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The Aviation Consumer®

Piper Archer DX

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The Aviation Consumer

EDITOR
Larry Anglisano

SENIOR EDITOR
Rick Durden

EDITORIAL DIRECTOR
Paul Bertorelli

CONTRIBUTORS
Craig Barnett
Douglas Fields

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

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CUSTOMER SERVICE MATTERS

A recent call to Garmin's technical support center for help with my Edge cycling computer got me thinking about the overall quality of customer service in our industry, how it defines a company and what consumers should reasonably expect when buying a service or product. Here at the magazine, we define customer service on the shop level as a company doing what it said it would on the schedule it promised, meeting its price estimate and promptly returning calls and queries. That's why it was no surprise the shops that scored well in our recent paint shop survey consistently excelled at customer service. Comments like "easy to work with, regularly sent photos and reported on progress, and brought the project in on time and on budget," define a shop that has it going on. You can read about the results of the survey and tips for selecting a paint shop starting on page 8 of this issue.

Dealing with a failed product is frustrating, but palatable if the company steps up and tries hard to resolve the issue on the first try. One company that's vowed to improve its customer service is SiriusXM and in my estimation, its longevity in the aviation market could depend on it.

Our report on SiriusXM's new weather packages in the May 2014 issue of *Aviation Consumer* apparently struck a nerve with some existing XM Weather subscribers. To recap, SiriusXM Aviation is the name of the new broadcast weather service that packages WSI weather products at a reduced monthly cost, in addition to lower receiver activation fees. The rub is you'll need to buy Garmin's new GXM42 receiver to play the new weather on Garmin's aera796 portable GPS because existing first-gen receivers won't work with the new data stream. That's not sitting well with customers that are stuck with old subscriptions and higher monthly fees.

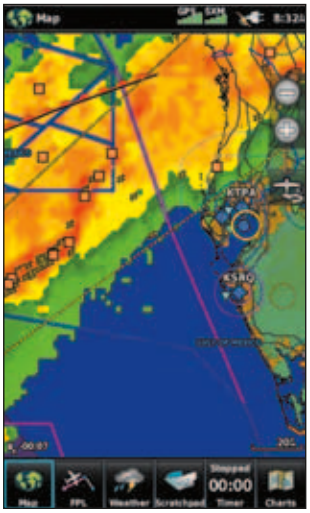
As enticing as the new pricing structure may be for new subscribers (you get more weather products as standard in a lower cost subscription bundle) SiriusXM faces strong competition from the FAA's free FIS-B ADS-B weather service. Moreover, the company knows it has to step up the performance of its customer service and support efforts.

Rewind to last year when my friend called looking for advice on how to get his XM Weather receiver working. He was sitting in the cockpit of his twin, ready to launch on a sizable trip in the clag when he noticed that the XM data was missing from his Avidyne display. I figured that a signal refresh request made on the SiriusXM web page would bring the data back online. Since he hadn't flown the airplane in over a month, it wouldn't be unusual for the receiver to time out and need a refresh. The signal refresh didn't solve the problem and my friend ultimately flew his trip without the XM data he paid for. I'll spare you the details of why the company shut off his receiver after a mix-up in billing that tagged his aviation receiver to a deactivated entertainment receiver that was in a vehicle he traded in. More important was the customer service representative's lack of understanding about aviation receivers and how pilots rely on them for almost every flight. To help ensure these kinds of issues don't happen again, SiriusXM Aviation set up a customer support center that's dedicated to aviation accounts. You can reach them at 855-796-9847. If you call this support center, let me know about your experience.

As for my experience with Garmin's support—which was obviously outsourced abroad—it was superb. The representative was cordial, patient, understood the product, understood my problem and got my cycling computer back in the game in short order. The experience was a textbook example of a company that knows that customer service really matters. —*Larry Anglisano*

ARE THEY SIRIUS?

I read the Garmin GXM42 satellite receiver and new weather subscription article in your May 2014 issue. Are these guys Sirius? Even with a $300 rebate, does SiriusXM really think many customers are going to pay roughly the cost of an ADS-B receiver only to pay another $385 to $1200 per year to get the weather data? Further, I don't think the data—which doesn't have traffic—is more useful than the free FIS-B ADS-B weather products.



Competing with free ADS-B doesn't sound like much of a business plan, no matter the advantages. I'd be reluctant to buy the hardware simply because I'd be worried about it being orphaned.

My suggestion to SiriusXM is to follow the model of the cellphone carriers—give away the hardware—and require a two-year contract. That would attract those who want cockpit weather, but aren't ready to pay the up-front cost of getting ADS-B. It would also provide some assurance that you haven't just purchased what will be another high-tech paperweight in a few months. I still wouldn't cough up $2100 for a two-year Sirius Aviation subscription.

Art Friedman
via email

In his SiriusXM weather article in last month's issue, Larry Anglisano notes that SiriusXM has two sets of satellites to work with. Does that mean the company plans to make the old Baron Services weather and the new WSI-delivered weather available? In other words, accommodate dual-receiver technology that can receive both transmissions.

Seth Argoni
via email

Good point, Seth, but there's no indication that SiriusXM plans to accommodate dual receivers. While this could allow users to take advantage of both weather providers, it's also clear that WSI is going to be the primary and only provider to SiriusXM moving forward. There could be hope for owners of older receivers. According to Garmin, it's working on making the new weather compatible with existing XM hardware.

BROKEN PLASTIC

The May 2014 issue had an article on replacement plastic, but there are other alternatives. I have an old Cessna 150 and much of its old Royalite plastic is shot and will need to be thrown away. However, I do have some pieces that could still be used if a few of the cracks could be repaired. I used Plast-Aid (www.plast-aid.com) on two cracks on a horizontal stabilizer wing tip. It worked like a charm and is very easy to work with.

Andrew H. Bittinger
via email

In your plastic replacement article, the metal panel sidebar suggested that replacing the plastic on the instrument panel with metal is a major modification that requires FAA approval. Since when is replacing cosmetic trim considered a major modification?

Richard McKinney
via email

It could be a major modification if you remove and replace structural metal, Richard. It's up to the shop to make that determination and whether they can or will sign it off without FAA approval. That's why we suggested using a panel kit that has STC approval.

DAKOTA POWER

I just finished reading the May 2014 *Aviation Consumer* and enjoyed the usual high level of content. However, whoever wrote the piece about the PA28-235 needs to brush up on his Lycoming knowledge, although you are long away from being the first to confuse these engines. The only thing the Lycoming O-540 in the PA28-235 and the TIO-540 in the Piper Navajo have in common is the manufacturer and the grey paint.

Lycoming builds no less than three unique O/IO-540 direct-drive engines (four, if you count the TIO-541 Duke engine.) These engines share little to no parts commonality. The highest normally aspirated rated power for the Lycoming parallel-valve engine family like the PA28-235 engine was 260 HP. Lycoming produced a TIO-540 parallel valve engine for the Mooney TLS, but that one suffered valve problems until Lycoming came up with cylinders with oil-cooled valve guides. Keep up the good work.

Terry Brokaw, A&P, I.A.
Three Rivers, Michigan

You're correct, Terry. We blew it on the engine comparison. What we should have said is that the engine is a derated version of the one Piper used in the Comanche, not the Navajo.

The TIO-540-J3A5D is at the lower horsepower range of an engine family that includes the 350-HP TIO-540-J2BD. They're related by dint of the same displacement and six cylinders.

CONTACT US

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

Subscription Department
P.O. Box 8535
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FLIGHT DEMO

Piper's New Diesel: Economy, Princely Price

The Archer DX delivers good performance and economy and makes sense as a trainer where avgas is unavailable. It needs a higher TBR for the U.S. market.

by Paul Bertorelli

When Continental Motors announced last summer that it had bought the assets of Thielert Aircraft Engines, it promised to move aggressively to expand the aerodiesel market. In April, it made the first delivery on that claim when Piper announced the Archer DX, its first diesel-powered aircraft and perhaps the first U.S.-manufactured model to make it through the cert hoops to market.

Piper unveiled the Archer DX at the Aero show in Friedrichshafen, Germany, for good reason. Given the DX's high purchase price—call it $400,000—and persistent high engine replacement costs, the DX's economics appear realistic only in parts of the world where avgas is either substantially more expensive than it is in the U.S. or not available at all. That would be Europe, Asia and eventually Africa, as the emerging economies there learn to fly.

The DX represents both Continental's first OEM deal for the Centurion and also the first new aircraft to have the Centurion 2.0s diesel, a 155-HP variant of the basic 135-HP powerplant that the former Thielert Aircraft Engines put on the map, along with Diamond and a handful of modifiers in Europe. The engine has been available for at least seven years, but thanks to Thielert's long bankruptcy snooze, it never found much market presence.

CHECKLIST

- ✚ Although delivering less power than the Lycoming, the Centurion is smooth and quiet.
- ✚ Fuel consumption is at least a third lower than the gasoline version.
- ✖ Short TBR (1200 hours) and required gearbox inspections are still weak points.

WORLD AIRPLANE

At Aero in April, Piper CEO Simon Caldecott was forthright about the DX's place in the market. He doesn't see it as a North American solution, nor does he see it cannibalizing sales of the Lycoming-powered Archer which, in 2013, were soaring to the highest numbers Piper has seen in years. (The company sold 48 Archer IIIs in 2013, making it Piper's best-selling model, even ahead of the popular Mirage and Meredian.)

"Piper has taken the strategic ap-

The DX's dimensions are identical to the Lycoming Archer, but it sports a lower cowl opening, top photo, that the gasoline version doesn't have.

Garmin's G1000 is standard equipment for the DX. For back-up, it has an Aspen Evolution. Engine control switches, center photo, are on the overhead while a single lever, lower, controls power.

proach to our products in trying to capture new markets where we really haven't been selling enough training aircraft. For us, one of the challenges has been the avgas issue and it's a global issue," Caldecott says.

As Aero was closing in mid-April, the DX demonstrator was scheduled to complete a Europe-wide tour before returning to the U.S. sometime later in the summer, probably for a showing at AirVenture. "We'll be showing it in North America. We believe there will be some interest there, but that's not the ultimate solution for the U.S.," Caldecott says.

Piper claims—and our economic analysis confirms—the DX's numbers appear to work with avgas prices above $8 and at least a $4 difference between avgas and Jet-A prices. Avgas in Europe typically costs between $9 and $12 while Jet-A hovers around $7. Still, the DX will appeal more to flightschools than to individual owners, even in Europe.

"Flightschools, where they're flying maybe 1000 hours a year, will get a very quick return on their investment," Caldecott says.

Piper's pitch to schools will be lower acquisition cost and considerably lower operating costs. Caldecott says Piper kept the DX's price below $400,000, if only by $500 at $399,495, to make it more appealing against its competition, chiefly the Cessna 172 and the Diamond DA40.

Cessna's 2014 list price for an autopilot-equipped Cessna with synthetic vision is about $418,000. The DA40 gasoline version price is $469,000, while the Austro-engine diesel version sells for $489,000, variable with exchange rate.

Purchase price aside, in its marketing materials, Piper claims 38 percent lower fuel burn than the Lycoming Archer and 31 percent lower operating costs. Although these numbers are a little rubbery depending on assumptions about power settings, our analysis supports the basic directionality.

AIRPLANE, ENGINE

The aircraft we flew with Piper's Dave Athay was a converted Archer LX, having been delivered to Continental's developmental center in Altenburg, Germany, for the refit. Altenburg is a former East German military airfield where Thielert did all of its test work beginning around 2002, including STC development for converting Cessna 172s, Piper Warriors and the French Robin to diesel engines. Thielert recognized that breaking into the OEM market with an untried, automotive-based engine would be difficult, so it developed the STCs early on.

The DX is a direct derivative of that work; it's not a new type certificate, but an STC engine conversion. Piper is using the Centurion 2.0s, which was a developmental offshoot of the 1.7 and 2.0 Centurions. All of the Centurions are based on the Mercedes OM640, a four-cylinder turbocharged diesel used in A-class sedans popular elsewhere in the world, but not sold in the U.S.

While the original Centurion has 135 HP, the 2.0s, simply by dint of ECU changes, delivers 155 HP through a three-blade MT wood/composite prop. Like the earlier engine variants, it has common rail,

The DX uses Continental's 155-HP Centurion 2.0s, left. Although it has only a 1200-hour TBR, the gearbox replacement interval, lower photo, has been raised to 600 hours.

electronically controlled fuel injection, water cooling and a gear reduction box to reduce the engine's best torque RPM to prop RPM. The 2.0s has Continental's improved gearbox, which requires replacement at 600 rather than 300 hours. Still, the entire gearbox replacement package costs about $7000, depending on exchange rates. The engine itself has a TBR—time between replacement—of 1200 hours, which Continental knows it has to increase. TBR replacement cost is $48,300.

Recall that in 2007, Cessna announced plans to use the 2.0s in a diesel Skyhawk, but it canned the project upon wind of Thielert's pending bankruptcy, but it too had concerns about the short TBR. Despite the improved performance of the 2.0s, the weight remains the same at 294 pounds complete (134 kg), about 33 pounds heavier than the type-sheet spec given for the Lycoming O-360-A4M it replaces. However, when all the installation details are added up, the Centurion is 80 pounds heavier than the Lyc version.

Some of that is gained back in fuel load; the DX is limited to 43 gallons compared to 48 for the gasoline Archer—same weights there given that Jet A is heavier than avgas. But because of its better fuel economy, the DX can—and probably will—tanker less fuel on a typical training mission. That said, the DX will never be a practical four-place aircraft, which may suit some flightschools just fine, since training flights tend to be limited to two or three occupants.

The DX demo we flew was fat, at an empty weight of 1884 pounds (856 kg) for a useful load of only 439 pounds (199 kg). That's far short of the 870-pound (395 kg) claimed useful load for the gasoline version. In its marketing boilerplate, Piper gives the DX's empty weight as 1764 pounds (802 kg) for a useful load of 794 pounds (360 kg). Why the difference? Athay said the DX demo was converted from a standard LX, the Archer luxury model, and had a heavier interior, including air conditioning. But we wouldn't be surprised if Piper put the DX on a diet before it begins delivering early next year.

G1000, SYSTEMS

Until very recently, only Diamond aircraft had the hooks to mate a Centurion diesel to a G1000. Other conversions use the Thielert-developed digital engine health indicator which, although adequate, looks dated in a modern cockpit. The G1000, or at least a large screen display, is a plus because there's a lot you might want to track when running a diesel, including coolant, gearbox and fuel temperatures, coolant level, ECU status and power output. The G1000 makes it simple, at least for engine management.

Less simple, perhaps, is the DX's POH, which is an add-on supplement to the standard POH. Its organization and design differs substantially from Piper's standard and takes some plodding to sort through.

Systems wise, the airplane is different, but thanks to its single-lever operation, it's also simpler to fly. Push forward to go fast, pull back to slow down. You can idle the engine for a descent. Obviously, there are no mags or primers, but there is an alternate air door, a clean swap for the Lycoming's carb heat.

The fuel system is revised to accommodate the Centurion's common rail system, which returns fuel to the tanks, heating it in the process. This is tracked and displayed on the G1000 through sensors. Also, there's a low fuel-tank temp limit for starting (-22 degrees F for Jet A; at least 32 degrees F for diesel). Just upstream of the fuel filter, there's a thermostatically controlled fuel pre-heater.

The engine has a single 28-volt alternator but the engine, at least, can also be wired for 14-volt, according to the POH. To keep the FADEC alive in

the event of electrical failure, there's a backup battery for the A-channel FADEC. (The engine is equipped with dual-channel ECU architecture.) The supplement says the backup will run the engine for at least 30 minutes.

While on the subject of the FADECs and engine controls, the DX's Centurion is virtually identical in operation to the Diamond versions, although Piper does the switches a little differently. Rather than an engine master switch and conventional key starter, the DX uses simply a rocker push switch on the overhead, similar to Piper's twins. New production gasoline models share this design.

FLYING IT

No surprise that the DX flies…just like an Archer, although both at idle and in flight, the engine is noticeably smoother than the Lycoming, with a faint whiff of kerosene at start-up.

According to the DX's draft POH and what performance observations we could gather, the DX requires a bit more runway for takeoff—918 feet (280 m) against about 800 feet (244 m) for the Lycoming-powered version. That's at gross weight, sea level on a standard day with flaps 25, which the DX POH recommends. The diesel climbs a little slower; the POH says 737 feet initial, compared to 775 for the gasoline version.

But climb rates can be misleading because the diesel Archer, thanks to its turbocharging, catches up at higher altitudes. In time/fuel/distance to climb, the two are close. The DX gets to 8000 feet in 11.2 minutes and flies 16.3 miles on 1.8 gallons. The gasoline Archer gets there half a minute sooner at about the same downrange distance, but requires 2.2 gallons.

Cruise comparisons aren't straightforward, either. Using equivalent horsepower, the best metric is speed vs. fuel burn. Seventy percent power in the DX is 108 HP. But for the gasoline version, which has 180 HP, 108 HP is 60 percent power. If the two are matched up at those settings, the DX cruises at 112 knots on 5.8 GPH while the Lycoming version delivers 114 knots on about 8.4 GPH.

The higher you go, the more advantage the DX has, mainly in speed, if not fuel burn. The Lycoming necessarily burns less the higher it goes because it's making less power. In the DX, the G1000 reported 126 knots TAS at about 80 percent power at 6000 feet, which was as high as we could get, due to cloud cover. Fuel burn was 6.2 GPH. The Lycoming Archer POH says it will do that speed at 85 percent power on 10.5 GPH.

CONCLUSION

Based on our demo flight generally confirming the POH claims, there's little doubt the DX delivers the economy Piper and Continental promise. And, in our view, that's a good thing, because the airplane's high price, low engine TBR and high replacement cost may prove challenging for Piper if the market is more purchase-price sensitive than operating-cost sensitive.

As noted in the sidebar above, the DX's numbers do work in Europe, where avgas is north of $10 and Jet-A is much cheaper. But would-be flightschool buyers will still have to finance capital costs that are $50,000 higher than the gasoline version and the debt load can chew into the operational cost savings.

As for North America, Piper will have a tough sell. Even at a 2400-hour TBR, DX operating costs run just a couple of dollars less per hour than a gasoline Archer. If the replacement for 100LL costs $7 or more, the diesel looks much better, but perhaps still not good enough.

It would look better still if Continental can ever figure out how to eliminate the gearbox replacement requirement, in which case the Centurion 2.0s might be a slam dunk in the Archer or other models. Or at least a nothing-but-net swish.

EUROPE, JA. NORTH AMERICA, NEIN

So let's get this straight: The DX's Centurion costs more than twice as much to manufacture as the Lycoming it replaces, it has an 800-hour shorter life cycle and requires a $7000 gearbox package every 600 hours. How can the economics possibly work?

Outside of the U.S., it works for three reasons: The engine burns a third less fuel, the fuel costs two thirds as much as avgas and in some parts of the world, avgas will never be an option.

The tables here show the details. The U.S. numbers are hardly worth considering, but we're presenting them anyway. At current average prices for Jet A and avgas in the U.S., the DX costs $13.79 an hour more to operate than the avgas version. That's just direct engine operating costs. Other costs, such as debt load, aren't baked into that number.

Bump the Centurion's TBR to 2400 hours and the diesel gains a $3 advantage. Even so, that slim margin could be eaten up by the capital costs of a higher purchase price.

Europe offers an entirely different cost universe. Even at the 1200-hour TBR and at current fuel prices, our analysis shows the DX enjoys a $23.26 per hour advantage over the Lycoming version. At a 2400-hour TBR, the difference is a whopping $40.49 advantage for the diesel.

If the gearbox replacement cycle went away, the DX's direct operating costs drops to $62.82, 45 percent lower than what it costs to feed the Lycoming.

OPERATING COSTS COMPARED

MARKET	AVGAS	JET A	1200 TBR	2000 TBR	2400 TBR
CURRENT U.S.	$5.90	$5.55	LYCOMING: $66.10	LYC: $66.10	LYC: $66.10
			CENTURION: $79.89	CENT: $68.67	CENT: $62.36
CURRENT EUROPE	$11	$7	LYC: $112	LYC: $112	LYC: $112
			CENT: $88.74	CENT: $77.97	CENT: $71.51
FUTURE U.S.	$7	$6	LYC: $76	LYC: $76	LYC: $76
			CENT: $82.64	CENT: $71.77	CENT: $65.41

NOTES: Top row TBR values refer to Continental Centurion diesel. Costs were calculated based on a 2000-hour Lycoming TBO and $26,000 overhaul cost, including mag inspections and potential cylinder work. Centurion numbers assume $48,300 engine replacement cost, plus approximately $7000 for gearbox packages at 600-hour intervals. Future U.S. avgas prices assume a $7 price for 100LL replacement.

Paint Shop Survey: Patience, Planning

Paint work requires sizable preparation. The better shops are the ones that get it right the first time, on time and know how to communicate.

by Larry Anglisano

Imagine fetching the family airplane from a paint shop, and as you're flying it on one of its first post-paint trips, part of the tail comes off. That's precisely what happened to a Cessna Conquest after a once reputable paint shop returned the plane to service without properly reassembling it. The shop—which got decent customer reviews in previous *Aviation Consumer* paint shop surveys—has since gone bankrupt, but it's a learning experience that other shops and owners can take to the bank.

While this kind of extreme drama is rare after paint work, there are other potential pitfalls. Fortunately, a high percentage of owners—85 percent—that took our recent paint shop survey report favorable experiences. Others, on the other hand, had problems that support the importance of choosing a shop that understands customer service and can accurately predict downtime and costs.

OUR SURVEY

As we've mentioned in previous surveys, the sampling can be skewed because it might attract customers that are disgruntled with a shop for whatever reason. Conversely, it's also an opportunity for happy campers to rave about exceptional service. These are the things we want to hear about, of course, but we're more interested in patterns that point to good or bad customer service, downtime and the value for the cost of the work.

AIRCRAFT REFURBISHMENT

We polled the readership of our sister publication AVweb and pored over 200 responses. Roughly 48 percent of those polled had an aircraft painted within the last two years, 40 percent had the work completed less than a year ago and the rest had paint work accomplished five or more years ago. We found that 72 percent of these paint jobs were on single-engine piston airplanes, 15 percent were on multi-engine pistons, 7 percent were multi-engine turbines, 3 percent were single-engine turbines and the rest fell into the ambiguous "other" category, likely helicopters and gliders.

Respondents rated the shop (on a scale of one to 10) for the quality of the paint job, in addition to cost/value relationship. In other words, did the quality live up to the price?

The chart on page 11 is a list of shops that received three or more standout reviews and no negative comments. The chart doesn't mean there aren't other shops, particularly smaller ones, that provide top-rate paint work, it's simply a list of the shops that stood out in the survey for consistently making customers happy. Face it, popular shops attract and keep more customers for a reason. Incidentally, many of the shops that made the list for this recent survey also scored well in previous surveys. Some, on the other hand, have slipped in quality and have gone out of business.

CONSIDERATIONS

Think past the paint job. Is the shop one that you can communicate with? In an age where communicating couldn't be easier, we're amazed that some shops drop the communication ball. Just because a shop delivers a

The complexity of the paint scheme is generally proportional to the price of the paint job. The twin Cessna in the main photo has a custom scheme designed by Scheme Designers.

high-quality paint job at a good price doesn't always make for a happy customer. "The paint job was supposed to take six to eight weeks. It took nearly five months. Phone calls were frequently unreturned and no progress pictures were supplied. Excuses were later provided that might have justified adding two weeks to the job, but not months," said Rick Steck after Central Aviation in Watertown, Wisconsin, painted his piston single. Still, he gave Central a 10 for the high-quality paint job and a nine for cost/value, proving that downtime and shop communication means a lot when choosing a shop. Every other Central customer that participated in the survey had positive comments (and there were at least a half-dozen.) We still included Central as a top shop.

"I was extremely satisfied with the work, the customer service and the follow-through on timing and execution. Don was easy to work with, regularly sent photos and reported on progress, and brought the project in on time and on budget," said C.L. Lee after Arizona Aeropainting completed a $25,000 paint job on his twin. Arizona Aeropainting was at the top in the survey. The raves just kept coming. "No issues. As advertised, on time and perfect quality. A low-volume, high-quality paint shop with lots of attention to detail. You just cannot find better," gushed Patrick McGarry about the company's work on his single. These are the consistent positive trends we were looking for.

But if you live and base in the Northeast, does it pay (literally) to fly across the country for a paint job? We don't think so. No matter how good the shop is, paint work is more than a strip and spray. In many cases, it requires sizable disassembly and potential airframe tweaking that you might not discover until you fly the airplane a bit. Some owners, like Joe Ludwigson, don't expect to become a test pilot after retrieving the airplane from a paint shop.

"When my Mooney was delivered back to me, it was dangerously misrigged. After two attempts to re-rig the controls, I had to refer the paint shop to another shop that ultimately flew in a mechanic to rig the airplane correctly," Ludwigson reported. Other than this snag, it seems the shop (Wipaire in Minnesota) performed a nice paint job, but it was overshadowed by mechanical problems. That's why you should be cautious during the first few flights with your newly painted bird.

Rob Parish knew something wasn't right with his airplane on the first takeoff roll. "Stripping the old paint went well. Then a larger plane came in and my stripped plane sat for several weeks. When it was finally done, I found that the plane was slow on the takeoff roll. That turned out to be an incorrectly installed nosewheel," he reported about his experience with Murmer Aircraft Services.

There's also paperwork. "One issue that came up repeatedly was the necessity of recalculating a weight and balance. Does a paint job require one? Many shops differ in opinion, but I think the answer is yes," said John Pritchett. He raved about the service and the $15,000 paint work that Lancaster, Pennsylvania-based Lancaster Aero performed on his Skyhawk. Some shops we spoke with suggested that a weight-and-balance calculation isn't part of a paint shop project, but control balancing is.

You'll also want to ask yourself if tacking on other major work while the plane is being painted makes sense. If the shop has the capability and manpower, sometimes it works, but expect delays."We had our 1979 Piper Aztec painted, plus had new glass and a new interior installed. I was told to expect a 10-12-week turnaround, which turned out to be 18 weeks. But considering all the work that was done to the plane (interior replacement, new glass, de-icing boots removal and an annual inspection) I was not too upset about it," said one owner. He brought his Aztec to Hawk Aircraft Painting in Tampa, Florida, and noted good shop communication. This wasn't Hawk's only good review. We found several in the survey.

"I bought my Navion sight unseen in California, then flew her back to Florida and straight to Hawk's paint shop. This ugly duckling got a custom and beautiful paint job with lots of input from the shop's owner. The day the airplane was finished, we flew straight to Sun 'n Fun in Lakeland, Florida, where it won the best in class. What an accomplishment for a paint shop," raved Matt Boucher.

Whenever possible, we would avoid scheduling other major projects and upgrades with different shops directly after the paint work unless the other shop is flexible. Chances are the project will take longer than projected. Consider your own schedule, too. "I was also trying to coordinate the new paint with new glass and interior work and the delays from the paint job impacted the schedule at the interior shop, as well as my travel plans and need for the plane," one owner reported. Rare is the shop that does all of this coordinating for you, but it does exist. Again, Hawk was praised.

"Besides painting, Hawk Aircraft played the role as project manager to coordinate all the other related mechanical, interior and avionics work that was going on at the same time. They were invaluable at keeping the project moving and coordinating all the moving pieces," said

What does retractable landing gear, lower photo, have to do with a paint job? A lot, actually. Expect sizable amounts of airframe disassembly while the aircraft is getting sprayed.

STEP ONE: GUIDANCE BY DESIGN

by Craig Barnett

At first, repainting your aircraft may seem like a simple process. Find a paint shop, drop the plane off, come back five weeks later, pay your money and fly away in a new bird. Of course, nothing is ever that easy. There are many more steps in between the decision to paint your aircraft and picking it up after it has been beautifully repainted.

For many of our clients, working with a professional designer to create the scheme that is just right for their aircraft is the best first step in the repainting process. The process of creating a design shouldn't be too time-constrained. In fact, the longer you spend on the design process, the more attention you pay to the fine details, and the more design concepts you explore, the more satisfied you will likely be with its final outcome.

A professional designer will be able to accurately render all design elements on the aircraft, and will aid in understanding the impact of design elements on the ultimate cost of the paint job long before it is even time to talk to the paint shop. More importantly, a professional design will yield detailed dimensioned drawings and written specifications, which in essence will become the contract controlling the paint scheme outcome between the owner and the paint shop. This clear documentation provides the information for paint shops to quote on, and clear instructions will avoid any questions or missteps in the layout.

Stripes and spaces have a significant effect on the final outcome of a design. Bad guidance that makes stripes too thin or thick can have a real impact on the "wow" factor. Make stripes too thin, and you end up with a toothpick or spaghetti stripe. During layout, one's eyes naturally tend to look at the outside edges of tape defining a stripe, while the real proportion is defined by the inside edges. Spaces that are too small in a design lose distinction from a distance and cause colors to merge. Make stripes and spaces too thick and you affect the visual length of the aircraft, making it look slower and less exciting on the ground.

The majority of the cost in a paint job is the labor and overhead related to the project. The more complex a design, the longer it will take to lay out the paint scheme on the aircraft. This directly impacts the total price of the work to be completed.

From a design point of view, complex is not always better. Think long-term, because more complex designs tend to age more quickly, and when it is time to sell, tend to have less broad appeal.

Craig Barnett is the CEO of Scheme Designers, Inc. The company website, www.schemedesigners.com, offers consumer tips and sample paint designs.

reader Steven Murray. Hawk charged him $11,500 for the paint job, which included painting the amphibious floats.

RISING COSTS

Like most things, the cost of painting an aircraft is on the rise. It wasn't long ago that a high-quality paint job for a small single-engine airplane might cost around $8000. Based on our survey, $12,000 seems to be the average, although there were some really low prices—$6000 for one single—that also yielded comments like, "It's certainly not the best paint job going, but it's fine by me," said the owner. A medium to larger twin could cost $25,000 or more. You could have at least some control over the bottom line, which includes taking extra time to plan the project.

We consulted with the respected paint designer Craig Barnett from Scheme Designers (the company received all positive comments in the survey) to get a feel for potential pitfalls in design that can have a negative impact on the work. Barnett noted that aviation paints are expensive, while every additional color that's added to a paint design significantly adds to the cost of the paint job.

According to Barnett, each new color means extra time in the paint booth, plus extra materials. As a rule of thumb, each additional color that's added to a design could increase the overall price by $750. Plus, some colors are simply more expensive to source than others.

Metallic colors, though often much prettier than their solid counterparts, add additional expense. That's because metallic paint is more expensive to purchase and requires extra applications and drying time. If metallic paint is a gotta-have, Barnett advises to go with a gold or silver because they often yield the best results. Metallic paint can typically add $500, per color, to a paint job.

You'll also need to consider the cost of logistics. "Because I had to fly the plane up to Hagarstown Aircraft Services in Maryland from my base in Florida, the additional cost for round-trip fuel and transportation was several thousand dollars," said Joseph Weinberg. He paid $20,000 to have his single painted. He also dealt with reccuring corrosion problems. The shop agreed to repaint the problem areas for free, but that meant flying long-distance to do so.

When it comes to helping with logistics, some shops go the extra mile and impress—well after the paint has cured.

"Over the past four years, the paint has worn quite well despite flying through various forms of precipitation and some ice, not to mention being tied down in the New York City metro area. Dick Gunther at Dial Eastern States Aircraft Painting in Cadiz, Ohio, provides good value between the service and quality. That's what I shopped for. He made

logistics easy by driving me to and from the airport for airline flights when I traveled between New York and Ohio," said T210 owner Scott Dyer.

EXPECTATIONS

When qualifying a paint shop, there are some imperative requirements that should be met as part of the job. In our view, a quality paint job should should include the full stripping of the old surface, the removal of all corrosion, plus acid etching and alodining, in addition to undercoating for preventing future corrosion.

As noted earlier, nearly every complete paint job will likely require the removal of major airframe components, including some landing gear and control surface components. Ask the shop what will be removed. That way you can pay close attention to them during your preflight inspection when you prepare to fly the aircraft home.

You'll also want to understand what kind of paint will be used and whether it will be easy to maintain as it ages.

"Ed's Aircraft Painting located at Brookhaven Airport on Long Island, New York, painted my Bonanza with epoxy urethane paint, which is easily buffed and polished, unlike some polyurethane paint. Touch-ups are easy. I use an airbrush and simply buff the section out afterward," said Joseph Fischetti.

When owners report stories of paint falling off the aircraft after a short time, we immediately suspect something went wrong during the strip and preparation stage or during the curing process. This was the sad story of a $35,000 paint job accomplished by Tejas Aero Services in San Marcos, Texas. According the aircraft's owner, this was the worst experience he could ever imagine. After several flights, the paint is coming off and the aircraft will have to be painted again. While most shops should stand behind the work, you'll want to ask what kind of warranty is implied or stated. Many shops offer a two-year warranty.

You should be absolutely clear on how much the project is going to cost and—like any major work— that means getting everything in writing. "The plane was in the shop for five months. The initial estimate was for $10,000. After showing the manager the plane (this was a new experimental aircraft that required no stripping and little preparation work) he agreed it could be done for $6,000. When I went to pick it up, the price was unexpectedly $10,000. The paint job was well done, but customer service was wretched," said reader Ken Summers.

Be direct and ask the shop if they plan to keep you in the loop during the project. Ask them how they communicate and if they can send you photos along the way.

"I could not have been more pleased with the quality, attention to detail and the customer interface. Walt Fedorishen, the owner of Prestige Aircraft in Swanton, Vermont, e-mailed pictures and progress reports to me regularly throughout the process," said one customer, that also advised to visit several different shops, and evaluate their attention to detail. We agree.

A paint project is a good time to replace old hardware, including Dzus fasteners and cowling screws, for example. But don't assume this is included in the price of the paint job. You'll need to ask. While you're at it, ask the shop if it paints over antennas. It seems silly, but it happens.

And that's the takeaway from this article. Ask questions and visit the shop before and during the project. We don't suggest selecting a paint job based on price alone. When it comes to aircraft paint work, there's far more to it than meets the eye.

SURVEY-WINNING PAINT SHOPS

THREE OR MORE STANDOUT REVIEWS, LIMITED NEGATIVE COMMENTS

SHOP	LOCATION	CONTACT
Advanced Aircraft Refinishers	Griffin, Georgia	www.advancedaircraftrefinishers.com 770-233-4600
Arizona Aeropainting	Eloy, Arizona	www.arizonaaeropainting.com 520-466-4336
Central Aviation	Watertown, Wisconsin	www.centralaviationwisconsin.com 920-261-1880
Dial Eastern States Aircraft Painting	Cadiz, Ohio	www.desapi.com 740-942-2316
Ed's Aircraft Refinishing	Shirley, New York	www.edsaircraftrefinishing.com 631-281-8236
Hawk Aircraft Painting	Tampa, Florida	www.hawkaircraftpainting.com 813-623-5819
Highlands Aviation	Avon Park, Florida	www.highlandsaviation.com 865-452-2600
KD Aviation/REESE Aircraft	Robinsville, New Jersey	www.kdaviation.com 609-259-4200
Lancaster Aero Refinishers	Smoketown, Pennsylvania	www.lancasteraero.com 717-394-5805
Master Aircraft Services	Wickenburg, Arizona	www.masteraircraftservices.com 928-684-4926
Prestige Aircraft	Swanton, Vermont	www.paintaircraft.com 802-868-3443
Sturgis Aviation	Sturgis, Michigan	269-659-3773

Soundproofing: Affordable, Effective

When the interior's out for a refurb or avionics upgrade, less than $2000 in materials and labor should quiet the cabin measurably.

by Rick Durden

It's no news to anyone that general aviation airplane cabins are loud. After all, the engines have minimal mufflers, the thin aluminum skins vibrate like a drum, the exhaust exits ahead of the cabin, the tail cone is shaped like a loudspeaker aimed at the occupants, the windows are thin, the prop tips are moving at a high percentage of Mach and the manufacturer's sound insulation is minimal.

How noisy are they? OSHA did extensive sound intensity testing and came up with a time-weighted average of just over 86 decibels (dBA). However, it was examining the work environment of flight instructors, so nearly half of the testing was done at less than 60 percent power. Testing by Dennis Wolter of Air Mod, an aircraft refurb and renovation shop on Clermont County Airport in Batavia, Ohio, in a number of airplanes revealed an average of 92 dBA at the pilot's ear at 70 percent power.

Not only does that noise level cause hearing loss, it also increases the fatigue level of the pilot, potentially affecting his or her ability to make good decisions and fly the aircraft well.

What can be done to reduce the cabin noise level? Our survey found that the most cost-effective approach is to install sound-absorbing material on the inside of the skin of the airplane around the cabin and to the rear baggage curtain. We think that the maximum economical level of reduction is on the order of 10 dBA (that's cutting the sound intensity by half—more on that later), which is significant—headsets are still going to be necessary. We don't believe any ads that claim to bring the noise level down to that of a car.

SOUND 101

The force of sound waves is measured in decibels—and the scale used is logarithmic. For reference, while individual reaction to sound intensity varies, 70 dBA is often the basis for sound comparison—it is about the level at which most people keep the audio on a TV. Sound in the high 70s dBA is annoyingly loud to most people; 80 dBA is twice as loud as 70 and is the sound level of garbage disposals; 90 dBA is four times as loud as 70—it's the sound of a motorcycle passing 25 feet from you. Sound at 100 dBA is eight times as loud as 70 and will cause serious hearing damage in as little as eight hours of exposure; 110 dBA is 16 times as loud as 70 and is what you hear during a runup with the windows open.

CHECKLIST

- Even fiberglass, applied appropriately, can cut noise measurably.
- We like SoundEx for its combination of cost and effectiveness.
- Even with high-end soundproofing, plan on wearing headsets.

SOURCES OF NOISE

Because weight is the enemy of general aviation aircraft design, much cabin noise is the result of efforts to reduce weight. The light aluminum skin vibrates and resonates with the energy generated by each passage of a prop blade. Each power pulse from the engine, blasting out of the exhaust, further activates the aluminum. The movement of the airplane, shoving the air out of the way, generates significant noise—if you've flown a glider you know the claims of "silent flight" just aren't true.

The cabin air distribution system can be a major contributor to the noise level, especially on airplanes where the intake is within the prop arc and there are sharp turns in the path the high-speed air has to follow.

What can be done to cut the racket? A combination of three approaches: reduce the intensity of the sound at its source; reflect the sound away from the cabin and absorb the sound before it gets to the cabin.

ATTACKING THE SOURCES

Prop noise can be reduced by turning the prop slower; using the POH, select the lowest RPM for the power

Soundproofing installed as part of interior upgrade, right. Corrosion found under the floor of a Bonanza, below right.

setting you want on an airplane with a constant-speed prop. Don't worry about an "oversquare" power setting; that OWT is a myth. Many airplanes have a particular RPM at which overall vibration is lower, allowing for a lower perceived sound level. Switching to a three-blade prop reduces cabin noise because the blades are shorter so the tips are moving more slowly and generating less noise. Three-blade props usually mean smoother operation, a benefit for the pilot and airframe.

Fixing collapsed or partially blocked ductwork can reduce cabin noise. According to Dennis Wolter, the ventilation system of Cessna singles can be quieted by sticking plastic dishwashing pads such as the S.O.S Tuffy in the cabin air inlets in the wing leading edge. The plastic strands slow down the air.

Noisy Cessna can-style air vents can be replaced with Precise-Flow Air Vents offered by Sporty's for $450.

Time spent on sealing the cabin doors may prove worth the investment. To further reduce cabin door noise, we like inflatable door seals, such as Bob Fields' "Ultimate Inflatable Door Seals, (www.ultimatedoorseals.com). They're a bladder that goes around the door and inflated either by hand or electrically once the door is closed. Prices start at just under $400 for manual systems and top out at $1650 for electric inflation on all the doors on a 36 Bonanza or 58 Baron.

While we have not seen hard data on door seal noise reduction, in the Piper and Cessna twins we've flown that had them, we could clearly tell the noise level difference when we waited until cruise to inflate the seal. We have been told that a pilot generally cannot detect less than 2 dBA sound change in flight.

SOUND DAMPING

Our survey of soundproofing products and techniques lead us to the conclusion that the most cost-effective method is sound damping by installing a sound-absorbing material against the inside of the skin of the airplane, completely around the cabin. For a little more money, using a material that is specifically designed for sound absorption combined with a foil that reflects sound away from the cabin just about doubles the effectiveness.

From an economic perspective, the time to install soundproofing is when you're upgrading the interior or avionics so at least part of the cabin is going to be opened to the stringers and skin.

The first step in installing any sound damping material is to remove the interior, peel off the factory-installed material (usually a thin layer of fiberglass) and whatever adhesive was used. Every shop we interviewed told that the odds are high that there will be corrosion caused by the moisture-wicking effect of the factory soundproofing and the adhesives that were used to install it. We learned that corrosion treatment and soundproofing go hand in hand.

We agree with Air Mod's approach to soundproofing—the stringers and skins are chromated before the soundproofing material is installed.

MATERIALS

Our survey of the field led us to the conclusion that you tend to get what you pay for with soundproofing materials. You also add more weight to the airplane, something to consider.

At a basic level, plain old fiberglass does a reasonable job for a reasonable price. Air Mod's Wolters told us that he considered fiberglass to be the best bang for the buck. An inch to 1.5 inches of lofted fiberglass costs $200 for materials and requires an experienced technician about eight hours to install in a four-place single. It adds five to six pounds over the weight of factory soundproofing in a Cessna 182 or Beech Bonanza and, in tests by Air Mod, gives a four-dBA noise reduction.

Derek DeRuiter of Northwoods Aviation in Cadillac, Michigan, told us that he got similar results from ¾ of an inch (½ inch under the floor) of Super Soundproofing foam from Aircraft Spruce (www.aircraftspruce.com) on a Cessna 180. He described the noise reduction in flight as sur-

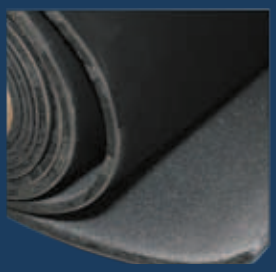
DIY Soundproofing: Realistic?

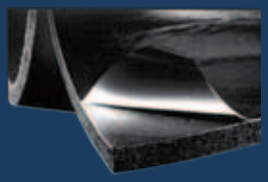
According to Gene Shackelford of SoundEx, half of his company's multilayer sound damping, deadening and reflective product are sold to end users who install it for sign off under a mechanic's supervision (it doesn't fall under approved owner-conducted aircraft maintenance).

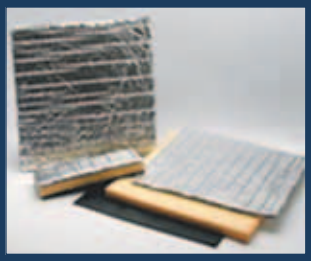
Step one is to choose a material that meets FAR Part 23.856 burn requirements so it can be installed in a production aircraft. For example, Super Soundproofing Foam Mat (and floor mat—black rolls shown below) is a closed cell vinyl-nitride foam that will not absorb moisture, sold by thickness and meets FAA burn requirements as does Sound Ex's soundproofing shown below. Both are available through Aircraft Spruce (www.aircraftspruce.com).

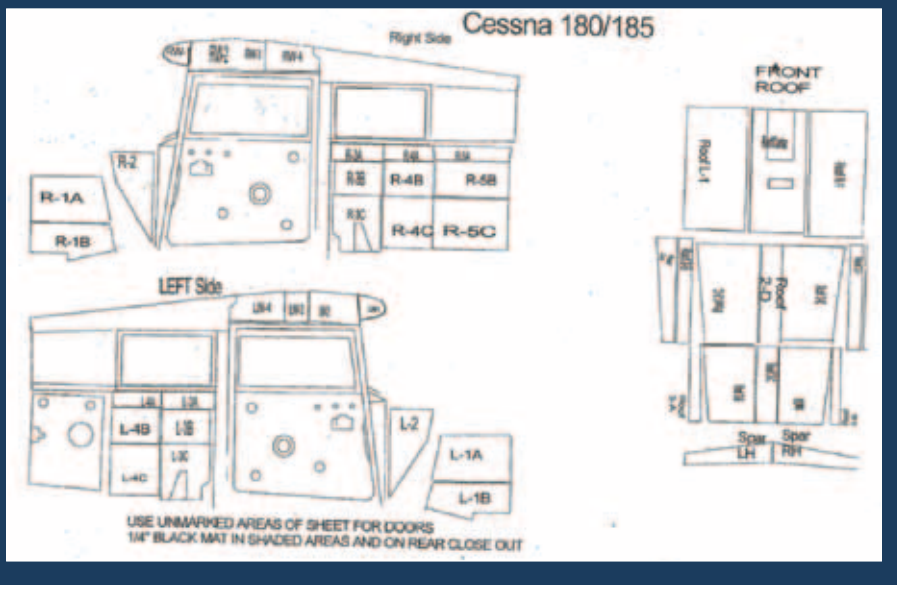
While designed for SoundEx material, PlanePatterns (www.planepatterns.com) templates (the sample below is for Cessna 180s and 185s) are available for precise cutting of most soundproofing materials. Cost is $45 per sheet—most airplanes require five to seven sheets.

Installation simply takes a little time and patience.









prisingly quieter and said there was an unexpected benefit in that the airplane was a lot warmer in winter.

The next step up in noise reduction involves using the three-layer composite material from SoundEx. It consists of a layer of sound deadener that rests against the skin, an absorbent center layer and a reflective foil on the cabin side to reflect sound back into the absorbent layer. For a four-place single, Wolters told us it costs about $800 for materials from SoundEx and a pattern kit from PlanePatterns. Installation takes eight hours of experienced labor. AirMod's measurements show a six to eight dBA noise reduction for a weight increase of 10 pounds over factory soundproofing. Keeping in mind the logarithmic decibel scale, a six- to eight-dBA reduction is significant.

We note that the SoundEx installation is "press fit," no adhesive is used and the material does not absorb water so it does not increase the corrosion risk to the airplane. Further, it can be removed and reinstalled easily during future maintenance.

The top-of-the-line sound proofing from shops such as Air Mod is generally not an owner-assist job as it involves more sophisticated engineered materials—different materials for different locations on the airframe—that are cut to size and then installed in individual bags that have been cut to size and then installed. From Air Mod, the materials kit itself is $1800, however, the cutting and bagging involved means 30 hours of labor by experienced technicians. Weight increase over factory original sound proofing is 22-24 pounds. The noise reduction, per Wolter's testing, is 10 dBA, the maximum we feel can be expected for such an installation. A 10 dBA reduction means the noise level has been halved.

WINDOWS

When it's time to replace the windshield and windows, thicker glass can mean a cabin noise reduction. In our November 2013 issue we noted that testing *Aviation Consumer* performed on a Mooney showed a 1-3.5 dBA reduction. Dennis Wolters said his testing showed that going to 3/8-inch thick acrylic windows resulted in a two-dBA noise reduction on most airplanes except Cessna singles because of the flat nature of the windshield.

CONCLUSION

SoundEx's Gene Shackelford said that most owners combine soundproofing with either an interior or avionics upgrade. That makes good sense to us. Once the cabin is opened up, the moderate additional cost of soundproofing with sophisticated material to get a six- to eight-dBA drop is worth it. We think SoundEx provides the best noise reduction for the money and we like that it is not glued to the aluminum skin.

While we don't believe any of the claims that your airplane is going to be quiet enough to fly without headsets, noise adversely affects the entire body, so in our opinion, reducing it is a worthwhile investment.

We think an owner has to go into the process with open eyes, because it may reveal hidden corrosion that will be expensive to correct, and be prepared to pay to have the area chromated to protect it going forward.

MyGoFlight SLD: Slaved App Display

MyGoFlight's Sight Line Display concept is a good solution for minimizing heads down-time, but we wish the remote display could be customized.

by Larry Anglisano

Whether you use a tablet for navigating, backing up flight instruments or fetching information on the fly, you know there are compromises. The reflective screen on the iPad doesn't do well in direct sunlight, full-size models are bulky when mounted on the control yoke and resting the device on a leg or kneeboard creates distracting heads-down time.

When tablet accessory supplier MyGoFlight showed us its Sight Line Display (SLD) solution at last year's AirVenture, we thought the concept was good, but was poorly executed. That's because the SLD prototype used cables to connect the iPad and iPhone to a remote portable display. Wires strung over the glare shield isn't an ideal situation. But now that the concept has gone wireless, we think it offers some utility, but it's up to app makers to bring the interface to a higher level.

AIRPLAY MIRRORING

Colorado-based MyGoFlight didn't pioneer the technology that enables you to mirror the data that's on your iOS device to a second screen. Instead, it capitalizes on Apple's existing mirroring technology, called AirPlay Mirroring. AirPlay started life as AirTunes and enables the wireless streaming of audio, video and metadata between devices.

MyGoFlight's SLD interface uses a Google Nexus 5 or 7 (that's a 5-inch and 7-inch screen configuration) Android tablet computer running the AirPlay app, which connects it with the controlling iPad, iPod or iPhone via Wi-Fi or Bluetooth. MyGoFlight bundles the tablet with preloaded software and has a variety of mounts for securing the display.

CHECKLIST

- Less heads-down time—especially during taxi—is a good thing.
- Not a game-changer for solving the challenges of tablet use in the cockpit
- Hanging a tablet on the glareshield could create a projectile in a crash.

VERSUS IPAD

We get the concept of a second display to minimize heads-down time, but the obvious question: Why not mount the iPad within your sight line? After all, MyGoFlight offers a variety of high-quality mounts for such (we covered them in the June 2013 issue of *Aviation Consumer*).

According to MyGoFlight CEO Charlie Schneider, the SLD concept addresses a couple of issues that users experience with cockpit iPad use.

"An iPad on a yoke requires reading a moving screen and, while not as much as a kneeboard user, still requires a head-lowering action. The SLD will allow the use of a sunlight-readable, high-definition monitor for those that find it difficult to read the iPad in certain light conditions. The SLD will also allow the pilot to split the control/operate function from viewing, which may allow for better mounting options," said Schneider.

In our trials, we mounted the Nexus 7 on the glareshield of a Cessna twin and flew some approaches in bright sun. We found that its 7-inch 1080p HD display performed better in direct sunlight than the iPad mini. MyGoFlight's swivel Sport suction

continued on page 32

When we mounted the SLD 7 on the glareshield, left, its screen wasn't as reflective as the iPad. That makes it a good choice for a slaved display.

Glass Training Aids: Saving Checkout Money

Learning the complexities of glass takes effort—we think these commercial courses can reduce expensive dual time in the airplane. Jepp is best by a whisker.

by Rick Durden

Perhaps we should just admit resistance is futile. Glass cockpits look cool and make a lot of money for airframe and avionics manufacturers, They're here to stay. But, with two-hour checkouts now becoming 10-hour events for glass newbies, what can you do to cut down on that $200-an-hour checkout dual so you can actually afford to rent and enjoy a 172 or Archer?

The good news is that there are good training courses for the G1000, Avidyne Entegra and Aspen Evolution in the form of DVDs, online courses, a book and apps. We looked at most of the commercially available courses—which ranged from good to excellent—although none will erase the need for in-airplane learning time.

The most expensive costs about 1.5 hours of dual—and we're convinced they'll save you more than that in time you don't have to spend figuring out the buttons and knobs in the airplane with an instructor. We also found an app and a book that can help keep that hard-won knowledge about the G1000 from leaking out between flights.

Because the Garmin G1000 is the most common glass panel installation and has the most training courses, we'll start with it.

ASA G1000 COURSE

Authored by Michael G. Gaffney, who also prepared ASA's Avidyne Course, this 2013 computer-based tutorial is advertised to run on both a Mac and a PC. We could not make it run on a Mac due to software incompatibility, apparently due to the age of the course. It ran fine on a PC.

The course consists of 14 lessons, each broken into several sections that range from under a minute in length to nine minutes. While the course is organized to match the various functions and components of the G1000, there is an attempt to make the learning "real world" by integrating a particular use into the bigger picture of the G1000 system and how it may be used in flight.

The course starts at a very basic level—and is structured so the user can skip over what he or she already knows as well as easily go back to cover a section again. Moving around within a section is via slider. The course is searchable and has a detailed glossary. There are quizzes at the end of each lesson—they vary in length, are scenario based and, in our opinion, do a good job of requiring the user have learned the material without going into trivia that will never be used. Passing each quiz with a score of 100 percent allows the user to obtain WINGS credit.

Within the slide-show styled course there are color-coded terms and figures that indicate more information is available or a figure is interactive. The narrator does read the text that appears in each slide, but goes into more detail than is presented in the text alone. A separate MP3 file on the CD allows listening to the narration away from a computer. ASA says the course takes four hours to complete. We agree with

Sporty's Garmin G1000 Checkout Course app on an iPad boasts clear and sharp graphics.

CHECKLIST

- Any of the courses should save you money on a glass checkout.
- Price is a good indicator of quality, although none of them is poorly done.
- Many will not run on a Mac and apps are only for iPads and iPhones.

that number if you are not going to take advantage of the features.

While the course felt a little dated to us, we are of the opinion that for the $49.95 price it is an inexpensive way for a pilot to get a solid introduction to G1000 operations, shave an hour or so off the checkout and have a reference to keep her or his skills alive.

MAX TRESCOTT

At $34.95, Max Trescott's G1000 and Perspective Glass Cockpit Handbook is one of the most comprehensive approaches to the G1000 we've seen. In 275 pages plus some useful appendices, Trescott walks the reader through a little-too enthusiastic introduction to the world of glass and then goes progressively through the G1000 systems, PFD, MFD, page system to information, instrument flying, failures and emergencies, advanced features and flying a trip behind a G1000 panel. He also goes into G1000 installations and operations in turboprops and light jets.

There are sidebars from time to time called "Tips," and are just that—shortcuts, hints and passing along real-world experience in flying the G1000 as well as differences between the original G1000 and the Perspective. The depth and extent of the secrets from experienced users is unusual in "how to" presentations, and something we value.

The presentation is tight, the writing crisp and the individual sections within the chapters are kept to a single component, concept or task, which makes for fast scanning when using the book as a reference. We also liked that Trescott identifies errors pilots commonly make when using the G1000—which may force the readers to come up with new ones.

The final chapter is devoted to flying the G1000 Perspective. The appendices include what we believe is handy information, including: difference by airframe manufacturers in G1000 warnings, cautions and engine instrumentation as well as a comparison of the G1000 with the GNS 430 and GNS 530, the latter truly helpful to someone new to glass but with experience with Garmin's GPS navigators.

Trescott's website advertises a $99.95 VFR and IFR Garmin G1000 CD-ROM course which we ordered with the intention of reviewing. After placing our order, we were contacted and told that the CD-ROM course is "out of print and not available."

JEPPESEN

The $199.95 and $299.95 prices for, respectively, the "Core & VFR Procedures" and $299.95 for the IFR and VFR bundle—Jeppesen's G1000 CDs— initially put us off. However, once we got the CD loaded (PC only, no Mac) and activated (it took a phone call to customer service), we found that the content was impressive. The course didn't mess around with filler. There was a clear, concise briefing on how things worked (unfortunately, once we got into the course, we found we couldn't get back into the briefing to refresh our recollection). Then it went right into how to use the G1000—explaining the why as the lesson goes along. Theory is nicely mixed with practice.

The animated graphics are absolutely first rate, clearly showing the G1000 as it looks in flight and carefully highlighting the knob, button or section of a screen of interest. They're configured for a Diamond DA-40 and look real.

Other than the introductory segments, most sections start out with a demo that explains the particular functions and operations. It's followed by a training section where you use a simulator, as the course has you conduct a series of tasks, such as calling up a particular page, finding and entering frequencies (click and drag because you can't grab a knob—it works well). It prompts you with red arrows to help you get it right.

Finally, there's a test—Jeppesen refers to the section as "solo"—and it's not the usual, easy multiple-

STAYING CURRENT ON GLASS

High-level technical skills, such as those involved with operating modern glass cockpits, are perishable—at a shockingly rapid rate. Think you're rusty on crosswind landings after three weeks? Your glass skills may erode even faster, especially if you learned them after you struggled through learning to land with the wind off to the side.

An added problem is that glass bumps your cost of flying significantly—the rental rate for a glass 172 is usually $20 per hour more than the round dial one sitting next to it; if you're an owner, you're shelling out well over $1000 a year just for database updates. Higher cost means you fly less—so it's more difficult to stay comfortable with the glass, not to mention that your overall risk of pranging an airplane is higher because you are flying less.

In addition to reviewing the glass training products from the standpoint of using them for initial education, we looked at them for ease of use and quality of content for recurrent training and reference. Simply put, is this something that has useful content and that we are going to be likely to "plug and play" when we have a few minutes and are aware we want to review glass ops?

Our conclusion was that all of the courses had content that meant that if we were to take the time to look then we'd get something out of the time we spent. In every case we had a few "Oh, yeah, I'd forgot about that" moments.

That boiled the analysis down to recognizing that ease of use was paramount. Therefore, the apps won outright. If we have an iPad or iPhone, and ten minutes of downtime, that's enough to review a segment in one of the courses. That the apps are limited to iPad and iPhone platforms needs to be corrected.

The content of each of the computer-based courses is more than good enough for recurrent training—if you have the self-discipline to go sit down at the computer. We do like the King course best for computer-based recurrent because of its completeness, ease of navigation and quiz set up that points you directly to the appropriate spot on the video.

For general reference, Max Trescott's book is our favorite.

SELECT GLASS TRAINING MATERIALS/COURSES

PRODUCT	PLATFORM/FORMAT	PRICE	COMMENTS
ASA, THE COMPLETE G1000 COURSE	COMPUTER-BASED CD-ROM FOR PC—WOULD NOT WORK ON A MAC	$49.95	Easy to use, slideshow with narration, scenario-based quizzes, solid introduction to the G1000
MAX TRESCOTT'S G1000 AND PERSPECTIVE GLASS COCKPIT HANDBOOK	SOFT COVER BOOK	$34.95	Detailed, well written, includes many shortcuts and tips based on experience, no quizzes, excellent reference.
JEPPESEN G1000 TRAINING	COMPUTER-BASED DVD FOR PC ONLY, NO MAC	$199.95 CORE AND VFR $299.95 CORE, VFR & IFR	Best course overall, sophisticated demo and challenging test after each section
KING SCHOOLS CLEARED FOR FLYING THE GARMIN G1000	COMPUTER-BASED ONLINE OR DVD FOR PC ONLY, NO MAC	$249	Excellent, complete presentation for initial or recurrent training, second only to Jeppsen overall
SPORTY'S GARMIN G1000 CHECKOUT COURSE	COMPUTER-BASED ONLINE OR DVD FOR PC, NO MAC, APP FOR iPAD AND iPHONE	$89.95 ONLINE AND DVD 479.95 APP	App makes the course easy to use and transport, downloadable PC trainer, good two-hour introduction to G1000
ASA, THE COMPLETE AVIDYNE ENTEGRA COURSE	COMPUTER-BASED CD ROM FOR PC OR MAC	$49.95	Easy to use slideshow presentation, excellent searchable glossary
SPORTY'S FLYING THE ASPEN EVOLUTION	COMPUTER-BASED ONLINE OR DVD FOR PC, NO MAC, APP FOR iPAD AND iPHONE	$31.95 ONLINE $29.95 DVD $29.99 APP	Decent basic introduction to the Aspen Evolution, not easy to navigate, no quizzes

choice pablum. It's as realistic as it can get on a computer version of a panel simulator—you are facing the panel and are directed to accomplish another series of tasks having to do with the segment—except that you are not given any prompts. You've got to use the controls correctly to get through the series. If you make a wrong input, you're told that it's an error—although it doesn't take you into a new, wrong page or software never-never land as it might in real life—and you try again. Once you get it right, the sequence moves on. More than two errors and you don't get credit for the test.

You can't nod off and then fake your way through this course. You watch the system in action while listening to a narrator that actually uses voice inflection (you can read the script if you wish, but there's usually a lot to watch on the panel), then you interact with the G1000 with guidance and finally, you do it on your own.

We think that making the effort to work your way through this course at a level where you pass all the exams is going to save you real time and money on the aircraft in your G1000 checkout.

KING SCHOOLS

King Schools offers its G1000 course either online or through an interactive DVD course for PC (no Mac). Broken down into lessons, called labs, made up of video snippets, each with a quiz at the end, the course covers both VFR and IFR operation of the G1000. The price, either online or DVD, is $249.00. The quality is very good; the overview does not get overly tangled up with minutiae of the system, but goes directly into the how and why of operating it.

You can skip around among lessons and video snippets and use a slider to go to a specific area in a video snippet you wish to review.

The quizzes use what the Kings refer to as a Procedures Trainer in which you answer questions by drawing lines from the question box to the appropriate button or point on the PFD or MFD or click on arrows to rotate the knobs. A wrong action generates a box explaining the correct answer or action and a link to the section of the video snippet that covers the question, something we liked. The use of the procedures trainer for the quizzes is a slick arrangement, although not as sophisticated and challenging as Jeppesen's simulator and method of directed practice first and then testing without prompts.

From the standpoint of recurrent training and review, rather than initial training, we think the King quizzes with a direct link to the relevant portion of the video snippet is maybe a little better than the Jeppesen course.

SPORTY'S

Sporty's offers three versions of what it refers to as a Garmin G1000 Checkout Course: online, on DVD or as an app for an iPad or iPhone. The app is $79.99; the online and DVD versions are $89.95. The only difference we could determine was that the downloadable PC trainer will not run on an iPad or iPhone, however, if you buy the app, Sporty's provides information on downloading the trainer to a Windows PC.

The course is just under two hours long, broken into 16 video segments. We reviewed the app because we wanted to see how it worked on the smaller screen and wanted the portability. It did well; the videos and graphics are sharp and clear. You can easily move between video segments and use the slider to move within a video. There is a single, 28-question review quiz at the end of all the videos—the questions each have a direct link to the appropriate video section.

In addition to the videos, the software includes a copy of the G1000 Cockpit Reference Guide (all 256

pages), a training course outline for students and instructors and images of G1000 installations in various airframes.

In under two hours, the course does not come close to the depth of the King or Jeppesen courses, however, we felt it will get a new glass pilot well down the road to understanding the G1000. We liked the ability to pull out our iPad when we had a few minutes and watch one of the videos.

AVIDYNE ENTRGRA

ASA's Complete Avidyne Course, by Michael G. Gaffney, is a 14-lesson CD course that will run on a PC or Mac or directly off the CD. Each lesson is broken into a number of segments that vary from less than a minute to nearly 10 minutes. Because there is so much information to cover, the bite-sized nature of the segments help to keep a newbie to glass from being overwhelmed.

After starting with the very basics of glass (a little too basic, we believe), including defining Technically Advanced Aircraft, how to scan, using checklists, warnings to keep one's head out of the cockpit and a system overview; the course is organized to walk the user through the various facets of the Entegra, including its controls, the PFD, MFD, engine monitoring, the associated transponder, audio panel and autopilot as well as flight planning, instrument procedures and emergency management.

It's a slide-show presentation, with on-screen text, and while the narration is a little dry, at least the narrator does not simply read the displayed text—he goes into more detail.

There is no requirement to progress through every section or even take the lessons in order. WINGS credit can be obtained by successfully completing the quiz at the end of each lesson. For us, the quizzes did a satisfactory job of walking the line between too easy and requiring memorization of inconsequential details.

The course includes a detailed glossary that can be accessed easily in the middle of a lesson or for reference. The course is also searchable. Exploring the "About" section of the course turns up a link to the Entegra Freeplay Simulator, which the author of the course recommends downloading to practice the skills learned in the course.

The Freeplay simulator is from 2007 and is compatible with Windows XP, not Macs.

For $49.95, we liked this course as a solid introduction to the Avidyne Entegra system and an easy reference, although it is now five years old and has not been updated.

Aspen Evolution course from Sporty's uses a combination of graphics and in-flight video, top. ASA's Avidyne Entegra course is a slide show presentation, above.

ASPEN EVOLUTION

As with Avidyne, there is a dearth of training programs for the Aspen Evolution—the only ones we found were from Sporty's—online, on DVD and an app. The online course is $31.95, DVD $29.95 and app $29.99. It's 1:30 of good-quality video without a way to skip to specific segments and does not have a table of contents—to navigate, it's a matter of fast forwarding. There are no quizzes.

While this is the weakest of all the training programs we reviewed, it did cover the wide range of installations (one to three screens of the Aspen). We nevertheless believe that it should be watched by anyone intending to fly behind the Evolution.

YOUTUBE

Not surprisingly, there are videos on YouTube with some degree of glass training—although not many, and what there exist are limited to the G1000. None of them, in our opinion, are in-depth enough to give more than an introduction to the G1000, although the one by Dick Rochfort, at an hour long, is the best of the bunch and worth the time to watch. Hey, it's free.

CONCLUSION

When it's time to go glass, we recommend any of the courses we reviewed. It's a close call as to which is the best of the G1000 courses, but we think Jeppesen wins by a nose because of the more rigorous directed practice and testing. For keeping our skills up, all are satisfactory, although we found that for quick reference at home we went to Max Trescott's book; away from home we used the Sporty's app.

AKG AV100 Headset: High-End Features

The new aviation headset from audio giant Harman AKG strikes a good balance of utility and comfort, but only average ANR performance.

by Larry Anglisano

Less well known in aviation circles, Austrian-based AKG Acoustics is respected in the studio and stage performance market with products endorsed by top performers. This includes Eric Clapton, Rod Stewart and Stevie Wonder, to name a few. Parent company Harman nearly owns the automotive OEM audio market. Its products are standard in BMW, Mercedes, Land Rover and Toyota.

Remaining true to its musical roots, the AV100 headset that's sold by AKG's new aviation division has a list of standard features that focus on wireless entertainment audio input. But these features come at a price premium, making us wonder if the current market—dominated by Bose and Lightspeed—will embrace another high-priced ANR model.

We put the $1100 AV100 through its paces to see how it performed and are impressed with its Bluetooth performance and features, its music quality and comfortable fit.

The AV100 has clever LED utility lights built into the leading edge of each earcup. The model has a high-end feel, as it should for its $1100 price tag.

BUILD AND FIT

It's immediately apparent that the AV100 has a high-quality build and modern styling. Each earcup is attached to the steel headband with a metal-injected swingarm that articulates up to 90 degrees. The unit weighs one pound, which is slightly heavier than the Bose A20, at 0.75 pounds.

When selecting a headset, it's important to look for build features that help safeguard against breakage. We found several on the AV100. For example, the swingarm attaches to the earcup assembly at two points. This might protect the set from a drop to the pavement or a crush in a flight bag. The set folds for easier storage and comes with a generous storage case. There's plenty of strain relief where the audio cable attaches to the earcup, at the audio plugs and at the control module. These areas are the most prone to eventual intermittent connections due to stretching and flexing. The set has a two-year warranty.

The bow extension (that's the adjustable piece that slides up and down the headband) offers plenty of adjustment to fit a variety of head sizes. We especially like the reference measurement marks on the slider so you can precisely adjust both the left and the right bow for a uniform fit. Our only beef is the measurement markings are difficult to read, blending in with the grey sheet metal surface on the headband slider.

Two compression-molded leather cushions are attached to the underside of the headband with Velcro and provided decent pressure relief on longer flights. We used the AV100 with and without a ballcap and were pleased with the overall comfort.

In fact, we brought along a Bose A20 and a Lightspeed Zulu during the evaluation flights and the AV100 consistently edged both for comfort. Our sense is that the Bose has a slightly lower clamping pressure, but the larger earcups on the AV100 offer a better fit around eyeglass temples. The downside is we struggled to adjust the glasses on the face because of the larger cup area surrounding the temples. It's important to note that the size of the eyeglass temples can affect the noise-cancelling performance of any ANR headset. That's why it's critical to precisely adjust the headband.

CONTROL SET

The AV100 comes standard with a 6-pin LEMO connector and dual-plug adapter. This enables plugging the set into a panel module for ship's

CHECKLIST

- The AV100 is packed with useful features and excels at Bluetooth audio control.
- It has a durable, high-quality build and larger ear cups lend to comfort.
- Its ANR performance is adequate, but we expected more.

power and audio (also used by Bose, Lightspeed and others), or plugging into standard microphone and headphone jacks.

The entire length of the cord is roughly 8 feet long. In many cabins, that's long enough to reach the rear seats. What's missing is an additional clothing clip (there's only one) for securing all of that cable and the control module to an interior sidewall or any other place you want to manage the cable slack.

When not using ship's power, the headset is powered by two AA batteries. AKG says battery endurance can be as high as 15 hours. A green LED power button flashes when the unit is on. There's a power button for turning the ANR circuitry on and off when using batteries, but we like that the ANR circuitry automatically powers on when the module receives bus voltage when used with the LEMO plug. AKG calls this feature intelligent power management. We can't count the number of times we've taken off with the Bose in passive mode because it doesn't power on automatically.

Speaking of passive, the AV100 provides ample performance when used without the ANR circuitry turned on. From our experience, the Bose A20 falls short for passive performance. You could be faced with such a dilemma with spent batteries. A low battery condition triggers a red flashing LED annunciator on the AV100 control module. There's also automatic shutoff to save battery life.

The control module has a total of nine buttons and switches, including rotary volume control wheels for left and right earcups. The volume control is linear throughout the range, and it was easy to set a comfortable listening level when plugged into a variety of audio control panels. In our evaluation, we used the headset with a PS Engineering 8000-series audio panel, a Garmin GMA340 and with a standalone intercom. The AV100 was a decent match for all of them.

There's a mono/stereo slide switch for configuring the headset in different aircraft. Most modern audio systems have stereo audio output, but if the installer didn't use stereo audio jacks in the interface, you'll need to operate the headset in mono mode. In stereo mode, you'll hear left and right channel stereo separation.

Contributor Doug Fields, right, gave the AV100 a confirmed edge in comfort over the Bose A20. That's partly because the AKG's larger ear cushion provides a better fit over eyeglasses. The control module, lower photo, is busy, but has a high-end feel and controls high-end features.

We initially thought the LED utility lights that are integrated in each ear cup were gimmicky, but they turned out to be useful. In a dark cabin, they throw plenty of light for reading a checklist or even illuminating the instrument panel. The lights are controlled with a pushbutton switch on the control module.

SMART BLUETOOTH

Any modern aviation headset should have wireless Bluetooth connectivity for making phone calls and for listening to music, and the AV100 excels at the task. There's also an auxiliary input jack on the bottom of the control module for plugging in a patch cable. Bluetooth takes priority over the auxiliary input, so if the unit is wirelessly connected to a phone or music player, the jack is disabled.

Initial Bluetooth pairing is easy. Simply hold the Bluetooth button and an audible voice prompt announces that the system is in pairing mode. The system mode LED rapidly flashes blue when in pairing mode and flashes blue slowly when it's connected to a phone. The LED double- flashes blue when receiving a Bluetooth audio signal. A triple flash of the LED indicates there is an active phone call in progress.

AKG takes the phone/music interface to a higher level with an audio source priority mode that's controlled with a dedicated sliding switch on the control module.

When the priority switch is in the Off mode, only the intercom and aircraft radio audio is forwarded to the headset. When set to Mix, the headset mixes intercom, radio, the Bluetooth signal or auxiliary audio. When the switch is set to Auto, the Bluetooth or auxiliary audio is muted when there's an intercom audio signal present and then fades back in once the communication has stopped. It's impressive to see these built-in features that are often part of high-end audio control panels.

If that's not enough, AKG includes a Bluetooth source volume control

on the control module. The volume control is linear and eliminates the need to reach for the music device or phone to adjust the volume.

Directly below the Bluetooth volume control is a music play/pause control. It proved to be a fast way to stifle the music when things get busy. The button is also used for handling telephone calls. To answer or hang up a call, simply press the Play button. Want to reject an incoming call? Press the Play button for more than two seconds. AKG says the feature depends on the capabilities of the connected telephone, but the function worked with the iPhone 5 used during the evaluation.

The play/pause control also controls music track selection. A double click of the Play button skips to the next song, while triple-clicking the button jumps one song backward. A long press of the button stops music playback. Again, the function depends on the capabilities of the music source.

ANR, AUDIO PERFORMANCE

Audiophiles will be impressed with the stereo music quality of the AV100. In our view, it's terrific. Still, more important is the overall quality of the ANR circuitry.

Based on evaluating the AV100 in three aircraft—a Cessna twin, a Cirrus and a Piper single—we think the overall audio quality and noise-cancelling performance is average. Frankly, we had higher expectations than what the AV100 delivered. It's not that it's bad, but both Bose and Lightspeed have raised the bar on ANR performance and buyers expect a lot from a $1100 headset.

"The AV100 had more bass, but overall, its sound quality was lower than my Bose A20. The AV100 has better passive performance than the Bose and while the ANR performance is certainly effective, it's noticeably worse than the Bose," noted one evaluator.

During an evaluation flight in the Cessna twin, we noted distracting background noise that seemed to originate from the ANR circuitry whenever the propellers were out of synch. In other aircraft, there was more background hiss than we would have liked.

As for microphone performance, the AV100 did well. It never clipped modulation and did a great job of handling wind noise from an open cabin door during taxi.

TIGHT COMPETITION

We had hoped to include the new Lightspeed Zulu PFX ANR model (that's expected to have a list price of $1100) in this review, but its release is delayed. While disappointing, we commend Lightspeed for not releasing a new product before it's ready.

From what we can see, the Zulu PFX has a chance to move into the top ANR headset spot, especially since the $1100 Bose A20 has been unchanged since its introduction nearly five years ago. If the AV100 were priced lower, we think it could offer stiff competition.

All of the evaluators for this review fly with either the Bose A20 or Lightspeed Zulu series, so it's natural to compare the AV100 to these high-end models. For comfort, ergonomics and features, the AV100 was a standout winner. We think its music-playing feature set is unmatched. But the unit's overall ANR audio quality just didn't blow anyone away. We'll include the AKG AV100 in our high-end ANR headset shootout that's planned for a future issue.

CONTACT

AKG Acoustics
818-920-3237
www.akg.com/aviation

Wearable WingX Pro7: Timers, Altitude Alerts

We think the Pebble Smartwatch and WingX Pro 7 app interface is a simple way of minding altitude and waypoints, while edging Garmin's D2 for simplicity.

by Larry Anglisano

We're generally not impressed by geeky personal gadgets, and the Pebble wearable technology is no exception. Moreover, we're trying to reduce our inventory of distracting portable electronics for the cockpit. That's why it was easy to shrug off the recently introduced interface between the Hilton WingX Pro7 navigation app and the Pebble Smartwatch. But valued readers rely on us to give this stuff a try before they buy, so we did. What's one more USB charging cable in a drawer full of a hundred of them, anyway?

DATA SYNCH, ALERT

That's the idea of the Pebble/WingX Pro 7 interface. The watch connects via Bluetooth to an iPad, iPod or iPhone and receives some of the data that's displayed on the WingX app. Connecting could be a problem if you also connect to another device. Don't expect the watch to display high-resolution mapping and weather data. That's not the point or within the current capabilities. Pebble has a fairly utilitarian 1.26-inch e-paper display with a 144x168-pixel count, but a user interface that's both intuitive and easy to work with, in our view. Battery life is impressive, with nearly a week of endurance per charge.

Pebble displays the battery level of the connected iDevice, in addition to its own battery status via two horizontal bars on the display. Once there is an active route programmed on WingX Pro 7, waypoint data is transmitted and displayed on the Pebble. The same waypoint data that's displayed on the Pebble is what's being displayed on the main app screen. The idea is to allow the user to toss the iDevice on the seat, for example, and rely primarily on the Pebble for waypoint alerts, altitude deviations and other prompts.

By default, the current time is displayed at the top of the Pebble display, but pushing the upper right mode button toggles through the current aircraft ground speed, current track and the current GPS altitude.

The lower right mode button changes the text that's on the lower portion of the screen. You can display the desired track and time to the currently programmed waypoint, including track data to intermediate fixes within an approach, if loaded.

The middle mode button brings up a menu for programming a timer. This can be used for switching fuel tanks, for example. Up and down softkeys make it simple to change the timer and a Go button (the center mode button) activates it. The upper left mode button serves as a Back command, sending you back one level in the menu.

The menu also sets an altitude alerter. If you're cruising at 6000 feet, for example, it's easy to set a target altitude in 500-foot intervals. The watch warns when you deviate plus or minus 300 feet of the buffered altitude.

We particularly like the app's ability to vibrate the watch when passing a fix. It's a real attention-getter that eliminates having to look down at the iDevice when flying an approach. Additionally, you can set a 1000-foot altitude warning so the watch will warn you at 1000 feet prior to reaching the destination airport. When you're on approach for landing, the watch vibrates five times when descending through 1000 feet to warn you to run a checklist, for example.

You'll need to differentiate between the various vibrating alerts. When the timer expires, the watch vibrates twice. It vibrates only once when passing a fix.

We reviewed Garmin's D2 pilot watch in the December 2013 issue of *Aviation Consumer,* with lukewarm results. We think the Pebble interface offers more utility and better contributes to situational awareness, mainly because of its vibrating timer and waypoint alerts. It's also less bulky.

The Pebble sells for around $150, in addition to a WingX Pro 7 subscription. Visit www.hiltonsoftware.com, 408-268-8418.

You'll need the WingX Pro 7 version 8.0 and the Pebble app to connect the iDevice with the watch, right.

Diamond DA40

A composite single that's modern, fast and efficient. Best of all, the DA40 Star has an impressive safety record.

Nate Morguelan

We've watched the evolution of the Diamond DA40 series with interest. Our first reaction to what would become the Diamond Star was to be less than impressed. We thought the canopy was a marketing ploy that would make emergency egress difficult, and the cabin looked small and uncomfortable.

Then we flew it. The canopy provided superb visibility, the speed was impressive—newer models are even faster—and handling was just plain fun. We liked the control harmonization and how easy it was to land in a crosswind.

The cabin proved to be roomier than it looked with control sticks instead of panel-blocking yokes, even if they did have to be used with the wrong hand.

Given its European roots, Diamond came at the DA40's design as sort of hybrid between the sleek glass gliders the company started out producing when it was Hoffman Flugzeugbau and more traditional aircraft U.S. customers are accustomed to. This yielded what we think can fairly be called a world airplane.

HISTORY OF THE LINE

Hoffman Flugzeugbau began life in 1981 in Friesach, Austria, producing the H36 Dimona motorglider, a popular recreational airplane in Europe. Ten years later, Christian Dries and family took over Hoffman and in 1992, it launched an effort at the North American market by opening a new plant in London, Ontario, in a converted World War II aircraft factory.

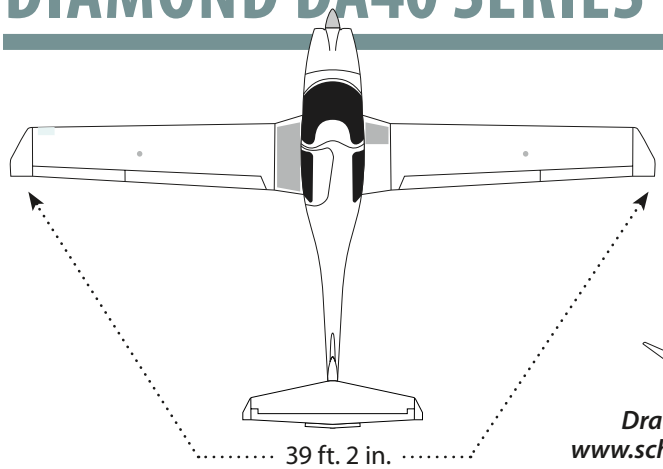
The canopy provides superb visibility, the speed is impressive and handling is just plain fun.

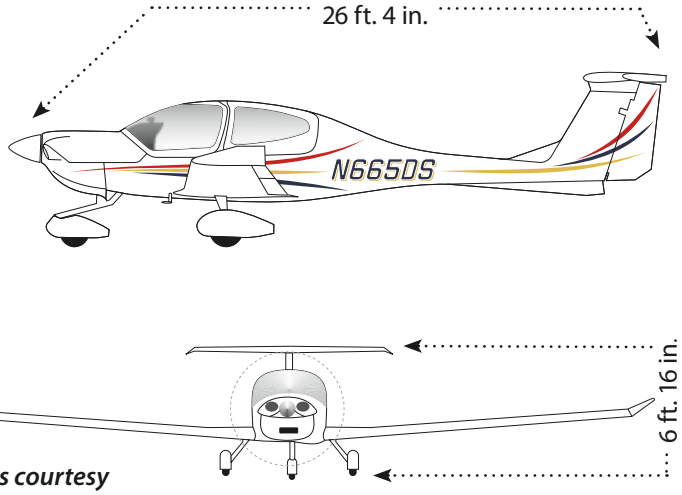
Diamond—then called Dimona—got its feet wet in the U.S. market by importing the Austrian-built DV20 Katana. In 1995, it began building Rotax-powered DA20-A1s in the London plant and selling these into what was then a lukewarm market for new trainers. By the time the company changed its name from Dimona to Diamond in 1996, it realized that both the North American and world markets had room for a composite four-place airplane.

In 1997, Diamond announced the DA40 Diamond Star at the big European show in Friedrichshafen, Germany, with the prototypes powered by the Rotax 914 and Continental IO-240. But the airplane clearly needed more power. In 2000, the DA40-180 was certified with the Lycoming IO-360 and a year later, production began in the London plant. Sales were initially brisk, especially to the

One thing Doug Roberston loves about his DA40, main photo, is the limitless view from the canopy.

DIAMOND DA40 SERIES



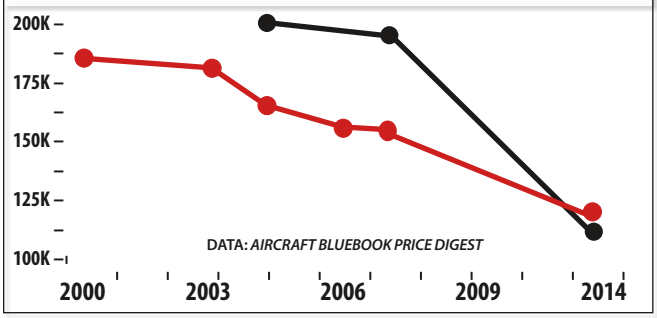


Drawings courtesy www.schemedesigners.com

DIAMOND DA40 STAR SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
2000 DA40-180 STAR	LYCOMING IO-360-M1A	2000	$25,000	41	915 LBS	145 KTS	±$105,000
2004 DA40-180 STAR	LYCOMING IO-360-M1A	2000	$25,000	41	915 LBS	145 KTS	±$125,000
2005 DA40F-180 STAR	LYCOMING O-360-A4M	2000	$25,000	41	915 LBS	135 KTS	±$100,000
2006 DA40-180 STAR	LYCOMING IO-360-M1A	2000	$25,000	41	915 LBS	145 KTS	±$145,000
2006 DA40F-180 STAR	LYCOMING O-360-A4M	2000	$23,000	41	915 LBS	135 KTS	±$105,000
2007 DA40F-180 STAR	LYCOMING O-360-A4M	2000	$23,000	41	915 LBS	135 KTS	±$115,000
2007 DA40-XL STAR	LYCOMING IO-360-M1A	2000	$25,000	41	915 LBS	145 KTS	±$205,000
2011 DA40-XLS STAR	LYCOMING IO-360-M1A	2000	$25,000	50	860 LBS	150 KTS	±$300,000
2013 DA40-XLS STAR	LYCOMING IO-360-M1A	2000	$25,000	50	860 LBS	150 KTS	±$377,800

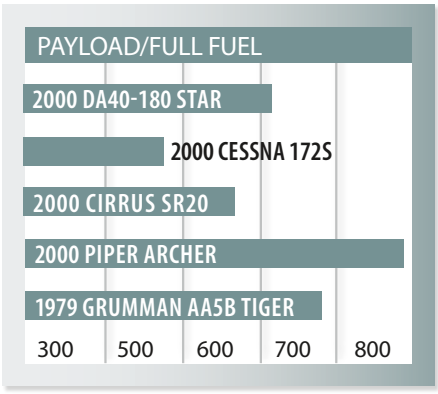
DIAMOND DA40 RESALE VALUE

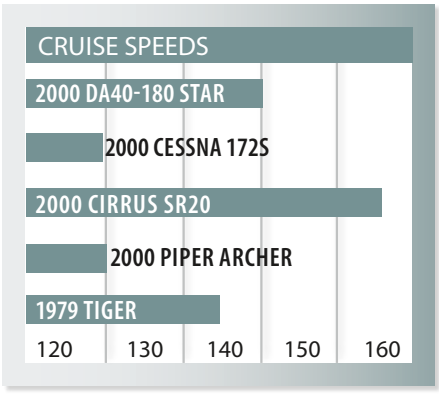


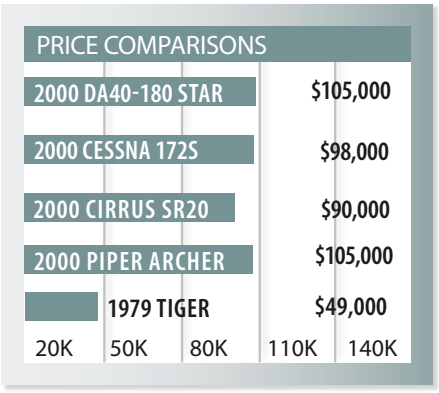
SELECT RECENT ADs

AD-2010-25-01	REPLACE REAR DOOR RETAINING BRACKET
AD 2009-10-04	REPETITIVELY INSPECT NOSE LANDING GEAR LEG FOR CRACKS
AD 2007-11-21	REPETITIVELY INSPECT FUEL SELECTOR UNIVERSAL JOINTS
AD 2006-12-07	REPLACE CERTAIN ECI CYLINDERS ON LYCOMING -360 AND -540 ENGINES

SELECT LATER-MODEL COMPARISONS







Front seat room is adequate even for taller pilots such as owner Jim Siverts (above). Early Stars offered a small baggage area and tube for larger items (left). The baggage area was later redesigned to include fold-down rear seats.

trainer market which, increasingly, was turning to Cessna 172s for new training aircraft. Many flight schools found would-be students weren't as price-sensitive as they once thought and wanted the option of two additional seats, which the Katana couldn't provide. When it initially appeared in the 2000 model year, the DA40 sold for $189,900, typically equipped.

Initial deliveries of DA40s were equipped with dual Garmin GNS430s and Bendix/King KAP140 autopilots. In 2004, Diamond announced that new Stars would have the Garmin G1000 EFIS system and that same year, Diamond announced a joint venture to sell and build DA40s for the Chinese market, primarily for training in that country's burgeoning airline sector. Knowing it had found a niche, in 2005, Diamond announced the DA40-FP, a fixed pitch-only version of the airplane, with the carbureted Lycoming O-360. This model was aimed specifically at the training market. The FP's base price at the time of introduction was $187,800.

In 2006, the DA40XL appeared, which was basically just packaging of high-end options, such as the Garmin GFC 700 autopilot, Powerflow exhaust system, a composite three-blade MT prop, a 110-pound gross weight increase, electrically adjusted rudder pedals and a premium interior.

The airplane was clearly aimed at the upscale owner-flown market, which Cirrus was having good success serving. Fully equipped, the XL model sold for $329,000.

In late 2007, yet more versions of the DA40 appeared, the XLS and the CS. The XLS has a wider, higher canopy and a luxury interior while the CS is essentially an à la carte model with a constant-speed prop that lets flight schools configure it with interiors and other options. The base price of the CS was $259,950, while the XLS base was $334,950, or over $380,000 fully loaded.

CONSTRUCTION

When Diamond bought Hoffman, it paid attention to the company's core expertise: building clean, strong glass structures. This is definitely reflected in the DA40's construction, that is built along the same lines as the two-seat Katana/Evolution/Eclipse series.

The fuselage is constructed of wet layup material in two halves which are bonded together longitudinally, with the vertical stab as part of the assembly. The T-tail is attached separately, as are the wings which, unlike the Cirrus aircraft, are two separate pieces joined at the fuselage center section. The wings themselves are laid up top and bottom in vacuum molds, then bonded together after the internals are installed.

The spar is a massive twin carbon-fiber spar layup between which the fuel is stored in removable aluminum cells. The fact fuel is exceptionally well protected may explain why Diamond aircraft have shown no tendency toward post-crash fires.

The cabin and cockpit is best thought of as a bathtub arrangement with a wraparound canopy in the front and a hinged rear hatch for the backseat occupants. The canopy hinges at the front, rather than the rear, as on the DA20. The rear hatch is on the airplane's left side and is equipped with a pin release for emergency egress. As with most of the modern composite aircraft, the DA40 has spring steel gear and a castoring nosewheel, with steering via differential braking. The gear attach point loads are carried into the center section through attachments on the spar.

Unique among the big three composite lines—Cirrus, Columbia/Cessna and Diamond—the DA40 has center sticks with push-pull rods for elevator

and ailerons and cables for the rudder. Rather than sliding seats, the DA40 has rudders that can be repositioned to adjust legroom. Trim is both electric and manual—there's a trim rocker on the sticks and a center console wheel—and is activated by cables to an anti-servo tab on the horizontal stab.

ENGINES, SYSTEMS

Diamond kept it simple when it came to the powerplant: Lycoming's 180-HP IO-360 has proven reliable and inexpensive to overhaul, at the expense of giving up some smoothness to six-cylinder Continentals. It's also fairly light, an advantage in an airframe as light as the DA40. (Gross weight in early models was 2535 pounds, while newer ones are 2645, compared to 2450 pounds for the Cessna 172 and 3050 pounds for the Cirrus SR22.)

Systems wise, the Star has all the required new-age glitz. The fuel system has right/left/off settings, only one step down from the ideal off/on system for minimizing fuel-related accidents. However, as there have been no fuel-related accidents reported on Diamond Stars in the U.S., we're hardly one to complain. The fuel selector is on the center console. One of the airplane's operating limitations includes a requirement to keep the fuel load balanced.

As is the fashion, the DA40 is an all-electric airplane, with no vacuum system. It has a single starting battery, but also a single alternator, although there's a battery backup for the electric gyros.

One of the DA40's strongest suits is the fabulous visibility afforded by the wraparound canopy; nothing else in GA comes close. But what plastic giveth, plastic taketh away. The cockpit can be boiling hot in the summer, although an opaque shade along the top of the plastic bubble helps. Air conditioning isn't an option in the DA40s; it lacks the power and payload. However, the canopy can be opened during taxi and is equipped with partial-open latches. The heating and ventilation, once airborne, are good. In early models, the panel air vents emitted a noticeable and irritating howl, but this has since been quieted down.

PERFORMANCE, PAYLOAD

When we reviewed the first production model DA40 in 2002, it blew away the competition, mainly the Cessna

SAFETY RECORD: STILL IMPRESSIVE

When we looked at used DA40s a couple of years ago, we found that the aircraft's accident record was so good that it's hard to make much sense of. It was no different when we looked at it this time.

When we swept the NTSB records for accidents involving the DA40, we again found only nine in the U.S., two of which were fatal. Of the nine reported accidents, one was a bird strike on a wing in which the flight instructor landed safely, and one involved a safe return and landing after the pilot noticed higher-than-normal engine RPM—it turned out the prop governor had been incorrectly assembled.

Of the two fatal accidents, one occurred on May 11, 2007, when a rented Star was flying at low altitude over a lake in Arizona. The pilot either lost control or unintentionally descended into the water, killing both occupants.

An earlier fatal accident happened in South Carolina, when the pilot of a DA40 commencing an instrument approach evidently descended prematurely and struck power lines, killing all three aboard. Despite the fact that the left wing and engine were severed by the impact, there was no post-crash fire.

In what might be a tribute to the airplane's crashworthiness, another accident probably should have been fatal, but wasn't. It was the classic box canyon trap, where a pilot flew the airplane into rising terrain with converging walls. Unable to climb out of the trap, he crashed into trees, which captured the airplane. Two of the occupants had minor injuries, two had none.

One accident was a garden-variety runway loss of control by a low-time pilot who ran off the runway during a landing, and one was a mid-air in the pattern, which resulted in one serious injury. We know of at least two accidents in the U.K. and Europe—neither fatal—involving engine stoppages of Thielert diesel-equipped DA40s.

With so little data to mine, we examined total accidents versus total registrations. According to FAA records, there are about 700 DA40s registered in the U.S., with only a handful of accidents.

By comparison, we found roughly 900 Cirrus SR20s on the FAA's rolls, with close to 70 accidents reported in the U.S., nearly two dozen of which were fatal. If fatals are expressed as a percentage of total accidents, around 46 percent of SR 20 crashes were fatal and 20 percent of DA40 crashes resulted in deaths.

The percent of SR20 is nearly identical to what we saw when we looked at its number last year—the Diamond number was down by 13 percent. We recognize that the total number of airplanes is not enough to be a statistical universe, however, with over 1400 SR20s and DA40s in the field, the numbers cannot be dismissed.

Over the years, we have noticed that Diamond airplanes show little tendency toward post-crash fires. In fact, we haven't been able to find any significant fires in Diamond airplanes and none in the DA40 series.

Diamond's competitors have argued that its accident rate is so low primarily because its airplanes are used as trainers. In our view, the use of Stars as cruisers and the legacy of the DA40 series has long ago disproven this.

All of the DA40 owners we spoke with attribute the aircraft's stellar safety record, in part, to its flying manners. One owner pointed out that a DA40 is difficult to stall and spin. Some credit the DA40's reliable engine.

Whatever, we still think Diamond can still rightly claim the best safety record in light aircraft GA. How, it doesn't really matter.

Diamond flirted briefly with the Avidyne Entegra, but new DA40s have the Garmin G1000. Some owners complain about limited software releases for non-WAAS G1000 versions, especially when it comes to enabling ADS-B compatibility.

172 and 172SP and the Piper Archer, both entry level four-placers. Only the Tiger comes close in older designs, although the Cirrus SR20—also entry level—is faster by about 12 knots or so on 20 more horsepower. It easily kept up with the 200-HP Piper Arrow. The early Stars toot along all day on 9.5 to 9.8 GPH at speeds up to about 140 knots. Subsequent models, say owners, are about 10 knots faster and, for the DA40 XLS, Diamond claims a 158-knot top speed with a 150-knot cruise on 10 GPH.

With its long wing and relatively high aspect ratio—reflecting its sailplane heritage—the Star is a terrific climber, even when loaded. Moreover, it leads the league in short-field capability, easily hopping off the runway in 1200 feet or less with a heavy load. At 2535 pounds (2635 for newer models) gross, the Star is light; at 14 pounds per HP, its power loading puts it in the middle of its class. (The Cirrus has power loading of 15.25 lbs/HP, while the Cessna 172 is lower, at 13.6 lbs/HP). Nonetheless, any competent pilot should be able to comfortably operate a Star out of 2000-foot runways, at reasonable density altitudes.

Payload-wise, the Star is really a three-place airplane with baggage space, even at the higher gross weights. Useful loads are in the 850-pound range, although some owners report less.

So with the tanks full, it can carry about 600 pounds—three people with some bags. There's a 10-gallon extended-range fuel tank option that further reduces cabin load.

In early Stars, the baggage compartment was a bit of an afterthought, accessible only through the cabin by tilting the rear seats forward. The area itself was quite shallow. This was later redesigned, and now the rear seats fold forward to essentially turn the backseat into one huge baggage bay.

The Star's weight-and-balance envelope is relatively benign, narrowing a bit toward the gross weight limit. It tends toward forward, rather than aft CG. Offloading fuel is always an option to stuff in more payload, but the airplane carries only 40 gallons usable to begin with, so its range is hardly exceptional. The 10-gallon extended range option helps, but owners complain it narrows the CG envelope, something that needs watching. The newer XLS models come with 50-gallon tanks as standard equipment.

ERGONOMICS, HANDLING

Entering the Star's cockpit requires hiking up onto the wing and stepping down into the well of the cabin. It's a bit of a practiced art, requiring gripping the canopy's tubular hinges to gain purchase, both for ingress and egress. Not easy, perhaps, but you get used to it.

The rear seat passengers simply step through the hatch and into the rear cabin, which is quite spacious. (Watch the opened rear hatch, though—it's just the right height to bonk an unwary head.)

The front seats don't slide fore-and-aft, although they do recline slightly. A six-foot-five-inch owner reported that, while a little cramped, the pilot's seat has adequate room for him. Rear-seat passengers enjoy adequate footroom, thanks to footwells. With their adjustable rudder sets, the front seats have good legroom for such a small aircraft. As noted, cockpit visibility is nothing short of fabulous—the best of any GA airplane, other than the Katana/Eclipse/Evolution series.

Of all the GA airplanes we've flown and tested, the Star ranks at the top as being the most fun to fly. It's not quite as well balanced as a Bonanza, but it has no bad habits, and pitch and roll forces are light and easy to manage with the stick. Slow flight and stalls are non-events and even deep into the stall, the airplane simply mushes and could probably touch down that way in a survivable impact. Flaps have little or no effect on trim condition, but neither are they as effective as the barn doors on a Cessna 172.

Landing a Star isn't particularly difficult, but the sight picture over the nose requires some acclimation to avoid too-high flares. Flown into the flare faster than about 65 knots, the Star will float; slower is better.

MAINTENANCE

Typically, airplanes new to the market evidence characteristic maintenance weaknesses at some point. But the Star has done well in this regard. The Lycoming IO-360 is one of the most reliable four-cylinder powerplants available; we heard no complaints from owners about it, save for a few owners that had problems with electric fuel pumps.

Some owner complained of early teething problems with the Garmin G1000. We also heard complaints about Garmin being slow to produce software upgrades for non-WAAS aircraft. The early Star's weak landing

lights are a point of contention. We found only four ADs against the airplane, one requiring replacement of the rear hatch retaining bracket, one requiring inspection of the nosegear pivot axle, one requiring inspection of the universal joint on the fuel switch and the last requiring a one-time fuel system inspection.

OWNER FEEDBACK

I grew up flying three different airplanes: a Cessna 172, a Beechcraft Sundowner and a Piper Archer. Today, I have owned my DA40 for a little over a year and have flown just under 100 hours. I fly whenever I can, even if it's just to go around the pattern. I keep trying to find a reason not to love this airplane. My girlfriend and I have flown all over the southeast. Hands down, the DA40 is my favorite airplane and I will be a DA40 owner for a long, long time.

I love the sleek appearance of the airplane. It's very roomy in the cockpit and the passengers are quite happy in the backseat. But one of the best features is the almost limitless view from the canopy. It's like a Disney ride; the view is breathtaking. Landing the DA40 is a breeze. Just hold back on the stick until the runway reaches up and pulls you out of the air.

This is the same airplane that many flight schools use to get pilots through their instrument rating. It's a great regional cross-country airplane. You can cruise easily at 132-140 knots, but I'm a gas saver. I cruise at 122 knots, while burning 8 GPH. The Lycoming IO-360 M1A is an almost bulletproof motor, in my estimation.

The three-blade MT prop is very smooth and a lot quieter than a two-blade Hartzell. Also, the three-blade reduces the vibration while shutting down. I just had mine rebuilt for $4500 and it was well worth it. It now has seven more years or 1800 hours of expected life. In my first year of ownership, nothing has broken, nothing has fallen apart and my airplane runs better than it did when I bought it.

The upkeep on a newer airplane—particularly a composite—is a lot less than some may think. Diamond just dropped the rudder cable AD last year. That was a big one. So far we have very few ADs to comply with compared to other manufacturers.

At annual, like any other airplane, we have a squawk list to deal with. Mostly, it's little things. To compare my DA40 to anything else in its class, upkeep is going to be less expensive for the most part.

Doug Robertson
via email

I purchased a 2008 DA40 XLS in January 2013 after cross-shopping with a newer 182T and an upgraded Model 35 Bonanza. I am based at RHV in San Jose, California, and currently have 280 delightful hours in this aircraft. Our trips include one across the U.S., four to Portland, Oregon, 30 landings at Lake Tahoe, plus numerous Bay tours.

My goal was to buy a safe, practical and fun IFR aircraft to accommodate at least three adults, with low enough operating costs that my inner cheapskate would not inhibit flying. I'm very pleased to report that our first full year of DA40 ownership greatly exceeded my hopes. The purchase was a one-time gouge in our finances, but at this point it costs me less to fly for an hour than a trip to the hardware store costs. It's safer than an hour driving on winding roads in our Mazda Miata—and way more fun.

The only significant downside to the DA40 is the limited useful load, which in our aircraft is roughly 850 pounds. I dream that Diamond will apply the same energy to weight-reduction on the DA40 that it has on the DA42. But with an economy cruise of 135 knots burning 7.5 GPH, 30 gallons of 100LL is good for two couples and day packs.

The flip side of the glorious canopy is dealing with heat on the ground, but unlatching the canopy slightly open until just before take-off makes this quite manageable. The DA40 has no ice protection, but I wouldn't fly a single anywhere near ice. I'm sure that a parachute would provide bonus marketing points (especially with all-important non-pilots), but with an already best-in-market safety record, I personally don't think that the cost in weight and dollars makes sense. It's interesting to note that the two DA40 fatalities in North America are due to colossal pilot error. The few fatalities are due to what-were-you-thinking

In-flight handling and visibility are consistently praised by owners of the DA40 series.

mistakes. There's not a single incidence of a pilot making an innocent (but fatal) mistake of stalling and spinning while turning on final, for example. This was important to me when I chose the DA40. I think that I fly well, but I don't want to have an off-day and kill my family.

The DA40 generally only sees 155 knots of true airspeed, maximum, but my planned normalizing supercharger modification from Forced Aeromotive will probably increase this to 165 knots, while increasing the high-altitude climb rate.

On the other hand, if speed is the only item on your agenda, I suggest buying a different airplane and living with the trade-offs. While the center stick control intrudes on useble space, I greatly prefer a stick with actual feedback, as opposed to being spring-loaded, and love hand-flying the DA40.

The seat height in the aircraft isn't adjustable, so I suggest buying Oregon Aero seat cushions. Still, there's outstanding visiblity in all direction from all seats. This pays off for traffic-spotting and sightseeing.

I think the GFC700 autopilot and G1000 integration is excellent, and especially like the go-around switch on the throttle. I also like that the standby flight instruments are conveniently located at the top of the instrument panel.

As for financials from 2013, maintenance was $12.05 per hour, including new tires. I perform my own oil changes and participate in the annual inspection. Repairs were $2500, or $11.85 per hour due to self-inflicted wheel pant damage. My advice is don't land the airplane on runways that are poorly plowed. I also replaced the Duke's fuel pump with a Weldon unit. The Duke's pump is one of the few known weak points in the OEM equipment.

Insurance was $2200 for $2 million smooth for a 200-hour pilot without an instrument rating. Data subscriptions—including the G1000 and XM Weather—was $1300. Incidentally, I just completed the 2014 annual inspection, which included refurbishing the magnetos, for a total cost of around $1500.

As for upgrades, I've installed AeroLED Pulsar NSP strobe and position lights. These only draw 2 amps, are several pounds lighter than OEM lights and are crazy bright. I also installed a Plane Power high-output alternator, which stifles the voltage alerts from the G1000 and reduces weight by a couple of pounds. As I said, I'm planning on moving forward with the supercharger upgrade.

Diamondaviators.com (aka DAN) is an excellent source for information on the DA40 Star. This site is not affiliated in any way with Diamond Aircraft and is a remarkably flame-free environment. DAN was instrumental in my decision to buy a DA40. I was able to get balanced and detailed information in order to make an informed decision. My user name on DAN is Chris B, in case you want to hit me up for advice. I'd be happy to host someone for a flight, show off the upgrades, provide more details or answer questions.

To summarize, I think the DA40 is an awesome aircraft that more pilots should consider. Recent models with the G1000 and GFC700 autopilot are pricey, but I believe that 10-year-old DA40s are an incredible value. The airframe is not life-limited and the Lycoming IO-360 engine is robust and ubiquitous. I physically don't fit in a pre-2008 model (I have a long torso), otherwise I would have seriously considered an older plane.

Chris Bennett
via email

I advise people on buying aircraft, using a multi-criteria scorecard to weigh and compare a variety of factors that need to be considered. But when asked to pick an overall best plane, my immediate answer is the plane I bought: the Diamond DA40.

The safety record, performance and price yields a plane with a tough-to-beat value. Unless you're doing a lot of mountain flying where a parachute might be desired, I think the DA40 is generally better than a Cirrus. The front-end cost to buy a plane with a parachute, fly it and pay for the repacking is expensive.

The DA40 so-called powered glider, with its high-G-impact seat, give me confidence that I could put this plane down safely almost anywhere. If it had a parachute, I'd be very unlikely to use it.

The safety record of the DA40 yields low insurance costs. I paid $1800 per year to insure myself and three other rental partners. I think the G1000 avionics suite in my 2004 DA40 is a great system. I am surprised that the plane doesn't sell at a more premium price given its overall top value.

The long wingspan can be a hangar problem—it is a tough, close fit for a 40-foot door—but that's easy to solve with a winch and painted lines.

I went to the Air Force Academy as a private pilot, but studying hard as a cadet caused my eyesight to go bad, and I was rejected from pilot school and never flew fighters. While my pilot classmates have long been flying desks, I'm flying a fantastic aircraft.

Dr. Drew Miller
via emai

My pilot-wife and I owned a DA40 XLS model for four years as our first

aircraft before recently trading up to a DA42 twin. During that time we flew our Virginia-based DA40 up and down the East Coast, to Oshkosh multiple years and across the U.S. to California and back.

We chose the DA40 because of its sleek modern composite design, advanced avionics (in 2008, ours was one of the first G1000 aircraft with Synthetic Vision), plus Diamond's exemplary safety record.

The DA40 is very much a pilot's airplane due to the outstanding visibility out the bubble canopy, combined with the feel of the stick and pushrod-controlled ailerons and elevators. The handling is very docile and forgiving with no bad habits, which made the plane ideal for us as relatively inexperienced pilots. The plane is so easily controlled that I later learned to fly our DA40 in tight formations with other Diamonds—a real thrill.

While it's possible to cruise at an honest 150 knots in smooth air, the sweet spot for cross-country flights is to fly around 8000-9000 feet, burning 9 GPH rich of peak and seeing 145 knots true airspeed. The long wing—with its sailplane-derived airfoil—produces more than 1000 FPM climb rates at lower altitudes. The plane often seems to levitate on takeoff and yaws a bit in bumpy summer conditions, but it helps to use the rudders to dampen the oscillations.

There are only two design flaws that we wish Diamond would fix. First, on most DA40s the nose wheel and fairing will rotate crooked to the right or left immediately after takeoff, causing a 5-knot speed decrease unless tension on the castering nosewheel is adjusted correctly. This is a trial-and-error process.

Second, the instrument panel air vents roar loudly when open, and it is necessary to keep them open to stay cool in the summer. The noise is due to an outside air resonance across the fuselage NACA intake, akin to blowing across the opening of a glass jug. Both of these issues could potentially be addressed with some simple aerodynamic tweaks.

Over the course of four years, we had our share of maintenance issues, but most were firewall-forward. The constant-speed MT propeller blades delaminated and the prop hub had to be rebuilt to fix oil and grease leaks, the starter failed and the Powerflow exhaust risers developed hairline cracks due to slip joints not being treated with anti-seize compound at each annual. But the rest of the aircraft was essentially trouble-free, reflecting Diamond's excellent build quality, fit and finish.

Multiple maintenance shops are qualified as Diamond Service Centers with extensive DA40 experience, and the folks at Diamond's Canadian factory (where our plane was built) are quite responsive to parts orders and owner questions.

One maddening item is that because DA40s—like all of today's automobiles—but unlike most aircraft, are metric, it is often difficult to obtain nuts or bolts from aircraft maintenance shops. Our aircraft was occasionally grounded until metric-sized aircraft hardware could be shipped from Canada. Of course, the reliable yet ancient-design Lycoming engine in the DA40 isn't metric. I used to tell people we flew a George Jetson aircraft with a Fred Flintstone engine.

Given Diamond's superior safety record, insuring a DA40 is straightforward even for relatively inexperienced pilots. Before my wife and I were instrument rated, we were easily able to obtain $1 million smooth coverage for a DA40 with $250,000 hull value for about $2500 per year. It later cost only a few hundred dollars more to add our student pilot daughter to the policy. As a newly minted CFI, I soloed my daughter in our DA40. How's that for a vote of confidence in the aircraft?

Dave Passmore
Leesburg, Virginia

I'm a proud owner of a 2005 Diamond Star with the G1000 avionics. I've raced gliders since I was 15 years old and in 2009 decided it was time for a change. I got my private pilot certificate with instrument rating and a DA40. I flew it 140 hours last year and plan to tour the southwest with my family. The DA40 is safe, efficient, and has the visibility of a glider and low maintenance costs. It also costs less to insure than my last glider, at $1600 per year.

Nilton Renno
Ann Arbor, Michigan

The Aviation Consumer

MyGoFlight

(continued from page 15)

mount allows for flexible mounting options. It's also extremely rugged. The Nexus 7 weighs 0.64 pounds, not counting the Seidio protective sleave.

We think MyGoFlight picked the right tablet for the task and give the Nexus high marks for display quality, despite it having a smaller screen than the iPad. Apple's new iPad Air with its Retina technology has a 9.70-inch display with 264-ppi resolution, versus the 323-ppi HD display on the smaller Nexus. The Nexus battery life can be as long as nine hours. That betters the iPad, based on our experience.

For the evalution, we used the latest ForeFlight Mobile app and connected with a Stratus II portable ADS-B receiver. This enabled ADS-B traffic and FIS-B weather on the SLD. Connecting the SLD was seamless and there were some, but limited, amounts of image lag on the slaved display.

LETTERBOXING

The 16:9 screen aspect ratio of the Nexus 7 isn't ideal for displaying the 4:3 aspect ratio of the iPad, due to letterboxing. This means the slaved display won't mirror the iPad in full screen (it will aspect in full screen when mirroring the new iPod Touch and iPhone 5).

The other nit we have is the inability to customize the remote display. For instance, it would be nice to move the standard Android control keys from the screen or off to the side to gain more real estate. Moreover, having the ability to pinch-zoom and move the image without altering the driving iOS device could provide another layer of utility that doesn't currently exist.

MyGoFlight said as app developers create ways to overlay a unique image on the SLD, it will be able to provide full-screen imaging from any device to the SLD, no control buttons and ultimately two different views at the same time—one for the iOS device and a separate one for the SLD.

EYES UP FOR SAFETY

"Historically, there are over 1200 runway incursions each year due to pilots not knowing where they are and not looking outside. While using a tablet that's outside of the line of sight it takes upward of 10 seconds for a pilot to look down, focus, read, look up and refocus," said Schneider.

Based on our evaluation, we believe that having the SLD mounted within a direct line of sight can reduce heads-down time. The ability to manipulate the data on the SLD might further reduce heads-down time. The tradeoff, on the other hand, is managing another portable device. We're concerned about portable tablets becoming projectiles in a crash and the SLD is no different.

MyGoFlight sells the SLD 7 with Sport mount for $397, which includes the Google Nexus 7 unit with the preinstalled AirDisplay that's configured for use as an Apple AirPlay device. There's a variety of optional mounting arms and accessories. The smaller SLD 5 is $469 with an optional surface mount. Both bundles include 90 days of technical support. Visit www.mygoflight.com, 303-364-7400.

For the app to display on the SLD's entire screen, you'll need to use an iPod or iPhone 5. The approach chart, left, originated from an iPad mini.

FEEDBACK WANTED

ROBINSON R44

For the September 2014 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Robinson R44, the four-seat piston helicopter. We want to know what it's like to own these machines, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Robbie to appear in the magazine, send us any photos you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the R44 by July 1, 2014, to:

Aviation Consumer
e-mail at:
ConsumerEditor@hotmail.com