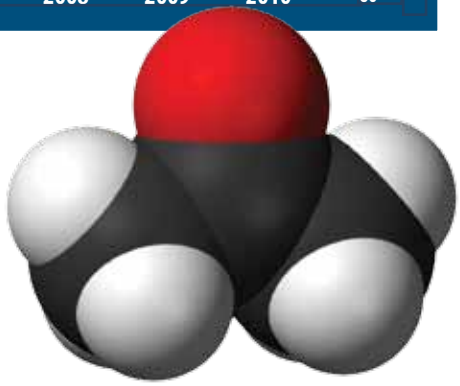
G100UL starts out with a higher quality alkylate than typically used for most avgas—95 or 96 octane. Estimating the price of the high-grade basestock is difficult, because like everything else, it's subject to market conditions and commodity swings and it's not a current product. A good guess is $3 to $3.50 If the G100 blend requires 40 percent high-quality gasoline and 40 percent xylols, the finished fuel comes out of the refinery for between $3 and $3.30, allowing for other blendstocks such as butane, which is added for vapor pressure control. Add in the markups and transporation and our best guess range is a retail price between $5.50 and $6.00 in the current market. But "current market" is a moving target.

*Chart at right shows how highly variable acetone prices are, from as little as 20 cents a pound to as much as 90 cents. To be economically viable, Swift needs the lower number.*




Both fuels are in ongoing testing, Swift in an Embry-Riddle project beginning this summer and GAMI with its own flight tests. One concern with heavy aromatic content fuels is how they behave in cold starts, especially with carburetors.

GAMI's George Braly says the company has done some initial testing in a Cessna 150 and has noted no significant cold start problems. Swift will need to conduct similar testing. Braly says if there are cold start problems



with heavy aromatic fuels, they may simply require more pre-heating or pre-heating at higher ambient temperature than that required for avgas.

The most immediate challenge ahead of both Swift and GAMI is that neither is ASTM approved. Until that happens, neither fuel will find its way to the FBO pump nozzle.

## NEW ADDITIVE SHOWS PROMISE

**Whether Swift Fuel or G100 are economically viable or not, they face one challenge: Who will make them in volume? Oil refiners may resist proprietary formulations that require capital investments and/or licensing arrangements. They would prefer a simple additive—just like lead.**

**Chemist Ed Kollin, the developer of the CamGuard oil additive, says he may have one. As we went to press in April, Kollin was continuing testing on a fuel additive that he says shows promise as a direct replacement for tetraethyl lead.**

**Kollin told us that when his additive was blended with a 90-plus octane aviation alkylate basestock dosed with half the current level of lead, it yielded a whopping measured 110 octane, far more than even the most octane-hungry GA engines need. When the new additive was used without the lead in the same basestock, it produced 101-octane fuel. Kollin is in the process of filing patents so he declined to reveal details on the additive, but he said that it could be blended with alkylate in just the way the lead is now, at the tail end of the refining process. Refiners would purchase it as a material, just as they do with TEL, with no need for license fees or royalties.**

**Kollin told us he has done some initial aging and stability tests, but no full-scale engine tests. Nor have any formal materials compatibility tests been done. Further, it's too early in the process to submit the additive for ASTM consideration.**

**"This is very encouraging," Kollin told us. "This is not a highly expensive molecule to produce. If nothing else comes of this for aviation, we will produce an automotive octane booster that you'll see on the shelves at your local NAPA."**

# TCM's FADEC Revisited: Will It Get Traction?

*Owners who have the system—that's not many—give it positive reviews. With other electronic systems coming, market timing may be improving for TCM.*

*by Paul Bertorelli*

More than a decade ago, Teledyne Continental bought a fully formed full authority digital engine control system from a startup called Aerosance. It made perfect sense, since at the time, many in the engine business thought the market was overdue for dumping magnetos in favor of electronics, which cars have had since the 1970s.

The many turned out to be wrong. TCM got hardly any traction with its FADEC system, even though those who have flown it, installed it and own it say it should have succeeded. Why it did not seems to be due to a combination of bad timing, a hidebound market and conservative OEMs. But with fuel prices rising and 100LL threatened, is there resurgent interest in electronic ignition in general and TCM's PowerLink specifically? It appears so.

***With its XL2 trainer/sport airplane, Liberty Aerospace was the only OEM to adopt the TCM system in the form of the IOF-240. The company's pleased with performance and maintenance history, but isn't sure it would make the same choice again due to lack of widespread industry acceptance.***


## THANK TOYOTA

Although most in the industry don't know it, the inspiration for TCM's PowerLink system may owe at least some of its inspiration to Toyota. In the mid-1990s, Toyota engaged a Hamilton Standard group to develop one of its Lexus engine models as an aircraft engine. The project was carried through to completion, was certified and actually flew test flights in a Twin Cessna. Toyota apparently dropped or at least shelved the project and it never came out of the ground. But the Hamilton Standard group, led by Steve Smith, carried on with piston-engine research, eventually forming Aerosance, the company that TCM bought to acquire the technology.

What became the PowerLink system was and is an automotive approach to aircraft engine management. It has variable timed spark based on stored performance mapping and closed feedback loops and it controls fuel through electrically activated injectors that precisely meter pulse width. Unlike diesels or some automotive gasoline engines, it doesn't have a common-rail fuel system, but uses an adaptation of Continental's familiar top-mounted spider distribution.

The system was intended to mature in a way to eventually include an electronically controlled prop governor and turbo controller, but it hasn't gotten that far yet. It is, nonetheless, a single-lever system and owners who have operated it say this is one of its principle advantages. The other is more consistent leaning and better thermal control of the engine, which Continental argued would improve engine durability. But in our view, there's too little operational history to prove that point.

## EVERYONE TRIED IT

To their credit, most of the OEMs we've asked about the PowerLink

system confirm that they tried it. Cirrus did, Cessna did and so did Mooney and Diamond. We were told by a Bonanza owner that Beechcraft planned to offer the system this year as an option, but Hawker Beechcraft declined comment one way or another.

Of all the OEMs Continental pitched the system to, only one picked it up: Liberty Aerospace. It now has about 150 PowerLink systems flying throughout the world in its XL2 trainer. We'll discuss Liberty's experiences later, but first, why didn't the other OEMs bite?

Diamond was actually in the best position to adopt PowerLink because one its C1 trainers was used by Continental as a testbed for the IOF-240. In fact, Continental still has that aircraft flying.

Diamond's Peter Maurer told us that a combination of cost, unfamiliarity and lack of strong buyer demand convinced Diamond to wait.

"At the time, we were a little bit nervous about the maturity of the system," Maurer said. "It's not that it didn't work or that we were suspicious of it, it was just an unknown with no established service record." Cost was an issue, too.

Diamond rightly saw the trainer market as more price sensitive than more expensive airplanes are and figured that a four to six percent premium might cost more sales than it would create. "The way we saw it, the biggest benefits were for a large engine burning a lot of fuel. A five percent savings on 4 or 5 gallons an hour would never pay for that system. We just couldn't see the benefit," Maurer explained.

"Now, it's 10 years later and I'd guess I'd say we definitely wouldn't refuse it. Continental has had it in the C1 for a long time and we think the airplane runs great. I could really see it being more attractive now. I'd have no qualms about going with it."

## LIBERTY'S EXPERIENCE

Liberty Aerospace evidently had no such qualms and adopted the IOF-240 for the XL2 around 2003 or so. About 150 have been produced and are in service worldwide, with significant numbers in Asia. Why did they say yes when Diamond said no?

"At the time," said Liberty CEO Keith Markley, "Continental said that given what they knew about the market, they couldn't conceive that anyone would be building airplanes without FADEC engines. That made sense to us. We wanted to be cutting edge without being silly."

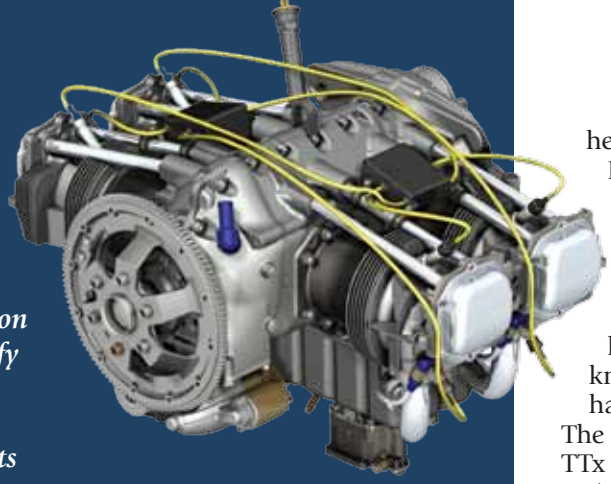
Markley told us that the engine's simplified single-lever operating mode, built-in diagnostics and the promise of slight economy improvements were attractive. "And to us, it still makes sense," he said. "It just works." But that's not to say there haven't been bumps. As did Diamond with the Rotax it originally used in the DA20 Katana, Liberty has encountered issues with shops who just won't or can't maintain it.

"We have run into shops where the guy just doesn't know how to use a PC. He doesn't even have one. He doesn't have internet service and he doesn't use e-mail. Shops have to learn to be computer literate. The industry just hasn't gone that way yet," Markley says. Interestingly, Liberty has placed some of its airplanes in countries where the airport maintenance shop is nothing but a rough lean-to, but even those mechanics have produced laptops capable of downloading PowerLink diagnostics, says Markley.

Customer reaction? "In most cases, it has been positive," Markley told us. After the usual initial teething pains, chronic maintenance issues or failures have been minimal. In fact, Markley said he knew of no engine failures with the system, although one owner, Daniel Spitzer, told us he had a brief inflight engine stoppage that was resolved without need for an emergency landing.

Spitzer owns XL2 serial number 30 and fully realized with a new airframe and a new engine, he would be a beta tester. "And indeed I have been on both of them," he told

*At Sun 'n Fun 2011, above, Liberty revealed what might be described as a lost opportunity for Continental. For Asian markets where mogas is a dominant aviation fuel, it will offer the Rotax 914S over the Continental IOF-240. The company says U.S. sales are a possibility. Another early TCM FADEC adopter was Malibu Aerospace, whose high-dollar conversions to the IOF-550 perform well, right, but haven't found many takers.*



*Continental isn't the only player in the electronic ignition field. In addition to its IE2 engine, Lycoming will have electronic ignition on its emerging O-233 for the LSA market, right. The system was developed by Champion as a means to lighten and simplify the engine. It uses a permanent magnet alternator and two coil boxes to generate spark to two sets of plugs. Meanwhile, E-Mag, lower photo, continues work on an electronic ignition system that will replace magnetos in certified engines. Electroair is also developing a certified system.*

us. With 900 hours on the airframe in five years, he has been through three sets of engine control units, but reports that the current pair have been operating flawlessly after some issues with software and switches were sorted out.

He's technically savvy enough to plug a laptop into the system to occasionally monitor its performance or download data, but has found little need to do that.

"I have never had so much as a fouled plug," Spitzer told us. "The system adjusts automatically to hot and cold days, it leans for altitude and I don't even need to think about it." When we asked if he would insist on a similar FADEC system if he upgraded to a larger aircraft, Spitzer said: "I can say unequivocally yes. I would not consider an airplane without FADEC. I could not see going backwards."

## AFTERMARKET

Although Liberty represents the largest single user for TCM, there are a number of systems flying in experimental aircraft and some shops—including Malibu Aerospace and TCM's Mattituck subsidiary—have pushed STC conversions. This has proved infertile ground so far. Says TCM's Rhett Ross: "TCM has made several attempts at offering STC products for the older fleet. This is not a core business for the company and has resulted in less success than we would like." He adds that this doesn't reflect a lack of commitment to the project, but the reality of STC economics. The potential fleet is large, but buyers may be hard to convince.

Chad Menne at Malibu Aerospace, whose well-engineered PowerLink conversion of the Malibu has been available for several years, has encountered this firsthand. Malibu Aerospace offers an IOF-550 for the PA-46, but the full-up conversion is about $200,000 on an airframe valued at little more.

Although the 550 is, in our view, a better powerplant than the airplane's original TSIO-520, buyers may not consider it better enough to invest the value of the airplane in an upgrade.

Like everyone else we spoke to, Menne believes the PowerLink system will gain market share when and if a major OEM or two picks it up. And we suspect that's about to happen.

When we visited TCM last year, we were told that the company is aggressively pursuing new approvals for the 550 series at the request of OEMs. This suggests to us that at least a couple are about to pull the trigger. Our guess would be Cirrus and Beechcraft and possibly Cessna. When we asked Jack Pelton about this in April, he said the company is evaluating Lycoming's new IE2 offering and will look at others. "You gotta believe that the way technology is evolving, eventually, all those knobs have to come out of the cockpit," Pelton said. But he also said only customers who know this technology is available have asked about it, if not ***for*** it. The recently introduced Corvallis TTx is Continental powered.

And that's where TCM comes in. Rhett Ross concedes that the company may not have pitched the FADEC system effectively to a skittish market. "I cannot argue with the premise that better marketing or a more focused effort to introduce the product in a key airframe would have worked, " he said.

But he says that TCM still believes in the product and even with its aggressive foray into heavy fuel engines, Ross believes gasoline aircraft engines have a long life ahead of them. "Until the market finishes its recovery and provides improved revenue to the industry, I expect a continued slow pace in moving these systems along at any level," he said. The FADEC system has an R&D budget for 2011, so it's clearly on one of TCM's burners.

Since Liberty has more OEM experience than anyone, we asked Keith Markley if the company would make the same decision to use FADEC again. "Yes and no," he said. Why the no? "Had I known the industry wouldn't adopt it to a greater degree than it did, I'd say no." The reason relates to volume and parts supply. Liberty has had problems getting some parts quickly, such as wiring harnesses and injectors. They inventory most of the critical items, but Markley says this adds to their costs on an airplane with little margin as it is.

In his view, if PowerLink were sold in larger volume—which Ross believes it will be—those issues would fade. Although Liberty surprised us at Sun 'n Fun by introducing a Rotax-powered LSA to capitalize on the Asian mogas market, Markley says it will continue to offer the Continental IOF-240.

But there's no question that the Rotax initiative represents a shot across TCM's bow, a company that needs all the engine sales it can get.

# Portable ADS-B WX: Free Data with Limits

*Can a portable device with ADS-B free you from the monthly fee for datalink weather? Yes, but not without a few sacrifices. WingX leads the pack.*

*by Jeff Van West*

In the formative days of ADS-B, the FAA had a carrot-and-stick plan. You'd have to invest in equipment to comply with the FAA's new traffic system. But you'd get free datalink weather in the cockpit as part of the bargain.

Unfortunately, that "bargain" requires a $10,000 Universal Access Transceiver (UAT) to transmit and receive your traffic data (called TIS-B) and receive the free weather (FIS-B). Cheaper solutions meet the ADS-B mandate, but without weather. That's all stick and no carrot.

The free weather data is still out there, however, and it was only a matter of time before someone built a receiver to paint that data on a portable display. To be clear: None of these comply with the ADS-B mandate for traffic data. They just provide weather data similar to XM's satellite-delivered weather.

## THE SKYRADAR SOLUTION

All three systems we reviewed use the SkyRadar receiver built by Ravena LLC (who was kind enough to lend us the unit for this review). It's about the size and shape of a small external hard drive with cables to a small remote GPS and power from the aircraft cigarette lighter. There are also two antennas: a tall one for the FIS-B weather signal and a short one for WiFi. The box isn't peanuts to buy at $1049.95. It also needs a spot in the aircraft where the GPS and ADS-B antennas can see the sky, however, the GPS is on an extendable USB cable, and a six-foot remote antenna for ADS-B can be had for an additional $60.

*The ADS-B receiver for all three platforms is the SkyRadar unit. It needs a spot in the aircraft where its GPS and ADS-B antenna can see the sky. SkyRadar has its own app (right) that shows METAR circles on a map, and detailed weather in a pop-up window.*

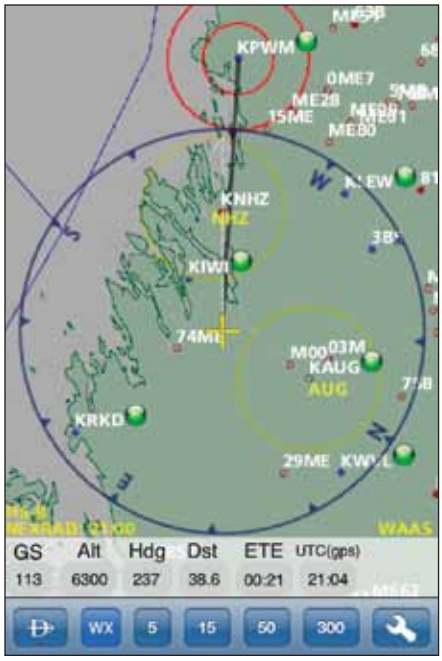
**CHECKLIST**

- ⊕ No monthly fee for all the critical weather products.
- ⊕ GPS position and ADS-B weather integrated in one receiver.
- ⊖ Ground-based transmission less accessible than satellite weather.

That's right, WiFi. The SkyRadar system acts like a wireless network router and uses WiFi in the cockpit to connect to it. You can put your iPhone/iPad into aircraft mode but still turn the WiFi back on to connect, and SkyRadar sells its own app to do just that. The slick part of this is that SkyRadar also sends its GPS signal so the iPhone has a GPS even in airplane mode.

The SkyRadar app is simple, but effective. It offers a basic moving map with color-coded METAR circles and a NEXRAD overlay. There's a direct-to function and the option to turn on terrain shading. Dragging a pointer over any airport pops up airport details, such as frequencies and runways, as well as FIS-B data details such as the full textual METARs, TAFs and NOTAMs.

The $25/year subscription price is right, but if you're in for $1050 for the ADS-B receiver, we think there are better options to use it.



*WingX on the iPad (right) uses WiFi to connect to SkyRadar, while the Essential Flight tablets need a USB cable. The 2Go Pad (left) is similar in size to the iPad. Other option, such as the Lenovo S-10 offer a real keyboard. (Vintage red interior not included.)*

## WINGX FOR IPAD

A far more robust solution that integrates this same data is Hilton Software's WingX for the iPad. WingX is a chart viewing and moving map program with extensive preflight weather and other tools. Version 5 just released with several beef-ups, including support for ADS-B weather using the same SkyRadar system. With this functionality, WingX effectively turns the iPad into a portable multi-function display.

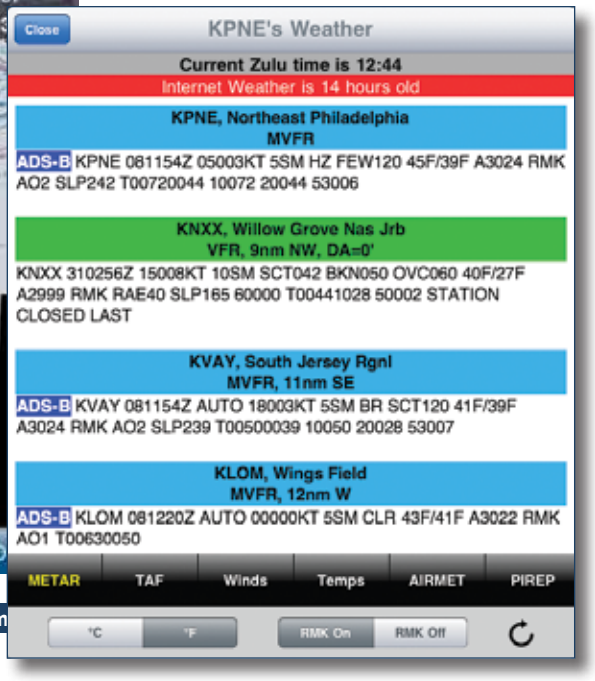
Weather data is well integrated into the program as a whole, with the option to layer METAR circles and NEXRAD on any of the moving map views. Tapping an airport or navaid always displayed a pop-up window in WingX with a weather option that showed the last-downloaded internet weather. With ADS-B added, more current data is shown with an ADS-B flag at the start of the text so you know it came from datalink. There's a convenient Zulu time on the pop-up window to cross reference the age of whatever report you're reading. Scrolling across the bottom gets you to all weather information, datalink if it's available or from a previous internet download if not, with the age of the internet weather shown for reference.

Currently, WingX streams METARs, TAFs, NOTAMs, AIRMETs and PIREPs. Further builds will support additional products such as TFRs.

We have two significant complaints with WingX 5. One is that the software released a bit before it was ready, in our opinion. We have seen several crashes with the version on the App Store. It recovers and restarts quickly and the company is prompt at releasing updates, but it happened enough to be mildly annoying.

We think there's also room for improvement in displaying the weather data. ADS-B NEXRAD comes in two flavors, a high-res local image and a low-res image for the lower 48. WingX currently only shows the local image, which means you can't see NEXRAD past 250 miles from the ground station closest to you. This could be an issue with long-range strategic planning, especially in faster aircraft. PIREPs are textual, and when you view them you can't simultaneously pan on the map to see where they are relative to your location. The same is true of AIRMETs. These issues may change upcoming

*WingX can layer NEXRAD and METARs on any moving map view. Tapping any airport brings up options that include weather. The weather details appear in a pop-up that distinguishes between ADS-B data and internet data downloaded before flight. Note the white NEXRAD (no data) in the lower left. Limited range can be an issue with all ADS-B weather.*

*ChartFlier shows NEXRAD and METAR circles, as well as the forecast winds for your position. It's two-tap menus system is as simple as it gets.*

releases. WingX is $99.95 per year, or $199 with georeferenced approach charts. Add another several hundred for an iPad.

## CHARTFLIER TABLETS

ChartFlier from Essential Flight offers much of the same capability as WingX—sectionals, high and low en route charts, approach charts and airport info—but running under Windows 7 on a Tablet PC. Windows 7 isn't as touch-friendly as the iPad OS, so it's not quite as easy to use. For example, ChartFlier has four fixed zoom levels for the moving map controlled by onscreen buttons. No pinch-to-zoom here. Windows 7 offers much more capability overall than an iPad, so if you're looking for a full-up portable computer that also works in the cockpit, ChartFlier might fit the bill.

The software is driven by onscreen buttons, which take some getting used to. But the overall layout is logical and well thought out. It's not as integrated as the iPad solution, with approach plates or airport data opening as separate PDF files. We saw some issues with hangs of Windows, but no problem with the ChartFlier software itself.

Weather data is integrated much like WingX, with METAR circles and NEXRAD on the moving map. NEXRAD age is prominent. Another nice touch is that the forecast winds aloft from the nearest station to your position and altitude are also shown, as well as forecast winds for any station with a forecast that's currently in the map view. Like WingX, ChartFlier offers a popup menu with a tap that includes an option to show METAR, TAF, wind and PIREP details. The next software release will add the rest of the weather products.

We tried ChartFlier on both a 2Go slate tablet, which has no keyboard and is similar in size and weight to an iPad, as well as a Lenovo S10 with a foldaway keyboard. Both want an external power supply, running out of power after about three hours. By comparison, the iPad was down to 70 percent power remaining even though it was using its WiFi. But both work with gloves on, something the iPad can't claim. ChartFlier also works with NavWorx, FreeFlight or any GDL-90 ADS-B receiver.

ChartFlier is $149 per year (georeferenced charts included), plus the Tablet PC. One year of ChartFlier bundled with a 2Go or an S10 tablet would be $879 or $849, respectively.

## TRADEOFFS AND PAYBACK

While the ADS-B weather is free, it's not equivalent to satellite weather. It usually can't be received until you're airborne. Over much of the country, that coverage is guaranteed by 1800 feet AGL, but in many places it's 5000 feet AGL or higher. The full suite of products is not as full as the complete XM offering. Lightning data, forecast icing or freezing levels are a few that aren't available.

Non-NEXRAD ADS-B weather is also local only. You can find the exact distances and updates in the AIM, but it's generally 500 miles from the broadcasting station. Outside that range, you'll only get low-res NEXRAD. Also, the way NEXRAD is transmitted, it's a time-smeared image with strips of newer returns mixing with older ones. This makes it harder to estimate error based on the image's age.

The SkyRadar box will pay for itself less than two years of XM monthly subscription. If you're OK with the limitations, this solution has legs. Platform-wise, we think WingX on the iPad is the best solution currently for ease and capability. That's unless you absolutely need a "real" computer for travel and want one solution that does it all.

This segment is an ever-moving target as well. More ADS-B systems are in the works and XM connections will be available for the iPad. We'll do our best to keep you up to date.

## CONTACTS

Essential Flight Technology (ChartFlier)
404-954-1915
www.essentialflight.us

Hilton Software (WingX)
866-429-4649
www.hiltonsoftware.com

Radenna LLC (SkyRadar)
888-759-2372
www.skyradar.net

# Today's Hangar Market: Options Vary Wildly

*Hangar space hasn't gotten cheaper but the odds of finding a spot are better than any time in the past decade. Sleuthing and location flexibility can pay off.*

*by Jeff Van West*

Like a kid with a treehouse, a hangar is the ideal for most any aircraft owner. Not only are you and your ride protected from the elements, but there's also room to store the miscellany accompanying aircraft ownership. The barriers to hangar heaven have always been availability and price. The former is often too scarce and the latter too high—at least on the surface.

Many owners put their names on the waiting lists for a hangar, but when it comes time to put down the $400/month or more, the $50/month tie-down doesn't look so bad. More than one owner responded to our recent AVweb.com survey that even when you factor in the wear and tear on paint and other exterior items like tires, the tie-down can be cheaper. A net of $4200/year buys a lot of maintenance.

We still think when you factor in the intangibles of convenience, comfort and just staying dry on a rainy-day preflight, a hangar is the way to go if you can swing it. Prices and options vary so wildly across the country, that we can't offer hangar advice so much as a hangar strategy.

## OPTION ONE: RENT IT

Over 60 percent of our survey respondents rent hangar space. It was more common at larger airports where the municipality owned the airport and the hangars. Prices varied, as you'd expect, with 40-foot, closed T-hangars in good condition at some rural airports available for less than $100/month. A median price was more like $400/month at a mid-sized metropolitan airport. Prices could climb over $900/month in the densely populated areas near New York City or in Southern California.

Waiting lists for available hangars are still the norm, but the lines are generally shorter than even two years ago. An owner from La Grange, Georgia, told us, "For the first time in 25 years we have two empty T-Hangars available." Many people reported that what was a multi-year wait was now six months or less, and a common comment was that shade hangars, or other three-sided hangars were waiting to be filled. The trend seems to be that newer, nicer hangars are being filled by pilots upgrading from less desirable hangars on the same field.

Location always matters, and it pays to shop around. One owner told us of long waiting lists at Endicott, New York, but open hangars waiting for tenants at Binghamton, New York, only nine miles away. A similar situation exists for Groton, Connecticut. It has hangars looking for tenants while Chester, Connecticut, and Westerly, Rhode Island, about 10 miles west and east of Groton respectively, are full. Why? Endicott is more GA friendly than Binghamton, and Chester's hangar prices for shared space are $200/month cheaper than a T-hangar at Groton. If you're willing to be flexible, you might find a hangar right away while you wait for the better choice down the line. We saw similar stories from Illinois, Minnesota and Washington State.

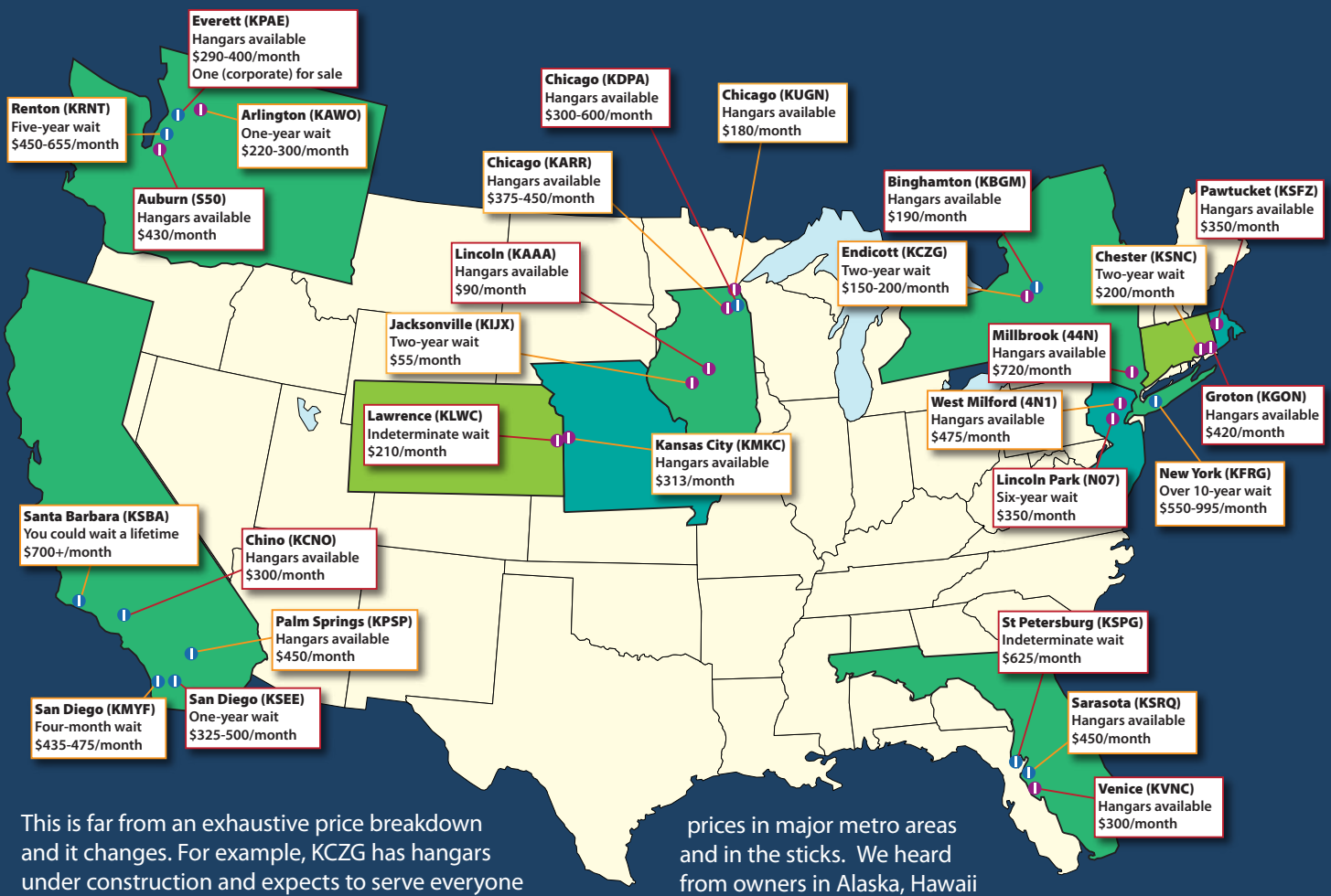
That said, any arrangement that puts the aircraft further from your home may cut your yearly flying hours just from inconvenience. That adds to your hourly cost and may

*Prices for rental or purchase of enclosed hangars haven't gone down, but availability has gone up. This has allowed many owners to trade up from shade hangars and other open structures, dropping these prices and making more available.*

**CHECKLIST**

- ⊕ Waiting lists are shorter than anyone can remember at many airports.
- ⊖ Rent and purchase prices remain steady.
- ⊖ Building a hangar with the exit strategy of resale is probably more risky than ever before.

# A SAMPLING OF HANGAR PRICES AND AVAILABILITY




This is far from an exhaustive price breakdown and it changes. For example, KCZG has hangars under construction and expects to serve everyone on the waiting list when they're done. But then the wait resumes. The numbers do show both the variability airport to airport while still washing out to a general consensus on prices in major metro areas and in the sticks. We heard from owners in Alaska, Hawaii and internationally as well. There was surprising consistency with the figures and mixed availability you see here. Hangars for sale varied too widely to draw conclusions.

offset the savings. And there may be no hope at the most popular airports. "The waiting period [at Santa Ana/Orange County] is between 100 to 200 years. There are close to 200 people on the waiting list."

Another option for hangaring is a shared hangar at an FBO. This opens the door to hangar rash as your aircraft gets moved in and out, but it has its perks. A pilot parked in Pawtucket, R.I., told us, "The plane is on the ramp when you get there or just inside the hangar door in bad weather. When you get back you just pull up and they chock the wheels and have a fuel truck and ladder up before you even have your headset off. They fuel the plane and put her away." Not bad for $350/month.

Comparison-shopping matters here as well, as this owner found:. "I'm doing a three-month contract in the Minneapolis area and calls to FBOs were very revealing. Costs ranged from $150-500/month with a range of services. That's a big saving for a half hour of calling around."

In the shared hangar space arena, we heard two disturbing trends. One is that several airports are not renewing leases for small aircraft and even demolishing hangars to cater to larger—and more lucrative—biz jets. A second is that it's getting more common for FBOs to require hold-harmless agreements as part of the hangar contract. This means they wouldn't be responsible for damage to your aircraft. Read the fine print on any shared hangar space. For that matter, read the fine print on single-occupancy hangars too. Some owners have been burned by contracts that forbade things like aircraft maintenance in their rented hangar.

## BUYING IN

Renting a hangar is like renting a home in that all the months of rent return no net equity. That's just fine with some, but if you have the option of buying a hangar or building your own there's the potential to recoup some cash from a resale.

Historically, this has been a good option if it was available. When we last did this review, it was less so because of higher building costs. The current climate may favor renting even more because a hangar purchase is really a real estate transaction and this real estate market isn't doing much better than homes.

Here's a story from White Lake, New York, that we don't think is

# HOW TO BUILD A $15,000 HANGAR

Who do you call when you need a place to hangar an Airbus right away and all the available space around New York is full? If you're the NTSB looking for a place to put Sully's Hudson River glider, you call ShelterLogic and it's done in 10 days.

Call it a compromise between a tie-down and a metal hangar, but an intriguing third option is to put up a "temporary" hangar. Called Low-Cost Aviation Shelters (LCAS), these are steel truss structures covered in polyethylene cloth. Ed McKenney, manager of ShelterLogic's aviation sector, says that each hangar is spec'd for its locale. "When somebody orders the hangar, we look at where they are geographically. We have hangars in Alaska where snow-loading is more an issue than Florida, where it 's a sun issue." Eleven new LCASs in Simsbury, Connecticut, saw 60 inches of snow this past winter without trouble.

An LCAS can be have up to 70-foot openings and be as long as you want. Pricing varies, but an average 50x40 structure would be $10,000. That's with only a zipper-and-cloth door on each end, but the frame is rigid enough for metal hangar doors, including an electric bi-fold. That could add another $10,000 to the price of the structure, but it's still favorable to a metal construction. ShelterLogic is developing its own low-cost door that opens like a venetian blind. No price is set yet. The LCAS cloth cover is under pro-rated warranty for 15 years, with a current replacement cost of $4000-6000.

McKenney points out there are several other potential advantages to a "temporary" hangar, depending on your airport's regulations. Often they don't require a building permit or sprinkler systems. They are usually taxed as a personal purchase rather than real estate. A door on both ends makes hangar sharing more practical if ramp access allows it. The structure is heavy enough that ground mounting is recommended, but not required. That ground connection may mandate sinking anchors in the airport asphalt, which could be an issue. Connecting power and insulating could also be an issue. While a motivated thief could probably break into any hangar, these hangars will give it up to a criminally wielded razor knife.

But McKenney's market research shows the need for cheaper, more-available hangars is hurting aviation. "We found pilots getting out of aviation because they didn't have a place to put their airplane, had to drive 100 miles or the prices were too exorbitant."

You can find out more at www.shelterlogic.com or 800-932-9344 ext. 2551.

unique: "Prior to building, I had eight of 15 'sold' to prospects and elected to build the other seven on spec. When completed, all eight who expressed commitment to buy disappeared. I wound up with 15 hangars for sale and no buyers. I rent them for a pitiful amount because the county also has rental hangars and undercuts reasonable rents. In the meantime, the county continues to collect the land lease payments."

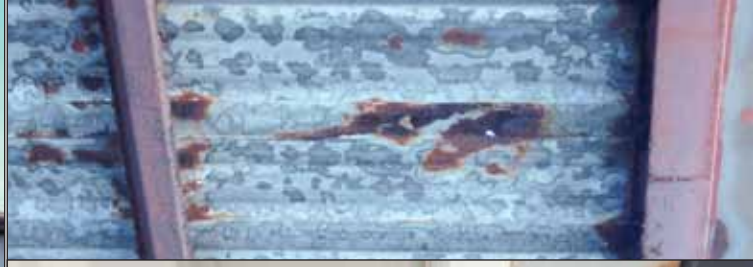
You'd think this environment would make for some bargain prices on hangars, but that's not what we saw. "Easy to get [a hangar] if you are willing to pay," was the word from Chesterfield, Virginia. Apparently some of the empty hangars are just like the empty homes. The lowest price the seller is willing to go is still too high for most buyers.

The land lease is a sticky aspect of buying as well. You're unlikely to find an airport other than a private airpark where you can buy the land. You'll lease that from the airport and build a hangar on top of it. The leasehold will expire at some point and the hangar becomes the property of the airport.

This means an existing hangar with 15 years left on the leasehold is worth more than one with five years left to amortize the purchase. Many leasehold arrangements have an option of the former hangar owner having first right of refusal to rent the hangar he formerly owned, but at the lessor's choice of rent.

Leaseholds might be renegotiable, and that five-year lease could turn into a 30-year one with a sudden gain in value. How well you play local politics could be as important as what the contract says in this game. But that's often true for those rental waiting lists, too.

If you do build, a good contractor is worth the trouble. "The word should be 'turn-key.'" says Marc Blais, a contractor in Maine authorized to locally assemble pre-fab hangars from several vendors. He points out a good contractor can save you from running afoul of local codes—required wind loads are 110 mph in Florida but only 70 mph in Maine—as well as suggest key improvements that will save you time and money in the long run. Building in snow country? Invest in an electric bi-fold door.



*A "bargain" hangar may be no bargain, in rental or purchase. Low reinvestment in airport infrastructure means plenty of ratty hangars that leak or could trap your bird behind broken doors.*

Construction costs obviously vary with how upscale you go, but expect at least $45,000 to build a sparse yet solid 40-foot hangar even if bought pre-fab. Many new constructions are twice that, especially with amenities like heat or electric doors.

Blais also points out that the average metal building is only designed to last 20-25 years. We saw many reports of old, cold and leaking hangars that necessitated pricey repairs on top of the purchase price. Additional gotchas can be an airport authority that passes on the property tax costs in addition to the yearly lease. More fine print to read.

Undeveloped sites at desirable airports are getting as rare as avgas under $5, but many old hangars are in serious need of complete overhaul. Hitting the trifecta of a shrewd purchase, a renegotiated leasehold and a reasonable cost to renovate is a long shot, but it's worth a try.

This shouldn't completely put you off to buying or building. With a reasonable leasehold agreement and a location at a popular airport, it can be a better use of your funds than renting. Said one hangar owner in Friday Harbor, Washington: "We planned to have our plane for 30 years. We have owned it 26 years to date. The hangar was one of our best investments."

### GOOD PROBLEMS TO HAVE

The hangar experience is far from guaranteed as this New Jersey owner reports: "The T-hangar that I rent is in horrible condition and unheated. This past winter my plane was held hostage for two months by my inability to open the hangar doors that were frozen shut. Unfortunately, I still pay an exorbitant rent for this piece of junk hangar, because there is no viable alternative."

However, the drop in GA usage overall means alternatives are more likely than any time in recent memory. If you're lucky enough to have a couple of airports to choose from, or a field where owners are vacating hangars that need a sub-lessee or buyer, make an effort to ask around. Websites like airnav.com or hangartrader.com can help. You might get a chance to come in from the cold.

## Garmin Versus Aspen

*(continued from page 7)*

non-linear vertical speed indications that disappear in calm air. Because of this, some owners insist on retaining the round-gauge VSI in the panel.

Lacking in the Aspen is audio output. The G500 altitude bug provides aural (and visual) alerts within 200 feet of, or when deviating 200 feet beyond, a bugged altitude.

### DECISION TIME

A basic G500 without SVT or GAD43 emulator retails for $15,995. The best equivalent Aspen system would be the Evolution 1500 package (no backup attitude option) for $14,990. Invest in the worthwhile SVT and GAD43 emulator for your autopilot and you get a G500 at $23,985. The better Aspen would be an Evolution 2000 (backup attitude capable), EA100 for the autopilot, remote battery and the planned synthetic vision ($2995) for $22,780. Average install labor favors the Aspen, widening the takeaway price gap.

For lean budgets, a single-screen Aspen offers decent amounts of utility if you can accept that it's a major step down from a G500 and offers little MFD function. On the other hand, it's liberal when playing with radios old and new and requires little if any instrument panel modification. With an out-the-door installed price that could fall well south of $15,000, we think it's a solid value with room to grow if you find a pot of gold a year later.

No solution is for all cockpits, and the G500 has the advantage in feature set and screen size. We also like its audio outputs, and autopilot vertical speed and altitude selector. It's the only choice if you want to wrap in on-board radar.

Here's a final thought for you: Expect a sizable learning curve with either system. A seasoned ATP told us it took him a solid 10 hours of VFR flying before he became comfortable going it IMC behind the Aspen in his single turboprop. This was after misprogramming the GPSS botched a departure procedure and turned him the wrong way after launching into the clouds. The last piece of equipment that must be upgraded with any of these installs is the one between the yoke and the seatback.

# Aerostar

*Its rep for speed isn't overstated. It has a taste for wrenching, but is still supported by a solvent company.*


PHOTO: GARY EVANS/ANDREW BROADFOOT

When you tell a fellow pilot what kind of airplane you fly, the list of responses that will elicit more than casual, feigned interest is short. But the Aerostar is on it. It has a deserved rep for being blazingly fast with good range. And unlike most piston twins, it has enough power to actually climb on a single engine.

But bring a VISA with high limits. The airplane's Lycomings are somewhat thirsty and although it's hardly a maintenance hog, the Aerostar fleet is aging and getting expensive to maintain. But for owners who can afford it, the model is hard to beat for getting from A to B faster than anything that doesn't burn Jet A.

The Aerostar is the product of famed aircraft designer Ted Smith, whose name is attached to such classics as the A-20 twin-engine bomber and the Twin and Jet Commander lines. In 1963, Smith formed his own company to build a family of fast fliers, all built around the same fuselage, wings and tail. Five years later, the Model 600 emerged in 1968, with normally aspirated Lycoming IO-540 engines and a takeoff weight of 5500 pounds. A year later, the 601 appeared, with a pair of Rajay turbochargers and manually controlled, electrically actuated wastegates on each engine. With turbos, the engines could maintain 290 HP from sea level to 16,000 feet.

## MANY OWNERS

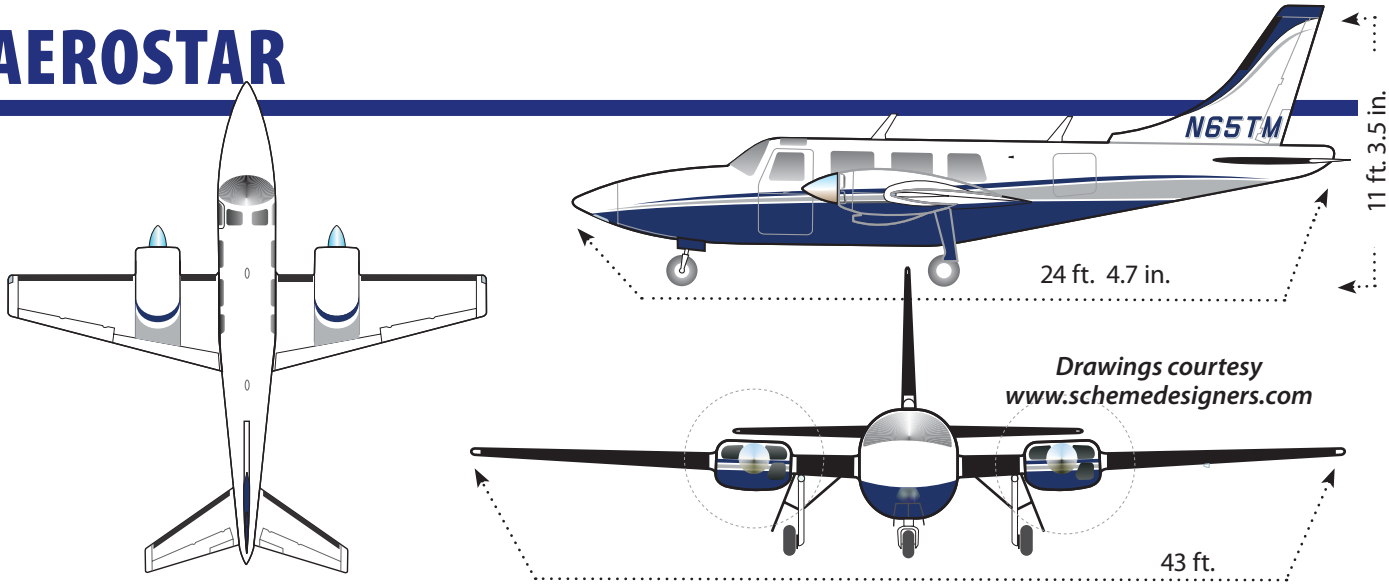
By this point, Smith had sold out, first to American Cement and later to Butler Aviation, which acquired both Aerostar and Mooney and moved them to Kerrville, Texas. A squabble between the new owner and the old over corrosion idled the line for two years. Unwilling to let his idea wither, Ted Smith organized a group of investors and bought the company back, setting it up in Santa Maria, California. The new company began building the 600A and 601A in 1973. The A models had Lycomings with heavier crankcases and crankshafts and engine TBO was boosted from 1400 hours to 2000 for the 600A and 1800 hours for the 601A.

The first pressurized Aerostar, the 601P, appeared in 1974, with a max differential pressure of 4.25 PSI, good for an 11,000-foot cabin all the way to 25,000 feet. The tenth 601P emerged with a longer wing (stretched from 34.2 to 36.7 feet) and higher max takeoff weight, 6000 pounds. These changes were incorporated in the un-pressurized turbo model in 1977. The engines on the new B-model 601 were fitted with an automatic wastegate control, dumping the electric version.

Ted Smith died in 1978 at 70 years of age, after open-heart surgery. Plans for nine-seat Aerostars with 450-HP piston engines and turbines died with him, unfortunately. Later that year, the company was acquired by Piper Aircraft, which moved it from Santa Maria to Vero Beach.

Piper kept at it, despite a soft

# AEROSTAR

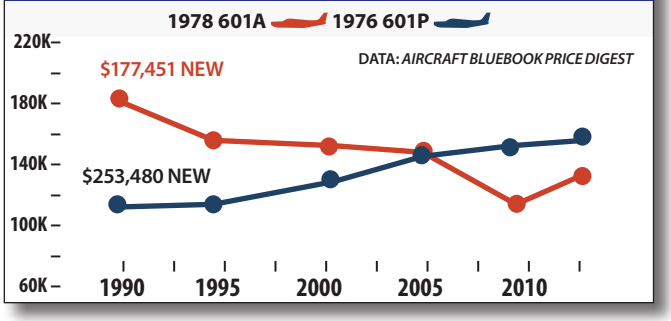



*Drawings courtesy www.schemedesigners.com*

## PIPER/TED SMITH AEROSTAR MODEL HISTORY

| MODEL YEAR | ENGINE | TBO | OVERHAUL | FUEL | USEFUL LOAD | CRUISE | TYPICAL RETAIL |
|---|---|---|---|---|---|---|---|
| 1969-70 AEROSTAR 600 | LYC 290-HP IO-540-G1B5 | 1400 | $40,000 | 165 | 1965 LBS | 211 KTS | ±$85,000 |
| 1973-75 AEROSTAR 600A | LYC 290-HP IO-540-K1F5 | 2000 | $40,000 | 165 | 1965 LBS | 211 KTS | ±$110,000 |
| 1976-78 AEROSTAR 600A | LYC 290-HP IO-540-K1F5 | 2000 | $40,000 | 165 | 1965 LBS | 211 KTS | ±$125,000 |
| 1979-81 AEROSTAR 600A | LYC 290-HP IO-540-K1J5 | 2000 | $38,300 | 165 | 1965 LBS | 211 KTS | ±$140,000 |
| 1969-70 AEROSTAR 601 | LYC 290-HP IO-540-P1A5 | 1600 | $40,300 | 165 | 1970 LBS | 237 KTS | ±$90,000 |
| 1973-76 AEROSTAR 601A | LYC 290-HP IO-540-S1A5 | 1800 | $40,300 | 165 | 1970 LBS | 237 KTS | ±$80,000 |
| 1977-78 AEROSTAR 601B | LYC 290-HP IO-540-S1A5 | 1800 | $40,300 | 165 | 2025 LBS | 233 KTS | ±$125,000 |
| 1974-76 AEROSTAR 601P | LYC 290-HP IO-540-S1A5 | 1800 | $40,300 | 165 | 2025 LBS | 232 KTS | ±$135,000 |
| 1977-78 AEROSTAR 602P | LYC 290-HP IO-540-S1A5 | 1800 | $40,300 | 165 | 1900 LBS | 232 KTS | ±$160,000 |
| 1979-81 AEROSTAR 602P | LYC 290-HP IO-540-AA1A5 | 1800 | $40,300 | 165 | 2025 LBS | 229 KTS | ±$145,000 |
| 1984 AEROSTAR 700P | LYC 350-HP TIO-540-UTA | 1800 | $73,000 | 165 | 2135 LBS | 258 KTS | $360,000 |

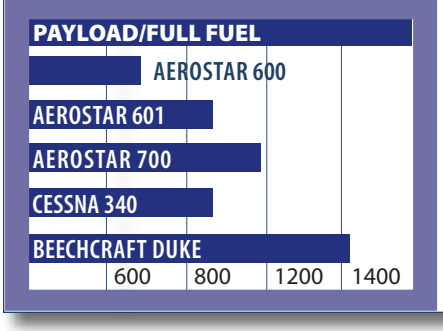
## RESALE VALUES

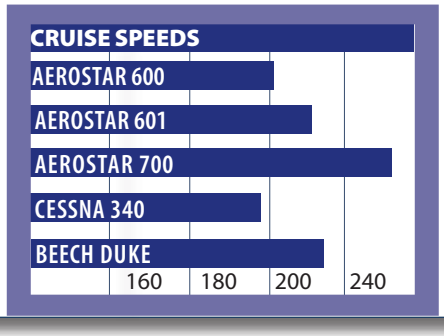


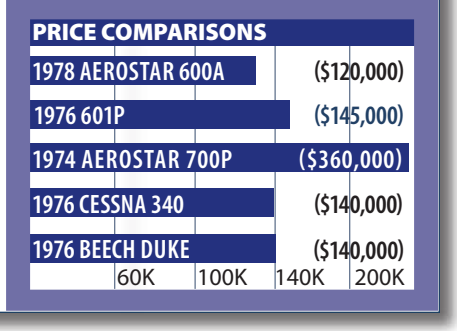

## SELECT RECENT ADs

| | |
|---|---|
| AD 03-22-01 | AUX FUEL PUMP TRANSFER |
| AD 01-08-10 | MAIN GEAR SIDE BRACE ASSEMBLIES |
| AD 98-24-29 | UPPER SPAR CAP INSPECTION |
| AD 94-15-13 | NOSEGEAR DRAG LINK CORROSION |
| AD 90-01-02 | FIRE DETECTION KIT/RETROFIT |

## SELECT MODEL COMPARISONS



*The Aerostar's panel is workmanlike and relatively spare as piston twins go. As is obvious from these photos, Uday Saraiya's Machen-upgraded 602P also has a state-of-the-art panel, something Ted Smith could only dream about.*

market. They improved the wastegate system in the 601B and 601P, increasing critical altitude from 16,000 to 21,500 feet. A known-icing package—boots—was also added.

In 1981, the 602P was introduced, with engines and turbos certified and installed as a package by Lycoming. (Previously, turbos and wastegates were tacked on at the Ted Smith and Piper shops.) The last model, the 700P, was introduced by Piper in 1984 and had intercooled, 350-HP engines, cowl flaps and outward-rotating propellers. With only 25 built that year, the 700P is the rarest model. The most prolific model was the 601P, with 454 built by both Ted Smith and Piper.

The 600A remained in production the longest—10 years—but only 206 were built. Piper's figures show 59 600s, 68 601s, 48 601As, 41 601Bs and 110 602Ps built before the line closed for good. Although Piper exited the cabin twin market by the late 1980s, the Aerostar line endured.

In May 1991, Piper sold the type certificates and STCs to Aerostar Aircraft Corp., headed by Stephen Speer and James Christy, both of whom had been involved in the Ted Smith days. The new owners pledged to keep Aerostar parts and support flowing and they've done just that.

One upgrade they offered is called the Super 700 Aerostar, which takes 601P and 602P Aerostars and fits them with 350-HP Lycoming TIO-540-U2A engines turning three-blade Hartzell props.

The airplane gets a gross weight boost to 6356 pounds ramp weight. Claimed 75 percent cruise is 261 knots, and initial climb rate is 1875 FPM. At economy cruise (55 percent), the fuel burn is 32 GPH and claimed speed is 225 knots. Owners report that the mod is worthwhile and the speed claims realistic.

## MID-WINGS

Ted Smith evidently liked mid-wing designs, as anyone who has seen a photo of an A-20 would surmise. The Aerostar's wings are mounted midway along the oval fuselage and are the same NACA-64 series used on the Learjet. External skins are butt-joined and flush-riveted. Primary flight controls are via push-pull tubes, torque tubes and bellcranks.

Like larger aircraft, the landing gear, main gear doors, flaps and the nosewheel steering system are electro-hydraulic. The nosewheel has its own steering control and isn't connected to the rudders. Fuel-selector valves and elevator and rudder trim systems are also electric.

The engines are supposed to draw fuel from the two 62-gallon wing tanks and from the 41.5-gallon fuselage tank at the same time and at a rate that leaves 12 gallons in the fuselage tank when the wings have been emptied. But this only works in straight-and-level flight. The thin wing tanks easily become unbalanced—there's only two degrees of wing dihedral—and crossfeed must be used to bring them back in synch.

This shortcut led to trouble if the single fuel pick-ups in the wings became unported and electrical power was lost, leaving no way to reposition the valves. AD 79-1-5 sought to solve the problem by placarding crossfeed procedures and installing a low-fuel warning light and individual tank quantity indicators.

The 601 models have relatively high-compression turbonormalized engines, producing 290 HP.

The 601P is especially prone to detonation if leaned to peak EGT at altitude. The 602P's engines have a lower compression ratio, alleviating the detonation problem, and are groundboosted to maintain 290 HP at 37 inches MP.

Alternators on most Aerostars are rated at 70 amps but can actually put out only about 55 amps due to heat. Potential buyers should be wary of any airplane with an electric air-conditioning system. It's heavy, has four motors that draw a lot of juice and cannot be used at night or in IMC. A better bet is an engine-driven-compressor system.

## PERFORMANCE

If you want speed, look no further than an Aerostar. The normally aspirated 600s will easily steam along at 210 knots on 34 GPH at 70 percent power. The 601s model can turn in an amazing 233 knots on 36 GPH at 70 percent power at 20,000 feet. The higher-powered 700P trues at a whopping 260 knots on an equally impressive 51 GPH at 81 percent power and 25,000 feet; throttled back to 65 percent power, a 700P can do 230 knots on 36 GPH.

As if the stock airplane weren't fast enough, Machen conversions make them even faster. At 75 percent power and 25,000 feet, a Machen Superstar 650 cruises at 240 knots on 42 GPH; a Superstar 680—intercooled—does 250 knots on 40 GPH. Machen conversions also improve single-engine performance.

Maximum published single-engine rates of climb are 360 FPM for the 600, 240 FPM for the 601s and 602P, and 320 FPM for the 700P. Accelerate/stop distances —with 20 degrees of flap for takeoff—are about 3100 feet for the 600 and un-pressurized 601s, 3400 feet for the 601P and 602P and 4000 feet for the 700P.

Since it was intended to become a jet one day, Aerostar handling can be said to be jet-like. That means high flap speeds—174 knots indicated for most models—and fairly high gear speeds of 156 knots. The Aerostar's wing loading is an eye opener: 35.4 pounds/square foot. High wing loading translates to high speed and a soft ride in turbulence, but also a brisk stall and a narrow slow-speed envelope. Crossing the fence at 100 knots, the Aerostar isn't a terrific short-field performer but owners say it's adequate.

*The Aerostar's Lycoming IO- and TIO-540s are tightly cowled with minimum cooling drag. The seating is three rows of two, right, but many owners remove a middle seat to make more room in the cabin. (Top photo: Dennis Wisnosky.)*

Both Piper and the factory have modifications to improve the Aerostar's stall behavior at aft CG and alleviate the restrictions imposed by AD 83-14-7. Most owners prefer Machen's vortex generators to Piper's water rudder. Stall behavior has been the focus of attention, thanks to tendencies to stall sharply when held into the break. The AD was issued to improve stall controllability with flaps extended with aerodynamic kits like those mentioned above.

## CABIN COMFORT, LOAD

Passengers are sometimes taken aback by having to enter the cabin by clambering over the pilot's seat; that's the only door in the airplane. Once inside, an Aerostar is reasonably comfortable but no one would mistake it for a chapel; the noise level is quite high, especially in models without pressurization.

The cabin is more than 3 inches wider than a 55-series Baron's, but 3 inches narrower than a Cessna 310's, and has 2 inches less headroom. Most owners have taken out one of the middle seats to make more space in the cabin. For a cabin-class airplane, it's on the tight side.

It's also not a great carrier. An Aerostar is hard-pressed to carry even five adults, their bags and a reasonable load of fuel. Real-world useful loads vary from a meager 1600 pounds for a lavishly equipped Aerostar to a marginal 1800 pounds with average equipment. Also, the airplane has a relatively narrow CG range and it's easy to bust the limits. Weight-and-balance calculations are a good idea for takeoff and landing profiles, because the CG moves forward as fuel is burned. And in a twin, CG is always a worry for engine-out operations.

## MAINTENANCE

No surprises here. The Aerostar can be a hangar queen, but owners who say it's a wrench hog also say that this is to be expected in any aircraft of this class and age. Even so, the Aerostar has a couple of marks against it. For one, it's a compactly built airplane, so its systems are

## ACCIDENT SCAN: THE GAMUT

If there's anything unusual about the Aerostar accident record, it's probably that there's not anything unusual. We examined accidents during a 30-year period between 1980 and 2010 and noticed no particular pattern worthy of note.

In fact, most of the accidents we would qualify as "other," meaning they don't fit our standard categories for sorting these things into meaningful groups. These accidents run the gamut from minor mechanicals, to icing incidents to only one structutral break-up that we could find during this period.

There were seven examples of what we could call CFITs, which include duck-unders during instrument approaches or inexplicable descents below MDA or DA. A couple of airplanes smacked into terrain after takeoff and for want of a better categorization, we slotted these as CFITs, too. One was heavily loaded.

There were two dual engine failures, both right after takeoff. One was a misfueling, the other was too vaguely described to draw a conclusion. There were seven single-engine failures that somehow made it into the accident record. Most don't, since the pilot cages one, lands and no one is the wiser.

Six of the accidents were the usual runway mayhem: loss of control in a crosswind, skidding off a slick runway or going ice skating with predictable (and expensive) results. In one accident, a pilot thought he was landing with a 10-knot tailwind—questionable enough—but in fact had a 30-knot quartering tailwind. You'd think you notice that sort of thing, but the pilot told the NTSB it slipped by him.

tightly packed and difficult to get to. Second, the systems themselves are complex. One owner reported dozens of individual failures in his first 18 months of ownership and another said elevating the airplane to squawk-free status is hopeless.

Since the type certificate is owned by a solvent business, owners do have a place to go for support. Aerostar Aircraft Corp. is holding up its end of the bargain, picking up on the task of issuing service bulletins. Some 18 have been published since the company bought the TC. All are conveniently listed on the Aerostar Web site. The most recent SB—600-136—describes visual inspection of the wing attach fittings. Contact the factory at 800-442-4242 or www.aerostaraircraft.com.

### MODS, OWNER GROUPS

Interestingly, the factory offers the most mods for the Aerostar. These range from service bulletin kits to factory options available at the time the airplane was built but not installed. The Machen Superstar upgrades are still available—the Aerostar factory Web site has a complete list—and given the low purchase price of the airplanes, many owners may find the prices attractive. Machen, by the way, still exists as a manufacturing company, but all of its mods are provided only through the Aerostar factory.

The Aerostar Owners Association publishes a magazine and holds regional meetings that focus on safety and maintenance. Contact the Aerostar group at 918-258-2346 and www.aerostar-owners.com.

### READER FEEDBACK

I have owned three Aerostars since 1993: A 601P, a 602P and now a 700P. I have a little over 2000 hours in these airplanes. I bought my first Aerostar because it was the only piston twin faster than my Mooney. I was traveling long distances and wanted pressurization and to get above weather. I flew this airplane like it was a car for a couple of years, but longed for even more power and known icing. The 602P with five more inches of boost and many refinements added by Piper was the solution.

I flew this aircraft nonstop from places such as Chicago to Boston and Chicago to Dallas.

I looked for a 700P with a good history for about a year. This aircraft incorporates all of the lessons learned from the others built in, not added on later. With 350-HP counter-rotating engines, the airplane is quiet and predictable. She will continue to climb to at least 18,000 feet on one engine. As for speed, flying from Telluride to Chicago at 25,000 feet in the winter, I was asked by ATC what kind of a jet I was flying. Ground speed was 400 knots, in economy cruise. Yes, I like to go fast, but every one of my engines exceeded TBO. They were not working hard.

There are some add-ons that make these airplanes better. Stock alternators and starters are notoriously unreliable. High output alternators from National Airparts saves taking a prop off every 50 hours.

I have not owned other twins, so I can't compare maintenance or insurance costs. As for the piloting skills required to be safe, this is a very fast airplane. But the number one requirement is patience. As in a Mooney, overreacting to a seeming pilot error is not a good thing. This certainly applies to landing. When she wants to land, she will—just fly the numbers. Stay trained and stay current. I have been in weather, not on purpose, where I had a 10,000 feet block altitude. Power to idle, just keep the wings level. The airplane will do the rest.

Dennis Wisnosky
Via e-mail

I have owned a 1982 602P/700 Aerostar with known-ice equipment since 1995 and have flown it over 1300 hours since then. I have the 700 mod with max gross to 6315 pounds, which includes intercoolers and the upgrade to 350 HP per side with vortex generators for better rudder effectiveness and excellent control through the stall regime. It handles very well on one engine with the 700 engines and flies well even with one windmilling.

I actually lost one on takeoff (blown intake manifold gasket) and I was able to easily keep it level and at blue line until I got my head working, cleaned it up and climbed out without a problem. They are very strong airplanes—they were originally designed to be a jet—and you very seldom see in-flight breakups no matter what the pilot does.

The Aerostar is one of the easiest airplanes to fly if you don't go too slow and keep ahead of it. With the

*Bob Davis sent us the top photo of a 600, whose characteristic mid-wing was a Ted Smith signature design feature. He used it on the Douglas A-20 Havoc attack bomber, lower, known as the Boston by the RAF.*

VGs, it does exactly what you tell it to. Its high wing loading makes it very good in turbulence, but the thin wing is not happy when stalled. This airplane takes at least 500 feet to recover from a stall and when it gets slow, it slows down very fast, thus it requires close attention to the airspeed especially in the pattern. The controls are crisp and responsive and lots of fun to fly with all that power. It typically climbs at 1000 FPM at climb power (85 percent) at gross weight at 160 knots all the way up to 17,000 feet-plus.

The 700 engines are basically the same low-compression engines as used in the Mirage and as such they require extra fuel to keep them cool. If you run them cool, at max TIT of 1550 degrees, they use about 23 GPH at 65 percent, which provides 220 knots in the high teens and 240 or so in the 20s. Seventy-five percent power will give you another 10 knots at 26 GPH. To get reasonable range, you need the optional 44-gallon aux tanks, which I have. The 601P with the high-compression engines and intercoolers is probably the most efficient Aerostar. You can run the 290-HP engines at 75 percent and get the same airspeeds as the high-compression engines and use much less fuel while keeping the TITs cool enough for good life. Some of the guys run the 601P engine lean of peak and have good luck doing that.

The best piece of advice I would have if you are thinking of buying one is to join the Aerostar Owners Association and ask lots of questions. Get good training and watch the airspeed like a hawk, especially if you have only flown Barons and Senecas before. There are several good instructors who will teach you in your airplane.

The owners blog has lots of knowledge and they can really help you get the right one that fits your mission. Aerostar Aircraft owns the manufacturing rights and is very good at helping you with advice and parts. Prices are not cheap, however, as when parts are built in small volumes they are expensive to manufacture and keep in stock.

I think a full-featured engine monitor is necessary to keep track of everything and makes maintenance much simpler. The only tender part I would be very careful about is the nose gear assembly. It is very easy to over turn the nosewheel when

towing and you can also break it just by turning from one side to the other too fast. Check for damage on a pre-buy. In general it is a very good, fast, responsive, fun owner-flown aircraft.

William E. Lawson
Somerset, Wisconsin

I have owned a 1976 601P/700 Aerostar since 1995.

**Performance**: My aircraft was manufactured with 290-HP Lycoming IO-540-S1A5 engines with turbochargers installed by Ted Smith. The prior owner overhauled the engines in 1988 and they were upgraded to 350 HP. I typically fly 15,000 to 17,000 feet MSL. At 65 percent power, my true airspeed ranges from 225 to 235 knots.

Although I do not normally climb into the flight levels unless my trip exceeds 300 miles, if I do go high, airspeeds range from 240 to 245 knots at 65 percent power. Depending on weight, the airplane at max takeoff power (42 inches and 2500 RPM) can climb at 1800 FPM-plus below 5000 feet MSL. Cruise at 65 percent power in the teens burns 42 to 44 GPH. With my fuel setup, I flight plan no further than 800 miles regardless of forecast winds.

With the additional fuel tank mod, Aerostar claims a range of up to 1000 miles. My full-fuel payload is about 600 pounds. My max payload (fuel plus passengers) is about 1800 pounds. Max payload varies from aircraft to aircraft depending interior and mods. Check the aircraft weight and balance sheet for accuracy and currency.

The aircraft is solid in turbulence due to high wing loading. The flight control system is all pushrod and bellcrank, no wires. The system is positive, although it would probably feel somewhat heavy to a pilot transitioning from smaller/lighter aircraft. It is a fine instrument aircraft with no surprises as flaps and gear are lowered. It has, in the past, had a poor reputation regarding safety. I believe this has, to large degree, diminished, if not disappeared.

**Insurance:** Until recently, the annual premium has fluctuated around $4500 to $5000 for $175,000 hull coverage and $1 million liability, with $100,000 per passenger sub limits. For reasons I can't explain, my latest premium was $3500 for the same coverage.

**Comfort:** This is definitely a headset aircraft. However, once headsets are on, the cabin noise level is not excessive. The cabin is not spacious, but once everyone is seated, it is comfortable. Like many owners, I have removed one of the center seats for comfort. Although I have flown with all seats full, weight limitations limit fuel load to a maximum range of around 300 to 350 miles.

**Maintenance:** Like all aging piston twin aircraft, the Aerostar requires careful, and at times expensive, maintenance. Although at times exasperating, one must keep in mind that most of the Aerostar fleet was built over 30 years ago. During the first 10 years of ownership, most of my maintenance focus was on replacing/overhauling components that one would expect to wear out. Such items as alternators, magnetos, turbos, hydraulic pump, fuel pump, waste gates and turbo controller have been replaced and/or overhauled. Once these were replaced, I've had no further problems. Any prospective purchaser must accept the fact that no matter how good the pre-buy inspection is, there will be subsequent maintenance expenses.

The Aerostar Owners Association is an excellent source for locating an experienced Aerostar mechanic. Aerostar Aircraft, located in Idaho, is also available for periodic maintenance, in addition to aircraft sales and installation of performance upgrades. It maintains a parts supply, develops aircraft modifications, publishes service bulletins and is an excellent resource for questions regarding the Aerostar. Al Hoover is the contact.

At this point, I am seeing the need for more age-related, as compared to use-related, maintenance issues. I just replaced ducting for the heater and pressurization system. It's hard to complain about replacing parts that lasted 35 years in service. Going forward as the fleet continues to age, I anticipate similar airframe and component issues. Based on what I've heard about other piston twins, I do not think this is unusual or limited to Aerostars.

It's been 16 years of ownership. The plane has always been a delight to fly. There is, quite simply, no general aviation aircraft available today which can match it in overall performance.

Robert Muhlbach
Manhattan Beach, California

My Aerostar is a 1981 602P that has been upgraded to a Machen 700 by the Aerostar Aircraft Corporation, complete with 5.5 PSI pressurization. I further upgraded it to a modern glass cockpit panel with the Garmin G600 and a JPI 960, plus a KFC-225 autopilot.

I get 255 knots true at 25,000 feet on 65 percent power burning 45 gallons total. Annuals run around $6900 without upgrades. Flying the fastest piston twin requires annual recurrent training from a certified instructor for insurance. I love this airplane and would not trade it in for another as it has the best value for money, given the speed.

Uday Saraiya
Las Vegas, Nevada

I have owned a 1980 Piper Aerostar 600A since 1993. I purchased it because I owned a Piper PA-30 Twin Comanche at the time and wanted to move up to a normally aspirated twin with more performance, safety, equipment capability and room.

Nothing could beat the performance. My normally aspirated Aerostar 600A cruises comfortably at 210 knots at 8000 feet, 2350 RPM and full throttle burning 33 GPH at 125 degrees rich of peak. At 10,000 and 2400 RPM, it does 205 knots and at 12,000 feet, 200 knots. Initial climb at 120 knots gives around 1600 FPM at full load and low density altitudes, or a spectacular 2000-plus FPM if lightly loaded on a cold day.

The controls are smooth and light, similar to a Bonanza. Flight in a 600A can be exhilarating and fun. With its high wing loading and the long fuselage, it tempers turbulence and tames the tail wag often associated with low-wing twins. As an IFR platform, it is especially stable with partial flaps and gear down shooting an approach at 120 knots.

The Aerostar has several safety plusses. On one engine, the Aerostar 600A will climb around 400 FPM at low altitude and gross weight, making it one of the best normally aspi-

rated engine-out climbers. Because the props are located close to the fuselage and to the center of gravity, flying on one engine requires only small rudder and aileron inputs. The airplane handles nicely on one engine.

The visibility is excellent up, down, and forward as the pilot is ahead of the wing and props and has the overhead windows for looking into steep turns. The cockpit door is next to the pilot so he can conveniently latch and unlatch it without leaning across or relying on others. An emergency exit is provided next to the rear seat.

The fuel system is simple. When the fuel selector for each engine is set to on, each engine draws fuel from its respective wing and the fuselage tank simultaneously. The fuel selector remains in the same position for all flights from takeoff to landing unless you need to use fuel from one side to correct an imbalance, which is rare.

My Aerostar has the Machen slow-speed control mod (most have this), which adds vortex generators, stall strips and other changes to provide a well-mannered, docile stall with good control throughout.

The Aerostar interior is 46 inches wide, which is two inches wider than the Twin Comanche. The cabin keeps this width for its entire length, making the rear seats as wide as the front. As a six seater, the Aerostar is tight and most owners remove one or two of the middle row seats. With both middle seats removed, it makes for an enormous area for carry-on items and unobstructed leg room. Everyone likes the big side windows.

For all this, the 600A will be a little noisier in the cabin at full power thanks to those props close to the fuselage. ANR headsets take care of that. It will also require a little longer runway. At gross weight, short final should be 100 knots, if light, not less than 90 knots. If near gross, plan on 3000 feet as a personal minimum with nominal temps and under 2000 feet of density altitude. That said, there are owners who fly regularly into home runways under 2500 feet with clear approaches.

My insurance premium for $1 million/$100,000 per seat liability with $160,000 hull is $2900 per year with U.S. Specialty through the AOPA insurance agency. Annual costs vary depending on whether a big ticket item needs replacing. When any airplane is 30 to 40 years old, things like windows, windshields, engine control cables, fuel hoses and so on need to be replaced or a prop or heater overhauled. Not every annual will require these kinds of items be accomplished, but buyers should expect many of them will.

Parts are usually easily available as Aerostar Aircraft Corp. maintains a huge inventory. There are also numerous upgrades available from Aerostar Aircraft which typically can be installed by your mechanic. An Aerostar 600 probably costs about the same to maintain as other 30- to 40-year-old normally aspirated six-cylinder light twins. However, it can probably be purchased at a better price, making it a good value in the twin market. A pre-buy inspection by an Aerostar-experienced shop is a must to determine the true condition and value of the plane. A bargain airplane is probably not a bargain at all.

Also, new owners must get good training from well-qualified Aerostar instructors. Plan on three days to cover systems and flying in your airplane. Joining the Aerostar Owners Association is a must to find an Aerostar guru for training or pre-buy!

This 40-year-old organization has a fantastic Website (aerostar-owners.com) with a very active member forum for answering any question, a hot line for asking questions or for maintenance help, Aerostar maintenance and safety seminars led by knowledgeable Aerostar gurus, DVDs on flying and maintaining the Aerostar, a parts loaner program and a quarterly full-color 48-page magazine.

The Aerostar 600A is considered by many Aerostar enthusiasts as having the best bang for the buck of all the Aerostar models. Compared to the Superstar 700, the 600A will burn 12 gallons less fuel per hour while giving up only 30 to 40 knots, and can be maintained for roughly half the cost.

If you do not need turbos and want a safe, comfortable, capable and swift IFR cross-country airplane, the 600A should be considered.

Dave Duntz
Dayton, Ohio

The Aviation Consumer

## Letters

*(continued from page 3)*

other products you reviewed are awkward, bulky or uncomfortable, in my view.

In short, I couldn't be more pleased with the LightSPEED Mach I headset and give it a five-star rating.

Michael Baraz
Chicago, Illinois

### Virtual HUD

Your article regarding the Virtual HUD Wingman in your March 2011 issue echoes my experience. I ordered a unit from Sarasota Avionics who advertised the unit in *Trade-A-Plane.* I paid my $1500 and had to wait almost a month for delivery.

The unit that arrived was non-functional. The owner of the company, William Steele, explained that some units were not properly programmed. He e-mailed me a UPS label so that I could return the unit for reprogramming. He promised to add some upgrades, gratis. I sent the unit back.

After two months, I had not received my unit back. I spoke both to Mr. Steele and Sarasota. My unit was then sent but the address, according to Mr. Steele, had been damaged by UPS and they tried to deliver the unit to the unoccupied house next door to me. He explained that the unit was returned to him.

He then instructed Sarasota Avionics to credit me for the price of the unit. He informed me that he was sending me a unit free of charge and would see that it got to me even if he had to deliver it himself.

He provided a UPS tracking number. The unit, as of three months later, has yet to arrive. I called UPS and they confirmed the tracking number, but stated that they had never received the unit from Mr. Steele.

Bob Achtel
Via e-mail

*We checked with Sarasota Avionics who confirmed they refunded reader Achtel's money.*

### Ground Power Additions

Thank you for your objective review of our 28-volt, 60-amp Ground Power Unit. I would like to offer your readers a little clarification on a couple of points. Because our GPU is used with such a wide range of GA aircraft—small pistons up to small jets—I want to clarify about its use as a starting device.

While its output can serve to assist a battery that is less than fully charged for starting a piston engine, it should not be used in a similar manner with any gas turbine engine. These engines can draw several hundred amperes, so we don't recommend our GPU for starting or dry-motoring a turboprop or turbofan engine.

Another unique aspect of ground power for a turbine-powered aircraft is the need for absolute peak battery performance to avoid the risk of a hot start. For this reason, conducting a thorough, deliberate pre-flight inspection is often compromised to conserve battery power. However, with a GPU in the hangar, the preflight can be conducted while simultaneously topping off the ship's battery.

So instead of depleting starting power, the preflight time serves to increase it. We think this procedure is cheap insurance against a compromised start, and of course, a thorough preflight is always an enhancement to safety. Our website (www.audioauthority.com) offers a video tutorial that demonstrates these and other operational tips.

Jonathan Sisk, CEO
Audio Authority Corp
Lexington, Kentucky

**FEEDBACK WANTED**

## BEECH 19/23

For the August 2011 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Beech Sport/Sundowner/Musketeer series. We want to know what it's like to own these starter 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 Sundowner by June 1, 2011, to:

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