May 2016
Volume XLVIII
Number 5

The consumer resource for pilots and aircraft owners

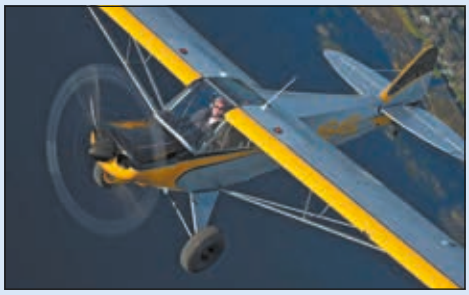
The Aviation Consumer®

Do Regs Really Matter? Page 2

Magneto Upkeep:

Take-it-to-the-shop advice for maintaining ignition systems.. page 14

Are buyers happy with this?… page 4



Another Super Cub clone hot rod… page 11

David Clark's new ENC headset… page 18

The Aviation Consumer

EDITOR
Larry Anglisano

SENIOR EDITOR
Rick Durden

EDITORIAL DIRECTOR
Paul Bertorelli

CONTRIBUTING EDITOR
Jonathan Doolittle

SUBSCRIPTION DEPARTMENT
P.O. Box 8535
Big Sandy, TX 75755-8535
800-829-9081
www.aviationconsumer.com/cs

FOR CANADA
Subscription Services
Box 7820 STN Main
London, ON 5W1
Canada

REPRINTS: *Aviation Consumer* can provide you or your organization with reprints. Minimum order is 1000 copies. Contact Jennifer Jimolka, 203-857-3144

AVIATION CONSUMER (ISSN #0147-9911) is published monthly by Belvoir Aviation Group LLC, an affiliate of Belvoir Media Group, 535 Connecticut Avenue, Norwalk, CT 06854-1713. Robert Englander, Chairman and CEO; Timothy H. Cole, Executive Vice President, Editorial Director; Philip L. Penny, Chief Operating Officer; Greg King, Executive Vice President, Marketing Director; Ron Goldberg, Chief Financial Officer; Tom Canfield, Vice President, Circulation.

Periodicals postage paid at Norwalk, CT, and at additional mailing offices. Revenue Canada GST Account #128044658. Subscriptions: $84 annually. Bulk rate subscriptions for organizations are available.

Postmaster: Send address corrections to AVIATION CONSUMER, P.O. Box 8535, Big Sandy, TX 75755-8535. In Canada, P.O. Box 39 Norwich, ON NOJ1PO, Canada. Publishing Agreement Number #40016479

ARE MORE PILOTS BLOWING OFF THE REGS?

One of our readers—an airplane owner and active CFI—recently called to ask why the magazine doesn't bring more attention to rule-bending, which he thinks is a growing trend. Although he had no hard statistics to back up his assertion, he offered the stereotype that older and financially capable pilots with medical issues are getting their hands on technically advanced and highly automated aircraft (yes, he mentions Cirrus). He went on that the combination of an aging pilot population and the anticipation of third class medical reform is making for a lot of scofflaws, while the advocacy of AOPA and other alphabets is fostering an arrogant sense of entitlement among the older and financially flush GA pilot community. Last, if these pilots fly without medicals (he found a half dozen recent crashes where the pilot had a lapsed medical), then they also must have a lax attitude when it comes to maintenance. Is it really a free-for-all out there? If it is, it's not exactly a new trend, in my estimation.

This got me thinking about one of the most mechanically skilled aircraft owners I've ever known. He would half jokingly proclaim that since it was he who owned his airplane—and not the FAA—he could do whatever the heck he wanted with it. If that included making improvements and modifications to his ride without jumping through a lengthy and convoluted FAA approval process—which wouldn't add a bit of safety to his mission—he's already done it. When I challenged my friend's rebellious ways, he admitted to trying to play by the rules, but after years of dealing with misinformed FAA airworthiness inspectors who shot at him from their hip, he started walking to the click of his own wrench. I have no idea if he flew his airplane out of annual inspection or without a medical certificate, but I do know that he never put a scratch on the airplane in 50-plus years of flying. He's lucky and skilled, but that doesn't make him right.

After researching lots of NTSB reports each month, it does make me wonder if the regs still matter. They should matter because they are the rules and responsible pilots follow rules, right? But how many other pilots are taking this do-what-I-want approach to flying because of the outdated medical requirements, not to mention a stale Part 23? Since flying—and aircraft ownership in general—is based almost entirely on the honor system, it's impossible to know exactly how many pilots fly without medicals, in unairworthy aircraft and without flight reviews. You'll have to look to the NTSB reports for hard evidence, which do have a healthy number of probable causes with narratives that include all of the above—especially pilots who were flying without a valid medical certificate. As we reported in the operational blunders article in the April 2016 issue of *Aviation Consumer*, if you crash, you or your lawyer might be defending your actions because almost every crash could have a rule-breaking gotcha in its wreck report.

The pilot who continued to fly VFR into IMC conditions and augered into rising terrain busted an FAR, and the FAA and NTSB can argue that the pilot should have known that the weather conditions were beyond his or her capabilities. That pilot would get slapped with a 91.13 bust—careless and reckless. But, it's easy to see why some rule-breaking is easy to justify by dint of common sense. For example, if the annual inspection on your airplane expired on May 31 and you hop in and fly it to the shop on June 3, are you really at an increased risk of crashing? I highly doubt it. Perhaps a 10-day grace period might keep rule-abiding pilots honest. The rest will fly on day 11.

I can't think of a workable alternative to the self-policing honor system that's currently in place. The naysayers of medical certification reform argue that self-certification is tantamount to allowing the fox to guard the chickens and is a step away from compliance. I say that as long as there is a human element involved, any and all rules will be bent. If you're among the crowd that can't stop yourself from bending the FARs, follow the lead of my rebellious friend and simply don't bend the airplane.—*Larry Anglisano*

SOARER ON ELECTRIC

Larry Anglisano's commentary on electric motorgliders (April 2016 *Aviation Consumer*) delivers a message that electric motor power is just as unattractive for gliders as it is for traditional powered airplanes. Allow me to give the other side of that coin.

The folks quoted in the commentary are accomplished touring motorglider pilots. Touring motorgliders (for sport soaring and transportation) do an admirable job for long cross-country flying missions—both in powered mode and in soaring flight—when conditions allow. Very significant here is that these aircraft use conventional small aircraft engines (often Rotax), which are proven reliable.

But auxillary-powered sailplanes have engines that are very low-volume production, have an extremely small form factor and many sub-optimal aspects when compared with a Rotax. They're also configured for climbing and not cruising—serving to replace the tow plane—allowing the pilot to return home when losing lift forces far out on course. These sailplanes are not cruisers.

This segment is absolutely prime for electric power, which is attractive for several reasons. It eliminates the terrible reliability factor and is independent of density altitude. The mission only requires a 10- to 15-minute initial burn to climb to 3000 feet and begin the soaring day. If battery capacity is one hour, this is easily adequate to serve the mission needs for a backup to get home. If far out on course and low in altitude, the regime is to climb under power for another 10 minutes and then glide for around 30 miles (50:1 glide ratio), and then another 10-minute climb (if necessary) to get home.

Frankly, self-launch motorgliders are the ideal first target for electric power. I have 16 years of experience with my two-cycle internal combustion engine—and a ton of war stories related to maintenance and reliability. If I was buying a sailplane right now I would most certainly consider electric power. A few electric gliders have been available on the market for a few years, but they haven't sold well. I think this is because of the steep evolution of this technology. As a result, pilots are wary of buying a glider that might be obsolete in a short time. My sense is that we are on the cusp of an inflexion point, and all of small aviation should consider targeting this rather small, but attractive niche for electric power. I urge you to avoid discouraging this natural target as a stepping stone for the coming electric revolution

Jim Herd
Minden, Nevada

Valid points, Jim. Anglisano should have clarified the two missions (touring and aux-powered sailplanes) in the commentary. While we're making clarifications, the Silent2 electric sailplane has a motor rated at 22.0 kW—not 220 kW as stated. If it were, that would be the equivalent to 293 HP and we would be sold on electrics for long-distance touring.

WINGX ON ANDROID

I'd like to remind *Aviation Consumer* readers that complete interoperability with hardware and navigation apps is not yet the norm.

I bought a new Samsung Galaxy tablet to replace my aging iPad and learned that not only is WingX several years behind for Android (compared to IOS), but it will not play with my SkyRadar ADS-B receiver. When I asked SkyRadar, they said that older SkyRadars use an ad hoc Wi-Fi mode that Android tablets don't support.

Mack Parrott
via email

Hilton Software's Hilton Goldstein responds: "Android devices and the Android operating system introduce some inconsistencies between releases and hardware devices. One of our challenges is to try ensure compatibility with as many (if not all) applicable Android devices. Our WingX Pro7 for Android release added a lot of functionality, including a powerful moving map. I can tell you that while WingX Pro7 for iOS is more mature (WingX Pro7 for iOS was in fact the first major EFB app to introduce ADS-B weather and traffic), we are working on adding ADS-B in the future to WingX Pro7 for Android."

NAVWORX ADS-B

You might want to update your ADS-B buyer's guide. NavWorx has been offering the ADS600-B as a fully certified and mandate-compliant ADS-B In/Out solution for $1999. By the time you add all of the options you need, it comes to $2772—perhaps one of the cheapest solutions on the market.

Mike Edwards
via email

Since we published that buyer's guide (April 2016 Aviation Consumer*), NavWorx and Garmin announced a deal that enables WAAS-equipped Garmin GNS430W/530W and GTN750/650 navigators to be used for WAAS position input for the NavWorx ADS600-B receiver.*

It should be a relatively simple task, since the GPS is connected to the receiver with a common RS232 datastream.

CONTACT US

Editorial Office
860-614-1987
Email: consumereditor@hotmail.com

Subscription Department
P.O. Box 8535
Big Sandy, TX 75755-8535
800-829-9081

Online Customer Service:
www.aviationconsumer.com/cs

Used Aircraft Guides:
203-857-3100
Email: customer_service@belvoir.com

For weekly aviation news updates, see www.avweb.com

MARKET SURVEY

Avionics Survey: Prices Tough To Justify

Our avionics retrofit survey shows that prices are too high and ADS-B Out equipage is lagging, but a remarkable regulatory breakthrough could fix that and more.

by Larry Anglisano

While new avionics might not be flying off dealer shelves, we've noticed a sizable increase in market competition—particularly for ADS-B solutions and wireless panel-mounted avionics.

But those are minor developments, compared to the stunning announcement at the recent Sun n' Fun fly-in this past April, which could lead to relief for buyers weary of budget-busting upgrades.

As we were preparing the following avionics satisfaction survey, the Experimental Aircraft Association (EAA)—in collaboration with Dynon Avionics—announced it won FAA approval to install an experimental EFIS display in a variety of certified aircraft. If that doesn't start the long-awaited trend toward more affordable avionics, there may never be hope for the struggling market.

SURVEY SAYS

We pored over 214 responses from the survey posted on sister publication AVweb.com. Our usual survey caveats apply. We recognize that the sampling can be skewed because it might attract buyers who are disgruntled with a particular brand or interface because the selling dealer shop botched the installation. On the other hand, it's an opportunity for happy buyers to tell us so and why. But what we're really interested in are buying trends, perceived cost/value and whether buyers would make the same purchase decisions again.

The buyer demographics were predictable—46 percent were between the ages of 41 to 55, and 48 percent were over the age of 65. The rest were 21 to 40 years old. When it comes to flying missions (which is a major factor in upgrade decisions), 45 percent fly between 50 to 100 hours per year, and 32 percent fly between 100 and 200 hours per year. Personal/recreational flying counted for 50 percent, while personal and business flying was 47 percent. Certified single-engine aircraft ops are the most popular, at 77 percent, while only 11 percent of our respondents upgraded twin-engine aircraft.

That photo to the left represents over $100,000 of fully certified retrofit avionics. Buyers might be able to eventually knock some zeros off that price if the Experimental Aircraft Association can further its outreach in relaxing Part 23 equipage standards.

We asked whether their avionics upgrade improved mission capability and respondents generally reported that it did, especially when it comes to ridding old equipment from the panel. Modern integration seems to be the key to saving space.

"It's made it easier and helped to eliminate several pieces of equipment from the panel, including an old audio panel, separate intercom and an ADF," said Dale Sanders of the new Garmin suite in his Cherokee Six.

When asked about the equipment's value for the price (54 percent reported satisfactory value and 23 percent said the value was high for the cost), Sanders said he was very satisfied with the Garmin purchase, but would be very unlikely to purchase the equipment again. Like many others in the survey, investing big in an older airframe is the issue.

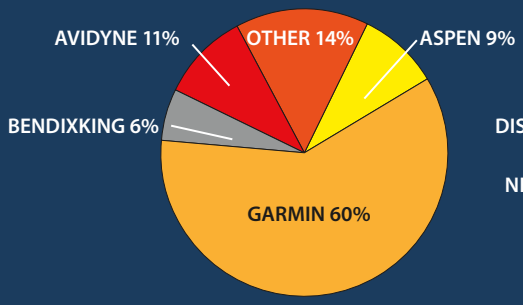
"Garmin makes excellent products, but its aircraft electronics are ridiculously expensive. It's difficult to justify a $15,000 installation on a 40-plus-year-old aircraft," he wrote. Sorry to rain on your already wet parade, Mr. Sanders, but shops we speak with say $15,000 is considered an entry-level retrofit.

"I put a lot of money into the avionics—close to the value of the airframe with its high-time engine—and I'm not sure that made economic sense. I understand the reluctance owners are feeling," said Garmin equipment owner Reece Pollack, who is very satisfied with the purchase.

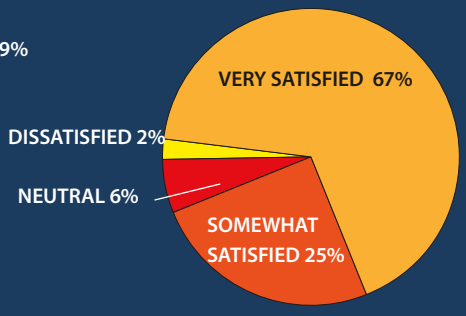
The staggering price of an upgrade has some buyers like Randall Dean eyeballing the used market. "I held out for most of the items I wanted to show up on eBay and was able to purchase a nearly new Garmin

AVIONICS BRAND SATISFACTION

What avionics brand did you install?



Describe your level of satisfaction with your avionics:

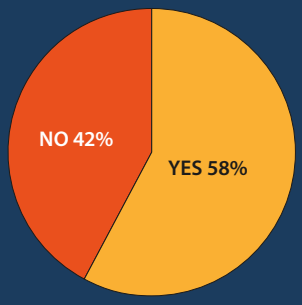


How did you learn to operate your avionics?

INITIAL TRAINING	
I TAUGHT MYSELF	52%
MANUF. MATERIALS	34%
AVIONICS SHOP	5%
CFI TRAINING	4%
OTHER MEANS	4%

ADS-B EQUIPAGE

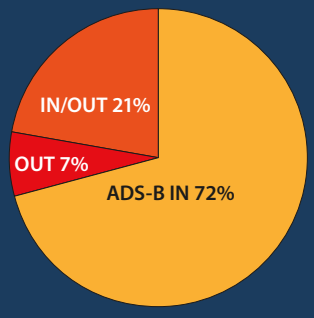
Have you done an ADS-B installation of some kind?



What brand of ADS-B equipment did you install?

ADS-B BY BRAND	
GARMIN	62%
AVIDYNE	8%
BENDIXKING	6%
FREEFLIGHT	6%
L-3 AVIONICS	5%
NAVWORX	3%
ASPEN/TRIG/OTHER	10%

What ADS-B interface did you install?

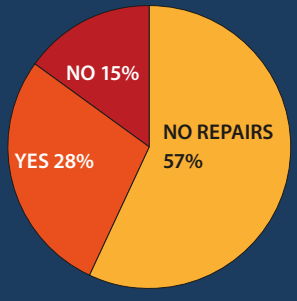


RELIABILITY

OVERALL PERFORMANCE	
VERY RELIABLE	76%
I'VE HAD SOME ISSUES	17%
NOT REALLY SURE YET	4%
VERY UNRELIABLE	3%

HOW MANY REPAIRS?	
NO REPAIRS NEEDED	60%
ONE OR TWO	33%
THREE OR MORE	4%
TOO EARLY TO SAY	3%

Was the repair under warranty?



GTN750 with 23 months of warranty remaining, along with the Aspen MFD1000, Garmin GDL69A XM unit, WX500 Stormscope and even an S-TEC 55X autopilot," he wrote. He had to purchase a new GDL88 ADS-B system and Aspen PFD1000. "Doing this saved me many thousands of dollars on a totally modern avionics suite," he said of the $40,000 project for his twin. We should stress that warranty support for the used equipment is critical. You don't want to buy these major systems without a warranty in place. Repair support is expensive.

When it comes to manufacturer support, only 50 percent said it was very good and 28 percent said it was satisfactory. Some of that might reflect buyer views on cross-brand compatibility. If you're mixing avionics brands, you might run into a troubleshooting roadblock.

"Flight planning apps and ADS-B manufacturers are very proprietary and that hurts GA," said one owner. "The avionics companies simply refuse to cooperate with each other," added another. Reader Jeffrey Aryan threw it all on the FAA.

"The FAA should mandate that all brands are compatible with each other, since the FAA is the approving agency. Plus, the FAA must mandate that all avionics are serviceable for at least 35 years," he told us. Good points, but be careful what you wish for. Good regulation can have a negative consequence on price. Still, it's not all doom and gloom.

We have noticed a growing trend that points to more open interfaces, especially in the ADS-B market. While it took some heat early on, Garmin has opened its Flight Stream wireless data stream to ForeFlight's Mobile tablet app, plus it added GPS navigator compatibility with the NavWorx ADS600-B system. This creates an easy solution for lots of

EAA'S JAW-DROPPER: DYNON STC FOR CESSNA, PIPER

How ironic that one of the biggest news stories in modern GA history was delivered in a press conference that was barely half full. For the record books, it was day two of Sun n' Fun 2016 where Experimental Aircraft Association (EAA) Chairman Jack Pelton told journalists that the organization, along with Dynon Avionics, has earned an AML-STC to install—as a primary standalone system—the Dynon experimental EFIS-D10A in Part 23 certified aircraft. While some may find this to be a modest first step (the AML is limited to Cessna 150s, 152s, 172s, Piper PA-28 and -38 series airplanes), it's a giant step toward finally bringing more affordable—and more advanced—avionics to existing Part 23 aircraft. While the STC is limited to the EFIS-D10A system, Pelton assured the audience there will be more approvals to come. This, we assume, means an expanded product line, plus opportunities for other established manufacturers to get in on the bliss. Yes, that includes a real opportunity for Garmin—a company that has spent the last few years ramping up its experimental avionics product line. Its G3X Touch has been so well-received that it has cut into Dynon's share of the experimental market—especially at the OEM level.

On the other hand, we can't help but wonder what this breakthrough means for the future of existing certified avionics. Will it send potential buyers running to the sidelines waiting for more STCs, rather than dropping serious bucks on existing certified stuff? Or will the threat of a new era of low-cost experimental products slash prices to a more palatable level?

Perhaps for the foreseeble future, it might not have much effect on the market's higher end. Instead, it could pump some sugar into the market's lower end. You know, the exact market for which Dynon's STC applies. These are modest airplanes, including ones you'll find on training flight lines and in desperate need of radio upgrades.

As for the 4-inch Dynon EFIS-D10A PFD, the MEMS rate sensor-equipped instrument associated with the STC is a version of the company's well-proven D10A standalone EFIS. It has been in Dynon's product lineup for 10 years. It differs slightly from the previous version in that it can't be used in an autopilot interface. It can be interfaced with the Dynon remote magnetometer for gyro-stabilized magnetic heading, and with an AoA probe for onscreen angle-of-attack data. The STC requires connections with the aircraft pitot and static system, with an external GPS antenna, plus the instrument has to replace the existing attitude gyro, but must not replace any other primary flight instrument.

As we go to press, exact pricing hasn't been set, but is expected to be around $2000 and will be available in a couple of months. Visit www.dynonavionics.com.

existing GNS430W/530W owners and could put a mandate-approved solution in their hands for as low as $3000. Remember, it wasn't long ago that such a solution easily topped $5000.

Garmin has even decided to play nicely with Aspen, recently announcing the compatibility of its GDL88 ADS-B system and new GTX345 transponder with Aspen's Evolution flight displays.

RISING COMPETITION

It's no surprise Garmin remains the dominant brand (60 percent), but Avidyne—once written off as dead by its critics—has come back impressively strong with several new interfaces. A handful were just introduced at Sun n' Fun this past April. This includes synthetic vision for its IFD-series navigators, a new wireless interface with the IFD100 iPad app and some rejiggering of its ADS-B products. It has even ramped up its sales support team as a result of increased demand. Better yet, brand satisfaction was generally favorable in our polling.

"The Avidyne 540/440 navigator is a truly transformational improvement over other current market offerings. It reduces pilot workload while providing tremendous situational awareness," said Lawrence Paratz of the new Avidyne stack in his twin. He wasn't the only buyer who recognized Avidyne's response to early user feedback, incorporating many improvements in free firmware upgrades. But others are frustrated with problems that seem to be the result of their shop's learning curve.

"My plane has spent about 99 percent of the last three years in the avionics shop trying to get the new Avidyne stack to work correctly. I ended up bringing it elsewhere (good plan). Some of the problems were due to the lack of familiarity with Avidyne equipment at the original avionics shop, but a lot of it was Avidyne hardware and software problems," said one owner.

As for operational complexity, 58 percent said the transition was very easy, while 33 percent told us it was somewhat challenging. Of those, 52 percent taught themselves how to use the stuff, while 34 percent used training material offered by the manufacturer.

In the age of tablet computers, it's too easy for users to compare panel avionics with the iPad. "Finding things in the Aspen Evolution PFD system was harder than accessing data on the iPad. Plus, it seems that

my iPad is more advanced for certain functions," said one VFR pilot of his Aspen/FreeFlight ADS-B combination.

Garmin got some attaboys for helping tame the learning curve. "The Garmin folks (and the training staff in particular) were fabulous when it came to helping me understand the capabilities of the new avionics installed," said one owner. We can vouch for the quality of Garmin's factory pilot training. We took the GTN/G600 course a couple of years ago (we reported on the experience in our December 2013 issue) and felt that it was thorough, if not fast-paced.

IT COSTS HOW MUCH?

We asked about total cost and downtime. Don't expect a short stay at the shop for a major job.

"It took three weeks to install a Garmin GTN650, GNC255 navcomm, GTX327 transponder, a GDL88/Flight Stream ADS-B system and an Aspen EFD1000 Pro PFD. The cost was $42,000, which included hardware to provide digital steering to the existing Century 2000 autopilot," reported Stu Landrum.

Basic ADS-B installs might tie the aircraft up for only a couple of days. "It took roughly $4000 and three days to install my Garmin GDL88 and Flight Stream 210 system," said J.B. Pavela, who also reported that the FIS-B weather capability has helped his tactical enroute decisions.

The easiest upgrade could be Avidyne's IFD navigator when replacing an old Garmin GNS navigator. Several owners said it really is a while-you-wait deal. Others who needed to replace a GPS antenna (in existing non-WAAS IFD upgrades) said it took roughly 12 hours total, which is around $1500.

FAST-MOVING ADS-B

If you've been keeping up with our biannual ADS-B buyer's guide, you know there is no shortage of ADS-B solutions. Based on our survey, the procrastination continues. With less than four years to go until the equipage mandate kicks in, only 27 percent of respondents invested in mandate-compliant ADS-B Out installs. A whopping 71 percent fly with ADS-B In, which includes portable receivers. Of the respondents who haven't made the investment, 80 percent said they plan to upgrade, while only 8 percent said they won't upgrade at all.

Our survey revealed lagging ADS-B equipage, but Garmin's opening architecture—including the GNS navigator's WAAS compatibility with the NavWorx receiver (top, middle photos)—could entice more buyers. Meanwhile, Avidyne is dialing up competition with new products like the synthetic vision-equipped IFD550, bottom.

Is the lack of cross-brand compatibility hindering ADS-B sales? One reader made an interesting point. "Until avionics companies are committed to interoperability and multi-vendor setups are tested and approved—including installation techniques—I fear many more people will simply wait until the last possible moment to equip," he wrote.

When it comes to ADS-B brand popularity, Garmin blows away the competition. In the survey, 62 percent bought a Garmin solution. That's not surprising, given the company's diverse ADS-B product line. But we found several pleased buyers from the FreeFlight camp, but others were not so pleased with dealer support for LSA models, including owner Serena Ryan.

"Installation of the FreeFlight Rangr ADS-B was a breeze. I love that I can have traffic and weather on my iPad using ForeFlight. I tried talking the avionics shop into putting the traffic on my Garmin 496 portable GPS. They wouldn't do it as it wasn't a 'documented' solution. It's an LSA and all it needed was manufacturer approval—which was available. I'm tired of aviation professionals not knowing about the LSA world," we were told.

WINDS OF CHANGE?

We aren't letting our guard down, but we suspect the market is at least pointed in the right direction. Non-certified avionics for Part 23 aircraft, evolving cross-brand compatibility and cheaper ADS-B solutions were some of the demands noted in our survey and it seems like manufacturers may finally be listening.

Insurance Market Scan: Shop Aggressively

Getting good coverage in an advanced step-up aircraft is easier and cheaper than ever. But if you're a high risk, think twice before switching companies.

by Jonathan Doolittle

The market for aviation insurance continues to be soft—perhaps very soft. There are simply too many aviation insurance companies offering to sell policies, relative to the number of aircraft owners looking to buy them. And each of these too-many companies is trying to keep the customers it has, and to grow by taking customers away from one of the other companies.

This is good for you, of course, because it means you could score rates cheaper than we've seen in years, plus have a better chance of getting covered to fly a complex machine. But it isn't exactly a free-for-all. There are still some gotchas in the aircraft insurance world you need to know about. In this article we'll cover them and take a fresh look at the market and what it might cost for a policy.

WELL-QUALIFIED WINNERS

The problem with today's market, as insurance people say, is capacity. In today's domestic general aviation insurance marketplace, there is an overabundance of capacity, or money. In order to insure things, insurers need money, which is set aside as reserves. When there is more capacity than is needed, we have a soft insurance market.

Most industry people will tell you that the current soft market started around 2006, making this cycle the longest that anyone has seen. And it shows no signs of letting up. Depending upon how you count, there are about 40 percent more companies selling aviation-related insurance than there were 10 years ago. The number of insurable airplanes is remaining relatively flat, and so, fortunately, is the number of accidents. But the cost of repairing airplanes and defending lawsuits is going nowhere but up, so insurers have their work cut out for them.

The only bad thing about the current soft insurance market is that it will not last forever.

The largest and most obvious effect of this embarrassment of riches is reduced rates for aircraft insurance. The main beneficiaries are corporate operators, many of whom are paying 30 percent of what they paid for insurance 10 years ago. The breaks that light airplane owners are getting are less dramatic, but still quite tangible. Most light aircraft underwriters who we spoke to felt that their pricing was off between 20 to 40 percent during that same time.

In general, the people who are benefitting the most from the price breaks are those who are the most attractive to insurers. Light singles have fared well. Piston twins—especially cabin-class models—have seen some breaks, but less than some of the other classes. Turbine airplanes flown by trained and well-qualified owners have seen substantial reductions.

Most underwriters said that their experience with light sport aircraft (LSA) was mixed. Because these airplanes only have two seats, the liability exposure was somewhat less. None offered hard numbers, but most insurance company people that we talked to felt that light sport airplanes often failed to have the robustness built into some legacy trainers, and that light stick forces in some led to landing accidents.

The overall picture for all types is a little muddied by the steady erosion in the value of most light aircraft. But even allowing for this, insurance rates have come down substantially for almost everybody.

MORE COVERAGE FOR LESS

Another effect of the continued competitive market is a gradual increase in the coverage provided to aircraft owners. This has taken on two forms. Insurers are being pushed to offer higher limits of liability coverage by other insurers who are willing

From an insurance standpoint, it's a good time to step up to a turboprop single. But, your insurer will likely expect you to complete recurrency training on a regular basis.

to provide them. Higher limits are being demanded by brokers who want to provide better protection for their clients, and who are trying to replace some of the losses to their percentage-based commission incomes.

In addition to higher liability limits, insurers are broadening the coverage provided in their standard policies to make their products more appealing to consumers. Most light aircraft policies now contain expansion endorsements that contain various ancillary coverages, mostly at no or very low cost. These range from providing coverage for rental of the insured airplane to listed pilots, to expanding the geographical territory where the airplane can be flown, to including coverage for the extra expense of renting an airplane to fill in for the damaged insured airplane while it is being repaired. Not every policy comes with these extras, but far more do than was the case 10 years ago.

The final frontier in this ongoing competitive market is underwriting guidelines. We have watched prices drop, coverage broaden and rise and now we are beginning to see sporadic slackening of underwriting guidelines. For instance, companies that had strict policies about limits provided to older pilots are rethinking their positions in order to hang on to some of their customers. It's easier in the advanced aircraft world, too.

Companies that required annual training for pilots of pressurized airplanes are now looking at training every other year. Companies that required annual simulator training for owners flying jets will sometimes relent and allow in-airplane training. Insurers who insisted that a new jet owner be accompanied by an instructor pilot for 50 hours after completion of school now may only require 25 hours, or simply that the owner graduate from the initial training and receive the type rating.

This is still more the exception than the rule, but an insurer that rigidly sticks to its guidelines is now in danger of losing business to a rival that, depending upon your point of view, is either more competitive or less disciplined. The companies are not throwing out their underwriting guidelines wholesale, but rather some of the companies are doing so selectively. They are more likely to make exceptions if they feel the pilot is a good fit for the airplane.

Consider that if you are an underwriter and one of your customers receives a competitive quote from an insurer willing to take on the same risk for less money, or the same risk with less training or to offer more liability protection for the same premium, then you have a tough decision to make.

Claims like the one that resulted in a total loss of that burnt RV, top, generally won't spike your rates. Insurers are still spooked by the light stick forces of LSA models, bottom.

HANGOVER

None of this is particularly new. Aviation insurance has always been a cyclical business, with fairly strong ups and downs. Most cycles, either hard market or soft market, last three to five years. What is different is the duration of this soft market cycle. Nobody has seen a cycle that has lasted for 10 years, with no obvious end in sight.

General aviation insurance is a very small piece of the worldwide insurance industry. While GA insurance rates are affected by GA accident rates, they are more driven by external forces, such as catastrophic events like windstorms, or economic developments. In part, this current soft market is a hangover effect from the financial crisis.

The cost of money is still historically low, and this more than anything else is what drives the cost of most types of insurance, including aircraft insurance. But compared to many other investment opportunities, general aviation insurance still looks fairly attractive, or it did five years ago. Hence the parade of new companies and the flood of capacity.

For consumers, a soft market is about 90 percent good news—maybe 95 percent. In fact, the only bad thing about it for consumers is that it will not last forever. At some point, the cost of money will increase, or a cataclysmic event will take place, and suddenly there will not be enough capacity. The soft market could come to a sudden, screeching halt, or it could end with a whimper.

But sure as gravity, at some point insurance for your airplane or helicopter will become more expensive, more restrictive and possibly less available. We are already seeing individual companies that are no longer offering larger limits of liability as they did two or three years ago.

TIPS FOR BUYERS

We spoke to underwriters and to a number of insurance brokers about tips for prospering in a buyer's market. The advice they gave us was suspiciously similar to what we were

TYPICAL CURRENT-MARKET INSURANCE PREMIUMS	
1985 Cessna 172, $75,000 hull value Pilot experience: 200 hours, private pilot	$933
2000 Beech Baron 58, $500,000 hull value Pilot experience: 1000 hours, instrument rated, 10 hours multi, 250 retrac	$8100
2005 Cirrus SR22, $200,000 hull value Pilot experience: 500 hours, instrument rated	$2900
2012 Piper Mirage, $600,000 hull value Pilot experience: 500 hours, instrument rated, 200 hours in Cirrus, 10 retrac	$8900
2000 Socata TBM700, $1,200,000 hull value Pilot experience: 500 hours, instrument rated, 200 hours in Cirrus, 10 retrac	$14,000
1978 Beech King Air 200, $500,000 hull value Pilot experience: 700 hours, instrument rated, 370 hours multi, 370 retrac	$8100
Based on a 40-year-old pilot, liability limit of $1 million, limited to $100,000 per passenger. All examples assume the pilot has a clean accident record.	

told during the last hard market. Underwriters particularly stressed the importance of long-term relationships between the aircraft owner and the underwriter, and most brokers agreed.

Having a long-term relationship with a company will often lead to a better solution in a claim situation. In the event of a gray area, the insurer is more likely to bend a little in favor of a long-term customer.

Another reason to stay with an insurance company over the long haul is that the company is more likely to bend when the owner is looking for any other kind of accommodation, such as a delay in annual training or help with a transition to a different type of airplane.

We were also reminded that insurers have specific likes and dislikes. As an example, the longtime insurer of a Beech Baron might not be the first choice if the owner is moving up to a Phenom 100 jet, no matter how long the company has insured the client in the Baron.

The downside of a long-term relationship—if it is not managed carefully—is that the insured can wind up paying more premium than he would if he simply bought the least expensive insurance each year. Our suggestion is that the owner make certain that his broker shops his insurance with all the companies that have the capacity to insure whatever he is flying.

If there is a less expensive but similar quote, everyone will know about it. If the current insurer can match a lower quote, the relationship continues. If the current company won't bend, or is willing to reduce but not match their premium, then there is a decision to make. In this way, however, the aircraft owner has situational awareness of where the premium he is paying fits into the rest of the market. In most cases and especially in this market, very few companies will want to lose a good customer if they can avoid it.

And here we stress "good customer," not one who bends the rules or falsifies information on the insurance application. Remember, while insurers don't want to lose customers, they can cancel them.

One of the problems associated with changing insurers frequently is the fear of finding damage on inspection right after policy renewal. This is especially the case with turbine aircraft, where foreign object damage is found (to name one scenario), and it is unclear when it took place or which insurer should pay for it.

PROMO UNDERWRITING

While general aviation accident rates vary only slightly from year to year, the number of accidents is small enough that different insurers can have very different results for the exact same kind of airplane.

For example, one company could have half of all the Cirrus accidents that year, while another company had no Cirrus losses. While underwriters set their rates according to industry experience, their own loss experience will have a lot to do with which airplanes they are pursuing aggressively, and which ones they will reduce limits on. They might increase training requirements for them or cease to underwrite altogether. One of the hallmarks of a soft market is promotional pricing. Insurers will often offer rates that are below their costs in order to gain new customers. Other forms of promotional underwriting are unusually lax training requirements, or larger limits of liability insurance than the owner could buy normally. As owner, you may encounter all of these, given the increased number of insurers who are all trying to grow in a market whose customer base is aging and shrinking.

Insurance for transitioning pilots often combines all three of these soft market characteristics. Another benefit of using a broker who shops the market is that your broker can show you which companies offered a one-shot promotional price or higher limits two years ago and have not been heard from since. On the other hand, there could be a company that has provided lower quotes and higher limits for three years in a row and that should be seriously looked at.

Whether or not you decide to change underwriters to save money should depend on your situation. The loss-free 35 year-old-instrument-rated pilot of a Cessna 182 may always have companies who will offer him good insurance at reasonable prices.

The 70-year-old pilot of a PC-12 who carries $5,000,000 of liability coverage should probably give very careful thought before changing insurance companies. Pilots of rare or difficult to insure airplanes should also tread cautiously here.

Another tip from both underwriters and brokers that holds for both hard and soft markets is to make yourself as attractive a risk as possible. While underwriters look at what kind of airplane you fly, they spend more time looking at the main cause of accidents—the pilot.

Anything that you can do to make yourself safer is likely to help. Given the drop in hours flown in the past few years, we would recommend that pilots make some sort of annual training event part of their regimen.

What you choose will depend upon what you fly, but for most airplanes, an FAA WINGS phase is helpful. The type-specific training programs are well respected, such as

continued on page 32

AIRCRAFT FLIGHT TRIAL

Super Legend HP: Another Titan Hot Rod

Continental's stroked 180-HP Titan engine is proving a popular LSA and experimental choice. It's a good match for what's essentially a Super Cub airframe.

by Paul Bertorelli

A decade ago, when the FAA and ASTM were dickering over what became the light sport aircraft rule, limitations on weight and performance—but not power—bubbled to the top of the discussion. The airplanes were supposed to be less expensive, light and simple, but the rule didn't say they couldn't have neck-snapping power-to-weight ratios and thus the era of the 180-HP LSA is upon us.

The latest is the Super Legend HP, which is essentially the Super Legend airframe fitted with Continental's increasingly popular 180-HP X340 Titan engine, a stroked version of the Lycoming-style O-320 that has proven a mainstay powerplant for 60 years. This engine has found wide acceptance in the experimental market and when CubCrafters jollied it through the ASTM approval process, it became the first such engine of its type to find practical application in LSAs.

The Super Legend HP, above, is essentially an over-powered Super Cub with an improved cabin. EAB version can nearly lift its own weight.

That buyers are choosing this engine in what passes for droves these days proves what aircraft manufacturers and salesmen have known all along: When writing a low six-figure check for a new airplane, owners want all the options and, no disrespect to ASTM, they don't want pokey, underpowered airframes. Just because a would-be LSA driver will never need tundra tires and a 50-foot takeoff roll for a Saturday morning toot around the county doesn't mean they're not willing to pay for such things.

THINK SUPER CUB

With its Cub-type airframes, American Legend has attracted a small but loyal customer base, plying the same market as CubCrafters, Aerotrek, Rans and Kitfox—the taildragging rag-and-tube crowd.

The original Legend has the Continental O-200-D, a lightened version of the original 100-HP O-200. The Super Legend followed, with the Lycoming YO-233, a lighter version of the 115-HP O-230. When it appeared four years ago, half of Legend's sales were Super Legends and the company's Darin Hart expects similar response to the Titan-powered Super Legend HP.

The airframe construction is conventional, with Ceconite 102 fabric and Poly-Tone coating over a welded 4130 fuselage cage. When the Super Legend first appeared, the company increased the size of the horizontal stab/elevator to provide about 18 percent more surface area. That's not too noticeable just looking at the airplanes side-by-side, but it does provide some increased pitch authority. Unique to the Legend design are doors on both sides of the cabin, a welcome feature for hot-day ground ops and transformational for float work, sometimes saving the need to dance across a walk wire when docking.

With the Titan's higher power comes higher weight and that chews into the airplane's useful load. Hart told us the original O-200 weighs about 199 pounds and the Lycoming O-233 used in the Super Legend adds 15 pounds to that. The Titan tips in at 248 pounds, which means the airplane went on a serious diet to stay inside the 1320-pound LSA weight limit.

The heavier weight up front does

CHECKLIST

- The Super Legend is already a good performer. Titan engine improves it.
- If STOL is your thing, the Super Legend HP excels at short takeoffs.
- Higher engine weight limits the airplane's legal load. But it will haul what you can stuff into it.

Visibility over the nose in the air and during taxi, top, is excellent. No S-turns required. The Titan engine, middle, is about 48 pounds heavier than the O-200. Landing gear, lower photo, uses an x-frame with springs in place of the ancient Cub's bungees.

shift the CG forward slightly, but it still stays within 3 inches of the forward limit when the airplane is occupied by two pilots. (The pilot weight is concentrated on or aft of the CG datum point.)

The original Legend has about a 500-pound useful load on an empty weight of 825 pounds, but the Titan-equipped HP is 80 pounds heavier than that, with an empty weight of about 905 pounds. In fact, it pushes the limit on LSA empty-weight requirements.

Realistically, with fuel aboard for more than an hour of flight, it's a single-person airplane, albeit one with good endurance. With 30 gallons of useful fuel aboard, the airplane can steam along on reduced power at 5 GPH and cruise for five hours comfortably at about 92 to 95 MPH.

And this gets us to the dirty little secret of light sport aircraft. The arbitrarily low gross weight is the most oft-ignored rule in aviation. The blunt truth is that the experimental version of the Super Legend has a gross-weight limit of 1750 pounds. With full fuel and two 200-pounders aboard, the EAB version would still be 260 pounds under that limit. Make your own moral judgment on the advisability of doing this or not, but the airplane can be flown safely at that higher loading.

Aerodynamics being what it is, stuffing this much power into a light airframe doesn't do much for cruise speed. Legend gives the maximum cruise speed of the HP as 104 MPH or about 5 to 7 MPH faster than the Super Legend. For cross-country flying, think of it as an 80- to 90-MPH airplane and plan accordingly.

WE HAVE LIFTOFF

But takeoffs, well, they're something else entirely. The company claims a minimum takeoff roll of 35 feet, followed by a maximum climb rate of up to 2000 FPM.

That takeoff performance may be achievable with the proper technique, but it requires a bit of nerve, using power to jack the tail up—against the brakes if you're sporty—and hauling the airplane off the runway with an abrupt tug. We might have used 100 feet of runway without trying very hard.

Similarly, with two aboard, we climbed at 1500 FPM with no heroics required. But that also means you get to pattern altitude by the turn from crosswind to downwind and better grab a handful of throttle reduction to keep from overrunning the altitude.

Although the Cub airframe wouldn't be confused with something sleek, it actually takes determination to slow it down on final approach. With a full-flap stall speed of 28 MPH, the airplane can be flown at 50 MPH or even slower on short final. Getting there takes effort, however, because until the airframe is dirtied up and slowed up, all it wants to do is glide.

A max-performance short-field landing with full flaps and power on can get the airplane into a postage-stamp runway. With its surplus power, there's little worry about getting unrecoverably behind the power curve.

The demo airplane we flew was equipped with Desser's 28-inch tundra tires and these may or may not absorb bounces on landings. They're mounted on 8-inch rims from Grove. Frankly, we're not fans of these big tires unless they're necessary for

operating over rough or soft terrain. They make the airplane more difficult to ingress and egress and, in our view, seem to move the center of mass higher, making the airplane feel less planted during ground handling.

The Grove brakes are powerful and require deft footwork because they're more than capable of putting the airplane on its nose. And indeed, that happened on another press demo flight, although it wasn't clear if it related to brake application. The airplanes can be fitted with either toe or heel brakes.

From the front seat, we found the heel brakes a little tricky to apply because of the distance from the rudder pedals to the brake pedals. That's probably a good thing to avoid the aforementioned nose prangs, but toe brakes have the advantage of being easier to get to and apply gently for a pilot used to them.

Cabin appointments in the Legend HP are comfortable, if not luxurious. The seats are the same weight-saving bungee designs Legend introduced in the Super Legend. The windows open in flight, held fast by a new clip that's easier to use than the previous design. Visibility in flight and on the ground is excellent from the front seat. There's no need for S-turns. One thing we would like to see improved is the hinge point for the flap handle. It's almost aligned with the pilot's shoulder axis and we found it awkward to manipulate for that last notch of flap. A forward bend in the handle might help.

The HP panel has room for basic avionics. The version we flew had ADS-B Out and a comm radio by Trig.

With the higher-performance airplane comes a higher price, of course. The base price for the Legend with the classic Cub cowl is $136,900, while the Super Legend base is $154,900. The Super Legend HP starts at $164,900 and the version we flew—with Garmin avionics, Trig ADS-B Out, AeroLED landing lights and a leather interior—spec'd out at $195,000. For more information, contact American Legend at www.legend.aero or 903-885-7000.

STROKING MORE POWER FROM THE O-320

Stroking an engine is the classic hot rodder's technique of coaxing more power out of an engine by modifying it. But tinkering with the basic geometry of crankshafts, connecting rods and pistons requires manipulating a complex set of variables.

When ECI—now a Continental unit—went at it, they decided to keep it simple by increasing the stroke of the O-320 marginally solely by machining the crankshaft journals to a different size and thus was born the X340 experimental engine. According to ECI's Bob Looper, the company originally had in mind a high-performance mod for the Cessna 172's O-320. When the engine was at overhaul, the crank could be replaced with the stroked version, increasing displacement and horsepower without requiring a 360 upgrade.

That project still hasn't sifted through certification, but in the meantime, the X340 has become the most popular engine in the company's Titan line and has spawned a stroked version of the O-360 called the X370. For homebuilders, these are highly customizable engines. Continental offers choices in crankshafts and cases, accessory cases, electronic or magneto ignition systems, constant-speed props and several fuel injection systems. Although engines offered for the LSA market are similar, there's less variation in accessories.

For its version of the 340 strokers, CubCrafters joined then-ECI to lighten the engine and guide it through ASTM approval. Working together, the companies lightened the 340 with a lighter accessory case and a smaller, lighter sump that has less oil capacity to save weight. That engine became the X340CC, which is unique to the Carbon Cub. The X340s used in other LSAs, including the Super Legend HP, are slightly different and are a bit heavier, lacking the CubCrafters' proprietary lightened sump.

On a power-to-weight ratio, the benefit of stroking is obvious. The dry weight of the X340, at 180 HP, is 245 pounds, according to Continental's data. A stock Lycoming O-320, at 150 HP, weighs between 244 and 255 pounds, depending on model and configuration. The power-to-weight Delta isn't huge, but it goes in the right direction, making the X340 the torque equivalent of an O-360.

Continental's Looper told us that other than increased torque, the X340 is identical to the O-320 in all respects, including RPM and operating temperatures. In addition to two stroked models, the Titan line includes three conventional configurations of popular Lycoming displacements, the O-320, O-360 and O-540.

Magneto Upkeep: Not Worth Overhauling

We tend to take our old-school magnetos for granted. Yet, a failure can be catastrophic—so plan on pulling and inspecting them every 500 hours.

External mag timing—a technician positions the crankshaft to put the number-one piston at the number of degrees before TDC specified by the mag manufacturer using an analog dial indicator. The mags will be physically adjusted so that the breaker points just begin to open at this crankshaft position.

by Rick Durden

The magnetos we've been relying on to fire our aircraft's spark plugs may be the trailing edge of technology, yet if cared for appropriately, they are remarkably reliable. It's the cared for part of the equation that matters—because they do require regular maintenance, otherwise some failure modes can mean engine stoppage or even catastrophic engine damage in a matter of seconds. The good news is that keeping your mags healthy usually costs less than two dollars per hour of engine operation per mag.

The purpose of a magneto is to provide enough electrical energy, at the right time, to fire a spark plug and ignite the fuel/air mixture in a cylinder. It operates on the principle that a rotating magnet will generate alternating electrical current in a coil of wire. By wrapping another coil of wire, with many more turns, around the primary coil, the voltage can be stepped up dramatically. The

AIRCRAFT MAINTENANCE

high-voltage current in the secondary coil—20,000 to 30,000 volts—is then mechanically directed to the appropriate spark plug as its piston reaches 20 to 24 degrees before top dead center (TDC). We'll take a brief tour through the major components of a magneto, discussing what they do, how they can go bad, what happens when they do so and how to prolong their useful lives.

The heart of a mag is a permanent magnet, referred to as the rotor. It is rotated by a drive on the engine's accessory case. On a four-cylinder engine, it rotates at the same RPM as the engine. On a six-cylinder engine, it spins at 1.5 times the engine speed. The magnet retains its magnetism for years, and is remagnetized when the magneto is opened up for repair or overhaul.

As the rotor loses its magnetism, the electric current generated as it spins diminishes, leading to a less powerful spark and such things as hard starting or slight engine power loss. We strongly recommend following the manufacturers' recommendations to pull mags at 500 hours time in service to replace them (Champion/Slick mags) or

Representative magnetos, clockwise from top: Bendix (Continental) dual mag, Slick 4371 and Bendix S6RN-1225.

(Continental/Bendix mags) open them up, inspect and replace components as necessary (IRAN—more about IRAN later).

About 200 turns of heavy-gauge copper wire make up the primary coil. One end of the wire is grounded to the mag's case. The other end is attached to a set of breaker points that are operated by a cam. The breaker points spend most of their life closed so that the current generated in the coil by the spinning rotor flows around the coil—producing a strong magnetic field.

MAGNETIC FIELD COLLAPSE

The cam is set to open the breaker points the moment ignition is desired. With the circuit suddenly broken, the magnetic field in the coil collapses and causes a voltage spike in the primary coil of 200 to 300 volts.

As the breaker points begin to separate and the voltage spike occurs in the primary coil, the electrical energy will attempt to arc across the widening opening between the points—they can't get to their full-open position instantly. Any arcing will cause the breaker points to pit and erode, one of the causes of magneto failure.

To prevent arcing across the points and cause a faster, more predictable magnetic field collapse—generating a greater voltage spike—a capacitor is included in the primary coil circuit. When the points start to open, the initial voltage spike charges the capacitor for a few microseconds rather than jumping across the widening point gap. By the time the capacitor is charged, the points are far enough apart that the 300-volt spike in the primary coil can't jump the gap.

If the capacitor goes south, there will be arcing and pitting of the breaker points and eventual magneto failure. Breaker points do wear in normal use, however; they should last five to seven years.

Once the sudden voltage surge in the primary has been stepped up to 20,000 to 30,000 volts in the secondary coil the energy needs to be routed to the appropriate spark plug. This is carried out mechanically by a distributor. A rotating wiper electrode on a plastic gear inside the distributor passes very near—but does not touch—the individual electrodes that connect to the individual spark plug lead wires.

The distributor components, other than the wires, are made of insulating material that can withstand the high voltages involved, although the materials can be damaged by heat.

The interior of the distributor must remain almost surgically clean as contamination will allow arcing between the rotating wiper electrode and the electrodes connected to the spark plug lead wires. Arcing will cause potentially damaging engine misfire. When arcing occurs, it leaves a trail of carbon from the burned contamination. That trail of carbon facilitates further arcing—making the misfire problem worse.

HIGH-ALTITUDE MISFIRE

Air helps prevent arcing between the electrodes in the distributor—it's a natural insulator. As the airplane climbs and the air gets thinner, its insulating properties diminish, making arcing and engine misfire more likely. We've experienced misfire when flying in the flight levels—and we can say with certainty that it's a scary event. The immediate solution is to reduce power and descend.

Reducing the power reduces the combustion chamber pressure and makes it easier for the spark plug to fire, reducing the potential for arcing in the distributor. As the air density increases, the insulating effect increases and should stop the misfiring. Once you land, have the mags pulled and opened up to inspect for carbon tracking inside the distributors—once it's started, it's easier for arcing to occur the next time. Any carbon tracking should be cleaned off.

For airplanes regularly being flown in the flight levels the method of preventing misfiring is either to use the largest magneto possible—so there is the greatest distance between spark plug lead electrodes—or install pressurized magnetos. Our research indicated that using large mags is preferable, although there is not enough space on some engines. Pressurizing the mags works, but adds complexity to the system and often introduces contaminates into the mags—increasing the risk of arcing and misfiring. If the pressurization system malfunctions at high altitude, it can cause both magnetos

IT'S ALL IN THE TIMING

When sending the high-energy burst of electricity to the spark plugs, the magneto has to do so at the right split second—every time. That requires that the mag be timed internally and externally. Setting the internal timing requires that the mag be removed from the engine and opened up. It should be performed every 500 hours of operation. External timing is done with the mags on the engine and should be done every 100 hours or at the annual inspection.

Internal timing involves setting the point gap and "E-gap" ("E" is short for efficiency). The point gap is set first—and involves rotating the drive shaft to the position where the breaker points are opened as far as they will go. The gap is measured with a feeler gauge and adjusted to the distance called for by the manufacturer.

The E-gap is the number of degrees of rotation between the magnetic neutral position of the rotor and when the points begin to open. It is prescribed by the manufacturer and the mag is set to that value.

The purpose is to have the breaker points open when the magnetic field induced in the coil by the rotor is at its maximum—to create the hottest spark.

External timing of the magnetos should be done every 100 hours or at the annual inspection, whichever comes first. The process involves pulling a spark plug in the number-one cylinder and rotating the crankshaft until the number-one piston is at the firing position specified for that type engine—typically 20 to 24 degrees before TDC. The technician then uses an ignition timing light connected to the mag's P-lead terminal while adjusting each mag by loosening its base clamps and rotating the mag on the mounting pad until the timing light indicates that the points are just beginning to open. The technician then tightens the clamps and checks the timing again—the mag may have moved.

External mag timing should be within one to two degrees of the published spec for the engine. Historically, an analog dial indicator has been used when setting mag timing—and they are only accurate to a degree or so. More recently technicians have been using digital inclinometers, which are accurate to a tenth of a degree.

We have seen serious engine damage caused by mistiming magnetos. Advancing the timing—even a few degrees more before TDC than called for by the manufacturer—will cause the engine to run hotter, reducing the detonation margin. Timing advanced by even four or five degrees on a big-bore engine combined with a hot day has caused detonation on takeoff and engine destruction. Advanced timing can be an expensive event on even smaller engines—we're aware of a Cessna 150 that required replacement of all four cylinders due to high CHTs because the timing was mis-set at the annual. The airplane did not have an engine monitor to warn that CHTs were unacceptably high.

Our research indicated that most mistiming occurs during an annual inspection. We recommend keeping track of EGTs and CHTs and checking that the after-annual readings are consistent with those prior to the annual. If the CHTs are higher and EGTs lower, the timing is advanced. Get the airplane straight back into the shop.

It's common to have to adjust external mag timing slightly at the annual as timing drifts due to component wear. We recommend that your technician keep a record of the direction and number of degrees he or she "bumps" each mag at each annual. If the cumulative bump exceeds three degrees in one direction before the next 500-hour IRAN, it's an indication that there's a problem with the internal timing and the mag should be pulled, opened up and inspected.

to arc, inducing misfire. Because of contamination risks, pressurized mags need to be pulled and inspected much more frequently than their non-pressurized brethren.

Additional protection against high-altitude misfire involves tightening up the gap on the spark plugs to make it easier for the spark to occur.

Arcing within the distributor generates heat, which can damage the plastic gear that rotates the main electrode, causing misfiring. Over time, the plastic gear can become brittle and lose teeth, throwing off the timing and causing the plugs to fire at the wrong time. Pulling the mag for IRAN every 500 hours of service allows a technician to check on the health of the distributor components and replace those that are at risk.

DEALING WITH MISFIRE

If you experience an engine that starts running rough, do a mag check. If the engine smooths out on one mag, but continues to run rough on the other—shut off the mag that is causing the engine to run rough. A failure within a mag that causes the engine to misfire is potentially serious. Misfiring can lead to detonation and catastrophic failure of the engine. We're aware of a number of accidents as well as wrecked engines caused by a mag problem in which the pilot did a mag check, identified the problem as related to one magneto and then continued to run the engine on both mags. If the engine is misfiring on one mag, don't keep using that magneto—that's one reason why there are two mags on the engine.

Because a magneto is always "hot," there has to be a way to disarm it to avoid the engine firing when it's not desired. To do so, a wire called a "P-lead" is connected from the ungrounded end of the primary coil ("P" is short for "primary") to the ignition switch to allow it to ground the primary coil. So long as the P-lead grounds the primary coil, the mag cannot generate electrical current and fire a spark plug.

P-leads are subjected to the environment of heat and vibration within the engine cowling, so they can and do come loose or break. If

Detonation damage to piston, right. Detonation can be caused by misfiring due to a distributor gear that has lost teeth, as at lower right.

the P-lead fails, that mag remains hot at all times and can cause the engine to fire if the prop is moved, a potentially dangerous event. Turning the engine off, briefly, with the ignition switch while idling just prior to shutdown will allow a broken P-lead to be detected.

MAG CHECK

The mag check you do during the pre-takeoff engine run-up will usually only reveal gross problems with the ignition system. Which means, if the max RPM drop or difference in RPM drop between the mags doesn't fall within the engine manufacturer's parameters, you've got something wrong that is significant enough that it needs to be dealt with prior to flight.

To find more subtle problems, before they become big ones, we recommend conducting a mag check in flight, when the ignition system is working harder, under more stress. We also highly recommend installing a digital engine monitor as it can save you more money than it costs in catching magneto problems before they become serious.

CHOICES

There are two manufacturers of magnetos and, depending on the type of engine on your airplane, you may or may not have a magneto choice. Bendix mags, now manufactured by Continental, come in three main types. The S-1200 series are large, robust, hot-sparking mags that are often used on airplanes that fly at high altitude—although they do not fit on all engines. The S-20/S-200 series are older, smaller-style mags that have a good reputation in service. The D-2000/D-3000 series are "dual magnetos"—two magnetos driven via a single shaft. They are only used on Lycoming engines and Continental no longer supports them. Parts availability is reportedly still good.

Slick magnetos, now manufactured by Champion, are smaller than comparable Bendix mags; however, they are significantly less expensive. Due to price, some models are considered throwaway—after 500 hours in service, the cost of buying a rebuilt exchange mag is often the same as opening up and repairing the existing mag. Our review of prices for rebuilt exchange Slick/Champion mags from the national specialty shops revealed prices in the $500 to $700 range. Prices for new Slick mags we saw were twice that of rebuilt units.

IRAN V. OVERHAUL

When your Bendix mags hit 500 hours in service, we recommend yanking them and sending them out to a specialized magneto shop for IRAN. For Slicks, we suggest getting an estimate for IRAN versus checking prices for rebuilt units—as they may be comparable and it can be faster to simply get rebuilt mags.

We do not recommend overhauling a magneto. To tag a magneto as overhauled, a shop must replace all of a specific list of parts, even if they are perfectly serviceable. Our research into prices showed it was generally twice as expensive to overhaul a mag as to inspect and repair and replace parts as needed. Depending on the parts that have to be replaced, we figure on $500-$700 for IRAN of a big Bendix mag—the smaller mags are less expensive. Bendix mags can be IRANed indefinitely. They do not need to be overhauled.

CONCLUSION

Until there is a way to affordably certify electronic ignition for general aviation aircraft, magnetos are going to continue firing spark plugs. They are reliable, robust devices that nevertheless need to be precisely timed—and the timing checked regularly. Accept that the components wear, and that a mag is not going to last until engine TBO, so plan on pulling and having them IRANed (or, for Slicks, replaced) every 500 hours.

David Clark DC One-X: Over-Ear, Hybrid ENC

David Clark takes a chance in the crowded high-end ANR headset market with a fresh over-the-ear model. We like its audio quality and rugged chassis.

by Larry Anglisano

A few years ago, the Pro-X-series aviation headset was a necessary shot in the arm for a mostly silent David Clark, a company facing fierce competition in a saturated market dominated by Bose and Lightspeed. With a street price under $700, the Pro-X appealed to remaining company loyalists who didn't want to spend over a grand on a modern noise-cancelling headset.

Just in time for the fresh flying season, David Clark throws another noise-cancelling headset into the competitive market, the One-X. At first blush, the new model looks a lot like the previously released Pro-X, but it has major design differences that contribute to better performance, while affecting comfort. It also has a higher price. Let's take a look.

CHECKLIST

- In David Clark tradition, the One-X is rugged and has a high-quality fit and finish.
- We welcome the simple ANR control module and easy Bluetooth pairing.
- Clamping forces are stronger than the company's on-ear Pro-X and other ANR models.

OVER-EAR VS SUPRA-AURAL

Unlike the Pro-X, which is a supra-aural design (meaning the earcups sit on top of the ear), the new One-X is a circumaural model, designed to fit completely around the ear. Both designs create several compromises, especially in comfort and in ANR performance.

Not surprisingly, a circumaural headset is expected to perform better in the noise-cancelling department and we found that to be true. In our long-term ANR headset evaluation (October 2015 *Aviation Consumer*), we found the supra-aural-designed Pro-X noise-cancelling performance to be modest, failing to match the performance of the others in the roundup, including the Bose A20, AKG AV100 and Lightspeed's PFX. But while it was somewhat lacking in ANR performance (it still performed well in low-frequency ANR signatures) it offered substantial gains in comfort. At 7.5 ounces, the Pro-X has low clamping forces, which is a non-issue with eyeglasses and ballcaps. It's a different matter with the new One-X, and if you try on each set back to back, you'll notice a big difference.

Part of that is the added weight. Since the One-X is nearly five ounces

With its adjustable alloy headband and suspension system, the One-X weighs 12.3 ounces, not counting the control module.

heavier than the Pro-X, it was obviously impossible for David Clark to design the same level of comfort into this new model. But there are some saving graces.

The One-X has a lightweight alloy headband that's precisely adjusted for just about any head size. On a side note, we think the headset's small frame makes it a good choice for children and for adults with small heads.

The headband offers generous tweaking, too. By adjusting each swiveling suspension stirrup, we found that you can accurately and evenly distribute the weight of the headset, which helps reduce fatiguing pressure points, but in our trials it didn't exactly eliminate all of the pressure. We couldn't help but compare the One-X's comfort to the Bose A20, which we think sets the standard for comfort. On a comfort scale of one to 10, we rate the Bose A20 a nine and the One-X a seven.

However, compared to the Bose, we found that the One-X offers a better seal around the ear, especially when wearing eyeglasses—an area where tighter clamping forces pay off. We wore the set with three pairs of eyeglasses for comparison—the Oakley M-frame, Ray-Ban Aviator and the Flying Eyes sunglasses equipped with interchangeable thin temples—and found that the One-X had a better fit than the Bose. Our sense is that the cups—creating a tighter seal—resulted in better noise attenuation.

The other trait we like is that the One-X has incredibly soft leatherette ear seals, which David Clark says reduces heat buildup, and we found that to be true. At nearly an inch thick and made of slow recovery memory foam, the oval-shaped seals also help absorb some of the pressure around the ear. While we didn't fly with them in a hot cabin, we suspect they'll perform well when heads get sweaty, without having to modify the ear seals with fabric covers as many pilots do.

On the topic of controlling sweat, the One-X uses what's called an Outlast fabric headpad. This is a breathable and vented pad that actually stores heat buildup and helps to eliminate hot spots. It also helps during cold conditions, releasing the stored heat onto the head for a warming affect. You can easily remove the pad for washing, too.

The full-ear enclosure DC One-X, top photo, has larger earcups and is heavier than the supra-aural DC Pro-X, middle. We like the simple and rugged ANR control module, and the headset's collapsible chassis, bottom.

Last, the One-X follows the lead of the Pro-X and collapses for compact storage in the supplied soft carry bag.

HYBRID ENC

The ANR circuitry on David Clark's One-X is the so-called hybrid electronic noise-cancelling system. Hybrid ENC isn't new and the company uses it on its Pro-X model.

Hybrid ENC circuitry samples noise with two microphones. One microphone is positioned on the exterior of the headphone dome, which isolates the microphone from the internal speaker. This is called the feed-forward portion of the circuit, while a second microphone is placed inside the dome adjacent to the speaker, as the feed-back portion of the circuit. Both the external and internal microphones send the sampled noise signals into a noise cancellation processor, which contains two inversion circuits, creating an anti-noise signal. The signal is then amplified and passed along to the speaker inside of the earcup.

We listened closely for the noise-

HIGH-END ANR HEADSETS COMPARED

MODEL	PRICE	WEIGHT	BATTERY LIFE	AUTO SHUT-OFF, AUTO MUSIC MUTE	COMMENTS
AKG AV100	$1099	13 ounces	50 hours	yes	Top performer for music quality, clever earcup flashlight function, music play/pause control, notable comfort, but mediocre ANR performance.
BOSE A20 BLUETOOTH	$1095	12 ounces	45 hours	yes	Consistent favorite among a diverse group of evaluators, advanced Bluetooth and multiple inputs are configurable for priority, simple in-the-field Bluetooth upgrade for older A20 models, poor passive performance.
DAVID CLARK ONE-X	$895	12.3 ounces	50 hours	yes	Excellent audio quality, plus better noise-cancelling performance than the supra-aural Pro-X. Rugged build quality and simple control module.
DAVID CLARK PRO-X	$637	7.5 ounces	50-plus hours	yes	Excellent value for the price, on-ear design is less intrusive, but ANR quality is a tradeoff, fold-flat storage, no hard-wired input for music.
LIGHTSPEED ZULU PFX	$1100	14 ounces	22 hours	yes	App-configurable software makes it the most advanced model on the market, excellent ANR quality, battery life isn't great, control module is too bulky for our liking.
LIGHTSPEED TANGO	$800	18 ounces	12 hours	yes	If you fly aerobatics or wander around a standup cabin, you won't miss being tethered to the audio jacks, but you'll have more devices to charge.

cancelling rumbling sound that's inherent with some ANR headsets, but we couldn't hear any with the One-X. Of course, that rumble often shows its ugly head when the headset is worn in the cabin of piston twins, but we only used the One-X in a piston single for this review.

Since the One-X has such tight ear seals, passive performance was quite good in the cabin of a Cirrus. But with a 50-hour battery endurance (the set uses two AA batteries), you might never have to try them without the ENC circuitry. The set is available in a version with a six-pin LEMO power plug for using ship's power. This will require additional wiring and the installation of a panel interface connector, of course.

We found the audio quality, which is driven by DSP (digital signal processing), to be quite good and the headset should be a good match with nearly all of the modern audio panels on the market.

For microphone audio, the set uses an M-55 electret mic attached to a reversible (you can place the mic on either side of the headset) and fully flexible boom assembly. The microphone performance was accurate and we never experienced clipping, as long as it's positioned on the lips.

BLUETOOTH

As everyone should expect, the One-X is equipped with wireless Bluetooth, which is commanded with a dedicated Bluetooth button on the control module. Initial pairing to an Apple smartphone was as easy as it gets. Press and hold the Bluetooth button for two seconds and the button flashes a purple annunciator, triggering an audible tone. Press the Bluetooth button again and you'll see the DC One-X in your wireless device's menu.

The wireless entertainment input audio quality is excellent, in our opinion, although we hoped for a touch more gain. Still, with the smartphone volume and headset volume cranked to the max, the music audio never distorted. Audiophiles should be content.

Adjusting headset volume is an easy affair, thanks to a simple and nicely designed control module that seems the perfect size. It isn't littered with complicated and misplaced controls. Independent volume controls for the left and right earcup are linear, while pressing and holding the power button turns the set on and off. When the batteries are going flat, the power key serves as a warning and flashes red.

We wish the One-X had a stereo/mono selector switch located someplace on the exterior of the control module, but it's buried on the inside, below the batteries. The inside of the module also houses a selector switch for automatic shutoff after five minutes whenever the headset is disconnected from the audio panel (or the panel is turned off) and when you aren't on a telephone call via the Bluetooth connection.

During a cellphone connection, there is plenty of sidetone (the sound of your own voice in the headphones), while answering and terminating an incoming call is accomplished by pressing the Bluetooth button on the control module. It's worth noting that cellphone audio isn't muted when receiving a radio call or when someone speaks on the intercom. If you want more advanced telephone functionality, you'll need a full-featured audio panel.

The One-X does, however, have a control for muting Bluetooth music. When the music is playing, press the Bluetooth button until it flashes blue, which mutes the music during a radio call or when there is intercom chatter. Press the button again and a purple flashing annunciator with a two-chime audible tone advises that the muting function is off. The default setting at power-up is always mute on.

MODERATE PRICING

The DC One-X has a list price of $895—a price point we consider to be moderate among high-end ANR models. David Clark offers a 30-day money-back guarantee and a five-year limited warranty. The company always had a fair and accommodating repair policy—even when its products are out of warranty. This in itself could entice buyers to jump on the One-X over the competition.

If comfort and price savings is your objective, we favor the supra-aural Pro-X, but you'll pay the price of slightly reduced ANR performance. David Clark sells through an extensive dealer network and directly on its website, www.davidclark.com. Contact them at 800-298-6235.

FlyQ EFB 2.2: Faster, More Features

The newest version of FlyQ's popular electronic flight bag delivers three times faster mapping, additional maps and a sophisticated search and rescue function.

by Rick Durden

Since taking back full control of its FlyQ EFB (electronic flight bag) from AOPA a few years ago, Seattle Avionics has continued to improve the iPad-based app while keeping true to its declared focus on ease of use and making life safer for pilots.

FlyQ has been characterized by a design that maximizes screen space for maps, buttons that are large enough to hit on the first try, easily readable fonts, color-coding for alerts that minimize distractions and a touchscreen set up with turbulence in mind. The recently released Version 2.2 provides, among other new features, a three-times faster mapping engine, new base maps and over 4600 Seattle Avionics-devised airport diagrams for airports that do not currently have FAA diagrams.

In addition to the standard maps one expects on an EFB—sectionals, IFR low and IFR high charts—FlyQ 2.2 introduces a terrain map, high-resolution road map—with road names—and an aerial photography layer with high-resolution images. FlyQ continues its "Rule of Two" with its access to the new mapping layers: There is never more than one or two taps of the screen needed to get to information the pilot needs.

SA AIRPORT DIAGRAMS

When the user pulls up an airport on FlyQ the first page reveals substantial information about the airport and presents three aerial views of the airport: a satellite image, the FAA diagram and the new SA (Seattle Avionics) diagram. According to Seattle Avionics' Steve Podrachik, the FAA only publishes some 700 airport diagrams, and those have limited information regarding the location of operators and services on an airport.

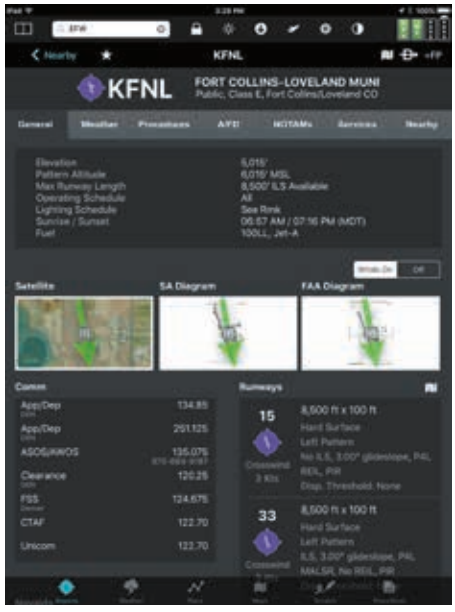
Seattle Avionics has developed nearly 4700 new airport diagrams that not only have runway, taxiway, ramp and building locations, they include the names and locations of the FBOs, fuel facilities and other operators on the airport. I spent some time looking through a random collection of the diagrams and I liked what I saw. I kept thinking about the times I'd guessed wrong about where to go on an airport, only found out after I'd shut down and then had to hot-start a recalcitrant engine to taxi to the right place.

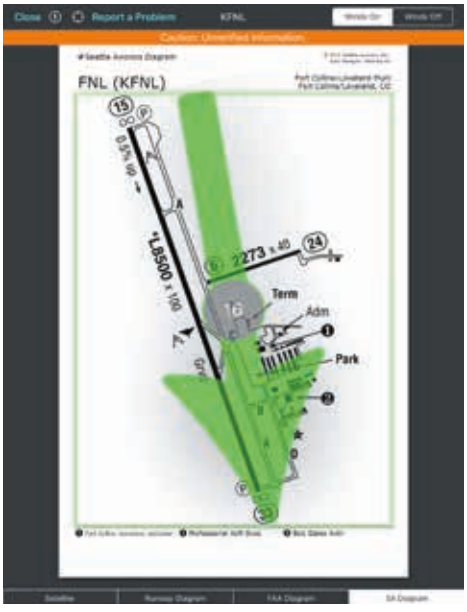
Podrachik said that FlyQ is actively seeking feedback on the accuracy of the SA diagrams. When an airport is displayed the user has the ability to submit feedback via the app.

I like a longtime feature of the airport diagrams and satellite images on FlyQ: A wind arrow is superimposed over the airport, making runway selection easy. The only thing I dislike is that the arrow is backward for wind indicators and airport wind tees—it points the direction the wind is going rather than from where it's blowing. Lining up for landing in the direction the arrow is pointing means setting up for a downwind landing.

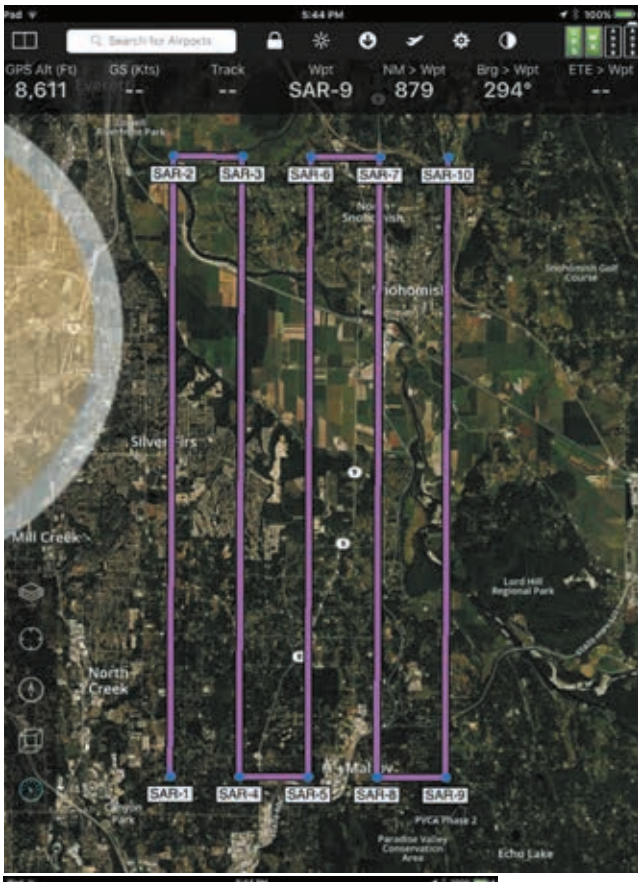
FlyQ supports more than 20 ADS-B systems. The new release adds the Dual XGPS 190 with AHRS and L-3 Lynx series, and now supports the AHRS unit in the Stratux.

While not a part of the new release, and despite the best efforts of FlyQ, the app has become less compatible with the Stratus ADS-B receiver line. Apparently the Appareo team does not want to sell new Stratus units to FlyQ users as it has installed firmware that now blocks FlyQ. I recognize that they want to push their ForeFlight app; however,





The airport page on FlyQ gives extensive information on the airport selected and offers three overhead views: satellite, SA diagram and FAA diagram—each with a wind arrow, right. The SA diagram, far right, shows the location of operators on the airport.



The FlyQ grid SAR pattern, one of nine patterns offered, displayed over the aerial photo base map, left. Focusing on turn point nine on the grid shows the high definition of the aerial photo map, below left.

it seems shortsighted to me. Garmin also blocks FlyQ from talking to its line of ADS-B receivers.

While FlyQ is an iPad tablet app, it has long synced with FlyQ Pocket for both iOS and Android smartphones. Another part of the new release allows it to sync with FlyQ Online on a Mac or PC. FlyQ Online allows a pilot to do flight planning on a computer then, without further action on the pilot's part, the results are automatically synced to the pilot's FlyQ EFB and FlyQ Pocket devices.

Podrachik explained that FlyQ Online is designed for in-depth flight planning to simplify the pilot's life in the airplane when using the EFB. He said the company wants the "pilot flying the airplane, not the iPad." Accordingly, there are a few features on FlyQ Online not on the EFB.

One new feature that struck me was that when looking at a potential destination airport or en route fuel stop, clicking on a fuel tab on the page brings up the fuel prices at that airport and ones surrounding it, in ascending order of price, simplifying the process of selecting a fuel stop when price is a consideration.

When working putting together a flight plan on any of the FlyQ platforms, there were little things that I appreciated. There's no need to type in the "K" prior to an airport identifier; the flight plan defaults to a direct routing—if you prefer airways, just type in "V" after the identifiers for your departure point and destination and you can have the system automatically optimize the flight plan for the winds aloft and plan your fuel stops based on the cheapest fuel. If I don't like the fuel stop, I just drag the line on the map over to the airport I prefer and the navlog that FlyQ has created is automatically updated. In addition, that flight plan is automatically available on the associated FlyQ EFB and FlyQ Pocket.

During our conversation Podrachik said that the company does not want FlyQ to be a standalone program—it should be able to work with other systems—as he described its new ability to accept flight plans from AOPA Flight Planner. After creating a flight plan on the AOPA platform the user emails it to him or herself. Upon opening the email on the iPad that has FlyQ installed, the user taps on the link provided and the iPad opens up FlyQ and displays the new flight plan. Dirt simple.

SEARCH AND RESCUE

The most involved, and certainly the most specialized, portion of the new release is the search and rescue (SAR) feature. It was optimized through several months of work with the Civil Air Patrol and was developed for CAP volunteer pilots. However, in looking at it, it can be used by any pilot who needs to fly a grid-type pattern such as for aerial photography and environmental research and tracking projects.

Nine different SAR patterns are available including grid, parallel track and expanding square. As the user fills out the parameters of the desired search a preview window appears at the bottom of the screen, giving instant feedback as to whether the parameters make sense and will work. The pilot's guide to FlyQ contains some 15 pages of detailed information on creating and using the SAR patterns.

The SAR pattern is overlaid on the map and works especially well with the new aerial photography base map rather than a sectional. Podrachik said that one of the reasons FlyQ added the aerial photography map layer was specifically to support SAR.

I've been long impressed with the simplicity of using the FlyQ EFB and not been at all surprised at its continued high ratings. The newest version makes a good thing better. The VFR app is $69.99, annually; the IFR version goes for $119.99. Download it at the Apple app store or get more information at FlyQ's website, *www.seattleavionics.com*.

Eustachian Exerciser: Stick It Up Your Nose?

Should pilots blow pressurized air into the nostrils to remedy ear blockage while in flight? Our docs want to see clinical testing results first.

by Larry Anglisano

A device called the Eustachi is being marketed to pilots as an alternative to the Valsalva maneuver they've been using for years. You know the drill—pinch your nose and blow to unclog blocked ears during and after a descent. While that can generally do the trick, Minnesota-based Exercore says its Eustachi product is far more effective.

It claims that the battery-operated Eustachi is drug-free, natural, safe and can be used during any activity—including flying—when you would perform the Valsalva maneuver. But I had to ask: Do you really want to be pumping 5 PSI of air up your honker while at the controls? The pilot docs I talked with have similar concerns.

WHERE'S THE BLOCKAGE?

The human eustachian tube connects the middle ear to the nasopharynx. It is approximately 1.4 inches long and 0.12 inches in diameter. When nasal/sinus congestion occurs, this tube may get blocked and hence, you may not be able to equalize the pressure that accumulates. We all know that chewing on gum, drinking fluids and yawning might work at clearing the blockage. But if the blockage occurs before descending, the pressure may build to the point of rupturing the eardrum.

The Eustachi, which sells for roughly $60, is a handheld device that's approximately the size of an electric razor. It has a battery-operated motor that runs a regulated air source that's piped through a fitting, tightly fitting into the nostril. Press the button and the device outputs 5 PSI of airflow out of the hole in the nose fitting.

Since the eustachian tubes are located in the back of your throat (or nasopharynx), Exercore says the device helps to exercise the tubes by delivering air as close to the tube opening as possible, which is the nostril.

The company says injecting the regulated air isn't enough. While the device is pumping, it says you should swallow, otherwise the air won't reach the eustachian tube opening. It's simple enough and I tried the device when safely on the ground, where it quickly unclogged my ears after a descent from altitude. But what are the potential risks?

I asked Dr. Robert Dodenhoff, our go-to AME, internist and an active pilot based in Hartford, Connecticut. Dodenhoff didn't dismiss the potential effectiveness of the product, but couldn't suggest using it—or not—without first seeing documented and approved clinical testing. Moreover, the device isn't recognized in the *American Journal of Medicine*, so there is little if any reassuring evidence that exercising the eustachian tubes with forced air pressure can't lead to complications. This includes barotrauma, ear infections and—worse for those at the controls—vertigo. I reached out to Exercore for comment, but they didn't reply.

Dodenhoff noted that pilots who suffer from blocked ears may have eustachian tube dysfunction, perhaps complicated by allergies and infection. But as Dodenhoff and other docs I talked to warned, whether you create pressure on the nasopharynx using the air-driven Eustachi device or the old-fashioned Valsalva maneuver, beware of induced vertigo. For more information, go to www.eustachiunclogsears.com

The Eustachi device, left and bottom photos, is nothing more than a regulated air pump that you stick into your nostrils.

Piper Malibu-Mirage

Piper's brawny PA-46 piston single is hardly cheap to own, but it pays back with high-flying efficiency and luxurious creature comforts.

When it first appeared in the mid-1980s, the PA-46 Malibu was a head turner. Aside from its ramp appeal, pilots were intrigued with its high-flying pressurized cabin, 200-knot cruise speed and its impressive range.

There was nothing quite like it and Piper soon found a loyal market for its new flagship product, mostly among well-to-do owners who could afford to sink a half-million bucks into a new single and who flew the kind of missions where the Malibu shined.

Pressurizing a single isn't easy—Mooney's Mustang was a bust. Cessna pulled it off using a proven airframe in the P210, but it had its growing pains. Piper's execution left something to be desired. Although owners generally raved—and still rave—about the Malibu's impressive capabilities, it gained a reputation as a problem airplane. The engine and systems were finicky to operate, and dispatch reliability ranged from barely acceptable to just awful for some years.

As the model evolved and became the Mirage, its reputation didn't improve. Indeed, some owners believe that with the Mirage, Piper jumped from the pan into the fire, especially with regard to engine longevity—or lack of it.

Yet, with time and the application of money, most of the problems got sorted out, and the fact remains, nothing quite does what a Malibu does. As one owner put it, "It's expensive to operate for a piston single, but cheap for what it does." We think that fairly sums up the Malibu. Anyone contemplating buying one should be ready to pay what we consider to be substantial maintenance bills, with the reward being fast cruise speeds above the weather in pressurized comfort and with reasonable payload.

The Malibu's performance puts it in the category of many twin-engine airplanes, on less fuel.

MODEL HISTORY

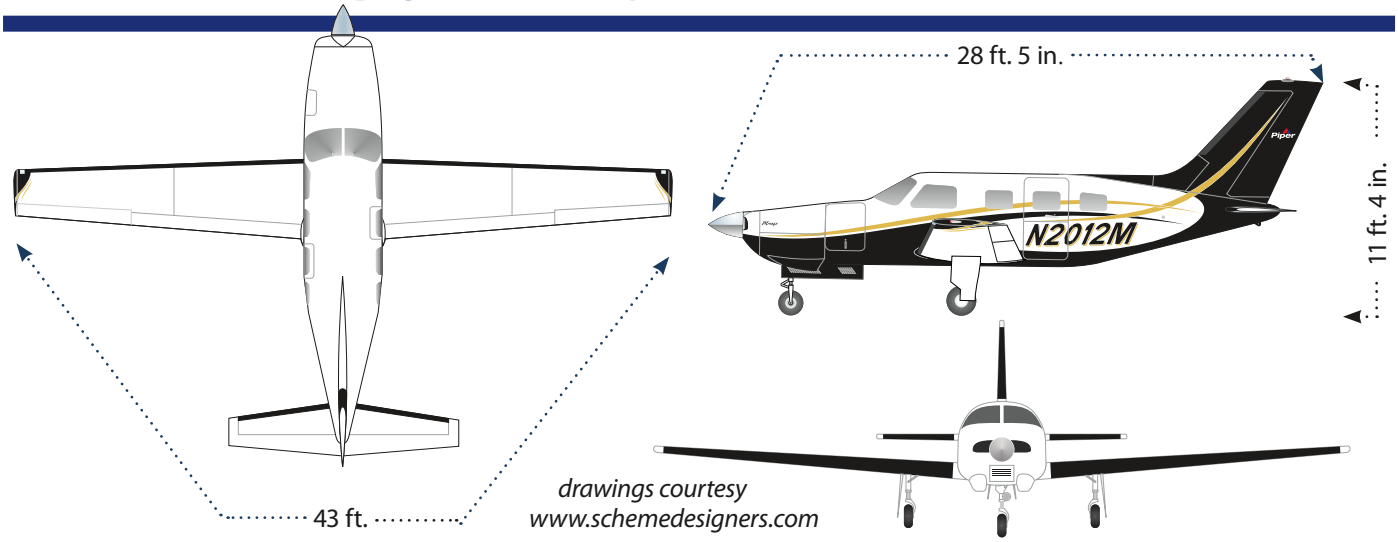
The PA-46 is the last from-the-ground-up new airframe Piper has produced, except for the PA-47 PiperJet Altaire, but that didn't make it. The turbine-powered Meridian uses the same basic airframe the Malibu pioneered but with substantial modifications. The Matrix is an unpressurized Mirage. The Malibu prototype emerged from the Vero Beach plant in late 1982, amidst much fanfare and excitement.

No one had seen anything quite like it. It had a long, rakish snoot housing a six-cylinder Continental TSIO-520BE rated at 310 HP and with two turbochargers, providing enough bleed air to keep the cabin comfortably inflated at FL250.

With its 43-foot wingspan, the Malibu looked as much like a glider as a powered aircraft. As one owner said, the thing looked like it was going 200 knots sitting on the ground. The base price was an eye-watering $275,000, but with accessories the typical invoice swelled to more than $320,000,

That's a 2001 Continental-powered PA-46-310P Malibu in the lead photo. It's retrofitted with aftermarket spoilers.

PIPER MALIBU-MIRAGE-MATRIX

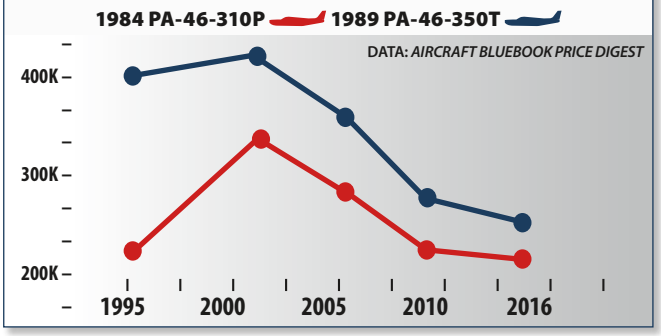


drawings courtesy
www.schemedesigners.com

PIPER MALIBU-MIRAGE SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1984 PA-46-310P MALIBU	310-HP CONTINENTAL TSIO-520-BE	2000	$55,000	120	1400 LBS	205 KTS	±$210,000
1988 PA-46-310P MALIBU	310-HP CONTINENTAL TSIO-520-BE	2000	$55,000	120	1400 LBS	205 KTS	±$250,000
1993 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1450 LBS	215 KTS	±$295,000
1996 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1400 LBS	215 KTS	±$345,000
1999 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1400 LBS	215 KTS	±$430,000
2002 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1350 LBS	215 KTS	±$480,000
2005 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1300 LBS	215 KTS	±$580,000
2011 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1300 LBS	215 KTS	±$830,000
2012-14 PA-46-350P MIRAGE	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1300 LBS	215 KTS	±$980,000
2008-10 PA-46-350T MATRIX	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1421 LBS	215 KTS	±$650,000
2009-14 PA-46-350T MATRIX	350-HP LYCOMING TIO-540-AE2A	2000	$75,000	120	1421 LBS	215 KTS	±$890,000

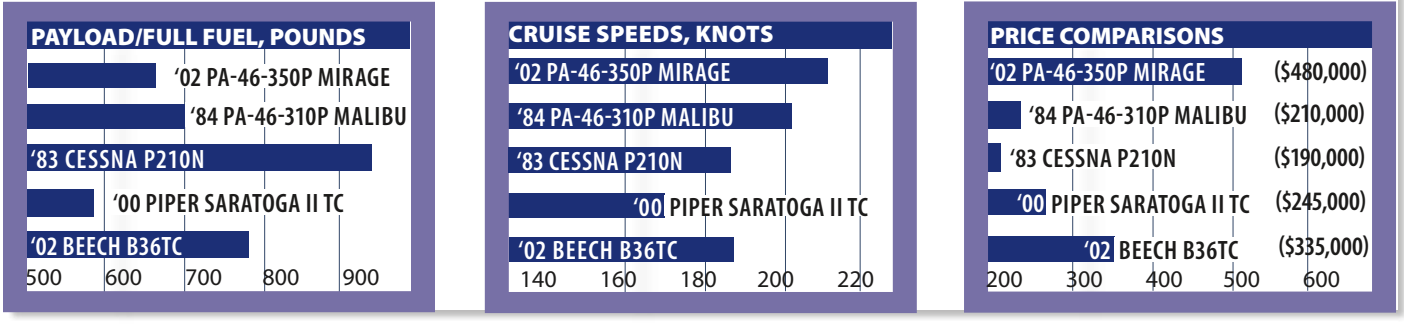
RESALE VALUES



SELECT RECENT ADs

AD 2013-13-01	INSPECT/REPLACE CERTAIN FUEL VENT VALVES
AD 2011-06-10	CLEAN, INSPECT AND CALIBRATE T.I.T. GAUGES
AD 2010-13-07	REPLACE V-BAND EXHAUST COUPLINGS
AD 2008-26-11	INSTALL STALL VANE HEATER MOD KIT
AD 2001-12-01	INSPECT/REPAIR INBOARD FLAP DRIVE BELLCRANK ASSEMBLY

SELECT MODEL COMPARISONS



Piper went with Avidyne's Entegra glass cockpit, top photo, in 2005 before eventually switching to Garmin's G1000. Most steam gauge models, middle, have lots of newer retrofitted avionics. The Matrix, bottom, is an unpressurized version of the Mirage.

or $550,000 in 2003 dollars.

Ironically, Piper launched the Malibu in 1984 into what was an overall GA slump. Yet Piper prospered with the Malibu because of its capabilities and unusual luxury. Although the company succeeded, its success was haunted by engineering decisions made early in the program.

As is often the case, the production airplane was heavier than intended, but this was offset by a boost in takeoff weight. Useful load worked out to be 80 pounds less than planned; not a deal breaker, but a weight equivalent to fuel for IFR reserves.

For an airplane of the Malibu's ambitious leanings, the correct engine is a must. Piper never seemed able to find the right powerplant, however. From the beginning, buyers favored a Lycoming because of a perceived reputation for reliability and robustness.

The would-be owners turned out to be correct, at least initially. The Continental package evolved into such a nightmare—piston pins and crankshaft bearings in particular—that in 1987, Piper asked owners to ground their airplanes voluntarily until the problems could be worked out.

Many owners maintain that the Continental was and is a superior engine for the Malibu, but in 1989 Piper introduced the Malibu Mirage with a Lycoming engine. It was essentially the same airplane with a Lycoming TIO-540-AE2A of 350 HP. The new engine weighed 113 pounds more, but the maximum takeoff weight was boosted by 200 pounds. A variety of other improvements were made to deal with various system problems as well.

MORE THAN ENGINE WOES

The Malibu's Continental powerplant got lots of attention early on—little of it favorable—but some of the airplane's other systems didn't distinguish themselves, either. The complex nosegear, which rotates 90 degrees to fit into its bay, proved delicate.

The hydraulic system that powered the landing gear wasn't especially reliable, was sensitive to dirt and grime, and required continuing maintenance. The hydraulics also ran the flaps on early models. To make the airplane appealing to what Piper thought was its core market, the company called for exceptional range well beyond the fuel specifics of most six-cylinder engines. Continental thus specified operating requirements for the engine that were unusual at the time, specifically lean-of-peak EGT operation.

To beat down the fuel flow, Continental required pilots to lean the engine to 50 degrees lean of peak for all operations below 80 percent power, which is the maximum recommended cruise setting. That went against what most pilots had been taught before the current understanding of lean-of-peak ops—and a fair number ignored the instructions and ran rich of peak.

Whoever was to blame for Malibu engine problems, squabbles between owners, Piper and TCM grew heated and ugly at times. The irony is that the fixes applied to the Continental made it as good as the Lycoming installation. Both are sensitive to proper operating technique. The lack of cowl flaps doesn't help matters.

IS THE LYCOMING BETTER?

Substituting one engine for another didn't solve all of the Malibu's problems and it brought some of its own, not the least of which is higher fuel consumption.

Owners suffered through Lycoming's massive crankshaft recall of 2002 and 2003 and weeks to months of downtime.

Want to ditch the piston? The DLX JetPROP conversion, main photo, lengthens the Malibu's snout and replaces a stock Lycoming (inset) or Continental engine with a Pratt PT-6A.

The perceived reliability of the Mirage got so bad among some owners that a class-action lawsuit was filed in 2000 against New Piper and Lycoming. The suit was settled after the court failed to certify the class.

Engine reliability has not been good, although the airplane is such a good glider that many events didn't become an NTSB report because the pilot was able to land safely on an airport. Our most recent survey of accidents showed that 17 percent were engine-related—no change since we looked at the aircraft roughly four years ago.

Maintenance is, as one owner told us, "a serious activity" for PA-46 owners, regardless of the powerplant type. Alternators, vacuum pumps and, in particular, the exhaust system are all items mentioned by our survey respondents and matched the Service Difficulty Reports reported to the FAA.

What we did see is that things have improved over the years. Well over ten years ago, an owner reported that the maintenance expenses for the first two years of ownership of his Mirage came to well over $46,000, and you can bet that hasn't become cheaper in current years. While we have received reports of squawk lists on annuals reaching 25 percent of the value of the airplane, the majority of owners say that they recognize it's expensive to maintain a pressurized single and if they stay ahead of the game, the price is not outrageous.

One reported that his annuals average $6500 for everything; another said $7000 to $10,000. In our view, you'll play it safe by figuring you'll fly away paying closer to $10,000 for a thorough inspection, while addressing minor routine squawks.

The PA-46 nosegear is tender and the hydraulic system continues to pose problems. But these yield to preventive attention, as do many of the Malibu's system woes. Even ardent supporters of the airplane admit that it requires frequent and ongoing maintenance. Owners emphasize the value of having a knowledgeable maintenance shop doing routine and ongoing work on the airplane. The Malibu is not an airplane that just any shop can fix.

More than a few owners have had experience with several Malibus and/or Mirages. Is one better than the other in terms of maintenance? Our impression is that they're about the same and that any owner contemplating buying a PA-46 should simply budget a pile of cash for annual maintenance and fix stuff as it breaks. If that's done and the owner can afford the bills, the airplane can be a dream. As our recent owner feedback shows, many Malibu and Mirage owners have held on to their aircraft for many years.

The PA-46 cabin, left, has club seating, but full-size adults can't stand up in it.

MIRAGE AND MATRIX

With the introduction of the Mirage, some of the quirky systems were addressed. The hydraulic system was improved, the engine cooling system was redesigned, the cabin door was improved, the seats were strengthened and the flaps were changed

PA-46 SERIES WRECKS: IMC ISSUES

We went through the NTSB's accident database for the most recent 100 accidents involving the PA-46 piston series—Malibu, Mirage and Matrix—and found that the early engine and nose landing gear issues with the airplane appear to have been resolved. We did, however, see what we felt to be an uncomfortably high rate of accidents in IMC involving spatial disorientation, CFIT and loss of control.

In the early years the Malibu and Matrix suffered a number of catastrophic engine failures, but the various fixes applied appear to have worked as most of the 17 engine-related accidents we found happened more than 10 years ago.

Likewise, we found seven instances of landing gear collapse, of which five involved the nose landing gear—all of which occurred more than 10 years ago. The nose gear problems, we think, were long ago identified and resolved.

We think the longago nosegear issues also caused some runway loss of control (RLOC) accidents. While 13 of the 15 landing events involved RLOC, we think that at least six were due to a nose gear issue on rollout, possibly an impending collapse, that caused the airplane to swerve off the runway.

There were only two accidents involving a PA-46 going off the end of the runway, a number we consider low for high-performance airplanes—so pilots must be getting them slowed down on final.

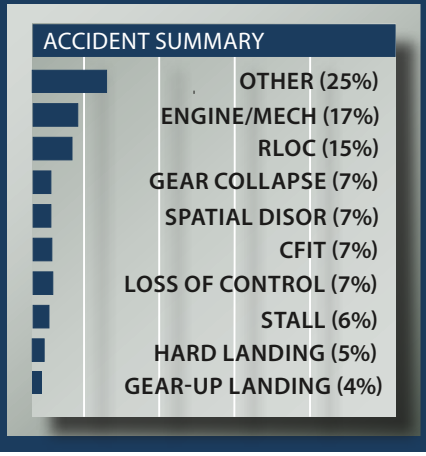
The Malibu/Mirage/Matrix series is as nearly all-weather capable as any piston single built. Not surprisingly, that meant that a certain number of pilots flew them into weather beyond the capability of the airplane or the person with sweaty hands on the control yoke. A couple pilots flew their pressurized single into thunderstorms, lost control and either experienced an in inflight breakup or bent the wings to a point just short of separation—a tribute to their strength. One pilot landed with the wings of his PA-46 bent upward nearly a foot after an encounter with clear air turbulence.

One pilot got fascinated with a failed ADI on the copilot's side of the panel while flying in clouds. He did not hear the autopilot disconnect warning as he leaned across the cockpit. At some point he realized the airplane was in a spiral dive and initiated a recovery. He lived to tell the tale, although the airplane needed a new set of wings to replace those he'd overstressed.

Seven pilots experienced spatial disorientation in IMC shortly after takeoff or on a missed approach and spiraled into the ground. Another seven flew into terrain in controlled flight either while trying to scud run, on a black night or when going the wrong way or too low on an instrument approach.

Of the six stall accidents, three involved over-gross airplanes and over-rotation on takeoff, leading to a stall.

A pilot departing from a 1300-foot runway said that he landed in the water just off the end because his engine had quit just after takeoff. The data recorded on the airplane's PFD and MFD presented another story—the airplane pitched up and stalled after takeoff; the engine was running at full power until impact. Takeoff data in the POH indicated that there was inadequate runway available for takeoff given the weight of the airplane and the flap position selected.



from hydraulic to electric operation. (Actually, some of the later Malibu models got the electric flaps and improved hydraulics for the gear.)

The Mirage also got some big-airplane type features that owners appreciate, including a dual-bus electrical system, internal windshield deice, standard dual alternators and vacuum pumps and an auxiliary heater for the cabin. It needed it. It's cold back there in the flight levels, even during the summer. Again, some of these mods appeared on later Malibus.

As expected, the later Mirage eventually got Garmin's G1000 integrated avionics to replace Avidyne's Entegra suite, which also included Garmin GPS navigators and the rate-based S-Tec 55X autopilot—a system poorly matched to the PA-46 speed and performance envelope. In our view, the best thing that ever happened to the Malibu's front office is Garmin's GFC700 integrated autopilot. Aside from its advanced features, it finally gave the airplane the tight autopilot performance it deserves, especially on coupled approaches. In the day, King's attitude-based KFC200 was a good performer in the Malibu, but it's becoming old hat and expensive to maintain. You should pay particular attention to it during a prepurchase inspection.

Priced at around $750,000 and welcomed with at least some skepticism back in 2007 (us included), Piper has done reasonably well with the PA-46-350T Matrix, which is still in the Piper lineup today. The Matrix is essentially a Mirage without the complex pressurization system that might increase workload to newer pilots. Plus, removing all of the pressurization hardware from the airframe bumps the useful load up to 1421 pounds, while fuel capacity remains the same.

It's easy to see how buyers considering a new Cirrus SR22T or Cessna TTx can be swayed by a used Matrix and its luxurious six-place cabin, club seating, airstair door and its big-airplane look and feel.

You can likely pick up a 2008 Matrix for around $600,000. That's less than an optioned-out new SR22T. A used Mirage has an *Aircraft Bluebook* suggested list price of $705,000. For those willing to deal with oxygen nose hoses, rather than cabin pres-

The nose landing gear has been an ongoing trouble spot for the PA-46 series. The one in the photo above has suffered a certain indignity.

surization, the savings in maintenance costs, operational simplicity and perhaps lower insurance premiums gives the Matrix appeal.

The current version of the Mirage is the Piper M-350, which has an updated version of the Garmin G1000 to include an automatic emergency descent mode to help rescue pilots and crew if overcome by cabin pressurization failures and hypoxia.

CABIN, COCKPIT

The PA-46's claim to fame is that it's a six-place airplane with cabin-class comfort. Well, yes. Starting up front, however, the cockpit isn't exactly cavernous. Getting into the seats requires minor contortions through a narrow aisle between bulkheads walling off the rear cabin.

Pilots who are wide of girth and long of leg will be cramped up front; the seats don't slide back as far as they do in a Mooney or a Cessna. The cockpit is well-designed in both models with well-placed gauges and plenty of room for all the avionics you could ever want. Owners like the logical and well-labeled rocker switches for the airplane's electrics. Later models have overhead switches that are a challenge for the presbyopic set and concern us from a crashworthiness standpoint.

The cabin arrangement is superb, with the Mirage somewhat better than the original Malibu. The airstair door is a plus, making for relatively easy entry and egress. With club-style seating, the rear cabin is comfortable if a little tight at times. Rear-seat passengers complain about too little heat—fixed with the aux heater—but the air conditioning/pressurization system is quite good, when it isn't broken. Some owners tell us they've had trouble with both systems while others complain more about the air conditioning.

Cabin and cockpit noise are on the low side as GA airplanes go. The Continental in the Malibu is noticeably less vibey than the Lycoming in the Mirage, according to the ones we have flown.

Like most airplanes, the Malibu is not a fill-the-seats-and-tanks six-seater. But it will comfortably carry four people and baggage with full tanks, yielding a nonstop range of about 1400 miles for the Malibu and 1000 to 1200 miles for the Mirage. Typical useful loads are 1400 pounds and 1300 pounds, respectively.

Baggage space is generous, with two baggage bays, one just aft of the engine compartment and the other behind the rear seats, making loading within limits easier. Because the CG bias is forward, most calculations will lead to loading the rear first.

The Mirage's Lycoming engine is larger and the accessory layout is

different, so the forward baggage bay in the Mirage is a bit smaller than that of the Malibu. The inclusion of an access panel in the firewall is a good tradeoff, since it makes it much easier to get at the backside of the powerplant.

PERFORMANCE, HANDLING

Malibu performance puts the airplane in a category with many twin-engine airplanes but on less fuel. Malibu pilots report cruise speeds of 205 knots TAS at FL220 at 67 percent power and 210 knots true at FL250 at 75 percent. Mirage pilots pay more at the gas pumps but in exchange, they go a little faster, with speeds typically of 220 knots at FL230-250 at 75 percent power burning 18.8 GPH.

Owners of both models say they can fly 1100-NM trips with IFR reserves. But we have our doubts about the fuel-guzzling Mirage matching range with the Malibu in real-world conditions. The power setting and leaning would have to be right. The -310P, with its lower fuel consumption—as much as 4 to 5 GPH when flown by the book—has nearly 25 percent better range and is only about 5 percent slower. One owner cited this as the reason he chose the Malibu over the Mirage.

On trips of any length, most owners climb rapidly into at least the high teens, but the airplane is perfectly at home up to FL250. One place it's not at home is taking off from short runways. Initial acceleration is sluggish, although the airplane will get in and out of 3000-foot strips at sea level with relative ease. We would pause at operating out of 2500 feet or less.

How about handling? "A delight to fly, high or low," says one owner. The handling characteristics of the PA-46 are indeed excellent, although they lack the rocklike stability that many instrument pilots prefer.

We're not talking Bonanza handling here but the controls are responsive, with pitch the lightest and roll the heaviest. The PA-46's long, high-aspect-ratio wing is good for climb and high-altitude performance, but along with it comes a low maneuvering speed in the mid-130s KIAS at gross, decreasing as the airplane gets lighter.

The long wings produce another undesirable trait: The roll rate at slow speeds is somewhat ponderous compared to other singles. Sharp stick-and-rudder work in crosswinds is a must.

During descents, it's easy to get above maneuvering speed or even redline if you're not paying attention. This, along with the autopilot and weather factors, was implicated in a string of inflight breakups that led to a great deal of consternation (and an AD-mandated restriction on operations) in 1991. But no positive link was confirmed and the airplane was given a clean bill of health.

Speed control is a must. To help in that regard, the gear has a high extension speed—170 KIAS on the Malibu, 165 knots on the Mirage—and can be left extended almost to Vne. The first notch of flaps can be extended at the same time as the gear. Pilots report that the gear makes an effective speedbrake. Retraction speed is much lower, at 130 knots (Malibu) and 126 knots (Mirage) KIAS.

Many PA-46 incidents occur during landing. There isn't anything particularly difficult about landing a PA-46, but the long wing encourages floating and when lightly loaded, the CG is forward. These two characteristics sometimes lead to abuse of the relatively delicate nosegear.

As owners report, the PA-46 is well-supported by one of the best owner groups in general aviation, the Malibu/Mirage Owners and Pilots Association found at www.mmopa.com. The group has excellent information on ownership issues. MMOPA also tracks mods for the PA-46, which include three- and four-blade props, IO-550 conversions, long-range tanks, interior mods, plus the JetPROP DLX turboprop conversion held by Rocket Engineering.

Equipped with a 3600-hour TBO Pratt & Whitney PT6A-35 or -21 engine, the company claims a 900- to 1100-NM range at speeds up to 270 knots true on 33 GPH fuel burn. With a Hartzell or MT four-blade reversing propeller, landing distance is reduced to nearly 1000 feet. We've seen nearly 3000 FPM climb rates on DLX conversions we've flown. The company also does avionics upgrades to older models.

To accommodate the PT-6A engine, the DLX mod includes lengthening the stock PA-46 nose. The resulting forward baggage area is an impressive 33 cubic feet. Contact www.jetprop.com, 509-535-6445. The company is based in Spokane, Washington.

OWNER COMMENTS

In 1986, I made a decision in which I am still reaping the rewards: I downsized from a Cessna 414A twin to a Piper Malibu single. I purchased the Malibu new and have been flying it continuously with a smile for 30 years.

I have an ATP rating and have logged 9000 hours of flight time. The reward of my downsize includes dispatch reliability just below 99 percent. I have flown my Malibu over 3800 hours (mostly for business) and about 70 percent IFR, year-round.

Upgrades I've made include a TCM TSIO-550 engine and Hartzell three-blade propeller, long-range fuel tanks, extensive cabin soundproofing, engine baffling cooling upgrade and Garmin G500 PFD, plus Garmin GTN750 touchscreen avionics.

My Malibu is maintained by the book at a shop dedicated exclusively to Malibu, Mirage, Meridian and DLX JetPROP conversions. Other than oil changes, it generally does not require additional maintenance between annual inspections. These inspections average $10,000 to $12,000 per year, with a low of $4500 and a high of $20,000.

Other than smoke in the cabin related to a burnt resistor, I have not experienced any inflight emergencies. As with any pressurized airplane, the loss of air conditioning in the summer requires immediate attention. The pressurization system has been flawless.

About 50 percent of my flights are under 140 miles and the rest are over 750 miles. Most long flights are above 18,000 feet. Generally, at altitudes above 23,000 feet, the airplane engine is not happy and requires perfect operating etiquette. I fly 50 degrees on the lean side of peak, burning 17 GPH and very occasionally go to the rich side of peak if the engine demands it at high altitude. Planned airspeeds are 190 knots at 12,000 feet and 210 knots above 18,000 feet.

The Malibu is a pleasure to fly in any weather, but you must be comfortable with a choppy ride in tur-

bulence due to the long wings. The payback is an excellent glide rate. Although it is approved for flight into known icing, flight characteristics change significantly with ice on the structure. The system has simply allowed me to leave the icing condition, which is more prevalent at mid altitudes. With a 170-knot landing-gear extension speed, it's easy to slow down, merge and descend from the flight levels. Range in no-wind conditions is 1400 NM with reserves and three people on board.

My biggest dislike about this aircraft is that it came from the factory with a plexiglass windshield, which interferes with visibility and the heating element. The cost to upgrade to a glass windshield is painful—plan on roughly $35,000.

My advice to potential buyers is to not purchase a poorly maintained PA-46 and demand an expert inspection on any one you consider. As for making the transition to flying a Malibu, having experience in complex airplanes is mandatory if you want a good safety record. Based on my experience, the PA-46—when properly flown—is in a class by itself when it comes to capabilities and comfort.

Guillermo DelCastillo
via email

I may hold the record for the longest ownership of a PA-46, having bought mine new from the factory in 1984. I like the airplane a lot and have flown it nearly 3000 hours. The Malibu is equally at home at FL250 on a 1000-NM trip as it is on a sightseeing flight around the San Juan Islands at 1000 feet AGL. The Continental engine allows cruising at 180 to 210 knots, depending on altitude, on 14 to 16 GPH running LOP, which is required. I've found the cabin to be ideal for carrying Angel Flight passengers and their families.

As with most early production airplanes, mine has a relatively low empty weight and a very decent useful load of 1325 pounds. There's a lot of flexibility to trade off between fuel and passengers, especially with the low fuel consumption and 120-gallon capacity.

Maintenance is a serious activity—I figure $7000 to $10,000 for an annual inspection—and only use shops that really know the airplane and maintain a lot of them. Insurance runs $6000 per year for $300,000 in hull value and $2 million liability coverage.

Bill Ayer
via email

After owning a Cessna 182T and T206, I purchased a 2010 Mirage. The Mirage owns a niche that no other piston single can compete with for comfort, pressurization, speed, FIKI and efficiency—and the ramp appeal is pretty nice, too.

I found no surprises while transitioning to the Mirage. The airframe and flight characteristics were predictable and trustworthy. It sure is nice to fly above the weather.

Being a fairly low-time pilot at 550 hours when I purchased the Mirage, I found the initial training and support from MMOPA to be invaluable. As a pilot and owner, I rely on the association for top-notch tech support, safety training, events and resources.

Chuck Basil
via email

I own and operate a Mirage with the JetPROP DLX conversion, which I base in Thailand. I was told this plane is the best bang for the buck in its class, and I have not been disappointed during multiple years of ownership. Dispatch reliability is excellent—I average 250 hours per year.

I operate out of an 800-meter by 10-meter asphalt runway. How many other aircraft have a performance envelope that allows takeoffs and landings in that distance, on very hot and humid days, and then a climb to FL270 and a cruise of 260 knots burning 30 GPH?

The basic Malibu design has stood the test of time very well. Most ADs and Service Bulletins are historical, with very few recent issues. The support from the MMOPA is second to none. I spent an extensive amount of effort and time in the forums before I decided to buy. It was well worth the cost of membership.

Eduardo Loigorri
via email

continued on page 32

The Aviation Consumer

INSURANCE

(continued from page 10)

MAPA, COPA, BPPP, CART and CPA. And if you are flying a turboprop or a jet, an annual training event will be a must. Consider other types of training—like upset training—that aim squarely at the greatest single cause of fatal accidents.

START SHOPPING

In general, our advice for pilots during this extended soft aviation insurance market is to make sure that your broker shops aggressively, but to change companies with care. At the end of this tunnel, insurance for your airplane will cost more and there will be fewer companies offering it.

The limits of liability that you carry now may not be available from all the companies that offer it now when the market turns, as it inevitably will. If someone is providing them to you now, it will be much more difficult for them to reduce them if you have been a long-term customer.

For pilots who are considering a transition up to a larger, faster airplane, there probably has never been a better time than now. Insurers are providing coverage for transitioning pilots under terms that many in the market have never witnessed before. Interest rates are low, and the price of many larger piston and turbine airplanes has never been lower. Even fuel prices are low, for a change. For the rest of us, let's enjoy the insurance savings while they last.

Contributor Jonathon Doolittle is the principal of Sutton James Aviation Insurance in Hartford, Connecticut.

PIPER MALIBU

(continued from page 31)

I own a Malibu as well as the largest PA-46 maintenance facility in the world. Occasionally a pilot will purchase a PA-46 thinking it is just a little more expensive to operate than his/her previous aircraft, only to find out that some of the systems installed on the plane are quite costly to maintain.

For some of the early aircraft, it is not uncommon for an annual inspection discrepancy list to exceed 25 percent of the value of the airplane. On the flip side, there is no other aircraft that can do what the PA-46 does as efficiently and inexpensively.

It is important to get a prebuy from a competent shop. I've generated a discrepancy list of $180,000 on an airplane only three hours out of an annual at a Piper dealer. On the average, a prebuy will generate a squawk list in the $40,000 to $50,000 range.

Chad Menne, Malibu Aerospace
Blaine, Minnesota

I have owned a 1990 Mirage for several years. After six months of ownership, I replaced the engine with a 460-hours-since-new surplus engine from Rocket Engineering (from a PA-46 that was converted to turboprop) and a three-blade prop conversion. The airplane will now do an ILS missed approach at Chihauhau, Mexico, without any circling or other gymnastics.

The airplane has been amazingly trouble-free, even when compared to a Cherokee. It is a pity Jack Riley is no longer with us; the airplane could do with a STOL conversion—our sea-level minimum runway limit is 3000 feet of pavement.

Jack Wybenga
via email

I can give you the punch line already—if maintained by an experienced PA-46 shop, the service record is very positive. The learning curve for the inexperienced is pretty steep because there are more systems than usual in a piston-powered airplane and the common systems are frequently set up differently.

John Foster
via email

FEEDBACK WANTED

CIRRUS SR22

For the August 2016 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Cirrus SR22. We want to know what it's like to own these aircraft, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Cirrus to appear in the magazine, send us any photographs **(full-size, high-resolution please)** you'd like to share to the email below. We welcome information on mods, support organizations or any other comments. Send correspondence on the Cirrus SR22 by June 1, 2016, to:

Aviation Consumer
Email at:
ConsumerEditor@hotmail.com